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Abstracts and Programme

Euroanaesthesia 2003

**Joint Meeting of the European Society of Anaesthesiologists and
European Academy of Anaesthesiology
Confederation of European National Societies of Anaesthesiology
Association of Anaesthetists of Great Britain & Ireland**

Glasgow, Scotland,
31 May–3 June 2003

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European Journal of Anaesthesiology

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Guide to Authors of Abstracts

The ESA/EAA solicits the submission of abstracts for the Euroanaesthesia 2004 Meeting, Lisbon, Portugal, 5–8 June, 2004

The ESA encourages, in particular, non-native English speakers to submit abstracts for the Annual Meeting. Please write as simply as possible and avoid language mistakes. After submission, each blinded abstract will be judged by three reviewers. Accepted abstracts will be published in the European Journal of Anaesthesiology, only if they are presented at the Meeting. Please be sure that your abstract, particularly any graphs, can be read easily, taking into consideration that the size of the original material submitted will be reduced for publication. The use of images, graphs or illustrations in colour is not allowed. Non-adherence to these submission guidelines may be cause for rejection of abstracts submitted.

All abstracts must be submitted online on the ESA Website
www.euroanesthesia.org

The submission module will be available to submitters from 1 November to 15 December 2003

- You will find all necessary information in the "How to write an abstract?" and "How to submit an abstract online?" sections, in the Congress part of the website.
- The ESA does **not** accept submission of abstracts by mail, fax or e-mail.
- Status of reviewed abstracts will be advised **exclusively** through the ESA Website.
- Schedule of presentation of accepted abstracts and nomination to the Best Abstract Competition will also be advised through the ESA Website.

Submission Conditions

When submitting your abstract, you will be prompted to accept the following conditions:

- The work in the abstract should not be presented at a large English-speaking meeting before the Euroanaesthesia 2004 Meeting, nor should the work appear in another form at that meeting.
- The work will not be published before the 2004 meeting, in whole or in abstract, in an indexed journal.
- If the abstract is accepted, the author commits him/herself to present his/her work at the Annual Meeting for which the abstract is submitted. Abstracts will not be published in the supplement of the European Journal of Anaesthesiologists if the presenter does not pre-register for the Annual Meeting.
- Studies involving animal or human subjects must satisfy the requirements of the institution or organization of the authors regarding the use of human subjects or animals in research.
- In consideration of the European Society of Anaesthesiologists taking action in reviewing and editing the submission, the author(s) must transfer(s), assign(s), and otherwise convey(s) all copyright to ownership in said work to the European Society of Anaesthesiologists in the event said work is published by the Society. This copyright assignment applies only to the abstract submitted and does not apply to, or prevent, subsequent publication elsewhere of a full manuscript relating to the subject matter of such abstract.

European Society of Anaesthesiologists Research Grants Programme

The European Society of Anaesthesiologists (ESA) is pleased to announce the Programme of Research Grants starting in 2004.

The grants are intended to promote anaesthesia-related research in Europe, and to encourage anaesthesiologists to extend the frontiers of their practice or understanding. Priority will be given to topics that have no alternative sources of funding.

Applications are sought for the following:

1. Project grants of up to €60,000 each, to support work of up to two years duration.
2. Research support grants for amounts up to €15,000 to assist work in progress or pilot studies.

There will be up to three grants of each type, and applications are invited for the following fields:

a. Clinical Research

b. Experimental Research

c. Patient Safety

These grants will be awarded to start on or after **1 March 2004**.

The areas of priority and the number and size of the grants may change from year to year.

Grant application must be received no later than **1 January** of the year in which the grants are to be awarded and late applications will not be accepted. Projects can be for up to 2 years, but a shorter planned time to completion is encouraged. The **total sum requested must not exceed the grant amounts on offer.** Application guidelines are available through the ESA web site.

Awards are made to a sponsoring institution, not to individuals or to departments. Any qualified member of a sponsoring institution in one of the European countries that is represented on the ESA Council may apply. At least one of the investigators should be an ESA member. The Grant recipient receives a free registration to the Annual Meeting to accept the grant during the Opening Ceremony.

Anaesthesia Trainee Research Prize Competition

The European Society of Anaesthesiologists hosts the Annual Anaesthesia Trainee Research Prize Competition. The prizes are awarded at each Annual Meeting of the ESA and consist of free registration for the annual meeting, an appropriate certificate and cash awards of Euro 3,000, 2,000 and 1,000 for first, second and third prizes, respectively.

Best Abstract Prize Competition

Three prizes are awarded for the best three abstracts presented at the Euroanaesthesia Meetings. Winners of these awards are announced during the Gala Dinner.

For complete details of the ESA Grants, Prizes and Competitions – consult our web site
www.euroanesthesia.org

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European Academy of Anaesthesiology

Awards

EAA Clinical Scholar Research Award

This Award has been created to further the understanding of anaesthesiology and related sciences of clinical practice through clinical investigations. Research must involve human subjects. The maximum amount to be awarded for any project is €25,000. Please note that institutional indirect expenses are not funded.

To qualify, the principal applicant must be member of the European Academy of Anaesthesiology (EAA) and be an investigator with a research record who has yet to establish a history of substantial funding. The award will go to a research project, which is judged by peer review to have high scientific merit and high probability of success. Priority funding will be awarded to proposals, which are independent of other grant support. Experienced investigators working in new areas will receive consideration. The proposed project must have direct relevance to the specialty of anaesthesiology.

Applicants must submit their Curriculum Vitae as well as an outline of their proposed research project. Furthermore, the application should be accompanied by a letter from the Chairman of the department outlining the applicant's research qualities.

EAA Teaching Recognition Award

The purpose of this Award is to discover an individual with outstanding teaching skills besides his/her research skills. The award winner will be required to give a total of five lectures. One lecture must be presented at the annual Euroanaesthesia congress. The other four lectures will be given in each of four different European countries, either at university departments or at the annual congress of the national societies. The award winner will receive a travel reimbursement for every lecture up to €1250. The rest of the travel expenses will be paid by the host departments or congress organisers, if necessary. The maximum amount to be awarded is €5000.

The recipients of the Teaching Recognition Award receive a bronze sculpture in recognition of their achievement after having presented their lecture at the Euroanaesthesia meeting. The "Sleeping Doc Award" is an original bronze sculpture of a sleeping dog by the Belgian artist Wim Janssens.

Applicants should not be older than 45 years of age and should have finished their PhD or an equivalent degree. To qualify, applicants must be a member of the European Academy of Anaesthesiology (EAA).

Applicants must submit their Curriculum Vitae as well as an outline of their lecture. Each application must be accompanied by a letter from the applicant's Chairman, and two letters from Residents in their own department, outlining the applicant's teaching qualities.

EAA Training Award

This Award has been created for young anaesthetists, including residents in their last year of training, with the aim of completing their training in another European Department of Anaesthesiology, recognised as a European centre for training of anaesthesiologists by the EAA/EBA joint hospital visiting programme. The chairman must be a member of the European Academy of Anaesthesiology.

The winner of the award will receive €2000 per month for a maximum of 6 months. To qualify, the applicant must have passed at least the Part I of the European Diploma of Anaesthesiology or be a member of the EAA.

Candidates must submit a Curriculum Vitae as well as a description of the special training which they intend to follow. Furthermore, each application must be accompanied by a letter from his/her chairman as well as a letter from the chairman of the host department.

Please submit one original application and nine copies to the Honorary Secretary before 31 January, 2004:

Prof. Dr. Klaus Olkkola
Department of Anaesthesia and Intensive Care Medicine
Turku University Hospital
PO Box 52
FIN-20521 Turku, Finland
e-mail: klaus.olkkola@tyks.fi

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EUROANAESTHESIA 2003

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PROGRAMME

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ESA Trainee Research Prize Competition Winners

A-1

Phosphodiesterase-III-inhibition leads to pathological contractures in skeletal muscle preparations of malignant hyperthermia susceptible swine

M. Fiege, F. Wappler, R. Weisshorn, M.U. Gerbershagen, K. Kolodzie, J. Schulte am Esch

Department of Anaesthesiology, University-Hospital Hamburg-Eppendorf, Hamburg, Germany

Background and Objective: The phosphodiesterase-III-inhibitor enoximone induced marked contractures in skeletal muscle specimens of malignant hyperthermia (MH) susceptible (MHS) humans and swine. Whether this is a substance specific effect of enoximone or caused by inhibition of phosphodiesterase-III remained unclear. Therefore, the effects of the phosphodiesterase-III-inhibitor amrinone in porcine MH normal (MHN) and MHS skeletal muscles were investigated.

Methods: MH-triggerfree general anaesthesia was performed in eight MHS and eight MHN swine. Skeletal muscle specimens were excised for the in-vitro contracture tests with amrinone. Amrinone was added cumulatively every five minutes to muscle specimens in order to obtain organ bath concentrations between 20 and 400 μmol L^{-1}. The in-vitro effects of amrinone on muscle contractures and twitch were measured.

Results: Amrinone induced contractures in all skeletal muscle preparations. MHS muscles developed contractures at significant lower bath concentrations of amrinone than MHN muscles. Contractures of MHS compared to MHN muscles were significantly larger at bath concentrations of 80, 100, 150, 200 and 400 μmol L^{-1} amrinone. Muscle twitch remained unchanged up to and including 200 μmol L^{-1} amrinone.

Conclusions: Inhibition of phosphodiesterase-III in general elicits specific effects in MHS skeletal muscles. Therefore, contribution of phosphodiesterase-III and the cAMP-system in pathophysiology of MH must be suspected.

A-2

Hypercapnic acidosis may attenuate endotoxin induced acute lung injury by a nitric oxide dependent mechanism

D. Honan[2], N. Hopkins[1], J.F. Boylan[2], P. McLoughlin[1], J.G. Laffey[1,2]

[1]The Department of Physiology, Conway Institute of Biomolecular and Biomedical Research and Dublin Molecular Medicine Centre, University College Dublin; [2]The Department of Anaesthesia and Intensive Care Medicine, St Vincent's University Hospital, Dublin, Ireland

Background: Acute Lung Injury (ALI) and ARDS may be made worse by mechanical ventilation. Strategies that limit lung stretch result in permissive hypercapnia, and increase patient survival. (1) Deliberate elevation of $FiCO_2$ [Therapeutic Hypercapnic Acidosis, TH] protects against lung injury in multiple models. (2) The efficacy of TH in sepsis, the commonest cause of clinical ARDS, is not known. We hypothesized that hypercapnic acidosis would protect against endotoxin-induced ALI.

Methods: After IRB approval two experimental series were performed. In Series I, 32 anaesthetized, ventilated rats were randomized to receive prophylactic hypercapnic acidosis (PHA; $FiCO_2$ 0.05) or control conditions (CON; $FiCO_2$ 0.00), prior to intratracheal administration of endotoxin [LPS] 20 mg/Kg or vehicle [Sham], in 4 groups: [1] PHA-LPS, [2] Con-LPS, [3] PHA-Sham, [4] Con-Sham. In Series II, 18 animals were randomized to receive therapeutic hypercapnic acidosis (THA) or control conditions following intratracheal administration of LPS 15 mg/Kg.

Results: In Series I, after 4 hrs, arterial oxygenation [mean $\pm$ SEM] was lower [$p < 0.05$] in Control-LPS [53.4 $\pm$ 5.4 mmHg] than in TH-LPS [81.4 $\pm$ 6.9], Con-Sham [95.3 $\pm$ 4.5] and TH-Sham [105.2 $\pm$ 6.9]. Peak airway pressure was higher and static lung compliance lower in CON-LPS than in all other groups. Bronchoalveolar lavage neutrophil count (x106) was higher in CON-LPS [8.6 $\pm$ 2.2] than TH-LPS [2.3 $\pm$ 0.6], CON-SHAM [1.2 $\pm$ 0.7] and TH-SHAM [0.6 $\pm$ 0.3]. In Series II, after 6 hours arterial oxygenation [52.1 $\pm$ 4.5 vs. 90.7 $\pm$ 5.3 mmHg] and static lung compliance were lower [$p < 0.05$] in Control-LPS than in TH-LP. Peak airway pressure and bronchoalveolar lavage neutrophil count were higher in CON-LPS compared to TH-LPS. TH attenuated the rise in bronchoalveolar lavage and lung tissue NO levels compared to CON-LPS.

Conclusions: Hypercapnic acidosis-induced by adding CO2 to inspired gas-attenuates acute sepsis induced lung injury. Hypercapnic acidosis is efficacious when applied prophylactically and therapeutically in this context. These data further support the emerging evidence for eventual clinical testing of Therapeutic Hypercapnia (3).

References:

1 Amato MB, Barbas CS, Medeiros DM, et al.: Effect of a protective-ventilation strategy on mortality in the acute respiratory distress syndrome. N. Engl. J. Med. 338: 347–354, 1998.
2 Laffey JG, Kavanagh BP: Biological Effects of Hypercapnia (Review). Intens. Care Med. 26: 133–138, 2000.
3 Laffey JG, Kavanagh BP: Carbon dioxide and the critically ill – too little of a good thing? (Hypothesis Paper). Lancet 354: 1283–1286, 1999.

Acknowledgements: supported by: Health Research Board [Ireland]; Irish Lung Foundation; Dr. Laffey is a holder of a Clinical Research Fellowship with the Health Research Board [Ireland]

A-3

Detection of partial endotracheal tube obstruction and airway constriction with the aid of the expiratory flow signal

R. Kawati[1], M. Lattuada[1], U. Sjöstrand[1], J. Guttmann[3] G. Hedenstierna[2], M. Lichtwarck-Aschoff[1]

[1]Departments of Surgical and [2]Medical Sciences; University Hospital, Uppsala, Sweden; [3]Department Anaesthesiology and Critical Care Medicine, University Hospital Freiburg, Germany

Background and Goal of Study: Progressive obstruction of the endotracheal tube (ETT) resulting from secretions might go undetected until rather late since any increase in peak inspiratory airway pressure (P_{peak}) depends not only on the degree of narrowing but also on the inspiratory flow rate. Moreover, monitoring of P_{peak} alone does not distinguish between ETT obstruction and airway constriction.

Materials and Methods: In 9 piglets during volume-controlled ventilation 3 grades of ETT obstruction were created with an external clamp. Additionally, infusing metacholine induced airway constriction. Dividing the flow signal of a passive expiration into 5 consecutive segments and calculating the corresponding time constants (τE) allows to analyze whether and how the flow rate is decelerated by the narrowing.

Results and Discussions: With increasing obstruction time constants increased in all animals, while P_{peak} did not increase in 3 animals with low-grade obstruction and by merely 1 cmH_2O in 2 further animals. Airway constriction was severe enough to close off entire lung units, decreasing lung volume and compliance, thereby the stiffer lungs accelerated the expiratory flow to the same rate as under control conditions and τE remained essentially unchanged. The combination of Ppeak increase and unchanged τE allowed for the detection of severe airway constriction.

Conclusion: We conclude that partial ETT obstruction can be reliably monitored with the expiratory flow signal, and together with the determination of Ppeak, helps distinguishing between ETT obstruction and airway constriction

Reference:

1 Guttmann J, Lichtwarch-Aschoff M, Geiger K, et al: Detection of endotracheal tube obstruction by analysis of the expiratory flow signal. Intensive Care Med 1998; 24: 1163–72.

Acknowledgements: This study was supported by a grant from the Lions Cancer Foundation, Uppsala, Sweden.

ESA Best Abstract Prize Competition

A-4

Safety and analgesic efficacy of Perfalgan® in children

I. Murat, R. Arnaud, A. Dillenscneider, O. Hiesse-Provost

Department of Anesthesiology, Hopital Armand Trousseau, Paris and Laboratoires UPSA/BMS, Paris, France

Background and Goal of Study: Pro-Dafalgan®, an injectable prodrug of paracetamol (2 g releases 1 g of paracetamol), has been widely employed in Europe for management of acute pain. Perfalgan®, a ready-to-use injectable paracetamol solution, has recently been developed. Clinical studies conducted in adults showed that Perfalgan® is comparable to Pro-Dafalgan® with regard to analgesic efficacy and is better tolerated locally. Local and

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general safety and analgesic efficacy of Perfalgan® were evaluated comparatively to Pro-Dafalgan®, in a randomized, double-blind, multicenter study conducted in children.

Materials and Methods: After the Ethics Committee's approval and parents' informed consent, patients undergoing inguinal hernia repair and having a postoperative pain >30 mm on a 100-mm VAS received a 15-min infusion of either Perfalgan® 15 mg/kg or Pro-Dafalgan® 30 mg/kg. Adverse events (AE), particularly local AEs, and efficacy measures, including pain intensity, pain relief, time to remedication and global evaluation of efficacy, were evaluated over a 6-hour period.

Results: 183 patients aged from 1 to 12 years (95 Perfalgan®, 88 Pro-Dafalgan®) were analyzed. The incidence of local AEs was significantly reduced in the Perfalgan® group compared to the Pro-Dafalgan® group. The incidence of the other AEs, mainly nausea and vomiting, was not significantly different between groups. No significant difference was observed between both groups for all of the efficacy measures (Table 1).

	Perfalgan® (n = 95)	Pro-Dafalgan® (n = 88)
Nber of pts with at least 1 local AE	14 (14.7)	32 (36.4)
(n (%) [95%CI])	[0.08–0.23]	[0.26–0.47]
Nber of pts with at least 1 non-local AE	7 (7.4)	8 (9.1)
(n (%) [95%CI])	[0.03–0.15]	[0.04–0.17]
Max Pain Intensity difference	45.0/20.4	45.4/20.3

Conclusion: This study showed that the analgesic efficacy of Perfalgan® in children is comparable to that of Pro-Dafalgan®. However, as previously described in adults, Perfalgan® is better tolerated locally.

A-5

Anaesthetic preconditioning and reduction of reperfusion injury by sevoflurane offered additive myocardial protection mediated by opening of KATP channels

D. Obal, J. Müllenheim, C. Favoccia, M. Kratz, S. Dettwiler, B. Preckel, W. Schlack

Clinic of Anaesthesiology, University Hospital of Duesseldorf, Duesseldorf, Germany

Background and Goal of Study: Sevoflurane (S) is known to induce myocardial preconditioning (PC) (1) and to reduce myocardial reperfusion injury (2). We investigated whether the combination of both cardioprotective mechanisms confer additional protection.

Materials and Methods: A total of 48 α-chloralose anaesthetized rats were subjected to 25 minutes of coronary occlusion followed by 120 min of reperfusion. The PC protocol consisted of two 5 minute periods of S-administration (1 MAC end-tidal) each followed by 10 minutes of washout (S-PC, n = 9). In S-REP (n = 10) 1 MAC S was administered for the first 2 minutes of reperfusion. In S-PC + S-REP (n = 10), both protocols were combined. In one additional group 5-hydroxydecanoate (5-HD), a blocker of K-ATP channels, was administered during the PC protocol, ischaemia and the first 2 minutes of reperfusion (S-PC + S-REP + 5-HD, n = 10). Nine rats served as untreated controls (CON). Infarct size was measured by triphenyltetrazoliumchloride staining and is expressed as percentage of the area at risk.

Statistics: ANOVA and Student´s t-tests with Bonferroni-Holmes correction. Mean values ±95% confidence interval.

Results and Discussion: Infarct size was 53 (41–65)% in CON and was reduced by S-PC (23 (14–32)%, $P = 0.0006$) and S-REP (18 (15–22)%, $P < 0.0001$). The combination of S-PC and S-REP confers additional cardioprotection (12 (8–16)% ($P = 0.0071$ *vs*. S-PC, $P = 0.0145$ *vs*. S-REP). Administration of 5-HD abolished the protection offered by S-PC + S-REP (S-PC + S-REP + 5HD: 46 (36-56), $P < 0.0001$).

Conclusion: The combination of sevoflurane-induced preconditioning and sevoflurane-induced protection against reperfusion injury confers additive cardioprotective effects, which are mediated by opening of K-ATP channels.

References:

1 Toller WG. *Anesthesiology* 1999; 91: 1437–1446.
2 Obal D. *Br J Anaesth* 2001; 87: 905–911.

A-6

Continuous infusion of the endothelin receptor antagonist tezosentan ameliorates endotoxin-induced lung injury in sheep

M. Kirov, V. Kuklin, O. Evgenov, S. Kirova, L. Bjertnaes

Department of Anesthesiology, Faculty of Medicine, University of Tromsø, Norway

Background and Goal: In sepsis, endothelin (ET) contributes to pulmonary hypertension and edema, thus, promoting acute lung injury (ALI) (1). We hypothesized that the novel ET receptor antagonist tezosentan (2) could counteract the endotoxin-induced ALI. Our goal was to assess the effects of tezosentan in endotoxemic sheep and to evaluate the dose response relationship between tezosentan and ET.

Materials and Methods: Twenty-one sheep were instrumented with vascular catheters, assigned randomly to three experimental groups, and studied awake during 24 h. A sham-operated group (n = 3) received only intravenous (IV) infusion of Ringer lactate 3 mL/kg/h. A lipopolysacharide (LPS) group (n = 7) additionally received an IV infusion of *E. coli* LPS 15 ng/kg/min. A tezosentan group (n = 7) after 4 h of endotoxemia, in addition to Ringer lactate and LPS, received IV tezosentan 3 mg/kg, followed by a continuous infusion of 1 mg/kg/h. Finally, four sheep, exposed to IV infusion of ET-1 20 ng/kg/min, after 1 h received tezosentan at stepwise increasing doses of 0.5, 1, and 2 mg/kg/h that were maintained for 1 h each. The measurements included hemodynamics, extravascular lung water (EVLW), blood gases, and plasma concentrations of ET-1. Data were assessed by ANOVA and Scheffe's test.

Results: In the sham-operated group, all variables remained unchanged. LPS caused pulmonary hypertension, increased EVLW, and arterial hypoxemia. Tezosentan decreased the LPS-induced increments in pulmonary vascular resistance and EVLW by 40–50%. In parallel, it increased cardiac index (CI), attenuated the falls in stroke volume and right ventricle ejection fraction, and reduced systemic vascular resistance. From 8 to 12 h, tezosentan attenuated arterial hypoxemia. Compared with the LPS group, tezosentan increased plasma concentrations of ET-1. Infusion of ET-1 induced systemic and pulmonary hypertension, increased EVLW, and evoked bradycardia and a fall in CI. All the above changes were attenuated by tezosentan at infusion rates of 1 and 2 mg/kg/h.

Conclusions: In endotoxin-induced ALI, tezosentan ameliorates pulmonary hypertension, lung edema, and arterial hypoxemia. Tezosentan counteracts the hemodynamic effects of ET-1 in a dose-dependent manner.

References:

1 Wanecek M, Weitzberg E, Rudehill A, et al. *Eur. J. Pharmacol.* 2000; 407: 1–15.
2 Clozel M, Ramuz H, Clozel JP, et al. *J. Pharmacol. Exp. Ther.* 1999; 290: 840–846.

A-7

Respective roles of mechanical ventilation and lung-infection in the genesis of bronchoalveolar distension in piglets

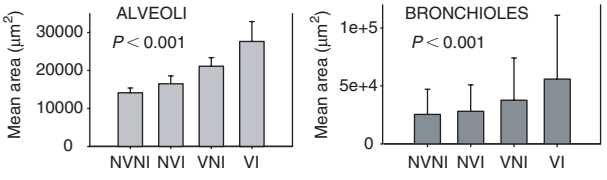
A. Sartorius, S. Vieira, I. Goldstein, G. Lenaour, C.H. Marquette, J.J. Rouby

Reanimation chirurgical Pierre Viars, Department of Anesthesiology, and the Department of Pathology, Pitié-Salpêtrière Hospital, Paris, France

Background and Goal of Study: The bronchoalveolar distension observed in mechanically ventilated patients with acute lung injury (1) can be reproduced in ventilated piglets with bronchopneumonia (2). To assess the respective role of mechanical ventilation and lung infection, lung morphometry was analysed in ventilated and spontaneously breathing piglets, with or without experimental bronchopeumonia.

Materials and Methods: Four groups of piglets were studied: non-ventilated and non inoculated (NVNI, n = 5), non-ventilated and inoculated animals (NVI, n = 6), ventilated and non inoculated animals (VNI, n = 6), ventilated and inoculated animals (VI, n = 8). Bronchial inoculation was performed with a solution of *E. coli* (10^5 to 10^9 cfu/ml) and mechanical ventilation was provided using a constant tidal volume of 15 ml/kg and zero end expiratory pressure. At day 4, the lungs were fixed at the functional residual capacity and multiple histologic blocks were sampled. The mean alveolar area and the mean bronchiolar area were measured using a specific morphometrical software (QUIPS, Leica Qwin, Cambridge, UK) (2).

Results and Discussions: The mean alveolar area and mean bronchiolar area are represented below:



Conclusions: (1) Lung infection by itself induced bronchoalveolar distension. (2) Mechanical ventilation by itself induced a greater distension than lung infection. (3) The association of both increased this distension in an additive way.

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References:
1 *Intensive Care Med* 1993, 19: 383–389.
2 *Am J Respir Crit Care Med* 2001, 163: 958–964.

A-8

Quality of recovery after abdominal hysterectomy is better with regional than with general anaesthesia

L.N. Yaddanapudi, S. Podder, P.A.R.V. Sujatha

Department of Anaesthesia and Intensive Care, Postgraduate Institute of Medical Education and Research, Chandigarh, India

Background and Goal of Study: Most outcome studies focus on economical or clinical end-points. We have evaluated the perceived health outcome in patients undergoing total abdominal hysterectomy under general anaesthesia (GA), and under combined spinal-epidural anaesthesia (CSE).
Materials and Methods: 100 ASA I-II patients were randomised to receive GA or CSE. 3 patients withdrew from the study. Patients were given 0.1 $mg \cdot kg^{-1}$ oral diazepam on the night before surgery, and 4 mg iv ondansetron intraoperatively. 24 hours postoperatively, Myles 9-point Quality of Recovery (QoR) questionnaire (1) was administered to all patients.
Results and Discussions: Data are shown in the table:

	GA (n = 48)	CSE (n = 49)
Age (yrs) [Median ± IQR]	50 ± 18	45 ± 11*
Weight (kg) [Median ± IQR]	60 ± 13	60 ± 16
Duration of surgery (min) [Mean ± SD]	137 ± 33	142 ± 38
QoR score [Median ± IQR]	15 ± 2	16 ± 2¶
Intraoperative adverse events [n (%)]	2(4)	14(28)§
Intraoperative blood transfusion [n (%)]	12(25)	8(16)

*p = 0.007, ¶p = 0.024, Mann–Whitney U test, §p = 0.003, χ^2 test.

Multivariate regression showed that weight (p = 0.013), intraoperative blood transfusion (p = 0.015) and GA (p = 0.017) were associated with poorer QoR scores.
Conclusions: Heavier patients and those receiving blood transfusion during surgery had a poor perception of their postoperative recovery. Despite a higher incidence of intraoperative adverse events, patients in the CSE group had a better perceived quality of recovery than the GA group.
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A-9

Effect of prophylactic or therapeutic application of cell-free hemoglobin HBOC-200 on severity of cardiac arrhythmias during myocardial ischemia-reperfusion in rats

C. Rempf, M.A. Burmeister, S. Bartsch-Zwemke, S. Rehberg, T. Standl, J. Schulte am Esch

Department of Anesthesiology, University Hospital Hamburg Eppendorf, Hamburg, Germany

Background and Goal of Study: Perioperative myocardial ischemia is frequent in cardiac risk patients and can result in severe cardiac arrhythmias. The present study tested for the first time the hypothesis that the prophylactic or therapeutic use of the hemoglobin solution HBOC-200 can reduce arrhythmias in an animal model of ischemia and reperfusion.
Materials and Methods: After approval of the animal ethics committee 46 Sprague Dawley rats were included. Following induction of general anesthesia rats were mechanically ventilated and an arterial and central venous line were inserted. After left thoracotomy a 6-0 silk suture was placed around the base of the left coronary artery. The animals were randomized to one of four groups. Animals of the sham control (G1, n = 9) received neither coronary occlusion nor HBOC while animals of the other groups received a 25-min coronary occlusion period followed by 120-min of reperfusion. In the prophylactic group (G2, n = 12) 0.4 g kg^{-1} HBOC-200 were applied 10 min before occlusion, in the therapeutic group rats were treated with 0.4 g kg^{-1} HBOC-200 (G3, n = 15) 10 min after occlusion. In the control group (G4, n = 10) animals received NaCl. Heart rate and rhythm disorders were derived from the electrocardiogram. Ventricular arrhythmias were analysed during the ligation period and the ligation and reperfusion time according to the Lambeth Convention guidelines for the analysis of experimental arrhythmias[1] using a severity score[2] (0-5). For comparison among groups data were compared by Mann–Whitney U-Test. A p value $\leqslant 0.05$ was considered statistically significant.
Results and Discussions: The severity of cardiac arrhythmias during ischemia was (0-5): G1: 8/1/0/0/0/0; G2: 6/4/2/0/0; G3: 8/2/2/3/0/0; G4: 1/5/1/3/0/0; ($p \leqslant 0.05$ G1 + G2 vs G4). The severity of cardiac arrhythmias during ischemia and reperfusion was: G1: 7/1/1/0/0/0; G2: 2/6/4/2/0/0; G3: 1/4/2/8/0/0; G4: 0/3/3/4/0/0; ($p \leqslant 0.05$ G1 vs G4).
Conclusion(s): The prophylactic application of the cell-free hemoglobin solution HBOC-200 provides a reduction of ventricular arrhythmias in this animal study. Therefore HBOC-200 may offer a new opportunity in the perioperative treatment of cardiac risk patients.
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Evidence Based Medicine, Quality Insurance and Safety

A-10

Continuous quality improvement on patient satisfaction with anaesthesia care

T. Heidegger*, Y. Husemann**, M. Nuebling†, J. Borg‡, R. Germann‡, K. Flueckiger§, T. Coi§, T.W. Schnider*

*Department of Anaesthesiology, *Kantonsspital St. Gallen, CH; **Picker Inst. Zug, CH; †Empirical Consulting, D; ‡Krankenhaus Feldkirch, A; §Inselspital Bern, CH, St. Gallen, Switzerland*

Background and Goal of Study: There is a lack of information about continuous quality improvement (CQI) on patient satisfaction with anaesthesia care. The goal of this study was to run through a quality loop and to evaluate the effects of improvement strategies undertaken after the first survey with a psychometric questionnaire (1).
Materials and Methods: All three participating hospitals made interventions in the most important dimension 'Information and Involvement in decision making' such as for example information meetings for doctors and nurses or expansion of the preanaesthetic care unit. After ethics approval, each hospital sent questionnaires to 600 elective surgery patients after discharge. We compared the mean problem score for the above mentioned dimension and its underlying questions from 2000 and 2002. Data are presented as means in % (95% CI). *$p < 0.05$ for the comparison of means (ANOVA) was considered significant.
Results and Discussions: The response rate was 58%. Our findings show an improvement on almost all items.

Information/Involvement in decision making	Year 2000	Year 2002
Information before anaesthesia	45 (3)	38 (3)*
Anxiety about anaesthesia	24 (3)	21 (3)
Understandable answers obtained	15 (2)	13 (2)
Involvement in anaesthesia method	27 (3)	21 (3)
Information about postanaesthetic feeling	43 (3)	43 (3)
Enough time to talk	20 (2)	16 (2)
Privacy during preanaesthetic talk	30 (3)	22 (3)*
Information at start of anaesthesia	21 (3)	22 (3)
Information during surgery	47 (6)	39 (7)
Mean problem score	31 (2)	28 (2)

Conclusion: Management of patient satisfaction with anaesthesia care is a continuous process with further room for improvement.
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Acknowledgements: The study was supported by the Department of Anaesthesia, and the Quality Committee, St. Gallen, Cantonal Hospital, Switzerland, the Picker Institute, Zug, Switzerland and the companies Fresenius, Gerot and Novartis, Austria.

A-11

Physiological and metabolic adaptability among anesthesiologists after on-call duty

P. Flisberg*, B. Malmberg#, B. Jönsson#, E. Ranklev-Twetman*, P. Örbaeck#

**Department of Anesthesia and Intensive Care; #Department of Occupational and Environmental Medicine, Lund University Hospital, Lund, Sweden*

Background and Goal of Study: The working environment as well as increased stress could be of importance for the reported increased mortality among anesthesiologists (1–2). This is the first long-term physiological report about anesthesiologist's adaptability and recovery after on-call duty.
Materials and Methods: In a University Hospital setting anesthesiologists (n = 19), ENT-surgeons (n = 10), and pediatricians (n = 6) with on-call duty participated. The participants were followed over a 2–3 week period. Metabolic and stress variables, defined as insulin, glucose, TSH, T4, testosterone, IGF-1, HDL, LDL, triglycerides, cortisol awakening response and evening levels were assessed on holiday, normal work day, one day and three days after on-call. Long-term heart rate variability was monitored with Holter-ECG. Sleep and restitution was studied with an activity logger (Activewatch®) combined with a sleep diary. All data were analyzed with repeated measurements models in SPSS mixed procedures.
Results and Discussions: Among all the participated specialties we found a significant decrease of TSH one day after on-call duty ($p = 0.001$). The cortisol level increased during regular working days compared with holidays ($p = 0.004$). No difference in cortisol level was found between on-call duty and a normal working day. No difference between anesthesiologists and other specialties were found.
Conclusion: The results indicate a limited metabolic influence in conjunction with on-call duty. Similar activation of the HPA-axis on normal working days and on days with on-call duty during the night were observed.
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A-12

Patient satisfaction with anesthesia

M. Capuzzo, A. Bassani, F. Landi, L. Grassi, C.A. Volta, R. Alvisi

Section of Anaesthesiology and Intensive Care, Department of Surgical, Anesthetic and Radiological Sciences, University Hospital of Ferrara, Ferrara, Italy

Background and Goal of Study: Satisfaction with anesthesia allows evaluating the patient's perception of the procedure. Literature examining this area (1,2) has used questionnaires consisting of items selected by doctors and nurses. The goal of this study was to obtain patient selection of items for satisfaction with anesthesia.
Materials and Methods: A list of 23 items was created considering literature and clinical experience. One hundred surgical patients were interviewed face-to-face at the first postoperative visit after hospital discharge. They were asked whether each item was relevant or not to him/her, they chose the most relevant among the relevant ones, and, then, they chose the most relevant among the remaining relevant items for four times.
Results and Discussions: Out of 100 patients, 53 were males; mean age 54 ± 16.5 y. The median time between surgery and interview was 11 days (interquartile range 7–16). The items chosen by >50 patients and the number of the patients who considered relevant or selected that item as one of the 5 most important are reported in the table.

Item	Relevant	Top five
Kindness/Regard of caregivers	98	63
Feeling of well being	97	55
Information given by anesthetist	96	74
Demands promptly answered	93	60
Attention to the patient	90	59
Feeling to be protected	89	27
Feeling to be relaxed	78	29
Pain at the site of surgery	69	29
Feeling anxious or frightened	59	21
Vomiting	56	19

When patients were grouped according to gender and type of surgery (abdominal, thoracic), there was no significant difference in the items relevant or not (chi square; Bonferroni correction). Only mental confusion was considered relevant by patients older (>55 vs <55 y) and by those educated >8 y (vs <8) (chi square; $p < 0.002$).
Conclusion(s): In patients' opinion, the most relevant item for patient satisfaction with anesthesia is the information given by the anesthetist before surgery.

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A-13

Development of a national level information management system in anesthesiology

A. Varosyan

Assistant Professor, Chair of Anaesthesiology and Intensive Care, Yerevan State Medical University, Yerevan, Armenia

Background and Goal of Study: Data management systems used in anaesthesia vary from country to country or even within a country and do not always contain optimal data for statistical analysis. The goal of the present research was to develop and test a uniform information management system covering all anaesthesia departments in the country.
Materials and Methods: Uniform database software was elaborated on the basis of the information model of anaesthesia service activity and installed in all relevant departments functioning in Armenia. Data set for inclusion in the database and further statistical treatment comprises four main parts: (1) general information about anaesthesia departments; (2) logistics and equipment; (3) staff; (4) clinical activity of departments. Data entered the database was used to calculate various derived parameters reflecting the overall state and activity of departments, e.g. deficit or excess of specialists, depreciation and update rate of equipment, incidence of anaesthesia related complications and a number of other useful parameters. The source for data collection was standardized documentation for registering the activity of anesthesia departments elaborated in the frames of the research. A data set for national benchmarking is selected and directed to the national database using Internet or regional networks at timed intervals.
Results and Discussions: During a two-year experiment (1999–2000) all elements of the system were tested. The preferred way of data transfer was email. In the future online management of the system will be considered and tested. The experiment demonstrated the full functionality of the system and the comprehension and positive attitude of the medical and administrative staff to the national-level data management system.
Conclusion: (1) Two main principles should be followed in the creation of the information management system: standardized system approach and application of advanced computer technologies; (2) standardization of information tools throughout the country improves efficiency of the operative management of national service of anesthesia, despite requiring the added task of updating and maintaining these tools.
Acknowledgements: Author thanks "Association Claire Gulian Guervin" (France) for support.

A-14

Quality of anaesthesia. A patient´s view

A.R. Heller, R.J. Litz, M. Horter, S. Horter, T. Koch

Department of Anaesthesiology, University Hosptial Carl Gustav Carus, Dresden, Germany

Background and Goal of Study: A multimodal anaesthesiological approach crucially contributes to both, patient safety and comfort and improves recovery (1,2,3). Within our anaesthesia quality assurance program we evaluated the patient´s view of anaesthesia systematically.
Materials and Methods: Contentment of the patients with the anaesthesiological service was evaluated by means of a questionnaire (38 items) over seven consecutive month in the department of urology. Qualitative data were judged from 1 (excellent) to 6 (insufficient).

Data analysis was performed with respect to the covariates age, extent of surgery, "anaesthesia experience" of the patient, and time since surgery. This study was approved by the Institutional Ethics Board.
Results and Discussions: The questionnaire return rate was 82%. After control of plausibility 803 questionnaires were eligible for analysis. Patients (57 ± 19 years) underwent minor (16%), intermediate (52%), and major (32%) urologic surgery which were performed in general anaesthesia (GA 63%) or regional anaesthesia (RA 37%). The pre-anaesthesia visit was judged 1.50 ± 0.55 which correlated with the assessment of the whole anaesthesia procedure. Preoperative anxiousness had a negative influence on the judgment of the visit (1.62 ± 0.52 vs. 1.50 ± 0.56, $p < 0.001$). Anxious patients, however, estimated oral premedication more effective (83% vs. 69% $p = 0.002$). 99.4% of the patients would again choose the performed anaesthesia procedure. In this regard RA (1.45 ± 0.60) was judged better ($p < 0.001$) than GA (1.54 ± 0.56). When oral premedication was considered to be successful postoperative nausea and vomiting was significantly suppressed (RR 0.39 CI95%: 0.23–0.68). While GA and RA did not differ in terms of headache or back pain GA was more often associated with a sore throat. Perioperatively

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patients were most concerned about: Pain 22%, anxiousness 18%, thirst 10%, no concerns 34%.

Conclusion: Appearance and communication of the anaesthesia team with the patient crucially determine his/her assessment of the anaesthesia-procedure. Every effort should be directed towards a satisfactory premedication.

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A-15

Will I be safe? How are the risks of anaesthesia presented in patient information materials?

A. Bonnett[1], C. Duncan[1], A.F. Smith[2]

Department of Anaesthesia [1]Liverpool Medical School, Liverpool, UK [2]Royal Lancaster Infirmary, Lancaster, UK

Background and Goal of Study: Written patient information is an important part of quality anaesthetic care. Proper assessment of the risk/benefit balance of different treatment options is only possible if information on risk is included.

Materials and Methods: We modified existing evaluation instruments [1,2] to develop an evaluation toolkit to analyse how risk and safety are presented. Two medical students with no prior knowledge of anaesthesia analysed photocopies of leaflets gathered as part of the UK Royal College of Anaesthetists' Patient Information Project. Scores were assigned in each of the following domains: formality of writing style, trust in the anaesthetist, confidence in understanding risks, presentation of safety and harm. We noted whether verbal or numerical estimates of likelihood were given, and whether references were cited to support them. Leaflets with high, low or divergent scores were subjected to further textual analysis to identify particular features to account for this.

Results: There were 60 leaflets on anaesthesia in general. Only 19 (32%) discussed risks specifically. Most leaflets were rated as inspiring confidence in the anaesthetist. Five expressed risk incidences numerically. These were either as percentages or odds. There were no attempts to compare anaesthetic risks with more familiar risks. Only 2 leaflets quoted sources for risk. These were both for risk of death due to anaesthesia, and were given as 1 in 10 000 and 1 in 185 000. Leaflets scoring particularly high or low on presentation of risk were analysed more closely. These were usually distinguished by 'tone of voice', and credibility of attempts to reassure. The use of the word 'safe' was particularly problematic.

Conclusions: The patient information leaflets in this sample deal with risk and safety poorly. This hinders proper involvement of patients in the process of care.

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Acknowledgement: We thank the RCA Patient Information Project for access to the leaflets.

A-16

Incidence density: a tool for reporting iatrogenic events in ICU

V. Vial, C. Charpentier, P. Welfringer, J. Garric, G. Audibert, M.C. Laxenaire, P.M. Mertes

Département dAnesthésie et Réanimation, Hôpital Central, Nancy, France

Background and Goal of Study: The assessment of iatrogenic events (IE) is an integral part of the quality of care in ICU. Their incidence is not clearly delineated and comparisons over time and between studies are difficult because data regarding IE exposure are usually lacking. We propose the use of incidence density and rate density to describe the occurrence of IE in ICU.

Materials and Methods: We monitored all admissions during a one-year period. IE were defined prospectively (nosocomial infections were the object of specific survey). An anonymous standardised data sheet was completed by any staff member (nurses, physicians). We recorded: the type of IE (related to invasive interventions, drugs, surgery or miscellaneous), its severity (minor or moderate, severe or fatal). Global incidence density was defined as: (IE number/total length of stay) $\times$ 1000. Specific incidence density was calculated using the duration of exposure to a specific risk. Specific incidence rate was calculated using the number of patient exposed.

Results and Discussions: We recorded 183 IE occurring in 105 patients among 456 admissions (23%). The types of IE were related to: invasive interventions 74%, drug 15%, surgery-related 4%, miscellaneous 7%. Severity was classified as minor or moderate 70%, severe 30% (3 deaths). Main incidence densities and incidence rates are reported in the table:

Global incidence density of IE (/1000 days of stay)	45
Self extubations (/1000 ventilator days)	24
Tracheotomy related incidents (/1000 tracheotomy days)	8
Central venous line related incidents (/100 exposed patients)	8.5
Peripheral venous line related incidents (/100 exposed patients)	5

Conclusion(s): IE in ICU are frequent and often severe. Systematic surveys using calculation of incidence densities and incidence rates could help to improve the quality of care and allow comparisons between ICUs.

A-17

The introduction of appraisal for consultant anaesthetists in NHS Scotland

N. Smart, D.A. Varveris

Department of Anaesthesia, Glasgow Royal Infirmary, Glasgow, United Kingdom

Background and Goal of Study: As part of a quality insurance process, appraisal was introduced as a national scheme for all consultant medical staff working in the NHS as of April 2002 following agreement between the UK Health Departments, the Royal Colleges and the British Medical Association (1). This study examines the beliefs and perceptions of key stakeholders at North Glasgow University NHS Trust and the Scottish Executive in the context of appraisal for consultant anaesthetists.

Methods: Results of this cross sectional study were based on analysis of data collected from qualitative semi-structured interviews with 7 key stakeholders across the organisation, qualitative data from a questionnaire to the Chief Medical Officer and qualitative and quantitative exploration by means of another questionnaire to 40 appraisee anaesthetists.

Results and Discussions: A mismatch of perception as to the aims and purposes of appraisal between individuals and groups was demonstrated. The needs of revalidation were shown to introduce ambiguity and confusion into the appraisal process, both real and perceived. Comparison to best practice appraisal systems identified a mixed picture of successes and failures. Respondents considered training problematic and deficits in performance measurement were apparent. Appraisal does meet many of the needs of the organisation, however, particularly with regard to clinical governance. A strategy for long term sustainability was not demonstrated.

Conclusion(s): There is a need for reassurance that appraisal will be developmental in tone. The way ahead lies in the careful presentation of potential benefits and, in practice, appraisal must be seen to be organisationally valid. Consideration should be given to separating the processes of appraisal and revalidation. Continuing education and training will be required and a support team to assist the implementation process in its early stages is suggested.

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A-18

Consequences of long term use of a commercially available epidural catheter on mechanical properities

P. Kim, G. Schuepfer, H.R. Gerber

Department of Anesthesiology and Critical Care, Kantonsspital Lucerne, CH-6000 Lucerne, Switzerland

Background and Goal of Study: Long-term application of epidural catheters may be required for patient comfort and adequate analgesia. Mechanical properties of epidural catheters may change due to their long placement in the subcutaneous tissue and the epidural space and complications may arise. Data on this issue is scarce.

Materials and Methods: To study the influence of the duration of epidural catheter placement, the catheters were tested after their removal using textile strength and pressure measurements for defined flow rates per minute. Five groups were studied. (a) new and unused catheters (reference group). (b) catheters removed immediately after lower limb surgery with an in situ duration less than 3 hours. (c) catheters in situ for 1–3 days. (d) catheters in situ for 4–6 days (e) catheters used for more than 6 days. Tensile strength was measured using two variables: The force used and lengthening till breakpoint. The force necessary to disrupt a catheter was measured at the tip of the catheter and at the previous skin exit point (possible kinking of a catheter 8–12 cm away from the tip), because these areas may be subjected to extra mechanical stress. Force was measured in Newton. A textile fiber quality assurance device was used for these tests (INSTRON 4500, Instron Co.,MA.,USA).

Results and Discussions: 123 epidural catheters (manufacturer: Fa. Braun, Melsungen, Germany) were investigated. The necessary pressure to achieve flow rates of 20 or 40 ml/h respectively were not significantly different among the five groups. Significantly more pressure for flow rates of 10ml/h was

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necessary in group e compared to groups a, b and d, but not c. Using a generalized linear regression model, duration of catheter placement in situ had a significant effect on the mechanical properties of the epidural catheters: The force at both areas tested (tip and position 8–12 cm from catheter tip) differed statistically significantly from the baseline values of group a ($p = 0.02$), although lengthening of the catheters after a defined stress did not differ between all groups.

Conclusion(s): In this laboratory investigation a set of flow and textile strength parameters were influenced significantly by the duration of the catheter placement in the epidural space and subcutaneous tissue.

A-19

Developing an evaluation tool for patient information about anaesthesia

L. White[1], J. Turner[2], C. Williamson[3], S. Parroy[4], A.F. Smith[2]

Department of Anaesthesia, [1]Southampton General Hospital; [2]Royal Lancaster Infirmary; [3]Patient representative, York; [4]RCA Project Co-ordinator, Southampton UK

Background and goal of study: The UK Royal College of Anaesthetists' Patient Information Project [1] was set up in 2000 to survey current practice and raise future standards in the provision of written information about anaesthesia. For this we needed (1) a rapid screening tool to categorise collected material and (2) a more detailed evaluation instrument to help identify features for closer scrutiny.

Materials and Methods: A group of three anaesthetists and a patient representative developed two evaluation tools. We reviewed two validated, commonly applied evaluation instruments [2,3]. These were designed for use on information for people with chronic disease. We modified them to acknowledge (1) that anaesthesia is not usually therapeutic in itself (2) offering choice may be less relevant than providing explanation (3) perceptions of risk and safety may be different. Emphasis on the factual content of words also tended to ignore their effect on patients' feelings. Our rapid evaluation tool allowed scores of 0,1 or 2 under each of 8 headings. This was applied independently to 185 leaflets by 2 observers. 30 leaflets were selected which had high scores. A more detailed evaluation questionnaire was then developed. This had 17 questions and scoring was by a numerical rating scale where possible. Five anaesthetists and six patient representatives applied the questionnaire to the selection of 30 leaflets.

Results and Discussion: The process of scoring was as useful as the scores themselves, as it enabled a structured approach to thinking about content and style. Scoring was also most valuable for identifying areas of divergence between anaesthetists and patient representatives, as this allowed more detailed exploration of reasons for disagreement.

Conclusion: Patient information materials in anaesthesia need to address different issues than in other branches of healthcare. We have developed evaluation tools to meet this need.

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A-20

PROSPECT – Procedure-specific clinical decision support for postoperative pain management

H. Kehlet[a], F. Bonnet[b], F. Camu[c], B. Fischer[d], R. McCloy[e], M. Puig[f], N. Rawal[g], C. Simanski[h], the PROSPECT Working Group

[a]Department of Surgical Gastroenterology 435 Hvidovre University Hospital, Hvidovre, Denmark; [b]Paris, France; [c]Brussels, Belgium [d]Redditch, UK [e]Manchester, UK [f]Barcelona, Spain [g]Örebro, Sweden hKöln, Germany

Background and Goal of Study: The PROSPECT Working Group of European anaesthetists and surgeons was convened to develop a new instrument to support clinical decision making in the management of post-operative pain. It was agreed that the program should be evidence-based and procedure-specific. Laparoscopic cholecystectomy was selected as the first procedure to be reviewed.

Materials and Methods: A systematic review was conducted to compare the efficacy and safety of analgesic, anaesthetic and operative techniques in influencing post-operative pain in adult patients undergoing laparoscopic cholecystectomy. The review was conducted according to the methods of the Cochrane Collaboration. MEDLINE was searched from 1966–June 2002 and EmBASE from 1988–June 2002. The data from 59 studies were reviewed by the PROSPECT Working Group and, with additional data and experience, classified into four groups: laparoscopic cholecystectomy evidence; transferable evidence from other procedures; practice-based evidence and practice recommendations.

Results and Discussions: The knowledge base was integrated with Arezzo® technology, which uses a powerful inference engine to process knowledge about clinical conditions. The combination of this sophisticated software and the data from the review resulted in a user-friendly program in which the clinician is presented with a range of therapeutic solutions and the supporting arguments for each. The clinical decision support pathway can be accessed from four different entry points: the complete anaesthetic/surgical pathway from pre-assessment to discharge; an individual step in the pathway (e.g. intra-operative); all management options (for all stages in the pathway); an individual management option.

Conclusion(s): This interactive procedure-specific guideline provides the user with the evidence to make optimal decisions for postoperative pain management in everyday clinical practice. It is the intention of the PROSPECT Working Group to develop clinical decision support programmes for a variety of commonly performed procedures.

A-21

Rigid nasendoscopy as a tool for difficult intubation – a mannequin study

N.Goodwin, I.P. Latto, I. Hodzovic, J.E. Hall

Department of Anaesthetics, University Hospital of Wales, College of Medicine, Cardiff, UK

Background and Goal of Study: Many strategies exist to deal with difficult intubations [1,2], but grade 4 intubation has been little investigated. This study examines the use of a rigid nasendoscope in a mannequin grade 4 intubation. Previous experience with this device is limited [3].

Materials and Methods: 40 anaesthetists of all grades were recruited. A grade 4 view was set up on a mannequin. Anaesthetists received 10 s tuition using a rigid 30° nasendoscope (Nas). The order was randomised in which they performed laryngoscopies with (Nas) and without (No Nas) this device, and with either a standard Eschmann re-useable bougie or an "optimally curved" bougie. An "optimal curve" bougie is an Eschmann bougie with a copper wire placed down the central aperture and bent into a curve that a previous experiment described as optimal. Time taken to obtain a view with the nasendoscope and to pass the bougie between the vocal cords was noted. Anaesthetists graded the view obtained with the nasendoscope. McNemar's test was used to compare the success rates with a Bonferroni correction for multiple testing. ANOVA with post hoc testing was used to analyse time difference between groups

Results and Discussion: There was a significant increase in successful placement of the bougie using both the nasendoscope and the "optimal curve" bougie.

Table: N° of successful attempts, out of a total of 40

	No Nas	Nas	p-value
Standard bougie	13	31	0.0003
"optimal bougie"	27	39	0.0044
p-value	0.0004	0.027	

There was no significant difference between groups in the time taken to pass a bougie. Mean time to obtain a view with the nasendoscope was 4.4 s. The view obtained by nasendoscopy varied from grade 1 to 3, with 16/40 reporting a grade 1 view.

Conclusion(s): The rigid 30 degree nasendoscope is a useful tool for improving laryngoscopic view and bougie placement in a grade 4 view. The "optimally curved" bougie further improves successful bougie placement.

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A-22

A Point-of-Care information system improves residents decision-making in simulated anaesthesia scenarios

Y. Yusim, H. Berkenstadt, A. Ziv, R. Katzenelson, D. Livingston, A. Perel

Department of Anesthesiology and Intensive Care, Sheba Medical Center, Tel Hashomer, Ramat Gan, Israel

Background and Goals of Study: The European Society of Anaesthesiologists sponsored the production of the On-Line Electronic Help (OLEH), a Point-of-Care information system going to be available on the anaesthesia monitor screen. The OLEH includes information that may improve patient safety by reducing errors in anaesthetic management. We have tested the potential value of the OLEH on the quality of decisions made by anaesthesia residents during simulated anaesthesia scenarios.

Materials and Methods: Twelve simulated scenarios were developed by the authors, and evaluated for content validity and expected performance

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by 5 independent senior anaesthesiologists. For each scenario the correct sequence of action was determined and a score assigned to each correct decision. After 30 minutes of a training session, 25 participants (so far) were presented with 6 scenarios with, and 6 without, the ability to use the OLEH. Scenarios were randomly balanced. Participants were encouraged to respond as fast as they could, though time to task completion was not limited. Two ratters evaluated the answers independently.

Results and Discussion: Using the OLEH, the scores achieved were higher than those without the OLEH in the following scenarios: MAO Inhibitors ($p = 0.04$), latex allergy ($p = 0.007$), myasthenia ($p = 5 \times 10^{-7}$), malignant hyperthermia ($p = 7 \times 10^{-4}$), local anaesthetic toxicity ($p = 0.02$), Ehlers Danlos syndrome ($p = 5 \times 10^{-6}$), bradycardia ($p = 1 \times 10^{-7}$), wide complex tachycardia ($p = 0.04$), paediatric cardiac arrest ($p = 1 \times 10^{-7}$), and pheochromocytoma ($p = 0.008$). In 2 scenarios (head trauma and narrow complex tachycardia) there was no difference in scores between the groups. The time for task completion was similar in 9 scenarios, and longer in 3 scenarios when the OLEH system was used. Seventy-two percents of the residents found the use of the OLEH to be easy, and in 55% of the scenarios it was considered by the residents to be helpful.

Conclusion: The OLEH significantly decreased the number of errors made by residents during the simulated management of variable scenarios and hence seems to be able to contribute to better decision making and to improved patient safety. More information on the potential and practical value of the OLEH needs to be gained by a more realistic simulation and use in the clinical environment itself.

A-23

Participatory design of software for sharing anaesthetic critical incidents between hospitals

J. Rooksby[1], B. Gerry[1], J. Rogers[2], S. Sharma[3], A.F. Smith[3]

Department of Anesthesia [1]Lancaster University; [2]BT; [3]Royal Lancaster Infirmary, Lancaster, UK

Background and goal of study: Critical incident reporting is well established in anaesthesia. In the UK, most departments of anaesthesia collect and discuss incident reports but the lessons are not often shared more widely. We aimed to explore the factors affecting reporting to help us design a way of linking individual departments together.

Methods: Semi-structured interviews with purposively sampled anaesthetists at hospitals in the North West of England and other stakeholders in incident reporting. A multidisciplinary framework has been applied to the analysis of these data, bringing together anaesthesia, computer science, organisational behaviour and sociology.

Results and discussion: (1) *Technical aspects*. Most hospitals use paper for initial reporting of incidents and as a basis for local discussion. Respondents felt that computer-based systems are an effective way of communicating reports between sites, but are less useful for authoring and reading reports. (2) *Proliferation of reporting schemes.* Local hospital-wide adverse incident reporting systems and a national scheme run by the new National Patient Safety Agency have been introduced in the last few years, but neither focuses specifically on anaesthesia. Respondents were reluctant to consider yet another reporting system. (3) *Trust*. Individual departments favour anonymous reporting and anaesthetists are also reassured that they are being judged by their peers. The other schemes prefer individuals to be identified. Whilst this allows full investigation and root cause analysis, anaesthestists feel it may expose their 'mistakes' to those who may not understand the context in which they work.

Conclusion: From our work it has become clear that a system to enable sharing incidents should focus on supporting existing incident reporting and discussion systems rather than trying to replace them (e.g. simple email rather than new discussion forum). Formative evaluation of this software will take place in a second round of interviews.

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A-24

Using the journal club format to foster critical appraisal skills in anaesthetic trainees

S.R. Knight, A.F. Smith

Department of Anaesthesia, South Manchester University Hospitals NHS Trust, Manchester, United Kingdom

Background and Goal of Study: Critical appraisal is a skill essential for the effective application of research evidence in clinical practice [1] but often does not feature in postgraduate anaesthetic training programmes. We have used a structured journal club format to promote critical appraisal skills in trainees in anaesthesia.

Materials and Methods: We put together a tutorial programme consisting of 10 hour-long sessions over 5 months. We aimed to teach trainees about (1) different study designs (randomised controlled trial, case-control study, qualitative work etc) and how to judge validity in each (2) the strengths and weaknesses of different sections of anaesthesia journals (editorial, review, correspondence etc) (3) the commoner terms used in evidence-based medicine and numerical expressions of the results of research. Participants completed a questionnaire asking for a subjective assessment of their understanding (scored 1 to 5) of various terms related to critical appraisal before and after the course. Comments were also invited. The median responses were compared using the Wilcoxon rank sum test.

Results and Discussion: Seven trainees took part. The programme was well received by participants. Many respondents commented that they would be more sceptical of research results in the future. Scores for self-professed understanding of terms were generally high before the programme started, and overall were not statistically different at the end. However, we felt that participants had overestimated their initial knowledge. For the faculty's part, such a programme is more challenging to run than a traditional journal club as it needs confidence in clinical epidemiology/biostatistics as well as clinical knowledge.

Conclusion: The educational potential of the journal club can usefully be extended to foster critical reading of anaesthesia journals and an understanding of the principles of evidence-based medicine. Realising this potential needs both clinical and appraisal skills in the teaching faculty.

Reference:

1 Møller AM, Smith AF, Pedersen T. *BrJ Anaesth* 2000; 84: 615–8.

A-25

Improving efficiency and economics in the operating room by means of overlapping induction of anaesthesia

R. Hanß, M. Bauer, B. Buttgereit, H.P. Tonner, A. Blunck, J. Scholz

Department of Anaesthesiology and Intensive Care Medicine, University Hospital Kiel, Kiel, Germany

Background: Overlapping Induction (OI), i.e. induction of anaesthesia before the end of the previous case may improve efficiency and economic outcome. We studied OI in a prospective controlled surgical setting.

Material and Methods: Three different settings were performed. First, OI was done in a visceral surgery unit in two and three OR's respectively. Second OI was performed in an ENT-unit in two OR's. Each setting was compared with a baseline-period of non-overlapping induction (BL). To evaluate efficiency, we compared the total number of cases (TNC), OR-Occupancy (OR-OC), Turn-Over-Time (TOT) and "Surgical Break" (SB) (end of surgical procedure→ start of next case surgical procedure). To estimate the economical benefit the break-point of the mean case-mix-index (CMI) was calculated based on a base-rate of 2300 Euros and staff costs (attending physician and nurse) (1). For comparability the operating-time (OT) and the "Daily End of Work" (DEW) is shown in addition. The Student's t-Test was used for statistical analysis (mean, standard deviation; $p < 0.05$)

Results: During 180 days (90 OL, 90 BL) a total number of 426 cases were studied. Demographic data and kind of operations did not differ between groups. OI can be profitable if a CMI > 1.74 is provided.

Table 1 shows the results. (times in hh:mm):

	TNC	TOT	SB	OR-OC	OT	DEW
OI	240	0:53 ± 0:19	0:26 ± 0:20	6:19 ± 1:24	1:45 ± 1:19	15:10 ± 1:23
BL	186	1:05 ± 0:24	0:43 ± 0:22	6:02 ± 1:42	2:00 ± 1:19	15:25 ± 1:26
p	0.018	0.001	⩽0.001	0.25	0.063	0.062

Conclusions: OI can improve hospital income and OR-efficiency. It leads to a significant increase of NC and decrease of TOT and SB. No significant differences were shown in OR-OC, OT and DEW. We conclude that OI may improve hospital income (CMI > 1.74) and further optimise OR-workflow, even in spite of additional staff costs.

Reference:

1 M. Bauer et al. Minerva Anestesiologica 2001; 67: 284–9.

A-26

Incidence of serious perioperative anaphylactoid reactions

J. Navarro, F. Escolano, J.C. Sanchez, R. Mansilla, J. Castillo

Department of Anestesiología y Reanimación, Barcelona, Spain

Background and Goals: Determine the incidence and the immune mechanisms implied in the severe perioperative anaphylactoid reactions (AR).

Material and Methods: Prospective epidemiological study carried out over a period of six years (1996–2000). In this study, all patients that had undergone anaesthesia at this hospital were included. We have only analysed the serious AR (grades III–IV)[1]. In the event of RA, a formal protocol was

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completed and blood and urine samples were taken over a period of the second, sixth and twenty-four hours.The serical triptase, complement factors (C3,C3a,C4), urinary metilhystame (Pharmacy Upjohn Diagnostics AB, Uppsala, Sweden), IgE latex and hemostasia tests were determined.[2]

Results: Over the period analysed, 70850 anaesthesia were carried out.Ten serious AR resulted (1 case out of 7085 anaesthesias).In 8 patients (2 cases of diclofenaco, 1 metamizole, 1 atracurium,1 cis-atracurium,1 cyprofloxacin, 1 protamin, 1 latex) the immediate immune alergical study was positive with a rise of triptase and/or urinary metilhystamine and not in one single case were changes detected in the factors of the complement nor in the hemostasia. The IgE specifical to latex was found high in one case.

Conclusions: The incidence of serious AR at our hospital is 1 case/7085 anaesthesias. In 80% of these, the findings of triptase and/or urinary metilhystamine have been positive. The most implicated drugs have been the nonsteroideal antiinflamatory drugs, followed by muscle relaxants. The periods of greatest risks have been the anaesthetical induction and the postoperatory in the reanimation unit.

References:

1 Laxenaire MC, Mertes PM. *Br. J. Anaesth.* 2001; 87: 549–558.

2 Escolano F, Valero A, Huguet J. *Rev. Esp Anestesiol Reanim*. 2002; 49: 286–293.

A-27

Preoperative assessment of difficult intubation in ENT surgery

D. Janjevic, R. Kolak, V. Pekovic

Department of Anesthesiology, Udruzenje anesteziologa Jugoslavije (Yugoslav Society of Anesthesiology); ESA, Clinic Center, ENT Clinic, Novi Sad, Yugoslavia

Background and Goal of Study: Difficult intubation is often unexpected and it represents a constant problem (1). The aim of this study is to assess the importance of (a) Mallampati test (MT) in predicting possible difficulties during endotracheal intubation and (b) preoperative indirect laryngoscopy.

Materials and Methods: In this prospective study, 162 randomly selected ASA 1–3 patients requiring tracheal intubation for elective ENT surgery were assessed. Patients who are known to be difficult to intubate due to anatomical anomalies, cancer of larynx were excluded. Intubation is considered difficult when there are more than three attempts, blade change, use of gum elastic bougies. Each patient was evaluated preoperatively by one senior anesthesiologist. Preoperative indirect laryngoscopy (IL) and MT were performed in each patient. MT class III and IV were used as the criterion for predicting difficult intubation. Predictors of difficult intubation were evaluated by calculating their sensitivity, specificity, PPV and NPV.

Results and Discussions: 162 patients of both sexes were studied (83 female, 79 male); age Med = 42, Sd = 14.70; height Med = 169, Sd = 10.79; BMI Med = 25, Sd = 3.99. The incidence of difficult intubation was 3.6%. Indirect laryngoscopy was possible in all patients and all structures were visible.The sensitivity and specificity of the MT were 82% and 92%, respectively. MT predicted 16 difficult intubations, but in our study only 5 such cases occurred. This result represents a PPV of 31%. According to MT, in cases of 146 patients easy intubation was expected, but in our study this was true for 145 patients. NPV is 99%.

Conclusion(s): MT is significant in difficult intubation assessment, but it shows moderate sensitivity. Preoperative laryngoscopy is of no significance in assessing endotracheal intubation in non-cancer ENT surgery.

Reference:

1 K. Karkouti, D.K. Rose, D. Wigglesworth, et al. Can J Anaesth, Aug 1, 2000; 47(8): 730–739.

A-30

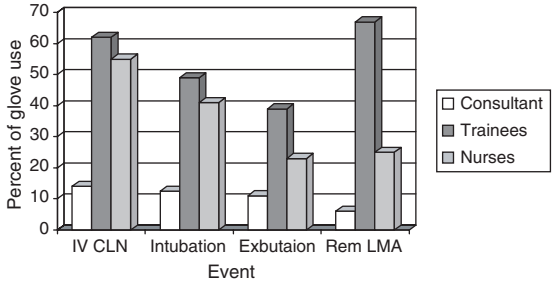
Compliance with gloving – Have we learnt any thing?

B. Gouda, M. Murray

Department of Aanesthesiology, Waterford Regional Hospital, Waterford, Ireland

Background and Goal of study: The risk of acquiring blood borne diseases via professional contact with body fluids is both real and dangerous. The only published study[1] of gloving practice during perioperative period among anaesthetists showed an overall compliance rate of 61.8% among trainees and 33.7% among attendings. We hypothesized that compliance with the glove use among anaesthesia personnel is poor and has changed little over the years.

Materials and Methods: After obtaining regional ethical committee approval data were gathered by direct prospective blinded observation of pattern of gloving among consultants (8), trainees (9) and anaesthetic nurses (14). Each one was observed on 10 occasions at IV cannulation, intubation or insertion of LMA, extubation and removal of LMA, over an 8-month period. The results are summarised in the graph.



Significantly two consultant anaesthetists never wore glove for any events and further three wore only once during 40 observations. Adherence to the use of protective gloves was seen most frequently among anaesthetic nurses followed by trainee anaesthetists. We expected the compliance would be poor among the consultant anaesthetists but not to the extent we observed.

Conclusion: There is significant difference between all 3 groups ($p < 0.01$). One possibility is the presumption that experience might reduce the chance of direct body fluid contact. However with the rising incidences HIV, hepatitis-B & hepatitis-C the above figures are a source of great concern.

Reference:

1 Ben-David B. J *Clinical Anesth* 1997; 9(7): 525–6.

A-31

Quality of recovery in Greek patients undergoing general anesthesia

P. Giannakopoulos, A. Volanaki, V. Skandalou, K. Stamoulis, S. Lyka, E. Karamihali

Department of Anesthesiology, Evangelismos Medical Hospital, Athens, Greece

Background and Goal of Study: Measurement of patient-rated aspects of recovery of anesthesia has been accomplished by using several scales such as the Myles Quality of Recovery score (QOR). Goal of our study was to evaluate the satisfaction with anesthesia and quality of recovery in Greek patients.

Materials and Methods: We studied 40 patients undergoing various surgical procedures of low or intermediate risk under general anesthesia. The 9-item QOR was translated to the Greek language and was utilized the day before the operation and 24 hours postoperatively. We compared the preoperative and postoperative QOR scores and we performed reliability testing with the aid of a visual analog scale (VAS). A comparison of preoperative and postoperative scores was made using various statistical tests (Wilcoxon signed rank tests, MANOVA and Cronbach alpha).

Results and Discussions: The mean value of preoperative QOR was 13.78 ± 2.35 and of the postoperative QOR was 11.61 ± 3.01. The median preoperative QOR was 14 and postoperatively was 12. The overall QOR score was significantly reduced postoperatively ($p < 0.003$). A significant reduction was also noted on questions 1 (feeling of general being $p < 0.046$), 4 (ability to look after personal hygiene unaided $p < 0.009$), 5 (ability to urinate and have no bowel function problems $p < 0.025$), 8 (be free from nausea and vomiting $p < 0.029$) and 9 (be free from severe, constant or moderate pain $p < 0.017$). Females showed a significantly lower preoperative and postoperative QOR than males ($p < 0.03$). Cronbach alpha was 0.6109.

Conclusion(s): The group of patients studied in our institution showed that a significant decrease in overall satisfaction with anesthesia due to experiencing significant pain, nausea and vomiting, urinate and bowel function problems, reduction of ability of self support and a reduction of overall feeling of general being. Women showed a significantly lower QOR score than men.

Reference:

Myles P. Anesth Analg 1999; 88: 83–90.

A-32

Anaesthesia-related mortality – Could safety be improved?

J. Samarütel

Department of Anaesthesiology and Intensive care, University of Tartu, Tartu, Estonia

Background and Goals: For social and medico-legal reasons, compounded by lack of universally accepted criteria, most data about anaesthesia-related mortality, collected by voluntary and confidential reporting, remain unreliable with 200-fold ranging from 0.05 to 10 per 10000 anaesthetics (1).

Material and Methods: Estonian Society of Anaesthesiologists has until now succeeded in retaining system of annual reporting of key data about

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professional activities in every hospital with presentation and discussion of results at Society's meeting. Perioperative death was considered anaesthesia related when the chain of morbid events ending in fatality began with anaesthesia-specific complication (no matter when the patient died).

Results: For 812000 anaesthesias in 11 years (1991–2001) overall related mortality was 0.6/10000 anaesthetics (1:19050 for 704800 GA-s and 1:11860 for 106700 RA-s). During years studied, there has been considerable improvement of safety, mainly of general endotracheal anaesthesia – mortality has fallen from 1:4770 in 1991–1995 to 1:26900 in 1996–2001. Progress in safety of spinal anaesthesia (which includes all deaths in RA group) has been less conspicuous – related mortality remains 1:11650 in 1996–2001 vs 1:5590 in 1991–1995. Intravenous (n = 234500) and mask inhalational anaesthesia (n = 124200), mainly used for short and less complicated cases, have been comparatively safer during all years studied, without significant change (mortality 1:78170 and 1:41400). Respiratory, combined respiratory/cardiovascular events and relative overdose or ill-advised choice of anaesthetic agents/techniques have been dominating identifiable causes of anaesthetic mortality.

Conclusions: As most of deaths are still caused by avoidable errors in management, there remains much room for improvement in safety of anaesthesia.

Reference:

1 Arbous M.S. et al Anaesthesia 2001; 56: 1141–1153.

A-33

Evaluation of 706 anaesthesias for MH-diagnostiks

M.U. Gerbershagen, F. Wappler, M. Fiege, R. Weißhorn, K. Kolodzie, J. Schulte am Esch

Department of Anaesthesiology, University Hospital Hamburg-Eppendorf, Hamburg, Germany

Background and Goal of Study: Experts do not recommend the prophylactic application of dantrolene prior to triggerfree anaesthesia in malignant hyperthermia susceptible patients [1]. But data fulfilling the criteria of evidence-based medicine are missing. Three studies with a total amount of 90 MH-positive patients showed no complications during regional or general anaesthesia without dantrolene prophylaxis [2]. Another retrospective analysis without prophylaxis in MH susceptible patients for muscle biopsies presented five cases with potential MH-symptoms [3]. Therefore, data is not unequivocal.

Materials and Methods: We analyzed 706 anaesthetic procedures retrospectively for the purpose of MH-diagnostics from 1991 up to today, which have been performed lacking dantrolene prophylaxis.

Results and Discussion: In 303 patients tested MH-positive (MH-susceptible and MH-equivocal) 67 triggerfree general anaesthesias were performed as well as 236 regional anaesthesias (femoral nerve block or local anaesthesia) with or without analgosedation. In none of these patients MH-typical symptoms such as unclear temperature elevation, tachycardia, arrhythmia or tachypnoea could be observed peri- or postoperatively. The standardized measurement of the creatine kinase value in blood prior to surgery and 4 to 5 hours after surgery showed no pathologically elevated value respectively significant change in preoperatively existing pathological values.

Conclusion: These results support the opinion that MH susceptibility does not in general elevate the risk of anaesthesia. When performed triggerfree and with an optimal perioperative management dantrolene prophylaxis does not seem to be necessary. Since only a far larger number of cases can proof the safety of a procedure, the present data is a first contribution for a future multicenter analysis.

References:

1 Hopkins PM. *Br J Anaesth* 2000; 85:118–128.
2 Ørding H, Hedengran AM, Skovgaard LT. *Acta Anaesthesiol Scand* 1991; 35:711–716.
3 Carr AS, Lerman J, Cunliffe M . *Can J Anaesth* 1995; 42:281–286.

A-34

Systematic review (metaanalysis) on ginger (Zingiber officinalis) to prevent postoperative nausea and vomiting

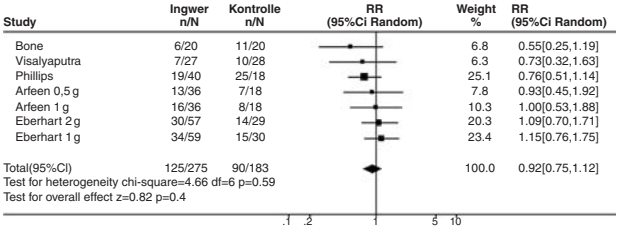
P. Kranke[1], G. Geldner[2], H. Wulf[2], L. Eberhart[2]

[1]Department of Anaesthesiology and Intensive Care, University of Würzburg, Würzburg, Germany; [2]Department of Anaesthesia, Philipps-University Marburg

Background and Goal of Study: In a recent systematic review on trials investigating the possible antiemetic effect of ginger (Zingiber officinalis) it was concluded that ginger was a promising antiemetic, but the clinical data available so far were insufficient to draw firm conclusions. Meanwhile new data has accumulated. Thus, an updated metaanalysis was performed.

Materials and Methods: Using several search strategies, randomized controlled trials (RCT) using ginger to prevent postoperative nausea and vomiting (PONV) were systematically searched electronic databases (Medline, EMBASE, Cochrane Controlled Trials Register). Four published articles were retrieved [2–5] and data on the incidence PONV within the first 24 hours postoperatively were pooled together with recently conducted RCT [6]. A random effects model was used to calculate pooled relative risk (RR) with its 95%-confidence interval (CI).

Results and Discussions: The following Forrest-plot shows the extracted data and the relative weight of the seven study arms. Pooled RR to suffer from PONV after oral premedication with ginger was 0.92. Since the 95%-CI (0.75–1.12) included the value 1,0 this was not regarded as statistically significant.



Conclusion: Results from this updated metaanalysis disprove a relevant antiemetic effect of the herbal remedy ginger in the PONV setting.

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3 Bone ME et al. Anaesthesia 1990; 45: 669–71.
4 Phillips S et al. Anaesthesia 1993; 48: 715–7.
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6 Eberhart LHJ et al. Anaesth Analg: in print.

A-35

A Systematic review of postoperative visual loss – Hemodynamics implicated

C. Voe, T. Bullard, J. Zavaleta, B. Bravenec, M. Ramsay

Department of Anesthesiology and Pain Management, The University of Texas Southwestern and Baylor Medical Center, Dallas, USA

Background and Goal of Study: Postoperative blindness, a rare, but tragic complication of surgery has been widely associated with intraoperative prone positioning and ocular trauma. There is speculation about possible precipitating events. However, as the event is so rare, no clear conclusions have been drawn. The purpose of this study was to perform a systematic literature review of all published reports of unexpected postoperative vision loss in order to assess possible precipitating factors.

Materials and Methods: A computer-assisted search in MEDLINE/PubMed, MD Consult, Cochrane Reviews, and Current Contents covering the period from January 1950 to September 2002 was performed to identify published case reports or case series in the English literature of peer-reviewed medical journals. Defined exclusion criteria were then used to remove cases with obvious postoperative vision loss etiologies (i.e. ocular surgeries, overt facial or head trauma, etc.).

Results and Discussions: 166 cases of postoperative vision loss met both our inclusion and exclusion criteria. Forty-two of these cases followed surgical procedures performed in the prone position. Only 18 cases were associated with known intraoperative ocular trauma. Eighty-nine percent of cases where an identifiable cause of blindness was excluded involved significant hemodynamic compromise.

Conclusion(s): Contrary to the prevailing view, a significant proportion of cases of unexpected postoperative vision loss does not involve prone positioning or intraoperative ocular trauma. Rather, hemodynamic compromise has been implicated as a major contributing factor.

A-36

Effect of fluid administration on recovery after laparoscopic cholecystectomy – A randomised, double blind study

K. Holte, B. Klarskov, D.S. Christensen, C. Lund, K.G. Nielsen, P. Bie, H. Kehlet,

Departments of Surgical Gastroenterology 435 and Anaesthesiology, Hvidovre University Hospital, Department of Physiology, Univ. of S. Denmark, Denmark

Background and Goal of Study: Intraoperative fluid administration is variable due to limited knowledge of physiologic and clinical effects of different fluid substitution regimens(1). We recently found 40 ml kg^{-1} lactated Ringer's solution (LR) to significantly decrease pulmonary function in volunteers (2).

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On the other hand, compensatory fluid administration for preoperative dehydration may improve outcome(3).
Materials and Methods: In a double-blind study, 48 ASA I-II patients undergoing laparoscopic cholecystectomy were randomised to 15 ml kg^{-1} (group 1) or 40 ml kg^{-1} (group 2) intraoperative administration of LR after IRB approval. All other aspects of perioperative management, as well as preoperative fluid status were standardised. Primary outcome parameters were pulmonary function (spirometry), exercise capacity (sub maximal treadmill test), balance function (BalanceMaster®), pain, nausea and vomiting, hospital stay and recovery.
Results and Discussions: Pulmonary function and exercise capacity were significantly improved in group 2. Also balance function, nausea, general well-being, thirst, dizziness, drowsiness and fatigue were significantly improved in group 2. Finally, significantly more patients in group 2 fulfilled the discharge criteria and were discharged on the day of surgery (see table).

	Group 1	Group 2	p value
PADDS ⩾ 9 (discharge criteria) the day of surgery	16/8	23/1	0,012
Discharge at day of surgery	15/23	21/22	0,022

Conclusion(s): Intraoperative administration of 40 ml kg^{-1} compared to 15 ml kg^{-1} of LR improves perioperative organ functions and recovery and shortens hospital stay after laparoscopic cholecystectomy.
References:
1 Holte K, Sharrock NE, Kehlet H. Br J Anaesth 2002; 89: 622–32.
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Acknowledgements: University of Copenhagen and the Danish Research Council (no. 22-01-0160).

A-37

Provision of a pre-operative oral carbohydrate drink reduces length of hospital stay in uncomplicated elective surgical patients

Z. Hofman, J. Drunen van, K. Yuill, R. Richardson, I. Davidson, T. Cecil, B. Moran, O.J. Garden

Departments of Clinical Nutrition and Diets, Numico Research, Wageningen(NL), Royal Infirmary/Queen Margareth University, Edinburgh, North Hampshire Hospital, Basingstoke (UK)

Background and Goal of Study: Compared with fasting, provision of a pre-operative carbohydrate (CHO) drink up to 2 hours prior to anesthesia can improve well being (1) and insulin sensitivity (2) and therefore may have an effect on post-operative length of hospital stay (LOS) (3).
Materials and Methods: In this double blind controlled trial, 102 major abdominal surgical patients were randomized to receive either a CHO rich clear fluid (Nutricia preOp®) or placebo (PL) – 800 ml on evening before and 400 ml 2 hrs before surgery. Difference in LOS between groups was tested by a Mann Whitney U test and by ANOVA after natural log transformation. In an a priori defined subgroup of uncomplicated patients (n = 79) and a per protocol analysis (no complications and taking all 1200 ml)(n = 58), duration of surgery, gender and age were included as co-variates. In an intention-to-treat (ITT) analysis (n = 102) complications were also included as a co-variate
Results and Discussions: Results of LOS (days) are shown in table.

	PL	CHO	p-value
Median – MWU test			
ITT	10.0	9.0	0.650
Uncomplicated	9.0	8.5	0.148
Per Protocol	10.0	8.0	0.070
EMM ± SEM (ANOVA)			
ITT	11.2 ± 0.8	10.6 ± 0.7	0.518
Uncomplicated	9.5 ± 0.5	8.5 ± 0.5	0.192
Per Protocol	9.8 ± 0.7	7.9 ± 0.6	0.040

22 patients (PL, n = 11, CHO, n = 11) developed complications unrelated to the intervention. In these patients there were no significant differences in LOS between groups.
Conclusion(s): Pre-operative oral CHO provision significantly reduced post-operative LOS in uncomplicated patients taking the prescribed dose. It did not influence post-operative complication rates.
References:
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A-38

Comparison of metoclopramide, ondansetron and granisetron for prophylaxis of post-operative nausea and vomiting after laparoscopic surgery

H. Oksuz, B. Zencirci, M. Ezberci

Department of Anaesthesiology, TARK [THE SOCIETY OF TURKISH ANESTHESIA AND REANIMATION], Sutcu Imam University, Medical Faculty, Kahramanmaras, Turkey

Background and Goal of Study: PONV is a widely encountered complication seen in 30% of non-medicated patients with anti-emetic drugs(1) and 40–75% (2) of patients who had undergone laparoscopic surgery.
Materials and Methods: We conducted this study in a group of 75 non-premedicated ASA I-II patients who had been planned to have laparoscopic cholesistectomy operation. Patients were allocated into three random groups. 30 minutes before the induction, 1st group (M) treated with 10 mg metoclopramide, 2nd group (K) with 40 mcg.kg^{-1} granisetron and 3rd. group (Z) with 15 mcg.kg^{-1} ondansetron iv. Induction wassupplied with 2–2.5 mg.kg^{-1} propofol and 0.6 mg.kg^{-1} rocuronium and also maintanence with 1–2% MAC sevofluorane, 50%O_2-Air and 1–1.5 mcg.$kg^{-1}h^{-1}$ fentanyl perfusion. Fentanyl effect was reversed with naloxane 15 minutes before the termination of the operation procedure. Cases were evaluated in the first 24 hours post-operatively according to the incidance of nausae and vomiting, additional anti-emetic drug requirements and also cost-effectiveness of the regimen.
Results and Discussions: Evaluated nausea and vomiting scores in the first 3 hours period revealed that each of the drugs had the similar antiemetic effect ($p > 0.05$).Nausea and vomiting scores, evaluated between the 4–24 st hours, also revealed that M group's scores were obviously higher than K and also Z groups ($p < 0.001$). According to the observation findings of anti-emetic drug requirements in the first three-hours period, none of the cases of the group K needed to be administered granisetron, but three cases of each M and Z groups neeeden antiemetic drug injection. Comparison of incidences of dose administrations were statistically nonsense among the groups ($p > 0.05$).
Conclusion(s): It is determined that granisetron is more effective than metoclopramide and ondansetron for the prophylaxis of PONV after laparoscopic surgery, cost-effectiveness of the drug is similar to ondansetron but more expensive than metoclopramide. While regarding the added costs of the theraphy, it is a good alternative .
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A-39

Assessment of psychomotor recovery after general anaesthesia: A study comparing continuous infusion of propofol with inhalation of sevoflurane

R. Hatzidaki, E. Koraki, E. Apostolidou, D. Vassilakos

Department of Anaesthesia, AHEPA University Hospital, Thessaloniki, Greece

Background and Goal of Study: The objective of the study was to compare the effect on the psychomotor recovery of the short acting new sedative drugs propofol and sevoflurane.
Materials and Methods: Double blind control trial involving 26 patients (m15/f:10, aged 54.68 ± 18.25years). 19 were sedated with propofol and 7 with sevoflurane (target BIS value < 30) using for both groups the sort acting narcotic remifentanyl. Induction and post operative analgesia were identical for all patients. The 2 groups were competitive in age, weight, duration of anaesthesia, type of surgery. During the procedure the changes in BIS, ABP and HR were registered every 10 min. Post sedation psycho motor tasks and visual analog scales (VAS) of mental and physical sedation were assessed in 2 hours post operatively.
Results and Discussions: Psychomotor test (mean ± SD)

	Propofol	Sevoflurane	Significance
Immediate recall No of pictures	4.52 ± 2.09	5.08 ± 1.48	NS
Attention No of letters missed	1.05 ± 1.78	1.16 ± .98	NS
Action judgment No of mistakes	0.23 ± 0.56	0.33 ± 0.51	NS
VAS of tranquilization	1.31 ± 2.54	3.80 ± 3.03	+NS (p = 0.053)
VAS of sedation	3.05 ± 3.51	3.90 ± 3.50	NS
VAS of headache	0.48 ± 2.62	3.20 ± 3.83	*S (p = 0.016)
VAS of pain	3.11 ± 3.14	5.40 ± 2.88	NS

There were not significant group differences in registered variables of BIS, ABP and HR conclusions.

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Conclusion(s): We conclude that the psychomotor recovery characteristics after propofol and sevoflurane are similar. VAS measures of headache and marginally of tranquilization were significantly more affected by sevoflurane than by propofol.

A-40

Comparison of the quality of recovery between desflurane and sevoflurane

T. Tuna*, J. Massaut*, O. Detriche*, S.J. Hosseini Bidgoli*

Department of Anaesthesiology and Intensive Care Medicine, University Hospital Brugmann, Free University of Brussels, Belgium

Background and Goal of study: We have observed in our daily practice different quality of emergence from anaesthesia between sevoflurane and desflurane. Different authors have reported this for ambulatory anaesthesia (1,2). We have decided to compare the quality of the recovery between desflurane and sevoflurane in a double blind prospective study for laparoscopic surgery.
Material and Methods: In 30 adult patients, ASA I and II, undergoing elective inguinal hernia repair or cholecystectomy by laparoscopic technique, anaesthesia was induced with propofol, sufentanil, cisatracurium and maintained with 0,85 MAC desflurane or sevoflurane with 60% air in oxygen. Early emergence from anaesthesia was assessed in the operating room by measuring time to spontaneous movement, cough, tracheal extubation, opening of the eyes and stating correct age, name and body parts. The return of cognitive functions in the late recovery phase was assessed in the post-anaesthesia care unit by the modified post-anaesthesia recovery score, the Trail Making Test, and Digit Symbol Substitution Test.
Results: In the early recovery phase, time to tracheal extubation, opening eyes, telling correct name, age and body parts occurred significantly faster in the desflurane group than in the sevoflurane group ($p < 0{,}001$). The mean <<triple orientation>> time (name, age, body parts) was 523 seconds for desflurane compared to 864 seconds for sevoflurane ($p < 0.001$). In the late recovery phase, desflurane patients had significantly greater post anaesthesia recovery scores during thirty minutes after extubation and came to complete scores earlier than sevoflurane patients ($p < 0.05$). Desflurane patients had more correct response to the Digit Symbol Substitution Test and fewer error responses to the Trail Making Test ($p < 0.05$).
Conclusion: Desflurane anaesthesia was superior to sevoflurane anaesthesia, not only in the emergence of anaesthesia but also in the recovery of cognitive functions, these differences disappearing after thirty minutes.
References:
1 Nathanson MH. *Anesth Analg* 1995; **81**: 1186–90.
2 Song D. *Anesth Analg* 1998; **86**: 267–73.

A-41

Sevoflurane versus desflurane: hemodynamic parameters and recovery characteristics

S. Gergin, B. Çevik, G.B. Yildirim, E. Çiplakligil S. Çolakoglu

Department of Anesthesiology and Reanimation, Dr. Lütfi Kirdar Kartal Education and Research, Kadiköy/Istanbul, Turkey

Background and Goal of Study: Recovery from prolonged anesthesia might be a problem especially in major surgical procedures[1,2]. The purpose of this study was to compare the hemodynamic, emergence and recovery characteristics of sevoflurane with those of desflurane in nitrous oxide anesthesia.
Materials and Methods: Forty patients (ASA I–II, ages 30–65y) scheduled for cholecystectomy procedures were randomly assigned to receive either sevoflurane 1% (Group I) or desflurane 3% (Group II) for maintenance of general anesthesia with nitrous oxide 50% in oxygen after standardized induction sequence consisting of fentanyl 1 μgr.kg^{-1}, thiopental 4 mg.kg^{-1} and vecuronium 0.1 mg.kg^{-1} intravenously. Measurement of hemodynamics occurred every 2 min prior to skin incision and every 5 min thereafter. The times for discontinuation of inhaled anesthetics to spontaneous movement, response to painful stimuli, extubation, recall of name and hand grip on command were measured in a standardized fashion.
Results and Discussions: The patient characteristics in the two groups were similar. Mean anesthesia duration was 96.2 ± 28.85 min and 124.65 ± 48.81 min in Group I and II respectively ($p < 0.05$). The two groups did not differ with respect of hemodynamic stability. Time to extubation, recall of name and hand grip on command were shorter in Group II ($p < 0.01$) (Table). At 5 and 15 min, significantly higher percentages of patients in Group II had recovery scores of ⩾10.

	Group I (min)	Group II (min)
Spont movement	4.40 ± 1.76	3.60 ± 1.66
Response to pain	5.25 ± 2.24	4.25 ± 1.97
Extubation	7.05 ± 2.35	5.40 ± 1.23*
Recall of name	8.00 ± 3.01	6.10 ± 1.44*
Hand grip	8.00 ± 2.79	5.90 ± 1.52*

Conclusion(s): We concluded that desflurane offers a transient advantage compare with sevoflurane with respect of early recovery eventhough the duration of anesthesia was longer in the desflurane group.
References:
1 Dupont J et al. Br J Anesth 1999; 82: 355–9.
2 Song D et al. Anesth Analg 1998; 86: 267–73.

A-43

Planned and unplanned intensive care admission in the postoperative head and neck patient

D.A. Varveris, N.G. Smart

Department of Anaesthesia, Canniesburn Plastic Surgery Unit, GRI, Glasgow, United Kingdom

Background and Goal of Study: Patients with head and neck cancer are at risk of developing significant post op complications (1) but data defining the extent of use of ITU services by this group are scarce (2). The aim of this study was to identify the frequency and causes of admission to ITU and to examine whether there was a single predominant pattern of complication such that practice guidelines could be improved.
Materials and Methods: Using the anaesthetic database, case notes of all head and neck patients admitted to ITU within 72 hours of surgery in the 5 years between July 1 1997 and June 30 2002 were reviewed retrospectively. Data collected were age, gender, ASA status, smoking history, pre-existing disease, operative procedure, planned or unplanned ITU admission, Apache II scores for first 24 hours, requirement for ITU specific intervention (ventilation/inotropes), duration of ITU stay and outcome.
Results and Discussions: 26 of 521 patients (4.9%) required ITU admission. 18 were men and 8 women. Mean age 60.7 years (range 49–78). Modal ASA 3. 19 (73%) were smokers. Mean Apache II on admission 18.1 (range 9–28). The causes of admission (see Table 1) were pulmonary, cardiac, and others (GI bleed, massive transfusion (2), perforated peptic ulcer, airway monitoring). Median length of stay was 7.6 days (range 0.7–28).

Table 1 (V/I = IPPV and/or inotropes)

Reason for admission	n	System Disease preop	Unplanned Admission (%)	V/I (%)	Went home
Pulmonary	12	6	9 (75)	12(100)	10
Cardiac	9	6	7 (77)	5 (55)	5
Others	5	0	5 (100)	4 (80)	4

Conclusion(s): The frequency of ITU utilisation was low. A single predominant class of complications could not be identified. Unplanned critical care admission as an outcome measure may be an indicator of the overall process of perioperative care (3). Since the majority of admissions were unplanned, strategies to minimize these are needed.
References:
1 McCulloch T et al. Head and Neck 1997;11: 372–377.
2 Downey R et al. Crit Care Med 1999;27: 95–97.
3 Rose D, Byrick R, Cohen M. Can J Anaes 1996;43:333–40.

A-44

Are fatty persons protected from CO_2 absorption during retroperitoneoscopies?

F. Atallah*, B. Riu*, T. Bastide-Heulin*, M. Soulié**, K. Samii*

**Anesthesia and Intensive Care Department, **Urologic Surgery department, Rangueil University Hospital, 31403 Toulouse, France*

Background and Goal of Study: Retroperitoneoscopy is a well adapted technique in urologic surgery. Surgical dissection of the retroperitoneal space can be difficult due to retroperitoneal fatty tissue. This can also limit, through a mechanical effect, the progressive space dissection caused by continuous CO_2 insufflation. [1] The aim of this study was to evaluate the effect of body mass index (BMI) on CO_2 absorption during retroperitoneoscopy.
Materials and Methods: 45 consecutive patients (ASA 1–3) undergoing an urological procedure in lateral position by retroperitoneoscopic approach were studied (mean age = 49 years, mean BMI = 25,3 Kg/m^2).General anesthesia was done with propofol, sufentanil, atracurium and isoflurane. Ventilation was controlled (O_2:N_2O = 50:50) with a tidal volume of 8 ml/Kg and a respiratory rate of 12/min. Minute volume (Vm) was adapted to maintain $PetCO_2$ = 30–40 mm Hg. Production and elimination of CO_2 (VCO_2) were calculated every 15 min as follows :

$$VCO_2\ (\text{ml/kg/min}) = \frac{PetCO_2\ (\text{mmHg}) \times Vm\ (\text{ml})}{(P\ \text{barometric} - P\ H_2O)\ \text{mmHg} \times \text{Weight (kg)}}$$

Spearman's correlation test was used for statistical analysis
Results and Discussion: A decrease of VCO_2 was noted with the increase of BMI only at 60 and 90 min after insufflation. However, this correlation was not statistically significant.

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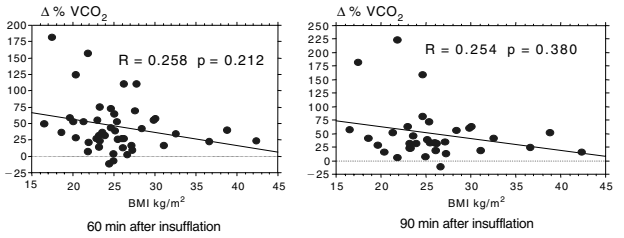
n = 45	Pre-Insufflation	15 min	30 min	45 min	60 min	75 min	90 min
VCO_2ml/kg/ min	4.06	4.70	5.13	5.49	5.86	6.12	6.25
ΔVCO%		15.8	26.4	35.2	**44.3**	50.7	**53.9**



Conclusion: Increased BMI is neither a protective nor a risk factor for CO_2 absorption during retroperitoneoscopic procedures.

Reference:

1 Wolf JS, Monk TG, McDougall EM, et al. J Urol 1995; 154: 959–63.

A-45

Major complications and anesthetic related deaths at tertiary care university hospital in Czech Republic – A result of prospective study

V. Cerny, K. Urbancova

Department of Anesthesiology and Intensive Care, Charles University, Faculty of Medicine, University Hospital Hradec Kralove, Hradec Kralove, Czech Republic

Background and Goal of Study: Several surveys have evaluated the rate of major complications and deaths that occur in relation to anesthesia, however the data from Czech Republic (and probably from other former East European countries) are lacking so far. The aim of the study was to analyze prospectively all major and fatal complications occurring during either general or regional anesthesia at second largest teaching hospital in Czech Republic.

Materials and Methods: A prospective study was conducted in period 1999-2001. All major and fatal complications were written on special protocol – case report. Number of anesthesia cases during selected period, number of all complications, in each case of complication: age, sex, ASA status, type of procedure (elective – emergency, abdominal, thoracic, vascular, neurosurgical, orthopedic), type of complications (death, serious complication during anesthesia, serious complications within 24 hours after anesthesia, other type), relationship between event and anesthesia, organ or system related to complication (airway, respiratory system, circulatory system, others), occurrence of complication (day–night call) and sequels of complication were recorded.

Results and Discussions: Only selected results due to high amount of data are presented. There were totally 58 279 anesthesia cases during studied period, overall incidence of major complications including death was 0,33%. Death during anesthesia occurred in 55 cases, however only one death was related to anesthesia technique, the majority of deaths occurred due to surgical reasons (mostly during cardio surgery), incidence of anesthesia related cardiac arrest was 0,0017%.

Conclusion(s): The overall incidence of anesthesia related complications did not differ in comparison with other large databases and their results. The incidence of anesthetic-related death was found lower than in recent similar studies (1).

Reference:

1 Newland M.C., Ellis S.J., Lydiatt C.A. et al. *Anesthesiology*, 2002, 97, 108–115.

A-46

Bilateral occipital neuropathy as a rare complication of positioning for thyroid surgery in a morbidly obese patient

S. Schulz-Stübner

Department of Anesthesia, University of Iowa Hospitals and Clinics, Iowa City, USA

Background and Goal of study: Peripheral neuropathies in various locations are described as complications after anesthesia and surgery. This is the first case report of temporary bilateral occipital neuropathy from positioning for thyroid surgery presented with a review of the literature. Case data are presented with informed consent of the individual.

Materials and Methods: A Medline-search with the key words occipital neuropathy and occipital neuralgia was performed. The case: "A 48-year-old women with a history of depression, fibro-myalgia, asthma, sleep apnea, diabetes mellitus and morbid obesity (127 kg, 165 cm) underwent 4 hours anesthesia with propofol/remifentanil without muscle relaxation for thyroid surgery. The neck with a very low range of motion secondary to fat tissue needed to be extended to facilitate surgery as much as possible. The head was carefully padded and there were no episodes of hypotension or hypoxemia throughout the case or in the PACU. At post op day 1 she complained of bilateral numbness in the distribution area of both greater occipital nerves. On post op day 2 tingling sensations and improvement of numbness was noticed. The patient recovered without residual symptoms after 6 weeks."

Results and Discussions: Pressure or shear stress to the nerve, hypoperfusion or metabolic disturbances are discussed as the leading etiology of nerve damage during surgery. Pressure from fat tissue during surgery seems to be the cause in this case, similar to a report in a football player with occipital neuralgia secondary to soft tissue pressure (1).

Conclusion: Pressure related to extension of the head in morbidly obese patients could cause occipital nerve damage under rare circumstances. Therefore extension of the head for a longer time should be avoided in these patients whenever possible to reduce pressure stress by the anatomic structures (2) surrounding the occipital nerves.

References:

1 Rifat SF, Lombardo JA. Occipital neuralgia in a football player: a case report. Clin J Sport Med 1995; 5: 251–3.
2 Bogduk N. The anatomy of occipital neuralgia. Clin Exp Neurol 1981; 17: 167–84.

A-47

Extrarenal potassium homeostasis during anesthesia

F. Yanagidate, S. Dohi, E. Terasawa

Department of Anesthesiology and CCM, Gifu University School of Medicine, Gifu, Japan

Background and Goal of Study: Hypokalemia is frequently observed during anesthesia (1). Normal potassium homeostasis is regulated by both renal and extrarenal mechanism. Acute potassium tolerance is largely determined by extrarenal tissues, potassium shift between intracellular and extracellular compartments. We examined whether following factors would affect plasma potassium concentration; (1) premedication, (2) tracheal intubation, (3) hyperventilation, (4) arterial or venous blood sampling.

Materials and Methods: We studied prospective, randomized study of 220 adult patients undergoing general anesthesia. First, patients were given as premedicant with or without clonidine(3–4 μg/kg) and plasma electrolytes was examined preoperatively, before and after tracheal intubation. Next, during the stable anesthesia, electrolytes, analysis of arterial blood gas tension, and pH were measured before and after hyperventilation of $ETCO_2$ 30% for 30 min. We compared plasma potassium in terms of arterial and venous blood gas tensions and pH simultaneously measured.

Results and Discussions: Patients' profiles were not different between patients with or without clonidine. Data are shown mean ± SD.

K (mEq/L)	Pre-ope	Pre TI	After TI
clonidine(+)	4 ± 0.3	3.7 ± 0.3	3.7 ± 0.3
clonidine(−)	4.1 ± 0.3	3.5 ± 0.3*	3.5 ± 0.4*

*$p < 0.05$ vs clonidine (+) TI: tracheal intubation

During anesthesia, 96% of the patients decreased potassium concentration compared with preoperative potassium. Clonidine premedication prevented the decrease potassium concentration. Hyperventilation did not affect electrolyte. Potassium concentrations at the normal and hyper ventilation were 3.4 ± 0.2, 3.3 ± 0.2 mEq/L, respectively. The correlation coefficient between arterial and venous blood sample potassium was 0.97.

Conclusion(s): Hypokalemia during anesthesia might be related to stress and anxiety, not hyperventilation or hemodynamic change due to tracheal intubation during induction of anesthesia.

Reference:

1 Kharasch ED. et al. Anesth Analg 1991; 72: 216–20.

A-48

Gastric mucosal-end tidal PCO_2 difference: A prognostic index of postoperative complication?

G. Lebuffe[1], B. Vallet, J. Takala, M. Lamy, G. Harstein, M. Mythen, J. Bakker, D. Bennet, O. Boyd, A. Webb

[1]*Department of Anesthesiology, University Hospital of Lille, Lille, France*

Background and Goal of Study: Automated on line tonometry displays a rapid, semi-continuous measurement of gastric-to-end tidal partial pressure of carbon dioxide (Pr-etCO_2) as an index of gastrointestinal perfusion during surgery. Its use to predict postoperative outcome has not been studied in general surgery patients.

Materials and Methods: After Ethical Comittee approvement and written consent obtained, 290 ASA III surgical patients with general anesthesia and a planned duration of >2 hours were included in a European, multicenter clinical study. Patients were randomized to have (n = 179) or not have

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(n = 111) a gastric tonometer inserted intraoperatively. The main outcome measure was the assessment of post-operative functional recovery delay (FRD) on day 2 and 8. The group without tonometry was used to assess FRD only. The prevalence of FRD and no FRD was calculated for all patients in the study. Using the sensitivities and specificities for each cut-off point and the prevalence of FRD among all patients included in the study, Bayes' theorem was used to assess the probability of FRD in a patient with an abnormal test and the probability of FRD in a patient with a normal test.
Results and Discussions: For the entire population studied, the incidence of FRD was 34%. Functional recovery delays frequently observed on day 8 included: locomotor 26%, gastrointestinal 15%, infection 13% and respiratory 12%. Maximum Pr-etCO_2 proved to be the best predictor increasing the probability of FRD from 34% for all patients to 65% at a cut-off of 21 mmHg (2.8 kPa) (sensitivity 0.27, specificity 0.92). The effect of prolonged Pr-etCO_2 was assessed by calculating the cumulative sum of Pr-etCO_2 above 8.25 mmHg (1.1 kPa) measured every 10 minutes. A cumulative sum Pr-etCO2 of 150 mmHg (20 kPa) raised the probability of FRD from 34% for all patients to 64% (sensitivity 0.13, specificity 0.96).
Conclusion: In a high risk surgical population with an expected duration of surgery above 2 hours, intraoperative Pr-etCO_2 may be a useful prognostic index of postoperative complication.

A-49

High oxygen concentrations during anaesthesia lead to artefacts in MR images

S. Münte, F. Götz, C. Hungershöfer, H. Hecker, S. Piepenbrock

Department of Anaesthesiology, Medical School of Hannover, Hannover, Germany

Backround and Goal of study: Recent findings imply that anaesthesia may cause artefacts on MR images of the brain that mimic diseases of the subarachnoid space such as haemorrhage or infection. Two restrospective analysis of MR images, one in children during propofol sedation (1) and another in adults breathing hich concentrations of oxygen (2) reported such artefacts on fast-FLAIR images. We investigated the possible artefacts caused by propofol and oxygen on MR-images in a double-blind, prospective and controlled setting.
Material and Methods: After informed consent of parents 40 children in age of 3 months to 8 years were included the study. The children, scheduled for MR examination of the brain under general anaesthesia, were randomly administrated one of the four types of anaesthesia: (1) sevoflurane +100% O_2, (2) sevoflurane +30% O_2, (3) propofol +100% O_2, and (4) propofol +30% O_2. At the beginning of the MR examination a fast-FLAIR image was obtained of all children. The images were analysed by a neuroradiologist, who was blinded to the anaesthesia method.
Results and Discussion: The application of 100% oxygen leaded in fast-FLAIR MR images to a hyperintense signal abnormality in subarachnoid spaces in convexity region. This artefact was observed in 17 of 20 images of patients who received anaesthesia combined with 100% oxygen ($p < 0.005$). The choice of the anaesthetic (sevoflurane vs. propofol) or their combination with 30% oxygen did not influence the image quality.
Conclusion: The administration of high concentrations of oxygen during general anaesthesia or sedation generates a hyperintense signal on fast-FLAIR images. This artefact may be misinterpreted as a haemorrhage or infection within subarachnoid spaces.
References:
1 Filippi CG, Ulug AM, Lin D, et al. *Am J Neuroradiol* 2001; 22: 394–399.
2 Deliganis AV, Fisher DJ, Lam AM, et al. *Radiology* 2001; 218: 152–156.

Ambulatory Anaesthesia

A-50

Can we find predictive factors of postoperative nausea and vomiting (PONV) after day surgery?

P. Lemos*, I. Castro*, I. Maio**, L. Fonseca*, C. Lourenço***, A.P. Magano***, T. Ribeirinho***, D. Marques*

**Anaesthetics Department of Hospital Geral Santo Ant% (HGSA), Instituto Ciências Biomédicas Abel Salazar; **Epidemiological Department (ICBAS); ***Day Surgery Unit (HGSA), Porto, Portugal*

Background and Goal of Study: Postoperative nausea and vomiting (PONV) are one of the major causes of morbidity[1,2] and dissatisfaction[3] on ambulatory surgery programmes. The goal of this study was to identify risk factors involved on the appearance/occurrence of PONV on patients submitted to day surgery.
Materials and Methods: We analysed retrospectively our database that included 2115 patients operated at our Day Surgery Unit (DSU) between January 2001 and November 2002. The following variables age, sex, surgical speciality, physical status (ASA), anaesthetics technique, time of anaesthesia and pain were identify in order to find if they were PONV risk factors. First we used Chi-Square Test for testing each factor individually. Differences were considered significant when $p \leqslant 0.05$. Secondly, we used logistic regression for identify the multivariate association strength of these factors.
Results: OR – multivariate odds ratio

		Total		PONV			
Variable		n	%	N	%	OR	p
Sex	Male	958	45.3	9	0.9	1.0	–
	Female	1157	54.7	61	5.3	4.94	**<0.001**
Anaesth Tech	Gen	918	43.4	51	5.6	1.0	–
	Comb	557	26.3	16	2.9	1.47	0.35
	Reg	298	14.1	2	0.7	0.15	**0.03**
	Sed	342	16.2	1	0.3	0.09	**0.02**
Time of	<60	1502	71.0	40	2.7	1.0	–
Anaesth (min.)	60–120	535	25.3	21	3.9	1.12	0.73
	120–180	68	3.2	6	8.8	2.20	0.12
	>180	10	0.5	3	30.0	8.13	**0.02**

At the multivariate analysis (multiple logistic regression), age, physical status, surgical speciality and pain intensity were not associated with PONV.
Conclusions: The identification of PONV risk factors such those found in our sample (female sex and time of anaesthesia longer than 180 min.) will allow us to establish better guidelines for PONV prophylaxis in these patients in order to improve the quality of our clinical care and the satisfaction of our patients.
References:
1 Chung F. Anesth Analg, 1995; 80: 896–902.
2 Twersky R et al. Anesth Analg, 1997; 84: 319–324.
3 Gan TJ et al. Anesth Analg, 2001; 92: 393–400.

A-51

Antiemetic efficacy of prophylactic intravenous dexamethasone in laparoscopic cholecystectomy with propofol based anestehsia

R. Krobot, J. Premuzic,

Department of Anesthesiology and Intensive Care, General Hospital Varazdin, Varazdin, Croatia

Background and Goal of Study: Postoperative nausea and vomiting (PONV) are highly unpleasent and frequent adverse effects of laparoscopic cholecystectomy, with incidence ranging from 38 to 68%(1).Goal of study was to assess whether the high rate of PONV after laparoscopic cholecystectomy could be reduced by prophylactic, intravenous administration of low-dose dexamethasone.
Materials and Methods: A total of 80 (n = 40 in each of the groups) ASA I–II patients undergoing laparoscopic cholecystectomy were randomly assigned to two groups. All patients received TIVA with propofol, fentanyl and rocuronium. After tracheal intubation, patients received either dexamethasone 4 mg iv. (Group 1) or saline 1 ml iv. (Group 2). Nausea and vomiting on a 3-point ordinal scale (0 = none, 1 = nausea, 2 = vomiting) and the need for rescue antiemetic medications were evaluated during 0–4 h (early PONV) and 4–24 h (late PONV) periods postoperatively. Data were analysed by Fisher's exact test and Mann–Whitney test (significance level $P < 0.05$).
Results and Discussions: Groups were comparable in demographic data and anesthetic drug dosage.The incidences of early PONV (0–4 h) were 2% in Group 1 and 17% in Group 2 ($P = 0.05$).Nausea was experienced by none(0%) in dexamethasone group and by 4(10%) patients in placebo group ($P = 0.11$) and emetic episodes occurred in 2% and 7% of the patients in the two groups, respectively. The incidences of late PONV (4–24 h) were 17% in dexa-methasone group(nausea 5% and vomiting 12%) and 40% (nausea 15% and vomiting 25%) in placebo group,$P = 0.04$. During the total observation period (0–24 h),incidences of PONV were 20% in dexamethasone

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group (nausea 5% and vomiting 15%) and 45% in placebo group(nausea 15% and vomiting 30%), P = 0.03. The proportions of patients who required antiemetic treatment during 24-h period were 2% in Group 1 and 20% in Group 2, P = 0.03. No clinically important side effects related to the use of dexamethasone were found.

Conclusion(s): Prophylactic intravenous administration of dexamethasone 4 mg reduces the incidence of PONV and the need for rescue antiemetic medications during 24-h period postoperatively in patients undergoing laparoscopic cholecystectomy with propofol-based general anesthesia.

Reference:

1 Thune A, Appelgren L, Haglid E. Eur J Surg 1995; 161: 265–268.

A-52

The pre-operative anxiety level and the circadian type of the patient influences the immediate recovery from ambulatory anaesthesia

C. Gros, L. Jouffroy, E. Challet, G. Hartman, J.C. Lleu, P. Ham, L. Pain

Faculté de Médecine Centre Ambulatoire des Diaconesses & UMR 7518 CNRS & GRERCA Inserm U405, IFR Neurosciences, Strasbourg, France

Background and Goal of Study: Immediate recovery from ambulatory anaesthesia is regularly assessed by visual analogical scales (VAS) on symptoms expressed by the patient. The aim of the study was to examine how pre-existing factors might influence the well-being assessment as performed usually in ambulatory units.

Materials and Methods: The prospective survey was performed on 154 patients scheduled for ambulatory anaesthesia (either gastrointestinal endoscopies or minor surgery): 100 women [mean (SEM) age : 52 (1.5) years] and 53 men [mean (SEM) age: 53 (1.5) years]. The spontaneous sleep-awake rhythm (circadian type) of the patient was determined using the Horne and Ostberg modified scale. The level of anxiety was determined few days before anaesthesia (A1) and at the entry to ambulatory unit (A2), using the Hamilton's scale. Recovery was assessed by VAS on pain, tiredness, mood, nausea and drowsiness. For each dependent variable, three sets of logistic multiple stepwise regression analysis was performed using age and sex, then circadian type, A1, and A2, and finally procedure (endoscopy or surgery) and anaesthesia procedure, associated with multivariate analyses of variance testing models: dependent variable, predictive factors (SPSS software). The observed mean differences between groups of patients as regards to the putative predictive factors, were assessed using confidence limits (1).

Results and Discussions: (1) Logistic multiple regression analyses pointed out different putative predictive factors for the dependent variables studied here : pain (age), tiredness (anaesthesia procedure, sex and circadian type), mood (A2), nausea (A2), drowsiness (circadian type). (2) Post-hoc analyses on confidence limits showed that nausea and bad mood were significantly increased in patients with pre-operative high level anxiety A1 or A2 (>75% quartil) while tiredness and drowsiness were significantly increased in patients with habits of early wake-up (circadian type) (all $p < 0.05$).

Conclusion(s): The preexisting anxiety level and circadian type of the patient modify the expression of some subjective symptoms following ambulatory anesthesia.

Reference:

1 Altman DG et coll. *Statistics with confidence*. London: BMJ Books, 2000.

Acknowledgements: Université Louis Pasteur

A-53

An audit of admissions following day surgery: is a dedicated ambulatory surgery unit advantageous?

C.J.C. Cheng

Department of Anaesthesia & Surgical Intensive Care, Singapore General Hospital, Singapore

Background and Goal of Study: Although this institution has a purpose-built Ambulatory Surgery Centre (ASC), day surgery (D/S) patients can also be listed as part of inpatient lists (DSMOT). This project looks at the admissions within 7 days of day surgery, comparing the incidence and reasons for admission from both sites during the period 1st January to 30th June 2002.

Materials and Methods: The medical records for all D/S patients who get admitted immediately following surgery or within 7 days of their operation were located and analysed for the reason(s) for admission and duration of stay.

Results and Discussions: A total of 5853 operations were done on a D/S basis over the study period, with 317 admissions, resulting in a gross admission rate of 5.42%, of which 88/4627 (1.90%) were from ASC and 229/1226 (18.68%) were from DSMOT. 17.67% of these patients were readmissions (15 from ASC and 41 from DSMOT).

The results from ASC could be more favorable as 4 of the 6 theatres operate under local anaesthesia only. However, many admissions following DSMOT could be from the perceived ease of staying a night as these patients await surgery and discharge in an inpatient ward, and from the blurring of the line between D/S and Same Day Admissions. In addition, insurance companies frequently refusing to compensate day cases! Patients also requested admission for rest or observation for minor symptoms.

There were 24 admissions due to post-operative urinary retention and 73 admissions from giddiness/ nausea/ vomiting/ excessive drowsiness. The use of D/S anaesthetic techniques could have reduced the admission rate. In addition, there were 4 admissions following anaesthetic complications.

Conclusion(s): The failure rate following D/S is significantly higher when done as part of an inpatient list in this institution.

A-54

Ginger (*Zingiber officinalis*) to prevent postoperative nausea and vomiting after gynaecologic laparoscopy

L. Eberhart[1], R. Mayer[2], A. Morin[1], G. Geldner[1], H. Wulf[1], W. Seeling[2]

[1]Department of Anaesthesia, Philipps-University, Marburg, Germany; [2]Department of Anaesthesiology, University Ulm

Background and Goal of Study: In previous studies [1,2] there were contradictious results concerning the antiemetic effect of the herbal remedy ginger (*Zingiber officinale*) to prevent postoperative nausea and vomiting (PONV). Thus, this randomized, double-blinded trial was performed

Materials and Methods: In this double-blinded trial 180 female patients undergoing gynaecologic laparoscopy were randomized to receive 100 mg or 200 mg of an acetonic extract of Zingiber officinale (drug extract ratio 10–20:1) or placebo in a double-blind fashion as an oral premedication. The same dose was repeated 3 hours and 6 hours postoperatively, resulting in a total dose of 300 mg and 600 mg ginger extract. A standardized balanced anaesthesia technique (propofol, fentanyl, desflurane in N_2O/O_2) was performed. The incidence of PONV was observed during the first 24 hours postoperatively and was defined as the main endpoint of the trial. Furthermore, the QoR-score [3] was used rate overall postoperative recovery and patient satisfaction with anaesthesia care was expressed on a verbal rating scale (1–6).

Results and Discussions: The incidence of PONV was not different between the groups: 49% (95%-confidence interval: 36–63%) in the placebo group, 58% (44–70%) in the 300 mg group, and 53% (39–66%) in the 600 mg group. Furthermore, need for rescue antiemetics, ratings using the QoR-score, and patient satisfaction did also not differ between the three groups.

Conclusion: Data from this trial disprove a relevant antiemetic effect of ginger in the PONV setting.

References:

1 Arfeen Z et al. Anaesth Intensive Care 1995; 23: 449–52.
2 Bone ME et al. Anaesthesia 1990; 45: 669–71.
3 Myles PS et al. Anesth Analg 1999; 88: 83–90.

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A-55

Does dexamethasone influence the postoperative nauseas and vomiting (PONV) incidence?

S. Borges[1], M. Ramos[1], R. Maio[3], A.C. Costa[1], A. Regalado[1], P. Afonso[2], A. Faria[2], P. Lemos[1]

[1]Department of Anaesthetic and Emergency, Hospital Center of Vila Nova de Gaia, Gondomar, Portugal; [2]Day Surgery Unit of HGSA; [3]Epidemiological Department of ICBAS. Portugal

Background and Goal of Study: One of major problems in Ambulatory Surgery is the high incidence of PONV. The actual literature refers the use of dexamethasone as an important factor to decrease the incidence of PONV. With this study, we will try to prove if corticoid administration alters the incidence of PONV.

Materials and Methods: We analysed retrospectively 2115 patients, ASA I–III, divided in two groups: Group A (n = 737) representing surgeries realised between Jun–Aug 2001, without the use of dexamethasone; Group B (n = 1378) representing surgeries performed between Sept 2001 and November 2002 with the administration of dexamethasone. We analysed the results with Chi-Square test and adopted a significance level of 0.05. We compared statistically the 2 groups with cross tabs and verified both homogeneity to age; sex; physical status (ASA); duration and type of surgery speciality and type of anaesthetic technique.

Results and Discussions:

	Total		With PONV		Chi-square test
	n	%	n	%	
Group A	737	34.8	38	5.2	p = 0.001
Group B	1378	65.2	32	2.3	

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In our study we found also an indirect proportion between the administration of dexamethasone and the level of pain, with statistical significance ($p < 0.001$). Both groups were similar in relation to age, sex, physical status (ASA), duration and type of surgery speciality and type of anaesthetic technique.

Conclusion(s): The group B had decrease incidence of PONV ($p = 0.001$) and low levels of post-operative pain ($p < 0.001$). As other papers in the literature, our study confirms a lower incidence of PONV ($p = 0,001$) and lower level of pain ($p = 0.001$) in patients that take dexamethasone prophylactly.

References:

1 Wang JJ, Ho ST, Liu YH et al. Br. J. Anaesth. 1999 Nov; 83(5): 772–5.
2 Wang JJ, Ho ST, Lee SC et al. Anesth. Analg. 2000 Dec; 91(6): 1404–7.
3 Huang JC, Shieh JP, Tang CS et al. Can. J. Anaesth. 2001 Nov; 48(10): 973–7.

A-56

Morbidity following day case anaesthesia for haemato-oncological procedures in paediatric patients

E.N. Kourteli, R. Bajekal, D. Chisholm, H.A. McLure

Department of Anaesthetics, Royal Marsden Hospital, London, United Kingdom

Background and Goal of Study: Day case anaesthesia is required for most paediatric haemato-oncology patients undergoing repeated intrathecal chemotherapy and bone marrow aspiration (BMA). As we could find no data on post-procedural morbidity we performed a telephone survey the following day to establish the prevalence in our institution.

Materials and Methods: Over a 6 month period 140 patients (median age 7 years, range 1–17) were included. A record was made of demographic and diagnostic details, anaesthetic technique, history of postoperative nausea and vomiting (PONV), procedure performed and complications. The majority (96%) of patients were in treatment for acute lymphoblastic leukaemia. Procedures included intrathecal methotrexate ($n = 134$), plus BMA ($n = 29$), BMA alone ($n = 2$) and central venous catheter removal ($n = 4$). Anaesthesia was induced with propofol (mean dose 2.8 mg/kg) maintained with sevoflurane (1–2%) in nitrous oxide (66%) and oxygen. Intravenous (IV) fentanyl (1 μg/kg) was administered to 43 patients according to the individual anaesthetist. Granisetron (40 μg/kg IV) was administered to 29 patients with a history of PONV. Total intravenous anaesthesia (TIVA) with propofol was administered to 4 patients with a history of PONV despite granisetron.

Results and Discussions: Headache was reported in 6 cases, and mild to moderate back pain in 11 cases, all of whom underwent lumbar puncture (20 gauge needle). Sore throat, dizziness, constipation and abdominal pain were reported in less than 1% of patients. Overall, PONV occurred in 22 patients (15.7%). The incidence was higher (27.5%) in patients with a history of PONV who received standard anaesthesia plus granisetron, although none of the patients who received TIVA reported PONV. Those with no history of PONV had a low frequency (12.6%) of PONV. The use of fentanyl did not significantly influence the incidence of PONV (p 0.08).

Conclusion(s): The incidence of morbidity was low, although PONV was problematic as it often occurred in the car on the way home. Patients with a history of PONV suffered a high incidence of further PONV despite use of granisetron. The use of TIVA in this group merits further investigation.

A-57

Does choice of inhalation anesthetic affect postoperative outcome following ambulatory surgery? A systematic analysis of randomized studies

A. Gupta, R. Zuckerman, T. Stierer, N. Sakima, S. Parker, L.A. Fleisher

Department of Anesthesiology & Critical Care, Johns Hopkins Medical Institutions, Baltimore, & University Hospital, Örebro, Sweden

Background and Goal of Study: This review was done with the aim of determining whether the choice of inhalation agent for maintenance of anesthesia affects outcome following ambulatory surgery.

Methods: We searched MEDLINE (from 1966 to June 2002) via PubMed using the MeSH terms: "ambulatory surgical procedure" OR "outpatients", AND "anesthetics, inhalation" limited to Humans, English language and adults. A second search using the text words "sevoflurane" (S), "desflurane" (D) and "isoflurane" (I) was done since some articles were missed in the first search. Finally, we searched the already published systematic reviews to look for any missing articles.

Results: Altogether, 16 studies were included which had data that could be extracted and used in a meta-analysis. A total of 1217 patients were studied. Statistically significant difference was found in early recovery ('time to eye opening' and 'time to obey commands') ($p < 0.01$) in favor of D compared to I by 4–5 min but not in intermediate recovery or postoperative complications. Significant differences were also found in early recovery (2.3 min), intermediate recovery (8 min) ($p < 0.00001$) and "home discharge" (25 min) ($p = 0.05$) and in drowsiness in the postoperative period ($p = 0.03$) when I was compared to S in favour of S. Early recovery parameters were in favor of D when compared to S (1–3 min) ($p < 0.01$). The 'time to transfer from Phase I to Phase II' was earlier in sevoflurane compared to desflurane (6 min) ($p < 0.00001$). Overall incidence of shivering was greater in sevoflurane and desflurane compared to isoflurane.

Conclusions: Minor differences were found between the inhalation agents. The clinical relevance of these differences in postoperative recovery and side effects between these inhalation anesthetics appears to be limited.

A-58

Prevention of postoperative nausea and vomiting following breast surgery. A comparison between dexamethasone and ondansetron

A. Gupta*, M. Wattwil*, S.E. Thörn*, Å. Lövqvist*, L. Wattwil*, G. Liljegren**

**Department of Anesthesiology and Intensive Care and **Department of Surgery, University Hospital, SE-701 85 Örebro, Sweden*

Background and Goals: Postoperative nausea and vomiting remain a common problem following breast surgery (1,2). This study assess whether dexamethasone is as effective as ondansetron in the control of postoperative nausea and vomiting.

Methods: 80 ASA1–3 patients undergoing breast surgey for carcinoma of the breast were included in the study. Following premedication with diazepam 5–10 mg, patients were induced with fentanyl 50 ug and propofol 2–2.5 mg/kg. A larynx mask was inserted and anesthesia maintained with sevoflurane in oxygen and nitrous oxide. Patients were then randomly divided into two groups: Group D was given 4 mg dexamethasone i.v. after induction and Group O was given 4 mg ondansetron at the same time point. Postoperatively, nausea, vomiting and pain were recorded at 1 h intervals during 4 h, and thereafter every 4 h during 24 h.

Results: No differences were found between the groups in the incidence of nausea, vomiting or pain at the different time intervals. Two patients in Group D received anti-emetic medication compared to none in Group O ($p > 0.05$). No side effects of these drugs were observed.

Conclusions: Ondansetron 4 mg or dexamethasone 4 mg is equally effective in the prevention of postoperative nausea and vomiting following breast surgery. However, the difference in cost between these drugs would favor the use of dexamethasone for prophylaxis against PONV.

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1 Sadhasivam S, Saxena A, Kathirvel S, Kannan TR, Trikha A, Mohan V. Anesth Analg 1999; 89: 1340–5.
2. Hammas B, Thorn SE, Wattwil M. Acta Anaesthesiol Scand 2002; 46: 232–7.

A-59

Postoperative pain after discharge from ambulatory anesthesia. Can we do better?

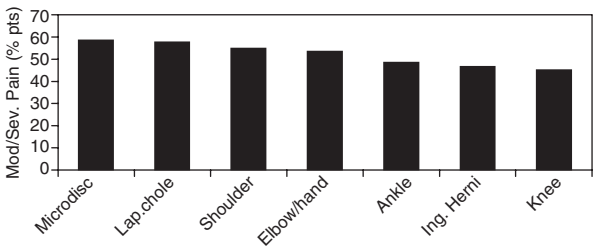
B. McGrath, F. Chung, H. ElGendy, B. Curti, D. Kamming

Department of Anesthesia, University of Toronto, Toronto Western Hospital, Toronto, Canada

Background and Goal of Study: We investigated the severity of pain at 24 hrs after ambulatory surgery and determined the most painful procedures. The need for further advice, clarity of postoperative instructions and overall patient satisfaction was also studied.

Materials and Methods: 5,703 ambulatory patients were telephoned 24 hrs after surgery. Patients graded their pain using the 10-point self-assessing verbal scale (0 = no pain, 10 = worst pain). Data was analyzed in 2 groups, those with moderate to severe pain (pain score 4–10) and those with no or mild pain (0–3).

Results and Discussions:



7 most painful surgeries

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30% of patients (1495/5073) had moderate to severe pain. Microdiscectomy, lap.chole, shoulder, elbow/hand, ankle, ing.hernia and knee surgery caused the most pain at 24hrs. 9.8% of patients required medical advice from the calling nurse, 3.4% phoned a doctor, 0.7% made an unplanned visit to a doctor and 0.7% had to go to the Emergency department. Commonest reasons for seeking help included pain, prescription advice, wound oozing and bleeding. 88% of patients with moderate-severe pain indicated that analgesic instructions were absolutely clear. 98% found postoperative instruction sheets and advice helpful. 99% indicated staff listened and answered their queries. Overall satisfaction of care received was excellent (78.2%), good 21.2%, fair (0.5%), and poor (0.2%).

Conclusion: Despite 30% of patients having significant pain at 24 hrs overall satisfaction ratings were high. As pain is one of the common reasons for delayed discharge and readmission[1] postoperative prescribing needs to be tailored according to type of surgery. Effective analgesia will allow continual development in ambulatory surgery.

Reference:

1 Chung F. *Anesth Analg* 1995; 80: 896–902.

A-60

Desflurane or sevoflurane via a laryngeal mask airway in patients who underwent TUR-BT

A. Dimakopoulou, A. Kontadaki, J. Stranomiti, A. Tachmintzi, K. Vagdatli, U. Hambouri

Department of Anaesthesiology, General Hospital of Athens, "G. Gennimatas", Athens, Greece

Background and Goal of Study: The aim of our study is to determine if desflurane when used in conjunction with the laryngeal mask airway causes clinically significant airway irritability.

Materials and Methods: Eighty patients, ASA II, III scheduled for TUR-BT (Transurethral Resection of Bladder Tumor) were studied. From the study were excluded patients with smoking history, presence of wheezing and history of asthma. All patients received bolus propofol 2.5 mg/kg^{-1} to facilitate insertion of the laryngeal mask. The patients were randomized to receive desflurane or sevoflurane for maintenance of anaesthesia. In addition both groups received oxygen and nitrous oxide, in a ratio 1:2 with 3 L/min^{-1} fresh gas flow. No fixed end tidal gas concentration was predetermined because the depth of the anesthetic was adjusted according to clinical needs. A blinded observer followed each patient into the operating room, noting any event of breath holding, laryngospasm or cough occurring from induction until laryngeal mask airway removal. Each event was graded 1–4, where grade 1–2 did not result in SpO_2 below 95% or require additional drugs. Data is presented as means (±SEM). Differences between groups were studied using ANOVA test. $P < 0.05$ was considered significant.

Results: The patients did not differ in age, weight or duration of either surgery or anaesthesia. There was no statistically significant emergence for patients receiving desflurane than for patients receiving sevoflurane. There were 8 events of airway irritability among the eighty patients studied, grades 1 or 2. Five of the patients receiving desflurane and three receiving sevoflurane had sings of upper airway irritability. The events were breath holding and coughing. Among the patients receiving desflurane two patients coughed and three had episodes of breath holding. Among the patients receiving sevoflurane two patients coughed and one patient had breath holding. There was no statistically significant correlation found between desflurane and sevoflurane and upper airway irritability using the laryngeal mask airway.

Conclusion(s): Desflurane or sevoflurane are safe when used in conjuction with the laryngeal mask airway in patients who underwent TUR-BT.

Reference:

1 TerRiet MF et al. BJA 2000; 85: 305–307.

A-61

Supraglottic airway devices: a comparison between Laryngeal Mask Airway (LMA) and Pharyngeal Airway (PAxpress)

A. Karapanagiotou, P. Pappas, A. Euthimiou, F. Aidoni

Department of Anaesthesia, "Hippokration" General Hospital, Thessaloniki, Greece

Background and Goal of Study: A comparison between the Laryngeal Mask Airway (LMA) and the Pharyngeal Airway (PAxpress™, PAX) concerning the ease of insertion, the ventilation achieved and post-insertion pharyngeal ache (1,2).

Materials and Methods: 60 patients ASA I-III were enrolled, scheduled for transurethral surgery under general anaesthesia. After random allocation in one of two groups, an LMA was planned to be inserted in 30 patients as an airway device and in 30 others a Pharyngeal Airway (PAX). Intraoperative monitoring included ECG, non-invasive blood pressure, SpO_2, blood gases analysis, and recording of tidal volume and airway pressure at the end of expiration. Induction was accomplished for both groups with i.v. propofol 1.5–2 mg/kg B.W. and fentanyl 1–2 mcg/kg B.W. The airway device was then put in position. Cuff inflation was gradual. Anaesthesia was maintained with sevoflurane 1–2% in O_2/N_2O mixture. Ventilation was manually controlled (MPPV). Tidal volume range: 7–10 ml/kg B.W. Airway pressure was kept $\leqslant 20$ cmH_2O. Blood gases analysis was carried out. Pharyngeal ache was assessed immediately after recovery and 24 hours later.

Results and Discussions: PAX was successfully inserted with the 1st attempt in 91.28% of cases, while LMA in 84.61% ($p > 0.05$). Cuff pressure was estimated in the LMA group 97.27 ± 30.73 mmHg, while in the PAX group 62.38 ± 13.75 mmHg ($p < 0.05$). Blood gases analysis revealed satisfactory oxygenation in both groups. All patients in both groups were haemodynamically stable. On removing the airway device and during emergence, group LMA patients complained of pharyngeal ache in 16.6% of cases, while group PAX patients had no pharyngeal ache or complaint ($p < 0.02$). After the first 24 hours 6.6% of group PAX patients complained of moderate pharyngeal ache; group LMA patients had pharyngeal ache in the same percentage as during emergence ($p > 0.05$).

Conclusion(s): Both LMA and PAX insertion have proved to be easy and safe for ventilating patients under general anaesthesia. Pharyngeal ache in the immediate post-anaesthesia period was more frequent after using LMA compared to PAX airway.

References:

1 Smith I, White PF. Anesthesiology 1992; 77: 850–5.
2 Greenberg RS et al. Anesthesiology 1998; 88: 970–7.

A-62

The SiBI connector a new device used for inhalational induction

B. del Blanco, E. Alsina, M.J. Yepes, E. Matute, B. Blanc, R. Roses

Department of Anaesthesiology, Hospital Universitario La Princesa, Madrid, Spain

Background and Goal of Study: The SiBI (single breath induction) connector™ is new device that allows simultaneous preoxygenation and priming of the circuit. It reduces waste of gases in the operating room one of the main concerns when using inhalational induction techniques. We have tried to demonstrate if vital capacity inhalational induction technique is better achieved with this new device.

Materials and Methods: We have designed a prospective randomized study that included 24 patients in two groups: SiBI group and control group.

We performed vital capacity inhalational induction technique with Sevoflurane 8% and oxygen/protoxide 50%, fresh gas flow 6 liters per minute. We kept sevoflurane at 8% during two more minutes before laryngeal mask (LM) insertion.

Data collected: demographic, loss of consciousness, LM insertion difficulty, sevoflurane end-tidal concentration in the first vital capacity, at the loss of conscious and at the LM insertion, haemodynamic values, and complications.

Results and Discussions: No demographic differences.

	SiBI (n = 13)	Control (n = 11)
Loss consciousness (s)	45 ± 18.22*	82.09 ± 40.89
No Vital capacity	3.3 ± 2.1*	5.54 ± 1.08
Sevoflurane end-tidal %		
1st vital capacity	5.7 ± 1.7*	3.9 ± 1.4
LM insertion	3.8 ± 1.8	3.6 ± 1.6
Moderate LM insertion difficulty %	23	9
Mean arterial pressure 1 min post LM insertion	80.8 ± 20.3*	109.3 ± 35.2
Complications %		
Cough	18.2	15,4
Excitement	7.7	–

*significative $p < 0.05$

Conclusion: Inhalational induction vital capacity technique with the SiBI connector™ is easier and faster than with conventional circuit. Complications are similar in both groups but haemodynamics show better profile in the SiBI group.

Reference:

1 Anesth Analg 2000; 91: 1555–59.

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A-63

The effects of different bolus doses of remifentanil on the laryngeal mask airway insertion

S. Izdes, E. Erkilic, M. Simsek, T. Gumus, O. Kanbak

Department of Anaesthesiology and Reanimation, Dr.M.U.Acil Yardim ve Travmatoloji Hospital, Ankara, Turkey

Background and Goals: Propofol is the most commonly used induction agent for the insertion of a laryngeal mask airway (LMA). As a sole anaesthetic, it may be associated with considerable amount of side effects (1). In our study we aimed at investigating LMA insertion conditions and haemodynamic effects of propofol supplemented with different doses of remifentanil
Materials and Methods: After local ethical committee approval, 100 ASA class I and II unpremedicated patients, aged 18 to 55 yr., undergoing outpatient surgery were included in a double blinded, randomised study. Following Propofol 2.5 mg.kg^{-1} IV administration over 30 s all the patients were randomly allocated into four equal groups. While Group I received 10 ml of 0.9% normal saline, Group II, III, and IV received remifentanil 0,5 μg.kg^{-1}, 1 μg.kg^{-1} and 1,25 μg.kg^{-1} diluted with 0.9% normal saline to 10 ml, respectively, over 60 s. Following this, jaw opening and reactions to the LMA were evaluated. If the first attempt was unsuccessful a second and third trial were performed following 30 s after another dose of propofol 0.5 mg.kg^{-1} bolus was given for each trial. After three unsuccessful attempts a muscular relaxant was given to facilitate the insertion. The quality and duration of the LMA insertion were recorded. Following successful LMA insertion, anaesthesia was maintained with 2% sevoflurane and 70% nitrous oxide in oxygen. During this time haemodynamic data were recorded on the 1st, 2nd, 3rd, 4th and 5th minutes of anaesthesia. Data were analysed with Kruskal–Wallis and χ^2 tests.
Results: The groups showed similarity in the demographic data obtained . The first trials were found successful in %64, %76, %96, and %96 patients in Group I, II, III and IV respectively. While no differences were found with regard to haemodynamic responses between group III and IV; significant differences were found between group I and all the groups, group II and III, group II and IV ($p < 0.05$).
Conclusion: It is concluded that addition of 1 and 1,25 μg.kg^{-1} remifentanil during the propofol induction of anaesthesia has significantly improved the conditions for LMA insertion with less haemodynamic changes.
Reference:

1 Ang S,Cheong KF,NG TI. Anaesth Intensive Care 1999; 27: 175–8.

A-64

The effects of low doses of three different muscle relaxants in outpatients during remifentanil-propofol based anaesthesia

A. Kar, S. Oztekin, H. Hepaguslar, U. Koca, Y. Tabel, F. Boyaci, Z. Elar

Department of Anaesthesiology, Dokuz Eylul University, Izmir, Turkey

Background and Goal of Study: Although management of anaesthesia without using a muscle relaxant (MR) has become popular in outpatients, poor intubating conditions were reported (1). We compared the intubating conditions and time course of action of low-doses of three different MRs during TIVA with remifentanil (R) and propofol (P).
Material and Methods: The study was conducted in two stages and 111 outpatients (ASA I–II, aged 18–65 yr) were included. In the first one; 87 patients were randomly allocated into three groups: rocuronium (R, $n = 28$), vecuronium (V, $n = 29$) and atracurium (A, $n = 30$). Premedication was with midazolam. Anaesthesia was induced with R 0.5 μg.kg^{-1} min^{-1} (2 min) and P 2 mg.kg^{-1}. Maintenance was with infusions of R 0.5 μg.kg^{-1} min^{-1} and P 5 mg.kg^{-1} hr^{-1}. Following induction, ED_{95} doses of MRs were administered and after three min intubating conditions (2) were assessed. In the second stage of the study (still in progress), 24 patients were randomly allocated into three groups: R, $n = 9$; V, $n = 7$; A, $n = 8$. Anaesthetic management was similar. Time course of action of same low-doses of MRs were investigated. Neuromuscular responses were monitored by TOF-Guard. After administration of ED_{95} doses of MRs; the lag time (LT), the onset time (OT), the maximum block of T_1% (MB), the clinical duration of action (T_1 25%), recovery index (RI) and TOF 80% recovery time were recorded. Statistical analysis was made with χ^2 and Kruskal-Wallis tests. $p < 0.05$ was considered significant.
Results: Intubating conditions were clinically acceptable in all groups. Neuromuscular data (mean ± SD) are shown in table (LT, OT in sec, T_1 25%, RI, TOF 80% in min).

	LT	OT	MB	$T_1$25%	RI	TOF80%
R	42 ± 7*	257 ± 60	83 ± 20	12 ± 5†	9 ± 3	26 ± 8†
V	69 ± 8	259 ± 53	95 ± 9	17 ± 6	13 ± 5	36 ± 10
A	62 ± 15	478 ± 214	96 ± 6	26 ± 6	15 ± 6	45 ± 11

*$p < 0.01$ compared to V, †$p < 0.01$ compared to A.

Conclusion: Although ED_{95} doses of MRs provided similar intubating conditions, rocuronium is preferable when early recovery of neuromuscular function is desired during TIVA with R-P.
References

1 Stevens JB, Wheatley LD. *Anesth Analg* 1998; 86: 45–49.
2 Viby-Mogensen J, Engbaek J, Eriksson LI et al. *Acta Anaesthesiol Scand* 1996; 40: 59–71.

A-65

Comparison of intubation conditions after two different low doses of rocuronium in children during remifentanil-propofol based anaesthesia

S. Oztekin, H. Hepaguslar, H. Kilercik, A. Kar, F. Boyaci, Z. Elar

Department of Anaesthesiology, Dokuz Eylul University, Izmir, Turkey

Background and Goal of Study: Rocuronium 0.6 mg.kg^{-1} provides clinically acceptable intubation condition (CAIC)s in children while complete recovery of neuromuscular function is too long for ambulatory surgery (1). In this randomised study, we investigated whether the low-doses of rocuronium provides CAICs or not in children during remifentanil-propofol based anaesthesia.
Material and Methods: 44 children (aged 3–12 yr, ASA I- I) who were scheduled for elective day-case surgery were included. Premedication was with p.o midazolam 0.5 mg.kg^{-1}. Anaesthesia was induced with atropine 10 μg kg^{-1}, remifentanil 0.5 μg.kg^{-1} min^{-1} (60 sec) and propofol 2.5 mg.kg^{-1}. Maintenance was with remifentanil 0.5 μg.kg^{-1} min^{-1} and propofol 6 mg.kg^{-1} h^{-1}. After starting propofol infusion, the children were randomly administered rocuronium 0.15 mg.kg^{-1} (Group I) or 0.3 mg.kg^{-1} (Group II). 90 s later, laryngoscopy was attempted by an anaesthesiologist blinded to the rocuronium dose. Intubation conditions were assessed as clinically acceptable (excellent or good) or not (poor) using the criteria including four variables; (i) jaw relaxation, (ii) the position and movement of vocal cords, (iii) the movement of the limbs, and (iv) coughing (2). Statistical analysis was made with χ^2 test. $p < 0.05$ was considered significant.
Results: Patient-demografics data were similar. The distribution of patients in both groups according to the intubation conditions is shown at the table.

	Intubation condition			
	Excellent	Good	Poor	CAIC
Group I ($n = 22$)	4(8.2%)	9(40.9%)	9(40.9%)	13(59.1%)
Group II ($n = 22$)	9(40.9%)	12(54.5%)	1(4.5%)	21(95.5%)*

Values are number (%),*($p < 0.05$).

Conclusion: Rocuronium 0.3 mg.kg^{-1} provides more CAICs than rocuronium 0.15 mg.kg^{-1} in children during remifentanil-propofol based anaesthesia.
References

1 Fuchs-Buder T, Tassonyi E. *Br J Anaesth* 1996; 77: 335–338.
2 Viby-Mogensen J, Engbaek J, Eriksson LI et al. *Acta Anaesthesiol Scand* 1996; 40: 59–1.

A-66

Sevoflurane vs. propofol bolus technique for light anesthesia compared during maintenance with sevoflurane and propofol

M. James, E. Karamichali*, R.D. Ostroff†

*Department of Anaesthesia, University of Cape Town and Groote Schuur Hospital, Cape Town, South Africa; *Evagelismos General Hospital of Athens, Athens, Greece; †Abbott Laboratories, Abbott Park, Illinois, USA*

Background and Goal of Study: This study examined the efficacy and safety of sevoflurane (sevo) and propofol (prop) boluses for light anesthesia during maintenance.
Materials and Methods: In this Phase IV, randomized, open-label, multicenter study, 290 adult patients (ASA I–II) undergoing elective, outpatient non-laparoscopic inguinal hernia repair were randomized into four groups:

Group	*N*	Induction/Maintenance	Bolus
S-S	75	Sevoflurane	Sevoflurane
S-P	71	Sevoflurane	Propofol
P-S	71	Propofol	Sevoflurane
P-P	73	Propofol	Propofol

In groups S-S and S-P, anesthesia was induced with sevo 8% in 60% N_2O in O_2 at 6 L/min, and maintained with sevo 1–3% at ⩽ 2 L/min. In groups P-S and P-P, anesthesia was induced with prop 2.5 mg/kg, and maintained with prop 4–12 mg/kg/h in 60% N_2O in O_2. Boluses were given for light

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anesthesia in groups S-S and P-S with sevo 8% at 6 L/min, and in groups S-P and P-P with prop 50 mg. If bolus failed, fentanyl 2 mcg/kg IV was given. Fentanyl doses were analyzed using one-way ANOVA. Percentage of successful bolus attempts and number of bolus attempts were compared using Fisher's Exact test and Wilcoxon Rank-Sum Test, respectively. Hemodynamics post-bolus and adverse events were compared using two-way ANOVA and Fisher's Exact test, respectively.

Results and Discussion: Mean fentanyl dose per bolus attempt was significantly higher for group P-P than S-S (48.3 ± 69.3 vs. 18.0 ± 49.8 mcg/bolus, $P = 0.037$). Percentage of successful bolus attempts was highest with sevo, but differences between groups were not significant (S-S: 89%, P-S: 84%, S-P: 80%, P-P: 69%; $P > 0.05$). Mean number of bolus attempts for patients requiring bolus was higher for prop (P-P + S-P) than sevo (S-S + P-S) bolus groups (1.37 + 0.75 vs. 1.11 + 0.31, $P = 0.025$). Hemodynamics post-bolus were similar between the 4 groups. The incidence of adverse events, including nausea and vomiting, was also similar between the 4 groups.

Conclusion(s): Sevo and prop boluses to treat light anesthesia during maintenance are both effective and safe. Patients who receive sevo boluses require fewer subsequent repeat boluses than patients who receive prop boluses.

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A-67

Comparison of sevoflurane vs. propofol for maintenance anesthesia when using sevoflurane or propofol for bolus technique

M. James, E. Karamichali*, R.D. Ostroff†

*Department of Anaesthesia, University of Cape Town and Groote Schuur Hospital, Cape Town, South Africa; *Evagelismos General Hospital of Athens, Athens, Greece; †Abbott Laboratories, Abbott Park, Illinois, USA*

Background and Goal of Study: This study examined the efficacy and safety of sevoflurane (sevo) and propofol (prop) as the maintenance anesthetic agent when a bolus of sevo or prop was administered for light anesthesia during maintenance.

Materials and Methods: In this Phase IV, randomized, open-label, multicenter study, 290 adult patients (ASA I–II) undergoing elective, outpatient non-laparoscopic inguinal hernia repair were randomized into four groups:

Group	*N*	Induction/Maintenance	Bolus
S-S	75	Sevoflurane	Sevoflurane
S-P	71	Sevoflurane	Propofol
P-S	71	Propofol	Sevoflurane
P-P	73	Propofol	Propofol

In groups S-S and S-P, anesthesia was induced with sevo 8% in 60% N_2O in O_2 at 6 L/min, and maintained with sevo, titrated by the investigator. In groups P-S and P-P, anesthesia was induced with prop 2.5 mg/kg, and maintained with prop infusion, titrated by the investigator, in 60% N_2O in O_2. Boluses were given for light anesthesia in groups S-S and P-S with sevo 8% at 6 L/min, and in groups S-P and P-P with prop 50 mg. If bolus failed, fentanyl 2 mcg/kg IV was given. Percentage of patients requiring bolus anesthesia by maintenance anesthesia treatment was analyzed using Fisher's Exact test. Intraoperative hemodynamics were compared using two-way ANOVA. Adverse events and clinical evaluations were compared using Fisher's Exact test.

Results and Discussion: Mean maintenance doses were 2.81% for sevo and 212 mcg/kg/min for prop. Percentage of patients requiring bolus anesthesia was significantly lower for the sevo (S-S + S-P) than prop (P-S + P-P) maintenance groups (29.5% vs. 59.0%, $P < 0.001$). Intraoperative hemodynamics were similar between the sevo (S-S + S-P) and prop (P-S + P-P) background anesthesia groups. Adverse events were similar between the sevo and prop groups. Analyses of clinical evaluations showed the prop group had a higher incidence of coughing ($P = 0.017$) and excitement ($P = 0.039$) during maintenance.

Conclusion(s): At the doses administered in this study, patients who receive sevo for maintenance are less likely to require bolus for light anesthesia intraoperatively than patients who receive prop for maintenance.

Acknowledgements: Supported by Abbott Laboratories.

A-68

Use of the Laryngeal Tube for general anaesthesia in ambulatory paediatric surgery

H.V. Genzwuerker, E. Hohl, K. Ellinger

Institute of Anaesthesiology and Intensiv Care Medicine, University Hospital Mannheim, Manheim, Germany

Background and Goal of Study: The Laryngeal Tube (LT, VBM Medizintechnik, Germany) is an airway device available in adult and paediatric sizes. The use for ventilation during general anaesthesia for elective interventions in ambulatory paediatric surgery is studied.

Materials and Methods: After approval of the local ethics committee and written consent of the guardians, patients scheduled for elective ambulatory paediatric surgery, 2 to 12 years old, ASA 1 or 2, Mallampati 1 or 2, were included. After induction of general anaesthesia with fentanyl (average 2.8 μg/kg) or remifentanil (0,5 μg/kg) and propofol (4.8 mg/kg), placement of a LT was attempted according to manufacturer´s instructions. LT position was verified by auscultation and endtidal CO_2-measurement. Oxygen saturation, cuff pressure, time for airway maintenance, number of attempts, intraoperative tidal volume and peak airway pressure were registered. Postoperative assessment was performed 2.5 hours after end of surgery before patient discharge.

Results and Discussions: 40 boys, mean age 5.7 (2.2–12.1) years, size 112.5 (87–151) cm, weight 20.5 (12–38) kg were included. In 38 patients (95%), the LT was placed successfully (85% first attempt, 10% second attempt). In 8 patients (20%), a chin lift was necessary for adequate ventilation, twice sufficient ventilation was not achieved. Laryngospasm occured in one case, sufficient ventilation was possible after deepening of anaesthesia. Time for airway maintenance was 12.2 (6–26) seconds, ventilation was performed for 45 (25–80) minutes (duration of surgery 7 to 50 minutes). The LT size 2 was used in 33 patients (87–129 cm, 12–26 kg), size 3 in 7 (117–151 cm, 20–38 kg). Oxygen saturation during ventilation via the LT was 99.8 (98–100)%, auscultation over the stomach was negative in all patients with a mean cuff pressure of 68.0 (60–100) cmH_2O. The mean tidal volume was 194.3 (110–350) ml (6.8–14.6 ml/kg) during controlled mechanical ventilation, resulting in a peak airway pressure of 16.5 (12–24) cmH_2O. Endtidal CO_2 was measured at 40.0 (34–50) mmHg. No traces of blood were found on the LT. One patient complained of mild swallowing problems (VAS 1).

Conclusions: In children older than 2 years, the Laryngeal Tube provides a patent airway in a high percentage. Minor manipulation is necessary in some patients to allow adequate ventilation, postoperative complaints are rare.

A-69

Expiratory levels of sevoflurane and isoflurane and quality of recovery after ambulatory anaesthesia

F. Roithmeier, P. Lirk, J. Rieder, W. Lingnau

Department of Anesthesiology and Critical Care Medicine, Leopold-Franzens-University, Innsbruck, Austria

Background and Goal of Study: The ambulatory management of surgery is increasingly preferred to reduce cost in health care systems. Patients have to recover fast to look forward to a safe postoperative period at home. Both sevoflurane (SF) and isoflurane (IF) are frequently used in these patients.

Materials and Methods: The study passed the IRB. We included all patients scheduled for day case surgery with their informed consent. Patients were randomly assigned to receive anaesthesia with SF or IF. We took three-litre samples of exhaled air at 12 time points (preoperative, two hours postoperative, twice a day during five days postoperatively). We determined SF and IF levels using Proton-Transfer-Reaction Mass-Spectrometry (PTR-MS). Physical and psychological status was assessed using the c.I. scale. We used the two-way ANOVA or the chi-square test, and a $P < 0.05$ was considered statistically significant.

Results and Discussions: Out of 62 outpatients we included 47 according to protocol (age: SF 41 ± 10, IF 43 ± 10; 70.2% male). Concentrations of SF were higher than those of IF at all time points.

Bag		Mean (ppb)	±SD	*P*-value
preop	Isoflurane	1.56	1.20	0.4962
	Sevoflurane	1.07	3.14	
postop	Isoflurane	1,653.58	1,206.09	0.0033
	Sevoflurane	7,140.27	8,474.08	
Day 1	Isoflurane	94.69	66.26	0.0099
	Sevoflurane	350.55	422.81	
Day 5	Isoflurane	5.13	3.73	0.0337
	Sevoflurane	14.28	17.65	

Volatile anesthetic levels were elevated above baseline until day 3. However, physiological abilities were better in the SF group, especially in the early postoperative period.

Conclusion(s): Our results demonstrate that SF may be the better choice in ambulatory anaesthesia. Recovery from anaesthesia is faster and the patients' cognitive function after SF is not different from preoperative baseline.

Reference:

1 Weidenhammer W and Fischer B (1987): c.I.-Skala – ein Selbstbeurteilungsverfahren zur Objektivierung leichter cerebraler Insuffizienzen, VLESS-Verlag.

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A-70

Multidose vials of remifentanil and alfentanil in outpatients anaesthesia: cost-minimization by reducing drugs wastage

L. Droghetti, F. Landi, A. Guberti, R. Zoppellari, E. Forini

Department of Anaesthesia and Intensive Care, S. Anna University Hospital, Ferrara, Italy

Background and Goal of Study: We studied the efficacy in cost reducing of multidose vials of either Alfentanyl(A) or Remifentanil(R) as part of TIVA with Propofol in urological day surgery.

Materials and Methods: We prepared multidose vials, with antibacterial filter, to be used for five consecutive patients: either R 3 mg in 60 ml saline solution, or A 5 mg in 50 ml saline. Fifty patients, ten patients per day, were randomly allocated to two groups: group R(25) received remifentanil 0.1 $\mu g\,kg^{-1}\,min^{-1}$ infusion through a 10 ml siringe pump, and refilled if necessary, through a three-way tap, and group A(25) received alfentanil bolus 7 $\mu g\,kg^{-1}$. Propofol was administred at a rate of 0.1–0.3 $mg\,kg^{-1}\,min^{-1}$ to obtain adeguate level of anaesthesia, while maintaining spontaneous breathing of oxygen/air through facial mask. We compared the amount of used and wasted drugs between the multidose device and the use of a single vial for each patient. Costs for O_2, staff and equipment were not considered. Statistical analysis was performed with t-test ($P < 0.001$ considered significant).

Results and Discussions: No significant differences between the groups in demografic data, operative time (6–35 min, mean 15), recovery time, pain and patient satisfaction were found.

Infused and wasted analgesic per min of anaesthesia

Analgesic(μg/kg/min)	Alfentanil	Remifentanil
Infused	0,50 ± 0,22	0.10 ± 0.05
Wasted (multidose)	0,45 ± 0,27*	0.50 ± 0.22†
Wasted (1vial/patient)	4,27 ± 2,15*	0.91 ± 0.37†

*† $P < 0.001$

Mean anaesthesia costs of drugs and disposable items

	A single	A multidose	R single	R multidose
€/min	0.87*	0.76*	1.15†	1.04†

Conclusion: Multidose vials, reducing the amount of wasted drug, could reduce the costs of both R and A anaesthesia.

References:

1 Watcha MF, White PF. Economics of anesthetic practice. Anesthesiology 1997; 86:1170–96.
2 Tait AR, Tuttle DB. Preventing perioperative transmission of infections: a survey of anesthesiology practice. Anest Analg1995; 80: 764–9.

A-71

Assesment of hypnotic level using bispectral index under monitored anesthetic care

M. Soyalp, B. Baltaci, A.G. Kaya, E. Toparlak, M. Özen

Department of Anesthesiology, Ankara Training and Research Hospital, Ministery of Health, Ankara, Turkey

Background and Goal of Study: In our study we aimed to assess the hemodynamic stability, level of sedation and patient comfort of midazolam and propofol in patients under monitored anesthetic care (MAC) and also the correlation between sedation scores and BIS(Bispectral index) monitorization in establishing the depth of sedation.

Materials and Methods: With the approval of the ethic committee and informed consent,45 ASA I–II patients,ages between 18–70 undergoing day case surgery were included in the study and randomized into three groups. 5 minutes before the local anesthesia, 50 μg fentanyl was given to all patients. 5 minutes after the local anesthesia; Group I received propofol 30 mg i.v. bolus and 2 $mg.kg^{-1}\,hr^{-1}$ infusion, Group II received midazolam 0,03 $mg.kg^{-1}$ i.v. bolus and 0,1 $mg.kg^{-1}.hr^{-1}$ infusion, Group III received placebo. Hemodynamic parameters, respiratory rate,oxygen saturation,BIS value,OAA/S score (The Observer Assesment of the Alertness- Sedation Scala) (1), infusion rate and side effects were recorded before sedation and 5 minutes intervally after sedation.Kruskall Wallis and Mann Whitney U,Chi-square and Fisher's exact chi-square tests were used for comparisons of the groups.

Results and Discussions: Mean arterial pressure was significantly decreased in Group I($p < 0.01$) and Group II ($p < 0.05$), while increased in Group III ($p < 0.05$). No significant change was observed in heart rate,oxygen saturation and respiratory rate in all groups. The level of sedation ($p < 0,001$) and patient comfort ($p < 0,01$) were statistically satisfactory in Groups I–II. In Group III, there was statistically significant excitation and patient comfort was inadequate($p < 0,01$). We observed a significant decrease in BIS scores in correlation with OAA/S scores in Groups I-II (1).

Conclusion(s): Propofol and midazolam can be safely used during monitored anesthetic care,and also BIS can be used to asses the depth of sedation (2).

References:

1 *Anesth Analg* 1997; 84: 185–9.
2 *Aneth Analg* 2000; 91: 1398–1403.

A-72

Survey of day case refusal. Could more patients benefit from day surgery?

A. Netherwood, M. Watters, N. Campbell

Department of Anaesthesia, Great Western Hospital, Swindon, UK

Background and Goal of Study: Patients listed for day surgery tend to have shorter waiting times and receive levels of care more appropriate to their needs (1). Currently 13% of patients assessed for day surgery are deemed unsuitable (in house audit). In addition the unplanned admission and readmission after day surgery rates are very low. We have investigated whether some patients refused day surgery are in fact having surgery and postoperative care equivalent to day case surgery, and could therefore have waited less time for the procedure.

Materials and Methods: This was a prospective case note review of all patients refused day surgery between August and October 2000. We surveyed what had happened to these patients one year later (October 2001). Primary end point – had patient had surgery. Secondary end points, length of patient stay, type of operation, reason for day case refusal.

Results and Discussions: 119 patients were refused day surgery in the 3 month period. At one year 113 of these case notes were retrieved. 42 patients were still awaiting surgery. 68 patients had inpatient surgery and 3 surgery through the day case unit after fulfilling acceptable criteria. Of the patients having inpatient surgery, 53% were discharged on the day of surgery, and 29% after one night stay in hospital. For patients having inpatient surgery but discharged the same day, the commonest reasons for day case refusal were obesity, and no carer at home.

Conclusion(s): Refusal for day case surgery prolongs the wait for surgery. Many patients refused day case surgery go on to have effectively day case surgery, being discharged on the same day. Stressing the importance of having a carer at home and accepting some patients with a body mass index between 30 and 40 would allow many patients to have earlier surgery.

Reference:

1 Audit Commission 1990. A short cut to better services. Day surgery in England and Wales.

Acknowledgements: Thanks to Hilda Cooper, Audit Department and Day Surgery Nurses, Great Western Hospital, Swindon

A-74

The effects of remifentanil and propofol on intraocular pressure and hemodynamics during sedation for cataract surgery

D. Dal, M. Demirtas, A. Sahin, U. Aypar

Department of Anesthesiology and Reanimation, Hacettepe University Faculty of Medicine, Ankara, Turkey

Background and Goal of Study: Remifentanil is a μ-opioid agonist with a rapid onset and very short duration of action. In this study, we aimed to compare remifentanil with propofol with regards to efficacy and safety of sedation and intraocular pressure (IOP) of patients undergoing cataract surgery.

Materials and Methods: After ethics committee approval, fifty patients aged 35–70 in ASA I–III, not previously operated and scheduled for only one eye cataract surgery, were enrolled into the study. In group I ($n = 25$), remifentanil infusion was initiated at a rate of 0.04 $mgkg^{-1}\,min^{-1}$ 10 min before retrobulbar block (RB). In group II ($n = 25$), propofol infusion was started at 2 $mgkg^{-1}h^{-1}$ 10 min before RB and reduced to 1 $mgkg^{-1}h^{-1}$ with the onset of the operation. IOP of the normal eye were measured before and after RB and at the end of the operation. Sedation scores (1–5) by using Observer Assessment Alertness Sedation Scale (1), blood pressures, heart rate and SpO_2 were assessed at 5 min intervals. Supplemental drug and postoperative complications were also recorded. Repeated measures ANOVA, Kruskal Wallis and Mann–Whitney U tests were used. The study had 93% power to detect a difference of 3.5 in IOP with an error of 0.05.

Results and Discussions: There were significant changes in systolic blood pressures at 5th, 10th, 15th, 25th, 30th, 35th min and mean blood pressure at 10th, 15th, 20th, 25th, 30th, 35th min. between two groups ($p < 0.05$). There was a significant decrease in IOP within time in both groups (Table). SpO_2, IOP, sedation scores and complications were similar ($p > 0.05$).

Table: Intraocular pressure (Mean ± SD)

	Remifentanil (n = 25)	Propofol (n = 25)
Before RB	17.4 ± 3.04	16.56 ± 2.4
5 min	15.9 ± 2.9	15.1 ± 2.06
End of surgery	15.5 ± 2.6	14.2 ± 2.5

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Conclusion: Remifentanil and propofol have both significant effects on IOP. And also remifentanil seems to be a suitable agent for sedation just like propofol for patients undergoing eye surgery under retrobulbar blockade.

Reference:

1 Chernik DA et al. J Clin Psychopharmacol 1990; 10: 244–251.

A-75

Propofol–ketamine versus propofol–alfentanil for urologic endoscopy

Z. Zrelli, K. Moncer, F. Miled, K. Saidil, M. Methamem, A. Ben Abdelaziz*, O. Kaabachil

*Department of anaesthesia and surgical intensive care; *Department of statistics; Sahloul Hospital, Sousse, Tunisia*

Background and Goal of Study: Propofol and ketamine may be paired for anaesthesia induction and for total intravenous anaesthesia.(1) The association provides stable hemodynamic and prevents emergence phenomena. (2) We compared the efficacy, respiratory and hemodynamic profiles and side effects of two anaesthetic regimes of co administration of propofol and either small dose ketamine or alfentanil.

Materials and Methods: Eighty four ASA physical status I–II patients undergoing urologic endoscopy were randomised in 2 groups. Propofol was associated to either initial intravenous bolus of 0.5 mg/kg ketamine in groupA or 5 μg/kg alfentanil in groupB. Induction dose of propofol was titrated until apnea, followed by an intravenous infusion (2mg/ml) to achieve an adequate level of sedation (no movement). Heart rate, arterial pressure, respiratory rate, oxygen saturation, endpoints hypnosis, recovery profile, side effects and propofol requirement were recorded. Statistic analysis used T test and Anova for continuous parameters and χ^2 and Fisher's exact test for parametric data. $P < 0.05$ was significant.

Results and Discussions: Demographic data were similar in both groups. Data (mean ± DS, %) were showed in table

	Group A (n = 42)	Group B (n = 42)	P
Induction dose P (mg/kg)	2.35 ± 0.5	2.08 ± 0.6	0.03
Total dose P (mg/kg/minutes)	0.4 ± 0.2	0.34 ± 0.2	0.1
Unresponsiveness to command (seconds)(s)	37 ± 17	42 ± 19	0.2
Loss muscle tonicity (s)	51 ± 24	52 ± 17	0.9
onset of apnea (s)	60 ± 19	49 ± 17	0.02
Hypotension (%)	0	28.2	<0.00
Time to recovery(min)	4.8 ± 3	3.7 ± 2	0.1

Conclusion(s): The adduction of small dose of ketamine (0.5 mg/kg) to propofol conferred a good quality of anaesthesia with a better homodynamic stability and no additional sides effects compared to alfentanil–propofol co administration

References:

1 Frey KDO Anesth Anal 1999; 89 :317–21.
2 Frizelle HP Anesth Anal 1997; 84: 1318–22.

A-76

Diprifusor TCI and sedation for colonoscopy in ambulatory setting: a randomized study

E. Vincenti, M. Ferrana, M. Varrati, P. Griggio, A. Carlot

Department of Anaesthesiology and Intensive Care, Dolo Hospital, Venice, Dolo, Italy

Background and Goal of study: Diprifusor-TCI (D-TCI) has been used successfully for sedation as sole anesthetic agent in a small group of patients submitted to colonoscopy [(1)]. Aim of study was to investigate both efficacy and safety of D-TCI in a wider number of pts randomly allocated in 3 groups to receive (A) propofol as sole agent, (B) propofol associated with droperidol (DBP) and lower dose of fentanyl (Fe), and (C) propofol associated with DBP and higher dose of Fe.

Materials and Methods: 150 consecutive ambulatory patients were included: 60 for Group A, 30 for B, and 60 for C. Group B received 2.5 mg DBP and 50 mcg Fe before D-TCI; Group C, 2.5 mg DBP and 100 mcg Fe before D-TCI. Plasmatic conc. target was maintained at level allowing a sedation score below 5 according to Murdoch et al [(2)]. Site effect concentration (SEC) and sedation score were recorded every 2 min. SEC at start of colonoscopy (SSEC), during colonoscopy (MSEC), at the end of procedure (ESEC), and at awakening (AWSEC) were collected. Data are presented as mean ± s.d. Statistical analysis by Student's T test for unpaired data.

Results and Discussion. All patients were satisfied, none had recall of the colonoscopy, and vital parameters were stable. As shown in table, total dose of propofol was reduced when Fe and DBP were used. Also, neuroleptanalgesic association allowed reduction of SEC both at start and at maintenance of sedation. On the contrary, sedation scores in Groups B and C were higher in comparison with group A.

	Group A	Group B	Group C
Number of pts	60	30	60
age (years)	58.5 ± 12.5	59.9 ± 16	57.0 ± 12.9
weight (kg)	71.4 ± 12	69.3 ± 15.2	72.2 ± 12.8
Exam time(min)	17.1 ± 7	16.7 ± 7.6	20.9 ± 10.8
Total Propofol(mg)	201.3 ± 76.4	162.2 ± 60.1*	158.0 ± 78**
MSEC (mcg/ml)	1.9 ± 0.38	1.6 ± 0.3**	1.5 ± 0.2**
sedation score	3.1 ± 1.8	3.9 ± 1.7**	3.7 ± 1.6**
SSEC (mcg/ml)	1.6 ± 0.4	1.2 ± 0.5**	1.0 ± 0.3**
ESEC (mcg/ml)	1.4 ± 0.4	1.4 ± 0.4	1.3 ± 0.3
AWSEC (mcg/ml)	1.1 ± 0.4	1.1 ± 0.3	1.0 ± 0.2
Awake time (min)	1.9 ± 1.7	2.0 ± 2.2	2.6 ± 2.2

(*P < .05; **P < .01)

Conclusions: TCI with propofol in association with small doses of fentanyl and droperidol is as safe as the use of propofol alone. 50 mcg Fe together with 2.5 mg DBP may improve anti-nociceptive protection and reduce propofol requirement.

References:

1 Leslie K et al. Anaesthesia 2002; 57: 693–7.
2 Murdoch JA et al. Br J Anaesth 2000; 85: 299–301.

A-77

Fast-track eligibility after total intravenous anaesthesia with propofol and balanced anaesthesia with desflurane

G. Geldner, S. Beekmann, L. Eberhart, A. Glaser, H. Wulf

Department of Anaesthesia and Intensive Care Medicine, Philipps-University Marburg, Germany

Background and Goal of Study: Total intravenous anaesthesia with propofol (TIVA) was compared with balanced anaesthesia using desflurane (BA) with respect to fast-tracking eligibility of ASA 1–2 patients undergoing minor gynaecological surgery.

Materials and Methods: After approval by the local ethics committee, 2 × 50 patients were randomized immediately before start of anaesthesia. In all patients anaesthesia was induced with propofol and alfentanil. Alfentanil was repeated as clinically indicated. In the TIVA-group maintenance of anaesthesia was provided by a continuous infusion of propofol (5–10 mg $kg^{-1} h^{-1}$) and in the BA-group by administering 3–6 Vol.% desflurane in air-oxygen. The main endpoint of the trial was defined as time from end of surgery until achieving fast-tracking eligibility according to a modified Aldrete recovery score [1]. Statistics were calculated using Kaplan-Meier survival analysis (Mantel-Cox log-rank test) using $\alpha = 0.05$.

Results and Discussions: Data of 96 patients were analysed. Biometric data, duration of surgery, and use of additional anaesthetic drugs were equally distributed between the two groups. The table lists the times to achieve fast-track eligibility (median; 25th–75th percentile) and the major causes for delayed discharge from the recovery room to the ward (relative incidence; 95%-confidence interval). There were no statistical significant differences between the groups.

		BA (n = 47)	TIVA (n = 49)
Fast-tracking eligibility	[min]	6; 3–10	6; 4–10
Impaired vigilance	[%]	9; 3–20	18; 10–32
PONV	[%]	19; 10–33	14; 7–27
Shivering	[%]	9; 3–20	6; 1–17
Desaturation (SaO_2 < 90%)	[%]	4; 0–15	8; 3–20

Conclusion: Postoperative recovery times were short in both groups. Impaired postoperative vigilance and postoperative nausea and vomiting (PONV) were the major causes for delayed fast-tracking eligibility.

Reference:

1 White PF, Song D. Anesth Analg 1999; 88: 1069–72.

A-78

Comparision of hyperbaric bupivacaine 7.5 mg and isobaric bupivacaine 10 mg with 25 mcg of fentanyl in outpatient lower limb saphenous vein stripping surgery

I. Golubovska, J. Stipins

Department of Anaesthesiology, Health Center 4 Hospital of traumatology and Orthopaedics, Riga, Latvia

Background and Goal of Study: The aim of this study was to ascertain the clinical efficacy of different types bupivacaine for outpatient lower limb saphenous vein stripping.

Materials and Methods: We studied 30 ASA I–II patients in a randomized and prospective manner. Spinal anaesthesia was performed in a lateral decubitus position L3–4 or L4–5 interspaces with BBraun G27 pencan needle with a hole to dependent side. In Group I patients received 7,5 mg of

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hyperbaric bupivacaine, in Group II-10 mg of isobaric bupivacaine with 25 mcg of fentanyl intrathecally.

Sensory level was registered by pinprick, motor blockade by Bromage scale (0–3). MAP, HR, SatO2, respiratory rate were assessed 5 min, 10 min, 1 h, 1.5 h, 2 h, 3 h, 4 h after introduction. Also side effects like nausea, vomiting, pruritus, hypotension, and problems with voiding were registered. Discharge time and patients satisfaction were notified.

Results and Discussions:

	I	II
Age	43,3 ± 12,2	42,1 ± 4,3
Sex	F	F
Weight	68,8 ± 8,2	72,2 ± 7,8
Height	167 ± 4	162 ± 6
Duration of sensory block	127 ± 23	174 ± 27
Duration of motor blockade	83 ± 18	120 ± 19
Discharge time	220 ± 24	290 ± 37
Nausea, vomiting		1
Pruritus		1
Hypotension	1	1
Patient satisfaction	+++	++

$P < 0.1$

Conclusion(s): Unilateral spinal anaesthesia with 7,5 mg of hyperbaric bupivacaine is significantly better for outpatient lower limb vein stripping-less side effects, shorter discharge time and higher patients satisfaction

References:

1 Gentili M, Senlis H et al. *Reg Anesth* 1997; 22: 511–514.

A-79

Sedation strategies for cataract surgery

V. Toprak, G.T. Keles, G. Ok, D. Tok

Department of Anaesthesiology and Reanimation, Celal Bayar University, School of Medicine, Manisa; Turkey

Background and Goal of Study: This study was designed to compare different anaesthesia management strategies for cataract surgery under local anaesthesia.

Materials and Methods: With the approval of the local ethics committee and written informed consent we studied 60 patients who were undergoing elective cataract surgery. Patients were randomized to one of four strategy groups differing in sedation and monitoring approach:

Strategy 1: Retrobulbar block + Premedication + Anaesthetist on-call.

Strategy 2: Retrobulbar block + Premedication + Anaesthetist present throughout the case.

Strategy 3: Retrobulbar block + Sedation + Anaesthetist present throughout the case.

Strategy 4: Retrobulbar block + Premedication + Sedation + Anaesthetist present throughout the case.

For each strategy group intraoperative haemodynamic instability, postoperative nausea and vomiting, surgical complication surgeon and patient satisfaction were compared. Premedication was obtained with 10 mg PO diazepam; seadation was obtained with remifentanil 0.5 μg/kg IV 2 minutes before retrobulbar block.

Results and Discussions: Two patients in Strategy 1 group had surgical complications, but there was no significant relation between strategy type, surgical complication and intraoperative instability. ($p > 0.05$). The presence of anaesthetist throughout the case increased patient and surgeon satisfaction significantly ($p < 0.05$).

Conclusion(s): Many different sedation and monitoring approaches can be chosen for cataract surgery under local anaesthesia[1]. The occurence of surgical and haemodynamic complications are not affected by the type of anaesthetic approach, but the patient and surgeon satisfaction increases with the presence of anaesthetist and sedation.

Reference:

1 Prabhu A., Chung F:. Eur J Anaesth 2001; 18: 36–43.

Monitoring: Equipment and Computers

A-80

Comparison of cardiac output measurements with electrical velocimetry and thermodilution in patients undergoing coronary artery bypass grafting (CABG)

H. Kiefer, M. Osypka, W. Bellinghausen, A. Petry,

Department of Anesthesia, Heartcenter Leipzig, Leipzig, Germany

Background: Electrical velocimetry (EV) is a non invasive method for determination of stroke volume (SV) and cardiac output (CO) using the rate of change of electrical conductivity of blood in the aorta. Theoretically, the orientation of disk-shaped erythrocytes in the aorta changes quickly from random to alignment in the direction of the blood flow upon opening of aortic valve. The pulsatile alignment of the erythrocytes during the early systole and the increasing random orientation during diastole correspond to a pulsatile increase or decrease in electrical conductivity. Aim of the study is to compare the non invasively obtained CO measurements with clinically established invasive standards (1, 2) preoperatively.

Materials and Methods: Standard ECG electrodes utilized for non invasive CO measurements were placed on 11 patients, 9 male and 2 female, with coronary artery disease undergoing CABG, who were subject to placement of a pulmonary artery catheter (PAC) and CO determination by bolus thermodilution (TD).

Results and Discussions:

	n =	Age	Weight	CO (TD)	CO (EV)	abs. diff.
Mean/SD	11	68/7	77.6/11.7	4.3/1.0	4.2/0.7	0.15/0.8
Max/Min		81/58	110/62	6.1/3.4	5.4/3.1	1.8/−1.6

A bias of 0.15 L/min and a precision of 1.74 L/min indicate a good correspondence of both methods.

Conclusions: EV is a suitable non invasive method for CO measurements. Further investigations have to be done to calibrate these technique with a standard thermodilution method in different clinical situations.

References:

1 Bernstein DP. Crit Care Med 1986; 14(10): 904–909.

2 Osypka MJ, Bernstein DP. AACN Clinical Issues 1999; 10: 385–399.

A-81

Extravascular lung water index as a predictive value for critical patient outcome

A. Mattei, F. Chiumiento, A. Corcione, A. Papa

Department of Scienze Anestesiologiche, Chirurgiche e delle Emerge, Società Italiana Anestesia Analgesia e Rianimazione (SIAARTI), Naples, Italy

Background and Goal of the Study: In patients with acute respiratory failure, variables such as ELWI following thermodilution and serum albumin predict the PaO_2/FiO_2 ratio and help choose appropriate types of ventilation and of weaning (1). In the present study, we have attempted to define the extent to what derangements of the ELWI relate to different clinical outcomes in critical patients.

Materials and Methods: We have evaluated 18 patients (mean age 46 yrs, range 21–75 yrs), with acute respiratory failure (APACHE II score 32, range 17–41). All received mechanical ventilation, fluids and amines according to standard protocols for haemodynamic stabilization.In each case, FiO_2 and PEEP were settled to achieve PaO_2 values >60 mmHg; plateau pressure values <40 cm H_2O and PEEP > the lower inflection point of the pressure/volume courve. ELWI was derivated with the Pulsion PiCCO (SEDA) system, admission values being 27.5 ml Kg^{-1} (range 5–40). All the data were expressed as means ± SD. Students t-test was employed for statistical analysis, the data being defined significant when the values were <0.005.

Results: In the group of individuals (n = 9) with ELWI <10 ml Kg^{-1} (5,125 ± 0.83; 95% CI), serum albumin was 2.78 ± 0.44 g/L and the PaO_2/FiO_2 ratio was 161.45 ± 114.16 mmHg. In the group of individuals (n = 9) with ELWI >10 ml Kg^{-1} (12,27 ± 2.80; 95% CI), serum albumin was 2.53 ± 0.29 g/L and the PaO_2/FiO_2 ratio was 195.45 ± 104.04 mmHg. Mortality was 12.5% in patients with the lower ELWI and of 72% in those with the higher ELWI. With the exception of the ELWI values (T = 0.000001), serum albumin and PaO_2/FiO_2 ratio in the two groups were comparable.

Conclusions: Regardless of the values of serum albumin and of the PaO_2/FiO_2 ratio, the measurement of the extrapulmunary water prior to and during mechanical ventilation predicted death in the present setting.

References:

1 Davey-Quinn A, Gedney JA, Whiteley SM, et al. Anaesth.Intens.Care 199, Aug;27(4): 357–62.

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A-82

Haemodynamic alterations in laparoscopic cholecystectomy using oesophageal Doppler

E. Antonopoulou, K. Papaioannou, D. Papadopoulos

Department of Anaesthetic, General Hospital, Xanthi, Greece

Background and Goals: To evaluate the changes in cardiac output during laparoscopic cholecystectomy.
Material and Methods: We studied 40 patients, ASA I–II Mean age 49.47. The Haemodynamic parameters were recorded during 5 phases: (a) after the induction (b) after the peritoneal insufflation, (c) when the patients were positioned in anti-Trendeleburg with left lateral tilt (d) in the end of pneumoperitoneum (e) just before the end of anaesthesia. Cardiac output (CO), Stroke Volume (SV), Corrected Flow Time (FTc), Peak Volume (PV), non-invasive blood pressure, heart rate, SpO_2, $PetCO_2$ was monitored. General anaesthesia with endotracheal intubation and controlled ventilation was used. The intra-abdominal pressure during peritoneal insufflation was less than 12 mmHg.
Results: Peritoneal insufflation resulted in statistically significant reduction of the cardiac output ($p < 0.001$). There was also significant reduction in stroke volume. There was no relationship between changes in cardiac output and mean arterial pressure or $PETCO_2$.
Conclusions: The oesophageal Doppler provides an easy-to-handle and non-invasive tool to monitor the haemodynamic changes. There is a statistically significant reduction in Cardiac output and Stroke Volume during the pneumoperitoneum. This is apparently well tolerated in healthy patients but a lot of attention should be paid in patients with cardiac disease.

A-83

The comparison of the hemodynamic effects of the inhalational anesthetics by using Thoracic Electrical Bioempedance method

S. Durukan, A. Ceyhan, B. Baltaci, K. Arslan, M. Özen

Department of Anesthesiology, Ankara Training and Research Hospital, Ministry of Health, Ankara, Turkey

Background and Goals: Almost all of the inhalational anesthetics cause myocardial depression and decrease in stroke volume and blood pressure (1). In our study we aimed to compare the hemodynamic effects of sevoflurane and desflurane by using a noninvasive method called Thoracic Electrical Bioempedance (TEB).
Materials and Methods: 40 patients,aged 20–60, ASA I–II group, undergoing lower abdominal surgery-lasting 60–120 minutes (min) were included in the study and randomized into 2 groups. Before anesthesia, 8 TEB and 3 ECG (D II) electrodes were placed and patients were monitored by using an ECG monitor and a NCCOM-3R7 (BOMED CO, USA) TEB monitor which is adjusted according to Bernstein-Sramek equality. Anesthesia was induced by thiopental 7 $mg.kg^{-1}$, vecuronium 0,1 $mg.kg^{-1}$ and fentanyl 1,5 $mg.kg^{-1}$. After intubation to group 1($n = 20$) sevoflurane 1 MAC(1.5–2%) and to group 2($n = 20$) desflurane 1 MAC (5–6%) were given in 50% N_2O and O_2.Heart rate (HR), mean arterial pressure (MAP), cardiac index (CI) and stroke index (SI) were measured before induction (t_1), 5 min. after intubation (t_2), 5 min. after surgical incision (t_3), on 10th min. (t_4) and 20th min. (t_5) and 5 min. after extubation (t_6). Repeated Measure ANOVA was used for statistical analysis.
Results: There was no significant difference between the demografic data of the groups. HR values of the groups were decreased significiantly at times t_4 ($p < 0.025$) and t_5 ($p < 0.005$).While there was a significant decrease in MAP at time t_5 in sevoflurane group ($p < 0.001$), no significant change was observed in desflurane group. There was a significant difference between the CI values of the groups ($p < 0.031$) at measured times. SI was decreased significantly at t_2, t_3, t_4, t_5 and t_6 compared with t_1 ($p < 0.001$) in both groups.
Conclusion: We observe that both sevoflurane and desflurane decrease HR, MAP, CI and SI. As a conclusion desflurane has similar effects on cardiovascular system like sevoflurane.
Reference:
1 Miller Ronald D. *Anesthesia* by Churchill Livingstone 2000;Volume I: 96–116.

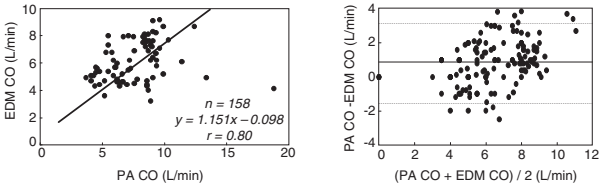
A-84

Comparison of cardiac outputs in major burn injury: esophageal doppler monitor vs. thermodilution pulmonary artery catheter

H.S. Kim, T.H. Han, I.S. Kwok, H.W. Wie, H.Y. Kil, K.M. Kim, J.H. Kim

Department of Anesthesiology and Pain Medicine, HanGang Sacred Heart Hospital, Seoul, Republic of Korea

Background and Goal of Study: After the major burn injury, patients often experience severe hemodynamic changes due to various reasons in a relatively short period of time, requiring invasive hemodynamic monitors. Usefulness of pulmonary artery catheter (PAC) is limited by its invasiveness. Noninvasive esophageal Doppler monitor (EDM) may offer an alternative in this setting. This study was conducted to evaluate the validity of Doppler derived cardiac output in comparison to that of PAC in a large amount of volume status change.
Materials and Methods: A total of 20 critically ill, major burn patients, scheduled for elective early escharectomy, were included. PAC and EDM were placed together in any single given patient. Three cardiac outputs (CO) were measured by thermodilution PAC at the end of expiration and averaged. EDM was set to measure CO at every 5 cardiac cycles. Simultaneous data were collected at regular time intervals. Pearson correlation coefficient and Bland and Altman plot were used for statistical analysis.
Results and Discussions: A total of 158 pairs of data in 20 patients were gathered. Extent of Burn Injury was 51.2 ± 15.7% TBSA. Early escharectomy was performed at 7.8 ± 5.3 days after initial injury. Estimated blood loss was 1840.0 ± 981.6 ml in 188.8 ± 122.5 min of surgical time. This was replaced by 4.7 ± 2.1 U of Packed RBC, FFP, approximately 4 liters of crystalloid and colloids. Average CO by EDM was 15% less than PAC CO. Pearson correlation coefficient (*r*) was 0.8. Bias mean ± 2SD was 1.22 ± 4.05(L/min).



Conclusions: EDM can be useful for the trend analysis of hemodynamic changes, but not for the measurement of absolute values of CO in the major burn patients.
References:
1 Valtier B, Cholley BP, Belot J, et al. Am J Respir Crit Care Med 1998; 158: 77–83.
2 Kamal GD, Symreng T, Starr J. Anesth 1990; 72: 95–9.

A-86

Continuous and bolus thermodilution cardiac output measurement during off-pump coronary artery bypass surgery

S.M. Kim, S.D.S. Oliveira, U.S. Fonseca, L.M.S. Malbouisson, J.O.C. Auler Jr, M.J.C. Carmona

Department of Anesthesia and Surgical Critical Care, Heart Institute (InCor) of Hospital das Clínicas of São Paulo University Medical School, São Paulo, Brazil

Background and Goal of Study: Off-pump CABG surgery is related to major and rapid hemodynamic changes that may not be immediately detected by continuous measurement of cardiac output (1). We compared results of CCO pulmonary artery catheter (PAC) versus standard bolus thermodilution method during coronary distal anastomosis.
Materials and Methods: We studied 10 patients undergoing off-pump CABG. They were monitorized with a CCO PAC with thermal filament (Baxter Edwards Critical Care, Irvine, CA). Measurements were taken after heart stabilization with the octopus device and at the end of the distal anastomosis. Data were analyzed using two-way RM ANOVA. P value <0.05 was considered significant.
Results and Discussions: Results are as follow (cardiac output indexed, mean ± SD):

	Bolus	Continuous
After induction	2.2 ± 0.7	2.6 ± 0.7
Before anastomosis	2.8 ± 0.7	3.0 ± 0.6
Beginning of 1st anastomosis	2.3 ± 0.8	3.2 ± 0.5*
End of 1st anastomosis	2.5 ± 0.8	3.1 ± 0.6*

* $P < 0.05$: difference between groups bolus vs continuous.

Conclusion: Continuous CO PAC presented a delay to detect acute hemodynamic changes due to heart positioning during off-pump CABG.
References:
1 Velissaris T. *Eur J Cardiothorac Surg* 2002; 22:852.
2 Singh A. *J Cardioth Vasc Anesth* 2002; 16:186–90.

A-87

Cardiac preload indexes: PAOP, ITBVI and EDAI vs SVI

M.G. Costa, L. Pompei, C. Coccia, G. Della Rocca

Department of Anesthesia, Clinica di Anestesia – University of Udine, Udine, Italy

Background and Goal of the Study: The end diastolic area index (EDAI) measured with the transesophageal echocardiography (TEE) has been

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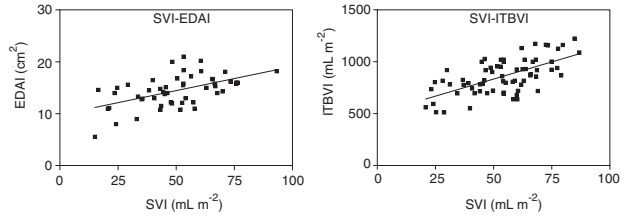
introduced in clinical practice for the estimation of preload. However cardiac preload is commonly monitored by pulmonary artery occlusion pressure (PAOP) and more recently by Intrathoracic Blood Volume Index (ITBVI) measured with the transpulmonary thermodilution technique[1].This study correlated ITBVI, EDAI and PAOP with Stroke Volume Index (SVI) in patients undergoing liver transplantation.

Materials and Methods: 18 patients (14M, 4F), mean age 52 ± 8, mean BSA 1.8 ± 0.2, undergoing liver transplantation were studied. All patients were monitored with a pulmonary artery catheter, with PiCCO System (Pulsion Medical System; Munich, Germany) and a TEE probe was positioned to obtain the standard trans-gastric short axis view to left ventricular estimate EDAI. All hemodynamic-volumetric data were recorded during four phases: after induction of anesthesia (T0), during anhepatic phase (Tc), at least 30' after graft reperfusion (Tr) and at the end of surgery (Tf). The relationship between the different preload variables (PAOP, ITBVI, EDAI) and the SVI were analyzed by linear regression analysis.

Results and Discussion: ITBVI and EDAI vs SVIpa showed a correlation coefficient (r^2) respectively of 0.40 ($p < 0.0001$) and 0.30 ($p < 0.0001$), while PAOP failed ($r^2 = 0.01$, ns).



Conclusions: ITBVI confirms to be a good predictor of cardiac response and EDAI can be considered as an advanced method to assess fluid administration during liver transplantation even if the cost and the operator dependency limit its application in clinical practice.

Reference:

1 Buhre W, Buhre K, Kazmaier S et al. Eur J Anaesthesiol 2001; 18 (10): 662–667.

A-88

PAOP, ITBVI and EDVI versus SVI as cardiac preload indexes

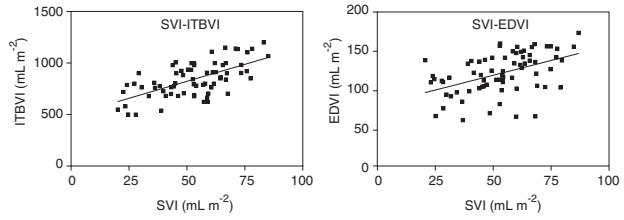
M.G. Costa, L. Pompei, C. Coccia, G. Della Rocca

Department of Anesthesia, Clinica di Anestesia – University of Udine, Udine, Italy

Background and Goal of the Study: Standard monitoring of cardiac preload is performed by measurement of pulmonary artery occlusion pressure (PAOP). Intrathoracic Blood Volume Index (ITBVI) measured with the transpulmonary thermodilution technique and the Right Ventricular End Diastolic Volume Index (EDVI) measured by a modified pulmonary artery catheter (PAC) have been proposed as improved measures of cardiac preload. This study correlated PAOP, ITBVI, and EDVI with Stroke Volume Index (SVI) in patients undergoing liver transplantation (LTx).

Materials and Methods: 18 patients (14M, 4F), mean age 52 ± 8, mean BSA 1.8 ± 0.2, undergoing LTx were studied. All patients were monitored with a modified 7.5 Fr PAC (Intellicath Edwards Laboratories, Irvine, CA, USA) and with the PiCCO System (Pulsion Medical System; Munich, Germany). All hemodynamic and volumetric data were recorded during four phases: after induction of anesthesia (T0), during anhepatic phase (Tc), at least 30' after graft reperfusion (Tr) and at the end of surgery (Tf). The relationship between the different preload variables (PAOP, ITBVI, EDVI) and the SVI were analyzed by linear regression analysis.

Results and Discussion: The analysis between ITBVI, EDVI and SVI showed respectively a r^2 of 0.40 ($p < 0.0001$) and 0.22 ($p < 0.0001$) while PAOP failed ($r^2 = 0.01$ ns).



Conclusions: ITBVI and EDVI proved to be valuable for cardiac preload determination and good predictors of cardiac response. More data are necessary to confirm this preliminary result on EDVI as measure of global cardiac preload during liver transplantation.

Reference:

1 Sakka SG, Bredle DL, Reinhart K et al. J Crit Care 1999; 14: 78–83.

A-89

Can a non invasive method to measure cardiac output be a substitute for Swanz-Ganz catheter?

J.L. Jover, M. Soro, G. Aguilar, R. Ferrandis, P. Caro, F.J. Belda

Department of Anesthesiology and Critical Care, Hospital Clínic Universitari València, València, Spain

Background and Goal of Study: Cardiac Output is a very valuable parameter in assessing cardiopulmonary status of ICU patients. Its measurement by thermodilution requires a central venous access and introduction of a pulmonary artery catheter with possible adverse effects. NICO device (Novametrix Medical System Inc.) represents a new non invasive approach based on Fick's CO_2 partial rebreathing[1]. The purpose of our study is to determine the accuracy of the NICO device in comparison with the thermodilution method in ICU patients after cardiac surgery.

Materials and Methods: After ethics committee approval, 20 patients undergoing cardiac surgery for CABG and/or valve repair were enrolled in the study. Paired measurements of cardiac output were obtained by thermodilution and NICO device in the post-operative period after securing hemodinamic stability and before sedation withdrawal and weaning onset. For statistical analysis Pearson's correlation and Bland-Altman analysis were used.

Results and Discussions: Demographic data of the 20 patients were: 16 men and 4 women. Age 65 ± 5 years. Weight, height and BSI: 74,65 ± 8,42 Kg, 162 ± 63 cm, 1,83 ± 0,12 m^2 (mean ± SD). Surgical proceedings were: 12 CABG, 7 valve repair in 7 and 1 combined. Arterial blood pressure, heart rate, central venous pressure, pulmonary pressure and PCPW: 78 ± 10 mmHg, 80 ± 8 b/min. 8 ± 2 mmHg, 20 ± 6 mmHg, 10 ± 3 mmHg. Thermodilution cardiac output was 5,33 ± 1,52 l/min. CI 95% (2, 80–9, 50); NICO cardiac output 4.80 ± 1.22 l/min. CI 95% (2.60–9.10). NICO monitor underestimated cardiac output in 70% of the measures. Pearson's correlation was $r = 0,78$ ($p < 0,005$). The mean cardiac output difference (BIAS) was 0,54 with a precision of 0,95 and limits of agreement −1,33 to 2,40.

Conclusions: According to our results NICO device cannot be accepted to replace the thermodilution method although it represents an approach to consider especially taking in to account its no side effects.

Reference:

1 Partial CO_2 Rebreathing Cardiac Output – Operating Principles of the NICO® System. Jaffe MB: *Journal of Clinical Monitoring and Computing* 1999, 15 (6): 387–401.

A-90

Correlation of Narcotrend® Index, entropy measures, and spectral parameters with calculated propofol effect-site concentrations during induction of anaesthesia

U. Grouven, B. Schultz, M. Siedenberg, A. Schultz

Department of Informatik/Biometrie, Medizinische Hochschule Hannover, Hannover, Germany

Background and Goal: The correlation of the processed EEG parameters Narcotrend® Index (NCT) (1), spectral edge frequency (SEF95), burst-corrected SEF95 (BcSEF95), spectral entropy (SpeEn) (2), amplitude entropy (AmpEn) (3), and approximate entropy (ApEn) (2) with the calculated propofol effect-site concentration in standardised inductions of propofol/remifentanil anaesthesia was investigated.

Materials and Methods: With approval of the local ethics committee inductions of anaesthesia with remifentanil (1.0 μg/kg/120 s, continued with 0.3 μg/kg/min) and 2 mg propofol/kg/60 s (group 1), 4 mg/kg/120 s (group 2), and 4 mg/kg/240 s (group 3) were analysed (10 patients each). After induction all patients received 4 mg propofol/kg/h. The EEG was recorded with the EEG monitor Narcotrend®. The EEG parameters were calculated off-line every 5 s for overlapping epochs with a length of 20 s. Data from start of propofol injection until 1 min after the end of induction were included in the statistical analysis. Propofol effect-site concentrations were calculated using a pharmacokinetic model (Software: STANPUMP). For statistical analysis Spearman rank correlation was used.

Results: Rank correlations are shown in the table (mean ± standard deviation). Narcotrend Index shows the highest correlation with the propofol effect-site concentration.

Parameter	Group 1	Group 2	Group 3
NCT	−0.96 ± 0.02	−0.97 ± 0.02	−0.97 ± 0.03
SEF95	−0.46 ± 0.44	−0.24 ± 0.50	−0.52 ± 0.36
BcSEF95	−0.48 ± 0.43	−0.42 ± 0.51	−0.72 ± 0.34
SpeEn	−0.35 ± 0.43	0.02 ± 0.53	−0.29 ± 0.39
AmpEn	0.34 ± 0.67	−0.24 ± 0.51	−0.17 ± 0.47
ApEn	−0.68 ± 0.32	−0.75 ± 0.26	−0.80 ± 0.13

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Conclusion: Changes in the propofol effect-site concentration during induction of anaesthesia were best described by the multivariate Narcotrend® Index compared to other EEG mono-parameters.

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2 Rezek IA, Roberts SJ. *IEEE Trans Biomed Eng* 1998; 45:1186–1191.
3 Bruhn J et al. *Anesthesiology* 2001; 95:30–5.

A-91

Entropy: a new anaesthetic depth monitor. Comparative study with BIS in the clinical setting

P. Vila, J. Canet, S. Muñoz, C. Espí

Department of Anaesthesiology. Hospital Universitari Germans Trias i Pujol, Badalona, Barcelona, Spain

Background and Goal of Study: Spectral entropy, a new method of EEG analysis based on the quantification of the EEG chaos signal, may monitor hynosis in a way similar to BIS. As in BIS, a scale, from 0 to 100, is used to assess anaesthetic depth. Also, the new approach separates state entropy (SE), which includes low frequency waves (<32 Hz), from response entropy (RE), which includes all frequency waves, even those arising from EMG. We aimed to compare the entropy values with those from BIS monitor in patients undergoing general anaesthesia.

Materials and Methods: After institutional approval and individual consent we enrolled 9 female patients (mean (SD) age 44(14) yr) undergoing abdominal gynaecological procedures under general anaesthesia. Anaesthetic induction and tracheal intubation were accomplished with thiopental and vecuronium. Desflurane/N_2O and fentanyl were used for anaesthetic maintenance. A BIS value between 40 and 50 was targeted. Two probes were placed in the front of each patient, to monitor BIS (Aspect) and entropy (SE and RE) (Datex-Ohmeda). Values were recorded simultaneously at determined moments of the procedure: baseline, post-induction, post-intubation, starting surgery, ending anaesthesia, when cough was present and when eyes opened. Statistical analysis was performed with a paired t-test.

Results: The table shows the values for BIS and entropy at the recording moments

	BIS	SE	RE
Baseline	93(5)	89(3)*	96(3)*$^{+}$
Post-induction	40(26)	33(19)	38(21)$^{+}$
Post-intubation	59(11)	62(16)*	66(17)*$^{+}$
Starting surgery	43(10)	40(10)	43(11)
End-anaesthesia	44(12)	41(15)*	38(12)
Coughing	76(11)	61(17)*	75(16)$^{+}$
Eyes opening	91(8)	84(6)*	95(4)$^{+}$

Significantly different from *BIS; from $^{+}$SE

Discussion: These preliminary results, suggest that entropy seems to evolve in a parallel way to BIS values over the course of a surgical procedure. Significant differences can be observed between BIS with SE or RE, possibly as a result of muscle activity. Separation of EEG and EMG signals obtained by entropy may offer a more accurate way to assess adequacy of anaesthesia.

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A-92

Comparison of entropy and bispectral index of EEG in propofol, sevoflurane and thiopental anaesthesia

A. Vakkuri*, A. Yli-Hankala#, S. Mustola, N. Tenkanen&, H. Viertiö-Oja&,

**Department of Anaesthesia and Intensive Care, Helsinki University Hospital, Helsinki, Finland; #Tampere University Hospital, Finland; &Datex-Ohmeda Div., Instrumentarium Corp., Helsinki, Finland*

Background and Goal of Study: Entropy of EEG is a novel measure of hypnosis during anaesthesia. Response entropy (RE) includes EEG and FEMG, State entropy (SE) mainly EEG. The performance of ENT and BIS monitoring were compared during three different types of anaesthesia.

Materials and Methods: RE, SE (Entropy Module, Datex-Ohmeda) and BIS (BIS XP, A-2000, Aspect Medical) were collected from 64 consenting patients, at 3 different test sites, after IRB approval. Loss of consciousness (LOC) at the induction of anaesthesia was tested every 10 sec by the patient's ability to follow verbal command. Regaining of consciousness (ROC) was tested in thio and propo groups after initial single bolus, in sevo group after anaesthesia and surgery. 28 patients were anaesthetised with propo 2 mg/kg, 18 patients with sevo inhalation, and 18 patients with thiopental 5 mg/kg. LOC and ROC were carefully tested and annotated. Sevo anaesthesia included N_2O, fentanyl and rocuronium. Data are mean ± 95% confidence intervals.

Results and Discussion: Sensitivity and specificity values for consciousness were similar for all the tested parameters (Table).

	Sens SE	Sens RE	Sens BIS	Spec SE	Spec RE	Spec BIS
Propo	96 ± 3	97 ± 2	96 ± 2	98 ± 1	98 ± 1	98 ± 1
Sevo	98 ± 2	100 ± 0	99 ± 1	98 ± 1	98 ± 1	98 ± 0
Thio	96 ± 3	99 ± 1	97 ± 3	91 ± 5	93 ± 3	95 ± 3
All	**97 ± 2**	**98 ± 1**	**97 ± 1**	**96 ± 2**	**97 ± 1**	**97 ± 1**

At ROC after a propofol bolus, RE, SE, and BIS values recovered by (81 ± 9)%, (75 ± 10)%, and (59 ± 7)% from the bolus-induced minimum relative to their baseline. After a thiopental bolus, RE, SE, and BIS values recovered by (81 ± 14)%, (83 ± 12)%, and (59 ± 10)%. The relative rise was significantly higher in RE and SE compared to BIS (paired t-test, $p < 0.0005$).

Conclusion: All indices, RE, SE, and BIS, performed excellently in detecting conscious and unconscious states during propofol, sevoflurane and thiopental anaesthesia. At ROC after thiopental or propofol bolus, RE and SE recovered significantly closer to their baseline levels than BIS.

A-93

Narcotrend or BIS monitoring during desflurane–remifentanil anaesthesia – a comparison with a standard practice group

S. Kreuer, L. Aniset, M. Silomon, R. Larsen, W. Wilhelm

Department of Anaesthesiologie and Intensive Care Medicine, University of Saarland, 66421 Homburg/Saar, Germany

Background: The BIS monitor (Aspect, USA) is currently the standard device used to assess the depth of anaesthesia and was shown to reduce drug consumption and shorten recovery times. The Narcotrend (MonitorTechnik, Germany) is an EEG monitor designed to measure the depth of anaesthesia, based upon a 6-letter classification from A (awake) to F (increasing burst suppression). This study was designed to investigate the impact of Narcotrend or BIS monitoring on recovery times and desflurane consumption when compared to standard anaesthetic practice.

Methods: With IRB approval and written informed consent 120 adult patients scheduled for minor orthopaedic surgery were randomised to receive a desflurane-remifentanil anaesthetic controlled either by Narcotrend or by BIS or solely by clinical parameters. Anaesthesia was induced with 0.4 μg/kg/min remifentanil and 2 mg/kg propofol. After intubation remifentanil was infused at a constant rate of 0.2 μg/kg/min whereas desflurane in 1.5 l/min O_2/air was adjusted according to EEG target values or clinical parameters: during maintenance of anaesthesia to a value of "$D_{0\text{-}1}$" (Narcotrend) or "50" (BIS), 15 min before the end of surgery to "C_1" (Narcotrend) or "60" (BIS), whereas in the standard protocol group desflurane was controlled according to clinical parameters (e.g. heart rate, blood pressure, movements). Recovery times and desflurane consumption were recorded by a blinded investigator. The desflurane vaporiser was weighed before and after anaesthesia and consumption per min was calculated. Statistics: ANOVA with # $P < 0.05$, data are mean ± SD.

Results: The groups were comparable for demographic data, duration of anaesthesia and mean remifentanil dosages.

	Standard practice	BIS	Narcotrend
Open eyes (min)	4.7 ± 2.2	4.2 ± 2.1	3.7 ± 2.0
Extubation (min)	5.0 ± 2.4	4.4 ± 2.2	3.6 ± 2.0#
Desflurane (mg/min)	443 ± 71	416 ± 99#	374 ± 124#

Conclusions: Compared to standard anaesthetic practice Narcotrend and BIS monitoring allow a small reduction of desflurane consumption whereas the time to extubation was only significantly reduced in the Narcotrend group.

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Hypnosis evaluation during induction and recovery: entropy analysis versus BIS

B. Tapia, E. Alsina, E. Matute, G. Blanc, R. Roses, F. Gilsanz

Department of Anaesthesiology, Hospital Universitario La Princesa, Madrid, Spain

Background and Goal of Study: The level of complexity of the EEG signal, measured as spectral entropy indicate the level of hypnosis with a prediction probability and sensitivity/specificity at least as high as that of the Bispectral Index (BIS, Aspect Medical Systems) (1–3). Entropy compute the following two values: EEG with frequency components up to 32 Hz (state entropy–SE-), and EEG+EMG (response entropy–RE-) with frequencies up to 147 Hz. The study compares sensitivity of entropy and BIS during induction and recovery of anaesthesia.

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Materials and Methods: We have designed a prospective randomised study that included 20 patients under major general surgery. Anaesthesia technique: Inhalation induction with sevoflurane and maintenance with sevoflurane, fentanyl and rocuronium. Data collected at induction (loss of eyelash reflex) and recovery from anaesthesia (response to verbal command) were: state and response entropy, BIS, neuromuscular blockade, temperature, and haemodynamics.
Results and Discussions:

	SE	RE	BIS
Induction	50 ± 5*	54 ± 6	63 ± 8
Recovery	78 ± 8	90 ± 6*	82 ± 10

*significative $p < 0,05$

BIS/Entropy shows significative differences for induction and recovery.
Conclusion: Spectral entropy is a new method of EEG signal analysis that seems to be more sensitive than BIS monitoring hypnosis level during induction and recovery from anaesthesia. This could be a new big step when searching the ideal hypnosis analyser.
References:
1 Viertiö-Oja H et al. *Anesthesiology* 2000; 93: A1369.
2 Bruhn J. et al. *Anesthesiology* 2000; 92: 715–26.
3 Zhang XS et al. *Med Biol Eng.Comput* 1999; 37: 327–34.

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Ocular microtremor frequency remains measurable despite neuromuscular blockade and prone position

M. Heaney, L. McEvoy, L.G. Kevin, C. Bolger, A.J. Cunningham

Departments of Anaesthesia and Neurosurgery, Beaumont Hospital, Dublin, Ireland, Medical College of Wisconsin, Milwaukee, USA

Background and Goal of Study: Ocular microtremor (OMT) is a fine physiologic tremor of the eye related to neuronal activity in the reticular formation (RF) of the brain stem. Frequency of OMT has previously been shown to be suppressed by propofol (1) and sevoflurane (2), and to predict response to command at emergence. The purpose of this study was to evaluate OMT as a monitor of anesthetic depth in patients receiving neuromuscular blocking drugs, and to evaluate the effect of changes in patient position on accuracy of OMT measurement.
Materials and Methods: 100 patients undergoing extracranial surgery under general anaesthesia gave written informed consent to participate in the study. Anesthesia was induced with propofol and maintained with sevoflurane or isoflurane in nitrous oxide/oxygen. OMT was measured continuously by the closed-eye piezoelectric technique. Neuromuscular blockade was measured by visual assessment of response to train-of-four (TOF) stimulation. Patients were placed in supine, lateral or prone position, as dictated by surgery.
Results and Discussions: OMT decreased at induction in all patients, increased transiently in response to surgical incision or airway instrumentation, and increased at emergence. Increased intensity of neuromuscular blockade did not affect OMT frequency, but OMT amplitude decreased. Measured OMT frequency was unaffected by changes in patient position.
Conclusions: OMT frequency decreases at induction of anaesthesia, increases at emergence, and increases in response to stimuli that activate the RF. OMT is measurable during profound neuromuscular blockade and in various patient positions.
References:
1 Bojanic S et al. *Br J Anaesth* 2001 Apr; 86: 519–22.
2 Kevin LG et al. *Br J Anaesth* 2002 Oct; 89: 551–5.

A-96

Hypnosis and analgesia evaluation using entropy monitor

E. Alsina, B. Tapia, E. Matute, G. Blanc, R. Roses, F. Gilsanz

Department of Anaesthesiology, Hospital Universitario La Princesa, Madrid, Spain

Background and Goal of Study: Spectral entropy analysis of the EEG signal complexity indicates the level of hypnosis. The monitor also separates the contribution of the EMG activity (response entropy, ER) from the total spectral entropy (state entropy, ES). Frontal EMG contaminates BIS values, however, ER filters EMG and provides additional information over subcortical pathways. This study compares sensitivity of ES, ER and BIS monitoring depth of anaesthesia and analgesic state.
Materials and Methods: Prospective randomized study that included 20 patients in two groups under major general surgery. Anaesthesia technique: Sevofluarne and rocuronium were used, group general (G, n = 10) using fentanyl as anlgesic and group epidural (E, n = 10) with analgesia based on epidural blockade. Whenever the ES values were over 65 we concluded that the patient needs more hypnotics, but on the other hand when mean arterial pressure (MAP) were over 15% from basal values we administered supplemental analgesia. Data collected: state and response entropy, BIS, neuromuscular blockade, temperature, and haemodynamics.
Results and Discussions:

Entropy values (ES) > 65

	Group E (n = 42)	Group G (n = 77)*
ER	70 ± 6	71 ± 7
BIS	63 ± 7	64 ± 8

MAP > 15% values -only from group G (group E patients did not show values over 15%)

n = 24	Pretreatment	Postreatment
ER	51 ± 8	48 ± 9
BIS	42 ± 7	45 ± 7

*significative $p < 0,05$

Conclusion: ER, ES and BIS show similar values predicting hypnosis sate. Subcortical pathways are involved on awakening the patient so in group G without epidural blockade more patients need hypnotic drug. In this study ER does not predict haemodynamic instability because of lack of analgesia.
References:
1 Bruhn J. et al. *Anesthesiology* 2000; 92:1485–7.
2 Paloheimo M. *Acta Anaesth Scand* 1990; Sup 93:1–50.

A-97

Effects of remifentanil dosage on propofol concentrations (TCI) during EEG monitored (Narcotrend®) propofol/remifentanil anaesthesia

G. Kraus[1], N.A. Ziem[2], G. Schönberg[2], U. Grouven[3], D. Patschke[2]

[1]Department of Anaesthesiology, Klinikum Hannover Siloah, Germany; [2]Paracelsus-Klinik Marl, Germany; [3]Klinikum Hannover Oststadt, Germany

Background and Goal: In TCI applications of propofol with different dosages of remifentanil it should be investigated which propofol concentrations were necessary to maintain a defined level of hypnosis (EEG stages D_2/E_0, EEG monitor Narcotrend® (1)) during the steady state of anaesthesia.
Materials and Methods: With approval of the local ethics committee 50 patients between 25 and 69 yrs of age (ASA I–II) scheduled for general, vascular, or gynaecological surgery were studied. All patients received 1 μg/kg/120 s remifentanil for induction of anaesthesia followed by 0.2 (group 1, n = 17), 0.4 (group 2, n = 18), or 0.6 μg/kg/min (group 3, n = 15) until the end of surgery. Beginning 1 min after the start of remifentanil induction propofol was titrated with a TCI pump (Diprifusor®) until a burst-suppression EEG (Narcotrend® stage F) was reached. During the steady state of anaesthesia the propofol dosage was titrated to achieve Narcotrend® stages D_2/E_0. All patients received atracurium (0.3 mg/kg) for intubation and pitriamid (0.1–0.15 mg/kg) at the end of anaesthesia for postoperative analgesia.
Results and Discussions: Results (mean ± standard deviation) are shown in the table. Group 3 had the lowest propofol concentration (TCI). Correspondingly, the lowest total propofol consumption was found in group 3. Intraoperative awareness was not observed in any case.

	Propofol concentration [μg/ml]	Calculated emergence time [min]	Real emergence time [min]
Group 1	2.94 ± 0.91	11.14 ± 8.64	7.94 ± 2.66
Group 2	1.94 ± 0.55	4.74 ± 4.59	7.58 ± 3.80
Group 3	1.69 ± 0.59	3.78 ± 4.81	6.87 ± 6.09
ANOVA	$p < 0.0001$	$p = 0.003$	$P = 0.78$

Conclusions: Propofol as well as remifentanil affect the hypnotic component of anaesthesia. The propofol dosage for maintenance of a defined level of hypnosis could on average be reduced with increasing dosage of remifentanil. Control of depth of hypnosis by EEG monitoring allows individually adjusted administration of propofol.
Reference:
1 Schultz B, Grouven U, Schultz A. *Biomed Technik* 2002; 47: 9–13.

A-98

EEG Entropy monitoring decreases propofol consumption and shortens early recovery times

A. Yli-Hankala, A. Vakkuri, S. Hoymork, S. Mustola, R. Sandin, P. Talja, H. Viertiö-Oja

Department of Anaesthesia, Tampere University Hospital, Tampere, Finland

Background and Goal of Study: Electroencephalogram entropy is a new measure of hypnotic component of anaesthesia (1). We studied the impact

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of Datex-Ohmeda Entropy monitoring on propofol consumption and early recovery times after anaesthesia.

Material and Methods: 222 consenting patients in 5 test sites, 18–80 yr, were studied after ethical approvals. 8 historical controls for each test site (Hist) were recorded before introducing Entropy. Thereafter the patients were randomised into Entropy monitoring (Ent) (n = 89), or control (Cont) (n = 93) groups. Entropy was collected in all cases, but displayed only in Ent group. Anaesthetics were propofol and alfentanil as infusions, nitrous oxide, and neuromuscular blockers as boluses, if needed. Goal was a rapid recovery without intraoperative recall. Patients were interviewed twice afterwards. T-test was used for comparisons of Ent and Cont groups. Data are mean ± 95% confidence intervals. $P < 0.05$ is the limit of significance.

Results and Discussion: Table below shows recovery times after anaesthesia, and total propofol consumption. Recovery times were 7–11 min shorter in Ent group than in controls. This was presumably due to the reduced use of propofol in Ent group, especially during the last 15 min of anaesthesia, shown as higher State Entropy levels (45 *vs.* 53; $P < 0.05$). Hist group did not have longer recovery times than Cont group. This was probably due to the participants long experience with propofol infusions and awareness monitors. No intraoperative recall occurred.

	Hist	Ent	Cont
Eye opening (min)	12 ± 2	6.4 ± 0.8**	13 ± 2
Hand squeeze on request (min)	14 ± 3	10 ± 1**	17 ± 2
Orientation (min)	17 ± 3	12 ± 2**	23 ± 4
Propofol use (mg/kg/min)	0.12 ± 0.01	0.1 ± 0.01*	0.12 ± 0.01

* $P < 0.05$, ** $P < 0.01$ as compared to Cont group.

Conclusions: Monitoring of entropy during propofol-alfentanil-nitrous oxide anaesthesia decreased propofol consumption and shortened early recovery times.

Reference:

1 Viertiö-Oja H et al. Eur J Anaesth, Vol. 17, Suppl. 19 (2000) p. 83.

A-99

Clinical investigation of ocular microtremor as a novel monitor, compared to bispectral index and other anesthesia monitoring methods

S. Church, J. Ratnaraj, D. Reddy, A. Kurz

Department of Anesthesiology, Washington University School of Medicine, St Louis, Missouri, USA

Background and Goal of Study: Conscious level and depth of anesthesia are monitored by observation of the patient's autonomic and somatic responses during surgery. The bispectral index (BIS) is being used increasingly to monitor conscious level by monitoring cortical function. Ocular microtremor (OMT) is a fine high frequency tremor of the eyes, emanating from the brainstem. The frequency of this tremor is decreased when conscious level is reduced. The purpose of the study was to assess if OMT could offer similar or additional information with regard to conscious level as BIS and observation of autonomic and somatic responses.

Materials and Methods: We studied 20 patients (mean age 41.2 years, range 19–55), ASA 1–3, under general anesthesia. A BIS monitor was placed on the forehead and an OMT monitor was taped to the patients closed eyelid. Baseline measurements of BIS, OMT and vital signs were taken before induction of anesthesia and then at 5 minute intervals throughout surgery. Specifically, measurements were recorded during the following events: induction of anesthesia, LOC (loss of consciousness, defined as loss of verbal contact), intubation and maintenance. Data was analyzed using paired t-test and Pearson's correlation coefficient. Data are presented as means ± SD.

Results and Discussions: OMT frequency and BIS decreased significantly at LOC, OMT: 64 ± 8 awake vs 55 ± 11 at LOC, ($p = 0.02$); BIS: 94 ± 5 awake vs 68 ± 25 at LOC, ($p = 0.001$). At intubation OMT increased significantly from 42 ± 13 to 51 ± 8 ($p < 0.001$) while BIS remained unchanged 40 ± 17 vs 38 ± 15, ($p = 0.2$).

Overall, BIS and OMT correlated when patients were either awake, $r^2 = 0.38$, $p < 0.001$, or deeply anesthetized, $r^2 = 0.27$, $p < 0.001$. However, there was no correlation at intubation ($r^2 = 0.003$, $p = 0.92$).

Conclusion: OMT and BIS both monitor conscious level, but from different areas of the brain. As OMT originates in the brainstem it reacted to painful stimulus such as laryngoscopy whereas BIS did not.

References:

1 Bolger et al. Vision Research 39(1999): 1911–1915.
2 Sebel et al. Anesth & Analg 1997; 84: 891–99.
3 Bolger PhD Thesis Trinity college Dublin (1994).

A-100

Preventing awareness during propofol–remifentanil anesthesia without EEG monitoring using effect-site concentrations

C. Lojewski, T.A. Crozier

Department of Zentrum Anaesthesiologie, Rettungs- und Intensivmedizin, University of Göttingen Medical School, Göttingen, Germany

Introduction: Bispectral monitoring (BIS) helps to reduce the risk of awareness that can occur during TIVA with propofol (1, 2) but the necessary equipment is not always available. We sought a relationship between the effect site concentration (Ceff) of propofol at loss of consciousness (LOC = loss of response to commands) and the intraopera-tive Ceff in combination with remifentanil that would give a BIS-index of 40 to 60 (BIS40–60) at which awareness is highly unlikely. This would allow hospitals without the equipment for BIS monitoring to give a propofol-remifen-tanil TIVA without risking awareness in their patients.

Methods: 18 surgical patients (18–50 years) took part in a study approved by our Ethics Committee. Premedication was with 7.5 mg midazolam PO. Remifentanil was infused at 0.5 μg kg^{-1} min^{-1} for 2 min before starting the target-controlled propofol infusion and then reduced to 0.2 μg kg^{-1} min^{-1}. Propofol was infused at an initial target plasma concentration of 3 μg ml^{-1}. Ceff was recorded at loss of consciousness (Ceff(LOC)). After intubation, the target concentration was set at 2 μg ml^{-1} and altered if necessary to keep BIS between 40–60. The corresponding Ceff (Ceff(BIS)) was recorded. Responses to surgery were treated by increasing the remifentanil infusion rate.

Results: LOC occurred at a mean Ceff of 1.3 ± 0.4 μg ml^{-1} (SD) and a BIS of 65 ± 9. During surgery, the mean Ceff(BIS) was 1.9 ± 0.3 μg ml^{-1} with a mean BIS of 46 ± 6; only 3 patients had a Ceff(BIS) over 2 μg ml^{-1}. The equation of the regression line is Ceff(BIS) = 1.29 + 0.46* Ceff(LOC) with $r^2 = 0.33$. The patients awoke at a Ceff of 1.4 ± 0.3 μg ml^{-1} and a BIS of 70 ± 10. The times to awakening and to extubation after stopping the drug infusions were 5.5 ± 2.5 and 5.9 ± 2.6 minutes, resp.

Conclusions: Ceff at LOC and the Ceff required to main-tain BIS at 40 to 60 during surgery were only loosely correlated. However, in combination with remifentanil and a midazolam premedication, a propofol effect site concentration of 2.0 μg ml^{-1} can prevent intraoperative awareness in nearly all patients and a 1.5-fold Ceff(LOC) would always be sufficient. Hospitals without the capacity for BIS monitoring can thus safely give propofol-remifentanil TIVA without risking intraoperative awareness.

References:

1 Miller DR et al. Can J Anaesth 1996; 43: 946–953.
2 Struys M et al. Anaesthesia 1998; 53: 4–12.

A-101

Requirements of hypnotics during opioid-induced hypotension

L. Trillo, S. Fernandez- Galinski, B. Rodriguez, J. Navarro, R. Mansilla, F. Escolano

Department of Anaesthesiology, Hospital del Mar. IMAS. UAB, Barcelona, Spain

Background and Goals: Assessment of the analgesia level and hypnotic drug requirements during induced hypotension is difficult. In this study we administer opioids in order to decrease arterial blood pressure and provide analgesia while evaluating hypnotic drug requirements by monitoring depth of anaesthesia using mid-latency auditory evoked potentials.

Material and Methods: Forty ASA II–III patients requiring general anesthesia for thyroid surgery entered the study. They were randomly distributed into four groups to receive remifentanil plus propofol (RP) or sevoflurane (RS) and alfentanil plus propofol (AP) or sevoflurane (AS). Induction was carried out with propofol and intubation was aided with cis-atracurium. Patients were ventilated with a mix of oxygen/air. Opioids were titrated in order to decrease mean arterial pressure by 30% of baseline value, and hypnotics were titrated to keep the A-Line ARX Index (AAI) under 30. We evaluated opioid and hypnotic drug requirements and extubation time (ET).

Results: The groups were comparable regarding demographics, ASA, and baseline HR and MAP. Data Mean(SD) are shown in table:

	Remifent µg/kg/min	Alfent µg/kg/min	Propofol mg/kg/h	Sevo % MAC	ET seconds
RP	0.44(0.14)		4.36(1.31)*		458(255)*
AP		1.68(0.47)	6.88(1.75)		829(179)
RS	0.53(0.13)			0.54(0.06)*	330 (55)*
AS		1.58(0.53)		0.79(0.12)	551(239)

*$p < 0.05$ vs corresponding group (U Mann–Whitney)

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Conclusions: In opioid-controlled hypotension, patients who received remifentanil: (1) required around 30% less sevoflurane or propofol for adequate hypnosis; (2) experiment a shorter extubation time with independence of the type of hypnotic drug.

References:

1 Westen R, Van Aken H, Glass P et al. *Anesthesiology* 2001;94:211–7.
2 Struys M, Jensen EW, Smith W, et al. *Anesthesiology* 2002;96:803–16.

A-102

Desflurane and isoflurane in low flow anaesthesia

A. Ozgultekin, H. Celik, G. Turan, E. Dincer, N. Akgun

Department of Anaesthesiology and Intensive Care; Haydarpasa Numune Teaching and Research Hospital, Istanbul, Turkey

Background and Goal of the Study: We compared the times needed for the end tidal concentration (F_A) to reach the 80% of the inspired concentration (F_I) of the agent during high flow and F_A/F_I ratios of these agents after institution of the low flow anesthesia.

Materials and Methods: Twenty four patients (ASA I–II; aged 38–60) undergoing elective lumber-cervical disc surgery were divided into two equal groups to receive either desflurane or isoflurane. After induction, vaporiser settings were adjusted as 5% for desflurane, 1,5% for isoflurane in 4 l/min of fresh gas flow (50% N_2O/O_2). F_A/F_I of the volatile anesthetics, as well as N_2O, O_2 and CO_2 were measured at the endotracheal tube connector (Ohmeda 5250 RGM). F_A/F_I ratio of 80% were accepted as the target alveolar concentration. The times to reach this value were accepted as the time constants of the agents and having reached it, the flow rate was decreased to 1l/min (Low flow) Vaporiser settings were kept constant at the same concentrations and the F_A/F_I were recorded every 5 min up to 30 min and every 15 min until the 90th min of the operation. Fentanil bolus doses (50 μg) were given if necessary. Student t and Tukey Kramer tests were used for statistical analysis.

Results:

Table I: The time constants and F_A/F_I ratios (*$p < 0.05$,** $p < 0.01$,*** $p < 0.001$)

Time (min)	Isoflurane	Desflurane
Time Constant (min)	5.66 ± 2.91	3.88 ± 1.45
F_A/F_I ratios (%)		
0	78.88 ± 5.57	88.11 ± 6.35*
5	82.22 ± 9.68	93.22 ± 3.11**
10	84.33 ± 7.93	94.33 ± 1.50**
15	86.22 ± 3.27	94.88 ± 2.84*
20	87.00 ± 2.64	95.33 ± 1.73***
25	87.11 ± 2.71	95.44 ± 2.06***
30	86.44 ± 6.94	95.77 ± 1.09*
45	87.55 ± 6.91	95.33 ± 1.87
60	84.00 ± 6.44	95.11 ± 0.78***
75	86.11 ± 4.56	94.88 ± 0.78*
90	84.44 ± 5.68	96.22 ± 1.20***

Conclusion: Although desflurane is a favorable inhalation agent for low-flow anesthesia with it's rapid uptake , fast and stable equilibration, the constant levels of F_A/F_I could be able to maintain with an acceptable rate with isoflurane as well.

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Algorithm of effect-site propofol TCI for breast reduction surgery: preliminary results

V. Crinquette*, J.F. Kulik**, V. Lambelin*, B. Tavernier*, R. Krivosic-Horber*, P. Pellerin**, L. Barvais***

Department of Anesthesia 1, DAR I, Lille Cedex, France; **Plastic Surgery CHRU Lille;*Erasme Hospital Brussels (ULB)*

Background and Goal of Study: Adequate effect-site concentrations of Propofol (EsC P) vary according to multiple factors: level of analgesia, intensity of stimuli, patient's requirements. How to adapt EsC P using computer-assisted anaesthesia. for individual patient in breast reduction surgery (BRS) is the purpose of study.

Materials and Methods: After approval of the ethics committee and informed consent, 45 women (ASA I: 40, II: 5; age: 36 ± 11 yrs; BMI: 24.7 ± 3.4) scheduled for BRS with more and less painful periods (MP, LP), sitting and back positions were studied. Effect site target anaesthesia (TCI) was controlled by a software (Toolbox®), using the pharmacocinetic model of Marsh for P and Minto (1) for remifentanil (R). EsC R were predetermined for each event (see Table). A predefined algorithm of targeted EsC P was based on a coefficient (CoeM) changing with the predefined events of anaesthesia and surgery. The recorded EsC P (rEsC) at loss of the eyelash reflex (LER) was defined as the first onset (O1). Second onset (O2) was defined as the sitting position after intubation. The targeted EsC P was the result of the multiplication of O1 by CoeM. pEsC and rEsC are compared and correlation ratios calculated with SPSS software.

Results: EsC R and EsC P (mean ± SD):

		Propofol			R1	R2
Events	Remifent. EsC (ng/ml)	Model CoeM	pEsC (μg/ml)	rEsC (μg/ml)	rEsC vs pEsC (O1)	rEsC vs pEsC (O2)
LER	2	–	–	O1: 2.29 ± 0.63	–	–
T2	6	1.30	2.99 ± 0.8	3.41 ± 0.58	0.712**	–
T3	3	1.10	2.53 ± 0.56	O2: 2.24 ± 0.43	0.696**	–
T4 (MP)	4	1.13	2.59 ± 0.61	2.50 ± 0.56	0.751**	0.811**
T5 (LP)	3.6	1.04	2.39 ± 0.57	2.26 ± 0.49	0.692**	0.857**
T6 (MP)	4	1.13	2.59 ± 0.61	2.42 ± 0.55	0.711**	0.757**
T7 (LP)	3.6	1.04	2.39 ± 0.55	2.28 ± 0.51	0.683**	0.732**
T8	3	0.93	2.13 ± 0.52	2.08 ± 0.41	0.693**	0.747**
T9	1.5	–	1.60 ± 0.00	1.87 ± 0.34	–	–
Extub.	0.75	–	–	1.38	$^{**}p < 10^{-3}$	

O1 can be used to predict the EsC P. O2 appears to be more pertinent (R1 and R2 $p < 10^{-3}$; R2 > R1).

Conclusion: To program an algorithm of variable EsC P associated with prefixed EsC R during BRS, the required EsC P when the patient is installed in the sitting position before incision seems to be more predictive of the following required Esc P during the next events of BRS than EsC P at LER.

Reference:

1 Minto. *Anesthesiology* 1997; 86: 10–23.

A-104

Which are the best indicators for stress response under anaesthesia with sevoflurane and alfentanil?

C.A. Pfister*, D. Leibundgut*, C.W. Frei+, A.M. Zbinden*

**Department of Anaesthesiology, University Hospital Bern, Bern, Switzerland; +Automatic Control Laboratory, ETH, Zürich, Switzerland*

Background and Goal of Study: Hypnosis can be monitored with EEG based devices, whereas analgesia cannot[1,2]. The goal was to correlate changes in various measurement parameters occurring after painful stimulation to concentrations of alfentanil and sevoflurane.

Materials and Methods: 16 patients received a standardised tetanic stimulation in the forearm during anaesthesia with sevoflurane within a range of 1.5 to 2.0 vol% and a target controlled alfentanil infusion of 0 to 200 ng/ml. We compared bispectral index (BIS), heart rate (HR), mean arterial pressure (MAP), electromyography (EMG), pulse wave amplitude (PW), endtidal sevoflurane (Fsev) and alfentanil arterial blood concentrations (Calf) as measured during two minutes before and after stimulation.

Results and Discussions: Preliminary data show significant changes to stimulation on HR, MAP, EMG and PW, not depending on sevoflurane concentrations within 1.5 to 2.0 vol% but depending on alfentanil concentration within a range of 0 ng/ml to 200 ng/ml. With BIS changes to stimulation did not reach significance, due to the high spontaneous fluctuations.

Table 1: Multiple linear regression: Significance of the correlation of the difference of the mean values over 120 sec before and after stimulation with the concentrations of sevoflurane and alfentanil.

	Sevoflurane [p]	Alfentanil [p]	R^2	Power
HR	0.284	0.018	0.391	0.753
MAP	0.717	0.016	0.375	0.729
EMG	0.993	0.025	0.332	0.659
PW	0.571	0.009	0.423	0.799
BIS	0.628	0.507	0.054	0.134

R^2 shows goodness of multiple regression.

Conclusion: BIS cannot be used to detect stress response. HR, MAP, EMG and PW are good indicators for the capability of alfentanil but not sevoflurane to block stress response.

References:

1 Struys MM et al.: Anesthesiology 2002; 96:803–16.
2 Kalkman CJ and Drummond JC: Anesthesiology 2002; 96:784–7.

A-105

Does the bispectral index (BIS) correlate with the classic parameters of stress?

T. Ledowski, W. Fudickar, P.H. Tonner, B. Bein, J. Scholz

Department of Anaesthesiology and Intensive Care Med, University Hospital Kiel, Kiel, Germany

Background and Goal of Study: Though measurement of the bispectral index (BIS) may be a possibility to quantify anaesthetic depth, Kussman

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et al. (1) could not demonstrate a correlation with cardiovascular or hormonal parameters during paediatric cardiac surgery. Objective of our study was to evaluate this correlation in an adult, cardiovascular healthy collective.

Materials and Methods: After approval by the regional ethics committee and written informed consent, a total of 43 subjects (ASA 1–2, minor elective ENT-surgery) was randomly included. Anaesthesia induction was performed with propofol (2 mg kg^{-1}) and remifentanil (0.5 mg kg^{-1} for 2 min). After endotracheal intubation patients received either sevoflurane (2 Vol% endtidal) or propofol (6 mg kg^{-1} h^{-1}). Maintenance of analgesia was achieved with remifentanil (initial 0.25 mg kg^{-1} min^{-1}) which was adjusted to intraoperative depth of anaesthesia (estimated by measurement of heart rate (HR), blood pressure (MAP) and bispectral index (BIS, Aspect Medical Systems; intraoperative aim: 40–60)). At 7 time points (P1 baseline before anaesthesia, P2 after tracheal intubation, P3 after skin incision, P4 at maximum operative trauma, P5 end of operation, P6 after extubation and P7 15 min after extubation) blood samples were taken for measurement of epinephrine, norepinephrine, ACTH, and cortisol. Statistical analysis was performed by Pearsons coefficient of correlation (r). Numerical data is presented as median. Level of significance was set at a p value of 0.05.

Results and Discussions: A total of 43 patients (31 male, 12 female) was analysed. The median BIS was (P1–7) 95, 67, 44, 41, 43, 59, 92 and 95. There was no correlation of BIS with HR, MAP or plasma levels of epinephrine, norepinephrine, cortisol and ACTH at any investigated time point.

Conclusion(s): We did not find any correlation between BIS and the classic parameters of stress in an adult collective. These results are in accordance to previous investigations during infant cardiac surgery (1).

Reference:

1 Kussman BD, Gruber EM, Zurakowski D et al. *Paediatr. Anaesth.* 2001; 11: 663–9.

A-106

Skin laser-doppler flowmetry as objective sedation monitor

G. Diaz-Reganon, M. Avellanal, L. Gonzalez-Zarco, D. Arnal, I. Grigorov, P. Navia

Department of Anesthesiology, Hospital Universitario Gregorio Marañon, Madrid, Spain

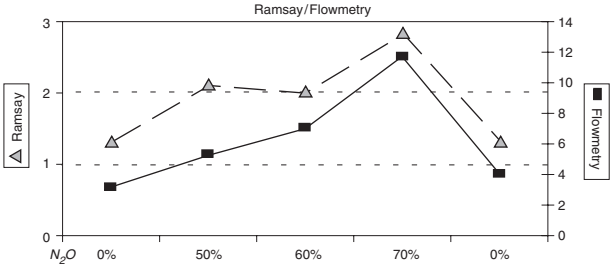
Background and Goal of Study: Level of sedation is a clinical parameter of difficult approach. It has an inner relationship with the autonomic nervous system activity (1) (2). We have studied the skin laser-doppler flowmetry as a new objective sedation monitor in patients submitted to nitrous oxide sedation.

Materials and Methods: 15 ASA I–II women undergoing obstetric curettage were studied. Pulse oxymetry, ECG, blood pressure and heart rate were monitored, as well as the cutaneous microvascular blood flow with a laser-doppler monitor (Transonic BLF21). The Ramsay scale was used to assess the level of sedation.

Patients were sedated prior to curettage with an inhalatory mixture of nitrous oxide in oxygen, progressively increasing the proportion of the former after periods of 3 minutes. Special attention was paid to the relation between the Ramsay scale and flowmetry values.

An ANOVA test and a Pearson's correlation test were conducted.

Results and Discussions: We found a parallelism between the skin flowmetry and the Ramsay values, obtaining a positive Pearson's correlation coefficient of R = 0.903 (p = 0.036).



Conclusion(s): Skin laser-doppler flowmetry is a useful objective sedation monitor for patients under nitrous oxide sedation. A very strong correlation exists between the subjective Ramsay sedation scale and the objective laser-doppler flowmetry.

References:

1 Shimoda O, Ikuta Y, Nishi M et al. *J Auton Nerv Syst* 1998 Jul 15;71(2–3):183–9.
2 Ikuta Y, Shimoda O, Ushijima K et al. *Anesth Analg* 1998 Feb;86(2):336–40.

A-107

Time dependent cerebral wash in of sevoflurane and response to noxious stimulation as evaluated with BIS and MLAEP

A. Ekman; R. Sandin

Department of Anaesthesia and Intensive care, Stockholm, Sweden

Background and Goal of Study: Intense traumatic stimulation may cause arousal and awareness. We studied the gradual increase in hypnotic action after a sudden increase in anaesthetic concentration, and how the arousing effect from traumatic stimulation is modified with time.

Materials and Methods: 21 healthy, patients were induced with sevoflurane. Bispectral Index (BIS,Aspect) and middle-latency auditory evoked potentials (AAI, Alaris AEP) were monitored simultaneously.18 min were allowed for equilibration while titrating sevoflurane to BIS = 50. At time 0 we doubled the end-tidal concentration of sevoflurane (ET_{sevo}). The BIS/AAI reponses to traumatic stimulation (laryngoscopy 30 s) were assessed at 7 randomly assigned time points within 0–15 min after the increase in ET_{sevo} (3 patients at each).

Results and Discussions: When an ET_{sevo} titrated to BIS = 50 in an unstimulated subject was doubled, the t½ for reaching the new hypnotic level as assessed by BIS was 70 s. Simultaneously recorded AAI did not change with time. In 20 of the 21 patients laryngoscopy increased BIS and AAI irrespective of the time elapsed after the sudden increase in ET_{sevo}. For both BIS and AAI, the numerical magnitude of the increase after laryngoscopy was not attenuated with time. After laryngoscopy BIS exceeded the highest recommended value, 60, in one patient stimulated at time 0. AAI in excess of highest recommended value, 25, was found in another patient at time 0, and also in one patient stimulated after 6 min. The response times for the two devices were similar, 44 s and 46.5 s, respectively for BIS and AAI.

Conclusion(s): An increase in hypnotic action in an anaesthetised subject is readily displayed by BIS, but not by AAI. The response time after traumatic stimulation is similar for BIS and AAI. Response to traumatic stimulation indicating arousal was displayed by both methods in 20 of the 21 patients.

A-108

Development and clinical evaluation of a model based closed-loop control system of anaesthesia depth using bispectral index and isoflurane

S. Locher*, T. Bühlen*, R. Wymann*, K.S. Stadler**, D. Leibundgut*, P.M. Schumacher*, A.M. Zbinden*

**Section of Research, Department of Anaesthesiology, University Hospital, Berne, Switzerland; **Automatic Control Laboratory, ETH, Zurich*

Background and Goal of Study: Control of depth of anaesthesia using BIS can help to reduce awareness by avoiding phases of inadequate control (1). While BIS control with propofol has recently been described (2) a comparable study with volatile anaesthetics is lacking. Our hypothesis was, that our new model based closed-loop control system can safely be applied and is at least as good as manual control.

Materials and Methods: 15 patients, ASA risk class I-III, scheduled for decompressive spinal surgery were randomised into a group with closed-loop (CC) or manual control (MC) of BIS using isoflurane. Alfentanil infusion was manually adjusted according to blood pressure. The BIS target was set to 50 during the operation. The necessity of human intervention into the control system and events of inadequate sedation (BIS < 40 or BIS > 60) were counted. The performance of the controller was judged by several indicators (L1 vector norm = difference between set-point and measured values with sample time weighted; MDAPE = Median Absolute Performance Error according to (3)) and measured during skin incision period (SIP) and the subsequent low flow period (LFP).

Results and Discussions: No human intervention was necessary in the CC group. The preliminary data show a lower percentage of inadequate BIS values for CC than for MC, especially for the more important upper limit: BIS > 60 (P = 0.027, Mann–Whitney Test) for CC = 1.1% and 4.0% for MC, respectively (median). During both periods the average of L_1 and MDAPE of CC was smaller than that of MC:

	L1, mean (sd)		MDAPE, mean (sd)	
	CC (n = 7)	MC (n = 8)	CC (n = 7)	MC (n = 8)
SIP	4.1 (1.2) *	7.4 (3.8)	7.2(2.3) *	14.5(6.8)
LFP	4.3 (0.7) *	6.6 (2.8)	7.5(1.8) *	12.8 (5.5)

* p < 0.05 (t-test)

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Conclusion(s): Closed-loop control of hypnosis using isoflurane is feasible and significantly better than manual control, even in phases with abrupt changes of stimulations that cannot be foreseen by the control system.

References:
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2 Struys MRF. Anesthesiology 2001; 95: 6–17.
3 Varvel JR. J Pharmaco Biopharm 1992; 20: 63–94.

A-109

Anemon-I monitoring of heart rate variability in healthy volunteers under non-painful stimuli

S. Serrano, R. Valero, C. Pizarro, P. Gambus, E. Carrero, L. Salvador, N. Fabregas

Department of Anesthesiology, Hospital Clinico y Provincial, Barcelona, Spain

Background and Goal of Study: Heart rate variability (HRV) reflects the modulation of heart rate by the autonomic nervous system (ANS)(1). The Anemon-I (A-I) monitor is a depth of analgesia monitor based on the evaluation of the autonomic regulation of heart rate. It computes a fractal representation of the RR interval and displays a calculated index from 0 to 100. The anesthetic agents reduce this ANS reactivity while surgical stress tends to increase it. The ANS (thus the HRV) reacts in front of different stimuli (2). The aim of this study is to establish a normal range of HRV in healthy patients basally and after non-painful stimuli, which has not been previously described.

Materials and Methods: 7 healthy volunteers (2 men and 5 women) with mean age of 34 yr (range 49–27 yr) took part in this study. HRV was continuously monitored with the A-I monitor. After 10 minutes lying in a supine position in a quiet atmosphere, a sudden cold stimuli (by applying ice during 5 seconds on the abdomen) was performed. Afterwards a tilt test was performed (stand up for 1 min) and then moved again to a horizontal position for 5 minutes.

Results and Discussions: Median value of HRV (A-I index) was 74,85 (range 40–96).This value significantly increased (40,6%) between basal time and 30 seconds after cold stimuli ($p < 0{,}005$) and significantly decreased to basal level (32,2%) between 30 seconds after cold stimuli and 90 seconds later ($p < 0{,}005$). We also observed a increase between basal time and 30 seconds after stand up and 30 seconds after lie down but not statistically different ($p = 0{,}09$). A significantly decrease to basal level (31,1%) between 30 seconds after lie down again and 90 seconds later ($p < 0{,}05$) was observed.

Conclusion(s): There is a normal variability of HRV as an answer after non-painful stimuli, up to of 40,6%. This variability occurs in a few seconds. Therefore, variations around 40% respect the basal A-I index in a short period of time during a general anesthesia could be considered a normal ANS response and no actions should be done.

References:
1 Schwarz G. *Eur J Anaesthesiol* 2002; 19: 543–549.
2 Tulppo MP. *Am J Physiol* 2001; 280: H1081–H1087.

A-110

A new method for measurement of FRC using perfluorohexane as tracergas

Marcelo Gama de Abreu, André Domingues Quelhas, Thea Koch, Antonio Giannella Neto

Clinic of Anesthesiology, University Clinic Carl Gustav Carus, Technical University Dresden, Dresden, Germany and PEB/COPPE, Federal University of Rio de Janeiro, Brazil

Background and Goal of Study: Perfluorocarbons are adsorbed only in small amounts by mammals. Due to the unique physico-chemical properties of perfluorohexane (PFH), we hypothesized that this perfluorocarbon is appropriate for the measurement of the functional residual capacity (FRC).

Materials and Methods: An anesthesia bag of 2 liters capacity was connected to the Y-piece of an anesthesia machine (Excel 210, Ohmeda, OH, USA) by means of changeable deadspaces (100 ml, 200 ml and 300 ml). The anesthesia bag was ventilated by the anesthesia machine with room air. An Isotec 5 vaporizer (Ohmeda, OH, USA) was filled with PFH and used to perform wash-in and wash-out maneuvers at each different dead space. Flow was measured by a Fleisch pneumotacograph and the gas concentrations of PFH, O_2 and N_2 were measured by a respiratory mass spectrometer (MGA 2000, Airspec, London, UK). Flow and gas concentration signals were acquired and processed off line. Signal processing included dynamic correction for time delay and compensation of viscosity variation. The FRC was calculated by means of the mass balance of PFH.

Results and Discussion: At equilibrium, plateau concentrations of about 6% PFH were achieved. Wash-in and wash-out maneuvers of PFH led to measurement errors of less than 3% and 5%, respectively, in the estimation of the FRC variation in this bench model.

Conclusion(s): The FRC can be measured with high accuracy by means of wash-in and wash-out maneuvers using PFH. Further animal experiments are necessary to confirm the reliability of this new method.

Reference:
1 Gama de Abreu et al. Method and arrangement for the measurement of the FRC of the lungs. Pending patent DE 10038818 A.

A-111

Suspected inaccurate calculation of tidal volume using the A/6 (Datex-Ohmeda) patient monitor in anaesthetized, spontaneous ventilating goats

G.F. Stegmann

Department of Companion Animal Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa

Background and Goal of Study: Tidal volume (V_T) measurement with a Capnomac Ultima (Datex-Ohmeda) unexpectedly indicated that the expired V_T was smaller compared to the inspired V_T. It is expected that heat and humidification increase the expired V_T (BTPS) compared to the inspired V_T (ATPS) (1). Biphasic expiration was observed. Measurement was repeated to obtain a record of the flow/volume loop, and to establish the possible cause of the erroneous volume measurement.

Materials and Methods: Anaesthesia was induced and maintained with isoflurane (ISO) on a circle anaesthetic breathing circuit at a 1% end-tidal ISO concentration in ten, 2 year-old female goats with a mean body weight of 28 $\pm$ 5.3 kg. V_T and flow/volume loop were recorded with the A/6 (Datex-Ohmeda) monitor. With biphasic expiration, intermittent positive pressure ventilation (IPPV) was applied to induce hypocapnoea and eliminate spontaneous ventilation.

Results and Discussions: The flow/volume loop suggested a temporary cessation of expired gas flow during spontaneous ventilation as result of biphasic expiration (Fig. 1), and was eliminated by IPPV (Fig. 2). The A/6 monitor calculates (integrate) V_T from pressure changes (1) during ventilation.

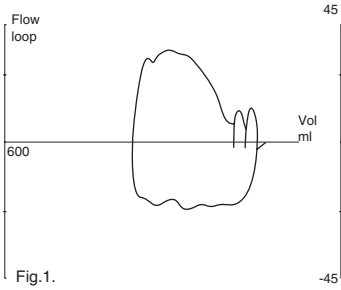

Fig.1.

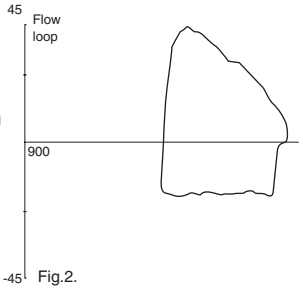

Fig.2.

Conclusion(s): The calculation of expired volume during spontaneous ventilation were inaccurate as result of a temporary cessation of gas flow.

Reference:
1 Meriläinen P, Hanninen H, Tuomaala L. *Int J Clin Monit Comput* 1993; 374–380.

Acknowledgements: The investigation was financially supported by the University of Pretoria.

A-112

Methane accumulates within the closed-circuit anaesthesia system PhysioFlex™ and relevantly influences anaesthetic gas measurement

A. Zimmermann, J. Stork, K. Zuechner, L. Frank, M. Wiesche, P. Saur

Department of Anaesthesiology, Emergency and Intensive Care Medicine, University of Göttingen, Göttingen, Germany

Background and Goal of Study: Humans exhale volatile metabolic products. Especially Methane accumulates within the closed-circuit anaesthesia system PhysioFlex™ (Draeger company, Luebeck) and influences its gas measurement (1). False-high indication of volatile anaesthetic concentration and insufficient anaesthesia may be the consequence. Methane accumulation had to be evaluated with regard to its reachable concentration under practical conditions.

Materials and Methods: After ethical approval, long-term TIVA-anaesthesias of 20 healthy adults with written informed consent have been observed. Methane concentration within the system PhysioFlex™ was measured redundantly with a quadrupole mass spectroscope and the Methane-calibrated gas measurement device of the PhysioFlex™.

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Results and Discussions: We found that 40% (n = 8) of patients did not exhale Methane. 40% (n = 8) exhaled Methane, but did not produce relevant Methane concentrations within 3 hours. 20% of patients (n = 4) relevantly delivered Methane into the system, causing a false-high indication of up to 2.5 vol% Halothane (or 1.0 vol% Isoflurane or 0.6 vol% Sevoflurane) within 3 hours. A concentration of 0.5 vol% Methane correlates to a Halothane indication of 3.5 vol%. In the evaluated concentrations, Methane is non-toxic and not explosive. However, the gas measurement within the PhysioFlex™ wrongly indicates the presence of anaesthetic agents under Methane. This causes too little delivery of volatile anaesthetics into the self-regulating system which might lead to intra-operative awareness.
Conclusion(s): To ensure the safety of gas-based anaesthesia with the PhysioFlex™, the manufacturer must immediately improve the system's gas measurement or at least integrate a Methane indicator.
Reference:
1 Mortier E, Struys M, Versichelen L et al. (1999): Influence of methane on infrared gas analysis of volatile anesthetics. *Acta Anaesth Belg,* 50: 119–123.

A-113

Continuous intra-arterial blood gas monitoring in rats

M.A. Pakulla, D. Obal, S.A. Loer

Klinik für Anaesthesiologie, Universitätsklinikum Düsseldorf, Düsseldorf, Germany

Background and Goal of Study: Studies on lung injury and its treatment options are often performed on small individuals like rats. Because conventional blood gas analysis may not detect rapid changes in gas exchange during respiratory distress syndrome and intermittent blood withdrawal can result in hypovolemia and anaemia we tested the applicability and accuracy of continuous intravascular blood gas monitoring (Paratrend 7+) in rats.
Materials and Methods: Anaesthetised rats with a body weight of 398 ± 45 g (n = 22) received a 20 gauge cannula in both carotid arteries. Via the left carotid artery a photochemical blood gas sensor (Paratrend 7+, Diametrics Medical, High Wycombe, Great Britain) was advanced into the thoracic aorta. Via the right carotid artery blood was sampled for intermittent blood gas analyses (ABL3, Radiometer, Copenhagen, Denmark). Inspiratory oxygen concentration was varied stepwise between 0.1–1.0. Arterial Pco_2 was varied by applying different respiratory rates (45–90 breaths min^{-1}). To compare continuous (Paratrend 7+) and intermittent (Radiometer) arterial blood gas determinations we used a linear regression analysis as well as a Bland-Altman analysis.
Results and Discussions: The sensor could be placed without complications or haemodynamic side effects despite the small size of the arterial vessels of rats. Only in one animal the sensor had to be replaced twice because of malfunction due to kinking of the tip during advancement from the carotid artery into the thoracic aorta. We analyzed 136 paired blood-gas determinations. The Po_2-values ranged from 40 to 578 mmHg, the Pco_2-values from 22 to 75 mmHg and the pH-values from 7.12 to 7.50. We found an acceptable correlation between continuous and conventional blood gas measurements for Po_2 ($r^2 = 0.98$), Pco_2 ($r^2 = 0.96$) and pH ($r^2 = 0.92$). The calculated bias and imprecision for Po_2 was −7.9 ± 25.0 mmHg, for Pco_2 +0.3 ± 2.1 mmHg and for the hydrogen ion concentration −0.05 ± 2.2 nmol l^{-1}.
Conclusion: In rats, continuous blood gas monitoring with a photochemical blood gas sensor provides Po_2-, Pco_2- and pH-measurements with acceptable accuracy.

A-114

Occlusion alarm times of syringe pumps with different syringe sizes and infusion rates

A. Dönmez, C. Araz, Z. Kayhan

Department of Anaesthesiology, Baskent University Faculty of Medicine, Ankara, Turkey

Background and Goal of Study: A sensitive alarm system of syringe pumps may inform occlusion earlier and help to eliminate inappropriate drug delivery. The aim of the study was to evaluate the effect of syringe size, type, and infusion rate on occlusion alarm times.
Materials and Methods: Two types (JMS® and Hayat®) and two sizes of syringes (20 and 50 mL) were studied at four infusion rates (0.5, 1, 2, and 5 mL/h). Forty syringe pumps [JMS SP-100 (n = 20) and JMS SP-500 (n = 20)] were used in the study. Syringes filled with saline were occluded with a stopcock, and times to occlusion alarms were recorded. It was not possible to lead the 50 mL JMS® syringe on to the syringe pump; therefore no data could be obtained regarding this type of syringe. Statistical analyses was performed with Wilcoxon and Mann–Whitney-U tests, $p < 0.05$ was considered significant.
Results: Syringe type did not effect occlusion alarm times ($p > 0.05$) and SP-500 gave occlusion alarm earlier than SP-100 ($p < 0.05$). The mean time to occlusion alarm was longer with low infusion rates and larger syringes ($p < 0.05$)

Table I: Occlusion alarm times (min) with Hayat® (1–4. rows) and JMS® syringes (5–8. rows) (mean ± SD)

PUMP	JMS SP-100 (n = 20)		JMS SP-500 (n = 20)	
Syringe size	20 mL	50 mL	20 mL	50 mL
Infusion rate				
0.5 mL/h	86,4 ± 32*#	117,3 ± 9*	48,2 ± 25#	83,0 ± 24
1.0 mL/h	49,8 ± 39*#	85,5 ± 33*	14,3 ± 4#	34,4 ± 15
2.0 mL/h	20,4 ± 14*#	38,6 ± 17*	7,2 ± 2#	15,9 ± 8
5.0 mL/h	11,6 ± 8,4*#	15,0 ± 7,1*	4,5 ± 7,2#	6,4 ± 2
0.5 mL/h	94,1 ± 28*#	112,7 ± 16	39,3 ± 17	–
1.0 mL/h	33,4 ± 21*#	95,6 ± 32	17,6 ± 8	–
2.0 mL/h	13,2 ± 8*#	42,4 ± 17	8,6 ± 3	–
5.0 mL/h	8,1 ± 4*#	17,5 ± 6	3,7 ± 1	–

Conclusion: Our results showed that the mean time to occlusion alarm was longer with low infusion rates and larger syringes. Therefore, for safe infusion of drugs, slow infusion rate at a high drug concentration with a large syringe size should be avoided.

A-115

An evaluation of pollution with inhalational anaesthetics of operating theatres in Poland

R. Szulc, A. Nestorowicz, W. Szyfter, P. Sobczynski, A. Fijalkowska, I. Stachecki

Chair of Anaesthesiology and Intensive Therapy, University of Medical Sciences in Poznan, Poland

Background and Goal of Study: Contamination of operating theatres with inhalation anaesthetics still poses the significant problem taking into account the possible health risks to medical personnel (1). The aim of our study was to measure the concentration of inhalational anaesthetics (nitrous oxide, halothane, isoflurane, and sevoflurane) in operating theatres in two regions of Poland (Lublin, Poznan).
Materials and Methods: Hospitals of different levels (general, regional and academic centres) were involved. The measurements were carried out using infrared spectrometer (Miran SapphIRe, OMC ENVAG Warsaw, Poland) capable of measuring the concentrations of particles per million (ppm). There were 2540 measurements (mean of 5 minutes intervals).
Results and Discussions: The maximum concentrations of nitrous oxide, halothane, isoflurane and sewoflurane were exceeded in over 40% of all measurements. They were exceeded during operating sessions but also between the consecutive procedures. We observed the characteristic coincidence between anaesthetic agent concentration, air-condition and gas scavenging installed in theatre.
Conclusion(s):
1. The pollution of operating rooms environment with inhalational anaesthetics is caused mainly by inefficient or not existing gas scavenging system and inadequate air-conditioning.
2. Occupational exposure of operating theatres personnel lasts throughout the entire working day.
3. The measurement of inhalation anaesthetics concentrations in operating theatres is necessary research element serving to improve the current situation in Poland.

Reference:
1 Rowland AS, et al. Nitrous oxide and spontaneous abortion in female dental assistants. Am J Epidemiol 1995; 141: 531–538.

A-116

Usefulness of a syringe pump with the ability to measure the outflow pressure in fluid therapy

Y. Obata, H. Igarasi, R. Obata, K. Morita, S. Sato

Department of Anesthesiology and Intensive Care, Hamamatsu University School of Medicine, Hamamatsu, Japan

Background and Goal of Study: The measurement of an accurate fluid infusion rate is very important in the treatment of critically ill patients, especially during catecholamine infusion. In order to evaluate the positioning of the catheter, we have examined the usefulness of a syringe pump, which is designed to measure the outflow pressure.
Material and Methods: A syringe pump (IVAC P-7000) that can measure the outflow pressure was used. The auricle vein of rabbits (n = 12) was cannulated with an intravenous catheter (24 G), after pentobarbital anesthesia. Fluid in the 20 ml syringe was administered into the vein at different infusion rates (1 ml/h, 10 ml/h) from the IVAC P-7000. The continuous outflow pressure was measured when 1) the tip of the catheter was partially occluded by

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the vein, and 2) the tip of the catheter was out of the vein. The pressure was measured every 15 sec until 15 min after the start of each experiment.

Results and Discussions: The outflow pressure values in each group are shown in the table. At a flow rate of 1 ml/h, none of the animals showed larger than 200 mmHg in partial obstruction and extravasation. At a flow rate of 10 ml/h, 50% (n = 7) of the animals in extravasatin showed larger than 200 mmHg. Hence, with currently marketed syringe pumps (alarm pressure 300 mmHg), partial occlusion and venous leakage cannot be detected, particularly at an infusion rate of 1 ml/h.

Table. The number of animals with a given outflow pressure

	<9	<99	<199	<299	<750 mmHg
(1) 1 ml/h (n = 12)	1	9	2	0	0
10 ml/h (n = 17)	2	9	4	0	2
(2) 1 ml/h (n = 14)	3	7	4	0	0
10 ml/h (n = 14)	0	5	2	2	5

Conclusion: The continuous measurement of the outflow pressure is useful in the early detection of partial catheter occlusion and extra-venous leakage. However, using a normal syringe pump, it is often impossible to evaluate catheter occlusion or extra-venous leakage.

A-117

Accuracy and precision of CO_2-analyzers in two simulated helicopter flight conditions

M. Zuercher, C.M. Spengler, B. Walder

Departments of Anaesthesiology, University Hospitals of Basel, Basel, Switzerland, Geneva; Exercise Physiology, University and ETH Zurich

Background and Goal: During air transport by helicopter, monitoring of $P_{ET}CO_2$ is essential to assure adequate ventilation. Hypobaric conditions in the helicopter may affect correct monitor measurements. The aim was to test accuracy and precision of portable CO_2-analyzers in normobaric and hypobaric conditions.

Materials and Methods: Nine infrared CO_2-analyzers (P = Propaq, N = Nellcor, O = Oridion, D = Datex, M = MRL, Z = Zoll) were tested in a hypobaric chamber at 500 m (720 mmHg) and 3500 m above sea level (495 mmHg), before and after ascent/descent with 5 m/s. A respiratory rate of 5/min was simulated with unidirectional alternating dry gas mixtures (3% or 6.5% CO_2 in 60% O_2, rest N_2 and pure oxygen). Data of the first 3 min after reaching the respective pressure were averaged and compared with PCO_{2calc} (0.03 or 0.065 multiplied by chamber pressure).

Results: Standard deviations were low, indicating good precision and rapid adaptation to changes in ambient pressure. D did not adjust to pressure changes within the observation period and the accuracy of M and Z decreased markedly in hypobaric conditions. Similar results were achieved using the 3% CO_2 gas mixture.

CO_2-Monitor mainstream sidestream microstream	$P_{ET}CO_2$ at 500 m (mmHg) N = 61	Accuracy at 500 m ($P_{ET}CO_2$ − PCO_{2calc})	$P_{ET}CO_2$ at 3500 m (mmHg) N = 91	Accuracy at 3500 m ($P_{ET}CO_2$ − PCO_{2calc})	Accuracy difference (acc.3500 m – acc.500 m)
P1 (main)	44.2 ± 1.8	−2.6	30.5 ± 0.8	−1.7	0.9
P2 (main)	43.9 ± 0.6	−4.5	30.2 ± 0.4	−2.0	0.8
P3 (side)	42.2 ± 0.4	−4.5	28.0 ± 0.3	−4.2	0.3
P4 (side)	44.1 ± 0.3	−2.6	30.8 ± 0.4	−1.4	1.2
N (micro)	49.8 ± 1.2	3.1	36.6 ± 1.1	4.4	1.3
O (micro)	46.7 ± 1.1	−0.1	32.9 ± 1.3	0.7	0.8
D (side)	44.6 ± 1.5	−2.1	45.0 ± 0.1	12.8	14.9
M (main)	45.4 ± 1.0	−1.3	25.1 ± 0.3	−7.1	−5.8
Z (main)	47.4 ± 1.4	0.6	35.1 ± 0.2	−3.3	−4.0

Conclusions: Eight of nine CO_2-analyzers rapidly adapted to ambient pressure changes. Lower accuracy was observed for some monitors at reduced ambient pressure.

A-118

Advanced signal processing algorithms modify the responsiveness of motion-resistant pulse oximeters

C H. Rauschmayer, E. Kozma, V. Meyer, N. Lutter

Department of Anesthesiology, University of Erlangen-Nuremberg, Erlangen, Germany

Background and Goal of Study: Adding novel signal processing technologies to eliminate motion artifacts, substantially improved the clinical reliability of third and fourth generation pulse oximeters (1). As these algorithms may modify the pulse oximeters' responsiveness to rapid changes in heart rate (HR) and/or saturation, the aim of this clinical study was to evaluate three representative devices in presence of transient alterations of HR.

Materials and Methods: After ISB approval and informed consent, 82 patients (ASA I–III), mean age 50.4 ± 17.2 yr, receiving electro-convulsive therapy (ECT) under general anesthesia were included into the study. Functional oxygen saturation and plethysmographically estimated pulse rates (PR) as generated by three different devices (Philips CMS, Nellcor N-395, and Masimo IVY 2000), as well as the referential HR provided by the ECG were recorded continuously and simultaneously. Dropout rates and delay times between the increase in HR and corresponding PR data were then calculated offline.

Results and Discussions: In 66 of 82 patients 255 dropout events occurred causing very short mean drop out times (CMS 0.99%, N-395 2.35%, Masimo 1.89%) during the whole measurement period (≈15 min per patient). However, 37.6% of these events revealing large differences between the pulse oximeters were recorded during short periods (37 to 114 s) of rapid HR alterations when ECT was applied (Tab 1). Significant tachycardia of >90 bpm occurred in 49 patients with a mean delay of the PR ascent when compared to the preceding increase in HR of 20.1 s for CMS, 14.2 s for N-395 and 8.2 s for Masimo.

Table 1

	CMS	N-395	Masimo
Dropout events	59	132	64
Dropouts during ECT	47	23	26
Dropouts ECT/all dropouts (%)	79.7	17.4	40.6
Mean dropout time during ECT (s)	13	16.8	26.2

Conclusion: The three pulse oximeters show significantly differing profiles which can be assigned to the specific proprietary algorithms implemented. However, this may positively or negatively modify the monitoring efficacy depending on the clinical requirements without ubiquitous superiority of a single device.

Reference:

1 Lutter N et al. Anesth Analg 2002; 96: S69–75.

A-119

Use of microdialysis to assess metabolic consequences of changes in liver perfusion during liver surgery

K. Van Belle, C. De Deyne, H. Verhelst*, K. Vanderspeeten*, E. Vandermeersch**, R. Heylen

**Departments of Anesthesia and Abdominal Surgery, Ziekenhuis Oost-Limburg, Genk, Belgium; **Department of Anesthesia, University Hospital Leuven, Belgium*

Background and Goals: Major liver surgery may necessitate extensive surgical manipulation of the liver hilus, with intermittent clamping of the hepatic artery. This manipulation and clamping may lead to major impairment in the hepatic microcirculation. Microdialysis (MD) permits continuous monitoring of metabolic changes by mimicking the passive function of a capillary blood vessel by perfusion of a tubular semipermeable membrane introduced into the tissue (1). The aim of this study was to analyse the metabolic effects of intermittent hepatic artery clamping on hepatic cellular metabolism, monitored by MD.

Material and Methods: With IRB approval, six consecutive patients, scheduled for major hepatic surgery and in whom repeated hepatic artery clamping was to be applied, were included. Intrahepatic implantation of a MD catheter (CMA 60) was performed at the beginning of the liver hilus manipulation. The catheter was connected to a MD perfusion pump with Ringer's solution set at 5 µl/min, enabling dialysate sampling and analysing every 5 min. Glucose, lactate, pyruvate and glycerol concentrations were measured immediately after sampling.

Results and Discussion: In all 6 pts, 2 periods of hepatic artery clamping (m27 min; range 21–43 min) was applied. Immediately after arterial clamping, extracellular hepatic glucose concentration increased markedly (2- to 4-fold). This increase in glucose went along with an increase in hepatic lactate concentration. Hepatic pyruvate concentration raised only after minutes of arterial clamping, while glycerol increased immediately after clamping but restored itself to normal values even during clamping. The mean duration between both clamping episodes (less than 30 min) did not result in a normalization of glucose, lactate or glycerol.

Conclusions: Liver MD allows monitoring of metabolic changes in liver parenchyma and might allow local metabolic monitoring of the effects of surgical and anesthetic interventions during major liver surgery.

Reference:

1 Liver Transpl 2002; 8: 424–432.

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A-120

Jugular bulb saturation and PCO_2 during carotid endartrectomy

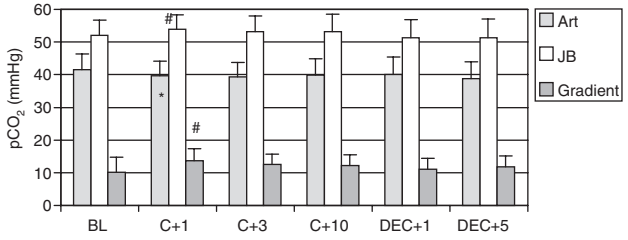
A. Eden, J. Carmeli, S. Fayer, R. Karmeli, R. Assadi, R. Pizov

Departments of Anesthesia and Vascular Surgery, Carmel M.C. and The Rappaport Faculty of Medicine, The Technion, Haifa, Israel

Background and Goal of Study: Jugular bulb (JB) saturation has been used for monitoring patients undergoing Carotid endarterectomy (CEA) (1). We evaluated whether JB saturation and pCO_2 changes may reflect hypoperfusion during carotid clamping in awake patients.

Materials and Methods: Following IRB approval and informed consent 38 consecutive patients undergoing elective CEA under cervical block anaesthesia were included in the study. JB catheter was placed under vision by the surgeon. JB and arterial blood were drawn before clamping (BL), 1, 3, and 10 minutes after clamping, and 1 and 5 minutes after reperfusion (C+1,C+3,C+10, Dec+1, Dec+5 respectively). Paired student T test was used, $P < 0.01$ statistically significant.

Results and Discussions: JB saturation decreased from 68 ± 7% at BL to 59 ± 9 at C+1 ($p < 0.001$), remained stable throughout clamping and increased again at DEC+1 to 68 ± 7% ($p < 0.001$). JB pCO_2 increased, while $paCO_2$ slightly decreased following clamping, leading to a greater rise in JB to arterial pCO_2 gradient (Fig).



*P = 0.01 # P < 0.001 compared to BL

Conclusion(s): We suggest that the increase in JB to arterial pCO_2 gradient during carotid clamping parallels brain hypoperfusion similarly to gastric tonometry (2). Further studies are required before its use can be recommended.

References:

1 Williams IM. *Br J Surg* 1994; 81: 1291–5.
2 Fiddian-Green RG. *J Surg Res* 1982; 33: 39–48.

A-121

Noninvasive continuous blood pressure measurement utilizing the pulse transit time: calibration and drift

N. Lutter, E. Kozma, W. Stork*

*Department of Anesthesiology, University of Erlangen-Nuremberg, Erlangen, Germany; *ITIV, University of Karlsruhe, Germany*

Background and Goal of Study: Arterial blood pressure (BP) can be reconstructed continuously and non-invasively (cNIBP) by determining either pulse transit time (PTT) and/or pulse wave velocity (PWV) (1). However, calibration is mandatory for this technology, and therefore the aim of this study was to quantify the baseline drift of the non-invasive configuration.

Materials and Methods: 11 patients (ASA II–IV) after abdominal surgery were included into this study after IRB approval and informed consent. Laser Doppler flow (LDF), plethysmogram (Pleth, Nellcor N-395), ECG (Einthoven I), and referential arterial BP of the contralateral radial artery were collected, processed and visualized by means of a prototype (2). A major BP variation (P_{sys}, P_{dia}) differing from baseline by >20% was utilized to calibrate (CAL) the non-invasive device, the 60 min period following close after was used to quantify the agreement (EVAL) between invasive and non-invasive BP over time.

Results and Discussions: During the calibration period cNIBP and referential arterial BP yield fairly high correlation coefficients (R), but Rs decrease significantly during the evaluation period ($P^* < 0.01$, Tab 1). However, Bland-Altman testing returns less significantly differing maximum SDs (CAL: ±4.62 mmHg vs. EVAL: ±7.13 mmHg). Despite marked drifting of both non-invasive techniques, individual cNIBP values during the evaluation interval do not differ by more than 2 mmHg from cNIBP data comprising the whole measuring period.

Table 1

	R_{LDF}* CAL	R_{Pleth}* CAL	R_{LDF}* EVAL	R_{Pleth}* EVAL
P_{sys}	0.95	0.91	0.80	0.74
P_{dia}	0.85	0.84	0.59	0.61

Conclusions: Therefore the major source of disagreement may be assigned to the calibration period and thus requires further investigation of the signal processing algorithms of the non-invasive arrangements including physiological components not yet considered adequately.

References:

1 Elter P et al. *Proc SPIE* 1998; 3570: 244–254.
2 Siebert Ch et al. *EJA* 2002; 19: Suppl. 24: 35.

A-122

Evaluation of new algorithms to estimate continuous systolic blood pressure using ECG and pulse oximeter in patients in post-anaesthesia care unit (PACU)

A. Benichou, P. Narchi

16, Centre Clinical, 16800 Soyaux, France

Background and Goal of Study: Surgical patients monitored in PACU after major surgery frequently exhibit hypotensive episodes due to either bleeding or residual anaesthetic effects. New algorithm (HASTE Technology) provides continuous non-invasive blood pressure monitoring. The goal of this study is to assess the accuracy of the Haste Technology in PACU.

Materials and Methods: After institutional approval and informed consent, 16 consecutive patients (68 years old in average, 8 male and 8 female) undergoing major surgery (knee arthroplasty, hip arthroplasty, radical prostatectomy, spinal fusion) were included. Patients were operated under spinal anaesthesia or combined general - epidural anaesthesia. The Haste monitor recording was started in PACU with 10 minutes NIBP interval measurements during a three hours period. The coupled ECG–SpO_2 triggered NIBP measurement as soon as rapid changes in blood pressure were detected. The Haste estimates beat-to-beat changes in systolic blood pressure by measuring the delay time between QRS of ECG and the plethysmograph of the pulse oxymeter. The Haste arrow on the screen shows the clinician such early changes in blood pressure. A 10% modification in blood pressure is shown by a 45° arrow on the monitor screen.

Results and Discussions: 348 sets of measurements were recorded for analysis. The calculated efficiency of the Haste arrow was 70.11%. This new algorithm was able to detect 4 minutes earlier than the automatical NIBP a drop of 20 mmHg in 5 patients allowing a more rapid medical intervention.

Conclusion(s): Our results are in agreement with those observed in a recent similar study in ICU patients (1). This feature is interesting in clinical situation when rapid changes in blood pressure may occur and potentially lead to adverse complication. Indeed, such early detection of changes in blood pressure leads to an earlier medical intervention in such high risk patients.

Reference:

1 Hiroshi Ito et al. Evaluation of New Algorithms to Estimate Continuous Systolic Blood Pressure using ECG and Pulse Oxymeter in Patients with Hemodynamic Changes in Intensive Care Unit. Anesthesiology 2001; 95: A 582 (abstract).

A-123

Comparison of cardiovascular and oxygen uptake responses to sub-maximal exercise, using a new impedance cardiograph device

H. Luery, E. Chaloner, M. Mythen

Exercise Physiologist, University College London; Consultant Vascular Surgeon, University College Hospitals NHS Trust; Portex Professor of Anaesthesia, University College London, London, United Kingdom

Background and Goal of Study: Cardiac output measurement during exercise can be used to assess cardiovascular function before major surgery. Most cardiac output measures are invasive and require experienced operators. However, the Physioflow system uses a novel indirect impedance method (1). Gas concentrations at the mouth are representative of respiration at the cellular level. Therefore, when demand for ATP resynthesis increases, cardiac output increases in proportion to oxygen consumption (2). This study aims to assess whether cardiac output, as measured by the Physioflow, increases in response to incremental sub-maximal exercise when compared to oxygen consumption in healthy volunteers.

Materials and Methods: Seven healthy male subjects (mean age, height and weight: 34years, 180 cm and 73 kg respectively) performed 4 minutes of dynamic leg exercise on a cycle ergometer at 40, 60 and 80 Watts. Steady state oxygen consumption (VO_2) and cardiac output (Q) were measured using a Medgraphics Cardiopulmonary Exercise Testing system and a Physioflow system, respectively.

Results and Discussions: Increases in VO_2 of 3.2 ml/kg/min (SD 0.8) and 3.7 ml/kg/min (SD 0.9) were found between 40–60 W and 60–80 W, respectively. VO_2 and Q were positively correlated ($r = 0.523$, $p = 0.015$). Q increased by 1.1 L/min (SD 1.5) between 40 and 60 W and by a further 1.1 L/min (SD 2.5) between 60 and 80 W. This study suggests that cardiac output measured by the Physioflow reflects the degree of metabolic stress experienced

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by normal individuals during exercise. Deviations from this normal response could be used to assess cardiovascular risk in patients prior to major surgery.
Conclusion(s): The Physioflow is a useful tool for the measurement of cardiac output during sub-maximal exercise testing and may have applications for preoperative risk stratification.
References:
1 Charloux A, Lonsdorfer-Wolf E, Richard R et al. *Eur J appl Physiol.* 2000; 82: 313–320.
2 Wasserman K. *Am. Rev. Respir. Dis.* 1984; 129(Suppl): S21–S24.
Acknowledgements: We gratefully acknowledge APC medical for providing the Physioflow device.

A-124

The value of intra-abdominal pressure measurement in patients undergoing ruptured abdominal aortic aneurysm repair. Preliminary report

K. Bieda, P. Sobczynski, R. Szulc

Chair of Anaesthesiology and Intensive Therapy, University of Medical Sciences in Poznan, Poznan, Poland

Background and Goal of Study: Multiorgan dysfunction caused by increased intra-abdominal pressure (IAP) and splanchnic ischaemia is well recognized postoperative complication in patients undergoing ruptured abdominal aortic aneurysm (RAAA) repair. The aim of this study was to evaluate predictive value of IAP measurement together with splanchnic perfusion monitoring in patients who underwent RAAA repair.
Materials and Methods: We studied 16 patients (15 males, 1 woman), mean age 66 ± 7 years presented for AAAR reconstruction. We assesed epidemiologic parameters (APACHE II, MOD, SOFA) and TISS 28, central hemodynamics (HR, CVP, MAP), splanchnic perfusion ($PgCO_2$. Pg-aCO_2 with Tonocap™), and IAP (modified Kron's technique). Intrabdominal hypertension was diagnosed with IAP > 15 mmHg. These parameters were analized every 8 hours postoperatively starting after admission to the ICU till the end of treatment there.
Results and Discussions: We observed increase in IAP value (>15 mmHg) during the 2nd postoperative day. IAP value did not differ in survivors and nonsurvivors. Abdominal perfusion pressure (APP = MAP-IAP) reached the value >70 mmHg in survivors and <70 mmHg in the patients who died. APP value <70 mmHg was observed in patients presenting with abnormal splanchnic perfusion ($p_g CO_2$ > 60 mmHg and pg-a > 15 mmHg. Similar correlation was not observed between IAP and splanchnic perfusion parameters.
Conclusion(s):
1 Intra-abdominal pressure does not appear to be a reliable prognostic factor in patients undergoing urgent abdominal aortic surgery.
2 Abdominal perfusion pressure was found to be a superior parameter compared to IAP.
3 Monitoring of splanchnic perfusion and APP seem to be a valuable clinical tool in postoperative management of these patients.
References:
1 Malbrain M.: Intra-abdominal Pressure in Intensive Care Unit: Clinical Tool or Toy?; in: Yearbook of of Intensive Care and Emergency Medicine 2001 (Ed.:Vincent J.-L.), Springer Berlin 2001.

A-125

The PiCCO®-device is not susceptible to MRI-induced heating in 1.5-Tesla procedures

J. Kampen, C. Liess, C. Casadio, P.H. Tonner, M. Reuter, J. Scholz

Department of Anaesthesiology and Intensive Care, Diagnostic Radiology, University Hospital Kiel, Kiel, Germany; Christian-Albrechts-University, University Hospital Schleswig-Holstein

Background and Goal of Study: Patient safety during MRI examination and MRI guided interventions in the critically ill may be affected by endovascular monitoring equipment because integrated wires may be susceptible to radiofrequency (RF) induced heating (1). Burns due to Ohmic heating or resonant RF-excitation have been reported (2). The PiCCO®-system for pulse-contour analysis (Pulsion, Munich, Germany) has gained high appreciation for haemodynamic monitoring (3). Currently, the device is not approved for MRI use. Risks of arterial cannulation and high costs limit repeated removal and reinsertion. Accounting for increasing demands for MRI procedures, this investigation addressed the quantification of MRI induced heating in the PiCCO®-device.
Materials and Methods: A no-flow phantom filled with isotonic saline with inserted PiCCO®-catheter was exposed to six different MRI sequences (Magnetom Vision 1.5-Tesla, Siemens, Erlangen) frequently performed in the critically ill. A Swan-Ganz-catheter with documented susceptibility to heating in MRI was measured for control. Temperature changes were determined by means of real-time fluoroptic thermoluminiscence (Luxtron 3100, Sta. Clara, CA, USA). Accuracy of this instrumentation was ± 0.1°C, range 0–120°C, response time 250 ms. Thus, the temperature resolution was considered 0.2°C.
Results and Discussion: No temperature increase from baseline value was detected in all experiments in the PiCCO®-device. In the Swan-Ganz-catheter a temperature rise of 0.5°C attributable to Ohmic heating was measured. No dislocation due to mechanical load caused by the magnetic field occurred. These results indicate that patient safety is not affected by heating or dislocation when the PiCCO®-catheter is not removed for 1.5-T MRI.
Conclusion: The manufacturer should initiate efforts for MRI approval of the device according to CE and FDA regulations.
References:
1 Dempsey MF, Condon B, Hadley DM. *J Magn Reson Imaging* 2001, 13:627–631.
2 Shellock FG, Kanal E. *J Magn Reson Imaging* 1996; 20:362–3.
3 Goedje O, Hoeke K, Lichtwark-Aschoff et al. *Crit Care Med* 1999; 11:2578–9.

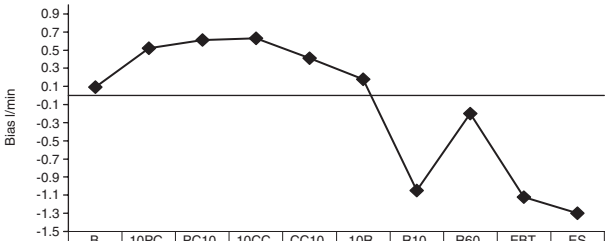
A-126

Accuracy of the pulse contour analysis for continuous monitoring of the cardiac output during liver transplantation

I.G. Tzenkov, D. Arnal, J. Perez-Peña, L. Olmedilla, I. Garutti, J. Sanz

Department of Anaesthesia Reanimation and Pain Treatment, University General Hospital "Gregorio Marañon", Madrid, Spain

Background and Goal of Study: The pulmonary artery thermodilution method (BTCOpa) is the actual clinical standard of measurement of the cardiac output. Recently, a new method of measurement based on the thermodilution calibrated pulse contour analysis (PCCO) was proposed (1). The aim of our study was to check out the accuracy of the new method during the liver transplantation.
Materials and Methods: In a prospective study, 220 paired measurements of the cardiac output were made in 25 patients undergoing orthotopic liver transplantation. The BTCOpa was averaged from 3 ice cold measurements. Initial calibration of the pulse contour analysis system (Pulsion PiCCO v 4.1) was made in all patients without further recalibrations. Ten moments (basal, 10 min before and after portal and caval clamping and reperfusion, 60 min after the reperfusion, after the biliary tract reconstruction and end of the surgery) were elected. The Bland and Altman's statistical method (2) was used for analysis. 15% variation was determinated as a limit of good agreement.
Results and Discussions: For the whole sample of paired measurement there was a very small bias (PCCO-BTCOpa) of 0.04 ± 0.15 l/min, with limits of agreement − 4.27 ± 4.35 l/min. Figure 1 shows the trend of the bias during the procedure:



	B	10PC	PC10	10CC	CC10	10R	R10	R60	EBT	ES
Bias	0.09	0.52	0.61	0.63	0.41	0.18	-1.05	-0.2	-1.12	-1.3
1.96SD	2.12	4.51	4.68	3.40	3.07	4.45	5.09	5.58	4.54	2.29

Moments of measurement

Conclusion(s): During the liver transplantation procedure the pulse contour analysis can detect changes in the cardiac output but large variations in the absolute value are possible.
References:
1 Gödje O, Höke K, Lamm P, et al. Thorac Cardiovasc Surg 1998; 46: 242–49.
2 Bland JM, Altman DG.. Lancet 1986; I: 307–10.

A-127

Effect of propofol on pulse wave velocity

T. Tanaka, N. Kurokochi, M. Narita

Department of Anesthesiology, Shinshu University School of Medicine, Komoro Kohsei Hospital, Komoro, Japan

Background and Goal of Study: Blood pressure pulse wave velocity (PWV) is a parameter which is related to arterial tonus. The aim of this study was to determine the effect of propofol on the vascular stiffness with PWV obtained simultaneously from two peripheral sites.
Materials and Methods: Pulse transit time (PTT) to the toes and fingers of 5 subjects was measured by photoplethysmography (PPG) and ECG. We measured two parameters; the pulse traveling time between the R-wave of the ECG and the arrival time of the pulses at the finger(F-PTT), between the R-wave of the ECG and the arrival time of the pulses at the toe (T-PTT).

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Control values were established before anesthesia induction using propofol, and sleep values were taken when response to verbal order disappeared, intubation values were determined at the time of intubation.
Results and Discussions: Data (Mean ± SD) are shown in the table:

	T- PTT	F-PTT
Control	100	100
Sleep	139 ± 33*	108 ± 12
Intubation	121 ± 41	102 ± 11

* $p < 0.05$ compared with control value

Conclusion(s): The distance between the heart and the sampling site is important when PWV is determined.
Reference:
1 Nitzan M et al, Physiol Meas 2002; 23(1): 85–93.

A-129

Subcutaneous glycerol release, assessed by microdialysis, as an indicator of peroperative sympathetic stress

H. Callewaert, C. De Deyne, L. Schouteten, T. Pittevils*, K. Vissers, E. Vandermeersch**, R. Heylen

**Departments of Anesthesia and Orthopedic Surgery, Ziekenhuis Oost-Limburg, Genk, Belgium; **Department of Anesthesia, University Hospital Leuven, Belgium*

Background and Goals: Peroperative sympathetic stress is reported to contribute largely to peri-operative cardiac morbidity. Until yet, direct measures of sympathetic stress were derived from whole body's estimates, such as catecholamines in blood or urine output. Recent investigations revealed that subcutaneous glycerol production as a result of increased lipolysis, can be interpreted as a result of increased sympathetic activity (1). Tissue microdialysis (MD) is a clinical tool enabling the collection of local glycerol produced in the subcutaneous adipose tissue. In the present study, we analysed whether MD might be used to monitor changes in local sympathetic stress during surgery.
Material and Methods: 10 ASA I–II pts scheduled for orthopedic lower limb surgery were included. All patients underwent general anesthesia (propofol/fentanyl/rocuronium/O_2/N_2O). After induction of general anesthesia, a MD catheter (CMA 60) was inserted in the subcutaneous tissue of the upper abdominal wall. The catheter was connected to a MD pump and perfused with a Ringer's solution at 5 μl/min. Dialysates were analysed every 5 min for glycerol.
Results and Discussion: After insertion of the catheter, glycerol values were initially high, most probably due to local traumatic lesions due to catheter insertion. We observed 4 events of marked glycerol release; at incision, during surgery, at emergence from anesthesia and in the early postoperative phase. In 4 pts we observed marked glycerol increase at incision, while in 7 pts we observed further progressive increase in glycerol during surgery. In 8 pts, we observed a 3- to 4-fold increase in glycerol at emergence from anesthesia. Finally, in 4 pts, we noted a postoperative rise in glycerol, which in all 4 pts corresponded with an significantly increased pain scale.
Conclusion(s): Subcutaneous MD can be used to monitor local sympathetic activity during surgical stress. In future, MD might be a valuable tool to evaluate any therapeutic intervention aimed at reducing peroperative sympathetic stress.
Reference:
1 Acta Anaesthesiol Scand 2002; 46: 585–591.

A-130

Auditory evoked potentials index and bispectral index in sevoflurane–nitrous oxide anesthesia

T. Nishiyama, K. Hanaoka

Department of Anesthesiology, The University of Tokyo, Bunkyo-ku, Japan

Background and Goal of Study: Middle-latency auditory evoked potentials (AEP) have been shown to detect hypnotic levels in general anesthesia. An advanced signal-processing device can extract AEP and presents the results by means of the A-line ARX index (AAI)(1). In the present study, we compared AAI and bispectral index (BIS) in sevoflurane (S)-nitrous oxide (N_2O) anesthesia.
Materials and Methods: After informed consent, 40 female, aged 40 to 60, scheduled for partial mastectomy without any complications, were divided into AAI and BIS groups of each 20 patients at random. Midazolam 5 mg and atropine 0.5 mg were administered intramuscularly 30 minutes before anesthesia induction. Anesthesia was induced with S rapidly increased to 5% and N_2O 3 L/min in oxygen (O_2) 3 L/min in 3 minutes. Laryngeal mask (LMA) #3 was inserted and S decreased to 0.5%. Anesthesia was maintained with S and N_2O 4 L/min in O_2 2 L/min. During surgery, S was kept at 0.5%, 1.0%, or 2.0% (end-tidal) for 5 minutes to measure AAI or BIS. AAI was measured by A-line™ AEP monitor (Danmeter, Odense, Denmark) and BIS was measured by A-1050 BIS™ monitor (Aspect Medical, Newtown, USA).
Results and Discussion: Mean values are shown.

	1	2	3	4	5	6	7
AAI	73	16	25[a]	24	21	16[b]	75
BIS	78	51	56	47	42	39[b]	85

1, before induction; 2, before insertion; 3, after insertion; 4, S 0.5%; 5, S 1.0%; 6, S 2.0%; 7, at removal of the LMA. [a]: $P < 0.05$ vs. before insertion, [b]: $P < 0.05$ vs. S 0.5%. AAI but not BIS increased at insertion. Both AAI and BIS decreased according to the increase in S concentration.

Conclusions: AAI changed parallel to BIS according to S concentration, but only AAI responded to insertion of LMA in S-N_2O anesthesia.
Reference:
1 Ge SJ. *Br J Anaesth* 2002; 89: 260–264.

A-131

Effect of pancuronium on the auditory evoked potentials-derived AAI index

H. Litvan, E.W. Jensen, B. Rodriguez, M.L. Maestre, J.M. Campos, P. Martinez, J. Galan, J.M. Villar Landeira

Department of Anaesthesia and P.O.-Intensive Care, Cardiac Anaesthesia Unit, Hospital Santa Creu i Sant Pau, Barcelona, Spain

Background and Goal of Study: Middle Latency Auditory Evoked Potentials (MLAEP) are a good measure of the hypnotic level during anesthesia[1]. The objective of this study was to evaluate the effect of the muscle relaxant pancuronium on the Aline-ARX Index (AAI) during the induction of anesthesia with propofol.
Materials and Methods: The AEP was recorded from 26 patients scheduled for cardiac surgery with the A-line® AEP-monitor (Danmeter A/S, Denmark) which derives the AAI on-line. Induction of anaesthesia was done with propofol until loss of consciousness (Modified Observer Assessment of Alertness and Sedation Scale (MOAAS/S) level 1) and continued at constant level with a TCI propofol pump. After five minutes in MOAAS/S 1, pancuronium (0.1 $mg.kg^{-1}$) (Group A) or placebo (Group B) were randomly administered.
Results: The average AAI (SD) value while awake was 75(8.3) in group A and 73.2(12.9) in group B. When the patients were anaesthetised, the average AAI decreased to 27(14.4) and 23(6.8) in groups A and B respectively (t-test, $p < 0.001$). Five minutes after the administration of pancuronium or placebo the average AAI in group A was 25(12) and in group B 21(5). There was no significant difference between the groups.
Conclusion(s): Patients who received pancuronium or placebo showed similar AAI behaviour. In this study, pancuronium did not have a significant influence on the AAI while the patients were asleep.
Reference:
1 H. Litvan, E.W. Jensen, M.Revuelta, et al. Acta Anaesth Scand 2002;46:245–252.

A-132

Is auditory evoked potential monitoring during anaesthesia of predictive value?

D. Russell, K. Canavan, K.J. OHare, G. McGinn, G.N.C. Kenny

Department of Anaesthesia, Southern General Hospital, Glasgow, United Kingdom; South Glasgow University Hospitals NHS Trust, Glasgow G51 4TF & University of Glasgow, Glasgow G31 2ER

Background and Goal of Study: The Auditory Evoked Potential Index (AEP_{index}), derived from the auditory evoked response, has been investigated as a monitor of anaesthetic depth (1). It has been shown to change repeatedly with transitions between consciousness and unconsciousness; patients had an AEP_{index} in the range 38–98 when awake and 21–55 when anaesthetised (2). It predicts movement in response to skin incision during sevoflurane anaesthesia (3). We investigated whether AEP_{index} predicts movement in response to skin incision in patients anaesthetised solely with propofol.
Materials and Methods: Twenty-six unpremedicated ASA 1 or 2 patients were studied. Median age was 43.5 years (range 17–68), median weight was 77.5 kg (range 55–96) and there were 8 females. Anaesthesia was induced and maintained with propofol by 'Diprifusor' target controlled infusion, to a target of 6.8 $mcg\ ml^{-1}$. Patients breathed oxygen-enriched air, and surgical incision was made a minimum of 12 minutes after induction. The AEP_{index}

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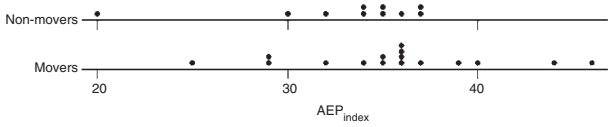
was elicited as previously described (1), and was noted immediately prior to surgical incision. The surgeon, who was blind to the AEP_{index}, determined the presence or absence of gross purposeful movement in response to a groin incision.

Results and Discussion: The values for AEP_{index} immediately prior to incision are shown below. Sixteen patients moved and 10 patients did not. The median (range) AEP_{index} in the movers was 36 (25–46) and 34.5 (20–37) in the non-movers. The two groups were not significantly different when compared using the Mann–Whitney Test ($p = 0.29$; 95% C.I. −1.004, 5.999).



Conclusion: The AEP_{index}, derived from the auditory evoked response, did not predict gross purposeful movement in response to the initial surgical incision in unpremedicated patients anaesthetised solely with propofol.

References:

1 Mantzaridis H. *Anaesthesia* 1997; 52: 1030–1036.
2 Gajraj RJ. *Br J Anaesth* 1998; 80: 46–52.
3 Kurita T. *Anesthesiology* 2001; 95: 364–7.

A-133

Bispectral index and auditory evoqued potentials relationships of desflurane during general anaesthesia

B. Guignard, C. Coste, A. Mongredien, M. Chauvin

Service dAnesthésie Réanimation, Hôpital Ambroise Paré, Boulogne Billancourt, Boulogne, France

Background and Goal of Study: Desflurane effect on BIS is lowered with surgical stimulation [1]. Auditory evoqued potentials (AEP) are available for depth of anaesthesia monitoring. Aim of the study was to compare effect-dose curves for sevoflurane (SEVO) with BIS and AEP with or without surgical stimulation.

Materials and Methods: After informed consent, 18 patients scheduled for laparotomy were studied. 20 minutes after standardized induction, end-tidal SEVO (EtS) was modified between 0.5 and 1.5 MAC (without N_2O). EtS, BIS (Aspect 2000, XP version), AEP (Aline™, Alaris Medical) were recorded every 5 sec. SEVO effect concentration (Cef) was estimate with relation Cef/dt = Ke0(EtS-Cef). Sigmoid model for SEVO effect was determined for BIS™ and Aline™ (Effect = E0 + (Emax-E0)*(Cef^g/($Cp50^g$ + Cef^g)). Dose-effect curves were fitting with a multifactor model with or without surgical stimulation. Statistical analysed consist in Student t test. Results are means ± SD. $P < 0.05$ is considered significant.

Results and Discussions:

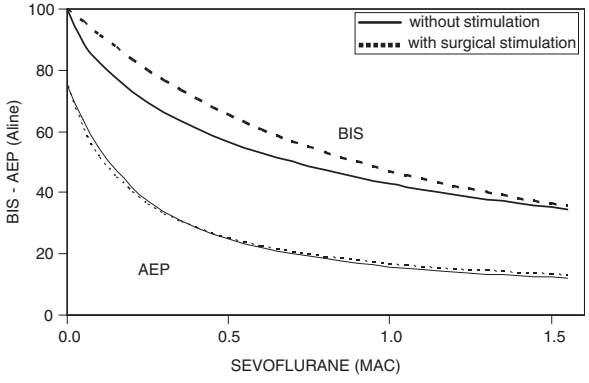


Figure 1: Sevoflurane Cef-effet relationship for BIS™ and Aline™.

SEVO Cp50 for the BIS without surgical stimulation is 0.7 ± 0.4 vs 0.9 ± 0.3 MAC with stimulation ($P < 0.05$).

Conclusions: Shift of the curve of BIS with surgical stimulation express an augmentation of SEVO requirements to maintain identical BIS values. Near maximum effect is reached since 0.5 MAC for Aline™ Index. These results are in agreement with that middle latency potentials are minimum since low level of anaesthesia and are not the reflect of greatest levels of SEVO anaesthesia.

Reference:

1 Ropcke H.et al. *Anesthesiology* 2001; 94: 390–9.

A-134

Dose-response relationship between desflurane concentrations and Alaris AEP or bispectral index

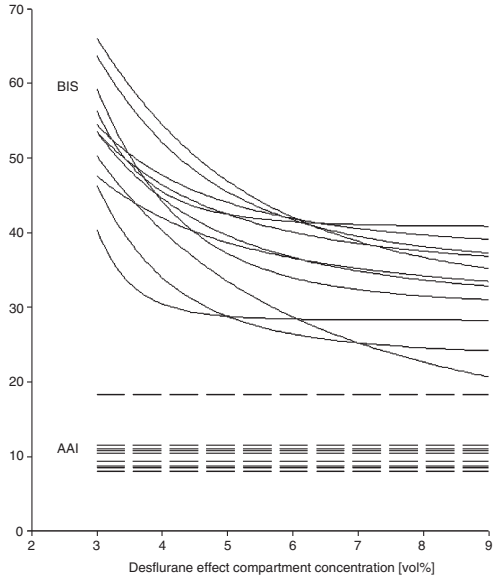
S. Kreuer, W. Wilhelm, C. Bauer, C. Osswald, R. Larsen, J. Bruhn

Departments of Anaesthesiologie and Intensive Care Medicine, University of Saarland, 66421 Homburg/Saar, Germany

Background: Autoregressive modeling with exogenous input of middle-latency auditory evoked potentials (Alaris AEP index, AAI, version 1.4) has recently been developed for monitoring of anaesthetic depth. We investigated the dose-response relationship between desflurane concentrations and AAI or bispectral index (BIS XP) values.

Methods: With institutional review board approval and informed consent, 16 adult male patients scheduled for radical prostatectomy were studied. Endtidal desflurane concentrations were varied between 0.5 and 1.5 MAC twice while remifentanil was infused at a constant rate of 0.1 μg kg^{-1} min^{-1}. AAI and BIS values were recorded every 5 s and matched with the respective desflurane effect compartment concentrations obtained by PK/PD modelling.

Results and Discussions: None of the patients showed a significant change of AAI values while varying the desflurane concentrations between 0.5 and 1.5 MAC. The dose response of BIS and desflurane was not uniform: In 2 patients BIS values increased with increasing desflurane concentrations, in 3 patients BIS values remained unchanged. Only in 11 of 16 patients (Fig.) decreasing BIS values adequately reflected the drug effect of increasing desflurane concentrations ($R^2 = 0.81 \pm 0.10$, mean ± SD).



Conclusion: In the range of 0.5–1.5 MAC of desflurane BIS proved to be an useful EEG measure of anaesthetic drug effect in most cases, whereas AAI failed in all cases.

A-135

The A-Line Monitor – the first commercially available Auditory Evoked Potential (AEP) monitor designed to measure depth of anaesthesia: A comparison with bispectral index

E. Iannuzzi, M. Iannuzzi, G. Viola, B. Mora, M. Chiefari

Departments of Anaesthesiological Surgical and Emergency Sciences, Second Service of Anaesthesia, Second University of Naples, Naples, Italy

Background and Goal of Study: Middle latency auditory evoked potentials have been reported to be superior to electroencephalogram to discriminate between consciousness and unconsciousness. AEP monitor (A-Line) was developed to calculate an "A line AEP index" (AAI). The aim of the present study was to investigate the depth of anaesthesia as indicated by AAI in comparison to Bispectral Index (BIS).

Materials and Methods: After obtaining Ethical Committee approval and written informed consent we studied 20 patients undergoing major abdominal surgery. Electrodes of BIS and A-Line and headphones were positioned parallel according to manufacturers.Induction of anaesthesia consisted of remifentanil (0.3 μg/kg/min) and a propofol TCI (3.5 μg/ml). After loss of

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consciousness patients received 0.6 mg/kg rocuronium. After intubation remifentanil was infused at 0.2 μg/kg/min whereas propofol TCI was adjusted to BIS target values of 60,50,40,30. Modified Observer Alertness Sedation Score was performed every minute till loss of verbal contact (LVC). AAI, BIS and TCI parameters were reported. t-Student test was performed. Prediction probability (Pk), receiver operating characteristic (ROC) and logistic regression were used to calculate the probability of predicting the conditions of LVC and anaesthesia.

Results and Discussions: Twenty patients (9M/11F; 52,2 ± 14,1 years; 68,6 ± 9,7 kg; 66,2 ± 8,5 cm; ASA I-II).Mean values before induction are 93,5 ± 5,3 for BIS and 85,1 ± 8,3 for AAI. At a BIS of 60,50,40,30 the corresponding AAI values were significantly different and indicated that decreasing BIS values were associated with significantly lower mean AAI values ($p < 0.05$). No patient with an AAI ⩽ 50 and a BIS ⩽ 70 was awake. The effective dose for predicting LVC of 95% was 45 for AAI (Pk 0.96) and 68 for BIS (Pk 0.84) and for anaesthesia 34 for AAI (Pk 0.92) and 52 for BIS (Pk 0.94).

Conclusion(s): Increase of hypnotic component of as indicated by BIS is accompanied by a decrease in AAI. AAI values of 45-25 are equivalent to BIS values of 40-60. AAI and BIS are valuable indexes to predict anesthetic conditions whereas AAI is more sensible than BIS referring to LVC.

References:

1 Br J Anaesth 1997,78: 180–184.
2 Anaesthesia 2001, 56: 879–905.

A-136

Effect of curarisation and decurarisation on depth of anaesthesia

F. Vasella, P. Frascarolo, D.R. Spahn, L. Magnusson

Department of Anaesthesiology, University Hopsital, Lausanne, Switzerland

Background and Goal of Study: Muscle paralysis may reduce signals from muscle stretch receptors that normally contribute to arousal from general anaesthesia. We therefore evaluated the effect of atracurium and neostigmine on BIS (bispectral index) and AEP (auditory evoked potentials) recordings.

Materials and Methods: After approval by the Local Ethics Committee and written informed consent, we studied 40 patients, ASA I-II, aged 18–69 yr, scheduled for elective surgery. General anaesthesia was induced and maintained by propofol and remifentanil by target-controlled infusion pumps, intubation was performed without myorelaxation. Study was divided in two parts, in the first part effect of myorelaxation was evaluated and in the second part effect of decurarisation. After intubation, when BIS reached stable values, patients were randomly assigned to one of two groups. Group 1 received 0.4 mg/kg of atracurium and, 5 min later, the same volume of NaCl 0.9%. Group 2 received first saline and then atracurium. For the second part of the study, when first twitch of a train of four reached 10% of prerelaxant intensity, one group received 0.04 mg/kg of neostigmine and 0.01 mg/kg of glycopyrrolate, the control group received only 0.01 mg/kg of glycopyrrolate.

Results and Discussions: There was no difference between the groups at baseline values of BIS and AEP. No decrease was seen after injection of atracurium or NaCl 0.9%. Compared to baseline, BIS and AEP increased significantly after injection of neostigmine and glycopyrrolate. When only glycopyrrolate was injected BIS and AEP remained unchanged.

	Baseline	6 min	*P*
BIS control	56 ± 6	57 ± 7	0.79
BIS neostigmine	54 ± 6	60 ± 11	0.02
AEP control	23 ± 8	24 ± 7	0.78
AEP neostigmine	23 ± 7	31 ± 13	0.02

Conclusion: Neostigmine alters the state of anaesthesia and enhances recovery. On the other hand, curarisation by atracurium has no effect on the level of anaesthesia.

A-137

Desflurane concentrations in combined anaesthesia for videoassisted colectomy surgery: utilization of auditory evoked potential

A. Corcione, A. Papa, C. Fusco, C.L. Esposito

Department of Anaesthesia and Reanimation, Monaldi Hospital, Naples, Italy

Background and Goals: Advantages of combined anaesthesia in major abdominal surgery may be markedly improved by monitoring of auditory evoked potential (mAEP). Aim of this study was to administrate the best concentration of desflurane during mAEP in combined anaesthesia.

Methods: 74 patients (46 m, 28 f, ASA I-III, age 63,2 ± 9,7 yr, weigh 72,6 ± 8,8 kg, to operate for video-colectomy) in combined anaesthesia were admitted in a prospective randomized study and divided into two homogeneous groups. All patients received a CVC and an peridural catheter in $T_7 - T_9$ space and was administrate a bolus of ropivacaine 0,75% (8–10 ml) and sufentanil 30 μg. Pin–prick, ice and Bromage test were effected. Tab I shows anaesthetic technique.

Table I

	GA	GB
Premedication	Atropine 0,01 mg/Kg i.m.; Midazolam 0,07 mg/Kg i.m.	
Induction	Sufentanil 0,2 mcg/Kg; Propofol 1-1,5 mg/Kg CIS-Atracurium 0,20 mg/Kg	
Maintenance	O_2-Air; CIS-Atracurium (boli) 0,04 mg/Kg, al 25% of TOF Desflurane 4–5% F_E	Desflurane (monitoring AEP)

Monitoring for NIBP, ECG and HR, and mini-invasive for haematic aortic flux, CO, SV and PVR was made. Moreover was monitored: SpO_2, $EtCO_2$, Et-halogenate, PVC, TC and diuresis. Neuromuscular blocking monitoring was effected with TOF watch. TC was maintained by means of air flux heating cover. Only in GB level of anaesthesia was monitored with AEP (Alaris). At the end of surgery, and after stopped dexflurane, were monitored parameters of tab II and adverse effects (PONV and shivering). We used Student's t-Test for coupled data (mean ± SD).

Table II

Parameters	GA	GB
Spontaneous breathing	6 ± 1 m	3 ± 1 m*
Eye opening	10 ± 2 m	6 ± 1 m*
Extubation	8 ± 2 m	5 ± 2 m*
Execution of simplex orders	13 ± 2 m	8 ± 1 m*

* $P < 0,05$

Results: Hemodynamic instability was never observed. Tab II shows post-surgical parameters. Expiratory dexflurane ratio in GA was 4,7, vs 2,05% $p < 0,05$. Awareness and adverse effects was never reported.

Conclusion: Our results show that mAEP reduces recovery times, consents the optimization of dexflurane ratio and minimizes adverse effects. We must remember the costs reduction for the low use of halogenate.

A-138

Comparison of cardiac output measured by transpulmonary thermodilution technic with aortic doppler flow measured by transoesophageal echocardiography (TEE) during abdominal aortic surgery

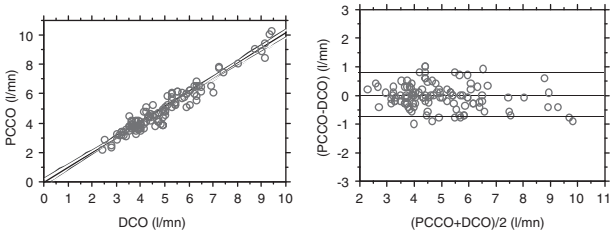
L. Lhotel, V. De Castro, T. Barbry, J.P. Goarin, P. Coriat

Department of anesthesiology, GH Pitie Salpetriere, Paris, France

Background and Goal of the Study: Control of cardiac output during the peri operative period is a major issue for patient hemodynamic stability during aortic surgery. A recent and minimally invasive method using pulse contour analysis coupled with transpulmonary thermodilution method allows continuous monitoring of cardiac output (PCCO) (Pulsion MS, München). We have compared this method to aortic blood flow (AFCO) measured with transoesophageal echocardiography – doppler during abdominal aortic surgery.

Methods: Simultaneous recording of PCCO and AFCO was made at different period of aortic surgery: after induction of anesthesia, before and after aortic cross-clamping, before and after declamping and after several fluid challenges in case of positive response of cardiac output (>15%). PCCO was recorded immediatly after recalibration and aortic flow was measured on a transgastric distal view of the heart at the same period.

Results: 114 measures were realised with 20 patients. The figure1 shows linear regression . The correlation factor is 0,93, slope is 1,02 and the intercept is −0,03. The figure2 shows the Bland & Altman analysis. The bias is −0,05 ± 0,35, precision is 0,34 ± 0,35 and the number of outliers for a deviation of 0,5 l/mn is 24.



Conclusion: This study shows a fair agreement between the 2 methods in a large range of cardiac output and in different loading conditions. The

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limitation of this study is that PICCO was always recorded after recalibration. because of acute changes of aortic compliance.

A-139

Alaris AEP and bispectral index monitoring during emergence from desflurane anaesthesia

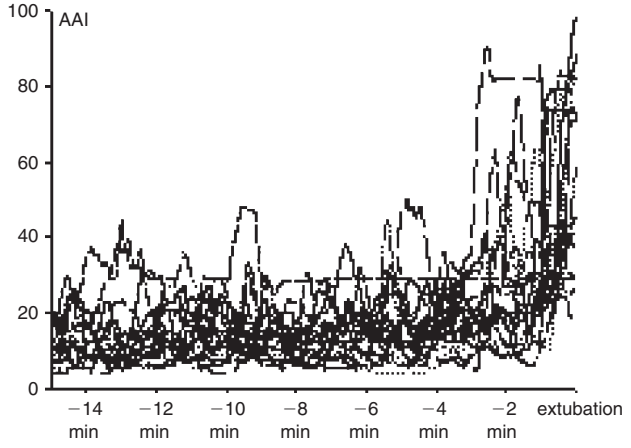
P. Bialas, S. Kreuer, J. Bruhn, C. Bauer, M. Hoepstein, W. Wilhelm

Department of Anaesthesiologie and Intensive Care Medicine, University of Saarland, 66421 Homburg/Saar, Germany

Background: The Alaris AEP monitor (Alaris, UK, version 1.4) is the first commercially available auditory evoked potential (AEP) monitor designed to measure the depth of anaesthesia. It generates an "Alaris AEP index" (AAI) which is a dimensionless number scaled from 100 (awake) to 0. This study was designed to compare AAI and BIS (Aspect, USA, version XP) values during emergence from a desflurane anaesthetic.

Methods: With IRB approval and written informed consent 20 adult male patients scheduled for radical prostatectomy were investigated. An epidural catheter was placed in the lumbar space and electrodes for BIS and Alaris AEP monitoring and a headphone for the application of auditory stimuli were applied to the patient's head. Induction of anaesthesia consisted of 2 mg kg^{-1} propofol and remifentanil which was stopped after intubation. For the further course of anaesthesia patients received 15 ml bupivacaine 0.5% epidurally, and desflurane in O_2/air was given for hypnosis according to clinical needs. BIS and AAI values as well as end-tidal desflurane concentrations were recorded in intervals of 5 sec during emergence from anaesthesia; data evaluation included the last 15 min before extubation. Prediction probability (P_K) was calculated with a spread-sheet macro; values are mean ± SD.

Results: Patients opened their eyes at AAI = 46.6 ± 20.3, BIS = 76.5 ± 14.0 and an end-tidal desflurane concentration of 0.72 ± 0.20 vol%. Mean values at extubation were 53.6 ± 25.4 for AAI, 83.6 ± 14.8 for BIS and 0.67 ± 0.29 vol% for desflurane. The prediction probability P_K for unconsciousness vs. consciousness (i.e. open eyes) was better for BIS (P_K = 0.94) than for AAI (P_K = 0.84) or the end-tidal desflurane concentration (P_K = 0.80). The individual courses of AAI values are shown in the figure.



Conclusion: Awakening from desflurane anaesthesia was detected by the BIS and the Alaris AEP monitor.

A-140

The laryngeal tube for airway management in morbidly obese

T. Gaszynski, P. Ratajczyk, J. Strzelczyk, W. Gaszynski

Departments of Anaesthesiology And Intensive Therapy, Medical University of Lodz, Lodz, Poland

Background and Goal of Study: In grossly and morbidly obese patients airway management and mechanical ventilation is difficult. Laryngoscopy and inserting endotracheal tube requires great experience from anesthesiologist. The laryngeal tube may be an alternative to endotracheal intubation especially when intubation attempts failed. We determined the efficacy of the laryngeal tube as a temporary ventilatory device in morbidly obese patients undergoing abdominal surgery.

Materials and Methods: 22 patients, aged mean 41.3 ± 14.5 (range 20–67), BMI mean 39.3 ± 5 kg m^{-2} (range 35–55) scheduled for elective surgery were anesthetized with midazolam, fentanyl and continuous infusion of propofol. For muscle relaxation cisatracurium was administered. The laryngeal tube was inserted and mechanical ventilation commenced. After 30 minutes of operation endotracheal intubation was attempted. Compliance of lungs, peak pressure and plateau during mechanical ventilation were determined. The number of failed insertion/attempts in laryngeal tube were recorded. For laryngeal tube a leak (Vi – Ve) as % of tidal volume was estimated.

Results and Discussions: In 3/22 cases (13.6%) the laryngeal tube insertion failed. Parameters during mechanical ventilation with laryngeal tube were higher than during ventilation with endotracheal tube and were within acceptable limits: compliance of the lungs 33.87 ± 7.9 (19.8–55.5) vs. 46.1 ± 8.5 (28–66), peak pressure 24.1 ± 6.1 cmH_2O (14–35) vs. 21.3 ± 3 (16–28), plateau pressure 19.45 ± 4.4 cmH_2O (12–29) vs. 19.1 ± 3.3 (12–27), respectively. Leak for laryngeal tube was mean 63.5 ± 30.4 ml (10–140 ml) which was about 10% of tidal volume.

Conclusion: Laryngeal tube is a good alternative for temporary mechanical ventilation in grossly and morbidly obese.

A-141

Does high resting cuff diameter of endotracheal tube result in lower incidence of sore throat and/or hoarseness after short-term operations?

F. Zand, A. Khosravi

Department of Anesthesia, Shiraz University of Medical Sciences, Shiraz, Iran

Background and Goals: Sore throat and hoarseness are common side effects of tracheal intubation (1). The role of high cuff inflation pressure (>30 cmH_2O) in the pathogenesis of tracheal mucosal injury is now well established (2). The goal of this study is to determine if lower cuff pressures observed with new tracheal tubes with high resting cuff diameter is associated with lower incidence of postoperative sore throat and/or hoarseness after short term operations.

Material and Methods: This prospective, randomized, single blind study includes 60 pregnant, full-term parturient scheduled for elective cesarean-section requesting general anesthesia. Thiopental sodium 4–5 mg/kg & succinylcholine 1.5 mg/kg were the induction drugs. The patients' tracheae were intubated randomly with either a traditional cuff tube; group I (SUPA, IRI, 16 mm resting cuff diameter) or a tube with high resting cuff diameter ; group II (Portex, profile soft-seal UK, 30 mm cuff diameter) Peak airway pressure and the minimum occlusive cuff pressure were recorded after initiation of ventilation with 10 cc/kg tidal volume. Similar anesthetic drugs and techniques were used thereafter. No operation lasted more than one hour. We asked the patients 24h after operation about sore throat and/or hoarseness. The results were compared with chi-square test.

Results: Minimum occlusive cuff pressure was 51.8 ± 4.7 cmH_2O (Mean ± SEM) in group I and 10.3 ± 1.2 cmH_2O in group II ($p < 0.001$) the incidence of sore throat and/or hoarseness 24h after intubation, although more frequent in group I (48.4% vs. 26.7%) was not different significantly ($P > 0.08$).

Conclusions: We concluded that although high resting cuff diameter resulted in significantly lower necessary cuff pressures (10.3 vs. 51.8 cmH_2O) it does not results in significantly lower incidence of sore throat and/or hoarseness in parturient 24h after short term cesarean-section.

References:

1 Christensen AM, Willemoes-Larsen H, Lundby L, et al. Postoperative throat complaints after tracheal intubation. Br J anaesth 1994; 73: 786–7.

2 Mandoe H, Nikolajsen L, Lintrup U, et al. Sore throat after endotracheal intubation. Anesth Analg 1992; 74 :897–900.

A-142

A comparison of the ease of insertion and application of the LMA-Classic™ with the PAxpress™ oropharyngeal airway, in patients anaesthetized in the prone position

E. Nani, E. Sakorafa, F. Boga, V. Koutroyanni, M. Samara

Department of Anaesthetic, General Hospital of Larissa, Greece

Background and Goal of Study: In this study we compare the ease of insertion and use of the LMA-Classic™ (LMA), with the PAx press™ oropharyngeal airway (PAx), in 40 patients who were induced into general anaesthesia in the prone position for elective pilonidal sinus excision.

Materials and Methods: 40 patients (ASA physical status I-II, age 25 ± 8 years, weight 70–110 kg) were randomly divided into two equal groups. Patients placed themselves comfortably in the prone position, standard monitors and preoxygenation were applied, and anaesthesia induced with propofol 2–2,5 mg/kg and fentanyl 0.005 mg/kg. A LMA or PAx was

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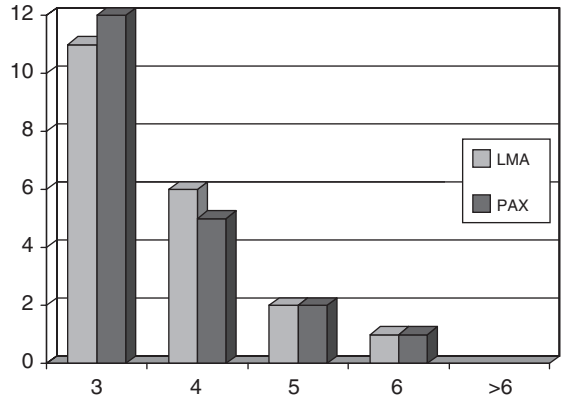
then inserted with the patient's head turned slightly to one side. Ease of insertion was graded clinically on a scale of 3 (best possible) to 12 (worst possible). Ventilation was assisted and anaesthesia was maintained with 2–2.5% sevoflurane and 60% nitrous oxide in oxygen. The airways were removed with the patients awake and in the prone position.

Results and Discussions: The ease of insertion of the airways is recorded in the graph. The patients recorded as 6, required a second attempt at insertion. The time to insertion was comparable with both devices. Ventilation and oxygenation were excellent with both airways.



Conclusion(s): Both LMA and PAx provided easy insertion in the prone position, and adequate ventilation and oxygenation. Anaesthetic induction and recovery with the patient prone has the advantages of avoiding injury to the patient by (1) patient selecting most comfortable prone position, (2) no lifting and turning of anaesthetized patients required and (3) all secretions drain away from the airways.

Reference:

1 Ng A, Raitt DG, Smith G. Anesth Analg 2002 May; 94(5): 1194–8.

A-143

A clinical comparison of the LaryngealTube™ and the LaryngealMask™

L. Kindlund, B. Nilvér, J. Albert

Department of Anesthesia and Intensive Care, Danderyd Hospital, SE 18288 Danderyd, Stockholm, Sweden

Background and Goal of Study: The laryngeal mask (LMA) can be used in general anaesthesia without neuromuscular block. The laryngeal tube (LT) is a new airway device, with similar airwayfeatures as LMA (1), and a distal cuff to prevent regurgitation (2,3). In this study we compared the LMA and LT concerning patient and user aspects.

Materials and Methods: Sixty patients ASA 1–2, scheduled for minor surgery, were randomised to be ventilated either through LMA or LT. After intubation, the nurses noted the number of intubation attempts, and evaluated "positioning" and "airway-assessment" on a scale of 1–4 (1 = easy – 4 = very difficult). The Visual Analogue Scale (VAS), was used by the patient to evaluate "sore throat" 30 and 60 minutes and the day after extubation.

Results and Discussions: Gender and mean age were equal in both groups. Successful intubation at first attempt was found in 25/28 with LMA and in 23/27 with LT. The nurses estimated LMA to be easier in "positioning", (table 1). No difference in "sore throat" was seen between LMA/LT.

Table 1 "positioning"

Device	1	2	3	4
LMA	22/28 (78.6%)	4/28 (14.3%)	2/28 (7.1%)	0/28
LT	14/27 (51.9%)	12/27 (44.4%)	1/27 (3.7%)	0/27

Conclusion(s): Intubation at first attempt was successful in most cases with LMA/LT, but LMA was easier to position (table 1). This could be due to the learning curve with LT, we started using the device three months prior the study. Both devices were well tolerated by the patients, with low VAS-scores for "sore throat". We conclude that concerning user and patient aspects, there is no difference between the LMA and the LT.

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3 Dörges V, Ocker H, Wenzel V, et al. Anasth Analg 2000; 90: 220–2.

A-144

New single use PVC laryngeal mask – an acceptable alternative of Classic-LMA®

A. Van Zundert, K. Fonck, B. Al-Shaikh, E. Mortier

Department of Anesthesiology, Catharina Hospital, Eindhoven The Netherlands, University Hospital Ghent, Ghent, Belgium

Background and Goals: There is growing concern over (1) the ability to clean used laryngeal masks (LM) effectively, (2) cost of disposable (DLM) and reusable LMs. In a randomized study, the authors compared reusable (LMA) and DLM, their clinical performance, morbidity, and the position of the LM in situ by fiberoptic evaluation in routine surgical procedures.

Material and Methods: We studied 200 adult patients, assigned to a size four LM in two equal-sized groups for airway management: (1) the re-usable LMA-Classic® (Intavent, UK), or (2) a new disposable Soft Seal Laryngeal Mask (Portex Ltd, UK). Anesthesia was administered with fentanyl, propofol, N_2O, O_2 and sevoflurane. The anatomic position of the LM was assessed by fiberoptic evaluation. On removal of the LM, any blood at all was considered positive. Patients were requested to grade any sore throat at 2 and 24 hrs post-operatively. Cost: DLM (12€) vs LMA (140€).

Results: DLM and Classic-LMA® show a similar clinical performance, as shown by their insertion time, ease of insertion, fiberoptic evaluation of the anatomical position of the LM and satisfactory anesthesia conditions. The incidence of sore throat was significantly increased at 2 hrs post-operatively when using the LMA-Classic®, although there was no difference at 24 hrs following the operation.

Results Study	Classic-LMA	DLM	P
Duration anesthesia (min)	59.6 ± 27.9	61.5 ± 32.5	NS
Insertion time within 20′	97%	98%	NS
Ease of Insertion (max 2 attempts)	97%	95%	NS
Blood on LMA on removal	4	0	NS
Laryngoscopic view (*)			NS
• no vocal cords visual	18	10	
• vocal cords/epiglottis	31	47	
• only vocal cords visual	51	43	
Sore throat incidence at	2 hrs (P = 0.04) LMA-DLM	24 hrs LMA-DLM	NS
• none	79.5–89.8	80.3–86.3	
• mild	11.4–10.2	9.2–14.7	
• moderate	5.7–0	6.6–0	
• severe	3.4–0	3.9–0	

Conclusions: The new low cost disposable device is an acceptable alternative to the reusable LMA, resulting in good laryngeal seal and offering similar clinical performance. Disposable Portex LM cause less trauma to patients, as assessed by the incidence of blood on the LM on removal and sore throat in the postoperative period.

A-145

Cuff pressures should be measured with reusable laryngeal mask airways, but is of less importance with disposable ones

A. Van Zundert, K. Fonck, B. Al-Shaikh, E. Mortier

Department of Anesthesiology, Catharina Hospital, Eindhoven, The Netherlands; University Hospital, Ghent, Belgium

Background and Goals: There is growing concern over intracuff pressure and laryngopharyngeal morbidity of laryngeal mask airways (LM). In a randomized study, the authors compared a disposable (DLM) and a reusable (LMA) and measured cuff pressures during N_2O anesthesia.

Material and Methods: We studied 200 adult patients, assigned to a size four LM in two equal-sized groups for airway management: (1) the re-usable LMA-Classic® (Intavent, UK), or (2) a new disposable Soft Seal Laryngeal Mask (Portex Ltd, UK). Anesthesia was administered with fentanyl, propofol, N_2O, O_2 and sevoflurane. Cuff pressures were adjusted to 45 mmHg immediately after insertion. During N_2O anesthesia, LM cuff pressures increased from 45 mmHg to 100.3 mmHg in the LMA-Classic® and from 45 to 46.8 mmHg in the new Soft Seal Disposable LM ($P < 0.001$).

Results:

Cuff Pressures (mmHg)	Classic-LMA	DLM	P
Mean cuff pressure			
• at insertion	68,9 ± 14,5	67,1 ± 12,2	NS
• at end of operation	100.3 ± 23.6	46.8 ± 3.6	P < 0.001
Mean increase	55.3 ± 23.6	1.8 ± 3.6	P < 0.001
Min-max cuff pressures	45–156	45–60	P < 0.001

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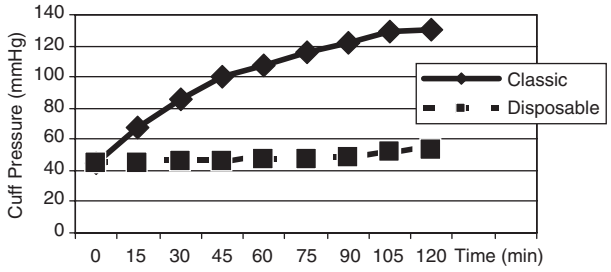

Conclusions: Mean increases in cuff pressure due to N_2O absorption during anesthesia are substantially higher in the re-usable "Classic" LMA® but neglectable when a disposable LM is used. Cuff pressures should be monitored during anesthesia when Classic/LMA are used is, but is of less importance when using the disposable Portex laryngeal mask.

A-146

Elisha Airway Device – fiberoptic assessment of the anatomical position

L. Gaitini*, S. Vaida*, D. Gaitini*, M. Somri*, B. Yanovski*, C. Hagberg**

*Department of Anesthesiology, *Bnai-Zion Medical Center, Haifa, Israel; **University of Texas, Houston, USA*

Background and Goal of Study: The Elisha Airway Device (EAD) is a new supraglottic device.[1] Its technical development was based on spiral-computed tomography of the oro-pharyngeal cavity and post-processing with multi-planar reconstruction, resulting in a device with accurate anatomical adaptation. Its uniqueness consists of its ability to combine three functions in a single device: ventilation, blind intubation without interruption of ventilation, and gastric tube insertion. The device has three separate channels for these purposes and two high volume, low pressure balloons for sealing. The ventilation outlet is situated between the balloons at the distal end of the device. The purpose of this study was to assess fiberoptically the anatomical position of the EAD.

Materials and Methods: We studied 50 patients undergoing elective general anesthesia with mechanical ventilation. After induction of anesthesia the EAD was inserted blindly. Fiberoptic position was determined using an established scoring system[2] (4 = only vocal cords visible; 3 = vocal cords plus posterior epiglottis; 2 = vocal cords plus anterior epiglottis; 1 = vocal cords not seen.)

Results and Discussions: Blind insertion of the device was successful in 96% of patients.

Fiberoptic score	Number of patients	Percentage
4	24	50
3	12	25
2	8	16.6
1	4	8.3
Total	48	100

Conclusion: Our results show a good alignment of the ventilation hole of the EAD with the laryngeal inlet. These may be of importance when considering EAD for spontaneous or mechanical ventilation.

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A-147

Evaluation of the modified Airway Management Device (AMD)

V.B. Bahlmann, R. Sivasankar, M.R. Stacey, R.C. Hughes, J.E. Hall

Department of Anaesthetics, University Hospital of Wales and University of Wales College of Medicine, Cardiff, UK

Background and Goal of Study: The AMD was re-introduced [1] for clinical use after modifications to its original design following reports [2,3] concerning its safety and efficacy. With Ethics Committee approval, we evaluated the modified AMD in anaesthetized, spontaneously breathing patients.

Materials and Methods: 60 ASA 1 and 2 day surgery patients were anaesthetized in a standardized fashion and size 3 AMDs were used in female patients and sizes 4 and 5 were used in male patients as per manufacturers recommendations. The ease of insertion and removal, ability of the AMD to maintain a clear airway, the frequency of untoward events, volume of air required to maintain a gas tight seal and pharyngeal cuff pressures were recorded.

Results and Discussions: Insertion and removal of the AMD were very easy. Loss of airway occurred in 33% of the male patients and 6% of the female patients. One patient developed laryngospasm. The volume of air mean (SD) required maintaining a gas tight seal was 34 (21) ml and the pharyngeal cuff pressure mean (SD) was 43 (26) cm water.

Table: Loss of airway (no.) in male and female patients

Size of AMD	Female	Male	Loss of airway
3	29		2
4		22	5
5		8	5

Conclusion(s): In spite of following the manufacturers recommendations, loss of airway was commoner in male patients with use of sizes 4 and 5 than in female patients where size 3 was used. Sizes 4 and 5 AMD may need redesigning to improve airway management.

References:

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2 Cook TM, Gupta K, Gabbott DA, et al. *Anaesthesia* 2001; 56: 660–664.
3 McGill F, Shoba R, Stacey M et al. *Eur J Anaesthesiol* (in press).

A-148

Light-guided tracheal intubation through a new type of pharyngeal airway (PAxpress™)

V. Dimitriou, C. Iatrou, E. Miniati, A. Chantzizisis, G.S. Voyagis

Department of Anaesthesia, Gennimatas & Sotiria Hospitals, Athens and Democritus University of Thrace, Alexandroupolis, Greece

Background and Goal of Study: The standard pharyngeal airway Paxpress™ (sPAx) is a cuffed pharyngeal airway designed to act as a ventilatory device and an aid for tracheal intubation (TI). Recently a new PAxpress (nPAx) with a stiffer material and more angulated (115° vs 120°) became available for the same purpose. We evaluated the efficacy of both types of PAxpress as an aid for light-guided TI using a prototype flexible lightwand.

Material and Methods: After IRB approval light-guided TI via PAx was attempted in 60 (M/F 34/26) consenting ASA 1–2 adults anaesthetized paralyzed patients, randomly allocated in two groups, the sPAx group (n = 30, M/F 18/12) and the nPAx group (n = 30, M/F 16/14). Patients with anticipated difficult airway or at risk of regurgitation were excluded. Both types of PAx were inserted with the patient's head in neutral position. Once an effective airway was obtained, a well-lubricated, 7.0–7.5 mm ID straight silicone tracheal tube (TT), preloaded with a flexible lightwand, was inserted into the PAx and advanced into the trachea whilst observing the glow in the neck. Whenever resistance was felt, a sequence of predetermined adjusting manoeuvres was instituted depending on the location of the light glow at the neck. Final position of the TT was confirmed by capnography. Maximum number of three attempts at TI was permitted. The number of adjusting manoeuvres, total duration of the procedure and final outcome were recorded.

Results: There were no demographic differences between groups. The success rate for light-guided TI through sPAx was 25/30 (83.3%, 95% confidence limits 65.3–94.4%) and through nPAx 30/30 (100%, 95% confidence limits 88.4–100%). The p-value between groups was 0.05 (Fisher's exact test). The table shows the mean values (±SD).

		Number of manouevres		
	Duration (s)	0	1	2–3
sPAx	38 ± 12	15	4	6
nPAx	33 ± 6	18	7	5
P-value	0.05 *		0.7 (NSS)§	

§χ^2 test, *t-test

Conclusion: Light-guided TI seems to be achieved easier via nPAx.

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A total propofol consumption in morbidly obese during general anaesthesia according to BIS monitoring

T. Gaszynski, J. Strzelczyk, W. Gaszynski

Department of Anaesthesiology and Intensive Therapy, Medical University of Lodz, Lodz, Poland

Background and Goal of Study: Overdosing of anesthetics during general anesthesia in morbidly obese is very common. According to BIS monitoring it is possible to find the exact dosage of drugs. A result of this is a decrease

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of total consumption of anesthetics. We compared two methods of estimating depth of general anesthesia in morbidly obese: based on clinical symptoms, and according to BIS monitoring.

Materials and Methods: 52 morbidly obese patients were randomly allocated in prospective clinical trial into two groups: (1) control group – anesthesia based on clinical symptoms of depth of anesthesia: 27 patients, (2) studied group – anesthesia according to BIS monitoring: 25 patients. In both groups anesthesia was provided the same manner: FNT, midazolam, cisatracurium and continuous infusion of propofol. The dosage of propofol was based on corrected weigh, initially rate 10 mg kg^{-1} h^{-1} and following reduced according to chosen way of estimating depth of anesthesia. The total consumption of propofol was estimated for both groups.

Results: Demographic profiles and duration of procedure did not differ between group (1) and (2): BMI mean 43.38 ± 4.76 kg m^{-2} and 43.45 ± 5.35 kg m^{-2} ; corrected weight mean 91.5 ± 12.8 kg and 94.2 ± 9.8 kg; duration of propofol infusion mean 127.5 ± 21.6 min and 131.0 ± 27.5 min, respectively. Total consumption of propofol was higher in group (1) than in group (2): mean 2012 ± 310 mg and 1210 ± 370 mg respectively, so was mean propofol infusion rate: 10 mg kg^{-1} h^{-1} in group (1) and 5.84 mg kg^{-1} h^{-1} in group (2). Cardiovascular parameters during surgery and consumption of other anaesthesia drugs did not differ between groups.

Conclusion: BIS monitoring during general anaesthesia allows for decreasing the total consumption of propofol in continuous infusion for anaesthesia in morbidly obese.

A-150

Nociceptive Stimulation does not impair the relationship between processed electroencephalographic parameters and probability of awareness

H. Roepcke, K. Freiberg, J. Bruhn, A. Hoeft

Department of Anaesthesiology and Intensive Care Medicine, University of Bonn, Bonn, Germany

Background and Goal of Study: Processed electro-encephalographic (EEG) parameters serve for monitoring absence of intraoperative awareness. The relationship between awareness and EEG parameters was obtained in volunteers given anesthetics without surgical stimulation[1]. Due to ethical considerations it has not been proven if the relationship between EEG parameters and probability of awareness remains unchanged in the presence of surgery. The observation of paradoxical arousal demonstrates that nociceptive stimulation may influence the EEG and consequently may impair EEG monitoring of adequate hypnosis.

Materials and Methods: After approval of the local ethics committee 12 Patients undergoing major surgery were anaesthetised with sevoflurane as the sole anaesthetic. Dose-response-curves for bispectral index (BIS), SEF 95 and median power frequency were obtained preoperative (during mask induction), intra- and postoperative using simultaneous pharmacokinetic and -dynamic modeling[2]. The patients were observed pre- and postoperative for response to verbal command.

Results and Discussions: Surgical stimulation and post-operative pain shifted the dose-response-curves towards higher anaesthetic concentrations. The relationship between EEG parameters and probability of awareness pre- and postoperative did not differ significantly (fig.).

Conclusion: Nociceptive stimulation as observed after surgery does not impair the relationship between EEG parameters and probability of awareness. Surgical stimulation may be slightly more intense expressed in terms of shifting anaesthetic dose-response-curves. However, there might be less space for impairing EEG monitoring of adequate hypnosis during surgery.

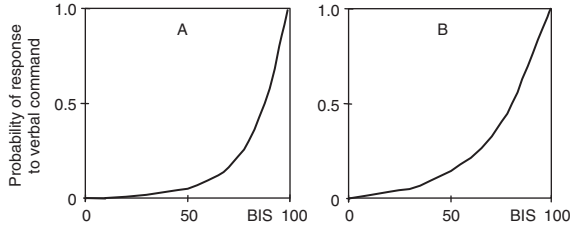

Fig.: BIS and awareness prior to surgery (A) and after surgery before administration of opioids (B)

References:

1. Glass, Anesthesiology 1997; 86: 836–47.
2. Röpcke, Anesthesiology 2001; 94: 390–9.

A-151

Effect of a ketamine bolus on the bispectral index and the auditory evoked potentials during general anaesthesia

C. Coste, B. Guignard, M. Chauvin

Département dAnesthésie-Réanimation, Hôpital Ambroise Paré, Boulogne, France

Background and Goal of Study: BIS has been shown not to reflect the level of hypnosis when high doses of ketamine are used (1). In this study, we analysed the effects of a low ketamine bolus on the BIS and auditory evoked potentials (AEP) during general anaesthesia.

Material and Methods: After institutional approval and patient informed consent, 20 adult patients (ASA 1–2) scheduled for elective general surgery were randomly assigned to one of two groups (n = 10). Group P (placebo) received an IV bolus of saline while group K received an IV bolus of ketamine (0.5 mg.kg^{-1}) administrated as anaesthesia was maintained with desflurane in a 50/50 air/oxygen mixture. Anaesthesia was induced in the 2 groups with propofol, sufentanil, atracurium, and maintained with desflurane 1 MAC. Mean Arterial Pressure, Heart Rate, BIS and AEP were continuously monitored during the study. K or saline injections were administered after the surgical incision during the dissection period while MAP, HR, BIS and AEP were stable. Those parameters were analysed before the bolus,1, 2, and 5 min after the bolus, then every 5 min after the bolus until the end of the stable period. Repeated values of ANOVA and Fisher's Exact test were used to analyse these data. $P < 0.05$ is considered significant.

Results and Discussion: Ketamine injection is followed by an important increase of BIS values whereas it has a minor effect on the AEP.

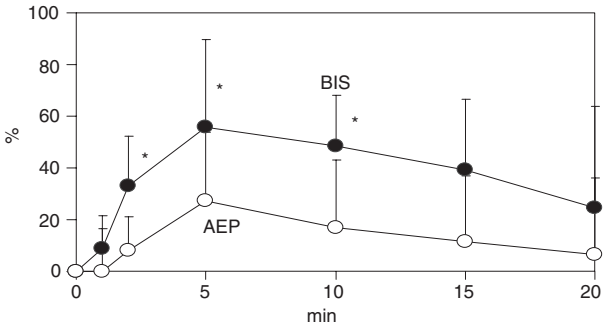

Fig 1: Time course of both indexes after K bolus.

Conclusions: These results suggest either a lesser sensibility of the AEP, or a lesser action of ketamine on the thalamocortical pathway.

Reference:

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A-152

Lack of effect of remifentanil bolus on the bispectral index (BIS) of the EEG in patients under stable propofol anesthesia

P. Amorim*, I.A. Santos*, L. Ferreira*, M. Casal*, C. Nunes#, L. Antunes$

**Serviço de Anestesiologia do Hospital Geral de Santo António, Porto, Portugal; $Patologia e Clínica Veterinária da UTAD; #Matemática Aplicada da FCUP*

Background and Goal of Study: There is some debate about the effect of remifentanil on the bispectral index (BIS) of the EEG, some studies showing that it may reduce BIS values[1,2]. We have recently showed excitatory effects of a bolus of fentanyl upon rat EEG and AE responses during anesthesia[3]. The present study was conducted to evaluate the effect of a large bolus of remifentanil on the BIS, during stable propofol anesthesia.

Materials and Methods: Adult ASA 1 and 2 patients subjected to general anesthesia for neurosurgical procedures were given one bolus of remifentanil from (1 to 2 μg/kg) before head-pins placement. All patients were under steady state propofol and remifentanil anesthesia, paralyzed with rocuronium and ventilated with air + O_2. Before the bolus all patients were free from stimulation. BIS was allowed to stabilize at around 40. Propofol target concentrations were unchanged for 10 min. BIS was measured with Aspect A-2000XP. Rugloop I® was used to drive the remifentanil pump; Rugloop II® was used to collect BIS data, HR and MAP. Remifentanil calculations used the Minto Schneider model. Parameters measured prior to and following the remifentanil bolus (at 30, 60, 90 and 120 seconds) were compared using repeated measures ANOVA. Data are mean ± SD.

Results and Discussions: There were nine patients studied: age 53.6 ± 12, weight 67.0 ± 15, 4 male. The remifentanil bolus lasted for 16.1 ± 5 seconds

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and amounted to 1.69 ± 0.43 μg/kg. Remifentanil theoretical plasma concentration increased from 1.13 ± 0.49 to 22.2 ± 4.6 ηg/ml; cerebral concentrations increased from 1.14 ± 0.4 to 8.0 ± 1.8 ηg/ml. There were no statistically significant changes in BIS, MAP and HR (see table).

	Before Bolus	30 sec	60 sec	90 sec	120 sec
BIS	37.6 ± 9	38 ± 8	41 ± 13	41 ± 14	38 ± 12
MAP	85 ± 15	84 ± 14	85 ± 17	83 ± 15	84 ± 13
HR	68 ± 15	67 ± 14	67 ± 15	66 ± 13	69 ± 15

Conclusion: Our study allowed us to examine the effect of high concentrations of remifentanil on the BIS, without the confounding effect of surgical stimulation. Our results suggest a lack of effect of remifentanil on BIS values.

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A-153

Bispectral index monitorization during total intravenous anesthesia with remifentanil and propofol

D.T. Akcali, Z. Ozkose, S. Yardim

Department of Anesthesiology and Reanimation, Gazi University Faculty of Medicine, Ankara, Turkey

Background and Goal of Study: Bispectral index (BIS) monitor derived from EEG measures sedation, hypnosis and loss of consciousness (1). It wasn't used in this department before, so the aim of this study was to investigate the effects of BIS monitorization on hemodynamic parameters, drug consumption, recovery, emergence and awareness during TIVA with remifentanil and propofol.

Materials and Methods: After institutional approval, ASA I–II 56 patients assigned for lumbar discectomy were divided in two as control and BIS groups. All patients were monitorized by non-invasive blood pressure, ECG, pulse oximetry, end-tidal CO_2 and BIS. Anesthesia was induced by bolus 1 μg kg^{-1} remifentanil in both groups; 2 mg kg^{-1} propofol in control group and propofol was titrated to BIS 45–65 values in BIS group. Anesthesia was maintained by remifentanil and propofol infusions adjusted according to clinical and hemodynamic parameters in control group and additionally according to BIS (for values between 45–65) in BIS group. BIS was recorded for all patients, but viewed only in BIS group. Drug consumption, time to extubation, emergence, recovery and awareness were recorded. Statistics were done by SPSS for Windows v 9.0.

Results and Discussions: Demographic parameters and operation time were similar between groups. Propofol induction and maintenance consumption decreased and time to extubation was shorter in BIS group, but BIS values were not correlated with noxious stimuli and hemodynamic responses. There was no significant difference between emergence, recovery and awareness among groups.

Conclusion(s): BIS monitorization was not advantageous except decreased propofol consumption. When cost is taken into account, it was concluded that, standard anesthesia titration due to hemodynamic parameters was enough for most patients.

Reference:

1 Rosow C, Manberg PJ. Bispectral index monitoring. Anesthesiology Clin North America 19: 947–966, 2001.

A-154

Effect of ketamine on the bispectral index under sevoflurane anaesthesia

D. Ciarafoni, V. Bonhomme, P.Y. Dewandre, J.F. Brichant, P. Hans

University Department of Anaesthesia & ICM, CHR de la Citadelle, Liege University Hospital, 4000 Liege, Belgium

Background and Goal of Study: Ketamine may be used as an analgesic adjuvant during surgery. It increases the bispectral index (BIS) of the EEG during propofol-based anaesthesia (1). This study investigated the effect of two doses of ketamine on BIS under sevoflurane anaesthesia.

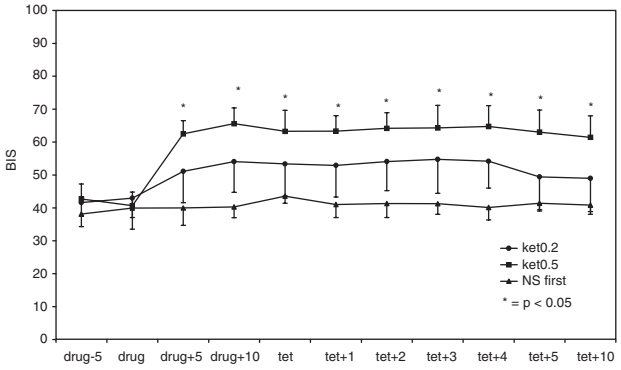
Materials and Methods: After approval of the Ethics Committee and informed consent, 16 patients undergoing lumbar surgery were enrolled in the study. Anaesthesia was induced with propofol, sufentanil and rocuronium, and maintained with sevoflurane in oxygen/air adjusted to keep the BIS around 50. All patients received 3 mg morphine and 1 μg/kg clonidine epidurally before surgery. Ninety min after skin incision, they received blindly and in a random order IV saline or ketamine at 30 min interval, and were divided into 2 groups according to the dose of ketamine: 0.2 (G1) or 0.5 (G2) mg/kg. After 15 minutes, each injection was followed by a 100 Hz tetanus stimulation applied for 5 sec. BIS values were continuously recorded throughout the study and analysed using ANOVA. A p value less than 0.05 was considered statistically significant.

Results: Ketamine provoked an increase in BIS persisting for at least 20 min. This increase was higher in G2 than in G1.Tetanos stimulation after saline or ketamine did not increase the BIS.

Conclusion: Ketamine provokes a significant and dose-dependent increase in BIS under sevoflurane anaesthesia. Its administration may confound the BIS as an index of the hypnotic component of anaesthesia.

Reference:

1. Kurehara et al. Masui 1999; 48: 611–6.



A-155

Is the A-line AEP-Monitor able to clearly differentiate between awake and asleep states in paralysed patients?

M. Messner, U. Beese, S. Albrecht

Department of Anesthesiology, Friedrich-Alexander Universität, Erlangen-Nuernberg, Erlangen, Germany

Background and Goal of Study: A recently introduced monitor (A-line™ AEP-Monitor, Alaris Medical Systems, Hampshire, UK) facilitates rapid extraction of mid-latency auditory evoked potentials providing an Index (AAI, A-line ARX-Index) promoted for monitoring depth of anesthesia. It has been suggested that this monitor produced only little overlap of values between asleep and awake states during Propofol sedation[1]. We investigated the ability of this monitor to distinguish between asleep and awake states in the presence of muscle relaxants.

Materials and Methods: After approval by the local ethic board, 12 patients undergoing carotid artery surgery gave informed consent. Electrodes for the recording of the AAI were placed according to the manufacturers instruction. Anesthesia was induced with Propofol by a target controlled infusion system. The dosage was stepwise increased until loss of consciousness defined as loss to response to a twice repeated verbal command to squeeze the hand, was noted. An infusion of Remifentanil 0,5 μg/kg/min was then started and a padded tourniquet was inflated on the opposite arm to isolate the forearm from the effect of the subsequent given 0,8 mg/kg Rocuroniumbromid. After endotracheal intubation the infusion of Disoprivan and Remifentanil were stopped. Every 10 seconds the patients were asked to squeeze the hand on command. When doing so, the patient were asked to squeeze the hand twice. This purposeful reaction was considered as the return of consciousness. The Propofol infusion was started again until loss to verbal command was noted for the second time. AAI values were noted at each stage of consciousness. Differences of the recorded values were analysed using univariate analysis with Student-Newmann-Keuls method. $p < 0,05$ was considered as statistically significant.

Results and Discussions: Although statistically significant differences of AAI values in between the conscious and unconscious stages during this study were found, the wide scattering of data and the resulting overlap did not allow to define a transition value or zone separating these stages.

	Loss of consciousness 1	Return of consciousness	Loss of consciousness 2
AAI	39 (26–56)	51 (35–72)	40 (21–63)

Conclusion(s): The ability of the A-line monitor to clearly differentiate between awake and asleep states could not be confirmed for paralysed patients. Since monitoring depth of anesthesia is of particular interest in these patients, the clinical value of this device remains to be defined.

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A-156

Effects of different doses of remifentanil on bispectral index changes associated with tracheal intubation

M.E. Antoniucci, E. Congedo, E. Gualtieri, P. Primieri, G. De Cosmo

Department of Anesthesiology and Intensive Care, Catholic university, Rome, Italy

Background and Goal of Study: Aim of this study was to evaluate whether Bispectral index (BIS) may provide information about the lightening of anesthesia depth associated to a painful stimulus like orotracheal intubation (IOT), as well as cardiovascular responses.
Materials and Methods: With Ethical Committee approval and written informed consent, after midazolam premedication (0.1 mg kg^{-1}), 30 patients (mean age 51 yr), without neurological diseases, scheduled for elective surgery, were randomly allocated to three groups according to remifentanil concentration ($\mu g\ Kg^{-1}min^{-1}$) received: R1 (0.15), R2 (0.20), R3 (0.25). Anesthesia was induced with propofol by diprifusor® TCI at a target effect-site concentration of 6 $\mu g\ ml^{-1}$, then reduced at 3.5 $\mu g\ ml^{-1}$. IOT was facilitated with cisatracurium (0.15 mg kg^{-1}). Systolic (SAP), diastolic (DAP) and mean arterial blood pressure (MAP), heart rate (HR) and BIS were recorded before and a minute after induction, before and immediately after IOT and every minute for the first 5 minutes after IOT. Analysis of variance was used as statistical test.
Results and Discussions: BIS value dropped after induction in all patients below 40. After laringoscopy and IOT we found a light increase of BIS value in R1 and R2 groups (in R1 group it was statistically significant, $p < 0.05$) while it remained unchanged in R3 group. SAP ($p < 0.05$), DAP ($p < 0.001$), MAP ($p < 0.01$) and HR ($p < 0.05$) showed a same trend.
Conclusion: BIS change is as sensitive as haemodynamic responses to a painful stimulus. So, even if BIS has been marked as a measure of hypnotic component, on the basis of equal hypnosis level, it may offer information to identify deficit of the analgesic component of anesthesia when cardiovascular parameters can be not adequate indicators, because of therapy or disease (1).
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3 Nakayama M, Ichinose H, Yamamoto S, et al. Can J Anaesth 2002 May; 49(5): 458–6.

A-157

BIS monitoring is associated with decreased isoflurane consumption and less profound hypnosis than in our standard clinical practice

D. Tulbure, D. Enescu, G. Droc, L. Dumitru, D. Tomescu

Department of Anesthesiology and Intensive Care, Fundeni University Hospital, Bucharest, Romania

Background and Goal of Study: Bispectral index (BIS) monitoring assesses the hypnotic component of anesthesia, facilitates volatile anesthetic titration (1) and can reduce isoflurane consumption (2). The study wants to evaluate the differences between a standard clinical practice anesthesia and BIS monitored anesthesia regarding: depth of hypnosis, isoflurane and fentanyl consumption and hemodynamic changes.
Materials and Methods: After hospital scientific and ethic board approval, 70 patients ASA I–III, aged 19–82 years scheduled for elective abdominal surgery, were randomly distributed into 2 groups of 35 patients each. General anesthesia with standard induction was maintained with isoflurane, fentanyl and atracurium. In group A (control) volatile anesthetic was administered according to standard clinical practice, anesthetists being blinded to the BIS value. In group B (study) isoflurane was titrated to maintain the target BIS value between 50–60. Heart rate (HR), non-invasive mean arterial pressure (MAP), BIS value and end-tidal isoflurane (Et ISO) were recorded every 5 min, during maintenance, along with other routine intra-anesthetic monitoring. Results were compared using two-sample student t-test, $p < 0.05$ was considered statistically significant.
Results and Discussions: mean values and SD.

Gr	BIS*	Et ISO *	F	MAP mmHg	HR B/min.
A	44 ± 5	0.86 ± 0.12	4.2 ± 0.3	80 ± 11.6	73 ± 15.1
B	53 ± 4	0.56 ± 0.15	4.1 ± 0.4	82 ± 12.2	71 ± 14.4

* $p < 0.05$; F = Fentanyl ($\mu g/Kg/h$)

No recall events were found in both groups. Isofluran consumption was reduced with 35% in the BIS group.
Conclusion(s): Isoflurane titration using BIS monitoring decreases maintenance dosage requirements. In our standard clinical practice the achieved hypnosis was more profound than the patients needs estimated by BIS monitoring. There is no difference in analgesic consumption and hemodynamic parameters.
References:

1 Song D, Joshi GP, White PF, Anesthesiology 1997;87; 842–848.
2 Guinard B, Coste C, Menigaux C et al, Acta Anaesthesiol Scand 2001; 45: 308–314.

A-158

Changes of bispectral index after laryngoscopy and orotracheal intubation in four different TIVA schemes

B. Schaedle, M. Rall, T. Kieber, R. Zimmermann, K. Unertl

Departments of Anaesthesiology and Intensive Care Medicine, University Hospital of Tübingen, Tübingen, Germany

Background and Goal of Study: In TIVA the actual state of hypnosis is not always known. The strongest stimulus in the early (pre)operative phase is the laryngoscopy followed by orotracheal intubation. To investigate the risk of arousal reactions and potential awareness episodes, we measured the Bispectral Index (BIS) in four different TIVA schemes.
Materials and Methods: We studied 56 patients (ASA I–III) aged 18 to 75 yrs undergoing ENT-surgery in a prospective, block-randomized and controlled design. Half of the patients received a short-infusion of clonidine (4 $\mu g/kg$) 30 min before the induction of anesthesia [C]. The others received placebo [P]. Propofol was used for all patients for induction and maintenance of anesthesia in a standardized dosage via TCI. Either Alfentanil [A] or Remifentanil [R] were given in comparable dosages as narcotics 120 sec before starting the Propofol-TCI. Due to this design we had four study groups with n = 14 patients each: [CA], [CR], [PA] and [PR]. BIS was measured in 10 sec intervals. We recorded the lowest BIS value within a period of 60 sec before laryngoscopy (BL) and the highest value within a 120 sec period after intubation (AI). Statistics: regression and analysis of variance.

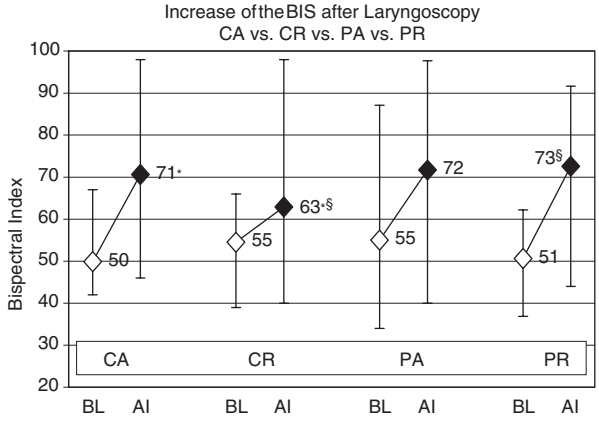

Fig.1: BIS (Median values, Min/Max) before laryngoscopy (BL) and after intubation (AI) in the four groups; *§*p < 0.05 for CR vs CA and CR vs PR*

Results and Discussion: Median BIS levels before laryngoscopy were comparable in all groups (CA:50, CR:55, PA:55, PR:51). We found an increase of BIS levels in all groups, which was lowest in the CR group (15,6%, from 55 to 63). This was significant ($p < 0,05$) compared to PR (43,5%, 54 to 73) and CA (41.5%, 50 to 71). Clonidine in combination with Remifentanil effectively attenuates the BIS response to laryngoscopy and orotracheal intubation.
Conclusion: To reduce arousal reactions and therefore potential episodes of awareness (measured by BIS increases) in this early (pre)operative period, the combination of Clonidine and Remifentanil seems to be best TIVA regimen.

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Repeatability of train-of-four monitoring in patient recovering from anaesthesia

C. Baillard, S. Bourdiau, B. Plaud†, P. Le Toumelin, B. Riou††, M. Cupa
C.M. Samama

Departments of Anaesthesiology, Avicenne Hospital, Bobigny, France; †Fondation Adolphe de Rothschild, Paris; ††Department of Emergency Medicine and Surgery, Pitié-Salpêtrière Hospital, Paris

Background and Goal of Study: This study evaluated the repeatability of train-of-four (TOF) ratio using the TOF-Watch acceleromyograph (Organon-Teknika, Puteaux, France) in patients recovering from anaesthesia.
Materials and Methods: Consecutive patients receiving non depolarising muscle relaxants in the operating room (n = 203) were prospectively studied.

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Immediately after arrival in the PACU, a pair of electrodes was applied over the ulnar nerve at the wrist to obtain the response of the adductor pollicis. The evoked response at the thumb was measured by the TOF-Watch®. The ulnar nerve was stimulated with TOF stimulation Typical current intensity was 30 mA. Two TOF stimulations were applied and recorded at 30-s interval. All the patients were tested by the same investigator. A Bland and Altman test was used. The repeatability was considered acceptable when the difference did not exceed 10%. The Kappa test (k) for clinical agreement between the two measurements was also calculated according to the presence or not of a residual curarisation defined as a TOF ratio < 0.90. Data are means $\pm$ SD, median [range], or percentage and 95% confidence interval (CI_{95}).

Results and Discussions: The characteristics of the patients were: age 53 $\pm$ 18 yrs; weight 69 $\pm$ 16 kg; women 40%; ASA 2 [1–4]. The surgical procedure lasted 140 [20–600] min and patients received rocuronium (n = 46), vecuronium (n = 134) or atracurium (n = 71). At the arrival in the PACU the mean body temperature was 36.6 $\pm$ 0.5°c. The TOF ratio measurement ranged from 0.03 to 1.0. The precision was 15 $\pm$ 17% and the limits of agreement were +43/−44%. A difference above 10% was found in 110 (43%, CI_{95}, 40–46%) patients. According to the presence of a residual curarisation (TOF ratio < 0.9), the paired TOF ratio were discordant in 61 patients (24%, CI_{95}, 21–27%). The kappa test indicated a moderate agreement (k = 0.47).

Conclusion(s): This study demonstrated a poor repeatability of TOF ratio determinations using acceleromyography in patients recovering from anaesthesia.

A-161

Evaluation of an infrared thermometer for measuring human skin temperature

H. Dohgomori[1], Kazuhiro Arikawa[1], K. Kawano[2], H. Kawamura[2], M. Sakamoto[2], Yuich Kanmura[2]

[1]Division of Emergency Medicine, Kagoshima University Hospital, Kogoshima, Japan; [2]Department of Anesthesiology, Kagoshima University Hospital

Background and Goal of Study: We evaluated a clinical infrared (IR) thermometer (RT-50; Hayashi Denko Inst., Tokyo, Japan) — which uses the same measuring mechanism as IR aural-canal thermometers — by comparing it with a reliable thermo-cup type (Mon-a-therm model 6510; Mallinckrodt Medical Inc., MO, USA).

Materials and Methods: The local ethical committee approved the present study. To measure skin temperature (foot, dorsal midline sites), the IR device was focused about 2–3 cm proximal to the thermo-cup probe. In each session, we noted the 3rd reading from the IR device (preliminary data showed good correlation between 2nd and 3rd readings, and small variability) and the simultaneous thermo-cup reading. Ambient temperature varied by less than $\pm$1 degree C. Data were analyzed using a Pearson's correlation coefficient test or the Bland-Altman method (B-A method). "Usefulness" was considered shown if the standard deviation (SD) of the mean difference was less than 0.5 degrees C [1]. We also calculated the sensitivity and specificity with which the IR device detected a temperature change of 0.5 degrees C. Statistical significance was set at $P < 0.05$.

Results and Discussion: In 17 female patients (mean age 32.1 $\pm$ 7.3 years) who scheduled for abdominal operations requiring epidural anesthesia and gave their informed consent, the IR device took readings from 86 sites in total. In a comparison with the thermo-cup device: (a) for recording absolute values, correlation was good ($r^2 = 0.84$), and bias was 0.25 but precision was poor (SD = 1.0) (B-A method), (b) for detecting changes in temperature, correlation was good ($r^2 = 0.68$), and bias was −0.1 but precision was poor (SD = 1.0) (B-A method). Similar results have been reported for IR aural-canal thermometers. For detection of a temperature change of 0.5°C (as revealed by the thermo-cup type), the IR device had a sensitivity of 82.2% and a specificity of 74.0%.

Conclusion: The present IR device showed a good correlation with the thermo-cup device, but evidence of poor precision in clinical situations.

Reference:

1 Imamura M, Matsukawa T, Ozaki, M et al. Acta Anaesthesiol Scand 1998; 42: 1222–1226.

A-162

Thermoregulatory efficacy of a new microprocessor controlled water garment in the neurosurgical setting

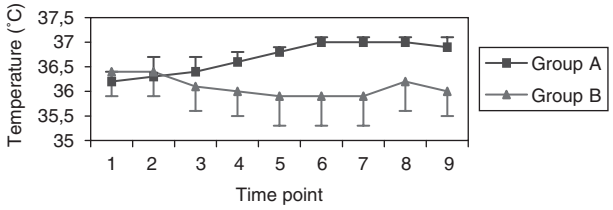
J. Stark, L. Brenner, L. Fischer, A. Holzer, S. Acimovic, M. Zimpfer, U.M. Illievich

Department of Anesthesiology and General Intensive Care, University of Vienna, A-1090 Vienna, Austria

Background and Goal of Study: Anesthesia induced impairment of thermoregulation and cold environment predipose patients to intraoperative hypothermia (1). Recently a new microprocessor controlled thermoregulatory system (Allon™) was developed, which circulates warm water through a special designed garment (2). The aim of this study was to compare this new device with a forced air warming system to determine its efficacy.

Materials and Methods: Sixteen patients undergoing elective endovascular embolisation of an intracranial aneurysm (IRB approval, written informed consent) were included in this prospective, randomised study. General anesthesia was performed in all patients using remifentanil and propofol. Group A was warmed with the water garment connected to the Allon™ sytem (MTRE, Or-Aktiva Industrial Park, Israel). Group B received a surgical access blanket, connected to a forced air warming system (Bair Hugger™, Augustine Medical Inc, Eden Prairie, MN). All intravenous fluids were warmed at 37°C and room temperature was maintained at 20°C in both groups. Bladder temperature was recorded after induction of anesthesia (tp 1) and every 30 minutes (tps 2–8) till the end of surgical procedure (tp 9). Data (mean $\pm$ SD) are considered significant at a $p < 0,05$ (ANOVA for repeated measurements).

Results:



$p < 0.001$, group A vs. B, ANOVA for repeated measurements

Conclusion: The Allon™ sytem is much more effective to maintain intraoperative normothermia than the forced air warming system in anesthetized patients.

References:

1 Sessler DI. Anesthesiology 2001; 95: 531–543.
2 Nesher N et al. Ann Thorac Surg 2001; 72: 1069–76.

A-163

The Trueview™ – a new laryngoscope

L. Gaitini, S. Vaida, M. Somri, R. Toame, B. Yanovski, I. Gankin, M. Fradis

Department of Anesthesiology, Bnai-Zion Medical Center, Haifa, Israel

Background and Goal of Study: The Trueview™ is a new laryngoscope that comprises a handgrip, a blade portion with an attached novel optical system. The optical system includes an eyepiece lens and a prism lens at the forward end, which shifts the view toward the blade portion tip. The main advantage of the Trueview™ consists in his lens refractions that offers an extreme anterior view refracting the image 20° from the horizontal. The aim of this study was to investigate whether the design of the Trueview™ results in better laryngeal visualization than using Macintosh laryngoscope, in patients with Mallampati airway classification III.

Materials and Methods: We studied 25 patients with Mallampati airway III classification undergoing elective surgery. After induction of general anesthesia the larynx visualization was attempted first with a size #3 Macintosh laryngoscope and then with a size 3 # Trueview™ laryngoscope. Laryngeal visualization was evaluated with the Cormack score.[1] (grade 1 = most of glottis visible, grade 2 = no more then arytenoid cartilages visible, grade 3 = epiglottis visible, 4 = failure to expose even epiglottis.)

Results and Discussions: The tracheas of all patients were successfully intubated, while in one patient with grade 4, fiberoptic bronchoscopy was used. In the Macintosh group five patients (20%) were evaluated grade 3 and two patients (8%) grade 4. The laryngeal view was significantly improved in Trueview™ group: 2 patients (8%) were evaluated as grade 3 and 1 patients (2.5%) as grade 2. The Cormarck grade was lower in the Trueview™ group ($p < 0.01$).

Conclusion: The Trueview™ laryngoscope improved laryngeal visualization in patients with Mallampati airway classification III.

Reference:

1 Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia. 1984; 39: 11105–11.

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The experience of four american clinics with the Macintosh video laryngoscopy

C.A. Hagberg*, M.B. Kaplan^, L. Lazada**, D. Ward^^, G. Berci***

**Department of Anesthesiology, University of Texas-Houston Medical School, Houston, USA; ^UCLA School of Med.; **Cleveland Clinic; ^^Univ. Rochester; ***Cedars-Sinai Med Center*

Background and Goal of Study: The MacIntosh Video Laryngoscope (MVL) projects an enlarged video image of the laryngeal structures onto a monitor. This multicenter study (University of Texas-Houston, Cleveland Clinic, UCLA, and University of Rochester) was performed to evaluate the MVL by comparing the view obtained with the (1) naked eye (traditional view) and (2) video monitor.
Materials and Methods: This study was conducted on 380 anesthetized, paralyzed, apneic patients, aged 18–80. Observations of the laryngeal structures were made by direct view of the oropharynx (naked eye) and an image projected onto a video monitor. Observations were categorized by the Cormack-Lehane grading system, modified by Yentis and Lee.[1] The necessity of external laryngeal manipulation (ELM) was determined, applied if necessary, and optimal views again recorded.
Results and Discussions: The MVL displayed a Grade IIa classification (partial view of the glottic opening) or better in 95.3% of the patients (65.3% Grade I), in contrast to 58.2% of the patients (28.9% Grade I) with the naked eye (Figure 1). ELM was utilized in 24.7% of the cases in order to improve visualization of the laryngeal structures.
Conclusion(s): The view on the video monitor provided a superior view of the laryngeal structures in comparison to the view obtained with the naked eye using the MVL. Further studies with this system are warranted.
Reference:

1 Yentis SM, Lee DJ: Evaluation of an improved scoring system For the grading of direct laryngoscopy. Anaesthesia 1998; 53: 1041–4.

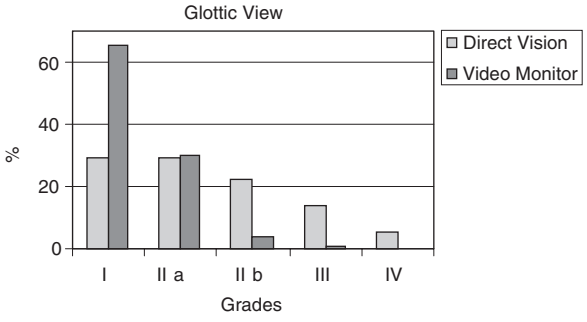

Figure 1: Direct vision vs. video monitor of glottic view.

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Heat distribution and transfer with conductive and convective warming

A. Taguchi, R. Lenhardt, J. Ratnaraj, B. Kabon, A. Kurz

Department of Anesthesiology, Washington University in St. Louis, St. Louis, USA; University of Louisville

Background and Goal of Study: Hypothermia is a serious complication of anesthesia and surgery. Many warming therapies have been developed over the past ten years. Convective warming with Forced-air was considered to be the most effective active warming system. Recently a new water filled garment Allon^{TM} System (MTRE advanced technology ltd., Israel), has been shown to transfer heat even more rapidly via conduction. We evaluated actual heat transfer, heat balance and distribution with these two different warming methods, which provide different warming rates.
Materials and Methods: With IRB approval, we studied nine volunteers (26 ± 4 years old, height 175 ± 10 cm weight 70 ± 12 kg) and each subject was evaluated on two randomly ordered study days. They were anesthetized and cooled to a core temperature near 34°C and active peripheral arteriovenous shunt vasoconstriction was established and maintained for 30 minutes. Subsequently, subjects were warmed on each day for two and half hours using one of two randomly assigned to two warming rates: 1. 1.2°C/h warming rate (Allon^{TM}) 2. 0.6°C/h warming rate (Forced–air, Bair Hugger®, Augustine Medical, Inc). Core temperature was recorded at the esophagus, area-weighted skin temperature and thermal flux from 15 skin-surface sites and muscle temperatures were measured using thermal flux transducers. Oxygen consumption was measured using a metabolic monitor. The data was analyzed with paired t-test. $P < 0.05$ was considered statistically significant different.
Results and Discussion: Metabolic heat production was similar with both warming rates. However, heat content during first one hour was significantly higher with Allon^{TM} as compared to Forced–air warming (152 ± 18 kcal/h, 84 ± 24 kcal/h, $p < 0.001$) and remained significantly different throughout the whole study period. This explains that core temperatures with Allon^{TM} could be increased 1.2°C/h, while with Forced–air warming the rise in core temperature was significantly less: 0.6°C/h ($p < 0.001$).
Conclusion: Allon^{TM} device transferred more heat compared to Forced-air warming. This suggests that conductive warming is more effective in hypothermic and vasoconstricted subjects.

A-166

A comparison of the forces exerted during laryngoscopy using disposable laryngoscope blades

A. Evans, R.S. Vaughan, J.E. Hall, J. Mecklenburgh, A.R. Wilkes

Department of Anaesthetics, University Hospital of Wales and University of Wales College of Medicine, Cardiff, UK

Background: Concern that reusable anaesthetic equipment may be a source of cross-infection with prion protein (1) has prompted the increased use of disposable laryngoscopes. We investigated the duration of laryngoscopy and the peak force generated using disposable laryngoscope blades.
Materials and Methods: The study was performed on a Mannequin, which was set on a mass balance to measure the vertical force applied, with a force transducer measuring the horizontal force. The magnitude of the resultant vector could then be calculated. Five blades were studied- one standard reusable Macintosh 3 blade, one disposable metal blade and three plastic disposable blades. Sixty anaesthetists performed laryngoscopy using each of the five blades which were presented in a random order, the end point of laryngoscopy being when a Cormack and Lehane grade 1 view was obtained. The whole exercise was then repeated with a rigid collar on the mannequin.
Results: The combined figures (mean and S.D) for all 600 laryngoscopies (collar on and off) are shown.

	Peak Force (N)	Duration (s)
Reusable Penlon (metal)	31.6 (12.3)	6.4 (3.5)
Marshall (metal)	31.6 (14)	6.5 (2.9)
Vital View (plastic)	36.4 (13.4)	10.9 (6.7)
Lite Blade (plastic)	37.2 (14.9)	8.5 (5.8)
Penlon Crystal (plastic)	36.5 (14.9)	8.3 (4.1)

Applying one way ANOVA proves significant ($p < 0.0001$) for both peak force and duration of laryngoscopy. Comparing either of the metal blades against any of the plastic blades using the Bonferroni/Dunn post hoc analysis also proves highly significant ($p < 0.001$) for both peak force and duration of laryngoscopy. Three of the Penlon Crystal blades snapped during use.
Conclusion: The use of plastic disposable blades results in greater peak force being applied during laryngoscopy. The duration of laryngoscopy is also prolonged when plastic rather than metal blades are used. Plastic blades have been introduced hastily on the assumption that their performance would be identical to reusable blades, which is not the case. This trial reinforces the need for equipment to undergo rigorous *in vivo* testing before their widespread use is adopted.
Reference:

1 Miller DM *et al*. *Anaesthesia* 2001; **56:** 1069–72.

A-167

Temperature maintenance strategies: during abdominal surgery. Clinical comparison of two different methods

Ath. Stamatelopoulos, V. Chantziara, G. Lazaridis, G. Sgroi

Department of Anesthesiology, Athens, Greece

Aim: The scope of this study was to compare two different strategies for the maintenance of intraoperative normothermia. One method used a single forced air warming system. The other method used a new water garment warming system, which permitted active warming of both upper and lower extremities and the back.
Materials and Methods: In this prospective, randomized study, 158 adult patients were enrolled in one of two intraoperative temperature management groups during open abdominal surgery with general anesthesia. The water garment group (no 76 pts) received warming with a body temperature (rectal) set point of 36,8°C. The forced air-warmer group (n = 82) received routine warming therapy using upper body forced air-warming system. The ambiental temperature in the operating hall was maintained constant at approximately ≅20°C. Rectal distal esophageal tympanic and fingertip temperatures were recorded perioperatively and during 2 h after surgery.
Results: The mean esophageal and rectal temperatures at incision 1h after incision, at skin closure, and postoperatively were significantly higher in group that received water garment warming when compared with the group that received upper body forced-air warming. The calculated 94,8% confidence

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internals for the above differences in core temperatures were 0,7–0,1, 0,8–0,2, 0,8–0,2 and 0,9–0,2, retrospectively. In addition, 13,6 and 7,3% of patients in the control upper body forced-air group remained hypothermic (<35,5°C) 1 and 2 h after surgery, respectively. No core temperatures less than 35,5 was observed perioperatively in any of the patients from the water-garment group. A similar frequency of the thermal stress events was observed after extubation in both groups during the 2 h after surgery.
Conclusion: The investigated water warming system, by virtue of its ability to deliver heat to a greater percentage of the body, results in better maintenance of intraoperative normothermia that does forced air warming applied only to the upper extremities, as is common practice.

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Performance of NMT stimulators

M. Adamus, P. Adamus, K. Kankovska

Departments of Anaesthesia and Intensive Care, University Hospital, Olomouc, Czech Republic

Background and Goal of Study: Accurate and reliable peripheral nerve stimulator (PNS) is a *conditio sine qua non* of adequate NMT (neuromuscular transmission) monitoring during general anaesthesia. High-quality nerve stimulator works in a "constant current" fashion; it delivers stable predetermined current irrespective of the loading resistance.
Materials and Methods: Six commercially available PNS's were studied in laboratory settings. Stimulator (single twitch mode, stimulating current 10, 20, 30, 40, 50 and 60 mA, respectively) was allowed to work into different loading resistance from 0 to 5000 ohms. Based on voltage measured on the load (and the Ohm's law) the actual intensity of the current was determined.
Results: Data are summarised in the table and given as RMSD ± SD (root mean square deviation ± standard deviation). RMSD is a measure of variation about the preset current (set point).

$$\mathrm{RMSD} = \sqrt{\frac{\sum_{n=1}^{N} (I_{ACT} - I_{SET})^2}{N - 1}}$$

I_{ACT} = Real current
I_{SET} = Present current

	RMSD of actual current error ± SD (mA)					
Stimulator	10 mA	20 mA	30 mA	40 mA	50 mA	60 mA
AS/3™	*§2,9 ± 0,47	*§3,0 ± 0,82	*§3,3 ± 1,20	*§3,7 ± 1,63	*§4,4 ± 2,00	*20,5 ± 17,00
Innervator NS252™	*3,9 ± 0,08	*5,0 ± 0,09	*4,9 ± 0,16	*4,5 ± 0,16	*4,0 ± 0,16	*4,2 ± 0,18
MultiStim Pajunk®	§0,1 ± 0,03	*§1,7 ± 1,30	*§7,5 ± 5,41	*§14,6 ± 9,56	*22,4 ± 13,24	*30,6 ± 16,87
Para-Graph®	*§7,4 ± 5,35	*§9,6 ± 6,53	*§12,5 ± 7,90	*16,4 ± 10,14	*20,2 ± 12,11	*22,9 ± 13,42
TOF-Guard®	§0,1 ± 0,09	§0,3 ± 0,17	0,8 ± 0,31	0,1 ± 0,09	0,7 ± 0,18	1,3 ± 0,17
TOF-Watch®	§0,0 ± 0,01	0,1 ± 0,07	0,1 ± 0,05	0,1 ± 0,04	0,1 ± 0,05	0,2 ± 0,10

* P < 0,01 *vs* TOF-Guard, TOF-Watch; § P < 0,01 *vs* 60 mA

Conclusions: TOF-Guard® and TOF-Watch® are the most accurate PNS's in terms of stimulating current. All stimulators (with the exception of NS252®, Fisher-Paykel) are less precise throughout higher currents (60 mA) than during lower stimulation intensities (10 mA).

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Previous experience with use of BIS changes daily anesthesia practice

I. Schneider, C. De Deyne, M. Struys*, E. Vandermeersch**, R. Heylen

*Departments of Anesthesia Ziekenhuis Oost-Limburg, Genk, Belgium; *University Hospital Gent, Belgium; **University Hospital Leuven, Belgium*

Background and Goals: Use of BIS EEG monitoring, guiding depth of the hypnotic component of anesthesia, generally results in a 25 to 40% reduction in the use of hypnotics. This implies that BIS use changes daily anesthesia practice. Until now, no data are available on a possible learning effect of BIS use. Therefore, we analysed whether a period of BIS use induced any changes in further anesthesia practice.
Material and Methods: During a 9 weeks period, all anesthesia procedures performed by an anesthesia resident, unexperienced with BIS monitoring, were included. During the first 3 weeks (=group 1), BIS was blinded (but recorded) to the anesthesiologist. During the next 3 weeks, BIS was unblinded and hypnotics were administered to maintain BIS between 40 and 60. Finally, the last 3 weeks (=group 2), BIS was again blinded (but recorded). Afterwards, all BIS values from 10 min after induction until 10 min before skin closure were compared between the two groups. (Anova statistical analysis).
Results and Discussion: In group 1, 41 ASA I-II pts were included, whereas in group 2 we included 42 ASA I-II pts. All pts were scheduled for elective abdominal surgery. There was no difference in gender, age, weight or duration of operation (group 1: m100min, group 2: m108min) between both groups. In both groups, half of the pts received an iv hypnotic (propofol) whereas the other half received an inhalational (sevoflurane) hypnotic agent. In the first group, we noticed a mean BIS of 40.67 We found that 42% of the BIS values were between 40 and 60, 3.6% were above 60 and 64.6% were below 40. In the second group, mean BIS was 42.31 with 52.6% of all BIS values between 40 and 60, 4,9% of all BIS values were above 60, whereas 42,4% of all values were below 40. Mean BIS values between both groups were not different, but the incidence of adequate anesthesia significantly (p:0;026) increased in the second group, as the incidence of too deep anesthesia significantly (p:0.024) decreased.
Conclusion: These data confirm a learning effect of BIS monitoring, especially reducing the incidence of too deep anesthesia.

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Does previous BIS experience improve clinical perception of the hypnotic component of anesthesia?

I. Schneider, C. De Deyne, M. Struys*, E. Vandermeersch**, R. Heylen

*Departments of Anesthesia, Ziekenhuis Oost-Limburg, Genk, Belgium; *University Hospital Gent, Belgium; **University Hospital Leuven, Belgium*

Background and Goals: Use of BIS monitoring introduced a new parameter providing an on-line estimation of hypnotic depth of anesthesia. In the present study, was analysed whether any previous use of BIS monitoring might influence the clinical perception by the anesthesiologist of depth of hypnosis.
Material and Methods: An anesthesiologist, unexperienced with BIS use, analysed 40 consecutive general anesthesia procedures (group 1) for his clinical perception of undeep hypnotic anesthesia (necessitating an increase of hypnotic administration) or too deep anesthesia (enabling a reduction in the hypnotic administration). In all 40 procedures, BIS monitoring was applied but was blinded. Afterwards, another 40 consecutive general anesthesia procedures were performed with unblinded BIS monitoring. Finally a last 40 procedures (group 2) were performed again with blinded BIS monitoring. In both groups (1 and 2) we compared the clinical perception of depth of hypnotic anesthesia with the BIS value, and we were especially interested to analyse if any change has occurred due to the experience with BIS monitoring.
Results and Discussion: There were no differences in gender, age, weight, or operative time between both groups. In group 1, the anesthesiologist observed 55 episodes of undeep anesthesia and 66 episodes of too deep anesthesia. Of the undeep anesthesia episodes, only 7% corresponded with a BIS value > 60. Of the too deep anesthesia episodes, 72% revealed to go along with a BIS value < 40. In group 2, the anesthesiologist noted 88 episodes of undeep anesthesia and 82 episodes of too deep anesthesia. Of the too deep episodes, 75% went along with a BIS value < 40, which was not different from the first group. However, of the undeep episodes, 23% corresponded with a BIS value > 60 in the second group, which was a significant improvement in the correct estimation of undeep anesthesia.
Conclusion: Experience with BIS monitoring alters the clinical perception of depth of hypnosis by the anesthesiologist. Especially undeep anesthesia (incurring the risk of peroperative recall) might be better estimated by an anesthesiologist who ever had any experience with BIS monitoring.

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Use of BIS-Monitoring to reduce induction dose of methohexital in anaesthesia for electroconvulsive therapy (ECT)

B. Buttgereit, M. Bauer, R. Hanß, P.H. Tonner, J. Scholz

Department of Anaesthesiology and Intensive Care Medicine, University Hospital Kiel, Kiel, Germany

Background and Goal of Study: Methohexital raises seizure thresholds and produces a dose-dependent decrease of seizure duration in electro convulsive therapy (ECT) (1). We evaluated the dose of methohexital needed for induction of short anaesthesia for ECT.
Materials and Methods: We studied 50 ECT-sessions in 6 Patients. Anaesthesia for the first session was induced with 1 mg/kg bodyweight methohexital. In the following sessions we administered 1 mg/kg methohexital or a dose reduced by 0.1 mg/kg compared to the last administered dose, respectively. At a BIS ⩽ 60 (BIS XP, Aspect Medical Systems) muscle relaxant was administered and seizures were induced. If the BIS-score did not reach 60 or less within 60 seconds additional 0.5 mg/kg methohexital was administered.
Results and Discussions: The first ECT in 5 of 6 patients was initiated using 1 mg/kg methohexital. In 2 patients we had to increase methohexital doses up to more than 1 mg/kg in the following sessions. In 5 of 6 patients

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administration of additional doses of methohexital were necessary even though it was possible to reduce induction dosage in following sessions. The lowest possible induction dose was 0.7 mg/kg methohexital (Table 1).

Table 1: Number of inductions without/with additional methohexital

	Dose of methohexital(mg/kg)					Cum. ECT-count
PatientNr.	0.7	0.8	0.9	1.0	>1.0	
1	-/-	-/-	1/1	3/1	-/-	6
2	-/-	1/1	1/1	4/-	-/-	8
3	-/1	1/-	1/-	5/-	-/-	8
4	-/-	-/-	-/1	-/2	11/1	15
5	-/-	-/-	-/1	2/2	2/-	7
6	1/-	1/-	1/-	3/-	-/-	6

Conclusions: (1) Using the BIS-Monitoring, a reduction of methohexital dose is possible in some patients. (2) The methohexital dose needed for induction varies from patient to patient and between sessions in the same patient. BIS-Monitoring allows a session- and patient-dependant dose limitation of methohexital in ECT.

Reference:

1 Bready LL, Tyler DS. In: Textbook of neuroanesthesia with neurosurgical and neuroscience perspectives. 1st ed. McGraw-Hill, New York, 1997:707–734.

A-173

Bispectral index monitoring during cardiac surgery: useful or mandatory?

G. Vretzakis, V. Papaioannou, G. Bitzikas, E. Ferdi, L. Luckman, F. Konstantinou, K. Tsakiridis

Cardiac Anesthesia Group and Dpt of Cardiothoracic Surgery, University Hospital of Alexandroupolis, Greece; Anesthesia Dpt of "G Genimatas" Univ. Hospital of Thessaloniki, Thessaloniki, Greece

Background and Goals: This study was designed to assess the act of Bispectral index (BIS) monitoring upon decision making during cardiac surgery.
Materials and Methods: After institutional approval, 68 patients (47coronary, 17 valve and 4 valve+coronary) were included, divided randomly in two groups. An observing anesthesiologist was collecting data from all monitoring devices along with BIS monitor and pump infusion rates. Conditions in which BIS values were subjectively considered illustrative were recorded as "events". In group A (n = 32), anesthetic management was "blind" to BIS values, while, in group B (n = 36), the anesthesiologist observing the BIS monitor was free to inform the attending anesthesiologist about the BIS score. Patients received the same anesthetic regimen (propofol + remifentanil). Monitoring was equal in all cases including an oximetry PA catheter. Mild hypothermic CPB was applied in 18 pts in A (56.2%) and in 18 pts in B (50.0%). Statistical analysis employed two-tailed t-test.
Results: Patient demography, underlying pathology and aortic cross clamping were similar in both groups. In group A, BIS value was considered by the observer as "useful to know" in 154 events (4.8 ± 1.5 per pt). No patient was moved from A to B. In B, the attending anaesthesiologist was informed about the BIS value 117 times (3.2 ± 1.3 per pt;p = 3.3E−05) and in 92 cases (78.6%) measures were taken. Titration of anesthetics was done in 65 (70.6%), of vaso-active drugs in 7 (7.6%), of both in 11 (11.9%) and other corrective actions in 9 (9.7%). In both groups, observer's comments about BIS scores included: change of pt's temperature, dilution on institution of CBP, marked diuresis and equipment tuning or failure. Distributions of BIS values were not differing statistically (37.3 ± 10.2 & 37.3 ± 10.0, A & B resp, p = 0.95). "Zenith" and "nadir" BIS values after induction were not statistically different (47.7 ± 6.5 & 46.8 ± 5.7, A & B resp, p = 0.59 and 27.2 ± 3.3 & 27.7 ± 2.7, A & B resp, p = 0.581). Awakening, extubation times and ICU length of stay were similar in both groups.
Conclusion(s): The usefulness of BIS monitoring is demonstrated by the measures taken and the reduced events in B. Nevertheless, mandatory character for its use in cardiac anaesthesia is not supported by our findings.

A-174

The use of target-controlled propofol infusion system and bispectral index for EEG burst suppression during intracranial aneurysm surgery

P. Roncucci*, R. Risaliti*, L. Benvenuti*, M.S. Mok**, A. Bayat**

*Department of Anesthesia, Spedali Riuniti, Institute of Anesthesia and ICU, Livorno, Italy; *Spedali Riuniti, Livorno, Italy; **University of Southern California, Los Angeles, USA*

Background and Goals: Intraoperative electroencephalographic evidence of burst suppression by the use of propofol during temporary arterial occlusion in intracranial aneurysm surgery has been considered as an adequate measure of reduced cerebral metabolic activity. The present study evaluated the dose of propofol and the BIS index for such therapeutic intervention.
Materials and Methods: Twelve patents of Hunt and Hess grade I and II undergoing intracranial aneurysm were monitored with EEG, SSEP and BIS monitors in addition to the routine monitors in the operating room. All patients were premedicated with midazolam 0.02 mg/kg i.v. and anesthesia was induced with propofol 2 mg/kg and continuous infusion of remifentanil 0.15–0.20 mg/kg/min. Intubation was facilitated with rocuronium 0.6 mg/kg i.v. Target plasma concentration of propofol(TPCP) was set to maintain the BIS index at 40–50. Patient was ventilated with air/oxigen mixture and maintained at normovolemic, normtensive and normothermic condition. Before clipping the feeding artery and the aneurysm, patient was given 100% oxygen and TPCP was boosted to reach a EEG burst suppression at 70–80%. After clipping of the aneurysm the TPCP was reverted back to maintain a BIS value of 40–50.
Results: Data (means ± SD) are shown in the table.

Age (yrs)	52.4 ± 8.7
Total occlusion time (mins)	15.8 ± 10.7
BIS value during burst suppression	17.1 ± 3.6
Suppression index (%)	74.7 ± 4.4
TPCP during burst suppression (mcg/ml)	6.2 ± 0.4
MAP (mmHg)	90.2 ± 6.5

Conclusions: Target-controlled infusion of propofol produced smooth burst suppression without any decrease of arterial pressure and no vasoactive drug was needed. A direct correlation was found between the BIS index and the value calculated from EEG during burst suppression.

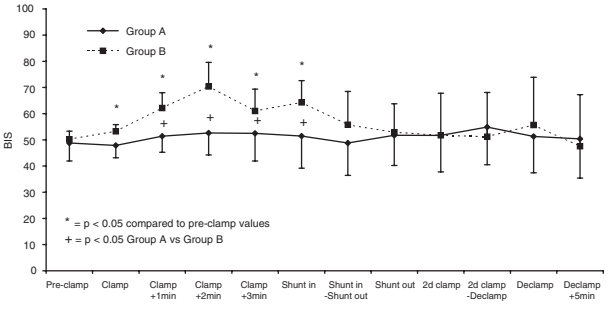
A-175

Transient increase of the bispectral index (BIS) during carotid clamping: preliminary results

Th. Lemineur, V. Bonhomme, Q. Desiron, P.Y. Dewandre, J.F. Brichant, P. Hans

University Dpt of Anaesthesia & ICM and Cardiovascular Surgery, CHR de la Citadelle, Liège, Belgium

Goal of Study: The present study investigated the BIS during carotid endarterectomy (CEA).
Methods: After Ethics Committee approval and informed consent, we studied 10 patients. Invasive blood pressure and ipsilateral BIS (Aspect° A-2000 monitor) were recorded throughout surgery. After induction, anaesthesia was maintained using a constant remifentanil infusion (0.25 $\mu g\,kg^{-1}\,min^{-1}$) and a target-controlled infusion of propofol adjusted to maintain BIS around 50 until carotid clamping (range: 1.5–3 μg/ml). A Javid shunt was placed in all patients. BIS, blood pressure and heart rate were recorded every 5 min before and every min during clamping. A systolic blood pressure lower than 120 mmHg was treated with 5 mg ephedrine boluses. Post hoc analysis assigned patients to one of two groups according to the evaluation of the internal carotid back-flow by the surgeon (Gr A: good, n = 5; Gr B: moderate or poor, n = 5). Data were analysed using ANOVA. A $p < 0.05$ was considered statistically significant.
Results: In Gr B compared to Gr A, BIS increased during clamping, peaked 2 min. after (Pre-clamp: 50.24 ± 3.09, Clamp + 2min: 70.41 ± 8.31), and remained elevated until shunt insertion. Haemodynamic parameters did not change throughout the study. Ephedrine requirements did not differ between groups. No patient complained about awareness or neurological deficit.
Conclusions: In patients suspected from alternative vascular supply insufficiency, carotid clamping was associated with a significant and transient ipsilateral increase in BIS. Further studies are needed to determine the clinical relevance of such an observation.



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A-176

Impact of transoesophageal echo-cardiography on haemodynamic management during non-cardiac surgery

C.K. Hofer, A. Zollinger, M. Rak#, R. Klaghofer*, TH. Pasch#, M.P. Zalunardo#

*Institute of Anaesthesiology, Triemli City Hospital Zurich; *Statistics, Department of Psychosocial Medicine, University Hospital Zurich; #Institute of Anaesthesiology, University Hospital Zurich, Zurich, Switzerland*

Background and Goal of Study: The role of transoesophageal echo-cardiography [TOE] as a haemodynamic monitoring tool during non-cardiac surgery still remains controversial, although some studies suggest a significant impact on haemodynamic interventions[1;2]. The aim of this observational data base analysis was to determine the impact of TOE on haemodynamic management during non-cardiac surgery.

Materials and Methods: 99 consecutive patients undergoing vascular [VASC], visceral [VISC], chest surgery [CHEST] or minor surgical interventions and candidates for lung/liver transplantations [TRANSPL] were available for statistical analysis. Indications for TOE comprised monitoring for coronary artery disease [CAD], left heart failure [LHF] and an ejection fraction [EF] $< 40\%$. New findings influencing therapeutic interventions (e.g. changes in left ventricular motility [LVM]) were recorded and changes of drug therapy [DRUG] as well as changes in fluid therapy [FLUID] based on TOE findings were rated (yes/no or BOTH). Statistical analysis was done using logistic regression and Fisher's exact test. A p-value < 0.05 was considered to be statistically significant.

Results and Discussions: 165 new TOE findings were recorded in 99 patients (33% VASC, 24% VISC, 11% CHEST, 16% TRANSPL patients). DRUG were noted in 47%, FLUID in 24% and BOTH in 39%. Intraoperative changes of LVM and other important diagnoses (e.g. atrial thrombus, patent foramen ovale) were observed in 32/10%, respectively. TOE showed a significant impact in DRUG for CAD and LHF (CAD: odds ratio [OR] = 3.4, confidence interval [CI] 95% = 1.1/11.2; LHF: OR = 5.8, CI 95% = 1.1/29.2) and in LVM for CAD and EF $< 40\%$ (CAD: OR = 5.4, CI 95% = 0.6/52.4; EF $< 40\%$: OR = 11.8, CI 95% = 2.8/49.2). FLUID was significantly influenced by TOE in TRANSPLANT (50% versus 24% non-TRANSPLANT, $p < 0.05$).

Conclusion: In this series of patients undergoing non-cardiac surgery TOE had a significant influence on intraoperative drug therapy in patients with CAD and reduced left ventricular function. TOE is useful in guiding fluid therapy during lung and liver transplantations.

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A-177

Perioperative factors affecting the duration of mechanical ventilation after cardiac surgery

G. Bitzikas, G. Vretzakis, V. Papaioannou, E. Ferdi, D. Mikroulis, V. Didilis, G. Bougioukas

Cardiac Anesthesia Group and Dpt of Cardiothoracic Surgery, G.GENIMATAS HOSPITAL, University Hospital of Alexandroupolis, Thessaloniki, Greece

Background and Goal of Study: To determine the prognostic factors, for postoperative prolonged mechanical ventilation, after cardiac surgery with cardiopulmonary bypass (CPB).

Materials and Methods: After institutional approval, we retrospectively analyzed the perioperative characteristics and data from 146 consecutive adult cardiac surgery patients in order to discriminate early extubation ($<$8 h). In this initial group, patients were operated with an appropriate anesthetic protocol (propofol + remifentanil). From them, 37 pt (group A) required prolonged mechanical ventilation and they were compared to a similar group from the same pool (group B, n = 37, matched for the next ID number). Twenty-two variables from demographic, clinical, angiographic, operational and postoperative data were evaluated using univariate and multivariate analysis. Kolmogorov-Smirnov one-sample test (normality of continuous data), Student's t-test or Mann–Whitney U test (continuous data) and Pearson 's X^2 or Fisher's exact test (categorical data) were performed. Multiple logistic regression analysis was performed to identify independent factor associated with late extubation.

Results and Discussions: Extubation was succeeded in 29.6 $\pm$ 27.4 h in A and in 6.0 $\pm$ 1.5 h in B (ICU stay: 3.4 $\pm$ 1.7 & 1.3 $\pm$ 0.6 days resp.). Prognostic factors for failure of early extubation were: EF ($\geqslant$ *0.45:* A = 20(54.1%), B = 29 (78.4%); *0.30 = EF < 0.45:* A = 17 (45.9%), B = 8 (21.6%); p = 0.027), CPB time (A = 130.8 $\pm$ 33.1 min, B = 106.6 $\pm$ 31.0 min; p = 0.002), aortic cross clamp time (A = 82.1 $\pm$ 22.4 min, B = 69.9 $\pm$ 27.5 min; p = 0.047), fluid balance during CPB (A = 2061.1 $\pm$ 506.1 ml, B = 1817.5 $\pm$ 322.8 ml; p = 0.016), fluid balance (1st 8 h) of ICU (A = 69.3 $\pm$ 1093.6 ml, B = 496.6 $\pm$ 879.7; p = 0.017), postop. low cardiac output syndrome (A = 10(27.0%), B = 2(5.4%); p = 0.012) and use of IA BP (A = 6(16.2%), B = 0; p = 0.025). Independent factors for prolonged mechanical ventilation were EF (p = 0.017), CPB time (p = 0.018) and fluid balance during CPB (p = 0.043).

Conclusion(s): Fluid balance seems to be the most modifiable between the factors affecting the need for mechanical ventilation in cardiac surgery patients. Accomplishing precise management of fluids leads to better conditions for early extubation.

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Anaesthesia and the QTc interval: Effects of Halothane, Isoflurane and Sevoflurane

A.H. Karagöz, E. Basgül, V. Çeliker, Ü. Aypar

Departments of Anaesthesiology and Reanimation, Hacettepe University, Faculty of Medicine, Ankara, Turkey

Background and Goal of Study: Inhalation anaesthetics have been recognized to influence the duration of the QT interval. It was demostrated that inhalation induction and maintanance with isoflurane prolongs the QT interval in contrast to halothane, which shortens it[(1)].The aim of this study was to assess time dependent effects of halothane, isoflurane, sevoflurane on the QT interval.

Materials and Methods: 49 ASA I–II patients undergoing inguinal hernia operation were recruited. Patients with congenital or acquired prolongation of the QTc interval(QTc = 440 ms),serum electrolyte abnormalities or receiving medication were not studied. No premedication was given. Patients whom randomly allocated into three groups, received thiopenthal, fentanyl, and vecuronium to facilitate induction and intubation. The vapour concentration was adjusted to achieve an end tidal concentration of 0.8% (halothane n = 18), 1% (isoflurane n = 15), 2% (sevoflurane n = 16). A three lead electrocardiogram was recorded before the induction, at 2,5,10,15,30,45,60 minutes and after extubation at a paper speed of 50 mms^{-1}. Heart rate,SAP,MAP,DAP and SpO_2 were recorded at the same time. Heart rate, corrected QT interval using Bazett's fomula were investigated. Statistical analysis, performed using multivariate analysis of variance for repeated measures, was used .

Results and Discussions: The critical value of 440 ms in the QTc interval was not exceeded in all groups. No statistically significant difference was found between QTc values of halothane and sevoflurane(p = 0.976) but, there was a significant difference between isoflurane and these two inhalation anaesthetics respectively (p = 0.003, p = 0.006). In isoflurane group QTc values were higher.Mean arterial pressures were similar in all groups.

Conclusion(s): Although the use of sevoflurane in induction of anaesthesia is not preferable, in maintenance halothane and sevoflurane are safe in patients susceptible to critical ventricular tachycardia, torsade de pointes.

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A-179

The effect of prophylactic β blocker and nitroglycerine on perioperative myocardial ischemia in patients with coronary artery disease undergoing noncardiac elective surgery

S. Karabayirli, O. Ozatamer, Y. Batislam, T. Korkmaz

Department of Anaesthesiology and Intensive Care Unit, University of Ankara, Ankara, Turkey

Background and Goal of Study: Peri-operative myocardial ischemia detected by Holter monitoring is associated with increased peri-operative cardiac morbidity and mortalitiy (1). Prophylactic therapy with nitrates, calcium-channel blockers, β blockers and α-agonists has been tried individually (2). We aimed to compare the administrations of β blocker to nitroglycerine to prevent perioperative myocardial ischemia for non-cardiac elective surgical patients with coronary artery disease.

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Materials and Methods: After ethics committee approval and informed consent, fifty patients with coronary artery disease were randomly assigned into three group. In group C(n = 20) placebo (SF 10 ml) was given before induction. In group BB(n = 14) 50 mg metoprolol SR was given orally and 10 mg metoprolol was given by slow injection before anaesthesia. In group NTG (n = 16) nitroglycerine 0.3 μg/kg/min infusion was given before anaesthesia and maintained by incremental doses of 0.9–1 μg/kg/min during the operation. Hemodynamic data was recorded during perioperative period. Levels of serum CK-MB, Troponin I of all patients were measured before the operation and at the 8th and 24th hours postoperatively. In perioperative period, arrhythmias, changes of ST-T segment have been analyzed. ST changes over 1 mV and lasting more than 1 minute has been accepted as a change of ST segment. All patients was monitored by Holter perioperatively and 24 hours postoperatively.
Results and Discussions: No patients displayed ST-T segment changes preoperatively. However, ratio of changes of ST-T segment were 50% in group C, 21,4% in group BB and 37,5% in group NTG perioperatively. However, statistical analysis did not show difference between the groups and this was attributed to the limited number of patients in groups . No patients had severe cardiac complication.
Conclusion(s): Since we found that in metoprolol group, the incidence of perioperative myocardial ischemia was lower, we suggest that perioperative β blocker application in patients undergoing non-cardiac elective surgery with coronary artery disease is beneficial.
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A-180

Cardiac Troponine I increases postoperatively in transurethral prostatectomy patients with ischemic heart disease

E. Stamataki, C. Barre, V. Mariatou, A. Alexandropoulou, A. Grigoratou

Department of Anaesthetic, Evangelismos Hospital, Athens, Greece

Background and Goal of Study: During transurethral prostate resection **(**TURP) rapid central cooling and thermogenic rigor put stress on aged heart, potentially contributing to long term cardiac morbidity1. Cardiac Troponine I (cTrI) is superior to ECG as a prognostic factor of future cardiac events. We measured cTrI in TURP and in suprapubic prostatectomy (SP), as control group, patients to correlate it with heart disease (HD) and perioperative events.
Materials and Methods: 71 patients underwent TURP, 71 ± 8 yrs, 47 ± 18 min and 53 SP 72 ± 6 yrs, 55 ± 15 min under spinal anaesthesia {T9–T10}. We classified pts according to HD as: 0. Normal 1. Mild 2. Severe. 3. Very severe CAD. We maintained hemodynamic stability and Hb 11,5–13,5 gr% throughout the study. Bladder irrigation fluid was at room temperature. We measured ccTrI pre induction and at 24 hrs. Statistical analysis was made with students test for paired and unpaired data and multivariate analysis.
Results and Discussions: Baseline cTrI was elevated in 4/8 class3 TURP and 3/6 SP pts of 3 class Fig 1. At 24 hrs cTrI increased ss in 6/8 TURP pts only and nss in 2/6 SP pts Fig 2. 24 hr ECG findings:TURP:three T wave abnormality, one new ST segment depression, one first degree AV block. In SP one T wave abnormality, all asymptomatic.

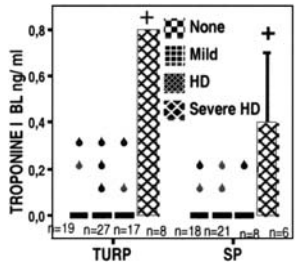

Fig 1. + = p < 0,000 within groups

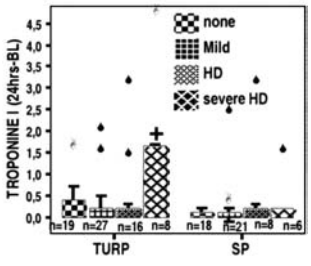

Fig 2. + = p < 0,01 within TUR-P group

Conclusion(s): In 50% of urological pts with very severe ischemic HD baseline cTrI was elevated. cTrI increased 24 hrs postoperatively in TURP patients only. TURP tecnique seems to put an extra myocardial stress and all precautions relevant to temperature maintenance and hemodynamic stability should be taken.
Reference:
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A-181

Selective coronary revascularization following preoperative thallium scanning improves long-term survival following major vascular surgery

Y. Golub, G. Landesberg, C. Weissman

Department of Anestesiology & CCM, Hadassah University Hospital, Jerusalem, Israel

Background and Goal of Study: Coronary artery disease is responsible for up to 60% of long-term mortality following major vascular surgery. Whether coronary revascularization (CR) in patients with positive preoperative thallium screening (PTS) improves long-term survival following major vascular surgery, has not been determined.
Materials and Methods: The perioperative data including PTS and CR details, and long-term survival (up to 10 years) of 502 consecutive patients who underwent 578 major vascular procedures were retrospectively analyzed. All patients with PTS who ultimately did not undergo the planned vascular operation were also investigated. Cox regression and propensity score analyses were utilized to compare long-term survival of patients with and without preoperative CR who had positive PTS.
Results and Discussions: Of 407 (81.1%) patients who had PTS: 221 (54.3%) had no or mild defects on PTS (Group I); 50 (12.3%) had moderate-severe fixed defects (Group II); 62 (15.2%) had moderate-severe reversible defects yet did not undergo CR (Group III) and 74 (18.2%) had moderate-severe reversible defects and subsequently underwent CR by CABG (36) or PTCA (38) (Group IV). Four additional patients who sustained cardiovascular complications, including one death, as a result of the preoperative cardiac workup and did not undergo the vascular surgery, were added to Group IV for the survival analyses. By Cox multivariate analysis, the age, type of surgery (lower-extremity bypass vs. aortic surgery), diabetes, previous infarction and moderate-severe reversible defect on PTS, independently predicted mortality [p = 0.001, 0.009, 0.039, 0.006 and 0.029 respectively]. Preoperative CR independently predicted improved survival [relative risk = 0.52, p = 0.018]. Long-term survival after CR (Group IV) was similar to that of patients with no or mild defects on PTS (Group I) and was significantly better than that of patients with ischemia on PTS who did not undergo CR (Group III) (relative risk = 0.38, p = 0.001) even after adjusting for confounding factors and for the propensity score for revascularization [p = 0.001].
Conclusion(s): Selective CR significantly improves long-term survival following major vascular surgery in patients with moderate-severe reversible ischemia on PTS.

A-182

Incidence of preoperative depression in Greek cardiac surgery patients – implications on morbidity and mortality

P. Giannakopoulos, E. Apostolakis, V. Skandalou, A. Volanaki, S. Lyka, K. Stamoulis, E. Karamihali

Department of Anesthesiology, Evangelismos Medical Hospital cardiac surgery department, Athens, Greece

Background and Goal of Study: Depression is a major predictor of mortality in patients suffering from coronary artery disease (CAD). Patients undergoing CABG surgery with clinically significant depressive symptoms have a higher angina recurrence and a higher 5 year mortality rate (1). Anxiety and depression are associated with, if not causally related to, CAD (2). Goal of study was to evaluate depression and its implications on Greek patients undergoing cardiac surgery.
Materials and Methods: We studied thirty two (32) patients undergoing various cardiac surgery operations. 19 patients (59.3%) underwent CABG and 13 (40.7%) patients non-CABG surgery. We utilized a Greek translation of Zung interviewer assisted depression scale and APAIS scale the day before the operation. We examined previous history of cardiac disease, the intraoperative and immediate postoperative cardiac events and the outcome of the patients up to six months after the operation.
Results and Discussions: 62.5% of the patients were found with mild to severe depressive symptomatology (ZUNG scale > 50). 6 patients (18.8%) were found with severe depression (ZUNG scale > 70) and 2 patients were already diagnosed with depression. The number of days of hospitalization was correlated significantly with the occurrence of immediate postoperative cardiac events (p = 0.024) but did not correlate to the ZUNG score. The ZUNG score was higher in patients with severe cardiac events and approached but did not reach statistical significance (p = 0.08). Interestingly the ZUNG scale was significantly inversely correlated to weight and body mass index (p = 0.02).
Conclusion(s): More than half of the patients of our study developed significant depressive symptoms preoperatively. The magnitude of depressive symptoms is inversely correlated to body mass index. The number of days

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of hospitalization before surgery was found to be an important factor for the development of postoperative cardiac events.

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A-183

Does outcome after adult ascending aortic surgery requiring deep hypothermic circulatory arrest (DHCA) depend on emergency status?

J.G.T. Augoustides, J. Weiner, D. Pinchasik, S. Raman, S. Fulford, D.R. Jobes, J.E. Bavaria

Department of Anesthesia and Department of Cardiothoracic Surgery, Hospital of the University of Pennsylvania, Philadelphia, USA

Background and Goal of Study: Adult ascending aortic surgery with deep hypothermic circulatory arrest (DHCA) is emergent (acute type A dissection: ATAD) or elective (chronic Type A dissection, and/or aneursym: CTADA). Although ATAD is associated with significant mortality[1], our integrated perioperative management significantly improved mortality and neurological outcome in ATAD[2]. The goal of this study was to assess whether integrated DHCA management including aprotinin influences outcome risk for emergent DHCA as compared to elective DHCA.

Materials and Methods: With IRB approval, a retrospective chart review was undertaken. The study cohort totaled 92 patients who in 2000/1 underwent ascending aortic surgery requiring DHCA. The data of interest were archived in a database constructed with *Microsoft Access*. Statistical analysis was performed with *Stata.*

Results: ATAD constituted 28% of the study cohort and had a 100% exposure rate to aprotinin. CTADA constituted 72% of the study cohort and had a 100% exposure to antifibrinolytic (62% aprotinin; 38% aminocaproic acid).

The groups were equivalent ($p > .05$) for age, gender, weight, reoperations, initial hematocrit, initial coagulation profile, initial serum creatinine, and CPB time.

DHCA time was significantly prolonged ($p > .05$) in the ATAD group due to more complex aortic arch reconstruction.

Important clinical outcomes were not significantly different ($p > .05$): mortality, stroke, new dialysis, renal dysfunction, bleeding, mediastinal re-exploration within 24 hours, and blood component (other than RBC) transfusion. RBC transfusion was only slightly higher in the ATAD group (1-2 RBC units per patient).

Conclusions: Integrated DHCA management including aggressive application of aprotinin appears to homogenize outcome risk between emergent DHCA and elective DHCA.

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A-184

Have blood pressure and haematocrit influence on free flaps survival in head and neck reconstructive surgery?

M. Milic, S. Gasparovic

Department of Anaesthesia and Intensive Care, University Hospital Dubrava, Zagreb, Croatia

Background and Goal of Study: Anaesthesia for free flap reconstructive head and neck surgery in patients with neoplastic disease presents several challenges to the anesthetist. Hypoperfusion and necrosis remain most important clinical problems in reconstructive surgery. Maintenance of blood flow to implanted free flaps may be affected by hypovolemia, hypothermia, periferal vasoconstriction, reduced cardiac output, hypoxia.

Materials and Methods: Over 5 year period, in 76 patients with malignant tumors after resection, reconstruction of defects are made with free flaps.The mean age was 55 y mainly men(63). In retrospective study we analized influence of systemic pressure and haematocrit on free flap survival.Patient were divided in two groups for pressure (border value was 17/11 kPa) and for haematocrit (border value 0,33) during procedure and in following 48 h.

Results and Discussions: 87% of flaps were succesfull (11 was failed). Mean preoperative sistolic pressure was 18,8 kPa. Patients in I group have average value of pressure 16,3/10 kPa (47% of total number) and second group with average pressure of 19,7/12 kPa (53%), and in group with smaller value of pressure we have higher incidence of failed flaps (8,3%). In the same way we analized value of haematocrit : I group has haematocrit 0,29 (50% of total number) and II group has 0,37, and in both group the incidence of failed flaps was the same. Eleven patients have pressure above 17/11 kPa and haematocrit below 0,33 and all flaps were succesfull.

Conclusion: Blood pressure has influence on survival and try to control haematocrit around 0,33.

A-185

Cardiac pacing in patients subjected to liver transplant for familial amyloidosis Met30 – evaluation of a 10-year experience with 143 patients

J.S. Viana, A. Romero, H. Vieira, S. Neves, C. Bento, C. Seco, R. Perdigoto, J. Ferrão, L. Elvas, L.A. Providência, A.L. Furtado

Departments of Anaesthesiology, Cardiology and Transplantation, Coimbra University Hospital, Coimbra, Portugal

Background and Aim: Familial Amyloid Polyneuropathy (FAP) may occur with severe rhythm and conduction disturbances. The decision to implant a pacemaker (PM) before liver transplant (LT) in FAP patients (pts) is a controversial subject. In some centers all FAP pts undergo permanent PM implantation, while in others general criteria for cardiac pacing are also applied to FAP pts (1,2). Our aim was to evaluate the adequacy of our guidelines for PM implantation in FAP pts before LT and also to evaluate if the need for a PM can predict a worse outcome in FAP pts undergoing LT.

Materials and Methods: We have studied all the 143 FAP Methionine 30 (Met30) pts that underwent a first LT in our institution, between 1992 and 2002, with a mean follow-up period of 53 ± 33 months. In those pts, a PM was implanted if there was any record of conduction disturbance (even if transient and not symptomatic) or any history of syncope (except if clearly non-cardiac).

Actuarial survival was calculated by Kaplan-Meyer curves, compared by Cox regression. An independent sample t-test was used when appropriated. Data expressed as mean ± SD.

Results and Discussion: A permanent PM was implanted before LT in 23 FAP pts (16.1% of pts), with age of 39.3 ± 8.1 y and weight of 56.9 ± 11.0 kg. The remaining 120 pts were thought not to have indication for PM (age of 34.7 ± 7.1 y − $p = 0.007$; mean weight of 58.2 ± 11.9 kg − $p = 0.63$). No serious bradyarrhythmias or conduction disturbances were reported during LT in FAP pts without PM. One-year survival was higher in pts not requiring a PM (92.6% *versus* 77.3%; $p = 0.014$). Peroperative cardiac deaths were reported in two cases, both in pts with permanent PM.

Conclusions: The large number of pts safely transplanted without PM suggests that its implantation in all FAP pts before LT is not necessary. A previous report from a Swedish group (26 pts) also supports our findings (1).

This study clearly suggests for the first time that, besides malnourishment, preoperative rhythm and conduction disturbances requiring PM implantation should be considered factors of worst prognosis in FAP Met30 pts and that ideally LT should occur before their development.

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A-186

Volatile agents during tympanoplasty: Combination with remifentanil for controlled hypotension

D. Dal, V. Celiker, E. Ozer, E. Basgul, M.A. Salman, U. Aypar

Department of Anesthesiology and Reanimation, Hacettepe University, Faculty of Medicine, Ankara, Turkey

Background and Goal of Study: Controlled hypotension is frequently used for obtaining better exposure during middle ear microsurgery. We aimed to compare the effects of different volatile anesthetics used in combination with remifentanil on hemodynamics and surgical condition in patients undergoing tympanoplasty.

Materials and Methods: After ethics committee approval, 39 patients aged 17–50 in ASA Class I–III and scheduled for tympanoplasty were randomly allocated into three groups. Anesthesia was induced with propofol 2 mg kg^{-1} and vecuronium 0.1 mg kg^{-1}. Desflurane 8%, isoflurane 1.5% and sevoflurane 2% were used respectively in Groups D, I and S for maintenance. All groups received remifentanil 0.2–0.5 μg kg^{-1} min^{-1}. Nitroglycerine infusion was initiated when aimed pressures (65–70 mmHg) could not be achieved. Hemodynamic parameters and nitro-glycerine requirements were recorded. Surgical field condition was evaluated by the surgeon blinded to the study by using a category scale(1). Repeated measures ANOVA, Kruskal-Wallis and Mann–WhitneyU tests were used. The study had 87% power to detect a difference of 20% in blood pressure with an alpha error of 0.05.

Results and Discussion: There were no differences among groups in demographic characteristics. There were significant decreases in blood pressures within time in all groups. ($p < 0.001$) but no difference was found among groups ($P = 0{,}360$). There was no difference among groups in surgical field

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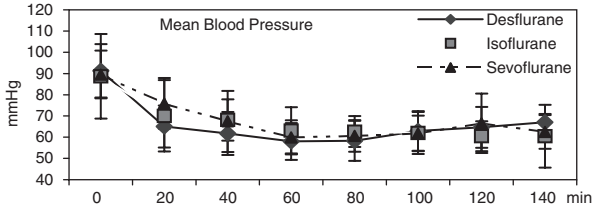
condition (p = 0,573). Heart rate was lower in Group S, compared to Group I. One patient in Group D and two patients in Group I required nitroglycerine.



Conclusion: Desflurane, isoflurane and sevoflurane used together with remifentanil infusion provide similar hemodynamics and appropriate surgical field condition. All of these agents are suitable for controlled hypotension in middle ear microsurgery combined with remifentanil.

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A-188

General anaesthesia, combined general and high thoracic epidural anaesthesia, or high thoracic epidural anaesthesia alone for off-pump coronary artery bypass grafting

P. Kessler, T. Aybek[1], V. Lischke, D. Bremerich, S. Dogan[1], G. Neidhard, C. Byhahn

Center of Anaesthesiology and [1]Cardiovascular Surgery, J.W.Goethe-University, Frankfurt, Germany

Background and Goal of Study: Worldwide, thoracic epidural anaesthesia (TEA) is increasingly administered as an adjunct to general anaesthesia (GA) in patients undergoing off-pump coronary artery bypass grafting surgery (CABG) and was already used as a sole anaesthetic technique in conscious patients (1). We compared GA, combined GA + TEA, and TEA alone in patients scheduled for CABG.

Methods and Methods: Following institutional ethic committee approval and written informed consent, 90 patients underwent off-pump CABG. Intraoperatively, propofol and remifentanil were administered (GA, n = 30), combined with an epidural infusion with ropivacaine 0.75% plus sufentanil 1.5 μg/mL (GA + TEA, n = 30), or epidural ropivacaine 0.75% plus sufentanil 1.5 μg/mL alone (TEA, n = 30). The epidural catheter was inserted at T1/2 or T2/3. Postoperative pain relief was achieved with either iv opioids (GA), or epidural ropivacaine 0.16% plus sufentanil 1 μg/mL (GA + TEA, TEA), respectively.

Results and Discussions: Four patients (GA n = 2, GA + TEA n = 2) who required unplanned cardiopulmonary bypass, and 4 patients in the TEA group who underwent unexpected intubation due to pneumothorax (n = 2), phrenic nerve palsy, or incomplete analgesia were excluded from further analysis. Heart rate decreased significantly with both, GA + TEA and TEA. Vasopressor requirements were significantly reduced with TEA (n = 4) and GA + TEA (n = 5; GA: n = 16, $P < 0.05$). Postoperative pain scores (VAS, 0–100 mm) were lowest after TEA alone, < GA + TEA and < GA alone ($P < 0.05$). There were no differences in patients' overall satisfaction.

Conclusion: Based on our data, GA + TEA was the most comprehensive anaesthetic technique. It allows for revascularization of any coronary artery, provides haemodynamic stability intraoperatively and reliable postoperative pain relief. GA alone should be used whenever contraindications for TEA apply. The use of TEA alone should be restricted to selected patients undergoing CABG surgery.

Reference:

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A-189

Volatile anesthetics preserve myocardial function in coronary surgery patients

S. Cromheecke, P. ten Broecke, E. Mertens, S. De Hert

Department of Anesthesiology, University Hospital Antwerp, Edegem, Belgium

Background and Goal of the Study: Anesthetic agents may protect against myocardial ischemia and reperfusion injury. The present study investigated the effects of propofol, desflurane and sevoflurane on recovery of myocardial function after coronary surgery.

Materials and Methods: 30 patients were randomly assigned to be anesthesized with either propofol, desflurane or sevoflurane. Cardiac function was assessed with a pulmonary artery catheter. Peroperatively, a high-fidelity pressure catheter was positioned in the left and right atrium and ventricle. Response to increased cardiac load, obtained by leg elevation, was assessed before and after cardiopulmonary bypass (CPB). Effects on contraction were evaluated by analysis of changes in dP/dt_{max}. Effects on relaxation was assessed by analysis of the load-dependence of myocardial relaxation (R: slope of the relation between time constant τ of isovolumic relaxation and end-systolic pressure). Postoperative levels of cardiac troponin I were followed during 36 hours. Data were compared using analysis of variance for repeated measurements and Kruskal-Wallis test. Statistical significance was accepted at $p < 0.05$. Data are expressed as means ± SD.

Results: After CPB, cardiac index was significantly lower in patients under propofol anesthesia (2.38 ± 0.17 l/min vs 2.98 ± 0.29 l/min for the desflurane group and 3.18 ± 0.21 l/min for the sevoflurane group). Leg elevation decreased dP/dt_{max} in the propofol group (−6.6 ± 1.8%), whereas the response in the desflurane (−1.1 ± 1.4%) and the sevoflurane group (1.2 ± 1.0%) was comparable to the response before CPB. Load-dependence of LV pressure fall was increased in the propofol group but not in the desflurane and sevoflurane group. Troponin I levels throughout the observation period were significantly higher in the propofol group.

Conclusion: Sevoflurane and desflurane preserved LV function after CPB. These data suggested a cardioprotective effect of desflurane and sevoflurane during coronary artery surgery.

References:

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A-190

Experimental model to study atrial tachyarrhythmias: comparison between Thiopental versus Propofol

M. Zaballos, J. Almemdral, M.J. Anadón, P. Gonzalaez, J. Navia

Department of Anaesthesia, Gregorio Marañón Hospital, Madrid, Spain

Background and Goal of Study: Animal models are important tools in the study of atrial tachyarrhythmias (AT). A requirement is the provision of stable, long lasting anaesthesia, with minimal depression of the circulatory or respiratory systems. The aim of the present study is to develop a closed-chest porcine model with the least possible instrumentation, in which AT are facilitated by an infusion of ethanol and to compare the effectiveness of two anaesthetics: Thiopental (T) and Propofol (P) regarding to stability of the experimental model and the ease to induce atrial tachyarrhythmias.

Material and Methods: 30 large white pigs were premedicated with ketamine and randomly assigned to undergo heavy sedation with T (4 mg/K for induction followed by 0.09–0.3 mg/K/min) or P (2 mg/K for induction followed by 3 mg/K/h). Then, a right atrial electrical stimulation protocol with up to three extrastimuli and burst pacing was performed on the baseline and during a continuous ethanol infusion (mean venous ethanol concentration 2.6 ± 0,8 g/L). Eight pigs also received anaesthetics and saline instead of ethanol and served as control group. Statistical test used: t-Student, X2.

Results and Discussion: The control group showed a stability regarding instrumentation, anaesthesia, and time. In the experimental group there were not SD during baseline. Data shown in the Table were obtained during ethanol infusion.

	Died	% Int.	L.L.A.	AF	AFL
Thiopental	4	62	7%	81%	19%
Propopol	2	39	38%	76%	76%
P	NS	NS	0.03	NS	0.001

Values reported as mean ± SD. %Int: percentage of intubation animals. LLA: long lasting arrhythmias (lasting ⩾ 300s). AF:atrial fibrillation, AFL: atrial flutter.

Conclusion: There is a trend towards a better respiratory stability with propofol than with thiopental in this model. Propofol compared to thiopental increased the propensity to long lasting atrial arrhythmias. AFL was statistically associated with Propofol. This closed-chest porcine model, using propofol as the anaesthetic agent, seems to be adequate to study AT.

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Prior sevoflurane exposure preserves vascular function and myocardium differentially after prolonged ischemia

L.G. Kevin, M.L. Riess, E. Novalija, A.K. Camara, D.F. Stowe

Department of Anesthesiology, Medical College of Wisconsin, Milwaukee, WI USA

Background and Goal of Study: Anesthetic preconditioning (APC) has been shown to protect myocardium and coronary vasculature from the

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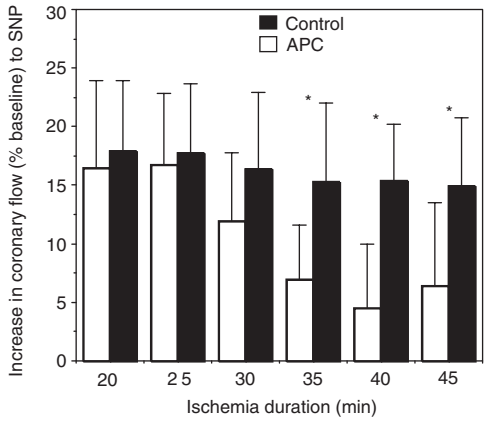
effects of ischemia and reperfusion. However, in intact heart models improved vascular function may largely reflect decreased extravascular compression from surrounding myocardium, rather than a direct effect on the vasculature. In this study, we examined the direct protective effects of prior sevoflurane exposure on the coronary vasculature in intact hearts.

Materials and Methods: Guinea pig Langendorff hearts were perfused in crystalloid buffer. Hearts underwent preconditioning (two pulses of sevoflurane 0.6 mM for 5 min) (APC) or no treatment (Control), before global ischemia and 120 min reperfusion. Ischemia durations were 20, 25, 30, 35, 40 and 45 min (n = 8/ischemia duration/treatment). Vasodilator responses to sodium nitroprusside (SNP) and bradykinin (BK) were tested at 60 and 90 min reperfusion.

Results and Discussions: Coronary flow, and responses to SNP (Figure) and BK, were improved by APC for ischemia durations >30 min. APC decreased infarction after ischemia of durations 25–40 min, but failed to decrease infarction after 45 min ischemia.



Conclusion: APC fails to protect the myocardium against prolonged ischemia but the vasculature remains protected.

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Postoperatory arrhythmias during thoracic surgery and changes in right ventricle function

I. Mourelle, J. Gomez-Arnau, R. Segovia, J. Fernandez-Guisasola, M. Varela, R. Iranzo

Department of Anesthesiology, Clinica puerta de Hierro, Madrid, Spain

Background and Goal of Study: Intraoperative and postoperative supraventricular arrhythmias are the most frequent complication of thoracic surgical procedures. The present prospective study looks for correlation between right ventricle dysfunction and perioperatory arrhythmias in major thoracic surgery.

Materials and Methods: After informed consent was obtained, 18 patients who underwent thoracic surgery (12 lobectomies and 6 pneumonectomies) were included in the study. Perioperative hemodynamic and electrocardiographic data were recorded with right ventricle Swan-Ganz catheter and Holter monitorization. Collected data were analyzed with multiway analysis of variance and the chi-square test. A value of $p < 0,05$ was considered significant.

Results and Discussions: The incidence of intraoperative supraventricular arrhythmias was 38.8%, (lobectomy 41.6% and pneumonectomy 33.3%). A higher decrease of the right ventricle ejection fraction during single lung ventilation occurred in patients who developed arrhythmias ($p < 0,05$). The 33,3% of patients developed postoperative supraventricular arrhythmias (66,6% after pneumonectomy and 16.6% after lobectomy ($p < 0.05$). A higher decrease of baseline right ventricle ejection fraction values during the immediate postoperative period was found in patients who developed arrhythmias: from 38.8% to 30%, ($p < 0.05$) vs. (no arrhythmias) 37.9% to 34%.

Conclusion(s): The incidence of intraoperatory arrhythmias was superior in the lobectomy group: an explanation to this finding could be a worse basal preoperatory respiratory function in this group (therefore, a worse basal right ventricle function). The postoperative arrhythmias´ incidence was higher in the pneumonectomy group. A higher right ventricle ejection fraction decrease was detected in patients with perioperatory arrhythmias.

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A-194

Perioperative endocrine stress response under propofol TCI/remifentanil anaesthesia for fast-track CABG surgery with CPB

W. Gozdzik*, P.Harbut*, G. Durek*, P. Maslanka*, W. Kustrzycki#, H. Nowosad#, A. Kübler*

**Department of Anaesthesiology and Inensive Therapy; #Department of Cardiac Surgery, Wroclaw University of Medicine, Wroclaw, Poland*

Background: Remifentanil/propofol could be an ideal anaesthesia for fast-track CABG surgery. The question is whether the use of such a short acting agents can effectively suppress perioperative stress response.

Materials and Methods: Prospective, randomised study of 24 adults scheduled for elective CABG with CPB. **Gr1** n = 12: propofol TCI/remifentanil. **Gr2** n = 12: midazolam/fentanyl/sevoflurane. Plasma samples for growth hormone (GH ng/ml), prolactin (PR ng/ml), cortisol (CO μg/ml), adrenaline (AD pg/ml), noradrenaline (NO pg/ml) were collected: T1-evening before, T2-before induction, T3-before CPB, T4–30 min. after CPB, T5, T6, T7 4, 12, 24 hours after surgery. Extubation time was registered.

Results: Data are presented in the table as mean (±SD).

G1	T1	T2	T3	T4	T5	T6	T7
GH	0.71	0.55	0.44	2.43	1.25	1.34	0.78
	(0.89)	(0.5)	(0.41)	(2.63)	(0.77)	(0.73)	(0.76)
PR	8.9	22.9	48.2	28.3	14.2	7.8	12.4
	(5)	(11)	(12)	(16)	(3)	(6)	(9)
CO	6.1	11.6	8.8	11.9	25.2	24.9	28.5
	(3)	(4)	(7)	(4)	(16)	(3)	(6)
AD	221.1	204.9	168.3	335.3	222.8	199.5	257.1
	(35)	(76)	(57)	(92)	(119)	(50)	(109)
NO	711.0	589.2	571.3	1048.4	954.1	961.4	1012.3
	(409)	(236)	(372)	(357)	(406)	(678)	(669)
G2							
GH	0.74	0.36	0.31	2.56	**2.38***	1.29	1.18
	(1)	(0.2)	(0.3)	(3.3)	**(1.2)**	(1.1)	(1.7)
PR	5.5	20.5	31.5	21.2	11.5	14.4	13.4
	(3)	(11)	(11)	(7)	(7)	(6)	(12)
CO	7.3	9.9	8.7	31.6	37.4	38.3	30.2
	(4)	(5)	(3)	(7)	(13)	(10)	(9)
AD	252.2	226.8	172.4	362.6	244.8	197.0	272.0
	(47)	(90)	(58)	(144)	(49)	(40)	(40)
NO	758.8	621.1	678.7	1373.2	907.7	846.0	1114.2
	(275)	(240)	(510)	(440)	(337)	(227)	(610)

Extubation time: G1 5.1 (1.9), G2 7.4* (2.0) h. *$p < 0.05$.

Conclusion: Propofol TCI/remifentanil when compared to midazolam/fentanyl/sevoflurane anaesthesia for CABG surgery shortens the early postoperative period with no influence on endocrine stress response profile.

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2. Roth-Isigkeit A.: J. of Endocr. Investig. 1998, 21:12–19.

A-195

Metabolic disturbance induced by high dose Diprivan® in an isolated perfused rat liver model

V. Nuyens, J. Boogaerts, F. Legros, M. Stadler

Department of Anaesthesiology, University Hospital Centre of Charleroi, Charleroi, Belgium

Background and Goal of the Study: Hepatic effect of propofol (prop) remains obscure, since it does not disturb transaminase release *in-vivo* but induces reversible subclinical disturbance (1). The aim was to study the biological effect of low and high dosage of Diprivan® (Dip) in an *ex vivo* perfused rat liver during ischaemia and reperfusion.

Materials and Methods: Female Wistar rats were anaesthetised (Nembutal®). The portal vein was cannulated, the liver removed and immediately perfused in a closed *ex vivo* system with HBSS supplemented with insulin, HEPES, O_2 at 37°C at a flow rate of 5 ml/min (pressure ± 12 cm H_2O) at 37°C. The experiment consists of three phases: perfusion for 15 min, ischaemia for 60 min, and reperfusion during 60 min. Rats were divided into 5 groups (n = 5): Control group HBSS (C), low dose (4 μg/ml) (LDip) and high dose (40 μg/ml) (HDip) of Diprivan®, low dose (LI) and high dose (HI) of Intralipid® equivalent to the lipid amount in Dip. Lactate (mg/dl), ALT, AST, LDH (IU/l) were analysed in perfusate samples.

Mean ± SD. ANOVA one way.

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Results and Discussion: High amount of Intralipid did not alter enzyme release. High dose of Dip, although demonstrated to have a neuroprotective effect (2), seems to release a high level of intracellular enzymes indicating an hepatocyte toxicity. Pharmacological dose of Dip could protect from changes in cell membrane permeation. Lipid diet decreased the production of lactate compared with C group. A shift of the metabolism to the lipid β-oxydation should be further investigated.

Table. Values measured at the end of the experiment.

		Low dose		High dose	
	C	LI	LDip	HI	HDip
Lact	60 ± 8	39 ± 15[a]	39 ± 5[a]	16 ± 12[a]	38 ± 10[a,c]
AST	120 ± 25	250 ± 68	80 ± 34[c]	258 ± 66[a]	608 ± 335[a,b]
ALT	74 ± 27	140 ± 87	48 ± 29	90 ± 52	343 ± 285[a]
LDH	1153 ± 325	1536 ± 607	890 ± 431[c]	1392 ± 244	2744 ± 571[a,b,c]

$P < 0.05$; [a] C *vs* others; [b] low *vs* high dose; [c] I *vs* Dip

Conclusion: High dose of Dip is hepatotoxic, whereas pharmacologic concentration might have a protective effect. Lipid diet decreases the release of lactate.

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A-196

Emergency intraaortic balloon counterpulsation during off-pump coronary artery bypass operations: Prevention of exposure to cardio-pulmonary bypass

C.K. Hofer, R. Tavakoli[#], A. Rist, M. Maloigne, M. Genoni[#], A. Zollinger

[#]*Institute of Anaesthesiology & Division of Cardiac surgery; Triemli City Hospital, Zurich, Switzerland*

Background and Goal of Study: Elective use of intraaortic balloon counterpulsation [IABP] has shown to improve haemodynamic stability during off-pump coronary artery bypass grafting [OPCAB] in 'high-risk' patients (e.g. unstable angina, left ventricular dysfunction)[1,2]. We report the safe and successful intraoperative use of IABP on an emergency basis in a series of 4 "low-risk" OPCAB patients avoiding cardio-pulmonary bypass.

Materials and Methods: Observational data base analysis of all 249 patients undergoing OPCAB at the Triemli City Hospital between 01.11.01 and 31.10.02 was performed and charts of the selected 4 patients were reviewed. Data are presented as mean ± standard deviation.

Results and Discussions: IABP was used in 35 patients undergoing OPCABG, in 4 patients (11.4%) on an intraoperative emergency basis. These 4 patients (gender: female/male = 3/1, ASA III, mean age = 73.5 ± 2.5, BMI = 28.3 ± 4.3) had multi-vessel disease, but no instable angina or impaired left ventricular function (ejection fraction [EF] = 59 ± 14%) and underwent elective OPCAB with 3–4 graft anastomoses. After grafting of the left anterior descending coronary artery, the heart was displaced and all patients developed haemodynamic instability (decrease of mean arterial pressure from 76 ± 5 to 39 ± 11 mmHg, increase of mean pulmonary artery pressure from 24 ± 3 to 59 ± 4 mmHg) due to development of severe mitral valve insufficiency and impaired left ventricular function. Heart displacement was released, but haemodynamics did not improve despite an increased use of catecholamines (dobutamine: 425 ± 96 mcg/min, norepinephrine: 13 ± 2 mcg/min). IABP was inserted and haemodynamics could be stabilized in 9 ± 4 min. Further displacement and grafting of the posterior vessels was uneventful. In the postoperative period we observed neither myocardial infarction nor neurologic dysfunction in any of these 4 patients.

Conclusion: IABP can safely be used on an emergency basis during OPCAB in patients with acute intraoperative cardiac dysfunction and thus can prevent the exposure to cardio-pulmonary bypass.

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A-197

Influence of temperature on calcium-dependent myocardial contractility

Goetzenich, Schroth, Schultz, Autschbach, Rossaint, Buhre

Department of Anästhesiologie, Klinikum der RWTH Aachen, Aachen, Germany

Background and Goal of Study: The inotropic effect of calcium at different temperatures is unknown in human myocardium. Therefore, we studied the positive inotropic effects of calcium during normo- and hypothermia in human atrial trabeculae in comparison to rabbit ventricular myocardium.

Materials and Methods: After ethical approval and written informed consent, 30 human atrial muscle stripes from 17 patients undergoing cardiac surgery were obtained. In addition, 32 rabbit muscle stripes from 6 male New Zealand White rabbits were studied. The trabeculae were stimulated at a frequency of 1 Hz. At 37°, 34° or 31°C the calcium concentration was increased stepwise from 2.5 to 10 mM. Maximum force of contraction (F), time to 50% of contraction ($T_{sys}50$) and time to 50% relaxation ($T_{dia}50$) were continuously recorded. Dates are presented as percent change ± SEM. The statistical analysis was performed by ANOVA.

Results and Discussions: In both groups, the response to calcium stimulation is diminished by hypothermia.

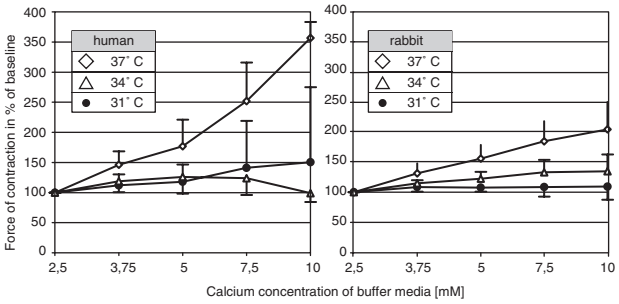

Fig. 1. Calcium dependent force of contraction in atrial and ventricular myocardium

Shortening of $T_{sys}50$ and lengthening of $T_{dia}50$ by increased calcium concentrations was independent from temperature.

Conclusion: In rabbit ventricular myocardium, mild to moderate hypothermia caused a diminished inotropic effect of calcium. The positive inotropic effect of Ca was completely abolished in human atrial tissue. This effect should be reconsidered in clinical anaesthesia when inotropics are administered that act on the myocardial calcium homeostasis.

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Haemoviscoelastography as a perioperative measure of Clexane anticoagulation therapy

O.A. Tarabrin, A.V. Simovskykh, E.O. Codrul, A.A. Simovskykh, V.I. Kuzmenko

Department of Anesthesiology and Intensive Care, Odessa Medical University, Kiev, Ukraine

Background and Goal of Study: Patients undergoing open prostatectomy are at risk for venous thromboembolic complications for up to three weeks postoperatively. We evaluated the efficacy and safety of postoperative regimen of Clexane. Currently, there is no convenient test to measure the degree of anticoagulation from LMWH.

Materials and Methods: We carried out a single-centre, prospective, randomized, double-blind trial with the aim of assessing the efficacy of postoperative prophylactic treatment. This prospective study examines the relationship of haemoviscoelastography (HVG), a viscoelastic test, measures clot formation and includes information on the cellular, as well as the plasmatic coagulation, system and serum anti-Xa concentration in patients treated with Clexane. 116 patients scheduled for open prostatectomy using epidural anesthesia were enrolled. Whole blood samples were obtained for haemoviscoelastography (HVG), activated clotting time, and anti-Xa level analyses at each of the four time intervals.

Results and Discussions: At the four sample intervals, the r time (mean ± SEM) (5,91 ± 0,65; 7,5 ± 0,25; 9,5 ± 0,55 min) and the k time (5,8 ± 0,1; 8,2 ± 0,27; ± 9,14 ± 0,2 min) of the HVG were significantly correlated with the expected peak and trough levels of LMWH and serum anti-Xa levels ($p < 0.05$). After fifth dose immediately, HVG r times exceeded the normal range in 29 of 116 patients (25%). Prolongation of r time and k time on postoperative day 5 may indicate an exaggerated response to LMWH. Lowfrequency haemoviscoelastography is a test that could potentially correlate with the degree of anticoagulation produced by low molecular weight heparin clexane.

Conclusion(s): Lowfrequency haemoviscoelastography, a viscoelastic test, measures clot formation and includes information on the cellular, as well as the plasmatic coagulation system is a test that could potentially correlate with

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the degree of anticoagulation produced by low molecular weight heparin. The r time from the haemoviscogram correlates with serum anti-Xa concentration. HVG is a convenient test to measure the degree of anticoagulation from LMWH.

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A-199

Methylene blues in treatment haemodynamic disorders due systemic inflammatory response in cardiac surgery

V.N. Poptsov, I.A. Kozlov

Department of Anesthesiology, Research Institute of Transplantology and Artificial Organs, Intensive Care Unit, Moscow, Russia

Background and Goal of Study: Systemic inflammatory response leads to endogenous nitric oxyde (NO) overproduction during cardiac surgery with cardiopulmonary bypass (CPB) [1]. Intravenous methylene blue (MB), an inhibitor of guanylate cyclase and NO activity/production, is useful method of systemic vasoplegia treatment [2]. The purpose of this study was to evaluate the efficacy of intravenous MB for post-CPB systemic vasoplegia treatment.
Material and Methods: 45 patients undergoing CPB were studied. Systemic vasoplegia was defined as MAP < 70 mmHg, CI $> 3{,}0$ l/min/m^2, SVRI < 1600 dyn sec cm^{-5} m^2, noradrenalin > 100 ng/kg/min. MB was given as a bolus of 2 mg/kg and 120 minutes later as a continuous infusion (0,5–1,0–1,5–2,0 mg/kg/h) in 4-hour period. Blood levels (ng/ml) of cytokines were analyzed before bolus MB. Haemodynamic data and noradrenalin doses were registered at baseline and after MB infusion. Data shown as mean $\pm$ SE with p-values <0.05 considered statistically significant.
Results and Discussion: Systemic vasoplegia was noted between 15–128 (86 ± 13) min after CPB. Blood level of IL-1β was 206 ± 61 (normal range $\leqslant 50$), IL-1RA – 972 ± 118 ($\leqslant 50$), IL-6 – 254 ± 39 ($\leqslant 30$), IL-8 – 136 ± 14 ($\leqslant 30$), TNF-α - 90 ± 33 ($\leqslant 50$), IF-γ - 252 ± 54 (128–256). The results are shown in the table (* – $p < 0{,}05$):

	baseline	after infusion MB
MAP, mmHg	$62{,}0 \pm 1{,}7$	$86{,}1 \pm 2{,}6$*
CI, l/min/m^2	$3{,}9 \pm 0{,}3$	$3{,}2 \pm 0{,}1$*
SVRI, dyn sec cm^{-5} m^2	1095 ± 57	1916 ± 91*
noradrenalin, ng/kg/min	342 ± 52	–

MAP and SVRI normalization by intravenous MB indicate that endothelial dysfunction and NO overproduction due systemic inflammatory response is potential mechanism of post-CPD systemic vasoplegia.
Conclusion: MB is effective in haemodynamic disorders in post-CPB systemic inflammatory response treatment .

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A-200

Ultra-fast-track anesthesia in OPCABG: TEA versus PCA: a prospective comparison

J. Fortier, J.L. Choiniere, F. Basile, I. Prieto, T.M. Hemmerling

Departments of Anesthesiology and Cardiac Surgery, Université de Montréal, Montréal, Canada

Background and Goal of Study: This study compared postoperative analgesia of high thoracic analgesia (TEA) versus PCA morphine after immediate extubation in off-pump cardiac surgery (OPCABG).
Materials and Methods: The study was designed as a prospective audit of 60 patients undergoing OPCABG. Anesthesia was either an anesthesia using sevoflurane titrated by BIS and a continuous thoracic epidural analgesia ($N = 38$, TEA group) or a modified balanced anesthesia using sevoflurane/fentanyl boli (<15 μg/kg total, PCA group) in patients on either low molecular heparine or intravenous heparine ($N = 22$). Postoperative analgesia during the first 48 hours was achieved by either thoracic epidural analgesia (TEA, bupivacaine 0.125%) or patient controlled application of morphine (PCA, 1 mg, lockout period: 6 min). Anthropometric data, success of extubation, postoperative hemodynamic and respiratory parameters and pain scores are presented as means (SD) and compared between the two groups using t-test ($P < 0.05$).
Results and Discussions: The anthropometric data and surgery-related parameters (concomitant disease, ejection fraction, number of grafts, ischemic time) were not different between the two groups. Time to extubation, first P_{O2} and P_{CO2} ($F_{iO2} = 50\%$) after extubation were 16 (11) and 14 (8) min, 159 (64) mmHg and 142 (44) mmHg, 45 (10) mmHg and 49 (8) mmHg in the TEA and PCA groups, respectively and not significantly different. Pain scores immediately postoperative were low in both groups (1.8 versus 2.7), significantly lower in the TEA group than in the PCA group up to 48 h after surgery.
Conclusion(s): Ultra-Fast-Track anaesthesia can be achieved with either TEA based or a conventional low dose fentanyl balanced anesthesia using sevoflurane. Lower postoperative pain scores and better side effect profile, however, favor TEA as a technique when there are no contraindications for its use.

A-201

Operating room extubation in simple and combined aortic valve surgery: a first experience of 20 patients

J.D. Fortier, J.L. Choiniere, F. Basile, I. Prieto, T.M. Hemmerling

Departments of Anesthesiology and Cardiac Surgery, Université de Montréal, Montréal, Canada

Background and Goal of Study: This study presents a first series of 20 patients where operating room extubation was achieved in simple (aortic valve replacement only) or combined aortic valve surgery using anesthesia based on high thoracic epidural analgesia.
Materials and Methods: The study was designed as a prospective audit of 20 patients undergoing aortic valve surgery. The goal was to immediately extubate the patients in the OR. Anesthesia was maintained using sevoflurane titrated by BIS and a continuous thoracic epidural analgesia (TEA, installed at arrival in the OR). Postoperative analgesia during the first 48 h was achieved by TEA (bupivacaine 0.125%). Anthropometric data, success of extubation, postoperative hemodynamic and respiratory parameters and pain scores are presented as means (SD).
Results and Discussions: All 20 patients undergoing simple aortic valve surgery ($N = 12$), aortic valve surgery and CABG ($N = 5$), Bentall procedure ($N = 2$) and redo aortic valve replacement ($N = 1$) could be extubated within 15 min after surgery. First P_{O2} and P_{CO2} ($F_{iO2} = 50\%$) after extubation were 153 (49) and 47 (5) mmHg, respectively. Pain scores postoperatively were low with 1.6 (2), 1.5 (1.6), 1 (1.5), 1 (0.9) immediately, 6 h, 24 h and 48 h after surgery, respectively. There were no complications. All patients where a mechanic valve was implanted had the epidural catheter removed after surgery with INR lower than 1.8.
Conclusion(s): Our results indicate that immediate extubation in the OR (Ultra-Fast-Track anesthesia) can be achieved in simple and combined aortic valve surgery using TEA based anesthesia.

A-203

Hemodynamics in patients undergoing abdominal aortic laparoscopic surgery

V. Joly, P. Alfonsi, B. Guignard, M. Chauvin

Department of anesthesia and intensive care, Hopital Ambroise Paré, Boulogne, France

Background and Goal of Study: Hemodynamic changes during aortic cross clamping are known. It is also known that peritoneal insufflation during laparoscopic surgery is associated with cardiovascular impairments. Total abdominal aortic laparoscopic surgery is a recent technic. The aim of this open prospective study was to evaluate hemodynamics during pneumoperiteum and cross clamping of infra-renal aorta.
Materials and Methods: After approval from our institutional Ethics Committee, 12 consecutive patients undergoing elective abdominal aortic reconstruction, were included. General anaesthesia was maintained with sufentanil and desflurane. Invasive mean arterial pressure (MAP), heart rate (HR), cardiac index (CI) measured by continuous esophageal aortic blood flow Doppler (Cardio Q) were continuously recorded. After baseline value record (control), patient was turned on the right lateral position and pneumoperitoneum (P14) was inflated to 14 mmHg. After infra-renal aortic cross clamping (P14 + C), pneumoperitoneum was deflated (P0 + C) and, then, progressively reincreased to 7 (P7 + C) and 14 mmHg (P14 + C'). Data were recorded after 5 minutes at each step. Results are expressed as mean $\pm$ standard deviation. Statistical analysis was performed using ANOVA (Statistical significance was considered at $P < 0.05$).

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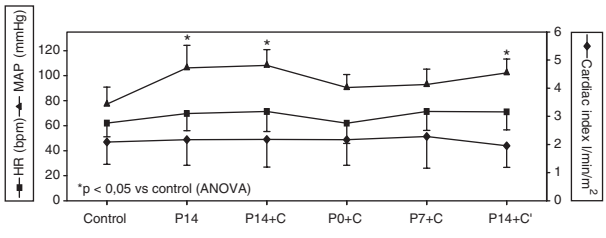

Results and Discussions: At P14, MAP and HR were significantly increased by 39 ± 22% and 13 ± 12%, respectively compared with baseline. MAP, HR and cardiac index (CI) were not modified by additive cross clamping (P14 + C). At P0 + C, MAP decreased to 22 ± 26% and HR to 10 ± 28% compared with P14 + C. After peritoneal reinsufflation MAP values were similar to these recorded at the first P14 + C.
Conclusion: During total abdominal aortic laparoscopic surgery, hemodynamic changes are principally due to the pneumoperitoneum.

A-204

Intraoperative stress response: anaesthesia with sevoflurane/remifentanil vs. propofol/remifentanil

T. Ledowski, P.H. Tonner, W. Fudickar, B. Bein, J. Scholz

Department of Anaesthesiology and Intensive Care Med, University Hospital, Kiel, Germany

Background and Goal of Study: The choice of the anaesthetic regime strongly influences the response to intraoperative stress (1).Though a balanced anaesthesia regime with sevoflurane/remifentanil is as common as a total intravenous anaesthesia (TIVA), only few studies regarding the difference in stress response are available.
Materials and Methods: After approval by the local ethics committee 43 patients were randomly assigned to one of two groups: SEVO: anaesthesia maintained with sevoflurane (2 vol%), or PROP: anaesthesia maintained with propofol (6 mg kg^{-1} h^{-1}). All patients received propofol (2mg kg^{-1}) and remifentanil (0.5 mg kg^{-1} min^{-1} within 2 min) for endotracheal intubation. Remifentanil was used for intraoperative analgesia in both groups. Its dosage was adjusted according to depth of anaesthesia such as blood pressure (MAP), heart rate (HR) and bispectral index (BIS). At 7 time points (P1 baseline before anaesthesia, P2 after tracheal intubation, P3 after skin incision, P4 at maximum operative trauma, P5 end of operation, P6 after extubation and P7 15 min. after extubation) blood samples were taken for measurement of epinephrine, norepinephrine, ACTH, cortisol. Statistical analysis was performed by Mann–Whitney-U-test and Chi-square-test. Numerical data is presented as median. Level of significance was set at a p value of 0.05.
Results and Discussions: A total of 43 patients (31 male, 12 female) was analysed. Regarding age, sex, height, body weight, duration of operation, dosage of remifentanil or MAP, no significant differences were seen. SEVO showed a lower HR at P4 and P5 and lower BIS values at P3 and P4. SEVO exposed higher plasma levels of epinephrine (P7: 100.5 vs. 54.0 pg ml^{-1}; $p < 0.05$), norepinephrine (P3: 221.0 vs. 119.5; $p < 0.01$, P4: 194.0 vs. 130.5 pg ml^{-1}; $p < 0.05$), ACTH (P2: 10.5 vs. 7.7, P5: 5.3 vs. 3.5, P6: 10.6 vs. 5.3, P7: 20.5 vs. 6.9 pg ml^{-1}; $p < 0.05$) and Cortisol (P7: 6.9 vs. 4 μg dl^{-1}; $p < 0.05$).
Conclusion(s): Compared to TIVA a balanced anaesthesia with sevoflurane/remifentanil results in higher plasma levels of epinephrine, norepinephrine, ACTH and cortisol.
Reference:
1 Crozier TA, Muller JE, Quittkat D et al. *Anaesthesist* 1994; 43: 594–604.

A-205

Hemodynamic changes during off-pump coronary artery bypass surgery

S.D.S. Oliveira, S.M. Kim, J.E.B.R. Zapata, M.J.C. Carmona, L.M.S. Malbouisson, L.B. Puig, A.S. Oliveira, J.O.C. Auler Jr

Department of Anesthesia and surgical critical care, Heart Institute (InCor) of Hospital das Clínicas of the University of São Paulo, São Paulo, Brazil

Background and Goal of Study: Off-pump coronary artery bypass grafting surgery (CABG) can be associated to hemodynamic deterioration during stabilization of the beating heart. The aim of this study was to compare hemodynamic changes on procedures to anterior and lateral walls of the left ventricule.
Materials and Methods: We compared hemodynamic parameters in 18 patients undergoing off-pump CABG during heart positioning. Anterior wall operating site (A = left descending artery or diagonal artery bypass, n = 9) was compared to lateral wall (L = obtuse marginal or circumflex artery, n = 9).
Results and Discussions: Data are presented in the table (mean ± sd):

		After induction	Baseline	1st anastomosis Beginning	1st anastomosis End
HR	A	65.1 ± 12.4	75.6 ± 16.4	79.8 ± 9.5	77.6 ± 8.5
	L	64.3 ± 6.5	79.8 ± 10.2	76.7 ± 9.9	76.9 ± 8.0
MAP	A	70.2 ± 10.1	76.8 ± 10.4	64.7 ± 7.9	70.0 ± 6.4
	L	82.0 ± 13.0	69.0 ± 12.5	70.4 ± 12.1	67.8 ± 12.8
CVP	A	11.7 ± 3.4	11.2 ± 3.0	14.2 ± 3.0	13.4 ± 5.0
	L	12.2 ± 3.3	10.4 ± 3.8	12.9 ± 5.0	16.1 ± 4.6
PawP		13.6 ± 4.0	13.2 ± 2.3	19.9 ± 5.3	20.4 ± 4.7
	L	13.7 ± 4.9	12.2 ± 6.2	17.8 ± 4.8	20.0 ± 6.0
PAP	A	20.8 ± 4.1	20.4 ± 4.6	26.7 ± 6.5	29.6 ± 5.6
	L	20.0 ± 5.9	18.4 ± 6.9	24.0 ± 7.2	27.2 ± 8.3
CI	A	2.7 ± 1.4	2.6 ± 0.6	3.3 ± 1.9	3.2 ± 1.6
	L	2.2 ± 0.8	3.1 ± 0.7	2.4 ± 0.7	2.3 ± 0.6
SvO_2	A	75.2 ± 7.8	81.4 ± 2.5	79.2 ± 4.9	76.0 ± 7.3
	L	76.6 ± 8.2	81.8 ± 7.6	71.8 ± 12.3	69.3 ± 12.9*

* $p < 0,05$: comparing L vs. A

Conclusion(s): Although hemodynamic changes did occur throughout surgery, we only observed significant decrease in oxygen mixed saturation in the lateral wall group compared to anterior wall group, showing higher sensibility of this parameter.
References:
1 Do QB. *Eur J Cardiothorac Surg* 2002; 21:385–90.
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A-206

The role of vasopressor therapy in the radial to femoral blood pressure discrepancies during liver transplant reperfusion

D. Arnal, I. Garutti, I. Tzenkov, G. Díaz-Regañón, J. Perez-Peña, L. Olmedilla

Dpto. Anestesia y Reanimación. Hospital General Universitario Gregorio Marañón, Madrid, Spain

Background and Goal of Study: Accurate blood pressure (BP) measurements are essential for effective clinical assessment and therapeutic intervention in the liver transplant (LT). Unexplained between femoral to radial BP differences (f-rBPD) have been reported in LT reperfusion (LTR) (1). Vasopressor therapy may differ depending on the site of BP monitoring (2). The aim of this study was to determine the relationship between f-rBPD and the use of vasopressors in LTR.
Materials and Methods: Sixty-four patients undergoing an LT were studied prospectively. Invasive radial and femoral arteries were monitored. Radial and femoral BP were recorded simultaneously within the first 3 minutes of the systemic LTR. Vasopressor therapy (Noradrenaline or adrenaline) was titrated according to radial BP.
Results and Discussions: BP differed depending on the site of monitoring (Femoral ± SD/Radial ± SD, p): Systolic BP: 91 ± 26/76 ± 24, $p < 0,0001$; Mean BP: 57 ± 16/54 ± 17, $p < 0,009$; Diastolic BP: 43 ± 13/41 ± 13, $p < 0,001$.

The 24 patients treated with vasopressor therapy during LTR showed higher femoral to radial BP differences.

Vasopressor therapy	Yes	No	p
Systolic f-rBPD (mmHg)	24 ± 27	9 ± 21	0,014
Mean f-rBPD (mmHg)	6 ± 8	1 ± 9	0,022
Diastolic f-rBPD (mmHg)	3 ± 4	1 ± 2	0,023

Adrenaline dose correlated with the magnitude of femoral to radial BP differences.

f-rBPD	Systolic	Mean	Diastolic
Pearson Correlation	0,42	0,26	0,31
P	<0,001	0,035	0,011

All patients that received adrenaline showed mean and systolic radial BP figures lower than 60 and 85 mmHg respectively. Nevertheless, 3 of these patients recorded femoral mean BP higher than the refereed threshold. When considering the systolic figures, the number of patients that might not have been treated increased to 11.
Conclusion(s): During LTR: f-rBPD is directly related with the adrenaline requirements; Systolic BP is especially sensible to the site of monitoring and

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vasopressor therapy requirements; Vasopressor dose might be decreased if treatment would be titrated according to femoral BP.

References:

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A-207

Diabetes mellitus blocks cardioprotection provided by late ischaemic preconditioning against myocardial infarction

D. Ebel, J. Müllenheim, J. Fräßdorf, B. Preckel, V. Thämer, W. Schlack

Department of Anaesthesiology, University Hospital of Düsseldorf, Institute of Physiology I, University of Düsseldorf, Düsseldorf, Germany

Background and Goal of Study: In patients with diabetes mellitus (DM), preinfarction angina is not associated with a better outcome after myocardial infarction as it is in patients without DM (1). We hypothesized that DM may block the cardioprotection by late ischaemic preconditioning (LPC) and that insulin treatment may restore LPC.

Materials and Methods: Rabbits, chronically instrumented with a coronary artery occluder, were subjected to 30 min coronary occlusion and 120 min reperfusion (I/R). Controls (n = 11) were not further treated. The LPC group underwent a 5 min coronary occlusion 24 h before I/R. In four groups, DM was induced by intravenous administration of 100 mg kg^{-1} alloxan 6 weeks before I/R. The DM group was not further treated (n = 10). The DM + LPC (n = 11) and the DM + LPC + I groups (n = 9) were additionally preconditioned 24 h before I/R as described above. In the DM + I (n = 10) and the DM + LPC + I groups, blood glucose concentration was reduced below 150 mg dl^{-1} by intravenous insulin 90 min before I/R. We measured blood glucose concentration (BGC), left ventricular peak systolic pressure (LVPSP), cardiac output (CO), and myocardial infarct size (IS). Statistical analysis: Student's t-test with Bonferroni's correction.

Results: BGC was 222 ± 90 (mean ± SD) and 199 ± 54 mg dl^{-1} in the control and LPC groups, 444 ± 72 and 462 ± 105 mg dl^{-1} in the DM and DM + LPC groups, and 108 ± 32 and 123 ± 21 mg dl^{-1} in the DM + I and DM + LPC + I groups. LVPSP and CO were similar in all groups during baseline (86 ± 17 mm Hg; 250 ± 74 ml min^{-1}) and after 120 min reperfusion (52 ± 15 mm Hg; 180 ± 55 ml min^{-1}). LPC reduced IS in non-diabetic animals from 43 ± 13 (control) to 23 ± 10% of the area at risk (LPC, P = 0.003). In the DM group, IS was 39 ± 11%, and in the diabetic animals LPC was blocked (DM + LPC, 41 ± 16%, P = 0.02 *vs*. LPC). Insulin treatment did not restore the IS reducing effect of LPC (DM + I,42 ± 10%; DM + LPC + I,40 ± 15, P = 0.03 *vs*. LPC).

Conclusions: DM blocks the cardioprotection by LPC against infarction in the rabbit, and the protective effect of LPC cannot be restored by short term insulin treatment 90 min before the infarct inducing ischaemia. Blockade of cardioprotection by LPC may partly explain the poor prognosis of diabetic patients with myocardial infarction.

Reference:

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A-208

Lactate elimination during the neohepatic phase correlates with graft weight in cadaveric organ liver transplantation

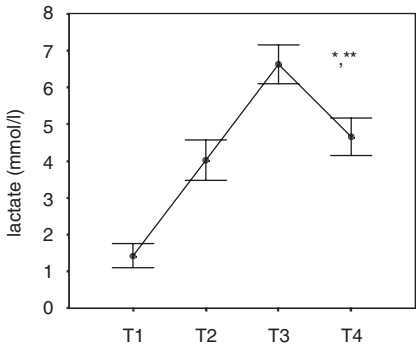
M. de Nadal, A. Mora, C. Bosch, C. Cortés, A. Camps, V.A. Gancedo

Department of Anesthesiology, Vall dHebron University Hospital, Barcelona, Spain

Background and Goal of Study: The graft size strongly affects lactate levels during the early neohepatic phase in living-related liver transplantation (LRLT) (1). Lactate metabolism is related to liver metabolic capacities (2). We hypothesized that blood lactate profiles could be related to graft size in cadaveric organ liver transplantation (COLT).

Materials and Methods: We studied 42 adult patients undergoing COLT (30 M/12W; age 56 ± 11 years) with a mean graft size of 1567 ± 347 g. Measurements included the duration of cold preservation and anhepatic phase duration. Arterial blood lactate levels were measured at the initiation of surgery (T1), just before reperfusion of the graft (T2) and at 10 and 60 minutes after reperfusion (T3,T4). The rate of lactate elimination during the neohepatic phase was calculated as the difference between T4 and T3 and it was compared with graft size using simple regression analysis.

Results: The figure shows changes in mean blood lactate during the phases of COLT. The difference of lactate during the neohepatic phase correlated significantly (p = 0.02) with graft size but not with the duration of cold preservation of the graft (p = 0.6) nor with the duration of the anhepatic phase (p = 0.09).



Results in mean ± SD. *, p < 0.001 compared with the mean T1 level. **, p < 0.001 compared with the T3 to T4 levels.

Conclusions: Mean lactate levels increased during the anhepatic phase and decreased during the neohepatic phase. Graft size correlated significantly with lactate levels' decrease during the neohepatic phase of COLT.

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2 Orii R. *Anesth Analg* 2001;92:1064–1070.

A-209

Does diabetes mellitus has any effect on peroperative inflammatory response during open heart surgery?

Z. Özer, A.A. Altunkan, H. Çamdeviren, S. Epözdemir, H. Serinol, U. Oral

Departments of Anesthesiology & Reanimation and Biostatistics, Mersin University Medical Faculty, Mersin, Turkey

Background and Goal of the Study: The effect of Diabetes Mellitus (DM) on peroperative inflammatory response in patients undergoing open heart surgery was investigated in our study.

Materials and Methods: Thirty patients (aged 40–70 years) scheduled for elective coronary artery bypass grafting surgery were included in the study. DM positive patients (n = 15) were accepted as Group I and DM negative ones (n = 15) as Group II. Anaesthesia was induced with remifentanil, etomidate and vecuronium. Maintenance was achieved with remifentanil infusion and sevoflurane in mixture of N_2O–O_2.

In all patients peroperative blood glucose concentrations were measured every 30 min from just before induction of anaesthesia until the operation was over and insulin infusion was applied according to the determined protocol (1). Blood samples were obtained before anaesthesia induction and after the cross clamp was removed for determining serum myeloperoxidase (sMPO), α-1 antitripsin, α-1-acid glycoprotein, CRP, RF, haptoglobulin and transferrin levels. Tissue MPO (tMPO) levels were also checked using the samples taken from aorta.

Repeated measurement of analysis of variance, pearson chi-square and independent t-test were used for statistical analysis.

Results: Mean glucose levels were 213 ± 68.63 in Group I and 195.16 ± 79.1 in Group II. No statistically difference was found between groups. sMPO, tMPO, α-1 antitripsin, α-1-acid glycoprotein, CRP, RF, haptoglobulin and transferrin levels in Grup I and II were measured respectively as (4.06 ± 4.07–2.5 ± 1.36), (2.95 ± 1.05–2.4 ± 1.10), (1.36 ± 0.25–1.32 ± 0.12), (0.95 ± 0.66–1.40 ± 1.95), (10.03 ± 6.05–6.05 ± 6.61), (10.58 ± 13.86–14.05 ± 25.19), (1.73 ± 0.73–1.44 ± 0.80), (2.25 ± 0.45–2.0 ± 0.44) . There was no statistically difference between two groups.

Conclusion: It was concluded that DM did not affect peroperative inflammatory response during open heart surgery.

Reference:

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A-210

Metabolic condition after coronary artery surgery: off-pump vs cardiopulmonary bypass

A. Heylen, D. Himpe, P. Thyssen, A. Debacker, Ph. Muylaert, E. De worm, W. Theunissen, Ph. Van Cauwelaert, E. Vandermeersch

Departments of Anaesthesia and Cardiac surgery, Middelheim General Hospital, Antwerpen, Belgium, (B); Catholic University Leuven (B)

Background and Goals: Coronary artery surgery (CABG) using cardiopulmonary bypass (CPB) is associated with acidosis and elevated lactate (1,2). We tested the hypothesis that off-pump coronary artery bypass (OPCAB) reduces this condition by use of a retrospective, case-controlled study.

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Material and Methods: Following institutional guidelines, 100 non-diabetic OPCAB-pts were retrospectively studied. A comparable control group of 100 CPB-pts (same period) was selected. Blood gases, haemoglobin (Hb), lactate (L) and glycaemia (G) sampled just prior to surgery and at skin closure (SC) were compared. For changes over time a Wilcoxon matched-pairs test was used. A Mann–Whitney U test compared observed changes *between* groups.

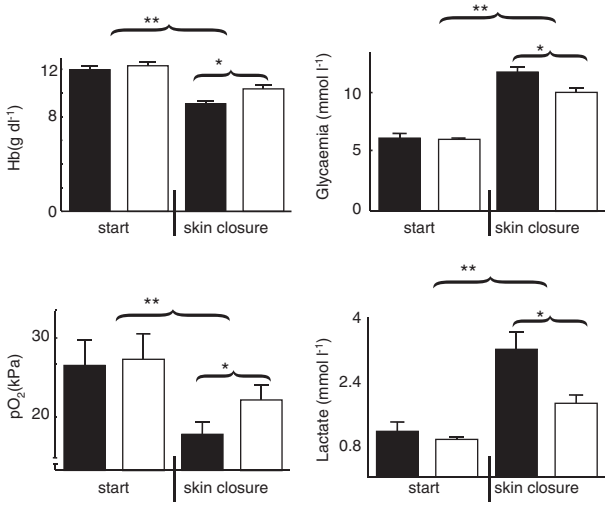

Figure 1. CPB (black bars) *versus* OPCAB (white bars) expressing means plus 1.96SEM error bars. [** significant differences from the start to skin closure; *differences between groups at skin closure].

Results and Discussion: Both groups were comparable. Significant differences occurred in Hb, G, pO_2 and L at SC. These changes were significantly less pronounced in the OPCAB-group (see Figure 1).
Lactic acidosis is associated with impaired cardiac contractility, vasodilatation, arrhythmia, reduced breathing power, and insulin resistance (1,2).
Conclusion: OPCAB provided better balances, higher Hb levels, and a better pO_2. These can facilitate the postoperative management and reduce ICU-stays.
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A-211

Gastric intramucosal pH(pHi) decrease after extubation in high risk patient in cardiac surgery

O. Guillery, J.J. Goudeau, M. Vernet, D. Bartoli, A. Musat, C. Girard

Cote dOr, Bocage Hospital, Dijon, France

Background: Several investigations [1] have proved that splanchnic vasoconstriction detected mesuring pHi (gastric intramucosal pH) can be an early indicator of general hypoperfusion for critically ill patients, and after cardiac surgery [2]. The aim of this investigation is to observe the evolution of pHi, intraluminal gastric carbon dioxyd pressure ($PgCO_2$), and the gradient $PaCO_2/PgCO_2$ before extubation in a stable ventilation mode (pressure support ventilation 10 cmH_2O) and after extubation.
Design: A prospective clinical trial.
Materials and Methods: Thirteen patients (med age 77), with Parsonnet scoring level upper than 25, were included, after approval of the ethic universitary hospital commity. They were operated in non emergent surgery for coronary arterial bypass graft or valvular replacement under cardiopulmonary bypass (CPB). They had no medical past pulmonary pathology. pHi, $PgCO^2$, and Pg-Pa CO_2 were mesured with a gastric air tonometer (Tonocap* Datex Engstrom) 30min before extubation, and 1h after. Results were analysed with a Wilcoxon test.
Results and Discussion: pHi is low and decrease significatively after extubation, but $PgCO_2$ and Pg-$PaCO_2$ haven't significative variation ($p > 0.05$). One patient with pHi = 7.18 developped a mesenteric ischemia, and needed mechanical ventilation support again for laparotomy. This analyse tend to prove that extubation and mechanical ventilation weaning have an impact on the splanchnic blood flow. Therefore, excepted when pHi is very low (<7.20), it doesn't seem to have consequences on the outcomes.

	Pre extub (mediane)	Post extub (mediane)	P
Phi	7.33	7.28	0.0004
$PgCO_2$ (mmHg)	40	39	0.2192 ns
Pg-Pa CO_2 (mmHg)	12	8	0.3222 ns
MAP (mmHg)	78	75	0.3841 ns
PaO_2 (mmHg)	149	138	0.1144 ns
$PaCO_2$ (mmHg)	34	38	0.0186

Conclusion: Regarding this results, extubation reduce the splanchnic blood flow after cardiac surgery with CPB, and prove that the weaning time is a critical period for these patients. Further investigations will be necessary, to confirm this hypothesis and detect patients who will need to be monitored with gastric tonometry.
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A-212

Role of sigmoid capnometry in the postoperative period of abdominal aortic aneurysm surgery in early diagnosis of ischaemic colitis

J. Prieto, P. Dra.Carmona, B. Dra.Prada, P. Dra.Piñeiro, I. Garutti, J.L. López-Berlanga, L. Fernández-Quero

Departments of Anesthesia and Intensive care, Hospital General Universitario Gregorio Marañó, Madrid, Spain

Background and Goal: The ischaemic colitis (CI) in the postoperative period of abdominal aortic anerurysm (AAA) surgery may cause mortality rates up to 75% when it is not early diagnosed. This implies the need of a method in order to guarantee an early diagnose of CI. The aim of this work is to asses the utility of monitoring pH sigmoid´s mucose when an early diagnose for CI is needed, using air-automated sigmoid capnometry in the ICU.
Material and Methods: 22 patients to undergo elective open surgery to repair AAA were consecutively studied, whenever they developped one of the next events during intraoperative stage: arterial hypotension, which required vasoactive drugs, or an aortic cross-clamping time over 90 minutes. pH sigmoid´s mucose (pH_{is}) was monitorized, as well as regional CO_2 pression ($PrCO_2$); the difference between $PrCO_2$ and arterial CO_2 pressure was also measured since the patient entered the ICU. Lactic acid levels and hemodynamic and oxymetric values from the Swan-Ganz catheter were also measured. Usual clinical signs of and high lactic acid levels were also assesed. Definitive diagnosis of CI was based on the colonoscopy that everypatient underwent within the first 48 hours of the postoperative period.
Results: Colonoscopy only showed anatomical signs compatible with CI in two patients who received surgery, consisting in colonic resection in both cases. pH_{is} remained under 7,00 in both patients during the first 24 hours. In the two patients who developed CI, the $PrCO_2$-$PaCO_2$ surpassed 50 since the patients entered the ICU. No differences were observed between the patients who developed CI and those who didn´t in the rest of the monitorized values. Lactic acid levels were higher than 2 mg/dl in the 2 patients with CI until colonic resection, that was done within the first 48 hours of the PO period.
Conclusions: pH_{is} resulted in an useful method for early diagnose of CI in postoperative period after AAA surgery. pH_{is} levels under 7,10 or $PrCO_2$-$PaCO_2$ over 30 within the first 24 hours in the postoperative period after abdominal aortic aneurysm elective surgery show the need of a colonoscopy to discard CI.
Reference:
1 Lebuffe G,et al. EJA 2001;18: 585–592.

A-213

Do beta-adrenegic drugs increase microcirculatroy blood flow in the gut in sepsis?

L.B. Hiltebrand, V. Krejci, G.H. Sigurdsson

Department of Anesthesiology, University Hospital, Berne, Switzerland

Background and Goal of Study: Beta-adrenergic agents are frequently administered in sepsis to increase global oxygen delivery (gVO_2) in an attempt to increase splanchnic blood flow as well. However, changes in microcirculation can not be predicted by changes in systemic blood flow(1). The goal was to measure the effects of dopamine and dobutamine, on systemic, regional, and microcirculatory blood flow in the intestinal mucosa in septic shock.
Materials and Methods: Cardiac index (CI), superior mesenteric artery flow and microcirculatory blood flow (MBF) were measured in 9 anesthetized pigs (24 kg). Mucosal MBF in the stomach, jejunum and colon was measured with laser Doppler flowmetry. Septic shock was induced by fecal peritonitis. At 360 min each animal received i.v. infusion of dopamine (5 mcg/kg/min, increased after 30 min to 10 mcg/kg/min for another 30 min) or dobutamine (same dosage). After 45 min recovery period a new baseline was taken before infusion with the other test drug.
Results and Discussions: Both tested drugs increased CI. Dopamin increased SMA blood flow significantly. Neither drug improved microcirculatory flow in the intestinal mucosa. Values in the table are in % of baseline

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Drug Dosage (mcg/kg/min)	Dopamine 5	Dopamine 10	Dobutamine 5	Dobutamine 10
CI (% of basline)	108 ± 2	118 ± 6*	124 ± 4*	148 ± 6*
SMA flow(%)	119 ± 3*	133 ± 5*	104 ± 3	103 ± 4
MBF stomach (%)	103 ± 3	103 ± 2	103 ± 2	101 ± 4
MBF jejunum (%)	103 ± 2	112 ± 7	105 ± 4	97 ± 3
MBF colum (%)	105 ± 3	107 ± 5	101 ± 2	99 ± 3

Conclusion(s): Both dobutamine and dopamine significantly increased CI and gVO_2 but the mucosa of the gastrointestinal tract does not profit from increased systemic flow.

Reference:

1 Hiltebrand LB. *Crit Care Med* 2000, 28: 3323–31.

A-214

Hemodynamic instability during human liver transplantion: relevance of the autonomic neuropathy

J.M. Pérez-Peña*, L. Olmedilla,* I. Garutti*, I. Tzenkov*, D. Arnal*, C. Jiménez*, D. Rincón**, R. Bañares**

**Dpto. of Anestesiología y Reanimación; **Servicio de Aparato Digestivo, Hospital General Universitario Gregorio Marañón, Madrid, Spain*

Background and Goal of Study: End-stage liver disease associates autonomous neuropathy (AN). The hemodynamic changes occurring during Liver Transplantation (LT) require an adequate autonomous response for maintaining cardiovascular stability (1). Aim: to evaluate the influence of AN in the evolution of liver transplantation procedure.

Materials and Methods: Forty-one LT patients were prospectively studied. AN was previously evaluated by seven cardiovascular tests assessing sympathetic or parasympathetic function. Patients were classified as absent (A), early (E) or definite dysfunction (D) (2). An hemodynamic study was performed before and after vascular clampings. Duration of LT, transfusion requirements, arterial hypotension episodes during surgery, incidence of post-reperfusion syndrome (PRS), cardiac arrhythmia and requirements of vasoactive drugs were evaluated.

Results and Discussions: Duration of surgery and transfusion requirements were similar among groups. Hemodynamic parameters were similar at baseline. However, hyperdynamic circulation worsened during surgery in D patients, with an increase in cardiac output and a decrease in systemic vascular resistances. The incidence of PRS was greater in the AN group. Vasoconstrictor requirements during reperfusion were similar among groups. AN patients suffered more arterial hypotension during neohepatic period (A: 46%, E: 56%, D: 63%), required more frequently vasoconstrictor (A: 30% E: 44% D: 68%) and inotropic therapy (A: 23% E: 33% D: 31%).

Conclusion(s): AN is associated with hemodynamic impairment, and with an increase of vasoactive drugs requirements during LT, probably associated to an impairment in reflex vasoconstrictor response to surgical manipulations and changes of blood volume. AN may be associated to a greater surgical risk during LT. The preoperative evaluation of AN may help to select a high risk population of LT recipients.

References:

1 Suhr. *Transplantation* 1997; 63: 675–9.
2 Trevisani. *Hepatology* 1999; 30: 1387–92.

Acknowledgements: Supported by: 08.3/0010/00 and 08.3/0030/98 from CAM, PR269/98-8172 from U. Complutense, Madrid (Spain).

A-215

Autonomic neuropathy in end-stage cirrhotic patients and evolution after liver transplantation

J.M. Pérez Peña*, L. Olmedilla*, D. Arnal*, I. Tzenkov*, I. Garutti*, C. Jimeno*, J. Sanz*, D. Rincón*, R. Bañares**

**Dpto. of Anestesiología y Reanimación; **Servicio de Aparato Digestivo, Hospital Gregorio Marañón, Madrid, Spain*

Background and Goal of Study: Autonomous neuropathy (AN) is frequently observed in end-stage liver cirrhosis and it has been related with higher mortality (1). Aim: To evaluate the prevalence of AN in end-stage liver disease, the relationship with the degree of liver dysfunction and systemic circulatory disturbances, and to analyse the evolution of AN after Liver Transplantation (LT).

Materials and Methods: Sixty-two end-stage liver cirrhosis patients evaluated for LT were prospectively studied including aetiology and severity of liver disease and AN. AN was evaluated by seven cardiovascular tests assessing sympathetic or parasympathetic function before and 6 month after LT. Patients were classified as absent (A), early (E) or definite dysfunction (D) (2). Haemodynamic studies were performed.

Results and Discussions: AN appeared in 67.7% of cases (E: 24.2%, D: 43.5%). Parasympathetic dysfunction was more prevalent than sympathetic dysfunction (59.7% vs. 20.9%). There were no relation between aetiology of liver disease and AN. AN was significantly related with Child score. Hyperdynamic circulation was more marked in patients with a definite AN as shown by a greater cardiac output (CO)(9 vs. 7.3 L/min) and a lower peripheral resistances (SVR) (666 vs. 866 dyn.s.cm-5) than in A group. Moreover, AN score significantly correlates with CO and SVR. The overall prevalence of AN decreased 6 months after LT (67.7% vs. 48%) due to a significant reduction in definite AN (43.5 vs. 14.8%; $p < 0.05$). AN improved in 70% of cases. Sympathetic dysfunction remained only in 1 patient after LT.

Conclusion(s): AN is frequent in liver transplant candidates, irrespective of aetiology of liver disease. The worsening of liver function is related with more severe AN. The severity of systemic circulatory disturbances seems to correlate with severity of AN. AN is clearly improved by LT. The evaluation of AN may contribute to a better selection of LT recipients.

References:

1 Fleckenstein. *Hepatology* 1996; 23: 471–5.
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Acknowledgements: Supported by: 08.3/0010/00 from CAM (Spain).

A-216

Saline-based fluid resuscitation is associated with metabolic acidosis in surgical patients

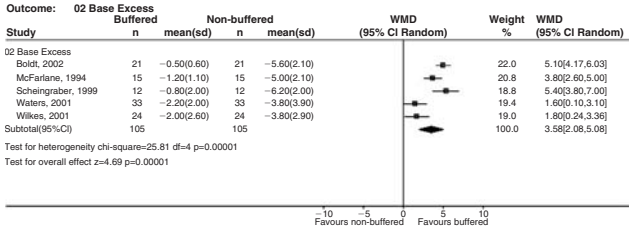
E. Burdett, T. Roche, T. Donnelly, R. Moulding, M. Mythen

UCL Centre for Anaesthesia, First Floor, Middlesex Hospital, London, United Kingdom

Background and Goal of Study: Saline-based fluids are frequently used for volume maintenance during surgery. There is strong evidence linking these non-buffered fluids to significant metabolic acidosis[1,2], which misleads the clinician and may result in adverse clinical outcomes[3]. This systematic review examines the evidence linking saline-based intra-operative fluid resuscitation with metabolic acidosis.

Materials and Methods: Using Cochrane methodology, a systematic review of the literature of randomized controlled trials was conducted, comparing buffered with non-buffered intra-operative fluid resuscitation.

Results and Discussion: Five studies, with a total of 210 patients, were identified. The statistical synthesis reveals a greater base deficit in the saline-based arm of 3.58 (95% C.I. 2.08–5.08, $p < 0.00001$). All of the trials identified found greater base deficit in the patients resuscitated with saline-based fluids. This was true even for those whose protocol allowed bicarbonate boluses to be given to acidotic patients in their saline arm.



Conclusions: Saline-based fluids cause a significant metabolic acidosis in surgical patients. This may be due to an excess chloride load in these fluids, or to their lack of bicarbonate (or bicarbonate precursor) buffer.

References:

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2 Scheingraber S, *Anesthesiology* 1999; 90(5):1265–70.
3 Stephens R, *Crit Care Med* 2000; 27: 3375–3377.

Acknowledgements: Abbott Laboratories, USA Centre for Anaesthesia, UCL, UK. Intensive Care National Audit Research Centre (ICNARC)

A-217

Use of myocardial performance index as a monitoring tool in CABG patients. An echocardiographic practicability study

J. Poelaert, J. Heerman, G. Schuepfer, A. Moerman, K. Reyntjens, C. Roosens

Department of Anesthesiology and Critical Care, University of Ghent Hospital, Gent, Belgium and Kantonsspital Lucerne, Lucerne, Switzerland

Background and Goal of Study: Myocardial performance index (MPI) permits a relativly easy estimation of systolic and diastolic left ventricular (LV) function. The current study analyzed the feasibility of using this parameter as a LV function monitor during and after coronary artery bypass surgery (CABG).

Materials and Methods: The study was conducted in 45 patients, undergoing CABG. After induction of anesthesia, 10 min. after revascularization and 2 h postoperatively, hemo-dynamics were assessed. Preload was characterized by LV end-diastolic area indexed for BSA (LVEDAI). Afterload was

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estimated by arterial elastance (Ea), LV end-systolic meridoneal wall stress (σm(es)), end-systolic pressure-area product and indexed systemic vascular resistance (SVRI). Global myocardial performance was assessed in terms of MPI and contractility was assessed by preload adjusted maximal power (PAMP).

Results and Discussions: MPI increased postoperatively (0.44 ± 0.13, 0.37 ± 0.17 and 0.50 ± 0.16, respectively; $P < 0.001$). PAMP did not alter significantly (1.90 ± 1.24, 2.02 ± 1.34 and 2.12 ± 1.00 W/cm^2 * 104, respectively). LVEDAI did not change in this study. Ea augmented to 0.76 ± 0.39, 0.80 ± 0.40 and 1.01 ± 0.43 mmHg/ml, respectively; $P < 0.001$). P-area increased significantly postoperatively (777 ± 357, 704 ± 456 and 854 ± 508 mmHg*cm^2, respectively; $P < 0.05$). Neither SVRI nor σm(es) did change. No correlation was found between LVEDAI and MPI nor Ea and MPI at any time point. This study showed the feasibility of measuring all left sided cardiovascular function parameters, such as preload, afterload, contractility and global myocardial performance during and after CABG. MPI cannot by itself discriminate between systolic and diastolic dysfunction, thus necessitating the use of more selective indices, such as PAMP.

Conclusion: This study shows the feasibility of measuring all major left sided cardiovascular function parameters: preload, afterload, contractility and global myocardial performance.

Reference:

1 Tei C. New non-invasive index for combined systolic and diastolic ventricular function. *J Cardiol* 1995;26:396–404.

Acknowledgements: Supported in part by a grant from the Flanders Research Fund (FWO Vlaanderen 2000–2002)

A-218

AAI pacing and left ventricular performance after cardiac surgery echocardiographic assessment

M. Dernedde, R. Amà*, C. Roosens*, J. Poelaert*

*Department of Anaesthesiology, University Hospital Centre of Charleroi, Charleroi, Belgium; *University Hospital of Ghent, Belgium*

Background: Artrial (AAI) or ventricular pacing (DDD) can provide, in particular in compromised left ventricular function, a significant improvement of left ventricular contractility. This study analysed the effects of one chamber artrial pacing on left ventricular (LV) contractility after coronary artery bypass graft (CABG) surgery using transoesophageal echocardiography (TEE). Direct assessment of LV contractility is possible by measuring preload-adjusted maximal power($PWR_{max.}/D^2$)[1] and myocardial performance index (MPI)[2].

Materials and Methods: After Ethical Committee approval, 12 patients undergoing CABG surgery were enrolled. Exclusion criteria were any oesophageal or gastric contraindication to TEE, pre-existing segmental wall motion abnormalities or any rhythm disturbances. Postoperatively in the ICU, TEE was performed: 1. in sinus rhythm; 2. after AAI pacing via an epicardial pacemaker wire at a fixed rate (90 ± 10 bpm). $PWR_{max.}/D^2$ defined as $\{P_{ao}(t)(V_{ao}(t)\} \times AVA \times 1.333 \times 10^{-4}$ and MPI defined as (ICT + IRT)/ET (ICT = Isovolumic contraction time; IRT = Isovolumic relaxation time; ET = Ejection time) were measured during each stage. Data are presented as mean ± SD. The statistical analysis was performed using Wilcoxon test with $p < 0.05$ significant.

Results and Discussion: There were no statistically significant differences regarding the MPI and the ($PWR_{max.}/D^2$) between baseline and pacing. Significant shortening of the duration of both transmitral E and A were registered with no changes of the E/A ratio.

	Baseline	AAI-pacing	p
$PWR_{max.}/D^2$	62.4 ± 47.5	82.8 ± 82.2	0.767
MPI	0.5 ± 0.1	0.4 ± 0.2	0.345
E/A	1.1 ± 0.5	1.2 ± 0.7	0.594
tE (ms)	232.9 ± 43.4	169.6 ± 54.5	0.010
tA (ms)	158.8 ± 35.6	118.0 ± 51.6	0.046

Conclusion: AAI pacing in this setting does not improve left ventricular performance but shortens considerably LV filling times.

References

1 C. Schmidt et al. Anesthesiology 1999;91:58–70.
2 L.H. Ling et al. J Am Soc Echocardiogr 2001;14:978–86.

A-219

Esophageal Doppler and aortic surgery

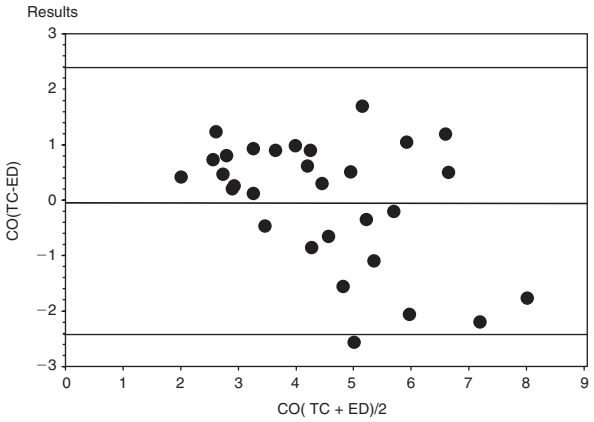
A. Lafanechere, P. Albaladejo, A. Wernet, R. Bocquet, J. Marty

Department of Anesthesiology, Beaujon Hospital, 92110 Clichy, France

Background and Goal of Study: Validity of cardiac output measured by an esophageal doppler could be questionned during aortic surgery. Aortic cross clamping may modify aortic diameter (Ao diam) and blood flow distribution between supra and infra aortic territories. We compared cardiac output (CO) obtained by an echo esophageal doppler (Hemosonic 100, Arrow) (ED) and by a thermodilution catheter (TC) during aortic surgery with infra renal aortic-clamping.

Materials and Methods: In 10 patients, mean arterial pressure (MAP), heart rate (HR), descending aortic blood flow (Dao), and Ao diam measured by ED were compared before, during and after aortic-clamping, with a two way ANOVA for repeated measures. Concordance between CO measured by both methods was analyzed using a Bland and Altman method.

Results:



Aortic Clamping	Before	During	After
HR (bpm)	62 ± 18	59 ± 16	71 ± 16 *
MAP (mmHg)	78 ± 16	76 ± 4	77 ± 12
Dao (l/mn)	3,5 ± 1,7 *	2,6 ± 1,3	3,7 ± 1,6 *
Ao Diam (mm)	29,3 ± 12	29,9 ± 9	28,8 ± 9

*: $P < 0,05$ vs During

Discussion and Conclusion: Thoracic aortic diameter and blood redistribution did not significantly impair CO measured by an ED when compared to TC. Hence, ED allows a continuous, reliable and non invasive monitoring of CO during infrarenal aortic surgery.

A-220

Effects of positive pressure ventilation on the left atrial appendage function

T. Nomura, K. Hashimoto, A. Shido, T. Nikai, S. Sakura, Y. Saito

Department of Anesthesiology, Shimane Medical University, Izumo, Japan

Background and Goal: Positive pressure ventilation (PPV) usually used during anaesthesia has been demonstrated to reduce the left heart filling, so that it is suspected to impair the function of left atrium and left atrial appendage (LAA)(1). It is also well known that the reduction of LAA function can be associated to cardiogenic thromboembolism. However, little is known how PPV influences the function of LAA. This study is, therefore, conducted to clarify the effects of PPV on LAA function by Pulse Doppler (PD) examination using transesophageal echocardiography (TEE).

Materials and Methods: With IRB approval and informed consent, 20 patients, undergoing PPV during general anaesthesia for surgery, were enrolled into the study. We measured peak velocities of LAA contraction flow (Peak-C) and filling flow (Peak-F) obtained by TEE PD examination to assess LAA function. The ratio of the peak velocity of rapid LV filling to the peak velocity of the filling during atrial contraction (Peak E/A) in transmitral flow was also measured to evaluate LV diastolic function. Echographic data were recorded both during PPV and during spontaneous respiration under light anaesthesia at the end of surgery. Statistical analysis was performed with Wilcoxon Rank test.

Results: Data(Mean ± SD) are shown in the table.

	PPV	Spontaneous respiration	P value
Heart Rate (bpm)	68.6 ± 8.8	71.1 ± 11.1	0.438
MBP(mmHg)	84.4 ± 16.4	82.2 ± 15.9	0.518
PIP(cmH_2O)	16.2 ± 3.6	–	–
Peak-C (cm/sec)	43.4 ± 13.1	49.8 ± 14.5	0.0057
Peak-F (cm/sec)	41.4 ± 10.8	44.4 ± 11.3	0.3202
Peak E/A	0.84 ± 0.19	0.91 ± 0.18	0.1359

MBP = mean blood pressure: PIP = peak inspiratory pressure.

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Conclusion: Our results demonstrate that LAA contractive function is reduced by ordinary PPV. PPV during anaesthesia might, therefore, increase the risk of thrombus formation in LAA in the patients with impaired cardiac function.

Reference:

1 J Am Coll Cardiol 1999;34:1867–77.

A-221

Comparison between wound-and arm tissue oxygenation in the postoperative period

B. Kabon, A. Nagele, D. Reddy, C. Eagon, A. Kurz

Department of Anesthesiology, Washington University, St. Louis, MO, USA, Vienna University Hospital, Vienna, Austria

Background and Goal of Study: Tissue oxygenation is a strong predictor for postoperative wound infections. The direct assessment of subcutaneous tissue oxygen tension ($PsqO_2$) in a needle-induced surrogate wound in the upper arm distant from the surgical wound constitutes a well-established method. (1) However local factors might alter the perfusion of the surgical wound in the postoperative period. Consequently the arm might not always reflect abdominal wound oxygenation accurately. Also, body morphology such as f.e. increased fat tissue mass, which causes relative tissue hypoperfusion (2), might affect tissue oxygenation in arm and wound differently. Consequently we simultaneously evaluated $PsqO_2$ in the upper arm and in the area of the surgical wound in obese and non-obese postoperative patients.

Materials and Methods: After IRB approval and informed consent, patients undergoing major abdominal surgery were assigned to two groups according to their body mass index (BMI): BMI $>$ 30, n = 23, and BMI $\leqslant$ 30, n = 21. Anesthesia technique and postoperative management were standardized. Subcutaneous tissue oxygenation ($PsqO_2$) was measured with a Clark type electrode (LICOX®, GMS Inc., Germany) in the upper arm and adjacent to the wound. Measurements were performed in the recovery room and on the first postoperative day.

Results: Data are presented as mean ± SD
P-values are for two-sided, paired t-tests.

	Arm Psq02 (mmHg)	Wound Psq02 (mmHg)	P-value
Recovery room			
BMI 24 ± 4	56.5 ± 15.5	60.2 ± 14.2	0.301
BMI 51 ± 15	45.3 ± 13.3	46.5 ± 19.6	0.760
1st post op day			
BMI 24 ± 4	51.0 ± 11.7	54.4 ± 11.6	0.275
BMI 51 ± 15	50.9 ± 17.8	47.2 ± 14.7	0.323

Conclusion: $PsqO_2$ values measured in the subcutaneous tissue of the upper arm very accurately reflect surgical wound tissue oxygenation in obese and non-obese subjects in the postoperativ period.

References

1 Hopf, H.W., et al., *Arch Surg* 1997,132 p: 997.
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A-222

The effects of phenylephrine on cardiac function as blood pressure increases

Z.Y. Peng, L.A. Critchley, S.P. Fok, A.E. James

Department of Anaesthesia & Intensive Care, Laboratory Animal Services Centre, Chinese University of Hong Kong, Sha Tin, China

Background and Goals: The pure α-agonist phenylephrine (PE) is used in anaesthesia to raise blood pressure. Its use may be associated with bradycardia, heart failure and cardiac arrest [1]. This may reflect detrimental effects on cardiac function. The aim of this study was to determine the relationship between PE induced blood pressure increases and cardiac function.

Material and Methods: In six anesthetized dogs an ultrasonic flow probe was placed on the aorta. Mean arterial pressure (MAP) was measured from the femoral artery. Heart rate (HR), cardiac output (CO) and cardiac contractility (dF/dt) were derived from the flowmeter waveform. PE infusion was given at a rate of 1–5 μg/kg/min to increase MAP. HR, CO and dF/dt were measured when MAP increased by 10, 20, . . . & 70%. Correlation and regression of the percentage increases in MAP with the HR, CO & dF/dt were performed.

Results: Increases in MAP (10% to 40%) were associated with linear decreases in HR, CO and dF/dt (Fig.). There were negative correlations between MAP and HR ($r = -0.83$; $p < 0.001$), CO ($r = -0.80$; $p < 0.001$) and dF/dt ($r = -0.66$; $p < 0.001$). A 10% increase in MAP was associated with an 8% decrease in HR, a 14% decrease in CO and a 9% decrease in dF/dt.

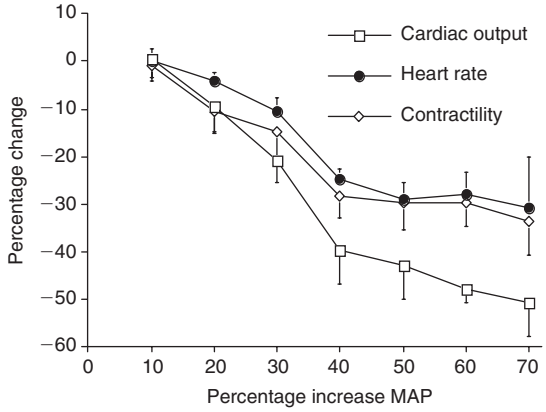

Fig. Effects of PE & MAP on cardiac function.

Conclusions: PE increases MAP, which is associated with decreases in HR, CO and contractility (dF/dt). This interdependence suggests the existence of a strong reflex response. The decreases become unacceptably large when MAP increased by more than 30–40%. Caution is advised when using PE in a clinical setting.

Reference:

1 Fraunfelder FW. *Am J Ophthalmol* 2002; 134: 624–625.

A-223

Haemodynamic and oxygenation changes during occlusion of the inferior vena cava and thoracic aorta for isolated abdominal stop-flow chemotherapy

M. Metaxari, E. Mamidakis, J. Romanos, A. Zoubrouli, D. Tsiftsis, H. Askitopoulou

Departments of Anaesthesiology and Surgical Oncology, University Hospital of Heraklion, Crete, Heraklion, Greece

Background and Goal of Study: Isolated stop-flow hypoxic perfusion for the regional administration of chemotherapeutic agents in patients with unresectable malignancies presents a challenge to the anesthesiologist.[1] In order to determine the necessity for invasive monitoring in such patients the present study investigated the haemodynamic and oxygenation effects of the combined occlusion of the inferior vena cava and the thoracic aorta.

Materials and Methods: Cardiovascular and oxygenation changes following stop-flow perfusion chemotherapy were studied in 12 patients, ASA II–IV with abdominal tumours. Before and during a twenty minutes inflation of the two balloon catheters occluding the inferior vena cava and thoracic aorta, and after their deflation, the following parameters were recorded through an arterial and pulmonary artery catheter: mean arterial pressure (MAP), heart rate (HR), central venous pressure (CVP), mean pulmonary artery pressure (MPAP), pulmonary capilllary wedge pressure (PCWP), systemic vascular resistance (SVR), cardiac index (CI), SvO_2, blood gases. Statistical analysis was performed with Wilcoxon matched-pairs signed ranks test, at $p < 0.01$ significance level.

Results and Discussion: Five minutes after the inflation of both balloons the most significant changes from control values were those of a mean rise of SVR (63%), MAP (15%), and SvO_2 (18%). At fifteen minutes also significantly increased PCWP (up to 25%), MPAP and CVP, while CI remained unchanged during inflation. Vasodilation was needed in 50% of patients. Shortly after deflation significantly increased from previous values CI (up to 16%), PCWP, CVP, while PaO_2 dropped significantly by 21% and MAP, SVR and SvO_2 returned to baseline values. Base deficit dropped from a 49% increase immediately after deflation to base line values at 30 min.

Conclusion: The occlusion of the inferior vena cava and thoracic aorta during isolated stop-flow perfusion chemotherapy causes major but transient hemodynamic changes necessitating invasive cardiovascular monitoring.

Reference:

1 Hofland J, Tenbrinck R, van Ijken MGA, et al. 2002;88:193–8.

A-224

Left ventricular systolic performance: peak rate of change of power

R. Amà*, P. Segers°, C. Roosens*, T. Claessens°, F. Catani**, P. Verdonck°, J. Poelaert*

*°Lab of Hydraulics, Ghent University; **Univ. Hospital of Torrette Ancona, Italy; *Department of Intensive Care Unit, Univ. Hospital of Gent, Gent, Belgium*

Background: Peak rate of change of power (peak dPWR/dt) is an index of ventricular contractile-performance that is independent on ventricular shape, dimension and doesn't require the calculation of volumes.

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Aims: Estimation of load dependence and inotropic sensitivity of peak rate of change of power in postoperative CABG patients.
Patients and Methods: 25 cardiac surgical patients with good left ventricular ejection fraction (EF $>$ 45%) and no valvular disease were consecutively evaluated. When stabilised haemodynamics were present after uneventful operation, in 11 patients load was changed with a bolus of phenylephrine (titrated to obtain a change in arterial systolic pressure of more than 20%). In 14 patients contractility was changed with a bolus of enoximone (1 mg/Kg).

Peak rate of change of power was estimated as the peak value of dPWR/dt during ejection (dPWR/dt = Q*dP/dt + P*dQ/dt). Peak dPWR/dt was calculated after 45 minutes from the injection of enoximone or immediately after administration of phenylephrine.
Results: In the 11 patients after injection of phenylephrine there was no statistical change in peak dPWR/dt between baseline and afterload change (baseline $1.85 \times 10^6 \pm 1.32$ and after phenylephrine $1.84 \times 10^6 \pm 0.9$). In the 14 patients after injection of enoximone there was a statistical significant change in peak dPWR/dt (baseline $1.24 \times 10^6 \pm 0.52$ and after enoximone $2.01 \times 10^6 \pm 0.58$; $p < 0.002$).
Conclusions: To the best of our knowledge this is the first study that demonstrates the load independence of peak rate of change of power and its sensitivity to acute changes in contractility in human beings.

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Load dependence of different left ventricular performance indexes

R. Amà*, P. Segers°, C. Roosens*, M. Dernedde**, F. Catani***, P. Verdonck°, J. Poelaert*

°*Department of Intensive Care Unit, Lab of Hydraulics, Ghent University; **University Hospital Centre of Charleroi; ***Univ.Hospit. Torrette AN, Italy; *University Hospital of Gent, Gent, Belgium*

Background: the index of myocardial performance (MPI) describes both systolic and diastolic ventricular function, is easy to evaluate and is independent on ventricular shape and dimension. Tissue Doppler Imaging (TDI) provides also information on systolic function through its systolic flow velocity wave, reflecting the velocity of the myocardium during the systole. These parameters can be easily detected at the bed-side of the patient and can give a quick and important information about the left ventricular performance.

None of these indexes were evaluated in terms of load dependence.
Aim: Evaluation of load independence of MPI and TDI S wave.
Patients and Methods: 11 cardiac surgical patients with good left ventricular ejection fraction (EF $>$ 45%) were consecutively evaluated. When stabilised haemodynamics were present after uneventful operation, load was changed with a bolus of phenylephrine (titrated to obtain a change in arterial systolic pressure of more than 20%). MPI was defined as the ratio of the sum of isovolumetric contraction time (ICT) and isovolumetric relaxation time (IRT), corrected for the ejection time (ET): MPI = (ICT + IRT)/ET. The S wave of TDI was obtained with pulsed wave at the lateral part of the mitral annulus.
Results: In the 11 patients there was not a statistical significant change in both indexes after the change in the afterload (MPI baseline 0.331 ± 0.061 after neosynephrine 0.32 ± 0.089; S wave baseline 7.42 ± 2.28 and after 7.56 ± 2).
Conclusions: This study demonstrates an independence of MPI and TDI S wave to changes in afterload.

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New insights into the mechanism of the hypercapnia-induced coronary flow response

A. Heintz*, M. Damm°, T. Koch*, A. Deussen°

°*Institute of Physiology; *Dept. of Anaesthesio, Anaesthesiology and Intensive Care Medicine, University Hospital of Dresden, Dresden, Germany*

Background and Goal of Study: Strong evidence for the contribution of nitric oxide in the mediation of hypercapnia-induced coronary vasodilation has been obtained by recent experiments performed on the isolated perfused guinea pig heart. To further determine the role of NO we compared the results obtained on guinea pig hearts with those obtained in wildtype (WT) and eNOS-knockout (KN) mice.
Materials and Methods: Isolated, isovolumically working hearts were perfused with Krebs-Henseleit-buffer at constant pressure. After 30 min normocapnic perfusion flow was switched to hypercapnic conditions (pCO_2 = 55–65 mmHg) for 10 min. L-NAME (100 μmol/l) and glibenclamide (3 μmol/l) were used to inhibit the endothelial NO-synthase and the K^+_{ATP}-channels, respectively. Venous effluent perfusate was collected and cGMP release determined as an index of endothelial NO-release using ELISA.
Results and Discussions: L-NAME reduced control flow in either species, whereas glibenclamide reduced basal coronary flow in mouse hearts (n = 6) but not in guinea pig heart (n = 18). In WT and KN mouse hearts the hypercapnic flow response was similar to that in guinea pig hearts consisting of an initial and a delayed (persisting) flow response. In WT and guinea pig hearts the latter was reduced by L-NAME. Basal cGMP-release (1.19 ± 0.30 pmol/ml) was increased (2.95 ± 0.23 pmol/ml) transiently during the hypercapnic flow response. Glibenclamide did not influence the hypercapnic flow response in either species.
Conclusion(s): Similar features of flow regulation were obtained in the two species. The delayed hypercapnic flow response largely depends on intact NO production. eNOS-KN mice have an yet unknown compensation for missing endothelial NO production that mediates the delayed hypercapnic flow response.
References:
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2 Smith G.L. *Cardiovas Res* 1998; 38: 316–331.
Acknowledgements: We are grateful to A. Gödecke and J. Schrader, Institute of Physiologie, University of Düsseldorf for providing the eNOS-knockout mice.

A-227

Influence of interleucin converting enzyme inhibitor on myocardial stunning *in vivo*

H. Barthel, H. Südkamp, D. Ebel, J. Müllenheim, H. Rütten, W. Schlack, B. Preckel

Klinik für Anaesthesiologie, University Hospital, Universitätsklinikum Düsseldorf, Düsseldorf, Germany

Background and Goal of Study: The pro-inflammatory cytokine interleukin-1β is converted into its active form by interleukin-1β converting enzyme (ICE).The inflammatory response plays a major role during ischaemia/reperfusion (1) and can restrict functional recovery. The aim of the present study was to investigate whether ICE inhibition by HMR-3840 improves myocardial function after stunning *in vivo*.
Materials and Methods: Anaesthetized (isoflurane/ fentanil) pigs were instrumented for measurement of left ventricular (LV) pressure, cardiac output (CO) and blood flow in the left anterior descending (LAD) and circumflex coronary artery (LCX). Regional myocardial function was assessed by sonomicrometry as systolic wall thickening (sWT) and mean systolic thickening velocity (v_s) in the antero-apical and the postero-basal walls. The animals were subjected to 10 min LAD occlusion followed by 4 h of reperfusion. The ICE-inhibitor (flow-adjusted to achieve coronary plasma concentrations of 10 μg/ml) or the vehicle were infused via a side branch into the LAD during ischaemia (ISCH, n = 7; vehicle: CON, n = 7) or during reperfusion (REP, n = 6) until 60 min of reperfusion.
Results and Discussions: In all groups, occlusion of the LAD resulted in systolic outward movement (bulging) of the antero-apical wall during ischaemia. Infusion of the ICE inhibitor had no effect on functional recovery, neither when given during ischaemia nor during reperfusion (values at the end of reperfusion: antero-apical wall, sWT: CON, $20.7 \pm 7.4\%$; ISCH, $22.3 \pm 11.0\%$; REP, $18.6 \pm 7.2\%$, P = ns; v_s: CON, 4.9 ± 1.2 mm/s; ISCH, 6.1 ± 4.2 mm/s; REP, 5.1 ± 2.0 mm/s, P = ns). LAD blood flow was not affected by HMR-3840 (37.8 ± 9.1 vs. 34.7 ± 11.4 ml/min, P = ns). Global myocardial function (LV pressure, LV dP/dt, CO) was not different between controls and the treatment groups during reperfusion.
Conclusion: ICE-inhibition by HMR-3480 had no effect on functional recovery after stunning in pigs in vivo.
Reference:
1 Ruetten H et al. *Circulation*, 100(Suppl.): I–10(1999).

A-228

Histamine release during adult cardiopulmonary bypass

K.M. Fayaz, S. Balachandran, P.S. Sudheer, J.E. Hall, S.C. Pugh, M. Harmer

Department of Anaesthetics, Univeristy Hospital of Wales, Cardiff, United Kingdom

Background: Cardiopulmonary bypass (CPB) is associated with systemic inflammatory response and mediator release including histamine [1]. This study investigated histamine levels in adult cardiac surgery on CPB. Histamine origin was investigated by tryptase assay (from mast cell degranulation) and CD63 expression (from basophils).
Method: With ethical approval, 15 adults having cardiac surgery on CPB participated in a prospective, observational study. Plasma histamine was assayed: 1: Pre-induction, 2: 15 min postinduction, 3: 5 min. post heparin, 4: 10 min. post aortic X-clamp, 5: 10 min. post aortic X-clamp removal, 6: After lung ventilation, 7: After protamine, 8: 2 h and 9: 24 h postoperatively. CD63

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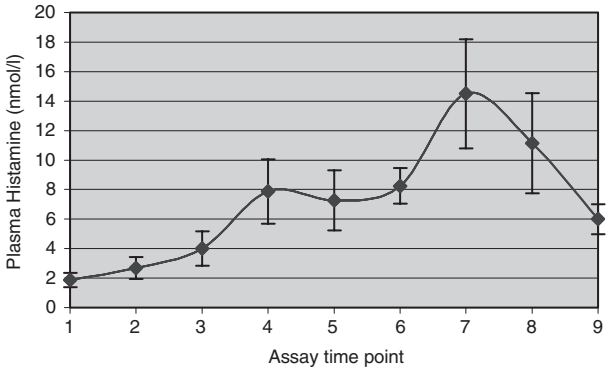
and tryptase were measured at times 1, 4 and 7 above. Analysis used ANOVA, $p < 0.05$.
Results: Mean (SD) plasma histamine



Plasma histamine at points 6, 7, and 8 were significantly different from baseline. Mean (SD) CD63 expression at points 1, 4, and 7 were 0 (0), 8.4 (6.2)* and 11.6 (6.8)* and tryptase levels at these times were 7.0 (3.2), 4.4 (1.6)* and 6.2 (3.1) respectively. All tryptase levels were within normal limits.
Conclusion: Plasma histamine increased significantly after lung ventilation and protamine administration. The rise corresponded to increased CD63 expression, so that basophils are the probable source. Increased histamine after protamine has not been shown previously [2].
References:
1 Seghaye MC. *J Thorac Cardiovasc Surg* 1996;112:687–97.
2 Guro V et al. *Agents Actions* 1994;41:11–6.

A-229

Renal function in patients during and after hypotensive anaesthesia induced by remifentanil combined with desflurane and sevoflurane

F. Altintas, B. Kahveci, S. Cakmakkaya, G. Kaya, M. Hacibekiroglu

Department of Anaesthesiology, Istanbul University Cerrahpasa Medical Faculty, Istanbul, Turkey

Background and Goal of Study: To evaluate renal function during and after hypotensive anaesthesia induced by remifentanil combined with sevoflurane or desflurane in patients undergoing bimaxiller osteotomy.
Materials and Methods: Thirty patients anaesthetized with 1 μg/kg/min remifentanil infusion, propofol 2 mg/kg, cisatracurium 0.2 mg/kg were randomly assigned in two groups. Continue remifentanil infusion (1 μg/kg/min) was used in Group D (n = 15, age 23.8 ± 5.5 yrs) with desflurane and in Group S (n = 15, age 21.8 ± 4.3 yrs) with sevoflurane for maintenance of anaesthesia. Remifentanil infusion and inhalation anaesthetics concentrations were adjusted to obtain mean blood pressure (MAP) within 50–60 mmHg. Blood samples were drawn given time intervals to determine the concentrations of β_2 microglobulin (β_2 MG), creatinin (Cr) and urea and urine samples for β_2 MG. Student's t-test and Wilcoxon test was used for data.
Results: Demographic and anaesthetic data were similar in two groups.

Stages	Groups	Serum β_2 MG (mg/L)	Urine β_2 MG (ng/mL)	Cr (mg/dL)	Urea (mg/dL)
Control	D	1.4 ± 0.2	134.5 ± 135.3	0.8 ± 0.2	23.4 ± 8.8
	S	1.3 ± 0.3	110 ± 84.3	0.7 ± 0.1	24.4 ± 6.7
Hypotensive	D	1.4 ± 0.4	73.8 ± 69.7	0.8 ± 0.2	22.9 ± 8.2
	S	1.4 ± 0.4	86.2 ± 45.2	0.8 ± 0.1	24.9 ± 6
Normotensive	D	1.3 ± 0.3	52.5 ± 36.9*	0.9 ± 0.2	22.4 ± 8
	S	1.3 ± 0.3	60.7 ± 45.8	0.8 ± 0.1	24.8 ± 6.4
24th hour	D	1.1 ± 0.3	317.3 ± 27.8*	0.9 ± 0.2	20.4 ± 9
	S	1 ± 0.3	359.5 ± 189.8*	0.8 ± 0.1	24.4 ± 4.2
48th hour	D	1 ± 0.2*	302 ± 193*	0.8 ± 0.1	22.6 ± 8.3
	S	1 ± 0.3*	335 ± 185*	0.8 ± 0.1	24.1 ± 7.4

*, denote $p < 0.05$, as compared with control values within groups.

Conclusion(s): In both group, serum β_2 MG concentrations showed no significant changes during per-operative period.Urine β_2 MG concentrations decreased during peroperative period and increased from control values on the post-operative first and the second days in both groups. These values were within the normal ranges. Results showed that there were no impairment in renal perfusion and absorbtion of proximal tubuli.

Reference:
1 Wang J, Lin J, Lin H. Effects of hypotension induced by isoflurane on hemodynamics and plasma beta 2 Microglobulins and creainine during cerebral aneurysm operation.

A-230

Comparison of single-breath vital capacity rapid inhalation with sevoflurane 5% in adults and intravenous propofol induction on QT interval and hemodynamics in laparoscopic surgery

Selda Sen*, G. Özmert**, E. Çaliskan**, N. Baran**

**Department of Anaesthesiology and Reanimation, Adnan Menderes University Medical Faculty, Aydin, Turkey; **SSK Ankara Maternity and Women's Health Teaching Hospital Etlik-Ankara*

Background and Goals: It is reported that when sevoflurane is used with classic induction techniques it increases QT interval (1,2). In laparoscopic surgery cardiac arrhythmias can be observed because of pneumoperitoneum (3). But there is not any study that shows effects of single breath vital capacity rapid inhalation with Sevoflurane on QT interval in laparoscopic surgery.
Material and Methods: ASA I–II, 44 patients who were scheduled to undergo elective laparoscopic gynecological surgery were divided into two groups. In the Group S (n = 22, Group Sevoflurane) general anesthesia was induced with single breath vital capacity rapid inhalation of sevoflurane 5%, and then anesthesia was maintained by nitrous oxide/oxygen with sevoflurane 1–1,5%. In the Group P (n = 22, Group Propofol) general anesthesia was induced with Propofol 2 mg/kg intravenously and maintained by propofol 6 mg/kg/hr intravenous infusion. Hemodynamics and end tidal CO_2 values were recorded before anesthesia induction (basic value), before intubations, after intubations and 10th minute of CO_2 insufflations in all of the patients. QT intervals were calculated with Bazzet formulate and the incidence of arrhythmias were recorded.
Results: QT intervals in groups

	Basic Value	Induction	10th minute	30th minute
Group S	434.9 ± 20.3	442.4 ± 24.2*	445.6 ± 27.5**	456.5 ± 19.4*
Group P	439.4 ± 26.7	440.1 ± 31.2	457.3 ± 20.7	440.4 ± 22.8

*(p < 0,001), **(p < 0,05)

In the sevoflurane Group 5 patients before intubations time and 2 patients 10th minute of CO_2 insufflations ventricular arrhythmia was observed and later it improved spontaneously. In the Group P only one patient a ventricular arrhythmia was recorded.
Conclusions: As a result in laparoscopic surgery single breath vital capacity rapid inhalation induction technique with Sevoflurane can cause prolongation of QT interval and incidence of arrhythmia related to pneumoperitoneum of laparoscopy and induction.
References:
1 Kleinsosser A. *Anesth Analg* 2000; 90: 25–27.
2 Gallogher JD. *Anesthesiology* 1998; 89:1569–1573.
3 Cunningham AJ. *Br J Anaesth* 1993: 70; 621–623.

A-231

Morphine and LPS induced late preconditioning: Are opioidreceptors trigger, mediator or both?

J. Fräßdorf, D. Obal, A. Malpohl, B. Preckel, J. Müllenheim, W. Schlack

Klinik für Anästhesiologie, Universitätsklinikum Düsseldorf, Heinrich-Heine-Universität Düsseldorf, Germany

Background and Goal of Study: Brief sublethal periods of ischaemia enhance the tolerance of myocardium to a subsequent period of sustained ischaemia (ischaemic preconditioning). The initial cardioprotection lasts for 1–2 hours (early preconditioning), and reappears after 24 hours (late preconditioning [LPC]). Activation of NFκB is an essential step in signal transduction of LPC(1). Morphine (MO) and lipopolysaccharide of E.coli membranes (LPS) administration led to an activation of NFκB(2). We investigated the role of opioid receptors (OR) in MO and LPS induced preconditioning.
Materials and Methods: After approval by the local authorities wistar rats were treated with intraperitoneal injection of 5 ml normal saline (NaCl), 1 mg kg^{-1} LPS or with 3 mg kg^{-1} morphine sulfate (MO). Twentyfour hours after this treatment, animals underwent 25 min of regional myocardial ischaemia and 120 min of reperfusion. To investigate the role of OR as trigger or mediator of LPC, animals received naloxone (NAL) 10 min prior or 24 h after treatment. Infarct size (IS) was assessed by TTC staining. Statistics: ANOVA and Bonferroni's multiple comparison test (mean ± SD).

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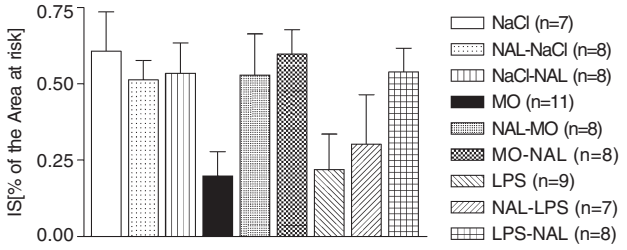
Results and Discussions:



NaCl vs. NAL-NaCl and NaCl-NAL: $P > 0.05$; NaCL vs. MO and LPS: $P < 0.001$; MO vs. NAL-MO and MO-NAL: $P < 0.001$; LPS vs. NAL-LPS: $P > 0.05$, vs. LPS-NAL $P < 0.001$.

Conclusion(s): Morphine induces LPC comparable to LPS. OR are involved as mediators for both, MO and LPS induced LPC and trigger MO induced myocardial protection.

References:

1 XuanYT, et.al. *Circ Res* 1999; 84:1095–09.
2 Fräßdorf J, et.al. *EJA* 2002; 19:Sup24 A195.

A-232

Which inhalational anaesthetic agent is more effective for deliberate hypotension in spinal surgery ?

F. Kurt, A. Derbent, K. Demirag, O. Eris, M. Uyar

Department of Anesthesiology, Ege University Hospital, Izmir, Turkey

Background and Goals: Inhalational anaesthetic agents can be used to induce controlled hypotension (1). We compared the efficacy of desflurane, sevoflurane and isoflurane to maintain haemodynamic stability for spinal surgery requiring moderate levels of controlled hypotension.

Material and Methods: After ethics commitee approval and obtaining written informed consent, 32 ASA I or II patients were randomly allocated to receive desflurane (n:10), sevoflurane (n:10), isoflurane (n:12) in O_2/N_2O (1:1) for maintenance of anaesthesia. Induction, fentanyl dosing and volume loading were standardized. Blood pressure was invasively monitored and maintained within a target systolic blood pressure (SBP) ranging 80 to 90 mmHg during the study period. Concentration of volatile anesthetics was adjusted by predetermined percentages, when SBP was lower than 80 mmHg and higher than 90 mmHg. Adjustments were done according to a certain scale. Being outside this range was considered as unexpected hemodynamic effect. Results were presented as medians and interquartiles and non-parametric statistical methods were used. Data were analysed by one way ANOVA, Mann–Whitney, Kruskall-Wallis tests with Bonferroni correction.

Results: Preoperative systolic and diastolic blood pressure and heart rate did not differ among the 3 groups. During the study period, arterial blood pressure control was maintained better with sevoflurane and isoflurane than desflurane. SBP was outside the range during 32% (15%–55%) of the whole study time with isoflurane, 26% (12%–42%) with sevoflurane and 44% (10%–80%) with desflurane ($p < 0,05$).

Conclusions: Sevoflurane and isoflurane administered in 2 L/min fresh gas flow maintained better hemodynamic stability than desflurane in spinal surgery requiring moderate arterial hypotension.

Reference:

1 Lawhon SM. Spine1984: 450–3.

A-233

Coronary and myocardial effects of Remifentanil and Sufentanil on isolated heart model

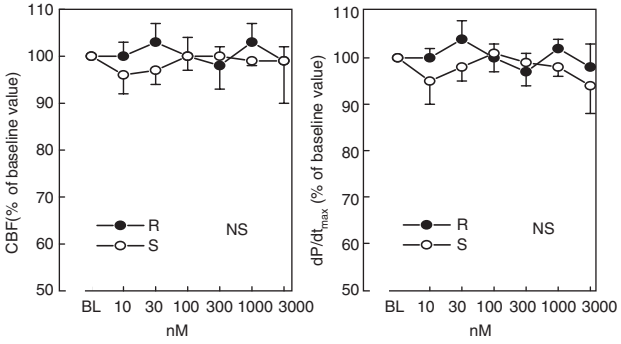
P. Lecomte, A. Ouattara, U. Kockler, G. Boccara, P. Coriat, B. Riou

Département dAnesthésie – Réanimation, Laboratory of Anaesthesiology, Department of Anaesthesiology CHU, Pitié-Salpêtrière Hospital, Paris, France

Background and Goal of Study: In coronary patients, Remifentanil (R)-induced cardiovascular depression could be associated to myocardial ischemia [1]. However, the hypothesis of intrinsic coronary effects of R remains to be tested. Therefore, we studied coronary and myocardial effects of R on isolated heart model. These effects were compared with those of Sufentanil (S), an opioid widely used in cardiac anaesthesia.

Materials and Methods: After general anaesthesia with sodium thiopental, hearts from New-Zealand rabbits were rapidly excised and mounted on an erythrocyte-perfused and isolated heart preparation using the Langendorff's technique. After an equilibration period, hearts were exposed to increasing concentrations (10 to 3000 nM) of either R ($n = 5$) or S ($n = 5$) during 5 min. Between each concentration, hearts were allowed to return to baseline values. The maximal coronary and myocardial effects of each concentration of R and S were noted. ANOVA for repeated measurements was used. $P < 0.05$ was considered significant.

Results and Discussion: Baseline values of coronary blood flow (CBF) and maximal positive intraventricular pressure derivative (dP/dt_{max}) were comparable between both groups.



NS = no significant difference between groups

Conclusion: R and S are devoid of significant intrinsic coronary and myocardial effects. These results suggest that myocardial ischemia reported during use of R in coronary patients is only the consequence of systemic haemodynamic disturbances.

Reference:

1 Elliot P. et al. *Anesth Analg* 2000; 91:58–61.

A-234

Comparison of ATP-$MgCl_2$, Sodium-Nitroprusside and the combination of Sodium-Nitroprusside and Esmolol on haemodynamics and ischaemia reperfusion injury during aortic cross-clamping

G. Froeba, H. Bracht, M. Schoaff, D. Vassilev, B. Hauser, A. Pittner, U.B. Brückner, M. Georgieff, B. Radermacher, H. Schelzig

Sektion Anästhesiologische Pathophysiologie und Verfahrenswentwicklung, Universitätsklinik für Anästhesiologie, Universität Ulm, Germany

Background and Goal of Study: Aortic cross-clamping is associated with severe hypertension which may result in left ventricular failure as well as ischaemia/reperfusion injury of visceral organs [1]. Our study investigated the effect of the ultra short acting vasodilator ATP-$MgCl_2$ on these haemodynamic and metabolic effects, in comparison to the clinical routine drug sodium-nitroprusside (SNP), as well as the combination of SNP and the β-blocker Esmolol (ESM), in a model of thoracic aortic cross-clamping in pig.

Materials and Methods: With approval of the local animal care committee, pigs were anaesthetized and mechanically ventilated and received either ATP-$MgCl_2$ (***A***; $n = 8$), SNP (***B***; $n = 8$) or SNP ± ESM (***C***; $n = 6$) during thoracic aortic cross-clamping (30 min). Measurements were performed before clamping, just prior declamping, and at 90 and 210 minutes after declamping.

Results and Discussions: Data are median (Min;Max). There were no significant differences in hepato-splanchnic haemodynamics and metabolic parameters between the groups. During cross-clamping mean arterial pressure could be held in pre-clamping levels with all drugs. Epinephrine levels [pg/ml] rose during cross-clamping from 15 (15;91) to 4062 (1369;9561) group ***A***, 15 (15;64) to 3657 (1353;5544) group ***B***, 15 (15;30) to 1426 (215;5484) group ***C***, respectively, resulting in a significant tachycardia [min^{-1}] in group ***B*** 178 (144;206: $p < 0.05$) compared to group ***A*** 114 (88;152) and group ***C*** 99 (85;115).

Conclusion: ATP-$MgCl_2$ can be used as an alternative drug for haemodynamic management during aortic cross-clamping, it prevents the development of disadvantageous tachycardia and related increase of myocardial oxygen consumption to a greater extent compared to SNP.

Reference:

1 Gelman S. The Pathophysiology of aortic cross-clamping and unclamping. *Anesthesiology* 1995;82:1026–1060.

Acknowledgements: Supported by the European Society of Anaesthesiologists, Research Grant Programme 2001.

A-235

Myocardial wound healing after transient ischemia is ameliorated in u-PAR-deficient mice

J. Larmann, J. Mersmann, M. Dewerchin, M. Lox, H. Van Aken, P. Carmeliet, G. Theilmeier

Department of Anesthesiology, University of Münster, Münster, Germany, CMVB-CTG, KU Leuven, Leuven, Belgium

Background and Goal of study: Myocardial wound healing strictly depends on leukocyte infiltration. However, reperfusion injury is characterized by an exaggerated inflammatory response. Modulation of inflammation may be a valid therapeutic strategy. The urokinase receptor (u-PAR) is critical for β-integrin activity(1). We therefore examined its role in myocardial remodeling after MI/R using u-PAR deficient (u-PAR$^{-/-}$) or wild type mice (wt).

Material and Methods: 12-week-old gender-matched mice were subjected for 30' to ligation of the left anterior descending coronary artery (LAD). LV, area at risk (AAR) and infarct were planimetrically delineated using TTC/coomassie blue. Echocardiography was carried out 5 days post MI. 7 d after MI CD45-staining leukocytes were semi-automatically detected and quantified on sections of paraffin-embedded hearts in the infarct, the penumbra and non-ischemic tissue.

Results and Discussion: At 3 h, wt infarcts were 35 ± 2.5% of AAR, but u-PAR$^{-/-}$-infarcts were 31% smaller (n = 7/5, $p < 0.05$). At 24 h infarcts in wt had enlarged by 40% but were still 35% smaller in u-PAR$^{-/-}$ (n = 9, $p < 0.0001$). Wall-thickening fraction had decreased by 26 ± 7% at day 4 (n = 5, $p < 0.01$) in wt, while regional function in u-PAR$^{-/-}$-mice remained largely unchanged (−5 ± 5%, n = 4). 7 days after ischemia we found significantly less CD45^{+}-cells in u-PAR$^{-/-}$ compared to wt-infarcts (364 ± 159 vs. 980 ± 339 leukocytes/mm^2, u-PAR$^{-/-}$ vs. wt, n = 5, ANOVA: $p < 0.01$). Importantly was the number of inflammatory cells in the infarct penumbra reduced in u-PAR$^{-/-}$ mice at 7 days (69 ± 24 vs. 153 ± 54 leukocytes/mm^2, u-PAR$^{-/-}$ vs. wt, n = 5, $p < 0.05$).

Conclusions: u-PAR deficiency significantly reduces infarct size after transient myocardial ischemia by ameliorating reperfusion injury. This effect is associated with reduced leukocyte recruitment. Reduction of post-ischemic inflammation improves myocardial wound healing and thus mitigates the functional consequences of myocardial ischemia. We therefore predict u-PAR to be an attractive target for modulation of reperfusion injury.

Reference:

1 Wei, et al. *Science* 1996;273:1551–1555.

Acknowledgement and Financial Support: DFG Th667/3–1; IZKF C21

A-236

Hemodynamic and hormonal changes during hemorrhage in Isoflurane-anesthetized dogs treated with angiotensin II and endothelin-A inhibitors

C. Hoehne, P. Vogler, G. Kaczmarczyk, W. Boemke

Clinic of Anesthesiology and Surgical Intensive Care Medicine, Charité, Campus Virchow-Klinikum, Humboldt-University of Berlin, Berlin, Germany

Goal of the Study: The hemodynamic and hormonal response towards acute hemorrhage was evaluated under isoflurane/NO_2 anaesthesia (1 MAC).

Materials and Methods: Six Beagle-dogs were studied in three protocols in randomised order: 1. In time controls, Control; 2. During angiotensin II-AT$_1$ (Ang II-AT$_1$) receptor inhibition using Losartan (100 μg kg bodywt^{-1} min^{-1} IV), LOS; 3. During endothelin-A (ET$_A$) receptor inhibition using ABT-627 (bolus: 1 mg/kg body wt, thereafter 0.01 mg kg body wt $^{-1}$min^{-1} IV), ABT. In all protocols, after a 30 min baseline period (awake), anaesthesia was induced with 10 mg/kg propofol and maintained with 1.2 vol% iso-flurane and 30/60% O_2/N_2O (anaesthesia). After 60 minutes of anaesthesia, the dogs were withdrawn 20 ml/kg bo-dy wt of blood within 5 min, i.e., about 250 ml, and again observed for one hour. Hemodynamics were continuously recorded and hormones measured after the baseline period (awake), 60 min after the start of anaesthesia, and 60 min after hemorrhage.

Results: Mean arterial pressure (MAP) decreased during anesthesia in Control and ABT (91-86 vs. 65 ± 2 mmHg*), in LOS from 92 ± 3 to 54 ± 3 mmHg§*. At the same time Ang II and vasopressin (ADH) increased in all groups, but norepinephrine (NE) and epinephrine (E) plasma concentrations did not changed. After hemorrhage, MAP decreased to 56 ± 2*$ (Control), 49 ± 3*$ (ABT), 41 ± 2 mmHg*$§ (LOS). Ang II increased about 50% in all protocols, but ADH increased more in ABT and LOS than in Control. NE and E increased in all protocols after hemorrhage. Cardiac output (CO) decreased during anesthesia in all proto-cols (2.2 ± 0.2 vs. 1.5–1.6 l/min*), but in ABT and LOS also after hemorrhage (1–1.1 l/min$). Means ± SEM, n = 6, GLM-ANOVA, *$p < 0.05$ vs. awake, $§p < 0.05$ vs. Control, $p < 0.05$ vs. Anaesthesia.

Conclusion: Angiotensin II inhibition impairs blood pressure regulation during isoflurane/NO_2 anaesthesia and acute hemorrhage despite stimulation of vasoactive hormones like ADH, Epinephrine, and Norepinephrine. In contrast, ET$_A$- receptor inhibition does not impair blood pressure regulation. To a lesser extent, the decrease in CO is impaired by both receptor inhibitions.

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A-237

Metabolic and neuroendocrine profiles of anaphylactic shock in rats

P. Dewachter[1,2], V. Jouan-Hureaux[3], P. Menu[3], P. Mairose[2], M.C. Laxenaire[1], A. Bellou[2], D. Longrois[1,2], P.M. Mertes[1,2]

[1]Departement danesthésie-réanimation chirurgicale, Centre hospitalier régional universitaire, Nancy, France; [2]EA 3447, UHP Nancy I; [3]EA 3452, UHP Nancy I

Background and Goal of the Study: The difficulties of anaphylaxis treatment during anaesthesia could be due in part to a pharmacodynamic or pharmacokinetic impairement of epinephrine. However, neuroendocrine modifications of anaphylaxis are poorly understood. The goal of this study was to evaluate metabolic and neuroendocrine profiles of anaphylactic shock in Brown Norway rats.

Materials and Methods: Two groups of 4 rats were involved in the study. Group anaphylaxis (anaphylaxis) induced by i.v ovalbumin and group nicardipine (NCD): control group in which pharmacologic hypotension of similar magnitude was induced. Blood pressure (MAP, right carotid artery) was continuously measured. A Clarke electrode and 4 microdialysis probes were implanted in both quadriceps to monitor tissue O_2 partial pressure ($PtiO_2$) and interstitial concentrations of lactate (Lac), Pyruvate (Pyr), Epinephrine (E tiss) and Norepinephrine (NE tiss). Plasma levels of Epinephrine (E pl) and Norepinephrine (NE pl) were simultaneously recorded. Values are expressed by mean ± SEM; intra and between groups comparison were achieved using ANOVA followed by Fisher's test when appropriate. ($p < 0,05$ was considered as significant).

Results and Discussion:

	Basal values		Shock + 20 min		Shock + 60 min	
Mean ± SEM	NCD	anaphylaxis	NCD	anaphylaxis	NCD	anaphylaxis
MAP (mmHg)	119 ± 6	144 ± 12	58 ± 2	44 ± 8	53 ± 6	53 ± 17
$PtiO_2$ (mmHg)	66 ± 7	58 ± 14	46 ± 5	8 ± 6	35 ± 6	2 ± 2
Lac/Pyr	14 ± 4	21 ± 4	22 ± 4	55 ± 11	18 ± 0,2*	547 ± 293*
E.tiss (ng.mL^{-1})	0,47 ± 0,2	0,35 ± 0,13	0,64 ± 0,17	0,18 ± 0,1	1,02 ± 0,3*	0,29 ± 0,1*
NE.tiss (ng.mL^{-1})	0,11 ± 0,04	indetectable	0,14 ± 0,09	0,02 ± 0,02	0,35 ± 0,2*	0,71 ± 0,3*
E.pl (ng.mL^{-1})	1,18 ± 0,64	0,42 ± 0,10	3,63 ± 2,28	6,9 ± 2,22	4,60 ± 1,61	7,50 ± 1,44
NE.pl (ng.mL^{-1})	0,26 ± 0,29	0,32 ± 0,03	2,47 ± 1,89	2,66 ± 0,95	3,33 ± 2,07	4,84 ± 1,52

Despite a similar reduction in MAP in both groups, tissue hypoxia and anaerobic metabolism were more pronounced during anaphylactic shock. Despite a strong sympathetic stimulation, tissue penetration of E during anaphylaxis was significantly reduced when compared with control group.

Conclusion: These results suggest that the pharmacokinetic properties of E could be modified during anaphylaxis.

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Anaphylactic shock with increase in serum tryptase and positive prick test after sentinel node mapping with Patent Blue V

A. Hunting*, A.B. Guttormsen, V. Wilhelmsen, Z. Mitic*

**Department of Anaesthesia and Intensive Care, Norwegian Radium Hospital HF, Oslo, Norway; *Anaes Dept, Haukeland U Hosp, Bergen, Heart Lung Centre, Ullevål U Hosp, Oslo, Norway*

Background and Goal of Study: Peritumoural injection of Patent Blue V (PBV) is useful for staining the primary draining lymph node (the sentinel node) of the tumour area blue. This facilitates its subsequent removal for diagnostic purposes. Adverse dye reactions have, however, emerged as an important problem (1).

Materials and Methods: Three (54–67 yr) of 228 breast cancer patients submitted to a sentinel node procedure with PBV developed suspected anaphylactic shock.

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Results and Discussions: *Clinical features:* 1. Uneventful anaesthesia for 22–35 minutes before dye injection. 2. Gradual or abrupt reduction of systolic blood pressure to 43–55 mm Hg at 20–30 minutes after dye injection, in spite of i.v. fluid loading, ephedrine, Trendelenburg position, and discontinuation of anaesthetics. 3. Persisting hypotension and tachycardia for 10–20 minutes. 4. Rapid or gradual normalisation of circulation (in patients 2 and 3 after epinephrine i.v.). 5. Skin manifestations in patients 2 and 3, generalised edema in patients 1 and 2.

Diagnostic investigations:

	Serum tryptase μg/L (normal < 24)			
	Before Exposure	1–2 hours after exposure	Next morning	Prick test PBV
Patient 1	4.3	20.1		Positive
Patient 2	5.8	58.1	19.3	Positive
Patient 3	7.2	34.6	13.7	Positive

All patients had normal total IgE as well as negative specific IgE for latex and suxamethonium. Skin prick tests were negative for latex, neuromuscular blocking agents and other anaesthetics, but positive for PBV.

Conclusions: Severe adverse reactions to PBV are common. Aggressive treatment with i.v. fluid loading and pressors, including epinephrine, are necessary. Mast cell activation (increase in serum tryptase) is involved in the reaction. Positive skin tests indicate that this is most likely an IgE-mediated reaction.

Reference:

1 Lyew MA, Gamblin TC, Ayoub M. Systemic anaphylaxis associated with intramammary isosulfan blue injection used for sentinel node detection under general anesthesia. *Anesthesiology* 2000; **93**: 1145–1146.

A-239

A comparison of haemodynamic response to tracheal intubation between two techniques, intubation via intubating laryngeal mask airway versus direct laryngoscopic tracheal intubation

F.H. Khan, N.T. Siddiqui

Department of Anaesthesiology, Aga Khan University, Karachi, Pakistan

Background and Goal of Study: The intubating laryngeal mask airway (ILMA) has been introduced by Dr Archie Brain in 1996, to facilitate tracheal intubation without laryngoscopy [1,2]. It has been suggested that ILMA guided intubation should be less stimulating than direct laryngoscopic tracheal intubation [3].The goal of the study was to compare the haemodynamic response to tracheal intubation using either direct laryngoscopy or ILMA.

Materials and Methods: This was a prospective randomized controlled trial, one hundred adult ASA-I & ASA-II patients were randomly divided into two groups. In group-I endotracheal intubation was done with the help of Macintosch laryngoscope while in group-II patients intubated with the help of the ILMA. Systolic, diastolic, mean arterial blood pressure and heart rate were recorded at baseline, at laryngoscopy and at 1 minute interval for 10 minutes following intubation. ANOVA was used for analysis of the data.

Results: The mean maximum increase in systolic blood pressure, diastolic blood pressure and mean arterial blood pressure in group-I was 26%, 23% and 27% respectively, compared with 13%, 6%, and 5% respectively for group-II, there was no change in heart rate among the two groups.

Conclusion: We concluded that intubation through intubating laryngeal mask airway is accompanied by minimal cardiovascular responses than those associated with direct laryngoscopic tracheal intubation, so it can be used for patients in whom a marked pressor response would be deleterious.

References:

1 Brain AIJ, Verghese C, Addy V, et al. The intubating laryngeal mask I: development of new device for intubation for trachea. *Br J Anaesth* 1997; 79: 699–703.

2 Brain AIJ, Verghese C, Addy V, et al. The intubating laryngeal mask II: a preliminary clinical report of a new means of intubating the trachea. *Br J Anaesth* 1997; 79: 704–709.

3 Kapila A, Addy V, Verghese C, et al. The intubating laryngeal mask a preliminary assessment of performance. *Br J Anaesth* 1995; 75: 228–229.

A-240

Vasopressin reduces the cerebral oxygenation in an animal model. A near infrared spectroscopy study

B. Bein*, E. Cavus*, K-H. Stadlbauer§, M. Steinfath*, P.H. Tonner*, V. Dörges*

*Departement of Aneasthesiology and Intensive Care Medicine; *University Hospital Kiel, Kiel, Germany; §University Hospital Innsbruck, Austria*

Background and Goal of Study: Animal research suggests an improved cerebral perfusion after administration of vasopressin during cardiopulmonary resuscitation. This action is thought to be mediated by NO [1]. We studied the effect of vasopressin on the cerebral oxygenation during spontaneous circulation in swine with near infrared spectroscopy (NIRS).

Materials and Methods: Following approval of the Austrian Federal Animal Investigational Committee, nine healthy piglets (12–16 weeks, 38 to 42 kg) were anesthetised with propofol and piritramid. Muscle paralysis was achieved using pancuronium. Optodes of the near infrared spectrometer (Niro 300, Hamamatsu Photonics, Japan) were placed directly behind the right and left orbita and the tissue oxygenation index (TOI; $O_2Hb + HHb/HHb$) was recorded continuously with 1 Hz. Each animal first received vasopressin (0,4 U/kg) alone followed by vasopressin after pretreatment with the NOS-inhibitor L-Name (20 mg/kg).

Results and Discussions: 1 minute after vasopressin administration the TOI was significantly ($p < 0,01$) reduced over both hemispheres. L-Name did not have a significant influence on TOI, while the second vasopressin administration again resulted in a significant TOI decline ($p < 0,01$). No significant changes were observed with respect to intracranial pressure.

Conclusion(s): The near infrared spectrometer showed a marked decrease of the cerebral oxygenation after administration of vasopressin both with and without pretreatment with L-Name. This is inconsistent with data in the literature generated with other methods, i.e. jugular bulb oxygen saturation (SjO_2). Further studies have to ascertain whether this is due to a contamination of NIRS readings by extracranial tissue (skull, scalp, liquor) or to differences between regional (NIRS) and global (SjO2) oxygenation.

Reference:

1 Dunser M, Wenzel V, Mayr AJ et al. Anaesthesist 2002; 51:651–659.

A-242

Effect of Etomidate on Angiotensin II signaling in rat aortic smooth muscle cell

S. Pili-Floury*, E. Samain*§, C. Lebouc*, C. Rucker-Martin*, G. Dagher, J. Marty*§, JF. Renaud*

CNRS ESA 8078, M. Lannelongue Hospital, Le Plessis Robinson; §Department of Anesthesiology, Beaujon Hospital, Clichy, France

Background and Goals of Study: Vascular smooth muscle cells (VSMC) response to angiotensin II (Ang II) is critical for blood pressure control. This response is altered by some anesthetic agents (1,2). We tested the effect of etomidate (ETO) on the Ang II-induced Ca_i^{++} transient in rat VSMC.

Material and Methods: The effect of Ang II (1 μM) on Ca_i^{++} release was studied in cultured aortic VSMC from 6 wk.-old Wistar-Kyoto rats, using fluorescent imaging microscopy (NPS, UK), in Fura-2 AM loaded cells. Ca_i^{++} release from internal stores (amplitude of Ca_i^{++} transient) was assessed in the absence of external Ca^{++}. Ca^{++} influx was assessed upon reintroduction of external Ca^{++} (1 mM). Cells were incubated for 15 min in the presence of 10^{-8} to10^{-4} M ETO (in propylene glycol), and then exposed to AngII. The effect solvent itself was tested. Results are m ± SEM. Statistical significance ($P < 0.05$) was assessed with ANOVA.

Results: Ca_i^{++} steady state and thapsigarghin-sensitive Ca_i^{++} storage pools were not significantly altered by ETO. The effects of ETO on AngII-induced Ca_i^{++} release from internal stores and on Ca^{++} influx are in Fig. 1. Solvent itself (highest anesthetic concentration) had no effect.

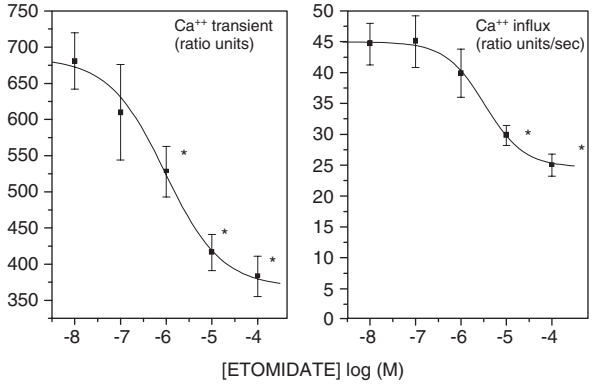

Fig.1 $P < 0.05$: ETO *vs* Contrôle.

Discussion: ETO alters Ang II signaling in VSMC, but in contrast to several other anesthetic agents, this effect is only observed only at supratherapeutic concentrations.

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1 Samain E, Bouillier H, Rucker-Martin C et al. *Anesthesiology*, 2002, 97:642–51.
2 Samain E, Bouillier H, Marty J, et al. *Anesth Analg*, 2000, 90:546–52.

A-243

Effects of Xenon on Hemodynamics in Expiremental Model of Hemorrhagic Shock

E.M. Yoshinaga, R.C. Franceschi, L.M.S. Malbouisson, A.O. Fraga, J.O.C. Auler Jr, M.J.C. Carmona

Department of Anesthesia and Surgical Critical Care, Heart Institute (InCor) of Hospital das Clínicas of São Paulo, University Medical School, São Paulo, Brazil

Background and Goal of Study: Xenon (Xe) is an inert gas with anesthetic properties that maintains hemodynamic stability during anesthetic induction. The objective of this study was to evaluate the hemodynamic effects of Xe in anesthetized dogs undergoing hypovolemic shock.
Materials and Methods: Twenty mongrel dogs were randomized in control or Xe groups. Hypnosis and paralysis were kept by continuous infusion of etomidate and vecuronium. Pulmonary and femoral artery catheters were inserted for hemodynamic monitoring. All animals were ventilated using air/oxygen misture with $FiO_2 = 0.21$. After hemorrhagic shock induction, Xe group received $O_2 = 0.21$ and Xe = 0.79 during 20 min. Hemodynamic data were obtained at baseline, after shock induction, 5 min and 20 min of Xe administration. Data were analyzed using two way RM ANOVA followed by S-N-K *post hoc* test when indicated. P value <0.05 was considered significant.
Results: There were no differences in BSA (0.7 ± 0.08 m^2 vs.0.71 ± 0.08 m^2) and shed blood volume (620 ± 152 vs. 570 ± 173) between the control and xenon groups . Hemodynamic data are shown in the table.

		Baseline	After shock	5 min	20 min
HR (bpm)	control	79 ± 22	145 ± 22	143 ± 28	139 ± 32
	Xe	79 ± 18	104 ± 28*	102 ± 27*	116 ± 29
MAP (mmHg)	control	143 ± 18	52 ± 17	57 ± 32	61 ± 30
	Xe	123 ± 17	61 ± 21	60 ± 26	76 ± 33
PAP (mmHg)	control	18 ± 2	10 ± 3	12 ± 2	13 ± 2
	Xe	18 ± 3	9 ± 2	11 ± 2	13 ± 3
PAWP (mmHg)	control	11 ± 3	5 ± 2	6 ± 2	6 ± 2
	Xe	11 ± 2	5 ± 1	5 ± 0	6 ± 2
CI (l.min-1.m-2)	control	1.8 ± 0.5	0.5 ± 0.2	0.7 ± 0.2	0.9 ± 0.3
	Xe	1.8 ± 0.5	0.8 ± 0.3	0.9 ± 0.3	1.2 ± 0.5
SVRI × 1000	control	5.4 ± 3.4	26.3 ± 17.1	13.8 ± 9.8	10.1 ± 7.5
(dyn.s.cm-5.m-2)	Xe	4.6 ± 2.8	13.6 ± 7.8*	9.1 ± 5.3	6.1 ± 2.6

* ($P < 0.05$ vs. control)

Conclusion(s): Xenon did not induce additional hemodynamic derangement in shocked dogs. It would be an alternative anesthetic to use in hypovolemic states. Further studies are needed to validate experimental data in clinical practice.
Reference:
1 Nakayama H - *Can J Anesth* 49; 375–79: 2002.

A-244

Anesthesia in circulatory arrest for aneurysm surgery

A. Levati, M.P. Moretti, R. Paino, S. Versari

Emergency Department, Neurointesive Care Unit, Niguarda Hospital, Milan, Italy

Introduction: Deep hypothermia and circulatory arrest are indicated in the management of some complex cerebral vascular lesions such as large and giant aneurysms. The data we report from our neuro ICU represents the largest Italian experience treated by this procedure.
Materials and Methods: In the last 3 years, 8 patients (7 females, 1 male) were submitted to cerebral aneurysm surgery with hypothermic circulatory arrest. We report the data from patients managed by the same neuroanesthesiology team (7): 5 patients had an aneurysm in the anterior circulation and 2 in the posterior circulation. Anaesthesia was performed in a routine way; standard cardiovascular parameters were obtained from central venous line (i.e. Swan Ganz catheter). EEG and evoked potentials were continuously registered up to the end of surgery. Before vascular cannulation for cardiopulmonary bypass (CPB) heparin was given at 300 U/Kg to maintain ACT > 400 sec, then was reversed at the end of CPB by protamine and confirmed by ACT test. TPS was given by i.v. infusion at a rate titrated to keep burst suppression. At the end of surgery all the patients were transferred to the ICU for monitoring and awaking.
Results: Mean values ± SD are reported in the table

Parameter	Mean value	SD
AGE (years)	34,7	13,8
Cir. Arrest (minutes)	26,4	16,1
Brain T (°C)	15,9	1,4
Core T (°C)	14,4	1,1
CPB duration (minutes)	153,3	22,4
TPS dosage (mg/Kg/h)	9,3	2,2
Neurol. Recovery(hours)	39	19,4
ICU stay (days)	11,1	7,2

Burst suppression was achieved in all the patients. No cardiac and hemorragic complications were noted. Weaning from ventilation was always possible; 3 patients required NIV. Outcome was as follow: GR 5, MD 1, SD 1.
Conclusions: Our experience encourage us to use the hypothermic cardiac arrest for surgery of difficult cerebral aneurysm: Multidisciplinary approach (to the patient) is necessary and of paramount importance to guarantee the good of such a complex procedure. TPS infusion was not correlated with any particular damage.
References:
1 Lawton M.T. *Neurosurgery*,1998;43;10–21.
2 Young W.L. *Anesthesiology,* 2002; 96;497–503.

A-245

Effects of xenon anaesthesia on the cardiovascular response to hypoxic hypoventilation in pigs

J-H. Baumert, K. Hecker, M. Reyle-Hahn, N. Horn, R. Rossaint

Klinik fuer Anaesthesiologie, University Clinic Aachen, Aachen, Germany

Background and Goal of Study: As xenon anaesthesia may provide haemodynamic stability[1], its influence on the cardiovascular response to acute hypoventilation was compared to isoflurane anaesthesia in pigs. Special attention was paid to the changes in left ventricular systolic function as determined by trans-oesophageal echocardiography (TOE).
Materials and Methods: 20 pigs, after induction of anaesthesia with propofol and orotracheal intubation, were randomised to receive anesthesia with either xenon 0.5 MAC/remifentanil 0.5 mcg/kg/min (group xe, n = 10) or isoflurane 0.5 MAC/remifentanil 0.5 mcg/kg/min (group iso, n = 10). Heart rate (HR), mean arterial pressure (MAP), and left ventricular fractional area change (FAC), as determined by TOE, were collected at control (co), after 5 min of hypoventilation (h5), sufficient to produce moderate hypoxia, and after 5 min of restored ventilation (p5). Data was analysed by use of repeated measures ANOVA.
Results and Discussions: Changes in HR, MAP, and FAC, as induced by hypoventilation, are shown in table 1.

	HR			MAP			FAC		
Gr	co	h5	p5	co	h5	p5	co	h5	p5
Xe	64.9	72.7*	70.4	74.2	71.6	80.7	0.60	0.66#	0.66
Iso	66.5	75.1*	71.4	76.8	73.8	79.4	0.61	0.61	0.62

Arterial pO_2, mean (SD), was decreased from 89.4 (12.6) to 52.6 (5.1) and restored to 77.2 (6.8) in group iso and from 88.4 (9.2) to 52.8 (10.3) and 78.7 (10.2) in group xe.
Conclusion(s): With an increase in HR similar in both groups (*$p < 0.01$), MAP is kept stable during hypoventilation. FAC is increased significantly (# $p < 0.05$) only with xenon. Xenon anaesthesia seems to augment LV function.
Reference:
1 Rossaint R, Reyle-Hahn M, Schulte am Esch J et al.: A multicenter randomized comparison of the efficacy and safety of xenon and isoflurane in patients undergoing elective surgery. *Anesthesiology* 2002; in press.

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Respiration

A-246

A clinical comparison of the Portex disposable versus classical Laryngeal Mask Airway in adult patients. Preliminary study

A. Lopez, R. Valero, M. Pons, N. De Riva, C. Gomar

Department of Anesthesiology, Hospital Clínic, University of Barcelona, Barcelona, Spain

Background and Goal of Study: Disposable LMA is an alternative to the reusable classic LMA (1). The Portex disposable LMA is made of clear PVC and has a wider tube without bars at its end. Differences in shape and physical properties may imply differences in clinical performance. We compared both LMA devices in terms of ease of insertion, airway seal efficacy, fiberoptic examination and complications of use.
Materials and Methods: Twenty five patients were studied randomly allocated in two groups (Classical or Portex). Time needed for insertion and number of attempts until optimal ventilation, seal pressure at 60 cmH_2O intracuff pressure, fiberoptic view (classified in 4 grades), intra and postoperative complications and *in vitro* cuff compliance were measured and registered.
Results and Discussions: No differences were found in time for insertion (C: 59 ± 24 vs P: 88 ± 62 sec) or number of attempts (insertion at first attempt in C: 9/12 vs P: 8/13). Air volume to achieve 60 cmH_2O intracuff pressure was significantly lower in classical LMA (C: 19 ± 5 vs P: 24 ± 5). Seal pressure was significantly higher in Portex LMA (C: 18 ± 4 vs P: 23 ± 6). Fiberoptic view was classified as grade I (complete view of vocal cords) or II (incomplete view of vocal cords) in C: 11/12 vs P: 10/12. Incidence of complications was low and similar in both groups. The most frequent were blood staining detected on mask removal (C: 2/12 vs P: 2/12) and postoperative sore throat (C: 2/12 vs P: 1/12). An *in vitro* test of compliance was performed and showed significantly lower compliance in classical LMA for all sizes tested (3, 4 and 5).
Conclusion(s): Preliminary results suggest that both LMA devices have similar clinical performance in spite of differences in *in vitro* compliance.
Reference:
1 Brimacombe J. *Anesth Analg* 1998; 87: 921–4.

A-247

Comparison between Standard Laryngeal mask airway and Proseal laryngeal mask airway as ventilatory devices

G.S. Voyagis,C. Iatrou, E. Skouteli, N. Noulas, J. Atsalakis, V. Dimitriou

Department of Anaesthesia, Gennimatas & Sotiria Hospitals, Athens and Democritus University of Thrace, Alexandroupolis, Greece

Background and Goal of Study: Standard laryngeal mask (SLM) and Proseal laryngeal mask (PLM) have gained acceptance for use during anaesthesia. In the following randomised, double comparative, prospective study, we compared the SLM and the PLM when used as ventilatory devices.
Material and Methods: After IRB approval, 50 ASA 1–3 adults undergoing elective surgery were included. Using closed envelopes patients were randomly divided in two groups and were ventilated either with the SLM (group A, n = 25) or with the PLM (group B, n = 25). The PLM was inserted without the aid of the introducer. The success rate and number of attempts at insertion, the maximum tidal volume (VTmax), the maximum positive inspiratory pressure at which a leak was noticed (PIP) and the dynamic compliance (Cdyn), were recorded. Additionally the success rate for nasogastric tube insertion (NGT) was recorded after both devices were inserted.
Results: There were no demographic differences between groups. The table shows success rates of SLM, PLM and NGT placement, as well as mean values ± standard deviation.

	SLM	PLM	P-value
Success rate (1st/2nd attempt)	25/0	20/5	0.05§
VT max (ml/kg)	15.6 ± 3.8	17.7 ± 4.2	0.07*
PIP (cmH_2O)	24.5 ± 6.6	31.5 ± 5.3	0.0001*
Cdyn (ml/cmH_2O)	50 ± 8.4	44.1 ± 7.2	0.01*
NGT success	25/25 (100%)	22/25 (88%)	NSS§

*Unpaired t-test, §Fisher's exact test, NSS: non statistical significant

Conclusion: The SLM seems to be inserted easier than the PLM. The PLM is not superior to the SLM as a ventilatory device. NGT insertion is similarly easy in both devices.

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Comparison between Intubating Laryngeal mask airway and Proseal laryngeal mask airway as ventilatory devices

G.S. Voyagis, C. Iatrou, A. Kaperda, M. Varveri, A. Chanzizisis, V. Dimitriou

Department of Anaesthesia, Gennimatas & Sotiria Hospitals, Athens and Democritus University of Thrace, Alexandroupolis, Athens, Greece

Background and Goal of Study: Intubating laryngeal mask (ILM) and Proseal laryngeal mask (PLM) have gained acceptance for use during anaesthesia. (1,2). In the following randomised, double comparative, prospective study, we compared the ILM and the PLM when used as ventilatory devices.
Material and Methods: After IRB approval, 50 ASA 1–3 adults undergoing elective surgery were included. Using closed envelopes patients were randomly allocated in two groups and were ventilated either with the ILM (n = 25) or with the PLM (n = 25). The PLM was inserted with the aid of the introducer. The success rate and number of attempts at insertion, the maximum tidal volume (VTmax), the maximum positive inspiratory pressure at which a leak was noticed (PIP) and the dynamic compliance (Cdyn), were recorded. Additionally the success rate for nasogastric tube insertion (NGT) was recorded after both devices were inserted.
Results: There were no demographic differences between groups. The table shows success rates of ILM, PLM and NGT placement, as well as mean values ± standard deviation.

	ILM	PLM	P-value
Success rate (1st/2nd attempt)	25/0	19/6	0.02§
VT max (ml/kg)	16.2 ± 4.5	19.9 ± 3.8	0.003*
PIP (cmH_2O)	30.2 ± 5.8	39.3 ± 6.7	<0.001*
Cdyn (ml/cmH_2O)	41.1 ± 7.3	38.8 ± 5.2	NSS*
NGT success	24/25 (96%)	23/25 (92%)	NSS§

*Unpaired t-test, §Fisher's exact test, NSS: non statistical significant

Conclusion: The ILM seems to be inserted easier than the PLM. The PLM is not superior to the ILM as a ventilatory device. NGT insertion is equally easy in both devices.
References:
1 Dimitriou V, Voyagis GS. *Eur J Anaesthesiol* 1999; 16: 448–53.
2 Dimitriou V, Voyagis GS. *Acta Anaesthesiol Scand* 2000; 44: 1002–6.

A-250

Laryngo-pharyngeal sequels to the use of two supraglottic devices for spontaneous breathing

A. Vachlioti, M. Vasiliadis, A. Koumpos, A. Konstantinidou

Department of Anaesthesia, "THEAGENIO", Anticancer Hospital of Thessaloniki, Thessaloniki, Greece

Background and Goal of Study: The PAxpress is a new supraglottic device. The aim of the study was to compare the incidence of sore throat, dysphagia and dysphonia following anaesthesia, using the LMA[1] and PAxpress[2], among female patients breathing spontaneously.
Materials and Methods: In a prospective trial, 97 female patients, ASA I-II, undergoing breast surgery were randomized into two groups (LMAgroup: n = 48, PAXgroup: n = 49) with respect to type of supraglottic device was used. Anaesthesia was induced with propofol 1.5 mg/kg and remifentanil 1 μg/kg. After the insertion of the device the ventilation was manually assisted until the patient started breathing spontaneously. Anaesthesia was maintained with sevoflurane 0.6–1.5 vol%, a mixture of N_2O 60% in O_2 and remifentanil 0.02–0.05 μg/kg/min.

Thirty minutes after recovery from anaesthesia, patients were assessed for sore throat, dysphonia and dysphagia. Statistical comparisons were performed by Student's unpaired t-test and Fisher's exact test as appropriate (statistical significance when $p < 0.05$).
Results and Discussions: The groups were similar according to age, body mass index, the duration of surgical intervention and cuff pressure. Insertion of the device was successful on the first attempt in all patients. The quality of spontaneous ventilation was satisfactory in both groups. Postoperative analgesic management was comparable in two groups. The incidence of sore throat in LMAgroup was higher than that of the PAXgroup (29.1% vs. 8.1%; $p < 0.05$). The incidence of dysphonia and dysphagia were comparable in two groups (LMA: 4% vs. PAX: 2% and LMA: 52% vs. PAX: 45% respectively).
Conclusion(s): Although effective spontaneous breathing ventilation can be accomplished with both devices, the lower incidence of sore throat with PAxpress was beneficial for the adult female patients of this study.

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2 Zaballos J. Anesthesiology 2002; 96: A1322.

A-251

Fluid leakage past tracheal tube cuffs: evaluation of the new Microcuff tracheal tube

A. Dullenkopf, A.C. Gerber, M. Weiss

Department of Anaesthesia, University children's hospital Zürich, Zürich, Switzerland

Background and Goal of Study: Cuffed tracheal tubes are intended to prevent aspiration of pharyngeal content into the lower trachea. Cuff pressure (Pc) should be monitored to avoid tracheal mucosal damage [1]. A widely quoted Pc limit is 30 cmH_2O. Commonly used cuffs do not reliably seal the trachea within this limit. Goal of our study was to in-vitro evaluate the resistance to fluid leak-age of the recently introduced Microcuff tube cuff and to compare it with different widely used tracheal tubes.
Materials and Methods: We compared the following tracheal tubes (ID 7,5 mm) in-vitro: (A) Mallinckrodt HiLo, (B) Microcuff HVLP, (C) Portex SoftSeal, (D) Rüsch SuperSafetyClear, (E) Sheridan CF. A vertical PVC trachea model (in-ternal diameter 20 mm) was intubated and the cuff inflated to 10/15/20/30, and 60 cmH_2O. 5 ml of coloured water was added atop of the cuff. The amount of leaked fluid was registered in a container below the model after 10 min. Each experiment was performed 4 times using 2 tubes of each type. Results of each type were compared to Microcuff results for each Pc (t-test; $p < 0,05$ as significant).
Results and Discussion: Leakage presented in ml as mean (±SD). Pc in cmH_2O. *indicates statistical significance.

Pc	10	15	20	30	60
A	4.8*(±0.1)	4.9*(±0.1)	4.9*(±0.1)	4.3*(±1.2)	0.8(±1.0)
B	0.5(±0.9)	0(±0)	0(±0)	0(±0)	0(±0)
C	4.9*(±0.1)	4.9*(±0.1)	4.9*(±0.1)	4.9*(±0.1)	2.2(±1.9)
D	4.9*(±0.1)	4.8*(±0.1)	4.6*(±0.1)	4.7*(±0.1)	2.3*(±0.1)
E	4.9*(±0.1)	4.8*(±0.1)	4.8*(±0.6)	4.8*(±0.2)	4.9*(±1.8)

In our in-vitro setup 4 of 5 commercially available tracheal tubes did not prevent fluid leakage around the cuff, if blocked within a range thought to be acceptable. The special design of the ultrathin (7 μm) Microcuff HVLP polyurethan cuff effectively sealed the trachea model within this range. In-vivo studies are required to confirm these results.
Conclusion: Within the limit for cuff pressure of 30 cmH_2O, the Microcuff tracheal tube was the only of the tested tubes to prevent fluid leakage in our setup. This goal was achieved using a cuff pressure of 15 cmH_2O.
Reference:
1 Latto P. The cuff. In Latto IP, Vaughan RS (ed.): Difficulties in tracheal intubation. London, WB Saunders 1997.

A-252

Does right tracheal tube cuff pressure depends on anaesthetists seniority and experience?

M.A. Wujtewicz, W. Sawicka, A. Bukowska, R. Owczuk, M. Wujtewicz

Department of Anesthesiology and Intensive Therapy, Medical University of Gdansk, Gdansk, Poland

Background and Goal of Study: Excessive tracheal tube cuff pressure (CP) can cause ischaemic changes in the tracheal mucose[1], and the most dramatic complication – rupture of a trachea[2].Too low cuff pressure increases the risk of aspiration of the gastric contents to the respiratory tract and spontaneous, accidental extubation. The aim of the study was to find out if maintenance of the proper cuff pressure depends on seniority and experience of the anaesthetist.
Materials and Methods: We measured the CP of the low-pressure high-volume PORTEX tracheal tubes in 106 patients undergoing general anaesthesia.The CP was measured during first 30 minutes of the anaesthesia. The cuffs were filled with air by a nurse under surveillance of an anaesthetist. We were using the manometer PORTEX designed for low-pressure high-volume tracheal tubes. The recommended range of CP was 1,56–2,54 kPa. Measurements were performed several times and the teams were unaware that the audit was taking place. If the CP was out of range, it was to corrected to proper values. The results were analized with reference to the seniority of anaesthetist, who were divided into 3 groups I:doctors in the first year of practice; II:doctors with 2–10 years of practice; III:doctors with > than 10 years of practice
Results and Discussions: Presented in table below:

Group	Mean CP/kPa/(STD)	Results < Range	Results in Normal Range	Results > Range
I (23 tests)	3,28 (2,19)	4,3%	43,5%	52,2%
II (62 tests)	3,94 (2,94)	14,5%	27,4%	58,1%
III (21tests)	3,06 (2,47)	23,8%	33,3%	42,9%

The data analysis with Fisher's test didn't reveal any differences among average values of all groups.
Conclusions: (1) The seniority and professional experience does not influence on maintenance of proper CP. (2) Over-inflation was more frequent than under-inflation in all groups.
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A-253

Use of target-controlled propofol infusion (TCI) and inhalational sevoflurane for fiberoptic intubation

M. Bonnin, J.M. Constantin, E. Albuisson*, H. Beaujard, P. Therre, I. Barthelemy**, J.M. Mondie**, P. Schoeffler, J.E. Bazin

*Department of Anesthesiology, Anesthésie-Réanimation (DAR), Hôpital Gabriel Montpied *Statistics; **Plastic and Facial Surgery, Hôtel-Dieu, Clermont-Ferrand, France*

Background and Goal of study: Propofol TCI is recommended for management of difficult airway intubation and fiberoptic intubation under spontaneous ventilation (1,2). No data are available about sévoflurane (3). The aim of this study was to compare propofol and sevoflurane as hypnotics during fiberoptic intubation under spontaneous ventilation.
Materials and Methods: After IRB approval 52 ASA 1–2 informed consent patients without any predicting sign for difficult intubation were randomly assigned to one of two groups. After a 3 min preoxygenation, the patients received either propofol with a target-concentration of 4 mg/l (group P; $n = 26$) or sevoflurane 4% with tidal volume ventilation (group S; $n = 26$). After 2 minutes, propofol concentration was increased of 1 mg/l, and sevoflurane concentration of 1% every 2 min until efficient concentration defined in the two groups by the absence of reaction to the mandible subluxation. This concentration was maintained during 4 minutes before the start of nasotracheal fiberoscopy for intubation. Pulse oxymetry, bispectral index (BIS), heart rate and arterial blood pressure were assessed during induction (before the start of fiberoscopy) and during fiberoscopy. Quality of intubation and operator satisfaction was evaluated using scores. Data have been compared using Student t test, Mann-Withney U test, and Khi square. A p value of 5% was considered as significant.
Results and Discussion: During induction, no difference in pulse oxymetry, BIS at the end of induction and duration of induction was noted between the 2 groups. No difference in duration and quality of intubation was noted. Five episods of desaturation (<90%) were observed during fiberoptic intubation in the group P versus 0 in the group S.
Conclusion: Anesthesia with sevoflurane allowed fiberoptic intubation of good quality in patients spontaneously breathing without hypoxemic episod as observed with propofol.
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A-254

The comparison of Intra Ocular Pressure changes after laryngeal mask airway and endotracheal intubation during general anesthesia

M.A. Attari, M. Ansari

Department of Anesthesia, Isfahan University of Medical Sciences, Isfahan, Iran

Background and Goal of study: The level of Intra Ocular Pressure (IOP) may affect the outcome of the cataract surgery. Laryngoscopy and tracheal intubation (LTI) have been shown to elevate the IOP (1). It has been shown that the use of Laryngeal Mask Airway (LMA) may be associated with lower increase in IOP (2) but the results of previous studies are contradictory (3). The goal of the present study was to compare the effect of LMA insertion on IOP changes with that of the LTI.
Materials and Methods: Thirty-five adult patients scheduled for cataract surgery under general anesthesia were randomly divided into LTI and LMA groups with the airway management in the form of tracheal intubation and LMA respectively. The IOP was measured before and after insertion of the

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respective airway. Data were compared within and between groups using repeated measures analysis of variance.
Results and Discussion: IOP rose significantly in both groups after airway insertion, but the rise was significantly higher in LTI group compared to LMA group ($P < 0.05$). Since the stimulation of sensitive pharyngeal and laryngeal structures are relatively lower during LMA insertion compared to LTI, it results in a lower level of IOP compared to what is happen after LTI.
Conclusion: It can be concluded that the use of LMA for cataract surgery under general anesthesia can prevent the increases of IOP and therefore may improve the outcome of the surgery.
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A-255

Perfluorohexane vapor attenuates ventilator induced lung injury

Marcelo Gama de Abreu, Beate Wilmink, Thomas Rössel, Jörg Uwe Bleyl, Thea Koch

Clinic of Anesthesiology and Intensive Care Medicine, University Clinic Carl Gustav Carus, Technical University Dresden, Dresden, Germany

Background and Goal of Study: Perfluorohexane vapor (PFH) attenuates lung injury induced by oleic acid (1). We tested the hypothesis that PFH may also have a protective effect in the development of ventilator-induced lung injury (VILI) in an isolated, perfused rabbit lung model.
Materials and Methods: Initially, the lungs were protectively ventilated, with peak inspiratory and positive end-expiratory pressures (PIP and PEEP, respectively) set to avoid lung collapse and overdistension (baseline). Following that, PIP and PEEP were set at 30 and 0 cmH_2O, respectively, and animals were randomized to one of two groups: (1) administration of 18% PFH; (2) control group (no administration of PFH). After 20 min of cycling collapse and overdistension, PIP and PEEP were set back to baseline levels and the protective ventilation was performed for 60 min (time 60) in all lungs, without interruption of PFH administration in the therapy group. Lung weight (WG), mean pulmonary artery pressure (MPAP) and the release ratio of thromboxane (TXB_2) were determined at baseline, time 0 and time 60.
Results and Discussion: No statistical significant differences were observed in the variables investigated at baseline and time 0. At time 60, WG, MPAP and the release ratio of TXB_2 were significantly lower in the therapy group, as compared to the control group (16 ± 12 vs. 59 ± 24, 32.4 ± 5.6 vs. 75.3 ± 24.8, 91.7 ± 53.4 vs. 179.2 ± 97.3, respectively. $P < 0.05$ for all tests).
Conclusion(s): We conclude that the administration of 18% PFH attenuates the development of VILI in this model.
Reference:
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A-257

Effect of NF-κB inhibition in acid-induced lung injury

B. Beck-Schimmer, L. Madjdpour, L. Reyes, C. Booy, T. Pasch, R.C. Schimmer

Institute of Anesthesiology, Institute of Physiology, Medical School, University of Zurich, Zurich, Switzerland

Background and Goal of Study: Acid aspiration is a clinically well known situation, but the underlying immunopathological processes are poorly understood. Transcription factor nuclear factor-kappaB (NF-κB) has been identified as a very important regulatory factor in many inflammatory conditions in the lung. Pyrrolidine dithiocarbamate (PDTC), an inhibitor of NF-κB activation, has been demonstrated to possess anti-inflammatory activity (1). Therefore, the anti-inflammatory effect of PDTC was evaluated *in vivo* in an aspiration model in the rat lung.
Materials and Methods: 300 μl PDTC (50 μM) were instilled intratracheally, followed by intratracheal application of 300 μl HCl (0.1M, pH = 1) 30 min later. Neutrophils in bronchoalveolar lavage fluid (BALF) and interstitial space (myeloperoxidase, MPO) were quantified 5 hours later. Vascular permeability was determined as well as lung inflammatory mediators such as intercellular adhesion molecule-1 (ICAM-1), tumor necrosis factor-α (TNF-α) and monocyte chemoattractant protein-1 (MCP-1). Statistical significance of differences between groups was assessed by a two-tailed Student's *t*-test.
Results and Discussions: BALF in control animals (PBS 1 hour, HCl 5 hours) showed 20×10^6 cells, while treated animals (PDTC 0.5 hour, HCl 5 hours) had only 12×10^6 cells ($p < 0.01$). Also neutrophil content in the interstitial space decreased by 50% ($p < 0.01$). Permeability was decreased by 31% ($p < 0.05$). mRNA for ICAM-1 was not changed by PDTC, TNF-α and MCP-1 mRNA, however, were significantly reduced.
Conclusion(s): Intratracheally applied NF-κB inhibitor PDTC seems to act as an anti-inflammatory agent in the acid-induced cellular inflammatory response.
Reference:
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A-258

Stimulation of adenosine A1 and A2 receptors improves energy balance in the lung under endotoxemia

A.R. Heller, M.A. Weigand, J. Rothermel, H.J. Bardenheuer, T. Koch

Departments of Anaesthesiology University Hospitals of Dresden and Heidelberg, Dresden, Germany

Background and Goal of Study: Although basic characteristics of adenosine (ADO) were described in 1939, the therapeutic potential of this compound during acute organ damage was focused not until a few years ago Thus, we investigated differential effects of adenosine A_1 and A_2-agonists on endotoxin (LPS)-induced lung injury and tissue energy balance in a standardized ex vivo model.
Materials and Methods: After approval by the Institutional Animal Protection Board experiments were performed in 18 isolated and ventilated rabbit lungs which were perfused with a Krebs-Henseleit-10% blood-buffer. It was tested whether pretreatment with ADO A_1 agonist (CCPA; 10^{-7}M, n = 6) or A_2 receptor agonist (CPCA; 10^{-7}M, n = 6) – prior to injection of LPS (0.5 μg/ml) influenced pulmonary artery pressure (PAP), lung energy state, and edema formation as compared to controls, solely infused with LPS (n = 6).
Measurements: Lung tissue concentrations of ATP, ADP, and AMP were measured by HPLC, the adenine nucleotide pool, and the adenylate energy charge of the pulmonary tissue were calculated.
Results and Discussions: Administration of LPS induced increases in PAP within 2 h up to 20.8 ± 2.9 mmHg ($p < 0.01$). While pretreatment with the A_1-agonist merely decelerated pressure increase after 2 hrs. (13.8 ± 1.1 mmHg; $p < 0.05$), A_2-agonist completely suppressed the pulmonary pressure reaction (9.6 ± 1.0 mmHg; $p < 0.01$). Emergence of lung edema after exclusive injection of LPS up to 12.0 ± 2.9 g was absent after A_1-(0.6 ± 0.5 g) and A_2-agonists (-0.3 ± 0.2 g). These observations were paralleled with increased ADO release rates compared with LPS-controls ($p > 0.05$). Moreover, tissue concentrations of ADP and ATP, were significantly reduced after LPS. Consequently, the calculated tissue adenine nucleotide pool and the adenylate energy charge collapsed after LPS but was maintained after ADO receptor stimulation ($p = 0.001$).
Conclusions: ADO A_1- and A_2-receptor agonists reduced LPS induced vasoconstriction and edema-formation by maintenance of cellular energy supply with high-energy phosphates. Interventions, in particular into the A_2-receptor mediated cellular signaling pathways, might offer therapeutic opportunities in acute lung injury.
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A-259

Efficacy and safety of a new jet nebulizer system for aerosolization in the ventilated rat

S. Hoegl, C. Hofstetter, M. Flondor, G. Kemming, E. Thein, B. Zwissler

Department of Anaesthesiology and Institute for Surgical Research, Ludwig-Maximilians University, Munich, Germany

Background and Goal of Study: Though being the most commonly used laboratory animal, rats presently do not serve to investigate aerosol-therapy using jet nebulizers due to the risk of pulmonary tissue trauma[1]. Our aim was to clarify if aerosol deposition is safe and effective in rats using a new jet nebulizer system during mechanical ventilation.
Materials and Methods: After governmental permission, 24 anaesthetized, ventilated rats (Siemens-Servo®900B) were treated with test aerosol (Siemens-Nebulizer®945, Micro-Cirrus®, PBS 1 ml) over a period of 40 min. We modified the nebulizer system by reducing the supply pressure and by installing a valve. In 8 rats, side effects were assessed from heart rate (HR, min^{-1}), arterial pressure (MAP, mmHg) and blood gases (paO_2, $paCO_2$, mmHg) before

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(PRE), during (JET) and after (POST) nebulization. Lung tissue trauma was assessed from light microscopy (HE) by a blinded pathologist. Statistics: Wilcoxon Signed Rank Test. In 16 rats, fluorescent microspheres (FMS 1.0 μm) were nebulized to prove for efficacy of alveolar deposition, which was investigated histologically (fluorescence-microscopy (n = 8)) and quantified by luminescence-spectrophotometry of digested lung tissue[2] (n = 8).

Results and Discussions: Data [Median (IQR)]:

	HR	MAP	paO_2	$paCO_2$
PRE	357 (14)	135 (22)	143 (21)	30 (7)
JET	350 (19)	142 (36)	156 (65)	28 (8)
POST	347 (26)	147 (33)	141 (52)	27 (11)

None of the *in vivo* parameters were significantly altered by nebulizing test-aerosol ($P > 0.05$). None of the tissue samples showed histological alteration. Alveolar deposition of FMS equalled 3.6% ± 0.92 of generated aerosol (Mean ± SD).

Conclusions: Our setup allows an effective alveolar deposition of aerosol particles in rats with no side effects on hemodynamics, gas exchange and lung tissue integrity.

References:

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A-260

Na^+/H^+ exchange inhibitor Cariporide: adverse effects on pulmonary function after cardiopulmonary bypass

W. Eichler[1], J.F.M. Bechtel[2], S. Klaus[1], J. Schumacher[1], M. Hernandez, K. Toerber[2], C. Bartels[2], K.F. Klotz[1]

Department of [1]Anaesthesiology and [2]Cardiothoracic surgery, Medical University of Lübeck, Luebeck, Germany

Background and Goal of Study: Cariporide a selective Na^+/H^+ exchange subtype 1 (NHE-1) inhibitor, has been shown to reduce tissue injury following cardiac ischemia in various models and clinical studies of myocardial ischemia (1). The lung is known to contain NHE-1 (2) and we therefore wanted to investigate the effect of Cariporide on pulmonary dysfunction after cardiopulmonary bypass (CPB).

Materials and Methods: After governmental approval 16 pigs underwent CPB for 60 min. Prospective and randomized vehicle (saline) or the NHE-1 inhibitor cariporide was administered 30 min before initiation of CPB and was continued throughout each protocol (bolus 180 mg, 40 mg/h). 5, 60, 120 and 180 min post CPB the alveoloarterial O_2-gradient ($AaDO_2$), the compliance (Cpl), the pulmonary arterial pressure (PAP_{mean}), the pulmonary capillary wedge pressure (PCWP) and the cardiac output (CO) were evaluated and compared to baseline (Wilcoxon-test). Group differences were estimated by Mann–Whitney-U-test, level of significance was $p < 0.05$.

Results and Discussions: Compared to baseline $AaDO_2$ and PAP_{mean} increased after discontinuation of CPB with significantly higher values after 60 and 120 min in the Cariporide group. Cpl dropped markedly in both groups whereas CO and PCWP remained nearly unchanged after CPB independently of the group. Parameters of gas exchange and pulmonary resistance worsened due to therapy with Cariporide without benefit in global cardiac performance.

Conclusion(s): The supposed beneficial effect of an NHE-1 inhibitor especially on myocardial ischemia might be counteracted by adverse effects of other organs like the lung.

References:

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A-261

Perfadex improves early ventilation/perfusion ratio after bilateral lung transplantation

M.I. Rochera, E. Molina, O. Martinez-Silva, M. Ribas, V.A. Gancedo

Department of Anaesthesia. Vall dHebron Universitary Hospital, Barcelona, Spain

Background and Goals: Reperfusion injury creates a marked alveolar dead-space ventilation immediately after bilateral lung transplantation (1). Perfadex improves graft function following lung transplantation (2).

Material and Methods: 45 consecutive patients, whose organs were preserved with Euro-Collins (n = 24, age 44 ± 13) or Perfadex (n = 21, age 49 ± 10), were assessed immediately after bilateral lung transplantation. Haemodynamic and respiratory parameters were determined at the end of the procedure: mean arterial pressure (MAP), mean pulmonary arterial pressure (MPAP), cardiac index (CI), partial pressure of carbon dioxide ($PaCO_2$), end-tidal CO_2 partial pressure ($PetCO_2$), arterial to end-tidal CO_2 tension difference (Pa-etCO2) and PaO_2/FiO_2 ratio. Duration of ischemia was registered. The ANOVA test was used for the statystical analysis.

Results and Discussion: Data (Mean ± SD) are shown in the table:

	Euro-Collins	Perfadex
MAP (mmHg)	83 ± 172	79 ± 21
MPAP (mmHg)	26 ± 13	21,6 ± 5
IC (L/min/m²)	3,14 ± 0,74	2,62 ± 0,64*
$PaCO_2$ (mmHg)	52 ± 16	42,5 ± 6,8*
$PetCO_2$ (mmHg)	32 ± 7,5	29 ± 3,9*
$Pa\text{-}etCO_2$ (mmHg)	21 ± 14,5	14,5 ± 6*
PaO_2/FiO_2 (%)	254 ± 213	261 ± 146
Ischemia 1st graft (min)	234 ± 56	227 ± 61
Ischemia 2nd graft (min)	395 ± 60	373 ± 73

*$p < 0.05$

$PaCO_2$, $PetCO_2$ and the $Pa\text{-}etCO_2$ difference were significantly decreased in the Perfadex group. PO_2/FiO_2 was comparable in both groups. IC, although normal in both groups, was significantly decreased in the Perfadex group. Duration of ischemia was similar in both groups.

Conclusions: Our data suggest less early alveolar dead space and better ventilation/perfusion ratio in lungs perfused with Perfadex.

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A-262

Comparison of total alveolar recruitment methods versus a single 3-cycled fast-insuflation maneuver in experimental ARDS

P. Ruiz-Gimeno, M. Soro, M. Varela, M. Santos, F.J. Belda, F. Tendillo, J.L. Jover, J. Maseda

105-ES-Act, Departments of Anesthesia and Critical Care, Hospital Clinico Universitario, Valencia, Spain

Background and Goals: Lung-protective ventilation is today the best approach to the treatment of ALI/ARDS and recruitment maneuvers (RM) are often included in the protocol[1].The importance of RM lies in permitting to adjust a PEEP level below the lower inflexion point (LIP) mantaining lung volumes[2]. However, the most optimal recruitment maneuver has not been figured out yet.

Methods: We produced an ARDS in 16 piglets by a repeated broncoalveolar lavage. After obtaining the distress, the LIP was determined by a slow-insuflation maneuver with the Galileo Gold ventilator (Hamilton Medical, Switzerland). Group A(n = 8) underwent several RM up to the control PaO_2 level. Group B(n = 8) underwent a single RM consisting of 3 fast insuflation maneouvres (Ti 0.4s, Te 0.6 s) under Pcontrol (Pc) of 35 cmH_2O. In both groups VT was adjusted at 7 ml/kg with PCV and PEEP level was 3 cmH_2O below the LIP. PaO_2, $PaCO_2$ and pH were measured before and after ARDS performance, and after 15 minutes and 1, 3 and 6 hours after RM. Kolmogorov-Smirnov test was used to prove he parameter´s normality, and the T-Student test to detect significant differences between means of both groups. Significance level was established at $p < 0.05$.

Results: As shown at the table below.

		Control	ARDS	15 min	1 h	3 h	6 h
PaO_2	A	528 ± 77	104 ± 31	490 ± 78	477 ± 101	524 ± 68	512 ± 73
	B	555 ± 45	97 ± 11	499 ± 46	512 ± 44	533 ± 58	533 ± 58
$PaCO_2$	A	4 ± 4	78 ± 27	59 ± 11	61 ± 13	5 ± 14	55 ± 13
	B	39 ± 5	75 ± 10	62 ± 5	61 ± 7	57 ± 5	59 ± 6
pH	A	7.4 ± 0.04	7.2 ± 0.01	7.3 ± 0.05	7.3 ± 0.07	7.3 ± 0.08	7.3 ± 0.08
	B	7.4 ± 0.04	7.1 ± 0.08	7.2 ± 0.03	7.3 ± 0.05	7.3 ± 0.03	7.3 ± 0.04
Pc	A	17 ± 5	19 ± 3	24 ± 5	24 ± 5	26 ± 6	26 ± 6
	B	19 ± 2	19 ± 2	24 ± 1	24 ± 1	25 ± 1	24 ± 2
PEEP	A	6 ± 2*	4 ± 2*	12 ± 2	13 ± 3	13 ± 3	14 ± 2
	B	3 ± 1	2 ± 0	11 ± 0	11 ± 0	11 ± 0	11 ± 0

*$p < 0.05$ when comparing A and B

Conclusions: Both maneuvers achieved the same PaO_2 level and no statistically-significant difference was found in any of the parameters at any moment. PEEP level adjusted 3 cmH_2O below the LIP was good enough to mantain oxygenation level at any time.

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1 Amato MB et al. N Engla J Med 1998; (348)347.
2 Lachmann B. Intens Care Med 1992; (18)319.

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Alveolar recruitment allows the setting of a PEEP level below the lower inflexion point of the PV curve in experimental ARDS

P. Ruiz-Gimeno, M. Soro, M. Varela, M. Santos, F.J. Belda, F. Tendillo, J.L. Jover, J. Maseda

105-ES-Act, Departments of Anaesthesia and Critical Care, Hospital Clinico Universitario, Valencia, Spain

Background and Goals: According to a lung-protective ventilation (LPV), PEEP level must be adjusted 2 cmH_2O above the LIP measured on the PV curve[1]. However, according to the Open Lung approach[2], LPV can be applied after a recruitment maneuver (RM) and the PEEP level should be able to mantain 95% of alveoli recruited when adjusted below the LIP. We studied this effect and its mantainance during a period of 6 hours.

Methods: We produced an ARDS in 6 piglets by broncoalveolar lavage with saline solution. LIP was determined by a slow-insuflation maneuver performed with the Galileo Gold ventilator (Hamilton, Switzerland), and PEEP was set 3 cmH_2O below its value. The RM consisted of a 3-cycled fast-insuflation maneuver with Pcontrol 35 cmH_2O. LPV was performed under the PCV mode with a VT of 7 ml/Kg. ABG values were measured before and after the ARDS was established, and 15min and 1, 3 and 6 hours after lung recruitment.

Results: LIP mean value was 16 ± 1 cmH_2O. Parameters' values throughout the study are shown at the table below.

	Control	Post ARDS	15 min	1 h	3 h	6 h
PaO_2	555 ± 45	97 ± 11	499 ± 46	512 ± 44	533 ± 58	533 ± 58
$PaCO_2$	39 ± 5	75 ± 10	62 ± 5	61 ± 7	57 ± 5	59 ± 6
pH	7.4 ± 0.04	7.1 ± 0.08	7.2 ± 0.03	7.3 ± 0.05	7.3 ± 0.03	7.3 ± 0.04
Pc	19 ± 2	19 ± 2	24 ± 1	24 ± 1	25 ± 1	24 ± 2
PEEP	3 ± 1	2 ± 0	11 ± 0	11 ± 0	11 ± 0	11 ± 0

Conclusions: After a single 3-cycled fast-insuflation recruitment maneuvre, total alveolar recruitment can be achieved and a PEEP level below the LIP proves efficient to keep proper PaO_2 levels in experimental ARDS caused by BAL with saline solution during a 6-hour study.

References:

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2 Lachmann B. Intens Care Med. 1992; (18) 319.

A-264

Effects of thoracic epidural block on oxygenation during one-lung ventilation: a pilot study

K. Iemi, G. Mascotto, G. Cappelleri, E. Bignami, E. Spreafico, A. Casati

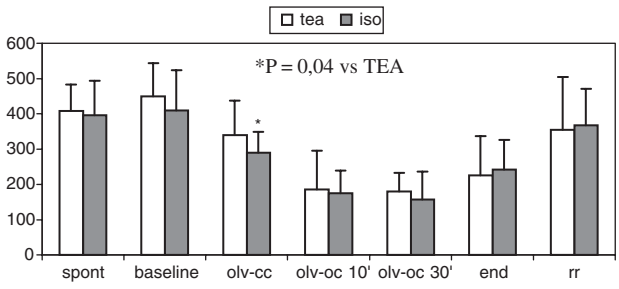
Dept. of Anesthesiology, Vita-Salute University of Milano, IRCCS H. San Raffaele, Milano, Italy

Background: The aim of this study was to evaluate the effects of thoracic epidural anesthesia on patients' oxygenation during one-lung ventilation (OLV).

Methods: 38 patients, ASA physical status I–III, undergoing thoracic surgery were randomly allocated to receive general anesthesia alone (group ISO, n = 16) or combined epidural-general anesthesia (group TEA, n = 22)

After induction (fentanyl 1 mcg/kg, thiopental 6 mg/kg, and atracurium bromide 0.5 mg/kg), general anesthesia was maintained with either isoflurane (End tidal concentrations: 0.6–1.5%) or epidural anesthesia (5 ml of 1% lidocaine every 60 min, after an initial 100 mcg bolus of fentanyl) combined isoflurane (End tidal concentrations: 0.3–0.6%). Lungs were mechanically ventilated with a 50% oxygen in nitrous oxide mixture, while isoflurane concentrations were adjusted to maintain cardiovascular stability. Arterial blood gasses were measured before surgery during two-lung ventilation, in lateral position with OLV-closed chest, 10 and 30 min after OLV-open chest, and at the end of surgery.

Results: Changes in PaO_2/FiO_2 ratio are reported in the figure:



11 patients (45,8%) of group TEA and 9 patients (56,2%) of group ISO required 100% oxygen to maintain $SpO_2 > 92\%$ (P = 0,748)

Conclusions: The higher values of PaO_2/FiO_2 observed during OLV before chest open in patients receving TEA were probably related to a reduced shunt because of vasodilatation of pulmonary vessels; however, thoracic epidural anesthesia did non further affect patients' oxygenation during OLV.

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Comparison of high frequency jet ventilation (HFJV) or continuous positive airway pressure (CPAP) on the non-dependent lung during one-lung ventilation (OLV) in a porcine model

K. Schwarzkopf, N. Preussler, T. Schreiber, L. Hueter, E. Gaser, K. Schmuecker, H. Schubert*, W. Karzai

*Department of Anesthesiology, *Institute for Experimental Animals, University of Jena, Jena, Germany*

Background and Goal of Study: Possible strategies to deal hypoxia during OLV are the employment of HFJV or the application of CPAP on the operated lung. In our study we compared both methods during OLV in pigs.

Materials and Methods: With approval of the local Animal Protection Committee 13 pigs were anesthetized (propofol, pancuronium) and ventilated (FiO_2 1.0, P_{max} 25 cmH_2O, PEEP 5 cmH_2O). Following placement of femoral arterial and pulmonary artery catheters, the orotracheal tube was replaced under fiberoptic control by a specially designed double lumen tube (DLT) via tracheotomy. After positioning in the right lateral decubitus position, OLV was started, and a left-sided thoracoscopy was performed to confirm lung collapse. OLV was continued in random order with 5 cmH_2O PEEP on the conventionally ventilated dependent lung or with 5 cmH_2O PEEP on the dependent lung and HFJV of the non-dependent lung ($FjetO_2$ 1.0, I:E 1:1, f 100/min) or with 5 cmH_2O PEEP on the dependent lung and 5 cmH_2O CPAP on the non-dependent lung. After equilibration cardio-pulmonary parameters were measured. For statistical analyses Friedman and Wilcoxon tests were used. A *P* value of < 0.05 was considered statistically significant.

Results: Data (Mean ± SD) are shown in the table:

	MAP (mmHg)	PAP (mmHg)	CO (l/min)	PaO_2 (mmHg)	$PaCO_2$ (mmHg)
OLV	84 ± 18	22 ± 5	4.0 ± 1	321 ± 94$^{\#}$	45 ± 8
HFJV	83 ± 19	22 ± 5	3.4 ± 0.9§	474 ± 58$^{\#}$	39 ± 6°
CPAP	85 ± 21	20 ± 4*	4.0 ± 1.2	400 ± 102	46 ± 6

*p < 0.05 for CPAP vs. OLV or HFJV; §p < 0.05 for HFJV vs. OLV or CPAP; $^{\#}$p < 0.05 for OLV vs. HFJV or CPAP and for HFJV vs. OLV or CPAP; $^{\circ}$p < 0.05 for HFJV vs. CPAP

Conclusion: Whereas oxygenation was improved with CPAP on the non-dependent lung a further improvement of oxygenation and ventilation was achieved with HFJV of the non-dependent lung in our porcine model.

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Positive end-expiratory pressure prevents atelectasis formation during induction of general anaesthesia in morbidly obese patients

M. Coussa, S. Proietti, P. Frascarolo, D.R. Spahn, L. Magnusson

Department of Anaesthesiology, University Hopsital, Lausanne, Switzerland

Background and Goal of Study: General anaesthesia promotes atelectasis formation. The amount of atelectasis and its persistence is increased in morbidly obese patients (1). Positive end expiratory pressure (PEEP) prevents atelectasis formation in non-obese patients (2). We therefore studied the efficacy of PEEP application in morbidly obese patients to prevent atelectasis.

Materials and Methods: 16 patients, ASA II-III, BMI > 35 kg/m^2, age 20–65 years, were randomly assigned either to PEEP or control group. General anaesthesia was induced with fentanyl, propofol and cisatracurium. In PEEP group (n = 8) patients were pre-oxygenated with 100% O_2 through a CPAP device (10 cmH_2O) for 5 min. After induction of anaesthesia patients were mechanically ventilated (VT 10 ml/kg of ideal body weight; RR 8/′; PEEP 10 cm H_2O) for another 5 min until tracheal intubation. In control group (n = 8), patients had the same induction technique but without any CPAP or PEEP. The mean area of atelectasis was assessed by analysis of 2 computed x-ray tomographies. The first was performed before pre-oxygenation and the second, directly after intubation. Written informed consent was obtained from each patient after local Ethics Committee had approved

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study. Statistical analysis consisted in a 2 way ANOVA for repeated measurements on 1 way (time).
Results and Discussions: There was no difference between groups at baseline. After endotracheal intubation, patients of the control group showed an increase in the amount of atelectasis from 3.2 ± 1.5% to 20.4 ± 7.0%; $P < 0.05$). On the contrary, patients of the PEEP group showed no change of the mean area of atelectasis, 2.1 ± 0.7% vs. 3.9 ± 2.0% after intubation. PaO_2 was also higher in the PEEP group after intubation than in the control group (446 ± 190 mmHg vs. 257 ± 12 mmHg, $P < 0.05$).
Conclusion: Atelectasis formation is effectively prevented also in morbidly obese patients by application of PEEP during preoxygenation and anaesthesia induction despite high oxygen concentration resulting in better oxygenation.
References:
1 Eichenberger AS, Proietti S, Wicky S, et al. *Anesth Analg* 2002;95:1788.
2 Rusca M, Wicky S, Proietti S, et al. *Anesthesiology* 2001;95:A1331.

A-267

Is vital capacity maneuver effective during cardiopulmonary bypass?

B. Muslu, A. Öktem, A. Demir, D. Zengin, K. Çagli, A.E. Demirbag, P. Durak, Ö. Erdemli

Department of Anesthesiology, Türkiye Yüksek Ihtisas Hospital, Anesthesiology, Cardiovascular and Gastrointestinal Surgery Clinics, 06100 Sihhiye, Ankara, Turkey

Background and Goal of the Study: Respiratory failure following cardiopulmonary bypass is one of the major complications of cardiac anesthesia. In this study we tested the hypothesis that vital capacity maneuver (VCM) performed during partial bypass bypass improves pulmonary gas exchange and lung compliances (1).
Materials and Methods: After getting approval of hospital ethics committee and patient consent 22 patients scheduled for CABG surgery were included into the study and patients randomly were divided into two groups (n = 11). All patients were premedicated with 10 mg diazepam p.o the night before the operation, 10 mg. Morphine i.m and 0.1 mg/ kg midazolam,10 μg/kg fentanyl and 0.1 mg / kg pancuronium bromide was used for induction. Patients were preoxygenated by %100 O_2 and were ventilated by %50 O_2 and %50 air during the operation. Patients were not ventilated during cross clamp period and in one of the groups VCM was performed consisted of inflating the lungs during 15 second to 40 cmH_2O pressure immediately after cross clamp is removed during partial bypass. No VCM was performed in control group. After cross clamp removal patients were ventilated by 10 ml/kg tidal volume and 8–10 min frequency. For measuring alveolar-arterial oxygen gradient arteriel blood samples were studied before sternotomy , after thorax is closed and 4 hours after the operation. For static and dynamic compliances peak and plato respiratory pressures were recorded during same periods. Statistical analysis were performed by Mann Whitney-U and Student t test.
Results and Discussions: There were no statistically significant difference between static and dynamic lung compliances in none of the groups ($p > 0.05$). In VCM group after thorax is closed although alveolar-arterial oxygen gradient ($P(A\text{-}a)O_2$) was significantly lower than the other group (116.7 ± 8.7–152.9 ± 14.2) respectively ($p < 0.05$) there were no statistical difference 4 hours after the operation.
Conclusion: It is concluded that VCM did not effect lung compliances but it helps to improve arterial gas exchange by decreasing alveolar-arterial oxygen gradient early after the operation but not more than four hours.
Reference:
1 Rathen HU, Sporre B, Engberg G: Reexpassion of atelectasis during general anesthesia. A computed tomography study. Br. J. Anaesth: 66: 423–32, 1993.

A-268

Effectiveness of positive end expiratory pressure during pre-oxygenation on duration of apnoea before arterial desaturation

A. Herriger, P.H. Frascarolo, D.R. Spahn, L. Magnusson

Department of Anaesthesiology, University Hospital, Lausanne, Switzerland

Background and Goal of Study: Induction of general anaesthesia is followed by early formation of atelectasis and pulmonary shunt. Positive end expiratory pressure (PEEP) prevents atelectasis formation (1). We studied the clinical benefit of pre-oxygenation with PEEP on duration of apnoea until SpO_2 reaches 90% in non-obese patients.
Materials and Methods: 40 ASA I-II patients were randomly assigned either to PEEP or control group. General anaesthesia was induced with fentanyl, propofol and rocuronium. In PEEP group (n = 20) patients were preoxygenated with 100% O_2 through a CPAP device (6 cmH_2O) for 5 min. After induction of anaesthesia patients were mechanically ventilated (VT 8 ml/kg; RR 10/′; PEEP 6 cmH_2O) for another 5 min until tracheal intubation (correct placement confirmed by bronchoscopy without ventilation). In control group (n = 20), patients had same induction technique but without any CPAP or PEEP. Apnoea duration until SpO_2 reached 90% was measured. Arterial punctures were performed just before apnoea and when SpO_2 reaches 92%. Written informed consent was obtained from each patient after local Ethics Committee had approved study. Statistical analysis consisted in a 2 way ANOVA for repeated measurements on 1 way (time).
Results and Discussions: Data are presented as mean values ± SD. Possible apnoea time was significatively higher in PEEP group (Table). Arterial partial O_2 pressure was significatively higher and $PaCO_2$ lower before apnoea in PEEP group (Table). These results were not influenced by age, BMI, or smoking. Female sex was found to be predictive of shorter apnoea duration (499s ± 135 vs. 558s ± 166 in males).

	Control	PEEP	P
Apnoea duration (sec)	470 ± 150	596 ± 135	0.007
PaO_2 before apnoea (mmHg)	511 ± 48	545 ± 43	0.029
$PaCO_2$ before apnoea (mmHg)	45 ± 6	41 ± 4	0.014

Conclusion: Application of positive airway pressure during induction of general anaesthesia prolongs the apnoea duration by more than 2 minutes.
Reference:
1 Rusca M, Wicky S, Proietti S, et al. *Anesthesiology* 2001;95:A1331.

A-269

Comparison of effect of PEEP after desufflation and throughout the pneumoperitoneum on respiratory mechanics

O. Demiroluk, Y. Dikmen, S. Demiroluk, Z. Salihoglu

Department of anesthesia and reanimation, Istanbul University, Cerrahpasa medical school, Istanbul, Turkey

Background and Goal of Study: Respiratory mechanics could be affected negatively during desuflation period patients had undergone pneumoperitoneum. PEEP can be useful to improve respiratory mechanics (1). We compared the effects of PEEP for a short time during desufflation period to PEEP throughout the operation on respiratory mechanics and oxygenasition.
Material and Methods: Fourty patients of ASA I-II were studied. Patients were distributed randomly into two groups to application of + 10 cm H_2O PEEP for a 10 min during desufflation (group 1), or + 10 cmH_2O PEEP throughout the operation (group 2). Ventilator adjustments were kept constant throughout the operation. Intraabdominal pressure was held at the level of 12 mmHg during laparoscopy and a constant CO_2 flow of 2 L min^{-1} administered through a laparoscopic insufflator device. VenTrak respiratory mechanics monitor (VenTrak®, CT, USA) was used to measure respiratory resistance (Raw), dynamic respiratory compliance (Cdyn) and peak inspiratory pressure (PIP). Respiratory mechanics were recorded at three time points: 5 minutes after induction of anaesthesia (induction), at 5 minutes after insufflation of the peritoneum (pneumoperitoneum), and 5 minutes after desufflation of the peritoneum (desufflation). Statistical analysis was carried out using repeated measures ANOVA with Tukey Kramer post test to evaluate the differences between the established study points. A p value < 0.05 was considered statistically significant.
Results:

Table 1: Compliance values

Periods	Induction	Pneumoperitoneum	Desufflation
Group 1	50 ± 12	35 ± 10*	52 ± 12
Group 2	49 ± 12	32 ± 6*	55 ± 14*†

*$P < 0.05$ compared induction, †$P < 0.05$ compared pneumoperitoneum

Raw and PIP were similarly like compliance.
Conclusion: PEEP during pneumoperitoneum has some positive effects on respiratory mechanics (2). We found out that two groups had an improvement on respiratory mechanics and oxygenisation. This improvement has more evident in the group that PEEP administrated during thorougout the operation than other group.
References:
1 BJA 1992; 68: 211.
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Effect of remifentanyl versus bupivacaine thoracic epidural analgesia on arterial oxygenation and shunt fraction during one lung ventilation

M.L. Tosca, R. Garcia-Guasch, S. Muñoz, T. Franco, R. Llasera, M. Lucas, I. Escobar

Servicio Anestesiología, Reanimación y Terapéutica del Dolor, Hospital Universitario Germans Trias i Pujol, Badalona, Spain

Background and Goal of Study: The aim of our study was to compare the effects of intravenous anaesthesia using remifentanyl (REMI) and thoracic epidural anaesthesia (TEA) with bupivacaine (in combination with intravenous anesthesia) on the shunt fraction and arterial oxygenation during one-lung ventilation.

Matherial and Method: Our study included 44 patients undergoing pulmonary resection. After obtaining the institutional approval and the patients' consent, they were randomly allocated to two groups. The REMI group received remifentanyl 0.5 μg/kg /min in 180 s for induction and 0.25 μg/kg/min for maintenance, whereas the TEA group received bupivacaine 0.5% in fractionated doses. An epidural catheter was placed before anesthetic induction in all of the patients, and they were given propofol (2.5 mg/kg for induction and 6–8 mg/kg/h for maintenance) and vecuronium (0.1 mg/kg and fractionated dosis if needed). All of them were intubated with double lumen tube and ventilated with 100% oxygen. Three arterial samples and three venous blood samples from the right atrium were withdrawn in the lateral position during two lung ventilation (TLV) and after 20 and 40 minutes of one lung ventilation (OLV). The shunt was calculated using Fick equation considering the blood sample from the right atrium to be mixed venus blood.

Results: Arterial oxygenation (PaO_2) and shunt fraction values are shown in the following table.

	TLV	OLV (20 min)	OLV (40 min)
PaO_2			
TEA	454.2 (74.5)	205.6 (122.8)	206.4 (106.8)
REMI	404.2 (106.5)	155.3 (76.2)	154.7 (84.4)
Shunt%			
TEA	19.7 (9.1)	36.2 (11.0)	35.9 (8.3)
REMI	16.7 (6.9)	38.4 (11.5)	35.0 (11.1)

The shunt fraction increased and the arterial oxygenation decreased significantly ($p < 0.05$) in both groups when the patients were switched from TLV to OLV. The shunt fraction and the arterial oxygenation values in the REMI group were lower than in the TEA group during two lung ventilation as well as during OLV. However the difference in the values of the two groups was not significant.

Conclusion: There is no significant difference in PaO_2 or shunt fraction when remifentanyl or thoracic epidural was used during OLV.

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Predictive factors of the effects of almitrine combined with nitric oxide during open-chest one-lung ventilation

S. Bermejo, T. Silva-Costa-Gomes, J. Vallès, L. Gallart, J.L. Minguella*

*Serveis dAnestesiologia Mar-Esperança I; *Cirurgia Toràcica, Hospital del Mar, Universitat Autònoma de Barcelona, Barcelona, Spain*

Background and Goal of Study: Almitrine combined with nitric oxide (ALM + NO) improve arterial oxygenation during open-chest one-lung ventilation (OLV)[1,2], also increasing mean pulmonary arterial pressure (mPAP). These responses have a considerable interindividual variability. As in ARDS[3], factors influencing the magnitude of these effects have not been clearly established, mainly concerning the vasoconstrictive effect of almitrine leading to an increase in mPAP. The aim of the study was the search for predictive factors for increasing oxygenation and mPAP.

Materials and Methods: 28 patients scheduled for open-chest surgery randomly received high (16 μg/kg/min) or low (4 μg/kg/min) doses of almitrine combined with NO 10 ppm (ALM + NO). The effects of the treatment were evaluated after 30 minutes OLV (OLV30′). To search for the predictive factors of the final PaO_2 and mPAP at OLV30′, logistic regression analysis was performed, considering as "response" to ALM + NO a 50% increase from basal PaO_2, and a mPAP greater than 20 mmHg, according to previous data[1,2]. Variables evaluated as potential predictive factors were, for final PaO_2: basal PaO_2, mPAP and FEV_1; for final mPAP: basal mPAP and FEV_1, and $PaCO_2$ at OLV30'. Linear regression analysis was tested between the changes from basal values in mPAP (ΔmPAP) and PaO_2 (ΔPaO_2), both induced by the treatment, to elucidate if the therapeutic effect of ALM + NO was related to the effect on pulmonary circulation.

Results and Discussion: Basal characteristics of the patients were (mean ± SD): age 63 ± 7 yr, weight 71 ± 12 Kg, height 1.66 ± 0.6 m, FEV_1 2.1 ± 0.6 L, PaO_2 83 ± 16 mmHg, $PaCO_2$ 40 ± 3 mmHg, mPAP 18 ± 5 mmHg.

None of the variables evaluated was a predictive factor for final PaO_2 at OLV30′. $PaCO_2$ at OLV30′ was a predictive factor for final mPAP (Odds ratio 1.46, $p = 0.042$). No correlation was observed between ΔmPAP and ΔPaO_2 (Pearson coefficient 0.19, $p = 0.3$).

Conclusions: In patients receiving ALM + NO during OLV, the effects on oxygenation cannot be predicted by basal PaO_2, mPAP or FEV_1, and they are not related to the vasoconstrictive effects of almitrine. The increase in mPAP can be predicted by hypercapnia, but not by basal mPAP or FEV_1.

References:

1 Gallart L et al. *Eur J Anaesthesiol* 2000; 17: A218.
2 Silva-Costa-Gomes T et al. *Eur J Anaesthesiol* 2002;19: A248.
3 Gallart L et al. *Am J Respir Crit Care Med* 1998;158:1770–7.

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A-272

Does $PaCO_2$ level depend on the upper airway management during anaesthesia with HFJV for the laser microsurgery on the larynx? Preliminary report from the study

M. Blaszyk, K. Kusza

Department of Anaesthesiology, Karol Marcinkowski University of Medical Sciences, Poznan, Poland,

The Goal of the Study: The elimination of CO_2 during HFJV is still not very well described. The goal of this study was to investigate the correlation between the two different approaches to upper airway management and $PaCO_2$ during anaesthesia for the laser microsurgery on the larynx.

Material and Method: After obtaining an approval of the local Ethics Committee, 30 ASA I-III patients were included in the study, 9 of which already had been tracheostomised (Group I, $n = 9$). Group II consisted of patients without tracheostomy ($n = 21$). There was no significant difference in BMI ($p > 0,05$) between groups. In both groups general anaesthesia was induced with alfentanil (30 mcg/kg), propofol (2 mg/kg) and mivacurium (0,15 mg/kg). After obtaining muscle relaxation, the tip of the Hunsaker teflon jet catheter was placed about 2 cm above carina, in group I via metal tracheotomy tube, in group II directly through the larynx. The HFJV was then commenced (frequency – 150/min, FiO_2 – 0,4, inspiration time – 40%, driving pressure – 2 bars). The arterial blood gas samples were taken for P_aCO_2, PaO_2, SaO_2 and pH analysis prior to the start of HFJV, at 5 and 15 min. during jet ventilation.

Results and Discussion: There was no significant difference between groups in obtained levels of $PaCO_2$ (kPa) before the start of HFJV: 5,4 ± 1,4 (group I, mean ± SD) vs. 6,2 ± 1,0 (group II), ($p > 0,05$); however we found significant difference at 5 min. (4,7 ± 0,7 vs. 6,5 ± 1,3 ($p < 0,001$)) and at 15 min. (4,7 ± 0,9 vs. 6,3 ± 1,4 ($p < 0,01$)) respectively. There were also significant differences between groups in pH values at 5 min., (7,33 ± 0,08 vs. 7,45 ± 0,05 ($p < 0,001$)), and at 15 min., (7,34 ± 0,08 vs. 7,45 ± 0,05 ($p < 0,001$)). Statistical analysis was performed with U Mann–Whitney test.

Conclusion: In our opinion the presence of metal tracheotomy tube (reduced dead space), produces a better conditions for CO_2 elimination. The smoke with the high CO_2 concentration forms a barrier for CO_2 elimination in the patiens with preserved natural way of elimination exhaled gases via larynx (group II). Because there is a marked difference in the number of the patients between groups our study needs to be continued.

References:

1 Bourgain JL, et al. *Br. J Anaesth*. 1990;64:327–330.
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A-273

Pressure support ventilation versus spontaneous ventilation during induction of anaesthesia with sevoflurane in adult patients

Y. Hervé, F. Banchereau, F. Masson, A. Bonnet, A.M. Cros

Department of Anaesthesia and Intensive Care, HIA Robert Picque, Department of Anaesthesia I and IV, Hopital Pellegrin, Bordeaux Armées, France

Background and Goal of Study: Pressure support ventilation (PSV) was used in adults during maintenance of anaesthesia (1,2). The goal of this prospective randomised study was to compare PSV with spontaneous ventilation during sevoflurane (S) induction.

Materials and Methods: After ethics committee approval and written informed consent, 35 adult patients, ASA grade I-II, 39.6 (± 10.6) yr. old were

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studied. Single breath induction with 8% in 6 L min^{-1} O_2 was performed. BIS (Aspect 2000) was recorded continuously. When the BIS value was under 50, PSV was used in group 1 (Felix®, Taema, France). The pressure was set at 15 cmH_2O. In group 2, patients breathed spontaneously. Two min later, S was set at 2% and remifentanil 1 μg kg^{-1} was injected over 2 min and followed by an infusion of 0.01 μg kg^{-1} min^{-1}. Then, 2 min after the end of bolus, patients were intubated. In case of apnoea, patients were ventilated with preselected PSV value in group 1 and with pressure control in group 2. In both groups pressure was set at 15 cmH_2O and respiratory rate (RR) at 15 min^{-1}. $Etco_2$, SpO_2, RR, expired tidal volume (VT_{exp}), SpO_2 and BIS values were recorded every minute for the last 5 min during induction. Data were also collected before the ventilatory mode selected and after the intubation. Results given are the mean and SD of data. Statistical analysis was performed using the Kruskal-Wallis U-test ($p < 0.05$).

Results and Discussions: Eighteen patients were included in group 1 and 17 in group 2. The groups did not differ in demographic data. During induction, $Etco_2$, RR and SpO_2 were similar in the two groups. BIS values were significantly lower [28.3 (±4) vs. 32 (±5.7)] and VT_{exp} was significantly higher [418 (±82) vs. 279 (±102) mL] in group 1. After intubation, $Etco_2$ was lower in group 1 [36.4 (±3.3) vs. 39.7 (±3.7) mmHg]. Apnoea occurred in 8 patients in each group. Fewer respiratory events i.e. strong coughing and laryngospasm, occurred in group 1 (1 vs. 4).

Conclusion(s): PSV provides lower level of anaesthesia (BIS value lower and fewer respiratory events after intubation) during S induction than spontaneous breathing. Alveolar ventilation and gas exchange are more effective.

References:

1 Bosek V et al. *J Clin Anesth* 1996; 8: 9–12.
2 Brimacombe J et al. *Anesthesiology* 2000; 92: 1621–3.

A-274

Measuring the performance of breathing system filters under wet conditions: a laboratory evaluation

D. Turnbull, C.P. Fisher, G.H. Mills, N.J. Morgan-Hughes

Anaesthetic Department, University of Sheffield and Central Sheffield Teaching Hospitals Trust, Sheffield, United Kingdom

Background: Humidification and filtration tests are routinely applied to heat and moisture exchanging filters (HMEFs) (BS EN ISO 9360-1: 2000 and BS EN 13328-1:2001). Liquid induced blockage can complicate HMEF use (1). We propose additionally testing HMEFs under wet conditions to assess susceptibility to this complication.

Methods: 5 ml saline increments were instilled into the patient end of 5 of each HMEF and the maximum volume instilled not resulting in the appearance of free saline within the HMEF housing was defined as the concealment volume (CV). Inspiratory and expiratory flow resistance (IR and ER) was measured as the pressure drop (cmH_2O) across each HMEF with 60 l min^{-1} cylinder airflow. 10 devices of each type were tested for each airflow direction. Resistance testing continued with the addition of 5 ml saline increments up to maximum CV or until airflow resulted in ejection (E) of saline from the HMEF for IR or saline penetration (P) of the device for ER. IR and ER (Mean ± SD) were calculated for the modal CV.

Results:

Model	CV	IR	ER
Dräger Hygrovent S	0	3.2 ± 0.1	2.8 ± 0.2
Siemans 172	20	9.8 ± 1.1	P
Datex HMEF 1000	20	5.5 ± 0.4	5.4 ± 0.9
Intersugical 1941	10	6.0 ± 0.4	P
Intersugical 1744	0	4.5 ± 0.3	4.0 ± 0.2
Vital Signs F2	15	E	P
Pall BB25	0	3.6 ± 0.1	3.7 ± 0.1
Pall BB100	0	2.0 ± 0.1	2.0 ± 0.1
Airsafety Comfort Fit	0	2.6 ± 0.1	2.3 ± 0.1
Airsafety Slimline	0	3.0 ± 0.1	2.8 ± 0.2
Rüsch Mirandola	25	11.0 ± 2.6	8.8 ± 0.8
Dar Hygrobac-S	20	8.2 ± 1.9	9.1 ± 2.6
Hudson 19402	10	E	P

Discussion: There was wide variation in device performance under wet conditions which may have patient safety implications. HMEFs that do not conceal fluid should have a low risk of liquid induced blockage. HMEFs that allow P may protect against excessive rises in ER but would allow the passage of infected liquid material.

Reference:

1 Wilkes AR. BJA CEPD Reviews 2002; 2: 151–154.

Acknowledgements: All manufacturers donated HMEFs.

A-275

Comparison of the effects of sevoflurane, desflurane and isoflurane on breathing pattern and occlusion pressure

P. Vila, J. Canet, M. Rotger, D. Navajas, S. Muñoz

Department of Anesthesiology, Servicio de Anestesiologia del Hospital Germans Trias i Pujol y Laboratorio de Biofísica del Hospital Clínico. Barcelona. Spain. Study supported by Fondo Investigaciones Sanitarias: FIS 99/1124, Badalona, Spain

Background and Goal of Study: Isoflurane (ISO) and sevoflurane (SEVO) have greater ventilatory depressant effects than halothane[1] but no data is available for desflurane (DES). We compared breathing pattern and occlusion pressure during SEVO, DES or ISO anaesthesia.

Materials and Methods: After institutional approval and informed consent, we enrolled 24 non obese women (aged 30 ± 4 yr) with no history of respiratory disease who underwent elective surgery. The day before, breathing pattern was studied at rest in supine. After induction, patients were allowed to breathe spontaneously and randomly assigned to receive ISO (8), SEV (8) or DES (8) at 1.2 and 2.0 MAC. After breathing pattern had become stable and before surgery, breath by breath analysis of the following variables was performed: respiratory rate(RR), tidal volume(V_T), minute ventilation(V_E), inspiratory duty cycle (T_I/T_{TOT}), mean inspiratory flow rate(V_T/T_I), end tidal CO_2 pressure($P_{ET}CO_2$) and occlusion pressure($P_{0.1}$). ANOVA performed for awake and anaesthetized state.

Results and Discussions: Breathing patterns during awake state were similar. Data (mean ± SD) are shown in the table: (awake state and ISO group are not included).

	Sevoflurane		Desflurane	
	1.2 MAC	2.0 MAC	1.2 MAC	2.0 MAC
CO_2	47 ± 9*	51 ± 13*†	51 ± 6*	57 ± 14*†
RR	25 ± 4*	27 ± 4.7*	27 ± 3.9*	25 ± 5*
VT	.29 ± 0.06*	.21 ± 0.1*†	.26 ± 0.04*	.21 ± 0.1*†
VE	7.4 ± 2	5.7 ± 2* †	6.9 ± 1.4	5.1 ± 1*†
$P_{0.1}$	1.9 ± 0.9	1.3 ± 0.7†	1.8 ± 0.8	1.4 ± 0.6†

*$P < 0.05$ vs awake; †$P < 0.05$ vs 1.2 MAC

Conclusion: SEVO and DES have similar effects on breathing pattern as ISO: a dose dependent ventilatory depressant effects with an increase in RR, decrease in V_T without differences in $P_{0.1}$.

Reference:

1 Canet J, Sanchis J, Zegrí A et al. Anesthesiology 81: 563–571, 1994.

Aknowledgements: FIS; 99/1124, Spain.

A-276

Is oxygenation improved in prone position during anesthesia?

E. Tureci, Y. Tunali, E. Yentur, M. Bahar

Department of Anesthesiology and Reanimation, Istanbul University, Cerrahpasa Faculty of Medicine, Istanbul, Turkey

Background and Goal of Study: Gas exchange is improved in the prone position in lung injured patients.[1] We aimed to test the hypothesis that during spine surgery gas exchange may be improved in the prone position and the effect may vary according to body mass index (BMI).

Materials and Methods: We measured dynamic respiratory compliance (mL cmH_2O^{-1}), dynamic airway resistance (cm L^{-1} sec^{-1}), Ppeak and Pmean (cmH_2O), SpO_2, $ETCO_2$ and arterial blood gases in supine and prone positions in 30 ASA I-II patients undergoing spinal surgery. Patients were given prone position with two foam rubber cushions placed bilaterally under iliac crests allowing the abdomen free. Anesthesia was maintained with isoflurane (0.6%), fentanyl and muscle paralysis by vecuronium. Ventilatory parameters (tidal volume 8 mL kg^{-1}, Respiratory Rate 12 breaths min^{-1}, FiO_2 0.4) were constant throughout the study. Data were analyzed by using Mann–Whitney U test and $p < 0.05$ were considered statistically significant.

Results: Data (Mean ± SD) are shown in Table

	BMI < 25 (n = 12)		BMI ⩾ 26 (n = 18)	
	supine	prone	supine	prone
PaO_2	24.1 ± 10.3	24.3 ± 3.6	15.2 ± 4.0	18.5 ± 5.1*
$PaCO_2$	4.1 ± 0.4	4.1 ± 0.5	4.2 ± 0.6	4.0 ± 0.5
P_{peak}	15 ± 1.9	17.1 ± 2.8*	16.7 ± 2.0	18.9 ± 3.2*
P_{mean}	6.5 ± 0.5	7.1 ± 0.7*	7.1 ± 0.5	7.5 ± 1
Comp.	55.5 ± 11.3	44.3 ± 8.8*	45 ± 10.1	37.3 ± 8.4*
Res.	8.5 ± 2.1	10 ± 3.8	10.4 ± 2.1	10.8 ± 2.9

*$p < 0.05$ supine vs prone. PaO_2 and $PaCO_2$ in kPa.

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Overall (n = 30) increase in PO_2 (from 18.8 ± 8.3 to 20.7 ± 5.3 kPa) and decrease in PCO_2 from supine to prone were not significant.
Conclusions: Prone position: (1) decreased compliance, (2) improved oxygenation only in patients with BMI ⩾ 26.
References:
1 Pelosi P, Tubiolo D, Mascheroni D, et al. Am J Respir Crit Care Med 1998; 157:387–393.
2 Palmon SC, Kirsch JR, Depper JA, et al. Anesth Analg 1998;87:1175–80.

A-277

Changes in respiratory parameters due to surgical manipulations during anaesthesia

A. Vachlioti, N. Stogiannidis, F. Kanakoudis

Department of Anaesthesia, "THEAGENIO", Anticancer Hospital of Thessaloniki, Thessaloniki, Greece

Background and Goal of Study: The aim of the study was to estimate the changes of respiratory parameters (P_{peak}, $P_{plateau}$ and $Compliance_{static}$) due to surgical manipulations during anaesthesia for laparotomies.
Materials and Methods: In a prospective trial, 37 consecutive patients, without respiratory diseases, ASA I-II, scheduled to undergo major abdominal surgery, were included in the study. The induction and the maintenance of anaesthesia were accomplished with propofol, remifentanil and cis-atracurium (for adequate surgical neuromascular blockade). Endotracheal tubes, ID 8 and 9, were used for females and males respectively. Ventilation was accomplished with TV: 10 ml/kg and RR: 8–10 breaths/min ($EtCO_2$: 4,5–5,5 $kpa_)$. P_{peak}, $P_{plateau}$ and $Compliance_{static}$ were recorded in five phases: A) after the induction to anaesthesia, B) after the incision of peritoneum, C) after settlement of retractors, D) after removal of retractors and E) after closure of peritoneum. Statistical comparisons were performed by repeated measures ANOVA and Dunnett test (statistical significance when $p < 0,05$).
Results and Discussions: Demographic data was: M/F: 18/19, (mean ± SD) age 60 ± 9 yr., weight 75 ± 14 kg, height 165 ± 8 cm. Duration of anaesthesia: 174 ± 53 min. Data of respiratory parameters are shown in the table:

	P_{peak}	$P_{plateau}$	Compliance
Phase A	20,9 ± 5,8	16,8 ± 4,8	49,6 ± 14,4
Phase B	20,9 ± 5,3	17,2 ± 15	47,4 ± 12
Phase C	21,7 ± 5,3	18,1 ± 4*	41,8 ± 9,4**
Phase D	20,2 ± 4,4	17,4 ± 4	46,2 ± 13,1
Phase E	20,9 ± 4,8	18,7 ± 4,6**	42,9 ± 11,6**

*$p < 0,05$; **$p < 0,01$ compared to control phase (phaseA).

Conclusion(s): In the patients of this study the $P_{plateau}$ and the $Compliance_{static}$ changed significantly after retractors' settlement and these changes remained after closure of peritoneum.
Reference:
1 Larsson A. Acta Chir Scand 1989; 155 (6–7): 329–32.

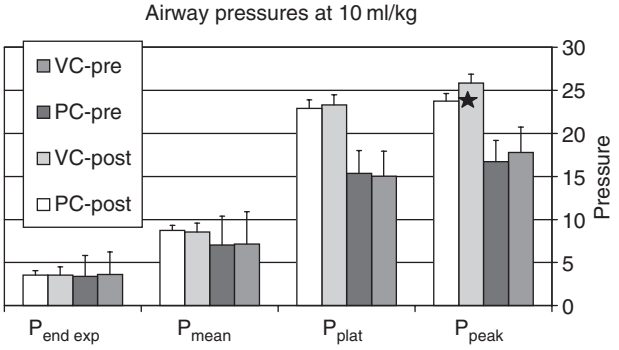
A-278

Pressure-controlled or volume-controlled ventilation during laproscopic surgery – is there a difference?

Y. Cohen, D. Ogorek, N. Adi, V. Rudick, A. Weinbroum

Department of Anesthesiology and Intensive Care, Tel-Aviv Sourasky Medical Center, Tel-Aviv, Israel

Background and Goal of Study: Several studies have suggested an advantage of pressure-controlled ventilation (PCV) over volume-controlled ventilation (VCV) during anesthesia using a laryngeal mask (1,2) or double lumen tube (3). We studied whether PCV offers an advantage over VCV in intubated patients undergoing laparoscopic surgery in a prospective, crossover study.
Materials and Methods: 20 ASA I–III patients undergoing laparoscopic surgery. Exclusion criteria were respiratory disease or BMI > 30. Patients were ventilated using a Datex-Ohmeda AS-3 anesthesia machine with either PCV or VCV adjusted to deliver a measured tidal volume of 10 ml/kg. I:E ratio was 1:2, RR12, medium pressure increase rate during PCV and no inspiratory pause during VCV. Airway pressures were recorded. Patients were then crossed over to the second mode of ventilation. A second set of measurements was performed after abdominal insufflation with gas.
Results and Discussions: Data results (mean + S.D.) are sown in the figure:



Pressure controlled ventilation resulted in slightly lower peak airway pressures only during abdominal insufflation ($p = 0.03$) (*). Other airway pressures did not differ significantly between PCV and VCV ($p > 0.6$). Abdominal insufflation caused a significant ($p < 1 \times 10E-8$) increase only in peak and plateau pressures.
Conclusion(s): PCV confers minimal advantage over VCV in patient ventilation during laparoscopic surgery.
References:
1 Natalini G. et al. J Clin Anesth. 2001;13:436–9.
2 Keidan I. et al Pediatric Anesthesia 2001;11:691–4.
3 Tugrul M. et al. Brit J Anaesth 1997;79:306–10.

A-279

Right ventricle function and pulmonary resection surgery

I. Mourelle, J. Gomez-Arnau, J. Fernandez-Guisasola, M. Varela, R. Iranzo, R. Marcos

Department of Anesthesiology, Clinica Puerta de Hierro, Madrid, Spain

Background and Goal of Study: Patients who undergo pulmonary resection often suffer from COPD. This causes right ventricle (RV) function deterioration which can be worsened after the RV afterload increase due to the lung surgery lost of vascular pulmonary territory. The present study sought to quantify perioperative RV function changes in major thoracic surgery.
Materials and Methods: After informed consent, 18 patients scheduled for pulmonary resection surgery were enrolled in the study (12 lobectomies and 6 neumonectomies). Patients with occlusive coronary artery disease or valvular disease were discarded. Perioperatory evaluation included spirometry, gas exchange variables, electrocardiographic, echocardiographyc and RV Swan-Ganz catheter and RV isotopic data. Collected data were analyzed with multiway analysis of variance. $P < 0,05$ was considered statistically significant.
Results and Discussions: Significant increases of right ventricle afterload (pulmonary vascular resistance index, PVRI) and mean pulmonary arterial pressure (MPAP) were detected after both neumonectomy and lobectomy (Table 1). However, RV ejection fraction (REF) did not decrease and in some patients an increase of the preoperative values was detected (lobectomies from 38% to 40% and neumonectomies from 37% to 38%). A significant decrease of the REF immediate postoperative measurements below baseline values occured (neumonectomies from 37% to 30% and lobectomies from 39% to 33%) ($p < 0.05$) in spite of right ventricle end diastolic volume increments and afterload values similar to baseline ones (in lobectomy group only). Isotopic and echocardiographic data showed similar preoperative and postoperative (PO) (seventh day) results.
Conclusion(s): REF intraoperative values were similar or higher respect preoperatory measurements; this means that RV is able to overcome afterload intraoperatory increases. However, RV function deteriorates during the first postoperative days. Echocardiographyc and isotopic studies showed a recovery of these values in the seventh PO day.
Reference
1 Reed CE, et al. Ann Thorac Surg.1996;62:225–232.

A-280

Hypercapnia following manual ventilation and tracheal intubation in patients subjected to general anesthesia for elective surgical procedures

R. Monte, I. Armesto, J. Santos, C. Suarez, B. Pereira, P. Amorim

Serviço de Anestesiologia, Hospital Geral de Santo António, Porto, Portugal

Background and Goal of Study: Manual ventilation with a face-mask during induction of anesthesia aims at good oxygenation and normocapnia. However, there is no good control of CO_2 levels, since end tidal (ET) CO_2

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may not be easily measured or reliable. In a recent study directed at cerebral blood flow, we found unexpectedly high $PaCO_2$ levels (>45 mmHg) at the moment of tracheal intubation[1]. The present study was designed to evaluate the occurrence of hypercapnia at the moment of intubation after induction of general anesthesia in "everyday" cases and assess the interest of a larger study to identify possible causative factors.

Material and Methods: Adult patients, ASA 1–3, subjected to general anesthesia and tracheal non-complicated, non-rapid sequence intubation for elective surgical procedures (7 specialties) were selected. IRB approval and written informed consent were obtained. One arterial blood gas analysis was performed simultaneously with tracheal intubation. Demographic, anatomic (face and neck) and anesthesia related variables were collected. Data is mean ± SD. Statistical analysis used t-test, linear correlation and Chi-square.

Results and Discussion: Thirty-seven patients aged 46.5 ± 18 years were studied. Average $PaCO_2$ at the moment of intubation was 46.0 ± 6,1 mmHg. Hypercapnia ($PaCO_2$ > 45 mmHg) was observed in 62% of the patients. $ETCO_2$ after intubation (36.4 ± 4.4 mmHg) was not a good indicator of hypercapnia. The average difference between $PaCO_2$ and $ETCO_2$ was 9.6 ± 5.3; the higher the $PaCO_2$ the larger the difference ($p < 0.001$). Manual ventilation duration was 309 ± 139 seconds; time between muscle relaxant administration and intubation was 277 ± 127 s. $PaCO_2$ correlated with age ($p < 0.01$), but not with ASA class, ventilation or intubation time, Mallampati grade, patients' weight or years of experience of the anesthesiologist.

Conclusions: Hypercapnia may occur frequently at the moment of tracheal intubation in everyday cases. This is certainly unwanted, namely because of the increased risk of arrhythmia. End-tidal CO_2 is not a reliable indicator of hypercapnia. A larger study directed at identifying causative factors is justified.

Reference:

1 J Neurosurg Anesth 2001;13:367.

A-281

Effects of perfluorohexane vapor on relative pulmonary blood flow distribution in non-injured isolated rabbit lungs

M. Hübler, A. Heller, J.U. Bleyl, T. Rössel, M. Heinz, T. Koch

Department of Anaesthesiology, University Hospital Carl Gustav Carus, Dresden, Germany

Background and Goal of Study: In healthy lungs, gas exchange deteriorates when partial liquid ventilation (PLV) is installed. This is partly due to a redistribution of pulmonary blood flow (Q_{rel}) to poorly ventilated areas leading to an impaired matching of ventilation and perfusion. The effects of vaporized perfluorohexane (PFH) on Q_{rel} distribution in non-injured lungs is unknown.

Materials and Methods: The study was approved by the appropriate gouvernemental institution. 15 isolated rabbit lungs were perfused with a Krebs Henseleit buffer solution (flow 150 ml/min). Pulmonary afterload was set to 3 mmHg. The lungs were ventilated with a small animal ventilator (FiO_2 0.21; $FiCO_2$ 0.04; RF 30 min^{-1}; TV 12 ml kg^{-1}; PEEP 2 cmH_2O). Following a steady state period, 18 Vol.% of PFH-vapor was administered to nine lungs for 30 minutes, whereas five lungs served as controls. Fluorescent microspheres were used to measure Q_{rel} before (t_0) and after PFH application (t_{30}). The unpaired t-test was used to compare variables between groups. The paired t-test, the Anderson-Hauck-test of equivalence and Pearson correlation were used to analyze changes within groups.

Results and Discussions: The mean correlation of Q_{rel} at t_0 and t_{30} was 0.56 ($p < 0.001$). No significant gravitational changes in Q_{rel} over time and between groups were found. Anderson-Hauck-test yielded a high level of equivalence.

Conclusion(s): In isolated lungs, PLV redistributes Q_{rel} towards less-dependent lung areas (1). According to our results, PFH-vapor lacks effects on Q_{rel} distribution in non-injured isolated rabbit lungs. Application of PFH-vapor in healthy animals was only reported once (2). The absence of negative effects on gas exchange in this study could be explained by an unaltered Q_{rel} distribution with an unchanged matching of ventilation and perfusion.

References:

1 Loer SA. *Crit Care Med* 2000; 28: 1522–1525.
2 Bleyl JU. *Crit Care Med* 2002; 30: 1340–1347.

Acknowledgements: Supported by Deutsche Forschungsgemeinschaft (Bonn, Germany) grant HU 818/3-1.

A-282

Does epidural analgesia for pain relief during labour influence the respiratory function of pregnant women?

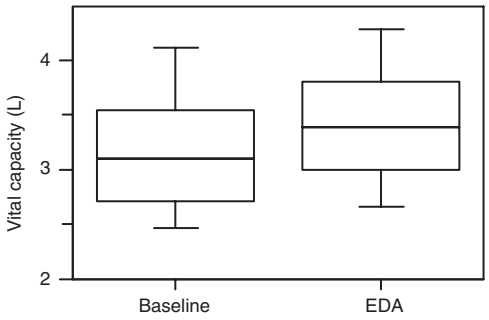
B.S. von Ungern-Sternberg, A. Regli, E. Bucher, A. Reber, M.C. Schneider

Department of Anesthesia, University of Basel/Kantonsspital, Basel, Switzerland

Background and Goal of Study: The prevalence of epidural analgesia (EDA) for pain relief during labour is increasing. Even at low local anaesthetic concentrations, EDA contributes to motor blockade, which might interfere with alterations of pulmonary function during pregnancy (1). The goal of this study was to assess the influence of EDA on respiratory function during labour.

Materials and Methods: With ethical committee approval, 53 consenting parturients requesting EDA for pain relief during labour were included consecutively in this prospective study. Spirometry was performed with each patient in a 45° head-up supine position during the antepartum visit (baseline) and after initiation of effective EDA (VAS score < 1). Vital capacity (VC), forced vital capacity (FVC), peak exspiratory flow (PEF) and forced exspiratory volume in one second (FEV_1) were measured. The level of the epidural blockade was assessed.

Results and Discussion: Baseline values were all within the normal range. The parturients showed significant increases in all parameters under effective EDA (sensory level between T10 and T4). The mean differences (±standard deviation) of EDA versus baseline (%) were: VC 8.0 ± 8.6*; FVC 5.7 ± 8.1*, FEV_1 5.6 ± 8.4*, PEF 2.0 ± 7.2*, FEV_1/FVC = 0 ± 2.6* (* = P < 0.05).



Mean with 25–75 interpercentile range, whiskers = 10% vs. 90% values

Conclusion: Epidural anaesthesia for pain relief during labour significantly improves respiratory function.

Reference:

1 Cugell DW. Pulmonary function in pregnancy. Am Rev Tuber 1953; 67: 568–599.

A-283

Absorption of CO_2 during retroperitoneoscopy in urologic surgery

F. Atallah*, T. Bastide-Heulin*, B. Riu*, M. Soulié**, K. Samii*

**Anesthesia and Intensive Care Department, **Urologic Surgery department, Rangueil University Hospital, 31403, Toulouse, France*

Background and Goal of Study: Retroperitoneoscopy main advantages in urologic surgery are direct access to the kidney, absence of intraperitoneal organs manipulations and little increase in intraperitoneal pressure. Importance of CO_2 absorption is debated. The aim of this study was to evaluate CO_2 absorption in retroperitoneoscopy.

Materials and Methods: 30 consecutive patients (mean age = 48 yrs), ASA 1–3, operated by retroperitoneoscopy in lateral position were studied. General anesthesia was done with propofol, sufentanil, atracurium and isoflurane. Ventilation was controlled (O_2:N_2O = 50:50) with a tidal volume of 8 ml/kg and respiratory rate of 12/min. Minute volume (Vm) was adapted to maintain $PetCO_2$ between 30–40 mmHg. The production or elimination of CO_2 was calculated every 15 min as follows:

$$VCO_2 = \frac{PetCO_2\ (mmHg) \times Vm\ (ml)}{(mL/kg/min)\ (P\ barometric - PH_2O) mmHg \times\ Weight\ (kg)}$$

Statistical analysis was done using ANOVA test.

Results and Discussions: After a rapid initial rise of 18%, 15 min after insufflation, VCO_2 followed a linear ascending curve, damped after 60 min.

n = 30	Before insuffl	15 min	30 min	45 min	60 min	75 min	90 min
VCO_2 ml/kg/min	4.10	4.83	5.16*	5.43*	5.76*	5.85	5.92
ΔVCO%		17.8	25.9*	32.5*	40.5*	42.9	44.4

*p < 0.00001

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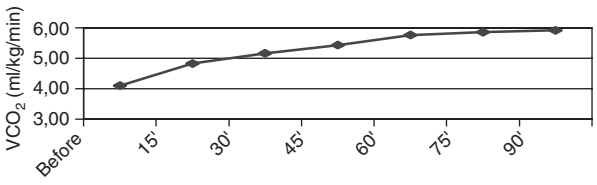


Conclusion: Contrarily to transperitoneal laparoscopy where an important initial absorption of CO_2 is usually followed by a plateau [1], retroperitoneoscopy causes a more progressive and prolonged increase in VCO_2.

Reference:

1 Mullet CE, Viale JP, Sagnard PE et al. Anesth Analg 1993; 76 : 622–6.

A-284

Influence of acute hypoxia on selected cognitive and physiological functions

V. Rogozov

Department of Anesthesiology, Resuscitation and Inte, Charles University in Prague, Faculty of Medicine%, Hradec Kralove, Czech Republic

Background and Goals: In high altitude (HA) organism is exposed to effects of hypoxia. Impairment of acute hypoxia on neuropsychological functions should be in correlation with degree of hypoxia e.g. with reached altitude (A).

Material and Methods: We studied physiological responses (1) and neuropsychological functions (2) in 11 healthy volunteers (9 males and 2 females) that were exposed to rapid ascent to HA (3500–6050 m). We measured heart rate (HR), blood pressure, oxygen saturation (SpO_2) and recorded scores of AMS (acute mountain sickness) symptoms. In the same time were performed tests on short time memory, concentration, reacting time and psychomotoric coordination. All these data were obtained twice time at sea level (before ascending and after returning) and then five times during ascending from 3500 to 6050 m in every next 500 m of A. In the table and graphs we related reached A and corresponded atmospheric PO_2 to data obtained by measuring of physiologic functions and scores of phychological tests.

Results: We showed strong correlation between A and SpO_2 – from 97–99% at sea level to 70–74% at 6050 m ($P < 0.001$). HR was also depended on reached A and higher A was connected with higher HR ($P < 0.05$). AMS scores showed also positive correlation with A ($P < 0.01$). As for cognitive functions we did not find relation between A and scores of short term memory tests. But there was negative correlation with A and scores of maintenance of concentration ($P < 0.05$), psychomotoric coordination and reaction times ($P < 0.01$). After returning to sea level A there was found strong tendency to bradycardia ($P < 0.001$).

Conclusions: We concluded that acute hypoxia provoked physiological changes and leads to impairment on cognitive functions like maintenance of concentration and psychomotoric reaction times. We also found tendency to bradycardia after return from high to sea level altitude.

References:

1 Jalil J. Rev-Med-Chil. 1994 Oct, 122(10): 1120–5.
2 Appenzeller O.Arch-Neurol.1998 Jul, 55(7):1007–9.

A-285

Seeking for optimal ventilation during laparoscopy

L.M. López, J. Barrio, G. Sanmiguel, V. García

Department of Anaesthesia, Hospital Arnau de Vilanova, Valencia, Spain

Background and Goal of Study: Laparoscopic surgery improves patient's outcome, but interferes significantly with mechanic ventilation and cardiocirculatory physiology. Ventilatory adjustments have to be done specially during pneumoperitoneum phase. We compare two types of ventilation at this point (pressure controlled ventilation (PCV) vs. volume controlled ventilation (VCV)).

Materials and Methods: 18 patients scheduled for laparoscopic surgery were alternatively ventilated with PCV and VCV recording maximal inspiratory pressure (Pmax), espiratory tidal volume (Vtesp) and compliance (Compl) at different rates of Vt (7–16 ml/kg) to determine the pressure/volume (P/V) curves for each patient and type of ventilation. Equation ($Vtesp = A \times P_{max} + B$) determined by linear regression was registered for all P/V curves when correlation rate (R^2) was > 0.95. Statistical analysis was performed with Student's Test for paired data.

Results and Discussions: PCV curves showed more efficient ventilation (higher Vtesp at the same Pmax) in 17 cases. Linear regression showed $R^2 > 0.96$ in 17 patients. One case had to be excluded because we couldn't complete the P/V curve with VCV. A-value of the equations and compliance (ml/cmH_2O) were significantly higher for PCV ($p < 0.0007$ and $p < 0.000001$ respectively):

	PCV	VCV
A-value (Mean)	42	34
	P = 0.0007	
Compliance(Mean)	35	30
	P = 2.5 × E-24	

Conclusion(s): PCV improves ventilation at clinical Vtesp ranges compared to VCV, during pneumoperitoneum phase of laparcopic surgery.

PCV may permit ventilation in patients without exceeding critical Pmax in some patients.

A-286

Do spinal anesthesia and body mass index influence the perioperative respiratory function?

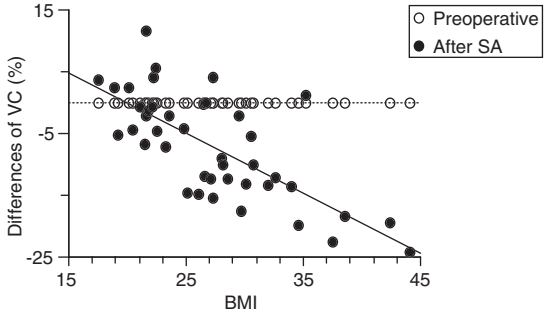
B.S. von Ungern-Sternberg, A. Regli, E. Bucher, A. Reber, M.C. Schneider

Department of Anesthesia, University of Basel/Kantonsspital, Basel, Switzerland

Background and Goal of Study: Obese patients are at high risk for postoperative pulmonary complications. In these patients, spinal anaesthesia (SA) is often considered as the anaesthetic procedure of choice for vaginal surgery (1). As the prevalence of obesity is increasing, we studied the influence of SA and body mass index (BMI) on perioperative respiratory function and whether early postoperative mobilisation had a positive impact on recovery of pulmonary function.

Materials and Methods: 42 patients scheduled for surgery in the vaginal region were included in this prospective study. SA was standardized. Spirometry was performed with each patient in a 30° head-up supine position. Vital capacity (VC), forced vital capacity (FVC), peak exspiratory flow rate (PEF) and forced exspiratory volume in one second (FEV_1) were measured at the preoperative assessment, after administration of SA and hourly after the operation until the block had worn off. The last spirometry was performed after mobilisation of the patient.

Results and Discussions: Baseline spirometric values were all within the normal range. At each assessment period during SA, respiratory function values progressively declined as exemplified by a decrease in VC (Fig.) where severity increased with increasing BMI. Postoperative mobilisation improved respiratory function as evidenced by a significant increase in VC (results not shown).



Conclusions: SA and obesity have a marked effect on perioperative respiratory function, correlating with increasing BMI values. Postoperative mobilisation was beneficial in restoring respiration.

Reference:

1 Freund FG. Respiratory effects of subarachnoid and epidural block. Clin Anesth 1969; 2: 97–107.

A-287

Do body mass index and site of surgery influence perioperative respiratory function of patients undergoing general anesthesia?

B.S von Ungern-Sternberg, A. Regli, M.C. Schneider, F. Kunz, A. Reber

Department of Anesthesia, University of Basel/Kantonsspital, Basel, Switzerland

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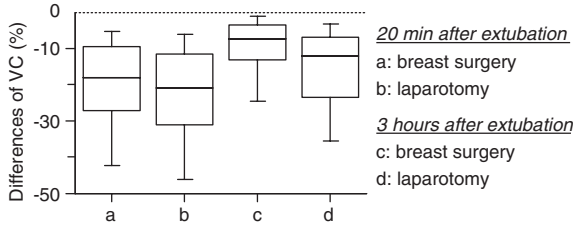
Background and Goal of Study: Obese patients are considered to be at high risk for postoperative pulmonary complications because of jeopardised respiratory function (1). As the prevalence of obesity is increasing, we studied the influence of general anaesthesia on respiratory function and evaluated the impact of body mass index (BMI) and site of surgery on perioperative spirometric parameters.
Materials and Methods: With ethical committee approval, 161 patients (BMI 17.2 to 43.0) scheduled for either breast surgery (group A, n = 80) or laparotomy (group B, n = 81) were consecutively included in this prospective study. Premedication and general anaesthesia were standardized. Spirometry was performed with each patient in a 30° head-up supine position. Vital capacity (VC), forced vital capacity (FVC), peak exspiratory flow rate (PEF) and forced exspiratory volume in one second (FEV_1) were measured at the preoperative assessment (baseline), after premedication, directly before induction, about 20 min, 1 h and 3 h after extubation. Relative differences of perioperative values with regard to baseline values were calculated.
Results and Discussion: Baseline spirometric values were all within the normal range for all BMI values. In both groups, the lowest values of VC were found 20 min after extubation (Fig.). At each time point, spirometric performance decreased significantly with an increasing BMI. Postoperatively, laparotomy was associated with a significantly greater respiratory compromise and a slower recovery of respiratory function than breast surgery.



Conclusions: General anaesthesia, BMI and site of surgery have a strong effect on perioperative respiratory function, which increases with a higher BMI. Laparotomy was associated with a greater pulmonary compromise than breast surgery and recovery took longer.
Reference:
1 Barrera F, Reidenberg MM, Winters WL. Pulmonary function in the obese patient. Am J Med Sci 1967; 254: 785–796.

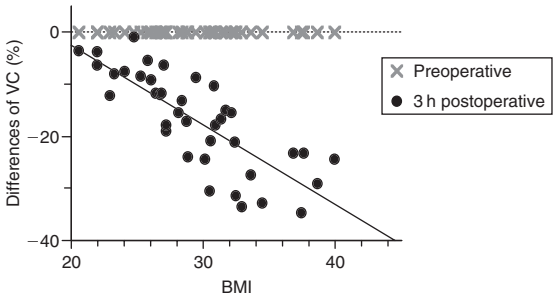
A-288

Do spinal anesthesia and body mass index influence perioperative respiratory function of pregnant women scheduled for elective caesarean section?

E. Bucher, B.S. von Ungern-Sternberg, A. Regli, A. Reber, M.C. Schneider

Department of Anaesthesia, Universtiy of Basel/Kantonsspital, Basel, Switzerland

Background and Goal of Study: As the prevalence of obesity is increasing constantly, we are frequently confronted with obese pregnant women in the operating theatre. Perioperative vital capacity can be worse in obese pregnant women (body mass index [BMI] > 30) in comparison to non-obese pregnant women scheduled for elective caesarean section under spinal anesthesia (SA) (1). Therefore, we studied the influence of BMI on perioperative respiratory function of pregnant women undergoing caesarean section under SA.
Materials and Methods: With ethical committee approval, 39 consenting patients with singleton pregnancies at term and without any cardio-respiratory disease were included (BMI 20.6 to 39.9). Premedication (ranitidine 50 mg and metoclopramide 10 mg) and SA (12.5 mg hyperbaric bupivacaine 0.5% with 10 mcg fentanyl) were standardized. Spirometry was performed with each patient in a 30° head-up position. Vital capacity (VC), forced vital capacity (FVC), forced exspiratory volume in one second (FEV_1) and peak exspiratory flow rate (PEF) were measured during the preoperative visit (baseline), under SA before surgery, immediately, 1 h, 2 h and 3 h (after mobilisation of the patient) after surgery.



Results and Discussion: After SA, VC was significantly decreased and remained so over the whole assessment period in comparison to baseline values in all patients. The decrease of VC had a strong negative correlation with the patients BMI.
Conclusion: Obesity significantly enhances the decrease in VC values observed in pregnant women after SA for caesarean section.
Reference:
1 Conn DA. Changes in pulmonary function tests during spinal anaesthesia for caesarean section. Int J Obstet Anes 1993; 2: 12–14.

A-289

Compensation for the additional work of breathing using three ventilatory modes

G. Aguilar, J.L. Jover, R. Ferrandis, M. Soro, F.J. Belda, A. Maruenda

Department of Anesthesiology and Critical Care, Hospital Clínic Universitari de València, València, Spain

Background and Goals: One of the goals in the design of new ventilators is to compensate for additional work of breathing (WOBadd). Classically, Pressure Support Ventilation (PSV) has been used to compensate for this WOBadd (1), and recently, automatic tube compensation (ATC), (2), and amplified spontaneous flow pattern (ASFP) can also be used in WOBadd compensation.

The aim of the study was to evaluate these modes in terms of WOBadd compensation, in patients with normal ventilatory demands.
Material and Methods: 30 postoperative weaning patients were studied. Three groups (PSV, ATC and ASFP) of 10 patients each, were formed. Assistance levels were: PSV = 15, 10, 5 and 0 cmH_2O; ATC = 100, 60, 40, 20 and 0 compensation %; ASFP = 8, 6, 4 and 1 amplification units. WOBadd values were obtained using a Bicore CP-100 monitor. For statistical analysis Kruskal–Wallis, Friedman and Willcoxon tests were used.
Results: Data (mJ/L, mean ± SD) are show in the table. On PSV, WOBadd decreased with increasing support, reaching zero with 15 cmH_2O. ATC only compensated for WOBadd at 100% and 60%, (46% at 100% ATC and 29% at 60% ATC). With ASFP, WOBadd is almost avoided independently of the amplification level, except for the lowest amplification level.
Conclusions: BP in these modes is the characteristic one of partial ventilation support. Despite ATC only compensating for the WOBadd at 100 and 60%, the three modes can be used to compensate for WOBadd in these patients. However, ATC should only be applied at 100%, having no clinical interest at lower compensation percentages.
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PSV 15	17 ± 27
PSV 10	78 ± 11
PSV 5	176 ± 21
PSV 0	538 ± 35
TT	545 ± 67
ATC 100	338 ± 30
ATC 60	444 ± 28
ATC 20	589 ± 28
ATC 0	625 ± 38
TT	572 ± 91
ASFP 8	6 ± 8
ASFP 6	9 ± 10
ASFP 4	123 ± 14
ASFP 0	510 ± 108
TT	563 ± 90

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Transfusion and Haemostasis

A-290

Effects of COX-2-inhibitors on platelet function measured by SONOCLOT and PFA-100

I. Breitenmoser, G. Schuepfer, H.R. Gerber

Department of Anesthesiology and Critical Care, Kantonsspital Lucerne, CH-6000 Lucerne 16, Lucerne, Switzerland

Background and Goal of Study: There are recent concerns that selective COX-2 inhibitors as new NSAID's may promote thrombotic cardiovascular events. Data on the effect of coxibs on platelet function in the clinical setting is scarce. So far no data has been published on the effects of rofecoxib (R) and celecoxib (C) on viscoelastic coagulation and PFA 100 platelet function measurements.
Materials and Methods: After institutional approval, 15 healthy and non smoking male volunteers were enrolled in a double blind cross over design study. Baseline coagulation parameters including PTT, PT (Quick/INR), fibrinogen, thrombin time and platelet counts were measured. In addition the effects of the coxibs on viscoelastic coagulation and platelet function were measured using a SONOCLOT and a PFA-100 apparatus (Dade Co., Miami, USA). This function analyzer investigates platelet function in a virtual vascular model and can detect platelet inhibition or dysfunction. The Sonoclot tracing was assessed visually and by measurements of the activated clotting time (ACT), clot rate (cr), time to peak (tp) and peak heights. After baseline measurement 400 mg of C or 50 mg of R were ingested and the effects on viscoelastic and PFA100 measurements were investigated after 3 hours. 14 days later the volunteers were switched to the other drug in order to complete the cross over design.
Results and Discussions: Only male volunteers were included in the study in order to exclude any effect of anticonceptive drugs. Baseline coagulation and hematological laboratory (white cell, erythrocytes, platelets counts, hemoglobin and hematocrit) results were normal. The PFA100 results (closing times under stimulation with ADP and epinephrine) were normal at baseline and after the intake of C or R. The objective parameters of the Sonoclot signature also did not differ from baseline. There was some, but not statistically significant evidence of hypercoagulability in the visual assessment of the Sonoclot tracing after the intake of R.
Conclusion(s): No effect on platelet function of R and C as measured by Sonoclot and PFA100 was found after 50 mg R and 400 mg C given orally. Further studies are needed to exclude a possible effect of hypercoagulation of R as seen by the Sonoclot.

A-291

Changes in D-dimers after orthopaedic surgery

G. Macouillard, G. Freyburger*, F. Sztark

*Department of Anaesthesiology and *Laboratory of Haematology, Hopital Pellegrin, Bordeaux, France*

Background and Goal of Study: Plasma D-dimers are sensitive markers for the diagnosis of venous thrombo-embolism (VTE) (1). However, fibrin formation and degradation after surgery induce an increase in D-dimer levels which reduces the specificity of D-dimer assay in this situation (2). The aim of this study was to describe the time course of plasma D-dimers after orthopaedic surgery.
Materials and Methods: We studied 51 patients who underwent total hip replacement (n = 39) or total knee replacement (n = 12). Prophylaxis against VTE associated low molecular weight heparin and gradual compression stockings. D-dimer levels were measured with the VIDAS D-dimer test (VIDAS 30, Biomerieux) one day before the surgery (D_{-1}), during the surgery (D_0), at the postoperative day 1 (D_1), then biweekly. Results are expressed as mean (SD). Analysis of the data was performed using one-way analysis of variance (ANOVA) with a significance level of 0.05.
Results and Discussions: The study population consisted of 27 male and 24 female patients, mean age 57 (16) yr. No patient had clinical evidence of deep vein thrombosis in the postoperative period. Plasma concentrations of D-dimers increased strongly during the surgery and at D_1, then they reached a mean level between 2000 and 2500 ng/ml (Table). After D_1, D-dimers were lower than 2000 ng/ml in 60% of the patients.

	D_{-1}	D_0	D_1	D_{2-5}	D_{6-9}	D_{10-13}
D-dimers (ng/ml)	901 (660)	5142* (3012)	5780* (4501)	2001* (898)	2317* (1190)	2456* (1201)

Mean (SD). * $P < 0.05$ versus D_{-1}.

Conclusion: Plasma D-dimer assay could be interesting for the diagnosis of VTE after the postoperative day 1. Sensibility and specificity of D-dimer thresholds between 2000 and 3000 ng/ml have to be investigated in a large population.
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A-292

Effects of Nafamostat Mesilate on anti-fibrinolytic state following head and neck tumour resection

M. Doi, T. Urano, T. Mochizuki, S. Sato

Department of Anesthesiology and Intensive Care, Department of Physiology, Hamamatsu University School of Medicine, Hamamatsu, Japan

Background and Goals: Large invasive stimuli of major surgery induce the synthesis of plasminogen activator inhibitor type-1 (PAI-1), which inhibits fibrinolysis and disturbs microcirculation. PAI-1 synthesis is regulated by inflammatory mediators. Nafamostat Mesilate (NM), a synthetic protease inhibitor, has been reported to suppress the activation of compliments and proinflammatory cytokines. The purpose of the present study was to investigate the inhibitory effects of NM on anti-fibrinolytic state.
Materials and Methods: We studied 15 scheduled cases of head and neck tumour resection, which required more than 10 hours. Ten of the patients (group NM) were continuously infused with NM 0.1 mg/kg/hr from the start of surgery until 24 hours after ICU admission. NM was not given to the other 5 patients, who were controls (group C). Urokinase 240,000 unit/day was administered to each patient after ICU admission. Blood samples were taken 5 times: before the start of surgery, at ICU admission, and at 2, 12 and 24 hours after ICU admission. We estimated the plasma concentrations of the following variables: tissue type plasminogen activator (t-PA), free PAI-1, euglobulin clot lysis time (ECLT), interleukin-6 (IL-6), and activated compliment 3 (C3a). Statistical analyses were performed using Kruskal-Wallis test. $P < 0.05$ was considered statistically significant.
Results and Discussions: C3a and t-PA did not differ between the two groups at all sampling points. Group NM had a lower IL-6 than Group C at 24 hr after ICU admission. Both groups showed extremely high plasma concentrations of free PAI-1 and prolonged ECLT at ICU admission. Although high free PAI-1 levels and prolonged ECLT were maintained in group C throughout the study, the two variables returned to the normal values at 24 hr after ICU admission in group NM. These results suggest that NM might contribute to normalising fibrinolysis resulting from the suppression of IL-6, but not from inhibition of compliments activation.
Conclusions: Following head and neck tumour resection by a long procedure, extremely elevated PAI-1 inhibited fibrinolysis. Although NM could not suppress the initial elevation of PAI-1, NM contributed to normalising fibrinolytic activity more quickly.

A-293

Is full Hammersmith aprotinin safe in ascending aortic surgery requiring deep hypothermic circulatory arrest?

J.G.T. Augoustides, J. Weiner D. Pinchasik, S. Raman, S. Fulford, D.R. Jobes, J.E. Bavaria

Department of Anesthesia and Department of Cardiothoracic Surgery, Hospital of the University of Pennsylvania, Philadelphia, USA

Background and Goal of Study: Full Hammersmith aprotinin (FHA) in ascending aortic surgery requiring cardiopulmonary bypass (CPB) and deep hypothermic circulatory arrest (DHCA) has been associated with substantial controversy.[1,2] Ehrlich et al. demonstrated in a randomized double-blinded placebo-controlled trial that half Hammersmith aprotinin is safe in DHCA.[3] The goal of this study is to evaluate the safety profile of FHA in DHCA.
Materials and Methods: With IRB approval, a retrospective chart review was undertaken. The study cohort totaled 66 patients who in 2000/1 underwent elective ascending aortic surgery requiring DHCA. The data of interest were archived in a database constructed with *Microsoft Access*. Statistical analysis was performed with *Stata.*
Results:
The antifibrinolytic exposure rate was 100%:
62% FHA and 38% E-ACA (epsilon aminocaproic acid).

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The following variables were equivalent between groups ($p > 0.05$): Age, gender, body surface area, initial hematocrit, initial coagulation profile, initial serum creatinine, CPB time, and DHCA time.
Re-operations clustered with FHA ($p < 0.05$):FHA 29% and E-ACA 8%.
Important clinical outcomes were not significantly different ($p > 0.05$): mortality, stroke, new dialysis, renal dysfunction, and length of ICU/hospital stay.
Bleeding and blood component transfusion were not significantly different ($p > 0.05$): despite a 3.5× greater incidence of re-operations in the FHA group ($p < 0.05$).
Conclusions: (1) FHA appears safe in adult elective DHCA. (2) FHA appears to ameliorate bleeding and transfusion in DHCA.
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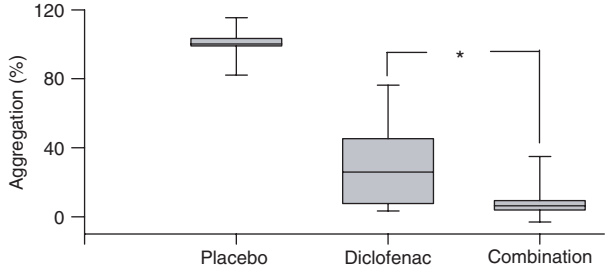
A-294

Propacetamol augments the inhibition of platelet function by diclofenac

E. Munsterhjelm, T. Niemi, P. Rosenberg

Department of Anaesthesiology and Intensive Care Medicine, Helsinki University Hospital, Helsinki, Finland

Background and Goal of Study: Paracetamol potentiates the analgesic effect of non-steroidal antiinflammatory drugs (NSAIDs). Paracetamol is a weak inhibitor of cyclo-oxygenase (COX), and its combination with an NSAID may augment COX inhibition-related side-effects. Combined treatment with diclofenac and paracetamol on platelet function was therefore investigated.
Materials and Methods: 10 healthy volunteers (20–30 yrs), were given diclofenac 1.1 mg/kg, propacetamol 30 mg/kg + diclofenac 1.1 mg/kg and placebo i.v. in a double-blind and cross-over study. Propacetamol is rapidly hydrolysed to half the amount of paracetamol in the blood. Platelet function was measured by photometric aggregometry in platelet-rich plasma (using several induction agents) and with the platelet function analyzer (PFA-100™) on whole blood samples at 5 min, 2 h and 24 h after the infusion. Statistical analysis was performed with reapeted measure ANOVA on ranks and Wilcoxon Signed Rank Test.
Results and Discussions: In aggregometry, initiated by arachidonic acid, platelet aggregation was fully inhibited by both diclofenac and the combination in comparison with placebo when the infusion ended ($p < 0.001$).



At 2 h from the administration (Figure, medians with 25th/50th and 5th/95th percentiles) the inhibition of platelet aggregation with the combination was greater than with diclofenac alone (*$p = 0.014$). After 24 h platelet function had returned to baseline. Platelet function testing with PFA-100 displayed similar results.
Conclusion: Diclofenac inhibits platelet function reversibly. By adding propacetamol this side-effect is significantly augmented. As demonstrated here the inhibitiory effect was almost total still 2 h after the administration of the drug combination.

A-295

Effects of storage of citrated blood on Thromboelastography in silicone coated glass tubes versus polypropylene plastic tubes

S. Chau, G. Lyons

Department of Obstetric Anaesthesia, St James University Hospital, Leeds, United Kingdom

Background and Goal of Study: TEG measures whole blood coagulation on native and citrated samples. The latter can be stored and recalcified prior to analysis. There are claims that TEG variables decay with storage in silicone coated glass tubes[1] but not in plastic polypropylene tubes.[2] However, the basis for this claim is on 2 sample analysis which may demonstrate a change but is insufficient to identify a trend. For valid comparison to be made, it is important to determine whether TEG variables are affected by storage in different mediums and whether they decay over time. The aim of this prospective observational study is to analyse the effects of storage in glass and plastic tubes on Maximum amplitude (MA) and Reaction time (r).
Materials and Methods: Ten healthy volunteers were recruited and blood drawn was stored in both plastic ($n = 10$) and glass tubes ($n = 10$). Venous blood was collected into 3 silicone coated glass tubes and 3 plastic polypropylene tubes. To prevent activation from repeated sampling, one of each type was labelled 1 hour, 2 hour and 4 hour to correspond to when they were to be analysed. After storage in room temperature, TEG was performed at the allocated times. All tubes contained 0.105 M sodium citrate in a ratio of volume of citrate to whole blood 1:9. TEG was assessed at 37°C with 330 μl blood recalcified with 30 μl 0.2 M calcium chloride. Results were expressed as means (SD) and analysed with 2 way ANOVA for differences in observations between glass versus plastic and for changes over time.
Results & Discussion: MA does not vary with time in either glass or plastic tubes ($P = 0.9,0.8$) but there is a trend towards a lower absolute value of MA in plastic tubes which does not reach statistical significance (51.5(7.1) vs 44.4(11.1)). r value does not vary with time in either tube ($P = 0.8,0.8$) but is prolonged in plastic tubes ($P < 0.001$).
Conclusion: MA and r value do not change with 4 hour storage at room temperature. Different reference intervals are required for glass and plastic tube samples. We do not recommend that comparison of r value and MA should be made between blood stored in plastic tubes against blood stored in glass tubes.
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A-296

Usefulness of heparinase-coagulation tests during cardiopulmonary bypass

M. Basora, G. Fita, S. Ninot, A. Pereira, J.C. Reverter, C. Gomar

Department of Anesthesiology, Department of Cardiovascular Sugery, Department of Hematology, Barcelona, Spain

Background and Goal of Study: To asses clinical usefulness of heparinase treatment of samples to perform Prothrombin Time (PT) and Activated Partial Thromboplastin Time (aPTT) during Cardiopulmonary bupass (CPB) in cardiac surgery. Early performance of these coagulation tests may be useful in deciding whether or not to conduct intraoperative plasma transfusion[1].
Materials and Methods: We studied 25 patients undergoing cardiac surgery with CPB. PT and aPTT were determined after samples treatment with heparinase, as well as coagulation level factors V, VII, IX, VIII at start of CPB (T0), 1 hour into CPB (T1), and in the case that CPB lasted 2 hours longer (T2). PT and aPTT were also determined at preoperative time. Patients requiring plasma transfusion were also noted.
Results and Discussions: Operations performed included CABG and valve replacement. Of the 25, 5 patients received plasma in 24 hours postoperation. Table I shows results of coagulation tests and factors at appointed times.

	Preop ($n = 25$)	T0 ($n = 25$)	T1 ($n = 25$)	T2 ($n = 3$)
PT (%)	88 ± 13	59.9 ± 1.3*	49.9 ± 8.8*	40.7 ± 2.5
aPTT (s)	29 ± 5	35 ± 6	35 ± 7	34 ± 9
F V (%)	NA	59.9 ± 22.0	38.1 ± 18.1*	24.7 ± 4.4
F VII (%)	NA	56.3 ± 17.9	42.1 ± 12.4*	25.5 ± 6.6
F VIII (%)	NA	139 ± 45	131 ± 57	217 ± 93
F IX (%)	NA	112 ± 29	93 ± 25	85 ± 34

NA: not available, preop = preoperative time, *$p < 0.5$

aTTP increased 13%, due to haemodilution, from preoperative time to T0, but remained stable until T2. PT showed significant drop from initiation of CPB to T1, and decreased from T1 to T2 in the three patients continuing CPB. Coagulation factors VII and IX showed similar values during CPB, while factors V and VII fell 30%.
Conclusion(s): aTTP did not change during CPB, but PT decreased during CPB along with and provoked by the decrease of factor VII and, in less measure, by that of factor V, more greatly affected by CPB. Early performance of PT in heparinase treated samples assists in determining the need for intraoperative plasma transfusion.
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A-297

Factor VII deficiency and epilepsy surgery – anesthetic management

S. Batista, R. Santos, M. Orfão, A.L. Craveiro

Anesthesiology Department, University Hospital of Coimbra, Coimbra, Portugal

Background and Goal of Study: Factor VII deficiency is an autosomal recessive bleeding disorder with a low incidence. The presence of coagulation disorders during neurosurgical procedures may be associated with a bloody operative field making the resection impossible and could increase the risk of cerebral hematomas. We report the perioperative treatment of a patient with this deficiency using Recombinant Activated Factor VII (rFVIIa).
Materials and Methods: We describe the case of 21 years old male patient with a cerebral tumor (frontal meningeoma and refractory epilepsy) proposed for stereotatic craniotomy and an epilepsy surgery.

During the routine tests we found a prothrombine time of 21 seg (13,5). The clinical investigation indicated that he had minimal hemorrhagic clinical signs. A complete laboratory evaluation revealed a factor VII deficiency (baseline of 17%).
Results and Discussions: This patient was submitted to a TIVA with propofol, remifentanil and vecuronium, during 8 hours. We have done prophylactic administration of 15 mcg/kg rFVIIa before the beginning of the craniotomy, and another dose before dura suture. After the surgery he continued to receive the concentrate every 8 hours during three days. During the intraoperative period we have done seriated analysis of the hemostase. We didn´t observe any signs or symptoms of bleeding or thrombotic events neither during, nor after the surgery.
Conclusion(s): An inherited Factor VII deficiency demands a careful laboratory and clinical evaluation. In this patient the utilization of Recombinant Activated Factor VII allow a successfully procedure without any complication. The rFVIIa prevents the of transmission infective diseases associated with blood products.

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Recombinant factor VIIa [rFVIIa] stops intractable postoperative bleeding when detailed coagulation-profile is not available immediately – A case-report

L. Heuer, M. Kruse, D. Blumenberg

Department of Anaesthesiology, Klinikum Osnabrueck GmbH – Osnabrueck, Germany

Background and Goal of Study: Recombinant activated coagulation factor VII originally was developed for the treatment of bleeding complications in haemophiliac patients with allo-antibodies against exogenous factor VIII or IX. A large number of case reports and results from initial clinical trials suggest that rFVIIa may also be effective in the prevention and treatment of bleedings besides it's approved indication.
Materials and Methods: We report on the successful use of rFVIIa in a patient with undiagnosed haemophilia A.
Results and Discussions: A 69-year-old male patient was admitted with macrohaematuria. The surface of a large tumor of the bladder was coagulated and the bleeding ceased. On the first postoperative day the patient started to rebleed and developed a tamponade of the bladder in combination with hemorrhagic shock. A second transurethral resection was performed but the bleeding continued. The patient was taken to the ICU. Continuous irrigation of the bladder with iced-water was established. 6 RBC, 10 FFP and one PC were transfused and tranexamic acid and DDAVP applied, but the irrigation fluid stayed bloody. The patients condition deteriorated further. We decided to use rFVIIa in a compassionate way. The patient received a bolus of 400 μg/kg via a central line. The bleeding ceased 30 minutes after the injection and the irrigation fluid became clear. A second bolus of 400 μg/kg was administered four hours later. The bleeding did not reoccur and the patients condition stabilized. He did not receive any further bloodproducts and was discharged from the ICU on the 8th postoperative day. Despite this mega-dose of rFVIIa we did not observe any thromboembolic events or triggering of DIC. Because aPTT spontaneously was 47,2 sec on admission we assumed a predisposing coagulopathy. We performed a coagulation check-up when the patient had not received any FFP for 48 h. aPTT at that time was 46,3 sec., Faktor VIII activity 8%. The patient suffered form an undiagnosed mild form of haemophilia A.
Conclusion(s): rFVIIa seems to be a new option in the treatment of intractable bleedings; especially when detailed coagulation check-up is not available immediately. Further clinical trials are needed to prove this assumption.

Reference:
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A-299

Recombinant factor VIIa [NovoSeven] – A new option in intractable bleeding episodes – A case-series

L. Heuer, M. Denter, M. Kruse, P. Marré, G. Sandmann, D. Blumenberg

Department of Anaesthesiology, Klinikum Osnabrueck GmbH, Osnabrueck, Germany

Background and Goal of Study: Recombinant activated coagulation factor VII originally was developed for the treatment of bleeding complications in haemophiliac patients with allo-antibodies against exogenous factor VIII or IX. A large number of case reports and results from initial clinical trials suggest that rFVIIa may also be effective in the prevention and treatment of bleedings besides it's approved indication.
Materials and Methods: We report on 9 ultima-ratio-administrations in intractable bleeding (bld) episodes. Before applying rFVIIa massive transfusion, DDAVP, aprotinin, tranexamic acid, terlipressin, somatostatin, re-operation and/or endoscopy had no effect on the bleeding.
Results and Discussions:

	Bleeding	Dosage	Retrospective cause	E	SE
1	GIT	2x 90 μg/kg	Angiodysplasia	+++	Ø
2	Lung	1x 90 μg/kg	Liver cirrhoses	++	Ø
3	Pharynx + GIT	1x 90 μg/kg	Platelet dysfunction	+++	Ø
4	Tumor: bladder	2x 400 μg/kg	Haemophilia A	+++	Ø
5	GIT	1x 90 μg/kg	Platelet dysfunction	+++	Ø
6	Trauma: head	1x 180 μg/kg	Trauma	Ø	Ø
7	Post delivery uterus atonia	1x 128 μg/kg	Uterus atonia	Ø	Ø
8	Lung + liver	1x 90 μg/kg	Liver cirrhoses + DIC	++	Ø
9	Abdominal wall	1x 60 μg/kg	Overdosage: LMW-heparin	+++	Ø

+++ = bld ceased ++ = bld reduced Ø = no effect on bld

We did not observe any thromboembolic side effects (SE). Patients 6 and 7 both were acidotic and hypothermic.
Conclusion(s): rFVIIa seems to be effective in diffuse intractable bleedings. Controlled clinical trials have to show which future potential this new therapeutic option has.
Reference:
1 Hedner U, Blood Coagul Fibrin [2000] 11.

A-300

The Effect of acute normovolemic hemodilution on regional cerebral oxygen saturation

S.H. Han, S.H. Do, J.H. Bahk, Y.S. Oh, J.Y. Joh

Department of Anesthesiology, Seoul National University Hospital, Hallym University Hospital, Seoul, Republic of Korea

Background and Goal of Study: Acute normovolemic hemodilution(ANH) is often performed to reduce the need for transfusion. It may reduce oxygenation of cerebral tissue because it reduces arterial oxygen content(CaO_2). With near infra-red spectroscopy, we examined the change in regional cerebral oxygen saturation(rSO_2) during ANH.
Materials and Methods: A prospective study. Patients (n=18, age 59 ± 10.5; Mean ± SD) scheduled for major orthopedic surgery with preoperative Hb >13 g/dl were enrolled. Patients with neurologic disease were excluded. Blood was withdrawn to reach a target Hb of 8 g/dl and simultaneously replaced by hydroxyethylstarch. Heart rate, mean arterial pressure, central venous pressure and rSO_2 were measured at; before ANH (B;baseline), when 25,50, 75 and 100% of target volume was withdrawn (V25-V100). Values of each period were compared by repeated measures ANOVA. $^{*,\dagger}P > 0.05$ vs baseline.
Results and Discussions: Retrieved blood volume was 935 ± 135 ml. Each hemodynamic data showed no difference throughout the study. The rSO_2 reduced from V75 period, when Hb was 10.1 ± 1.0 g/dl. Change in rSO_2 and Hb during ANH are shown in the graph. Although cerebral blood flow is known to increase during ANH1), its overall effect on cerebral oxygenation is controversial 1,2,3). The present study shows actual reduction of rSO_2 during ANH.

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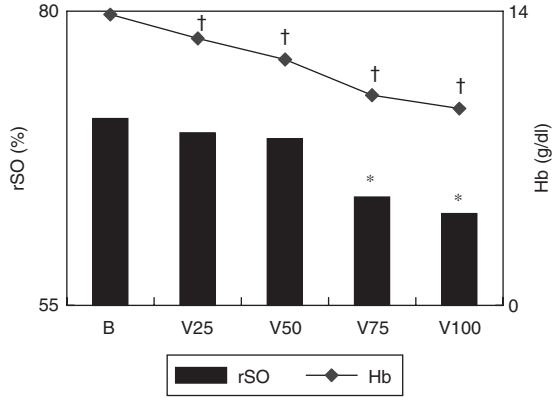

Conclusion: During ANH, monitoring of cerebral oxygenation would be helpful, since it could be decreased.

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A-301

Use of a hemoglobin-based oxygen carrier as an adjunct in a therapeutic regimen for severe anemia

A. Shander, J. Lui, R. Alalawi

Department of Anesthesiology, Englewood Hospital and Medical Center, Critical Care Medicine and Pain Management, Englewood, USA

Background: The conventional treatment for acute hemorrhage is transfusion of allogeneic blood. Hemoglobin-based oxygen carriers (HBOC's) may reduce or avoid blood transfusions and can be used in patients who cannot receive or who refuse allogeneic blood. We report two patients with severe anemia treated with an o-raffinose-crosslinked human hemoglobin solution. Each unit of HBOC is 250 ml. and contains 25 grams hemoglobin. Both patients were treated under the US FDA "compassionate use" regulations.

Methods: To prevent tissue ischemia and organ failure, an o-raffinose-crosslinked human hemoglobin solution was administered. Patient 1: a 20 year old female Jehovah's Witness was admitted to the hospital with symptomatic anemia secondary to dysfunctional uterine bleeding. She received HBOC on Days 6 (4 units) and 7 (1 unit). The nadir hemoglobin was 3.4 g/dL on Day 4. Patient 2: a 54 year old male Jehovah's Witness with anemia secondary to esophageal varices bleeding. He received 3 units HBOC on Day 19 after his hemoglobin fell to 2.8. g/dL. Sequelae included mild fever in Patient 1 with no observable vasomotor or hemodynamic effects.

Results and Discussions: The HBOC's helped to maintain adequate hemoglobin concentrations for tissue oxygenation and that allowed surgery to correct the underlying condition.

Conclusion: Hemoglobin based oxygen carriers can potentially be used in to the patients with anemia who cannot receive or who refuse allogeneic blood transfusion. HBOC's hold promise as a valuable adjunct for the treatment of severe anemia.

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A-302

Potential blood saving with a new perioperative autotransfusion device in joint arthroplasty

M. Osman, D. Durupty, N. Rosencher, A. Belbachir, L. Eyrolle, Y. Ozier

Department of Anesthesiology, Cochin Hospital-University, Paris, France

Background and Goals: Reinfusion of perioperative salvaged shed blood is used in primary joint arthroplasty. Nevertheless controversies focus on the poor quality of unwashed shed blood collected postoperatively and on the low blood volume collected. The aim of this study is to evaluate a new portable (9 kg) washing salvage device (Ortho-PAT®; Haemonetics), dedicated to the intra and postoperative period.

Material and Methods: We prospectively studied 53 patients undergoing primary hip (THA) and knee (TKA) arthroplasties in two different institutions.

Results: The number of THA/TKA is 25/28. The mean packed cell volume of this processed and infused blood is 0.70 (0.59–0.77). The mean duration of the procedure was 4 hours (2–6). The device was found easy to use. The median total volume of reinfused blood is 150 mL (range 40–500) in THA and 300 mL (50–1200) in TKA. The proportion of patients receiving the equivalence of at least 1 and 2 allogeneic PRBCs units are indicated in the table.

		THA		TKA	
		Center A	Center B	Center A	Center B
PRBCs units equivalent	<1	84.6%	63.6%	25.0%	20.0%
	⩾1	15.4%	27.3%	58.3%	60.0%
	⩾2	0.0%	9.0%	16.7%	20.0%

None of the patients developed any adverse reactions after reinfusion

Conclusion: The device is an effective source of red cells in TKA surgery. The effectiveness is less clear and varies according to the institution in THA.

A-303

Predictability of allogeneic transfusion requirements in patients undergoing primary hip replacement

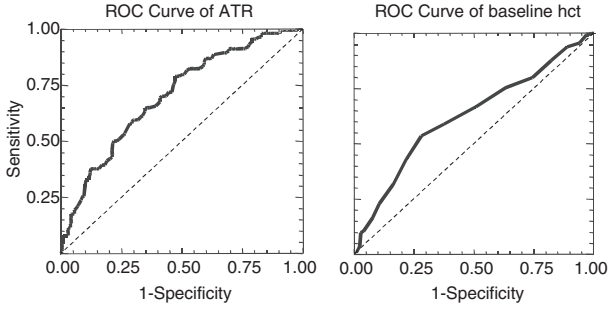
R. Hackl, P. Rehak*, H. Gombotz

*Department of Anesthesiology and Intensive Care, General Hospital Linz; *Department of Surgery, University of Graz, Linz, Austria*

Background and Goal of Study: Preoperative calculation of allogeneic transfusion requirements (ATR) may help to avoid medically and economically unjustified blood conservation methods but also unnecessary supply of allogeneic blood. Although numerous factors have been adressed as risk factors for ATR, reliable predictors on an individual basis are still lacking. The aim of our study was to evaluate the predictability of the individual calculated ATR by using Mercuriali's algorithm (1).

Materials and Methods: We included 356 consecutive patients (65 ± 12yrs, 78 ± 16 kg) undergoing primary hip replacement. The average total perioperative red cell loss was calculated and the 80% percentile was used as an estimate of the expected blood loss for determination of the individual ATR. Sensitivity and specificity of calculated ATR as well as of baseline hematocrit were determined. In addition ROC curves were constructed to show sensitivity and specificity for various values of the estimated blood loss, and the preoperative cut-off value of the hematocrit, respectively.

Results and Discussions: Using Mercuriali's algorithm the sensitivity for predicting ATR was 95.6% whereas the specificity was only 20.7%. Using baseline hematocrit with a cut-off value of 42% a sensitivity of 75.4% and a specificity of 36.4% could be reached. ROC of calculated ATR and baseline hematocrit are shown below.



Conclusion: Both methods for predicting ATR showed poor results. However, the ROC indicates that Mercuriali's algorithm would be slightly better when more accurate estimates of the expected blood loss and strict transfusion criteria are used.

Reference:

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A-305

Graft flushing with saline-albumin solution does not reduce transfusion requirements during orthotopic liver transplantation

C. Bosch, M. de Nadal, A. Mora, A. Camps, C. Cortés, V.A. Gancedo

Department of Anesthesiology, Vall dHebron University Hospital, Barcelona, Spain

Background and Goal of Study: Post reperfusion syndrome in liver transplant (LT) recipients can be mitigated by graft flushing prior to revascularization (1).

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The variability in transfusion requirements in LT most likely results from intraoperative factors (2). The aim of the study was to evaluate the effects on blood transfusion requirements of flushing grafts with saline-albumin solution compared with autologous portal blood.

Material and Methods: We studied 42 adult patients undergoing liver transplantation (30 M/12 W; age 56 ± 11 years) divided in two groups according to the type of flushing graft solution, one received 500 ml of autologous portal blood (Group I) and the other 500 ml of 0.9% saline solution with 20 g human albumin (Group II). Primary diagnosis, Child-Pugh's classification, duration of surgery, preoperative serum albumin and hemoglobin (Hb) levels, platelet count and activated partial thromboplastin time (APTT) were recorded and total blood loss and blood transfusion per kg calculated.

Results: Both groups were homogeneous in qualitative variables and hemostatic parameters. No differences in blood loss nor in transfusion requirements were found between groups. Quantitative variables data (mean ± SD) are shown in the table:

	Group I	Group II	p-values
Albumin (g/dl)	2.5 ± 0.5	2.6 ± 0.6	0.4
Hb (g/dl)	12.2 ± 1.9	11.8 ± 1.8	0.5
Platelet count/mm^{3}x1000	111 ± 73	97 ± 55	0.2
APTT (sec)	40.5 ± 7.4	44 ± 15.2	0.06
Blood loss (ml/kg)	55 ± 38	49 ± 30	0.1
Blood tranfusion (ml/kg)	32 ± 22	28 ± 15	0.3

Conclusions: Graft flushing with saline and albumin compared with autologous portal blood does not reduce transfusion requirements in patients undergoing liver transplantation.

References

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A-306

Predictive model for blood transfusion in adult cardiac surgery

D. Piétrin, L. Soubiron, S. Lavazais, H. Lanquetot, B. Debaene

Département d'Anesthésie Réanimation, Centre Hospitalier Universitaire, Poitiers, France

Background and Goal of Study: Homologous blood transfusions (HBT) remain frequent in adult cardiac surgery, despite normothermia and common use of high dose of aprotinin. The aim of this study was to define a predictive model for perioperative transfusion to enhance transfusion strategy.

Materials and Methods: After ethical review board and patient approval, 329 patients were included in this prospective study from January 2000 to December 2001. Coronary artery bypass graftings with or without valvular replacement using cardiopulmonary bypass were performed under normothermic condition. All patients received the same anaesthetic and surgical techniques [1]. Emergencies, aortic surgery, redo or off pump procedure and length of stay (LOS) over 7 days were excluded. No patients received autologous blood. Several items were recorded: age, weight, height, sex, Parsonnet score pre and postoperative hemoglobin (Hb) and platelets levels, aspirin medication, aortic clamping cardiopulmonary bypass duration, surgery duration (SD), postoperative total bleeding, circulatory failure and intensive care LOS. The main end point of the study was the need of HBT. Logistic regression was performed for multivariate analysis.

Results and Discussions: Transfusion rate is 20.3 percent. Multivariate analysis showed that preoperative Hb lower than 127 g L^{-1}($P < 0.0001$), female ($P < 0.0001$), age older than 74 year ($P < 0.0001$) and SD longer than 320 minutes ($P = 0.05$) were independent variables of perioperative HBT. This model had a sensitivity of 57.8%, specificity of 97.8%. Positive predict value was 78.5% and negative predict value was 94.3%.

Conclusion: According to these results, a simple and valid prediction rule can be developed to identify a high risk of transfusion population.

Reference:

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A-307

Use of hemoglobin raffimer for life-threatening anemia

S.E. Hill, M.J. Lanzinger, L.E. Niklason

Department of Anesthesiology, Duke University Medical Center, Durham, USA

Background and Goals: Hemoglobin raffimer (Hemolink™, Hemosol, Inc., Toronto, Canada) is a purified, cross-linked, human hemoglobin (Hb) solution developed as a substitute for red blood cell Hb. Because this product is a purified Hb solution devoid of other cellular components, it may be accepted as therapy by patients who, due to religious conviction, refuse allogeneic red blood cell transfusion.

Material and Methods: A fifty-three year old female Jehovah's Witness with a prior history of multiple orthopedic procedures for avascular necrosis underwent right total hip replacement. A two-liter intraoperative blood loss and continued hemorrhage from the operative site in the postoperative period complicated surgery. Due to prior patient directive, packed red blood cells were not administered. The patient developed tachycardia, hypotension and mental status changes with nadir total Hb concentration of 3.2 gm/dL on postoperative day #1. After obtaining informed consent as well as FDA and IRB approval, two liters of Hb raffimer (200 gm Hb) were administered along with ferrous sulfate and erythropoietin therapy (10,000 units three times/week).

Results and Discussion: The patient's Hb level rose to 5.5 gm/dL with resolution of tachycardia, hypotension and mental status changes. Because of time required for marrow replacement of red blood cell mass in response to erythropoietin, additional 1000 mL doses of Hb raffimer (100 gm Hb) were required on postoperative days #3, 5 and 7 (total dose = 5000 mL) to maintain a Hb level of >4.5 gm/dL. The patient developed no serious adverse events related to treatment with Hb raffimer. Mild elevations of bilirubin, amylase and lipase were noted but were not associated with symptoms of nausea, vomiting or abdominal pain. By postoperative day 14, the patient's Hb level climbed to 6.5 gm/dL with a hematocrit of 23%. The patient was discharged to a rehabilitation facility.

Conclusions: Limited clinical data in the Jehovah's Witness population suggest adverse clinical sequelae once the Hb concentration falls below 4.5 gm/dL. If untreated, mortality exceeds 95% when the concentration falls below 3.0 gm/dL.[1] Use of Hb raffimer as a bridge to recovery of this patient's red blood cell mass may have prevented adverse clinical outcome.

Reference:

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A-308

ABO blood group and outcome after cardiac surgery

E. Burdett, R. Stephens, J. Eliahoo, A. Ziyad, M. Curtis, M. Kakmanalou, M. Grocott, R. Moulding, M. Mythen

Department of First Floor, Middlesex Hospital, UCL Centre for Anaesthesia, London, United Kingdom

Background and Goal of Study: Associations between ABO blood group and disease and susceptibility to infection are well recognised[1]. Very little data exist, however, on the correlation between blood group antigen and outcome in non-transplant surgery. Here, we observed the relationship between blood groups and outcome following cardiac surgery.

Materials and Methods: We conducted a retrospective, blinded audit of 1101 consecutive cardiac operations at our unit between Jan 1998 and Feb 2000. We collected data regarding mortality, length of hospital stay, EuroSCORE[2] and blood group. We used Fisher's Exact Test to detect a significant difference between the groups. Logistic regression modeling was used to control for preoperative risk.

Results and Discussions: Our sample had comparable blood group distribution to the UK, and similar pre-operative scores. There was no significant difference between the groups, both for hospital stay and mortality.

Blood group	A	O	B	AB
N (%)	447 (41%)	463 (42%)	148 (13%)	43 (4%)
UK distribution[3]	42%	47%	8%	3%
EuroSCORE*	3 (1–6)	3 (2–6)	3.5 (1–6)	3 (2–6)
Length of stay*	7 (5–10)	7 (6–8)	7 (6–9)	7 (6–9)
Mortality N (%)	26 (5.8%)	33 (7.0%)	13 (8.8%)	5 (11.6%)
P Value (Fisher)	0.402	0.598	0.573	0.402

*data expressed as median (IQ range)

Conclusions: In our cardiac surgery population, ABO blood group is not associated with post-operative mortality or length of hospital stay. We are currently examining a larger data set, controlling for other independent variables.

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A-309

Recombinant human erythropoietin therapy increases the postoperative endogenous erythropoietin response

A. Hyllner, A. Åvall, J.P. Bengtson, A. Bengtsson

Department of Anesthesiology and Intensive Care, Sahlgrenska University Hospital, Gothenburg University, Gothenburg, Sweden

Background and Goals: The use of recombinant human erythropoietin (rHuEPO) improves autologous blood donation before elective operation but may suppress postoperative erythropoietin production and hemoglobin recovery. Cytokine production is induced by rHuEPO therapy, which may explain unresponsiveness to erythropoietin therapy in dialysis patients. We investigated whether rHuEPO therapy influences the postoperative endogenous erythropoietin response.
Material and Methods: Plasma concentrations of pro-inflammatory cytokines and complement were followed to study the effect of rHuEPO therapy on immune responsiveness. Thirty women scheduled for radical hysterectomy and pelvic lymphadenectomy were randomly assigned to either a control group with no rHuEPO therapy or to receive rHuEPO. Three units of autologous blood were collected from each patient before operation. Concentrations of erythropoietin, complement anaphylatoxin (C3a), terminal SC5b-9 complex and the cytokines interleukin (IL) 6 and IL-8 were repeatedly analysed before and after operation.
Results and Discussion: Significantly increased concentrations of serum erythropoietin were found early postoperatively in the rHuEPO group compared with the control group. There was a significant increase in IL-6 and IL-8 concentration one hour after operation. No complement activation was found.
Conclusions: rHuEPO therapy prior to operation increases the postoperative endogenous erythropoietin response but does not result in activation of the complement cascade or IL-6/ IL-8 release.

A-310

Anaphylatoxin generation in prestorage filtered plasma

M. Hyllner, M. Tylman, J.P. Bengtson, L. Rydberg, A. Bengtsson

Department of Anesthesiology and Intensive Care, Sahlgrenska University Hospital, Gothenburg, Sweden

Background and Goals of the Study: Complement activation and generation of pro-inflammatory cytokines occur during storage of blood components. The aim with this study was to investigate complement activation and cytokine generation during storage of whole blood and plasma, and the effect of prestorage filtration of plasma on inflammatory mediator release.
Material and Methods: Twenty-four blood units were collected from healthy blood donors and stored for 35 days. Eight units were stored as whole blood, 8 units as plasma and 8 units as prestorage filtered plasma. Samples were collected weekly, during the storage time, for analyses of potassium, WBC, free plasma hemoglobin, complement activation (C3a and SC5b-9) and pro-inflammatory cytokines (IL-6, IL-8 and TNF-α).
Results and Discussion: C3a levels increased during storage. IL-8 and TNF-α increased in whole blood. Elevated levels of C3a and SC5b-9 were registered in filtered plasma from the very beginning of storage. The cytokine levels generated in plasma and filtered plasma were low and there was no significant difference between the units.
Conclusion: Complement activation is present in whole blood, plasma and filtered plasma during storage. Prestorage filtration of plasma activates the complement cascade but does not influence cytokine generation.

Neurosciences

A-311

Comparison of N_2O/O_2-Isoflurane-low dose pentothal, N_2O/O_2-Isoflurane and total intravenous anesthesia by pentothal on serum potassium level in patients with severe head injury

T. Bisri, A. Himendra

Department of Anesthesiology and Intensive Care, Medical Faculty Universitas Padjadjaran, Bandung, Indonesia

Background and Goal of study: There are systemics sequele due to head injury, including electrolyte disturbances, such as low serum potassium and low serum sodium level. The objective of this study is to evaluate clinical effect of anesthetics on serum potassium and serum sodium ions level.
Material and Methods: An experimental randomized clinical trial design had been conducted on three groups, each group consist of nine moderate to severe injury patients, who underwent emergency craniotomy. All subject were handled without premedication, were induced with pentothal (5 mg/kg), fentanyl (2 μg/kg), facilitated intubation (0.15 mg/kg) and maintained with vecuronium bromide (0.1 mg/kg). First group was anesthesized by combination of N_2O/O_2, isoflurane ($\leqslant$1 vol%), and low dose pentothal (1–3 mg/kg), the second group was anesthesized by N_2O/O_2, and isoflurane ($\leqslant$1 vol%) , and the third group was anesthesized by total intravenous anesthesia by pentothal (5 mg/kg/hour). Serum potassium and sodium ion level were measured prior to anesthesia, during anesthesia and surgery, and six hour post operative. Data collected were analyzed statistically with one way Anova and post hoc test by Duncan and Tukey.
Results and Discussion: There is a significant improvement on serum potassium level in the total intravenous anesthesia by pentothal group ($p = 0.011$), while in the of N_2O/O_2, isoflurane ($\leqslant$1 vol%), and low dose pentothal (1–3 mg/kg) group and N_2O/O_2, isoflurane group there is no significant improvement ($p = 0.054$ & $p = 0.54$). Pentothal have membrane stabilization properties and also depress overreactivity due to symphatic stimulations.
Conclusion: There is a significant ($p = 0.011$) improvement on serum potassium ion level in the total intravenous anesthesia by pentothal group during anesthesia.
References:

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A-312

Association between plasma nitric oxide concentration and outcome in patients following severe head injury

K. Ghori, A. Elashall, F. Walsh, P. Seigne, M. OSullivan, G. Shorten

Department of Anaesthesia and Intensive Care Medicine, Department of Neurosurgery, Cork University Hospital,Cork, Ireland

Background and Goal of Study: Head injury may lead to devastating outcome in many survivors. Several biochemical markers have been investigated as predictors of outcome. Increased plasma nitric oxide (NO) concentration is associated with experimental cerebral ischaemia. In this study we examined the association between plasma concentrations of NO with outcome after traumatic brain injury.
Materials and Methods: Twenty isolated traumatic head injury (HI) patients aged 25–65 years with a Glasgow Coma Scale of $<$9 were admitted to our Intensive Care Unit (ICU). 10 healthy volunteers (age matched) were also included in the study as control. All patients were sedated and mechanically ventilated for control of intracranial pressure (ICP). All study patients were treated according to the study protocol. During their stay in ICU cerebral perfusion pressure, ICP, mannitol dosage, haemoglobin, temperature, creatinine, inotropes and other sedative medications were recorded. Blood samples were taken on arrival, 2 and 24 hours after admission to the ICU from a peripheral arterial line. Outcome was assessed six months after discharge from ICU using the Glasgow Outcome Score (1,2 poor outcome and 3–5 good outcome). Data were analysed by Mann–Whitney U test, $p < 0.05$ was considered significant. All data are given as mean $\pm$ standard deviation.
Results and Discussions: Eight patients (40%) had a good outcome. The plasma NO concentration at 24 hours was higher in patients with a poor outcome (20 mM $\pm$ 7.7) when compared to patients with a good outcome (10 mM $\pm$ 7.4) $p = 0.02$, and with control group (12.1 mM $\pm$ 0.98) $p = 0.001$. There was no difference on admission or at two hours in the plasma NO concentration between the groups.
Conclusion: The preliminary results of our study suggest that increased plasma NO concentration may be a predictor of poor outcome following severe HI.
References:

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A-313

Burst Suppression during cardiac surgery: A reliable indicator of Neurological outcome

H. Litvan, J.A. Fernandez, M.L. Maestre, P. Paniagua, M.J. Bernat, J.M. Campos, J. Galan, A. Aris

Department of Anaesthesia and P.O.-Intensive Care, Cardiac Anaesthesia Unit, Hospital Santa Creu i Sant Pau, Barcelona, Spain

Background and Goal of Study: Cardiac surgery is associated with significant cerebral morbidity. Attempts were made to monitor patients with electroencephalogram (EEG) during surgery to prevent bad neurological outcomes. However, the complexity of the technique made it impractical in clinical practice. New monitors of depth of hypnosis let us identify not only patients in a state of deep anaesthesia, but patients with low brain activity caused by brain hypoperfusion (BHP) or hypothermia[1]. When high doses of anaesthetics are given, periods of very low EEG activity named burst suppression (BS), can appear. Besides from deep anaesthesia BS also represents a state of low brain activity e.g. associated to hypothermia or acute brain ischemia. We studied the usefulness of continuous BS monitoring in determining neurological complications during cardiac surgery.
Materials and Methods: Five hundred and eighty-six consecutive patients were monitored during the surgical procedure with the AAI® monitor (Danmeter A/S, Odense, Denmark) which continuously estimates the level of consciousness and the occurrence of BS as defined by EEG amplitudes $<3.4\ \mu V$ during periods larger than 0.5 s. Episodes of BS were classified as caused by deep anaesthesia, hypothermia, or BHP. Patients with neurological disturbances were studied with brain CT-scan or MRI in the postoperative period.
Results: Seventy-eight patients (11.6%) showed BS during surgery. In 47 (60.3%) it was associated to deep anaesthesia, in 3 (3.8%) to deep hypothermia and in 28 (35.9%) to BHP. Of them, 11 patients died intraoperatively. In the remaining 67 patients that showed BS, 15 (22.4%) presented neurological disorders during the postoperative period. In the group with no BS during surgery, 20 patients presented neurological deficits (3.9%) ($p < 0.01$). Appearance of BS led to implementation of corrective measures (cannulae repositioning or $paCO_2$ and blood pressure adjustments).
Conclusion(s): When BS appeared during surgery significatively more patients presented postoperative neurological complications than when BS did not appear. On-line monitoring of BS might be a useful technique for early detection of neurological disorders caused by BHP during cardiac surgery.
Reference:
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A-314

Study of cognitive function in neurosurgical patients

P. Doménech, J. Hernández-Palazón, L.F. Falcón, J. Moya, M. Ros, F. Manresa

Department of Anaesthesia, "Virgen de la Arrixaca" University Hospital, Carretera Madrid – Cartagena s/n, El Palmar, Spain

Background and Goal of Study: Routine use of cognitive test to Asses changes in mental function, might help to the recognition of delirium in surgical patients. We assessed the mental function in neurosurgical patients, using the abbreviated mental test (AMT).
Materials and Methods: We studied 60, (ASA I–III, 18 to 75 years old) neurosurgical patients. Anaesthesia was induced with thiopental and maintained with sevoflurane and remifentanil Elective extra cranial procedures were performed in 30 (mean age 42 yr) while elective intracranial procedures were performed in 30 (mean age 47 yr). Each patient's medical record was reviewed in searching of potential causes of mental impairment. Mental status was assessed before, 2 h and 24 h after surgery. Patients who exhibited preoperative AMT score ⩽8 were excluded.
Results and Discussions: Mean (SD) AMT score are shown in the table.

Surgery	Intracranial	Extra cranial
Before	9.87 (0.35)	9.8 (0.41)
2 h after	9.40 (0.89)	9.63 (0.49)
24 h after	9.73 (0.64)	9.80 (0.41)

There were no significant differences in mean AMT scores, neither before nor after intracranial or extra cranial surgery. No patient submitted to extra cranial, but 4 patients undergoing intracranial surgery (13%) showed a postoperative AMT score ⩽8.
Conclusion: The Abbreviated Mental Test is a simple and useful tool to evaluate postoperative cognitive function, deficits, as a result of different surgical techniques.

A-315

Effect of head elevation on intracranial pressure, cerebral perfusion pressure, and regional cerebral oxygen saturation in patients with elevated intracranial pressure

P. Doménech, J. Hernández-Palazón, L.F. Falcón, A. Soria, V. Robles, M.J. Pujante

Department of Anaesthesia, "Virgen de la Arrixaca" University Hospital, Carretera Madrid – Cartagena s/n, El Palmar, Spain

Background and Goal of Study: This prospective study was designed to assess the effects of head elevation on intracranial pressure (ICP), cerebral perfusion pressure (CPP) and regional cerebral oxygen saturation (rSO_2).
Materials and Methods: We studied 15 patients with intracranial hypertension, submitted to continuous IV midazolam infusion and normocapnic mechanical ventilation. Patients' head were successively placed at 0, 30 and 60 elevation degrees. Each time a new position was achieved, mean arterial pressure (MAP), heart rate (HR), ICP, CPP and (rSO_2) were recorded, after a 5 minutes stabilisation period. ICP and systemic arterial blood pressure were monitored at level of the head. Each time a new position was achieved, the transducers used to measure ICP and MAP were zeroed to the external auditory meatus level.
Results and Discussions: Are shown in the table (Mean & SD)

Head Elevation	0°	30°	60°
ICP (mmHg)	19.1 (5.1)	11.9 (3.4)*	7.0 (4.7)*
MAP (mmHg)	92.4(15.5)	87.3 (15.7)*	86.4 (15.1)*
CPP (mmHg)	73.3 (15.8)	75.4 (15.5)	78.3 (17.1)

* = $p < 0.001$ vs baseline value

ICP and MAP were significantly lower when the patient's head was elevated at 30 and 60 degrees. There were no significant CPP changes.
Conclusion(s): These results suggest that head elevation in patients with intracranial hypertension, significantly reduces ICP without reducing CPP. No evidence of cerebral ischemia was observed in the patients studied.

A-316

Increased peroperative cerebral glutamate release monitored by cerebral microdialysis predicts a worsened postoperative outcome

E. Geypen, C. De Deyne, J. Wuyts*, N. De Neve, R. De Jongh, R. Heylen

Departments of Anesthesia and Critical Care Medicine and Neurosurgery, Genk, Belgium*

Background and Goals: Glutamate is known as the most important excitatory transmitter in mammalian brain. Excessive accumulation of extracellular glutamate, which occurs predominantly during cerebral ischemia, induces neuronal injury and death. Cerebral microdialysis (MD) provides the possibility of monitoring interstitial substances, such as glutamate, in the extracellular space. The aim of the present study was to analyse if peroperatively – almost on-line – measured MD glutamate concentrations might have any prognostic value in predicting postoperative outcome after major neurosurgery.
Material and Methods: With IRB approval, 24 patients scheduled for major neurosurgery (14 aneurysm clipping, 10 large tumor resection) were included. After opening of the dura, a MD catheter was inserted in the cortex of the most critical brain area during neurosurgical intervention. The catheter was perfused by a MD pump at 5 μl/min, enabling dialysate sampling for every 3 min. Dialysate samples were immediately analysed for glutamate concentrations.
Results and Discussion: In 22 pts, we observed no or only a modest (less than 2-fold) increase in glutamate. In the other 2 pts, we observed a marked increase (4- to 10-fold) in glutamate. Neurosurgical procedure was uneventfull in 20 pts. In 4 pts, major intraoperative complications occurred (1 brain bulging, 3 intraoperative bleedings of aneurysm). In 2 of these 4 pts, a marked increase in glutamate concentrations, occurring during or slightly after the surgical problem, was observed. Both these pts had a significantly worser neurological outcome than the other 2 pts with major intraoperative complications, and than the other 20 pts in whom the neurosurgical procedure was uneventfull.
Conclusions: Use of peroperative cerebral microdialysis might provide usefull prognostic information as we found that marked peroperative increases in cerebral glutamate concentrations were significantly correlated to a worsened postoperative outcome.

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A-317

Online assessment of brain tissue oxygen autoregulation in traumatic brain injury and subarachnoid hemorrhage

M. Soehle[1], M. Jaeger[2], J. Meixensberger[2]

Departments of Anesthesiology and Intensive Care Medicine, University of Bonn, Germany[1]; Dept. of Neurosurgery, University of Leipzig, Bonn, Germany[2]

Background and Goal of Study: Monitoring of brain tissue oxygenation ($p_{ti}O_2$) enables early diagnosis of secondary cerebral ischemia and may guide a cerebral perfusion pressure (CPP)–orientated therapy. The purpose of our study was to explain the concept of $p_{ti}O_2$-autoregulation, defined as the ability of the brain to maintain $p_{ti}O_2$ despite changes in CPP, and to show the different states of $p_{ti}O_2$-autoregulation we found.
Materials and Methods: Microcatheters to assess $p_{ti}O_2$ and intracranial pressure were implanted into cerebral 'tissue at risk' of patients suffering from traumatic brain injury or subarachnoid hemorrhage. By using a multimodal neuromonitoring setup and in-house built software we assessed and displayed online the relationship between $p_{ti}O_2$ and CPP based on a data buffer consisting of 12 hours. Depending on the linear regression slope ($b_{ptiO2} = \Delta p_{ti}O_2/\Delta CPP$), we defined the state of $p_{ti}O_2$-autoregulation as present ($0 \leq b_{ptiO2} \leq 1/6$), moderate ($1/6 < b_{ptiO2} \leq 1/3$), impaired ($b_{ptiO2} > 1/3$) or inverse ($b_{ptiO2} < 0$).
Results and Discussions: When $p_{ti}O_2$-autoregulation is present, an elevation in CPP is ineffective to raise $p_{ti}O_2$. In contrast, an increase in CPP elevates $p_{ti}O_2$ more pronounced in impaired than in moderate $p_{ti}O_2$-autoregulation, but decreases $p_{ti}O_2$ in inverse $p_{ti}O_2$-autoregulation.
Conclusion(s): We conclude that online assessment of $p_{ti}O_2$-autoregulation gives valuable information on which patient will benefit from an increase in CPP and which CPP should be achieved to do so.
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A-319

Cognitive recovery after EEG-controlled anaesthesia with Propofol or Sevoflurane measured with a standardized test battery

F.A. Beger[1], A. Schultz[1], U. Grouven[1], J.C. Ennen[2], J. Hausdörfer[1], B. Schultz[1]

[1]Department of Anaesthesiology, [2]Department of Neurology and Clinical Neurophysiology, Hannover Medical School, Hannover, Germany

Background and Goal of Study: The aim of the study was to detect even discreet impairments of manifold cognitive functions after EEG-controlled anaesthesia with propofol (prop) or sevoflurane (sevo). Thus, patients performed a standardized test battery including 5 single tests until the 3rd postoperative day. For this test battery age-correlated norm values were recently provided [1].
Materials and Methods: In a prospective randomized study 41 gynaecological patients (ASA I–II) were induced with prop (2 mg/kg/60 sec) and intubation was facilitated with remifentanil (1 μg/kg/120 sec, continued throughout anaesthesia with 0.25 μg/kg/min). For maintenance either prop (n = 20) or sevo (n = 21) was given targeting a burst-suppression EEG for skin incision and an EEG with dominating δ-activity for the steady state (EEG monitor: Narcotrend® [2]). For postoperative analgesia piritramid was given followed by metamizol and piritramid prn. In the evening before surgery, 1 h and 6 h post extubation, on the evening of the 1st, 2nd and 3rd postoperative day (POD) the 5 valid and objective tests were performed (digit-symbol-test, number-connection-test [version A and B], serial-dotting-test, line-drawing-test). Test raw data of each single test were transformed into scores according to standard deviation (SD) of norm values. The sum of the 5 scores defined the total score for the respective evaluation. Approval of the local ethics committee was obtained.
Results and Discussions: Between the 2 groups mean of age (prop 37.0, SD 5.1 yrs, sevo: 35.5, SD 6.9 yrs), weight, and duration of anaesthesia (prop: 183.2, SD 70.4 min, sevo: 160.2, SD 94.0 min) did not differ significantly. Main EEG stage during steady state showed dominating δ-activity in both groups. The table shows the percentage of patients with regained preoperative total score for each group at each evaluation (p-values by Chi-Square test).

	1 h	6 h	POD 1	POD 2	POD 3
Prop	0.0%	15.0%	55.0%	80.0%	89.5%
Sevo	0.0%	38.1%	78.9%	84.2%	94.4%
p-value		0.10	0.11	0.73	0.58

Conclusion(s): The test battery was suitable for use in the field of anaesthesia. In our study cognitive recovery after prop and sevo anaesthesia was comparable. Some patients still had cognitive impairments on the 3rd POD.
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A-320

Cerebral blood flow autoregulation in patients with intracranial lesions – a temporal profile

K. Engelhard, C. Werner, M. Pape, E. Kochs

Department of Klinikum rechts der Isar, Klinik für Anaesthesiologie of the Technische Univ, Munich, Germany

Background and Goal of Study: There is controversy concerning the status of cerebral blood flow (CBF) autoregulation following head injury and intracranial hemorrhage. While some studies have shown that autoregulation is maintained others found impaired CBF responses to changes in cerebral perfusion pressure (CPP). The conflicting results may be related to a specific temporal profile of autoregulatory decompensation and recovery. The present study, therefore, investigates static and dynamic CBF autoregulation in patients with acute intracranial lesions for a period of 7 days from insult.
Methods: In eight patients with head trauma and/or intracranial hemorrhage cerebral blood flow velocity was measured in both middle cerebral arteries using transcranial Doppler sonography. Static autoregulation was measured by increasing CPP to 20 mmHg above baseline using norepinephrine infusion (2–6 μg/min i.v. for 15 minutes). Dynamic autoregulation to hypotension was measured by a rapid deflation of large cuffs placed around both thighs which have been inflated for three minutes above systolic blood pressure. Autoregulation studies were performed for seven days starting at day one following insult. Physiological variables were controlled.
Results and Discussions: CBF autoregulation was maintained in 50–70% of the patients one day after the insult as related to type of regulatory response and hemisphere tested. On day 4 autoregulation was impaired in all patients. On day 7 autoregulation was recovered in 30–60% of the patients. This time course may explain some of the discrepancies between studies that differed in their time point of measurements. During this investigation the interindividual variability of cerebrovascular responses to hyper- and hypotensive challenges was substantial. This suggests that individual CBF monitoring is mandatory in patients with intracranial lesions in order to taper the CPP management according to the individual CBF status of the patient.

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Postoperative changes in the full field electroretinogram following sevoflurane anaesthesia

G. Iohom, A. Whyte, T. Flynn, G. OConnor, G. Shorten

Departments of Anaesthesia and Intensive Care Medicine and Ophthalmology, Cork University Hospital and National University of Ireland, Cork, Ireland

Background and Goal of Study: We tested the hypothesis that minor disturbances of the visual pathway persist following sevoflurane anaesthesia, even after clinical discharge criteria have been met.
Materials and Methods: We performed full field flash electroretinograms (ERG) (1) in the right eye of 10 ASA I patients who did not receive preanaesthetic medication and underwent sevoflurane anaesthesia. Electroretinograms were recorded on three occasions: preoperatively, immediately after discharge from the recovery room and two hours after discontinuation of sevoflurane. Patients completed visual analogue scales (VAS) for sedation, anxiety and pain immediately before each ERG recording. The time at which criteria for home readiness were first met (Postanaesthesia Discharge Score, PADS > 9) was also noted (2). Results were compared using paired, one tailed Student's t test. $P < 0.05$ was considered significant.
Results and Discussions: The latency of the b-wave on the photopic ERG was greater (30.5 ± 0.9 and 30 ± 1.3 vs 29.2 ± 0.8 ms, $p < 0.001$ and $p = 0.04$ respectively) at each of the postoperative time points compared to preoperatively. The A-B amplitude of the b wave diminished (220.3 ± 52.7 and 210.3 ± 42.7 vs 248.1 ± 57.6 uV, $p = 0.03$ and $p = 0.01$, respectively) at the same time points. Similarly, oscillatory potentials (OP) latencies were greater at both postoperative time points compared to baseline values (21.4 ± 0.5 and 20.8 ± 0.6 ms vs 20.4 ± 0.4 ms, $p < 0.001$ and $p = 0.03$ respectively). OP amplitudes were decreased at the first postoperative time point (17.5 ± 6.1 uV vs 22 ± 6.4 uV, $p = 0.04$) compared to preoperatively.
Conclusion(s): Postoperative ERG abnormalities are consistently present in patients who have undergone sevoflurane anaesthesia. These abnormalities

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persist beyond the time at which standard clinical discharge criteria (PADS > 9) are met and at least until two hours postoperatively.

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A-322

Pregnancy-induced arterial hypertension (PIH) – the assesment of the blood brain barrier (BBB) permeability in connection with computer tomography of the brain

G. Michalska-Krzanowska, R. Sajdak, E. Stasiak-Pikula

Departament of Anaesthesiology, Clinical State Hospital No 2, Szczecin, Poland

Background and Goal of the Study: The aim of the work was to study the influence of PIH on permeability of BBB. Neurological consultation was followed by cranial computer tomography which revealed changes within structures of central nervous system.

Materials and Methods: The observations were performed in 4 pregnant women with PIH – study group G and 2 pregnant woman without PIH – control group C. All women had caesarean section performed in conductive anaesthesia. The method included collection of 15 ml venous blood and 4 ml cerebrospinal fluid. Albumin and IgG serum concentrations, microalbumin and IgG CSF concentrations, and permeability indexes for albumin Q_{alb} and for IgG Q_{IgG} were estimated.

Results: In contrast to group C, increased Q_{alb} and Q_{IgG} indexes proved lack of integrity of BBB in the group G. Control cranial CT scans revealed partial subsidence of changes after 3–5 days, and complete subsidence after 9–14 days.

Conclusions: PIH leads to injury of the BBB integrity. Cranial CT scans in woman with PIH is valuable and safe investigation that shows pathological changes in the CNS.

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Somatosensory-evoked potentials (SSEP) and neurological function during carotid endarterectomy (CEA) under regional anaesthesia

C. Schneemilch[1], A. Stübing[1], Z. Halloul[2], T. Hachenberg[1]

[1]Department of Anesthesiology and Intensive Care, [2]Department of Surgery, Otto-von-Guericke-University, Magdeburg, Germany

Background and Goal of Study: Cerebral perfusion is markedly affected by clamping of the carotid artery during CEA. In the present study we analysed SSEP and neurological function in patients undergoing CEA in regional anaesthesia.

Materials and Methods: The study had been approved by the ethics committee and informed consent had been obtained from each patient. 36 patients (age: 65 ± 9 years) undergoing CEA were prospectively studied. After regional anaesthesia of the cervical plexus (40 ml ropivacain 0,2% plus prilocain 1%) SSEP were recorded preoperatively, before and after carotid clamping, during CEA and at the end of surgery. Significant neurological deficits were defined as hemiplegia, aphasia, acute loss of consciousness and convulsions.

Results and Discussions

Patients (n = 36)	Neurological deficits	Reduction of SSEP-amplitude N20-P25 >50%	no reduction of SSEP-amplitude N20-P25
12	present	9	3
24	absent	10	14

Shunting procedure		Shunting	Without shunting
planed	5	3	2
not planed	31	9	22

SSEP alterations were not observed in 3/12 symptomatic patients and showed false negative results in 10/24 asymptomatic patients.

Conclusion(s): Significant neurological deficits occurred in 12/36 patients undergoing CEA. 25% of these alterations were not detected by SSEP. The sensivity of SSEP was 75% and the specifity was 58%. Monitoring of SSEP is unreliable to predict cerebral ischaemia during CEA.

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A-324

Use of cerebral microdialysis to monitor changes in local metabolism induced by temporary artery clipping

N. De Neve, C. De Deyne, J. Wuyts*, F. Weyns*, E. Mortier**, R. Heylen

Departments of Anesthesia and Neurosurgery; ZOL, Dept of Anesthesia** University Hospital Gent, Genk, Belgium*

Background and Goal of Study: Temporary arterial occlusion applied during microsurgical dissection of middle cerebral artery (MCA) aneurysms carries the risk of focal infarction secondary to the induced arrest of local arterial flow. Monitoring of local brain metabolism by cerebral microdialysis might reveal early indicators of local brain ischemia and might guide safe application of temporary clipping (TC).

Materials and Methods: With IRB approval, 13 pts scheduled for elective surgical clipping of an MCA aneurysm were included. After opening of the dura, a microdialysis catheter (CMA70) was inserted into the parenchyma of the MCA vascular territory and was perfused at 5 μl/min, enabling the collection of dialysate every 3 min. Concentrations of glucose, lactate, pyruvate and glycerol were immediately analysed.

Results and Discussion: In 10 of the 13 pts, a total of 30 episodes of TC was applied for mean 4.1 min (1–9 min). In all pts, TC was applied under barbiturate protection (guided by EEG monitoring). Every episode of TC resulted in a decrease in extracellular glucose. The extent of the decrease in glucose was widely variable among pts, but was generally more marked during longer periods of TC. Overal, every TC resulted in a minor increase in extracellular lactate. In 16 episodes, a marked 2- to 3-fold increase in lactate was observed. Lactate/pyruvate ratio increased in 12 of these 16 episodes, indicating the development of local cerebral ischemia. Finally, in 8 of these 12 episodes, we observed a large increase in glycerol, revealing local brain cell death. In these episodes, the mean duration of TC was 6.2 min, although it also occurred after a TC of only 2 min. As to repeated TC's in the same patient, we observed that intervals shorter than 3 min between repeated TC's did not result in a normalization of either glucose or lactate.

Conclusion(s): Cerebral microdialysis reveals the local production of ischemia markers during TC (increased lactate/pyruvate ratio, increased glycerol). Use of high pump flow rate shortened the delay to analysis to less than 5 min, making usefull information readily available for the neurosurgeon, especially during the riskfull longer periods of TC.

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Local Cerebral Ischemia Induced by Brain Retraction during Craniotomy, Monitored by Cerebral Microdialysis

N. De Neve, C. De Deyne, J. Wuyts*, F. Weyns*, E Mortier**, R. Heylen

Depts of Anesthesia and Neurosurgery, Dept of Anesthesia**, University Hospital Gent, ZOL, Genk, Belgium*

Background and Goal of Study: Brain retractors applied during craniotomy are known to induce local changes in cerebral perfusion by applying local pressure to brain tissue under the retractors. Cerebral microdialysis (MD) is a recently available tool for monitoring local cerebral metabolism and ischemia. In the present study, we evaluated whether MD revealed any changes in local metabolism in the brain area under the retractor and whether this information was of any clinical value.

Materials and Methods: With IRB approval, 12 pts scheduled for large tumor resection received peroperative MD. After opening of the dura, the MD catheter was inserted into the brain cortex and was perfused at 5 μl/min enabling analysis (for glucose, lactate, pyruvate, glycerol and glutamate) of the dialysates every 3 min. A brain retractor was finally applied for the period of tumor resection above the area of MD catheter insertion.

Results and Discussion: Insertion of the brain retractor, resulted in a overall decrease in local glucose concentration, most probably due to a decrease in local perfusion. In 7 patients, there was a further progressive and marked decrease in glucose during brain retraction. In these 7 pts, we observed an increase in local lactate concentration. In 5 of these 7 patients, we also observed an increase in lactate/pyruvate ratio, revealing the development of local cerebral ischemia under the retractor. All these 5 episodes also revealed a large increase in glycerol, a sign of ongoing cerebral cell death. In one patient, these metabolic ischemic events were observed 15 min before any neurosurgical warning sign (extensive brain bulging) occurred. In this case, replacement of the retractor resulted in an immediate normalization of all parameters. Only in the last pt, an extensive increase in glutamate was observed. Postoperative outcome was uneventfull for all pts, except for this last one.

Conclusion(s): Use of MD during routine brain retraction revealed the possible presence of pronounced local cerebral ischemia under the retractor. Peroperative use of high flow MD, enabling almost on-line metabolic monitoring

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of brain tissue under the retractor, might be a valuable warning tool during neurosurgical procedures necessitating extensive brain retraction.

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Continuous assessment of cerebral autoregulation in subarachnoid hemorrhage

M. Soehle[1], M. Czosnyka[2], J.D. Pickard[2], P.J. Kirkpatrick[2]

[1]Dept. of Anesthesiology and Intensive Care Medicine, University of Bonn, Germany; [2]Academic Neurosurgery Unit, University of Cambridge, UK

Background and Goal of Study: Cerebral vasospasm remains a leading source of morbidity and mortality in subarachnoid hemorrhage (SAH). Cerebral ischemia may ensue when autoregulation fails to compensate for spasm of the proximal cerebral arteries. We examined how autoregulation is affected by cerebral vasospasm detected using transcranial Doppler sonography.
Materials and Methods: The moving correlation coefficient between slow changes of arterial blood pressure (ABP) and mean or systolic flow velocity (FV), termed Mx and Sx respectively, was used to characterise cerebral autoregulation. Cerebral vasospasm was declared when the mean FV rose above 120 cm/s, and the Lindegaard ratio above 3. This occurred in 15 of 32 SAH-patients. Based on the bilateral transcranial Doppler recordings of the middle cerebral artery in vasospastic patients, Mx and Sx were calculated for baseline and vasospasm.
Results and Discussions: Mx rose during vasospasm (Mx = 0.46 ± 0.32, mean ± SD) and was significantly higher ($p = 0.021$) than at baseline (Mx = 0.21 ± 0.24). Sx was also significantly elevated (Sx = 0.22 ± 0.26 versus Sx = 0.05 ± 0.21 at baseline, $p = 0.03$). Mx correlated significantly with mean FV ($r = 0.577$, $p = 0.025$) and the Lindegaard ratio ($r = 0.672$, $p < 0.006$). Mx ($p = 0.006$) and Sx ($p = 0.044$) was higher on the vasospastic side (Mx = 0.44 ± 0.27, Sx = 0.24 ± 0.23) when compared with the contralateral side (Mx = 0.34 ± 0.29, Sx = 0.16 ± 0.25).
Conclusion(s): The increased Mx and Sx during cerebral vasospasm demonstrate impaired cerebral autoregulation. Mx and Sx indices provide additional information on changes in autoregulation in patients with SAH.
Acknowledgements: Supported by Technology Foresight Challenge Award FCA234/95; G4200005 and MRC programme Grant #G9439390 to JDP.

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Measurement of cerebrovascular resistance in patients with subarachnoid hemorrhage before and during vasospasm

M. Soehle[1], M. Czosnyka[2], P.J. Kirkpatrick[2], J.D. Pickard[2]

[1]Department of Anesthesiology and Intensive Care Medicine, University of Bonn, Germany; [2]Academic Neurosurgery Unit, University of Cambridge, UK

Background and Goal of Study: Cerebrovascular impedance, critical closing pressure, pulsatility index (PI) and index of resistance (IR) are thought to characterise the resistance of cerebral vessels. We examined how they change in patients suffering from subarchanoid hemorrhage before and during vasospasm.
Materials and Methods: In 15 out of 32 SAH-patients, vasospasm occurred as defined by a mean flow velocity (FV) > 120 cm/s and a Lindegaard ratio >3. Based on the bilateral transcranial Doppler recordings of the middle cerebral artery in those 15 patients, cerebrovascular resistance was calculated as CVR = CPP/FV and impedance was determined by the ratio of the harmonics of arterial blood pressure (ABP) divided by that of FV. The critical closing pressure (CCP) was calculated as described by Aaslid (1).
Results and Discussions: CVR was significantly ($p = 0.013$) lower during vasospasm (0.63 ± 0.09 mmHg*s/cm, mean SD) as compared to before vasospasm (1.22 ± 0.44 mmHg*s/cm). Furthermore, impedance decreased during vasospasm (0.96 ± 0.37 versus 0.58 ± 0.13 mmHg*s/cm, $p = 0.001$) as well as critical closing pressure (24.4 ± 20.3 mmHg versus 6.3 ± 22.9 mmHg, $p = 0.036$). In addition, PI (0.72 ± 0.15 vs. 0.90 ± 0.28, $p = 0.054$) as well as IR (0.50 ± 0.07 vs. 0.56 ± 0.07, $p = 0.029$) were lower during vasospasm.
Conclusion(s): The findings of a decreased impedance during vasospasm are in contradiction to reports in the literature. However, the observed changes in resistance indices may be simply explained by mathematical effects of an increased mean FV in spastic vessels and hence to do not necessarily reflect actual changes in cerebrovascular resistance. Therefore results based on the described methods need to be interpreted with great caution.
Reference:
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A-328

Neural auditory processing in children under EEG-controlled anaesthesia revealed by positron emission tomography (PET)

F.A. Beger[1], B. Schultz[1], E. Lüllwitz[1], A. Lesinski-Schiedat[2], T. Brunkhorst[3], A.R. Boerner[3], A. Warnecke[2], A. Schultz[1]

[1]Department of Anaesthesiology, [2]Department of Otolaryngology, [3]Department of Nuclear Medicine, Hannover Medical School, Hannover, Germany

Background and Goal of Study: Functional positron emission tomography (PET) is an established procedure for the assessment of stimulus-dependent central auditory processing in adults [1], but it is difficult to perform in young restless children. To evaluate children with suspected neural hearing loss for cochlear implant surgery, PET scan was performed under light anaesthesia. The EEG was used for the control of depth of anaesthesia to enable potential central auditory processing.
Materials and Methods: In clinical routine 5 children underwent sevoflurane mask induction and intubation was facilitated with mivacurium and remifentanil (1 μg/kg/30 sec, continued with 0.35 μg/kg/min throughout PET scan). For maintenance midazolam was given targeting EEG stages with dominating β- and θ-activity. The EEG monitor Narcotrend® was used [2]. Acoustic stimuli were applied via the cochlea implant device or a transtympanal needle electrode. Stimulus-dependent PET scans with O-15-labeled water were assessed related to basic scans in silence.
Results and Discussions: The children were between 2 and 15 yrs old (mean 5.4, standard deviation 4.8 yrs) and weight ranged between 12.5 and 35 kg (mean 19.9, standard deviation 8.0 kg). Throughout the PET scan β-activity dominated in the EEG (Narcotrend® stage B). Mean midazolam dosage per patient ranged between 0.58–1.05 mg/kg/h. In accordance with the clinical impression 3 children showed no functional activation in the primary auditory cortex. 2 children presented a stimulus-induced neuronal activity in the primary auditory cortex, one child contralaterally, the other one bilaterally.
Conclusion(s): Despite high doses of midazolam and remifentanil β-activity dominated in the EEG allowing stimulus-dependent neuronal activity in the primary auditory cortex of some children. Demonstrating acoustic perception these light EEG stages should be avoided during general anaesthesia for surgical procedures.
References:
1 Lauter JL et al. *Hear Res* 1985; 20: 199–205.
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A-329

Cerebral hemodynamics assessment by transcranial near-infrared spectroscopy during internal carotid artery transluminal percutaneous angioplasty

L. Salvador, J. Fontanals, E. Carrero, R. Valero, N. Fábregas

Department of Anesthesiology, University of Barcelona, Hospital Clínic de Barcelona, Barcelona, Spain

Background and Goal: Carotid artery transluminal percutaneous angioplasty (TPA) is a treatment associated to a high risk of cerebral ischemia(1), and oedema or brain haemorrhage after the procedure(2). Near infrared spectroscopy (NIRS), a non invasive monitoring technique, can be helpful to indirectly assess cerebral blood flow (CBF) (3). Our aim has been to assess NIRS usefulness as a continuous monitoring of cerebral blood flow variations during TPA procedures.
Material and Methods: 25 patients who underwent unilateral internal carotid artery TPA -under monitored anaesthesia care- were included in a prospective study. EKG, invasive blood pressure, pulsioximetry, and bilateral regional oxygen saturation (SrO_2) by means of NIRS (Somanetics®, INVOS 3100) were monitored: baseline (T1), before TPA after local papaverine infusion (T2), during TPA (T3) and 5′ and 30′after TPA (T4–T5). NIRS changes >15% baseline for longer than 30" were recorded. Neurological complications were also registered.
Results: Mean age 69 ± 9 (range 49–78 years).

	T1	T2	T3	T4	T5
SrO_2 (%)	64 ± 6	65 ± 14	63 ± 6	67 ± 8*	66 ± 6
SBP mmHg	159 ± 16	159 ± 16	147 ± 18	153 ± 15	147 ± 13

** p = 0.01 respect T3.* Two patients who developed intracranial hypertension symptoms (headache, confusion) showed SrO_2 increase over 15% after the procedure. Three patients developed transitory ischemic attack in the postoperative period.

Conclusions: SrO_2 values vary according to expected CBF changes during TPA. NIRS seems to be a useful tool to assess CBF variations and to optimise hemodynamic management during TPA.

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A-330

Relationship between dopamine release and deleterious effects of dexamethasone in ischaemic rat brain

T. Mitsuyo, N. Adachi, T. Arai

Department of Anaesthesiology and Resuscitology, Ehime University School of Medicine, Onsengun, Japan

Background and Goal of Study: Glucocorticoids have been reported to aggravate ischaemic neuronal damage in both humans and experimental animals. The agents also change the activity of the central dopaminergic system. Because excess release of neurotransmitters is closely related to the outcome of ischaemic neuronal damage, the authors evaluated the effects of dexamethasone on dopaminergic release and histologic outcome.
Materials and Methods: Changes in the extracellular concentrations of monoamines and their metabolites in the striatum produced by occlusion of the middle cerebral artery for 20 minutes were investigated by a microdialysis procedure and effects of intracerebroventricular administration of dexamethasone (10 μg) were evaluated in halothane-anaesthetized rats. The histologic outcome was examined 7 days after ischaemia by light microscopy. The relationship between ischaemic release of dopamine and the histologic outcome was estimated by assessing the effect of the lesion of the substantia nigra.
Results and Discussions: The extracellular concentration of dopamine was not affected by the administration of dexamethasone in the non-ischaemic state. The occlusion of the middle cerebral artery produced a marked increase in the extracellular concentration of dopamine in the striatum, the peak value being 240 times that before ischaemia. The value returned to the basal level immediately after reperfusion. The preischaemic administration of dexamethasone enhanced the increase in the dopamine level during ischaemia, and the peak value in the dexamethasone group was 640% of that in the vehicle group. The value returned to the basal level 2 hours after reperfusion. After 7 days, ischaemic neuronal damage in the dexamethasone group was severe compared with that in the vehicle group. In rats receiving the substantia nigra lesion, ischaemic release of dopamine was abolished, and aggravation of ischaemic neuronal damage by dexamethasone was completely alleviated.
Conclusion: Changes in release of dopamine may be a contributing factor in development of ischaemic neuronal damage by glucocorticoids.

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Non-invasive estimation of zero flow pressure using a bench-top model of simulated cerebral circulation

J.A. Davies, S.M. Hancock, R.P. Mahajan

Department of Anaesthesia, Queens Medical Centre, Nottingham, United Kingdom

Background and Goals: Various methods estimate zero flow pressure (ZFP) in the cerebral circulation using transcranial Doppler ultrasonography. We evaluated ZFP derived from methods described by Belfort et al[1] (B), Michel et al[2] (M) & Czosnyka et al[3] (C), using a bench-top model.
Materials and Methods: A pulsatile flow model was constructed from artificial vessels and perfusion media. A section of the circulation included a collapsible vessel immersed in a column of water of varying height (0–20 cmH_2O) to simulate intracranial pressure (ICP). The flow profile of the carotid artery was simulated, and flow velocity was changed step-wise over a range of pressures at different levels of simulated ICP. The flow velocities and system pressures were recorded continuously using an 8 MHz Doppler probe and a pressure transducer. The ZFP was predicted at each level of simulated ICP using regression analysis between mean arterial pressure & mean flow velocity values. ZFP was also derived using three methods i.e. B, M & C and the resulting values were compared to the predicted ZFP using Bland-Altman plots.
Results: Mean (s.d.) of simulated ICP (cmH_2O) & ZFP (mmHg) are shown in the table:

ICP level	Predicted ZFP	B method ZFP	M method ZFP	C method ZFP
20	33.8	28.0 (2.0)	27.0 (1.7)	9.0 (5.1)
15	34.8	24.1 (8.9)	22.6 (6.6)	8.6 (5.8)
10	27.7	17.8 (7.3)	14.2 (7.8)	6.6 (7.3)
5	20.0	10.9 (7.1)	5.7 (8.0)	0.7 (4.6)
0	16.2	1.7 (10.3)	−2.6 (9.4)	−2.7 (2.2)

Over the complete range of flow, the differences between predicted ZFP and ZFP derived from B, M & C methods were 10.2 (7.4), 13.3 (7.6) & 22.2 (5.5) respectively ($p < 0.001$). Methods B & M were more sensitive (93% & 100%) than method C (80%) in detecting changes in ZFP.
Conclusions: ZFP as assessed by methods B, M & C is significantly different from predicted ZFP, and methods B & M are more useful in assessing changes.

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A-332

Nitrous oxide and volatile anesthetics act through distinct mechanisms in vivo: Genetic evidence in C. elegans

P. Nagele, L. Metz, C.M. Crowder

[1]Department of Anesthesiology and General Intensive, Washington University, St. Louis, USA, [2]Dept. of Anesthesiology, University of Vienna, Vienna, Austria

Background and Goal of Study: Volatile anesthetics and nitrous oxide (N_2O) both produce anesthesia. However, their molecular mechanisms have been assumed to differ. The evidence for distinct mechanisms is primarily *in vitro* electrophysiological data showing different potencies of the two drugs against putative targets. Here we provide behavioral and genetic evidence in *C. elegans* that the mechanism of action of N_2O is distinct from that of volatile anesthetics and that N_2O likely produces its behavioral effects in *C. elegans* by inhibition of glutamatergic transmission.
Materials and Methods: Adult *C. elegans* animals were transferred to agar pads; the pads were placed into glass chambers containing either a 70:30 N_2O:O_2 mixture or air. After a 30-min incubation in air or in 70% N_2O, various parameters of the animal's locomotion were scored over a seven-minute period.
Results and Discussions: N_2O produced behavioral effects quite distinct from that by volatile anesthetics. Unlike volatile anesthetics, N_2O did not alter the rate of locomotion of wild type animals, but it did markedly change the character of the movement. N_2O reduced the frequency of reversing direction of movement by greater than 3-fold relative to animals in air. This behavioral abnormality is unusual in *C. elegans* and has only been reported in strains with reduced glutamatergic transmission.[1] Nitrous oxide did not worsen the phenotype of the NMDA receptor null mutant *nmr-1(ak4)*, consistent with the hypothesis that N_2O acts by inhibiting these receptors. However, *nmr-1(ak4)* was not resistant to volatile anesthetics. Likewise, the highly volatile anesthetic resistant mutant *unc-64(md130)* had a wild-type response to N_2O.
Conclusion(s): The molecular mechanisms whereby N_2O and volatile anesthetics disrupt behavior in *C. elegans* differ. The behavioral, genetic, and pharmacological data are consistent with N_2O inhibiting NMDA receptors whereas volatile anesthetics act presynaptically to inhibit neurotransmitter release.

Reference:
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The presynaptic SNARE complex is a molecular target for volatile anesthetics

P. Nagele, W.J. Placzek, C.M. Crowder

[1]Department of Anesthesiology and General Intensive, Washington University, St. Louis, USA, [2]Department of Anesthesiology, University of Vienna, Vienna, Austria

Background and Goal of Study: Despite considerable efforts, the molecular mechanism of anesthesia remains unknown. Based on our previous genetic results in *C. elegans*, we hypothesized that a presynaptic SNARE protein or the ternary SNARE complex are molecular targets for volatile anesthetics. Neuronal SNARE proteins (SNAP-25, syntaxin, and VAMP) interact with each other and are essential for synaptic vesicle exocytosis.
Materials and Methods: His_6- tagged recombinant rat SNARE proteins were expressed in BL21(DE3) bacteria and purified by Ni-NTA-agarose chromatography and FPLC. Binding of isoflurane and halothane to SNARE proteins and complex was measured at different concentrations by ^{19}F-NMR. Protein bound anesthetics have a significantly lower T2 time compared to buffer.
Results and Discussions: Binding characteristics of volatile anesthetics to the tested SNARE proteins and the complex were markedly different. The ternary SNARE complex and syntaxin bound isoflurane and halothane in a saturable, dose-dependent manner at clinical concentrations, as did SNAP-25 multimers. Monomeric SNAP-25 and VAMP do not bind volatile anesthetics.

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Addition of isoflurane markedly increased the T2 time of halothane and vice versa (+40%), indicating competition between the two anesthetics.

Conclusion(s) Our results show that volatile anesthetics bind to two presynaptic SNARE proteins (syntaxin and SNAP-25 multimers) and the SNARE complex. These proteins share the common structural feature of a 4-α-helical bundle, which has been shown to bind volatile anesthetics with high affinity. Based on our genetic and biochemical results, SNARE proteins and ternary SNARE complex are plausible presynaptic targets for volatile anesthetic action.

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Effect of inducible nitric oxide synthase inhibitor on apoptosis of hypoxic-ischemic injury in the neonatal rat brain : 1H magnetic resonance spectroscopic study

M. Gwak, E.H. Suk, H.S. Hwang, P.H. Park

Department of Anesthesiology, University of Ulsan, Asan Medical Center, College of Medicine, Seoul, Republic of Korea

Background and Goals: Inducible nitric oxide synthase (iNOS) is expressed at late stage of ischemia and may play an important role in the delayed progression of ischemic brain injury. This study was conducted to investigate the effect of N-[3-(aminomethyl) benzyl]acetamidine (1400 W), a potent and selective inhibitor of iNOS on hypoxic-ischemic injury in the neonatal rat brain.

Materials and Methods: Seven-day old Sprague-Dawley rat pups were used. The right common carotid artery was ligated under halothane anesthesia. After 3 hours of recovery, they were exposed to 8% oxygen at 37°C. The animals were divided into 2 groups: 18 hours after the injury, the treatment group (n = 14) received 7 intraperitoneal injections of 20 mg/kg of 1400 W at 8 hour interval. The control group (n = 13) were given vehicle. The right cerebral hemispheres of the rats were examined with a localized ^{1}H-MR spectroscopy and terminal deoxynucleotidyltransferase-mediated dUTP-biotin nick end-labeling(TUNEL) stain 3 days after the injury. Lipid/N-acetyl aspartate (Lip/NAA) and Lipid/Creatine (Lip/Cr) ratios were used as apoptotic markers. Data were analyzed by unpaired t-test.

Results: There were no significant differences in Lip/NAA, Lip/Cr ratios on ^{1}H-MR spectroscopy and the number of TUNEL positive cells between 2 groups.

Conclusions: The iNOS inhibitor did not have protective effects against the delayed neuronal damage and apoptosis after the hypoxic-ischemic injury in newborn rats.

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A-335

Thiobarbituric acid reactive substances assay in an inflammatory rat model

C. Leduc, M.E. Gentili, J.P. Estèbe, J.P. Moulinoux, C. Ecoffey

Departement of Anesthesia II and Laboratory of Cellular Biology, University Hospital Pontchaillou, Rennes, France

Background and Goal of Study: Thiobarbituric Acid Reactive Substances (TBARS) were assessed (1) in tissues and organs (brain, heart, liver and kidney) to appreciate the oxidative stress in an inflammatory rat model.

Materials and Methods: In 45 Sprague-Dawley males (250–300 g) including a control (n = 10) and a saline placebo groups (n = 5) and six other groups (n = 5 in each one) with 0.2 ml injection of carrageenan in the right hind paw: edema was measured with a thread. Organs and blood samples were collected at 0 h, 3 h, 6 h, 9 h, 12 h and 24 h thereafter. Results are expressed in mean ± SD; statistics used non-parametric Mann and Whitney U test. ($P < 0.05$).

Results and Discussions: Edema increased at 6 h and 24 h ($P < 0.01$ and $P < 0.05$, respectively). Plasmatic TBARS arise at 6 h ($P < 0.01$) and at 24 h ($P < 0.05$). In organs (i.e. organs brain, heart, and liver), the TBARS values were not different of the control group except in kidney were TBARS values significantly decrease at 6 and 24 h ($P < 0.01$).

Conclusion(s): In carrageenan-induced inflammation, plasmatic TBARS reflects the oxydative stress. The lower TBARS in kidney need further studies.

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A-336

The effect of midazolam on neurological outcome following transient forebrain ischaemia in rats; association with serum concentration of S100β and nitric oxide

K. Ghori, S. Szarvas, E. Johns, F. Walsh, P. Seinge, G. Shorten

Department of Anaesthesia and Intensive Care Medicine, Department of Physiology, Cork University Hospital, University College, Cork, Ireland

Background and Goal of Study: Benzodiazepines have some protective effect against brain ischaemia. Plasma S100β and nitric oxide (NO) have been shown to be the most promising biochemical markers of cerebral injury. The objective of this study was to examine the neuroprotective effect of midazolam following cerebral ischaemic injury and to establish the association between the plasma NO and S100β with outcome following transient forebrain ischaemia in rats.

Materials and Methods: Thirty Wistar rats were studied. They were divided into group A (halothane) group B (midazolam + halothane) and group C (Control halothane only but no ischaemic insult). Bilateral carotid arteries were clamped temporarily to produce a forebrain ischaemia for four minutes. Blood samples for S100β and NO were taken at 10 min, 2 h, and 24 h after the ischaemia. Neurological examination was performed to assess the neurological behavior of rats 1 h and 24 h following the ischaemia. All data are presented as mean ± standard deviation. The data was analysed by one-way analysis of variance.

Results and Discussions: There was no difference in the three groups in S100β and NO concentration at 10 min after ischemia. The S100β concentration was increased in the halothane group (1.06 μg/L ± 0.73) after 2 hours of ischaemia when compared to the midazolam group (0.45 μg/L ± 0.27) p = 0.015. The concentration of NO increased only in the halothane group (25.98 mM ± 5.53) at two hour when compared with the control group (12.3 mM ± 3.85) p = 0.003. The neurological deficit at one hour was greater in the halothane group when compared to the midazolam group while there was no difference at 24 hours.

Conclusion(s): There was less neurological deficit and early reduction in biochemical markers of severity of brain injury after transient forebrain ischaemia in rats treated with midazolam.

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A-337

Effects of propofol and erythropoietin on oxidative stress in closed-head injury in rats

E. Ozturk, S. Demirbilek, A. Koroglu, A. But, Z. Ozpolat, M. Gulec, O. Akyol, M.O. Ersoy

Departments of Anaesthesiology and Biochemistry, Inonu University School of Medicine, Malatya, Turkey

Background and Goal of Study: It has been suggested that reactive oxygen species play a role in the pathophysiology of brain damage, and that their neutralization by endogenous or exogenous antioxidants has a protective effect (1). In this study we aimed to investigate the effects of propofol and erythropoietin (EPO) on antioxidant enzyme (superoxide dismutase (SOD), catalase (CAT)) activities, oxidative enzyme (xanthine oxidase (XO)) activity, nitric oxide (NO), and last product of membrane lipid peroxidation (malondialdehyde (MDA)) after closed head injury (CHI) in rats.

Materials and Methods: After approval of animal ethics committee, rats were divided into five groups, as follows: sham-operated group, which underwent all procedures except CHI; control group, in which produced CHI; propofol group, in which produced CHI and given propofol 100 mg/kg intraperitoneally (i.p.); EPO group, in which produced CHI and given EPO 5000 U/kg i.p.; combined group, in which produced CHI and given propofol (100 mg/kg) + EPO (5000 U/kg) i.p. Twenty-four hours after CHI, rats were anaesthetized and the brains were removed.

Results and Discussions: There were no significant differences in SOD and CAT tissue activity in all groups. MDA and NO levels were decreased significantly in EPO, propofol and combined groups than control group ($p < 0.01$). XO activity was significantly lower in EPO group than control group ($p = 0.026$) and significantly higher in propofol group than sham-operated group ($p = 0.034$).

Conclusion(s): After CHI, EPO and propofol have antioxidant properties for brain tissue. However, combination of EPO and propofol has no significant beneficial advantage than EPO or propofol alone.

Reference:

1 Shohami E, Beit-Yannai E, Horowitz M, Kohen R. *J Cereb Blood Flow Metabol* 1997; 17(10):1007–1019.

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A-338

The influence of midazolam on cerebral blood vessels state during induced arterial hypertension (IAH)

G. Michalska-Krzanowska, M. Leszczynska, R. Sajdak

Departament of Anaesthesiology, Clinical State Hospital No 2, Szczecin, Poland

Background and Goal of the Study: For many years benzodiazepine has been used for "brain protection" in case of the brain ischemia and for the treatment of the convulsions. The aim of the study was to explain the influence of midazolam on cerebral blood vessels state during IAH and to determine the influence of midazolam, that increases excitability of the hindbrain.
Materials and Methods: Having an approval of the Institutional Animal Use Committee, adult rabbits of both sexes were assigned to one of two control groups (without IAH, without IAH + Midazolam M) and to one of two investigated groups (with IAH, with IAH + M). AH was induced with Metaraminol. Horseradish peroxidese was used as a permeability marker. After brain perfusion with Karnowski' fluid, segments of cerebral and cerebellar cortex were sampled for analysis in LM and EM. Statistical analysis included Shapiro & Wilk test and U-Mann–Whitney test.
Results: 20 minutes after Metaraminol stimulation the following clinical changes in both investigated groups were noticed: 1. statistically significant increases diastolic, systolic and mean atrterial pressure. 2. statistically significant increases permeability coefficient of gentamycin 54,14 ± 4,13 versus 17,55 ± 3,6 in control groups. 3. Evaluated arterial pressure was associated with increase of ICP and CPP. In samples of cerebral and cerebellar cortex of the investigated animals groups the following changes were founded: stroke foci, perivascular oedematous changes and BBB injury – presense of horseradish peroxidase grains outside the lumen of blood vessels. Changes in cerebellar cortex were more intense.
Conclusions: During IAH Midazolam increases the pathological changes in the brain.

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Effect of sciatic nerve block upon local histamine release in an inflammatory animal model

M.E. Gentili, C. Leduc, J.P. Estèbe, R. Havouis, J.P. Moulinoux, C. Ecoffey

Department of Anaesthesiology II, Laboratory of cellular biology, Hôpital Universitaire Pontchaillou, Rennes, France

Background and Goal of Study: In a carrageenan rat model, sciatic nerve block was able to reduce inflammatory edema (1), we studied the effect of local block upon the local histamine release in the same model.
Materials and Methods: Four groups of 10 Sprague-Dawley males (250–300 g) recived 0.2 ml injection of 1% carrageenan in the right hind paw under 2–3% halothane; in 3 groups, a sciatic nerve block was performed with respectively 2 ml of saline, 0.5% bupivacaine and 2% lidocaine and none in the fourth group. The animals were killed 6 h later and histamine levels were determined by HPLC in plasma and in exsudate from inflamed paw. Results are expressed as nanomoles of histamine/l of exsudate. Statistical analysis used Mann and Whitney *U* test ($P < 0.05$).
Results and Discussions: No statistical difference was shown between control, saline , lidocaine and bupivacaine groups with respectively: 1298 ± 969; 779 ± 274; 715 ± 190; 998 ± 471 nmoles (NS)
Conclusion(s): Sciatic nerve block with lidocaine or bupivacaine does not inhibit the local release of the histamine in inflamed hind paw.
Reference:
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A-340

5-HT_4-R agonist BIMU-8 augments respiratory drive in juvenile rats and does not interfere with fentanyl-induced depression of nociceptive C-fibre reflex

U. Guenther, T. Manzke, E. Ponimaskin, M. Haller, D.W. Richter, D. Kettler

Department of Zentrum Anaesthesiologie, Georg-August-Universität, Rettungs- und Intensivmedizin, Zentrum Physiologie und Pathophysiologie, Goettingen, Germany

Background and Goal of Study: Expression of 5-$HT_{4(a)}$ receptors in the pre-Boetzinger complex (PBC), a brainstem area which plays a major role in respiratory rhythm generation, was proven by using a polyclonal antibody. This was confirmed by single-cell RT-PCR and immunostaining of biocytin-labeled respiratory neurons identified in the rhythmic slice preparation of postnatal rats (P5–P8). The present study has been carried out to clarify the physiological relevance and clinical options of these findings.
Materials and Methods: In accordance with local animal protection laws, the 5-HT_4-R selective agonist BIMU-8 and fentanyl were applied to a perfused brainstem-spinal cord preparation of juvenile rats (P21–28). This model generates a spontaneous respiratory rhythm (PN_{min}) and allows for simultaneous studies of a nociceptive C-fibre reflex (CFR).
Results and Discussions: In a first series of experiments, cumulatively applied BIMU8 strongly accelerated respiratory activity (n = 8, 1 μM BIMU8 + 59.9 ± 19.7%,; 3 μM + 67.4 ± 19.5%; 10 μM + 64.9 ± 19.53%; all $p < 0.05$, t-test). At the same time, BIMU8 depressed CFR dose-dependently (1 μM − 23 ± 6.7%; 3 μM − 20.6 ± 8.5%; 10 μM − 23.26 ± 7.0%; all $p < 0.05$).

In the second series, fentanyl was applied stepwise until respiratory depression became obvious. Fentanyl (5 to 20 nM) suppressed PM_{min} to −91.2% ± 4.2% (n = 8; $p < 0.01$) and CFR to − 60.9 ± 6.5% ($p < 0.01$). Subsequent application of BIMU8 almost completely restored PN_{min} (1 μM BIMU8 − 44.5 ± 20.8% of pretreatment level; 3 μM − 26.2 ± 16.2%; 10μM − 14.6μM, all changes from fentanyl level $p < 0.05$), whilst CFR remained depressed (1 μM BIMU8 − 54.3 ± 9.4%; 3 μM − 51.8 ± 9.2%; 10 μM − 65.6 ± 7.2%).
Conclusions: It is obvious that expression of 5-$HT_{4(a)}$-R in mammalian respiratory network does offer pharmacological options for protecting respiration. Moreover, BIMU-8 is capable of restoring spontaneous respiratory activity even in a fentanyl-induced respiratory depression without interference with antinociception in rat.
References:
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Acknowledgement: BIMU-8 was a gift from Boehringer Ingelheim, Germany.

A-341

Effects of vasopressin and nitroglycerine on brain tissue oxygenation with and without pre-treatment with L-NAME during spontaneous circulation

E. Cavus, H. Wagner-Berger, K.H. Stadlbauer, M. Steinfath, V. Dörges

Department of Anaesthesiology and Intensive Care Medicine, University Hospital Kiel, Kiel, Germany

Background and Goal of Study: Brain tissue oxygen pressure correlates with cerebral blood flow during spontaneous circulation (1); one important regulator to ensure adequate cerebral oxygenation may be nitric oxide (NO) (2). Although it is established that vasopressin improves cerebral blood flow during cardiopulmonary resuscitation (3), it is unknown whether similar beneficial effects are present during spontaneous circulation. The purpose of this study was to investigate the effects of vasopressin with and without pre-treatment with N-omega-nitro-L-arginine methyl ester (L-NAME) on brain tissue oxygen pressure ($PbtO_2$) in a beating heart model.
Materials and Methods: Following approval of the Animal Investigational Committee, nine healthy piglets (12 to 16 weeks, 38 to 42 kg) underwent general anaesthesia. After preparing a small burr hole, a probe was inserted into the cerebral cortex to measure parenchymal brain oxygen pressure adjusted to brain temperature, and intracranial pressure. Fraction of inspired oxygen (35%), body temperature (38 to 39°C), and normocapnia ($P_{et}CO_2$ 35 to 40 mm Hg) were carefully controlled. Each animal was assigned to receive either vasopressin (0.4 U/kg) alone, or after a wash-out period, L-NAME (25 mg/kg over 20 min) followed by vasopressin (0.4 U/kg). After 30 min of each vasopressin administration, Nitronal® (nitroglycerine, 25 μg/kg over 1 min) was given.
Results and Discussions. Three minutes after vasopressin, $PbtO_2$ was significantly ($P < .05$) higher compared to baseline. After pretreatment with L-NAME, vasopressin resulted in a significant ($P < .05$) decrease of $PbtO_2$ compared to baseline; in both groups, $PbtO_2$ was significantly ($P < .05$) higher 5 min after administration of Nitronal®. No significant changes were observed in regards of intracranial pressure.
Conclusion(s): Vasopressin improved oxygenation of brain tissue, but not after inhibition of NO synthesis with L-NAME in this beating heart porcine model. In contrast, L-NAME had no effect on administration of NO-Donor Nitronal®.
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1 Doppenberg EMR, Zauner A, Bullock R, et al. *Surg Neurol.* 1998;49:650–4.
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Evaluation of optimal remifentanil infusion rate for intracranial surgery with desflurane anaesthesia

G. Tsaousi, J. Ipsilantis, N. Tasianas, M. Peftoulidou, D. Vasilakos, M. Giala

Department of Anaesthesiology-ICU, AHEPA University Hospital, Thessaloniki, Greece

Background and Goal of the Study: Brain surgery ne-cessitates stable and easily controllable haemodynamics, during intense surgical stimulation. Remifentanil (R), a rapidly metabolized opioid analgesic, seems to be ideal to confer the above charasteristics. Aim of the present study was to identify the optimal R infusion rate to maintain appropriate haemodynamic performance in a "balanced" anesthetic technique for intracranial procedures.

Materials and Methods: We studied prospectively 54 adult patients (29 male/25 female, ASA I-II) scheduled for supratentorial craniotomy. After a standardized induction sequence consisting of propofol 2 mg/kg, lidocaine 1 mg/kg, cis-atracurium 0.2 mg/kg and remifentanil 0.5 μg/kg/min, anaesthesia was maintained with desflurane (0.6–0.8 MAC) in an air/oxygen mixture. BIS value < 50 was used to assess depth of anesthesia and to guide desflurane requirements accordingly. Patients were allocated randomly to three groups of 18 each according to the R consant-dose infusion: 0.0625 μg/kg/min (Group A), 0.125 μg/kg/min (Group B) or 0.25 μg/kg/min (Group C). When the MAP or heart rate (HR) increased >20% from basal values, 1 μg/kg bolus dose of R was administered. However, if the MAP or HR decreased >20% from basal values, the R infusion was transiently discontinued. Total use of R was also recorded. For statistical purposes ANOVA and Fisher's exact test were used as appropriate.

Results: Demographic characteristics, type of surgery and its duration and total dosages of R, were comparable in all three groups. Data is given on the table.

Parameters	A	B	C	p-value
High BP (min)*	6.6 ± 3.4	4 ± 2.6	0	=0.02
Low BP (min)*	0	5.2 ± 4.1	41 ± 16	<0.001
High HR (min)*	3.1 ± 1.7	1 ± 0.7	0	<0.05
Low HR (min)*	0	2.4 ± 0.8	33 ± 18	=0.006
Bolus doses	75%	50%	0	=0.005
Discontinuation	12.5%	25%	100%	<0.001

*mean ± SD

Conclusion: Our results indicate that, an initial remifentanil infusion rate of 0.125 μg/kg/min, followed by the appropriate titration, can be considered as optional to maintain "targeted" haemodynamic performance during intracranial surgery with desflurane anesthesia.

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Remifentanil based anaesthesia with propofol versus sevoflurane in patients undergoing craniotomy for supratentorial space occupying lesions

J. Markovic, B. Visocnik, I. Potocnik, A. Spindler-Vesel, J. Sustersic

Clinical Department of Anaesthesiology and Intensive, University Medical Centre, Ljubljana, Slovenia

Background and Goal of Study: Complete awakening and orientation are highly desirable immediately after elective craniotomy (1). Remifentanil may be useful in neuroanesthesia allowing more predictable emergence and recovery (1). We compared recovery profiles, hemodynamics, and postoperative need for antiemetics, antihypertensive drugs or analgesics of remifentanil based anaesthesia with propofol and sevoflurane in small hypnotic concentrations.

Materials and Methods: 40 patients (18–75 years, ASA I, II or III) undergoing craniotomy for supratentorial space-occupying lesion were randomised to receive a remifentanil loading dose of 0,5–1 μg/kg followed by a continuous infusion regarding to anaesthesia response (from 0,1 μg/kg/min) in combination with sevoflurane (group S, n = 20; vol. % 0,8–1,2) or propofol (group P, n = 20; 0,05–0,1 mg/kg/min). At the time of dura closer metamizol 2,5 g and piritramid 5–10 mg were administered. Hemodynamic parameters were monitored continuously. At the end of the surgery and in the postanesthesia care unit (PACU) arterial blood pressure and need for additional antihypertensive drugs, antiemetics or analgesics were recorded. The modified Aldrete score was recorded 5 (AS5) and 30 minutes (AS30) after extubation. We used Students t-test and χ^2 test (means ± SD or number of pts; $p < 0,05$).

Results and Discussions: Demographic data and the duration of the surgery didn't differ. In S group there were lower mean arterial pressure during surgery (62,83 *vs.* 71,58, p = 0,001), greater blood loss (432,5 *vs.* 280, p = 0,049) and more colloids used (145 *vs.* 10, p = 0,013). Total doses of anaesthetic drugs didn't differ. In P group time to extubation was faster (5,55 *vs.* 11,9, p = 0,005) and the AS5 was 9,7 *vs.* 7,95 (p = 0,0001). No differences between the need for additional analgesia and antiemetics were found.

Conclusion(s): Recovery after remifentanil anaesthesia is more rapid with propofol than sevoflurane in craniotomy for supratentorial space-occupying lesion. This is of greater benefit for early neurological evaluation and facilitating fast – tracking.

Reference:

1 Warner DS. Experience with remifentanil in neurosurgical patients. Anest Analg 1999; 89: S33–S39.

A-344

Does the loss of proprioception (P) generate the phantom limb sensation (PLS) phenomenon?

M.E. Gentili*, X. Paqueron, M. Le Guen, P. Coriat

*Department of Anaesthesiology, CH Saint Grégoire, CHU Pitié-Salpétrière Paris and *CMC Saint Vincent, Saint Grégoire, France*

Background and Goal of Study: The phenomenon of PLS is often reported by patients under regional anaesthesia (RA) and is classically related to the loss of proprioception (P).(1,2) This study assessed the relation between loss of proprioception and PLS.

Materials and Methods: After local ethic comity approval and written consent, 40 patients received an infraclavicular block with ropivacaine 0.75%, 40 ml. After the block (B) had been performed, sensations for warmth, pain, coldness, and proprioception were assessed every 5 min for 60 min, and scored P2 if normal, P1 if diminished, and P0 if abolished. The onset of PLS was also measured. Results are means and its CI 95%, and were compared using a Student t-test. $P < 0.05$ was considered significant.

Results: 38 of 40 patients developed a PLS (95%). Mean times to PLS, P1 and P0 were 22 min (18–25), 24 min (19–29) and 37 min (31–43) ($p < 0,05$ vs PLS) respectively. Then, P was unaltered (P2) in 47% of patients in whom PLS developed, and suppressed (P0) in 6%. Number of patients with normal and altered P (P1 + P0) was similar.

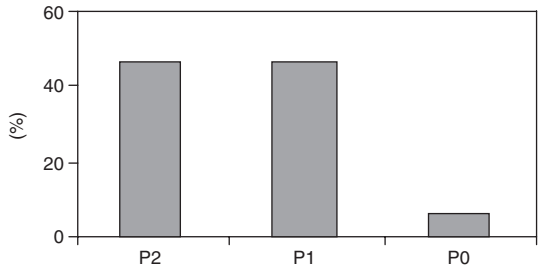

Figure: Status of proprioception at the onset of PLS

Discussion: This study showed that the loss of P cannot explain the occurrence of the PLS. Other causes have to be considered.

References:

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A-345

Upper cervical vertebrae movement during intubation laryngeal mask, fiberoptic and direct laryngoscopy: a video-fluoroscopic study

A. Sahin, M.A. Salman, A. Erden, U. Aypar

Department of Anesthesiology, Hacettepe University, Ankara, Turkey

Background and Goal of Study: The technique of endotracheal intubation in patients with cervical pathologies is controversial. In this study we aimed to compare the excursion of upper cervical vertebrae during endotracheal intubation using three different techniques.

Materials and Methods: After ethics committee approval 33 consecutive patients undergoing lumbar laminectomy were enrolled in the study. Patients were intubated under general anesthesia and neuromuscular blockade and were randomly allocated into three groups to be intubated using direct laryngoscopy (DL), intubating laryngeal mask (ILMA) and fiberoptic bronchoscope (FOB). Mallampati scores, hyomental distance, Cormack Lahen scores and duration of intubation were noted. A senior anesthesiologist performed all intubations. The procedure was recorded by video-fluoroscopy and analyzed by computer-assisted measurements. The variation of C_{1-2} and C_{2-3} excursions during intubation was obtained. One-way ANOVA with Bonferroni correction and Kruskal Wallis tests were used for statistical analysis.

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Results and Discussions: The demographical data showed no significant difference among the groups.

	DL	ILMA	FOB
Baseline C_{1-2} (°)	71.2 ± 7.6	71.7 ± 8.9	69.5 ± 12.8
Intubation C_{1-2} (°)	61.0 ± 6.3	66.7 ± 7.7	67.9 ± 14.3
Baseline C_{2-3} (°)	104.9 ± 7.6	103.0 ± 8.8	100.8 ± 14.9
Intubation C_{2-3} (°)	105.0 ± 13.6	100.7 ± 9.5	99.7 ± 14.7
Intubation duration (sec)	17 (12–25)	85 (50–130)	25 (12–130)

Angles: Mean ± SD, Intubation duration: Median (range).

The comparison of change in C_{1-2} angle was statistically significant ($p = 0.011$), while C_{2-3} angle showed no difference ($p = 0.701$). Post hoc analyses revealed that the difference was between DL and FOB groups ($p = 0.010$). Duration of intubation was significantly longer in ILMA group ($p < 0.001$).

Conclusion: FOB should be considered as the first line intubation technique in patients with higher cervical pathology since atlanto-axial movement is reduced with this technique. ILMA's advantage over DL could not be demonstrated.

Reference:

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A-346

Oral quazepam the night before general anesthesia deteriorates perioperative hypothermia

A. Shido, J. Ota, T. Nomura, S. Sakura, Y. Saito

Department of Anesthesiology, Shimane Medical University, Izumo, Japan

Background and Goal of Study: Preanesthetic body heat distribution state is largely related to the intraoperative hypothermia (1) and is affected by premedications such as midazolam (2) and droperidol (3). But it has not been reported how quazepam, the long acting benzodiazepine often used as hypnotic, influences perioperative body temperatures.

Materials and Methods: Thirteen ASA physical status I or II patients scheduled for head and neck surgery in the morning were randomly assigned to two groups to receive no hypnotics (4 males/1 female, age 39 ± 24 yrs) or oral quazepam 30 mg the night before surgery (5 males/3 females, age 45 ± 17 yrs). Core (tympanic membrane, Tt) and peripheral (fingertip skin, Tf) temperatures were monitored during general anesthesia (propofol and fentanyl) for 90 min.

Results: Compared to the patients without hypnotics, those with quazepam developed more centralized body heat distribution with lower core temperature before anesthesia. Temperatures (°C, mean ± SD) before (pre-) and during (dur-) anesthesia are shown in the table:

group	pre-Tt	pre-Tf	pre-(Tt-Tf) gradient	dur-Tt (minimum)
no hypnotics	36.6 ± 0.4	33.2 ± 1.3	3.4 ± 1.2	36.0 ± 0.2
quazepam	36.0 ± 0.2 #	27.6 ± 4.0 #	8.5 ± 4.0 #	35.5 ± 0.3#

(# $P < 0.05$ vs no hypnotics group, unpaired t-test)

Conclusion: Quazepam decreased preanesthetic body heat content, resulting in deteriorating intraoperative hypothermia.

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A-347

Comparison of the effects of total intravenous anesthesia (TIVA) and desflurane anesthesia on haemodynamics and recovery in cases of supratentorial craniotomy

E. Dincer, G. Turan, A. Ozgultekin, B. Ozsoy, N. Akgun

Department of Anaesthesiology and Intensive Care, Haydarpasa Numune Teaching and Research Hospital, Istanbul, Turkey

Background and Goal of Study: In our study, TIVA and desflurane anesthesia were compared in cases of supratenteorial craniotomy.

Materials and Methods: 30 patients (aged;15–70) in ASA Group I–II, who were being planned for the intracranial surgery, were randomly selected and classified into two groups. Intramuscular atropin (0,5 mg) and diazepam (10 mg) were given for premedication. Remifentanil (1 μg/kg), propofol (1,5–2 mg/kg) and cisatracurium (1,5–2 mg/kg) were used in both groups for induction. For the maintanence of anesthesia, Group I; had desflurane 3–5% in 50% O_2/N_2O and Group II had propofol (75–150 μg/kg/min) and remifentanil (0,25 μg/kg/min) infusions in 50% O_2/N_2O. SBP, DBP, HR, SPO_2, $ETCO_2$ values were maintained. Time to spontaneous eye opening, extubation and appropriate response to verbal orders as well as Aldrete recovery scores and side effects were recorded. Statistical analysis were done Tukey-Kramer, Student-t, Chi-Square test.

Results and Discussion: There were no statistical differences between the two groups in terms of SBP, DBP and MBP. HR was significantly higher in the desulfrane group after surgical incision, during maintanence and extubation ($p < 0{,}001$, $p < 0{,}001$, $p < 0{,}05$). Time to extubation; GI : 3.13 ± 1.30 min, GII: 10.33 ± 4.54 min ($p < 0{,}001$). Aldrete recovery scores were significantly higher in desflurane group on the 5th and 10th minutes after extubation ($p < 0{,}001$, $p < 0{,}001$). Time to verbal orders, spontaneous eye opening and side effects were similar and Aldrete recovery scores were complete in both groups on 20th minute. Desflurane increasing cerebral blood flow over 1,5 MAC and it should not be given over 1,5 MAC and opioid combination should be used when necessary.

Conclusion: Desflurane can be prefered for its shorter recovery when compared TIVA.

Reference:

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A-348

Phantom limb sensation (PLS) and regional anaesthesia: loss of proprioception or illusion ?

M. Le Guen, X. Paqueron, M.E. Gentili*, P. Coriat

*Department of Anaesthesiology, CHU Pitié-Salpêtrière, Paris, and *CMC Saint Vincent, Saint Grégoire, Paris cedex 13, France*

Background and Goal of Study: the PLS is described as an incorrect spatial perception (P) of a blocked limb (1) and is presumably generated by the loss of proprioception (2). Further, this phenomenon frequently involves both the anaesthetised limb and adjacent non-anaesthetised areas. This study aimed to assess, both the role of P and of asomatognosia in the genesis of PLS under regional anaesthesia.

Materials and Methods: After local ethic comity approval and written consent, 40 patients received an infraclavicular block (ICB) with ropivacaine 0.75%, 40 ml. After the block had been performed, the arm was set along the body (Position A) or at 90° abduction (Position B), hidden from patient's sight, and P was assessed every 5 min for 60 min. After the PLS had occurred, patients were asked to describe precisely their limb perception, before and 5 min after inversion of the postion of their limb (Position A becoming Position B and *vice versa*).

Results: A PLS occurred in 95% of patients

Mean ± SED or %	PA	PB
Onset of PLS (min)	20 ± 15	18 ± 10
Decrease of P = P1 (min)	19 ± 6	24 ± 10
Loss of P = P0 (min)	41 ± 15	45 ± 19
Lack of perception of mobilization	100 %	95 %

Discussion: Although the axillary nerve is not anaesthetised during ICB, the mobilisation of the anaesthetized limb is not perceived when PLS is present. As the loss of P cannot explain the extension of PLS beyond the anaesthetised area, an illusion probably takes part in the genesis of this phenomenon. Then, PLS results from both, an altered perception of body image induced by the disruption of sensory fibres function, and of an asomatognosia expressed by this illusion.

References:

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A-349

The effect of propofol anaesthesia on auditory event-related potentials mismatch negativity, early right anterior negativity and P1

W. Heinke, R. Kenntner, T.C. Gunter, D. Sammler, D. Olthoff, S. Koelsch

Department of Anaesthesiology and Intensive Care Therapy, University of Leipzig, Leipzig, Germany

Background: Studies related to the effect of anaesthesia on late components of the auditory event-related potential (AERP) are sparse (1,2). We investigated the effect of propofol anaesthesia on the auditory event related potentials mismatch negativity (MMN), early right anterior negativity (ERAN) and P1.

Materials and Methods: An auditory oddball paradigm was used to elicit the MMN and the ERAN. AERP`s were recorded in surgical patients (n = 18) during four levels of anaesthesia, adjusted with target controlled infusion

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of propofol: awake state (target concentration of propofol: 0.0 μg/ml), light sedation (0.5 μg/ml), deep sedation (1.5 μg/ml) and unconsciousness (2.5–3.5 μg/ml). The depth of anaesthesia was assessed using the bispectral index (BIS).

Results and Discussions: Propofol sedation resulted in a progressively decrease in amplitudes and an increase of latencies with a similar pattern for MMN and ERAN. Both components were still detectable during light (BIS mean 87.6 ± 7.45) as well as deep sedation (BIS mean 72.1 ± 7.11), but were abolished during unconsciousness (BIS mean 50.4 ± 6.74). When compared irregularity detection (as reflected in the MMN and ERAN) with sensory encoding (as reflected in the P1) of the acoustic input we found that, in contrast to the MMN and the ERAN, the amplitude of the P1 was unchanged by sedative doses of propofol, but markedly decreased during drug induced unconsciousness.

Conclusion: Our results indicate an ongoing auditory irregularity detection up to BIS values around 70, and suggest a greater sensitivity of auditory irregularity detection to propofol compared to auditory sensory encoding.

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A-350

Midazolam effects on the retention of learned fear

L. Pain, M.E. Bouton, P. Oberling

Department of Faculté de Médecine, Department of Psychology, UVM, Burlington, USA, GRERCA, U405 Inserm, Institut de Physiology, IFR Neurosciences, Strasbourg, France

Background and Goal of Study: Midazolam(MZ) as sedative or premedicant sought to alleviate anxiety and to prevent memory for frightening experiences in patients. Recent data suggested that midazolam did not suppress the acquisition of fear, but rather blocked the retrieval of memory for fear (1). We were therefore interested in understanding how emotional memories that might be acquired under the influence of low dose of MZ, can recover inside the drug state.

Materials and Methods: We used a rodent model of classical fear conditioning in which a signal (tone) was paired with a brief and mild footshock (0.5 s, 0.6 mA) in a distinctive context (skinner box). Once the rat has learned to associate the signal and the shock in the context and remember this fearful event, it exhibits a fear response (freezing) to the context and/or the signal that can be measured. The experimental procedure consisted in three phases : *acquisition,* **[A]** (4 tone-shocks during 30 minutes in the context), *exposure* **[E]** to the context (no tone, no shocks) to extinguish the fear to the context (1 hour daily, two days), *testing* **[T]**. Three series of experiments were performed 1/ A, E and T, all under saline *versus* A under MZ, E and T under saline 2/ A under MZ, E and T under saline *versus* A and T under MZ, E under saline, 3/ A and T under MZ, exposure under saline *versus* A, E and T under MZ. Rats were given MZ 1 mg kg^{-1} or the same amount of saline. All animals received the same number of MZ and saline injections. Two way analyses of variance were performed on freezing to the context and to the tone.

Results and Discussions: 1/ MZ given for acquisition suppressed the expression of memory for the fearful event ("amnesic" effect) 2/ When rats were given MZ during both acquisition and testing, they exhibit a renewal of fear to the context previously associated with the fearful event 3/ MZ given during exposure reversed the renewal of fear exhibited by rats when given MZ during both acquisition and testing, indicative of its cueing effect for context.

Conclusion(s): Among its many effects, midazolam provide contextual cues that can facilitate renewal of fear to a context in which occurred previously a fearful event.

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A-351

Postoperative skull block with bupivacaine decreases pain following craniotomy

L.F. Falcón, J. Hernández-Palazón, P. Doménech, V. Nuño de la Rosa, B. Segura, F. Manresa

Department of Anaesthesia, "Virgen de la Arrixaca" University Hospital, El Palmar, Spain

Background and Goal of Study: We studied whether skull block with bupivacaine reduces postoperative pain following craniotomy.

Materials and Methods: After scheduled craniotomy, under standardised anaesthesia, 24 Adult patients were randomly assigned to receive skull block, with either bupivacaine (0.25%) and epinephrine (1:200.000) or saline/epinephrine (1:200.000), in a double-blind fashion. The block was performed at skin closure before awaking. Skull block involves regional anaesthesia to the greater and lesser occipital, supraorbital, supratrochlear, zygomaticotemporal, greater auricular, and auriculotemporal nerves. Postoperative pain was assessed at 2, 4, 8, 12, 16 and 24 hours using a Visual Analog Scale (VAS), verbal rating scores (VRS) and Total Pain Relief (TOTPAR). Intravenous morphine (2 mg in bolus) was given when required. Postoperative nausea, and vomiting were recorded.

Results and Discussions: Patients age, weight and gender were similar in both groups. The total dose of morphine at 24 h was smaller in the bupivacaine Group (3.7 ± 1.7 *vs* 17.4 ± 2.9 mg; $P < 0.001$).

The time elapsed before the requirement of the first dose of morphine, was longer in the bupivacaine group. (777 *vs* 82 min, $P < 0.001$). Pain scores were significantly lower in the bupivacaine Group. Higher TOTPAR scores were recorded in patients in the bupivacaine than in the saline Group. The incidences of nausea/vomiting was significantly lower in patients receiving bupivacaine ($P = 0.002$).

Conclusion(s): Postoperative skull block with bupivacaine 0.25% was associated with a satisfactory analgesia, lower morphine consumption, and lower incidence of nausea/vomiting.

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Auditory evoked responses and unconscious memories during inhalational and intravenous anaesthesia

P. Aceto, A. Clemente, A. Valente, E. Adducci, G. De Cosmo

Department of Anesthesiology e Rianimazione and Intensive Care, Catholic University of Sacred Heart, Roma, Italy

Background and Goal of Study: It has been suggested that patients may be able to pick up some auditory information during surgical anaesthesia and to retain them in form of unconscious memories (1). The aim of this study was to detect these memories after inhalational or total intravenous anaesthesia (TIVA) by using implicit memory test and to evaluate the efficacy of the Mid-Latency Auditory Evoked Responses (MLAERs) to predict intraoperative unconscious memories.

Materials and Methods: We studied 32 patients, ASA I–II, undergoing elective surgical procedures. Patients were randomly assigned to 3 groups. In groups A and B anaesthesia was induced with TPS 5 mg/kg and fentanyl 2 mcg/kg; for maintenance was used respectively isoflurane 1MAC + air in O_2(40%) or sevoflurane 1MAC + N_2O (60%). Group C received induction with propofol 2 mg/Kg + remifentanil (0.4 mcg/kg/min) and maintenance with the same drugs at the doses of 10-8-6 mg/Kg/h and 0.05–0.25 mcg/kg/min respectively. Tracheal intubation was facilitated with cis-atracurium 0.15 mg/kg in all patients. MLAERs were recorded before anaesthesia and 5 min after skin incision. An audiotape with one of two stories was played immediately after intra-operative MLAERs recording. Explicit and implicit memory was assessed 24 hours after awakening by using recall test and free-association test respectively. Values are shown as mean ± SD. Data were elaborated by using Mann–Whitney and Kruskal-Wallis tests.

Results and Discussions: None of the patients had explicit recall. Two patients from group B had a "dream". Another patient from group A showed implicit memory of the story. No patients had some unconscious memories in group B. Patients with unconscious memories, compared to those without, had a intraoperative MLAERs waves pattern more similar to that of awake state with Pa latency increase remarkably smaller (5.3 ± 2.2 vs 26 ± 9.7 msec; $p < 0.05$).

Conclusion(s): When MLAERs are perserved during surgical anaesthesia auditory information may be processed and implicitly remembered as shown postoperatively by indirect memory test. There were no evidence of unconscious memories during TIVA.

Reference:

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A-353

A single dose of lignocaine or alfentanil did not avoid the ICP and MAP increases, induced by ETS in sedated neurocritical patients

P. Doménech, J. Hernández-Palazón, L.F. Falcón, J. Giménez, A. Soria, V. Robles

Department of Anaesthesia, "Virgen de la Arrixaca" University Hospital, Carretera Madrid – Cartagena, El Palmar, Spain

Background and Goal of Study: In neurocritical patients the endotracheal suctioning (ETS) is potentially dangerous, because it can transiently increase the intracranial pressure (ICP). The effects of an IV bolus of (SF) alfentanil (Al) and lignocaine (Ll) on the cerebral hemodynamic responses to the ETS have been studied.

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Materials and Methods: Ten neurosurgical patients, sedated at the time of the study with midazolam infusion, were submitted to routine ETS at 6 hr intervals. Two minutes prior each ETS manoeuvre, patients received, SF (1.5 cc), LI (1.5 mg/kg), or AI (1.5 μg/k). Mean arterial pressure (MAP), ICP and cerebral perfusion pressure (CPP) were recorded, before and 0.5, 1, 2, 3 and 5 min after ETS. Cough and/or movement occurred during ETS were also recorded.

Results and Discussions: Mean (SD) are shown in the table

	Basal	0.5 min	1 min	3 min	5 min
ICP					
SF	12 (5)	20 (9)‡	15 (7)†	12 (5)	11 (5)
LI	11 (5)	14 (6)‡	13 (5)†	12 (5)	11 (4)
AI	11 (4)	17 (6)‡	15 (6)‡	13 (5)†	12 (5)
MAP					
SF	91 (18)	101 (23)‡	100 (23)‡	99 (23)‡	94 (22)
LI	91 (20)	98 (21)†	97 (21)†	92 (20)	88 (19)
AI	90 (19)	95 (19)‡	95 (20)†	93 (21)	88 (20)
CPP					
SF	79 (16)	81 (20)	86 (20)*	88 (21)†	84 (20)
LI	80 (19)	84 (21)	85 (20)†	81 (18)	77 (18)
AI	80 (17)	80 (14)	81 (17)	80 (18)	76 (16)

‡ = $p < 0.0015$, † = $p < 0.01$ and * = $p < 0.05$ vs baseline value.

Conclusion(s): A single dose of lignocaine or alfentanil did not avoid the ICP and MAP increases, induced by ETS in sedated neurocritical patients.

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Use of Ondansetron in Supretentorial Tumor Surgery

A. Hasani*, N. Baykan*, O. Isbir**

*Department of Anesthesiology, *Marmara University Institute of Neurological Sciences, **Acibadem Hospital, Istanbul, Turkey*

Background and Goal of the Study: Postoperative nausea and vomitting (N/V) still continues to be one of the major problems in neurosurgical patients. It is complicated almost in %55–70 of the craniotomies [1]. The neurological evaluation of these patients can be difficult due to the secondary results of N/V or due to the use of sedative antiemetics. Ondansetron is a serotonin receptor antagonist with minimal sedative effects. In this study the timing of ondansetron was evaluated in supratentorial tumor surgery.

Material and Methods: With local ethic committee approval and patient consent 120 ASA I–III patients ages 18–70 (mean 46) undergoing supratentorial tumor surgery were recruited. Operations lasting more then 4 hours were excluded. Anesthesia was induced with Na Thiopental (4–6 mg/kg), Vecuronium Bromide (0.1 mg/kg). Anesthesia was continued with remifentanil infusion 0.2 mcg/kg/min and Isoflurane (%0.5–0.7) carried in air and O_2. Patients were allocated randomly in two groups. In the first group ondansetron 0.15 mg/kg were given immediately after induction while in the second group it was given right before the closure of the dura. All the patients were recorded according to the surgical times and total opioid dosage as well as the N/V in the first 6 hours with 30 min. intervals according to the scorring system [2].

No nausea and no gagging	0
Complaining and gagging	1
Vomitting 1–2 times in 30 min.	2
Vomitting >2 times in 30 min.	3

Results and Discussion:

	0–1. hour		1–3. hour	
Score	Group 1	Group 2	Group 1	Group 2
0	23(%38.3)	41(%68.3)	58(%96.6)	56(%93.3)
1	24(%40)	16(%26.6)	0(%0)	3(%5)
2	10(%16.6)	2(%3.3)	2(%3.3)	1(%1.6)
3	3(%5)	1(%1.6)	0(%0)	0(%0)

The use of ondansetron at the end of surgery decreased postoperative N/V significally when compared with the use immediately after induction.

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Remifentanil at extubation after prone position

E. Tureci, A. Hasani, N. Baykan, S. Ozgen, S. Ustalar

Department of Anesthesiology, University of Marmara, Institute of Neurological Sciences, University of Istanbul, Cerrahpasa Medical Faculty, Acibadem Hospital, Istanbul, Turkey

Background and Goal of the Study: During extubation, several methods had been used in order to blunt the hemodynamic response to endotracheal tube and reduce the complications as laryngospasm, coughing especially after the operations performed at prone position.(1) In this study, the effects of remifentanil, alfentanil, and lidocaine on hemodynamic response and the quality of extubation have been compared in spinal surgery patients.

Materials and Methods: Forty patients who had been scheduled for elective spinal surgery had been included in this prospective, randomized and double blind study after the approval of the ethic committee and written consent of the patients. At the end of the surgery, 10 ml of either saline(control, n = 10), or 1 mic/kg remifentanil (REM, n = 10), 10 mic/kg alfentanil (ALF, n = 10), or 1mg/kg lidocaine (LIDO, n = 10), had been administered intravenously before the patient had been positioned supine. The heart rate (HR), blood pressure (BP) and oxygen saturation were recorded during extubation, at 1st, 5th min after extubation. The extubation time, time to opening eyes, and to obey commands were also noted. ANOVA, Tukey-Kramer did statistical analysis, $p < 0.05$ was accepted as significant.

Results and Discussion: No increase in HR and BP were recorded in groups ALF and REMI ($p < 0.05$). Five patients coughed and 7 of them was responsive to the endotracheal tube in group ALF. Three patients in group REMI and 2 patients in group LIDO showed reaction to tube. Laringospasm was noted only in two patients in the control group.

Groups/time (min)	Extubation	Opening eyes	Obey commands
Control	4.5 ± 1.35	5.0 ± 1.63	7.4 ± 2.67
Remifentanil	8.0 ± 1.90***	8.0 ± 3.02	8.0 ± 3.61
Lidocain	3.1 ± 1.10	7.0 ± 1.56**	10.3 ± 2.31***
Alfentanil	4.8 ± 1.61	6.9 ± 2.60*	10.4 ± 4.45***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Conclusion: Remifentanil, 1 mic/kg i.v, administered before the patient turned supine at the end of the spinal surgery not only blunts the hemodynamic response during extubation, but also improves the quality of extubation and warrants a comfortable recovery.

Reference:

1 Gonzales RM, Bjerke RJ, Drobycki T,et al. Anesth Analg 1994;79:792.

A-356

Cognitive recovery after sevoflurane/remifentanil or propofol/remifentanil neuroanesthesia for elective supratentorial craniotomy

F. Bilotta, F. Baisi, F. Musolino, E. Lauta, B. Pizzi, G. Centola, V. Fabbrini, G. Rosa

Department of Anesthesiology, Intensive Care and Pain Medicine, University of Rome, Rome, Italy

Background and Goal of Study: Whether total intravenous anesthesia is superior to isoflurane inhalation anesthesia for neurosurgery, is not yet demonstrated (1). Sevoflurane has a favourable recovery profile because of its low blood/gas partition coefficient (2), and provides faster recovery and postoperative neurological assessment than isofluorane in long-duration neurosurgical cases (3). This study is designed to compare recovery times and cognitive recovery in patients undergoing elective craniotomy for supratentorial expanding lesions with sevoflurane/remifentanil or propofol/remifentanil anesthesia.

Materials and Methods: Forty patients ASA I–II (28–74 years, GCS 15) undergoing craniotomy for supratentorial expanding lesions were prospectively enrolled and randomly assigned to two groups. In all patients anesthesia was induced with thiopental (4–6 mg/kg), cisatracrium fentanyl (2 mcg/kg) and maintained with oxygen and air, remifentanil (0.2–0.25 mcg/kg/min), cis atracurium and either propofol (10–20 mg/kg/h) or sevoflurane (0.3–1 MAC). In all patients cisatracurium was stopped after skin closure and remifentanil, sevoflurane and propofol were stopped after skin dressing. Recovery time was measured as time elapsing from the end of propofol or sevoflurane infusion to eye opening; time of extubation was also measured. In order to evaluate the recovery of neurological and behavioural function the Short Orientation Memory Concentration Test (SOMCT) and the Rancho Los Amigos Scale (RLAS) tests were administered to all patients before anesthesia, 15 minutes and 3 hours after extubation.

Results and Discussion: The recovery time and extubation time were similar in the sevoflurane and propofol groups (11 ± 7 min and 13 ± 9; 14 ± 6 and 16 ± 5, respectively). The SOMCT was similarly reduced 15 minutes after extubation, in both groups (16 ± 10 and 18 ± 9, respectively; $P < 0.05$ compared to baseline) and reverted to normal at 3 hours after extubation. The RLAS had a similar trend.

Conclusions: The results of this study suggest that sevoflurane/remifentanil and propofol/remifentanil neuroanesthesia have similar recovery times, cognitive and behavioural function in the early postoperative course.

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Local and Regional Anaesthesia

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Post dural puncture headache(PDPH) – conventional medical treatment versus epidural blood-patch(EBP)

D. Sandesc, M. Lupei, O. Bedreag, C. Plavat

Department of Anesthesia and Intensive Care, County Hospital Timisoara, European Society of Anaesthesilogists, Romanian Society of Anesthesia and Intensive Care, Timisoara, Romania

Background and Goal of Study: The post dural puncture headache(PDPH) represents a complication of spinal anesthesia with an increased incidence in obstetric patients (1). The aim of the study is to evaluate the efficacy of the epidural blood-patch(EBP) versus the conventional medical treatment.
Materials and Methods: We studied in a prospective, randomised, double-blinded manner 32 obstetric and non-obstetric patients with PDPH. The patients were randomly divided in 2 groups: group A (16 patients) who received a conventional treatment (oral and iv. hidratation, NSAIDs, coffeine) and group B (16 patients) in whom an epidural blood-patch was performed. The intensity of headache was evaluated using a visual analogue scale (VAS) from 0–5, before and two hours after the dural puncture. The results were statistically analysed, with a value of $p < 0,05$ considered significant.
Results and Discussions: There were no statistical differences concerning the demographic data and the cause of PDPH between the groups. The intensity of PDPH was similar (with a mean value of $4,1 \pm 0,7$ on VAS in group A, and a mean value of $4,0 \pm 0,8$ on VAS in group B). After treatment, the intensity of headache diminished significantly ($p < 0,01$) in patients with epidural blood-patch (the mean value was $0,5 < 0,09$ on VAS), comparatively with those with the conventional treatment (with a mean value of $4,1 < 0,68$ on VAS). The same difference were recorded after 24 hours: the mean value on VAS $0,35 < 0,08$ in group B versus the mean value on VAS $3,9 < 0,6$ in group A. The possible etiologies of PDPH are: "the leakage theory"(2), a secondary vasodilatation, neuro-modulation(3).
Conclusion(s): The epidural blood patch represents the first choice treatment of PDPH, significantly superior to the conventional treatment.
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The efficiency of prolonging the period of the supine position after epidural blood-patch(EBP) in the treatment of post dural puncture headache(PDPH)

D. Sandesc, M.I. Lupei

Department of Anesthesia and Intensive Care, County Hospital Timisoara, European Society of Anaesthesiologists, Romanian Society of Anesthesia and Intensive Care, Timisaora, Romania

Background and Goal of Study: The epidural blood patch (EBP) with autolog blood is a gold standard therapy for post dural puncture headache (PDPH) (1), but the 90% efficiency after the procedure diminished in time to 61,75%(2). The aim of the study is to evaluate if the results could be improved by prolonging the period of the supine position after EBP.
Materials and Methods: The prospective, randomised, double-blinded study considered 20 patients with PDPH. The patients were randomly divided in two groups according to the duration of the supine position after EBP: group 1- 30 minutes and group 2- 120 minutes. The intensity of headache was evalauted on a visual analogue scale (VAS) from 0–5, before, 2 and 48 hours after EBP. The results were statistically analysed, with a value of $p < 0,05$ considered significant.
Results and Discussions: There were no statistical differences between the two groups in regard of demographical data and the causes of PDPH. The intensity of pain was similar in both groups before EBP, but it was significantly different at 2 and 48 hours after EBP(table).

Table. The intensity of PDPH on VAS (the mean values and standard deviations) before, 2 and 48 hours after EBP.

	VAS in gr. 1	VAS in gr. 2
Before EBP*	$4,1 \pm 1,1$	$3,9 \pm 0,9$
2 hrs after EBP**	$1,6 \pm 1,3$	$0,29 \pm 0,2$
48 hrs after EBP***	$0,5 \pm 0,5$	$0,1 \pm 0,1$

*$p = 0,6616$; **$p = 0,0055$; ***$p = 0,0232$

Conclusion(s): (1) EBP represents an efficient therapeutical option for PDPH. (2) The intensity of pain diminished significantly by prolonging the period of supine position after EBP.
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A-359

Patient-controlled epidural analgesia after anterior cruciate ligament repair: is it useful adding sufentanil to 0.2% ropivacaine?

E. Spreafico, F. Vinciguerra, A. Albertin, G. Aldegheri, G. Cappelleri, A. Casati

Department of Anesthesiology, Vita-Salute University of Milano, IRCCS H. San Raffaele, Milano, Italy

Background and Goal of Study: The aim of this prospective, randomized, double-blind study was to evaluate the effects of adding 0.5 μg/ml sufentanil to 0.2% ropivacaine for patient controlled epidural analgesia on the quality of postoperative pain control in patients undergoing anterior cruciate ligament (ACL) reconstruction.
Materials and Methods: 20 ASA physical status I–II in-patients, scheduled to have elective ACL repair were studied. Combined spinal-epidural anesthesia was performed at the L3–L4 or L4–L5 interspace using a needle-through-needle technique. Spinal anesthesia was induced with 10 mg of 0.5% hyperbaric bupivacaine. Postoperative epidural analgesia was started at the end of surgery using a continuous epidural infusion of 0.2% ropivacaine alone ($n = 10$) or 0.2% ropivacaine/0.5 μg ml^{-1} sufentanil ($n = 10$). The degree of pain was evaluated at 1, 8, 16, 24 and 48 hours after surgery; at the same observation times the degree of motor block, sedation, oxygen saturation, total consumption of PCEA solution and incremental doses given to the patient were also recorded.
Results and Discussion: No differences in the quality of intraoperative anesthesia was observed. Figure 1 shows the degree of postoperative pain: patients receiving the combination of ropivacaine and sufentanil showed lower levels of VAS 16 hours after surgery as compared with the Ropivacaine group ($P = 0.02$). However, no differences in the degree of pain were observed between the two groups during continuous passive mobilization.
Conclusions: Adding 0.5 μg/ml sufentanil to 0.2% ropivacaine for patient controlled epidural analgesia improved pain control at rest but did not result in significant improvement of postoperative analgesia during continuous passive mobilization.

Table 1: Degree of pain measured at rest with the visual analogue scale (VAS) at 1, 8, 16, 24 and 48 hours.

	Ropivacaine	Ropivacaine–sufentanil
VAS 1 h (mm)	0 (0–40)	0 (0–10)
VAS 8 h (mm)	0 (0–80)	0 (0–35)
VAS 16 h (mm)	30 (0–45)	21 (0–50)*
VAS 24 h (mm)	18 (0–60)	12.5 (0–60)
VAS 48 h (mm)	7.5 (0–45)	0 (0–20)

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Effective continuous infusion and bolus doses for patient-controlled epidural analgesia using ropivacaine

D.H. Kim

Department of Anesthesiology, College of Medicine, Dankook University, Cheonan, Republic of Korea

Background and Goal of Study: Epidural analgesia is often considered the most effective technique for providing pain relief after cesarean section. Epidural infusion of local anesthetics combined with opioids provides better analgesia and reduces unwanted side effects. This study examined the efficacy of patient-controlled epidural analgesia (PCEA) using 0.2% ropivacaine with butorphanol and compared the suitability of four different volumes of bolus dose (BD) and continuous background infusion (CBI).
Materials and Methods: Sixty patients received 0.2% ropivacaine with 50 mcg/ml butorphanol by PCEA after cesarean section. These subjects were divided four groups according to volumes of BD and CBI (2 ml and 2 ml/hr: group 1; 3 ml and 3 ml/hr: group 2; 4 ml and 4 ml/hr: group 3) during 24 hours postoperatively. The visual analogue scale (VAS) was used to measure pain and the incidences of side effects were assessed.

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Results and Discussions: The incidences of numbness of the lower extremities were significantly lower in group 1 (5%) than either group 2 (15%) or group 3 (15%) (both, $P < 0.05$). There were no differences in PCEA drug consumption, VAS pain score, other side effects and patient's satisfaction among the groups.
Conclusion(s): This study suggests that 2 ml of BD and 2 ml/hr of CBI for PCEA using 0.2% ropivacaine and 50 mcg/ml butorphanol can provide a sufficient analgesic effects after cesarean section.
References:
1 Scott BD. Anesth Analg 1989; 69: 563–569.
2 Zaric D. Reg Anesth 1996; 21: 14–25.

A-361

Maternal hypotension after epidural ropivacaine 0.2%

F. Peramo, J. Caballero, F. Garcia-Hernandez, V. Montero, R. Carlos

Department of Anestesiologia Reanimacion y Tratamiento del Dolor, Hospital Clinico Universitario "San Cecilio", Granada, Spain

Background and Goal of Study: Epidural ropivacaine can produce maternal hypotension that need treatment to prevent the appearing of hypoxia in the fetus[1]. We conducted a study of maternal hypotension among patients undergoing labour epidural analgesia with ropivacaine 0.2% in a Regional hospital. We aimed to identify those patients at greater risk and determine which factors can predict outcome (maternal hypotension).
Materials and Methods: For a period of 3 months all patients at Hospital Clínico San Cecilio who underwent labour epidural analgesia entered the study (ropivacaine 0.2%, bolus = 10–12 mL, then 8–12 mL/h). All patients received a crystalloid preload before epidural administration of ropivacaine. We considered as maternal hypotension a systolic blood pressure (SBP) decrease greater than 30% or a SBP < 90 mmHg. For hypotension management we used Hydroxietilstarch 6% 500 ml (HES) and ephedrine (boluses of 5 mg) if hypotension didn´t responded in 5 minutes. Bradycardia (Heart Rate < 50 bpm) was treated with atropine 0.7 mg. In every patient we recorded several variables that would explain outcome (all were binary) and we tried to determine both the variables that were associated with hypotension (Fisher exact test) and those that could predict hypotension (multiple logistic regression model, stepwise method of variable selection). We used SPSS for Windows 9.0 for statistical analysis ($p < 0.05$ was regarded significant).
Results: Data was collected from 310 patients of whom 7% (23) presented maternal hypotension. SBP < 110 mmHg, HR < 65 bpm and the level or intensity of blockade were associated with hypotension. Variables that can predict the possibility of maternal hypotension were SBP < 110 mmHg or SBP > 150 mmHg, HR < 60 bpm, sensitive blockade $\geq$ T6 and inability to flex knees (Bromage ≥ 2). Maternal hypotension responded to HES and ephedrine (if necessary); APGAR test were normal.
Conclusions: Maternal hypotension can appear in patients receiving epidural ropivacaine 0.2% when the patient present before the epidural administration hypertension, high degrees or levels of blockade and a blood pressure or heart rate in the lower limit of normality.
Reference:
1 Lee et al. Reg Anesth Pain Med 2002; 27:31–36.

A-362

Sevoflurane and thoracic epidural anaesthesia for thymectomy in myasthenia gravis

M.J. Yepes, B. Tapia, E. Alsina, E. Matute, R. Roses

Department of Anaesthesiology, Hospital Universitario La Princesa, Madrid, Spain

Background and Goal of Study: Myasthenia Gravis (MG) is an autoimmune disease characterised by weakness and fatigue of voluntary muscles. Surgical treatment of choice is transsternal thymectomy. We describe the perioperative management of 15 MG patients undergoing thymectomy.
Materials and Methods: We report a retrospective trial that includes 15 cases. The anaesthesia technique did not include muscle relaxants. We performed the procedure with inhalational Sevoflurane and thoracic epidural at T1–T4. Analgesia was achieved with Lidocaine 1.5%: 5–10 ml and 50 micrograms of fentanyl.

Postoperative pain was controlled with epidural infusion at 5 ml/h with bupivacaine 0,125% anf fentanyl 5 mcg/ml. Datas collected: demographic, Osserman Grade, associated diseases, surgical time, extubation time, postoperative analgesia and complications.
Results and Discussions Only 1 male patient was operated. ASA physical status was between I–III. The treatment of 14 patients included piridostigmine and 7 patients were taken corticosteroids also. Osserman grade: I (n = 1), II (n = 13), IV (n = 1). Surgical time 120 $\pm$ 15 min. All patients were extubated at the operating room.without complications.

Visual analogic scale (VAS) was recorded at 3 moments:

VAS	≤3	4–7	≥8
Operating room	15	–	–
1st hour at recovery room	13	2	–
Discharge to ward	15	–	–

We have changed the infusion to 2 ml/h in 2 patients because of arm paresthesias. No severe complications were found.
Conclusion: Anaesthesia technique with Sevoflurane and thoracic epidural is a good technique to perform transsternal thymectomy without the use of the muscles relaxants. This procedure makes easy extubation at the operating room with good pain control and a few rate of complications.
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2 Eur J Anaesthesiol 2000; 17: 325–8.

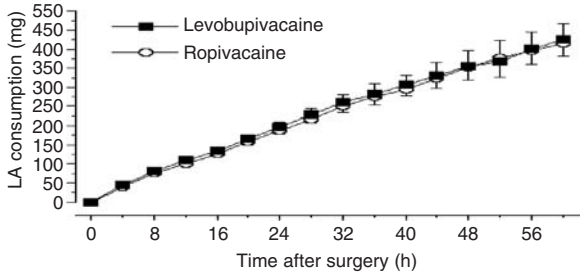
A-363

Comparison of epidural levobupivacaine and ropivacaine 0.1% combined with morphine for postoperative analgesia after major abdominal surgery

M. Senard, J. Joris, M. Jacquemin, L. Maquoi, M.P. Geortay

Department of Anaesthesia and Intensive Care Medicine, University Hospital of Liege, CHU Liege, Liege 1, Belgium

Background and Goal of Study: Levobupivacaine (LEVO) (1) and ropivacaine (ROPI) (2) are less cardio and neurotoxic than bupivacaine and could be associated with less motor block (3). They appear to be suitable for postoperative epidural analgesia. We compared analgesia, dose requirements and side effects of LEVO and ROPI 0.1% combined with morphine for postoperative analgesia after major abdominal surgery.
Materials and Methods: After IRB approval and informed consent, 50 patients scheduled for abdominal surgery were included in this study. Anaesthesia consisted of general and thoracic epidural (T9–T10) anaesthesia. Upon arrival in the PACU, patients were randomly allocated to one of the 2 groups (n = 25/group): PCEA LEVO or ROPI 0.1% (Bolus: 5 ml, lockout interval: 10 mn, no basal infusion). All patients received a continuous epidural infusion of morphine 0.1 $mg.h^{-1}$. Pain scores (100 mm VAS) at rest, on coughing and mobilisation, extension of sensory block, side effects profile including motor block were assessed 3 times a day for 3 days. Local anaesthetic consumption was recorded every 4 hours. Anova, Student's t test or chi square were used as appropriate.
Results: Demographic data, pain scores, extension of sensory block, profile of side effects and motor block did not differ in the 2 groups. Local anaesthetics consumptions were similar in both groups (fig 1). No Bromage score > 1 was observed in any patient after the 4th postoperative h.
Conclusion: PCEA using LEVO 0.1% or ROPI 0.1% provide similar analgesia when combined with low dose epidural morphine. Both local anaesthetics solutions are clinically indistinguishable concerning efficacy and side effects.



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A-364

Comparative effect of R(+)- and S(−)-bupivacaine on ventricular conduction and contractility in the isolated rabbit heart

N. Kariya, L. Simon, A. Edouard, D. Benhamou, J.X. Mazoit

Department of Faculté de Médecine, Laboratoire dAnesthésie UPRES EA 3540 Université Paris-sud, F-94276, Le Kremlin-Bicêtre, France

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Background and Goal of Study: Bupivacaine (BUPI) may induce severe dysrhythmias and decreased contractility. Ventricular conduction is less impaired with the S(−) enantiomer than with the R(+) enantiomer (1). We compared the effect of R(+)BUPI, S(−)BUPI on both ventricular conduction and contractility using an isolated rabbit heart preparation.
Materials and Methods: Twenty one male New Zealand rabbits (1600–2000 g) were divided in three groups. The hearts were mounted on a Langendorff preparation infused at constant flow (40 ml/min) with a modified Krebs solution and paced at 240 bpm. They received increasing concentrations of R(+)BUPI or S(−)BUPI (2.3 to 55.6 μM) by 8 min increments. ECG was measured at high speed using surface electrodes and left ventricular pressure was measured using a balloon inserted in the left ventricle. An Emax model was used to compare the increase in QRS duration and the relative decrease in developed pressure (DP) by mixed effect modelling with NONMEM.
Results: DP decreased similarly with R(+) and S(−) BUPI, whereas QRS increase was higher with R(+) than with S(−) BUPI (table).

		ΔQRS		DP
		Emax (ms)	EC50 (μM)	EC50 (μM)
BUPI	R(+)	209*	19.3†	33.2†
	S(−)	113*		

*P < 0.001 R(+) vs S(−), †NS R(+) vs S(−).

Conclusion: As previously described, ventricular conduction was more impaired with R(+) BUPI than with S(−) BUPI (1). The two enantiomers induced similar decrease in contractility. In addition, EC50 for decrease in DP was 1.7 times higher than for increase in QRS duration.
Reference:
1 Mazoit JX, Decaux A, Bouaziz H et al. Anesthesiology 2000; 93: 784–92.

A-365

Is cardiac toxicity lidocaine–bupivacaine mixture lower than ropivacaine and bupivacaine alone?

M. Real*, P. Domenech**, M.D. Carceles**, L. Falcon**, J. Hernandez***, B. Alonso**

**Pharmacy and **Anaesthesia Department, U.C.S.V.Arrixaca, Murcia, Spain ***Farmacology Department; Murcia University, Murcia, Spain*

Introduction: It has been speculated that the addition of lidocaine to a bupivacaine solution, reduces cardiac toxicity (De Jong.1994[1]). In fact, evidence indicating the clinical usefulness of the mixture of 2% lidocaine and 0,5% bupivacaine (1:1 vol.) has been presented (Gaertner 2002[2]).However, no conclusive studies on cardiac toxicity of such combination has been performed as yet. The purpose of the present study was to asses the effect of 2% lidocaine and 0,5% bupivacaine mixture on cardiac contractility in human heart.
Methods: All protocols for obtaining cardiac tissue were approved by the ethic committee in our hospital. Right atrial trabecula, obtained from patients undergoing open heart surgery, were suspended in an organ bath, superfused with Tyrode s solution and paced by field stimulation at 1 Hz. Tissues were in contact with accumulative concentration to local anaesthetics.
Results:

% Cardiac Contractility

M	Control	Lido-Bupi Mixt	Ropivacaine	Bupivacaine
Basal	100 ± 0	100 ± 0	100 ± 0	100 ± 0
E-8	98 ± 1	95 ± 1	93 ± 1	90 ± 1
3E-8	98 ± 1	91 ± 2*	82 ± 2	76 ± 5
E-7	93 ± 2	83 ± 3*	74 ± 3	68 ± 5
3E-7	85 ± 2	75 ± 4*	64 ± 3	61 ± 5
E-6	80 ± 3	68 ± 5*	54 ± 3	54 ± 5
3E-6	76 ± 3	59 ± 6*	42 ± 6	45 ± 4
E-5	72 ± 2	49 ± 8*	32 ± 5	28 ± 5
3E-5	69 ± 2	32 ± 7*	15 ± 4	12 ± 4
E-4	67 ± 2	5 ± 1*	5 ± 1	1 ± 1
3E-4	65 ± 4	0 ± 0	0 ± 0	0 ± 0

N = 10 in each group. Data are expressed as mean ± s.e.m. of % basal contractility. *p < 0,05 (*vs* Ropivacaine and Bupivacaine alone).

Discussion: In all cases contractility was significantly reduced when compared to control. Our results indicates that either ropivacaine or bupivacaine induce a negative inotropic effect similar to that previously reported (Harding et al.1998[3]) but it is statically significant higher than the combination of 2% lidocaine and 0,5% bupivacaine in this preparation. We conclude that this association would mean clinical advantages.

References:
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2 Gaertner E, Estebe JP, Zamfira, Cuby C, Macaire P. Infraclavicular plexus block: Multiple injection versus simple injection. Reg. Anesth. Pain. Med. 2002; 27(6): 590–4.
3 Harding DP, Collier PA, Huckle RM, et al. Comparison of the cardiotoxic effects of bupivacaine, levobupivacaine and ropivacaine: an in vitro study in guinea-pigs and human cardiac muscle. Br.J.Pharmacol. 1998; 125 suppl: 127P.

A-366

Epidural racemic bupivacaine and laevobupivacaine after partial hepatectomy

J.M. Kennedy, G.H. Mills, R. Ledger, A. Hart, I. Wrench, A.W. Majeed, G.T. Tucker

Department of Academic Unit of Anaesthesia (K floor), University of Sheffield, United Kingdom, University of Otago, New Zealand

Background: Bupivacaine is largely metabolised by the liver. High concentrations of RS bupivacaine are known to be cardio/neurotoxic. Epidural bupivacaine is commonly used after partial hepatectomy, because other forms of analgesia are often unsuitable. Therefore we measured R, S and total bupivacaine levels in 20 patients receiving racemic bupivacaine and 11 receiving laevobupivacaine.
Materials and Methods: All patients received a general anaesthetic, plus a bupivacaine 0.1% and fentanyl 5 mcg/ml infusion running at 0 to 15 mls/hr via a thoracic epidural during the intra and postoperative period. The dose was titrated to patients' requirements. Blood sampling was at 8-hour intervals, when infusion rates were changed and for 24 hours after epidural discontinuation.
Results and Discussions: 5 to 90% (median 40%) of the liver was removed. α_1 acid glycoprotein (AAG) levels, (which binds to bupivacaine, so reducing free levels) fell from a baseline median 0.92 g/l (quartiles 0.76, 1.1) to a low of 0.55 (0.37, 0.63) after 5 hours (3,11), taking 29 hours (23, 43) to climb back above baseline values, reaching a maximum of 1.35 (1.05, 1.54) after 85 hours (62, 138). However, return to baseline values was not achieved within the study period in 5 subjects.

In the racemic bupivacaine group, peak total RS levels reached 3.0 (1.5, 3.5). Four patients exceeded 4 mcg/ml. In the laevobupivacaine group peak S levels reached 2.0 (1.6–2.8), with one patient exceeding 3 mcg/ml. Peak levels were reached around 72 hours from surgery. However, only one patient developed an arrhythmia (1 in 2 ventricular ectopics) and no serious adverse events could be attributed to bupivacaine. Some of the variability in peak levels could be attributed to the size of the resection (r^2 0.24 for racemic and 0.23 for laevobupivacaine). Similarly the percentage of the dose recovered excreted unchanged from the urine was related to the size of resection (racemic r^2 0.22 and laevobupivacaine r^2 0.52).
Conclusion: High levels of total RS and S bupivacaine are reached after major hepatic resection. Fortunately the initially low AAG levels had recovered by the time these high levels were achieved. However, caution with high dosage regimes especially after 72 hours is suggested.
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Absence of supraclavicular diffusion of the local anesthetic after infraclavicular block

J. Rodriguez, M. Barcena, J. Alvarez

Department of Anesthesiology, Complexo Hospitalario Universitario de Santiago, Santiago de Compostela, Spain

Background and Goal of Study: The rates of side effects and complications of infraclavicular block seem to be low (1,2). We studied the distribution of the local anesthetic solution within the neurovascular space with the infraclavicular approach for brachial plexus anesthesia in order to explain the low rate of side effects observed in our institution.
Materials and Methods: We prospectively studied the distribution of a local anesthetic solution with radiological contrast medium by fluoroscopy in 18 patients. Six patients received an interscalene block, six patients a perpendicular supraclavicular block and 6 patients a perpendicular coracoid block. Differences among coracoid block group and the other two groups were assessed with Fisher's exact test followed by Bonferroni's correction and with one-way ANOVA. A $p < 0.05$ was considered significant. Additionally, we reviewed a series of 209 consecutive perpendicular coracoid blocks performed in our institution for related side effects and complications.
Results and Discussions: Distribution of the anesthetic solution in the interscalene group and in the supraclavicular group extended to both supraclavicular and infraclavicular spaces in all patients. This distribution was significantly different ($p < 0.05$) with respect to that of infraclavicular group. In this group the solution remained below the clavicle in all patients. No case

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of pneumothorax, hoarseness, Horner's syndrome and dyspnea was found in the retrospective study.

Conclusion(s): The perpendicular coracoid approach is a technique with a low rate of complications and side effects. This can be explained by the peripheral site of puncture and by the lack of supraclavicular distribution of the anesthetic.

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1 Jandard C, Gentili ME, Girard F et al. *Reg Anesth Pain Med* 2002; 27: 37–42.

2 Salazar CH, Espinosa W. *Reg Anesth Pain Med* 1999; 24: 411–5.

A-368

Continuous interscalene block: lidocaine versus ropivacaine

P. Manzoni, E. Spreafico, G. Aldegheri, M. Putzu, E. Bignami, A. Casati

Department of Anesthesiology, Vita-Salute University of Milano, IRCCS H. San Raffaele, Milano, Italy

Background and Goal of Study: This prospective, randomized, double-blinded study compared 1% lidocaine and 0.2% ropivacaine for patient-controlled interscalene analgesia after open shoulder surgery.

Materials and Methods: Forty patients undergoing open shoulder surgery received an interscalene brachial plexus block with 30 ml of either 1.5% lidocaine (n = 20) or 0.5% ropivacaine (n = 20), followed by a continuous patient-controlled interscalene analgesia (PCIA) with 1% lidocaine or 0.2% ropivacaine, respectively (infusion 6 ml/h; ID 2 ml; LO 25 min; max 3/h). All patients also received 100 mg ketoprofen iv overy 8 h; while 100 mg tramadol iv was available if requested. A blinded observer recorded the quality of analgesia and recovery of motor function during the first 24 h of infusion, as well as total consumption of C.A. and rescue analgesia. The Mann–Whitney u-test was used to compare continuous variables, while categorical data were analyzed using the chi-square test with the appropriate corrections. Results are presented as median (range) or as number (percentage).

Results and Discussion: The onset time of surgical block was shorter in patients receiving 1.5% lidocaine [7.5 (5–40) min] than in patients receiving 0.5% ropivacaine [30 (10–60)] ($p = 0.0005$). Postoperative pain intensity was higher with lidocaine than ropivacaine for the first 8 hours of infusion, then no further differences were observed. The ratio between boluses given and asked to the PCIA pump was 0.5 (0.13–0.7) with lidocaine and 0.7 (0.4–1.0) with ropivacaine ($p = 0.005$). Rescue IV tramadol was required during the first 24 h of infusion by 16 patients of the Lidocaine group (84%) and 8 patients of the Ropivacaine group (46%) ($p = 0.05$). At the 16 h and 24 h observation times a larger proportion of patients receiving ropivacaine had complete regression of motor block (70% and 95%) than patients receiving lidocaine (50% and 55%) ($p = 0.05$ and $p = 0.013$, respectively).

Conclusion: Although 1% lidocaine can be effectively used for patient-controlled interscalene analgesia, 0.2% ropivacaine provides a better preservation of motor function.

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0.2% ropivacaine, 0.2% levobupivacaine and 0.125% levobupivacaine for continuous sciatic nerve block after foot surgery: a pilot study

A. Casati, F. Vinciguerra, P. Manzoni, D. Mamo, P. Bergonzi, G. Aldegheri

Department of Anesthesiology, IRCCS H. San Raffaele, Milano, Italy

Background and Aim: Levobupivacaine has been demonstrated to be effective and safe for single shot nerve blocks. However, little is known about its use for continuous nerve blocks. The aim of this prospective, randomized, double-blind study is to compare the analgesia efficacy and motor block resolution of 0.2% ropivacaine, 0.2% levobupivacaine and 0.125% levobupivacaine for continuous sciatic nerve block after foot surgery.

Methods: With ethic committee approval and written consent, continuous sciatic nerve block with the lateral popliteal approach was performed in 30 patients undergoing hallux valgus repair. After an initial bolus of the 0.5% concentration of the study drug, patients were randomly allocated to receive a patient controlled infusion of 0.2% ropivacaine (n = 10), 0.2% levobupivacaine (n = 10) or 0.125% levobupivacaine (n = 10) using a basal infusion of 6 ml/h, a ID of 2 ml with a LO time of 15 min, max 3/h. A blind observer evaluated the onset of the surgical block, the degree of pain (10 cm VAS), and the resolution of sensory and motor blocks, the total anesthetic consumption as well as consumption of rescue tramadol at 8, 16, 24 hours.

Results: No differences in onset time were reported. Postoperative pain relief was excellent in all the 3 groups; the median VAS score during motion is showed in the table. Complete recovery of motor function at 24 hours was observed in 100% of cases with 0.2% ropivacaine, 87.5% of cases with 0.125% levobupivacaine, and only 54.5% in patients receiving 0.2% levobupivacaine ($p = 0.058$). Median (range) volume infused during 24 hours was 146 (135–199) ml with 0.2% ropivacaine, 146 (138–174)ml with 0.2% levobupivacaine, and 148 (106–152) ml with 0.125% levobupivacaine ($p = 0.562$).

	0.2 ropi	0.2 levo	0.125 levo
VAS 8	0 (0–4)	0 (0–3)	0 (0–3)
VAS 16	0 (0–6)	0 (0–7)	0 (0–6)
VAS 24	0 (0–9)	0 (0–8)	1.5 (0–7)

Conclusion: Continuous sciatic nerve block with both 0.2% and 0.125% levobupivacaine provided excellent analgesia after hallux valgus repair. However the 0.2% concentration showed a trend toward a higher degree of motor block than 0.2% ropivacaine and 0.125% levobupivacaine.

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Thoracic versus lumbar epidural analgesia in major colorectal surgery

I. Grecu, A. Culda, M. Nicolau, D. Ologoiu, M. Vartic, I. Grintescu, D. Tulbure

Anesthesia and Intensive Care Department, Clinical Emergency Hospital of Bucharest, Bucharest, Romania

Background and Goal of Study: Combined epidural and general anesthesia (GA) and postoperative epidural analgesia became the standard of care in major colorectal surgery[1]. There are studies emphasizing the advantages of thoracic epidural analgesia (TEA) over lumbar epidural analgesia (LEA)[2] in this type of surgery, avoiding parasympathetic blockade. Our study tries to demonstrate the superiority of TEA on stress response to surgery and on improving postoperative outcome.

Materials and Methods: After Ethical Committee approval and patient informed consent, 60 ASA 1–3 patients scheduled for major colorectal surgery were enrolled in a prospective study and randomized to have an epidural catheter inserted before induction of GA either at T8–T10 (group T, n = 30) or at L1-L2 (group L, n = 30). Prior to induction, 10–15 ml ropivacaine 0.75% were injected. Postoperatively, continuous epidural analgesia was performed in both groups with 0.3% ropivacaine, 6–8 ml/h for maximum 4 days. We monitored VAS 1–100 mm at rest and mobilization, motor block (Bromage), time to ambulation and digestive function recovery, adverse events and complications, length of hospital stay (LOS) and glycemia, ACTH and cortisol preoperatively, after incision, emergence, at 4, 12, 24 and 48 postoperative hours. Statistics included student's t-test, Mann–Whitney and multiple ANOVA ($p < 0.05$).

Results and Discussions: No significant differences regarding demographics, length of surgery, transfusions, VAS, perioperative hypotension, PONV, complications, laboratory levels of glycemia, ACTH and cortisol were registered. A significant increase ($p < 0.05$) in group L than in group T of mild/moderate motor block (4 vs 0 pts), time to passing stools (76 ± 12 vs 58 ± 14 hrs), time to urinary catheter removal (58 ± 10 vs 36 ± 12 hrs), time to fully resumed oral intake (98 ± 18 vs 70 ± 14 hrs, LOS (10 ± 3 vs 7 ± 2 days) was noticed.

Conclusion(s): Although both TEA and LEA provide same quality analgesia and stress response to surgery, TEA improves early postoperative outcome and shortens LOS.

References:

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2 Basse L et al. – Ann Surg 2000;232 (1): 51–57.

A-372

Analgesia by mandibular nerve block for oropharyngeal carcinoma surgery

F. Plantevin, J. Pascal, M. Roussier, D. Perret, M.A. Rebaud, M. Navez, S. Molliex

Department of Anesthesia and Reannimation, DAR Hôpital Bellevue, C.H.U Saint Etienne, Saint Etienne, France

Background and Goal of Study: The aim of this study was to evaluate postoperative analgesia after oropharyngeal carcinoma surgery when mandibular nerve block (V3) is performed before general anaesthesia.

Materials and Methods: After ethical committee approval and informed consent, 28 patients scheduled for lateral mandibulectomy and/or partial glossectomy were included in a prospective double blind randomized study. Patients were assigned in two groups receiving either a mandibular nerve block with 10 ml of ropivacaïne 10 mg/ml (Group 1 n = 14) or a subcutaneous physiologic serum infiltration (Group 2 n = 14). General anaesthesia was induced and maintained with propofol and remifentanil in the two groups. Postoperative analgesia started 45 minutes before the end of

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surgery was similar in the 2 groups and was performed with propacetamol (2 gr/6 h) and intravenous morphine using PCA system (1 mg in bolus with a lock-out interval of 10 minutes) after a bolus of 0,15 mg/kg. Morphine consumption was evaluated during 48 h. Statistical analysis was done with ANOVA and Student's test ($p < 0.05$).

Results and Discussion: The 2 groups were comparable (age, weight, sex ratio, type of surgery) and had the same level of analgesia from H0 to H48 (VAS evaluation).

Morphine Consumption from H0 to H48: (mg) [moy. ± SD]:

	Group 1 block (n = 14)	Group 2 (n = 14)	p
1 h	3,43 ± 3,65	11,33 ± 8,11	<0,003
4 h	6,14 ± 5,01	19,79 ± 8,99	<0,001
8 h	10,36 ± 6,83	28,07 ± 11,65	<0,001
12 h	15,21 ± 10,48	37,86 ± 14,98	<0,001
16 h	21,15 ± 15,38	47,69 ± 17,72	<0,002
24 h	28,08 ± 20,88	59,14 ± 21,89	<0,001
36 h	42,69 ± 29,75	68,79 ± 29,48	<0,031
48 h	51,14 ± 32,51	73,50 ± 33,24	ns

Discussion: Mandibular nerve block performed before surgery decrease significantly morphine consumption after oropharyngeal carcinoma surgery during the first 36 hours.

Reference:

1 Neill RS, Watson R. Br J Anaesth. 1984; 56(5): 485–92.

A-374

CUN: a proportional measurement system used in acupuncture utilized for the description of anatomic landmarks in regional anesthesia – preliminary results of a pilot trial

S. Schulz-Stübner, A. Henszel

Department of Anesthesiology, University of Iowa Hospital and Clinics, Iowa City, USA

Background and Goal of Study: The description of anatomical landmarks for regional anesthetic procedures varies widely. Oftentimes, measurements are given in centimeters, inches or even "fingerbreadths" while failing to indicate whether it is the patient's or the doctor's finger and which finger to use. Consequently, it is common for regional anesthesiologists to adapt that information to the reality of the patient's proportion. However, the adaptive mechanism is quite individualized. Acupuncture plays a major role in the practice of Traditional Chinese Medicine and has been used for more than two millennia (1). Traditional Chinese Medicine recognizes the variance among individuals and uses a proportional system to describe the acupuncture-points that is based on the width of the thumb at the level of the distal interphalangeal joint. This distance is defined as one CUN, and can be further divided into ten FEN to describe smaller distances (2). The correlation of CUN to centimeter measurements and the relationship to the height and weights of a western population has never been studied previously.

Materials and Methods: 500 peoples age, gender, weight, height and width of the thumbs are measured after IRP approval and with informed consent. Data are analyzed for normal distribution and a linear regression analysis is performed.

Results and Discussions: In the first 300 people we found a greater correlation between weight ($r = 0,83$) than height ($r = 0,79$) and no significant differences between right and left thumbs or gender. The CUN of a "normal person" with 180 cm height and 75 kg weight would be 19,8 mm.

Conclusion: The CUN might be a useful system to describe anatomic landmarks for regional anesthesia and conventional descriptions in centimeter can be "translated" by using the CUN of a defined "normal person". This hypothesis will be studied in an ongoing trial for peripheral nerve blocks.

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A-375

Cholecystectomy under combination of continuous lumbal epidural anesthesia and coeliac plexus blockade in two patients with severe chronic obstructive pulmonary disease (COPD) : case report

E.B. Sener, S. Kocamanoglu, E. Ustun, Z. Malazgirt, A. Tur

Department of Anesthesiology, Mayis University, Samsun, Turkey

Cholecystectomy usually necessitates general anesthesia to prevent aspiration and surgical pain. Sometimes, the procedure may be performed under regional anesthesia in patients with coexisting pulmonary disease who are deemed high risk for general anesthesia (1). However surgical analgesia may be inadequate in these methods. Coeliac plexus blockade (CPB) had been used in order to provide analgesia for major biliary interventions successfuly (2).

We performed combination of epidural anesthesia (EA) and CPB in order to prevent deep visceral pain during cholecystectomy, in two patients with COPD and bronchiectasis. The effects of EA and CPB on glucose and cortisol levels were studied at pre and intraoperative period. An epidural catheter was introduced at L_{2-3} intervertebral space and 6 mL 0.25% bupivacaine was administered. Later CPB was performed with 30 mL 0.25 % bupivacaine bilaterally. Before the surgery, 16 mL 0.25% bupivacaine was given via epidural catheter. Sensorial blockade level was achieved T_4 dermatome. Midazolam 2 mg and fentanyl 50 μg i.v. were used for sedation. Neuroendocrine response was attenuated intraoperatively. Both of patients tolerated the procedure well. Median operating time was 100 minutes. The epidural catheter was removed the morning after the operation. No complications occurred postoperatively.

Conclusion: Cholecystectomy can be performed under combination of EA and CPB, attenuated stress response to surgery and morbidity, in patients with severe COPD.

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A-376

Rostral distribution of epidural administered mepivacaine, ropivacaine and levobupivacaine in sheep

U. Gosch[1], C. Lang[1], J. Schumacher[1], M. Heringlake[1], H. Iven[2], K.F. Klotz[1]

[1]Department of Anaesthesiology, [2]Department of Pharmacology and Toxicology, University of Lübeck, Lübeck, Germany

Background and Goal of Study: In spite of successful performance of epidural anaesthesia for decades, we still lack detailed knowledge of the spatial distribution of local anaesthetics after epidural application. Mepivacaine, ropivacaine and levobupivacaine are chemically a homologous series and represent different options for clinical indications. The aim of this study was to compare the disposition of these substances in the vertebral canal.

Materials and Methods: With institutional approval 10 anesthetized sheep were prepared with an epidural catheter in L2 for substance application and diagnostic epidural microdialysis catheter (CMA 20/Sweden) at L3, T11, T7 and T3. After joint equimolar application of the 3 local anesthetics (0.3 ml/kg of 12 mM solution, resp.) into the epidural space, microdialysis samples were collected over 150 minutes in 10 minute intervals. The free drug concentration was measured with HPLC (1).

Results and Discussions: The sum of the free drug concentrations demonstrated very low values at T3 in contrast to T7, T11 and L3. At every level of the vertebral canal the boxplots displayed the same rank order: mepivacaine > ropivacaine > levobupivacaine. According to the Friedman-Test they represented 3 different groups ($p < 0.05$).

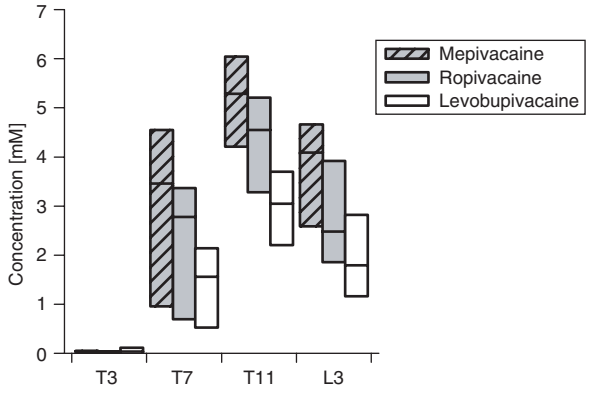

Figure 1. Sum of free drug concentrations over 150 min. Boxplot displays median, lower and upper quartiles.

Conclusions: A single epidural bolus of mepivacaine, ropivacaine and levobupivacaine yielded a high local concentration with the rostral spread distinctly limited below T3. This series of 3 chemically homologous local

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anaesthetics displayed pharmacokinetic differences according to their physicochemical parameters.

Reference:

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A-379

Comparison of 0.5% bupivacaine and a mixture of 0.5% bupivacaine and 2% lidocaine for epidural anesthesia

F. Zand, S.R. Razavizadeh, S. Azamati

Anesthesia Department, Namazi Hospital, Shiraz University of Medical Sciences, Shiraz, Iran

Background and Goals: Local anesthetic solutions are frequently and safely mixed to take advantage of the useful properties of each drug (1) but the medical literature is surprisingly deficient in well controlled studies of onset and duration of action of these mixtures for epidural anesthesia (2)

Material and Methods: 33 patients scheduled for elective pelvic and lower extremities operations were enrolled in this prospective randomized controlled study: group I; 16 patients received 15 ml solution containing bupivacaine 0.25% and lidocaine 1% as a single injection epidural anesthesia in L4–L5 interspace after 3 ml test dose containing 15 mcg epinephrine, group II; 17 patients received 15 ml bupivacaine 0.5% with the same technique. The times from injection of the test dose to the onset of sensory anesthesia at inguinal ligament (L1) and umbilicus (T10) and the time of termination of anesthesia in the maximum sensory level and two levels regression of anesthesia level were checked with pinprick test. The results were compared with two-sample t-test.

Results: Times to onset of sensory block in L1 and T10 levels (mean ± SD) were 14.87 ± 3.1 min and 21 ± 3.37 min in group I ($p < 0.025$) and 17.12 ± 2.18 min and 24.9 ± 2.54 min in group II respectively ($p < 0.003$) Times to termination of sensory anesthesia in the maximum level of anesthesia and two dermatomes regression were 75.12 ± 8.26 min and 87.8 ± 7.01 min in group I ($p = 0$)and 116.37 ± 22.4 min and 134.87 ± 21.64 min in group II respectively ($p = 0$). There was no significant difference in IV sedation required for the two groups ($p < 0.28$).

Conclusions: We concluded that mixing lidocaine 2% with bupivacaine 0.5% in a 50:50 ratio compared to 0.5% bupivacaine solution results in significantly more rapid initiation and termination of sensory block. This technique is recommended to shorten OR and PACU stay.

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A-380

Improved analgesia after axillary block with levobupivacaine or bupivacaine selectively added to mepivacaine

G. Vitale, E. Martinez, S. Sordi, E. Montrasio, B. Cadore, M. Amigoni, A. Cantù, M. Saini, M. Giovannini

Department of Anesthesia, S. Gerardo Hospital, Monza, Italy

Background and Goal of Study: The use of local anesthetic mixtures for regional anesthesia has led to conflicting results.(1) We compared small doses of long-acting local anesthetics added to mepivacaine versus mepivacaine alone for axillary block.

Materials and Methods: Consentient ASA ⩽ III patients undergoing hand surgery were randomized to receive an axillary block, using an electrostimulated needle and multiple injection technique, with: (1) 2% mepivacaine 5 ml for each terminal branch of the plexus; (2) as in group 1 plus 0.5% bupivacaine 5 ml injected only near the branch mainly related to the surgical procedure; 3) as in group 1 plus 0.5% levobupivacaine 5 ml injected as in 2. Patients unsuited for regional anesthesia, non compliant, undergoing procedures involving a field covered by >1 branch or leading to negligible postoperative pain (e.g. carpal tunnel release) were excluded. All patients received paracetamol 1 g every 8 hours po. Ketoprofen was used as iv rescue analgesic. A blinded observer registered time of block onset and recovery, VAS pain scores at 1–2–4–6–8–12–24 hours, total consumption and time of first request of rescue analgesic. Data (mean ± SD) are compared using analysis of variance with Bonferroni correction. Time of first analgesic request was described by Kaplan Meier curves and compared by log-rank test.

Results and Discussions: 69 patients were studied (age: 16–77 years; M/F:52/17). Anesthesia was adequate in all cases. Rescue analgesic consumption was lower in group 2 and 3 (1: 105 ± 90 mg; 2: 58 ± 65 mg; 3: 43 ± 89 mg; $p = 0.045$). The proportion of rescue analgesic-free patients had a slower decrease in groups 2 and 3 than in 1 (analgesic-free at 24 h: 34% in group 1, 49% in group 2, 73% in group 3; $p < 0.001$). Pain scores were lower in groups 2 and 3 than in 1 (1 vs 2, $p = 0.03$; 1 vs 3, $p = 0.018$). Time of loss and of recovery of sensory and motor function was similar among groups.

Conclusion: Selective addition of bupivacaine or levobupivacaine improves analgesia after axillary block with mepivacaine, without affecting onset and duration of sensory and motor block.

Reference:

1 Seow et al. *Anesthesiology* 1982; 56: 177–183.

A-381

Paravertebral analgesia increases latissimus dorsi flap tissue oxygen tension compared with intravenous morphine analgesia after mastectomy with immediate breast reconstruction

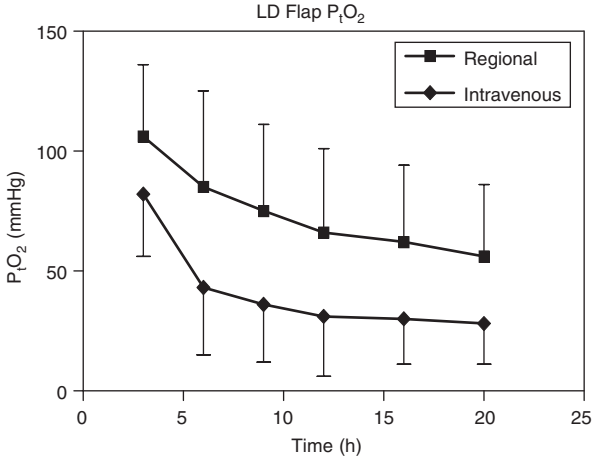
D.J. Buggy, M.J. Kerin

Department of Anaesthesia, National Breast Screening Programme and The Mater Miscericordiae Hospital, Dublin, Ireland

Background and Goal: Directly-measured tissue oxygen tension (P_tO_2) reflects the adequacy of local tissue oxygenation and influences surgical-wound healing.[1] Epidural analgesia increases P_tO_2 compared with IV morphine analgesia after abdominal surgery.[2] We tested the hypothesis that paravertebral regional analgesia would increase P_tO_2 compared with IV patient-controlled analgesia.

Methods: Twenty patients undergoing mastectomy with immediate latissimus dorsi breast reconstruction were randomised to receive either general anaesthesia (GA) with postoperative IV morphine analgesia or combined GA/paravertebral anaesthesia with continuous paravertebral postoperative analgesia in this prospective, open study. All patients had a tissue oxygen sensor implanted in the flap muscle. The oxygen sensor was located within a subcutaneous, saline-filled tonometer, on a single-use probe and displayed on a digital bedside monitor. Data was downloaded continuously for 20 hours postoperatively.

Results: P_tO_2 was significantly higher in paravertebral patients (Fig). Intraoperative and postoperative core temperature, fluids administered and mean arterial pressure was similar in both groups.



Conclusion: Postoperative P_tO_2 was higher for 20 hr after breast reconstruction with paravertebral analgesia, compared with IV morphine analgesia, reducing the risk of surgical-wound infection.

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A-382

Sub-Tenons vs. peribulbar anaesthesia – the question is

M. Kendrisic, N. Tomanovic*, M. Ivic, M.M. Kendrisic

Department of Anaesthesia and Intensive Care, Health Centre Sremska Mitrovica, FR Yugoslavia, Kent and Canterbury Hospital, Canterbury, UK, Sremska Mitrovica, Yugoslavia

Background and Goal of study: Sub-Tenon's block has become a safe alternative to peribulbar block in patients undergoing ophthalmic surgery. We compared these two techniques by comparing the volume of local anaesthetic (LA) used, the interval from administration of LA until the operation, the patients discomfort during the injection and throughout the operation, the akinesia and the presence of minor complications (conjunctival haemorrhage and/or chemosis).

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Patients and Methods: After approval of the local ethics committee, two groups of spatients were included in this prospective randomised study. Group P(peribulbar block) of 68 patients aged 57–88 (ASA II–III) and group S(Sub-Tenon's block) of 62 patients aged 53–87 (ASA II–III). Peribulbar block was performed with a 25G, 2.5 cm long needle with two injections, using the transconjunctival approach. Sub-Tenon's block was performed with a 19G, blunt curved cannula. All the patients were administered a mixture of 2% Lignocaine and 0.5% Bupivacaine.To assess patient discomfort a visual analogue pain score chart was used. Statistics were analysed with the Chi-Squared test and the Student's *t* test.

Results:

	S group	P group	p value
Vol. of anaesthetic (ml)	4,8 + 0,39	11,72 + 1,69	$p < 0,01$
Onset of block (min)	6,56 + 1,40	13,33 + 1,94	$p < 0,05$
Pain on injection (mean)	1,33	2,8	$p < 0,05$
Pain of operation (mean)	0,45	1,3	$p > 0,05$
Total akinesia	41 (67%)	31 (31%)	$p < 0,01$
Partial akinesia	16 (25%)	28 (41%)	$p < 0,01$
Ptosis complete	13 (21%)	38 (56%)	$p < 0,01$
Ptosis incomplete	21 (34%)	24 (36%)	$p < 0,01$
Chemosis	58 (94%)	3 (4%)	$p < 0,01$
Conj. haemorrhage	23 (37%)	1 (2%)	$p < 0,01$

Conclusions: Sub-Tenon's block is more efficient than peribulbar block. It requires a smaller amount of anaesthetic, onset of the block is faster and akinesia is more complete. Pain during injection is significantly lower while during the operation anaesthesia is satisfactory in both methods. Advantages of peribulbar block are a greater effect on orbicularis oculi and levator palpebral muscle. Also, the incidence of side effects is significantly lower.

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A-383

Sub-Tenons anaesthesia – educational method

M. Kendrisic, N. Tomanovic*

*Department of Anaesthesia and Intensive Care, Health Centre Sremska Mitrovica, FR Yugoslavia; *Kent and Canterbury Hospital, Canterbury, UK*

Background and Goal of Study: Sub-Tenon's block is a reliable local anaesthesia technique for cataract surgery. For facoemulsification operative technique, ophthalmic surgeons practice on pig cadaver eyes which are structurally similar to human. Analogue to that, we performed the sub-Tenon's block by injecting contrast into the eyes of pig cadavers and a distribution of the contrast media was observed.The purpose of the study was to describe the spread of injected solution as well as the mechanism of development of analgesia and akinesia.

Materials and Methods: After approval of the local ethics committee 10 pig cadaver heads were used (20 eyeballs) as well as 32 enucleated eyeballs. At the inferonasal quadrant of the eyeball, 5 mm from the corneal limb, an incision was made. A 19G, blunt, curved cannula was then advanced along the curvature of the globe until a depth of approximately 15–20 mm was reached. For the enucleated eyeballs, 5 ml of gentiana violet solution was injected. For ten of the rest of the eyeballs 3 ml of radiosensitive contrast (Gastrografin®) were used and for another ten eyeballs 5 ml of the same contrast were used.

Results: We observed the presence of contrast solution on the enucleated eyeball structures. The eyeballs and ocular muscles were evenly coloured over the 23 models (71.87%).The optic nerve and its sheath was coloured on five of the models (15.62%). The distribution of the radiosensitive contrast in the twenty remaining eyeballs was tested using X-rays. Eyeballs into which less than 3ml were injected the spread of the contrast media was restricted to the sub-Tenon's space, which in itself was not wholly filled with the contrast media. When, however, 5 ml were injected the sub-Tenon's space was completely filled with contrast media. A smaller diffusion of the contrast media was also identified in the ocular muscles.

Conclusion: This study confirms that sub-Tenon's block is an episcleral injection. A distribution of the contrast was identified at the fascias of the ocular muscles and optic nerve sheaths. Sub-Tenon's block is a safe and efficient local anaesthesia technique. It is easy to teach and we recommend that anaesthetists practice it in vitro.

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A-384

Anesthetic management of Charcot-Marie-Tooth (CMT) disease

S.N. Narouze, E. Farag, J.E. Tetzlaff

Department of Anesthesiology and Critical Care Medicine, The Cleveland Clinic Foundation, Cleveland, USA

Background: We report the anesthetic management of a patient with Charcot-Marie-Tooth disease and review the pertinent anesthetic issues.

Case Report: A 29 year-old (60 kg) white female presented for a right ankle arthrodesis with a past medical history of Charcot-Marie-Tooth disease. The patient underwent right ankle arthrodesis under continuous lumbar epidural anesthesia at L3–L4 with bupivacaine 0.75%. An initial bolus of 12 ml in divided doses was administered. The patient received an additional 6 ml after 90 min as the surgery lasted about 3 hours. The patient was then started on an epidural patient controlled analgesia (PCA) pump for postoperative pain relief. The patient had no complications from the epidural anesthesia. She had good pain relief and was discharged home on the second postoperative day.

Discussion: Charcot-Marie-Tooth disease (peroneal muscular atrophy) is the most common form of hereditary motor-sensory polyneuropathy. It occurs most commonly as a dominantly inherited demyelinating neuropathy. The diagnosis is based upon abnormal nerve conduction velocities and sural nerve biopsy[1]. The anesthesiologist caring for the CMT patient will be faced with a number of decision dilemas related to the potential for: (1) susceptibility to malignant hyperthermia (MH)[2], (2) an exaggerated response to non-depolarizing muscle relaxants, (3) a hyperkalemic response to the depolarizing muscle relaxant succinylcholine, (4) an abnormal response to induction agents, (5) neuronal sensitivity to local anesthetic agents, and (6) postoperative ventilatory failure.

Conclusion: The authors report a successfully administered epidural anesthesia in a CMT patient and suggest that this approach may be considered as an anesthetic option.

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A-385

Does general anesthesia affect regional anesthesia quality? Randomized controlled trial evaluating the effect of intravenous and balanced anesthesia on caudal ropivacaine pediatric block

P. Ingelmo[1], B. Locatelli[2], S. Di Marco[2], A. Spotti[2], S. Clarizia[2], E. Zaranko[2], V. Sonzogni[2]

[1]Facoltà di Medicina. Università Milano Bicocca, Italy; [2]Dipartimento di Anestesia e Rianimazione. Ospedali Riuniti di. Bergamo, Italy

Background and Goal of Study: Caudal block may influence general anaesthesia effects. These study evaluate general anaesthesia effects on paediatric caudal block.

Materials and Methods: After institutional approval and informed consent 60 patients (ASA I–II, 0–8 years, 5–20 kg, inguinal hernia, hydrocele or phimosis), using a computer generated list, were randomised to receive: ketamine 1–2 mg/kg, propofol 2 mg/kg bolus and propofol infusion of 125 mcgr/kg/min (IV group) or sevoflurane up to 5% and fentayl 2 mcgr/kg followed by sevofluorane 1,5% (BAL group). Both groups were premedicated with rectal atropine 0,01 mg/kg and midazolam 0,5 mg/kg. Caudal block was performed with ropivacaine 0,2%, 0,25% and 0,3% in double blind fashion. End points were: block onset (skin stimulus every 3 min. from local anaesthetic injection); motor block (Bromage > 0)(1) at wake up (Aldrete $\geqslant 8$)(2) and 180 min. after caudal block; pain (Objective Pain Scale $\geqslant 4$)(3) before 180 min. of caudal block. Continuous data were analysed with Anova or Kruskal-Wallis test and non continuous data with chi-square or Fisher exact test.

Results and Discussions: 56 patients were included and 4 excluded (lack of premedication). There were no statistical differences between ropivacaine concentration effects. Results are presented as mean and standard deviation (±) or 95% confidence interval (%)

Group	IV (n 28)	BAL (n 28)	P
Anaesthesia. (min)	46 (±21)	39 (±11)	0,29
Block onset (min)	6,9 (±4,3)	3,8 (±1,7)	0,0002
Motor block at wake up	15/28 (34–73%)	13/28 (28–66%)	0,59
Motor block at 180 min.	2/15 (2–41%)	6/13 (19–75%)	0,06
Pain before 180 min.	2/28 (1–24%)	5/28 (6–40%)	0,21

Conclusion(s): Onset time difference between BAL and IV group confirms that general anaesthesia can affect the caudal block quality. The persistent motor block with balanced anaesthesia should be investigated.

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A-386

The effect of adding to lidocaine morphine or tramadol during brachial plexus blockage on postoperative analgesia time

N. Doruk, S. Atici, Z. Özer, N. Sucu, E. Bilgin, I. Cinel, S. Epözdemir, U. Oral

Departments of Anesthesiology and Reanimation, Cardiovascular Surgery, Medical Faculty of Mersin University, Mersin, Turkey

Background and Goal of Study: Combined using of local analgesic and opioids to prolong the analgesia time during brachial plexus blockage is a widespread practice.

In this study the effect of lidocaine/morphine and lidocaine/tramadol usage during brachial plexus blockage on postoperative analgesia period was planned to compare.

Materials and Methods: 75 patients (ASA I-II) scheduled for arm and forehand surgery were included in the study. They were divided into three groups. Premedicated by midazolam (1 mg, IV). After giving suitable position for brachial plexus blockage to patients 22 Gauge 5 cm needle was connected to peripheric nerve stimulator (0.2–5 mA, frequency of 1 Hz, 50–500 μs). 30–40 ml lidocaine with a concentration of 1% was enjected to the patients in group I, 30–40 ml 1% lidocaine + 5 mg morphine was enjected to the patients in group II, 30–40 ml 1% lidocaine + 50 mg tramadol was enjected to the patients in group III. After blockade was performed analgesic level evaluated with VAS (visuel analog scala, 0:no pain, 10:severe pain) and motor blockade was stressed with motor blockade scala, at 5, 10, 15, 30, 60 minutes and 2, 3, 4, 5, 6, 12 and 24 hours. Respiratory and hemodynamic parameters were also recorded at the same intervals.

Results and Discussions: There were no statistical difference between groups by means of demographic, hemodynamic and respiratory parameters ($p > 0.65$). VAS values were not different between two groups on the postoperative period. ($p > 0.05$). No motor blockage, side-effects or complications were dedected.

Conclusion(s): It was concluded that the usage of lidocaine and opioids together during brachial plexus blockade was not effective than lidocaine alone on postoperative pain.

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A-387

Optimal target concentration of alfentanil for the sedation of urologic surgical patients

D.H. Kim

Department of Anesthesiology, College of Medicine, Dankook University, Cheonan, Republic of Korea

Background and Goal of Study: The purpose of this study was to define the optimal target concentration of alfentanil effective in achiving a sedative, antianxietic, and analgesic effect during spinal anesthesia in urologic patients.

Materials and Methods: Sixty patients underwent spinal anesthesia with 0.5% hyperbaric bupivacaine 12–18 mg and received a target controlled infusion (TCI) of alfentanil with 0 ng/ml (group A0, n = 15), 20 ng/ml (group A20, n = 15), 30 ng/ml (group A30, n = 15) or 40 ng/ml (group A40, n = 15). Sedation scale, bispectral index (BIS), anxiety level and infusion rate of alfentanil were checked during the operation.

Results and Discussions: Sedation scale was significantly higher in group A30(3.3) and A40(3.8) than group A0(1.9) and A20(2.5) ($P < 0.05$). Incidences of intraoperative hypotension, respiratory depression, postoperative nausea and vomiting, and dizziness were significantly higher in group A40 than the other groups($P < 0.05$). There were no significant differences in BIS, anxiety level and incidences of recall of the operative procedure among the groups($P < 0.05$).

Conclusion(s): TCI of alfentanil with 30 ng/ml produces effective sedation and antianxiety without significant side effects during spinal anesthesia.

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A-388

The efficacy of caudal ropivacaine and clonidine versus ropivacaine and meperidine for postoperative analgesia in children

P. Papagiannopoulou, M. Georgiou, E. Sfyra, Th. Georgiadou, A. Katsanikos, F. Kanakoudis

Department of Anesthesiology, "G. Gennimatas" Hospital, Thessaloniki, Greece

Background and Goal of Study: The aim of this study was to assess the analgesic efficacy and the incidence of adverse effects postoperatively, after caudal blockade in children, using two different drug combinations: ropivacaine plus meperidine or ropivacaine plus clonidine.

Materials and Methods: Thirty five paediatric patients (ASA I-II), scheduled for moderate paediatric surgery were randomly assigned to receive a single caudal epidural injection of 1 ml Kg^{-1} ropivacaine 0.2%, with additional meperidine (0.5 mg Kg^{-1} – Group MEP, n = 17) or clonidine (3 μg Kg^{-1} – Group CLO, n = 18), after the end of surgery and before anaesthesia recovery. The general anaesthetic technique was standardised in all groups. Patients were evaluated at 8 and 24 h postoperatively for pain intensity (with visual analogue scale – VAS), for motor blockade (with Bromage scale), for sedation (with a 4-point scale), for additional analgesics and for nausea, vomiting and pruritus. Statistical analysis was performed with student's t-test and Fisher's exact test as appropriate. A $p < 0.05$ value was considered statistically significant.

Results and Discussion: Demographic data were similar in both groups. Although VAS scores, at all times recorded, did not differ statistically between groups, patients of group CLO experienced less pain compared to group MEP (VAS scores at 8h postoperatively: Group MEP:0.76 ± 1.15, Group CLO:0.56 ± 1.54 and at 24 h: Group MEP:0.39 ± 0.98, GroupCLO:0). Paracetamol consumption was lower in Clonidine group, although without reaching level of significance (At 8 h postoperatively: in group CLO 25 ± 65 mg, in Group MEP 30 ± 95 mg and at 24 h: in group CLO 31 ± 119 mg and in group MEP 36 ± 132 mg). Motor blockade and sedation scores were low and similar in both groups. The incidence of nausea, vomiting (11.7%, 5.55% in groups MEP and CLO respectively) and pruritus was with no statistical difference in both studied groups.

Conclusion: Both drug combinations investigated in this study provided effective postoperative analgesia in children, but the combination of ropivacaine plus clonidine may be preferable because of its lower pain intensity and paracetamol consumption.

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Comparison of tramadol–lidocaine, sufentanil–lidocaine and plain lidocaine for brachial plexus blockade

J. Celik, C.O. Ogun, A. Duman, N. Gormus, S. Okesli

Department of Anaesthesia and Intensive Care, Meram Medical School, University of Selçuk, Konya, Turkey

Background and Goal of Study: Tramadol has a dual mode of action with weak μ-opioid agonist effects and amine-uptake-inhibiting actions which may play a role in activating monoaminergic inhibition of pain. We examined the analgesic effects of tramadol and sufentanil with lidocaine for brachial plexus block in patients undergoing upper extremity surgery.

Material and Methods: After institutional approval and informed patient consent, patients were randomized into 3 groups to receive axillary plexus blockade with either of 1% lidocaine and normal saline (Group L) (n = 20), tramadol 100 mg and 1% lidocaine (Group TL) (n = 20), or sufentanil 20 μg and 1% lidocaine (Group SL) (n = 20) in total 40 ml solution. Onset time and duration of sensory and motor blocks were measured. The sedation score was evaluated on a five-point scale. Heart rate, systolic and diastolic arterial pressure, oxygen saturation, respiratory rate and side effects were recorded intraoperatively. ANOVA test, Bonferroni test and χ^2 analysis were used for statistical analysis. Results are given as mean ± SD. $p < 0.05$ is considered as significant.

Results: Sensory analgesia was adequate for surgery in 57 patients. Three patients in Group 1 required additional local anaesthetic infiltration. In all three study groups, the onset time of sensory and motor block were similar. Duration of sensory and motor block were significantly longer ($p < 0.05$) in Group TL (234 ± 45 min and 210 ± 32) than in Group L (168 ± 28 min and 146 ± 31 min) and Group SL (172 ± 35 min and 160 ± 42 min). Sensory and motor block characteristics were similar between groups L and SL. Haemodynamic and respiratory parameters and sedation scores were similar to baseline values and no differences were observed among the groups. No side effects including respiratory depression, nausea, vomiting, or itching were reported in all three groups.

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Conclusion: The combination of tramadol with lidocaine provides a significant prolongation of sensory and motor blockade without side effects in brachial plexus block without changing the onset time. Combination of sufentanil and lidocaine results in similar block characteristics with plain lidocaine.

A-390

Effect of sciatic nerve block upon local TNF-alpha release in an inflammatory animal model

C. Leduc, O. Toutirais, M. Gentili, J.P. Estèbe, J.P. Moulinoux, C. Ecoffey

Department of Anaesthesiology II, and Laboratory of cellular biology, Hôpital Universitaire Pontchaillou, Rennes, France

Background and Goal of Study: In an carrageenan rat model, sciatic nerve block was able to reduce inflammatory edema (1), we studied the effect of local block upon the local Tumor Necrosis Factor-alpha (TNF) release in the same model.

Materials and Methods: Four groups of 10 Sprague-Dawley males (250–300 g) had a 0.2 ml injection of 1% carrageenan in the right hind paw under 2% halothane; a 2 ml sciatic nerve block was performed in 3 groups with respectively saline, 0.5% bupivacaine and 2% lidocaine and none in the fourth group (control). Animals were killed 3hr later and TNF-alpha was determined by a specific ELISA test (R&D systems) in hind paw exsudate. Results are expressed in picogrammes per ml of exsudate. Statistical analysis used Mann and Whitney *U* test. ($P < 0.05$).

Results and Discussions: TNF levels in groups bupivacaine ($1637 \pm 837 \pm 92\%$ $p < 0.05$) and lidocaine ($2198 \pm 600 + 158\%$ $p < 0.01$) were significantly greater than for control group (695 ± 384) and saline (851 ± 470) this could be due to a delay in TNF release carra:

Conclusion(s): We suggest that the rate of TNF could be due a delay in release, and this could be associated to the anti-inflammarory effect of local anaesthetics.

Reference:

1 M.E Gentili, X.Mazoit ,D.Fletcher et al. Anesth.Analg.1999;89:979–984.

A-391

Effects of postoperative epidural analgesia on local cellular metabolism, monitored by subcutaneous microdialysis

K. Tavernier, C. De Deyne, L. Schouteten, K. Vissers, T. Pittevils*, E. Mortier**, R. Heylen

Departments of Anesthesia and Orthopedic Surgery, Department of Anesthesia**, University Hospital Gent, Ziekenhuis Oost-Limburg, Belgium*

Background and Goals: Until yet, most studies on the metabolic effects of epidural analgesia have focused on metabolic markers in blood or urine to represent whole body estimates. Few studies have addressed the tissue's local metabolism in the anesthetized area during long-term postoperative epidural analgesia. Tissue microdialysis (MD) enables the local monitoring of metabolic substances (glucose, lactate or glycerol).

Material and Methods: 15 patients undergoing knee prothesis surgery were included. All pts have received an epidural catheter (L3–L4) before induction of anesthesia. Postoperative epidural analgesia was performed by PCEA modus (ropivacaine 1.6 mg/ml + clonidine 3 μg/ml + sufentanil 2 μg/ml set at 2 ml/hr). A MD catheter (CMA60) was inserted subcutaneously after induction of anesthesia, was connected to a perfusion pump with Ringer's solution set at 0.3 μl/min. The MD catheter was maintained for the first 24 h postoperatively and every 2 hours a microvial containing the dialysate was analysed for glucose, lactate, pyruvate and glycerol.

Results: In all 15 pts, MD catheter was easily inserted and maintained for 24 hours. Glucose, lactate and pyruvate revealed a minor gradual increase over the first hours postoperatively. On the morning of day 2, we observed marked variations in glucose, and minor variations in lactate and pryuvate, that most probably went along with oral glucose intake. In all pts, we observed a 5- to 10-fold increase in glycerol between 16 and 20 hrs postoperatively. All these increases were observed during or after the first kinetec mobilization. However, in none of these patients we observed an excessive high VAS score or an excessive high need for PCEA support.

Conclusions: Subcutaneous MD seems a promising tool to assess local metabolic changes in the early postoperative period. Especially, the observed imbalance between the sympatholytic effects induced by epidural analgesia and the sympathetic stress induced by physical activity in the operated area might reveal important information as to optimal postoperative stress relief.

A-392

The addition of dexamethasone or tenoxicam to lidocaine for intravenous regional anaesthesia

Z. Bigat, N. Boztug, N. Cete, G. Arici, E. Ertok

Department of Anaesthesiology, Akdeniz University Faculty of Medicine, Antalya, Turkey

Background and Goal of Study: Intravenous Regional Anaesthesia (IVRA) is a safe and effective way to provide anaesthesia for hand surgery expected to last less than 1 hour, but it often does not provide effective postoperative analgesia so various analgesics have been administered concomitantly with the local anaesthetic in IVRA (1). Our aim was to compare the effects of lidocaine and lidocaine + tenoxicam or lidocaine + dexamethasone on analgesia and anaesthesia in IVRA.

Materials and Methods: After getting the approval of the ethic committee in ASA I–II, 70 patients undergoing on a surgery for Carpal Tunnel Syndrome or higroma, separated into 3 groups randomly. For IVRA; in group L ($n = 25$) 3 mg/kg lidocaine + isotonic NaCl = 40 ml, in group LT ($n = 20$) 3 mg/kg lidocain + 20 mg tenoxicam + isotonic NaCl = 40ml, in group LD ($n = 25$) 3 mg/kg lidocaine + 8 mg dexamethasone + isotonic NaCl = 40 ml solution was used. The initiation of motor and sensorial block (MB,SB) was assessed in every minute. Pulse rate, mean arterial blood pressure, PaO_2, visual analog scale (VAS) and verbal pain scale (VPS) were observed intraoperatively and 2 hours postoperatively. 2 hours later if there is pain, 500 mg paracetamol tablet was given orally. Need for analgesics during the first 24 hours was recorded. Mann–Whitney U and Independent Sample T Tests were used for statistical analyse and $p < 0.05$ was reported as meaningful.

Results and Discussions: Initiation of SB (mean ± SD) was higher in group L ($L = 4.16 \pm 2.88$ min, $LT = 2.70 \pm 1.34$ min, $LD = 2.90 \pm 2.13$ min) ($p < 0.05$). Duration of SB was shorter in group LT but the duration of the operation was shorter in group LT too. Duration of the MB were similar between groups ($p > 0.05$). After the tourniquet release recovery time of MB and SB were longer in group LD than LT ($p = 0.02$, $p = 0.006$). VAS and VPS values in group LD were lower than the other groups. The need for the analgesics in the first 24 hour were similar between LT and LD but higher in group L ($p < 0.05$).

Conclusion(s): The addition of 20 mg tenoxicam or 8 mg dexamethasone to lidocaine for IVRA in patients undergoing ambulatory hand surgery improves postoperative analgesia without causing significant side effects during the first postoperative day.

Reference:

1 Scott S.R., Robert B.S. et all. Anaesthesiology 1999; 91:654–8.

A-394

Loco-regional anesthesia for carotid endarterectomy

D. Masinovic, D. Matlekovic, M. Buhin, D. Cakalo-Loncar

Department of Anaesthesiology and Intensive Care Medicine, University Hospital "Merkur", Zagreb, Croatia

Background and Goal of Study: Loco-regional (LR) anaesthesia for CEA has been introduced again because sophisticated neurological monitoring still not exist. We analysed the patients who underwent CEA under LR and general anaesthesia (GA) and compared regarding intraoperative and postoperative complications.

Materials and Methods: We retrospectively analyzed 182 patients undergoing CEA between July 2001 and October 2002. Patients were divided in two groups regarding the type of anaesthetic technique. Group A ($n = 71$) was operated on under GA. GA was introduced with etomidate 0,2 mg/kg and rocuronium 0,9 mg/kg and maintained with O_2/N_2O, propofol infusion (100–200 mg/kg/min), fentanyl and rocuronium on demand. Group B ($n = 111$) was operated on under LR anaesthesia. We performed superficial cervical plexus block with 1% lignocain (max dose 3 mg/kg). In all patients, catheter was placed in radial artery for continuous measurement of blood pressure. We analyzed intraoperative complications, ICU and hospital stay and postoperative morbidity and mortality.

Results and Discussion: In group B 107 pts (96.4%) was successfully operated on under LR anaesthesia while four pts. (3.6%) had to be converted to GA due to complete loss of consciousness and airway obstruction.

ICU stay was the same in both groups while hospital stay was slightly shorter in LR group (4.7 vs. 6.3 days). One patient in both groups suffered massive stroke and died.

Results	LR group (111 pts)	GA group (71 pts)
ICU stay	1 day	1 day
Hospital stay	4,7 days	6,3 days
Stroke	1	1
TIA	1	1
MI	0	0
Mortality	1	1

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Our study showed low conversion rate (3.6%) and good compliance of the patients involved while stroke and death rate was the same in both groups.

A-395

Ultrasound guidance facilitates performance and improves quality of supraclavicular blockade

S.R. Williams, P. Chouinard, G. Arcand, P. Harris, M. Ruel, F. Girard

Department of Anesthesiology, Centre Hospitalier de lUniversité de Montréal, Montreal, Canada

Background and Goal of Study: Ultrasound guidance is an attractive new technique which may improve the quality and safety and reduce the technical difficulty of peripheral nerve blockade. The present study prospectively compared ultrasound and neurostimulator guided supraclavicular blockade to surface anatomy and neurostimulator guided supraclavicular blockade in order to determine whether the theoretical advantages of ultrasound guidance translated into significant clinical superiority.
Materials and Methods: Eighty patients were randomised into two groups of 40, group US (supraclavicular block guided in real time by an ultrasonic image, with neurostimulator confirmation of correct needle position) and group NS (supraclavicular block using the subclavian perivascular approach and neurostimulator confirmation of correct needle position). Blocks were performed using 0.5 ml/kg (40 ml maximum) of local anesthetic solution comprised of equal parts of 2% lidocaine and 0.5% bupivacaine, along with epinephrine 1:200000. The onset of motor and sensory block for the musculocutaneous, median, radial, and ulnar nerves was evaluated every five minutes over a 30 minute period. The incidence of serious complications was verified one week after blockade. Means were compared using t-tests while proportions were compared using a Fisher exact test.
Results and Discussions: Surgical anesthesia was achieved in 85% of patients in group US and 77.5% of patients in group NS ($p = 0.28$). No patient in group US and 7.5% of patients in group NS required general anesthesia ($p = 0.12$). The quality of ulnar sensory block was significantly inferior to the quality of block in other nerve territories in group NS ($p = 0.01$–0.05), but not in group US ($p = 0.24$). The performance of the block required an average of 9.8 minutes in group NS, and 5.0 minutes in group US ($p = 0.0001$). No major complication occurred in either group.
Conclusion(s): Ultrasound-guided supraclavicular block can be performed more quickly and provides a block of better quality than supraclavicular block using only anatomic landmarks and neurostimulator confirmation.

A-396

Can subcutaneous microdialysis be used to monitor local sympatholytic effects induced by epidural analgesia?

L. Schouteten, C. De Deyne, K. Vissers, T. Pittevils*, H. Adriaensen**, R. Heylen

Departments of Anesthesia and Orthopedic Surgery, Department of Anesthesia**, University Hospital Antwerpen, Ziekenhuis Oost-Limburg, Genk, Belgium*

Background and Goals: The sympathetic nervous system, which can be attenuated by epidural anesthesia, influences lipolysis and the release of glycerol. Until yet, few studies have analyzed the tissue's local metabolic effects induced by epidural analgesia. Microdialysis (MD) provides the possibility of monitoring interstitial substances, such as glycerol, in various tissues. In the present study, we evaluated if subcutaneous MD might detect changes in local metabolism between pts undergoing surgery with or without epidural analgesia.
Material and Methods: With IRB approval, 20 pts (knee replacement surgery) were included. Patients were randomly assigned to general anesthesia (GEN; n:10) or to general + epidural anesthesia (EPI; n:10). In the EPI group, an epidural catheter was inserted (L3–L4) before induction of anesthesia (epidural bolus of bupivacaine 50 mg). In both groups, general anesthesia was induced (and maintained) with propofol TCI, O_2/N_2O, fentanyl, rocuronium. After induction of anesthesia, a MD catheter (CMA 60) was inserted into the subcutaneous adipose tissue of the abdominal wall (i.e. in the anesthetized area). It was connected to a MD pump and perfused at 5 μl/min. This high pump flow rate enabled the collection of dialysates every 5 min. Dialysates were analysed for glucose, lactate, pyruvate and glycerol.
Results and Discussion: There were no differences between the groups regarding gender, age, weight or height. We did not observe any difference in local glucose or lactate between both groups, but glycerol changes differed significantly. In the GEN group, we observed a significant increase in local glycerol (to four-fold values) during surgery. We did not observe this increase in local glycerol during surgery in the EPI group. In both groups we however observed significant increases in glycerol at emergence from general anesthesia or in the first hour postoperatively. This later sympathetic stress reaction observed in the EPI group might be explained by a weakened epidural analgesia in the dermatomes where the MD catheter was inserted.
Conclusion(s): Subcutaneous microdialysis offers the ability to monitor changes in local metabolism induced by the sympatholytic effects of epidural analgesia.

A-397

Patient-controlled extended femoral block for arthroscopic knee surgery

G. Vitale, E. Martinez, E. Stocco, S. Sordi, E. Montrasio, L. Mazza, B. Cadore, M. Saini, M. Amigoni, P. Maisano

Department of Anesthesia, San Gerardo Hospital, Monza, Italy

Background and Goal of Study: Extended femoral block is effective after prosthetic surgery.(1) We compared patient-controlled femoral analgesia with 2 different doses of ropivacaine versus intraarticular analgesia after anterior cruciate ligament reconstruction (ACLR).
Materials and Methods: Consentient ASA I and II patients undergoing ACLR with subarachnoid anesthesia were randomized to receive: (1) Patient-controlled analgesia with 0.5% ropivacaine, 10 ml bolus dose, 20 min lock-out time, via a femoral catheter inserted through an electrostimulated needle at inguinal level; (2) As in group 1, with a 4 ml bolus dose; (3) Intraarticular analgesia with a single bolus of 0.5% ropivacaine 20 ml. Iv ketoprofen was given on demand; sc morphine was used as rescue analgesic. A blinded observer registered VAS pain scores at 1, 3, 6, 12, 24, 36 hours, total consumption and time of first request of ketoprofen and morphine, occurrence of local anesthetic side effects. Patients unsuited for spinal anesthesia or non compliant were excluded. Data (mean ± SD) were compared using analysis of variance with Bonferroni correction. Time of first analgesic request was described by Kaplan Meier curves and compared by log-rank test.
Results and Discussion: 60 patients were studied (age: 18–45 years; 51 males). Pain scores were lower in group 1 than in 3 ($p = 0.01$ among groups; 1 vs 3, $p = 0.01$; 2 vs 3 $p = 0.5$). Ketoprofen consumption was lower in group 1 than in 3 (1: 185 ± 138 mg; 2: 263 ± 130 mg; 3: 345 ± 131 mg; $p < 0.01$ among groups; 1 vs 3, $p < 0.01$; 2 vs 3 $p = 0.2$). Morphine consumption was lower in group 1 than in 3 (1: 0 mg; 2: 1.6 ± 5; 3: 5 ± 6 mg; $p = 0.01$ among groups; 1 vs 3, $p < 0.01$; 2 vs 3, $p = 0.06$). In groups 1 and 2 the proportion of analgesic-free patients decreased in time more slowly than in 3 ($p < 0.01$ for 1 vs 3 and 2 vs 3). Number of patient-controlled boluses was not different between group 1 and 2 (1: 16 ± 8; 2: 18 ± 10). No side effects occurrred.
Conclusion: High volume patient-controlled femoral analgesia was safe and more effective than conventional intraaticular analgesia after ACLR.
Reference:
1 Singelyn et al. *Anesth Analg* 2001; 92: 455–459.

A-398

Combined sciatic-femoral nerve blockade: ropivacaine versus ropivacaine–clonidine mixture

M. Cittadino, F. Tropea, M. Pezzi, B. Amantea, E. Santangelo

Department of Experimental and Clinical Medicine "G. Salvatore", University of Catanzaro, Catanzaro, Italy

Background and Goal of Study: Combined sciatic-femoral nerve block represents one of the most widely used regional anaesthesia techniques for interventions involving the foot. In this randomised study, we have compared ropivacaine and a ropivacaine–clonidine mixture during combined sciatic-femoral nerve block.
Materials and Methods: After informed consent, 24 patients undergoing surgery for elective hallux valgus repair were randomly assigned to one of the two groups as follow:

A group (n = 12) received Ropivacaine 0.75% (25 mL);
B group (n = 12) received Ropivacaine 0.75% + Clonidine 50 μg.

All nerve blockades were performed using a peripheral nerve stimulator. Each patient received intravenous Midazolam (1 mg) and Atropine (0.5 mg) 5 min prior to induction of the block. Time required for onset of sensory and motor block on the operated limb and resolution of motor block, as well as duration of post surgical pain was recorded. Analysis of variance and t tests were used for the statistical comparisons.
Results: The two groups were similar with regard to demographic variables and duration of surgery (50 ± 20 min). The onset of sensory and motor blockade, defined as the time corresponding to the end of the regional anaesthesia, and resolution of block were similar in A group than B group. Duration of postoperative analgesia was longer in B group (1020 ± 250 min) than A group (960 ± 300 min).
Conclusions: Quick onset of block with prolonged postoperative analgesia is an important goal in peripheral nerve blockade[1]. Our results show that

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there were no clinically relevant advantages in terms of onset time and quality of the block in two groups, but duration of postoperative analgesia with ropivacaine-clonidine mixture was longer than only ropivacaine during combined sciatic-femoral nerve block.

Reference:

1 Fanelli G, Casati A, Beccaria P et al. Anesth Analg 1998; 87:597–600.

A-399

Use of clonidine as adjuvant in brachial plexus block: a randomized prospective study

F. Tropea, M. Pezzi, M. Cittadino, A.M. Giglio, B. Amantea, E. Santangelo

Department of Experimental and Clinical Medicine "G. Salvatore", University of Catanzaro, Catanzaro, Italy

Background and Goal of Study: The purpose of the present study was to evaluate the effects of adding 1,5 $\mu g\,kg^{-1}$ clonidine to 25 ml of ropivacaine 0,75% for brachial plexus block before carpal tunnel surgical release.

Materials and Methods: After informed consent, 80 ASA I–II physical status patients, aged 40–70 years, undergoing carpal tunnel surgical release, were randomly divided in two groups. Each patient received intravenous Midazolam (1 mg) and Atropine (0.5 mg) 5 min prior to induction of the block.

In group A (n = 40), the brachial plexus block was performed with 25 ml of 0,75% ropivacaine, in group B (n = 40), the brachial plexus block was obtained with a mixture composed of clonidine 1,5 $\mu g\,Kg^{-1}$ and 25 ml of 0,75% ropivacaine .

Nerve block was placed using a nerve stimulator with the multiple injection technique. Onset time (pinprick test) and duration (first analgesic request) of analgesia were recorded. SAP, DAP, HR, SpO_2, sedation and pain degree were recorded before, during and after surgical procedure. Analysis of variance and t tests were used for the statistical comparisons.

Results: No differences in the onset time and the quality of analgesia were observed between two groups. No significant variations of haemodinamic parameters were observed. The duration of analgesia was longer in B group (820 ± 80 min) than in A group (630 ± 90 min).

Conclusion: Adding 1,5 $\mu g\,kg^{-1}$ clonidine to 25 ml of ropivacaine 0,75% for brachial plexus block prolongs the duration of analgesia without significant modification of haemodynamic parameters[1].

Reference:

1 Erlacher W, et al. Acta Anaesthesiol. Scand 2000;44:53–7.

A-400

Axillary block: does the anaesthesia of the medial and medial antebrachial cutaneous nerves before the neurostimulation modify the patient's pain?

J.P. Tourtier[1], G. Mion[1], P. Chazalon[1], C. Pelletier[1], P. Rivière[1], C. Héricheé[2], C. Le Marec[1], J.M. Saïssy[1]

danesthésie, [1]HIA Bégin – 94163, Saint Mandé, France; [2]Hôpital Antoine Béclère 92141, Clamart, France

Background and Goals: The axillary block (AB) is a technique of anaesthesia that is now commonly used. The subcutaneous infiltration for anaesthetising the medial and medial antebrachial cutaneous nerves can be carried out before, rather than after, the phase of neurostimulation. The goal of this study was to know whether the anaesthesia of these sensory nerves before the neurostimulation decreases patient's discomfort during AB.

Patients and Methods: This prospective study was made with approval of the Ethics Committee. 45 informed adults patients, undergoing elective orthopedic surgery, were randomly allocated in 2 groups:

– group A: subcutaneous infiltration after neurostimulation
– group B: subcutaneous infiltration of 5 mL of lidocaïne 1% 5 minutes before neurostimulation.

A premedication with 1.5 mg kg^{-1} of hydroxyzine was given on the previous evening and in the morning of the day of surgery. There was no associated IV sedation. The located nerves were anaesthetised with ropivacaine hydrochloride 7.5 mg mL^{-1}. The pain level evoked by neurostimulation was evaluated using a visual analogic scale (VAS). Data, expressed as mean ± standard deviation, were analyzed with a Student t-test.

Results: One patient was excluded for incomprehension of the VAS. Group A (n = 23 patients) and group B (n = 21 patients) were similar as far as age, sex, size and ASA class were concerned.

	B Group	A Group	Test t
VAS (mm)	30 ± 16	32 ± 15	p = 0,67 (NS)

Conclusion: Given the standard deviation (15 mm) and the number of patients in each group, the probability of showing a clinically significant difference of VAS (20 mm) was 80% (β = 0.2). Nevertheless, no significant difference was found during this study. Therefore, it should be emphasised that performing the subcutaneous infiltration before or after the phase of neurostimulation does not modify significantly the patient discomfort feeling during the AB.

A-401

Plasmatic concentrations of ropivacaine during regional anaesthesia using parasacreal sciatic nerve and femoral blocks

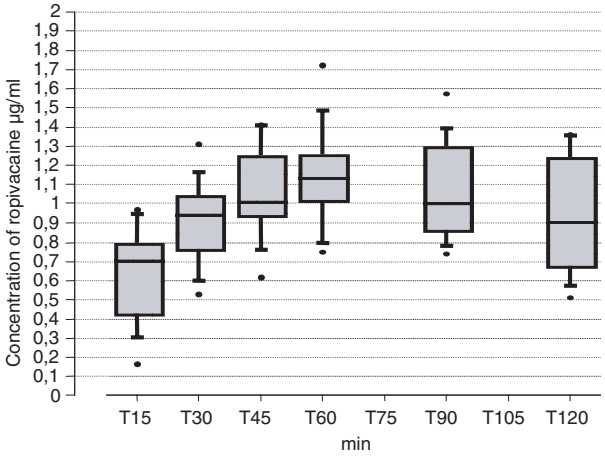
J.P. Tourtier[1], P. Chazalon[1], I. Drouillard[2], A. Carde[1], G. Fevre[1], J.M. Saïssy[1], G. Mion[1]

danesthésie, [1]HIA Bégin – 94163, Saint -Mandé, France; [2]HIA Clermont Tonnerre – 29240, Brest, France

Background and Goals: The aim of this study was to evaluate the venous concentration of ropivacaine observed at the time of the plasmatic peak (Cmax), after a regional anaesthesia (RA) combining parasacreal sciatic nerve and femoral blocks using ropivacaine 6 mg mL^{-1} (0.6%).

Patients and Methods: This prospective study was made with approval of Ethics Committee. 13 informed patients, (weight > 60 kg), ASA class 1 or 2, were included. Each received ropivacaine 0.6% 50 mL (20 mL on the sciatic nerve and 30 mL for the femoral block). Venous blood samples were collected 15, 30, 45, 60, 90, and 120 min. after the injection. Dosages were realised by gaschroma-tographic analysis coupled with mass spectrophotometry. Clinical effectiveness and possible adverse events were also studied. Data were expressed as mean ± sd.

Results: Cmax was 1.2 ± 0.3 $\mu g\,mL^{-1}$. The median time needed to reach the peak (Tmax) was 60 min (30–90). The delay of installation was 17 ± 8 min and the duration of analgesia was 773 ± 198 min. No sign of central neurological or cardiovascular toxicity was detected. One patient required a complementary sedation.



Conclusion: The 6 mg mL^{-1} ropivacaine was efficient for regional anaesthesia combining parasacreal sciatic nerve and femoral blocks. The maximum venous concentrations seem to be very close to the toxic range (1,2).

References:

1 Plowman AN, Bolsin S, Mather LE. *Anaesth Intensive Care* 1998; 26: 2: 204–6.
2 Mardirosoff C, Dumont L. *Can J Anaesth* 2000; 47: 1263.

A-402

Axillary block: does the palpation of the median nerve allow a faster realization?

J.P. Tourtier[1], P. Chazalon[1], P. Zetlaoui[2], F. Petitjeans[1], C. Descraques[1], J.M. Saïssy[1], G. Mion[1], D. Benhamou[2]

danesthésie, [1]HIA Bégin – 94163, Saint Mandé, France; [2]CHU Kremlin-Bicêtre – 94275, Kremlin-Bicêtre, France

Background and Goals: During an axillary block (AB), the puncture site is classically located on regard of the axillary artery. However, another anatomical reference is often palpable: the median nerve. The goal of this study was to determine if the median nerve is a suitable landmark for AB, and if it permits a faster realisation of AB.

Patients and Methods: After Ethics Committee approval, 58 informed adult patients, scheduled for orthopedic surgery, were included in this prospective study, and randomly allocated in 2 groups:

– group A: puncture on regard of the axillary artery
– group M: puncture on regard of the median nerve.

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The collected data were : ability to locate the median nerve by palpation, first nerve located by neurostimulation (median or another nerve), time necessary to realise AB (including 3 nerves stimulations), incidence of paraesthesias. Results expressed as mean ± standard deviation were analysed by a Student t-test or Chi^2 according to their nature.

Results: Patients in Group M (n = 25) and groups A (n = 28) were not different according to age, sex, weight, size and ASA-PS class. In five patients, the median nerve was not located by palpation. Results are reported in table 1.

Table 1

	Median located first	Duration of realisation of AB (sec)	Paraesthesias
Group M	21/25	450 ± 90	0/25
Group A	14/28**	540 ± 120**	0/28

**: $p < 0.01$ vs. group A

Conclusion: In 25 patients out of 29, the median nerve was located by palpation. Moreover, for 84 % of this patients, the median nerve was, as expected, the first nerve located by neurostimulation, confirming the validity of the palpation. By taking as anatomical reference the median nerve rather than the axillary artery, the time to realise an AB was significantly decreased without notable difference in the incidence of paraesthesias.

A-403

Parasacreal sciatic: which length of needle is necessary?

J.P. Tourtier[1], P. Chazalon[1], E. Morell[1], D. Giraud[1], E. Bordier[1], I. Rouquette[2], G. Mion[1], D. Benhammou[3]

danesthésie, [1]HIA Bégin – 94163, Saint Mandé, France; [2]HIA Val de Grace – 75005, Paris, France; [3]CHU Kremlin-Bicetre – 94275, Kremlin-Bicetre, France

Background and Goals: To anaesthetise the sciatic nerve by parasacreal way, the needle of neurostimulation classically used is 100 mm long (1). But sometimes, it's too short. The goal of this study was to measure which length of needle is necessary to locate the sciatic nerve by neurostimulation, and to look for possible predictive morphological factors.

Patients and Methods: This prospective study was made with approval of Ethics Committee. 34 adult informed patients, undergoing orthopedic surgery, were included. The data collected were: weights, size, body mass index (BMI), distance measured between the posterosuperior iliac crest and the ischiatic process (D) and length of needle necessary to locate the sciatic nerve (L). The variables were expressed as mean ± standard deviation. The coefficient of correlation (R) was calculated according to standard formulas.

Results: L = 90 ± 17 mm. In 4 patients, L was above 100 mm. L was correlated with the BMI (R = 0,69; $p < 0,001$; fig.1). On the other hand, L was not correlated with D.

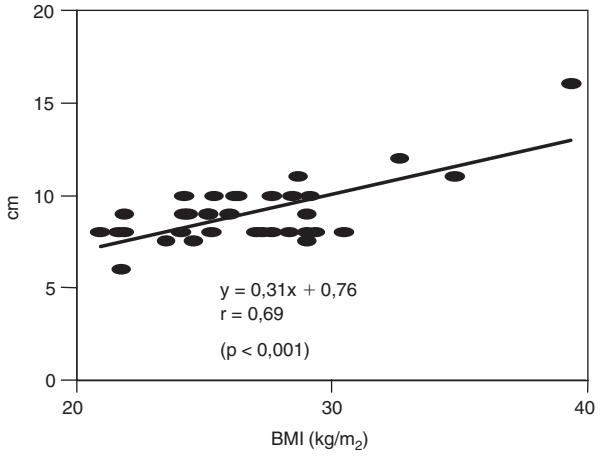

Figure 1

Conclusion: A needle of 100 mm was not adapted in 12% of the patients. BMI > 30 predicted L > 100 mm with a sensitivity of 75% and a specificity of 97% (fig. 1). In practice, it seems that obesity implies the choice of a needle of 150 mm to locate the sciatic nerve by parasacreal way.

Reference:

1 Mansour NY. *Reg Anesth* 1993; 18: 322–323.

A-404

Evaluation of the interadductor approach to the obturator nerve blockade in transurethral surgery

M. Ciechomski, L. Jureczko, E. Mayzner-Zawadzka

Department of Anesthesiology and Intensive Care, Warsaw Medical University, Warszawa, Poland

Background and Goal of Study: Transurethral resection (TURT) is a commonly used procedure in urology for resection of bladder tumour. If resection in lateral bladder regions is necessary, blockade of the obturator nerve is often required to prevent severe complications caused by violent adductor muscle contraction. The goal of the study was an evaluation of the rare approach to the obturator nerve blockade – the interadductor approach.

Materials and Methods: From 1.10.2000–30.11.2002 we studied prospectively 145 patients (age 69,2 ± 11, 95 males, 45 females), required obturator nerve blockade during TURT. Patients were placed on lithotomy position under spinal anesthesia. Blockade of a obturator nerve was performed with nerve stimulator and 22G insulated needle. Position of the obturator nerve was identified 2 cm laterally to pubis bone beneath adductors of a thigh. Response to stimulation has been observed once the needle was advanced 3–5 cm medially. 10 mL Lignocaine 2% was used for the blockade. The assessment comprise rate of success and rate of complication.

Results and Discussions: Complete blockade was observed in 134 (92,41%) patients, incomplete but sufficiently in 9 (6,21%) and no blockade in 2 (1,38%) patients. There weren't observed any complications related to the blockade. Among study group, 1 (0,69%) of the patients with obturator nerve blockade had perforation of the bladder caused by adductor muscles spasm during resection.

Interadductor approach to the obturator nerve enables blockade without changing patient position – that means – it allows to perform blockade even after the surgical procedure has begun. High rate of success has been observed.

Conclusion: Interadductor approach to the obturator nerve blockade is a safe and reliable procedure in case of prevention of muscle contraction during resection tumours on lateral bladder regions.

References:

1 Wassef MR, Reg Anesth 1993 Jan-Feb;18(1):13–7.
2 Ong EL, Chan ST. Ann Acad Med Singapore 2000 Mar;29(2):259–62.

A-405

Psoas compartment block as supplementary analgesia in the anaesthetic management of hip arthroplasty

S. Petrovic, B. Dulic, O. Petrovic, S. Zoric, B. Milikic

Department of Orthopedic anaesthesia, Anaesthesia and Intensive Care, Clinical Centre, Institute of anaesthesiology and Intensive Care KCS, Institute of orthopedic surgery KCS, KBC Bezanijska Kosa, Belgrade, Yugoslavia

Background and Goal of Study: Posterior approach of lumbar plexus (LP) block reduces pain associated with total hip arthroplasty (THA)[1]. We hypothesized Chayen's psoas compartment (PC) block[2] will reduce opioid requirements as well.

Materials and Methods: 60 randomized patients (age 62 ± 12) undergone THA during general anaesthesia (GA). PC group (No30) received PC block prior to GA and GA group (No30) GA alone. PC block: loss of resistance, a single – injection 0.5% bupivacaine (0.4 mg/kg). GA maintenance: propofol (1–2 mg/kg/h) and fentanyl (1 μg/kg) adequate to control MAP in the range of 80–100 mmHg.

We were recording MAP, total fentanyl used, anaesthesia recovery, pain scores (blinded observer) 30 minutes, 2, 4, 6, 12 and 24 h postoperatively according to 5 point verbal rating scale (VRS), PONV and PC complications. Beside standardized analgesic therapy (tramadol 50 mg i.v. and metamizol/i.v. infusion 2.5 g/6 h alternatively) when VRS > 3, rescue doses of tramadol 50 mg were injected. Data were analyzed using Student t test, Mann–Whitney *U* test and chi square with $p < 0.05$ as significant.

Results and Discussions:

Parameters	PC	GA	p
MAP	87.03 ± 7.61	99.17 ± 6.04	0.000
Fentanyl (pts)	8 (26.7%)	28 (93%)	0.00
Fentanyl (μg)	186.67 ± 28.9	358.9 ± 14.68	0.000
Smooth recov. (pts)	28 (90%)	21 (70%)	0.05
VRS	2.53 ± 1.17	3.77 ± 1.1	0.00
No i.v.analgetic (pts)	4(13.3%)	none	0.038
Rescue tramadol (pts)	5(16.7%)	14 (46.7%)	0.012
PONV	none	6 (20%)	0.001
PC complication	none		

Pts (patients); % of total number in a group.

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Conclusion: PC block is simple, efficient and safe supplemental analgesia for THA during surgery and 24 h postoperatively. Beside reduction in opioid requirements and PONV, it enables steady hemodynamic stability, smooth anaesthesia recovery and better analgesia quality.

References:

1 Stevens R et al. *Anesthesiology* 2000; 93: 115–21.
2 Cheyen D et al. *Anesthesiology* 1976; 48: 675–8.

A-406

Influence of regional anaesthesia on anaesthetic management delay in superior limb trauma in children

P. Poivre*, D. Garrigue**, B. Marciniak***, A.S. Szypura**, G. Streker**

Department of Anesthesie urgences, Hopital Roger Salengro, Lille, France

Background and Goal of Study: Superior limb trauma is a common cause of emergency admittance in children. In this study we evaluated benefit of regional anaesthesia (RA) in children compared to general anaesthesia (GA) on different management duration.

Materials and Methods: This prospective study has been realized during a five month period in the emergency unit of a teaching hospital. Eighty one children have been included for superior limb trauma. Two groups were considered according anaesthetic management:

Group 1: RA (n = 43): An axillary blockade with nerve stimulator was performed under sedation with an inhaled equimolar oxygen-nitrous oxide mixture to prevent procedural pain.

Group 2: GA (n = 38): A standard general anaesthesia with alfentanyl was performed. Data collected were: age in month, time between admittance and surgery (AS in minutes), NPO period (NPO in min), delivery time of hospital (DT in min). Mean ± SD were used for age and median ± IQR for the other parameters. Statistical analysis was performed using Mann-Withney test to compare quantitative data between the two groups. $p < 0,05$ was considered as statisticantly significant.

Results and Discussions: Data values are showed on table:

	Group 1	Group 2	p
Age	122,6 ± 40,2	97,1 ± 42,8	<0,01
AS	138,0 ± 96,2	270,0 ± 150,0	<0,0001
NPO	300,0 ± 102,0	405,0 ± 150,0	<0,0001
	min 180 max 720	*min 310 max 960*	
DT	862,5 ± 562,5	960,0 ± 330,0	NS

RA allow an earlier surgery (AS and NPO significant). Duration of stay is smaller in Group 1 but not significantly, probably due to organization difficulties.

Conclusion(s): RA can allow quicker management of children with superior limb trauma and should be prefered when an early hospital discharge is possible for the surgeon.

A-409

Superficial cervical plexus block: comparison of ropivacaine with and without clonidine

E. Rossini, L. Caberti, E. Sani, M. Muzzi, A. Vecchione, C. Barbieri, F. Mosso, S. Sivelli, G. Fanelli*, P. Salcuni**

Department of anesthesiology and vascular surgery**, University of Parma, Parma, Israel*

Background and Goal of Study: Clonidine improve quality of anesthesia for orthopedic procedure under regional anesthesia, however few experience have been conducted for carotid endoarterectomy (TEA) with regional anesthesia (RA). Aim of this study was to evaluate clonidine effect with ropivacaine (R) for superficial cervical plexus block (CPB)(1).

Materials and Methods: After ethical committee approval 30 ASA physical I-III patients scheduled for TEA under combined CPB and preincisional anesthesia with 10 mL of 1% lidocaine were randomly allocated, in a double blinded study to receive CPB with 20 mL of either R (20 ml 0.75%) alone (group I = n = 15) or R with 50 mcg clonidine (group II, n = 15). The main outcome misure was the amount of supplemental lidocaine 1% used by the surgeon. Hemodynamic value, onset, level of sedation (OASS score), SpO_2, as well as the time to first analgesic request, were also recorded by a blinded observer. The study size (sample power = 30) was calculated to detect a 5 min. difference in time required to achieve adequate surgical anesthesia between two groups, accepting a one tailed α error of 5% and a β error of 105(2), for all variables statistical significance was assessed by Mann-Whiteney U-test as appropriate, a level of $P < 0.05$ was taken as statistically significant.

Results and Discussions: No differences in OASS score, SpO_2, hemodynamic variables and degree of pains until first analgesic request were observed between the two groups. A lower use of intraoperative 1% lidocaine was recorded in group II (6.4 mL DS 5.79) versus group I (15,25 mL DS 12.1) (p 0.016), a longer time taken for the first analgesic request [(group II 15.63 hr DS8.4); (group I: 22.13 hr DS 10.3)], but not statistically significative p 0.063. Results of this study demonstrated that adding 50 mcg clonidine to 20 mL of 0.75% Ropivacaine for superficial CPB reduce block reduce the intraoperative consumption of 1% lidocaine without significative side effects, if this result will be confirmed the addiction of clonidine may improve the safety of superficial CPB without deep CPB.

References:

1 Stoneham et al. Anesthesiology 1998;89:907–912.
2 A.Casati et al . Anesth Analg 2000;91:388–392.

A-410

Interest of preoperative regional anaesthesia in children with superior limb trauma

P. Poivre*, D. Garrigue**, B. Marciniak***, A.S. Szypura**, C. Barre**

*Department of Anesthesie urgences, Hopital Roger Salengro; *DARC 1 CHRU Lille; **Anaesthesia Emergency departement CHRU Lille; ***DARC 2 CHRU Lille, Lille, France*

Background and Goal of Study: Superior limb trauma is a common and painful cause of emergency admittance in children. In this study we evaluated the benefit of preoperative regional anaesthesia (RA) with axillary blockade on pain management in children with superior limb trauma.

Materials and Methods: This prospective study has been realized during a five months period in the emergency department of a teaching hospital. Forty-three children with superior limb trauma were included. Axillary blockade has been performed with a nerve stimulator (two nervous stimulation) after classical monitoring including EKG and SpO_2. An inhaled equimolar oxygen-nitrous oxide mixture (entonox®) has been systematicaly used to prevent procedural pain. Data collected were: pain on a visual analogue scale (0 to 100) at the entry (P1), and fifteen minutes after RA (P2); Satisfaction index for parents(PSI), children(CSI), surgeon(SSI) and anesthetist (ASI) in the post operative period on a 0 to 100 scale. Adverse effects of entonox® and RA were recorded. Mean ± SD were used for the results expression.

Results and Discussions:

Table 1

P1	55 ± 19
P2	2 ± 6*
PSI	92 ± 17
CSI	92 ± 15
SSI	96 ± 10
ASI	94 ± 11

Mean age was 122.6 ± 40.2 months (min 33, max 193). Satisfaction index was good for patient and family, better for practicians (Table 1). Analgesia occured quickly (<15 min) and was effective in 100% of cases allowing surgery in 89.37% of children without complementary anaesthesia. No major adverse effect was recorded, vomiting occured in 2 patients.

Conclusion(s): RA is effective on preoperative pain, easy to realize, and can often allow surgery. It's acceptability is good for all. This technic should be evaluated as the first intention anesthetic management for superior limb trauma in children.

A-411

Comparison of three different techniques on brachial plexus blockade

Z. Ertug, A. Yegin, N. Sahin, N. Hadimioglu, E. Ertok

Department of Anaesthesiology, Akdeniz University, Medical Faculty, Antalya, Turkey

Background and Goal of Study: Brachial plexus blockade provides good intraoperative anaesthesia as well as prolonged postoperative analgesia when long-acting local anaesthetics are used. In our study, we compared three different techniques on brachial plexus blockade for the arm surgery, performed by lateral infraclavicular, vertical infraclavicular and axillary approaches.

Material and Methods: 36 ASA I-II patients were randomly allocated into three groups: Group I (axillary approach; no = 12), Group II (lateral infraclavicular approach; no = 12) and Group III (vertical infraclavicular approach; no = 12). A catheter was inserted to all patients, and 40 ml 0,375% bupivacaine was administered. Sensory and motor blocks were recorded selectively for each nerve distribution. Duration of anaesthesia and operation time, and the presence or absence of tourniquet pain, and application times of catheters were also recorded for all patients. Visual Analogue Pain scores were recorded at the postoperative 1., 2., 4., 6., 12., and 24. hours.

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Results and Discussion: Demographic data was comparable in both groups. The onset of sensory block was earlier, and the onset of motor block and the duration of sensory and motor block were longer in the Group II and III compared with the Group I, however these results were not statistically significant ($p = 0.063$, $p = 0.11$, $p = 0.076$, and $p = 0.32$; respectively). Tourniquet pain was significantly higher in the Group I ($p = 0.044$). Mean Visual Analogue Pain scores were not significantly difference between the groups ($p = 0.089$).
Conclusion: The lateral infraclavicular or vertical infraclavicular approaches are more suitable methods than the axillary approach for the arm surgery; especially vertical infraclavicular blockade provides more comfortable positioning for painful conditions of traumatic patients.
References:
1 Br J Anaesth 2001; 86: 80–3.
2 Acta Anaesthesiol Scand 1999; 43: 609–13.

A-412

Variability in assessment of akinesia in ophthalmic regional anaesthesia

A. Patel, M. Saldana, H.A. McLure

Departments of Anaesthesia & Ophthalmology, St Jamess University Hospital, Leeds United Kingdom

Background and Goal of Study: Extra-ocular muscle (EOM) akinesia is commonly assessed in ophthalmic regional anaesthesia. Scoring systems differ in number of points and scale direction. Detailed scales may improve study sensitivity, although this may be offset by increased observer variability. We studied observer variability with a four-point scale of EOM movement including the influence of scale direction.
Materials and Methods: Ten anaesthetists and 11 ophthalmologists scored akinesia in the secondary directions of gaze in 15 video sequences of patients with varying degrees of EOM paresis following regional blockade. Two four-point (0–3) scoring scales were used. In scale 1: full movement – 3, partial movement – 2, twitch – 1, no movement – 0. In scale 2: full movement – 0, partial movement – 1, twitch – 2, no movement – 3. The first five sequences were used to familiarise the observers with the scale, then the following 10 were test cases and could be seen a maximum of twice. This was repeated with the scale in the opposite direction. The scale used first was allocated randomly. 1680 scores were obtained and compared with consensus scores of the investigators.
Results and Discussions: Scores agreed with the investigators in 63.2% of observations in scale 1 (range 48–78%), and 63.3% of observations in scale 2 (range 53–75%). Disagreement was by a single point in 98.5% of observer differences. Where there was disagreement the observers could under or over-estimate the degree of block. The table shows the direction of disagreement.

	Scale 1		Scale 2	
	Under	Over	Under	Over
No move	45		47	
Twitch	54	99	66	86
Partial	31	54	42	48
Full move		28		16

Conclusion: There was a wide inter-observer variability with both of these scoring scales which may contribute to the conflicting results seen in studies of ophthalmic anaesthesia. In addition, where more than one akinesia assessor is required there should be attempts to 'calibrate' their assessments. There does not seem to be an increase in variability with differing direction of scales.

A-413

A comparison of ropivacaine/morphine versus levobupivacaine/morphine for patient-controlled analgesia after major surgery of lower abdomen

A. Passias, K. Papageorgiou, A. Petsiti, P. Mavridou, A. Manataki

Department of Anesthesiology, Hatzikosta General Hospital, Ioannina, Greece

Background and Goal of Study: Epidural opioids combined with local anesthetics improve the quality of postoperative analgesia[1]. The aim of the study is to compare ropivacaine versus levobupivacaine combined with morphine for patient-controlled epidural analgesia (PCEA) via a lumbar catheter in lower abdominal surgery.
Materials and Methods: 28 ASA I-III patients scheduled to have elective major surgery were included in the study. The R-group ($n = 15$) received ropivacaine 0.2% with 0.005% morphine and the L-group ($n = 13$) received levobupivacaine 0.2% with morphine 0.005%. Patients of each group received a loading dose of 10 ml of the mixture, 45 min before the end of the surgery followed by continuous infusion of 8 ml.h^{-1} of the mixture. Postoperative epidural analgesia was provided using patient controlled pump with background infusion rate 8 ml.h^{-1} and incremental doses of 2 ml with 20 min lock out time. Twenty four hours after surgery, 1/ worst pain at rest, 2/ pain during mobilization (10 point numerical rating scale), 3/ motor blockade (Bromage scale), and 4/ number of incremental doses (calls) were assessed. Data were analyzed with a student's t-test and Fisher's exact test.
Results and Discussions: Pain intensity in both groups was <4 on a 10 point numerical rating scale with no statistically significant differences between groups (Tab.). Six patients in the R-group (40%) and five in the L-group (38.4%) developed motor blockade ($p > 0.05$). No patient developed major respiratory complications.

	R-Group	L-Group	
	Mean (SD)	Mean (SD)	*p*
Pain at rest	0.46 (0.63)	0.30 (0.48)	0.46
Pain during mobilization	2.06 (0.79)	1.84 (0.68)	0.44
No of calls	3.53 (2.55)	2.76 (1.53)	0.35

Conclusion(s): Both ropivacaine and levobupivacaine combined with morphine when applied by a PCEA device via a lumbar epidural catheter produce sufficient postoperative analgesia. A considerable number of patients with some degree of motor blockade may be observed under both regimen.
Reference:
1 Dahl JB, Rosenberg J, Hansen BL et al. Anesth Analg 1992;74:362–5.

A-414

Interest of peribulbar block combined with general anesthesia for vitreoretinal surgery

J. Pascal, J. Morel, D. Perret, V. De Pasquale, M. Roussier, P. Gain, S. Molliex, C. Auboyer

DAR & - Service ophtalmologie, Pav 50 Hôpital Bellevue, CHU St Etienne, 42055 St Etienne, France

Background and Goal of Study: The aim of this study was to evaluate postoperative analgesia after vitreoretinal surgery when peribulbar block is performed before general anaesthesia.
Materials and Methods: After ethical committee approval and informed consent, 62 patients scheduled for vitreoretinal surgery were included in a prospective double blind randomized study. Patients were assigned in two groups receiving either a peribulbar anaesthesia performed by a 12 ml 1% ropivacaïne inferolateral injection (Group 1 $n = 31$) or a subcutaneous physiologic serum infiltration (Group 2 $n = 31$). General anaesthesia was induced and maintained with propofol and remifentanil in the two groups. 30 minutes before the end of surgery, analgesia was performed in the 2 groups with propacetamol (2 gr/6 h) and a bolus of 10 mg nefopam followed by nefopam PCA at recovery (5 mg in bolus with a lock-out interval of 30 minutes) Nefopam consumption and EVA were evaluated during 48 h. When EVA > 4, an infusion of tramadol 300 mg/24 h was started. Statistical analysis was done with Student's test ($p < 0.05$).
Results: The 2 groups were comparable (age, weight, sex ratio, ASA status, type of surgery). Analgesia was equal in 2 groups except during first 2 hours postoperative (H2: EVA [moy. ± SD] = 1,13 ± 1,48 in G1 vs 4,40 ± 2,04 in G2). First nefopam bolus was earlier in G2 vs G1 (46 ± 58 min vs 148 ± 99 min). Tramadol consumption was less in G1 (6 patients in G1 vs 23 patients in G2).

Nefopam Consumption: (mg) [moy. ± SD] * $p < 0,05$.

	G1 (n = 31)	G2 (n = 31)
H4	12,6 ± 11	22,2* ± 10,3
H6	18,9 ± 14	28,3* ± 14,6
H8	22,7 ± 18	31,7* ± 16,8
H12	27,1 ± 21	38,5* ± 24,4
H18	34,8 ± 28	44,3 ± 32,3
H24	46,3 ± 34	50 ± 38,7
H48	65,7 ± 51	52,8 ± 44,3

Discussion: Peribulbar block with 1% ropivacaïne performed before vitreoretinal surgery improve postoperative analgesia decreasing significantly nefopam consumption during the first 12 hours.
Reference:
1 Shende D. et al. Anaesthesia, 2000; 55: 970–75.

A-415

Axillary brachial plexus anaesthesia versus general anaesthesia for distal upper extremity surgery lasting less than 1 hour. What is really worth?

I. Cucereanu-Badica, D. Ologoiu, I. Grintescu, D. Tulbure

Department of Anesthesia and Intensive Care, Clinical Emergency Hospital of Bucharest, Bucharest, Romania

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Background and Goal of Study: Axillary block is a valuable anaesthetic alternative for distal upper extremity surgery. This study asseses the best anaesthetic technique for this kind of surgery in terms of cost, patients acceptance, O.R. occupancy and adverse events.
Materials and Methods: After approval from our hospital ethics committee 140 ASA I-III patients undergoing elective surgery of the hand, forearm, elbow or distal humerus were randomised in 2 groups, each of 70 pts. receiving general (group G) or regional (group R) anaesthesia. In group R: axillary block was performed in preoperatory room using the multiple injection technique with a nerve stimulator and 40 mL of 5 mg/mL ropivacaine. In group G: patients received general anaesthesia (GA) using a standard anaesthetic technique and for postoperative analgesia ketorolac or ketoprofen. The costs of anaesthesia and recovery were calculated using 2002 Euro values. The time for anaesthesia, recovery and discharge, the satisfactory anaesthesia and postoperative complications were assessed.
Results and Discussions: Groups did not differ in terms of demographic data, ASA class, type and length of surgery. The median costs for group R (34,5 Euro) was less than that for group G (48,6 Euro) ($p < 0{,}001$). Time for induction and recovery from GA was nonsignificantly shorter in group G (21,8 min) than time necessary to perform the block in group R (22,2 min) ($p > 0{,}05$). Complete sensitive block was achieved in all group R patients. No perioperative incident was noticed in group R, no clinical complain of nerve damage after 3 weeks. Arterial pressure variations with more than 40 mmHg from basal values during anaesthesia were documented in 18 pts (25,7%) from group G and none from group R. Vomiting requiring treatment occurred in 8 pts (11,42%) from group G and none from group R. In group G 14 pts (20%) needed stronger analgesics than that prescribed in the first 24 hours postoperative; in R group NSAID were enough.
Conclusion(s): Axillary block is cheaper and minimises complications and time occupancy of O.R. Using the technique described no failure and nerve damage were reported. The time spent by anaesthesiologist to perform the block was comparable with that necessary for induction and recovery from general anaesthesia but the previous procedure can be done in a preoperatory room.

A-416

Analgesic efficacy of intraperitoneal levobupivacaine in laparoscopic cholecystectomy

I. Gregoriades, S. Tsirigotou, T. Saranteas, E. Koursoumi, P. Paraskevopoulou, A. Arabatzi, M. Varveri, V. Dimitriou

Department of Anaesthesia, "G.Gennimatas" General Hospital, Athens, Greece

Background and Goals: The analgesic effect of intraperitoneal local anesthetics (lidocaine, bupivacaine) after laparoscopic (LAP) cholecystectomy is controversial (1,2,3). In this prospective, double blind, controlled clinical trial, we investigated the effect of intraperitoneally administered levobupivacaine (LB) on pain management and analgesic requirements after LAP cholecystectomy.
Material and Methods: Thirty patients ASA I-III, aged 30–70, undergoing elective LAP cholecystectomy were randomly assigned to 2 groups. Group C (control, n = 14) received 40 ml of a normal saline (NS) solution while group L (n = 16) received 40 ml of a 0,25% LB solution. Induction and maintenance of anesthesia were standardized in all patients. Local anesthetic or NS solutions were applied: a) 20 ml under the right hemi-diaphragm just after pneumoperitoneum and b) 20 ml to the gallbladder bed after its removal. Postoperatively overall pain at rest (C_A, L_A) and at deep inspiration (C_B, L_B) was assessed during the first 8 h at 5 time-points (T_0: 0 min, T_1: 30 min, T_2: 2 h, T_3: 4 h, T_4: 8 h) using a 5-point verbal analogue scale. Total analgesic consumption (meperidine 1mg/kg on request) was also recorded.
Results: Data (mean ± SD) concerning pain scores are shown in the table:

	T_0	T_1	T_2	T_3	T_4
C_A	1.9 ± 1.3	2.4 ± 0.7	2 ± 0.9	2.3 ± 1	1.9 ± 1
L_A	2 ± 1.1	2.1 ± 0.9	1.4 ± 0.5	1.5 ± 0.6	1.4 ± 0.5
C_B	2.4 ± 1.5	2.7 ± 0.6	2.5 ± 0.7	2.6 ± 0.8	2.1 ± 0.8
L_B	2 ± 0.6	2.8 ± 1.2	2.2 ± 1.1	2.1 ± 0.7	2.2 ± 0.6

No statistical significance (NSS) was found through T_0–T_4 among groups (one-way ANOVA). C_A vs L_A and L_A vs L_B: $p < 0.05$ (two-way ANOVA with DUNETT correction). NSS was found between groups in mean analgesic consumption (1.7 vs 1.8 requests, t-test).
Conclusion: Intraperitoneal infusion of levobupivacaine seems to be a safe and effective technique in reducing postoperative pain after LAP cholecystectomy during the first 8 hours.
References:
1 Elhakim M, et al. *Acta Anaesth Scand* 2000; 44: 280–9.
2 Pasqualucci A, et al. *Anesthesiology* 1996; 85:11–20.

A-417

Spinous processes and the difficulty of neuraxial block

M. Karraz

Department of Anesthesiology, Poly clinique de Beauvaisis, Beauvais, France

Background and Goals: Landmarks on patient's back are the best predictor of the difficulty of neuraxial block (DNB) (1). We devised a score predicting this difficulty (2), this score contained four grades: Grade I: the spinous processes (SP) are visible; Grade II: the SP are not seen but easily palpated; Grade III: the SP are not seen and not palpated but the interval between them is palpated as a low landmark under the thumb; Grade IV: none of the previous cases. We designed this preliminary study to prove the validity of this score as a predictor of DNB.
Material and Methods: We have chosen epidural block as one of the neuraxial blocks, and applied it on parturients. Parturients with toxemia-eclamptic were excluded. We defined the difficulty of performing epidural block in two aspects: a) The time needed to reach the epidural space. b) The obligation to redirect Tuohy needle or the obligation to change the intra-vertebral space. We studied 90 consecutive parturients. To define the grade of this score we asked the parturient to sit down, bend the head, neck and shoulders toward the chest as much as possible to protrude her spinous processes. The score's grade was determined immediately before starting the epidural procedure, by vision and palpation when needed. $P < 0.05$ was considered to be significant.
Results: The results were divided to two groups: Easy group = grade I + grade II; Difficult group = grade III + grade IV. We excluded one patient of grade (I) and another patient of grade (III) due to their movements.

Table 1: Comparing easy group *vs* difficult group (Mean ± SD):

	Easy Group Grade I+II N = 49 (55.7%)	Difficult Group Grade III + IV N = 39 (44.3%)	*P* value
Time (second) *	7.7 ± 2.6	10.7 ± 4.1	<0.001
Number of difficulties †	5	11	0.035

* Time needed to reach the epidural space; †Number of times of redirecting Tuohy needle or changing intra-vertebral space

Conclusion: This score predicts DNB, it is simple, easy to identify, easy to communicate, reproducible, and it could become a base to unify anaesthesiologists' language.
References:
1 Sprung J, et al. *Anesth & Analg* 1999; 89: 384–9.
2 Karraz M. *Anesth & Analg* 2002; 94: 476.

A-418

Sciatic nerve block: a prospective, randomized, double-blind comparison between 0.75% ropivacaine and 0.75% levobupivacaine

F. Vinciguerra, E. Spreafico, G. Cappelleri, K. Iemi, E. Cerchierini, A. Casati

Department of Anesthesiology, Vita-Salute University of Milano, IRCCS H. San Raffaele, Milano, Italy

Background and Goal of Study: The aim of this prospective, randomized, double-blind study was to evaluate the intra- and postoperative clinical properties of levobupivacaine 0.75% for sciatic nerve block and compare them with those of 0.75% ropivacaine.
Materials and Methods: With ethic committee approval and written informed consent, 30 healthy patients undergoing hallux valgus repair were randomly allocated to receive sciatic nerve block with 0.75% levobupivacaine (group Levo-7.5, n = 15) or 0.75% ropivacaine (group Ropi-7.5, n = 15). Onset time and recovery of nerve block as well as time to first pain medication and rescue analgesic consumption during first 24 h after surgery were recorded in a double-blind fashion.
Results and Discussion: The onset time of surgical block was shorter in patients of group Levo-7.5 [5 (5–40) min] than in patients of group Ropi-7.5 [25 (5–50) min] (P = 0.04). The mean time from block placement to first request for pain medication was shorter in group Ropi-7.5 [13 (5–20) hours] than in group Levo-7.5 [18 (10–26) hours] (P = 0.008). No differences in motor recover were detected between the two groups (p = 0.4); on the contrary sensitive recovery was faster in ropivacaine group [16 (8–20)] than in levobupivacaine group [18 (12–24 hours] (p = 0.02). Total consumption of rescue tramadol during the first 24 h after surgery was lower in the group Levo-7.5 [median: 0 mg (range: 0–100 mg)] than in group Ropi-7.5 [median: 100 mg (range: 0–200 mg)] (P = 0.02).
Conclusions: 0.75% levobupivacaine provides a shorter onset time and a longer duration of nerve block as compared to 0.75% ropivacaine, with a longer duration of postoperative analgesia, leading to significant reduction in consumption of postoperative pain medication.

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A-419

Intrathecal levobupivacaine for endoscopic urological surgery

M. Marandola, A. Erriquez, L. Ferrenti, R. Fazio, A. Antonucci, G. Delogu

Department of Anaesthesia and Critical Care, "La Sapienza" University, Rome, Italy

Background and Goal of Study: Levobupivacaine is the isolated S-enantiomer of bupivacaine and may be a favorable alternative to spinal bupivacaine. However, its clinical efficacy and its dose-response characteristics in spinal anaesthesia are not yet well known (1,2). We evaluated intrathecal levobupivacaine for endoscopic urological procedures, comparing three different dosages in terms of the level and duration of induced motor and sensory blockade, the need for anaesthetic supplementation and the incidence of side effects.

Materials and Methods: We enrolled 30 patients undergoing endoscopic urological surgery (resection of bladder, mapping, laser folgoration). Patients were randomized into three groups. Group 1 received 12.5 mg of levobupivacaine 0.5%, Group 2 15 mg and Group 3 17.5 mg. Spinal anaesthesia was administered with the patient in the sitting position, at the L_{2-3} interspace via the midline approach using a 20 Ga introducer and a 25 Ga Whitacre needle. Sensory changes were assessed in the mid-clavicular line by means of both cold (alcohol swab) and pinprick tests. Motor blockade in the lower limbs was recorded bilaterally using a modified Bromage scale.

Results: Spinal anesthesia was successful in all groups. No patients required vasoactive drugs. The motor blockade was similar in the three groups, with the maximum level observed at t_3–t_4 study times (t_3 = 15 min. after spinal anesthesia; t_4 = at the end of surgery). The mean duration of motor blockade was 270 ± 73 min. Group 2 and 3 demonstrated a higher level of sensory blockade than Group 1, difference not significance. The mean duration of sensory blockade was 235 ± 68 min. No patients had post dural puncture headache or backache.

Conclusion: Although our sample size was small, intrathecal levobupivacaine demonstrated a good clinical efficacy in all patients. We determined that 12.5 mg of subarachnoid levobupivacaine was sufficient for obtaining effective anaesthesia for endoscopic urological surgery, but there was no evidence of any specific advantages to using this drug.

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A-420

Thoracic paravertebral blockade for postoperative pain treatment after thoracoscopic surgery

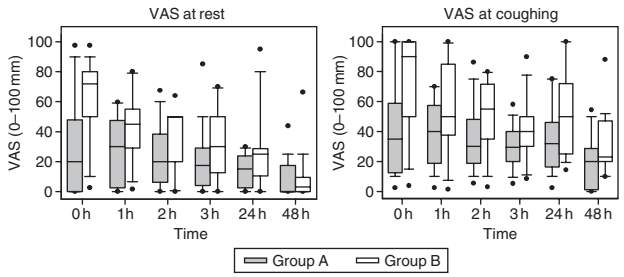
A. Vogt, D. Stieger, C. Theurrillat, M. Curatolo

Department of Anaesthesiology, University Hospital of Berne, Bern, Switzerland

Background and Goal of Study: Pain treatment after thoracoscopic surgery with intravenous morphine (PCA) is often inadequate. Therefore we studied the effect of a single-injection thoracic paravertebral blockade on postoperative pain scores. Preliminary data of a still ongoing study are shown.

Materials and Methods: 31 patients were randomly allocated to two groups: morphine-PCA plus single injection thoracic paravertebral blockade with bupivacaine 0.375% and adrenaline 1:200'000 0.4 ml/kg (group A, n = 15) and morphine-PCA alone (group B, n = 16). Postoperative pain scores (VAS 0–100) were recorded during the first 48 postoperative hours.

Results: Pain scores at rest and at coughing were significantly lower in group A than in group B ($P < 0.001$).



Conclusion: Single-shot thoracic paravertebral blockade may improve postoperative pain treatment after thoracoscopic surgery.

A-421

The potentiation of spinal anaesthesia by co-administration of pethidine and ropivacaine

C. Bodolea, I. Acalovschi, O. Teodorescu

Department of Anaesthesia and Intensive Care, University of Medicine and Pharmacy "Iuliu Hatieganu" Cluj, Cluj-Napoca, Romania

Background and Goal of Study: Intrathecal and epidural administration ropivacaine has proved less potent than equianalgesic doses of bupivacaine (1). Pethidine is the only opioid in current use that is effective for spinal anaesthesia as sole agent or in co-administration with other local anesthetics (2).

Materials and Methods: After institutional approval and informed consent, 45 patients ASA grades I-II scheduled to have spinal anesthesia for inguinal hernia repair, were randomly divided into three equals groups. Group R received 15 mg of ropivacaine, Group B received 15 mg of bupivacaine and the patients in Group RP received a mixture of 10 mg ropivacaine and 50 mg pethidine preservative-free. The sensory block was assessed by onset time at the L_2, maximum extension of sensory blockade and time for regression to L_2. The degrees of motor block were assessed by using the Bromage scale: the onset time and the duration of the block were also recorded. Haemodynamic responses, duration of postoperative analgesia and occurrence of side effects were assessed.

Results and Discussions: There were no differences among groups regarding demographic data. The onset and level of sensitive block did not differ significantly among the groups. The mean time for regression to L_2 was significantly longer in both Group B and Group BP ($p < 0.05$). The time to first reported pain was significantly longer only in Group BP ($p < 0.001$).

There were no significant differences in the onset time and the incidence of different degrees of motor block among the three groups. The duration and intensity of motor block was significantly increased by addition of pethidine to ropivacaine. Changes in mean arterial pressure and heart rate did not differ significantly among the groups.

Conclusion(s): By adding 50 mg of pethidine to 10 mg ropivacaine the potency of spinal sensory and motor block and the duration of postoperative analgesia were improved. Moreover, the haemodynamic stability was maintained without a significant increase of side effects.

References:

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2 Nguyen Thi TV, Orliaguet G et al. Acta Anaesthesiol Scand 1992;36:516–518.

A-422

1% Chloroprocaine for spinal anesthesia

T. Palas

Department of Anesthesia, Klinik Linde, 2503 Biel, Switzerland

Background and Goal of Study: Chloroprocaine (cp) is a very short acting local anesthetic that is used for epidural anesthesia, peripheral nerve blocks and for intravenous regional anesthesia. So far it has not been used for spinal (intrathecal) anesthesia. In ambulatory surgery a spinal local anesthetic drug with a fast onset and a rapid recovery would be of advantage. An additive free 1% isobaric cp solution was used for spinal anesthesia to determine the clinical feasibility.

Materials and Methods: 500 consecutive patients for short (less than 50 minutes) surgical procedures were concluded in the study. After their oral consent 30–40 mg were injected intrathecally in the lumbar region. Postoperative observation was carried on at the PACU until full recovery. Possible signs of pain during injection, transient radicular irritation (TRI), bladder function and PONV were noted.

Results and Discussions: The onset time was between 3 and 5 minutes. The highest level of anesthesia was at T6. The surgical procedures were from 10 to 45 minutes. Surgical anesthesia was complete in all cases. There were no pain during injection, no signs of TRI, no urinary detention, no postoperative side-effects. All patients could stand up after 90 minutes from the start of surgery. A complete patient satisfaction.

Conclusion(s): Chloroprocaine has a very low toxicity, fast onset, and a rapid breakdown, and should therefore be an ideal local anesthetic drug for shorter surgical procedures. In search of a short acting spinal drug lidocaine has been used, but reports of TRI eliminated this local anesthetic for intrathecal anesthesia. Neurologic deficits after intrathecal cp injection has been described (1). This mixture was not pure cp, but consisted of antioxidants and preservatives. In a later animal study cp was not found to cause any neurological damage (2). It seems that an additive free plain 1% chloroprocaine solution is suitable for short surgical cases and is especially suitable in ambulatory anesthesia.

References:

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A-423

Two different application techniques for spinal anesthesia using hyperbaric levobupivacaine 0.5% solutions

D. Ioannidou, A. Margaritou, A. Filosoglou, A. Leontidou, E. Blugoura, P. Petropoulou

Department of Anesthesiology, Papageorgiou General Hospital, Thessaloniki, Greece

Background and Goal of Study: Baricity is one of the most important factors to influence the characteristics of distribution of the local anesthetic aiming to success and spread of the blockade. The addition of glucose 35% to levobupivacaine (levo) 0.5% as a mixture, or the intrathecal injection of glucose on top of the levo administration, was the goal of our spinal anesthesia study.

Materials and Methods: 40 pts (ASA I-III), undergoing spinal anesthesia, received in a sitting position 4 ml levo 0.5%. In Group A (n = 20) 5 ml glucose 35% was added to the levo solution as mixture, while in Group B (n = 20), 5 ml glucose 35% was administered intrathecaly after injection of the levo solution. Maximum cephalad spread and regression of sensory block was tested by pinprick evaluation at 2, 5, 10, 15, 20, 25, 30, 60, 90, 120, 150min after SA. Motor block was evaluated by a modified Bromage scale. Arterial pressure, heart rate, hypotension and CNS side effects were also recorded. Statistical analysis: Mann–Whitney test, Kruskal-Wallis test.

Results and Discussion: Group demographics were similar. Block characteristics are presented as mean (SD), number (%) or media (range) in the table:

	Group A (n = 20)	Group B (n = 20)	p
Sensory block*			
Onset time at T10 (min)	8.87 (2–15)	12.28 (2–20)	0.09
Max cephalad spread (dermotome)	T6 (T3–T10)	T8 (T4–T10)	NS
Time to max cephalad spread (min)	19.06 (10–30)	19.29 (5–30)	NS
Block height at 90′ (dermotome)	T8 (T4–O1)	T10 (T5–T12)	NS
Motor block			
Grade 4 block (n, %)	20 (100)	20 (100)	NS
Time to max degree (min)	6.87 (2–20)	7.35 (2–20)	NS

Conclusion: Addition of dextrose to levobupivacaine 0.5% as an hyperbaric mixture for SA provides similar sensory and motor blockade characteristics to the intrathecal injection of dextrose after the spinal administration of the local anesthetic.

Reference:

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A-424

Clinical significance of baricity on spinal anaesthesia with levobupivacaine

N. Gorgias, P. Maidatsi, K. Karakoulas, A. Fakidou, V. Babouka, Ch. Labropoulos

Department of Anaesthesiology, Saint Demetrios General Hospital, Thessaloniki, Greece

Background and Goal of Study: Plain solutions of levobupivacaine may be associated with variable spread of analgesia, due to their hypobaricity (1). Also our experience with the plain 0.5% levobupivacaine solution for transurethral procedures, revealed delayed establishment of operative anaesthesia. This study examines whether the subarachnoid administration of an hyperbaric levobupivacaine solution improves the clinical characteristics of spinal blockade.

Materials and Methods: Following institutional approval we studied 60 men, ASA status I-II, scheduled for transurethral procedures under spinal anaesthesia. They were randomly allocated to receive 4 ml of 0.375% levobupivacaine with no glucose (group A), or 8% glucose (group B), which was injected into the L3–L4 interspace, in sitting position. After injection sensory and motor block (Bromage scale 0–3), were recorded. Data were analyzed by median and Mann–Whitney U tests, $p < 0.05$.

Results and Discussions: Blocks were satisfactory in all patients receiving levobupivacaine with glucose. However four patients in the glucose free levobupivacaine group required supplemental anaesthesia, and were therefore excluded from analysis.

Table: Results of spinal block characteristics

	A (n = 26)	B (n = 30)	P
†max.height (dermatome)	T9 (T5–T11)	T8 (T6–T11)	NS
≠min to onset at T10	20.55(2.47)	7.19(1.15)	0.001
≠min to onset at max. height	29.43(9.52)	10.25(3.14)	0.001
≠duration at T10 (min)	117.34(21.45)	113.57(23.17)	NS
patients with grade 3 motor block (%)	70	73	NS

NS = non significant, † = median (range), ≠ = mean (SD).

Conclusion(s): The addition of glucose 80 mg/ml to levobupivacaine 3.75 mg/ml produces an hyperbaric solution in relation to CSF, which results in more reliable subarachnoid block with faster establishment of operative anaesthesia.

Reference:

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A-425

Determination of minimum effective anaesthetic concentration (MEAC) of hyperbaric levobupivacaine for spinal anaesthesia

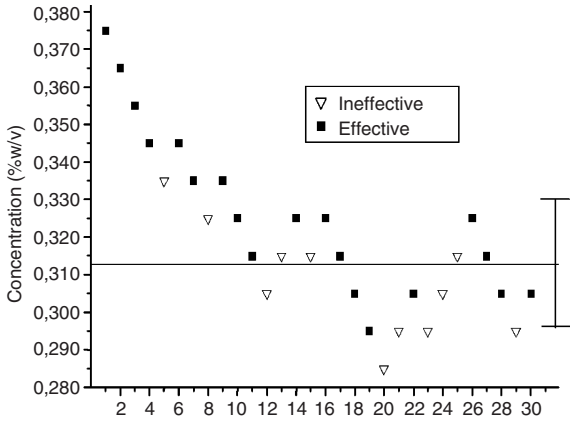
N. Gorgias, P. Maidatsi, K. Karakoulas, A. Zaralidou, E. Amaniti, V. Ourailoglou, M. Giala

Department of Anaesthesiology, AHEPA University Hospital, Thessaloniki, Greece

Background and Goal of Study: According to our clinical experience subarachnoid administration of 4 ml of levobupivacaine 0.375% with 8% glucose, can produce effective surgical anaesthesia with median highest sensory level at T8. However neurological complications have been reported with hyperbaric solutions, due to their restricted distribution in CSF (1). This has resulted to a tendency for reducing the concentrations of hyperbaric local anaesthetic solutions for spinal anaesthesia. The aim of our study was to determine the MEAC of spinally administered levobupivacaine in hyperbaric solution.

Materials and Methods: Following institutional approval we studied 30 patients undergoing elective inguinal hernia repair. Using combined spinal-epidural technique 3ml of hyperbaric levobupivacaine (8% glucose) was administered intrathecally into L3–L4 interspace. The first patient received 0.375% levobupivacaine. Up-down sequential allocation was used to determine subsequent concentrations at a testing interval of 0.01%. Spinal block was considered effective if loss of pinprick sensation occurred at T12 or above within 30 min. Otherwise epidural anaesthesia was initiated to allow performance of surgery. The up-down sequences were analyzed using the formula of Dixon and Massey.

Results and Discussions: The MEAC of hyperbaric levobupivacaine was 0.313% (95% CI 0.296–0.330). Effective anaesthesia was obtained in 19 patients, lasting 28–73 min. Highest sensory level ranged from T10 to T12.



Conclusion(s): Surgical anaesthesia at T12 level can be obtained with very dilute levobupivacaine concentrations (0.295–0.375%) in hyperbaric solution.

Reference:

1 Tarkkila P et al. Reg Anesth 1996;21:26–29.

A-426

Effect of subarachnoidal block on the sedation by intravenous infusion of propofol

H. Lee, I. Shin, J. Sohn, Y. Chung

Department of Anesthesia and Pain Management, Gyeongsanf University Hospital, Jinju, Korea

Background and Goal of Study: Subarachnoidal block has been reported to decrease the dose of hypnotic requirements of intravenous or inhalational anesthetics for the sedation(1). The speculated mechanism for this phenomenon is that decreased afferent input from the spinal cord decreased the

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stimulation to cerebral arousal system(2). We evaluated the sedative effect of subarachnoidal block on the patient receiving propofol infusion using BIS monitor.

Materials and Methods: We studied 30 patients. Fifteen patients(Group M) received a intramuscular injection of bupivacaine 14 mg in paraspinal muscle, 15 patients(Group S) subarachnoidal injection with 0.5% heavy bupivacaine 14 mg. BIS were checked at resting state, 20 minutes after injection, at the time of 1.0 μg/ml and 1.5 μg/ml at effect site concentration of propofol.

Results and Discussions: Data (Mean ± SD) are shown in the table.

	Group M (BIS)	Group S (BIS)
Resting state	97.50 ± 1.10	97.47 ± 0.80
20 min. after injection	97.27 ± 2.20	97.15 ± 1.15
1.0 μg/ml (ESC)	86.88 ± 11.26	80.53 ± 8.47
1.5 μg/ml (ESC)	76.00 ± 13.41	62.88 ± 12/42*

* $P < 0.05$ versus group M; ESC: Effect site concentration

Conclusion(s): There were no significant difference of BIS at resting state, 20 minutes after injection between two groups. Subarachnoidal injection group showed significant decrease of BIS at effect site concentration with 1.5 μg/ml. Subarachnoidal block enhanced the sedative effect of propofol.

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A-427

Low doses of bupivacaine (4 mg) combined with 15 μg of each fentanyl and clonidine, provide effective spinal anaesthesia in elderly patients undergoing joint replacement

D. Fernandez Galinski, C. Pulido, A. Rodriguez, J. Real, J. Marco, M.M.Puig

Department of Anaesthesiology, Hospital de Sabadell, CSPT. Hospital Universitari del Mar, UAB, Barcelona, Spain

Background and Goals: In elderly patients, spinal anaesthesia may be associated with significant adverse events (AE). We have investigated if the combination of a very low dose of bupivacaine (BP) plus fentanyl and clonidine, would provide satisfactory subarachnoid anaesthesia (SAA) and decrease the prevalence of AE.

Material and Methods: The protocol was approved by the Ethics Committee of the Institution. Forty five ASA II-III patients (70–88 y.o) scheduled for total knee or hip replacement under SAA entered the study. They were randomly distributed in two groups who received (double blind) for SAA: 6.25 mg BP + 25 μg fentanyl (Group I) or 4 mg BP + 15 μg fentanyl + 15 μg clonidine (Group II). A combined spinal-epidural procedure was performed, and the epidural catheter used for post-operative PCEA (BP 0.0625% + fentanyl 2 μg/ml). Motor & sensory block, and side effects (hypotension, O_2 desaturation, sedation, pruritus, nausea-vomiting N&V) were recorded intra-operatively. In the PACU pain intensity (VAS 0–100) was assessed at the time of analgesic request (TAR), 1 and 2 hrs later, and every 8 hrs thereafter.

Results: are expressed as mean values ± SD except for sensory block and prevalence of side effects.

	Group I (n = 24)	Group II (n = 21)
Surgery(min)	92.5 ± 19.1	90.9 ± 14.1
Motor sensory	2.2 ± 0.6	2,0 ± 0.5
block (0–3)	T9–T10	T9–T10
VAS (mm)		
TAR	38.2 ± 26.1	28.4 ± 14.0
1hr	24.8 ± 24.3	6.6 ± 14.1*
2hrs	22.1 ± 25.4	5.5 ± 8.8

Mann Whittney test p = 0.02

Side effects prevalence, n	Group I	p value	Group II
Hypotension	12/24	0.2	7/21
O_2 desaturation	5/24	0.8	4/21
Pruritus	5/24	0.3	7/21
N & V	4/24	0.05	0/21

Conclusions: In elderly patients undergoing joint replacement, the combination of 4 mg BP plus 15 μg of each fentanyl and clonidine, provides adequate SAA and reduces N & V in the postoperative period.

Acknowledgement: Partially supported by a grant from the Generalitat of Catalunya 2001SGR00409, Barcelona, Spain.

A-428

Can the introducer used for insertion of spinal needle protect it from bacterial contamination?

C. Dragoumanis, A. Grapsa, V. Theodorou, E. Monastiriotou, T. Gioka, T. Voyatzaki

Departments of Anesthesiology & Microbiology, General Regional Hospital of Alexandroupoli, Alexandroupoli, Greece

Background and Goal of Study: Bacterial contamination of needles used for spinal anesthesia is indicative for transmission of skin flora through normal antimicrobial barriers into structures of central nervous system during lumbar puncture. Can the introducer used for insertion of spinal needle protect it from contamination? In our study we have compared the rate of bacterial contamination during lumbar puncture between the spinal needles Pencil point 25G, and their introducers.

Materials and Methods: We studied the needles and their introducers used for spinal anesthesia performed in 75 ASA I – III patients. Patients were not under antibiotic medication and their hospital stay was up to 24 hours before anesthesia. The lumbar punctures were realized in operating theater by anesthesiologist wearing operating room dress, face mask, hat, and sterile gloves, using sterile drapes. Skin was prepared with 10% aqueous solution of povidone iodine. Soon after successful lumbar puncture the spinal needle and its introducer were transferred in separated sterile tubes to microbiological laboratory for cultivation with qualitative method.

Statistical analysis of results was performed with χ^2 test

Results and Discussions: Bacterial contamination was observed in 12 (16%) of the introducers, (9 coagulase negative staphylococci, 3 enterococci) and in the 2 (2,7%) of the needles (1 S epidermidis and 1 S.Capitiscapitis) p = 0,01.The prevalence of bacterial contamination in introducers compared to needles with typical skin organisms can be explained with direct contact of introducers with skin.

Conclusion(s): Insertion of spinal needles via introducers protects the needles from bacterial contamination during lumbar puncture.

A-429

Cognitive function in elderly patients after orthopedic surgery under spinal anaesthesia

A. Rodriguez, D. Fernandez Galinski, J. Real, C. Pulido, I. de Miguel, M.M. Puig

Department of Anaesthesiology, Hospital de Sabadell, CSPT and Hospital Universitari del Mar,UAB, Barcelona, Spain

Background & Goals: In the elderly, different factors such as previous cognitive impairment, brain disease, impaired sight/hearing, or drugs, may precipitate postoperative acute confusional states. The aim of our study was to investigate perioperative aspects that could have an impact on cognitive function in this population.

Material & Methods: Forty one non confused patients ⩾70 y.o scheduled for total knee or hip replacement under subarachnoidal anesthesia entered the study. The protocol was approved by the Ethics Committee of the Institution. Mini Mental State Examination (MMSE) was used to evaluate cognitive function before and after surgery (normal 24–30). All patients had spinal anaesthesia (SA) with low doses of bupivacaine (BP) (4–6.25 mg) combined with fentanyl (15–25 μg). Clonidine 15 μg was added to BP 4 mg. Four factors than could affect cognitive status were assessed: premedication with 5 or 10 mg p.o. diazepam, intraoperative sedation (midazolam 1 or ⩾1mg), decrease of MAP below 25% of basal values (hypotension) and O_2 desaturation (% O_2 Sat < 90%). The Student's-t and χ^2 tests were used for statistical comparison.

Results: MMSE mean values were 26.4 ± 3.3 and 26.4 ± 3.4 before and after surgery. The table shows differences between MMSE scores before and after surgery in relation to the four perioperative variables considered.

	N° patients	MMSE differences Mean values ± SD
Premedication (Diazepam 5/10 mg)	21/16	0.3 ± 1.7/−0.25 ± 2.1
Sedation (Midazolam 1/>1 mg)	15/20	0 ± 2.4/0.2 ± 1.5
Hypotension (yes/not)	18/23	−0.27 ± 2.2/0.3 ± 1.4
O_2 desaturation (yes/not)	8/33	0.25 ± 3.2/0.03/± 1.3

Conclusions: Major surgery under SA did not alter cognitive function in elderly patients; moreover, none of the variables evaluated had an impact on cognitive scores in the study population.

Acknowledgement: Partially supported by a grant from the Generalitat of Catalunya 2001SGR00409, Barcelona, Spain.

A-430

Intrathecal catheter placement following inadvertent dural puncture during attempted epidural analgesia for labor. Influence on the risk of headache in obstetric patients

S.N. Narouze, S. Ayad, Y. Demian, J.E. Tetzlaff

Division of Anesthesiology and Critical Care Medicine, The Cleveland Clinic Foundation, Cleveland, OH USA

Background and Goal of Study: The incidence of post-dural puncture headache (PDPH) is reported to be as high as 75% in obstetric patients.[1] Subarachnoid catheter placement has also been reported to reduce PDPH after obstetric wet tap.[2]

We were interested in whether subarachnoid catheter placement would be superior to a second attempt epidural catheter placement for reduction of PDPH.

Materials and Methods: Over a 5-year interval, 115 wet taps were identified in a teaching program. There were assigned to 3 groups. Group A ($n = 41$) received an epidural catheter that was removed after delivery. Group B ($n = 39$) had the 20G epidural catheter placed in the subarachnoid space that was maintained until after delivery. Group C ($n = 35$) had a subarachnoid catheter that was left in place 24 hours after delivery.

Results and Discussion: The overall incidence of PDPH was 46.9% and the need for blood patch 36.5%. There was significantly less PDPH in the 2 subarachnoid catheter groups (A = 91%, B = 51%, C = 6%, $p < 0.0001$) and need for blood patch (A = 81%, B = 31%, C = 3%, $p < 0.001$). For both, group C was significantly less than group B ($p < 0.0001$).

We speculate that the effect of the subarachnoid catheter on PDPH may be related to an immediate and delayed effect. The immediate effect of the catheter is to partially occlude the dural puncture and decrease the CSF leak. The improved effect of leaving the catheter in place for 24 hours may be related to an inflammatory process that facilitates closure of the dural puncture after catheter removal.

Conclusion: Subarachnoid catheter placement was compared to a second attempt at epidural catheter placement for reduction of PDPH after wet tap for obstetric patients in labor. The rate of PDPH and the need for epidural blood patch was significantly lower in the subarachnoid catheter group.

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A-431

Vertebral canal haematoma associated with neuroaxial anaesthesia in Spain

J. Castillo, J. Castaño, X. Santiveri, F. Escolano

Department of Anestesiología, Hospital Mar-Esperança, IMAS, Barcelona, Spain

Background and Goal of Study: The aim of this study was to analize the incidence and features of spinal haematomas associated with neuroaxial blocks in Spain.

Materials and Methods: The abstracts of the cases of spinal haematomas presented at the Spanish anaesthetic meetings from 1990 to September 2002 were reviewed. The following data were recorded for each case: anaesthetic technique, related antithrombotic drugs, medical or surgical treatment of the haematoma, neurologic improvement, and further publication of the case in Medline indexed journals.

Results and Discussions: There were 16 cases of spinal haematomas: seven following a subarachnoid block, 8 after an epidural block and 1 associated with combined intradural-extradural anesthetic technique. The first case was presented in 1996. Ten cases had received low- molecular-weight-heparin, 1 unfractioned-heparin and thrombolytic, and no anticoagulants drugs were mentioned for the other 5 cases. The time elapsed between antithrombotics administration and the neuroaxial block was < 9 hours in 7 cases. A laminectomy was performed in 8 patients, and the others 8 received conventional treatment, basically high doses of steroids. Two patients died from causes unrelated to the haematoma, 3 had an important neurological deficit, and 11 were completely recuperated. Only 3 cases (18,8%) were published.

Conclusion(s).: (1) The incidence of postneuroaxial blocks haematomas in Spain is apparently high. (2) The incidence is higher than the published cases. (3) Laminectomy indication must be optimized. (4) The efficacy of steroids needs further investigation.

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A-432

Comparative study of two low doses of bupivacaine in spinal anaesthesia for transurethral resection of prostate

M. Toumi, M. Methamem, K. Moncer, D. Ben Letaifa, Z. Zerelli, A. Ben Abdelazziz*, O. Kaabachi

**Department of anaesthesia and surgical intensive care; Department of statistics, Sahloul hospital, Sousse, Tunisia*

Background and Goal of Study: Spinal anaesthesia in elderly is associated with high incidence of hypotension (1). The synergism between intrathecal opiods and local anaesthetic may make it possible to achieve reliable and safe spinal anaesthesia using a minidose of local anesthetic (2).The goal of this study was to compare two low-doses of bupivacaine added to fentanyl in spinal anaesthesia for patients undergoing transurethral resection of prostate.

Materials and Methods: One hundred and ten ASA physical status I-II patients were randomised in two groups. GroupA received spinal anaesthesia of hyperbaric bupivacaine 7.5 mg and groupB received 5 mg of bupivacaine. Fentanyl 25 μg was added in both groups; We recorded onset and peak level of sensory block (SB), intensity of motor blockage (MB), time to two segment regression, number of hypotensive measurements and total vasopressor use. Statistic analysis used T test and ANOVA for continuous parameters and χ^2 and Fisher's exact test for parametric data; $p < 0;05$ was significant.

Results and Discussions: Demographic data were similar in both groups. Data (mean ± SD, %) are shown in table.

	GroupA N = 55	GroupB N = 55	P
Onset of SB (minutes)	9 ± 3	8,8 ± 5	0.8
SB > T12 (%)	17	83	<0.00
Motor blockage (%)	53.5	11	<0.00
2 segments regression (minutes)	87 ± 31	62 ± 23	<0.04
Vasopressor use (%)	9	2	0.2
Peroperative analgesic use (%)	7	5	0.4
Postoperative analgesic use (%)	25	22.7	0.5

Conclusion(s): Low-dose of 5 mg hyperbaric bupivacaine combined with 25 μg fentanyl in spinal anaesthesia for transurethral resection of prostate provides an adequate depth of anaesthesia, less motor block and rapid recovery than 7,5 mg bupivacaine.

References:

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A-433

Efficacy and safety comparison of levobupivacaine 0.5% and bupivacaine 0.5% for spinal anesthesia

F. Atallah, B. Riu, T. Bastide-Heulin, K. Taj, L. NGuyen, A. Antonini, M. Merouani, K. Samii, R.D. Ostroff*

*Services dAnesthésie-Réanimation du CHU de Toulouse, Toulouse, France; *Abbott Laboratories, Abbott Park, Illinois, USA*

Background and Goal of Study: Levobupivacaine has less toxicity than bupivacaine on the heart and central nervous system. This study compares the efficacy and safety of isobaric levobupivacaine 0.5% and isobaric bupivacaine 0.5% for spinal anesthesia.

Materials and Methods: 81 ASA I-III patients undergoing surgery of the perineum were enrolled in this Phase III, double-blind, randomized, multicenter study. Patients received 3 mL of either levobupivacaine 0.5% ($n = 40$) or bupivacaine 0.5% ($n = 41$) intrathecally. Efficacy variables were time to onset and duration of sensory block (pinprick test), time to peak sensory block height, and duration of motor block (modified Bromage score). Safety variables were intraoperative hemodynamics and adverse events related to study drug. Statistical analyses were done using two-way ANOVA or Cochran-Mantel-Haenszel tests. Data were expressed as mean ± SE.

Results and Discussion: All patients achieved adequate block for surgery. There were no statistically significant differences between the two groups for any of the measured efficacy parameters:

Parameters (min)	Levo	Bupi	P-value
Duration of sensory block (L5 block to L5 regression)	259 ± 14	280 ± 15	0.14
Time to L5 sensory block onset	6.9 ± 1.0	6.0 ± 1.1	0.37
Time to peak sensory block height	8.1 ± 1.1	8.3 ± 1.1	0.87
Duration of motor block	308 ± 17	318 ± 17	0.47

Peak level of sensory block varied between L5 and T4, with no statistically significant differences between the two groups. Intraoperative hemodynamics and incidence of adverse events related to study drug were similar between the two groups. No patients experienced transient neurological

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symptoms. One patient in the levobupivacaine group was excluded from the efficacy analyses due to a protocol violation.
Conclusion: Isobaric levobupivacaine 0.5% offers similar efficacy and safety to isobaric bupivacaine 0.5% for spinal anesthesia.
Acknowledgements: Supported by Abbott Laboratories.

A-434

Spinal bupivacaine–fentanyl anesthesia in urologic surgery, five years experience with 3824 patients

L. Szilagyi, S. Dobjanschi, G. Bumbu, T. Maghiar

Department of Urology Clinic – Anesthesy, University of Medicine Oradea, Clinical County Hospital of Oradea, Oradea, Romania

Background and Goal of Study: To asses the efficiency, safety, of the intrathecal-IT Bupivacaine–Fentanyl anesthesia in urological surgery we prospectively evaluated 3824 randomized, ASA I-III patients (5 years experience), for the quality of analgesia, muscular relaxation and recovery, hemodynamic, respiratory stability, complications and side effects.
Materials and Methods: Depending on the patient's ASA score and type of surgery, we used 0,08–0,15 mg/kg Bupivacaine (Bu), and a fixed dose of 25 mcg Fentanyl (Fe). For 1635 upper urinary tract (group I) procedures, we used Bu 0, 25% with the patient in orthostatic position, maintained 90–120 seconds after injecting the anesthesics at the L2–3 level(1). For 2189 lower urinary tract procedures (group II), Bu 0, 5% (heavy) was used. Pain was assessed with the Visual Analog Scale-VAS, muscular relaxation (intra/postoperative) with the Bromage scale-Br.
Results and Discussions: Results are presented in the table bellow. 3 patients (0,08%) had to be converted to general anesthesia. 82% of all patients had a stable hemodynamic function. Severe bradycardia (<30/min) was noted after ventral positioning in 1 patient and was successfully treated. 3 patients (0,08%) presented respiratory depression treated with opioid antagonists. Minor complications consisted of: pruritus 24%, nausea and vomiting 2,5%, sleepiness 2%, headache 1,5%, priapism 7,5%.

Anest.	Onset	Spread	VAS	Iop.Br	Pop.Br
Group I	3–5 min	T3–4	0–1 (94%)	0–1 (89%)	0 in 70–120 min
Group II	3–5 min	T6–8	0–2 (87%)	2–3 (91%)	0 in 160–190 min

Conclusion(s): The IT Bu-Fe anesthesia is efficient, safe, simple to perform, and inexpensive. Fe allows: a decrease of Bu dose(2) favoring early ambulation(3), improving the hemodynamic stability, preserving the quality of analgesia and respiratory function. Side effects can be managed easily, and major complications are rare but possible.
References:
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3 Ben-David B, Levin H, Solomon E et al.: Anaesth-Analg.1997;85:560–65.

A-436

Intrathecal anaesthesia during outpatient arthroscopic surgery: ropivacaine versus bupivacaine

N. Boztug, Z. Bigat, N. Kayacan, N. Saykal, E. Ertok

Department of Anaesthesiology and Reanimation, Akdeniz University Faculty of Medicine, Antalya, Turkey

Background and Goal of Study: Ropivacaine a relatively new local anaesthetic with similar local anaesthetic properties as bupivacaine, is the first single-enantiomer local anaesthetic to be produced commercially(1). This study was designed to compare intrathecal ropivacaine to bupivacaine for outpatient arthroscopic surgery.
Material and Methods: After getting approval of the ethic committee 30 patients were randomly double blindly received 3 ml solution either 15 mg of isobaric ropivacaine + 1 ml isotonic NaCl (Group R) (n = 15) or 7.5 mg of isobaric bupivacaine + 1.5 ml isotonic NaCl (Group B) (n = 15) through a 27-gauge pencil point spinal needle at the L3-4 level in the lateral decubit position. Onset and offset times for sensory and motor blockades, the highest level of sensory blockade, duration of the sensory and motor blockades, first ambulatory and urination time, mean arterial pressure and heart rate were recorded. During the first three postoperative days, patients were asked about postoperative complications such as nausea, vomiting, headache and transient neurological symptoms. For statistical analyse Independent Sample T, Mann–Whitney U and χ^2– Tests were used.
Results and Discussion: Onset time for sensorial blockade (mean ± SD) to T10 and offset time to L1 were shorter in group R (ropivacaine = 3.5 ± 0.5 min, 116.0 ± 8.9 min; bupivacaine = 5.4 ± 0.4 min, 152.2 ± 16.6 min). Complete motor blockade occurred in 11 patients with ropivacaine and 13 patients with bupivacaine. First ambulatory time and first urination time were similar between groups (ropivacaine = 297.4 ± 24.1 min, 288.1 ± 19.0 min; bupivacaine = 296.2 ± 21.5 min, 332.1 ± 27.0 min) ($p > 0.05$). Cephaled spread of sensory blockades was higher with ropivacaine (pinprick T7 in 7 patients) than with bupivacaine (pinprick T10 in 1 patient) ($p < 0.05$). Hemodynamic changes and postoperative complications were similar between the groups ($p > 0.05$).
Conclusion: We conclude that 15 mg isobaric ropivacaine provided higher sensory blockade level and shorter sensorial onset and offset times than 7.5 mg of isobaric bupivacaine.
Reference:
1 Malinovsky J-M, Charles F, Kick O, et all. Anesth Analg 2000; 91: 1457–60.

A-437

Early ambulation does not influence the incidence of TNSs after lidocaine spinal anaesthesia

M. Silvanto, P. Tarkkila, M-L. Mäkelä, P.H. Rosenberg

Department of Anaesthesia and Intensive Care, Research Institute of Military Medicine and University of Helsinki, Helsinki, Finland

Background and Goal of the Study: The etiology of transient neurologic symptoms (TNSs) after lidocaine spinal anaesthesia remains unsolved. It has been proposed that early ambulation after surgery could play a significant part in causing TNSs [1]. We studied if ambulation time could affect the incidence of TNSs after spinal anaesthesia with 2% lidocaine for knee arthroscopy.
Materials and Methods: One hundred and twenty ASA1 or 2 patients were randomized into three groups of equal size, i.e., early (E), 6h (6h) and late (16–24h) ambulation (L) groups. Spinal anaesthesia was performed with a 27-gauge Quincke needle and 50 mg of 2% lidocaine. In the E-group the patients were encouraged to walk as soon as the block had vanished. In the 6h and the L groups the patients remained in bed for six and 16–24 hours, respectively. TNSs were defined as back pain or dysesthesia radiating bilaterally to the legs or buttocks after total recovery from spinal anaesthesia and beginning within 24 hours of surgery.
Results and Discussion: The patient groups were comparable. The incidence of TNSs was highest in the 6h group and was significantly higher compared with the E group (Table).

Table. Mean (SD), or the number of patients. *$p < 0.05$, **$p < 0.01$ compared with E-group.

	E	6h	L
Tourniquet (min)	48 (12)	67 (28)	58 (13)
Ambulation (min)	210 (29)	354 (31)*	1279 (105)**
TNSs	3 (8%)	11 (28%)*	6 (15%)

Similarly to this study, the incidence of TNSs in published studies has been high after knee arthroscopy with lidocaine spinal anaesthesia [1]. This study supports the concepts that decreasing concentration of lidocaine from 5% to 2% does not prevent development of TNSs [2]. Interestingly, not even the relatively small dose of lidocaine (50 mg) could reduce the incidence of TNSs.
Conclusions: Early ambulation was not found to be a risk factor for TNSs after spinal anaesthesia with 2% lidocaine. The role of lidocaine in the mechanism of TNSs after spinal anaesthesia is still unresolved.
References:
1 Freedman JM, et al. *Anesthesiology* 1998;89:633–641.
2 Pollock JE, et al. *Anesthesiology* 1996;84:1361–1367.

A-438

Hearing loss following spinal anaesthesia with bupivacaine

A. Dimakopoulou, J. Zogogiannis, J. Stranomiti, A. Kontadaki, Z. Pappas, U. Hambouri

Department of Anaesthesiology and Department of Otorinolaryngology, General Hospital of Athens "G. Gennimatas", Athens, Greece

Background and Goal of Study: This study was designed to evaluate the degree of cochlear dysfunction following spinal anesthesia administered through spinal needles of different shape and diameter.
Materials and Methods: We studied 120 patients ASA II, III aged 55–85 years who underwent transurethral prostatectomy. The patients were randomly allocated to six groups in which the anesthetic was administered through 22G Quincke, or 22G Whitacre, or 25G Quincke, or 25G Whitacre, or 26G Quincke, or 26G Atraucan. Spinal anaesthesia was administered through $L_{3/4}$ or $L_{4/5}$ interspace using bupivacaine 0.5% 3 ml. Audiometric evaluation was made with pure tone audiometry on the day preceding surgery. On the second postoperative day a new audiogram was performed. All results are presented as means (±SEM). In all groups the preoperative minus the postoperative hearing levels for any change at each frequency were compared using the student's t-test $p < 0.05$ was considered significant.
Results: In the group which received spinal anesthesia via 22G Quincke or via 22G Whitacre needle an increase in the hearing threshold of 10–15 dB

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was found at the lower frequencies. $P < 0.05$. In the group which received anesthesia via 25G Quincke or via 25G Whitacre needle an increase in hearing threshold of 10–15 dB was found at the lower frequencies. $P < 0.05$. In the group which received anesthesia via 26G Quincke or via 26G Atraucan needle no significant change was observed. In comparing the 22G Quincke and the 22G Whitacre needle group there was a statistically significant hearing loss at 250 Hz and at 500 Hz. In comparing the 25G Quincke and 25G Whitacre group there was a statistically significant hearing loss at 125 Hz. In comparing 26 G Quincke and 26G Atraucan group there was no statistically significant hearing loss. In comparing the 22G vs 25G vs 26G Quincke needle group there was a statistically significant hearing loss at 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz and at 4000 Hz. In comparing the 22G Whitacre vs 25G Whitacre vs 26G Atraucan needle group there was a statistically significant hearing loss at 125 Hz, 250 Hz, 500 Hz and at 2000 Hz.

Conclusion: The shape and the diameter of the spinal needle used for dural puncture are related to the degree of cochlear dysfunction.

Reference:

1 Finegold H. Anesth. Analg 2002;95:198–203.

A-439

Intrathecal Fentanyl and Clonidine as adjuncts to subarachnoid anaesthesia with Levobupivacaine: influence on quality of surgical analgesia

I. Grigoropoulou, S. Papanastsiou, G. Nikolaidou, P. Kouki, C. Zolindaki, I. Topalidis, E. Chrona, N. Palgimesi

Department of Anaesthesia, Piraeus General Hospital, Athens, Greece

Background and Goals: Opioids as Fentanyl (F) or adrenergic agonists as Clonidine (C) are increasingly being administered intrathecally as adjuncts to spinal anaesthesia. A prospective study was conducted to assess the quality of surgical analgesia induced by subarachnoid anaesthesia either with Levobupivacaine (L) alone, Levobupivacaine plus Fentanyl (L + F) or Levobupivacaine plus Fentanyl plus Clonidine (L + F + C).

Material and Methods: 82 patients undergoing elective procedure under subarachoid anaesthesia were enrolled. Patients were randomized in three groups to receive group L (n = 25) Levobupivacaine 0,5% 10 mg, group L + F (n = 27) Levobupivacaine 0,5% 10 mg plus Fentanyl 10 μg and group L + F + C (n = 30) Levobupivacaine 0,5% 10 mg plus Fentanyl 10 μg plus Clonidine 30 μg in the subarachnoid space. Spinal anaesthesia was performed at L_{2-3} interspace in the lateral decubitus position. Immediately after spinal injection patients were turned supine and remained in the horizontal position up to the end of the study. Sensory and motor blockade were estimated at 5, 10,15, 20, 30, 40, 50, 60, 75, 90, 120 min after spinal injection. Incisional pain, inadequacy of surgical analgesia, patient discomfort requiring i.v. general anaesthesia and i.v.supplemental analgesia and sedation were recorded. Results are mean (SE), proportions and analyzed using one way ANOVA, Fisher`s exact test as indicated. $P < 0,05$ was considered significant.

Results: Groups were comparable with respect to number, age, weight and ASA. Incisional pain was noticed in 2 (8%) patients in group L, 1 (3,7%) patient in group L + F and 0 patient in group L + F + C. Inadequacy of surgical analgesia was noticed in 4 (16%) patients in group L, 1 (3,7%) patient in group L + F and 0 patient in group L + F + C, (P = 0,03). 3 (12%) patients in group L were given i.v. general anaesthesia and 2 (8%) patients of this group required i.v. supplemental analgesia, 1 (3,7%) patient in group L+F was given i.v. sedation and 0 patient in group L + F + C received i.v. analgesia or sedation, (P = 0,04).

Conclusions: Co-administration of Levobupivacaine 0,5% 10 mg plus Fentanyl 10 μg plus Clonidine 30 μg is indicated to improve the quality of surgical analgesia as no patient in this group expressed incisional pain or was given i.v. general anaesthesia, analgesia and sedation, difference statistical significant.

A-440

Spinal anaesthesia for cesarean section: ropivacaine vs bupivacaine with morphine. Preliminary findings

G. Danelli, A. Cornini, O. Farina, G. La Cava, C. Barbieri, E. Sani, A. Vecchione, S. Sivelli

Department of Anesthesiology, University of Parma, Chair G.Fanelli, Parma, Italy

Background and Goal of Study: Comparison of efficacy and safety of plain ropivacaine (R) vs plain bupivacaine (B) with morphine (M) in spinal anesthesia (SA) for cesareansection(c-s).

Materials and Methods: 30 ASA < II women scheduled for elective c-s were submitted to SA in a sitting position at L_3–L_4 with 25 G Whit. needle over 60 sec. We choose an equipotent ratio between B. and R. of 2:3(1) and with a computer randomization we performed SA as follow:group I = R 20 mg; group II = B 15 mg. both with morphine 0.1 mg (volume 2 mL). Hemodinamic value, sensory changes to pinprick with higher cephalic spread and motor block (Bromage score) were recorded at 5 min. intervals. Post operative analgesia was provided by PCA set to deliver morphine (ID:1 mg/lock out 5 min.). Every six hrs for the first 24 hrs were also recorded hemodynamic value, sPO_2 VAS (0–100 mm) and morphine consumption. Using previous data was calculated a sample size of 20 patients (error $\alpha = 90\%$; $I\beta = 25\%$ on difference in the duration sensory anaesthesia at L1), data were presented as mean ± SD or median as appropriate (1). Comparison between groups were performed with Mann–Whitney U-test,significance level was set at $P < 0.05$.

Results and Discussions: No differences in demographic data, onset, cephalad spread of sensitive block and bromage score recorded intraoperatively. Adequate anesthesia for surgery was achieved in all patients with a degree of pain until 24 hrs low in all patients (VAS ⩽ 30) without differences in morphine consumption, no neurologic symptoms were found until discharge. However we found an interesting finding comparing regression time of sensitive and motor block, patients submitted to SA. with B. show a slow regression time of sensitive and motor blockade [motor block:group I: (121,33 min. DS 21.66); group II: (166,00 min. DS 29,95] [sensory: group:I (236 min. DS 41.36); group II (310 min. DS 66.97)]. This study evidenced a differential blockade between B. and R. an explanation of which may involve a lower lipid solubility of R vs B. If this finding will be confirmed SA. with R will need larger study also for other context.

Reference:

1 Anest Analg 2002;94(3):680.

A-441

Unilateral spinal anaesthesia: bupivacaine versus bupivacaine + fentanyl

Z. Bigat, N. Boztug, B. Karsli, Y. Unuvar E. Ertok

Department Of Anaesthesiology, Akdeniz University Faculty of Medicine, Antalya, Turkey

Background and Goal of Study: Unilateral spinal anaesthesia may be advantageous, especially in the outpatient procedure (1). We searched for block features, recovery, complications and postoperative analgesic requirements at unilateral spinal anaesthesia during knee arthroscopy by lowering the local anaesthetic dose and adding fentanyl to bupivacaine.

Materials and Methods: After approval taken from local ethic committee 30 ASA I-II unpremedicated patients were randomly and double blindly allocated into 2 groups. Spinal anaesthesia was performed between L_{3-4} interspace in the lateral decubit position and the operating side being below. We administered intrathecal 7.5 mg hiperbaric bupivacaine 0.5 % in group I (n = 15) and 5 mg hyperbaric bupivacaine 0.5 % + 25 μgr fentanyl in group II (n = 15). Patients were turned to supine position after keeping them in the lateral position for 10 minutes. Maximum sensorial and motor block levels of both extremities, block time, side effects, complications, first analgesic requirement, first urination and ambulation time were recorded. For statistical analysis independent sample t test, mann whitney U test and χ^2 tests were used.

Results and Discussions: Sensory block levels were above T_{10} level in 100% of patients in group I and 53.33% of patients in group II ($p < 0.05$). Bilateral sensory block occurred in 73.3% of patients in group I and 26.6% of patients in group II ($p < 0.05$). First ambulation (group I-II; 301.13 ± 102.55–220.60 ± 57.44 min p = 0.013) and urination times (group I-II; 337.66 ± 151.89–236.60 ± 65.44 p = 0.025) were statistically significant between groups. During postoperative first 24 hours analgesic requirements were seen in 73.33% of patients in group I and 40% of patients in group II ($p < 0.05$). The incidence of side effects such as; pruritis, shivering, nausea-vomiting were similar between groups.

Conclusion(s): In unilateral anaesthesia; lowering the bupivacaine dosage and adding fentanyl ensures enough block for knee arthroscopy without increasing side effects and also this provides earlier recovery and decreases postoperative analgesic requirement. This is an important property for outpatient anaesthesia.

Reference:

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A-442

Low dose intrathecal bupivacaine–fentanyl anaesthesia for transuretheral resection of prostate (TURP): a double blind study

S. Gombar, S. Lata, K.K. Gombar

Department of Anaesthesia and Intensive Care, Government Medical College and Hospital, Chandigarh, India

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Background and Goals: Purpose of the present study was to compare the effects of intrathecal (IT) low dose hyperbaric bupivacaine (HB) with fentanyl (F) vs. conventional dose of bupivacaine in elderly patients for transurethral resection of prostate (TURP).
Material & Methods: 100 patients, ASA 1–3, aged 60 and over received IT block with 26G needle. Patients were randomly divided in double blind manner into 4 groups to receive IT: 0.5% HB 10 mg with 0.4 ml normal saline in group I, HB 10 mg with F 20 μg in group II, HB 7.5 mg with F 20 μg in group III and HB 5 mg with F 20 μg in group IV, final volume being 2.4 ml in each case. Assessment was made of the time to onset, peak sensory level and duration of sensory block. Motor block (MB) was assessed by modified Bromage scale.
Statistics: ANOVA, Student's t test. $P < 0.05$ significant.
Results: Data (mean ± SD) are shown in table:

	Group1	Group2	Group3	Group4
Onset (Min)	1.88 ± 0.34	1.68 ± 0.69*	1.83 ± 039	2.91 ± 1.93*
Duration	145.0 ± 1	154.1 ± 2	130.1 ± 2	115.0 ± 1
(Minutes)	6.5	4.5	3.8*	4.2*
Median peak level (range)	T6(TR–T10)	T6(T2–T8)	T8(T6–T8)*	T10(T8–T11)*
Failed block	0	0	2	3
MB 0-1-2-3	3-1-5-16	2-0-4-19	10-5-6-4≠	13-9-3-0≠
MB duration(min)	154.2 ± 28.4	162.3 ± 26.5	107.8 ± 23.3≠	96.3 ± 7.4≠
Hypotension no.(%)	6(24%)	7(28%)	1(4%)	0(0%)

*$p < 0.05$, ≠$p < 0.01$

Conclusions: A subarachnoid block with small dose HB 7.5 mg & F 20 μg provides adequate anaesthesia without haemodynamic instability in elderly patients for TURP.

A-443

Bacterial meningitis after spinal anaesthesia: a case report

N. Lages, A. van Veenendaal, E. Fuentes, J. Tavares

Departamento de Anestesiologia e Cuidados Intensivos, Hospital S. João, Porto, Portugal

Background and Goal of Study: The authors want to emphasize the importance of aseptic conditions in the operation room.
Materials and Methods: A 74-year-old female patient, ASA-II, was proposed for a total hip arthroplasty after having been diagnosed a closed fracture of the femoral neck. The patient was given cefazoline 2 g EV preoperatively. Spinal anaesthesia (SA) was performed with a 22G spinal needle, introduced medially at L3–L4. Clear CSF was obtained immediately. Levobupivacaine 0,5% was subsequently administered. Aseptic conditions were maintained whenever possible. The procedure was uneventful. The patient was discharged on the 7th postoperative day, but returned 2 days later with severe occipital headache and fever. She was somnolent and showed neck stiffness at physical examination. Purulent CSF was collected from lumbar puncture, showing 1290 cells/mm^3, proteins 0,46 g/l glucose:0,4 g/l. Gram stain was negative. The patient was hospitalised and treated empirically with ampicilline and cefotaxime. Six days later, a strain of *Streptococcus viridians* was isolated from the CSF. Eventually, the patient was discharged after a complete resolution of the clinical state.
Results and Discussions: Bacterial meningitis is a rare complication of SA; in a series of 65.000 SA only 3 cases of (fatal) meningitis were described. Diagnosing may be difficult: a post-dural puncture headache may be considered first. The CSF is contaminated mainly exogenously. Microorganisms residing in hair follicles, such as *S. viridians* are difficult to eliminate even when the skin is well disinfected. Pharyngeal flora may be transmitted to the patient when the OR personnel do not take protective measures (e.g. facemask). A third mechanism is the administration of contaminated local anesthetics. Unfortunately, in this particular case, it was impossible to find the source.
Conclusion(s): Although rare, bacterial meningitis is a serious and a potentially lethal condition. The low incidence may induce a more relaxed attitude towards aseptic measures. OR personnel should be made aware of this possible complication of SA and be instructed to always take precautionary measures.

A-444

Spinal anaesthesia with fentanyl and meperidine: haemodynamics, plasma levels of histamine, IgE, basophil, eosinophil and analgesic requirements

A. Koroglu, S. Erdem, M. Cicek, Z. Dogan, N. Sezgin, M.O. Ersoy

Department of Anaesthesiology School of medicine, Inonu University, Malatya, Turkey

Background and Goal of Study: The aim of this study is to compare clinical effects of intrathecal fentanyl and meperidine combined with bupivacaine, and to determine whether side-effects of these agents such as pruritus, tachycardia and bradycardia are related to the histamine release or allergic, immunologic reactions.
Materials and Methods: After ethics committee approval, 45 ASA I-II patients undergoing knee arthroscopy were included into the study. Blood samples were taken for measure the plasma levels of histamine, IgE, basophil and eosinophil 30 min before spinal anaesthesia, and at the 8th, 60th minutes of spinal anaesthesia. After standard anaesthesia monitorization, heart rate (HR), mean arterial pressure (MAP), SpO_2 values were recorded. All patients received bupivacaine heavy intrathecally and additionally 0.5 mL 0.9% NaCl in group B, 25 μg fentanyl in group F, 25 mg (range, 0.2–0.4 mg.kg^{-1}) meperidine in group M were given.

During spinal anaesthesia HR, MAP, respiratory rate, SpO_2, and $ETCO_2$, the levels of motor and sensory block were recorded with five minutes intervals. Time to onset of analgesia, duration of action, time to onset and offset of motor block and operation times were recorded. After the end of operation, VAS scores, analgesic requirements, side effects and hospitalization time were recorded at the 3rd, 6th, 12th and 24th hours.
Results and Discussions: There were no significant differences regarding haemodynamic results between groups. Whereas in group M, motor blockade offset time was longer; VAS scores and postoperative analgesic requirements were significantly lower than the other two groups. Despite the indifference between groups according the side effects, the plasma levels of histamine and basophil were significantly higher in the group F and group M than group B at the 8th min of spinal anaesthesia.
Conclusion(s): We suggest that the intrathecal meperidine was more effective than fentanyl administered with hyperbaric bupivacaine for intraoperative and postoperative analgesia. It is also revealed that despite both meperidine and fentanyl significantly increased the histamine release, there was no relationship between histamine release and pruritus.
Reference
1 Kuusniemi KS. Anesth Analg 2000;91:1452–6.

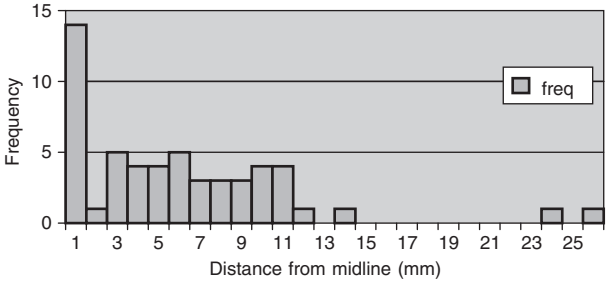
A-446

Patient-led identification of the midline of the lumbar spine

C. Eickmann, I. Hodzovic, D. Howells, T.S. Vasu, J. Mecklenburgh

Department of Anaesthetics, University of Wales College of Medicine, Newport, United Kingdom

Background and Goals: The techniques used to identify the midline of the back necessary for successful placement of an epidural catheter or spinal needle are limited (1). A volunteer study of patient-led identification of the midline, using fine touch and proprioception, suggested that this simple technique may well be of value (2). We evaluated the ability of patients to identify the midline of their back by comparing it to the midline derived from the x-ray of the patient's lumbar spine.
Methods: Following approval of the local research ethics committee, we studied 56 patients coming for chronic pain procedures under x-ray control. Mean (range) values for age, height and weight were 55 (25–85) yrs, 162 (150–183) cm and 76 (46–118) kg correspondingly. Patients with previous back surgery and/or spine deformity were excluded. The patient was asked to sit on the stool and to point at the midline of their back. The point of touch was marked with a radiological marker. The anterior/posterior x-ray of the lumbar spine was taken with the patient lying prone.
Results: Deviation from the midline is shown on the bar chart. Each bar represents a 1mm range.



Mean [SD (95% CI Upper)] distance from the midline was 6.1 [5.5 (7.3)] mm.
Conclusions: This simple patient-led technique confirms the finding of the previous study (1) of a patient's ability to identify the midline of their back with potentially clinically useful accuracy.
References:
1 Obert B, Poulsen TD. *Acta Anesthesiologica Scandinavica* 1996;**40:**191–200.
2 Wills JS, Bowie R, Bogod DG. *Anaesthesia* 2002;**57:**390–4.

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Pharmacology

A-447

Effect of aminophylline on bispectral index

A. Turan, D. Memis, B. Karamanlioglu, Z. Pamukcu, N. Sut

Department of Anaesthesiology, Trakya Univ. Medical Faculty, Edirne, Turkey

Background and Goal of Study: Aminophylline was demonstrated to be effective in improving recovery from volatile anesthetics by using clinical observations (1), however bispectral index (BIS) values were not evaluated. We aimed to investigate the effect of aminophylline on BIS values in recovery from sevoflurane anesthesia.

Material and Methods: After obtaining approval by ethical commitee and informed consent of 60 patients with status of ASA I-II scheduled for elective surgery with duration of more then 1hr were enrolled. After standard premedication anesthesia was induced by 2 mg kg^{-1} propofol and 0.5 mgkg^{-1} atracurium, maintained with 1:1 ratio oxygen + nitrous oxide and 2–2.5% sevoflurane keeping BIS values at 50 ± 5. At the last 30 minutes of operation no muscle relaxant was given and continued without decreasing anesthetic concentration keeping the BIS value below 50. At the end of operation, after sevoflurane discontinuation; serum saline was given to Group P, 5 mg kg^{-1} aminophylline to Group A. BIS values, heart rate, blood pressure and oxygen saturation were determined in all the patients before and every min after injection of the test drug for 15 min's. The following variables were measured in both groups eye openning, extubation time, response to command and perform three simple arithmetic calculations asked every 3 min. interval. The Aldrete scores were recorded when patients arrived in post-anaesthetic recovery room and every 15 min thereafter.

Results: Between groups there was no statistically significant difference in mean arterial blood pressure, SpO_2 and anesthesia time. Heart rate was found statistically higher ($p < 0.001$) at 2 to 6 mins in group A when compared with group P. Eye opening, verbal response, extubation and arithmetic calculation times were significantlly shorter ($p < 0.001$) in group A. BIS scores were significantly higher in group A, 1 to 12 mins after aminophylline injection when compared with plasebo ($p < 0.001$).

Conclusions: Aminophylline improves BIS scores and this is in correlation with clinical observations.

Reference:

1 Turan A, Memis D et al. Effect of aminophylline on recovery from sevoflurane anesthesia. Eur J Anaesthesiol 2002; 19: 452–454.

A-448

Prevalance of impaired adrenal function in patients undergoing elective major abdominal surgery

G. Schuepfer, F. Studer, J.I.T. Poelart, C. Henzen

Department of Anaesthesia and Critical Care, Kantonsspital Lucerne, Lucerne, Switzerland

Background and Goal of Study: Partial adrenal insufficiency may contribute to perioperative morbidity and mortality. Few epidemiological data exists on the adrenal function in patients undergoing major surgery.

Materials and Methods: A prospective cohort study in a large urban teaching hospital, including patients under-going elective major elective surgery. The study was approved by the local institutional ethics committee, and informed consent was obtained from all participants. Patients with a history of glucocorticoid therapy, endocrine diseases, acute pulmonal, cardiac or septic problems were excluded. For the low-dose (1 mcg) ACTH test, a bolus intravenous injection of 1 mcg (1–24)-cortico-tropin was given. Baseline and stimulated Plasma cortisol were measured 24 hours before surgery and immediately after the end of surgery. A normal response to intravenous ACTH was defined as a stimulated plasma cortisol concentration above 550 nmol/l (20 mcg/dl).

Results and Discussions: Seventy two patients were included (28 females/44 males), mean age 64.3 years ± 14 standard deviation (sd). Immediately after surgery Preoperatively, 42 patients (58%) had normal stimulated plasma cortisol levels (mean 708 nmol/l ± 140 (sd). 30 patients had a impaired adrenal response with mean plasma cortisol levels of 373 nmol/l ± 75 (sd). The increase of cortisol was 338 nmol/l (mean) ± 172 (sd) in patients with normal stimulated cortisol levels and 121 nmol/l mean ± 80 (sd) in patients with impaired stimulation ($p < 0.001$). Basal plasma cortisol levels were also significantly lower in patients with impaired response (mean 251 nmol/l ± 82 (sd) versus mean 370 nmol ± 135 (sd); $p < 0.01$). Postoperatively patients with normal preoperative response had significantly higher simulated plasma cortisol levels (mean 715 nmol ± 295 (sd) versus mean 556 nmol/l ± 229 8 (sd)), but the increase from baseline cortisol levels were similar (192 nmol/l ± 147 (sd) versus 186 nmol/l ± 11 (sd)).

Conclusion(s): In a surprisingly high proportion of these patients partial adrenal insufficiency can be diagnosed be means of the low dose ACTH test. These patients not only have diminished stimulated plasma cortisol levels but also significantly reduced cortisol increase to ACTH. Cortisol levels in these patients remained significantly lower also under surgical stress.

A-449

Isoflurane–fentanyl interaction: effect on early recovery from anaesthesia

H.R. Muñoz, F.R. Altermatt, M.E. Ibacache, P. León

Departamento de Anestesiología, Escuela de Medicina, Pontificia Universidad Católica de Chile, Santiago, Chile

Background and Goal of Study: While optimal combinations of propofol and opioids for anaesthesia have been determined [1], there are no similar studies for isoflurane (Iso) and fentanyl (Fen). Thus, the objective was to determine the effect of different combinations of Iso and Fen on early recovery from anaesthesia.

Materials and Methods: After IRB approval, ASA I-II adults scheduled for laparoscopic cholecystectomy were studied. After induction of anaesthesia with Fen 2 μ g kg^{-1} and thiopental 5 mg kg^{-1} patients were randomized to one of four groups for maintenance with O_2 100%: G1 (n = 11): Iso 0.6% ET + Fen, G2 (n = 17): Iso 1.2% ET + Fen, G3 (n = 16): Iso 1.8% ET + Fen, and G4 (n = 15): only Iso. In groups 1 to 3 Iso was kept unchanged and only Fen was administered to maintain the mean arterial pressure (MAP) within ± 10% of the minimal value measured in the ward, in group 4 only Iso was administered to the same goal with no additional Fen. At the end of surgery, anaesthesia was discontinued (T_0), patients were ventilated during 2 minutes with O_2 100% and then left in apnoea without stimulation. A blinded investigator measured from T_0 the times (min) to spontaneous breathing (TSB), to extubation (TE), and to eyes opening (TEO). Intraoperative awareness, degree of sedation, SpO_2, respiratory rate, pain and morphine requirements, and postoperative emesis were evaluated in the PACU. One- and two-way ANOVA and Student's t test were used for statistics. A $p < 0.05$ was considered significant. Values are mean ± SD.

Results and Discussions: No differences were found in general data among groups. Fen requirements (μg kg^{-1}) were 7.2 ± 2.6 in G1, 3.9 ± 1.4 in G2, 2.9 ± 0.7 in G3, and 2.0 ± 0.1 in G4. TSB was 4.7 ± 2.9 in G1, 3.1 ± 2.2 in G2, 5.2 ± 2.8 in G3, and 3.9 ± 1.7 in G4 (NS). TE was 6.3 ± 3.2 in G1, 13.1 ± 5.7 in G2, 21.5 ± 7.2 in G3, and 19.3 ± 7.7 in G4 ($p < 0.001$). TEO was 6.3 ± 3.3 in G1, 14.6 ± 5.3 in G2, 24.7 ± 7.1 in G3, and 24.8 ± 7.1 in G4 ($p < 0.001$). There were no differences in adverse effects among groups.

Conclusion(s): Iso 0.6% ET plus Fen given in doses as to maintain a stable intraoperative MAP results in a significantly faster recovery from anaesthesia than higher concentrations of Iso and with no more adverse effects.

Reference:

1 Vuyk J, Mertens MJ, Olofsen E, et al. *Anesthesiology* 1997; 87: 1549–62.

A-450

Minimum anesthetic concentration (MAC) of sevoflurane with different xenon concentrations in swine

K. Hecker, J.H. Baumert, N. Horn, M. Reyle-Hahn, N. Heussen, R. Rossaint

Department of Anaesthesiology, Universitätsklinikum der RWTH Aachen, Aachen, Germany

Background and Goals: In a previous study we described a partial antagonism of xenon (Xe) in combination with isoflurane (1). This warrants investigating the combination of Xe with sevoflurane in order to look at the relationship between Xe and another volatile anesthetic. We therefore investigated the influence of Xe on the MAC of sevoflurane (MAC_{sevo}) in pigs.

Materials and Methods: The study was performed in 10 pigs (weight 26.8–33.6 kg) ventilated with xenon 0%, 15%, 30%, 40%, 50%, 65% in oxygen. With each Xe concentration, various concentrations of sevoflurane were administered in a step-wise design. For each, a supramaximal pain stimulus (claw clamp) was applied, and the appearance of a withdrawal reaction was recorded (2). The MAC_{sevo} was defined as the end-tidal concentration required to produce a 50% response rate. A logistic regression model was fitted to the results to determine MAC_{sevo}.

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Results: MAC_{sevo} was decreased by inhalation of xenon in a linear manner. Results of the logistic regression and MAC_{sevo} are shown in Table 1 and 2.

Parameter	Estimate	95% CI	p-value
Intercept	−5.9476	−8.1029; 3.7922	<0.001
sevoflurane	2.2669	1.0682; 3.4656	0.0002
Xenon	0.0574	0.0062; 0.1085	0.0279
sevoflurane*Xe	−0.0126	−0.0273; 0.0020	0.0898

Xe (Vol. %)	MAC_{sevo}	95% CI
0	2.53	2.23–2.83
15	2.30	2.00–2.60
30	2.08	1.78–2.38
40	1.92	1.62–2.22
50	1.77	1.47–2.07
65	1.54	1.24–1.84

Conclusion(s): MAC_{sevo} is reduced by administration of Xe in a linear way, that is the anaesthetic effects of sevoflurane and Xe are apparently additive.

References:

1 Hecker KE, Reyle-Hahn M, et al. Minimum Anesthetic Concentration (MAC) of Isoflurane with Different Xenon Concentrations in Swine. *Anesth Analg* in press.

2 Eger EI2, Johnson BH, et al. Minimum alveolar concentration of I-653 and isoflurane in pigs: Definition of a supramaximal stimulus. *Anesth Analg* 1988; 67: 1174–7.

A-451

The correlation between the sevoflurane uptake pattern and vaporizer dial settings at different fresh gas flows

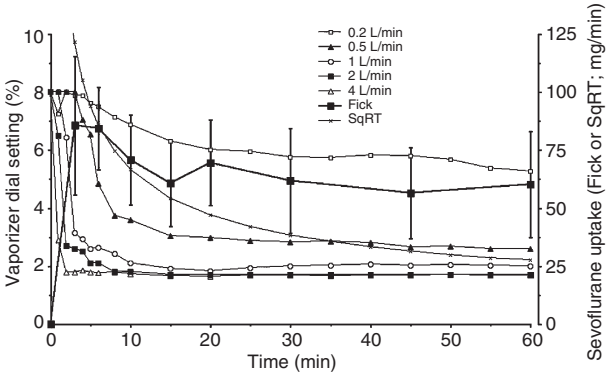
P. Frietman, J.F.A. Hendrickx, R. Grouls, A.A.J. Van Zundert, A.M. De Wolf

Department of Anesthesiology, OLV Hospital, Aalst, Belgium; Catharina Hospital, Eindhoven, The Netherlands; North Western Uiversity, Chicago, IL, USA

Background and Goal of Study: Lowe and Ernst used the square root of time (SqRT) uptake model to predict the vaporizer dial setting (vap%) course required to maintain a constant end-expired concentration (Et) of an inhaled anesthetic with any fresh gas flow (FGF) (=general anesthetic equation)(1). Because the SqRT model has been challenged recently (2), we studied sevoflurane uptake (V_{sevo}) and how it is reflected in vap% with different FGF.

Materials and Methods: After IRB approval, 9 patients undergoing cardiac surgery were enrolled. Et_{sevo} was maintained at 0.75%. Fick-derived V_{sevo} was calculated using thermodilution cardiac output and arterial and mixed venous blood sevoflurane content (chromatography) in samples take at 0, 3, 6, 10, 15, 20, 30, 45, and 60 min. In 40 other patients, we determined vap% to maintain Et_{sevo} at 0.75% with FGF of 0.2, 0.5, 1, 2, and 4 L/min O_2 (n = 8 each). V_{sevo} and vap% patterns were compared.

Results and Discussions:



During the first few minutes, vap% were high in all FGF groups to prime the circuit and lungs, and because uptake is highest during the first few minutes after wash-in (figure). After 15–20 min, V_{sevo} was almost constant over the next 45 min, which is reflected in the absence of vap % adjustments with any FGF. The uptake pattern is reflected in the vap%, especially with FGF < 1 L/min, because of increased feedback of uptake on the inspired concentration during rebreathing. This effect is also translated in a higher vap% variability with low FGF. The SqRT model did not predict vap% for 0.2 L/min FGF.

Conclusion: A stable V_{sevo} between 15–60 min is reflected in stable vaporizer%, facilitating the use of lower FGF. A complex regimen such as the SqRT model is not needed.

References:

1 Lowe HJ, Ernst EA: The Quantitative Practice of Anesthesia. Baltimore/London, Williams & Wilkins, 1981.

2 Anesth Analg 1997; 84: 413–8.

A-452

Haemodynamic response to sevoflurane during infusion of norepinephrine in pigs

L. Lacoste, A. Ouattara, J.C. Caritez*, M. Carretier*, B. Debaene

*Department of Anaesthesiology, University Hospital of Poitiers, 86021 Poitiers, France;*INRA Le Magneraud, 17700 Surgères, France*

Background and Goal of Study: Sevoflurane (S) has been proposed to control adrenergic crisis during phaechromocytoma surgery (1). The aim of our study was to assess the haemodynamic responses to (S) in norepinephrine induced – hyperadrenergic state in pigs.

Materials and Methods: 17 Large-White pigs were studied during general anaesthesia using volatile anaesthetics in N_2O/O_2 mixture. Animals were randomly divided into 2 groups. Control group C (n = 9) received 1.7% expired fraction isoflurane (I). Group S (n = 8) received 3% sevoflurane. An arterial and a Swan-Ganz catheters were inserted. After equilibration period and baseline haemodynamic measurements (T0), animals received an increasing infusion of norepinephrine begun at the rate of 0.5–3.5 μ g kg^{-1} min^{-1} by steps of 0.5 μg kg^{-1} min^{-1} (T1). While norepinephrine infusion was maintained: (I) was unchanged in group C, during 60 min (T2); in group S, the concentration of (S) was progressively increased with the aim to return haemodynamics to baseline values or as closely as possible (T2). Anova for repeated measurements was used ($p < 0.05$).

Results: Results are expressed as mean (SD)

		HR ($b.min^{-1}$)	MAP (mmHg)	CO ($l.min^{-1}$)	SVR ($dynes.s.cm^{-5}$)
T0	C	110(7)	65(9)	4.1(0.7)	1231(176)
	S	115(19)	63(9)	4.1(1.2)	1306(374)
T1	C	241(18)*	103(13)*	7.4(2.1)*	1136(242)
	S	230(20)*	88(12)*	8.2(2.2)*	929(414)*
T2	C	253(15)*	90(10)*§	6.8(1.2)*	1011(143)
	S	210(13)*§	65(11)§	8.0(1.9)*	643(165)*
Interaction Group x time		P < 0.05	P < 0.05	NS	NS

Intragroup comparison: * vs T0 §vs T1.

In group S, the expired fraction of (S) was 6.1 ± 0.7% at T2. Three animals presented ventricular arrhythmia. In one animal a cardiovascular collapse occurred.

Conclusions: During norepinephrine induced-hyperadrenergic state in pigs, (S) allowed to normalize MAP and to slightly decrease HR, but CO remained unchanged. The observed cardiac arrhythmia leads to challenge high concentration sevoflurane use during phaechromocytoma surgery.

Reference:

1 V Louw A et al. *Ann Fr Anesth Réanim* 1998; 17: 301–305.

A-453

Effect of carrier gases on isoflurane vaporizer dial settings during minimal flow anesthesia

E. Slock, J.F.A. Hendrickx, A.A.J. Van Zundert, T. Deloof, A.M. De Wolf

Department of Anesthesiology/CCM OLV Hospital, Aalst, Belgium; North Western Unversity, Chicago, IL, USA

Background and Goal of Study: Uptake of a second gas of a delivered gas mixture decreases the amount of carrier gas and potent inhaled anesthetic leaving the circle system through the pop-off valve, causing the vaporizer setting (vap%) required to maintain a constant end-tidal (Et) sevoflurane% to be lower with O_2/N_2O than with O_2 with low fresh gas flows (FGF) (1). We now examined the effect of O_2, O_2/air or O_2/N_2O on the vap% required to maintain a constant Et isoflurane% (Et_{iso}) with a FGF of 0.5 L/min (=minimal flow anesthesia or MFA).

Materials and Methods: After IRB approval and informed consent, 42 ASA I-II patients presenting for peripheral surgery were randomly assigned to 1 of 3 groups (n =14 each), depending on the carrier gas and FGF sequence: group O_2 or group O_2/air (both MFA after 5 min high FGF) and group O_2/N_2O (MFA after 10 min high FGF). Vap% to maintain Et_{iso} at 0.75% were compared.

Results and Discussion: After 10', vap% are identical for O_2 and O_2/air, but lower for N_2O(figure). With O_2/N_2O, less gas and vapor leave the pop-off valve than with O_2 or O_2/air because almost all of the delivered O_2 and N_2O is taken up by the patient. The vap% to maintain Et_{iso} constant is therefore lower than with O_2 or O_2/air. Differences with N_2O fade with time because N_2O uptake decreases. Vap% do not differ between O_2 and O_2/air because almost all the delivered N_2 leaves the circle system. Other unexplored factors may contribute to our findings.

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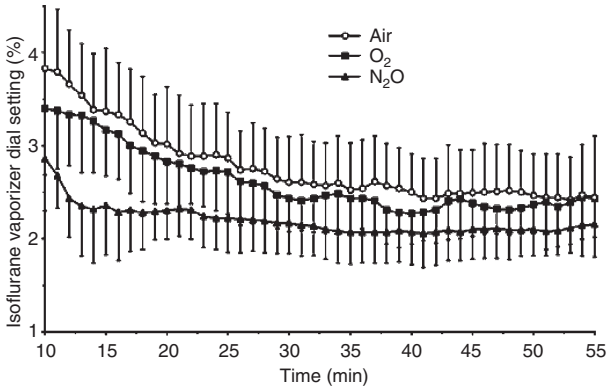

Conclusion: The choice of carrier gases affects the required isoflurane vaporizer dial settings during MFA.

Reference:

1 Anesthesiology 2002; 97: 400–4.

A-454

Deflurination rates of sevoflurane in different tissues: in vivo study on rabbits

N. Erdem*, M. Kanbak*, A. Erdem**, N. Ertas***, U. Aypar*

**Department of Anesthesiology, Hacettepe University, Ankara, Turkey; **Department of Plastic and Rec.Surgery; ***Department of Analytic Chemistry Gazi University*

Background and Goals: It's believed that sevoflurane is deflurinated in the liver and kidneys (1). Extrahepatic metabolism of the sevoflurane is unclear. The aim of this study was to investigate deflurination of sevoflurane in liver, kidney, lungs, gut, soft tissues and brain.

Materials and Methods: After Instutional Animal Ethical Committee aproval, the study was performed on 9 New Zelland white rabbits. After sedation with ketamine and xylazine, anaesthesia was induced with sevoflurane (2%). Blood (carotid and pulmonary artery, renal, portal, iliac, hepatic and carotid vein), urine and gall samples were obtained before administration of sevoflurane, 15th , 60th min during anaesthesia and 60th min after cessation of the sevoflurane (120th min). The differences of the arterial and venous fluorid concentrations of the tissues were calculated. At the end of the procedure tissue samples were obtained. All of the samples were evaluated for inorganic fluoride levels respectively by using ion selective electrode.

Results and Discussion: Data are summarized in Table I.

Table I: Inorganic F concentrations (micromol/L) (Mean ± SE)

	Time (Minute)			
	0	15	60	120
Carotid artery	0,23 ± 0,23	3,14 ± 0,38	10,48 ± 0,81	9,75 ± 0,30
Renal vein	0,24 ± 0,09	2,27 ± 0,92	10,58 ± 4,32	8,99 ± 3,67
Portal vein	0,23 ± 0,23	7,36 ± 0,91	11,39 ± 0,96	8,33 ± 1,17
Hepatic vein	0,17 ± 0,17	8,16 ± 0,67	14,14 ± 0,76	12,32 ± 0,73
Pulmonary art.	0,27 ± 0,27	2,84 ± 0,31	12,8 ± 0,93	9,71 ± 0,62
Carotid vein	0,28 ± 0,27	2,48 ± 0,42	11,65 ± 0,62	10,79 ± 0,61
Iliac vein	0,20 ± 0,20	3,19 ± 0,66	11,08 ± 0,66	11,24 ± 0,60
Urine	2,41 ± 0,12	3,29 ± 0,31	39,44 ± 6,81	63,28 ± 5,54
Gall	1,90 ± 0,14	34,50 ± 2,72	50,16 ± 5,04	33,68 ± 2,56

Tissue inorganic fluoride concentrations (microgr/gr) were 3384,03 ± 342,8 in liver, 12597,33 ± 986,3 in lung, 372,71 ± 26,86 in soft tissue, 311,73 ± 80,69 in kidney and 52,81 ± 6,65 in gut.

Conclusions: We concluded that**,** sevoflurane was deflurinated predominantly in liver and kidney and elimination of inorganic fluoride occurs in urine and gall. Inorganic fluoride was mostly accumulated in the lung tissue, followed by the liver. Soft tissues and brain didn't have an important role in deflurination process.

Reference:

1 Kharash ED, Hankins MA, Thummel KE. Human kidney methoxyflurane and sevoflurane metabolism Anesthesiology 82: 689–699, 1995.

A-455

A comparison of 8% and 12% sevoflurane for induction of anaesthesia in adults

N. Goodwin, A. Campbell, J.E. Hall, N. McCann, S.J. Plummer

Department of Anaesthetics,University Hospital of Wales, Cardiff, UK

Background and Goal of Study: Increasing sevoflurane concentration up to 6% speeds induction of anaesthesia [1]. Quality and speed of induction may be further improved by increasing concentration. We have compared induction times in adults using 8 and 12% sevoflurane.

Materials and Methods: With Ethics Committee approval, 40 ASA 1-2 patients over 18 yr were recruited to a double blind study. Patients were not premedicated. Full monitoring including Bispectral Index (BIS) was used. After 3 min. of pre-oxygenation at 6 $l.min^{-1}$ using a circle circuit, 8 or 12% sevoflurane was commenced during expiration. Patients then took 3 deep breaths with a 10 s breath hold on the final breath. Time zero was taken when the sevoflurane was turned on. Loss of eyelash reflex (ELR) and pupil convergence were noted [2]. BP and BIS were recorded at time zero, loss of ELR, pupil convergence and 4 min. Results were analysed using unpaired t-test, $p < 0.05$ is significant.

Results and Discussion: Pupil convergence is more rapidly obtained with 12% than 8% sevoflurane. Time to loss of ELR was the not significantly faster with 12%.

Table: Data are mean (SD)

	8%	12%
ELR (s)	139 (39.3)	112 (29.7)
Convergence (s)	247 (78.9)*	202 (78.9)*
BP change at 4 min	−23.2 (22.4)	−19.9 (29.6)

BIS score (SD) at loss of ELR was 75 (21), and at pupil convergence was 45 (22). 3 patients in the 12% group had short episodes of cough, and 1 patient in the 8% group had mild laryngospasm. None required airway intervention. One patient in the 12% group required 3 mg ephedrine for hypotension. Lack of difference in the time to loss of ELR may be related to the supratentorial influence exerted by adults on the process of loss of consciousness. Conscious over-ride may then be lost as anaesthesia deepens.

Conclusion(s): Surgical anaesthesia is achieved more rapidly using 12% than 8% sevoflurane.

References:

1 Yurimo M, Kimura H. J Clin Anaesth 1995; 7: 228–23.
2 Guedel AE. Inhalation Anesthesia - A Fundamental Guide.1937, Macmillan New York.

A-456

Comparison of recovery in elderly patients following combined anaesthesia for eye surgery, employing sevoflurane versus desflurane

C. Dimitropoulou, A. Chatzizisis, A. Tachmintzi, A. Arabatzi, O. Chambouri

Department of Anaesthesiology, General Hospital of Athens "G. Gennimatas", Athens, Greece

Background and Goal of Study: Combined (general and local) anaesthesia for eye surgery in elderly patients can potentially reduce opioid use, permitting a more concise evaluation of recovery profiles for sevoflurane (sevo) and desflurane (des).

Materials and Methods: We studied 50 patients (⩾65 years old, ASA I–III), randomized to sevo or des maintenance. Induction consisted of propofol, cis-atracurium, 1–1.5 μg/Kg fentanyl. Peribulbar local anaesthetic employed was 6 ml of 0.75% ropivacaine. For maintenance, O_2/N_2O (40/60) with 1.25–1.75% sevo or 2.5–3.5% des was used to achieve BIS values of 40–50. Immediate recovery times and Mini Mental Status Examinations (MMSE) were employed to evaluate recovery. Student's t-test, paired t-test and χ^2-test were used for statistical analysis.

Results: Data (mean ± SD) are shown in the table:

	Group	Sevo	Des
	Gender	15M, 10F	19M, 6F
	Age (yrs)	71.9 ± 4.2	72.3 ± 5.2
	Weight (kgr)	79 ± 13.5	74.3 ± 9.5
	Height (cm)	167.2 ± 7.8	168.5 ± 9.3
Time (min)	Surgery	118 ± 34.7	137.6 ± 40.4
	Extubation	7.1 ± 2.8	4.7 ± 2.8*
	Orientation	12.6 ± 4.5	12.2 ± 11.4
MMSE results (max score 30)	Pre-surgery	26.3 ± 2.4	27.3 ± 2.7
	30 min post	24.6 ± 3.9**	22.9 ± 10.1**
	60 min post	26.3 ± 2.3	26.9 ± 3.3

* $p < 0.05$ versus Sevo group. **$p < 0.05$ versus MMSE pre-surgery.

Conclusion: Desflurane allowed a faster immediate recovery but patients of both groups demonstrated a similar trend in their orientation and cognitive function restoration, based on MMSE assessments.

Reference:

1 Chen X, Zhao M, White PF et al. Anesth Analg 2001 Dec: 93(6) 1489–94.

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A-457

Sevoflurane induce apoptosis and inhibits the activation of 'Activator Protein-1' in human T-lymphocytes in vitro

T. Loop, P. Scheiermann, L. Egger, D. Lachenmeier*, H.L. Pahl, K.K. Geiger, B.H.J. Pannen

*Department of Anesthesiology, Molecular Medicine, University of Freiburg; *Legal Medicine, University of Bonn; Germany*

Background and Goal of Study: Inhalation anesthetics (IA) are known to affect the immune system. It has been demonstrated that lymphocytopenia and the expression of proapoptotic 'death'-signals, like Fas and FasL, occurred perioperatively.[1,2] Furthermore, sevoflurane (SEVO) is able to induce apoptosis in peripheral lymphocytes.[3] It was the aim of this study to answer the question, by which mechanism IA induce apoptosis, and whether the transcription factor 'Activator Protein-1' (AP-1) may be involved in this biological effect.

Materials and Methods: T-lymphocytes from healthy donors were incubated with the IA SEVO, isoflurane (ISO), or desflurane (DES) and stimulated with phorbol-myristate-acetate (PMA) and ionomycin (I). After extraction of proteins, activation of AP-1 was evaluated by 'Electrophoretic Mobility Shift Assay' (EMSA). Transactivation was studied using reporter gene assays, release of interleukin-3 (IL-3) was measured by ELISA, and caspase-activity by fluorogenic assay. Autoradiographs were analyzed densitometrically and compared statistically ($p < 0.05$) by variance analysis (ANOVA with Student-Newman-Keuls-post-hoc-test).

Results: Data (means ± SD).

PMA/I	−	+	+	−
SEVO	−	−	8 Vol. %/24 h	
AP-1-DNA-binding activity [Densitometric units]				
	1654 ± 582*	5611 ± 1936	2157 ± 1543*	1162 ± 514*
Luciferase-activity [RLU]				
	210 ± 211*	26996 ± 22824	8868 ± 9717*	77 ± 95*
IL-3 release [pg/ml]				
	69 ± 14*	945 ± 227	536 ± 107*	94 ± 58*
Caspase-activity [x-fold induction]				
	1,0 ± 0	2,1 ± 0,6#	1,6 ± 0,6	2,7 ± 0,5#

*$P < 0.05$ vs. PMA/I alone; #$P < 0.05$ vs. negative control.

Conclusion: Our results demonstrate the SEVO-dependent activation of caspase and the inhibition of PMA/I induced AP-1 binding activity in human T-lymphocytes. The SEVO-mediated proapoptotic effects seem to be independent from AP-1, because they were not associated with an AP-1 activation.

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A-458

Laryngeal morbidity and quality of tracheal intubation

T. Mencke, M. Echternach, S. Kleinschmidt, P.K. Plinkert, T. Fuchs-Buder

Departments of Anaesthesia and ENT, University of the Saarland, Homburg/Saar, Germany

Background and Goal of Study: Vocal cord sequelae (VCS) and postoperative hoarseness (PH) after general anaesthesia are a significant source of morbidity for patients and a source of liability for anaesthetists (1). Several risk factors for laryngeal injury have been identified in the past (2). However, whether the quality of tracheal intubation affects their incidence or severity is unclear.

Materials and Methods: 80 patients were randomised in 2 groups ($n = 40$ for each) to receive propofol (2.5–3 mg/kg) and fentanyl (2–3 μg/kg) with or without atracurium for induction of anaesthesia. Intubating conditions were evaluated (3), PH was assessed at 24, 48 and 72 h after surgery and the vocal cords were examined by stroboscopy before and 24 and 72 h after surgery. If PH or VCS persisted examination was carried out until complete restitution. The number-needed-to-harm (NNH) was calculated (4).

Results and Discussion: Without atracurium PH occurred more often (16 vs 6 patients; $p = 0.02$) and the number of days with PH was higher (25 vs 6; $p < 0.001$). Similar findings were observed for VCS: Incidence of VCS 15 vs 3 patients, respectively, $p = 0.002$; days with VCS: 50 vs 5, respectively; $p < 0.001$. The NNH to produce one patient with VCS by omitting atracurium compared with giving this drug was 2.9 (CI:1.9–6.6). Excellent intubation conditions were less frequent associated with PH compared to good or poor conditions: (11%, 29%, 57% of patients, respectively; excellent vs poor: $p = 0.008$. Similar findings were observed for VCS (11%, 22%, 50% of patients, respectively; excellent vs poor: $p = 0.02$).

Conclusions: The quality of endotracheal intubation may affect the incidence of laryngeal morbidity. Adding atracurium to a propofol/fentanyl induction regimen decreased PH and VCS. PH as a clinical relevant outcome parameter should regularly be assessed in studies investigating intubating conditions.

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A-459

Sevoflurane anaesthesia does not induce sister chromatid exchanges in lymphocytes of adult patients

F. Wappler, T.H. Krause, K. Augustin, O. Herden-Kirchhoff, J. Schulte am Esch

Department of Anaesthesiology, University Hospital Hamburg-Eppendorf, Hamburg, Germany

Background and Goal of Study: Compound A, a degradation product of sevoflurane, was shown to induce sister chromatid exchanges (SCE) in Chinese hamster ovary cells in-vitro (1). The formation of SCE in metaphase chromosomes is considered to be a sensitive cytogenetic indicator for suspected carcinogenic or mutagenic agents (2). Therefore, we investigated the formation of SCE in mitogen stimulated T-lymphocytes of adults before and after sevoflurane anaesthesia in-vivo.

Materials and Methods: After IRB approval and written informed consent, twenty patients undergoing surgical procedures in general anaesthesia (ASA classification I–III) were included in this study. Anaesthesia was induced with sufentanil, etomidate and rocuronium. Anaesthesia was subsequently maintained with sevoflurane 0.8–1.2% in an oxygen/air mixture (FiO_2 0.35). Sevoflurane exposure was calculated to an average of 1.5 MAC hours. Blood was collected before and after administration of anaesthetics. Blood samples were prepared following the methods of Perry et al. (3). Analysis was performed under a fluorescence microscope, each 25 metaphases per blood sample were screened for SCE rates from coded slides and averaged. Data are shown as mean ± SEM. Statistics: Wilcoxon and Mann–Whitney tests (*p* value < 0.05 was considered as significant).

Results and Discussions: An average rate of 6.00 ± 1.18 SCE per metaphase was determined before induction of anaesthesia. Following anaesthesia an average rate of 5.86 ± 1.47 SCE per metaphase was observed, thus demonstrating no significant increase in resulting SCE rates after sevoflurane challenge.

Conclusion(s): Our results indicate that sevoflurane anaesthesia does not induce SCE in adult patients. Nevertheless, it might not be excluded from our data, that during sevoflurane anaesthesia e.g. with dry soda lime or a low fresh gas flow rate, compound A and further degradation products might be generated at a remarkable and possible genotoxic amount.

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A-460

The effects of inhalation anaesthetics on melatonin levels

A.H. Karagöz, E. Basgül, V. Çeliker, Ü. Aypar

Department of Anaesthesiology and Reanimation, Hacettepe University, Faculty of Medicine, Ankara, Turkey

Background and Goal of Study: The pineal hormone melatonin and anaesthetics affect sleep and behaviour. Although the effects of propofol and isoflurane on circulatory melatonin have been investigated, the effects of inhalation anaesthetics have not (1). We hypothesised that physiological increases in melatonin hormone may occur during general anaesthesia like in sleeping period.

Materials and Methods: The influences of inhalation anaesthetics on circulating melatonin and responses during anaesthesia and the recovery period were investigated in 46 patients scheduled for elective laparoscopic cholecystectomy. Patients were randomly assigned to three groups. General anaesthesia was induced with thiopenton/vecuronium/fentanyl. Maintenance of anaesthesia was achieved with isoflurane ($n = 15$), sevoflurane ($n = 15$) or halothane ($n = 16$) with a N_2O_2/O_2 flow ratio of 3:3 in all groups. During anaesthesia, the patients' eyes were carefully taped shut to prevent the effects of light. Venous blood samples were taken at 02:00, just before the induction, 15 minutes after the induction, and just after extubation. Statistical

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analysis was performed using multivariate analysis of variance for repeated measures. Anaesthesia time and vital signs were similar in all three groups.
Results and Discussions: There were no differences in circulatory melatonin levels between the groups ($p > 0.05$). During anaesthesia plasma melatonin levels decreased.
Conclusion(s): Although in all recent studies melatonin levels increased during general anaesthesia like sleeping period, in our study decreased. These showed that the relationship between anaesthesia and melatonin levels may not be simple because of the several factors which influence regulation of melatonin. To add to all of these various studies, we also need to do more.
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A-461

The effects of halothane, isoflurane and sevoflurane on immune response

B. Bahadýr, E. Basgül, V. Çeliker, A.H. Karagöz, Ü. Aypar

Department of Anaesthesiology and Reanimation, Hacettepe University, Faculty of Medicine, Ankara, Turkey

Background and Goal of Study: Anaesthetic agents have been shown to have inhibitory effects on both the specific and non-specific components of immune response (1). The perioperative immunomodulatory effects of halothane, isoflurane and sevoflurane have been studied previously, but there is a lack of information concerning comparisons of these three agents.
Materials and Methods: Thirty-five patients, scheduled for laparoscopic cholechystectomy, were randomly allocated to one of three groups according to the inhalation anaesthetic agent used (halothane $n = 12$, isoflurane $n = 12$, sevoflurane $n = 11$). In the three groups, general anaesthesia was induced with thiopental and vecuronium and maintained with nitrous oxide in oxygen and one of the three volatile agents. Blood samples were taken immediately before the induction of anaesthesia and the skin incision, at the end of anaesthesia and surgery, and 24 h postoperatively. Serum IgA, IgG and IgM, IL-2 and IL-6 levels were measured. Data were analysed by one-way ANOVA, paired t test and repeated measurement ANOVA.
Results and Discussions: Serum IgG, IgM and IgA levels showed a significant decrease before the incision and at the end of the surgery in all groups ($p < 0.001$). Serum IL-2 levels showed a significant decrease , and serum IL-6 levels showed a significant increase in all groups ($p < 0.001$). There wasn't any statistical difference between three groups at any time interval according to the measured immunological parameters ($p > 0.05$).
Conclusion(s): Halothane, isoflurane and sevoflurane maintenance anaesthesia during laparoscopic cholecystectomy had basically similar effects on serum immunoglobulin and cytokine levels.
Reference:
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A-462

Use of a model based predictive display to guide end-tidal sevoflurane during low flow anaesthesia

R.R. Kennedy, S. Giles, R.A. French

Department of Anesthesia, Christchurch Hospital and Christchurch School of Medicine and Health Sciences, Christchurch, New Zealand

Background and Goal of Study: A 7 compartment model accurately predicts end tidal (ET) sevoflurane (sevo) and isoflurane concentrations (1). The model has been adapted to use real-time fresh gas flow and vaporisor settings to display a 10 min prediction of ET sevo concentrations. This study aimed to evaluate the effect of the predictive display on the speed and accuracy of changes in ET sevo.
Materials and Methods: 12 patients in whom sevo based anaesthesia was expected to last more than 2 hrs were studied. Four step changes of target ET concentration (+0.5%, +1.0%, −1.0%, −0.5%) were made either unaided (Group U) or with the prediction display (Group P) using a fresh gas flow of 1 l/min. Response time and overshoot were compared using a two tailed paired t-test.
Results and Discussions: Results as mean (SD) are shown in the table. The average time for the change was at least 70% longer in Group U. These differences were statistically significant for both increases (1% rise $p < 0.05$, 0.5%rise $p < 0.01$) but not the 1% fall. For the 0.5% fall $p = 0.05$. There were no differences in the overshoot.

	Time for change (sec)		Overshoot (%)	
	Group P	Group U	Group P	Group U
1% rise	98 (30)	176 (118)	9.3 (9.3)	11.5 (17.5)
0.5% rise	75.9 (74)	258 (182)	29.3 (25.3)	17.9 (17.2)
0.5% fall	64.4 (46)	163 (134)	25.2 (29.4)	22.2 (23.8)
1% fall	146 (115)	225 (100)	12.4 (15.3)	7.33 (6.51)

Conclusion(s): The predictive display led to faster ET changes. These differences are comparable to those seen with automatic feedback control systems (2). Use of the predictive display system may simplify the use of low flow anaesthesia.
References:
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Acknowledgements: Support for this study provided by the Canterbury Medical Research Foundation.

A-463

Perfomance of a predictive model of anaesthetic uptake with desflurane

R.R. Kennedy, S. Giles

Department of Anaesthesia, Christchurch Hospital and Christchurch School of Medicine and Health Sciences, Christchurch, New Zealand

Background and Goal of Study: We have previously shown that a model of anaesthetic uptake and distribution, developed for use as a teaching tool (1), is able to predict end-tidal (ET) isoflurane and sevoflurane concentrations at least as well as commonly used propofol models predict blood levels of propofol (2). Models with good predictive performance may be used as part of real-time prediction systems. The aim of this study was to assess the performance of this model with desflurane.
Materials and Methods: 20 adult patients undergoing routine anaesthesia were studied. The total fresh gas flow and vaporisor settings were collected at 10 second intervals from the anaesthetic machine. These data were used as inputs to the model which had been initialised for patient weight and desflurane. Output of the model is a predicted ET value at each point in time, These values were compared with measured ET desflurane using a standard statistical technique (3).
Results and Discussions: Data was analysed from 19 patients. Median performance error was 78% (95%CI 8–147), Median Absolute Performance Error 77% (6–149), Divergence 10.6%/hr (−80–101) and Wobble 8.9% (−6–24).
Conclusion(s): The predictive performance of this model with desflurane was poor with considerable variability between patients. The reasons for the difference between desflurane and our results with isoflurane and sevoflurane are not obvious. The data collected in this study will allow us to further investigate these differences and assist in the development and evaluation of improved models.
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Acknowledgements: This study was supported by a grant from Baxter Healthcare.

A-464

Second gas effect in clinical practice. Is it significant when we use sevoflurane?

A. Katsanikos, M. Meitanidou, N. Stogiannidis, P. Papagiannopoulou, C.H. Zachariadou, F. Kanakoudis

Department of Anaesthesiology "G.Gennimatas" Hospital, Thessaloniki, Greece

Background and Goal of study: Faster uptake of second gas (N_2O) of a delivered gas mixture decreases the amount of carrier gas and increases the F_{ALV} of volatile agents.[1] The goal of the study was to investigate the second gas effect under clinical conditions using sevoflurane, an agent with low blood solubility and fast uptake and elimination.
Materials and Methods: Forty adult patients (ASAI-III) were enrolled in this study. During general anaesthesia (propofol-remifentanil) patients were randomly allocated to receive for 15 minutes a) sevoflurane 1% in oxygen (group OXY, $N = 20$) or b) sevoflurane 1% in a N_2O/O_2 (66/33%) mixture (group N_2O, $N = 20$). IPPV was standardized in all patients as TV 10 ml/kg and RR 8 breaths/min. F_{insp} and F_{exp} values of sevoflurane were recorded every 1 min during the 15 min of sevoflurane administration plus a period of 15 min after discontinuation. F_{insp}/F_{exp} for uptake and F_{exp}/F_0 for elimination were calculated. Statistical analysis was performed with Area Under the

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Curve estimation followed by student's t-test. A $p < 0.05$ value was considered statistically significant.

Results and Discussion: Demographic data were similar in both groups. The F_{insp}/F_{exp} ratio was significantly ($p < 0{,}001$) lower in group OXY, compared to group N_2O (Fig 1). The washout curve F_{exp}/F_0 was did not differ significantly between the two study groups (Fig 2).

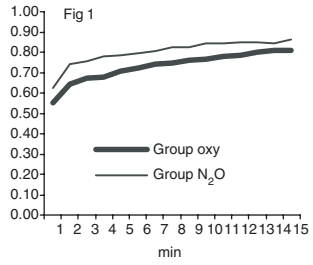

Fig 1

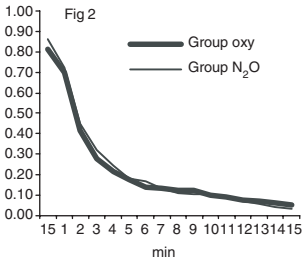

Fig 2

Conclusion: Faster uptake of sevoflurane was achieved with the use of N_2O as carrier gas. So, the second gas effect seems to be significant in clinical practice with sevoflurane, known for it's fast pharmacokinetics properties.

Reference:

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A-465

Effect of nitrous oxide uptake on $PaCO_2$

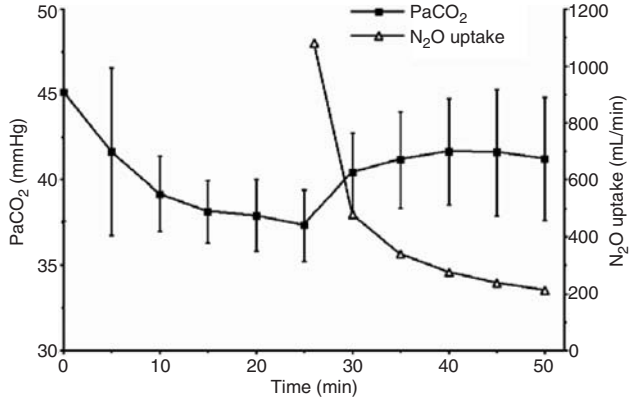
G. Ver Eecke, J.F.A Hendrickx, G. Cammu, L. Foubert, T. Deloof, A.M. De Wolf

Departments of Anesthesiology/CCM OLV Hospital, Aalst, Belgium; Northwestern University, Chicago, IL, USA

Background and Goal of Study: During the early part of the administration of N_2O, large amounts of the more soluble N_2O enter the tissues while small amounts of the less soluble N_2 leave the tissues, resulting in a *temporary* increase in the concentration of the inhaled agent, O_2, and CO_2 (1). While this effect has been described and found to be maximal after 1 min for the alveolar PCO_2 (2), its time course has not been described for arterial PCO_2 ($PaCO_2$) nor has it been correlated with the course of N_2O uptake (V_{N_2O}). The rate at which $PaCO_2$ decreases after the effect has reached a maximum should parallel V_{N_2O}.

Materials and Methods: After IRB approval, 11 ASA III patients undergoing cardiac surgery were enrolled. After induction of anesthesia, mechanical ventilation was started with a fixed respiratory rate and tidal volume of 8–10 mL/kg. After using an O_2/air mixture (FGF 6 L/min total; $F_IO_2 \approx 0.33$) for 25 min, the gas mixture was changed to O_2/N_2O (FGF 6 L/min total; $F_IO_2 \approx .0.33$). $PaCO_2$ was determined after intubation, and every 5 min thereafter, and its course compared with V_{N_2O} ($1080 \times t^{-0.505}$[3]).

Results and Discussions: The $PaCO_2$ course did not parallel N_2O uptake (figure). Because the time course of $PaCO_2$ after the administration of N_2O cannot be entirely explained by volume shifts due to N_2O uptake alone, additional factors are responsible. For PaO_2, for example, ventilation/perfusion inhomogeneity has been suggested to affect PaO_2 at "steady-state" levels of N_2O uptake (4). Similar mechanisms may affect $PaCO_2$.



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A-466

Mechanism of halothane induced GIRK channel modulation

L.G. Weigl, S. Milowic

Department of Anaesthesia (B), University Hospital Vienna, Vienna, Austria

Background and Goal of the Study: We have shown that GIRK (G protein activated inwardly rectifying K^+) channels are targets for the volatile anaesthetic halothane (1). The modulation by halothane of channels coexpressed with the m2 acetylcholine (ACh) receptor is characterized by inhibition of agonist activated GIRK1* (=$GIRK1^{F137S}$) mediated currents. In contrast, at high concentrations halothane induced GIRK1* mediated currents in the absence of ACh. This indicates the existence of at least two independent mechanisms: inhibition of the G protein mediated signaling pathway and activation of the GIRK1* channel itself. To elucidate the molecular mechanism we studied the halothane action on single GIRK channels.

Materials and Methods: For expression of channels we used the Xenopus oocyte expression system. GIRK mediated currents were measured with the patch clamp technique in the cell attached mode with or without 50 nM ACh in the patch pipette. Data are given as mean ± S.D, Student's t-test was used for statistical analysis.

Results and discussion: Single channel recordings showed complex activation patterns of GIRK channels with at least 3 populations of openings each characterized by a different life time. Open times ranged from less than 1 ms up to more than 50 ms. ACh preferentially induced channel openings with life times of less than 1 ms.

Activation of GIRK1* channels by halothane was due to an increased number of channel openings and activation of channels with long open times. The overall mean open times of the channels was therefore prolonged (2.1 ± 1.2 ms vs. 7.6 ± 4.6 ms, $p = 0.031$, $n = 5$). Single channel conductance was not affected (15.9 ± 1.1 pS vs 15.1 ± 0.7, $p = 0.225$). In contrast channels which had been activated by ACh were inhibited by halothane via suppression of short channel openings (<1 ms) which are typical for agonist activated channels. At the same time, halothane propagated events with longer open times, as already seen for channels not activated by the agonist.

Conclusion: These data indicate that inhibition of ACh induced channel activity and the activation of channels in the absence of an agonist is due interaction with the channel itself and not by interaction with the G-protein.

Reference:

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A-467

Prolonged recovery after neuromuscular blocking agents infusion

P.E. Dubois, E. Collard, J. Jamart, P. Eucher, K.L. Joucken

Department of Anesthesiology, Mont-Godinne University Hospital, Université Catholique de Louvain, Yvoir, Belgium

Background and Goal of Study: The recovery of some neuromuscular blocking agents (NMBA) can be affected by the duration of their infusion (1). The goal of this study was to compare the extent of the recovery variability of four NMBA after infusion.

Materials and Methods: After Ethical Committee approval and informed consent, 80 ASA3 patients undergoing coronary artery bypass grafting with normothermic cardiopulmonary bypass were randomized to receive either atracurium, cisatracurium, mivacurium or rocuronium, monitored by acceleromyography. During propofol and sufentanil anesthesia, the effect of an equipotent NMBA bolus (2 × ED95) recovered first up to a train-of-four ratio (TOFr) of 0.75. Then, a potency- adjusted infusion maintained the first twitch at 15 ± 5% of control until chest closure and a second spontaneous recovery. We compared the TOFr recovery index (the time from TOFr 0.25 to 0.75) of the two recoveries using paired samples t test. Results are expressed as mean ± SD, and time in minutes.

Results and Discussion: Groups were similar concerning age (65 ± 10 y.o.), weight (74 ± 13 kg), renal and hepatic function. The infusion lasted 3 ± 1 hours.

TOF ratio recovery index	After bolus	After infusion	Delay after infusion	p
Atracurium	13.4 ± 3.6	19.7 ± 6.4	6.2 ± 5.3	<0.001
Cisatracurium	15.9 ± 3.4	21.6 ± 3.5	5.7 ± 2.8	<0.001
Mivacurium	8.2 ± 4.0	13.4 ± 4.8	5.2 ± 2.6	<0.001
Rocuronium	15.9 ± 8.7	38.0 ± 20.5	22.1 ± 19.8	0.001

The four NMBA showed a significantly prolonged recovery after the infusion. The rocuronium group was the most affected (unpaired t test, $p < 0.001$).

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The interindividual variability of recovery was increased in the rocuronium group, but this was especially clinically relevant after the infusion (Levene test, $p \leq 0.001$).

Reference:

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A-468

Target controlled infusion versus manually controlled infusion of rocuronium: comparison of clinical efficacy

K.M. Vermeyen, V. Saldien, V.L. Hoffmann, M.P. Van Iersel*

*Department of Anesthesiology, University Hospital Antwerp, Edegem, Belgium; *Organon, Oss, The Netherlands*

Background: Both manually controlled infusion (MCI) and target controlled infusion (TCI) of rocuronium may provide stable neuromuscular blockade. Studies comparing the clinical efficacy of both techniques have not been reported.

Materials end Methods: After written informed consent, 60 adult healthy patients scheduled for elective orthopedic surgery were included. Standard anesthesia procedures (fentanyl/propofol) were followed. Neuromuscular block (NMB) was measured acceleromyographically (TOF-Guard). Train of Four (TOF) counts were used for analysis. Patients were randomised to receive TCI-rocuronium to a target effect site concentration of 2000 ng mL^{-1}, or to receive MCI-rocuronium (0.3 mg kg^{-1} followed by a continuous infusion of 0.6 mg kg^{-1} min^{-1}). TCI was done with a syringe driver controlled by Stanpump (1) programmed according to a pharmacokinetic data set derived from clinical trial CT 05.4.309 (2) and a keo value of 0.168 (3). Both TCI and MCI were adjusted to maintain NMB at 1 or 2 TOF counts. The percentage of the control period during wich the NMB was on target was studied, as well as the number of interventions needed to obtain a NMB of 1 or 2 TOF counts.

Results and Discussion: Demographic data were comparable in all groups.

	TCI (n = 30)	MCI (n = 30)
Duration of administration (min)	79 (39)	84 (47)
Mean infusion rate (mg kg^{-1} h^{-1})	0.80 (0.22)	0.78 (0.20)
Total dose given (mg)	74 (26)	79 (31)
Percentage of control period on target (%)	93 (7)	91 (13)
Number of interventions per 15 min (n)	0.7 (0.5)	1.2 (0.9)*
Time to TOF 0.9 after stop (min)	46 (13)	57 (33)

Values are mean (SD); *$p < 0.05$ t-Test.

TCI and MCI resulted in a similar percentage of NMB on target (1–2 TOF counts). An estimate of 50% less corrections per 15 minutes were needed when TCI was used. No difference was found regarding recovery of NMB to TOF 0.9.

Conclusion: TCI as well as MCI allowed us to provide a stable neuromuscular block. TCI needed less interventions to do this.

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A-469

Priming rapacuronium and rocuronium

D. Steinberg

Department of Anaesthesia, Hospital Clinicas Caracas & Policlinica Mendez Gimon, Caracas, Venezuela

Background and Goals: A previous study demonstrated that it is possible to significantly reduce onset time for rocuronium (ROC) by priming it with vecuronium, although the opposite seems to be less satisfactory (1). Another trial shows that priming ROC and mivacurium either way reduces 64% onset time (2). Beside chemical structural differences among these drugs, ROC has a shorter onset time in comparison to the other two. Rapacuronium (RAP) on the other hand have a faster action in comparison to ROC (3) and the aim of this study is to compare priming of both RAP and ROC, which belong to the same molecular family.

Material and Methods: Four groups of adult, elective and consenting patients anesthetized with propofol and nitrous oxide were randomly allocated to receive: ROC 400 μg Kg^{-1} (group 1, n = 25), RAP 100 μg Kg^{-1}, 3 minutes before ROC 360 μg Kg^{-1} (group 2, n = 20), RAP 1000 μg Kg^{-1} (group 3, n = 26)(¶) or ROC 60 μg Kg^{-1} 3 minutes before RAP 900 μg Kg^{-1} (group 4, n = 23). Using electromyography time to 80% blockade, maximal effect, onset time and clinical duration was determined. T test and 5% level significance were used for statistical comparisons.

Results: No significant difference was noticed between the two doses of ROC and RAP used ($p = 0.656$). Onset time was statistically faster and clinical duration shorter for RAP ($p = 0.0001$). Other results are shown in Table 1.

Table 1

	80% (sec)	MAX (%)	ONSET (sec)	DUR (min)
1) ROC	160 ± 61	92 ± 3	286 ± 59	27 ± 8
2) RAP-ROC	149 ± 67	91 ± 6	260 ± 52	26 ± 10
p	0.531	0.561	0.107	0.761
3) RAP	139 ± 56	93 ± 6	218 ± 69	9 ± 2
4) ROC-RAP	103 ± 42	97 ± 4	178 ± 48	12 ± 5
p	0.02	0.013	0.021	0.004

Conclusions: Priming RAP with ROC significantly reduces both early (80% blockade) and onset time and increased neuromuscular block and clinical duration. None of these effects are present during the opposite sequence.

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(¶)Rapacuronium data was collected before its withdrawn.

A-470

Priming rocuronium reduces onset time and increases speed of action

D. Steinberg

Department of Anaesthesia, Hospital Clinicas Caracas & Policlinica Mendez Gimon, Caracas, Venezuela

Background and Goals: According to some authors, rocuronium (ROC) has an initial rapid onset followed by a slower final (1), but referred supporting data only show that time to 75% blockade is less than onset time (2). Non of these terms refers to velocity, which is a vectorial magnitude measured by the ratio between time and displacement. Neither is an agreement on the final results of priming ROC (3). The aim of this study is to define both, the adequate terms for velocity and the actual effect of priming ROC.

Material and Methods: Under intravenous anesthesia two groups of adult, elective and consenting patients, received ROC, either by bolus (n = 25) (400 μg Kg^{-1}) or primed (n = 23)(60 and 340 μg Kg^{-1}, 3 minutes apart). Initial onset time: (IOT), maximal effect (%), and onset time were determined by electromyography. Velocity was calculated as the ratio between time and fractional percentage of block and expressed as sec/%, during the initial period, until 80% block (Index 1) up to maximal effect (Index 2) and the period between both (Index 3). T test and analysis of variance and Student-Neuman-Keuls tests were used for statistical comparison between groups and $p < 0.05$ was considered as a significant level.

Results: Are shown in Table 1.

Table 1

	MAX	IOT	ONSET	
BOLUS	92 ± 3	160 ± 61	286 ± 59	
PRIMING	94 ± 5	87 ± 45	204 ± 75	
p	0.102	0.0001	0.0001	
Velocity	INDEX 1	INDEX 2	INDEX 3	SIG
BOLUS	1.95 ± 0.5	3.1 ± 0.7	10.8 ± 4.9	3) vs = 1–2
PRIMING	1.09 ± 0.5	2.2 ± 0.8	9.4 ± 4.2	3) vs = 1–2
p	0.0001	0.0001	0.615	

Conclusions: Priming ROC reduces onset time and increases speed of action when properly velocity parameters are used. Also the effect of ROC is faster at an early stage and then slower (SIG).

References:

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2 Wierda JMKH, DeWit APM, Kuizenga K: Br J Anaesth (1990) 64: 521–23.
3 Redai I, Haxby E: Anaesth Pharmacol Rev (1995) 3: 209–11.

A-471

Optimal dose of rocuronium for rapid tracheal intubation under sevoflurane anesthesia

H.C. Lee, Y.S. Shin, S.O. Koh

Departments of Anesthesiology and Pain Medicine, Yonsei University College of Medicin, Seoul, Korea

Background and Goal of Study: There are situations in anesthesia in which may be desirable to achieve rapid tracheal intubation. Rapid tracheal intubation with rocuronium has been studied using a probability-based approach (1). But these studies used intravenous anesthetics for anesthetic induction. So we aimed to predict doses of rocuronium giving 90% and 95% probability of intubation within 60 seconds and to estimate their durations of action using sevoflurane for anesthetic induction.

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Materials and Methods: Anesthesia was induced in sixty patients with sevoflurane. Patients received randomly rocuronium, 0.0, 0.3, 0.6, 0.9 and 1.2 mg/kg (n = 12/dose). Laryngoscopy began 40 seconds later, aiming for intubation at 60 seconds, and conditions were graded perfect, acceptable and unacceptable, with the first two conditions being successful intubation. Duration of action was time until recovery of 15% of twitch height. The dose versus fraction of patients with successful intubation was analyzed by logistic regression. Doses giving 90% and 95% (D90 and D95) probability of successful intubation were calculated.
Results and Discussions: Out of 12 patients in each group (0.0, 0.3, 0.6, 0.9 and 1.2 mg/kg), intubation was successful in 4, 10, 12, 12 and 12 patients, respectively. The D90 and D95 doses were 0.34 and 0.43 mg/kg, respectively.
Conclusions: After induction with sevoflurane, rocuronium 0.43 mg/kg, gives 95% probability of successful intubation at 60 seconds.
Reference:
1 Kirkegaard-Nielsen H, Caldwell JE, Berry PD. Anesthesiolgy 1999; 91: 131–136.

A-472

In humans, offset of neuromuscular block is longer at the abducting laryngeal muscle than at the adducting laryngeal muscles

T.M. Hemmerling, D. Babin, F. Donati

Department of Anesthesiology Université de Montréal, Neuromuscular Research Group, Montreal, Canada

Background and Goal of Study: This study investigates the onset and offset of Neuromuscular block (NMB) at the adducting and abducting laryngeal muscles in humans.
Materials and Methods: After approval of the local Ethics Committee and informed consent, 10 patients were included. Intubation was performed without neuromuscular block. Two small condenser microphones were inserted into the throat and placed lateral of the tube near the vestibular fold to record the response of the adducting laryngeal muscles (1) and behind the larynx to record the response of the abducting laryngeal muscle. Percutaneous stimulation of the laryngeal recurrent nerve was performed in routine fashion using superficial electrodes placed over the thyroid notch. Train-of-four stimulation was performed every 12 sec and supramaximal stimulation current determined.

Mivacurium 0.1 mg/kg was injected IV. Onset, peak effect and offset of NMB was determined. Data presented as mean (SD) and compared using *t*-test, $P < 0.05$.
Results and Discussions: Pharmacodynamic data are presented in the table with offset being significantly longer at the abducting laryngeal muscle.

	Adductors	Abductor
Peak (%)	71 (18)	84 (18)
Onset 90 (s)	89 (38)	105 (26)
Onset max. (s)	118 (34)	142 (20)
T 25 % (min)	9 (3)	11 (3)
T 75 % (min)	9 (5)	14 (5)*
T 90 % (min)	11 (6)	17 (6)*
T 0.8 (min)	11 (6)	16 (6)*

*$P < 0.05$

Conclusion(s): This is the first study in humans presenting a complete onset and recovery profile of NMB at the adducting laryngeal muscles and abducting laryngeal muscle. Offset of NMB after 0.1 mg/kg mivacurium is 4–5 min longer at the abducting laryngeal muscle. This is in contrast to previous findings in cats (2).
References:
1 ASA 2002, A-985.
2 Acta Anaesth Scand 2000; 44: 503–10.

A-473

Effects of desflurane and propofol on the neuromuscular block of mivacurium

F. Ertugrul, N. Hadimioglu, Z. Ertug, Y. Unuvar, E. Ertok

Department of Anaesthesiology, Akdeniz University, Medical Faculty, Antalya, Turkey

Background and Goal of Study: Volatile anaesthetics agents potentiate neuomuscular blockade. It is reported that the depression of T_1 after mivacurium during potent inhalational anaesthesia was enhanced compared with total intravenous anaesthesia (1). In this study, we investigated the effects of desflurane and propofol on intubating conditions and neuromuscular blockade of mivacurium.
Material and Methods: After obtaining Local Ethics Committee approval and informed patient consent, 30 ASA physical status I-II adult patients scheduled for elective surgery were randomyl allocated in to two groups. Following preoxygenation, anaesthesia was induced by 2 micg kg^{-1} fentanyl and 2.5 mg kg^{-1} propofol in group propofol (P) and 2 micg kg^{-1} fentanyl with an inhalational induction with desflurane 8–10% in oxygen in group desflurane (D). The intubation dose of mivacurium 0.2 mg kg^{-1} was administered in both groups. Train-of-four stimulation was applied every 15 sec to the ulnar nerve. All patients were intubated when 80% neuromuscular block obtained. Anaesthesia was maintained by continuous infusion of propofol in group P or desflurane in group D, increments of fentanyl and 60% nitrous oxide in oxygen. Onset time, intubating conditions, recovery time of T_1 and TOF, time to extubation and opening of the eyes were recorded. Data were analysed using Student t test, Fishers's Exact Chi-Square and Mann–Whitney U tests . P value of <0.05 was considered significant.
Results: The two groups were comparable in patients characteristics. The differences of intubating conditions and the time to intubation were not significant.The time for onset of block, the time recovery of T_1 to 75%, 95% and TOF to 95 % after the initial dose were significantly longer in group D ($p = 0.04$; $p = 0.001$; $p = 0.029$; $p = 0.041$, respectively). The time from the end of anaesthesia to extubation and opening of the eyes were sigificantly shorter in group D ($p = 0.04$ and $p = 0.038$).
Conclusion: Neuromuscular recovery after an intubating dose of mivacurium was prolonged by desflurane compared with propofol- based anaesthesia. Early clinical recovery after maintenance of anaesthesia with desflurane was rapid than propofol.
Reference:
1 Wulf H, Hauschild S, Proppe D. Anaesthesiol Reanim 1998 ; 23(4): 88–92.

A-474

Priming accelerates the onset of rocuronium at the larynx

J. Schmidt, T. Muenster, A. Irouschek, S. Albrecht

Department of Anaesthesiology, University of Erlangen-Nuremberg, Erlangen, Germany

Background and Goal of Study: The effect of priming on the onset of the neuromuscular block (NMB) after application of rocuronium is controversially discussed (1,2). Therefore we compared a bolus application of 0.6 mg/kg versus a priming technique of 0.06 mg/kg 3 minutes before application of 0.54 mg/kg on the onset of NMB at the laryngeal muscles measured by electromyography.
Materials and Methods: After approval of the local ethics committee and informed consent 30 women undergoing thyroid surgery were included in the two study-groups. Anaesthesia was induced using an infusion of propofol and remifentanil. Subsequently the endotracheal tube with a laryngeal surface electrode (Magstim®) was inserted in the trachea adjacent to the vocal cords. After 10 min of transcutaneous supramaximal stimulation of the recurrent laryngeal nerve (0.1 Hz, 40–60 mA) a bolus of 0.6 mg/kg rocuronium (bolus-group) or a priming dose of 0.06 mg/kg followed by 0.54 mg/kg rocuronium 3 minutes later (priming-group) were injected. Lag time, onset 90, onset and peak effect were recorded using multiliner® software. Data were compared using MWU-test, results are shown as mean ± SD, ** = $p < 0{,}01$.
Results and Discussions: The demographic data of both groups, lag time as well as peak effect were comparable and did not show any significant differences. The onset 90 and onset time were significant shorter in the priming group (Table 1).

Mean ± SD	Priming-group	Bolus-group
Lag time (sec)	25 ± 9	29 ± 11
Onset 90% (sec)	41 ± 7 **	67 ± 24
Onset time (sec)	44 ± 7 **	74 ± 24
Peak effect (%)	94 ± 9	93 ± 11

Conclusions: Our results indicate that a priming technique in comparison with a single bolus technique accelerates the onset of NMB at the laryngeal muscles. This might be important if rocuronium is used as alternative to succinylcholine for rapid sequence induction. The onset times after priming are comparable to the onset times of succinylcholine measured in (3).
References:
1 Yavascaoglu B. Eur J Anaesthesiol 2002; 19: 517–521.
2 Griffith KE. J Clin Anesth 1997; 9: 204–207.
3 Hemmerling T. Br J Anaesth 2000; 85: 251–255.

A-475

Influence of Xenon on onset-time, duration and recovery after Mivacurium induced neuromuscular block

O. Kunitz, J.H. Baumert, K. Hecker,.J. Faßl, M. Coburn, T. Beeker, R. Rossaint

Department of Anaesthesiology, University Hospital Aachen, Aachen, Germany

Background and Goal of Study: It is well known that onset-time, duration and recovery from neuromuscular block is prolonged by inhalational anaesthetics (1). We investigated the influence of the noble gas Xenon on this parameters.

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Materials and Methods: We studied 40 patients according to the requests of the Good Clinical research practice guidelines (2). Anaesthesia was induced with propofol and remifentanil. Group A (Xe, N = 20) received xenon via mask until an endexpiratory concentration of 60% was reached. After calibration of the acceleromyograph (TOF-Watch SX®) a single bolus of mivacurium (2xED 95) was given and intubation was performed when T5 was reached. Anaesthesia was maintained with Xenon and remifentanil (group A) or with propofol and remifentanil (group B, control, N = 20). Onset-time, duration and recovery were measured using train of four. Statistical analysis was done with the wilcoxon rank sum test.

Results and Discussion: Data are shown in the table: Xe = Xenon (Group A), Co = Control (Group B) T5 = onset-time, T25 = duration and T25-T0.8 = recovery in seconds SD = Standard deviation

	T5 Xe	T5 Co	T25 Xe	T25 Co	T25-T0.8 Xe	T25-T0.8 Co
Mean ± SD	180 ± 64	195 ± 77	971 ± 298	941 ± 370	525 ± 154	557 ± 137
Median	165	165	878	960	525	570
25% Quartile	135	143	795	705	420	458
75% Quartile	225	240	1088	1005	600	623

Conclusion(s): Results did not differ between the groups. Xenon does not influence onset-time, duration and recovery from neuromuscular block induced by a single dose (2xED 95) of mivacurium.

References:

1 Rupp S, Miller RD, Gencarelli PJ, Anesthesiology 1984; 60: 102–105.
2 Viby-Mogensen J, Engbaek J, Erikson LI, et al. Acta Anaesth. Scand. 1996;19:59–74.

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A-476

Dendritic cells present neuromuscular blocking agent related epitopes to T Cells from allergic patients

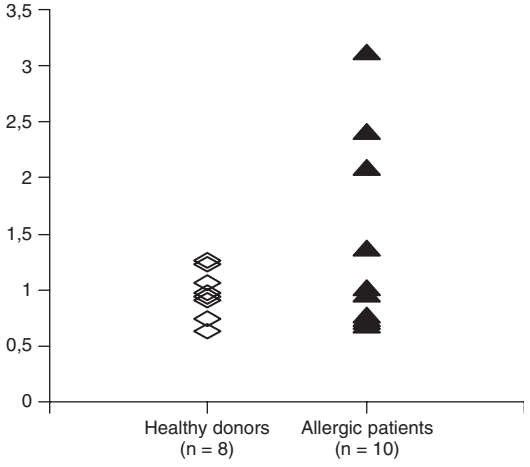
N. Aubert*, M. Janaszak*, M.C. Laxenaire**, G. Kanny**, F. Lavaud*, J. Bernard*, P.M. Mertes**

**Institut Jean Godinot, BP 171 - 51066 Reims cedex, France; **Department of Service dAnesthésie–Réanimation, Hôpital Central, CO n° 34 - 54035, Nancy cedex, France*

Background and Goal of the study: Anaphylactic reactions to neuromuscular blocking agents (NMBA) remain a major life-threatening complication during anaesthesia[1]. Dendritic cells (DC) are the most powerful antigen-presenting cells, and play a central role in the control of immune responses[2]. The aim of this study was to assess whether DC from patients having presented an anaphylactic reaction to a NMBA during anaesthesia were able to present this drug and to stimulate T cells.

Materials and Methods: Ten patients sensitised to a NMBA and 8 control subjects were involved in the study. Immature DC were generated from purified monocytes in a 5-day culture with GM-CSF and IL-4, then matured for 2 additional days with TNF-α and PGE_2 in the presence or absence of NMBA. Both NMBA-pulsed and control DC were cocultured with T lymphocytes from the same donor. After 5 days lymphocyte proliferation was quantified by ^{3}H-thymidine incorporation. Stimulation indices (SI) were calculated as "cpm in culture with NMBA-pulsed DC/cpm in culture with unpulsed DC" and were considered as positive when SI > 2.

Results and Discussion: NMBA-pulsed DC induced a specific proliferative response of T cells in 3 patients, whereas no response was observed in healthy donors.



Results are presented as stimulation index (SI) as described in the text.

Conclusion: Our results are in favour of the ability of DC to present NMBA related epitopes that are recognised by T cells. This could be of particular importance for the development of DC-based assays for the *in vitro* diagnosis of allergy to NMBA.

References:

1 Laxenaire MC and Mertes PM. Br J Anaesth 2001; 87: 549–58.
2 Hannad H, Charbonnier AS, Duez C et al. Blood 2001; 98: 1135–41.

Acknowledgement: This work was supported by a grant from the Société Française d'Anesthésie et de Réanimation.

A-477

Effects of atenolol or diltiazem pretreatment on the cardiovascular response to anaesthesia induction and tracheal intubation

P. Papagiannopoulou, M. Meitanidou, T.H. Georgiadou, A. Katsanikos, C.H. Kostoglou, F. Kanakoudis

Department of Anaesthesiology, "G. Gennimatas" Hospital, Thessaloniki, Greece

Background and Goal of study: The aim of this study was to evaluate the effect on the cardiovascular response of atenolol or diltiazem pretreatment, during anesthesia induction and tracheal intubation.

Materials and Methods: Sixty adults patients (ASA I-III) were randomly assigned to receive before anaesthesia induction atenolol 5 mg (Group AT, n = 20), diltiazem 0.15 mg/Kg (Group DI, n = 20) or placebo (Group C, n = 20). Anaesthesia was induced with propofol 2 mg/kg and fentanyl 2 μg/Kg. Tracheal intubation was facilitated by cis-atracurium 0.15 mg/Kg. Mean arterial pressure (MAP) and heart rate (HR) was recorded a) before anaesthesia induction (baseline), b) after induction of anaesthesia, c) after intubation and d) 5 min later. Percent variation of values in relation to baseline was estimated and statistical analysis was performed with ANOVA followed by posthoc tests. A $p < 0.05$ value was considered statistically significant.

Results and Discussion: Demographic data were similar between groups. After anaesthesia induction MAP was significantly lower compared to baseline in all tested groups ($p < 0.001$), with group DI showing the lowest values. MAP response to intubation increased significantly ($p < 0.05$) in groups C and DI in comparison with group AT (Fig.1). HR fluctuation was similar between AT and DI groups, but compared AT and DI groups to group C they showed significantly lower values ($p < 0.05$) (Fig 2).

Fig 1

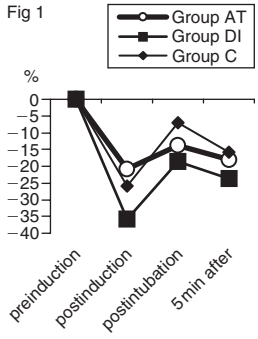


Fig 2

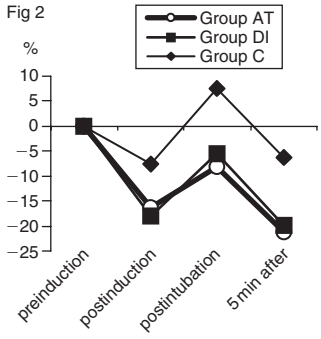


Fig 1. Fig. 2

Conclusion: MAP response to induction of anaesthesia and tracheal intubation seems to be better attenuated with atenolol than diltiazem. HR fluctuation was similar in both study groups (AT and DI).

A-478

Haemodynamic and oxygenation effects of aerosolised iloprost as compared with intravenous milrinone in cardiac surgery patients

K. Theodoraki, L. Tsourelis, P. Sfyrakis, D. Zarkalis, T. Antoniou

Department of Anaesthetic, Onassis Cardiac Surgery Center, Athens, Greece

Background and Goal of Study: Impaired right ventricular function due to elevated pulmonary vascular resistance can make discontinuation of cardiopulmonary bypass (CPB) particularly laborious. Selective pulmonary vasodilation could be an advantageous therapeutic strategy in this setting. The aim of the present study was to compare the effects of inhaled iloprost and intravenous milrinone on haemodynamics and arterial oxygenation in patients with severe post-CPB pulmonary hypertension (PH).

Materials and Methods: Eighteen patients with persistent PH after discontinuation of CPB were included in this prospective randomised study.

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The patients were assigned to receive either 14–17 μg of aerosolised iloprost via a conventional nebulising system (Group I) or a bolus of milrinone (70 μg kg^{-1}) followed by a continuous infusion of the drug (Group II). Complete sets of haemodynamic and oxygenation measurements were performed before administration of either drug (T0) and at two 10-min intervals thereafter (T1 and T2 respectively). Statistical analysis was performed by ANOVA for repeated measures.

Results:

		T0	T1	T2
MPAP/MAP ratio	Group I	0.45 ± 0.17	0.37 ± 0.11*†	0.33 ± 0.12*†
	Group II	0.45 ± 0.09	0.43 ± 0.09	0.41 ± 0.09
PVR/SVR ratio	Group I	0.21 ± 0.05	0.19 ± 0.07	0.15 ± 0.06*†
	Group II	0.20 ± 0.06	0.19 ± 0.08	0.19 ± 0.03
Qs/Qt (%)	Group I	10.82 ± 3.21	9.82 ± 4.65	8.89 ± 4.01
	Group II	9.48 ± 2.23	8.86 ± 4.54	8.60 ± 3.39

(* $p < 0.05$ in comparison to baseline, † $p < 0.05$ between groups).

Conclusions: No drug induced any consistent effect on gas exchange and intrapulmonary shunt. However, in this study inhaled iloprost was shown to be a more selective pulmonary vasodilator with little systemic effects and should perhaps be considered as the preferred treatment for severe post-CPB pulmonary hypertension.

Reference:

1 Haraldsson A et al. *Anest Analg* 2001; 93: 1439–45.

A-479

The effect of amino acid infusion on thermoregulatory response during heating and cooling in humans

T. Mizobe, Y. Nakajima, S. Taniguchi, Y. Kitamura, Y. Tanaka

Department of Anesthesiology, Kyoto Prefectural University of Medicine, Kyoto, Japan

Background and Goal of Study: Administration of protein/amino acid stimulates the oxidative metabolism with enhancing thermogenesis. Intravenous amino acid infusion during general and neuraxial anesthesia prevents perioperative hypothermia.

Materials and Methods: To characterize the changes in the control of central thermoregulation associated with amino acid infusion, we studied nine male participants on four different study days, separated each other by at least six days, given amino acid infusion at a rate of 4 kJ kg^{-1} hr^{-1} for 2.5 h, or given the same amount of saline infusion. After the core temperature was stabilized, external heat or cold exposures were applied until thermoregulatory responses were fully observed.

Results and Discussions: Amino acid infusion caused the increase in resting core temperature by 0.3 ± 0.1°C, and oxygen consumption by 35 ± 10 ml min^{-1}. The increase in core temperature threshold for active cutaneous vasodilation by amino acid infusion was 0.3 ± 0.1°C, that for sweating response was 0.3 ± 0.1°C, that for thermoregulatory vasoconstriction was 0.4 ± 0.1°C, and that for thermogenic response was 0.5 ± 0.1°C. The final change in core temperature at the end of the experiment, and the gain of thermoregulatory response did not show significant differences between amino acid infusion and saline infusion during heating and cooling.

Conclusion(s): Our present findings of the concomitant increase in core temperature threshold triggering all autonomic thermoregulatory responses, support the concept of resetting the setpoint temperature for thermoregulation in the central nervous system.

References:

1 Brundin T. Am J Physiol 1994; 266: E396–402.
2 Nakajima Y. Br J Anaesth 2003; in press.

A-480

Changes of corrected QT (QT_c) interval during anesthesia with isoflurane in women treated for breast cancer with anthracycline antibiotics

R. Owczuk*, M.A. Wujtewicz*, W. Cichocka*, M. Swierblewski^, M. Wujtewicz*

**Department of Anesthesiology and Intensive Therapy, Medical University of Gdansk, Poland; ^Department of Oncological Surgery*

Background and Goal of Study: Using of inhalation anesthetics may results in changes in ECG curve. There was observed phenomenon of QT_c prolongation in patients without any cardiac pathology anesthetizied with isoflurane or sevoflurane (1). It was interesting for us to determine if isoflurane may induce or augment QT_c prolongation in patients with high risk of the complication – treated with anthracyclines for cancer (2).

Materials and Methods: 18 women operated for breast cancer were involved to the study; they were divided into 2 groups: A – women previously treated with anthracyclines and B – women untreated with antineoplastic drugs.

Patients were premedicated with midazolam – 1 hour before anesthesia. For induction there were used: etomidate, fentanyl and wecuronium. Mechanical ventilation with N_2O/O_2 (2:1) and 0,5 vol% isoflurane was used. Measurment of QT and corrected QT were performed as presented in table below. For calculation there were used statistical tests: t-Student's for independent variables, Fisher's test and LSD.

Results and Discussions: Results of average QT_c (s) measurment and statistical analysis are presented in table:

Group	Before anesthesia	After intubation	1′	5′	15′	30′	60′	90′	After anesthesia
A	0,39	0,44	0,40	0,41	0,42	0,43	0,45	0,43	0,41
B	0,38	0,37	0,36	0,38	0,39	0,39	0,40	0,39	0,39
p	n.s.	0,01	0,02	0,05	n.s.	0,01	0,05	0,04	n.s.

In both groups we observed tendency to QT_c prolongation, but statistically significant differences among 1st and all successive measurements were revealed only in group A.

Conclusions: (1) During general anesthesia with isoflurane tendency to QT_c prolongation was observed. (2) In female-patients treated with anthracyclines the tendency was more strongly expressed.

References:

1 Kleinsasser A, Loeckinger A, Lindner KH, et al. *Anaesthesia* 2000; 56(3), 248–250.
2 Nousiainen T, Vanninen E, Rantala A, et al. *J Intern Med* 1999; 245(4), 359–64.

A-481

The effects of desflurane and sevoflurane anaesthesia on haemodynamics, recovery, cognitive function and serum fluoride levels

S. Tokat*, O. Kurtipek*, A. Berkkan**, B. Esmer*, S. Yardim*

**Department of Anaesthesiology and Reanimation Gazi, University Faculty of Medicine; **Gazi University Faculty of Pharmaceutics, Ankara, Turkey*

Background and Goal of Study: Sevoflurane and desflurane provide better maintenance of anaesthesia and shorter recovery times compared to others (1). The aim of this study is to compare the recovery characteristics, cognitive functions and serum fluoride levels after sevoflurane and desflurane anaesthesia.

Materials and Methods: The study included 40 patients (ASA I-II, aged 25–65 years). They were divided into two groups randomly; Group I (n = 20), group II (n = 20). In all groups, 5 mg/kg thiopental, 0.1 mg/kg vecuronium, 0.1 μg/kg fentanyl were used at induction. In group I desflurane and in group II sevoflurane was used in N_2O/O_2 (65%/35%) for maintenance of anaesthesia. Both lungs were ventilated as to maintain $ETCO_2$ below 35 mmHg. Arteriel pressure, heart rate, SpO_2 and end tidal concentrations of CO_2, desflurane and sevoflurane were recorded during operation. After discontinuation of anaesthesia, Sedation Score, Aldrete Score and Wechsler Memory Score were recorded. Fluoride levels were studied preoperatively and at postoperative 1st and 24th hours. Comparisons were performed using Mann–Whitney U test and Wilcoxon Signed Ranks test.

Results and Discussions: Time to open eyes and extubation were significantly higher in group II ($p < 0.05$). Sedation score was higher in group I at 10th and 30th minutes. In group II sedation score at 10th minute and recovery scores at 10th and 30th minutes were significantly lower ($p < 0.05$). Serum fluoride levels were shown at Table I.

Table I: Serum fluoride levels (μmol/L)

	Group I (n = 20)	Group II (n = 20)
Pre F	1.00 ± 0 (1–1)	1.11 ± 0.37 (1–2.58)
Post F1	1.28 ± 0.62 (1–2.95)	18.50 ± 9.01*+(6.32 ± 44.12)
Post F24	1.06 ± 0.16 (1–1.58)	6.94 ± 5.11*+ (1–21.22)

*Between groups; +Compared to preop. F levels $p < 0.05$.

Conclusion(s): Having a lower sedation score and higher orientation and recovery scores, we conclude that desflurane anaesthesia provides faster recovery. And also serum fluoride levels were not elevated by desflurane.

Reference:

1 Larsen B, Seitz A, Larsen R. Recovery cognitive function after remifentanil-propofol anesthesia: A comparison with desflurane and sevoflurane anesthesia. Anesth Analg 90: 168–174, 2000.

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A-482

Effects of cortisole on inhibitory effect of halothane on human tumour cells, in vitro study

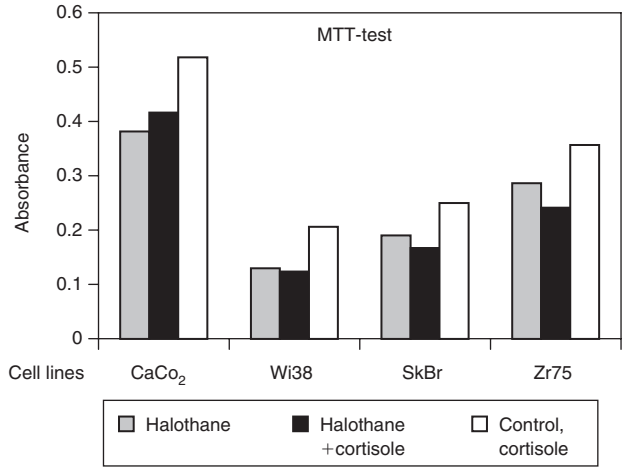
S. Kvolik, L.J. Glavas-Obrovac, I. Karner

Department of Anaesthesiology, Department of Nuclear Medicine and Pathophysiology, Clinical Hospital Osijek, Osijek, Croatia

Background and Goal of the Study: The aim of this *in vitro* assay is to evaluate whether addition of cortisole in dose observed intraoperatively modifies cell growth inhibition achieved by inhaled anaesthetic halothane.

Materials and Methods: Human breast carcinoma (Zr-75, SKBr), human large bowel carcinoma ($CaCo_2$) cells and normal fibroblasts (WI38) with cortisole 3 $\mu g\,ml^{-1}$ were exposed to halothane 1,5 vol in O_2: N_2O 35:60% and CO_2 5% respectively. Exposition was performed 3 times at 37°C for 6 hours. Cytotoxicity of anaesthetics was analysed by using of validated tetrazolium dye assay (MTT): Cells were incubated at 37°C, after 24 hours 20 µL of 5 mg/ml MTT in phosphate buffered saline was added to each well. Medium was removed after 4 hours and cells were washed out. The plates were transferred to Elisa reader (Stat fax 2100) to measure the dye extracted at 570 nm. Three groups of cells were analysed: exposed to halothane, to cortisole and halothane and incubated with cortisole alone.
Differences of 20% and more were assumed as significant.

Results and Discussion: Results observed in assay are shown on Fig 1.



There was not found a signifficant differece between cell lines exposed to halothane and cortisole and halothane alone (correl = 0.9716).

Conclusions: Addition of cortisole does not modify inhibitory effects of halothane to tumour cells growth.

Reference:

1 Elena G, Puig NR, Bay ML. et al. *Int J Immunopharmacol.* 1997; 19: 699–707.

A-484

Xenon modulates neutrophil adhesion molecule expression in vitro

L. de Rossi, N. Horn, A. Stevanovic, W. Buhre, G. Hutschenreuter, R. Rossaint

Department of Anaesthesiology and Institute of Transfusion Medicine, University Hospital, Aachen, Germany

Background and Goal of Study: Xenon reduces the infarct size after regional ischemia in the rabbit heart in vivo (1). Since adhesion molecules on neutrophils are closely involved in the pathophysiology of ischemia/reperfusion injury and modulation of neutrophil function (2), we investigated the effect of xenon on neutrophil adhesion molecule expression in vitro.

Materials and Methods: Freshly isolated neutrophils were incubated with 30 or 60% xenon for 60 minutes. In unstimulated and after stimulation with either N-formyl-methionyl-leucyl-phenylalanine or phorbol-12-myristate-13-acetate neutrophil surface expression of PSGL-1, L-selectin, CD11a and CD11b were measured by flow cytometry.

Results and Discussions: At both concentrations, xenon reduced the surface expression of PSGL-1 by 10% ($P < 0.05$), and of L-selectin by 15% ($P < 0.05$) in the 60% xenon group. Furthermore, N-formyl-methionyl-leucyl-phenylalanine activated neutrophils showed an increased removal of L-selectin from the neutrophil surface following incubation with xenon (30% compared to controls, $P < 0.05$). Neutrophil β_2-integrin expression was not altered by xenon.

Conclusion(s): Xenon increases the removal of the selectins PSGL-1 and L-selectin from the neutrophil surface in vitro. Since both selectins are involved in the initial contact between neutrophils and endothelial cells, xenon may affect neutrophil adhesion to endothelium during ischemia/reperfusion injury. However, because the β_2-integrin expression was not affected by xenon, further investigations are required to clarify whether xenon may modulate neutrophil transmigration.

References:

1 Preckel B. *Anesth Analg* 2000; 91: 1327–32.
2 Collard CD. *Anesthesiology* 2001; 94: 1133–8.

Acknowledgements: This study was supported by START (research grant) and xenon was donated from Messer GmbH, Germany.

A-485

Anaesthesia with remifentanil infusion in diabetic and non-diabetic patients undergoing vitrectomy. A Holter-controlled study

S. Aura, M. Rorarius, H. Koivu, P. Annila

Department of Anaesthesia and Intensive Care, Tampere University Hospital, Tampere, Finland

Background and Goal of Study: Diabetic patients have additional risks in surgery. No studies exist comparing diabetic and non-diabetic patients during and after remifentanil anaesthesia. Therefore, we evaluated haemodynamic profiles, arrhythmias and post-operative recovery when remifentanil infusion was used.

Materials and Methods: We compared 22 diabetics with 22 age-matched healthy controls undergoing vitrectomy. The day before operation a two-lead ECG Holter monitoring was started and continued throughout the operation and 20 hours postoperatively. Autonomic tests including breathing and stand up was done in the beginning of Holter-monitoring and heart rate (HR) changes were analysed. Anaesthesia was induced with a bolus of remifentanil (1 g/kg) and continued with 0.4 g/kg/h and then adjusted to keep mean arterial pressure (MAP) > 65 mmHg. Thereafter, a bolus of propofol (0.5 mg/kg) was given with additional doses of 0.25 mg/kg. The anaesthesia was maintained with 40% oxygen in air and 0.5% isoflurane. After the operation the well-being of the patient was evaluated up to 90 min. Pain scores, nausea and vomiting, and haemodynamic parameters were registered.

Results and Discussions: In the autonomic tests both breathing and stand up tests differed statistically between the groups ($P = 0.001$ and $P = 0.000$, respectively). Control patients needed higher doses of remifentanil ($P = 0.039$) than diabetics. Hypotensive periods were more frequent in diabetic patients ($P = 0.013$) and they needed more etilefrine than controls ($P = 0.014$). Diabetics required more antiemetics than controls ($P = 0.052$). No difference was observed in pain scores. HR and MAP did not differ between the groups in different time points. In Holter recordings no ischaemic episodes were observed. Episodes of short ventricular and supraventricular extra beats without any clinical relevance were observed in both groups.

Conclusion(s): Diabetic patients were haemodynamically more instable with frequent hypotensive periods during anaesthesia despite of less amount of remifentanil. Diabetics also needed more antiemetics. Holter recordings did not reveal any ischaemic or clinically significant arrhythmic episodes in either group.

A-486

Rapid reversal of rocuronium-induced neuromuscular block by Org 25969 in the guinea pig is not modified by occlusion of the blood supply to one kidney

A.H. Bom, F. Hope

Department of Pharmacology, Organon Laboratories Ltd., Scotland

Background and Goal of Study: In guinea pigs, rocuronium is not excreted via the kidneys, but administration of the novel reversal agent Org 25969 causes a rapid renal excretion of rocuronium (1).

Aim of this study was to determine whether occlusion of the blood supply to one kidney modifies the speed of reversal of rocuronium-induced neuromuscular block induced by Org 25969.

Materials and Methods: Guinea pigs were deeply anaesthetized and artificially ventilated. Single twitch contractions of M. gastrocnemius were induced by sciatic nerve stimulation.

Results and Discussions: After occlusion of the blood supply to one kidney, the infusion rate of rocuronium, needed to obtain ~90% block, was reduced from 14.9 ± 0.7 to 7.4 ± 0.7 nmol/kg/min (Mean ± SEM).

The time needed to obtain 90% recovery of twitch height is shown in the table. Org 25969 caused a marked improvement in speed of recovery from neuromuscular block.

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	Two kidneys		One kidney	
	Time to 90% recovery (min)	n	Time to 90% recovery (min)	n
Spontaneous	7.5 ± 1.6	8	10.7 ± 2.6	3
Org 25969				
69 nmol/kg	2.9 ± 0.7*	8	1.6 ± 0.3*	3
230 nmol/kg	1.4 ± 0.3*	8	2.4 ± 0.8*	4
460 nmol/kg	0.5 ± 0.1*	9	1.6 ± 1.0*	3

*: $p < 0.05$ versus spontaneous recovery.

Conclusion(s): Even after occlusion of the blood supply to one kidney, Org 25969 is still able to cause rapid recovery of rocuronium-induced neuromuscular block. This suggests that the Org 25969-induced reversal is not dependent on renal clearance as main mechanism of action.

Reference:

1 Epemolu O, Mayer I, Hope F et al. Rapid Commun Mass Spectrom 2002; 16: 1946–1952.

A-487

Does chronic therapy with combination of anticonvulsants affect neuromuscular block (NB) by rocuronium stronger than carbamazepine alone?

A. Spacek, F.X. Neiger

Department of Anaesthesia and General Intensive Care, University of Vienna, Vienna, Austria

Background and Goal of Study: Patients chronically receiving carbamazepine are known to be resistant to rocuronium (1). We studied if the chronic therapy with the combinations of anticonvulsants affects the rocuronium-induced NB stronger than carbamazepine.

Materials and Methods: After IRB approval and informed consent, until now a total of 28 patients with ASA physical scores I-III scheduled for neurosurgical procedures could be included in the study. Group I (n = 11) patients received chronically carbamazepine. Group II (n = 6) patients were on chronic therapy with carbamazepine, phenytoin and valproic acid. Group III (n = 11) patients served as controls. After induction of anaesthesia, rocuronium (0.6 mg/kg) was given. Anaesthesia was maintained with N_2O 70% and isoflurane 0.5% in 02. The ulnar nerve was stimulated at the wrist with train-of-four stimuli. Using a Datex NMT monitor, lag time, onset, 10%, 25%, 50%, 75% recovery and the recovery index (RI: 25–75%) were determined. Statistical analysis were made using the two tailed t-test for unpaired data and ANOVA. $P < 0.05$ was considered statistically significant.

Results and Discussions: There was no significant difference in demographic data between all groups.

Table: mean ± SD in min.

	Carbamazepine	Mixed	Control
Lag time	0.9 ± 0.2	0.8 ± 0.16	0.9 ± 0.3
Onset	2.8 ± 1.2	2.8 ± 1.1	2.6 ± 1.0
10% Recovery	19.8 ± 6.9 *	19.0 ± 5.9*	29.2 ± 13.5
25% Recovery	25.7 ± 7.6 *	23.7 ± 6.1*	36.1 ± 13.1
50% Recovery	30.4 ± 8.2 *	28.1 ± 6.9*	43.5 ± 15.6
75% Recovery	36.5 ± 10.6 *	32.8 ± 7.5*	57.0 ± 23.8
Recovery Index	10.9 ± 4.6 *	9.1 ± 3.5*	20.8 ± 12.5

* $p < 0.05$ vs control.

Conclusion(s): Our results demonstrate that patients on chronic carbamazepine therapy and on combination of various anticonvulants are resistant to rocuronium-induced NB. The combination of several anticonvulsants does not affect NB of rocuronium stronger than carbamazepine alone.

Reference:

1 Spacek A et al. Anesthesiology 1999; 90: 109–112

A-488

Comparison of pancuronium, cis-atracurium and mivacurium for pretreatment to prevent succinylcholine-induced fasciculations and myalgia

G. Lotz, P. Hofmann, J. Godelmann, P. Meyer-Breiting, T. Rinne, C. Byhahn

Department of Anesthesiology, J.W. Goethe-University Hospital, D-60590 Frankfurt, Germany

Background and Goal of Study: Despite significant pharmacokinetical improvement of non-depolarizing neuromuscular blocking agents (NBA), succinylcholine (SC) has still some unique features, primarily most rapid onset and shortest duration of action. Fasciculations (F) and postoperative myalgia (PM) are common side-effects after SC administration and can be reduced by pretreatment with a small dose (≈20% of ED95) of a non-depolarizing NBA. We studied the effect of pretreatment with pancuronium (P) and the newer agents cis-atracurium (C) and mivacurium (M) on the incidence of SC-induced (F) and (PM), as well as on intubating conditions in a randomized-controlled, double-blinded clinical trial.

Materials and Methods: 240 adult patients (ASA I/II) presenting for elective ENT-surgery were randomly assigned into eight groups to receive pretreatment with either P 15 μg/kg, C 20 μg/kg, M 30 μg/kg, or saline (S). Anesthetic induction was performed with remifentanil and propofol. Then SC 1 or 1.5 mg/kg was injected. Onset of neuromuscular block was monitored with a TOF stimulation pattern with a 10-s pause between each stimulus train. With TOF = 0 or 2 min after SC injection in case of incomplete neuromuscular block, the patients tracheas were intubated. Severity of fasciculations and intubation conditions were assessed according to established standards (1). 24 hrs postoperatively, all patients were asked for myalgia.

Results: Fasciculations were almost absent with pancuronium pretreatment regardless of the SC dose. No myalgia occurred in these two groups. With pancuronium and SC 1.5 mg/kg, intubation conditions were excellent in all patients. Pretreatment with C or M produced markedly poorer intubation conditions, accompanied by an increased rate of F and PM, the latter being most pronounced with saline pretreatment. The severity of PM did not correspond with the severity of F in any group.

Conclusion(s): Pretreatment with P is still the most effective and cheapest prevention of SC-induced F and PM when compared with C and M. Along with SC 1.5 mg/kg, P provided excellent intubation conditions in all patients. If SC is used to facilitate tracheal intubation, pretreatment should be performed with P.

Reference:

1 Viby-Morgensen J, et al.: Acta Anaesthesiol Scand 1996: 40–59–74.

A-489

No evidence for an inflammatory origin of postoperative myalgia after use of succinylcholine

J.U. Schreiber, T. Mencke, A. Biedler, O. Fuerst, S. Kleinschmidt, H. Buchinger, T. Fuchs-Buder

Department of Anaesthesia and Critical Care Medicine, University of the Saarland, Homburg, Germany

Background and Goal of Study: A common side effect associated with succinylcholine is postoperative myalgia (POM) (1). The pathogenesis of POM is still unclear; inflammation as a cause has been suggested but without convincing evidence (2). Therefore the present study was designed to assess whether pretreatement with dexamethasone – a glucocorticoside with a powerful anti-inflammatory potency – can decrease POM.

Materials and Methods: After ethics commission approval 64 patients (ASA I-II) who underwent minor ENT-surgery were randomized in two groups (n = 32 each) and pretreated either with dexamethasone 8 mg iv or saline. Incidence and severity of myalgia was determined 6, 24, 48, and 72 h after anaesthesia. In a subgroup of 10 patients pretreated with saline, interleukin 6 (IL-6) as an early marker of inflammation was assessed before surgery, at the end of surgery, 6, and 24 h after anaesthesia. Statistics: Mann–Whitney-Test, Chi-Square-Test, t-Test. A $p < 0.05$ was considered significant.

Results and Discussions: 15 patients in the dexamethasone group complained of myalgia compared to 18 patients in the saline group (NS). Severe myalgia was reported by 5 patients and 3 patients respectively (NS). At 48 h after anesthesia 12 patients in both groups still suffered from mylagia (NS). In the subgroup we found an increase of IL-6 in three patients but only one patient reported myalgia; no relationship between incidence or severity of myalgia and increase of IL-6 was found.

Conclusion(s): Administration of dexamethasone before succinylcholine was not effective in reducing POM; a pretreatment with dexamethasone to prevent POM is not justified. Furthermore there was no significant correlation between IL-6 and incidence or severity of POM. No evidence for an inflammatory origin of POM could be found.

References:

1 Pace NL. Anesth Analg 1990; 70: 477–483.
2 Leeson-Payne CG et al. Br J Anaesth 1994; 73: 788–790.

A-490

Rocuronium–vecuronium interaction revisited by an alternate method

D. Steinberg

Department of Anesthesia, Hospital Clinicas Caracas & Policlinica Mendez Gimon, Caracas, Venezuela

Backgrounds and Goals.: Potency can be obtained from a single data point if the slope of this relationship is assumed, averaging individual estimates

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determined by using the modifications of the Hill equation (1, 2). The interaction between rocuronium (ROC) and vecuronium (VEC) was revisited by using such an alternate method.

Material and Methods: After institutional informed and signed consent 135 elective patients (44 ± 4 years, 68 ± 3 Kg) anesthetized with intravenous agents and ventilated with nitrous oxide-oxygen, were allocated randomly to nine groups (n = 15) according to the relaxant and dose. Single drug dose-response relationship were concluded first using ROC 50, 100 and 200 μg Kg^{-1} or VEC 10, 20 and 30 μg Kg^{-1} and ED_{50}'s determined by the above mentioned method, using the maximal effect obtained by EMG and TOF stimulation, subsequently ED_{50} for the combination was calculated using 0.2, 0.3 and 0.4 fractions of each ED_{50} by the same alternate method. An algebraic analysis was used to identify the type of interaction ($dr/(ED_{50})r + dv(ED_{50})v$) (3).

Results: Data showed in Table 1 indicate additivism. For comparison results from a previous work using log/probit are included (3).

Table 1

	ROC	Theo	Exper	(Theo/ED)	VEC	Theo	Expr	frac
ED_{50}	143 ± 61	64 ± 14	65 ± 15	0.45	24 ± 8	11 ± 2	11 ± 2	0.46
	144**	72**	66**	0.46**	23**	12**	10**	0.46**
	(Exp/ED)ROC		VEC	(Theo/Exp)ROC		VEC	Analysis	
ED_{50}	0.45		0.46	1.01		1	0.91	
	0.5**		0.5**	0.91**		0.9**	0.92**	

(**) Naguib et al: Br J Anaesth (1995) 75: 37

Conclusions: This alternate method is a useful tool for the calculation of a dose-response relationship and seems to be used for the first time with VEC and an interaction.

References:

1 Kopman A, Klewicka MM, Neuman GG: Anesth Analg (2000) 90: 1191.
2 Wright PM, Hart P, Lau M et al: Anesthesiology (1994) 81: 159.
3 Naguib M, Samarkandi AH, Bakhamees HS et al: Br J Anaesth (1995) 75: 37.

A-491

Time-dependent effect of rocuronium neuromuscular blockade during sevoflurane versus propofol anaesthesia

F.J. Orellana[1], M. Guasch[2], F. Gilsanz[3]

[1,2]Department of Anaesthesia, Hospital Central de la Defensa, Madrid; [3]Professor of Anaesthesiology. Hospital La Paz, Madrid, Spain

Backgrounds and Goals: Anaesthetic techniques have been shown to influence duration of action and recovery of rocuronium induced neuromuscular (NM) blockade (1,2). The aim of this study was to determine pharmacodynamic properties of rocuronium during sevoflurane versus propofol anaesthesia and any time-dependent effect on recovery.

Materials and Methods: 26 non-obese patients were studied (14 males/12 females, age 18–70 years, ASA I/II, under rocuronium NM block) and randomly allocated to maintenance of anaesthesia with sevoflurane (1.2 MAC ± 10%) or propofol 10-8-6 mg/kg/h in O_2/N_2O, FiO_2 = 0.4. NM block was monitored with TOF-Guard® nerve stimulator at the adductor policies after tetanic preconditioning (50 Hz for 5 seconds). We measured onset time, variables of spontaneous recovery till 1st supplementation dose and interval 25% T1 recovery to TOF ratio 0.9 (IR) in relation to length of anaesthesia (<120 or ⩾120 min). Statistical analysis was performed with unilateral Student's t test and Mann–Whitney U test ($\alpha = 0.05$ and $\beta = 0.2$).

Results: Data (Mean ± SD) were as follows:

Onset time of rocuronium NM block was 1.4 ± 0.6 min.

	Sevoflurane	Propofol
No-twitch response (min)	34.8 ± 17	30.3 ± 2
Duration 10% (min)	41.9 ± 21	36 ± 8.2
Duration 25% (min)	53.3 ± 32.2	42 ± 9.6
IR:		
Duration TOFr 0.9 < 120 (min)	9.5 ± 6.2	8 ± 2.4
Duration TOFr 0.9 ⩾ 120 (min)	13.9 ± 3.6*	7.2 ± 1.4

*$p < 0.004$.

Conclusions: Time course of rocuronium NM blockade varies widely under sevoflurane anaesthesia. When duration of anaesthesia exceeds 120 min, sevoflurane prolongs rocuronium induced NM blockade to complete recovery versus propofol. Under these circumstances use of nerve stimulators should be mandatory.

References:

1 Schmidt J, Gäbler R, Speckmann E, et al.. *Eur J Anaesthesiol-Suppl*, 1997; 14(16): 7.
2 Lowry DW, Mirakhur RK, McCarthy GJ, et al. *Anaesth Analg*, 1998; 87: 936–940.

A-492

Rapacuronium pretreatment effects on succinylcholine–mivacurium sequence: a comparison with rocuronium

D. Steinberg

Department of Anesthesia, Hospital Clinicas Caracas & Policlinica Mendez Gimon, Caracas, Venezuela

Backgrounds and Goals: Despite warnings succinylcholine (SCH) continues to be used (1). A small dose of a non-depolarizing relaxant is recommended as a prophylaxis for some SCH's side effects. The sequence of SCH – mivacurium (MIV) for short lasting procedures have been advised (2). Rocuronium (ROC) but no rapacuronium (RAP) have been studied as a pretreatment drug, (1, 2, 3). The aim of this study is to present the effects of RAP pretreatment on the sequence: SCH-MIV.

Materials and Methods: Elective patients (n = 45), were anesthetized with intravenous agents and nitrous oxide and randomly allocated to three groups (n = 15) according to the muscle relaxant sequence. Group 1 received SCH 1 mg Kg^{-1} and when a 50% spontaneous recovery took place, MIV 100 μg Kg^{-1} was used for muscular relaxation to complete short lasting surgical procedures. The same technique was employed in the other patients, but those in group 2 received RAP 100 μg Kg^{-1} (¶) three minutes before SCH and in group 3 ROC 60 μg Kg^{-1} was used with the same timing. Independent observers looked after fasciculations classified them in a 0 to 4 scale, and mean average used for calculations. Time to 80% blockade, maximal effect, onset time and clinical duration was assessed by electromyography. Analysis of variance, Student-Neuman-Keuls and Kurskal-Wallis tests and a 5% level for significance were used for statistical comparisons.

Results: Significant findings are shown in Table 1.

	80% (sec)	Max	Onset	Dur
1) SC	33 ± 11	99 ± 0,6	66 ± 16	7 ± 1
2) RAP-SC	55 ± 14	86 ± 12	107 ± 23	7 ± 2
3) ROC-SC	67 ± 18	92 ± 8	102 ± 19	4 ± 1
Sig	3)vs = 1.-2.-2)vs = 1.-	1)vs = 2.-3	1)vs = 2.-3	3)vs = 2.-1
	Fasciculations	Max	Onset	Dur
1) SC-MIV	10	98 ± 4	135 ± 26	15 ± 8
2) RAP-SC-MIV	0.13	97 ± 5	110 ± 21	18 ± 6
3) ROC-SC-MIV	0.33	99 ± 1	137 ± 42	18 ± 6
Sig	0.0001	N.S.	0.039	N.S.

Conclusions: ROC have been classified as the best prevention for SCH fasciculations despite a 15% incidence (2). In the present study this side effect almost disappeared the same with ROC and RAP. But RAP antagonizes SCH's action and accelerate MIV sequence. Maximum blockade was most affected by RAP.ROC but not RAP reduces clinical duration.

References:

1 Can J Anaesth (1998) 45: 397.
2 Can J Anaesth (1998) 45: 521.
3 Can J Anaesth (1997) 44: 1262.

(¶) Rapacuronium data was collected before its withdraw from the market.

A-493

Onset time and duration of action of neuromuscular blockade induced by rocuronium in major burn injury

H.S. Kim, H.W. Wie, I.S. Kwok, T.H. Han, H.Y. Kil, K.M. Kim

Department of Anesthesiology and Pain Medicine, HanGang Sacred Heart Hospital, Hallym University, College of Medicine, Seoul, Republic of Korea

Background and Goal of Study: It is well known that burn patients are resistant to the action of nondepolarizing muscle relaxants. Rocuronium, with a shorter onset time and devoid of electrolyte side effects, may be considered for rapid sequence induction in these circumstances. This randomized, double-blind study was conducted to assess the onset time, duration of action of neuromuscular blockade and intubating condition induced by rocuronium in major burn patients.

Materials and Methods: Adult patients, suffered from major burn injury, aged 18–59 years, ASA physical status I or II, more than 2 weeks and less than 6 months after the initial injury, were included. Propofol and fentanyl based intravenous anesthesia was conducted with nitrous-oxide and oxygen. Neuromuscular blockade was monitored with an acceleromyography, TOF-Watch® (Organon Teknika B.V., Boseind, The Netherlands), using Train of Four (TOF) stimulation. Rocuronium (Esmeron®, Organon Inc., U.S.A.), at $ED_{95} \times 3$ (0.9 mg/kg) and × 4 (1.2 mg/kg) were given intravenously over 5 s

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in both groups of burn and nonburn patients, respectively. Onset time, duration of action, and intubating conditions were assessed and graded according to "the Guidelines for Good Clinical Practice".

Results and Discussions: Average burn TBSA were between 30% and 40%, and the elapsed time after the burn injury were approximately a month. Demographic data revealed no significant differences between burn and nonburn groups. The average time to 95% neuromuscular block was significantly prolonged in the burn group compared to non-burns' (115.0 ± 58.4 vs. 68.4 ± 15.8 sec at 0.9 mg/kg, 86.1 ± 19.7 vs. 56.9 ± 10.9 sec in 1.2 mg/kg, $p < 0.05$). Period of no response, time to reappearance of T1, duration 10%, 25%, 75% and 80% were significantly shorter in the burn group. Intubating conditions were ranged from good to excellent in the majority. When the different dosages were compared in the burn groups, all measured parameters improved as dose escalates.

Conclusion: Rocuronium showed significant resistance in neuromuscular blockade of burn patients. This appeared to improve depending upon increasing the dosage.

Reference:

1 Viby-Mogensen J, et al. Acta Anaesthe Scand 1996; 40: 59–74.
2 Martyn J, et al. J Clin Pharmacol 1986; 26: 680–5.

A-494

Quantification of skin blood flow response to the injection of non-depolarising muscle relaxants

D. Burke, G. Simpson, K. Smythe, G.A. McLeod, J.H. Levy

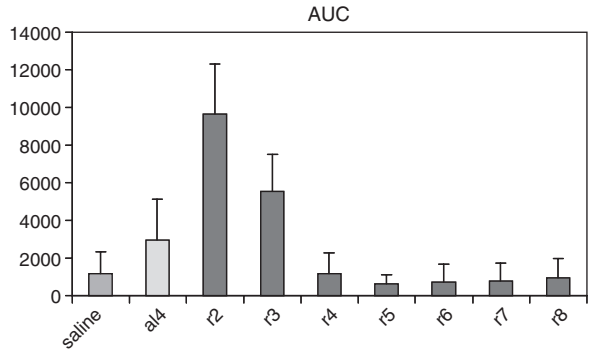
Department of Anaesthesia, St. Johns Hospital, Livingston, Scotland

Ninewells Hospital, Dundee, Scotland

Background and Goal(s) of Study: Allergy testing relies on visual observation for weal and flare reactions. However, the vasodilatory threshold needs to be determined to exclude false positive results[1]. We have therefore attempted to quantify skin blood flow following the injection of non-depolarising muscle relaxants.

Materials and Methods: In a double-blind study, 8 volunteers received 0.02 ml injections of rocuronium (r) 10^{-8}M, R10^{-7}M, 10^{-6}M, 10^{-5}M, 10^{-4}M, 10^{-3}M, 10^{-2}M, atracurium 10^{-4}M (+ve control) and 0.9% saline (−ve control) intradermally. One site was untreated. Skin blood flow was measured using laser doppler imaging at regular intervals for 40 minutes. AUC was measured and compared using single measures ANOVA and the Bonferroni correction. Visual observations for weal and flare were also made at 15 and 30 minutes.

Results:



Conclusion(s): Rocuronium at concentrations of $\geqslant 10^{-3}$M causes a significant increase in skin perfusion compared with saline. This is associated with weal and flare reactions in the majority of subjects. Atrac10^{-4}M does significantly increase skin perfusion.

Reference:

1 Levy JH, Gottge M, Szlam F et al. *Br J Anaesth* 2000; 85(6): 844–9.

A-495

Neuromuscular blockers and apoptotic death on peripheral blood lymphocytes

A. Antonucci, C. Iannarone, M. Marandola, T. Valerio, C. Di Lauro, G. Delogu

Department of Anaesthesia and Intensive Care, "La Sapienza" University, Rome, Italy

Background and Goal of Study: Several works focused on the immunosuppression following surgical trauma in general anaesthesia. Lymphocyte apoptosis appears a crucial factor involved in this postoperative immunological deficit, but the ultimate mechanism triggering the apoptotic process is not elucidated so far. We hypothesized that anaesthetic drugs may play a role in possible pro-apoptotic effect of two muscle relaxants commonly used in anaesthesia practice such as suxametonium and *cis*-atracurium.

Materials and Methods: Lymphocytes were separated from heparinized peripheral blood samples of 15 healthy volunteers and were incubated with suxametonium and *cis*-atracurium at clinically relevant concentrations (4.125 μg/ml and 3.225 μg/ml, respectively). The absolute counts of cells bearing either the $CD4^+$ and $CD8^+$ or the Fas/FasL ligand phenotypes were determined by flow cytometry. Assessment of lymphocytes undergoing apoptosis was made by phenotypic analysis of apoptotic cells with Annexin V staining.

Results and Discussion: We found that either suxametonium- or *cis*-atracurium-treated lymphocytes exhibited a significantly enhanced expression of Fas/FasL proteins as compared with control without drug. In addition, a significant rate of Annexin V positive lymphocytes was detected among cells incubated with the musclerelaxants in comparison with untreated cells. (Data are shown in Figure 1, *$p < 0.05$ *vs* control).

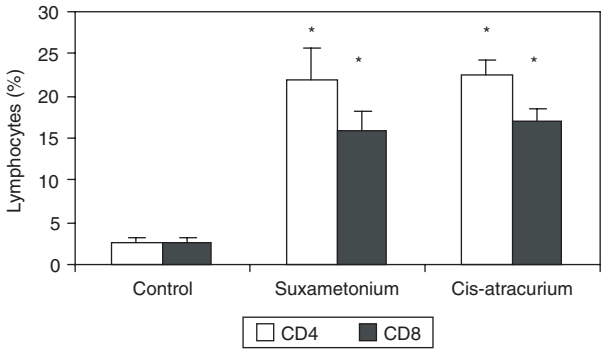


Fig. 1 Annexin-V positive cells.

Conclusions: This work demonstrate that suxametonium and *cis*-atracurium were able to increase Fas/FasL expression and to induce apoptotic death on human peripheral blood lymphocytes. The clinical impact of this finding appears to be worthy of further investigation.

A-496

Genetic influences on propofol anaesthesia: a role for brain sensitivity?

L. Pain, W. Falls

GRERCA, Inserm U405, IFR Neurosciences, Strasbourg, France & University of Vermont, Burlington, USA

Background and Goal of Study: It is unclear to what extent genetic influences on propofol anaesthesia is due to differences in metabolism and/or in brain sensitivity (1). In this initial study, we compared the anesthetic potency of propofol in two inbred strains of mice that differ largely on brain functioning, C57BL/6 (B6) and DBA/2J(D2). Briefly, D2 mice have a lower electrical convulsions threshold, display poor contextual learning and have less hippocampal protein kinase (PKC) compared to B6 mice and others.

Materials and Methods: We studied adult male weighing 25–34 g, B6 strain ($n = 11$) and D2 strain ($n = 11$) using a cross-over design. To assess the effects of propofol, each mice received intraperitoneally different doses of propofol in a counterbalanced randomized order with at least 5–6 days between each treatment session. The number of animals who lost the righting reflex out of the total of 11 animals per group was used to calculate the percentage loss of righting reflex, 95% confidence limits of that value and the significance of difference in ED50 between the two strains were determined.

Results and Discussions: Propofol increased the percentage of loss of righting reflex in a dose dependent-manner in the two strain of mice. The ED50 values were 113 mg kg^{-1} (95% confidence limits 86–140) and 220 mg kg^{-1} (95% confidence limits 185–255) for B6 and D2 strains, respectively. The mean difference in ED50 values (107 mg kg^{-1}, 95% confidence limits 88–125) between the two strains was statistically significant ($p < 0.05$).

Conclusion(s): Genetic differences in brain functioning as observed in D2 strain are associated with D2 mice being relatively resistant to propofol anaesthesia compared to B6 mice.

Reference:

1 Ortolani O et al., Anesth Analg 2001, 93: 1222–6.

Acknowledgements: Philippe Foundation, Programme Lavoisier & Université Louis Pasteur.

A-497

Gender differences of recovery times and drug consumption after propofol–remifentanil anaesthesia

C. Stracke, S. Kreuer, S. Altmann, R. Larsen, W. Wilhelm

Department of Anaesthesiologie and Intensive Care Medicine, University of Saarland, 66421 Homburg/Saar, Germany

Goal of Study: We investigated gender differences of drug consumption and recovery times after propofol-remifentanil anaesthesia.
Methods: With IRB approval and written informed consent adult patients scheduled for minor orthopaedic surgery were randomised to receive a propofol-remifentanil anaesthetic controlled either by EEG monitoring (Narcotrend or BIS) or solely by clinical parameters. We used a gender-balanced study design with a male : female ratio of 1:1 in each group. Anaesthesia was induced with remifentanil 0.4 μg/kg/min and a propofol target-controlled infusion (TCI) at 3.5 μg/ml. After intubation remifentanil was reduced to 0.2 μg/kg/min whereas propofol TCI was adjusted according to clinical parameters or to the following EEG target values: during maintenance to "D_{0-1}" (Narcotrend) or "50" (BIS), 15 min before the end of surgery to "C_1" (Narcotrend) or "60" (BIS). Recovery times were recorded by a blinded investigator and average normalised propofol consumption was calculated from induction and maintenance doses. Statistics: t-test, $p < 0.05$, data are mean ± SD.
Results: Sixty male and 60 female patients completed the study. Gender differences were observed for recovery times (with standard practice) and for propofol consumption (with BIS or Narcotrend monitoring).

	Male	Female	p
Standard practice			
Propofol (mg/kg/h)	6.7 ± 1.4	6.9 ± 1.1	0.569
Open eyes (min)	11.7 ± 6.1	6.9 ± 2.6	0.003
Narcotrend			
Propofol (mg/kg/h)	4.2 ± 0.8	4.8 ± 1.3	0.087
Open eyes (min)	3.9 ± 2.4	2.9 ± 1.8	0.144
BIS			
Propofol (mg/kg/h)	4.4 ± 0.9	5.1 ± 0.9	0.019
Open eyes (min)	3.9 ± 3.6	3.1 ± 2.0	0.390

Conclusion: Women emerge faster from anaesthesia than man if they receive the same weight normalised propofol dosage. If propofol is titrated according to EEG parameters, women needed more propofol to achieve the same Narcotrend stages or BIS values than men.

A-499

3,4-Methylenedioxymethamphetamine ("Ecstasy") is a trigger of malignant hyperthermia in susceptible swine

M. Fiege, F. Wappler, R. Weisshorn, M.U. Gerbershagen, M. Menge, J. Schulte am Esch

Department of Anaesthesiology, University Hospital Hamburg-Eppendorf, Hamburg, Germany

Background and Goal of Study: 3,4-Methylenedioxymethamphetamine (MDMA, "ecstasy") can mediate acute toxic effects such as muscle rigidity, metabolic acidosis and hyperthermia (1,2). Due to the close clinical similarities an association between malignant hyperthermia (MH) and MDMA intoxication was suggested (1,2). The aim of this study was to investigate, whether MDMA is a trigger of MH in susceptible swine.
Materials and Methods: After approval of the animal care committee, MH-triggerfree general anaesthesia was performed in 6 MH susceptible (MHS) and 6 MH normal (MHN) swine. The animals were exposed to MDMA in cumulative intravenous doses of 0.5, 1, 2, 4, 8 and 12 mg/kg. Clinical occurrence of MH was defined by achievement of two out of three conditions: venous $pCO_2 \geqslant 75$ mmHg, pH ⩽ 7.20 and increase of body temperature ⩾ 2.0°C. Data are given as mean ± SD, statistical significance ($p < 0.05$) was evaluated using ANOVA and Scheffe's test.
Results and Discussions: Administration of 8 mg/kg MDMA triggered MH in all MHS swine. The MHN swine developed also clinical signs of hypermetabolism, but changes were moderate compared to the MHS swine. Data after administration of 8 mg/kg MDMA are shown in the table:

	MHS		MHN	
	Baseline	MDMA	Baseline	MDMA
pCO_2 (mmHg)	44.5 ± 1.4	78.7 ± 1.8	44.6 ± 2.1	60.8 ± 4.7
pH	7.44 ± 0.03	7.19 ± 0.03	7.42 ± 0.02	7.28 ± 0.03
Temp. (°C)	38.6 ± 0.2	40.3 ± 0.7	38.5 ± 0.2	39.2 ± 0.3

Conclusion(s): MDMA in abusive doses is a trigger of MH in susceptible swine. Therefore, MHS patients should always avoid use of MDMA or related drugs. Furthermore, patients with a personal or familiar history of MDMA-induced hyperthermia should be supplied to diagnostics of MH susceptibility.
References:
1 Kalant H. *CMAJ* 2001; 165: 917–28.
2 Shannon M. *Pediatr Emerg Care* 2000; 16: 377–80.
Acknowledgements: This study was supported by fundings of the "Deutsche Forschungsgemeinschaft (DFG)", Bonn, Germany, WA 1570/1-1.

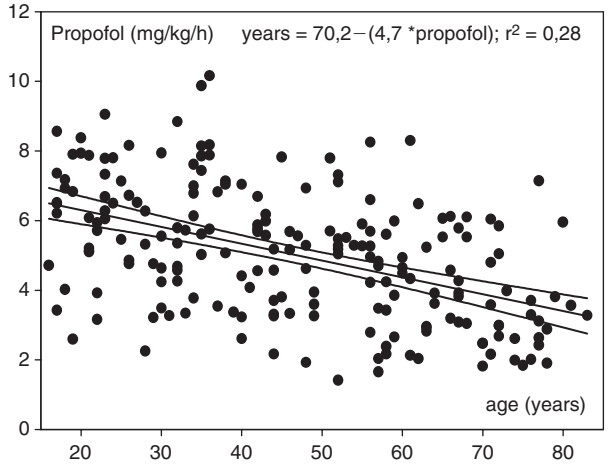
A-500

Impact of patient age on propofol consumption during propofol–remifentanil anaesthesia

M. Wrobel, S. Kreuer, A. Biedler, W. Werth, R. Larsen, W. Wilhelm

Department of Anaesthesiologie and Intensive Care Medicine, University of Saarland, 66421 Homburg/Saar, Germany

Background: The Narcotrend EEG monitor was designed to measure the depth of anaesthesia based upon a 6-letter classification from A (awake) to F (increasing burst suppression). We investigated the impact of patient age on propofol consumption.
Methods: With IRB approval and written informed consent patients of different ages received a propofol–remifentanil anaesthetic. Narcotrend EEG electrodes were positioned on the patient´s forehead as recommended by the manufacturer. Anaesthesia was induced with 0.4 μg/kg/min remifentanil and 2 mg/kg propofol. After intubation remifentanil was reduced to a constant rate of 0.2 μg/kg/min whereas propofol was adjusted to achieve a target Narcotrend stage of D indicating general anaesthesia. Average normalised propofol consumption (mg/kg/h) was calculated from the maintenance doses. Statistics: Linear regression analysis and ANOVA with post-hoc Student-Newman-Keuls test, $p < 0.05$, data are mean ± SD.
Results: A total of 200 patients (ASA I-III, 16–83 yrs) was studied. Mean propofol consumption significantly decreased with patient age: ⩽ 30 yrs 5.9 ± 1.7; 31–50 yrs 5.4 ± 1.8; 51–70 yrs 4.5 ± 1.7; > 70 yrs 3.5 ± 1.4 mg/kg/h.



Conclusions: With Narcotrend monitoring mean propofol consumption is age-dependent. However, age *per se* does not allow a prediction of the individual propofol need.

A-501

Oxygen consumption during propofol anaesthesia with remifentanil or fentanyl

U. Johann, S. Kreuer, P. Niederprüm, M. Bauer, R. Larsen, W. Wilhelm

Department of Anaesthesiologie and Intensive Care Medicine, University of Saarland, 66421 Homburg/Saar, Germany

Goal of Study: This study was designed to compare the impact of total intravenous anaesthesia with remifentanil or fentanyl on oxygen consumption as an index of stress response in patients undergoing lower abdominal surgery.
Methods: With IRB approval and written informed consent adult women scheduled for abdominal hysterectomy were randomised to receive a remifentanil-propofol (RP) or a fentanyl-propofol (FP) anaesthetic. During maintenance of anaesthesia in the RP group remifentanil was infused at 0.3 μg $kg^{-1} min^{-1}$ and propofol at 4 mg $kg^{-1} h^{-1}$. In the FP group, fentanyl was

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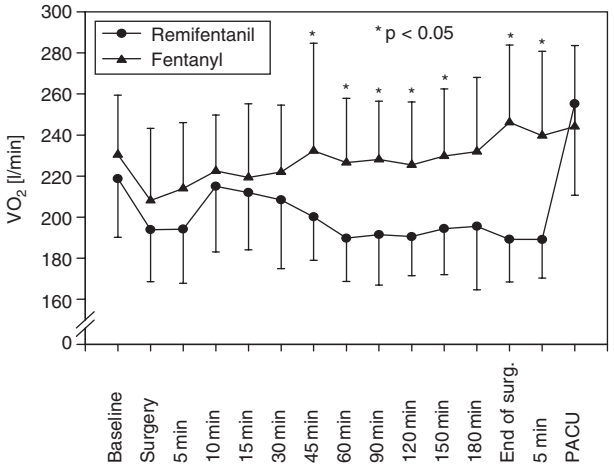
given as a bolus dose of 2 μg kg^{-1} before induction and repeated at skin incision, and propofol was infused at 6 mg kg^{-1}h^{-1}. Oxygen consumption (VO_2) was measured in intervals of 5 min using a Deltatrac Metabolic Monitor (Datex-Ohmeda, Finland). Statistics: Mann–Whitney U test; data are mean ± SD; $p < 0.05$.

Results: Forty patients completed the study. The groups were comparable for demographic data and duration of anaesthesia.



Conclusion: During ongoing surgery oxygen consumption turned to be significantly lower with remifentanil–propofol than with fentanyl–propofol. Suppression of intraoperative stress response seems to be better with remifentanil than with fentanyl.

A-502

Influence of speed of injection of propofol on induction dose under continuous measure of depth of anesthesia

P. Panousis, H. Thomsen, T. Koch

Department of Anesthesiology and Intensive Care Medicine, Carl Gustav Carus Medical Faculty Dresden, Dresden, Germany

Background and Goal of Study: The influence of various infusion rates of propofol on the induction dose under continuous measure of depth of anesthesia by the Narcotrend™ EEG-monitor has not been investigated (1). Does the combination of slow injection and measure of depth of anesthesia affect the induction dose?

Materials and Methods: 60 patients (ASA I-II, age 45 ± 13) were randomly assigned to 4 groups. Propofol was administrated at 20, 10, 5, 2,5 ml/min (group 1–4 respectively) until stadium of depth of anesthesia D0 (Kugler-classification) was attained and a blood sample (10 ml) was taken from each patient for analysis of plasma propofol concetration at that stadium. Anesthesia was maintained thereafter as a TIVA.

Results and Discussions: Data (Mean ± SD) are shown in the table:

	Group 1	Group 2	Group 3	Group 4
Induction time (sec)	61 ± 13	88 ± 15	173 ± 56	234 ± 56
Induction dose (mg)	223 ± 44	141 ± 21	138 ± 39	95 ± 24
Dose/body weight (mg/kg)	3 ± 0,7	1,9 ± 0,4	1,7 ± 0,3	1,2 ± 0,2
Decrease of MAP(mmHg)	20 ± 11	10 ± 12	11 ± 10	8 ± 13

Using slower infusion rates induction time took significantly longer $p < 0{,}005$ (except group 3 vs. 4) and was achieved with significantly smaller doses of propofol $p < 0{,}005$ (except group 2 vs. 3). Slow infusion caused less depression of the MAP, but the differences were not statistically significant.

Conclusions: The combination of slow infusion rate of propofol with a continuous measure of depth of anesthesia reduces the induction dose and has important pharmacokinetical and economical implications.

Reference:

1 Kazama T, Ikeda K, Morita K, et al.: Investigation of effective anesthesia induction doses using a wide range of infusion rates with diluted and undiluted propofol. Anesthesiology 2000; 92: 1017–28.

Acknowledgements: Plasma propofol concntrations are at the moment under evaluation.

A-503

Remifentanil and fentanyl potentiate activation of NMDA receptors (NR1A/2B) in Xenopus oocytes by activation of proteinkinase C

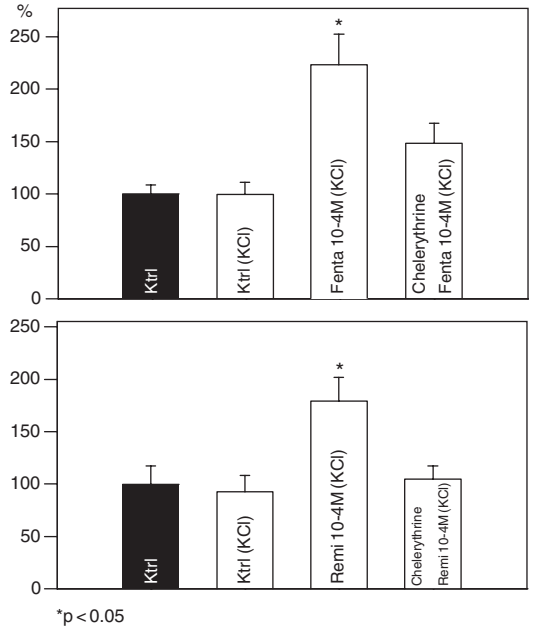
K. Hahnenkamp, S. Egger, S. Schauerte, A Hahnenkamp

Department of Anaesthesiology and Intensive Care, University Hospital Muenster, Muenster, Germany

Background and Goal of Study: Intraoperatively administered remifentanil (Remi) and fentanyl (Fent) result in acute opiod tolerance and hyperalgesia (1). *N*-methyl-D-aspartate (NMDA) receptors play a critical role in this "wind up" phenomena.. Remi directly stimulates the NMDA receptor in *Xenopus* oocytes, an effect not shared by Fent (2). We hypothesize that apart from Remi's effects, both opioids share one mechanism and investigated their potential influence on PKC.

Materials and Methods: Human NMDA receptors (NR1A/2B) were recombinantly expressed in *Xenopus* oocytes. Two electrode voltage clamping was performed at a holding potential of −70 mV. The EC_{50} of agonists (glutamate/glycine) were applied in 50 μl aliquots. Peak currents (μ A) were measured. Cells were incubated with 10^{-4} M Remi or Fent. For PKC experiments cells were incubated with 500 μM chelerythrine (PKC inhibitor) in 150 mM KCl intracellularly. Control cells were incubated with 150 mM KCl.

Results and Discussions: Non-injected cells were unresponsive to glu/gly. Injected cells responded concentration dependently. Remi or Fent incubation increased responses to glu/ gly (EC_{50} 7.9 μM/ 12 μM)of agonists 98% or 114% ($p < 0.05$ vs cntrl). Intracellular incubation of PKC inhibitor chelerythrine inhibited this potentiation (Fig, mean and ste.)



Conclusion(s): Our results indicate that the structurally related opioids remifentanil and fentanyl potentiate the NMDA mediated responses to glu/gly by activation of PKC.

References:

1 Celerier E, Laulin JP, Larcher A et al. Brain Res 1999; 847: 18–25.
2 Hahnenkamp K, Nollet J, Van Aken et al. Anesth Analg 2002; 94: S211.

Acknowledgements: The work was in part supported by the ESA Residents Research Award 2002.

A-504

Platelet 5-HT$_{1A}$ receptors modulation by fentanyl in cardiovascular surgery

I. Bellido*, A. Gomez+, L. Delange+, Sanchez de la F. Cuesta*

**Pharmacology and Clinical Therapeutics; +Anaesthesiology, School of Medicine of Málaga, Spain*

Background and Goal of Study: Cardiovascular pathology (CVP) and extracorporeal circulation (ECC) induce platelet activation (1,2). 8OH-DPAT (5-HT$_{1A}$ receptor selective agonist) stimulated platelet cyclooxygenase products (3), although 5-HT$_{1A}$ receptors have not been detected in platelet

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membranes. Fentanyl positively modulate the 5-HT_{1A} receptors (4). The platelet 5-HT_{1A} receptors were marked in patients subjected to cardiovascular surgery (CVS) and fentanyl anaesthesia.

Materials and Methods: ^{3}H-8-OH-DPAT binding sites were marked with ^{3}H-8-OH-DPAT (10 nM) in platelet membranes of 83 patients (47 male, 36 female) subjected to CVS plus ECC and major vascular surgery (VS) and healthy non treated voluntaries. Patients with pathology or under drug-therapy able to affect the 5-HT system were rejected. Platelet ^{3}H-8-OH-DPAT binding sites were marked before anaesthetic induction (basal), chirurgic incision, and ECC/vascular clamp and after the surgery.

Results and Discussions: Patients with CVP showed basal platelet ^{3}H-8-OH-DPAT binding sites diminished (-32%, $p < 0.05$) with respect to control values (2.218 ± 0.47 vs. 3.30 ± 0.006 fmol/mg prot). Patients subjected to CVS showed increased platelet ^{3}H-8-OH-DPAT binding sites after surgery with respect to basal values (0.0142 ± 0.002 vs. 0.0091 ± 0.001 fmol/1000 platelet, $+ 56\%$, $p < 0.05$) while patients subjected to VS showed it not. Fentanyl dose correlated positively with the total time of surgery (Pearson correlation coefficient (PCC) $+ 0.237$, $p = 0.031$). Fentanyl dose correlated positively with platelet ^{3}H-8-OH-DPAT binding sites up-regulation. ECC time correlated negatively with platelet ^{3}H-8-OH-DPAT binding sites (PCC -0.259, $p = 0.032$).

Conclusions: Cardiovascular pathology diminish the platelet membranes ^{3}H-8-OH-DPAT binding sites with respect to healthy voluntaries. In these patients, the ^{3}H-8-OH-DPAT bound to platelet membrane sites appears to be positively related with the dose of fentanyl and negatively related with the time of extracorporeal circulation.

References:

1 Koster A. Anesthesiology 97(4): 837, 2002.
2 Kereveur A. Arterioscler Thromb Vasc Biol 20(10): 2233, 2002.
3 Dragan YP. Biochem Pharmacol 40(2): 309, 1990.
4 Bellido I. The Pharmacologist 44(2, Supp 1): A50, 2002.

A-505

The effects of remifentanil and alfentanil on response to extubation

A.H. Karagöz, E. Basgül, V. Çeliker, Ü. Aypar

Department of Anaesthesiology and Reanimation, Hacettepe University, Faculty of Medicine, Ankara, Turkey

Background and Goal of Study: The responses to tracheal extubation may be attenuated by i.v. opioids, vasodilators, β -blockers, local anaesthetics or by extubation under deep anaesthesia.[1] Smooth extubation is particularly important in inguinal hernia operations. In the present study, we compared the effects of remifentanil and alfentanil on the cardiovascular responses to and timing of emergence from anaesthesia and tracheal extubation.

Materials and Methods: Thirty ASA I-II male patients presenting for elective inguinal hernia operations were allocated to receive remifentanil 0.5 $\mu g\,kg^{-1}$ or alfentanil 10$\mu g\,kg^{-1}$ at the end of surgery. Anaesthesia was induced with thiopental and maintained with 1% isoflurane and 66% nitrous oxide in oxygen. Heart rate (HR) and arterial pressure were measured non-invasively at 1 min intervals from t_o (extubation) until 5 min after extubation. Statistical analysis was performed using analysis of variance for repeated measures, paired and unpaired t tests and Mann–Whitney tests.

Results and Discussions: There was no difference in the incidence of coughing at extubation and time to fitness for discharge from the recovery room ($p > 0.05$). SAP, DAP, MAP and HR decreased significantly after alfentanil and remifentanil were administered ($p < 0.05$). There were no significant differences between the groups in terms of HR or arterial pressure at any time ($p > 0.05$).

Conclusion(s): Remifentanil and alfentanil were similarly effective in reducing the cardiovascular response to extubation without compromising recovery from anaesthesia. In hernia operations in particular, it is possible with alfentanil or remifentanil to perform a smooth extubation without complications.

References:

1 Miller KA, Harkin CP, Balley PL. Postoperative tracheal extubation. Anesth Analg 1995; 80: 149–72.

A-506

The role of alpha-2A-adrenoceptor subtype in inflammatory hyperalgesia and morphine-induced antinociception

H. Mansikka[1], J. Lähdesmäki[2], M. Scheinin[2], A. Pertovaara[3]

[1]Department of Anaesthesiology, Turku University Hospital; [2]Pharmacology, University of Turku; [3]Physiology, University of Turku, Finland

Background and Goal of Study: Previous studies have indicated that alpha-2-adrenergic and mu-opioid receptors play important role in pain modulation during acute pain and inflammatory hyperalgesia (1). There is also evidence that these two receptors interact in the modulation of pain (2). We studied the role of alpha-2A-adrenergic receptor subtype (A2R) in intraplantar carrageenan-induced inflammatory hyperalgesia and the interaction between A2R and mu-opioid receptors in inflammatory pain.

Materials and Methods: Behavioral responses to mechanical and heat stimuli were studied in A2R knockout (KO) and wildtype (WT) mice. The effect of i.p. mu-opioid agonist, morphine (MOR 1–10 mg/kg), was evaluated on mechanical and thermal paw withdrawal responses before and after inflammation in KO and WT mice.

Results and Discussions: Paw withdrawal threshold to radiant heat and frequency of responses to von Frey (VF) filaments were similar in WT and KO mice before and after the hindpaw inflammation. The antinociceptive effects of MOR in thermal and mechanical nociceptive tests were similar before and after carrageenan-induced inflammation in WT and KO mice.

Conclusion(s): This study indicates that alpha-2A-adrenergic receptor subtype does not contribute to the behavioral responses in inflammatory hyperalgesia or mu-opioid agonist-induced antinociception

References:

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2 Ossipov et al. Anesth Analg 1989; 68: 194–200.

Acknowledgements: Supported by the Academy of Finland and Finnish Pain Research Society.

A-507

Remifentanil augments block of sympathetic responses to skin incision during sevoflurane anesthesia in adults

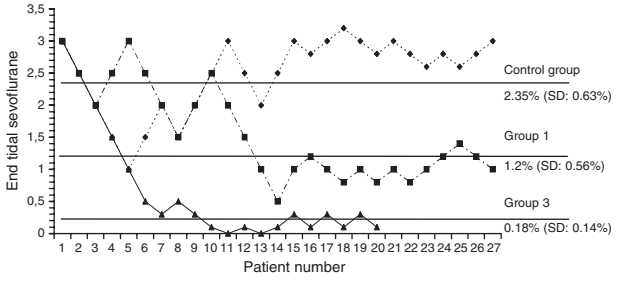
P. Bergonzi, A. Albertin, D. Mamo, E. Cerchierini, M. Putzu, A. Casati

Department of Anesthesiology, Vita-Salute University of Milan, IRCCS H. San Raffaele, via Olgettina 60, 20132 Milano, Italy

Background and Goal of Study: The aim of this prospective, randomised, double blind study was to evaluate the effects of two concentrations of remifentanil on the MAC-bar of sevoflurane.

Materials and Methods: The combined MAC-bar of sevoflurane with 60% N_2O was measured with an up-and-down sequential allocation technique in 74 ASA I patients (20–50 years-old), undergoing general anesthesia for elective surgery and randomly assigned to receive no remifentanil infusion (control group, n = 27), 1 ng/ml remifentanil (group 1, n = 27) or 3 ng/ml remifentanil (group 3, n = 20). In last two groups remifentanil plasma concentration was maintained with a target controlled infusion device (Rugloop© software). The up-and-down sequence started with an end-tidal concentration of 3% sevoflurane (1,5 MAC). This end-tidal concentration was maintained for more than 10 min before skin incision. The response was considered positive when the HR or MAP increased 15% or more. In case of positive response the end-tidal concentration of sevoflurane for the following patient was increased by 0,5%; in case of negative response the end-tidal concentration was decreased by 0,5%. After three negative to positive deflections, in each group the step change between each patient was reduced from 0,5% to 0,2%.

Results and Discussion: The figure shows the up-and-down sequence in the three groups.



Conclusion: Opioids drugs are known to reduce the minimum alveolar concentration of inhalational agents preventing cardiovascular response to skin incision (MAC-bar). We demonstrate that with 1 ng/ml and 3 ng/ml of remifentanil the MAC-bar of sevoflurane is reduced respectively of 49% and 92.7% as compared to the control group.

A-508

Droperidol added to morphine PCA. A randomised, multicentre, dose-finding study

X. Culebras, J.B. Corpataux, G. Gaggero, M.R. Tramèr

Division of Anaesthesiology, Department APSIC, Geneva University Hospitals, CH-1211 Geneva, Switzerland

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Background and Goal of Study: The antiemetic dose-response of droperidol when added to morphine-PCA is not well understood (1).
Materials and Methods: Adults receiving postoperative morphine-PCA (bolus 1 mg, lockout 5 minutes) were randomly allocated to one of four droperidol regimens: none (control), 5 μg, 15 μg, and 50 μg per mg morphine. Efficacy and adverse effects were recorded during 24 h, and analysed using number-needed-to-treat/harm (NNT/H).
Results and Discussions: 83 controls received no droperidol, 83 received 5 μg, 82 15 μg, and 83 50 μg per mg morphine. The incidence of nausea without droperidol was 48.2%; the NNT to prevent nausea with droperidol 5 μg compared with control was 17 (95% CI 4.7 to −11), with 15 μg was 6.6 (3.3–214), with 50 μg was 3.8 (2.5–8). The incidence of vomiting without droperidol was 24.1%; the NNT to prevent vomiting with droperidol 5 μg compared with control was 83 (7.1 to − 8.6), with 15 μg was 47 (6.7 to −9.3), with 50 μg was 8.3 (4.2–206). The incidence of pruritus without droperidol was 12%; the NNT to prevent pruritus with droperidol 5 μg compared with control was 17 (15 to − 2.7), with 15 μg and 50 μg was 10 (1.9–17). The incidence of sedation without droperidol was 2.4%; the NNH for sedation with droperidol 5 μg compared with control was 17 (7.8 to −124), with 15μg was 27 (10 to −41), with 50 μg was 6.4 (4.1–15). There were no extrapyramidal symptoms. There was no difference in patients' satisfaction.
Conclusion(s): Droperidol 5 μg per mg morphine is not antiemetic, nor antipruritic or sedative. Droperidol 15 μg shows some antiemetic efficacy, is antipruritic, but not sedative. Droperidol 50 μg is clearly antiemetic, is no more antipruritic than 15 μg, and is clearly sedative. The optimal dose of droperidol lies between 15 and 50 μg per mg morphine.
Reference:
1 Tramèr & Walder. *Anesth & Analg* 1999; 88: 1354–61.
Acknowledgements: Dr Tramèr is a recipient of a PROSPER grant from the Swiss National Research Foundation (N° 3233-051939.97/2).

A-509

Anesthesia using TCI in vascular patients : prevalence for propofol or prevalence for remifentanil?

M. Reina, G. Godet, M. Raux, C. Martinon, P. Coriat

Department of anesthesiology, H. Pitie Salpetriere, PARIS, France

Background: Remifentanil (R) is a potent ultra-short-acting opioid, which permits rapid emergence. However, R is expensive, and may have detrimental effect on hemodynamics in case of overdose and may be the cause of postoperative (PO) hyperalgesia. Target control infusion (TCI) permits to adapt infusion to pharmacokinetic models. The aim of this study was to compare intraoperative hypotension, PO hypertension, R requirement during anesthesia, need for PO vasoactive agents and PO EVA, in 46 patients scheduled for carotid surgery, and receiving either high (2 μg/ml) (HP) or low (1.2 μg/ml) (LP) central nervous target of propofol (Diprifusor, AstraZeneca), remifentanil being administered using TCI (Minto model, Rugloop).
Methods: 46 patients were enrolled in this randomized study. Premedication consisted of po midazolam 5 mg. Monitoring included invasive arterial pressure and BIS. Patients were anesthetised using TCI for propofol (central nervous target at 3 μg/ml then 1.6 after intubation). Then, 23 patients received HP and 23 patients received LP. In both groups, TCI for remifentanil was adjusted according to hemodynamics and BIS values. All patients received atracurium and a 50% mixture of N_2O/ O_2. Hypotension and hypertension were defined as 30% of variation in comparison with preoperative values, lasting more than 30 seconds. Data were analyzed using paired-t test.
Results: HP was significantly associated with less requirement for R, less frequent episodes of intraoperative hypotension and PO hypertension, requiring less frequent administration of calcium-blockers or clonidine, in comparison with LP. EVA was not significantly different between both groups.

	HP	LP	P
Remifentanil requirement (mcg/ min of anesthesia)	4.0 ± 2.0	6.0 ± 2.0	<0.05
Intraoperative hypotension (%)	54	81	<0.05
PO hypertension (%)	46	75	<0.05
PO need for β -blockers (%)	65	39	ns
PO need for calcium-blockers (%)	33	64	<0.05
PO need for clonidine (%)	0	23	<0.05
EVA > 3 (%)	38	46	ns

Conclusion: In comparison with LP, HP is associated with a better stability in perioperative hemodynamics, probably related to a less requirement of remifentanil, without difference in postoperative pain.
Reference:
1 Anesthesiology 2000; 93: 409–17.

A-510

Akrinor produces transitory contraction of pig coronary artery pre-treated with propranolol

S. Foellner, T.I. Usichenko, Ch. Lehmann, M. Wendt, D. Pavlovic

Anaesthesiology and Intensive Medicine Department, Ernst Moritz Arndt University, Greifswald, Germany

Background and Goal of Study: Akrinor (AKR) (theodrenalinhydrochloride and [1R,2S]-7-[2-(2-Hydroxy-1-metyl-2-phenylethylamino)-ethyl]-theophyllin-mono-hydrochloride) is widely used to counter transitory hypotension during anaesthesia. Although some cases of myocardial ischemia associated with AKR have been reported (1) there are no experimental data about its direct effects on coronary arteries.
Materials and Methods: We studied in vitro effects of AKR (2×10^{-8} to 10^{-2}M from the original concentration for intravenous application, i.e. 10.5 gram% solution) on the isometric contraction of the ring preparations in pig left coronary artery. We tested the effects of AKR alone or in combination with beta-adrenergic blocker propranolol (1.3×10^{-5}M) or alpha-1-adrenergic blocker prazosin (10^{-5}M). In some preparations endothelium was mechanically removed (+ or −EN).
Results: AKR had a minimal relaxing effect on basic tension of the pig coronary artery (11 ± 6%) but completely relaxed the preparations precontracted with KCl. The preparations −EN were more sensitive then +EN to the relaxing effects of AKR (EC_{50}, +EN vs. −EN: 2.33 ± 0.32 vs. 3.89 ± 0.45; P = 0.01; N = 8). Low concentrations of AKR produced transitory contraction in the preparations pre-treated with propranolol (63.6 ± 27.2% over maximal tension produced by 20 mM KCl; N = 10). That contraction was abolished by incubation with prazosin (N = 5). Higher concentrations of AKR relaxed propranolol pre-treated preparations similarly as the controls (EC_{50}: 2.1 ± 0.7).
Conclusions: We found that AKR relaxes pig coronary arteries. That relaxation was not mediated by beta-2-adrenoreceptors, K-channel activation or endothelium-dependent nitric oxide liberation. Transitory contraction in the preparations pre-treated with propranolol was probably due to alpha-1-adrenoreceptor stimulation. It should be verified whether AKR can produce coronary vasoconstriction in patients taking beta-blocking agents.
References:
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A-511

Fick-derived halothane uptake: a comparison with the 4C and SqRT Models and with closed-circuit anesthesia liquid injection-derived halothane uptake

P. Frietman, J.F.A. Hendrickx, A.A.J. Van Zundert, R. Grouls, T. Deloof, A.M. De Wolf

Department of Anesthesiology OLV Hospital, Aalst; Catharina Hospital, Eindhoven, The Netherlands

Background and Goal of Study: The uptake pattern of inhaled anesthetics remains controversial (1). We measured halothane uptake (V_{halo}) using Fick's method (V_{halo}Fick), and compared it with closed-circuit anesthesia liquid injection (CCALI) derived uptake (V_{halo}CCALI)(2) and uptake predicted by the square root of time (V_{halo}SqRT) and 4-compartment model (V_{halo}4C) (1).
Materials and Methods: After IRB approval and informed consent, 9 ASA I-III patients undergoing cardiac surgery were enrolled. While maintaining the end-tidal halothane % at 0.5, thermodilution cardiac output and arterial and mixed-venous blood samples were collected at 0, 3, 6, 10, 15, 20, 30, 45, and 60 min. The halothane content (μg/ml) in the blood samples was determined (chromatography). V_{halo}Fick (mg/min) was calculated and compared with V_{halo}CCALI, V_{halo}SqRT, and V_{halo}4C.
Results and Discussions: V_{halo}Fick differs from V_{halo}CCALI (figure), because V_{halo}Fick does not include wash-in of circuit and functional residual capacity; blood and lung tissue uptake; and adhesion and degradation by or losses from circuit components. When the effect of many of these factors has dissipated (after 10–15 min), V_{halo}Fick becomes very similar to V_{halo}CCALI, suggesting that both Fick and CCALI are appropriate techniques to determine halothane uptake after the initial wash-in phase. Initially, V_{halo}4C and V_{halo}SqRT are higher than V_{halo}Fick, again because they measure different uptake components. After 15 min, when the effect of most of the factors responsible for the differences has faded, V_{halo}4C becomes similar to V_{halo}Fick and therefore seems to estimate halothane uptake correctly, contrary to V_{halo}SqRT.

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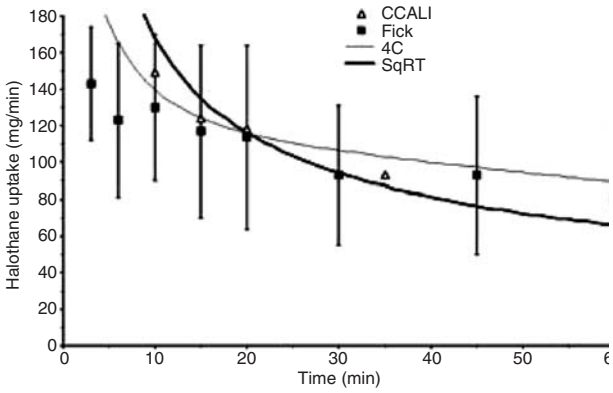


Conclusion: Different methods to determine uptake of inhaled anesthetics may measure different components of uptake, and therefore can lead to different results.

Reference:

1 Anesthesia, 5th Ed. Miller RD. 2000, pp 74–95.
2 BJA, 1983; 55: 1053–59.

A-512

Fick-derived versus closed-circuit liquid injection derived sevoflurane uptake

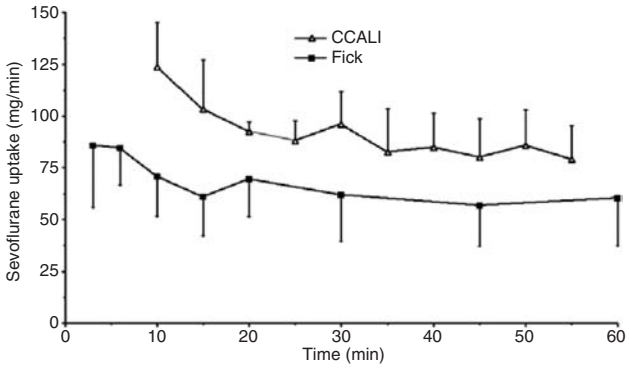
P. Frietman, J.F.A. Hendrickx, A.A.J. Van Zundert, R. Grouls, T. De Loof, A.M. De Wolf

Departments of Anesthesiology, OLV Hospital, Aalst, Belgium; Catharina Hospital, Eindhoven, the Netherlands; NWU, Chicago, IL, USA

Background and Goal of Study: Because sevoflurane (sevo) is absorbed and degraded by sodalime more than other agents, the use of closed-circuit anesthesia liquid injection (CCALI) to measure sevo patient uptake (V_{sevo} CCALI) may be inaccurate (1). We compared Fick-derived uptake (V_{sevo}Fick) with available V_{sevo}CCALI data (2).

Materials and Methods: After IRB approval and informed consent, 11 patients undergoing cardiac surgery were enrolled. Et_{sevo} was maintained at 1.3%. Arterial and mixed venous blood was sampled at 0,3,6,10,15,20,30,45, and 60' and their sevo content determined (chromatography). Using thermodilution cardiac output (CO), V_{sevo}Fick (mg/min) was calculated and compared with V_{sevo}CCALI.

Results and Discussions: Age, weight and CO were similar in both groups (73 ± 4 vs 67 ± 5 years; 68 ± 11 vs 67 ± 5 kg; and 4.5 ± 1.3 vs 4.4 ± 0.9 L/min Fick vs CCALI, respectively). V_{sevo}Fick was lower than V_{sevo}CCALI at all times (figure). V_{sevo}Fick does not include circuit and lung wash-in nor uptake by the blood and lung tissue. Because the effect of many of these factors has dissipated after 10–15 min, V_{sevo}Fick should become similar to V_{sevo}CCALI, but it did not. It is unlikely that this was caused by differences in patient population. More likely, continued degradation by sodalime caused the difference, because its effect is of the order of magnitude of the difference between V_{sevo}Fick and V_{sevo}CCALI (2).



Conclusion(s): CCALI does not measure V_{sevo} by the patient accurately because uptake/degradation by circuit components is high relative to patient uptake, making it difficult to separate out both uptake components.

References:

1 Eger EI II. Anesth Analg 1998;86:1070–4
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A-513

Antacid prophylaxis for the kidney transplantation from cadaver donor

T. Torlinski, L. Wolowicka, M. Glyda, M. Karczewski, A. Bartkowska-Sniatkowska, I. Trojanowska

Department of Intensive Care and Pain Clinic, University of Medical Sciences, Department of Transplantology, Szpital Wojewodzki, Poznan, Poland

Background and Goal of Study: Patients with chronic renal insufficiency represent the high risk of aspiration of gastric content during kidney transplantation according to uremic gastropathy and emergency of procedure. Aim of this study was to compare the need, efficacy and safety of different schemes of antacid prophylaxis during kidney transplantation from the cadaver donor.

Materials and Methods: After approval of The Ethic Committee prospective, single blind, controlled, randomized trial was conducted on 33 patients ASA III during kidney transplantation from the cadaver donor (mean age 49 ± 7 years and BMI 23,6 ± 1,99, 17 males and 16 females). Demographic data shows no statistical difference between the groups.

Patients were randomly allocated into 3 groups receiving: F – famotidine 20 mg iv. 45 min. before induction; O – omeprazole 20 mg iv 45 min. before induction and C – control group. PH and volume were measured twice: after intubation and before recovery. The patients were screened during whole perioperative period with special respect to side effects.

Results and Discussions: The lowest pH values were found in the C group before and after operation (2,36 ± 1,92 and 2,75 ± 1,94) and they differ statistically ($p < 0,01$) from F (5,19 ± 2,26 and 5,75 ± 2,28) and O group (5,73 ± 1,73 and 5,86 ± 1,72). There were no differences between F and O group. Although there were no differences between the groups according to mean volume of gastric contents (C 8,50 ml/4,81 ml; O 8,54 ml/4,54 ml and F 5,01 ml/4,27 ml) it is worth to notice that 2 patients in C group had more that 50 ml of contents with pH between 1,05 to 1,84 in spite of 6 hour fasting. None of the patients had aspiration pneumonia or serious side effects related to study drugs.

Conclusion(s):

1. There is a need for antacid prophylaxis in the group of chronic nephropatic patients according to very low level of pH and high risk induction of anesthesia for transplantation.
2. There is no difference in safety and efficacy between omeprazole and famotidine given intravenously before the procedure

A-514

Influence of clonidine on extubation time in laparoscopic cholecystectomies

N. Pozar Lukanovic, V. Novak Jankovic, S. Stupnik, V. Paver Erzen

Clinical Department of Anaesthesiology and Intensive Care, University Medical Centre, 1000 Ljubljana, Slovenia

Background and Goal of Study: Clonidine has been used in anaesthesia to potentiate analgesia and sedation and to reduce sympathetic response to surgery (1).

The aim of the study was to investigate its effect on extubation time after laparoscopic cholecystectomy.

Materials and Methods: In a prospective, randomised, double blind study 40 patients (ASA I) planned for laparoscopic cholecystectomy were randomly divided in two groups. Patients in clonidine group (N = 20) received 4 μg/kg clonidine in 100 ml of saline infusion during 15 min before induction, while patients in control group (N = 20) received only 100 ml of plain saline. Anaesthesia with isoflurane, fentanyl and vecuronium was used in both groups. Time between end of operation and extubation (extubation time) and end tidal concentrations of isoflurane (E_T Iso) at these two points were noted and compared between groups. Statistical analysis was performed with Student t-test. Results are expressed as mean ± SD.

Results and Discussions: Extubation time was significantly prolonged ($p < 0,001$) in the clonidine group compared to the control group (Fig.1). E_T Iso (vol. c/o) at the end of operation was significantly higher in the control group (0,69 ± 0,16) compared to the clonidine group (0,48 ± 0,16) ($p < 0,001$), while at the extubation there was no difference between groups.

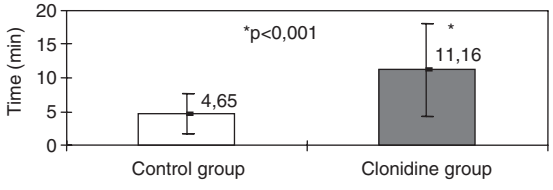

Fig. 1: Extubation time

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Lower concentrations of isoflurane were needed for adequate depth of anaesthesia in the clonidine group, that was the reason for lower E_T Iso at the end of operation.

Conclusion(s): Despite lower E_T Iso at the end of operation clonidine prolonged extubation time because of its central effect (2). This may be a disadvantage in short procedures such as laparoscopic cholecystectomy.

References:
1 Maze M. *Anesthesiology* 1991; 74: 581–605.
2 Andrade R. *J Neurosci* 1985; 5: 2359–64.

A-516

Protamine activates basophils: a study using CD63 as a marker of activation

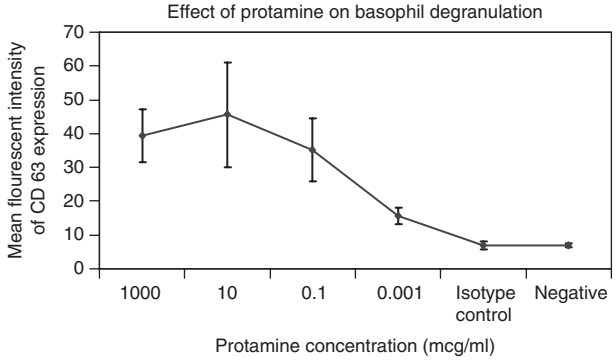
P.S. Sudheer, A. Rowbottam, P.E. Williams, J.E. Hall

Department of Anaesthetics, University Hospital of Wales, Cardiff, United Kingdom

Background: Protamine is a basic polypeptide used to reverse heparin in cardiopulmonary bypass surgery. Adverse events have been reported with its use including respiratory and cardiovascular effects. Basophil degranulation may explain some of the mechanisms by which protamine exerts its adverse effects. Basophils express CD63 on their cell surface when activated (1) and is being increasingly used in the investigation of drug allergy as an in vitro test for activation (2). The effects of protamine on basophil activation (histamine release) is conflicting (3). We used CD63 expression as a marker of activation to investigate protamine induced basophil cell activation.

Methods: After ethics committee approval and informed consent 9 normal volunteers were recruited. 100 μl aliquots of blood were then challenged with either 10 μl of four different dilutions of protamine (1 mg/ml, 10 μg/ml, 0 .1 μg/ml and .001 μg/ml) and a (PBS) negative control. After incubation at 37°C for 30 min the blood was stained with 10 μl of CD45-Cy 5, IgE FITC, CD63-PE and isotype control for CD63 (Dako). After incubation at 4°C in the dark for 15 min, samples were analyzed using flow cytometry (Dako) and analyzed using the flomax software (Partec, USA).

Results: The fig shows mean fluorescent intensity (s.e.m), against different concentrations of protamine.



Conclusion: The data suggests that protamine in the concentrations we used upregulates CD63 expression.

References:
1 Knoll et al. J Allergy Clin Immunol 1991; 88: 328–38.
2 Monneret G. Clin Exp Immunol 1999; 115: 393–6.
3 Patella V et al. Br J Anaesth 1997 Jun; 78: 724–30.

A-517

The bolus 4-chloro-3-ethylphenol in-vitro testing. A promising optional test for malignant hyperthermia susceptibility?

M.U. Gerbershagen, F. Wappler, M. Fiege, R. Weißhorn, K. Kolodzie, J. Schulte am Esch

Department of Anaesthesiology, University Hospital Hamburg–Eppendorf, Hamburg, Germany

Background and Goal of Study: The in-vitro contracture test (IVCT) with 4-chloro-3-ethylphenol (CEP) revealed a significant difference in contracture development without overlap in swine [1]. The aim of the present study was to investigate the in-vitro effects of CEP on muscle preparations from patients with clinical suspicion to MH.

Materials and Methods: After approval of the local ethic committee and written informed consent muscle biopsies were obtained from 31 patients. The patients were classified by the standard IVCT with halothane and caffeine [2]. In case of supplementary preparations bolus CEP IVCTs in concentrations of 75 and 100 μM were performed. Following parameters were evaluated: Time to the start of contracture development, time to achieve 2, 5 and 10 mN contractures and maximum contracture. Medians and ranges were calculated. Group differences were analyzed with the Mann–Whitney-Test. A value of $p < 0.05$ indicates statistical significance.

Results and Discussion: For both CEP concentrations the defined contracture levels were obtained significantly delayed and less often in the MH-negative (MHN) group. The maximum contracture after 75 μM was significantly higher in MH-susceptible (MHS) specimens (med/min/max: 18.4/3.1/39.5 mN) compared to the MHN-preparations (0.0/0.0/10.9 mN). The administration of 100μM CEP induced significantly greater maximum contractures in MHS- (20.6/10.4/41.3 mN) in comparison to MHN-muscles (0.2/0.0/13.3 mN). Nevertheless, none of the defined parameters was able to differentiate unequivocally without overlap between the two diagnostic groups.

Conclusion: Bolus IVCTs with CEP in concentrations of 75 and 100μM cannot differentiate completely between human MHS and MHN skeletal muscle specimens. Thus these CEP IVCTs are not useful for the in-vitro MH-diagnosis.

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A-518

Coating of the platelet surface by hydroxyethyl starch molecules

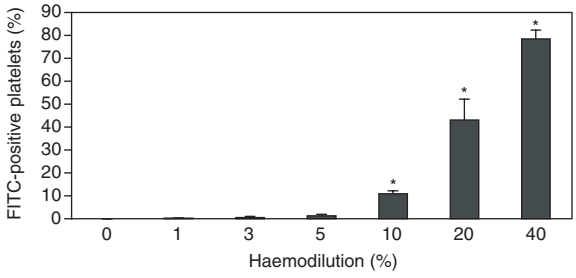
E. Deusch, T. Gamsjäger, H.G. Kress, S. Kozek

Department of Anaesthesia and General Intensive Care B, Medical University Vienna, Vienna, Austria

Background and Goals: Hydroxyethyl starch (HES) solutions impairs platelet function by reducing the availability of the functional receptor for fibrinogen on the platelet surface (1,2) which is not achieved through interference with intracellular signal transduction (3). The aim was to determine whether the platelet inhibiting effect of HES is mediated by an extracellular mechanism.

Material and Methods: We evaluated the binding of fluorochrome-conjugated HES molecules to the surface of platelets using whole blood flow cytometry. Citrated whole blood of 8 healthy volunteers were incubated for 5 min at 22°C in the dark with fluorescein isothiocyanate (FITC)-conjugated HES (200 kDa molecular weight, 0,5 degree of substitution, FITC-conjugation 0,042; Fresenius Kabi Austria GmbH, Linz, Austria) resulting in 0%, 1%, 3%, 5%, 10%, 20% and 40% haemodilution. The percentage of platelets binding FITC-HES was determined. Statistical analysis: ANOVA and Tukey's post hoc test (*$P < 0{,}05$; mean ± SD).

Results: The percentage of FITC-positive platelets increased in a concentration-dependent manner (Fig.).



Conclusions: HES molecules coat the platelet surface. This mechanism may be responsible – at least in part – for the platelet inhibiting effects of HES macromolecules by blocking the availability of the functional receptor for fibrinogen on the platelet surface.

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A-519

Pharmacokinetics of ketamine and S-ketamine after epidural adminisitration in rabbits

H. Adachi, Y. Inagaki, N. Okazaki, D. Wen, Y. Ishibe,

Department of anesthesiology and critical care medicine, Tottori university faculty of medicine, Yonago, Japan

Background and Goal of Study: Intravenous and epidural ketamine has been widely used for treatment of chronic pain. However, it has been unclear about pharmacokinetics of ketamine(K) and S-ketamine (S-k) after their epidural administration.

Materials and Methods: After obtaining approval of our institutional ethics committee for animal experiment, eight white japanese rabbits weighs 2.6–3.5 kg in each group (K group and S-k group) were studied. The rabbits were anesthetized with pentobarbital and underwent tracheotomy. Anesthesia was maintained with sevoflurane in oxygen. A catheter was inserted into the carotid artery to collect blood samples for determining plasma(P) concentrations. Then, rabbits were positioned to prone. An epidural catheter was inserted at L5-6 intervertebral space for injecting ketamine and S-ketamine and was remained 3 cm within the epidural space and laminectomy was done at C2-3 for inserting the catheter to collect the cerebrospinal fluid(CSF) for determination of CSF concentrations. After administrating ketamine(2 mg/kg) or S-ketamine (2 mg/kg) epiduraly, blood and CSF samples were collected simultaneously at 1,3,5,10,15,30,60, and 120 min. Plasma and CSF concentrations were measured by using high-performance liquid chromatography. Data was analyzed by one-way ANOVA. A P value < 0.05 was considered statistical significant.

Results and Discussions:

		AUC	Cmax	Tmax
K	P	104.36(35.83)*	2.23(0.51)	4.68(1.20)*
	CSF	28.80(5.35)*	0.56(0.13)	9.06(5.24)
S-k				
	P	159.26(31.83)*	2.27(0.21)	9.82(5.00)*
	CSF	40.92(8.95)*	0.66(0.12)	7.84(3.84)

AUC = area under the curve; Cmax = maximal drug concentration(μg/ml); Tmax = time of maximal concentration (min); Values are mean (SD) *P < 0.05 (Ketamine vs S-ketamine)

Conclusion(s): There are significant differences of AUC between ketamine and S-ketamine in plasma and CSF, and there is also a significant difference of Tmax in plasma. The difference of transition rate into plasma may arise from difference between their structures.

A-520

Clinical significance of S-100b protein blood concentration after liver resection: a pilot study

O. Rivera*, D. Eyraud*, J.-L. Beaudeux#, O Gostian*, J Medel*, O. Benabdesselan#, L. Hannoun§, P. Coriat*[1]

**Département dAnesthésie-Réanimation; #Service de Biochimie, §Service de Chirurgie digestive et de transplantations hépatiques*

Objective: The serum S-100b protein blood concentration is a specific marker of damage of the central nerve system (CNS). We studied its significance in major hepatic surgery, in which major hemodynamic changes happen, as a possible marker of CNS damages.

Methods: In 20 consecutive patients, undergoing major liver surgery with liver clamping, we measured the serum S-100b protein concentration using Elisa. A control group of 15 patients undergoing non-hepatic major abdominal surgery was also evaluated. The S-100 beta protein was measured just after anaesthetic induction (t0), three hours after induction or before unclamping in liver surgery group (t1), at the end of surgery (t2) and at postoperative day 1 and 7 (t3 and t4). Cognitive dysfunction were evaluated with minimental test the day prior anesthesia, at day 2 and day 7.

Results: Data (Mean ± SD) are shown in the table.

	t0	t1	t2	t3	t4
Control group	0,25 ± 0,15	0,79 ± 0,3*	0,96 ± 0,6*	0,51 ± 0,3	0,08 ± 0,05
Control surgery	0,22 ± 0,12	0,71 ± 0,35*	1,21 ± 0,71*	0,5 ± 0,27	0,13 ± 0,11

*p < 0,05 with to no-difference between the two groups. Two patients presented cognitive dysfunction at t3. These two patients had prot-100b > 2,5 at t2 and > 1 at t3.

One was in control group, the other in liver surgery group. The cognitive function and S-100b protein concentration returned to normal value in all patients at t4.

Protein S-100b significantly increased in two types of surgery and value > 2,5 at the end of operative was found only in-patients with transitory cognitive dysfunction.

Reference:

1 Anesth Analg 2002; 95: 1173–8.

A-521

Effects of melatonin and midazolam for premedication on sedation, anxiety, orientation scores and psychomotor performance

M. Açýl, E. Basgül, A.H. Karagöz, *B. Demir, Ü. Aypar

*Hacettepe University, Faculty of Medicine, Department of Anaesthesiology and Reanimation, Ankara, Turkey; *Hacettepe University, Faculty of Medicine, Department of Psychiatry*

Background and Goal of Study: Effects of melatonin and midazolam given for premedication on sedation, anxiety, orientation scores and psychomotor performance were evaluated in only one study (1). For further information we aimed to evaluate the perioperative effects of melatonin and midazolam in premedication by using different neurocognitive tests.

Materials and Methods: 66 patients were given sublingual midazolam 15 mg, melatonin 5 mg or plasebo, approximately 90 minutes before a standard anesthetic. Sedation scores (1 = awake, 2 = drowsy, 3 = asleep but arousable, 4 = asleep but not arousable), anxiety scores (Visuel Analouge Scale) and orientation scores (0 = none, 1 = orientation in time or place, 2 = orientation in both) were quantified before and 10,30,60 and 90 min after premedication, and 15, 30, 60 and 90 min after admission to the recovery room. Neurocognitive performance was also evaluated at these times , using the Trial making A,B and Word Fluency Tests. The differences between groups were analysized by using Annova. The two way comparision was made by Schaffe Analysis. Sedation , amnesia and satisfaction were analysized by using chi square test.

Results and Discussions: Patients who received premedication with either midazolam or melatonin had a significant decrease in anxiety levels and increase in levels of sedation before operation compared with controls ($p < 0.05$). After operation, patients who received midazolam or melatonin premedication had increased levels of sedation and impairment in performance on the Trial Making A,B and Word Fluency Tests at 15, 30, 60 min compared with controls ($p < 0.05$). There were no significant differences between the three groups for anxiety levels or performance after operation ($p > 0.05$).

Conclusion: Melatonin can be used effectively for premedication without changing neurocognitive performance.

References:

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A-522

Intravenous anaesthesia improves surgical conditions during endoscopic sinus surgery

L. Eberhart[1], B. Folz[2], H. Wulf[1], G. Geldner[1]

[1]Department of Anaesthesia, Philipps-University Marburg; [2]Department of Otolaryngology, Philipps-University Marburg

Background and Goal of Study: Controlled hypotension is used to improve surgical conditions during microscopic and endoscopic sinus surgery. New short acting anaesthetics like propofol and remifentanil allow exact control of intraoperative blood pressure and thus might be valuable tools to improve intraoperative conditions for the ENT-surgeon [1]. Intravenous anaesthesia was compared with traditional balanced anaesthesia by subjective assessment of surgical conditions made by two experienced ENT-surgeons.

Materials and Methods: In this prospective, patient and observer-blinded study 90 consecutive patients were randomized to receive intravenous anaesthesia (IVA-group) with propofol 5–8 mg $kg^{-1} h^{-1}$ and remifentanil 10–30 μg $kg^{-1} h^{-1}$ or with isoflurane (0.4–1.0 Vol.%) and repetitive doses of alfentanil 0.5–1 mg (BA-group). An injectable vasodilatator was used in both groups to keep mean arterial pressure between 60 and 70 mmHg (8–9.3 hPa). The attending ENT-surgeon was unaware of the type of anaesthesia administered. Immediately after the operation, they rated surgical conditions (bleeding from the surgical field) on a visual analogue scale (0 = optimal surgical conditions to 10 = worst possible conditions). These ratings were compared using Mann–Whitney's U-test.

Results and Discussions: Blood pressure was not different between the two groups but heart rate was lower in the IVA-group (mean heart rate IVA-group: 62 min^{-1}; 95%-confidence interval: 52–72 vs. BA-group: 75 min^{-1}; 95%-CI: 67–83). Surgical conditions were rated to be significantly better ($p < 0.0001$) during anaesthesia with propofol-remifentanil compared with

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isoflurane-alfentanil (VAS median; 25th/75th percentile: IVA-group: 2.8; 2.0/3.4, BA-group: 4.9; 3.6/7.6).

Conclusion: Intravenous anaesthesia using propofol-remifentanil provides better surgical conditions compared to a traditional balanced anaesthesia technique using isoflurane-alfentanil. It is hypothesized that lower cardiac output caused by decreased heart rate during deep general anaesthesia is responsible for this result.

References:
1 Degoute CS, et al. Can J Anaesth 2001; 48: 20-7.

A-523

Gabapentin protects against hydrogen peroxide-induced toxicity in cultured C6 glioma cells

I. Browne*, H. Gallagher, C. Regan, D*. Moriarty

Department of Anaesthesia, Mater Misericordiae Hospital, Dublin and Conway Institute, University College Dublin

Background and Goal of Study: Oxidative injury is suspected to be involved in numerous brain pathologies such as neurodegenerative diseases or acute injury (1). Gabapentin is a structural analogue of the inhibitory neurotransmitter GABA. Its exact mechanism of action is not yet elucidated (2). The aim of this study was to further elucidate its potential neuroprotective role in cultured C6 glioma cells exposed to exogenous hydrogen peroxide (H_20_2).

Materials and Methods: C6 glioma cells were seeded in 24-well plates and grown in modified DMEM at 37°C for 5 days until sub-confluent. Cells were then pre-treated with varying concentrations of gabapentin [0.1 mM, 1 mM, 10 mM,100 mM] 1 hour prior to a 12-hour incubation with H_20_2 [10 μM, 30 μM, 50 μM, 100 μM]. Cell viability was assessed by analysis of MTT activity. Statistical analysis was performed using an unpaired Student t-test.

Results and Discussion: Exposure to H_2O_2 caused a significant reduction in cell viability when compared to vehicle-treated control C6 cells; 100 μM, 50 μM and 30 μM H_2O_2 reduced viability to 71%*, 78%* and 73%* respectively (* = $p < 0.05$). Pre-treatment of cells with gabapentin reversed this peroxide-induced reduction in cell viability in a dose-dependent manner. For example, pre-treatment of cells with 0.1 mM gabapentin resulted in 91.5% viability following exposure to 100 μM H_2O_2, in comparison to the 71% viability observed in relevant controls.

Conclusion: Gabapentin protects C6 cultured cells against H_20_2- mediated injury. Its clean pharmacological profile and ability to cross the blood brain barrier suggests it may have a role in neurological conditions where oxidative damage is involved.

References:
1 Whittemore ER et al. Neuroscience 1995: 67; 921–32.
2 Taylor CP, Gee NS, Su T-Z et al. Epilepsy Res 1998; 29: 233–49.

A-524

The impact of lidocaine/prilocaine cream (EMLA®) on human skin flora

I. Batai, V. Juhasz, R. Batai, M. Kerenyi

Department of Anaesthesia, Pecs University, Pecs, Hungary

Background and Goal of Study: Cannula related infections are responsible for about half of nosocomial bacteremia and contribute to perioperative morbidity and mortality. The components of lidocaine/prilocaine cream (EMLA®) has antibacterial effects in vitro (1,2). In this study we investigated the impact of EMLA® on human skin flora.

Materials and Methods: Following ethical committee approval twenty healthy volunteers we included in the study. Bacterial samples were taken with 60 mm contact Rodac Petri plates (tryptic soya agar) (Neomed, Italy). This method allows quantitative and qualitative bacterial evaluation. First a sample was taken from the back of hand. Then EMLA® (Astra®, Sweden) was applied according to the manufacturers recommendations. Other samples were taken 1, 2, 3, 4 and 24 hours following the use of EMLA®. The plates were incubated for 24 hours at 37°C and the colony forming units (cfu) were counted.

Using analysis of variance performed statistical analysis.

Results and Discussions: There were 44 ± 27 cfu/cm^2 on the skin before EMLA® treatment. One hour after applying EMLA® the cfu fell to 1,9 ± 2,8/cm^2. It remained at this low level by the end of the fourth hour (2,3 ± 2,6/cm^2). These changes were significant ($p < 0.05$). The cfu at 24 hours (14 ± 18/cm^2) was significantly higher than at 1 h following the use of EMLA® but was still significantly lower than before EMLA® was used ($p < 0,05$).

Conclusion(s): This study suggests that the use of EMLA® cream significantly decreases normal skin flora. As cannula related infections may originate from the skin flora the application of EMLA® may help controlling infections. On the other hand, changes in normal flora may be harmful as well. Further research is needed to evaluate whether EMLA® has any impact on cannula related infections.

References:
1 Eur J Anaesth 1999; 16: 425–40.
2 Curr Ther Res 1975; 17: 369–74.

Acknowledgements: Grant ETT 385/2000 of the Ministry of Health and Bolyai scholarship supported this study.

A-525

EMLA® cream (lidocaine/prilocaine) has antibacterial effect in vitro

M. Kerenyi, R. Batai, J. Falvai, I. Batai

Department of Medical Microbiology, Pecs University, Pecs, Hungary

Background and Goal of Study: Postoperative infection is a serious consequence of surgery. Drugs used in anaesthesia may influence bacterial growth (1). Lidocaine/prilocaine cream (EMLA®) can be applied to reduce pain before intravenous or intraarterial cannulation and to reduce stress for various painful procedures. EMLA® is prepared in a multidose tube and the contamination of drugs used in anaesthesia can be as high as 6%. In this study we examined the in vivo effect of EMLA® to bacterial growth.

Materials and Methods: Bacterial strains were isolates of *Pseudomonas aeruginosa* (ATCC 27853), *Escherichia coli* (ATCC 25922), *Staphylococcus aureus* (ATCC 27853), and a clinical isolate of a Micrococcus sp. The tested pharmaceutical preparation was EMLA® 5% cream (lidocaine 25 mg, prilocaine 25 mg) (Astra®, Sweden). Bacterial suspensions were prepared to give approximately 10^4 colony forming units (cfu) mL^{-1}. Ten μL of this suspension (10^2 cfu) was added to 100 mg EMLA® cream and was incubated at room temperature for 1, 2, 3, 4 or 24 hours. After the incubation time 1 mL 0,4% Tween 20 in Mueller Hinton (MH) broth was added to the cream to solubilise it and was plated on dried MH agar and incubated for 24 h at 37°C. The cfu was counted. Using analysis of variance performed statistical analysis.

Results and Discussions: All of the strains grew in the control MH broth and in 0.4% Tween 20. EMLA® killed *E. coli* and *P. aeruginosa* within 1 hour, the Micrococcus sp. after 1 hour, and the *S. aureus* after 3 hours exposure at room temperature.

Conclusion(s): Local anaesthetic solutions has antibacterial properties (2). Our results suggest that the eutectic mixture of lidocaine and prilocaine is bactericidal and its use in a multidose tube is safe as far as infection control is concerned.

References:
1 Eur J Anaesth 1999; 16: 425–40.
2 Anaesthesia 1977; 32: 69–70.

Acknowledgements: Grant ETT 385/2000 of the Ministry of Health and Bolyai scholarship supported this study.

A-526

Non steroid anti-inflammatory drugs induced modifications in clonidine binding to liver tissue of rabbits in vitro

C. Chantzi, T. Saranteas, C. Mourouzis, A. Spyrou, A. Ioakimidou, C.H. Alexopoulos, C. Tesseromatis

Department of Pharmacology, University of Athens Greece, General Hospital of Athens, G. Gennimatas, Athens, Greece

Background and Goals: This study was designed to investigate the protein binding of clonidine to liver proteins as well as its possibility to interact in the binding process with other drugs used in pain management, such as non-steroid anti-inflammatory drugs (NSAIDs).

Material and Methods: The investigation was performed with liver of rabbits (n = 7), weighing 2–3 Kg. To prevent metabolic process of the liver enzymes NaH_3 2% was added to the incubation fluid. The binding of H_3 clonidine (20 mCi/Mm) to slices (S) and homogenized slices (H), which were incubated with the drug in Ringer solution at 37°C for 360 min, was estimated. It was also measured the liver binding of clonidine (CL) after the simultaneous addition of the following NSAIDs: flurbiprofen (F), ketoprofen (K) and ibuprofen (I). The method of ultra-filtration was used to determine the percentage of drug bound to liver tissue.

Results: % binding of clonidine is depicted in the following table:

	CL	CL + F	CL + K	CL + I
S	73.02 ± 6	65.27 ± 9*	64.25 ± 4*	72.9 ± 8
H	67.15 ± 2	63.1 ± 5#	63.04 ± 5#	70.84 ± 3

*$p < 0.01$ vs intact slices incubated clonidine alone; #$p < 0.05$ vs homogenized slices incubated clonidine alone (statistical analysis:Wilcoxon- Mann–Whitney).

Conclusions: (1) The binding of clonidine to liver was not altered by homogenization even in presence of NSAIDs. (2) Flurbiprofen and ketoprofen decrease

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the binding of clonidine to liver. (3) Ketoprofen does not change the extent of clonidine's displacement in liver. This is probably due to dual Pka of ibuprofen (4.4/5.2) as compared to Pka of flurbiprofen (4.16) and ketoprofen (4).

A-528

Thermothreshold of the beginning of amino acid infusion for preventing further decrease in core temperature

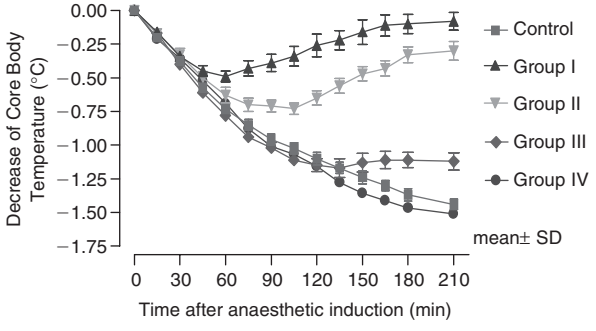
Y. Inagaki, H. Adachi, T. Funakoshi, H. Tsubokura, Y. Ishibe

Department of Anesthesiology and Critical Care Medicine, Tottori University Faculty of Medicine, Yonago, Japan

Background and Goal of Study: Amino acid (AA) infusion before or at anesthetic induction not only inhibits the decrease of body temperature but also hastens recovery from neuromuscular block (1). However, thermothreshold of the beginning of AA infusion to prevent further temperature decrease has been unknown.

Materials and Methods: After obtaining the approval of our institutional review board and informed consent from each patient, sixty patients of ASA physical status 1 and 2, aged more than 70 yr who were scheduled for total hip arthroplasty anaesthetized with sevoflurane and epidural anesthesia were studied. The patients were randomly assigned to five study groups; control group (Group C) and group I received an infusion of 200 ml of normal saline and a balanced mixture of 18 AAs for 1 h from anesthetic induction, respectively; groups II, III, and IV received an infusion of 200 ml of AAs for 1 h from the point when core body temperature decreased by 0.5°C, 0.7°C and 1.0°C from the baseline, respectively. Patients received no preanesthetic medication. A thermometer probe for measuring core temperature was inserted to distal esophagus via an orifice of nose at the loss of consciousness. Then, laryngeal mask airway was inserted. Patients were covered with paper surgical drapes. The operating room were maintained 21–22°C for temperature, 45% for humidity and vertical airflow at a rate of 1.1 m/s. Parametric data was analyzed by two-way ANOVA and an appropriate post-hoc test. A P-value < 0.05 was considered statistically significant.

Results and Discussions: Figure shows time course of decrease of core temperature after anesthetic induction. The start of AA infusion at the point of decrease by 0.7°C prevented further decrease of core temperature after the end of AA infusion. II, III and IV.



$p < 0.01$, vs. Control group and Group IV at 180 min and 210 min after anesthetic induction

Conclusion(s): We concluded that AA infusion should be begun until the core temperature decreased by 0.7°C.

Reference:

1 Br J Anaesth 2001; 86: 814.

A-529

Asymmetric dimethylarginine: relevance for graft function in human liver transplantation

L. Olmedilla*, J.M. Pérez-Peña*, P. Martín-Sanz**, D. Arnal*, I. Garutti*, I. Tzenkov*, B. Quintana*, S. Barrigón***, L. Boscá**

Anestesiología y Reanimación, Hospital Gregorio Marañón; **Facultad de Farmacia UCM; * Facultad de medicina UCM, Madrid, Spain*

Background and Goal of Study: In liver transplantation (LT) there is a potent nitric oxide synthase (NOS) inhibitor activity into the graft during cold ischemia period (1).

The aim of this investigation is to evaluate relationship between the degree of NOS inhibition in the graft and early graft function, and to identify the inhibitors.

Materials and Methods: Seventy seven LT patients have been prospectively studied. Arterial blood samples were collected 10 min before (E-10), and 10 and 60 min after reperfusion (E10 and E60). The preservation solution was removed by washing it out (200 ml, E0 sample) with portal blood. The graft function was evaluated depending on the aspartate transaminase levels, coagulation, and bile production (2). The effect of the samples on the NOS was evaluated measuring the nitric oxide production in rat cultured macrophages stimulated with lipopolysaccharide.

Results and Discussions: Reversible NOS inhibition was obtained after addition of E0, E10 or E60 samples to cultured macrophages. Relationship has been observed between degree of NOS inhibition by E0 sample and liver function after LT ($p = 0.004$), with more potent inhibition in malfunction grafts.

L-N-monomethylarginine and asymmetric dimethylarginine (ADMA) were identified as main NOS inhibitors in E0, using HPLC and mass spectrometry. Average concentrations of 0.450 mM ADMA were measured in E0 from malfunction grafts.

Conclusion(s): Measurement of methylated arginine might provide an indication of graft functional status. Studies on the mechanisms responsible for appearance of these metabolites might help to define better conditions for clinical management of the graft.

References:

1 Martín-Sanz. *Clin. Transplant* 1999; 13: 221–30.
2 Greig. *Transplantation* 1989; 48: 447–53.

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A-530

Atenolol and propranol pharmacokinetics changes in patients undergoing coronary artery bypass surgery

M.J.C. Carmona, V.A. Pereira, M.A. Bertolini, L.M.S. Malbouisson, K.B. Le Bihan, M.R. Lopes, J.O.C. Auler Jr, S.R.C.J. Santos

Department of Anesthesia and Surgical Critical Care, Heart Institute (InCor) of Hospital das Clínicas of São Paulo University Medical School, São Paulo, Brazil

Background and Goal of Study: Betablockers plasma levels and kinetics may be altered by hypothermic cardiopulmonary bypass (CPB)[1]. The aim of this study was to compare atenolol (A) and propranolol (P) pharmacokinetics (PK) in patients undergoing coronary artery bypass surgery employing CPB.

Materials and Methods: We investigated patients receiving peroraly propranolol ($n = 11$) or atenolol ($n = 8$) pre and postoperatively. A serial of blood samples was collected every 2 hours after dose, at time dose intervals, one day before and after surgery. Plasma levels were determined using a selective detection and reversed phase system in high performance liquid chromatography followed by PK-modelling (software PK solutions, 2.0). Statistics were performed applying Wilcoxon, a non parametric test ($p < 0.05$: statistically significant).

Results and Discussions: Pre and postoperative atenolol and propranolol data (medians) of biological half-life ($t_{(1/2)}$(), total body clearance (CL_T/F) and apparent volume of distribution (Vd/F) are shown in the table.

Pharmacokinetic parameter	Drug	Preop	Postop	P
$t_{(1/2)}\beta$ (h)	A	11.7	10.4	0.6406
	P	4.5	10.6	0.0098
CL_T/F (mL/min kg)	A	3.2	4.0	0.5469
	P	9.2	10.7	0.5771
Vd/F (L/Kg)	A	3.0	3.8	0.1953
	P	4.0	8.3	0.0097

Conclusions: Data obtained suggest that hypothermic CPB influence significantly only propranolol kinetic disposition, once kinetic parameters for atenolol remained unchanged after surgery.

Reference:

1 McAllister RG – Effects of hypothermia on propranolol kinetics. *Clin Pharmacol Ther* 1979; 25: 1–7.

A-531

A combination of tropisetron and dexamethasone reduces the incidence of PONV in high-risk patients

F. Wappler, F. Lipka, J. Scholz, H.-J. Hennes, J. Schulte am Esch

Departments of Anaesthesiology, University Hospital Hamburg-Eppendorf; University Hospital Kiel; University Hospital Mainz

Background and Goal of Study: The 5-HT_3 receptor antagonist tropisetron has been shown to reduce the incidence of postoperative nausea and vomiting (PONV) (1). However, it has been suggested that a combination with a glucocorticoid might improve the efficacy of tropisetron (2). Therefore, we investigated the effects of tropisetron intravenously as well as orally versus an oral combination of tropisetron and dexamethasone.

Materials and Methods: After approval by the local ethic committee 2.091 adult patients (ASA I-IV) scheduled for elective surgery under general

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anaesthesia were included in this prospective follow-up study. All patients had an increased risk for PONV following the MEGA score. Patients were divided into three groups with different antiemetic prophylaxis: group I (n = 604 patients) received tropisetron 2 mg intravenously after induction of anaesthesia. In group II (n = 704 patients) tropisetron 5 mg per os was administered 60 minutes prior anaesthetic induction; and in group III (n = 783 patients) an oral combination of tropisetron 5 mg plus dexamethasone 12 mg was applicated. Statistics: Chi-Scare-test and post hoc Fisher's exact test were used ($p < 0.05$).

Results and Discussions: There were no statistical differences between the groups with respect to biometric data. Using an intravenous prophylaxis with tropisetron 2 mg incidence of PONV was 42.7%. PONV incidence was significantly reduced to 37.6% by oral administration of 5 mg tropisetron; and in group III a further significant reduction to 24.5% was registered.

Conclusion(s): Despite antiemetic prophylaxis by tropisetron intravenously, PONV has a high incidence in patients with an increased risk profile for this complication. Administration of tropisetron per os, or better an oral combination of tropisetron with dexamethasone, can sufficiently reduce the incidence of PONV. Further studies should determine whether higher doses of tropisetron and/or dexamethasone can enhance the efficacy of antiemetic prophylaxis.

References:

1 Scholz J. *Eur J Anaesthesiol* 1998; 15: 676–658.
2 Henzi I. *Anesth Analg* 2000; 90: 186–194.

Acknowledgements: This study was supported by Novartis foundation.

A-532

Postoperative nausea and vomiting (PONV) – preoperative chemotherapy should not be blamed

J. Osadzinska, M. Symonides, J. Jarosz, P. Sowinski

Department of Anaesthesiology, The Maria Sklodowska-Curie Memorial Cancer Centre and Institute of Oncology, Warsaw, Poland

Background and Goal of Study: Preop. chemotherapy (chth) may correlate with PONV. In a prospective study we investigated the possible influence of chth on frequency of PONV in pts. undergoing mastectomy (model of high risk PONV related to anaesthesia; no abdominal surg.) with or without preop.chth under volatile anaesthesia (fast recovery profile), also assessing the quality and acceptability by pts.

Materials and Methods: 84 pts (45 non-chth; 39 chth) consecutive ASA I/II mastectomy pts.(all women); mean age: 50.8 (SD ± 12,6) were anaesthetised with desflurane (6–8 vol% in air + O2) & fentanyl,cisatracurium (+neostigmine where necessary). We noted PONV in recovery room (R) and up to 8 hrs after discharge (D) with regard to previous chth. We also noted sedation scale and pain (VAS) 30 min. after recovery, and pts' assessment of the procedure (1-5 scale, where 5 – v.good) the day after. Also the PONV(+) and PONV(−) groups were compared for common promoting factors- pt. age, weight, duration of anaesthesia, i.v. neostigmine. Statistical analysis: Statistica software (Student T, Chi square, Fisher's exact test).

Results and Discussions: There was no difference as to the frequency of PONV between the chth and non-chth groups (p = 0.65). PONV in (R) – 20/85 (23.5%), PONV (D) 21/84 (24.7%); sedation: level 1–72/84 (84.7%); level 2–13/84 (15.3%); VAS 0–2–73/84 (85.9%); 3–4–9/84(10.6%); 5–6–3/84 (3.5%). Pt. assessment − 4.58(SD + 0.82). PONV (+) and (−) groups did not differ as to weight (p = 0.73), anaesth. duration (p = 0.97), neostigmin (p = 0.58). The only significant factor was age ($p = 5.56 \times 10^{-16}$) – mean age in PONV(−) group 55.8 yrs. (SD ± 10.3) and PONV(+) group – 36.45(SD ± 5.87) yrs.

Conclusion(s): PONV after mastectomy appears to have no correlation with preoperative chemotherpy. Young pts are more likely to have PONV, which calls for further study – greater sensitivity? psychooncological reasons – young women more apt to perceive the procedure as vitally handicapping?

A-533

Pain on injection of propofol: 1% propofol with lignocaine versus 1% propofol MCT/LCT

A. Melero, S. Muñoz, J. Bassons,T. Pintanel J. Canet

Department of Anaesthesiology, Hospital Universitari Germans Trias i Pujol, Badalona, Barcelona, Spain

Background and Goal of Study: Various strategies for increasing the pain-reducing effect of propofol injection have been demonstrated to be effective. Pre-mixing small doses of lignocaine to standard propofol is among the most widely used[1]. A new formulation of propofol in an emulsion of long and medium-chain triglycerides (MCT/LCT) has also proved advantageous[2]. Our aim was to compare the incidence and intensity of pain with injected propofol mixed with lignocaine vs propofol-MCT/LCT.

Material and Methods: After institutional approval and individual consent, we conducted a prospective, randomised double-blind study. We enrolled 150 non-premedicated ASA I–III patients, aged 18–65 yr, scheduled for daycase surgery under general anaesthesia. Patients in group I received standard 1% propofol (Rovi^{R}) pre-mixed with 1 mL of 1% lignocaine. Patients in group II received 1% propofol MCT/LCT (propofol^{R} Lipuro, B. Braun). Propofol was injected in a similar fashion for each patient: 2 mg/Kg through a 20-gauge cannula into a dorsal vein of the hand, at room temperature and at a speed of 20–40 mg in 10 s. Patients were observed for spontaneous complaint of pain or were asked about pain sensation after 15 s of the start of injection. Pain was graded as none, mild, moderate or severe. Statistical analysis: Chi-squared test.

Results: One hundred and forty-seven patients were evaluated. Patients in group I had a significantly lower incidence of pain on injection compared with group II (35% vs 65%, p = 0.001). There were no differences in intensity of pain between the two groups: 40.7 vs 34.7% none or mild, 37 vs 41.3% moderate and 22.2 vs 24% severe (p = 0.88) for group I and II, respectively. Patients in group II perceived pain more frequently through the venous line than did those in group I (60% vs 37%, p = 0.05).

Conclusions: The formula of 1% propofol pre-mixed with lignocaine is associated with a lower incidence of pain compared with the new propofol-MCT/LCT formulation, injected into the small dorsal vein of the hand of ASA I–III patients receiving general anaesthesia. Pain intensity is similar with both preparations.

Reference:

1 Eriksson M, Englesson S, Niklasson F, et al. *Br J Anaesth* 1997; 78: 502.
2 Larsen B, Beerhalter U, Biedler A, et al. *Anaesthesist* 2001; 50(11): 842.

A-534

Drug consumption and cost analysis for TIVAs in endoscopic ENT-surgery – Can clonidine minimize the expenses?

T. Kieber, M. Rall, B. Schaedle, R. Zimmermann, K. Unertl

Deparment of Anaesthesiology, University Hospital Tuebingen, Tuebingen, Germany

Background and Goal of Study: Clonidine is known to reduce Propofol and Opioid requirements in Anesthesia [1]. We investigated 4 different TIVA combinations using Clonidine, Propofol, Alfentanil and Remifentanil in terms of drug consumption and expenses.

Materials and Methods: In a prospective and placebo-controlled study design n = 56 patients (ASA I–III, age 18–75 yrs) under-going microlaryngoscopic surgery were randomly assigned to one of four groups (n = 14) receiving Alfentanil (A) or Remifentanil (R) with either Clonidine (C) (4 μg kg^{-1} i.v. 30min before induction of anesthesia) or Placebo (P). Patients receiving Clonidine got a reduced opioid and Propofol dosage for induction of anesthesia. Remifentanil was further adjusted to age and body-weight. Alfentanil was administered via i.v. boluses (results are shown in μg/kg/min to make them more comparable). Cost analysis was performed with recent wholesale prices. We used logistic regression and MANOVA as statistical methods.

Results and Discussion: Table 1 shows the mean drug consumption. We found sign. differences in the Propofol usage between the study groups, lowest in the CR-group. Fig 1 shows sign. differences between the expenses for Propofol. The CR-group produces the lowest costs. Total costs are lowest in CA and highest in the PR-group.

Table 1: Drug consumption (Means ± STD-dev.)

	Propofol (mg/kg/h)	Remifent. (μg/kg/min)	Alfentanil (μg/kg/min)
CA	11,14** ± 2,84	–	0,32$^{\#}$ ± 0,09
CR	8,40* (**) (***) ± 1,81	0,33 ± 0,16	–
PA	11,76* ± 2,58	–	0,54$^{\#}$ ± 0,27
PR	9,79*** ± 1,90	0,32 ± 0,10	–

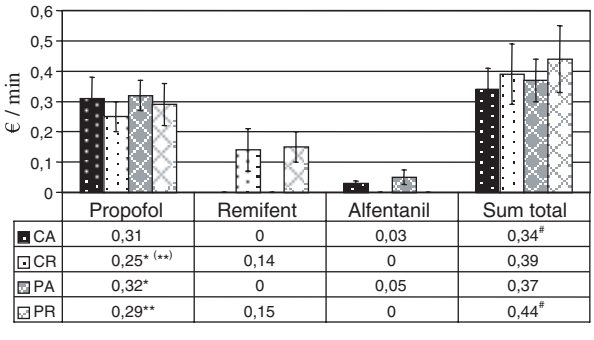

Fig. 1: Cost Analyses in €/min (means ± STD-dev.)

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Conclusion: Clonidine is able to reduce Propofol consumption. When using Remifentanil, adjuvant Clonidine can lower costs.

Reference:

1 Fehr, SB et al. Br.J.Anaesth. 2001; 86: 627–632.

A-535

A comparative study of the antiemetic efficacy of ondansetron, propofol and midazolam during the early postoperative period

H. Unlugenc, T. Guler, Y. Gunes, G. Isik

Department of Anaesthesiology, Cukurova University, Faculty of Medicine, Adana, Turkey

Background and Goal of Study: Although the sedative-hypnotic effects of propofol and midazolam are known, their antiemetic effects in the treatment of PONV are not.The aim of this study was to compare the antiemetic efficacy of ondansetron with two different hypnotic drugs (propofol 15 mg, midazolam 1 mg and 2 mg) for the treatment of established postoperative nausea and vomiting.

Materials and Methods: A total of 453 patients scheduled for elective gynaecological or abdominal surgery were enrolled, of whom 120 (26 %) experienced postoperative emesis and were randomised to receive intravenously, when nausea scores reached 2 or greater on a 5-point scale: propofol 15 mg (1.5 ml) in group P, midazolam 1 mg in group M1, midazolam 2 mg in group M2 and ondansetron 4 mg in group O.

Results and Discussion: Four patients (13,3%) in group P, 13 patients (43,3%) in group M1, 5 patients (16,6%) in group M2 and 1 patient (3,3 %) in group O required a second dose of the study drug. After administration of the study drugs nausea scores were significantly lower in all groups than before the study drugs were given ($p < 0.05$). No patient had a sedation score over 3 (the patients remained awake and/or responded to verbal contact). The sedative effects of midazolam and propofol lasted much shorter than the antiemetic effects of these drugs.

Clinicians may hesitate to use hypnotic agents for antiemetic purposes, because of the danger of sedation. Although the doses we used were lower than those recommended for sedation[1], a mild degree of sedation (OAA/S = or < 3) was observed in some patients.

Conclusion: Propofol and midazolam used in subhypnotic doses were as effective as odansetron in treating postoperative nausea and vomiting in patients undergoing abdominal or gynaecological surgery without untoward sedative or cardiovascular effects.

Reference:

1 Kay NH, Sear JW, Uppington J et al. Br J Anaesth 1986; 58 : 1075–1079.

A-536

Gender differences in propofol consumption during EEG monitored (Narcotrend®) propofol/remifentanil anaesthesia

G. Kraus[1], M. Bartlog[1], U. Grouven[2], P. Tsahuridis[3], B. Schultz[2], A. Schultz[2]

[1]Klinikum Hannover Siloah, Germany;[2]Medizinische Hochschule Hannover, Germany; [3]Bertaklinik, Hannover, Germany;

Background and Goal: Vuyk et al. (1) described gender differences of propofol effects in older patients and recommended a 10% higher infusion rate of propofol for older women. It was investigated if there are gender differences in the propofol consumption in adult patients of all age groups during propofol/remifentanil anaesthesia.

Materials and Methods: With approval of the local ethics committee 26 male and 68 female patients between 24 and 80 yrs of age undergoing thoracic or vascular surgery were enrolled in the investigation (study 1). Anaesthesia was monitored with the Narcotrend® (2). After initial deepening of anaesthesia until a burst-suppression EEG (Narcotrend® stage F) was reached, propofol was titrated to maintain an EEG stage with dominating delta activity (stage D_2/E_0) for the steady state of anaesthesia. Remifentanil was given continuously in a dosage of 0.3 μg/kg/min. Additionally, a retrospective analysis of 612 female and 383 male patients between 15 and 82 yrs of age undergoing different surgical procedures was carried out (study 2). In study 2 the average dosage of remifentanil was 0.29 μg/kg/min.

Results and Discussions: The propofol dosage (mg/kg/h) in the steady state of anaesthesia is shown in the table (median ± standard deviation). The propofol consumption of female patients was 19% (study 1) and 13% (study 2) higher than in male patients.

	Study 1	Study 2
Female	4.4 ± 2.2	4.5 ± 1.7
Male	3.7 ± 1.3	4.0 ± 1.5
t-test	p = 0.016	p = 0.0002

Furthermore, a significant reduction of propofol with increasing age could be observed in both studies.

Conclusion: Female patients needed a higher dosage of propofol than male patients in a defined depth of hypnosis during the steady state of propofol/remifentanil anaesthesia.

References:

1 Vuyk J et al. *Br J Anaesth* 2001, 67: 41–48.
2 Schultz B, Grouven U, Schultz A. *Biomed Technik* 2002; 47: 9–13.

A-537

Influence of peroperative ketamine and magnesium administration on postoperative analgesic requirements

A. Gostian, I. Grecu, M. Nicolau, I. Grintescu, D. Tulbure

Department of Anesthesia and Intensive Care, Clinical Emergency Hospital of Bucharest, Bucharest, Romania

Background and Goal of Study: Evidence suggests that secondary hyperalgesia, induced either by tissue injury or by opioid administration, involves the activation of NMDA receptors. Ketamine, an NMDA receptor antagonist, prevents the occurrence of postoperative hyperalgesia, effect that may be modulated by the presence of magnesium ions. We studied the effect of perioperative administration of small-dose ketamine or/and magnesium sulfate on postoperative pain scores and morphine requirements.

Materials and Methods: After Ethical Committee approval and informed consent, 80 patients ASA 1–2, scheduled for abdominal hysterectomy, were enrolled in a prospective, randomized, controlled study and divided in 4 groups. Anesthesia was induced with propofol 2–2.5 mg/kg and maintained with isoflurane, while intraoperative analgesia was achieved with fentanyl in a balanced technique. After the induction of the anesthesia, the patients received IV magnesium sulfate 50 mg/kg (Group 2), ketamine 0.15 mg/kg (Group 3), ketamine 0.15 mg/kg and magnesium 50 mg/kg (Group 4) or normal saline (Group 1). Pain scores (VAS), morphine requirements and side effects were recorded during the first 24 postoperative hours. Data were analyzed using Fisher's exact test and ANOVA. $P < 0.05$ was considered statistically significant.

Results and Discussions: Postoperative morphine consumption in Groups 2, 3 and 4 was, respectively, 10, 40 and 54% less than that in the control group. Pain scores in Groups 3 and 4 were approximately 35 and 40% less than those in the control group. There was no significant group difference in the occurrence of side effects.

Conclusion(s): Peroperative low-dose ketamine administration may reduce postoperative morphine requirements, effect that appears to be enhanced by magnesium supplementation.

References:

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A-538

Effects of oral clonidine premedication on pattern of heart rate and blood pressure changes after Neostigmine–Atropine administration

H.A. Soltani, A. Honarmand

Department of Anesthesiology and Critical Care, Isfahan university of medical science, Isfahan, Iran

Background and Goals: The injection of Neostigmine–Atropine mixture (N–A) may cause tachycardia and hemodynamic changes (1). Clonidine as an α_2 agonist can decrease catecholamine output and reduce hyperdynamic state (2).This study was designed to determine effects of oral clonidine premidication on pattern and desirability of heart rate (HR) and mean arterial blood pressure (MAP) changes after N-A injection.

Materials and Methods: In this double blind randomized clinical trial we studied 80 adult patients without cardiovascular disorder who where scheduled for elective surgery of orthopedics, gynaecology and laparotomy were assigned to receive either 5 μg/kg oral clonidine (n = 40) or placebo (n = 40) to compare the HR and MAP after N–A mixture injection for reversal of muscle relaxant effects at the completion of surgeries.

Results and Discussion: In clonidine group, absolute values of HR changes after N–A injection were significantly less than that of placebo group ($p < 0.05$), whereas absolute values of MAP changes were similar in two groups. Changes of HR and MAP after N–A injection were linear in both groups. In clonidine group, slope of HR changes 1 to 10 minutes after injection was less than the placebo group (−2.09 vs −2.72).

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Conclusion: It seems that preoperative clonidine has an attenuating effect on hemodynamic changes and preserves basal parasympathetic nervous activity after N–A mixture injection at the completion of surgeries.

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A-539

Efficacy of intravenous tropisetron in the prevention of intrathecal-morphine induced pruritus

C. Iatrou, C. Dragoumanis, C. Michailidis, T. Vogiatzaki, C. Simopoulos, V. Dimitriou

Department of Anaesthesia, Democritus University Hospital of Thrace, Alexandroupolis, Greece

Background and Goal of Study: Preemptive efficacy of ondansetron on intrathecal-morphine induced pruritus was proved (1). In a prospective, randomized, double blind, and placebo controlled study we evaluated the efficacy of intravenous (iv) tropisetron, a long acting 5-HT3 receptor antagonist in prevention of intrathecal-morphine induced pruritus.

Materials and Methods: After IRB approval spinal anesthesia with bupivacaine 0.5% and 0,25 mg morphine was performed in 57 patients scheduled for gynaecological, urological, and inguinal hernia repair surgery. Ten minutes before administration of spinal anesthesia patients were randomly divided in two groups: Group A (n = 28) received tropisetron 5 mg iv, and Group B (n = 29) received iv 5 ml normal saline. Presence and severity of pruritus, postoperative pain with visual analogue scale (VAS, 0–10), and vital signs were recorded every 2 h during the first 24 h. For statistical analysis was used Student's t test for parametric data, χ^2 with Yates correction for incidence of pruritus, and Mann–Whitney U test for severity of pruritus.

Results: Randomization was successful with respect to demographical data. In the postoperative period all patients presented no or mild pain score (0–3). Vital signs were within acceptable normal ranges. Pruritus was presented in 16/29 patients (55%) in Group A, and in 21/28 patients (75%) in Group B (p = 0,12). Overall severity of pruritus measured as sum of VAS score/patient with pruritus/24h was statistical significantly lower in group A compared to Group B (p = 0,01).

Conclusion: Prophylactic intravenous tropisetron reduces the severity of intrathecal morphine induced pruritus.

Reference:

1 Dimitriou V, Voyagis GS. *Br J Anaesth* 1999; 82(3): 478–9.

A-540

Assessment of target-controlled infusion of propofol for sedation

A. Quinart, K. Nouette-Gaulain, S. Malbert, F. Sztark

Department of Anaesthesiology, CHU Pellegrin, Bordeaux, France

Background and Goals: Target-controlled infusion (TCI) of propofol is a suitable technique for sedation of patients during monitored anaesthesia care (1). The purpose of this prospective study was to determine the target concentration of propofol and bispectral index required to achieve and maintain a steady level of sedation.

Materials and Methods: After local Ethics Committee approval and written informed consent, consecutive patients scheduled for tension-free vaginal tape procedure (TVT) under local anaesthesia were included. After premedication with hydroxyzine (100 mg), propofol was administered using the TCI system Diprifusor® and the Marsh's PK set at an initial target plasma concentration (Cpt) of 1 μg.ml^{-1}. Cpt was adjusted every 5 min by 0.2 μg ml^{-1} steps in order to maintain a level 4 or 3 on the Observer's Assessment of Alertness/Sedation (OAA/S) scale (2). Effect-site concentration (Ce) of propofol, OAA/S scale and bispectral index (A2000 XP, v3.1, Aspect Medical System) were recorded every 5 min through the procedure. Results were expressed as mean ± SD. Analysis of the data was performed using ANOVA and Bonferroni test with a significant level of 0.05.

Results: The study population consisted of 50 female patients, mean age 62 ± 12 yr. The sedation period was 45 ± 9 min and the average propofol infusion rate was 3.2 ± 0.5 mg kg^{-1} h^{-1}. Mean Ce of propofol at OAA/S score 4 or 3 was 1.0 ± 0.2 μg ml^{-1} (Table). Three patients (age > 75 yr) were oversedated (OAA/S score 2) with the same Ce of propofol but at a lower BIS. Just one patient was unsatisfied.

OAA/S	Ce of propofol (μg ml^{-1})	BIS
2	1.1 ± 0.1	77 ± 4*
4/3	1.0 ± 0.2	88 ± 7
5	0.8 ± 0.2*	95 ± 4*

Mean ± SD. * $P <$ 0.05 *versus* OAA/S 4/3.

Conclusion: TCI with propofol provided easy and safe management of intraoperative sedation. An initial Cpt fixed at 1 μg ml^{-1} appears as an effective target concentration in most patients.

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Paediatric Anaesthesia and Intensive Care

A-542

Muscle relaxants free anaesthesia with remifentanil/propofol in short-duration elective ENT-surgery in children 0–10 years old – a five year experience

S. Sgoll*, M. Leischik#, H.B. Hopf$

**Medical student; #Senior staff anaesthesiologist; $Chief Department of Anaesthesia and Perioperative Medicine, Langen, Germany*

Background and Goal of Study: While there is an increasing medico-legal pressure on anaesthesiologists to avoid succinylcholine for intubation in elective child surgery (1), clear cut data and recommendations for its substitution specifically in very short surgical procedures such as ENT-surgery are rather scarce (2). Accordingly, based on our own experience we retrospectively evaluated, whether or not succinycholine can be substituted safely and conveniently by a combination of remifentanil and propofol for children undergoing elective adenotomy or tonsillectomy (±paracentesis ± tube placement).

Materials and Methods: With institutional approval 651 charts of children up to 10 years old operated on between January 1st 1997 and December 31 2001 were reviewed. Comparison of either alfentanil 10 μg kg^{-1}/propofol 1.5 mg kg^{-1}/succinylcholine 0.5 mg kg^{-1} anaesthesia (n = 88, only childs out of 1997) with remifentanil (bolus 1 μg kg^{-1}, maintenance 0.2 μg kg^{-1}) /propofol 3 mg kg^{-1} anaesthesia (n = 563, 1997–2001), supplemented by enflurane or sevoflurane in N_2O/O_2. Variables: age, height, weight, induction time, duration of operation, anaesthesia, and post-anaesthesia care unit (PACU) stay, use of postoperative analgetic drugs, need for inhalational or intramuscular ketamine induction, and for succinylcholine. Statistics: factorial ANOVA with adjustment for multiple comparisons or chi-square-test, p-value <5% significant.

Results and Discussions: Induction time (means ± SD) with alfentanil/succinylcholine was 9 ± 5 and 9 ± 4 min in the 0–5 and 6–10 year group, respectively which increased on average by 2 minutes with remifentanil. PACU stay increased by 30% with remifentanil (from 41 ± 12 to 56 ± 21 in the 0–5 and 36 ± 12 to 55 ± 21 min in the 6–10-year group). Analgetic requirements in the PACU were comparable after both opioids. Succinylcholine had to be used for thorax rigidity once in the 0–5 and 6–10 year group respectively. Intramuscular/inhalational induction was necessary seven times in the 0–5 and three times in the 6–10 year group.

Conclusion: Remifentanil/propofol appears to be a feasible substitute for succinylcholine in elective ENT-surgery in children up to 10 years old.

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2 Simon L, Boucebi KJ, Orliaguet G et al. *Paediatric Anaesthesia* 2002;12: 36–42.

A-543

Tracheal intubation in paediatric patients with sevoflurane or propofol as sole anaesthetic agent

C. Bratzou, P. Pappas, E. Koraki, M. Milona, I. Ntzani, M. Ventouri

4th Department of Anaesthesia, "Hippokration" General Hospital, Thessaloniki, Greece

Goal of Study: The evaluation of the haemodynamic response to intubation and the intubating conditions in paediatric patients with sole anaesthetic agent being used either sevoflurane(1) or propofol.

Materials and Methods: 60 children were enrolled, ASA I, 46 male and 14 female, aged 1 to 9 years (4.3 ± 1.9 y), randomly allocated to 2 groups of 30

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children each, A and B. Group A had an inhalation induction with sevoflurane 8% in 100% O_2 until pupils were constricted and fixed; then laryngoscopy and intubation were attempted. Group B had an i.v. induction with propofol bolus 3 mg/kg B.W. After suppression of breathing and fixation of the pupils laryngoscopy and intubation were attempted. Heart rate, blood pressure and SpO_2 were recorded before induction and after intubation. Quality of intubation was assessed using a scale 1–3: 1 for excellent intubating conditions (no patient movement), 2 for good (movement after intubation) and 3 for bad conditions (difficulty in intubation). Parametric variables were assessed using the paired or independent student t-test. Non-parametric variables were assessed using the chi-square test. p values <0.05 were considered statistically significant.

Results: Our groups were uniform and comparable considering their demographic characteristics (male:female ratio, age and body weight). The haemodynamic profile and haemoglobin saturation in each group separately were stable with the exception of heart rate: tachycardic response to intubation in both groups; 23% raise in group A and 19% in group B. Comparing the haemodynamic parameters between groups, the post-intubation values of mean and diastolic arterial pressure were lower in group A. Quality of intubation: group A presented excellent conditions in 90% vs 36.7% in group B, good conditions in 6.7% vs 36.7% and bad conditions in 3.3% vs 26.7%. ($p < 0.001$, significant differences)

Conclusion: Paediatric tracheal intubation using as sole anaesthetic agent propofol or sevoflurane is possible and safe. Sevoflurane brings about greater reduction than propofol in mean and diastolic arterial pressure, though without obvious clinical significance. Concerning the quality of intubation, sevoflurane allows better tolerance of direct laryngoscopy and intubation than propofol.

Reference:

1 O'Brien K, Kumar R, Morton N.S. *Br J Anaesth*. 1998; 80: 452

A-544

Which type of general anesthesia should we use in pediatric regional anesthesia? Randomized controlled trial comparing intravenous and balanced anesthesia

B. Locatelli[1], P. Ingelmo[2], S. Di Marco[1], A. Messa[1], E. Zaranko[1], M. Favarato[2], V. Sonzogni[1]

[1]Dipartimento Anestesia e Rianimazione, Ospedale Riuniti di Bergamo, Italy; [2]Facoltà di Medicina, Università Milano Bicocca, Italy

Background and Goal of Study: The aim of the study was compare the efficacy of intravenous and balanced anaesthesia in paediatric combined anaesthesia.

Materials and Methods: After institutional approval and informed consent 40 patients (ASA I-II, 0–8 years, 5–20 Kg, inguinal hernia, hydrocele or phimosis), using a computer generated list, were randomised to receive: ketamine 1–2 mg/kg, propofol 2 mg/kg bolus and propofol infusion of 125 mcgr/kg/min (IV group) or sevofluorane up to 5% and fentayl 2 mcgr/kg followed by sevofluorane 1,5% (BAL group). Both groups were premedicated with rectal atropine 0,01 mg/kg and midazolam 0,5 mg/kg. Caudal block was performed with ropivacaine 0,2%, 0,25% in double blind fashion. End points were airway control (tracheal intubation or laryngeal mask), inadequate sedation (patient movement), wake up time (end of anaesthesia to Aldrete[(1)] $\geqslant 8$), and postoperative sedation (Ramsay[(2)] $\geqslant 2$ 120 min. after anaesthesia induction). Continuous data were analysed with Anova or Kruskal-Wallis test and non continuous data with Chi-Square or Fisher exact test.

Results and Discussions: 38 patients were included and two excluded because of lack of premedication. Results are presented as mean and standard deviation (±) or frequency and 95% confidence interval (%)

Group	IV (n 19)	BAL (n 19)	P
Anesthesia (min)	48 (±24)	37 (±10)	0,09
Airway control	1/19 (0–26%)	9/19 (28–75%)	0,001
Intraoperative movement	6/19 (13–57%)	0/19	0,007
Wake up (min)	48 (±14)	16 (±8)	0,0001
Postop. sedation	3/19 (3–40%)	3/19 (3–40%)	1

BAL group had better intraoperative sedation and shorter wake up time than IV group, with similar postoperative sedation. IV group needed less airway interventions.

Conclusions: We need to clarify the safety of these two methods to conclude which one is better for paediatric combined anaesthesia.

References:

1 Andrete JA. *Anesthesia Analgesia*. 1970, 49: 429.
2 Ramsay MAE. *Br Med. J*. 1974, 2: 656–659.

A-545

Incidence of oculocardiac reflex during strabismus surgery in children under spontaneous breathing with laryngeal mask airway

M. García-Raimundo, P. Ruiz-Gimeno, J.L. Jover, J. García de la Asunción, J.M. Gallego, F.J. Belda

Department of Anaethesia and Critical Care, Hospital Clínico Universitario, Valencia, Spain

Background and Objectives: The oculocardiac reflex (OCR) caused by ocular extrinsec-muscle traction may have important haemodynamic and respiratory effects. Our purpose was to check the incidence of OCR in strabismus surgery performed under spontaneous ventilation via laringeal mask airway (LMA), comparing its incidence whenever propofol or sevoflurane were used.

Material and Methods: We studied two different groups 35 children each (age 4–12, ASA I) undergoing surgical correction of strabismus while breathing spontaneously through a LMA. atropine (0,01 mg/Kg) was provided prior to induction. In group 1, propofol was used for induction and maintainance of anaesthesia .In group 2, induction was performed with an increasing concentration of sevoflurane and mantained with sevoflurane 2%. Both groups got N_2O 66% in O_2 throughout surgery. Anaesthetic stage was under control (BIS 60 ± 12). Electrocardiographic beat-to-beat heart rate (HR) changes were measured during and after standarized traction was applied to an external eye muscle (5 Newton, 45 s). OCR was defined as a 20%-HR change from baseline, induced by traction.

Results: Median HR change in group 1 (−30 bpm) was significantly greater ($p < 0,05$) than that in group 2 (−6 bpm) as shown by Chi square statistic test.

Conclusions: Sevoflurane induces less episodes of OCR than propofol in surgery involving eye muscles traction, therefore it may be a more appropiate anaesthetic for this kind of surgery in children under spontaneous respiration via LMA.

References:

1 Gurkan Y. *Paediatr Anaesth* 1999; 9(6): 495–9.
2 Hahnenkamp K et al. *Paediatr Anesth* 2000; 10(6): 601–8.

A-546

Perioperative low-dose S-ketamine has no preventive effects on postoperative pain and morphine consumption after major urological surgery in children

K. Becke, B. Schmitz, W. Koppert, J. Schüttler, S. Albrecht, W. Hering

Department of Anesthesiology, University Clinic Erlangen, D-91054 Erlangen, Germany

Background and Goal of Study: Clinical studies suggest low-dose ketamine to have preventive effects on postoperative pain in adults [1]. The objective of this study was to determine whether perioperative low-dose S-ketamine leads to a reduction of postoperative pain and morphine consumption in children undergoing major urological surgery.

Materials and Methods: After approval by the local Ethics Committee a prospective, randomized and double-blinded study in 29 children undergoing major urological surgery was undertaken. Anaesthesia was performed as total intravenous anaesthesia (TIVA) with alfentanil and propofol. Patients of group K ($n = 17$) received an intravenous bolus of S-ketamine (0.2 mg/kg) followed by a continuous infusion of 5 μg/kg/min, which was stopped immediately after skin closure. Patients of the control group P ($n = 12$) received an infusion of saline. After transfer to the PACU, pain intensity was evaluated using a numeric rating scale (NRS). If pain intensity exceeded 3 (out of 10), an intravenous patient controlled analgesia (PCA) with morphine was started (0.05 mg/kg). First PCA request, cumulative morphine consumption and pain intensities within the first 24 hours were noted and compared. Data were statistically evaluated using RM-ANOVA, followed by post-hoc tests. Significance levels throughout this study were $P < 0.05$.

Results and Discussions: Both groups were comparable with regard to age and weight. No differences were found in morphine consumption during the first 24 hours (Group P: 4.9 mg, 2.4–10.7 mg, Group K: 5.5 mg, 4.0–8.6 mg; median, 1.–3. quartile; n.s.). However, differences were found in pain intensity during the first postoperative hour (Group P: 4.3 ± 2.7, Group K: 2.6 ± 1.7; mean ± SD; $p < 0.05$) and in the time to first PCA use (Group P: 41 ± 17 min, Group K: 56 ± 21 min; mean ± SD; $p < 0.1$).

Conclusion In our study intraoperative low-dose S-ketamine had no effects on morphine consumption during the first 24 hours after surgery. The differences in pain intensity and time to first PCA use reflect an additional sedative and antinociceptive effect of S-ketamine rather than a true preventive effect on pain perception.

Reference:

1 Schmid RL, et al. *Pain* 1999; 82: 111–25.

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A-547

A Low flow anaesthesia (LFA) regimen for children

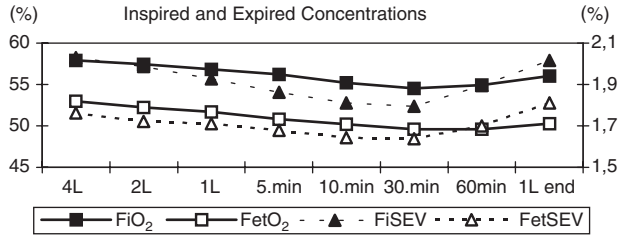
P. Bozkurt, N. Saygi, G. Kaya, Y. Yeker

Istanbul University, Cerrahpasa Medical Faculty, Department of Anaesthesiology, Istanbul, Turkey

Background and Goal of Study: The reports regarding use of LFA in children are scarce in the literature (1,2). Our aim was to evaluate the applicability and benefits of a modified LFA regimen.

Materials and Methods: Following ethics approval, LFA program was prepared to achieve the lowest possible complication rate in a teaching hospital. Thirty children aging 2–17 undergoing surgery were included. Following induction by 8% sevoflurane in 100% O_2 and atracurium and a bolus of morphine (M) children were intubated. Anaesthesia was maintained with 2% sevoflurane and M infusion. After induction with 4 L/min, flow rates were reduced to 2 L/min and 1 L/min (0.5 L oxygen + 0.5 L air: $FiO_2 = 58\%$) (Cicero EM, Drager-Germany), 5 and 10 min to the surgery. Before the end of surgery flow rate was increased. In addition to routine monitoring inspired and expired gases were monitored. Bolus dose of M was given in case of awakeness. ANOVA for repeated measurements applied.

Results and Discussions: The duration of LFA was 133 ± 98 min. The changes at FiO_2 were significant ($p < 0.05$). SpO_2 was above 98%. Only 3 patients required supplemental M boluses. Meakin had pointed out the unpredictability of anaesthetic concentrations and advised the frequent adjustment of vaporizer settings (1) Baum introduced a new era in LFA using O_2 as carrier gas to omit the risk of hypoxia primarily(2). The use of M enables the abandonment of N_2O.



Conclusions: This regime has shown additional advantages as simplicity in teaching hospitals, ease of application,decrease in hypoxia risk and enables use of machines which does not have O_2 analyzer.

References:

1 Meakin G.H. *Br J Anaesth* 1999; 83: 50–57.

2 Baum J.A. *Low flow anaesthesia*. Butterworth-Heinemann. Oxford, 2001.

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A-548

Non steroidal anti-inflammatory drugs and perioperative bleeding in paediatric tonsillectomy

M.E. Cardwell, G. Siviter, A. Smith

Department of Anaesthesia, Royal Manchester Childrens Hospital, The Cochrane Collaboration, Pendlebury, United Kingdom

Background and Goal of Study: Non steroidal anti-inflammatory drugs (NSAID's) are used for pain relief after tonsillectomy in children. As they also inhibit platelet aggregation [1], they have the potential to increase bleeding. We have attempted to explore the clinical risk/benefit ratio in this systematic review.

Materials and Methods: We sought randomised controlled trials (RCT's) comparing NSAID's given by any route with other analgesics in elective tonsillectomy in children up to and including 16 years. Outcomes sought were (1) pain (2) nausea and vomiting (3) bleeding requiring non-surgical intervention e.g. transfusion (4) bleeding requiring further surgery. Relevant data were extracted independently by two reviewers and effect sizes calculated using a fixed effects model [2].

Results and Discussions: We found 12 relevant RCT's. Data are presented as odds ratios with 95% confidence intervals. We found no evidence of a difference in analgesia when NSAID's were compared to other analgesics (paracetamol/paracetamol & codeine/opiods) but there was significantly less nausea and vomiting (0.43, 0.3–0.61). Neither bleeding requiring surgical intervention (1.54, 0.57–4.14) nor bleeding requiring non-surgical intervention (0.87, 0.33–2.31) were significantly different from control. However, RCT's were generally small and event rates were low in both groups, leading to broad confidence intervals for these findings. There is however no strong evidence at present that NSAID's give rise to more clinically important bleeding than other analgesics.

Conclusion: We conclude that there is insufficient evidence to withhold non steroidal anti-inflammatory drugs in paediatric tonsillectomy for fear of postoperative bleeding.

References:

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2 RevMan. Version 4.1 2000 *The Cochrane Collaboration*. Update Software Ltd.

Acknowledgments: The protocol for this review is published on the *Cochrane Library*. Oxford: Update Software, Issue 4 2002.

A-549

Disorders of nutritional parameters after major spinal surgery

M.J. Colomina*, C. Godet*, M.P. Lalueza**, S. Clemente**, J. Bagó***

**Department of Anesthesia; **Pharmacy Department; ***Orthopaedic Surgery, Hospital Traumatología Vall Dhebron, Barcelona, Spain*

Background and Goals: To analyze the degree of nutritional depletion that patients with idiopathic scoliosis after major spinal surgery. We analysed also the correlation between the degree of nutritional depletion and factors related to spinal surgery.

Material and Methods: Between January 1999–July 2001, we studied 31 patients (24 w/7 m, average age 18 years, SD 6,99). All patients were given total parenteral nutrition (TPN) after surgery until obtaining the nutritional oral requirements, according to the Institutional Nutritional Protocol. The data collected were: type and duration of the surgery, total blood loss and duration of hospital stay. The nutritional parameters (total serum protein, albumin, prealbumin, transferrin, lymphocyts, and body mass index) were collected at differents times: before and after surgery (BSS-ASS), at the end of TNP, and at hospital discharge. The statistical analysis was carried out using the SPSS 8.0.

Results: The results of nutritional parameters were:

	BSS	ASS	End TNP	Discharge
Proteins (g/dl)	7,1 (0,4)	5,6 (0,7)*	6,2 (0,7)	7,7 (0,5)
Albumin (g/dl)	4,3 (0,3)	3,1 (0,4)*	3,3 (0,4)	4 (0,4)
Prealbumin (mg/dl)	27,6 (6,9)	17,1 (7,7)*	20,2 (8,4)	32,2 (10)
Transferrin (mg/dl)	278,3 (67)	183,2 (27,2)	196,6 (36,5)	273,9 (37)
Lymphocyts (10^9/L)	2,1(0,5)	0,75 (0,2)*	1,1 (0,5)	1,7 (0,1)

*$p < 0.001$

Conclusions: All patients were in a normal nutritional status before surgery. After surgery, an important nutritional depletion ocurred in all parameters analysed. We did not find any correlation between the degree of nutritional depletion and the evaluated parameters of the surgery, only between total serum protein and blood loss ($p = 0.026$).

Reference

1 Lapp MA, Bridwell KH, Lenke LG et al. Prospective randomization of parenteral hyperalimentation for long fusions with spinal deformities. *Spine* 2001: 26: 809–17.

A-551

Air or water warms children better? Final results

M. Gal, J. Metzner, J. Katz

Section of Pediatric Anesthesia, Schneider Childrens Medical Center of Israel, Sackler Faculty of Medicine, Tel Aviv University, Petah Tiqwa, Israel

Background and Goal of Study: Heat gain should offset heat loss in order to avoid intra-operative hypothermia. Keeping small children warm during major surgery is especially difficult. Traditionally, forced air warming was considered more effective than water mattresses (1), but the physical properties of water makes it a better choice for heat transfer, and a recent study proved this. (2) We compared the two methods in infants in clinical settings.

Materials and Methods: Fifty-nine ASA 1 and 2 infants scheduled for major abdominal surgery were enrolled in this prospective, randomized and controlled study. After institutional ethical committee approval and informed parental consent, the patients were allocated into two groups: Warmed Air Device (WAD) group (n = 21) and flexible water filled garment (Allon) group (n = 38). In the WAD group, we used Bair Hugger Model 505 with the original U-shaped cover. In the Allon group a thermistor feedback microprocessor controlled heat pump supplied warmed/cooled water into a flexible water-filled garment (ThermoWrap™) covering 40–70 per cent of the

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children's body surface area. Apart from the temperature control, patient care was the same in the two groups. Skin and core temperatures were recorded. Unpaired t-test was used for statistical analysis. $P < 0.05$ was considered significant.

Results and Discussions: There was no significant difference between the two groups in terms of age, body weight, starting core temperature, type and length of surgery. Infants in the WAD group were colder than in the Allon group all through the surgery and temperature difference between the two groups became significant 15 minutes after anaesthesia induction. The patients were hypothermic (core temperature < 36.0 Celsius average) for >90 minutes in the WAD group, while for <15 minutes in the Allon group. We did not encounter any complications related to any of the thermoregulatory systems.

Conclusion: Water filled garment (ThermoWrap™) regulated by microprocessor controlled Allon™ 2001 system is more effective than forced air warming.

References:

1 Kurz A, Kurz M, Poeschl G et al. *Anesth Analg* 1993; 77: 89–95.
2 Taguchi A, Ratenaraj J, Sharma N et al. *Anesthesiology* 2002; 96: A588

Acknowledgements: MTRE Advanced Technologies Ltd. Israel for providing the Allon™ 2001 System and ThermoWrap™ garments for the study.

A-552

Paediatric haematology/oncology patient outcome following PICU admission

D. Rohan*, B. OHare*, W. Casey*, A. OMeara*, F. Breathnach†, D. Mannion*

**Anaesthesia/Critical Care Medicine; †Haematology/Oncology; Our Ladys Hospital for Sick Children, Crumlin, Dublin, Ireland*

Background and Goal of Study: Intensive chemotherapeutic treatment regimens have led to an increase in survival of children with both haematological and solid malignancies.[1] These patients may require either elective or emergent admission to the paediatric intensive care unit (PICU). The aim of our study was to determine survival rates and prognostic indicators among patients with childhood malignancies who were admitted to our PICU.

Materials and Methods: Five-year retrospective data review of 129 paediatric oncology patients admitted to a tertiary referral paediatric intensive care unit between 1997 and 2001.

Results and Discussions: 113 (88%) of 129 children with childhood malignancy who were admitted to our paediatric intensive care unit survived. Patients with either respiratory or systemic infection had the poorest survival (74 % survival) whereas postoperative patients had the best survival (100% survival). Forty-four patients required mechanical ventilation with a 68% survival in ventilated patients (14 deaths). The mean (standard deviation) admitting paediatric risk of mortality score (PRISM) for survivors and non-survivors were 5.2 (6.1) and 14.5 (9.6), respectively [$p < 0.01$; 95% confidence interval (CI), 1.13 to 4.71].

Conclusion(s): The PRISM score may assist in discrimination between survivors and nonsurvivors of a paediatric intensive care admission. The majority of this cohort of patients who require mechanical ventilation now survive. Cooperation between the family, oncology and intensive care teams is essential and will allow the most appropriate care for the paediatric oncology patient.

Reference:

1 Heney D, Lewis IJ et al. *Arch Dis Child* 1992; 67: 294–8.

A-553

Impact of prolonged laparoscopic surgery in neonates on systemic haemodynamics and circulating blood volume: An experimental study in rabbits

G. Marx[1], T. Schuerholz[2], N. Jesch[3], D. Haertl[2], B.M. Ure[3], R. Sumpelmann[2]

[1]Department of Anaesthesia, University of Liverpool, UK; [2]Department of Anaesthesia; [3]Paediatric Surgery, MHH, Germany

Background and Goal of Study: Prolonged minimally invasive surgery in neonates does not equate with minimally invasive anaesthesia. Knowledge of associated pathophysiological changes is very limited due to technical difficulties and potential complications using invasive monitoring.

Materials and Methods: In a prospective animal laboratory study 6, anaesthetized and mechanically ventilated New Zealand rabbits (median weight: 3.5 kg) were investigated. A central venous line and an arterial catheter with an integrated thermistor and fiberoptic (Pulsiocath 4 F PV 2024 L, Pulsion Medical Systems) were inserted. Circulating blood volume (CBV) was calculated by transpulmonary thermo-dye dilution technique. Under visual control, a camera trocar (Storz, Tuttlingen) was introduced into abdominal cavity. CO_2 was insufflated to establish a pneumoperitoneum with an intraabdominal pressure of 8 mmHg. CBV, systemic haemodynamics and oxygenation were measured. To compare baseline values with those after 4h of CO_2 exposure (T2) and 30 min after the laparoscopic procedure (T3) Friedman test with post-hoc Wilcoxon was performed (data as median and interquartile range). * $p < 0.05$ was considered significant.

Results and Discussions:
see table.

	Baseline	T2	T3
Mean arterial pressure (mmHg)	66 (59–69)	65 (56–69)	59 (53–66)
Central venous pressure (mmHg)	7 (6–7)	10 (8–11)*	6 (5–7)
PH	7.37 (7.35–7.41)	7.39 (7.27–7.44)	7.31 (7.18–7.33)
Lactate (mmol/l)	3.2 (2.6–4.2)	6.7 (5.0–7.4)*	7.5 (6.8–8.3)*
Cardiac output (ml/min)	362 (342–420)	352 (301–415)	289 (265–326)*
Central venous oxygen saturation (%)	81 (74–90)	71 (59–77)*	58 (53–63)*
Oxygen delivery (ml/min)	62 (53–70)	47 (43–54)*	36 (35–40)*
CBV (ml)	301 (259–385)	223 (134–305)	159 (135–239)*

Conclusion(s): In this animal model we could demonstrate that clinically used parameters, pH, MAD and CVP, could not indicate CO_2 pneumoperitoneum induced impairment of systemic haemodynamics, oxygenation and reduction of CBV. This impairment was even more marked 30 min after the end of the laparoscopic procedure.

A-554

Pseudocholinesterase and albumin values after portosystemic shunting in children

Lj. Popovic, V. Majeric Kogler, K. Oremus, M. Domijan, Z. Sonicki

Division of Anaesthesiology, Department of Surgery, University Hospital Center, Zagreb, Croatia

Background and Goal of Study: Pseudocholinesterase (PChE) is an enzyme (EC 3.1.1.8) synthesized in the liver and plays a role in the metabolism of some anaesthetic drugs. The aim of this study was to determine PChE activity as an index of early liver function recovery after portosystemic shunting in children.

Materials and Methods: During the last two years we have measured PChE activity as well as serum albumin values before, 10 and 20 days after portosystemic shunting in 6 children with portal hypertension. Indications were biliary atresia, portal vein thrombosis, portal vein cavernoma (2 patients), congenital hepatic fibrosis and portal vein thrombosis after living donor segmental transplantation. PChE activity was determined by the spectrophotometric method of Ellman using butyrythiocholine as substrate (Sigma Chem Co, St. Louis, USA), and serum albumin was determined by immunonephelometry as described by Naatelson, using the Behring Nephelometer Analyzer II. The results were analyzed using the Friedman and Wilcoxon Signed Ranks tests.

Results and Discussions: There was a statistically significant increase in PChE activity ($p = .002$) as well as in serum albumin concentration ($p = .006$) after portosystemic shunting with regard to their preoperative values. At day 10 PChE activity showed a more significant ($p = .028$) rise compared to its preoperative value than serum albumin ($p = .046$).

Conclusion(s): The marked increase of PChE activity at day 10 shows early improvement of liver function after portosystemic shunting and can be used to asses liver function in terms of synthesis.

A-555

Clinical evaluation of pressure support ventilation during induction and maintenance of paediatric anaesthesia

Y. Hervé, A. Quinart, H. Rossi, A. Didier, F. Banchereau, A.M. Cros

Department of Anaesthesia, HIA Robert Picque, Department of Anaesthesia IV, Hopital des enfants, Bordeaux, France

Background and Goal of Study: Pressure support ventilation (PSV) was used with laryngeal mask (LMA) or in intubated adults during anaesthesia (1,2). The goal of this prospective open study was to evaluate PSV during induction and maintenance of anaesthesia in paediatric patients.

Materials and Methods: After ethics committee and informed parents approval, 18 ASA 1–2 classification 5.5 (±3.2) yr. old scheduled for anaesthesia with LMA and spontaneous ventilation were studied. Anaesthesia was

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induced with sevoflurane (S) 8% in N_2O/O_2 1/1 and maintained with S at MAC. After loss of consciousness, PSV was introduced with a pressure set at 10 cm H_2O (Felix®, Taema, France). When jaw relaxation was judged sufficient by the anaesthetist, the LMA was inserted. PSV was maintained until the end of the surgery. A minimal respiratory rate (RR) of the ventilator was set between 10 and 15 min^{-1} according to the child's age. End tidal CO_2 ($Etco_2$), SpO_2 and RR were recorded every minute during induction and every 5 min during maintenance. Results given are the mean and SD of data during this two periods. After LMA insertion, data were also collected. Occurrence of respiratory events i.e. laryngospasm, stridor and apnoea were noted.

Results and Discussions: Average time (SD) of ventilation with PSV was 26.5 (±6) min. $Etco_2$ were 29 (±7), 45 (±7.6) and 43.7 (±5.6) mm Hg respectively during induction, after LMA placement and during maintenance of anaesthesia. At the same times, RR were 26.3 (±12), 21 (±9.7) and 25 (±8.3) min^{-1}. Five short episodes of apnoea occurred in 3 children during maintenance. They were ventilated with pressure support by the ventilator with the preselected setting until they activated PSV again. A mild laryngospasm occurred after LMA placement in one child. Anaesthesia was deepened. No desaturation episode was noted.

Conclusion(s): PSV allows support of spontaneous breathing during induction and maintenance of anaesthesia with a LMA providing adequate and safe ventilation. Further comparative studies are needed to specify the role of PSV for paediatric anaesthesia.

References:

1 Bosek V et al. *J Clin Anesth* 1996; 8: 9–12.
2 Brimacombe J et al. *Anesthesiology* 2000; 92: 1621–3.

A-556

Does acute hemodilution affect cerebral blood flow velocities?

A. Dönmez, D. Sargin, U. Can, N. Güngör, E.A. Akpek, S. Mercan

Departments of Anaesthesiology, Neurology and Cardiovascular Surgery Baskent, University Faculty of Medicine, Ankara, Turkey

Background and Goal of study: Patients with cyanotic heart defects and elevated hematocrit (htc) levels have significant risk for adverse neurologic events. Blood viscosity and hct levels are the main determinants of cerebral blood flow rate, and cerebral perfusion. The aim of our study was to determine the effects of acute hemodilution on cerebral blood flow velocities obtained with transcranial doppler (TCD) in cyanotic infants undergoing cardiopulmonary bypass (CPB).

Patients and Methods: After Ethics Committee approval 8 cyanotic and 16 noncyanotic children between 2–36 mo old without known neurological disease were studied. Standard anaesthesia, CPB, and hypothermia protocols were used. Haemodynamic variables, rectal temperature, htc and $PaCO_2$ were recorded. Systolic, diastolic, mean middle cerebral artery velocity (V_{MCA}), pulsatility (PI) and resistance (RI) indexes were recorded with TCD at same periods. Statistical analyses were performed with Mann Whitney-U test, and $p < 0.05$ was considered significant.

Results: are shown in Table I.

Table I: (*$p < 0.05$)

	Cyanotic (n = 8)	Noncyanotic (n = 16)
Age (months)	19.4 ± 11.2	11.6 ± 9.1
Weight (kg)	10.1 ± 3.3	7.28 ± 2.9
CPB/XC (min)	92 ± 21*/55 ± 16*	55 ± 22/33 ± 19
Htc (%) -T1	40.75 ± 8.3*	29.75 ± 3.4
-T2	29.63 ± 5.4	28.5 ± 2.5
Systolic V_{MCA}		
(cm/sec) -T1	110.5 ± 26.6	88.5 ± 24.1
-T2	91.6 ± 38.2	66.8 ± 24.7
Diastolic V_{MCA}		
(cm/sec) -T1	39.0 ± 17.3	27.8 ± 11.5
-T2	41.1 ± 33.9	21.9 ± 12.4
Mean V_{MCA}		
(cm/sec) -T1	61.0 ± 22.6	43.3 ± 15.4
-T20	55.9 ± 36.8	34.1 ± 13.9
PI -T1	1.41 ± 0.92	1.62 ± 0.74
-T2	1.18 ± 0.51	1.47 ± 0.79
RI -T1	0.65 ± 0.14	0.71 ± 0.14
-T2	0.61 ± 0.16	0.66 ± 0.18

T1:before CPB, T2:1st min of CPB

Conclusion: Acute hemodilution did not effect middle cerebral artery flow velocity measurements obtained with TCD in cyanotic infants undergoing CPB.

A-558

Intra-operative volume replacement with hydroxyethyl starch 130/0.4 in comparison with albumin in newborns and infants

T. Standl, G. Schwarzmann, H. Hagemann

Departments of Anesthesiology, University Hamburg, Würzburg, Hannover, Germany

Background and Goal of Study: For decades the *gold standard* of volume replacement in paediatric anaesthesia has been human albumin while clinical experience with artificial colloids like hydroxyethyl starch (HES) is still limited (1).

Materials and Methods: After approval of the ethics committee and written informed consent by parents, 2 × 41 children (<24 months scheduled for major surgery at 9 different hospitals, 49 m, 33 f, ASA class 1–3) randomly received 6% HES 130/0.4 (Voluven®, Fresenius Kabi, Germany) or 5% human albumin (HA) for intra-operative volume replacement. Primary parameters were fluid input, hemodynamics, Quick's value, aPTT, clinical chemistry, and adverse events from induction of anaesthesia until Day 3 post-op. Treatment groups were compared by ANOVA or ANCOVA ($P < 0.05$ = sign.).

Results and Discussions: Groups were well balanced with respect to demographics and fluid input. Mean doses of fluids (mL/kg ± SD) in different operations (except 10 other indications) until 6 hours post-op are shown in the table:

Surgery	Neuro	Orofacial	Urologic	Abdominal
HES/HA	5/5	10/12	8/7	12/13
Colloid				
HES	27 ± 12	9 ± 3	12 ± 9	17 ±
HA	28 ± 13	11 ± 5	17 ± 13	18 ± 8
Crystalloid				
HES	68 ± 7	30 ± 10	34 ± 18*	111 ± 80
HA	84 ± 44	29 ± 9	87 ± 86*	75 ± 52
RBCs				
HES	34 ± 26	0	0	3 ± 6
HA	40 ± 32	0	0	5 ± 8

*median: 30 (HES) vs. 37 (HA)

Changes of hemodynamics, coagulation and laboratory parameters were comparable between groups. Adverse events were reported in 80% [HES] and 78% [HA] of patients, respectively. None of the adverse events were considered as probably drug-related to HES or HA.

Conclusion(s): Results of this multicenter trial suggest that HES 130/0.4 is effective, well-tolerated and as safe as HA in different surgical settings in children <24 months.

References:

1 Boldt J et al. *Brit J Anaesth* 1993;70:384–5.

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A-559

A comparison of effects of remifentanil and fentanyl on cardiovascular responses to tracheal intubation in paediatric patients

T. Gaszynski, P. Krajewski, A. Piotrowski, W. Gaszynski

Department of Anaesthesiology and Intensive Therapy Medical University of Lodz, Lodz, Poland

Background and Goal of Study: In paediatric anaesthesia opioids should be used very careful for short procedures. Therefore remifentanil may be an option. However, it may give a profound bradycardia and hypotension after administration. Fentanyl gives more stable induction to anaesthesia but in standard doses may be the reason for residual respiratory depression. We compared fentanyl and remifentanil in equipotential doses for attenuating haemodynamic response to intubation in children.

Materials and Methods: 104 paediatric patients scheduled for adenoidectomy were randomly allocated to one of two groups: 1) remifentanil 2 mcg/kg (53 patients); 2) fentanyl 2 mcg/kg (51 patients). Premedication consisted of midazolam and atropine. Anaesthesia was induced with thiopental and mivacurium. Cardiovascular parameters were recorded after premedication (base line), after induction of anaesthesia, and after intubation. Cardiovascular events after induction were recorded: hypotension- basing on tables of arterial pressure for age, bradycardia – <80 bpm (children < 8 yr) and <60 bpm (children > 8 yr). A hypertension was defined as an increase in MAP over 20%

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after intubation when compared to baseline and was considered as the symptom of light anaesthesia.
Results: Mean age was 6.12 ± 1.8 yr (3–11), and 6.15 ± 1.9 yr (3–13) and mean weight was 23.4 kg (SD 7.13) kg, and 23.5 (SD 8.3) kg, in group 1 and 2 respectively. Hypotension occurred in 13.2% (7/53) and 9.8% (5/51) of children and symptoms of light anaesthesia after intubation in 43.4% (23/53) and 58.8% (30/51) in remifentanil and fentanyl groups respectively. In one case in remifentanil group a bradycardia was noted. The differences in compared parameters were statistically significant ($p < 0.05$) for the incidence of light anaesthesia only.
Conclusion: We found remifentanil safe and more potent than fentanyl in equipotential doses for attenuating cardiovascular response to intubation in children.

A-560

Dexmedetomidine reduces emergence agitation after Sevoflurane anesthesia in children

M. Ibacache, H. Muñoz, V. Brandes

Department of Anesthesiology, Catholic University of Chile, Santiago, Chile

Background and Goal of Study: Sevoflurane anesthesia is associated with emergence agitation in children (1). Since Dexmedetomidine (Dex) is an alpha 2 agonist useful for postoperative sedation (2), we examined the effect of two different intraoperative bolus doses of Dex on emergence characteristics of Sevoflurane anesthetized children.
Materials and Methods: In a double-blind, prospective trial, 90 ASA I, 1–10 years old children, undergoing general anesthesia for inguinal hernia repair, orchiopexy and/or circumcision, were randomized to receive placebo (Group 1: n = 30), Dex 0.15 μg/kg IV (Group 2: n = 30), or Dex 0.3 μg/kg IV (Group 3: n = 30), administered in 10 minutes, after induction. Induction and maintenance of anesthesia was with Sevoflurane and N_2O 50% in oxygen. A caudal block was performed before surgery for pain management. Patients breathed spontaneously through a LMA. Hemodynamic (heart rate, mean arterial pressure) and ventilatory (respiratory rate, $ETCO_2$) variables were recorded every 5 minutes, during the entire procedure. At the conclusion of surgery, anesthetics were terminated. Recovery (time to eye opening, time to achieve Aldrete score > 10, time to discharge from postanesthetic care unit (PACU)) and anesthetic emergence characteristics (3) (incidence, severity and duration of agitation), were assessed until the discharge from PACU. ANOVA for parametric data, χ^2 for agitation and Bonferroni's correction for paired comparisons were used for statistical analysis. A p value < 0.05 was defined as statistically significant.
Results and Discussions: There were no differences in demographic, hemodynamic, ventilatory and recovery data, in the three groups. Duration and severity of emergence agitation were similar among groups; however, the incidence was 37% in Group 1, 17% in Group 2 and 10% in Group 3 ($p < 0.05$ among groups and $p < 0.05$ for Group 3 versus Group 1).
Conclusion(s): A bolus dose of Dex 0.3 μg/kg IV after induction is safe and effective to reduce emergence agitation in children after Sevoflurane anesthesia.
References:
1 Jöhr M. *Paediatric Anaesthesia* 2002; 12: 293–295.
2 Hall J, et al. *Anesth Analg* 2000; 90: 699–705.
3 Aono J, et al. *Anesthesiology* 1997; 87: 1298–1300.

A-561

Two different doses of rocuronium for neuromuscular blockade in paediatric patients

N. Stogiannidis, E. Sfyra, M. Georgiou, A. Foulidou, A. Vachlioti, F. Kanakoudis

Department of Anaesthesia, "G. Gennimatas" Hospital, Thessaloniki, Greece

Background and Goal of Study: Rocuronium 0,6 mg/kg provides adequate intubating conditions and rapid onset time in children.[1] The aim of the study was to compare the onset time and the duration of action of two different doses (0,45 mg/kg and 0,6 mg/kg) of rocuronium in paediatric patients.
Materials and Methods: In a prospective trial, 43 paediatric patients, ASA I, aged 2 months to 12 years, were studied. They were assigned to two groups according to rocuronium dose (Group A: 0,45 mg/kg, n = 21 and Group B: 0,6 mg/kg, n = 22). After induction of anaesthesia with propofol 3 mg/kg and fentanyl 3 μg/kg, a single dose of rocuronium was administered. Anaesthesia was maintained with sevoflurane 1vol% and a mixture of N_2O 60% in O_2. Neuromuscular blockade was assessed by the accelerographic response of the adductor pollicis, stimulating the ulnar nerve with single twitch stimuli. The onset time (from 100% to 0% response) and the reversal time (from 0% to 25%, from 25% to 50% and from 50% to 75% response) of neuromascular blockade were recorded. Intubating conditions were also evaluated. Statistical comparisons were performed by Student's t-test (statistical significance when $p < 0,05$).
Results and Discussions: There were no significant differences in distribution of age and weight between the groups. Intubating conditions were adequate in both groups. Data (mean ± SD) of time are shown on the table:

	0% (sec)	25% (min)	50% (min)	75% (min)
Group A	62 ± 32	17 ± 8	4 ± 2	4 ± 3
Group B	62 ± 20	25 ± 7	6 ± 5	5 ± 3
	NS	$p < 0,05$	NS	NS

Conclusion(s): In patients of this study rocuronium 0,45 mg/kg provided adequate intubating conditions and onset time similar to rocuronium 0,6 mg/kg but it had significant shorter duration of action compared to rocuronium 0,6 mg/kg.
Reference:
1 Vuksanaj D. *Paediatr Anaesth* 1996; 6(4): 277–81.

A-562

Inflammatory response in children undergoing open or laparoscopic appendectomy

G. Wild, S. Spaniel, U. Sack, U. Burkhardt

Departments of Anaesthesiology and Intensive Care, University of Leipzig, Leipzig, Germany

Background and Goal of Study: Laparascopic appendectomy (LA) is said to be less traumatising than open appendectomy (OA). A prospective controlled study was performed to describe differences of the inflammatory response in children diagnosed for acute appendicitis comparing OA versus LA.
Materials and Methods: A total of 47 children (median age 11 years) were analysed, OA was performed in 24 patients, LA in 23 patients. General anaesthesia (TIVA) was standardized. Blood samples were drawn on 6 defined points of time (POT), between start of anaesthesia and 48 hours after surgery and tested for leucocytes, CRP, PMN – elastase and the cytokines IL1-RA, sIL-2R, IL-6, IL-8, TNF alpha, sTNF-R. Histological, microbiological and antibiotic findings were documentated.
Results and Discussions: IL-6 and CRP and to a smaller extent IL-1RA and PMN-elastase, presented clear peri-operative dynamics. A difference in the inflammatory response between LA and OA was not detectable by measuring the cytokines, leucocytes or CRP. Patients with complications had significantly higher IL-6 levels at POT 3.

IL-6 (mean)	1	3	6
all	20,5	30,8	12,2
OA	17,4	27,6	8,9
LA	23,5	33,9	15,9
complications	26,8	**81,3 s**	27,4
no complications	19,9	26,0	10,8

Conclusions: We favour IL-6 as a very reactive parameter for the perioperative inflammatory monitoring. Because of its early onset time it has a higher predictive value than CRP as for the development of complications.
References:
1 Merhoff AM et al. *Am J Surg* May 2000, 179: p. 375–378.
2 Goodwin et al. *Ann R Coll Surg Engl*. 79: p. 130–133.

A-564

Children's drawings as a measure of preoperative anxiety level

K. Puura[1], A. Puura[2], M. Rorarius[1], P. Annila[1,3], H. Viitanen[1], G. Baer[1]

[1]University Hospital and University of Tampere, Finland; [2]District Hospital of Valkeakoski; [3]City Hospital of Tampere

Background and Goal of Study: No simple method exists to distinguish children in need for premedication. The present study was planned to detect preoperative anxiety level of children by rating their drawings.
Materials and Methods: Sixty ASA I children aged 4–7 years undergoing adenoidectomy were divided in AGIT and CALM groups according to agitation level observed during venous cannulation by a nurse blinded to the

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groups. All children drew a picture at three different times: 1. Just after arrival in the day-case unit, 2. 10 min before operation and, 3. prior to leaving for home. The children were also randomized to three premedication groups: group D rectal diazepam 0.5 mg/kg, group P 0.9% NaCl 0.1 ml/kg rectally and group NT no premedication.

Five features from the children's drawings were rated with a three point scale with zero indicating no or very little anxiety, 1) moderate anxiety and 2) clear anxiety. The size of the drawing, the form of the drawing line, the colours used, the mark of the pen and the clarity of the picture were rated. The ratings of each feature were made to form a sum score of anxiety ranging from 0 to 10. An independent assessor familiar with the criteria (KP) assessed all the pictures blinded to the group belonging and the time point of the child drawing the pictures.

The anxiety scores of the drawings of these two groups with different agitation levels were compared. In the analysis of variance for repeated measures both the premedication group and agitation score were taken into the model as factors.

Results and Discussions: The anxiety score of the drawings of the very agitated children (during venous cannulation) was significantly higher already after arrival into the hospital [AGIT 4.76 (SD 2.5) vs CALM 3.67 (SD 2.4) $P = 0.029$]. There were no statistical differences in the drawings between the different premedication groups at any time point.

Conclusion: When routine sedative premedication is not used the drawings of the children might detect the children needing sedative premedication.

A-565

Generating a learning curve for penile block in children

G. Schuepfer, M. Jöhr

Department of Anesthesiology and Critical Care, Kantonsspital Lucerne, CH-6000 Lucerne 16, Switzerland

Background and Goal of Study: Penile block is an effective analgesic method. Few data exist on the learning curve for this block**.**

Materials and Methods: After premedication with rectal midazolam (1 mg/kg up to 15 mg) anesthesia was induced by inhalation of 8% sevoflurane and 60% nitrous oxide in oxygen. The standard monitors were applied, the airway was secured using a laryngeal mask, and venous access was achieved. During surgery spontaneous ventilation was maintained with 0.7 to 1.2 MAC sevoflurane. For the subpubic penile block the penis was fixed between the thighs using tape. The symphysis pubis was palpated with the index of the left hand and two paramedian injections using 25 G, 2.54 cm, neonatal spinal needles (Becton Dickinson) were performed. The needles were inserted 0.5 to 1.5 cm lateral to the midline, immediately below the pubic bone, and directed slightly medially (10° to 20°) and slightly distally (10° to 20°), until a marked give was felt when Scarpa's fascia was pierced and the tip of the needle entered the subpubic space. After careful aspiration 0.1 ml/kg (up to 4 ml) bupivacaine 0.75% without epinephrine was injected on each side, resulting in a total dose of 1.5 mg/kg bupivacaine. The effect of the block was assessed during surgery by an independent observer during surgery using binary rating. The data were assessed using a bootstrap technique in conjunction with a Monte Carlo simulation procedure to estimate confidence intervals and to reach consistent results.

Results and Discussions: A total number of 392 blocks were performed, the overall success rate was 92.1%. There was no statistical difference between the success rate of the two staff members (success rate: 96.3%) and the overall success rate of the 29 residents performing a total of 339 blocks. The total success rate for this group was 91.5%. The failure rate for the first 10 blocks performed by the residents was 8.82% (95% – confidence interval (CI): 5,0–14.14%), for the next 10 blocks it was 4.12% (CI 95%: 1.13–10.22%) and from block 21 to 40 6,5% (CI95%: 2.65-12.9%). For block 41 to 60 the failure rate was 4.4% (CI 95% 0.54–15.15%).

Conclusion(s): Penile block in children is easy learnt by residents. A steep learning curve was found. After more than 40 blocks the success rate is over 93.5%. A small dip in performance after the 20th block was observed.

A-566

Spinal anesthesia for diagnostic cardiac catheterization in children

I. Keidan, R. Katzenelson, T. Hegesh, Y. Salem, Y. Danieli, A. Perel

Department of Anesthesia and Intensive Care and Department of Paediatrics, Sheba Medical Centre, Tel Hashomer, Israel

Background and Goal of Study: To study the efficacy of spinal anaesthesia during diagnostic cardiac catheterisation in children with congenital heart disease.

Materials and Methods: The demographic data and diagnosis of six infants studied are presented in table 1. Spinal anaesthesia was performed with hyperbaric bupivacaine 0.5% 1 mg/kg. For additional sedation (3 patients) incremented doses of midazolam 0.05 mg\kg were given. Hemodynamic, respiratory and neurological status was evaluated in each patient before and during the procedure. Recovery profile and complications were also recorded.

Results and discussions: Spinal anaesthesia was performed successfully in all patients. No hemodynamic or respiratory variables changed significantly after spinal anaesthesia (table 2). At the end of the procedure femoral vessels compression was easily performed. Discharge criteria were met within 30 minutes from the end of procedure in all patients.

Conclusions: Spinal anaesthesia is a safe alternative to other anaesthetic methods for cardiac catheterisation in high-risk infants. It provides a stable hemodynamics and respiratory status and allows rapid recovery and discharge.

Table 1: Patient's demographics.

Patient	Age (weeks)	Weight (g)	Diagnosis
1	3	2680	HLHS.
2	4	3630	TGA
3	52	7700	Corrected TGA
4	12	5200	TAPVR
5	17	4490	VSD, PFO, MR,
6	24	5940	MR, CHF
Mean ± SD	19 ± 18	4920 ± 1780	

Table 2: Hemodynamic and respiratory parameters

Parameter	Before Procedure	During Procedure	End of Procedure
MAP (mmHg)	64 ± 4.9	65 ± 13.9 *	58 ± 9.3
HR (beats/min)	144 ± 11.6	138 ± 12 *	13 ± 7.21
Saturation (%)	84 ± 14	82 ± 14 *	83 ± 13
PaCO2 (mmHg)	40.7 ± 1.8	43 ± 2.8*	

*p > 0.05 when comparing parameters before and during the procedure

A-567

The effects of clonidine on bupivacaine 0.25% in ilioinguinal and iliohypogastric nerve block in children

M. Methamem, Z. Zrelli, F. Sliman, K. Saidi, D, Ben letaifa, Ben Abdelaziz*, O. Kaabachi

*Department of anaesthesia and surgical intensive care; *Department of statistics, Sahloul Hospital, 4011 Sousse, Tunisia*

Background and Goal of Study: The admixture of clonidine to local anaesthetics in peripheral nerve block has been reported to result in a prolonged block (1,2). Clonidine has never been used in peripheral nerve block in children. The aim of the present study was to evaluate the effects of clonidine added to bupivacaine on duration and quality of ilioinguinal and iliohypogastric nerve block.

Materials and Methods: Eighty two children undergoing either hernia repair or orchydopexy were randomised in two groups. Group A received 0.3 ml/kg bupivacaine 0.25% added to 1 μg/kg clonidine and group B received only bupivacaine. Heart rate, arterial pressure, respiratory rate, oxygen saturation, intravenous analgesic requirement were recorded during surgery. Modified CHEOPS and analgesic supplementation were recorded in the recovery room. The quality of pain relief on the first day and parental satisfaction were assessed via a phone interview. Statistic analysis used T test and ANOVA for continuous parameters (mean ± DS) and X2 and Mann–Whitney test for parametric data (%). $P < 0.05$ was significant.

Results and Discussions: Demographic data; age, weight and duration of surgery were similar in both groups. No difference was noted with respect to preoperative records and intravenous analgesic supplementation (groupA 18% vs. groupB 36% $P = 0.51$), postoperative analgesic requirement in the recovery room (groupA 15.4% vs. groupB 22.5% needed rectal or oral analgesics $P = 0.28$) and parental satisfaction. Side effects, sedation, bradycardia, hypotension, nausea and vomiting were absent in both groups.

Conclusion(s): The adduction of 1 μg/kg clonidine to bupivacaine 0.25% in ilioinguinal iliohypogastric nerve block for hernia repair and orchydopexy in children did not lead to any advantage compared with only bupivacaine.

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A-568

Paediatric spinal anaesthesia with 1% hyperbaric bupivacaine

E. Vincenti, C. Garro, A. Grieco, A. Carlot, S. Sarmast-Samimi

Department of Anaesthesiology and Intensive Care, Dolo Hospital, Venice, Italy

Background and Goal of Study: Regional anaesthesia is widely used in paediatric surgery, but spinal block remains confined to few cases. The reason is that 0.5% bupivacaine (B) spinally injected offers a duration of action too short in children. We have chosen 1% hyperbaric B for spinal administration in order to obtain a strong spinal block suitable to assure anaesthesia for a duration of surgery of no more than 75 min without increase of the anaesthetic volume.

Materials and Methods: 124 consecutive children aged 0–15 yrs ASA I–III scheduled for general (non abdominal), orthopaedic or urologic surgery were submitted to spinal anaesthesia. Pencil point spinal needles of 35–70 mm were employed. The volume of 1% B was chosen by each anaesthesist according to his own experience. Only lateral decubitus was adopted for spinal puncture. S-ketamine orally, rectally or i.m. was administered in children less than 6 yrs old or when necessary. In older children i.v. propofol was injected when useful. All patients, breathing oxygen, were monitored and actively warmed. General anaesthesia was performed when the surgery was too long. For practical reasons three consecutive groups of age have been determined for statistical analysis: 0–3, 4–8, and 9–15 yrs.

Results and discussions: Table shows the main results. In all cases but 1 in younger, 3 in median, and 2 in older group the spinal blocks assured complete anaesthesia until the end of surgery. No side effect was observed.

	Range (yrs)	n.of cases	Age (yrs)	Weight (Kg)	1% B (ml)	Surg.dur. (min)
	0.33–3	38				
mean			**1.97**	**12.82**	**0.51**	**50.7**
Std.Dev			0.92	2.77	0.13	18.9
	4–8	47				
mean			**5.55**	**18.87**	**0.66**	**51.4**
Std.Dev			1.40	4.07	0.11	20.4
	9–15	39				
mean			**11.72**	**39.33**	**1.02**	**52.3**
Std.Dev			2.01	14.20	0.24	23.1

Conclusion: Spinal block in children with 1% bupivacaine offers a very good anaesthesia for peripheral surgery lasting until 75 min without producing any side effects, if the operators are trained and skilled anaesthesists.

A-569

Efficiency of continuous peripheral nerve block with elastomeric disposable pumps associated to initial Biers bloc for recurrent paediatric Complex Regional Pain Syndrome (CRPS)

R. Troncin, C. Dadure, F. Motais, C. Ricard, X. Capdevila

Department of Anaesthesiology A, Hospital Lapeyronie, Avenue du Doyen Gaston Giraud, Montpellier Cedex 5, France

Background and Goals: Complex Regional Pain Syndrome (CRPS) I is not rare in a paediatric population. We conducted this study to evaluate the efficiency of a continuous peripheral nerve block with elastomeric disposable pumps associated to initial Bier's blocks for the treatment of recurrent CRPS in children.

Methods: After parental informed consent, 10 children non-responders to CRPS conventional treatment were included. After general anaesthesia, peripheral nerve block (PNB) was performed. 0.5 $ml.kg^{-1}$of 1% lidocaine with epinephrine and 0.5 % ropivacaïne were injected in the PNB catheter. Then, a 20 min Bier's block was realised using a tourniquet. 0.2 $ml.kg^{-1}$ of 1 % lidocaine, 3 $ml.kg^{-1}$ of Elohes^{R} (HES 130/06) and 5 $mg.kg^{-1}$of buflomedil were intra-venously injected. A continuous infusion of 0.2 $ml.kg^{-1}.h^{-1}$ of 0.2 % ropivacaïne was realised on the catheter using an elastomeric pump (Infusor LV, Baxter, France) for 96 hours (H). Rescue analgesia, side effects, motor or sensory block were noted at H24, H48 and H96, as well as ambulatory score ranging from 1 (stays in bed) to 5 (walks easily). Children and parents were asked for satisfaction (satisfaction scale). A follow up was done for all children after two months.

Results: 10 children of 13 (9–16) years old were included. Neither PNB catheters or Bier's block involved side-effects. Duration of continuous infusion was 48 hours. Pain score and Bromage scale score (median and extremes) are shown in table

	H1	H6	H12	H24	H48	H72	H96
Pain	0	0	0	0	0	0	0
Score	(0 ;6)	(0;6)	(0;0)	(0;7)	(0;0)	(0;0)	(0;0)
Bromage	1	1	1	0	0	0	0
Score	(0;3)	(0;3)	(0;3)	(0;2)	(0;2)	(0;1)	(0;1)

One child needed rescue analgesia. All children were able to walk easily after a 24 hour period (walking score $>$ 4). Children and parents were all satisfied. After two months, none of the children presented any clinical symptom of recurrent CRPS.

Conclusions: An initial Bier's block with a continuous peripheral nerve block seems the best treatment for recurrent paediatric CRPS. It allows early mobilization, one day hospital stay with a real psychological benefit for young children.

A-570

Continuous Psoas compartment block with disposable elastomeric pumps for postoperative analgesia in children

C. Dadure, R. Troncin, P. Gaudart, O. Raux, X. Capdevila,

Department of Anaesthesiology A, Hospital Lapeyronie, Montpellier, France, Hospital Lapeyronie, 34295 Montpellier Cedex 5, France

Introduction: Femoral or hip surgeries are very painful in children. The aim of this prospective study was to evaluate the feasibility and efficiency of continuous psoas compartment blocks using disposable elastomeric pumps for postoperative analgesia after these major orthopedic surgeries.

Methods: After parental informed consent, 15 consecutive children scheduled for hip surgery were included. After general anaesthesia, psoas compartment blocks catheters were inserted according to the technique described by Capdevila and al (Anesth Analg 2002;94:1609–13). 0,5 ml/kg bolus of a mixture of 1% lidocaïne with epinephrin (1/200000) and 0,5% ropivacaïne were injected. After contrast media assessment of the catheter location, a disposable pump (Infusor LV® Baxter) with 0,2% ropivacaïne was connected and each pump flow was adjusted to patient's weight. Postoperative pain was evaluated using VAS or CHIPPS scores values at H1, H6, H12, H24, H36 and H48, as well as amounts of rescue analgesia, adverse events and the motor (Bromage score) blocks. Niflumic acid and paracetamol were systematically used. 0,2 mg/kg IV nalbuphine was used as rescue analgesia if VAS score $>$ 3. Ambulation (scale ranged from 1 (remain in bed) to 5 (free ambulation outside the hospital)), parents and nurses satisfaction and the workload generated by this process of analgesia were evaluated. Results are shown by median (range) values.

Results: 15 children of 8 (1–14) years old were included. The median time of surgery was 134 (49–540) minutes. All blocks were effective for surgery. Postoperative analgesia was excellent (table).

Median (range)	H1	H6	H12	H24	H36	H48
VAS/CHIPPS	1 (0–3)	0 (0–3)	0 (0–8)	0 (0–9)	0 (0–7)	0 (0–0)
Motor block	1 (0–3)	1 (0–3)	1 (0–3)	1 (0–3)	0 (0–3)	0 (0–2)
Rescue analg.	7/15	2/15	0/15	6/15	3/15	1/15

No major adverse event was noted. 5 patients on 15 (33%) moved freely outside the room (score $\geqslant$ 4), 9 on 15 (60%) remained in bed without pain. 14 parents on 15 (93%) were satisfied. The nurses were satisfied (14/15) and found that their workload was decreased (13/15) compared to a traditional analgesic regimen.

Conclusions: Postoperative analgesia with continuous psoas compartment blocks is a very efficient technique in children after major lower limb orthopedic surgery.

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Obstetric Anaesthesia

A-571

Self-controlled intranasal analgesia using alfentanil for pain relief in labour

P. Shannon A. Harrison

Anaesthetics and Critical Care, Doncaster Royal Infirmary Doncaster DN2 5LT, UK

Background and Goal of Study: Intramuscular opioids produce poor analgesia for women in labour [1]. Epidural analgesia is not acceptable or available to all labouring women. This study assesses the acceptability of self-controlled intranasal spray using alfentanil [2].

Materials and Methods: 50 low-risk women, in spontaneous or induced labour, who requested analgesia for pain were offered alfentanil nasal spray. The spray delivered 90 micrograms of alfentanil per actuation, with a 3-minute lockout interval. Pain, pain relief, sedation and nausea scores were recorded on a regular basis. After delivery, women completed questionnaires to assess the acceptability of the analgesia.

Results and Discussions: 9 (18%) women required epidural analgesia. The current epidural rate in our unit is 30%. No women in spontaneous labour required epidural analgesia. The median amount of alfentanil used was 3 mg (range 0.75–9.5). Median satisfaction score was 7 out of 10 (mean 6.18, range 0–10). 80% reported that the spray worked quickly enough, 98% that the spray was easy to use, 88% that the taste was not unpleasant and 76% would be happy to use the spray again. Median Apgar score was 9 at 1 minute, and no baby required naloxone.

Conclusion: Self-controlled intranasal analgesia using alfentanil was acceptable to most women in labour and was without significant side effects. It may provide an alternative to both intramuscular opioids and epidural analgesia, and could be used in a community setting. We now plan to conduct a randomised, controlled trial on this technique.

References

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2 Hallet A, O'Higgins F, Francis V and Cook TM. Patient-controlled intranasal diamorphine for postoperative pain: an acceptability study. *Anaesthesia*. 2000; **55**: 532–539.

A-572

Minimum local analgesic dose of intrathecal levobupivacaine, ropivacaine and bupivacaine for labor analgesia

M. Camorcia, G. Capogna, G. Lyons*, M.Columb+

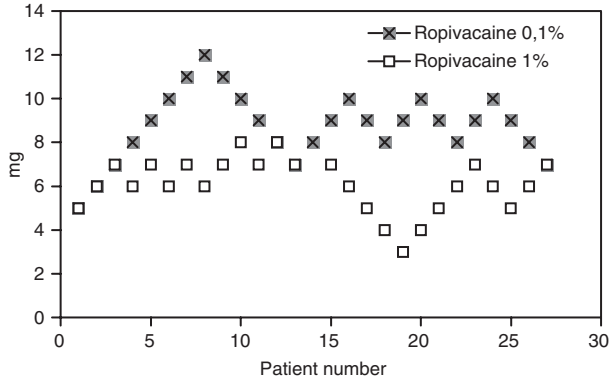
*Departments of Anesthesiology, Città di Roma Hospital, Rome, Italy; *St James's University Hospital, Leeds, UK; +South Manchester University Hospital, Withington, UK*

Introduction: This study aimed to determine the median effective analgesic dose (ED_{50}) of intrathecal levobupivacaine, ropivacaine and bupivacaine for the first stage labor analgesia.

Methods: After informed consent, we enrolled into this prospective double blind sequential allocation study, 97 nulliparous parturients with spontaneous labor, 2–6 cm cervical dilatation undergoing combined spinal epidural analgesia. Parturients were randomised to receive either spinal 0.25% levobupivacaine, ropivacaine or bupivacaine. The dose was determined by the response of the previous parturient to the higher or lower dose, according to up–down sequential allocation. Analgesic effectiveness was assessed using 100 mm visual analogue pain scale with less than or equal to 10 mm within 30 minutes defined as effective. The starting dose was 2.5 mg and the testing interval was 0.25 mg. The ED_{50} was calculated using the formula of Dixon and Massey.

Results: The ED_{50} and the relative potency ratios are reported in the table.

	ED_{50} (mg)	95% *CI*	P
Levobupivacaine	2.95	2.74–3.2	
Ropivacaine	3.75	3.48–4.12	
Bupivacaine	2.32	2.14–2.51	
Potency ratios			
Levobupivacaine vs Ropivacaine	0.8	07–0.9	0.01
Bupivacaine vs Levobupivacaine	0.8	0.7–0.9	0.01
Bupivacaine vs Ropivacaine	0.6	0.5–0.7	0.001



Discussions: We found spinal bupivacaine to be 20% more potent than levobupivacaine and 40% more potent than ropivacaine.

A-573

Cervical dilation in nulliparous women: comparison of combined spinal epidural and epidural analgesia

F. Coskun, M.A. Salman, O. Yapakci, U. Aypar

Department of Anesthesiology and Reanimation, Hacettepe University, Faculty of Medicine, Ankara, Turkey

Background and Goal of Study: Increased cervical dilation rate has been reported during labor with combined spinal–epidural analgesia using spinal sufentanil (1). We aimed to compare cervical dilation rates in patients receiving combined spinal–epidural and epidural bupivacaine fentanyl analgesia.

Materials and Methods: 30 nulliparous full term healthy women in spontaneous labor with vertex presentation were enrolled into the study after ethics committee approval. The patients were allocated into two groups (n = 15) by randomization in order to receive combined spinal epidural or epidural analgesia. The patients in the epidural group received 10 ml of 0.125% bupivacaine and fentanyl 2.5 g ml^{-1} at the onset and infusion of the same solution was initiated at 8 ml hr^{-1}. Infusion was titrated according to the level of sensory block. Catheters were placed before cervical dilation reached 5 cm. The patients in the combined spinal epidural group received 1 ml of bupivacaine 0.25% and 25 μg of fentanyl intrathecally. Obstetricians blinded to the study performed cervical examinations. Cervical dilations were divided by the period between examinations to calculate cervical dilation rates. The results were compared with Mann Whitney U and T tests according to their distribution.

Results and Discussions: There were no significant differences between groups in maternal and fetal demographic characters. Initial cervical dilation rates were greater in the combined spinal – epidural group (2,48 ± 1,50 cm hr^{-1}) compared to epidural group (1,51 ± 1,32 cm hr^{-1}) (p = 0,026) but the duration of the first stage of labor was not different between groups. (p = 0,775 Overall cervical dilation rates were not different (2.40 ± 0,92 cm hr^{-1} in epidural group, 2,74 ± 1,42 cm hr^{-1} in spinal–epidural group p = 0,967). The duration of the second stage of labor was not different (p = 0,838). The oxytocin use, total and maximum doses were not different between groups.

Conclusion: Combined spinal epidural analgesia may cause rapid dilation of the cervix in the initial hours of labor. Duration of labor was not found to be shorter in the combined spinal epidural group. Further studies are required in order to find out the mechanisms that might take place.

Reference:

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A-574

Quality assurance survey for labour analgesia: Results from the University Hospital of Geneva

R. Giraud, C. Kern, R. Landau

Division dAnesthésie, Hôpitaux Universitaires de genève, Geneva, Switzerland

Background and Goals: Combined spinal-epidural (CSE) (1) and patient-controlled epidural analgesia (PCEA) (2) are two popular methods for initiation and maintenance of labour analgesia. As part of a Quality Assurance (QA) program, we standardised our labour analgesic practice and initiated

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our team to CSE with PCEA. The goals were to examine anaesthetic complications, obstetrical and neonatal outcomes, and maternal satisfaction.
Material and Methods: With institutional approval, data was gathered from all parturients delivering with neuraxial analgesia in our institution (HUG) as of July 2001. Choice of epidural (EPID) or CSE was made by anaesthetist. CSE consisted of spinal 2.5 mg bupivacaine (BUP) + 25 mcg fentanyl (F), followed immediately by PCEA BUP 0.0625% + F 2 mcg/cc (10 cc infusion, 5 cc bolus/15 min). For EPID, BUP 0.125% 10 cc + 50 mcg F was given, followed by same PCEA settings. A QA form started in the Labour Room, was completed 24–72 h post-partum by a follow-up of complications and maternal satisfaction.
Results: This prospective study recorded 2174 cases over 15 months. Data are shown in the table. Unpaired *t*-tests were used, $p < 0.05$ considered significant.

	EPID 26% (n = 569)	CSE 74% (n = 1605)	*P*
Uterine hypertonus → fetal brady ♥	1.8%	2.9%	NS
Paraesthesia during procedure	14%	15%	NS
No CSF during CSE	–	5%	–
Wet tap (18G) → epid cath placed	n = 2	n = 6	NS
Unexpected spinal catheter	n = 2	n = 8	NS
Failed analgesia → cath replaced	6.2%*	3.1%	<0.01
Failed analgesia → GA for CS	1.8%	0.9%	NS
PDPH (% treated by BP)	n = 3 (100%)	n = 10 (70%)	NS
Neurol deficits (% due to anaesth)	n = 6 (0)	n = 19 (0)	NS
Pruritis	20.5%	21.8%	NS
Insufficient 1st stage analgesia	8.1%**	4.5%	<0.01
Insufficient 2nd stage analgesia	14.9%	12.9%	NS
Motor block	3.7%	2.8%	NS
Satisfaction (VAS 0–10, ±SD)	8.8 ± 2.1	9.2 ± 1.9	<0.01

*RR 1.6 (95% CI 1.2; 2.1), **RR 1.5 (95% CI 1.2; 1.9)

Conclusions: While introducing new anaesthetic techniques, QA surveys offer important tools to monitor outcome parameters. With PCEA, CSE appeared to provide excellent labour analgesia and maternal satisfaction, with few complications.
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1 Norris M. *Anesthesiology* 2001; 95: 913–20.
2 Van der Vyver M. *BJA* 2002; 89: 459–65.

A-575

Determination of the minimum local anaesthetic concentration (MLAC) of epidural levobupivacaine in nulliparous and multiparous women in labour

S.L. Maguire, I. Razzaq, C. Lok, R. Wadsworth, M.O. Columb

Department of Anaesthesia, South Manchester University Hospitals NHS Trust, Manchester, UK, Central Manchester University Hospitals, Manchester, United Kingdom

Background and Goal of Study: Pain scores during labour differ between nulliparous and multiparous women and this may influence analgesic requirements. The minimum local analgesic concentration (MLAC)[1] model has been used to determine the median effective concentration (ED50) of epidural local anaesthetic agents. A previous metanalysis[1] of these studies found that parity was not a significant factor in influencing local anaesthetic requirements. The aim was to compare the MLACs of levobupivacaine for nulliparous and multiparous women receiving epidural analgesia during the first stage of labour.
Materials and Methods: After local ethical approval, 32 women who requested epidural analgesia at 2–7 cm cervical dilation and who had not received opioid were enrolled. Patients were identified as the nulliparous (n = 20) or multiparous (n = 12) in this prospective study. After lumbar epidural catheter placement, 20 mL of levobupivacaine was given with the test dose omitted for the purposes of the study. The concentration of levobupivacaine was determined by the response of the previous patient to a higher or lower concentration using up-down sequential allocation. Analgesic efficacy was assessed using 100 mm visual analog pain scores with ⩽ 10 mm within 30 min defined as effective. The testing interval was 0.01% wt/vol with 0.10% wt/vol as the initial concentration.
Results: Three patients were rejected leaving 29 women for analysis. Demographics were similar in the groups as was cervical dilatation. MLAC (*95% CI*) was estimated using the up-down formula of Dixon and Massey.[1] Results are shown in the Table:

Group	MLAC % wt/vol (95% CI)
Nulliparous (n = 19)	0.098 (0.042–0.153)
Multiparous (n = 10)	0.103 (0.089–0.117)

Conclusion: The MLACs of levobupivacaine were similar for the nulliparous and multiparous parturients studied. Instantaneous epidural local anaesthetic requirements do not appear to be greater for women experiencing labor for the first time.
References:
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2 Columb MO. Anesthesiology 1999; 90: (Supplement) A74.

A-576

Minimum local analgesic concentration (MLAC) of epidural ropivacaine and levobupivacaine combined with sufentanil in nulliparous patients in advanced labor

S. Loonbeek, I. Buyse, W. Stockman*, E. Vandermeersch, M. Van de Velde

*Departments of Anesthesiology, UZ Gasthuisberg, Leuven, Belgium; *Heilig Hart Ziekenhuis, Roeselare, Belgium*

Background and Goals: A potency difference was observed between epidural administered ropivacaine (ROP) and bupivacaine using the MLAC-methodology (1). Recently, the MLAC of ROP and levobupivacaine (LBUP) were found comparable (2). The aim of our study was to determine the epidural MLAC of ROP and LBUP combined with sufentanil in nulliparous patients who had progressed to more advanced labor.
Materials and Methods: 50 term, vertex-presenting, healthy parturients in advanced labor (>4 cm cervical dilation and ruptured membranes, were randomized to two groups. The first patient in each group received 20 ml of ROP or LBUP 0.13% combined with SUF 7.5 μg. If in the first patient of each group satisfactory analgesia was achieved (visual analogue scale (VAS) for pain >20 mm within 30 minutes and lasting for 60 minutes after the epidural injection), the next patient received a 20 ml dose of 0.01% less concentrated local anesthetic. If however pain relief was insufficient, the next patient received a 20 ml dose of 0.01% more concentrated local anesthetic. From this up-and-down sequential allocation technique the MLAC of epidural ROP and LBUP was then calculated using the Dixon and Massey methodology (1). Maternal and fetal hemodynamic data were recorded and analysed using repeated measures ANOVA for parametric data and Chi-square analysis for non parametric results. Data are presented as a mean ± SD.
Results: The MLAC in the ROP group was 0.090% wt/vol (95% CI 0.039–0.141) and the MLAC in the LBUP group was 0.127% wt/vol (95% CI 0.061–0.193). This difference was statistically significant. Hemodynamic data were comparable between the two groups.
Conclusion: In nulliparous patients in active and advanced labor, ROP, combined with sufentanil, was more potent as compared to LBUP, combined with sufentanil, based on the MLAC methodology. This is in line with Polley et al. who reported similar potency of pure epidural ROP and LBUP (2). This finding is surprising since racemic bupivacaine is significantly more potent then ROP (1).
References:
1 Capogna et al. *Brit J Anaesth* 1999; 82: 371–373.
2 Polley et al. *Anesthesiology* 2002; 96: A1052.

A-577

Analgesic effect of epidural neostigmine in early labour

C. Bavencoffe, F. Roelants, S. Aunac, V. Stainier, P. Lavandhomme

Department of Anaesthesiology, Université Catholique de Louvain, St-Luc Hospital, 1200 Brussels, Belgium

Background and Goal of the Study: Spinal Neostigmine (N) produces analgesia. During labour, intrathecal administration provokes inacceptable side effects like nausea and vomiting (1). In contrast, epidural injection induces analgesia in postoperative conditions without side effects (2). The study evaluates the effect of increasing doses of N (250–750 μg) to initiate labour analgesia.
Material and Methods: At the begin of labour, lumbar epidural puncture was performed at L3–L4 and a catheter inserted in healthy parturients. When VAS was ⩾ 30/100, after a test dose, parturients were randomly allocated to one of the following groups: Sufentanil 10 μg (S; n = 24), S 10 μg and N 250 μg (SN250; n = 20), S 10 μg and N 500 μg (SN500; n = 21) and S 10 μg and N 750 μg (SN750; n = 19) in a total volume of 12 mL. Pain score at 3, 5, 10, 15, 20 and 30 minutes, sensory level, motor block, maternal and fetal vital parameters were assessed. Time until request for supplemental epidural dose (VAS ⩾ 30/100) and maternal side effects were also recorded. Results were expressed as mean ± SD. Statistical analysis used ANOVA; p ⩽ 0.05 was significant.
Results and Discussion: Parturients did not differ concerning demographic data. Maternal and fetal vital parameters remained stable. Duration of epidural analgesia was significantly longer in SN500 and SN750 groups than in S and SN250 groups (respectively 122 ± 59 and 104 ± 42 vs 70 ± 37 and

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62 ± 27 min). Analgesia onset (VAS <30/100) was similar in all groups: ≤5 min. Only N 750 μg provoked nausea and vomiting (4/19). No motor blockade or weakness was recorded in any group.

Conclusions: To initiate labour analgesia, epidural N 500 μg (±6–7 μg/kg) significantly prolonges the duration of S without side effects. Lower dose (N 250 μg; ±3–4 μg/kg) is ineffective and higher dose (N 750 μg; ±10 μg/kg) induces maternal side effects.

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A-578

Epidural neostigmine and sufentanil combination provides rapid and profound analgesia in early labour

V. Stainier, F. Roelants, S. Aunac, C. Bavencoffe, M. Schreiner, P. Lavandhomme

Department of Anaesthesiology, Université Catholique de Louvain, St-Luc Hospital, 1200 Brussels, Belgium

Background: During the first stage of labour, a major goal is to provide rapid and profound analgesia without motor blockade. Epidural sufentanil (S) has been used with success alone or combined with low dose local anesthetics or clonidine (1). Epidural neostigmine (N) is analgesic and potentiates opioids in postoperative conditions without major side effects (2). The study examinates the efficacy of epidural sufentanil–neostigmine combination to initiate labour analgesia.

Material and Methods: At the begin of labour, lumbar epidural puncture was performed at L3–L4 and a catheter inserted in healthy parturients. When VAS was ≥30/100, after a test dose, parturients were randomly allocated to receive: S 10 μg (S10; n = 24), S20 μg (S20; n = 18), S 10 μg and N 250 μg (SN250; n = 20) and S 10 μg and N 500 μg (SN500; n = 21) in a total volume of 12 mL. Pain score at 3, 5 and 10 min, sensory level, motor block, maternal and fetal vital parameters were assessed as well as time until request for supplemental epidural dose (VAS ≥ 30/100) and maternal side effects. Statistical analysis used ANOVA and appropriate tests; p ≤ 0.05 was significant (*with S10 and SN250).

Results and Discussion: Parturients did not differ concerning demographic data. Maternal and fetal vital parameters remained stable. Analgesia parameters are expressed in Table: onset time (% parturients with VAS < 30/100) and duration (min; mean ± SD).

Analgesia	S10	S20	SN250	SN500
Onset 3 min	37.5%	50.5%*	29.4%	47.6%*
Onset 5 min	58.3%	75.2%*	52.9%	57.1%
Onset10 min	58.3%	87.5%*	58.8%	90.4%*
Duration (min)	70.7 ± 37	113.3 ± 33*	64.3 ± 28	122.5 ± 58*
Side effects	0	+	0	0

No motor blockade was recorded in any group. Only epidural S 20 μg induced prurit (35%) and nausea (15%).

Conclusions: To initiate labor analgesia, epidural N 500 μg with S 10 μg is as effective as S 20 μg (potency and duration) but devoid of bothersome side effects.

References:

1 Connely et al, *Anesth Analg* 2000: 91: 374–8.
2 Omais et al, *Anesth Analg* 2002; 95: 1698–1701.

A-579

Prevention of epidural venous puncture. Two types of catheters and two different techniques

A. Reuveni, D. Amsellem, A. Eden, M. Grach, M. Bardiecef, R. Pizov

Department of Anesthesia and Intensive Care, Affiliated to the Rappaport Faculty of Medicine, Technion-haifa, Israel

Background and Goals: Intravascular injection is a major complications of epidural anesthesia. The incidence of blood vessel puncture in obstetrics is in the range of 1 to 11.7% of epidurals [1–2].

Previous studies show that epidural venous puncture is less likely (only 1%) if the epidural space is distended by injection of 10 ml of solution, before catheter insertion [2]. No difference in the incidence of epidural venous puncture was found when two types of epidural catheters were compared [1].

The purpose of this study was to compare two types of epidural catheters with different rigidity [B. Braun 401,18G] (Bra) and [Portex minipack 18G] (Por) and the influence of prior injection of 10 ml of saline on the incidence of epidural venous puncture.

Material and Methods: The study was carried out on 171 consecutive parturients in established labour who request epidural analgesia.The parturients were randomly assigned to four groups:

Group A: Bra without NS; Group B: Bra + NS; Group C: Por without NS; Group D: Por + NS.

The presence or absence of blood in the catheter was recorded. The result were analysed by the Chi square method.

Result: There was no significant difference (p = 0.8) in the incidence of epidural vein pucture among the four groups, as shown in Table 1.

	B. Braun without saline	B. Braun with saline	Portex without saline	Portex with saline	Total
Blood in catheter	6 (12.5%)	3 (7.0%)	5 (12.8%)	5 (12.2%)	19 (11.1%)

Conclusion: No reduction in the incidence of epidural venous puncture was found, neither following the injection of saline, nor with different catheter types (polyamid of B. Braun and nylon of Portex).

References:

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2 Tseng CH. *Acta Anaesthesiol Sing* 1995; 33(1): 27–30.

A-580

Minimum local analgesic concentration (MLAC) of spinal ropivacaine and bupivacaine combined with sufentanil for first stage labor analgesia

R. Tircoveanu*, M. Van de Velde**, B. Hagon*

**Department of Anesthesiology, CHU-Brugmann, Brussels, Belgium; **Department of Anesthesiology, UZ Gasthuisberg, Leuven*

Background and Goal of Study: A significant difference in potency was previously observed between epidural ropivacaine (ROP) and bupivacaine (BUP) using the MLAC-methodology (1). This difference was also observed by the spinal route (2). The aim of our study was to determine the spinal MLAC of ropivacaine and bupivacaine combined with sufentanil (SUF).

Materials and Methods: Following ethical committee approval and written patient informed consent, 60 term, vertex presenting, healthy parturients in labour, requesting epidural analgesia, were randomised to two groups. The first patient in each group received a spinal dose of 2.4 mg ROP or BUP combined with 1.5 μg of SUF. If the first patient's analgesia was satisfactory (visual analogue scale for pain leq; 10 mm within 15 minutes and lasting for 60 minutes), the next patient's dose was decreased by 0.2 mg. If conversely pain relief was insufficient, the dose was increased by 0.2 mg. Spinal doses were diluted in 2 ml saline. From this up-and-down sequential allocation technique the MLAC of spinal ROP and BUP was then calculated using the Dixon and Massey method (3). We recorded the onset and duration of spinal analgesia, the quality of pain relief, relevant obstetric data, demographic data, maternal haemodynamics and foetal heart rate. Side effects were also recorded. Data were analysed using repeated measures ANOVA for parametric data and Chi-square analysis for non parametric results. Data are presented as a mean ± SD.

Results and Discussions: Demographic and obstetric data were similar between the 2 groups. The MLAC in the BUP group was 0.056% wt/vol (95% CI 0.017–0.129) and the MLAC in the ROP group was 0.138% wt/vol (95% CI 0.092–0.184). This difference was statistically significant. All other recorded data were comparable between the two groups.

Conclusion(s): Based on the MLAC methodology using the up-and-down sequential allocation technique, spinal BUP is significantly more potent then spinal ROP.

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A-581

Pregnancy in patients with pulmonary vascular disease: Management and outcome 1997–2002

B.M. Weiss

Department of Anesthesiology, University Hospital, CH-8091 Zurich, Switzerland

Background and Goal of Study: Pulmonary vascular disease (PVD) poses one of the highest risk of maternal mortality. Most women die postpartum (1–3). The goal of the study was to analyze the current management and outcome of pregnancy in women with PVD.

Materials and Methods: Reports of PVD complicating late pregnancy and published from 1997 through 2002 were included in the analysis. Patient and management characteristics (n = 40), early (peripartum) and late (months postpartum) maternal deaths, and fetal/neonatal outcome (n = 42) were

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summarized for Eisenmenger syndrome (ESy), primary pulmonary hypertension (PPH) and secondary vascular pulmonary hypertension (SVPH).

Results and Discussions: Peripartum survival rates slightly improved in the period 1997–2002, compared with 1978–1996 (1–3). Nine of 10 patients died peripartum (day 0 to 21), irrespectively of anesthetic technique and mode of delivery used. Despite low SaO_2 [85% (6)] in ESy women, all neonates survived.

Mean (SD), n (%)	ESy (n = 14)	PPH (n = 17)	SVPH (n = 9)
Age, years	28 (4)	29 (5)	32 (3)
Admission, weeks'	31 (6)	31 (6)	30 (4)
PAP systolic, mmHg*	90 (22)	87 (24)	63 (21)
Delivery, weeks'	34 (3)	35 (3)	33 (2)
Cesarean delivery, n	9 (64%)	11 (69%)	8 (89%)
Vaginal delivery, n	5 (36%)	5 (31%)	1 (11%)
Regional anesthesia, n*	6 (43%)	12 (75%)	4 (50%)
General anesthesia, n*	6 (43%)	4 (25%)	4 (50%)
Pulmonary vasodilators, n	5 (36%)	15 (88%)	5 (56%)
Antithrombotic drugs, n	8 (57%)	15 (88%)	5 (56%)
Early maternal death, n	4 (29%)	3 (18%)	3 (33%)
Late maternal death, n	1 (7%)	3 (18%)	2 (22%)
Fetal/neonatal death, n	0 (0%)	2 (11%)	1 (10%)

*data not available for all patients

Conclusion(s): As in the previous years (3), late diagnosis, late admission, patient's lack of compliance, no/late use of available drugs, and therapy-resistant PVD increased the risk of maternal mortality in 1997–2002.

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A-582

Effects of opioid analgesics on pregnant uterine muscles

N. Kayacan, G. Arici, B. Karsli, M. Akar, M. Erman

Department of Anesthesiology and Reanimation, Akdeniz University Faculty of Medicine, Antalya, Turkiye

Background and Goal of Study: Opioids are often used for labour pain. Some opioids may alter the contractility of uterine muscle. In our study, the effects of opioids: meperidine, fentanyl, alfentanil and remifentanil on contractility of pregnant rat myometrium were studied and compared in vitro.

Methods: The albino rats pregnant for 18–21 days were taken care of in compliance with the guidelins of the Animal Care Center. We obtained a full-thickness myometrial muscle strip (measuring 4×10 mm) from each animal. The myometrial strips were allowed to equilibrate at 1 g tension for 30 min before the addition of experimental drugs. When the contractions became regular, strips were exposed to increased concentrations of meperidine, fentanyl, alfentanil and remifentanil at cumulative concentrations to investigate their effect on spontaneous contractions of myometrium isolated from pregnant rats. The study drugs were used the concentrations from 10^{-8} M to 10^{-4} M in the study. Data were analyzed by analysis of variance with $p < 0.05$ considered statistically significant.

Results: Meperidine at cumulative concentrations of 10^{-5}–10^{-4} M decreased contractile activity of myometrial strips isolated from pregnant rat (66%). Meperidine produced a decrease in the frequency of contractions. The exposure of myometrial strips to alfentanil (43%)* and remifentanil (13%) at cumulative concentrations of $3 \times 10^{-5} - 10^{-4}$ M decreased the contractile activity (*$p = 0.037$). However these drugs had no effect on frequency. Fentanyl at the concentration of 3×10^{-6} M decreased contractile activiy (18%) of myometrial strips with significant effects on the contraction frequency ($p = 0.01$).

Conclusion: All drugs had an inhibitory effect on contractions. Opioid analgesics may help to reduce myometrial contractile activity but further studies are required to verify this possibility both in experimental animals and in pregnant women.

Reference:

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A-583

Anaesthetic management in 9 women with myasthenia gravis for caesarean section

J. Çelik, S. Tuncer, R. Reisli, C.O. Ogün, A. Kamaz, S. Ökesli

Departement of Anaesthesia and Intensive Care, Meram Medical School, University of Selçuk, Konya, Turkey

Background and Goal of Study: We aim to report our experience in anaesthetic management of women with myasthenia gravis (MG) undergoing caesarean section operations and also to review the choice of the anaesthetic technique for caesarean delivery in such cases.

Material and Methods: Nine pregnant women with diagnosed MG, underwent caesarean section operations between the years 1997 and 2002. In four patients, after pre-oxygenation, general anaesthesia was induced with 1–1.5% sevoflurane and i.v. ketamine (2 mg/kg) and maintained with 50:50 O_2/N_2O combined with sevoflurane. In these patients, intubation was performed without muscle relaxation. In other five patients, lumbar epidural block was performed with 16 ml of 0.5% bupivacaine and 100 μgr fentanyl. During delivery and postpartum period, course of the disease was evaluated and haemodynamic and respiratory parameters were recorded. The presence of severe neonatal myasthenia and anaesthetic management of patients during caesarean section were assessed.

Results: Symptoms of MG worsened in one patient receiving general anaesthesia. Her discharge from the hospital was delayed for seven days. No change in course of MG was observed in the other eight patients. Two neonates suffered neonatal MG. (one in epidural anaesthesia and one in general anaesthesia).

Conclusion: General anaesthetic drugs may increase respiratory and muscular symptoms during MG. Therefore we conclude that epidural anaesthesia may be a useful alternative for caesarean section in women with MG. Combining of opioids with local anaesthetics for epidural block is considered particularly beneficial for these patients as it allows the motor blockade to be decreased.

Reference:

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A-584

Spinal isobaric levobupivacaine for cesarean section

M. Camorcia, G. Capogna

Department of Anesthesia, Città di Roma Hospital, Rome, Italy

Introduction: The aim of this prospective, double blind study was to evaluate the same dose but different volumes of spinal levobupivacaine for cesarean section.

Method: After informed consent, we randomised 78 parturients into three equal groups to receive 15 mg of either 0.25%, 0.5% or 0.75% spinal levobupivacaine under combined spinal epidural anesthesia. Sensory block was evaluated with pinprick and light touch test, motor block was assessed based on a modified Bromage scale. Parturients were asked to assess their level of pain on a 100 cm visual analogue pain scale (VAPS). Intraoperative pain was treated with supplemental boluses of epidural 2% lidocaine. Arterial blood pressure was recorded. Hypotension was defined as a 20% decrease in mean arterial pressure. All data were analyzed by a chi square test or a two way ANOVA for repeated measures were appropriate.

Results: There were no differences in onset time (2 min) for sensory and motor block and maximum cephalad spread of anesthesia at 20 minutes. Number (%) of parturients with intraoperative pain and hypotension did not differ between the groups (table).

Levobupivacaine	Pain	Hypotension
0.25%	6 (23%)	17 (65%)
0.5%	5 (19%)	19 (73%)
0.75%	6 (23%)	21 (81%)

Discussion: Provided the dose given (15 mg) to the subarachnoid space is the same, different volume do not affect spinal block.

A-585

Severe pulmonary hypertension during pregnancy: mode of delivery and anaesthetic management

M. Bonnin, F.J. Mercier, O. Sitbon*, S. Roger, M. Humbert*, F. Audibert**, R. Frydman**, D. Benhamou

*Departments of Anaesthesiology, *Pneumology; **Obstetrics; hospital A. Beclere, Clamart, France*

Background and Goal of Study: Pregnancy in patients displaying severe pulmonary hypertension (PH) is a difficult problem in clinical practice. In particular, little is known about mode of delivery and anaesthetic management (1, 2).

Materials and Methods: We retrospectively assessed all pregnant women with severe PH followed in our institution during the last 10 years. Subjects were either pregnant women with a known history of PH prior to pregnancy or *de novo* PH detection during pregnancy.

Results and Discussion: Thirteen pregnant women with severe PH were managed over this period: 5 Eisenmenger's syndrome (ES), 4 primary pulmonary hypertension (PPH), 1 fenfluramine-associated PH (FAPH), 1 PH associated with mixed connective tissue disease (CTDPH), and 2 chronic thromboembolic pulmonary hypertension (CTEPH). Mean age was 32 [22–39] years old and mean duration of gestation was 31 [12–40] weeks. Pregnancy revealed PH in 3 patients (1 PPH, 1 ES, 1 CTDPH). Two patients died before delivery at

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12 & 23 weeks of gestation (1 PPH, 1 FAPH); two other died 1 week & 3 month postpartum (1 CTEPH, 1 PPH). Four patients delivered vaginally with regional analgesia in each case: 1 died (PPH), 1 worsened and 2 remained stable after delivery. Four patients had a caesarean section under general anaesthesia: 1 died (CTEPH), 1 worsened and 2 remained stable after delivery. Three patients had a caesarean section under combined low dose spinal-epidural anaesthesia: all of them remained stable during and after delivery (3 ES).

Conclusion: Pregnancy and delivery carry a high risk of mortality in severe PH patients (2). These data support the contraindication of pregnancy in severe PH. In our series, delivery with caesarean section under spinal-epidural anaesthesia appeared to be a safe approach, although this could be also linked to a better prognosis of ES.

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2 Weiss BM et al. *J Am Coll Cardiol* 1998; 31: 1650–7.

A-586

Remifentanil as maternal sedative agent during endoscopic intrauterine surgery on the placental bed in second trimester pregnant women

J. Dewolf, J. Deprest, D. Van Schoubroeck, R. Devlieger, L. Lewi, A. Teunkens, M. Van de Velde

Departments of Anesthesiology and Obstetrics and Gynecology, University Hospital Gasthuisberg, KULeuven, Belgium

Background and Goal of Study: Remifentanil has been used for sedation during surgery under regional anesthesia[1]. It was demonstrated that minor ventilation decreases occurred[2]. Remifentanil induces fetal immobilization during endoscopic surgery of the placenta[3]. We studied the effects of a prolonged infusion of remifentanil in 25 mothers, undergoing endoscopic surgery of the placenta.

Materials and Methods: Following ethical committee approval and patient consent, 25 2nd trimester pregnant patients were included in a prospective study. Patients underwent combined spinal epidural anesthesia using spinal bupivacaine. Anesthesia was maintained using epidural ropivacaine 0.5%. Following echographic fetal evaluation, IV maternal remifentanil was given in a dose of 0.1 μg/kg/min. Remifentanil was increased or decreased, using 0.025 μg/kg/min increments or decrements, based on pre-decided criteria. Maternal and fetal effects of remifentanil were recorded. Maternal blood gas analysis was performed. Fetal ultrasound was done during surgery to assess fetal mobility. Data are presented as a mean ± SD.

Results and Discussions: Duration of surgery was 64 ± 17 minutes, mean remifentanil dose was 522 ± 181 μg and mean remifentanil rate was 0.115 ± 0.020 μg/kg/min. Fetal immobility was scored excellent or good in 23 women both by the endoscopic surgeon as well as by the ultrasonographer. Fetal heart rate remained stable. No complications were observed. Maternal hemodynamics remained stable. Mild sedation was established in all women using remifentanil infusion (OAA/S score 4 or 5). All maternal and fetal effects of remifentanil were easily reversible within 30 minutes following cessation of the infusion. Remifentanil produced mild respiratory depression (PCO_2 increased from 31 ± 3 to 39 ± 4 mmHg), but this never resulted in apnea or desaturation.

Conclusion(s): Remifentanil effectively sedates 2nd trimester mothers undergoing intrauterine placental surgery with only minimal respiratory depression. Furthermore remifentanil successfully produced fetal immobility, facilitating intrauterine manipulations and surgery.

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3 Verbeure et al. *Anesth Analg* 2001; 92: S223.

A-587

Maternal and fetal blood glucose concentration during anesthesia for cesarian section

H. Hayami, M. Kaneko, H. Kobayashi H. Ettchu

Division of Intensive Care, Yokohama City University Medical Center, Yokohama, Japan

Background and Goal of Study: Because the major factor responsible for placental glucose transport to the fetus is the maternofetal glucose concentration gradient, induction of maternal hypoglycemia should depress fetal glucose uptake (1). We examined changes of maternal and fetal blood glucose concentration during anesthesia for cesarian section.

Materials and Methods: 22 healthy patients have undergone elective cesarian section. Spinal anesthesia using 0.5% hyperbaric bupivacaine 2.0 ml was performed. Ringer's lactate of 700–1000 ml was administered after induction of anesthesia until delivery. Blood glucose concentration was checked at the time described below; (a) Preoperative examination, (b) Before induction, (c) At delivery, (d) Just after operation, (e) 2 hours after operation, (f) 6 hours after operation. Blood glucose concentration of umbilical vein and umbilical artery was also checked just after delivery of placenta.

Results and Discussions: Blood glucose concentration (mmol/l) were; (a) 5.06 ± 1.33, (b) 3.94 ± 1.96, (c) 3.18 ± 0.76, (d) 4.51 ± 1.34, umbilical vein 2.99 ± 0.69, umbilical artery 2.56 ± 0.64. There was a case of a mother who became sleepy and her respiratory frequency decreased to 7/min, her blood glucose concentration was 2.2 mmol/l and blood glucose of umbilical vein was 1.2 mmol/l. All the cases that exhibited blood glucose of umbilical vein under 2.2 mmol/l, maternal blood glucose was under 3.3 mmol/l. Hemodilution by aggressive volume load without glucose, sympathetic nerve blockade by spinal anesthesia can be major causes of maternal hypoglycemia during anesthesia for cesarian section. Symptoms like nausea are often considered to be the results of contraction of uterus but it may be due to hypoglycemia.

Conclusion(s): Both maternal and fetal hypoglycemia can occur during anesthesia for cesarian section even in healthy case.

Reference:

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A-588

What should be the optimal dose of intrathecal morphine for post-caesarean analgesia?

G. Turker, N. Uckunkaya, E. Mogol, S. Sahin, A. Gurbet

Department of Anaesthesiology and Reanimation, Uludag University Medical Faculty, Bursa, Turkey

Background and Goal of Study: Low-dose intrathecal morphine (ITM) and intravenous (IV) patient controlled analgesia (PCA) have both been shown to reduce pain after caesarean delivery.[1,2] The aim of the current double-blind study was to evaluate the quality of analgesia and the incidence and severity of the side effects of ITM administered over a dose range of 0.0–0.4 mg and also determine the optimal dose of ITM for post-caesarean analgesia.

Materials and Methods: After informed consent and ethics approval, fifty term parturients undergoing cesarean delivery and given spinal anesthesia were randomized to one of five groups to receive between 0.0 and 0.4 mg (0.0, 0.1, 0.2, 0.3, or 0.4 mg) ITM in addition to a standard dose of 8 mg heavy bupivacaine. Each patient received IV PCA with morphine (1 mg boluses and 5 min lockout) after the operation and 24-h IV PCA morphine use was also recorded. If the visual analog pain score (VAS 0–10 cm) at rest exceeded 4/10, the PCA morphine dose was increased to 2 mg. The severity score (four point scale) of nausea, vomiting and pruritus were assessed intraoperatively and 4-h intervals during the first 24-h postoperatively. Statistical analysis was done with ANOVA and linear regression analysis for trends among groups.

Results and Discussions: Demographic data and postoperative pain scores were comparable in all groups. IV PCA morphine use was higher in the control group (0.0 mg) than in groups receiving 0.1, 0.2, 0.3, or 0.4 mg ITM (Table 1).

Table 1. 24-h IV PCA morphine use

Groups	0.0	0.1	0.2	0.3	0.4
PCA Morphine (mg)	58 ± 19	25 ± 12*	26 ± 19*	20 ± 14*	19 ± 15*

*$P < 0.001$

There was no difference in IV PCA morphine use between the 0.1 and 0.4 mg groups; despite a fourfold increase in ITM dose. There was no difference between control and treatment groups or among treatment groups with respect to nausea and vomiting. Pruritus increased in direct proportion to the dose of ITM (linear trend, $P = 0.0001$).

Conclusion(s): We concluded that the doses of 0.1 mg ITM produces analgesia comparable with doses as high as 0.4 mg with significantly less pruritus.

References:

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A-589

Postoperative continuous wound irrigation versus patient controlled epidural analgesia (PCEA) following Cesarean delivery: a randomized study

S. Devroe, M. Van de Velde, A. Teunkens, B. Spitz, A. Pexters, E. Vandermeersch

Department of Anesthesiology, University Hospital Gasthuisberg, Leuven, Belgium

Background and Goal of Study: Local anesthetic wound infiltration is effective to treat postoperative pain also following Cesarean section[1,2,3]. In our institution, patient controlled epidural analgesia (PCEA) is the standard

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for post-cesarean section pain relief. This investigation compared standard PCEA versus continuous wound irrigation with ropivacaine 0.2%.
Materials and Methods: Following ethical committee approval and patient consent, 60 patients, scheduled for C-section, were included. Combined spinal epidural anesthesia was performed in all patients. A subcutaneous catheter was implanted in the wound. The catheter was connected to an elastometric pump (Painbuster®, I-flow, Lake-Forest, USA) which infused 5 ml/h of the study solution for 48 h. Mothers were randomized to receive either saline (PCEA-group) or ropivacaine 0.2% (ROP-group). In the PCEA-group, postoperative pain relief consisted of an epidural infusion of 10 ml bupivacaine 0.03% with sufentanil 1 μg/ml and epidural boli of 2 ml with a lock-out of 20 min. In the ROP-group, 5.3 ml bupivacaine 0.03% with sufentanil 1 μg/ml could be infused epidurally using PCEA (lock-out 20 minutes). Data were analyzed with appropriate parametric and non-parametric tests. Data are presented as a mean ± SD.
Results and Discussions: Demographic data were similar between the groups. Visual analogue scale scores for pain in rest and during mobilization were low and similar between the groups. In the ROP-group significantly less epidural local anesthetic was used (420 ± 77 vs 157 ± 53 ml, in the PCEA-group versus the ROP-group). Maternal satisfaction was similar between the two groups. Hospital stay was similar between the groups.
Conclusion(s): Continuous wound irrigation with ropivacaine 0.2% appears effective to manage post-cesarean section pain relief.
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A-590

Intrauterine lignocaine gel application for pain relief during hysterosalpingography: a randomized double blind placebo controlled trial

H. Kafali, M. Cengiz, S. Ganidagli, S. Yurtseven

Department of Anesthesiology and Reanimation, Sanliurfa, Turkey

Background and Goal of Study: The goal of the present study was to evaluate the benefit of lidocaine gel for hysterosalpingography (HSG) and to determine whether intrauterine application of lidocaine gel can reduce the overall pain or the pain of any step of the procedure.
Materials and Methods: 86 patients who underwent HSG were randomized to receive either lidocaine gel (n = 41) or placebo gel (n = 45). Patients, recruiters and assessors were blinded to the gel. Over all pain and pain experienced at various steps of the procedure, and the need for a non-steroidal anti-inflammatory drug (NSAID) after procedure were measured.
Results and Discussions: All eighty-six HSG procedures performed successfully, without artifacts and technical difficulty in imagining the uterus and fallopian tubes. The only significant difference in pain scores was determined on grasping the cervix and at 30 minutes after HSG, with discomfort being significantly less in the lidocaine group
Conclusion(s): Intrauterine instillation of lidocaine gel is not effective in reducing pain experienced during hysterosalpingography however; it may alleviate the pain on grasping of cervix with tenaculum and pain experienced after HSG.

Intensive Care Medicine

A-591

Metoclopramide improves gastric emptying in cardiac surgery patients with early postoperative gastric supply of nutrients

A. Sustic, M. Zelic, J. Sokolic, O. Simic

Departments of Anesthesiology, ICU and Cardiosurgery, University Hospital Rijeka, Rijeka, Croatia

Background and Goal: Early postoperative intra-gastric enteral feeding in cardiac surgery patients is frequently complicated by delay gastric emptying and intolerance of nutrition. Metoclopramide accelerate gastric emptying in mechanically ventilated, critically ill patients. The aim of this study was to evaluate the effect of metoclopramide on gastric emptying in coronary artery by-pass graft (CABG) surgery patients with early postoperative gastric supply of nutrients.
Materials and Methods: In the prospective, randomized, placebo-controlled, double-blind study 40 patients treated at ICU after CABG surgery were studied. The patients were divided in two groups: metoclopramide group M (20 patients: age 60 ± 9 yr.; male 85%) and control group C (20 patients: age 59 ± 8 yr.; male 70%), respectively. In the both groups gastric supply of isoosmotic enteral formula begun 18 hours after surgery (Fresubin, Fresenius Kabi; 30/50 ml/h; total 240 ml) by nasogastric tube and paracetamol absorption test was used to evaluate gastric emptying. After 6 hours, the gastric supply was stopped, paracetamol solution (1000 mg) was administrated by gastric tube and the patients received concurrently 10 mg of metoclopramide i.v. or 2 ml of saline i.v. Venous blood samples were obtained immediately before (t_0) and at 15 (t_{+15}), 30 (t_{+30}), 60 (t_{+60}) and 120 (t_{+120}) min after administration of paracetamol. Paracetamol absorption was assessed from the plasma paracetamol concentration (PPC) and the area under the paracetamol concentration curve from 0 to 120 min (AUC).
Results: The values of PPC immediately before the administration of metoclopramide or saline (t_0) was not significantly different between the groups: group M 2.8 ± 0.9 *vs.* group C 2.4 ± 1.8 ($p = NS$). The PPC values at 15, 30, 60 and 120 min were significantly higher in protocol group M *vs.* control group C: (t_{+15}) 5.4 ± 2.7 *vs.* 3.3 ± 2.5 ($p < 0.05$); (t_{+30}) 6.7 ± 2.4 *vs.* 3.7 ± 2.0 ($p < 0.001$); (t_{+60}) 7.7 ± 2.5 *vs.* 5.1 ± 3.2 ($p < 0.01$); (t_{+120}) 8.5 ± 2.2 *vs.* 5.2 ± 2.8 ($p < 0.01$). The AUC value was 34% larger in the M group than in patients from C group.
Conclusion: In CABG surgery patients with early postoperative intragastric feeding, a single dose of metoclopramide effective improves gastric emptying.

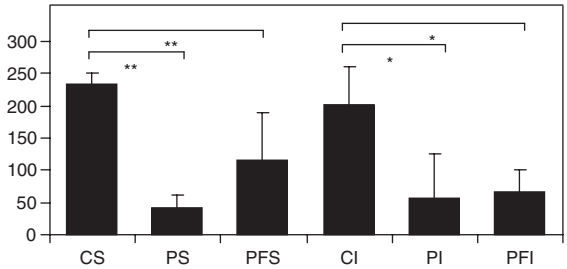
A-592

Effects of propofol and fentanyl on gastric fed pattern in pig

J. Schnoor, J.K. Unger, T. Kuepper, *J. Silny, R. Rossaint

*Department of Anaesthesiology, *Helmholtz-Institute of Biomedical Engineering, University Hospital Aachen, Germany*

Background and Goals of the study: The effects of anaesthetics on gastric motility are still discussed controversially. To investigate the influence of propofol and fentanyl on duration of fed pattern in avoidance of any drugs used for premedication or acute manipulations a long term porcine model was used.
Material and Methods: Six pigs (32–40 kg) were instrumented with an entero-gastrostomy (PEG) and an impedance catheter (1), which was introduced via PEG into the stomach. Measurements were performed for 8-hour-periods on the following three days: I. conscious, II. propofol sedated (8–18 mg $kg^{-1} h^{-1}$), III. propofol-fentanyl analgosedated (propofol: 8–16 mg $kg^{-1} h^{-1}$, fentanyl: 1–8 μg $kg^{-1} h^{-1}$). Anaesthetics were given via CVC. Measurements were started after morning feeding followed by an intermittent nutrition (Biosorb®, Multi Fibre, Germany) via PEG 4 hours after measurements began. Fed pattern were defined as phase II/phase III activities right after gastric intake. Data are shown as mean ± SD analysed by Rank Sum Test of Wilcoxon. Significant differences were regarded for p values < 0.05* and p < 0.001**.
Results:



(Duration of fed pattern in minutes; conscious standard = CS; conscious intermittent = CI; propofol standard = PS; propofol intermittent = PI; propofol–fentanyl standard = PFS; propofol–fentanyl intermittent = PFI).

Conclusions: Gastric fed patterns were significantly shortened during both, propofol sedation and propofol–fentanyl analgosedation.

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Reference:
1 Nguyen HN, et al. *Am J Gastroenterol* 1999; 94: 306–17.
Acknowledgement: Supported by START, RWTH-Aachen, Germany, and B. Braun Melsungen, Germany.

A-593

Evaluation of a new long-term model for measurements of intestinal motility in awake and unrestrained pigs

J. Schnoor, S. Bartz, *B. Klosterhalfen, °W. Kupper, R. Rossaint, J.K. Unger

*Departments of Anaesthesiology, *Pathology, and °Veterinary Medicine, University Hospital Aachen, Germany*

Background and Goals of the Study: In avoidance of any influences by agents used for premedication a new method was used to investigate the effects of anaesthetics on intestinal motility in awake and unrestrained individuals

Material and Methods: The investigation was approved by the local Institutional Animal Use Committee. Seven pigs (male, 32–40 kg) were trained for habituation (HAB) to local housing conditions and laboratory. After the pigs habituation, they were instrumented (OP) during general anaesthesia with a central venous catheter (CVC) and a percutaneous enterogastrostomy (PEG). A catheter for impedancometry (1,2) was introduced via PEG into the stomach and duodenum by endoscopy. Measurements were performed on the following three days in conscious unrestrained, propofol sedated (SD), and propofol-fentanyl analgosedated (ASD) state during spontaneous breathing. Sedation and analgosedation were induced via CVC in avoidance of other drugs.

Results: In four pigs, duodenoscopy was impossible due to pyloric spasm while remifentanil was used for general anaesthesia. The latter could be avoided when (S)-ketamine was used instead. Measurements in conscious unrestrained pigs were feasible without any problems. The resulting protocol is listed in the table:

HAB (n = 7)	OP (n = 3)	SD (n = 3)	ASD (n = 3)
9 days including 4 days of special training	propofol: 15.7 ± 4.2 and (S)-ketamine: 0.5 ($mg\,kg^{-1}\,h^{-1}$)	propofol: 12.2 ± 5 ($mg\,kg^{-1}\,h^{-1}$)	propofol: 13.2 ± 5.7 ($mg\,kg^{-1}\,h^{-1}$) and fentanyl: 4.1 ± 3.7 $\mu g\,kg^{-1}\,h^{-1}$

Conclusions: The porcine model described promoted measurements of intestinal motility in conscious unrestrained pigs and avoided the use of drugs for premedication.

References:
1 Silny J, *Gastrointest Mot* 1991; 3: 151–162.
2 Nguyen HN, et al. *Am J Gastroenterol* 1999; 94: 306–17.
Acknowledgement: Supported by START, RWTH-Aachen, Germany, and B. Braun Melsungen, Germany.

A-594

Perioperative factors associated to postoperative renal dysfunction in orthotopic liver transplantation

A. Sabate, M. Koo, A. Dalmau, C. Moreno, A. Rafecas, C. Lama, J. Figueras, E. Jaurrieta

Departaments dAnestesia i de Cirurgia, Ciutat Sanitaria i Universitaria de Bellvitge, Universitat de Barcelona, Barcelona, Spain

Background and Goal of Study: Orthotopic liver transplantation (OLT) has been associated with a high incidence of renal dysfunction. The aim of our study was to detect which preoperative and intraoperative factors influenced the presentation of acute postoperative renal dysfunction (ARD).

Material and Methods: We prospectively followed up patients scheduled for OLT during a two-year period. We defined ARD when postoperative creatinine was 1.5 times preoperative value (normal creatinine levels <120 μmol/l) and oliguria (<500 ml/24 hours) was presented during the first postoperative week. Preservation of vena cava and portocaval shunt were performed in all patients. Prophylaxis with vancomicine and aztreonam and immunosupresive therapy with basiliximab (started intraoperatively) and cyclosporine in the immediate postoperative period were made.

Results and Discussion: Twenty six patients presented ARD (27.6%). We didn't find differences in relation to: demographic, pre and intraoperative data, except for data showed on the table.

	ARD (n = 26)	Control (n = 68)	P value
Creatinine-pre (umol/l)	108 (57)	92.6 (28)	0.021
Duration of OLT (min)	413 (91)	350 (60)	0.000
Operative-RBC (u)	3.85 (3.8)	1.75 (2)	0.001
Operative-FFP (u)	2.3 (3.3)	1 (1.76)	0.019
Operative platelets (u)	7.2 (7.6)	4.6 (4.5)	0.045
Total (op + post) RBC (u)	5.4 (5.2)	2.6 (3.6)	0.004
Total (op + post) FFP (u)	4 (4.7)	1.8 (2.2)	0.005

Data are expressed as mean (sd). t-Student
Four patients (4.25%) were treated with hemodialysis

Conclusions: ARD was related to preoperative creatinine levels and the duration of OLT. By reducing as much as possible blood product consumption, some renal protection might be obtained.

A-595

Metoclopramide does not stimulate the motility of gallbladder in cardiac surgery patients with early postoperative gastric supply of nutrients

A. Sustic, M. Zelic, J. Sokolic, I. Medved

Departments of Anesthesiology, ICU and Cardiosurgery, University Hospital Rijeka, Rijeka, Croatia

Background and Goal: The gallbladder (GB) volume is a predictor of biliary stasis and the formation of biliary sludge. Early postoperative gastric supply of nutrients after cardiac and noncardiac surgery diminishes volume and stimulates the motility of the GB. The aim of this study was to confirm does metoclopramide further stimulate motility of the GB in cardiac surgery patients with early postoperative intragastric feeding.

Materials and Methods: In the prospective, randomized, placebo-controlled, double-blind study 40 patients treated at ICU after coronary artery by-pass graft CABG surgery were studied. The patients were divided in two groups: metoclopramide group M (20 patients: age 60 ± 9 yr.; male 85%) and control group C (20 patients: age 59 ± 8 yr.; male 70%), respectively. In the both groups gastric supply of isoosmotic enteral formula begun 18 hours after surgery (Fresubin, Fresenius Kabi; 30/50 ml/h; total 240 ml) by nasogastric tube. After 6 hours the gastric supply was stopped and the patients received 10 mg of metoclopramide i.v. or 2 ml of saline i.v. In all patients sonographic measurement of GB volume was performed immediately before beginning of gastric supply (t_{-6}), 6 hours later (t_0), and after 15 (t_{+15}), 30 (t_{+30}), 60 (t_{+60}) and 120 (t_{+120}) min. The measurement was done with portable ultrasonographic scanner (3.5–5 MHz), and the GB volume and gallbladder ejection fraction (GBEF) was calculated with ellipsoid method.

Results: The GB volume in both groups was significantly lower after the period of intragastric feeding comparing to GB volume before: group M 50 ml (t_{-6}) *vs.* 43 ml (t_0) ($p < 0.05$); group C 58 ml (t_{-6}) *vs.* 51 (t_0) ($p < 0.01$). There is not significant differences in GBEF between groups during the study (group M *vs.* group C: (t_{-6}–t_0) 7% *vs.* 5%; (t_0–t_{+15}) −2% *vs.* −2%; (t_{+15}–t_{+30}) 1% *vs.* 3%; (t_{+30}–t_{+60}) 0% *vs.* 0%; (t_{+60}–t_{+120}) 1% *vs.* 3%; p = NS).

Conclusion: Metoclopramide does not have any additional prokinetic effects on GB motility in patients with early postoperative intragastric feeding after CABG surgery.

A-596

Cerebral salt wasting syndrome in patient with severe head injury – a case report

N. Kovac, M. Novkoski, A. Gopcevic, M. Peric

Departments of Anaesthesiology and Intensive Care, University hospital "Sestre Milosrdnice", Zagreb, Croatia

Background and Goal of Study: Cerebral salt wasting syndrome (CSWS) is a rare brain injury complication. It includes severe disorders of both water and salt homeostasis. CSWS comprise profound hyponatremia, polyuria, natriuresis and hypovolemia /dehydration. The excessive natriuresis is common features of both CSWS and Syndrome of inappropriate antidiuretic hormone secretion (SIADH). Those syndromes, however, differ in the mechanisms of water/electrolyte disorders. CSWS develops dehydration, whereas SIADH develops hyperhydration.

Materials and Methods: 16-year-old girl was admitted to hospital because serious polytrauma, with severe head damage including basal scull fracture. After resuscitation she had GCS 4. CT scan at admission indicated cerebral contusion in the occipital region without oedema. The diagnosis of CSWS was established on these clinical data: Plasma sodium 116 mmol/L; Diuresis 8800 ml; Urine sodium excretion 1689 mmol/day; CVP −3 mm Hg. In addition we found: Urine osmolarity 555 mOsm/L; Plasma osmolarity 246 mOsm/L; Digitalis like hormone <0,6 IU/L; Plasma potassium 3,6 mmol/L; GCS 4 with multiple tonic-clonic spasms; control CT scan showed diffuse cerebral oedema.

Results and Discussions: Following the CSWS diagnosis, we started treatment with normal saline and with 3% NaCl infusion. After a few days of these treatment laboratory findings had normalised and neurologically status slightly improved. After seventy days of comma our patient waked up and discharged from ICU to rehabilitation.

Conclusion(s): Since the syndromes of CSWS and SIADH share common clinical and neurological features, it is important to establish diagnosis in the early stages of disorder. These case report indicates the importance of

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electrolyte, osmolality and signs of body fluid volume monitoring in head injured patients, which enable the CSWS diagnosis.

Reference:

1 Harrigan MR. Cerebral Salt Wasting Syndrome: A Review. *Neurosurgery* 1996; 38: 152–160.

A-597

Effects of fish-oil supplementation on the clinical course of critical illness. A multicenter trial

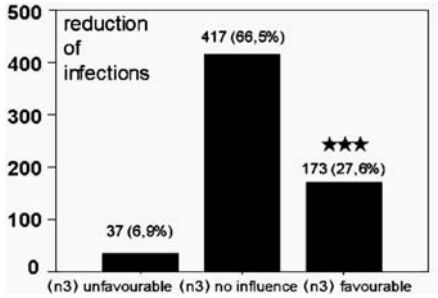
A.R. Heller, J.P. Striebel, T. Koch

Departments of Anaesthesiology and Intensive Care Medicine, University Hospitals of Dresden and Mannheim, Germany

Background and Goal of Study: Supplementation of clinical nutrition with fish-oil, rich in omega 3 fatty acids, exerts immune-modulating and organ-protective effects, even after short term infusion (1,2).

Materials and Methods: We evaluated the impact of supplementation of total parenteral nutrition (TPN) with a 10% fish oil emulsion (Omegaven-Fresenius) on the clinical course of critically ill patients. Primary study end point was occurrence of infections, secondary endpoint was length of hospital stay (LOS). 661 Patients who received TPN for at least 3 days from 82 German hospitals were enrolled in this prospective multicenter trial. TPN was supplemented with 0.1 g/kg/d of FO. Exclusion criteria were lipid- or coagulation disorders, severe diabetes mellitus and circulatory shock. The analysis was approved by the institutional Ethic Review Board.

Results and Discussions: The patients of this survey were 62.0 ± 16.5 years old, with a body mass index of 25.1 ± 4.2. Median length of hospital stay was 24 days (8 ICU). TPN including FO was administered for 8.7 ± 7.5 days and was well tolerated. 529 (80.0%) patients had gastrointestinal diseases, 50 (7.6%) had multiple trauma and 27 (4.1%) had SIRS. While no changes in LOS were detected, occurrence of complications were significantly reduced under fish oil supplementation. Moreover, evaluation of the patients clinical course was found more advantageous ($p < 0.001$). Patients who received at least 5% of the daily calorie intake as FO (corresponding to >20% FO of the lipid fraction) had lower demand of antibiotics within the observation period.



Effects of a fish oil emulsion (n3) on the incidence of postoperative infections. ***$p < 0.001$ M.Whitney U-test

Conclusion: Fish-oil supplementation of TPN is well tolerated and has favourable effects on the perioperative course in terms of lower infection and complication rates.

References:

1 Gadeck JE, et al. *Crit Care Med* 1999.
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A-598

The effect of preventive use of glutamine on diafragma muscle function in CLP-induced sepsis model

N. Doruk, B. Büyükakilli, S. Atici, I. Cinel, L. Tamer, D. Avlan, E. Bilgin, U. Oral

Departments of Anesthesiology and Reanimation, Biophysics, Biochemistry, Pediatric Surgery Medical Faculty of Mersin University, Mersin, Turkey

Background and Goal of Study: In hypercathabolic status glutamine becomes essential for organism and deficiency of glutamine results decreasing of body muscle mass. To search the effect of preventive use of glutamine on diafragma muscle function in sepsis model that is made by çecal ligation and puncturing (CLP) our study was planned.

Materials and Methods: After local ethic comittee aproval 150–200 gr, 32 male Wistar rat divided into four groups. All groups took 45–50 kcal/day normal rat food. During 6 days Group I (n = 8) and Group III (n = 8) took aminoacid solution (aminomix, Abott), Group II (n = 8) and Group IV (n = 8) took aminomix + glutamine (dipeptiven, Fresenius) intraperitoneally. CLP performed to Group I and Group II , Sham procedure performed to Group III and Group IV. The muscle action potentials of diafragma recorded at the beginning of the study and on the 24th hour of CLP (8th day). Measurement was done by BIOPAC MP100 Acquisition System using standardised electromyography technique. The area and amplitude of united muscle action potential has calculated . All groups diafragma Ca-ATPaz levels has calculated biochemically on the 24th hour of CLP.

Results and Discussions: At the measurements done on the 24th hour of CLP in Sham + glutamine group higher amplitude and area has observed then CLP, CLP + glutamine and Sham groups ($p < 0.05$). Diafragma Ca-ATPaz levels were statistically lower in CLP group then other groups ($p < 0.05$).

No decreasing of Ca ATPaz levels in glutamine taking sepsis group thought that glutamine has a important role in calcium metabolism. But no united muscle action potential results parallel to decreasing has seen, that may be a result of early measurement of action potentials (on 24th hour of sepsis).

Conclusion(s): In conclusion to evaluate muscle contractions we need studies done on the 48th, 72th of CLP.

Reference:

1 O'Leary MJ, Ferguson CN, Rennie MJ, Hinds CJ, Coakley JH, Preedy VR. Sequential changes in in vivo muscle and liver protein synthesis and plasma and tissue glutamine levels in sepsis in the rat. *Clin Sci(Lond)* 2001; 101(3): 295–304.

A-599

Antithrombin reduction in acute phase of burn injury. Correlation with severity and organ dysfunction scores

A. Lavrentieva, A. Mina, K. Manos, T.h. Frangia*, P. Kinigopoulou*, L. Lazaridis

*Departments of Plastic Surgery, Burn ICU and *Haematology, Papanikolaou General Hospital, Thessaloniki, Greece*

Background and goal of study: An antithrombin (AT) deficiency develops in severe burn injury as a result of the subclinical disseminated intravascular coagulation and an acquired deficiency of coagulation factors. The aim of this study was to evaluate the correlation of AT activity level with severity and organ dysfunction scores in early postburn period.

Materials and methods: This prospective study was conducted on 15 patients, aged 19–90 years, with severe burn injury (Total Burn Surface Area 58 ± 30%). Blood samples were taken from each patient on days 1 (first postburn day), 3, 7, 14 and, AT activity levels were measured. APACHE II, SAPS II, SOFA scores and Abbreviated Burn Severity Index (ABSI) were evaluated on admission and days 3, 7, 14.

The statistical analysis was performed using ANOVA test and Spearman correlation test.

Results and discussion: On the first postburn day AT activity levels were correlated to ABSI, as well as, to severity and organ dysfunction scores ($p < 0.01$). On day 1, mean AT was 57 ± 29%, ABSI 9.2 ± 2.9, APACHE II 17.4 ± 8, SAPS II 37.7 ± 12 and SOFA 2.7 ± 1.8. During the late postburn period AT activity levels increased in patients with an uncomplicated course only, and correlation with severity and organ dysfunction scores remained significant ($p < 0.01$). AT levels were significantly lower in non-survivors as compared to survivors, from day 1 to day 14. (47.8 ± 13 vs. 87.8 ± 28 on day 1; 95.5 ± 15 vs. 54.5 ± 20 on day 14).

Conclusion: In severe burn injury concomitant antithrombin reduction seems to be present. It is very interesting to notice a high correlation between AT activity levels and organ severity, as well as, burn severity scores.

A-600

EEG burst suppression ratio assessed in the early hours of hospital admission of comatose patients: Any prognostic value?

I. Tanghe, C. De Deyne, A. Van Tichelen, G. Vundelinckx, R. Heylen

Department of Critical Care Medicine, ZOL Genk, Belgium

Background and Goals: Recent investigations (1) have revealed that the EEG silence ratio is a valuable variable showing a high reliability with respect to outcome prediction in severe head injury. Currently, commercially available BIS EEG monitors display this variable as burst suppression ratio (BSR). In the present study we evaluated whether BSR monitoring during the first 24 hours after admission could have any prognostic value in comatose patients arriving to the ER department.

Material and Methods: Over a 12 months period, 26 adult patients with a GCS lower than 8 admitted to our hospital were included. Of these 26 pts, 14 pts suffered from a severe head injury, 7 from intracerebral bleeding and 5 from severe stroke. In all pts, BIS EEG monitoring, with BSR monitoring,

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was applied for a 2 hrs period during the first 24 hrs of admission. Afterwards, all patients received extensive neurological evaluation at 1, 3 and 6 months postinsult.

Results and Discussion: In 3 of 26 pts (all 3 pts revealing BSR exceeding 40%) a markedly high BSR was noted. The BSR pattern of the other 23 pts revealed moderate BSR elevations in 6 pts (BSR between 0–10) while for the other 17 pts no BSR was observed (no burst suppression pattern).

Neurological outcome in the 3 pts with BSR above 40 was extremely poor. 2 pts suffered from severe ischemic stroke, 1 pt suffered from severe subarachnoid hemorrhage and in all 3 pts bad neurological outcome was already predicted by the clinical picture. All 3 pts died within 48 hrs of admission. In the 6 pts with BSR between 0 and 10 no correlation could be found with neurological outcome, as these pts did not reveal a worsened outcome compared with pts that revealed 0% BSR on hospital admission.

Conclusions: Use of BSR to early outcome prediction after severe neurological insult seems only to confirm a bad neurological prognosis, already predicted by the clinical picture. However, in the majority of cases, BSR monitoring seems not able to add new prognostic information.

Reference:

1 *Crit Care Med* 2000; 28: 3522–3529.

A-602

Prognostic significance of organ failure: A comparison between different organ systems

S.G. Sakka, O. Thuemer, K. Reinhart

Department of Anaesthesiology and Intensive Care Medicine, Friedrich-Schiller-University of Jena, Germany

Background: In general, assessment of organ function is important in intensive care medicine, particularly since the degree of organ failure is known to correlate with outcome. Most recently, the SOFA score [1] has been introduced, however, it is still unclear which variables should be used for the assessment of each organ system and to which relative weight each organ system may contribute to the prognosis.

Materials and Methods: We retrospectively analysed data from 195 critically ill patients (69 female, 126 male, age 10–88 yrs, mean 54 $\pm$ 18 yrs) who were treated in our surgical ICU between 1996 and 2000. All patients were sedated, intubated and mechanically ventilated. In all patients (109 non-survivors and 86 survivors) we assessed renal function (creatinine), lung function (PaO_2/FiO_2 ratio), liver function (indocyanine green plasma-disappearance rate, ICG-PDR) [2], coagulation (platelet count) and lactate – as a global marker – within the first 24 hours after admission. Sensitivity and specificity of each variable with respect to survival were analysed by ROC statistics and different ROC curves were compared by using MedCalc (Version 4.16e – Windows 3.1). A $p < 0.05$ was considered as statistically significant.

Results: The area under the curve (AUC) as a measure of accuracy was highest for ICG-PDR (AUC = 0.75) and creatinine (AUC = 0.75). For comparison, PaO_2/FiO_2 ratio (AUC = 0.70), platelet count (AUC = 0.65) and lactate (AUC = 0.63) had lower values. The AUC's were significantly higher for both, ICG-PDR and creatinine, when compared to platelet count and lactate.

Conclusion: ICG-PDR and creatinine as measures of liver and renal function were most accurate and equivalent in their prognostic properties. There was a slightly lower accuracy with respect to outcome for coagulation and lung function, while the prognostic value of lactate was significantly lower. However, the results of this retrospective analysis need to be confirmed in appropriate prospective clinical trials.

References:

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2 Sakka SG. *Chest* 2002; 122: 1715–1720.

A-606

Prognostic value of body temperature and intracranial pressure for patients with severe brain injuries

V. Papuga, S. Milovanovic, P. Mazi

Department of Anesthesiology and SICU, General and Teaching Hospital Celje, Slovenia

Background and Goal of Study: Intracranial pressure (ICP) measurements are an essential part of neurological monitoring when treating patients with severe brain injuries (SBI). Controlled hypothermia is one of the current challenges in efforts to find ways of reducting the risk of secondary brain damage (1). The study was done over a five-year period (1998–2002) on 303 patients with SBI. At admission, the average Glasgow Comma Scale (GCS) value was 7,35. All patients received treatment complying with the approved guidelines for treating SBI (2). The electrode for measuring ICP was applied on 50 patients with the most SBI. We wanted to establish the influence of body temperature (BT) and ICP on the results of the treatment.

Materials and Methods: We followed the higest daily ICP and BT values in the first seven days after injury. As to their BT, the patients were ranked in three groups: I – severely hypothermic (<33°C), II – mild hypothermic (33–35,9°C) and III – patients with BT >36°C. Within the first 48 hours, all patients reached normothermia.

Results and Discussions: In group I, the average GCS was 3,5, and 85% of the patients died. The measured ICP values in patients who died was considerably higher (3,3-8,7 kPa) than in those who survived (0,7 kPa). In group II the average GCS at the time of admission was 5,59. 23,8% of the patients died. The measured ICP values in patients who died was three times higher (4,2 kPa) than in those who survived (1,4 kPa). In group III the average GCS at admission was 7,48. 28,5% of the patients died. The measured ICP values in patients who survived was within the optimal range all the time (0,8 kPa) compared to the ICP values in patients who died (3,9 kPa).

Conclusion(s): We have established that a spontaneous hypothermia within the first 48 hours had no protective role when treating patients with severe brain injuries. High ICP values in patients with a poor outcome of treatment proved to be a crutial indicator of the poor prognosis.

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A-607

Gastric mucosal-end tidal PCO_2 difference variability in surgical critically ill patients

G. Lebuffe, H. Tytgat, P.A. Rodie Talbere, B. Leroy, B. Vallet

Department of Anesthesiology, University Hospital of Lille, Lille, France

Background and Goal of Study: Gastric-to-end tidal partial pressure of carbon dioxide (Pr-etCO_2) has been recently reported as an early indicator of circulatory failure (1). This parameter is rapidly (10 minutes) displayed by an automated on-line capnometer (Tonocap) which opens further perspectives to use it as an end point to guide therapeutic intervention. However, the Pr-etCO_2-associated spontaneous variability over time has not yet been studied.

Materials and Methods: In a University Hospital surgical intensive care unit, 10 sedated and ventilated patients were monitored with the Tonocap during 48 hours. Patients were treated according to the routine clinical practice and the medical staff was blinded to the Tonocap measurements. Any clinical modification requiring therapeutic intervention and/or technical problem associated with the tonometric device were consigned by the medical staff in charge of the patient. Pr-etCO_2, heart rate (HR) and mean arterial pressure (MAP) were registered every 10 minutes and values were automatically stored on a computer disk. The variability of Pr-etCO_2 was assessed before and after removing clinical changes and technical problems. It was expressed as the coefficient of variation (CV) defined as the SD/mean $\times$ 100. The 95% confidence interval was used to describe the expected range of variability of Pr-etCO_2.

Results and Discussions: For the entire population studied, 2880 measurements for each parameter were registered. The corresponding CV was 8% for HR, 11% for MAP and 27% for Pr-etCO_2. By eliminating the variations associated with clinical changes and technical problems (248 values), the mean Pr-etCO_2 value was 11.6 mmHg (1.5 kPa) for the overall pooled patients and the corresponding CV was then 19%. The 95% confidence interval was $\pm$4.5 mmHg (0.6 kPa) variability.

Conclusions: In critically ill surgical ICU patients with stable hemodynamics, a spontaneous variation of Pr-etCO_2 has been demonstrated. A clinical relevance can be considered for variation of Pr-etCO_2 above 4.5 mmHg.

Reference:

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A-608

How good are ICU doctors at predicting hospital outcome?

M. Daniel, P. Stuart, F. McKirdy, J. Norrie

Department of Anaesthesia, Scottish Intensive Care Society Audit Group, Glasgow, United Kingdom

Background and Goal of Study: The majority of patients discharged from intensive care units (ICU) survive to be discharged from hospital. A proportion of patients die in hospital after ICU discharge. We aimed to identify how good ICU doctors' predictions of expected hospital outcome at time of ICU discharge were of actual hospital outcome.

Materials and Methods: The Scottish Intensive Care Society Audit Group database for 1999 was reviewed. At discharge of each patient from ICU, medical staff selected one of 3 options for expected hospital outcome:

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survivor, non-survivor, or uncertain. Final hospital outcome (alive or dead) was recorded in the database. Likelihood ratios (LR) and 95% confidence intervals (CI) were calculated for each prediction of hospital outcome.

Results and Discussions: In 1999, 7250 patients were discharged from 26 adult general ICUs in Scotland. 87% patients survived to hospital discharge. The likelihood ratios for each prediction are listed in the table. 93% of patients predicted to be survivors survived to hospital discharge. 69% of patients for whom doctors were uncertain of hospital outcome survived to hospital discharge. 19% of patients predicted to be non-survivors survived to hospital discharge.

	Hospital outcome		
Doctors prediction	Alive	Dead	LR (95% CI)
Survivor	5612	406	2.00 (1.86–2.15)
Uncertain	672	295	0.33 (0.29–0.37)
Non-survivor	51	214	0.03 (0.03–0.05)

Conclusions: LRs less than 0.1 greatly reduce the probability of the outcome of interest [1]. ICU doctors are able to identify patients who are likely not to survive to hospital discharge; the likelihood ratio is much smaller than that of many commonly used tests [2]. The post-test probability of survival to hospital discharge also depends on the pre-test probability (87%). Despite the small LR, roughly one in five of patients considered by ICU doctors to be non-survivors survive to hospital discharge.

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1 Sackett DL, Straus S. *Evidence-Based Medicine* 1998; 3: 68–70.
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A-609

Procalcitonin levels before and after heart transplantation

E. Urbanska, P. Nadziakiewicz, M. Knapik, W. Saucha, P. Knapik

Department of Cardiac Anaesthesia, Silesian Centre for Heart Disease, Zabrze, Poland

Background and Goal of Study: PCT levels are usually slightly increased after cardiopulmonary bypass or transplantation surgery [1]. The aim of our study was to find out, whether the increase in PCT levels after transplantation could indicate the development of postoperative complications [2].

Materials and Methods: 34 patients underwent heart transplantation. PCT levels were measured before the procedure and within first 24 hours postoperatively. Patients were divided into two groups according to PCT rise from preoperative values during first 24 hours after transplantation group A with PCT rise $<$2,3 ng/ml and group B with PCT rise $>$2,3 ng/ml. Mortality and an incidence of: infection, multiple organ failure (MOF), the need for platelet supplementation (PS) or norepinephrine infusion (NE), renal failure with haemofiltration (HF) as well as the duration of mechanical ventilation (IPPV) have been compared between groups.

Results and Discussions: Study group consisted of 34 patients, the mean age of transplant recipient was 46,9 years. Group A and B consisted of 17 patients each. Mean preoperative PCT value was 0,76 $\pm$ 0,96 ng/ml while mean postoperative PCT value was 12,3 $\pm$ 31,0 ng/ml. The observed rise in PCT values was statistically significant ($p < 0,05$). Median value of PCT rise was 2.3 ng/ml and this level was used as a cut-off point for groups. There were no significant differences in ventilation time or analyzed complications between groups with PCT rise below and above 2,3 ng/ml.

Conclusion(s): Observed increase rise is higher than PCT rise observed after cardiopulmonary bypass or major surgery described in literature. Initial postoperative PCT rise might not signify higher incidence of postoperative complications.

References:

1 Meisner M et al. *Cardiovasc Engineering* 1998; 3: 174–178.
2 Hensel M. et al. *Anesthesiology* 1998; 89: 93–104.

A-610

Focused outreach care can reduce readmissions to critical care and reduce mortality in readmitted patients

D. King, R. Hayden, D. Higgins, I. Ewart

Department of Southend critical care, Southend hospital, Southend, United Kingdom

Background and Goal of Study: A need for critical care outreach services has been identified (1) but a comprehensive service requires additional funding (2). Readmission to critical care is associated with a high mortality. Introducing an unfunded outreach service we focused solely on this high risk group. All discharges from critical care were visited by a critical care nurse. We audited the effect of introduction of outreach on both readmission rates and mortality of readmitted patients.

Materials and Methods: Data was collected prospectively from the date of introduction of outreach in March 2002, recording readmissions, reasons for readmission and outcome. This data was compared with retrospective data from the corresponding period of the previous year.

Results and Discussions:

Time period	ITU discharges	Readmitted	Died on wards	Mortality readmissions
1/3–30/9/01	152	11	35	5/11(45%)
1/3–30/9/02	203	2	26	0/2(0%)

This data reveals an 82% reduction in readmissions after introducing "focused outreach" which is both clinically and statistically significant ($p = 0.0028$, 2-sided Fishers exact test). Mortality associated with readmission was also reduced.

Conclusion(s): Introduction of a "focused outreach service" can reduce readmissions to critical care and mortality of those readmitted, with no additional funding in this case.

References:

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2 Intensive Care Society. *Guidelines for the introduction of outreach services* 2002.

A-611

Comparison between sufentanil and sufentanil+magnesium sulphate for sedation in the intensive care unit with bispectral index

M. Dilek, T. Alparslan, K. Beyhan, O. Nihal, P. Zafer

Department of Anaesthesiology, Trakya University Medical Faculty, Edirne, Turkey

Background and Aim: Inadequate sedative techniques may adversely affect morbidity and even mortality in the intensive care unit (ICU) and the search for the ideal sedative agent continues (1,2). In our study, in ICU patients we aimed to assess addition of magnesium infusion did decrease or not the sufentanil requirements by using BIS.

Material and Method: Thirty adult patients expected to require a 6 h artificial ventilation in ICU were randomized to receive with either sufentanil infusion or sufentanil + magnesium infusion. We used continuously using the bispectral index (BIS). Patients were maintained at sleep was associated with BIS levels in the range of 61–88 BIS values were kept at range of 61–88 by decreasing or increasing sufentanil levels in both groups, hourly sufentanil consumption was determined. Cardiovascular, respiratory, biochemical data were obtained.

Results: There was no significant difference between the groups with respect to cardiovascular, respiratory, biochemical changes. Magnesium infusion when added to sufentanil infusion, decreased the consumption of sufentanil in all the measured times accept first hour ($p < 0.001$). In BIS values, there was no significant difference between the groups ($p > 0.05$).

Conclusion: As a result, this is the first clinical study demonstrating that magnesium infusion decreased sufentanil requirements. Because of the limited number of patients in our study and the short period of observation, our findings need to be confirmed by larger clinical trials of magnesium infused in a dose-titrated manner.

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A-612

Dobutamine inhibits the activation of NF-κB in human T-lymphocytes in vitro

T. Loop, T. Broß, M. Humar, A. Hoetzel, R. Schmidt, H. Pahl, K. Geiger, B. Pannen

Department of Anaesthesiology, University Hospital, Freiburg, Germany

Background and Goal of Study: β-adrenergic agonists are able to inhibit cytokine release from immune cells.[1,2] The nuclear factor κB (NF-κB) regulates the expression of many cytokines and plays a central role in the immune response. It was the aim of this study to answer the question, whether β-agonists interact with the activation of NF-κB in human T-lymphocytes.

Materials and Methods: T-lymphocytes from healthy donors were incubated with dobutamine (D) or phenylephrine (P) and stimulated with phorbol-myristate-acetate (PMA). After extraction of proteins, activation of NF-κB was evaluated by Electrophoretic Mobility Shift Assay (EMSA). Transactivation was studied using reporter gene assays, release of interleukin-8 (IL-8) and -10 (IL-10) were measured by ELISA. Stability of the inhibitor of NF-κB, IκBα , was determined by immunodetection. Autoradiographs were analysed densitometrically

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and compared statistically ($p < 0.05$) by variance analysis (ANOVA with Student-Newman-Keuls-post-hoc-test).

Results: D inhibited dose-dependently the activation of NF-κB, the reportergene-activity, and the release of IL-8 and IL-10. The degradation of IκBα was inhibited by D (1000 μM). However, P had no inhibitory effects.

Table: Data (means ± SD). *P < 0.05 vs. PMA alone.

PMA	–	+	+
Concentration [μ M]	–	–	1000
NF-κB-DNA Binding Activity [Densitometric units]			
D	1464 ± 236*	4235 ± 222	1507 ± 428*
P	876 ± 395*	2283 ± 1054	2216 ± 1178
IκBα stability [Densitometric units]			
D	268 ± 52*	80 ± 17	264 ± 38*
Reportergene-activity [RLU]			
D [×10^3]	13,3 ± 6,4*	66,8 ± 26,2	24,1 ± 8,5*
Cytokine release [pg/ml]			
D – IL-8	671 ± 288*	1260 ± 289	504 ± 237*
D – IL-10	6 ± 5*	3545 ± 523	4 ± 3*

Conclusion: Our results demonstrate the inhibition of NF-κB activation by D in human T-lymphocytes. These inhibitory effects may be a potential molecular mechanism for the antiinflammatory effects of β-agonists.

References:

1 Severn A et al. *J Immunol* 1992; 148:3441–5.
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A-613

Renal effects of norepinephrine in septic and non septic patients

M. Leone, J. Albanèse, A. Bourgoin, J. Antonini, C. Martin

Département dAnesthésie et de Réanimation, CHU Nord, Marseille, France

Background and Goal of Study: In order to assess the effects of norepinephrine on renal function in septic and non septic patients, we conducted an open and prospective study.

Materials and Methods: Fourteen patients with septic shock and 12 uninfected patients with head trauma (GCS < 8) received norepinephrine infusion to raise mean arterial blood pressure > 70 mmHg in the septic group, and cerebral perfusion pressure > 70 mmHg in the head trauma group.

Results and Discussions: Mean arterial pressure increased in both groups ($p < 0.001$) and cerebral perfusion pressure significantly increased in the head trauma group ($p < 0.001$). Cardiac index was not modified in either group. Before norepinephrine infusion, urine flow was respectively 14 ± 13 and 97 ± 11 mL/h in the septic and head trauma groups. Norepinephrine infusion reestablished urine flow in 12 out of 14 septic patients ($p < 0.001$) with a decrease in serum creatinine ($p < 0.001$) and an increase in creatinine clearance ($p < 0.01$) after 24 hours. Urine parameters were not affected in the head trauma group.

Conclusion(s): Norepinephrine has positive effects on renal function in septic patients but has no significant effect on the same urinary parameters when administered to uninfected patients with normal renal function.

A-614

Effects of hydrocortisone in stress doses on host defence

A.R. Heller, S.C. Heller, A. Borkenstein, T. Koch

Department of Anaesthesiology and Intensive Care Medicine, University Hospital of Dresden, Dresden, Germany

Background and Goal of Study: Although the use of corticoids during sepsis is controversial, reversal from septic shock has been reported due to stress doses of hydrocortisone. We investigated the effects of hydrocortisone on neutrophil (PMN) respiratory burst, phagocytosis and elimination of E.coli from blood and tissues.

Materials and Methods: To quantify the bacterial clearance process, defined numbers (10^8 colony forming units (CFU)) of E. coli were injected intravenously into 48 anesthetized rabbits, 60 min after bolus administration of hydrocortisone 1.4 mg/kg (n = 8 + 8) or 14 mg/kg (n = 8 + 8) followed by continuous hydrocortisone 0.18 mg/kg/h (n = 32). Additional endotoxin (LPS, 40 μg/kg/h) was infused to n = 8 of each group. Sole LPS (n = 8) or saline infusion (n = 8) served as positive and negative control, respectively. To evaluate hydrocortisone effects on bacterial elimination and killing, blood clearance of E. coli and colonization of different organs were investigated.

Measurements: After approval by the Institutional Animal Protection Board we monitored neutrophil respiratory burst and phagocytosis activity, rates of bacterial elimination from the blood, arterial blood pressure, blood gases, serum lactate and LPS concentrations as well as nitrite and nitrate (NO_x) levels. Three hours after bacterial injection the animals were killed and tissue samples of liver, kidney, spleen and lung were collected for bacterial counts.

Results and Discussions: In controls hydrocortisone significantly delayed elimination of injected E. coli from the blood ($p < 0.01$). LPS also prolonged bacterial elimination and additional hydrocortisone depressed respiratory burst, whereas phagocytosis functions remained unaltered. Bacterial colonization of organs was reduced after hydrocortisone in the LPS groups, significance, however, was reached only in the liver ($p < 0.05$). Correspondingly, during endotoxemia clearance from LPS ($p < 0.01$) and lactate ($p < 0.05$) were improved due to hydrocortisone. Levels of NO_x did not differ among the groups.

Conclusions: Hydrocortisone demonstrated immunomodulatory effects even in stress doses. Thus, use of hydrocortisone might be justified after onset of septic shock, not, however, as a prophylactic agent in "at risk" groups.

References:

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A-615

Epinephrine increases the formation of platelet-leukocyte conjugates in whole blood – in vitro

N.A. Horn*, D.M. Anastase§, K.E. Hecker*, L. de Rossi*, T. Robitzsch#, R. Rossaint*

**Department of Anaesthesiology, RWTH Aachen Germany; #Transfusion medicine RWTH Aachen Germany; §Clinic de Ortopedie fosoir, Bucuresti Romania*

Background and Goal of Study: Adhesion of platelets to leukocytes has an important role in the development of inflammatory processes, thrombosis and myocardial infarction (1–3). Since many patients suffering from such diseases are treated with catecholamines, we investigated whether β-adrenergic stimulation affects the binding of platelets to neutrophils, monocytes or lymphocytes.

Materials and Methods: Whole blood was incubated with increasing concentrations of epinephrine (10 nM, 100 nM, 1 μM) for 10 min. After stimulation with *N*-formyl-methionyl-leucyl-phenylalanine (FMLP) and staining with flourescence-conjugated antibodies, platelet-leukocyte adhesion and surface expression of P-selectin on platelets were measured by means of two-colour flow cytometry.

Results and Discussions: Epinephrine enhanced significantly the adhesion of platelets to neutrophils and monocytes in unstimulated and FMLP-stimulated whole blood. The formation of platelet-lymphocyte aggregates was not affected. This increased adhesion was accompanied by an increased surface expression of P-selectin on platelets, thus contributing to conjugate formation.

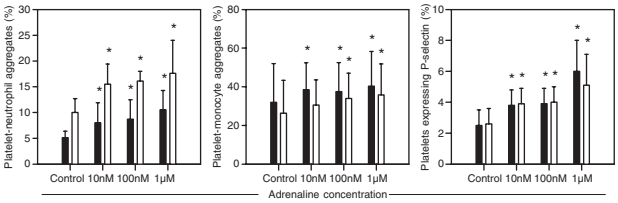

Figure 1: Percentage of platelet-leukocyte aggregate and P-selection expression (Means + SD), filled columns: unstimulated samples, empty columns: FLMP stimulated samples, *p < 0.05 vs. control

Conclusion(s): The study indicates that β-adrenergic stimulation increases the formation of platelet-monocyte and platelet-neutrophil aggregates, and may therefore contribute to the pathophysiology of inflammatory or thrombotic processes.

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A-616

Intrathecal anaesthesia with petidine–lydocaine–marcaine in the elderly patients

N. Mircea, E. Jianu, C. Georgescu, C. Stoica

Department of Anaesthesiology, Coltea Clinic Hospital, Bucharest, Romania

Background and Goal of study: To evaluate the efficacy of the 3 drug, in intrathecal anaesthesia, for the elderly (80) patients.

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Materials and methods: Is a prospective study, including 3 series of 15 patients,over 80 (80 years old) who received intrathecal anaesthesia with one of the above mentioned drugs, in single dose.The spinal puncture was chosen depending on the type of surgery: L1–L2, L2–L3. Surgery included lower abdominal, lower limb and perineal interventions.Monitorized parameters included: time to onset of vegetative block, sensitive block and motor block; duration of motor block; clinical data monitoring (pulse, blood pressure, EKG, respiratory rate, SO_2) both intra- and postoperatively (24); duration of postoperative analgesia; intra-and postoperative complications (24 h).
Results: Monitorized Parameters: GroupI (petidine), GroupII (lydocaine) Group III (marcaine)

Duration of motor block 87.5 ± 6.8 min.-group I, 45.8 ± 10.3 min.-group II and 112.4 ± 7.9 min.-group III.

Clinical Parameters Modification: Pulse-bradycardia in 3 cases (groupIII); blood presure-moderate hypotension in all groups; EKG-ventricular extrasystoles in 2 cases (group III); SO_2-under 96% (group III) in 2 cases; respiratory rate-no modification. Duration of postoperative analgesia: 30.18 h-group I, 1.4 ± 0.8 h-group II and 4.1 ± 0.8 h-group III. Intraoperative complication (nausea, vomiting) – 1 case in groups II and III. Postoperative complications (urinary retension:4 cases (group II) and 3 cases (group III).
Conclusions: The fastest onset of complete – vegetative,sensitive and motor) block is observed in uses of lydocaine and the slowest-in marcaine. The longest duration of motor block is given by marcaine and the shortest-by lydocaine. The highest rate of clinical parameters modification was seen in the marcaine group. If we anticipate surgery with a less than 90 minutes duration, pethidine intrathecal anaesthesia is to be prefered because it has added benefit of 24 to 48 h postoperative analgesia. We must not forget that elderly patients have an alevated pain threshold.
References:

1 Littlewood D.G. et al. *Br. J. Anest* 1979; 51: 475.
2 Heberer J.P. Anesthesie peridurale loco-regionale. Red. Gauthier-Lafaye p., ed. Masson, Paris, 1985.

A-617

ITU bed or not ITU bed that is the question

C. Matejowsky, M. Mutch, M. Grocott, M. Hamilton, D. Levett, R. Patel, F. Haddad, M. Emberton, J. Browne, J. Van der Meulen, M. Mythen

1. Surgical Outcomes Research Centre, SOURCE, UCL Hospitals NHS Trust, London, 2. Clinical Effectiveness Unit, RCS England

Background and Goal of Study: Health care resources and ICU beds a limited. Previous studies have suggested that more intensive peri-operative management of major surgical patients may improve outcome. As part of an ongoing study of outcome following major surgery in our institution we have examined the post-operative location of patients and sought to determine a rational for it.
Materials and Methods: Prospective, observational cohort study of major elective surgery patients at a University Hospital. Major surgery was defined as anticipated duration >2 hrs and anticipated blood loss of > 500 mls ([1]) Study measures are included in Table 1.
Results and Discussions: There are no existing criteria for admission to ITU following major surgery at our institution. 265 patients were studied with an overall P-POSSUM ([2]) observed/expected mortality ratio of 0.55. 87% of patients returned to the ward post-op and 13% of patients to ITU. There are no obvious differences in terms of pre-operative factors. The only differences appear to be intra-operative (duration & operative severity). It is interesting to note that despite there being no documented guidelines the ward patients experienced 0% in hospital mortality.

Table 1:

Total (N = 265)	ITU (N = 34)	Ward (N = 231)
Age	52.5 median	65 median
ASA I	8	52
ASAII	10	131
ASA III	15	45
ASA IV	1	1
Op Duration	296 min	210 min
Post-op LOS	18.5 median	10 median
Range LOS	2–58 days	2–53 days
Physiological	16	16
Operative severity	16	9
Mortality	5	0

Conclusion: In our institution the vast majority of patients are returned to the general ward following major surgery. In terms of survival the ward patients outcome was good. There are no obvious pre-operative criteria for selecting patients for post-operative intensive care.

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1 Bennett-Guerrero E et al, *Anesth & Anal* 1999; 89; 514–9.
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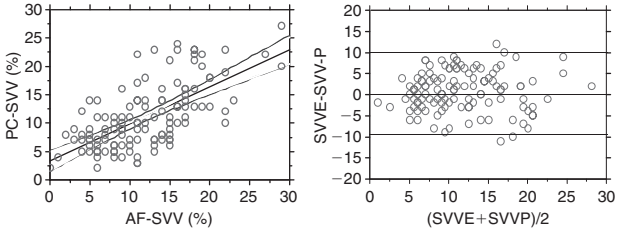
A-618

Comparison of two methods of measurements of stroke volume variation: pulse contour analysis and aortic doppler flow

L. Lhotel, V. De Castro, T. Barbry, J.P. Goarin, P. Coriat

Department of anesthesiology, G.H. Pitie Salperiere, Paris, France

Background and Goal of the Study: Cardiac preload dependancy, as a guide to fluid therapy, is generally estimated by respiratory variation of different hemodynamic parameters (peak pressure, pulse pressure or delta-down). On a physiological basis, stroke volume variation is the more reliable method to evaluate the influence of mechanical ventilation.
Methods: Pulse contour analysis (Pulsion MS, München) coupled with computer recording allows measurements of minimal and maximal values of stroke volumes during a floating period of 30 seconds and calculation of mean stroke volume variation (PC-SVV). During the same period aortic blood flow was recorded with simultaneous air-way pressure curve on video tape. Measurements of end-expiratory and end-inspiratory stroke volume allows calculation of mean SVV (AF-SVV) during respiratory cycle
Results: 121 measures were realised with 20 patients. The figure 1 shows linear regression . The correlation factor is 0,66, slope is 0,65 and the intercept is 3,34. The figure 2 shows the Bland & Altman analysis. The bias is 0,8 ± 4,8, precision is 3,9 ± 2,8 and the number of outliers for a deviation of 3% is 55.



Conclusion: This study shows a mild agreement between the 2 methods in a large range of SVV and in different loading conditions . The precision of the PCCO method is limited because it cannot precisely determine the period of respiratory cycle.

A-619

Dopamine does not increase systemic vascular resistances in dysautonomic patients with familial amyloidosis Met30 – preliminary report of an evaluation in patients waiting for liver transplantation

J.S. Viana, L. Coelho, C. Seco, R.M. Martins, L.A. Providência, A.L. Furtado

Departments of Anaesthesiology, Cardiology and Transplantation, Coimbra University Hospitals, Coimbra, Portugal

Background and Aim: Abnormal responses to sympathomimetic amines were reported in Familial Amyloid Polyneuropathy (FAP) (1,2). Dopamine was never studied in these patients (pts), although this drug has been extensively used during their liver transplants (LT) (2). Our aim was to evaluate the effects of dopamine in FAP pts.
Materials and Methods: We have studied 12 FAP methionine 30 (Met30) pts on the active waiting list for LT. Age was 39.8 ± 5.8 y; pts had 3.6 ± 1.6 y of know disease and a autonomic score of 4.4 ± 2.7 (neurological scale of Macedo). After 60 min in supine position, blood pressure (BP), heart rate (HR) and cardiac output (CO) were measured (the later one by Doppler). Measurements were repeated after 10 min of a 2.5, 5, 10, 15 and 20 μg/kg/min dopamine infusion. Systemic Vascular Resistances (SVR) were calculated assuming right atrium pressure as constant. Each dopamine-induced value was compared to baseline with paired *t*-test. $P < 0.01$ was significant.
Results: (mean ± DP) – Baseline values were normal. Dopamine induced a dose-dependent increase in HR, CO (Table, differences of baseline, as percentage) and systolic BP (maximun + 33 ± 15%, with 10 μg/kg/min, $p < 0.001$), and a decrease in SVR (Table). Neither stroke volume (10 ± 16% with 5 μg/kg/min; $p = 0.071$) nor diastolic BP (9 ± 30%, 15 μg/kg/min, $p = 0.428$), changed significantly.

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μg	N	HR (%)	p	CO (%)	p	SVR (%)	p
2.5	12	+4 ± 6	0.067	+3 ± 10	0.337	−3 ± 13	0.280
5	12	+11 ± 14	0.034	+20 ± 20	0.006	−12 ± 14	0.018
10	12	+24 ± 21	0.004	+34 ± 23	0.001	−10 ± 20	0.082
15	11	+47 ± 23	<0.001	+61 ± 34	<0.001	−24 ± 17	0.002
20	5	+46 ± 15	<0.001	+55 ± 17	0.002	−32 ± 11	0.006

Conclusions: Dopamine induced vasodilation and not vasoconstriction in pts with FAP Met30. This can be due to baroreceptor denervation and hypersensitivity of $Beta_2$ receptors. The clinical implications of our results suggest the need of future controlled studies also using other vasoactive drugs (e.g. dobutamine) and other dysautonomic populations (such as diabetic pts).

References:

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2 Viana JS, Bento C, Vieira H, *et al. Transplant Proc* 2000; 32: 2652–2653.

A-620

Sepsis outcome data: a retrospective analysis for the interpretation of current therapies

S. Jacobsson, O. Winso

Department of Anaesthesiology and Intensive Care, Umeå University Hospital, Umeå, Sweden

Background and Goal of Study: Severe sepsis and septic shock are associated with mortality rates as high as 30 to 60% (1). Sepsis outcome data from Scandinavia are sparse. The aim of this study was to describe the frequency, length of stay (LOS) in the ICU and outcome for patients with sepsis in a university hospital in Sweden.

Materials and Methods: A retrospective analysis of electronic patient records from the 1st of January 2000 to the 1st of September 2002. Inclusions criteria were age > 18 years, admission diagnosis of sepsis or urosepsis according to APACHE III. The material was divided in three groups; patients with sepsis, severe sepsis or septic shock according to ACCP/SCCM criteria (2).

Results and Discussions: Of 91 patients retrieved, 16 patients were excluded. The age of the remaining 75 patients was 56 ± 16,2 years. 42 were men. The mean ICU-LOS was 9,5 (SD ± 12,3) days. 12 of 17 deaths (70,6%) occurred within the three first days after admission. Patients with a APACHE II score of 25 or less had a mortality of 5,7% (3 of 52) compared to 60,9% (14 of 23) for patients with APACHE II scores of >25. Table 1 absolute numbers. Table 2 mean ± SD.

Year	2000	2001	2002	Total	Mortality (%)
Number	31	29	15	75	22,7
1. Sepsis	9	7	4	20	0
2. Severe	13	14	5	32	12,5
3. Shock	9	8	6	23	56,5

Year	2000	2001	2002	Total
Apache II	20,6 ± 6,7	22,7 ± 9,7	26,9 ± 7,6	22,6 ± 8,4
LOS	8,0 ± 10,3	9,7 ± 11,8	12,1 ± 16,9	9,5 ± 12,3
Dead	6,3 ± 10,6	8 ± 15,6	6,6 ± 11,8	7,0 ± 12,1
Survivors	8,3 ± 10,4	10,1 ± 11	14,8 ± 18,9	10,2 ± 12,4
Mortality (%)	19,4	20,7	33,3	

Conclusions: Previous reports on high mortality in association with severe sepsis and septic shock are valid also at our university hospital in Sweden. A retrospective analysis like ours is useful for the local interpretation of currently available sepsis therapies and it provides valuable back-ground information for statistical power analysis.

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A-621

Effects of external cranial cooling on severe head injury

M. Mantouvalou, I. Iatrelli, C. Nikolaidis, P. Roumbos, M. Agellidi, F. Pavlopoulos

Departments of Intensive Care Unit and Anaesthesiology, Tzanion General Hospital, Pireaus, Greece

Background and Goal of Study: We studied the effects of mild cranial hypothermia (32–34°C), on patients with severe head injury.

Materials and Methods: 38 patients were randomly divided into two groups. Group A ($n_1 = 19$) included patients with severe head injury (GCS 5–7) and was the hypothermia group. Group B ($n_2 = 19$, GCS 5–7) was the control group receiving the usual treatment for severe head injury as well as trying to maintain brain's normothermia. The demographic characteristics of the patients were similar in both groups. Ice was applied to the heads and necks of patients in group A, and brain temperature (Tbr) was measured through a multiparameter camino catheter, as well as brain tissue oxygen ($PtiO_2$) and carbon dioxide ($PtiCO_2$) pressures in both groups.

Results and Discussions: Mild induced hypothermia (Tbr 32–34°C), decreased $PtiO_2$ from 30 ± 20 to 28 ± 18 mmHg and $PtiCO_2$ from 45 ± 10 to 40 ± 5 mmHg ($p < 0,0005$). The same parameters remained almost without change from their primary values in group B (Tbr 36 ± 2°C, $PtiO_2$ 35 ± 6 mmHg and $PtiCO_2$ 48 ± 8 mmHg). 12 out of 19 patients (63%) in group A, survived and showed improvement of their condition, that is they had sufficient neurologic function and were discharged home or to a rehabilitation facility, as compared with 9 of the 19 (47%), in the normothermia-treated group B ($P < 0,01$) . There was no difference in the frequency of adverse events.

Conclusion(s): Our study suggests that treatment with moderate hypothermia appears to improve the outcome in patients with severe head injury.

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A-622

Lung recruitment and carbon dioxide during PEEP trial in ALI/ARDS patients

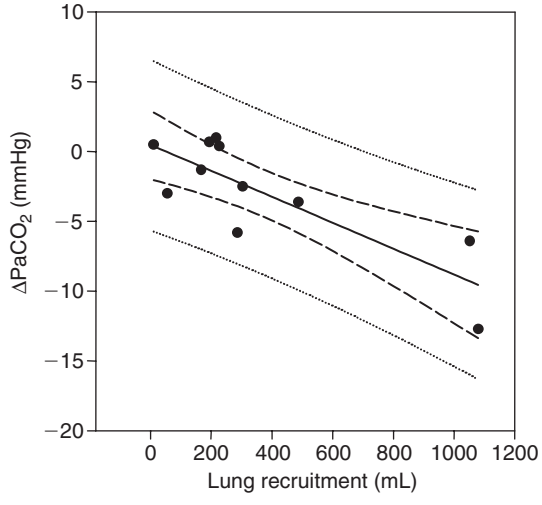
D. Chiumello, F. Vagginelli, P. Taccone, E. Carlesso, G. Li Bassi, E. Storelli, N. Bottino, P. Pelosi*, L. Gattinoni

*Institute of Anesthesia and Intensive Care, Policlinico Hospital-IRCCS, Milan, Italy; *Department of Clinical and Biological Sciences, University of Insubria, Milano, Italy*

Background and Goal of Study: To assess the effects of different PEEP levels on the variations of arterial carbon dioxide and lung recruitment in ALI/ARDS patients.

Materials and Methods: Eleven ALI/ARDS sedated paralyzed patients (PaO_2/FiO_2 197 ± 59 mmHg, age 63 ± 16 years, measured body weight 75.3 ± 14.4 Kg, PEEP 12.6 ± 3.4 cmH_2O, days of mechanical ventilation 6.6 ± 6) were ventilated with a low tidal volume strategy according to NIH protocol[1] (6.9 ± 1.6 ml/Kg). 5, 8, 10, 12, 14, 16, 18 cmH_2O of PEEP were selected in crescent order. At the beginning of the study a recruitment maneuver was performed. Lung recruitment and gas exchange were measured at each PEEP level after thirdly minutes. Lung recruitment was calculated as the measured minus the predicted volume (i.e., ΔEELV at 5 cmH_2O of PEEP – PEEP/elastance at 5 cmH_2O of PEEP)[2]

Results and Discussions: The best PEEP was defined as the PEEP level at which the patient presented the highest $PaCO_2$ decrease ($\Delta PaCO_2$). We found a significant correlation between $\Delta PaCO_2$ and lung recruitment at best PEEP.



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Conclusion(s): The lung recruitment was associated with a decrease in the carbon dioxide suggesting an increase in the alveolar ventilation.

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A-624

Outcome in bariatric surgery: differences between obstructive sleep apnea, overlapping respiratory condition and the hypoventilation syndrome

C. Marti, A. Sabate, C. Masdevall, I. Camprubí, A. Dalmau, T. Gracia, M. Koo, R. Sanzol, M. Suarez, P. Moreno, J. Pujol

Departments de Anestesia i Cirurgia. Ciutat Sanitaria i Universitaria de Bellvitge, Universitat de Barcelona, Barcelone, Spain

Background and Goal of Study: Obstructive sleep apnea syndrome (OSAS) is present in 44% of patients scheduled for bariatric surgery. Associated respiratory problems to OSAS are related to overlapping condition (COPD) and/or obesity hypoventilation syndrome (OHS). The aim of our study was to know the influence of respiratory morbidity in the surgical outcome.

Material and Methods: We have followed all patients scheduled for open Roux-Y gastric bypass plus gastroplasty during a five-year period. OSAS were diagnosed on basis of polysomnographic studies. OHV was diagnosed when the Alveolar-arterial difference on room air was higher than 20 mmHg. Overlap condition was diagnosed on basis of symptoms of pulmonary disease, X-Ray and spirometric values. All patients were managed by the same protocol: preoperative CPAP when indicated; rapid anaesthesia induction sequence with propofol-succinil-choline and fentanyl-atracurium-sevoflurane for maintenence; balanced analgesia with PCA-morphine, metamizol and proparacetamol; early mobilization; water tolerance at 3rd day and contrast study to detect leak; planned home at 4th day.

Results and Discussion: Main results are on the table mean ± Standard Deviation.

	OSAS (n = 40)	OHS (n = 40)	OverlapCOPD (n = 25)	P value
BMI (Kg/m^2)	51.6 ± 8	52.3 ± 8.7	50.4 ± 8.6	0.67*
A-a O_2 Diff. mmHg	14.2 ± 5.4	25.3 ± 3.8	12.6 ± 8.4	0.00*
FEV1/FVC %	82.7 ± 4.8	80.8 ± 6.4	77.8 ± 6.8	0.02*
Hospital Stay days (median, range)	6.4 ± 1.6 (6, 4–11)	6.9 ± 1.9 (7, 4–13)	6 ± 1.63 (6, 4–11)	0.12*
Postoperative Fever	6 (15%)	12 (30%)	1 (4%)	0.024 #
Overall Complications	11 (25%)	21 (50%)	7 (28%)	0.044 #

*Anova. # Chi-square

Conclusions: Although hospital stay was not affected, patients with preoperative altered blood gases have more risk of postoperative complications. Fever was a frequent complication, mainly in those patients with hypoventilation syndrome.

A-625

Therapeutic hypothermia after cardiac arrest

T. Karlsson, N. Nielsen, A. Ersson, H. Friberg

Department of Anaesthesia and Intensive Care, Helsingborg Hospital, Sweden, University Hospital MAS, Malmö, Sweden

Background and Goal of Study: Survival rates after circulatory arrest are depressingly low and have not improved over the last decades. An increasing load of experimental data supports the use of postischemic hypothermia as a neuroprotective therapy but this treatment has only recently been shown to be protective in man (1, 2). We present data from a pilot study with combined cooling of cardiac arrest victims. The goal of the study was to investigate logistics and the efficacy of cooling with our organization and method.

Materials and Methods: A common protocol was defined and a local study group was created in each of the two centers in Sweden where the study was performed. Five witnessed cardiac arrest victims with return of circulation were included. All patients, four men and one woman with an average age of 58 y (50–75 y), were unconsciouss (GCS 3–5) at the initiation of treatment. Initially, sedation and muscle relaxants were given in paralell with combined infusion of cold Ringer's solution (1000 ml/20 min), application of a cooling cap and a cooling dress with circulating cold water (Allon 2001, TRE). Patients were cooled to 33 ± 0.5°C for 24 h after which they were slowly rewarmed, 0.5°C/h. Bladder temp was used as core temp.

Results and Discussions: Three patients with initial rhythm of ventricular fibrillation (VF) and two patients with initial asystole were included. Average time from cardiac arrest until initiation of cooling was 1 h 45 min and average time from cardiac arrest until goal temperature was reached was 5 h 40 min (4 h–8 h 50 min). Treatment was easy to perform and temperature control was stable. Three patients could return home (all with initial rhythm VF); two with intact cerebral function and one patient with minor memory deficits. Both patients with initial asystole died in the ICU without regaining consciousness. S-100 and NSE values during and after cooling will be presented.

Conclusion(s): Cooling to 33°C of cardiac arrest victims by a combination of cold fluids and external cooling is rapid, relatively easy to perform and treatment seems safe.

References:

1 The HACA Study. *N Engl J Med.* 2002; (8): 549–56.
2 Bernard SA, Gray TW, Buist MD et al. *N Engl J Med*. 2002 Feb 21; (8): 557–63.

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A-626

Correlation between plasma lactate levels and lactate levels measured by tissue microdialysis in critically ill patients

A. Van Tichelen, C. De Deyne, R. De Jongh, G. Vundelinckx, R. Heylen

Department of Critical Care Medicine, ZOL Genk, Belgium

Background and Goals: Elevated serum lactate levels occurring during critical illness are generally reflecting a critical tissue perfusion. After hemodynamic stabilisation, any increase in serum lactate levels is often interpreted as an improved peripheral circulation with a wash-out of peripheral lactate. Tissue microdialysis (MD) enables the local monitoring of metabolic substances (lactate) by mimicking the passive function of a capillary blood vessel by perfusion of a tubular semipermeable membrane introduced into the tissue. The aim of this study was to analyse, by use of subcutaneous MD, if there was any correlation between serum lactate levels and peripheral concentrations of lactate in critically ill patients.

Material and Methods: 6 critically ill patients, presenting with an elevated serum lactate level on ICU admission were included. In all pts, a MD catheter (CMA 60) was inserted subcutaneously in the adipose tissue of the abdominal wall and was connected to a MD pump, perfusing a Ringer's solution at 0/3 μl/min. Every 2 hrs, dialysates were analysed for lactate concentration. Every 4 hrs, serum lactate concentrations were determined. MD monitoring was maintained for 72 hrs after admission.

Results and Discussion: Overall, in all 6 pts, we found a good correlation between changes in serum lactate and peripheral tissue lactate, as assessed by MD. In 5 of 6 pts, hemodynamic parameters were normalized and serum lactate levels returned to normal values within the first 24 hours of admission. However, in all 5 pts, small increases in serum lactate levels were noticed, without any correlation to deteriorating hemodynamic status. In all 5 pts, we observed marked increases in local lactate concentrations, as measured by MD, preceeding the increase in plasma concentration. In one pt, hemodynamic instability persisted and as well serum lactate levels as peripheral lactate concentration (MD) remained correlated but highly elevated.

Conclusions: Subcutaneous MD might offer a valuable tool to monitor local metabolic changes in peripheral tissues during critical illness.

A-627

Prostacyclin prevents decrease in mesenteric tissue oxygenation induced by lung recruitment

J. Claesson, S. Lehtipalo, O. Winso

Department of Surgical and Perioperative Sciences, Anaesthesiology and Intensive Care, Umeå University Hospital, Umeå, Sweden

Background and Goal of Study: We hypothesised that repeated lung recruitment manoeuvres (RM) would induce mesenteric vasoconstriction, and that the metabolic effects of this vasoconstriction would be attenuated by an infusion of prostacyclin.

Materials and Methods: 13 pigs were subjected to oleic acid induced acute lung injury. Following 80 minutes stabilisation 6 pigs were randomised to receive prostacyclin 33 ng/kg/min (group P) and the other 7 served as controls (group C). The pigs were subjected to RMs with a peak airway pressure of 40 cmH_2O for 4 s followed by a PEEP of 20 cmH_2O for 1 s consecutively repeated during 2 min. Each 2 min RM period was conducted 3 times, separated by a 15 min pause. Mesenteric perfusion and oxygenation was assessed by measurements of superior mesenteric venous blood flow (Q_{MES}; transit-time ultrasonic flowmetry), jejunal mucosal perfusion (LDF; laser Doppler flowmetry) and jejunal tissue oxygen tension ($PtiO_2$; microoximetry). Data were collected before RMs (L5), 15 min (C4) and 60 min (C5) following RMs.

Results and Discussions: Comparisons between groups and within groups following RMs showed no differences in Q_{MES}, mesenteric vascular resistance and LDF. In the control group there was a decrease in $PtiO_2$ after RMs

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at C4 and C5. In the prostacyclin group $PtiO_2$ was not significantly altered by RMs, and significantly higher at C5 in comparison with the control group.

	L5	C4	C5
Q_{MES}, ml/min, C	0.65 ± 0.06	0.59 ± 0.04	0.63 ± 0.04
Q_{MES}, ml/min, P	0.63 ± 0.06	0.55 ± 0.04	0.58 ± 0.04
LDF, PU, C	271 ± 41	285 ± 48	356 ± 41
LDF, PU, P	263 ± 41	190 ± 18	219 ± 60
$PtiO_2$, mmHg, C	55 ± 8	44 ± 6*	44 ± 6*#
$PtiO_2$, mmHg, P	59 ± 7	55 ± 9	57 ± 8

*$p < 0.05$ vs L5 within groups, #$p < 0.05$ between groups.

Conclusion(s): Three repeated recruitment manoeuvres did not induce mesenteric vasoconstriction, but decreased mesenteric tissue oxygen tension. This decrease was prevented by an intravenous infusion of prostacyclin. Our data does not indicate that this effect was mediated by regional or local mesenteric vasodilatation.

A-628

Cyclooxygenase-2-derived prostanoids promote endotoxemic shock

K. Höcherl*, K. Taeger, M. Bucher

*Departments of Anaesthesiology and *Pharmacology, University of Regensburg, Regensburg, Germany*

Background and Goal of Study: Non-selective inhibitors of both cyclooxygenase-(COX)-isoforms, COX-1 and COX-2, did not improve survival in patients with sepsis (1). Therefore, we aimed to determine the relevance of COX-2 derived prostanoids in the pathogenesis of experimental endotoxemic circulatory failure.

Materials and Methods: Male Sprague-Dawely rats (n = 8) received lipopolysaccharide (LPS, 10 mg/kg) i.v. and were treated with different COX-inhibitors. Systolic blood pressure was measured by the tail-cuff-method. Plasma- and organ-concentrations of PGE_2 and 6-keto $PGF_{1\alpha}$, nitrate/nitrite, IL-1β , TNF-α, IFN-γ, transaminases and genexpression of nitric-oxide-synthase-II (NOS-II) and COX-2 were measured. Data were analyzed by ANOVA with multiple comparisons followed by the *t* test with Bonferroni´s adjustment. $p < 0.05$ was considered significant.

Results and Discussions: Injection of LPS caused a marked fall of systolic blood pressure from 128 to 79 mmHg and a concomitant increase of heart rate from 380 to 530 min^{-1}. Both the fall of systemic blood pressure and the increase of heart rate were almost absent if the animals received in addition the COX-2-inhibitor rofecoxib (20 mg/kg), whereas ketorolac, at a dose preferentially inhibiting COX-1, did not prevent LPS-induced circulatory failure. Plasma and organ levels of prostanoids were lowered by rofecoxib, but not by ketorolac. The characteristic LPS-induced increases of tissue cytokine concentrations, NOS-II- and COX-2-genexpression as well as of plasma and tissue nitrate/nitrite-concentrations were not affected by rofecoxib. However, rofecoxib, but not ketorolac, markedly improved LPS-induced liver damage, as indicated by the fall of transaminases. Moreover, the overall well being of the LPS-injected animals improved upon concomitant treatment with the COX-2-inhibitor.

Conclusion: Our data suggest that COX-2-derived prostanoids are major mediators for the detrimental effects of LPS on cardiovascular and organ function.

Reference:

1 Bernard GR, et al. *N Engl J Med*. 1997; 336: 912–918.

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A-629

Skin conductance changes as a measure to monitor discomfort in artificial ventilated children

A.C. Gjerstad*, B.C. Hellerud*, K. Wagner**, T. Henriksen***, H. Storm*

**Skill training center; **Intensive care unit; The National Hospital, and Intensive care unit; ***Ullevål Hospital, Oslo, Norway*

Background and Goal of Study: Skin conductance (SC) as a measure of emotional state or arousal may be a tool for monitoring stress in artificial ventilated patients. When an outgoing sympathetic nervous burst occurs to the skin, the palmar and plantar sweat glands are filled up, and the SC increases before the sweat is removed and the SC decreases. This creates a SC fluctuation. Emotional sweating is specific for the stimuli that induce the stress response, and reacts immediate to pain. Emotional sweating is not influenced by circulatory changes such as found in heart disease, hypertension, lung disease and sepsis, and should therefore be more specifically linked to pain/discomfort responses than blood pressure and heart rate. The purpose of this study was to measure SC fluctuations during suction from trachea in artificial ventilated patients, and to evaluate whether the number of SC fluctuations correlates with the COMFORT sedation score.

Materials and Methods: In 10 girls and 8 boys from 2 days to 9 years of age that were circulatory stable and artificial ventilated, we measured the number of SC fluctuations, heart rate, intra arterial blood pressure and COMFORT sedation score before and during suction from trachea. Linear regression tests were performed on the changes from before to during suction in the airways between the sedation score and SC fluctuations, the sedation score and heart rate, and the sedation score and blood pressure.

Results and Discussions: The increase in number of SC fluctuation correlates with the increase in discomfort measured by COMFORT sedation score during suction from trachea, different from the heart rate and blood pressure changes:

	Number of SC fluctuations	Heart rate	Blood pressure
Sedation score	$p < 0.01$ ($r^2 = 0.83$)	NS	NS

Conclusion: Changes in SC fluctuations seem to be a better measure of discomfort than changes in blood pressure and heart rate in patients that are artificial ventilated.

A-630

Long term evaluation of a new passive-active HME

P. Pelosi, D. Chiumello*, P. Severgnini, E. Bianchi, R. Terzi, R. Di Stella, M. Chiaranda

*Department of Clinical and Biological Sciences, University of Insubria, Varese-Circolo and Fondazione Macchi Hospital, Varese, Italy; *Institute of Anesthesia and Intensive Care, Policlinico Hosp*

Background and goals: To evaluate the conditioning provided by a new passive-active heat moisture exchanger (Umistar Starmed®).

Material and Methods: We measured the absolute humidity (A.H.) and relative humidity (R.H.) of inspired and expired gases in 40 sedated, paralyzed mechanically ventilated patients (mean age 60,7 ± 16,9 years). The R.H. and A.H. was measured using a psycrometer (Yokogawa®). The airflow was separated by a flow separator placed between the Y piece of the respiratory circuit and the catheter mouth. Umistar® is a passive-active – HME, composed by a thin metal layer (active element) placed between two heat and moisture exchangers (passive element) and an antimicrobic filter. The active part provides three different levels of heat regulation (set I, II, III). An infusion of physiological solution or bidistilled water with a common pump is given. The measurements were taken after one and eight hours, using the Umistar with and without adding the water and heat.

Results: In table the data are presented as mean ± ds. (dbt = dry temperature, wbt = wet temperature, i = inspired and e = expired).

	Passive (1h)	I (1 h)	II (1 h)	III (1 h)	II (8 h)
dbti (°C)	29,8 ± 1,0	31 ± 1,1	31,7 ± 1,1	32,6 ± 1,0	31,9 ± 0,9
Dbte (°C)	32,7 ± 1,4	32,8 ± 1,3	32,9 ± 1,4	33,3 ± 1,4	33,4 ± 1,7
wbti (°C)	29,7 ± 0,9	30,9 ± 1,2	31,5 ± 1,2	32,3 ± 1,1	31,8 ± 0,9
wbte (°C)	32,3 ± 0,9	32,5 ± 1,0	32,6 ± 1,1	33,1 ± 1,1	33,1 ± 1,1
A.H.i (mg/l)	30,7 ± 1,6	32,7 ± 2,2**	33,8 ± 2,2**	35,3 ± 2,3***	34,4 ± 1,8*
A.H.e (mg/l)	35,1 ± 1,6	35,7 ± 2,0	35,9 ± 2,0	36,9 ± 2,2	36,8 ± 2,1
R.H.i (%)	99,2 ± 1,0	99,4 ± 1,3	98,9 ± 2,0	98,9 ± 2,2	99,4 ± 1,7
R.H.e (%)	97,4 ± 4,5	98,2 ± 4,2	98,3 ± 4,0	98,4 ± 3,8	98,1 ± 4,7

***$p < 0{,}0001$ passive vs set III; **$p < 0{,}01$ passive vs set I, II; *$p < 0{,}05$ set II (1st hour) vs set II (8th hour)

Conclusions: Umistar®: (1) in passive condition is effective; (2) when heated it improves; (3) after 8 hours of using it further improves its conditioning capability.

Reference:

1 Branson RD RRT. *Respir Care* 1999; 44: 630–641.

A-631

Prone positioning delays the progression of ventilation induced lung injury

M. Guglielmi, M. Maffioletti, C. Tedesco, S. Giacomini, M. Irace, S. Gatti, F. Valenza, L. Gattinoni

Department of anesthesia e rianimazione, ospedale maggiore di milano IRCCS, Milan, Italy

Background and Goal of Study: Prone position has been shown to influence the extension and distribution of ventilation induced lung injury (VILI)[1]. Aim of this study was to test the hypothesis that prone position delays the progression of VILI.

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Materials and Methods: 30 rats were randomized to receive similar ventilator strategies (constant high volume, ZEEP), in supine or prone position. Before randomization, tidal volume (Vt) and respiratory rate (RR) were adjusted to obtain similar mean airway pressure (Pawm of 6.5 cmH_2O). Thereafter, rats were randomized to supine or prone position, with no further change in ventilator setting. Progression of VILI was assessed by measuring, throughout the experiment, the respiratory system elastance (Ers), until 150% of the baseline value was reached. Lung injury was then assessed by lung wet to dry ratio (W/D). End point of the study was time to reach similar lung injury (Ers%, W/D). Differences between supine and prone position were assessed by t-test; data are expressed as mean ± SD.

Results:

	Supine	Prone	
Vt (mL/Kg)	31 ± 2.94	32.03 ± 3.76	p = 0.80
RR (bpm)	24 ± 1	24 ± 1	p = 0.79
Pawm (cmH_2O)	6.61 ± 0.11	6.56 ± 0.15	p = 0.29
W/D	6.54 ± 0.46	6.57 ± 0.79	p = 0.91
Ers (%)	158 ± 5	155 ± 5	p = 0.14
Time (min)	73 ± 37	112 ± 42*	p = 0.01

Results are shown in the table below: Animals in supine and prone position were ventilated similarly. Both of them reached the target increase of Ers. Similar level of lung injury was confirmed by W/D. The length of time to achieve comparable level of lung injury was 35% greater in prone position versus supine.

Conclusion: These data confirm the hypothesis that prone position is protective against VILI delaying the progression of lung injury.

Reference:

1 Broccard A., Shapiro R.S., Schmitz L., L. et al. *Crit Care Med* 2000; 28(2): 295–303

A-632

Percutaneous tracheostomy: comparison of Griggs and Fantoni techniques in critically ill patients

J. Paleczny[1], P. Knapik[2], D. Maciejewski[1]

[1]Department of Anaesthesia and Intensive Therapy, Bielsko – Biala, Poland; [2]Silesian School of Medicine, Zabrze, Poland

Background and Goal of Study: Tracheostomy (T) is a common surgical procedure in the intensive care unit (ICU) and several different types of percutaneous tracheostomy (PT) techniques have been already described. The aim of this study was to compare early and late results of PT with the use of Griggs technique (GT) or Fantoni technique (FT) in critically ill patients.

Materials and Methods: All consecutive patients requiring T treated in the general ICU in the period of five years have been retrospectively evaluated. All T were performed with the use of PT. Patients have been divided into groups: I – GT (n = 82) and II – FT (n = 32). Prospective evaluation of long-term results with spirometry and CT scan have been done in patients discharged from the hospital.

Results and Discussion: Patients in both groups were in comparably bad condition at admission (mean APACHE II score 25.7 vs 25.5, p = NS) and there were no differences in demographic data. Procedure time was significantly shorter in group I (11,2 ± 7,8 min. vs 26,7 ± 18,6 min., p < 0,001). There were no deaths as a result of the procedure. Complications during T and in the postoperative period were recorded in 16 patients (19,5%) in group I and in 4 patients (12,5%) in group II (p = NS). In group I complications included: bleeding (7), pneumothorax (1), subcutaneous emphysema (3), wound infection (2), difficulties during cannula exchange (3). In group II complications included: bleeding (3), and cardiac arrest (1). Technical difficulties were found in 11 patients (13,4%) in group I and in 5 patients (15,6%) in group II (p = NS). No differences were found in patient's haemodynamics in the early postoperative period, however temporary decrease of the mean paO_2/FiO_2 ratio was recorded in group I. Only 15 patients (13,2%) from both groups were prospectively evaluated after hospital discharge. One patient developed asymptomatic narrowing of trachea, diagnosed with the use of spirometry and CT scan.

Conclusions: Procedure time is significantly longer with the use of FT. The choice of PT technique has no significant influence on early postoperative course and number of complications. Both techniques of PT may be routinely used in ICU patients.

A-633

Validation of a fuzzy rule-based advisor for adjusting FiO_2 and PEEP

H.F. Kwok, G.H. Mills, M. Mahfouf, D.A. Linkens

Academic Department of Anaesthesia, and Department of Automatic Control and Systems Engineering, University of Sheffield, Sheffield, UK

Background and Goal of Study: We are developing a combined knowledge and model based decision support system for the intensive care ventilators. It exploits the excellent qualitative decision making ability of human and the precision of control offered by computer systems. The upper level module consists of a set of fuzzy rule-bases and it generates advice, such as whether to increase or decrease certain ventilator settings. The fuzzy rule-bases were derived using knowledge acquired from a study in which the clinicians' actions during a simulation were recorded. We then validated this system against the real changes in FiO_2 and PEEP made by clinicians on the ICU, which we determined by examining retrospective data.

Materials and Methods: To create the fuzzy rule base, data from 10 ICU patients were used to construct the case scenarios in a patient simulator. 4 intensive care consultants were invited to take part in the simulation. The advice they gave on the ventilator settings during the simulations were recorded. The fuzzy rule-bases for the FiO_2 and PEEP control were derived from the statistical analysis of this advice. 93 sets of blood gases and ventilator measurements were retrieved from the computerized record of 6 ICU patients. The actual change in FiO_2 and PEEP at each instance was compared with the advice generated by the fuzzy rule-base given the blood gas and ventilator measurements.

Results and Discussions:

Table 1. The degree of matching between the fuzzy system's advice and the clinician's action. (Perfect match: fuzzy's advice = clinician's action. Partial match: fuzzy's advice ≠ clinician's action but the two are not conflicting. Mismatch: fuzzy's advice is in the opposite direction to the clinician's action). Total number of blood gases = 93.

Ventilator setting	Perfect Match	Partial Match	Mismatch
FiO_2	71 (76%)	22 (24%)	0 (0%)
PEEP	62 (67%)	31 (33%)	0 (0%)

Conclusion(s): The advice generated by the fuzzy advisor matched the actual clinician's advice as recorded in the PDMS in the majority of cases with no conflicts. Therefore the fuzzy rule base has potential to be developed into an advisory system.

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A-634

An unusual complication of tracheostomy case report

A. Özgültekin, M. Tuygun, G. Kiliçoglu, F. Ormanci, N. Akgün

Department of Anaesthesiology and Reanimation, Haydarpasa Numune Hospital, Istanbul, Turkey

The common complications of long term tracheostomies are tracheal stenosis, difficulty in decannulation, tracheocutaneous fistulae and scars (1).

A patient who has been under mechanical ventilation for four years and whose tracheostomy cannula could not has been withdrawn for the last nine months is presented.

Case Report: 17 years old male patient admitted with the diagnosis of Guillian-Barre syndrome in June 1998. As his respiratory weakness requiring ventilatory support has not recovered completely and respiratory muscles become atrophic in time, he has been ventilated with SIMV-PS modes since then. His tracheostomy care and change of the tube (Once every week) was performed as routine. He used double cuffed tracheostomy tube in his second year and changed to the tube without cuff afterwards. After he completed four years in ICU, the tube could not be removed during a regular change. It was noticed that his last change was almost a month ago with some bleeding and difficulty during withdrawal. CT of the tracheal region showed marked growing of the soft tissue surrounding the cannula from the skin into the trachea deviating it anterolateraly towards right. It's total length was about 2.5 cm; 1.5 cm between the skin and the trachea; 1 cm lying in the trachea around the tube. 2.5 cm distal part of the tube was free of the surrounding tissue. Because of his general condition, his care was continued for another 8 months without any intervention. CT controls were done every 2 months. Then the surgical exploration under general anaesthesia was decided. Under the guideness of bronchoscopy, tracheal stoma was explorated, granulations and fibrotic strictures were excised. The cannula was removed without any complication.

Conclusion: When the tracheal cannula has been in place for weeks, months or even years, removal may be difficult; granulations may have formed developing into fibrous masses resulting in tracheal strictures. Minimising the gap between the skin and the trachea by suturing the skin to the mucosal edge of the trachea avoids the growing granulation tissue and, therefore, suggested for long term tracheostomies (2).

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A-635

Prone position in head injured patients with severe respiratory failure

P. Pelosi, D. Donofrio, C. Gamberoni, F. Misani, P. Severgnini, G. Minoja, M. Chiaranda

Department of Clinical and Biological Sciences, University of Insubria, Varese-Circolo and Fondazione Macchi Hospital, Varese, Italy

Background and Goals: The prone position is effective to improve respiratory function in patients with severe respiratory failure[1]. Patients with acute traumatic and medical brain injury are at particularly high risk to develop respiratory failure due to ventilatory associated pneumonia[2]. The goal of our study was to evaluate the effects of the prone position on the oxygenation (PaO_2/FiO_2) and the compliance of the respiratory system (Cst,rs) in patients with brain injury and respiratory failure.

Materials and Methods: The study has been performed prospectively, under licence from the Ethic Committee, on 23 consecutive patients who presented the following inclusion criteria: (1) brain injury (trauma-T/non trauma-NT [11T/12NT]); (2) respiratory failure ($PaO_2/FiO_2 < 26{,}6$ kPa); 3) presence of a new infiltrate on chest X-ray. The exclusion criteria were: (1) hemodynamic failure; (2) multiple non stabilized bone fractures; (2) ICP $> 2{,}6$ kPa, despite adequate treatment. All patients were mechanically ventilated, in volume control mode with constant inspiratory flow and sedated with propofol and morphine and paralysed with vecuronium bromide boluses.

The PEEP (6.5 ± 2.4 cmH_2O) was selected according with the better oxygenation in supine

Results and Discussion:
ICP and SjO_2 were not negatively affected in trauma patients by pronation

			Prone		
		Basal Supine	1 h	4 h	Supine 24 h
PaO_2/FiO_2[kPa]	T	19.1 ± 8.1	33.2 ± 8.4*	37.9 ± 8.9*	37.2 ± 6.4*
	NT	22.8 ± 7.3*	33.7 ± 11.3*	34.8 ± 13.6*	32.2 ± 11.1*
$PaCO_2$ [kPa]	T	4.5 ± 0.4	4.4 ± 0.6	4.2 ± 0.4	4 ± 0.5
	NT	5.1 ± 0.3	4.9 ± 0.3	5.1 ± 0.4	4.9 ± 0.6
C,rs[mL/cmH_2O]	T	35 ± 9	38 ± 7	37 ± 6	54 ± 20**
	NT	50 ± 11	49 ± 16	51 ± 20	56 ± 20

*$p < 0.01$ vs Basal Supine; **$p < 0.05$ vs Basal Supine*

Conclusions: In patients with brain injury and respiratory insufficiency: (1) the prone position rapidly improves the oxygenation; (2) the beneficial effects of the prone position last after 24 hours in supine.

References:
1 Gattinoni L et al. *N Engl J Med* 2001; 345: 568–73.
2 Ewig S, et al. *Am J Respir Crit Care Med* 1999: 159, 188–98.

A-636

Changes in splanchnic circulation during an alveolar recruitment maneuver in healthy lungs

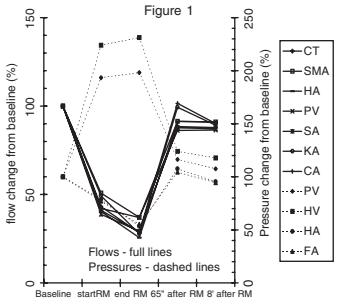
S. Nunes, H.U. Rothen, L. Brander, S. Jakob, J. Takala

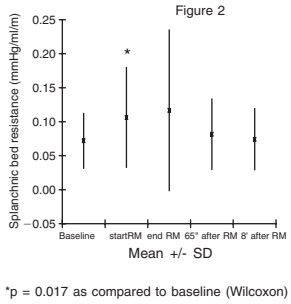
Department of Intensive Care Medicine, University Hospital, Bern, Switzerland

Background and Goals: Recruitment maneuvers (RM) are advocated as a complement to mechanical ventilation both during anesthesia and in acute lung injury. The high pressures and volumes involved might have a detrimental effect on hemodynamics. We studied the effect of a RM on splanchnic and cerebral circulation in 10 pigs.

Materials and Methods: A sustained inflation to 40 cmH_2O lasting 20″ [1] was performed 120′ after the end of surgery. Blood flow was measured in the celiac trunk (CT), superior mesenteric artery (SMA), hepatic artery (HA), portal vein (PV), kidney artery (KA), spleen artery (SA) and carotid artery (CA). Blood pressure was measured in hepatic vein (HV), femoral artery (FA), HA and PV. Arterial blood gases were obtained before RM and 8′ after RM. Total resistance across splanchnic bed was calculated: pressure (FA-HV)/flow (CT + SMA).

Results: All flows ($p < 0.005$) and arterial pressures ($p < 0.008$) decreased during the maneuver, while venous pressures increased ($p < 0.005$) (Wilcoxon). 65″ after RM, all flows and pressures returned to close to 90% of baseline and remained reduced until the end of the measurement (Fig. 1). Splanchnic resistance increased at start of RM (Fig. 2). Arterial pO_2 remained unchanged.





Conclusion(s): A RM performed in healthy animal lungs produces a marked, though transitory impairment of splanchnic and cerebral circulation. Despite prompt partial recovery, both splanchnic and cerebral circulation remained reduced. This may present a risk in conditions with markedly compromised circulatory reserves.

Reference:
1 Rothen H.U. et al. *Br. J. Anaesth.* 1993; 71: 788–795.

A-637

FRC can be measured with washin/washout of N_2 by changing inspired O_2 concentration only 10%

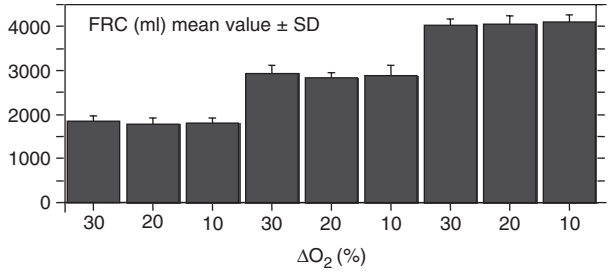
C. Olegård, S. Söndergaard, S. Lundin, O. Stenqvist

Anesthesia/ICU, Sahlgrenska University Hospital.Göteborg, Gothenburg, Sweden

Background and Goal of study: The purpose of "the open lung concept" is to maintain pulmonary functional residual capacity (FRC). Measurements of FRC are done by dilution of poorly soluble gases, SF_6 or He, and N_2-washout. The latter methodology has usually been based on large changes of inspired O_2-concentration. This may be difficult in patients with acute lung injury, ALI. N_2-analysis has been substituted with O_2 and CO_2-analysis. Calculations have been hampered due to difficulties in synchronization of flow and gas analysis. To circumvent these problems, end-tidal fractions, F_{ET}, were used for calculation of FRC.

Materials and Methods: O_2 and CO_2 were analysed with a standard side-stream gas monitor. Carbon dioxide output was determined by indirect calorimetry and tidal alveolar ventilation, TV_A, calculated as $(VCO_2/F_{ET}CO_2)$/ f. F_IO_2 was raised and lowered and washout/washin of N_2 was followed to equilibrium. The washin/washout volume of N_2 was calculated as the sum of TV_A $((1\text{-}F_IO_2)\text{-}(1\text{-}F_{ET}O_2\text{-}F_{ET}CO_2))$ during washin/washout and FRC as the washin/washout volume N_2 through ΔF_{N2} (F_{N2} at start and end of washout and washin). In an O_2-consuming/CO_2-producing lung model, the method was tested with known FRC of 1.8, 2.9 and 4.0 L. Frequency and minute volumes where varied during measurements. Inspired O_2 concentration was changed with 10, 20 and 30 %-units.

Results and Discussion: There was no difference in FRC-values between washin and washout. Precision was independent of magnitude of change in F_IO_2.



Conclusion: We have used end-tidal values for calculation of FRC with nitrogen washout technique and been able to circumvent the problem of synchronizing flow and gas analysis. We obtained stable measurements even when inspired O_2 was only changed 10%-units which may make it possible to use the method in patients with ALI.

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A-638

FRC measured by quantification of O_2/CO_2 fluxes during a short apnea versus N_2 washin/washout

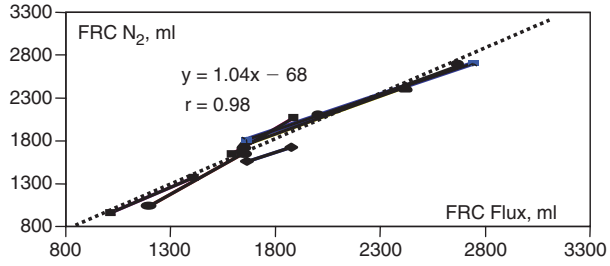
C. Olegård, S. Söndergaard, H. Odenstedt, S. Lundin, O. Stenqvist

Anesthesia/ICU, Sahlgrenska University hospital, Gothernburg, Sweden

Background and Goal of study: We have presented a lung model validation of a new method for functional residual capacity (FRC) based on quantification of O_2 and CO_2 fluxes during a short apnea, the "flux method" (1). The aim was to compare the flux method with a nitrogen washout/washin technique in ventilated patients.

Materials and Methods: FRC was determined at two PEEP levels with the flux method in seven postoperatively ventilated patients. Baseline oxygen uptake and carbon dioxide output from and to the alveoli, i.e. the FRC, were determined by indirect calorimetry. End-tidal O_2/CO_2 concentrations were obtained before and after an apnea of ~10 seconds duration using standard monitoring equipment. FRC was calculated as the volume O_2/CO_2 taken up/excreted during the apnea divided by the difference in endtidal O_2/CO_2 from/to FRC during the apnea. The increased solubility of CO_2 in blood when the CO_2-tension increased as a result of the apnea was taken into account. Reference FRC measurements were performed by changing FIO_2 by ~0.3 to achieve a washin/washout of nitrogen. FRC was calculated as volume N_2 through ΔFN_2 over the washout/washin period.

Results and Discussion: The results showed good correlation ($r = 0.98$) for all measurements comparing the two methods. The change in FRC in all individual patients when increasing PEEP was close to line of identity.



Conclusion: The flux method showed good correlation with nitrogen washin/washout measurements of FRC. The flux measurements can be repeated every third minute without changing FIO_2.

Reference:

1 Monitoring functional residual capacity, FRC, by quantifying oxygen/carbon dioxide fluxes during a short apnea. Stenqvist O, Olegård C, Søndergaard S, et al. *Acta Anaesthesiol Scand* 2002; 46: 732–739.

A-639

Ketoconazole prevents acute respiratory distress syndrome in sepsis patients

H.A. Soltani, H. Moshtaghion

Department of Anesthesiology and Critical Care, Isfahan University of Medical Science, Isfahan, Iran

Background and Goals: Ketoconazole probably inhibits synthesis of thromboxane A_2 and prevents acute respiratory distress syndrome (ARDS) in patients with ARDS risk factors (1, 2).This study was conducted to determine the efficacy of ketoconazole in preventing ARDS at high risk patients.

Material and methods: 46 consecutive patients with risk factors including sepsis, fat emboli, pulmonary aspiration and lung contusion randomized to receive either daily ketoconazole 400 mg (K Group) or placebo (P Group) via nasogastric tube in a double blind fashion. This drug administered during ICU management or up to 21 days. The patients were followed for the development of ARDS.

Results: Data are shown in the table:

Risk factors	K Group	ARDS cases	P Group	ARDS cases
Sepsis	12	2*	12	7
Fat embolism	2	0	2	0
Pulmonary aspiration	4	2	7	3
Lung contusion	5	1	5	0
Total	23	5	23	10
Mortality	–	3	–	4

*$P < 0.05$ vs P Group, Values are numbers.

Conclusions: Prophylaxis with ketoconazole results in significant reduction in frequency of ARDS in patients with sepsis but not all patients compared with P group. This study supports the use of ketoconazole in sepsis patients as prophylaxis of ARDS.

References:

1 Slotman GJ, Burchard KW, Arezzo D, et al. *Crit Care Med* 1993; 21: 1624.
2 Yu M, Tomasa G. *Crit Care Med* 1993; 21: 1635–42.

Resuscitation and Emergency Medicine

A-640

AED's in a German emergency system: A 4 years retrospect

J. Schnoor, C. Herfurtner-Pröpper, O. Kunitz, S. Haaf-v. Below, U. Wainwright

Department of Anaesthesiology, University Hospital Aachen, Aachen, Germany

Background and Goals of the Study: The decrease of mortality after sudden cardiac arrest treated by "first responders" using Automated External Defibrillators (AED) could almost be demonstrated (1). Only few data exist about the AED usage in Germany (2). To investigate the influences of AED's used by emergency medical techniques (EMT) on the rate of spontaneous resuscitation retrospective analysis of trauma protocols (Aachen, Germany) was performed.

Material and Methods: The trauma protocols (Medlinq®, Germany) of a four years period (1998–2002) were reviewed. All cases of AED's (08/16®, Corpuls, Germany) used by EMT's were analysed and compared to common defibrillations by emergency physicians (EP) in the same town in 2000. Data were analysed as follows: sex, age, interval between emergency call and arrival/defibrillation (DEF), time interval (in case of AED usage) between emergency call and delayed arrival of EP's (DAEP), rate of spontaneous circulation (ROSC). Data are shown as mean ± SD analysed by Wilcoxon Rang Sum test and Fisher exact test. Differences were regarded for p values $<0.05^*$, and $p < 0.001^{\#/\neq}$.

Results:

	EP (n = 91)		EMT (n = 22)	
	Male	Female	Male	Female
n	68 (71.6%)	23 (28.4%)	18 (81.4%)	4 (18.2%)
age (y)	67.6 ± 13.8	71.1 ± 16.4	62.2 ± 13.9*	80.3 ± 7.4*
DEF (min)	8.5 ± 5.4	9.2 ± 6.5	4.2 ± 1.4#	5.2 ± 2.1≠
DAEP (min)			10.3 ± 3.1#	11.1 ± 2.5≠
ROSC	24 (35.3%)	11 (48.8%)	11 (61.1%)	2 (50%)

Conclusions: AED usage by German EMT's was associated with a significantly shortened time interval between emergency call and arrival/defibrillation. Obviously, the abridged time interval was followed by a higher ROSC in men, although significant difference was lacking.

References:

1 Valenzuela TD, et al. *N Engl J Med* 2000; 343: 1206–1209.
2 Arntz HR, et al. *Resuscitation* 1993; 26: 39–46.

A-641

Experience with an in-hospital physician-operated mobile emergency medical service in a large hospital

G. Lotz, M. Bück, C. Byhahn, P. Küppers, V. Lischke

Department of Anesthesiology, J.W. Goethe-University Hospital, Frankfurt, Germany

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Background and Goal of Study: Many hospitals have a special emergency medical service (EMS) that is responsible for life-threatening emergencies outside the hospital's intensive care units, i.e. in the wards and in patient-treatment areas. In contrast, there is often no EMS caring for patients, visitors or personnel outside of these areas. In order to provide emergency medical care in the entire hospital area, we instituted an additional in-hospital EMS to cover the larger hospital area. We describe the structure of our in-hospital EMS and our experience in the first 26 months after its establishment.
Materials and Methods: Our hospital covers an area of 455 acres. 17 miles of streets and walkways connect 60 buildings. On an average workday, 1,250 patients, 4,200 employees and 4,600 medical students dwell on the hospital area, while another 10,000 pedestrians and bikers, along with 3,000 cars, cross the hospital area every day. The in-hospital EMS is available 24 hours and consists of a fully equipped ambulance staffed with two paramedics and an experienced anesthesiologist. If callers report an emergency anywhere in the hospital area to the hospital's security headquarters, the EMS team is dispatched to the scene. We analyzed the emergency protocols of all rescue missions that occurred within the first 26 months and classified them according to type and severity of disease by using the NACA score.
Results and Discussions: The EMS team responded to a total of 147 calls, including 3 missions in the immediate vicinity outside of the hospital. Seven calls turned out to be pranks. Out of the total of 125 treated cases, type of disease and NACA score are depicted in the tables. 101 of the patients treated at the scene had to be admitted to the hospital's emergency room, including one drug-addicted person who was found in cardiac arrest in the parking garage and, despite a core temperature of 79°F, was successfully resuscitated.
Conclusion: Since its establishment, knowledge of the existence of our in-hospital EMS has steadily increased within the hospital community. As a consequence, the number of events has likewise steadily increased. We believe that a total of 20.4% life-threatening events (NACA 4–6) underscores the importance of the EMS in our large and extended hospital area.

A-642

Resuscitation in a metropolitan area

M.L. Gosta, B. Christian, S. Kortüm*, P. Kessler, L. Volker

*Department of Anesthesiology, J. W. Goethe-University, Frankfurt, Germany; *Fire Department, City of Frankfurt, Germany*

Background and Goal of Study: To determine survival from out-of-hospital cardiac arrest in the Frankfurt EMS system and compare the findings with results from literature.
Materials and Methods: The city of Frankfurt, a metropolitan area with 650,000 residents, has a two-tiered EMS system with emergency medical technicians (EMT) without defibrillation capability on the first tier (BCLS) and paramedics assisted by a physician on the second tier (ACLS). EMS protocols from January 1, 1997 through March 31, 1998 were retrospectively analyzed according to Utstein style recommendations.
Results and Discussions: Of 504 consecutive cardiac arrests on which resuscitation was attempted, 447 met entry criteria as primary cardiac events. 35,8% of those patients were admitted to hospital. The rate of hospital discharge was 7,8%.

	Year	Patients admitted to hospital	discharged alive	
21 studies	1976–2001	15323	33,1%	13,9%
Frankfurt	2002	447	35,7% ($p > 0,05$)	7,8% ($p < 0,05$)

Comparison of Frankfurt results vs. meta-analysis

Conclusion(s): The overall survival rate was significantly lower than those reported in similar studies, compiled in our meta-analysis. Key reason for the poor outcome may be the large proportion of patients with the initial rhythm of asystole. The "Chain of Survival"[1] should be strengthened by the introduction of early defibrillation by EMTs. Whether the implementation of early defibrillation for EMTs can improve the relatively poor survival rates will be analyzed in an ongoing study of the Frankfurt EMS system.
Reference:
1 Circulation 83:1832–1847.

A-643

Does dispatching accuracy differ between centers?

B. Schoenmaekers[1], A. Nieuwenhof[1], F. Gijsenbergh, J. Hendrickx[2]

[1]*Emergency department of the Stuivenberg hospital, Antwerp, Belgium;* [2]*Anesthesiology, O.L.V. hospital, Aalst, Belgium*

Background and Goal of Study: Cost-effective dispatching ensures mobile advanced life support (ALS) teams are properly allocated to those patients most in need of emergency medical assistance while minimizing needless yet expensive unnecessary interventions. We define an "inaccurately" dispatched intervention or IDI as an intervention that was aborted after 5 min, without contact with a patient or an other rescue team, and without a proper explanation. We examined whether dispatching centers in a rural and urban area differ in their accuracy, taking into account case load mix.
Materials and Methods: 1255 emergency interventions by 2 ALS teams during 6 months were examined. One ALS team (ALS-R; $n = 456$ cases) was located in a rural area (Aalst, Belgium), the other one (ALS-U; $n = 799$ cases) in an urban area (Antwerp, Belgium). An "intervention" was defined as the ALS team having to leave the hospital after being ordered to do so by the dispatching center. Differences in patient's age, case mix (diagnoses), the numbers of IDI's, and patient disposition were examined using Pearson's Chi square test.
Results and Discussions: Age distribution and case mix were similar (table 1). Differences in specific cases (gunshot/stab wounds) are related to local factors (alcohol and drug abuse and related violence and social neglect is higher in urban areas). The main difference was number of IDI's.
Conclusions: Dispatching centers differ in their accuracy. Identifying those factors leading to differences in IDI's could optimize resource allocation. Because differences in case mix cannot provide the sole explanation for this phenomenon, factors like differences in training level, experience, protocols, feedback sessions, and MD assistance of the dispatch center might be responsible, but this cannot be derived from our current data.

Table 1. Number of cases in each group.

	ALS-R	ALS-U	P value
Age	456	799	=0.642
Internal pathology	225(57.3%)	444(59.0%)	=0.292
Traumatology	117(29.8%)	230(30.5%)	=0.292
Psychiatry	47(12.0%)	66(8.8%)	=0.292
Gynaecology	4(1.0%)	13(1.7%)	=0.292
Gunshot/stab wounds	2(0.5%)	29(3.9%)	=0.01
Idl	47(10.3%)	13(1.6%)	<0.01

A-644

In-hospital arrests: ¿different results in differents rooms?

E. De Dios-Tomás, M. Santos, F Ramasco, C. Figueroa, G. Martín Hernández, M. Borja, L. Quecedo, R. Roses

Department of Anaesthesiology, Princess University Hospital, Madrid, Spain

Background and Goal of Study: We present a descriptive study of the registry of in-hospital arrests in a general hospital, comparing the reanimation results between conventional rooms of hospitalization and monitored units with staff trained in the field of cardiopulmonar resuscitation maneuvers.
Patients and Methods: We made a descriptive study according to the Utstein style[1,2] of in-hospital cardiac and/or respiratory arrests in a period of 6 months in the University Hospital of the Princess of Madrid, Spain. Results are analyzed comparing the cases registered in special units (Resuscitation, Urgencies, Coronary Unit, Hemodynamics) with those registered in rooms of hospitalization.
Results: A total of 36 cases was registered (32 cardiorrespiratory arrests, 2 only respiratory and 2 false calls). The average age of the patients was of 62.13 years (rank 22–86). Immediate causes were: myocardic ischemia (16.67%), arrhythmias (13,89%), respiratory depression (8.33%), others-traumatisms, massive bleeding, seizures – (19.44%), and unknown cause (41.67%). Spontaneous circulation was recovered in 30.56% of the total.

In special rooms were recorded 15 cases (41.67% of the total), with average age: 50.37 years (rank 22–75), and mortality 53.33%.There were 21 cases in conventional rooms (58.33% of total), with average age 68.4 years (rank 42–86) and mortality 80.95%.

A comparative analysis of the difference of mortality between both groups shows an CI (95%): −0,0329–0.8944 ($0,05 > p < 0,1$). In relation with this tendency, 70% of diagnosis of ventricular fibrillation (better prognosis), and so single 31% of asystolias were registered in specialized units, provided with monitorization systems; these data are consistent with the known fact that a delay in diagnosis implies more probability of asystolia, and a worse prognosis.
Conclusions: There is a tendency to a greater percentage of exitus in arrests registered in rooms of hospitalization, probably in relation with less availability of adequate technology and staff familiarized with resuscitation maneuvers, which lead to a precocious diagnosis and treatment. Specific courses of reususcitation for hospital staff is encouraged.
References:
1 Idris AH, Becker LB, Ornato JP, et al. Utstein-style guidelines for uniform reporting of laboratory CPR research. A statement for healthcare professionals from a task force

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of the American Heart Association, the American College of Emergency Physicians, the American College of Cardiology, the European Resuscitation Council, the Heart and Stroke Foundation of Canada, the Institute of Critical Care Medicine, the Safar Center for Resuscitation Research, and the Society for Academic Emergency Medicine. Writing Group. Circulation. 1996; 94(9): 2324–36. Review
2 Gullo A. Cardiac arrest, chain of survival and Utstein style. *Eur J Anaesthesiol* 2002; 19(9): 624–33.

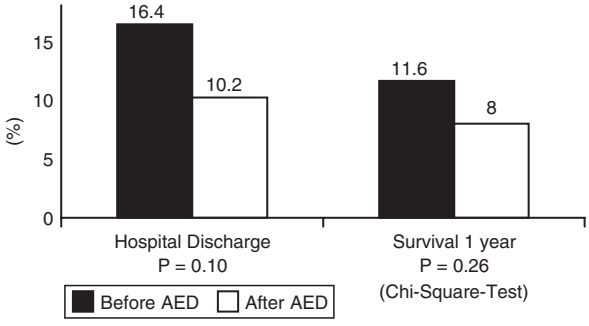
A-645

"Delayed" early defibrillation does not increase survival rates in out-of-hospital cardiac arrest

M. Stotz[1], G. Zwicker[2], R. Albrecht[1], W. Ummenhofer[1]

[1]Department of Anaesthesia, University Hospital, Basel, Switzerland; [2]Emergency Medical Sercice, Basel, Switzerland

Background and Goal of Study: Early defibrillation has been shown to improve survival of out-of-hospital cardiac arrest (OHCA) due to ventricular tachycardia (VT)/ventri-cular fibrillation (VF) (1). In July 1997, we incorporated automated external defibrillators (AED's) into our emergency medical service (EMS). Before, paramedics performed only basic life support (BLS) with defibrillation postponed until the physician arrived.
Materials and Methods: A retrospective study over a 9-year period (1993–2001) to determine the outcome survival rates before and after the introduction of AED. Data collection followed Utstein-style guidelines.
Results: Before AED, the EMS was called for 177 non-taumatic OHCA's, 146 of which were witnessed. Initial rhythm was VT/VF in a total of 97 patients. From July 1997 to December 2001 the EMS handled 203 cases of OHCA, 176 were witnessed. The initial rhythm was VT/VF in a total of 108 patients. Times to defibrillation before versus after introduction of AED were 16.6 ± 6.7 min and 6.2 ± 3.7 min, respectively ($P < 0.001$, ANOVA). Outcome data are shown in the figure.



Conclusions: During its initial 31 months of use by our EMS, there was no positive effect from AED on the survival rate of OHCA patients. Time to defibrillation was significantly shorter, but our EMS did not meet the criteria for early defibrillation (<4 min.). BLS prior to "delayed" early defibrillation seems to improve survival in patients with VF/VT (2).
References:
1 Valenzuela T, Roe D, Nichol G et al. *NEJM.* 2000; 343: 1206–1209.
2 Cobb L, Fahrenbruch C, Walsh R et al. *JAMA.* 1999; 281: 1182–1188.

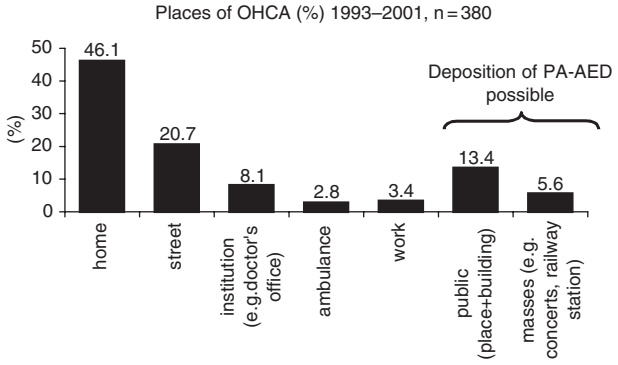
A-646

Public access defibrillation – yes, but where?

M. Stotz[1], G. Zwicker[2], R. Albrecht[1], W. Ummenhofer[1]

[1]Department of Anaesthesia, University Hospital, Basel, Switzerland; [2]Emergency Medical Srevice, Basel, Switzerland

Background and Goal of Study: To shorten time to defibrillation in out-of-hospital cardiac arrest (OHCA) due to ventricular tachycardia(VT)/fibrillation(VF), the use of public access automated external defibrillators (PA-AED) has been advocated (1). The use of PA-AED by formerly not instructed personnel has recently shown promising results in respect to survival (2).
Materials and Methods: A retrospective study over a 9-yr period (1993–2001) of the emergency medical system (EMS) to determine suitable places for PA-AED deposition.
Results: The EMS was called for 380 cases of non traumatic OHCA; 205 patients (mean age 66 yrs) suffered from VT/VF, 175 from asystole/PEA, 73.1% of patients were male. The mean arrival time for EMS was 5.9 ± 3.4 min. 11.1% of patients survived to hospital discharge, 8.2% were alive 1 yr after OHCA. Surroundings of OHCA are shown in the figure.



Conclusions: Most people suffer from OHCA at home. Availability of PA-AED seems to be advatageous for about 20% of the patients studied. For PA-AED, regional conditions should be examined before placement of devices is inaugurated (2).
References:
1 Graham N. et al. *Circulation.* 1998; 343: 1309–1314.
2 Caffrey S.L. et al. *NEJM.* 2002; 347: 1242–1247.
Acknowledgement: Presented in parts at the Swiss National Congress on Anaesthesiology.

A-647

Use of automated external defibrillators in a large hospital by non-physicians. The first 100 patients

H. Fischer, B. Weh, R. Freynschlag, M. Irnsdorfer, D. Brandstätter, W. Mitterndorfer, H. Gombotz

Department of Anesthesiology and Intensive Care, General Hospital Linz, Austria

Background and Goal of Study: The use of automated external defibrillators (AEDs) has been shown to improve outcome in patients with cardiac arrest in different settings (1,2). Therefore the implementation of AEDs in medical institutions with a much higher incidence of cardiac arrests seems to be mandatory. In this observational study the first 100 intrahospital cardiac arrests initially treated with AEDs by non-physicians are reported.
Materials and Methods: Twenty eight biphasic AEDs (Philips Heartstream ForeRunner 2) have been installed in a 1000 bed hospital. All nurses were given training for correct application of the device. Event data and ECG were recorded using Code Runner Software (Philips). Key event information following Utstein style for intrahospital resuscitation was documented.
Results and Discussions: Out of 100 pts. 16 could not be evaluated due to incomplete documentation. Of the remaining 84 pts. (m = 44;71 ± 16 yrs) the initial ECG and the survival rate are summarized in the table below.

	ROSC yes (no)	Intrahospital death	Discharge	>6mo	>12mo
VT	4 (1)	1	3	3	0
VF	9 (2)	4	5	2	1
Asyst.	9 (29)	5	4	4	2
PEA*	14 (16)	13	1	0	0
Total	**36 (48)**	**23/36**	**13/36**	**9/36**	**3 (30)**

*PEA pulseless electric activity.

In 48 pts. no return of spontaneous circulation (ROSC) could be obtained. In 36 pts. with ROSC 23 died during their hospital stay. Main causes of 71 deaths were cardiac (n = 37), respiratory (n = 10) and pulmonary embolism (n = 11). Out of 16 pts. with ventricular tachycardia (VT) or fibrillation (VF) 8 pts. could be discharged alive.
Conclusion: Defibrillation with AEDs can be safely performed by non-physicians in the hospital setting. The highest survival rate could be obtained in patients with ventricular tachycardia/fibrillation. The documented 50% survival rate for intrahospital defibrillation with AEDs is higher when compared to conventional intrahospital defibrillation (3) and comparable with reports in the nonhospital settings (1,2).

https://doi.org/10.1017/S0265021503001704 Published online by Cambridge University Press

References:
1 Valenzuela et al. *NEJM* 2000; 343: 1206
2 Caffrey et al*: NEJM* 2002; 347: 1242
3 Huang et al. *Resuscitation* 2002; 53: 265

A-648

Use of LMA in the ventilation of the newborn during the first minute of life

E. Margaria

Professor of anaesthesia, Torino, Italy

Materials and Methods: We considered 80 newborns, born from caesarean section in epidural anaestesia; the neonates were divided into two groups: 1 – those not requiring ventilation support (Apgar > 7 at 1st minute) 2 – those who received ventilation support with LMA (Apgar 6–7 at 1st minute): this second group was subdivided into 3 subgroups:
(a) neonates who received ventilation support with LMA only
(b) neonates who received ventilation support with LMA and Ambu (air)
(c) neonates ventilated with LMA allied to an oxygen erogator

We measured oxygen saturation, partial carbon dioxide pressure and HR of each newborn.
Results: 1-Many normal newborns, even though presenting a high Apgar score, thus not needing ventilation support, didn't present a satisfactory oxygen saturation, mean values remaining under 89% even after the 14th minute. 2-Group A: we did not observe an improvement in oxygen saturation with spontaneous respiration. Group B: we observed a general improvement of hypoxia: oxygen saturation reached a mean value of 90% at the 7th minute. Group C: oxygen saturation reached 90% on average, before the 4th minute. We did not observe variations in HR.
Conclusions: The fast achievement of normal O_2 levels improves neonatal outcome. Because also physiologic neonates are hypoxic and hypercapnic, our experience suggests the efficacy of ventilation in O_2 for all newborns in the first minutes of life, even when ventilation support does not appear necessary; from this point of view, LMA appears to be a particularly suitable and non invasive device, which allows to reach equilibrium in respiratory omeostasis (oxygen saturation higher than 90%, carbon dioxide partial pressure less or equal to 35 mmHg), faster than FM (facial mask) and less traumatic than IOT.

A-649

Efficacy of the use of the parker tube over a gum elastic bougie in tracheal intubation

K. Koga, T. Noguchi, Y. Shiga, A. Shigematsu

Department of Anaesthesiology, University of Occupational and Environmental Health, School of Medicine, Kitakyushu, Japan

Background and Goals: The use of a gum elastic bougie is useful in difficult tracheal intubation. However, a tracheal tube may sometimes get caught on the epiglottis or the arytenoids, causing difficulty in threading the tube over the bougie (1). We compared the ease of tracheal intubation over a bougie using two different types of tracheal tube.
Material and Methods: After obtaining from the ethics committee and written informed consent from all patients, we studied 26 adult patients scheduled for general anaesthesia. The patients were allocated randomly to one of two groups: Parker tube group and Portex tube group. Anaesthesia was induced with propofol and muscle relaxation was provided by vecuronium. Tracheal intubation over a gum elastic bougie was then attempted using either a newly designed Parker tube or a conventional Portex tube. The ease of tracheal intubation over the bougie was evaluated in three grades: optimal (=no hold-up), suboptimal (=hold-up, relieved by rotation) and difficult (=hold-up, requiring some manipulations) (2).
Results:

	Optimal	Suboptimal	Difficult
Parker tube (n = 12)	9	3	0
Portex tube (n = 14)	2	8	4

P = 0.03; Chi-squared test

Conclusions: We frequently encountered difficulty in advancing a Portex tube over a bougie. The use of the Parker tube facilitated tracheal intubation over it.
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A-650

Endotracheal intubation using the Bonfils fibrescope and the Intubating Laryngeal Mask Airway – a comparison in a model of cervical spine injury

V. Dörges, K. Gerlach

Department of Anaesthesiology and Intensive Care Med, University Hospital Kiel, Dept of Anaesthesiolgy, University Hospital Lübeck, Germany

Background and Goal of Study: In case of cervical spine injury endotracheal intubation is complicated because in-line-position of the head is required (1). The purpose of this study was to investigate whether the intubating laryngeal mask airway (ILMA) and the Bonfils fibrescope may be suitable alternative devices compared to the standard Macintosh blade when intubating an adult airway management trainer.
Materials and Methods: 30 volunteer healthcare professionals performed endotracheal intubation using the ILMA, the Bonfils fibrescope and a Macintosh laryngoscope blade (3 or 4) in a random order in an adult airway management trainer (Laerdal, Stavanger, Norway) which was stabilised in in-line-position. The number of orotracheal intubating attempts was counted. The time from touching the device to the first adequate lung insufflation was measured. The participants reported the laryngoscopic view according to Cormack and Lehane. Additionally, the subjective assessment regarding the handling of the three devices was reported on a numeric rating scale.
Results and Discussions: Orotracheal intubation with the Macintosh laryngoscope blade took significantly ($p < .01$) less time (21–105 s; median 37 s; successful in 100%) when compared to the Bonfils fibrescope (15–111; 48; 90%). The ILMA was inserted in 22–92 s (39; 100%); while endotracheal intubation through the inserted ILMA was performed in 26–41 s (32; 93%). The volunteers reported the laryngoscopic view according to Cormack and Lehane to be significantly ($p < .001$) better when using the Bonfils fibrescope compared to the Macintosh laryngoscope blade.
Conclusion: When intubating a model of cervical spine injury both the ILMA and the Bonfils fibrescope may be suitable alternatives to the standard Macintosh laryngoscope blade.
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A-651

Is there a place for cuffed oropharyngeal airway (COPA) in resuscitation–emergency medicine?

M. Mantouvalou, I. Iatrelli, C. Nikolaidis, P. Tselioti, A. Prekates, Pavlopoulos F

EKAB, Tzanion general hospital, Athens, Greece

Background and Goal of Study: We studied 67 cases with difficult/impossible intubation–ventilation in an emergency care unit. 34 of them were ventilated with a bag-valve-mask after inserting a cuffed oropharyngeal airway (COPA). 33 of them were ventilated after inserting a laryngeal mask airway(LMA).
Materials and Methods: The variables recorded were the number of attempts needed to achieve correct placement (a tidal volume of 200 ml), the insertion time of the COPA and the LMA and the average time taken to achieve the first ten correct ventilations.
Results and Discussions: LMA required fewer attempts for correct placement than did the COPA. Time to achieve ten correct ventilations was also shorter with the LMA than the COPA. ($P < 0{,}001$)
Conclusion(s): We conclude that the LMA offers an easier and quicker way to provide ventilation for resuscitation than does COPA. Earlier experience affects the ease of insertion of both the LMA and the COPA, as well as the total time to achieve adequate ventilation.
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A-652

A new device to facilitate blind endotracheal intubation

P. Tjong Joe Wai

Department of Anesthesiology, Onze Lieve Vrouwe Gasthuis, Amsterdam, The Netherlands

Background and Goal of Study: Laryngoscopic endotracheal intubation may be difficult. A new intubating device facilitating blind endotracheal intubation

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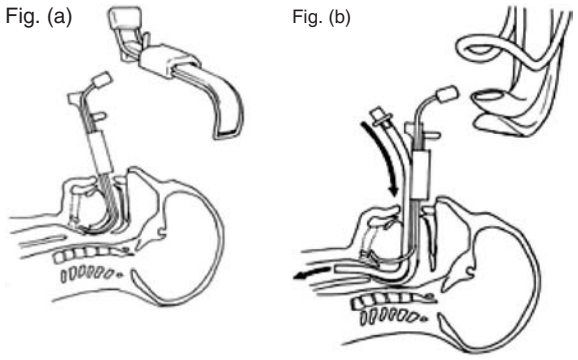
was tested. This device causes minimal movement of cervical vertebrae and puts little pivotal stress on the incisors. The goal of the pilot study was to see if it was possible to endotracheally intubate with the device.

Fig. (a) Fig. (b)



Materials and Methods: The device (consisting of two J-shaped parts) is positioned blindly with minimal interdental displacement, placing the curve of the device into the oropharynx and the tip in the vallecula (fig.a). Then the two parts are displaced longitudinally by a ratchet mechanism to create space between the base of the tongue and the back wall of the oropharynx. The anterior part is digitally recognized by external palpation above the thyroid. The part against the back wall of the oropharynx provides a slide. An endotracheal tube is introduced into the device, follows the curve of the slide and slips into the trachea (fig.b).

Twenty patients, ten of them edentulous were included.

Results and Discussions: Endotracheal intubation was successfully achieved in 19 patients. Fifteen of them were intubated at the first attempt, four after two attempts.

Conclusion(s): The present device seems suitable for endotracheal intubation without producing excessive movement of the neck. It might offer a new approach to the difficult airway situation and could also be useful for the inexperienced practitioner.

A-653

Supraglottic airway devices with oesophageal access: Comparison of Combitube, LMA-ProSeal and LTS in a resuscitation model

H.V. Genzwuerker, T. Finteis, H. Krieter, K. Ellinger

Institute of Anaesthesiology and Intensive Care Medicine, University Hospital Mannheim, Germany

Background and Goal of Study: Alternatives to mask ventilation and tracheal intubation should offer gastric access besides providing a reliable airway seal to increase safety during emergency airway management. Three airway devices allowing placement of a gastric tube, Combitube (CT), LMA-ProSeal (PS) and LTS, are compared with facemask and tracheal tube in a manikin.

Materials and Methods: 80 CPR-cycles of 3 minutes each are performed in a resuscitation model consisting of an Ambu Cardiac Care trainer with connected PC for measurement of respiratory parameters, signs of gastric insufflation and chest compressions and a thumper to standardize chest compressions (100/min, depth 46 mm). Ventilation was performed with a bag-valve device with a volume of 1.700 ml, cuff pressures were adjusted to 80 cmH_2O. With facemask, CT (37 Fr, oesophageal position), PS (size 4) and LTS (size 4), 10 CPR-cycles each were performed with a compression: ventilation-ratio of 15:2. With tracheal tube, CT, PS and LTS, 10 CPR-cycles each were performed with continuous chest compressions after two initial ventilations. The Wilcoxon test (software SAS 8.1) was used for statistical comparison of tidal volumes.

Results and Discussions: According to ILCOR guidelines (1), all devices allow sufficient ventilation (TV > 400 ml).

Ventilation via	CC	Resp. Rate	MV	TV	Stomach
Facemask	15:2	9.7/min	7.3 l	0.76 l	2.4%
Combitube	15:2	9.3/min	7.3 l	0.79 l	0%
LMA-ProSeal	15:2	9.5/min	7.8 l	0.78 l	0%
LTS	15:2	8.0/min	6.5 l	0.82 l*	0%
Tracheal tube	cont.	10.0/min	8.6 l	0.86 l	0%
Combitube	cont.	9.9/min	7.1 l	0.71 l+	0%
LMA-ProSeal	cont.	10.3/min	8.2 l	0.80 l+	0%
LTS	cont.	10.2/min	8.1 l	0.80 l+	0%

[CC = chest compression, MV = minute ventilation, TV = tidal volume, cont. = continuous; significant difference ($p < 0.01$) compared to *facemask and +tracheal tube]

Conclusions: Combitube, LMA-ProSeal and LTS allow sufficient ventilation in the resuscitation model chosen even under simulated extreme conditions during continuous chest compressions. The use of these alternatives to facemask and tracheal tube for airway management during resuscitation in patients should be studied, with additional focus on successful insertion of device and gastric tube.

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A-654

In-line-intubation in cervical spine injury – first evaluation of the Dörges laryngoscope blade

K. Gerlach, V. Dörges[1]

Department of Anaesthesiology, University Hospital Lübeck; [1]Dept of Anaesthesiology and Intensive Care Med, University Hospital Kiel, Germany

Background and Goal of Study: Endotracheal intubation should be performed in in-line-position, if cervical spine injury is suspected (1). The in-line-position complicates endotracheal intubation. The Dörges universal laryngoscope blade was designed to facilitate endotracheal intubation and, due to its special design, to reduce the number of laryngoscope blades to two or even one (2). The purpose of this study was to evaluate the new Dörges universal laryngoscope blade and to compare it with the standard version of the Macintosh laryngoscope blades size 3 or 4 in in-line-position of the head when cervical spine injury is suspected.

Materials and Methods: 25 volunteer healthcare professionals utilised a Macintosh laryngoscope blade size 3 or 4 and the Dörges laryngoscope blade in a random order for endotracheal intubation of an adult airway management trainer (Laerdal, Stavanger, Norway) which was stabilised in in-line-position using a rigid collar (Stifneck®, California Medical Products Inc., Long Beach, USA) in order to ensure standardised conditions. The number of orotracheal intubating attempts was counted. The participants reported the laryngoscopic view according to Cormack and Lehane and the subjective assessment regarding the handling of both blades. The time from touching the laryngoscope to the first adequate lung insufflation was measured with a stopwatch.

Results and Discussions: No differences were found between the Dörges laryngoscope blade and the Macintosh laryngoscope blade regarding the number of intubation attempts, the laryngoscopic view according to Cormack and Lehane and the subjective assessment regarding the handling of the laryngoscopes. The time from touching the laryngoscope to the first adequate lung insufflation was 17–73 s (median 38 s) for the Dörges laryngoscope blade and 21–105 s (38) for the Macintosh laryngoscope blade.

Conclusion: The Dörges universal laryngoscope blade was comparable to the Macintosh laryngoscope blades size 3 or 4, when volunteer healthcare professionals intubated an adult airway management trainer which was stabilised in in-line-position.

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A-655

Light-guided tracheal intubation via the intubating laryngeal mask during out-hospital cardiopulmonary resuscitation by ambulance medical staff

V. Grosomanidis, D. Ekklisiadis, R. Iosifidou, G.S. Voyagis, V. Dimitriou

National Emergency Pre-hospital Service of North Greece, Thessaloniki, Greece

Background and Goal of Study: Use of the laryngeal mask in emergency medicine has been suggested since 1984 (1). Tracheal intubation (TI) is therefore the most suitable method of securing the airway during cardiopulmonary resuscitation (CPR) (2). Light-guided (LG) TI via the intubating laryngeal mask (ILM) using a flexible lightwand (FLW) has a higher success rate than the conventional blind technique (3). We evaluated the efficacy of LG TI during out-hospital CPR by the medical staff in national ambulance pre-hospital service.

Material and Methods: After IRB approval and training of ambulance medical staff (video, mannequin, anaesthetic practice), LG TI was attempted in 37 cases aged 45–83 yr during out-hospital CPR. Whenever access to the head end of the victim was difficult the insertion of the ILM and LG TI were performed with the intubator standing lateral or in front of the victim. The ILM was inserted and the cuff inflated. The tracheal tube (TT) preloaded with the FLW was passed down the ILM tube and advanced into the trachea while observing the location of the glow in the neck. Whenever resistance was felt, a predetermined sequence of adjusting manoeuvres were instituted depending

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on the location of the glow [3]. The success/failure of ILM placement, LG TI and restoration of spontaneous circulation (ROSC) were recorded.
Results: The position of the intubator was behind the victim's head in 29/37 (78%) cases and lateral/in front in 8/37 (22%) and the ILM was placed successfully at 1st attempt in 28/29 (96.5%) and 7/8 (87.5%) respectively. In the rest two cases a 2nd attempt of ILM insertion was needed. All victims were intubated successfully (37/37, 100%), 25/37 (67.5%) at 1st attempt, 7/37 (19%) at 2nd and 5/37 (13.5%) at 3rd. The incidence of successful TI at 1st attempt was similar either with the intubator behind the victim's head (19/29, 65.5%) or lateral/in front (6/8, 75%). ROSC was succeeded in 10/37 (27%) cases.
Conclusion: LG TI via the ILM seems to have a role during out-hospital CPR by ambulance medical staff.
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A-656

The laryngeal mask airway in emergency medicine

M. Mantouvalou, C. Nikolaidis, D. Koufoudakis, I. Iatrelli , A. Stefanidou

Greek National Center for Life Support(EKAB), Athens, Greece

Background and Goal of Study: The laryngeal mask airway has gained widespread acceptance as an alternative to the face mask. Its role outside the operating room may include an adjunct in the management of difficult airway especially for ventilation in the cannot ventilate- cannot intubate scenario. Is there a place for the laryngeal mask in emergency medicine? The purpose of our study was to assess the time for insertion of the laryngeal mask as well as adequate lung ventilation and gastric inflation when perfoming ventilation with a laryngeal mask.
Materials and Methods: We studied 54 patients that needed ventilation-intubation in an emergency unit and had difficult airway management for several reasons (obesity,burns,trauma etc). After two failed attempts to intubate physicians working in the emergency unit (not always anesthetists) inserted a laryngeal mask and tried to ventilate the patients.
Results and Discussions: The time for insertion was significantly fast (22–37 s) even from doctors without much experience. Mean 1-min lung volumes were 15 + 6,6 L.
Conclusion(s): Laryngeal mask airway has definitely a place in emergency medicine as it provides physicians with a fast, easy and relatively cheap tool for ventilation in case of emergency. The primary risk with the LMA is aspiration of gastric contents, a risk seriously considerated in emergency medicine where the doctor rarely has adequate information about the patient.
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A-657

Serum S-100 protein as a prognostic marker for irreversible brain damage in comatose cardiac arrest survivors

O. Piazza, A. Cauteruccio, E. De Robertis, G. Servillo, G. Esposito

Department of Anaesthesia and Intensive Care, University of Naples "Federico II", Department of Clinic Pathology IRCS Pascale Napoli, Naples, Italy

Background and Goal of Study: Patients with cardiac arrest have a very high mortality and early determination of outcome after successful cardiopulmonary resuscitation is a common problem with great ethical, economic and social consequences. Clinical parameters, EEG and Evoked Potentials are used for outcome prediction (1). S-100 is an established biochemical marker of central nervous system injury (2). The aim of this study was to determine whether the use of serum determination of S-100 is a useful tool for outcome prediction.
Materials and Methods: We prospectively investigated 13 adults comatose patients who have been resuscitated after in-hospital cardiac arrest. Serum S-100 levels were determined within the first 12 hours of post arrest, using commercial luminescent immunoassay. All the patients were followed until return of consciousness (group 1) or death due to CNS failure (group 2). Student's T test was used to compare S-100 levels of group 1 and 2.
Results and Discussions: The serum level of S-100 were increased during the first 12 hours post-arrest. Mean value was 1,46 ± 1,2 g/L. Seven patients out of 13 regained consciousness. An inverse correlation between S-100 levels and outcome was found, not significant ($r = -0{,}06$). No difference was found between group 1 and 2 as S-100 values were concerned.
Conclusion(s): Measurement of serum S-100 does not allow the clinicians to distinguish patients with a poor cerebral outcome in the early phase following a cardiac arrest.
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A-658

Reporting one-year data of patients with traumatic injuries and the factors associated with poor outcome

P. Roca, R. Garcia-Guasch, B. Oller, L. Tosca, J. Roca

Serveis dAnestesiologia i Reanimació i Cirurgia, Hospital Universitari Germans Trias i Pujol, Badalona, Spain

Background and Goal of Study: The aim of our study was to collect the data of the patients with traumatic injuries admitted to the Emergency Department (ED) during a period of one year, and to analyse factors associated with a poor outcome.
Marterial and Methods: The study was carried out in our teaching hospital which has 450 beds and covers a population of 600.000. The data of all the patients with traumatic injuries admitted to the ED throughout the year 1996 were collected prospectively. The following items were recorded: sex, age, cause of injury, site of injury (cranium, thorax, abdomen, limbs), cardiac arrest, emergency surgery, ASA, Revised Trauma Score (RTS), Glasgow Coma Scale (GCS), Injury Severity Score (ISS), emergency hematologic and laboratory tests, complications (ARDS, mechanical ventilation, tracheostomy, atelectasis, respiratory infections), and the date and cause of death (shock, brain death or multiorganic failure). Univariate and multivariate analysis were carried out, for which "outcome of death within 40 days after injury" and "Glasgow Outcome" were defined as the dependent variables. Descriptive analysis was used for comparing independent variables.
Results and Discussions: Out of 103 patients, 77 were men and 26 women, with a mean age of 34.50 ± 19.90 years. Traffic accidents were the most common cause of injury (84; 81,6%), followed by accidental falls (13; 13%), violent attacks (4; 3.9%) and staircase falls (1; 0.9%). Most of patients were ASA I (75), II (19), III (9). Twenty one (20.4%) patients died in the hospital of which more than half (11) died following cardiac arrest. Six died in the first week, 3 during the next two weeks and one died in hospital within 40 days. Median UCI stay was 10.91 ± 17.87 days and median hospital stay was 13.41 ± 13.93 days. Factors associated with "outcome of death within 40 days after injury" were, GCS < 9, RTS of 7 or less, anemia and clot disorders. Factors associated with poor "Glasgow outcome" were: accidental fall, acute respiratory distress syndrome, mechanical ventilation, GCS <9 and RTS < 7.
Conclusion(s): In our setting, traffic is the first cause of injury in the young age group. A Revised Trauma Score < 7 and GCS < 9 were significantly associated with death and poor outcome.

A-659

Changes in brain tissue oxygen pressure during cardiopulmonary resuscitation with vasopressin and after return of spontaneous circulation in pigs

E. Cavus, M. Steinfath, K.H. Stadlbauer, P.H. Tonner, V. Dörges

Department of Anaesthesiology and Intensive Care Medicine, University Hospital Kiel, Kiel, Germany

Background and Goal of Study: In the adult porcine preparation with ventricular fibrillation and basic life support cardiopulmonary resuscitation (CPR), vasopressin improved vital organ blood flow (1) and cerebral oxygen delivery (2). After return of spontaneous circulation (ROSC), initial cerebral hyperaemia is followed by hypoperfusion (3). Nevertheless, little is known about brain tissue oxygen pressure ($PbtO_2$) during CPR and vasopressin administration.
Materials and Methods: Following approval of the Austrian Federal Animal Investigational Committee, nine healthy piglets (12–16 weeks, 38 to 42 kg) were anaesthetised with propofol, piritramide, and pancuronium. A 50-Hz, 60-V alternating current was then applied to induce ventricular fibrillation (VF). After four minutes of untreated VF, CPR was started with a chest compression rate of 100/min, and mechanical ventilation with 100% oxygen. Vasopressin was administered after three ($0.4\,U \cdot kg^{-1}$), eight ($0.4\,U \cdot kg^{-1}$), and 13 ($0.8\,U \cdot kg^{-1}$) minutes of CPR. Biphasic defibrillation was performed after another five minutes of CPR. After ROSC, the pigs were observed for 60 minutes. Cerebral and hemodynamic parameters, and arterial blood gases were measured throughout the experiment.
Results and Discussions: After initiation of ventricular fibrillation, the no-flow state of the brain (indicated by a cerebral perfusion pressure of zero) resulted in a decrease of $PbtO_2$, compared to baseline (mean ± SEM; 1.8 ± 1 mmHg

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after 4 min of VF vs. 22.2 ± 5.7 mmHg; $P < .05$). During the low-flow state of CPR, $PbtO_2$ increased, and reached maximum values (25 ± 7 mmHg; $P < .05$ vs. no-flow) 5 min after the first vasopressin administration. No further changes were seen, until VF was converted to ROSC by defibrillation. During the initial 5 min of ROSC, a marked increase of $PbtO_2$ was observed (18.1 ± 7.8 mmHg to 95.3 ± 24.4 mmHg; n = 3, $P = .1$).

Conclusion(s): Basic life support CPR provides brain tissue with oxygen, which may be improved by administration of vasopressin. The high increase of brain tissue oxygen pressure after ROSC may be due to initial hyperaemia in the postresuscitation phase.

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A-660

Major trauma in the elderly: prehospital evaluation and one week mortality

M. Bernardino*, D. Arnal**, E. Corral***, T. Isasia****, J. Estrada*, R. Ruiz-Campa*

**Anestesia y Reanimación, Hospital Universitario Getafe; **HGU Gregorio Marañón; ***SAMUR-P.Civil; ****HU La Princesa, Madrid, Spain*

Background and Goal of Study: As far as the population frame over 65 years is growing, the severe trauma in the elderly becomes an emergent problem. Trauma is the fifth cause of mortality in the elderly(1). The aim of this study was to compare the one-week survival of the severe trauma elderly patients attended by a prehospital emergency medical service compared with the younger patients and to review the accuracy of one of the most specific prehospital trauma severity score: the Triage Revised Trauma Score (T-RTS)(2).

Materials and Methods: From a 2 year period, clinical reports of severe trauma patients attended by the SAMUR-Protección Civil of Madrid's council were retrospectively analyzed. Data collected were gender, age, cause of traumatism, initial Glasgow Coma Scale (GCS), respiratory rate, blood pressure, T-RTS and survival at 6 hours, 24 hours and 7 days.

Results and Discussions: From an overall of 826 severe trauma patients, 94 were older than 65 years and, from these, 26 older than 80 years. The main cause of severe trauma in patients older than 65 yr was struck pedestrian whereas in younger patients was the vehicle accident.

Table 1. Evaluation and mortality vs. age groups

Age (years)	<65	65–80	>80
GCS (3–15)	10,3 ± 4,8	10,3 ± 4,9	6,5 ± 4,3*
GCS < 9 (%)	37	33,3	77**
T-RTS (0–12)	9,4 ± 3,1	9,6 ± 2,8	7,5 ± 3,1*
Mortality 6 hs (%)	10,4	24,1†	36
Mortality 24 hs (%)	13,4	26,5†	44
Mortality 7days (%)	17,8	39†	68*

Patients <65 yr vs. 65–79 yr †p < 0,001;
Patients 65–79 yr vs. >80 yr *p < 0,05; **p < 0,001

Conclusion(s): Mortality is increased in elderly severe trauma patients (older than 65 years). The differences are even wider between the "young and old" elderly patients (the so-called "over 80 phenomenon"(3)). The T-RTS may be revised for elderly patients: a correction reason with regard to age and an increase the influence of the GCS may be introduced.

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Acute and Chronic Pain Management

A-661

Cannula insertion: Does site selection influence pain on insertion

B. Gouda, J. ODonnell, J. Lyons

Department of Anaesthesiology, Waterford Regional Hospital, Waterford, Ireland

Objective: Many methods are available to decrease the pain on insertion of IV cannula. A small departmental questionnaire indicated that 16 out of 30 anaesthetists and 33 out of 40 non-anaesthetic doctors thought the antecubital fossa (ACF) to be a less painful site than the dorsum of the hand (DOH) for cannula insertion. However 59 of that 70 were willing to alter their choice of cannulation site if one were to be significantly less painful than other. The objective of the present study was to compare the pain on insertion of a 20 G cannula in the ACF vs. the DOH.

Subjects and Methods: In a randomised, prospective, controlled trial, 60 consenting adult patients undergoing elective major gynaecological surgery were divided into two groups. Two 20G IV cannulae (Adsyte) were inserted by an experienced anaesthetist one each in ACF and DOH on the opposite side with the patient's eyes closed. To avoid possible central sensitisation the site of the cannulation was randomised. Pain scores (Using visual analogue scale) were obtained at the end of each cannulation.

Results: 60 patients completed the trial. Mean age was 35.8 years (Range 19–56). 38 of the 60 patients found the DOH more painful than ACF. 14 of them found ACF more painful with 8 patients finding no difference. Analysis using Chi test showed ACF to be significantly less painful than DOH ($P < 0.01$)

Conclusion: By choosing the ACF as the first choice of cannulation site, the pain on insertion can be reduced significantly. It remains to be seen whether this benefit outweighs the practical problems of choosing this site.

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A-662

The prevention of pain from injection of rocuronium by magnesium sulfate, lidocaine, sodium bicarbonate and alfentanil

A. Turan, D. Memis, B. Karamanlioglu, N. Sut, Z. Pamukcu

Department of Anesthesiology and reanimation, Trakya University Faculty of medicine, Edirne, Turkey

Background and Goal of Study: The incidence of pain on injection of rocuronium is frequent; reports suggest that 50–80% of patients suffer pain. We aimed to compare the efficacy of magnesium sulfate, lidocaine, sodium bicarbonate and alfentanil on rocuronium injection pain.

Material and Methods: After ethics committee approval and obtaining written informed consent, 250, ASAI-II patients, scheduled for various elective operations were included. Patients were catheterized at the back of both hands with a 20 G catheter. The forearm was squeezed with a tourniquet; 50 patients in each group were administered; saline (Group C), 2.48 mmol magnesium sulfate (Group M), lidocaine 30 mg (Group L), 8.4% sodium bicarbonate (Group N), alfentanil 1000 μg (Group A), diluted into a 3 mL with saline.The occlusion was released after 20 seconds, 0.6 mg kg^{-1} rocuronium was injected over 10–15 seconds. The patients were observed and asked immediately if they had pain in the arm and the response was assessed. Anesthesia induction was done by 5 mg kg^{-1} thiopental and maintained by 50% N_2O/O_2 and sevoflurane. Patients were asked 24 h after whether they had recall of pain in this arm during induction of anaesthesia and injection site was checked for any complications.

Results: Correlation determined with log linear analysis, significant difference were found in no pain in group C ($P < 0.01$) and light pain in group C ($P < 0.05$).

	No pain	Light	Moderate	High
Group C	12 (22%)	10 (20%)	17 (34%)	12 (24%)
Group M	37 (74%)	10 (20%)	3 (6%)	0
Group L	36 (72%)	12 (24%)	2 (4%)	0
Group N	33 (66%)	14 (28%)	3 (6%)	0
Group A	25 (50%)	19 (38%)	5 (10%)	1 (2%)

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Conclusions: All the drugs decreased the level of rocuronium injection pain. Between these drugs, magnesium sulfate, lidocaine and sodium bicarbonate was the most effective while alfentanil was the least effective.

A-663

Tracheal tube cuff inflation with lidocaine does not decrease morphine requirement following thyroidectomy

C. Lentschener, N. Jude, A. Gomola, Y. Ozier

Department of Anaesthesia, Hôpital Cochin, Paris, France

Background and Goal of the Study: In spite of multimodal analgesia significant morphine must be administered for pain relief following thyroid surgery (1). We hypothesised that pain following thyroidectomy partly resulted from intubation related tracheal injury. Inflation of the tracheal tube cuff with lidocaine reduced the incidence of coughing and pain following trachea intubation (2). We investigated the effect of cuff inflation with lidocaine on pain following thyroidectomy.

Material and Methods: Twenty-five consecutive patients undergoing total thyroidectomy under standard, thiopental-sufentanil-atracurium general anaesthesia including mechanical ventilation using 60 percent nitrous oxide in oxygen, were studied. After intubation of the trachea, the cuff of the tracheal tube was inflated with 2% lidocaine until no leak was detected around tracheal tube (2). Forty minutes prior to the end of surgery all patients received 1 g propacetamol and 50 mg ketoprofen. Cervical plexus block was not performed in order to strengthen the results. A nurse team unaware of this investigation evaluated global postoperative pain using a verbal scale [0–10]. Pain was treated by incremental boluses of 3 mg IV morphine at 5-minute intervals until pain score was $\leqslant 4$ on the verbal scale, or respiration rate was <10. Twenty five patients matched for demographic and intraoperative data, previously operated on by the same surgeon, were used as control. Patients requiring morphine, and morphine requirement in the PACU were compared. The sample size was determined using a power analysis. Mann–Whitney U-test, and Chi square test were used. $P < 0.05$ was significant.

Results: Patients (Lidocaine vs. Control) requiring morphine in the PACU (10 vs. 9, $P = 0.8$) and morphine doses (median[range]) (0[0–13] vs. 0[0–14], $P = 0.6$) did not differ significantly.

Discussion and Conclusions: Tracheal tube cuff inflation with lidocaine did not alter pain following total thyroidectomy. This is, indeed, a retrospective evaluation. However, both the surgeon who performed the operations and the nurse team in charge of the evaluation were not aware of the study.

References:

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A-664

No influence of endogenous cholecystokinin on pain perception in a human model of acute pain and hyperalgesia

W. Koppert, I.R. Pahl, C. Enk, R. Sittl, M. Schmelz, D. Schwalb

Departments of Anesthesiology, Medicine and Physiology, University of Erlangen-Nürenberg, Erlangen, Germany

Background and Goal of Study: Interactions between gastrointestinal hormones and pain are obvious for diseases like pancreatitis. However, cholecystokinin (CCK) can also directly modulate pain perception via CCK-receptors or by interactions with opioids. The present study was designed to determine analgesic effects of different endogenous CCK plasma levels, and possible interactions with concomitant opioid analgesia.

Materials and Methods: Ten volunteers were enrolled in this randomised, double-blind, and placebo controlled study. CCK-excretion was induced by a liquid formula diet with either long-chain triglycerides (LCT) or medium-chain triglycerides (MCT), CCK plasma levels were measured by RIA. Gastric emptying was evaluated by C13-breath testing. Transcutaneous electrical stimulation at a high current density (5 Hz, 70.1 $\pm$ 5.8 mA) was used to provoke acute pain (NRS 5–6 out of 10) and stable areas of secondary mechanical hyperalgesia for two hours. Ongoing pain ratings as well as areas of pinprick-hyperalgesia and allodynia were compared between both liquid formula diets. In a second series of experiments, alfentanil was administered for 90 minutes using target controlled infusions (4.1 $\pm$ 0.5 mg in total), and measurements were performed as stated above. ANOVA, followed by posthoc tests, was used for statistical analysis.

Results and Discussions: The administration of the LCT-diet induced higher CCK-release into the plasma than the MCT-diet with a peak at 15 minutes after ingestion (11.2 $\pm$ 5.4 vs. 2.1 $\pm$ 2.0 pmol/l; $P < 0.01$). The LCT-diet during alfentanil infusion led to a delayed and longer-lasting increase in CCK-plasma levels, which may be related to a reduced gastric emptying during the therapy with the opioid. No effects of the liquid diets on pain ratings and on the hyperalgesic areas were observed ($P = 0.76$ and $P = 0.23$, respectively), suggesting no effects of endogenous CCK on pain perception and opioid-induced antinociception.

Conclusion: Depending on their formula, triglyceride diets provoked a marked release of endogenous CCK. The increase of peripherally released CCK did not modulate acute pain or opioid-mediated analgesia in our study. The local effects of endogenous CCK on visceral pain sensitivity remains to be investigated.

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A-665

Laparoscopy is associated with greater immediate-postoperative pain and analgesia requirement than open surgery

A. A. Weinbroum

Post-Anesthesia Care Unit, Tel Aviv Sourasky Medical Center and Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

Background and Goals: Clinical observation has raised the suspicion that laparoscopic surgery induces severe pain compared to similar open procedures. I have recently documented the beneficial effect of morphine + ketamine IV in postoperative painful cases (1). This study assessed pain intensity and requirements for analgesics in surgical patients who underwent small bowel resection under laparoscopy or open laparotomy ($n = 20$/group) under propofol-fentanyl-rocuronium standardized anesthesia.

Materials and Methods: During the 3-h-stay in PACU, when pain >6/10 (subjective visual analogue scale, VAS) despite 0.1 mg/kg intravenous morphine had been administered within a 30-min period, patients received up to 3 boluses of 15 μg/kg morphine + 250 μg/kg ketamine IV within 15 min until pain VAS $<$ 4/10 or no more analgesia was requested. Diclofenac 75 mg IM as a rescue drug was available. Data were recorded by protocol-blinded nurses.

Results and Discussion: Hemodynamic variables followed changes in pain intensity (data not shown). The laparotomy group's pain VASs were 4.14 $\pm$ 2.14 and 1.39 $\pm$ 0.35 10- and 120-min, respectively, after a mean of 1.33 $\pm$ 0.59 injections; the laparoscopy group's VASs were 5.00 $\pm$ 1.21 and 2.81 $\pm$ 1.14, respectively ($P < 0.05$, ANOVA) following 2.00 $\pm$ 0.75 injections ($P < 0.05$, ANOVA). SpO_2 increased by 3.19 $\pm$ 0.12% and respiratory rate decreased by 4.4 $\pm$ 1.1 breaths/min in the laparotomy group compared to + 3.26 $\pm$ 0.08% and -2.9 ± 0.8 breaths/min in the laparoscopy patients 15-min after treatment was started ($P < 0.05$, ANOVA). Three laparoscopy patients used diclofenac. Pain intensity and demand for diclofenac were similar between the groups at 3–9 h after surgery but started to increase in the laparotomy group thereafter. One laparotomy vs. 3 laparoscopy patients (P = NS) experienced nausea/vomiting. These immediate differences in pain intensity and analgesia requirements complete previous data showing better recovery of laparoscopy patients 24 h after surgery compared to post-laparotomy individuals.

Conclusions: More analgesia is needed to satisfactorily control immediate post-laparoscopy pain compared to post-laparotomy because of higher pain intensity.

Reference:

1 Weinbroum AA. *Anesth Analg.* 2003 (in press).

A-666

Shoulder pain after gasless laparoscopic surgery: preventable by arm positioning

Y. Kojima, H. Ina, S. Yokota, S. Kojima, M. Narita

Department of Anesthesiology, Suwa Red Cross Hospital, Shinshu University School of Medicine, Suwa, Japan

Background and Goal of Study: Shoulder pain after laparoscopic surgery is caused not only by persistent pneumoperitoneum (1) but also by shoulder stretching. We examined whether avoiding this stretching could negate that pain.

Materials and Methods: Gynecological 72 patients who underwent laparoscopic surgery using gasless, wall lift method were studied. Patients were assigned to two groups; abduct-group (one arm with intravenous catheter was abducted to 80–90 degrees from the trunk with the other arm tucked to the side) and flex-group (both arms were flexed at the shoulder and the elbow with both hands on the forehead), and asked about the shoulder pain one day after the operation. Statistics were analyzed using one-way ANOVA and Fisher's exact test.

Results and Discussions: Data (Mean $\pm$ SD) are shown in the table: *:$p < 0.05$ vs abduct-group

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	Age (y.o.)	Height (cm)	Time of operation(min)	Patients with shoulder pain (%)
Abduct-group (n = 56)	38 ± 11	158 ± 4	108 ± 42	33 (59%)
Flex-group (n = 16)	39 ± 8	158 ± 5	103 ± 77	3 (17%) *

Despite of high incidence among gynecologic patients, post-laparoscopic shoulder pain is often ignored by anesthesiologists because of its late onset (2). Our study showed 59% of the patients in abducted arm position suffered shoulder pain even by gasless method, whereas 17% in flexed arm position. Trendelenburg position and inadvertent pressure from a surgeon in gynecologic laparoscopy may overstretch the patient's abducted arm; i.e. the muscles or ligaments attached to the shoulder joint.

Conclusion(s): Majority of shoulder pain after gasless gynecologic laparoscopy could be prevented by avoiding placing the arm in abducted position.

References:

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2 Joris J, Thiry E, Paris P et al. *Anaesth Analg* 1995; 81: 379–84.

A-667

Comparison of incisional bupivacaine and bupivacaine + neostigmine on postoperative pain of hysterectomy patients

A. Turan, D. Memis, B. Karamanlioglu, Z. Pamukçu

Department of Anesthesiology and reanimation, Trakya University, Edirne, Turkey

Background and Aim: Studies have shown peripheral antinociception effect of neostigmine in different models (1,2). We aimed to evaluate incisional adjunct of neostigmine to local anesthetics in total abdominal hysterectomy operations.

Materials and Method: After ethics committee approval and written informed consent, 60, ASAI-II patients, scheduled for total abdominal hysterectomy operation were included. Standard anesthesia protocol using 2 mg/kg propofol for induction, 0.5 mg/kg atracurium for muscle relaxation and %2 Sevoflurane in %50 oxygen and %50 N_2O was applied to all patients. At the end of operation peritonea, muscle, fascia and subcutaneouslly; 20 mL of %0.5 bupivacaine was applied to 30 patients in group I, plus 0.5 mg neostigmine to 30 patients in group II. Mean arteriel pressure, heart rate, peripheric oxygen saturation (SpO_2) and pain scores were recorded after 30 minutes of extubation and at postoperative 2., 4., 6., 12., 24.hrs in sitting and laying positions. When pain scores were above 5, 0.5–1 mg.kg^{-1} meperidine, 3–5, 500 mg acetaminophene was given to patients and first analgesic requirement time and side effects were noted.

Results: There was no difference in mean arteriel pressure, heart rate,peripheric oxygen saturation (SpO_2) and pain scores in sitting and laying positions at all the measured times. Meperidine dose, in GroupI (150 + 24 mg) was statistically different($p < 0.05$) when compared with group II (85 + 31 mg). Acetominophen consumption and first analgesic requirement time were indifferent between group I and group II.

Conclusion: Addition of neostigmine decreased postoperative opioid consumption, but had no effect on first analgesic time and acetominophen consumption. Addition of neostigmine to local anesthetics may be usefull in post-hysterectomy pains.

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2) Yang LC, Chen LM, et al. *Anesthesiology* 1998; 88: 334–9.

A-668

A comparative study on postoperative pain and morphine consumption of pre-emptive tramadol and pre-emptive morphine for postoperative pain management after major abdominal surgery

H. Unlugenc, Ozalevli, Y. Gunes, T. Guler, G. Isik

Department of Anaesthesiology, Cukurova University, Faculty of Medicine, Adana, Turkey

Background and Goal of Study: Studies of preemptive analgesia in humans have shown conflicting results[(1)]. In this randomized controlled study we tested whether intravenous (iv) tramadol, administered just after the induction before dermal incision, resulted in improved analgesic efficacy, lower pain scores and reduced patient-controlled morphine consumption compared with iv morphine after major abdominal surgery.

Materials and Methods: Ninety patients were allocated randomly to receive iv tramadol (1 mg kg^{-1}) (T), iv morphine (0.1 mg kg^{-1}) (M) or saline (2 cc) (C) just after the induction before dermal incision. At peritoneal closure, first, a standardised (0.1 mg kg^{-1}) morphine loading dose was given to the patients for postoperative pain management. After this procedure, patients were allowed to use bolus doses of morphine (0.025 mg kg^{-1}) with a PCA device. Discomfort, sedation, pain scores, cumulative morphine consumption and side effects were recorded at 1, 2, 6, 12 and 24 hours after the start of PCA.

Results and Discussion: The level of discomfort, the level of sedation and VRS scores decreased significantly with time in all groups ($p < 0.017$). No statistically significant differences were found among the three groups in pain, sedation and discomfort scores at any time after the starting of PCA. Cumulative morphine consumption after 24 hour was found statistically significantly higher in C group than in M and T groups with similar VRS ratings ($p < 0.017$). However, cumulative morphine consumption was similar in M and T groups.

Conclusion: Administration of tramadol and morphine, as a pre-emptive agent, before surgery did not result in lower pain scores compared with control group, but led to a significantly lower consumption of morphine.

Reference:

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A-669

Comparison of perioperative pain relief for lung biopsy: Minithoracotomy versus video assisted thoracoscopy

L. Kashyap, N. Sharma, Chandralekha S. Bal, D.R. Shende, R. Guleria, V. Mohan

Department of Anaesthesia, Additional Professor, All India Institute Of Medical Sciences, New Delhi, India

Background and Goals: An open lung biopsy by conventional thoracotomy is the procedure of choice but it is a painful operation and results in increased morbidity and mortality (1). Minithoracotomy results in less postoperative pain. Video-assisted thoracoscopic surgery (VATS) is an effective alternative for diagnosis and treatment of lung lesions. VATS is associated with less postoperative pain, less analgesia requirement and early ambulation (2). Pain and analgesia requirement following VATS and minithoracotomy were compared.

Material and Methods: A randomized prospective study was designed to assess perioperative analgesia requirement is patients undergoing lung biopsy by VATS or minithoracotomy. 30 patients were randomly divided into two groups (n = 15). Intravenous PCA morphine was given during the first 24 hours for postoperative analgesia. Pain was assessed at 0, 1, 6 and 24 hours post operatively.

Results: Data (Mean ± SD) [Range] are shown.

	VATS	Mini-thoracotomy
Morphine requirement intraop (mg)	5.66 ± 0.58	6.10 ± 1.32
Morphine requirement postop (mg)	39.43 ± 11.19	43.56 ± 10.01
Pleural drainage time (hrs)	58.53	72.13
Hospital stay (days)	3.80 [2–6]	4.86 [3–7]

VAS score for pain at cough, discomfort and range of shoulder movements during the postoperative period was statistically comparable in both groups.

Conclusion: Post-operative morphine requirement and length of hospital stay in patients undergoing lung biopsy by minithoracotomy or VATS were similar. Minithoracotomy is safe and comparable to VATS for lung biopsy.

References:

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2 Landreau RJ, Hazelrigg SR, Mack MJ, et al. *Ann Thorac Surg* 1993; 56: 1285–9.

A-671

Blockade of Ganglion Impar through sacrococcygeal Junction

N. Uckunkaya, E.B. Mogol, G. Turker, S. Sahin

Department of Anesthesiology and Reanimation, Uludag university School of Medicine, Bursa, Turkey

Background and Goal of Study: Impar Ganglion Block provides pain relief in patients who suffer from sympathetically mediated pain arising from disorders of the viscera and somatic structures within the pelvis and perineum. Conventional technique through anococcygeal ligament described by Plancarte (1) is needed the needle to be bent. We report a study including Impar ganglion blockade that was performed through sacrococcygeal junction in 5 cases who had localized perineal pain of visceral origin.

Materials and Methods: 3 patients with rectum cancer and 2 patients with cervix cancer were positioned in the prone position, and a skin wheal was raised in the midline over the sacrococcygeal junction. The 22 G spinal needle was inserted through the skin wheal and sacrococcygeal junction under fluoroscopic guidance and was directed down to anterior surface of the junction. Retroperitoneal location of the needle was verified by observation

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of the spread of 2 ml water-soluble contrast medium. Six ml of 10% phenol was slowly injected after 4 ml of 0.25% bupivacaine. Pain intensity by visual analog scale (VAS) and the amount of drugs used for pain relief were recorded before and 10 days after the block.

Results and Discussions: All the blocks were easy to perform without complication. Assessments of pain and the drugs used for pain relief of 5 patients before and 10 days after the block were shown in the table.

	Case 1	Case 2	Case 3	Case 4	Case 5
VAS I	8	5	6	7	7
Drugs I	M 2 × 120	T 4 × 50	M 2 × 60	M 2 × 90	M 2 × 60
VAS II	3	1	2	2	2
Drugs II	M 2 × 60	NSAI	T 2 × 50	M 2 × 30	T 4 × 50

Drugs: Drugs that the patients used for pain relief; I: Before application of the block; II: 10 days after the block; M: Morphine in mg, po; T:Tramadol in mg, po.

Conclusion: Because of this technique's easy and practical application and effectiveness, we concluded that impar ganglion block through the sacrococcygeal junction could be preferred when compared with conventional technique.

References:

1 Plancarte R, *Anesthesiology* 1990; 73: 236.

A-673

Continuous target-controlled infusion (TCI) with sufentanil versus patient-controlled epidural analgesia (PCEA) with bupivacaine 0,0625% plus morphine for postoperative pain relief in gynaecology

N. Faitondjieva, S. Georgiev, I. Smilov

Department of Anaesthesiology and Intensive Care Medicine, University Hospital of Obstetric and Gynaecology, Sofia, Bulgaria

Background and Goal of Study: The aim of our study is to find a method with better analgesic results and fewer adverse effects, which can be easily used for the postoperative analgesia in gynaecology.

Material and Methods: After institutional approval 60 ASA I–II patients, undergoing elective gynaecological operations, were randomised in two groups. Groups were similar in age, weight and type of operations. The patients in group A (n = 31) received total intravenous anesthesia with Sufentanil–TCI at variable target plasma concentrations, propofol, pancuronium bromide, 50% O_2 in air and combined general and epidural in group B (n = 30). Before induction of anaesthesia in group B 15–18 ml bupivacaine 0.5% and morphine 4 mg bolus was administered. After 90 min an epidural infusion was started through an epidural catheter with bupivacaine 0.0625% at 10–12 ml/h. The Sufentanil-TCI in group A started 115 ± 49.9 min after the extubation and transfer to the postoperative care unit for 24 hours at an initial target concentration 0.05 ng ml^{-1} and was increased in steps of 0.05 ng ml^{-1} until adequate analgesia (VAS ⩽ 3) was achieved. In group B epidural analgesia was set up as PCEA-mode: continuous infusion of bupivacaine 0.0625% at 8–12 ml/h and demand dose 0.1 mg morphine, 45 min lockout interval for 24 hours. Visual analogue scale (VAS) was used for postoperative pain degree (0–10). The sedation level was assessed using Ramsay scale. The motor blockade was evaluated with the Bromage scale. Pain intensity, heart rate, respiratory rate, arterial pressure, sedation, motor blockade and incidence of adverse effects of drugs (nausea, vomiting and pruritus) were assessed at 0, 1, 2, 3, 5, 7, 9, 12, 18 and 24 postoperatively hours. The statistical analysis was performed by Student's t-test, Mann–Whitney U-test and Kolmogorov-Smirnov test.

Results and Discussion: Satisfactory analgesia, defined as a rating of VAS < 3 was obtained by all patients. Episodes of respiratory depression did not occur and haemodynamics was stable during the whole period of infusion. The level of sedation was <4, there were no cases, requiring Naloxone.

Conclusions: Continuous target-controlled infusion (TCI) with Sufentanil versus patient-controlled epidural analgesia (PCEA) with Bupivacaine 0,0625% plus Morphine for postoperative pain relief in gynaecology.

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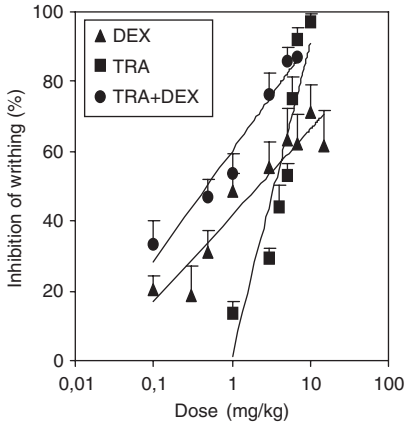
Dexamethasone enhances the antinociceptive effects of tramadol in mice

A. Mases, C. Dursteler, O. Pol, V. Fernandez, N. Jimenez, M. Puig

Department of Anaesthesiology, Hospital del Mar-Esperança, Universitat Autonoma de Barcelona, IMIM, Barcelona, Spain

Background and Goals: In the postoperative period, tramadol (TRM) is often administered in combination with anti-emetics, in order to prevent opioid-induced nausea and vomit (PONV). It has been recently reported that ondansetron and droperidol can partially antagonise TRM induced antinociception. Our aim was to evaluate a possible interaction between TRM and dexamethasone (DEX) on antinociception and inhibition of intestinal transit (GIT). The results could give relevant information regarding the most advantageous antiemetic to be combined with TRM in the treatment of PONV.

Materials and Methods: The protocol was approved by the Ethical Animal Committee of the Institution. We used Swiss CD-1 mice to evaluate antinociception with the acetic acid writhing test, while GIT was assessed with charcoal meal. Dose-response relationships were established for TRM and DEX alone, and for TRM in the presence of a fixed dose of DEX (0.3 mg/kg.). Results are expressed as % inhibition of writhing or GIT. The presence of interaction was analysed by two-way ANOVA and Student's t-test.



Results and Discussion: TRM and DEX induced dose-related inhibition of writhing and their ED_{50}'s were 4.2 ± 0.3 mg/kg and 0.75 ± 0.08 mg/kg, respectively. A dose-response curve was also obtained with the TRM + DEX combination (ED_{50} was 0.50 ± 0.09 mg/kg). A two way ANOVA showed a significant effect of the treatment, the dose and their interaction ($p < 0.001$). For each dose of the combination, the observed effects were greater ($p < 0.05$) than the sum of the effects of TRM + DEX alone, demonstrating synergy. No synergy was present for the inhibition of GIT.

Conclusions: Low doses of DEX potentiate the antinociceptive effects of TRM, but not the effect of TRM on GIT. Thus the combination could be useful in clinical practise to prevent PONV.

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A-675

Assessment of three analgesic regimens and effect on oxygenation and extubation time in cardiac patients

K.M. Fayaz, R. Abel, S. Pugh, J.E. Hall, M. Harmer

Department of Anaesthetics, University Hospital of Wales, Cardiff, UK

Background: The use of balanced analgesia in postoperative pain relief is well established [1]. Simple analgesia may reduce opioid consumption, respiratory depression and speed extubation. This study assessed the analgesic efficacy, oxygenation and time to extubation of 3 regimens after coronary artery bypass (CABG) surgery.

Method: With ethical approval, 60 patients undergoing CABG were recruited to a randomised single blind study. Patients were allocated into 3 groups to receive: Group A: voltarol 100 mg and paracetamol 1 g PR postoperatively, voltarol repeated after 18 h and paracetamol 6 hourly for 24 h. Group B: voltarol as Group A with placebo replacing paracetamol. Group C: 2 placebo suppositories given at the times in group A. Patients received morphine patient controlled analgesia (PCA), initially nurse controlled, until they were able to use the PCA. Morphine consumption (mg) and 4 point pain score (where 1 = no pain, 4 = severe pain) at 12, 24 h, intubation time (IT) and PaO_2 30 min post extubation on FiO_2 1.0 were all noted. Analysis used ANOVA and Kruskal-Wallis tests and $p < 0.05$ is significant.

Results: Variables expressed as mean (SD) or median [range].

	Morphine: mg		Pain score: no.			Extubation
	12 h	24 h	12 h	24 h	IT: min	PaO_2: mmHg
A	13 (5)	22 (11)	1 [1–2]	1 [1–1]	478 (150)	175 (44)
B	15 (9)	26 (13)	1 [1–2]	1 [1–1]	487 (257)	157 (43)
C	22* (13)	37* (15)	2* [2–3]	1* [1–2]	710* (326)	117* (22)

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Conclusion: In patients undergoing CABG surgery the addition of simple analgesia significantly reduces postoperative morphine consumption. Morphine sparing and improved analgesia produced more rapid extubation, associated with better oxygenation. There was no difference between the effect observed whether voltarol alone or voltarol and paracetamol combined, were used.

Reference:

1 Kehlet H, Dahl JB. *Anaesth analg* 1993; 77: 1048–56.

A-676

Systematic review of the impact of operative techniques on post-operative pain in laparoscopic cholecystectomy

R. McCloy[a], F. Bonnet[b], F. Camu[c], B. Fischer[d], H. Kehlet[e], M. Puig[f], N. Rawal[g], C. Simanski[h], the PROSPECT Working Group

[a]Manchester, UK; [b]Paris, France; [c]Brussels, Belgium; [d]Redditch, UK; [e]Hvidovre, Denmark; [f]Barcelona, Spain; [g]Örebro, Sweden; [h]Köln, Germany

Background and Goal of Study: A systematic review was conducted to compare the efficacy and safety of analgesic, anaesthetic and operative techniques in influencing post-operative pain in adult patients undergoing laparoscopic cholecystectomy.

Materials and Methods: The review was conducted according to the methods of the Cochrane Collaboration. MEDLINE was searched from 1966–June 2002 and EmBASE from 1988–June 2002. A total of 59 studies was included in the review: randomised trials of peri-operative analgesia compared with either placebo or other methods of analgesia, and trials of anaesthesia and operative techniques conducted to examine their effect on post-operative pain.

Results and Discussions: Fifty-nine studies were included for analysis. *Microlaparoscopic cholecystectomy (5 studies):* 3/5 studies showed superiority for post-operative pain scores and the length of convalescence *vs.* conventional laparoscopic cholecystectomy. *Radially expanding trocars (2 studies)*: Limited data do not provide definitive evidence of an advantage for radially expanding trocars *vs.* conventional trocars on pain scores. *Warmed pneumoperitoneum (PP [3 studies]):* Warmed CO_2 PP is not superior to conventional CO_2 PP in reducing pain scores. *Pressure of CO_2* PP (2 studies): Low pressure CO_2 PP is superior to conventional CO_2 PP in reducing pain scores, the use of supplementary analgesia, and the length of hospital stay by a median of 0.5 days. *N_2O vs. CO_2 PP (1 study)*: The use of N_2O is superior to CO_2 for pain scores. *Helium vs. CO_2* PP (1 study): Helium is not superior to CO_2. *Gasless vs. gas techniques (1 study):* Gasless techniques are not superior to gas techniques. *Suction of CO_2/lavage and suction (1 study)*: CO_2 suction is superior to no suction for pain scores, but it is not clear whether lavage and suction are superior in combination.

Conclusion(s): Of available techniques, microlaparoscopy, low pressure CO_2 pneumoperitoneum and suction of CO_2 appear to have a beneficial effect on postoperative pain in laparoscopic cholecystectomy. For other techniques, further data are required for definitive conclusions to be made.

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Acute pain management: is there a difference between anesthesiologists and surgeons?

M. Delanoue-Ben, K. Barek, S. Leclerc-Foucras, M.L. Gilbert, V. Fuzier, D. Samson, T. Gallas, D. Concina, K. Samii

Acute Pain Unit, Department of Anesthesia, Toulouse Hospital University, Toulouse, France

Background and Goal of Study: In the 20 past years many studies demonstrated a deficit in the pain relief treatment. One of the reasons of this insufficiency is the divergent attitude among house staff and nurses.

The aim of our study was to compare the knowledge of anesthesiologists and surgeons on postoperative analgesic care.

Materials and Methods: A questionnaire composed of 17 mainly one-choice questions was distributed to all: 118 anesthesiologist and 108 surgeons, 38 residents in anesthesiology and 79 residents in surgery of our University Hospital.

Results and Discussions: 247(70%) questionnaires were returned. A total pain relief was expected by only 53% of the respondents. The residents expected a higher end point of treatment than doctors did ($p = 0.0020$). The use of the Visual Analogic Scale was higher in anesthesiologists than surgeons (54.6% Vs 27.4 $p = 0.0003$). If there were no statistical difference between anesthesiologists and surgeons in fear of narcotic prescription and its necessity in severe pain, anesthesiologists were still more afraid of pruritus and respiratory depression than surgeons and residents ($p = 0.0016$ and 0.022 respectively). Residents thought analgesic drug administration had to be systematic, 71% Vs 83.6 doctors ($p = 0.026$). Lastly, concerning the use of Patient Controlled Analgesia 94.5 % residents thought it gave more work Vs 62.5% doctors ($p < 0.0001$) and only 24.5% of them thought it gave less work ($p > 0002$). Analgesic training seemed to be more sufficient for anesthesiologists (42.3% doctors and 39.3% residents) than surgeons (19.2% Vs 20.5% respectively) $p < 0.001$;

Conclusion(s): This study emphasizes the lack of knowledge about analgesic care by the anesthesiology staff. Even though surgeons claim not to be trained, our data show no difference between them and the anesthesiologists. The largest difference exists between doctors and residents.

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Hypertensive patients have less postoperative pain than normotensives

S. Yaddanapudi, L.N. Yaddanapudi, G. Joseph

Department of Anaesthesia and Intensive Care, Postgraduate Institute of Medical Education and Research, Chandigarh, India

Background and Goal of Study: There is an association between hypertension and decreased perception of experimentally induced pain in animals (1) and humans (2). We have attempted to confirm this association in clinical postoperative pain.

Materials and Methods: We measured pain at rest and on deep breath (101 point verbal numerical rating scale) for 8 hours postoperatively in 50 patients [29 normotensives (Group N) – age (mean ± SD) 45 ± 13 yrs; 21 hypertensives (Group H) – age 53 ± 8 yrs] undergoing open cholecystectomy. Rescue analgesia (1 $\mu g\,kg^{-1}$ i.v. fentanyl) was given whenever the pain score was ⩾ 40. A correlation analysis of the areas under the curve of the pain scores at rest (AUC_R) and on deep breath (AUC_{DB}) was performed against preoperative systolic (SBP) and diastolic BP (DBP) in each group. The number of rescue analgesic doses, AUC_R and AUC_{DB} were compared between the two groups using Student's unpaired t test.

Results and Discussions: The results of the correlation analysis are shown in the table:

	Group H		Group N	
	R	p	R	p
SBP – AUC_R	0.64	0.002	0.14	0.47
SBP – AUC_{DB}	0.59	0.005	0.09	0.63
DBP – AUC_R	0.48	0.026	0.03	0.89
DBP – AUC_{DB}	0.43	0.052	0.01	0.97

The AUCs were significantly lower in hypertensives than in normotensives [AUC_R – (mean ± SD) 355 ± 228 vs. 630 ± 152, $p = 0.00003$; AUC_{DB} – 391 ± 254 vs. 684 ± 170, $p = 0.00006$]. Hypertensives required fewer analgesic doses than normotensives [1.2 ± 0.8 vs. 2.1 ± 0.7, $p = 0.0002$].

Conclusions: Hypertensive patients had less overall pain and required less analgesic compared to normotensives after open cholecystectomy. The AUC of pain scores were inversely correlated to the preoperative SBP in hypertensives.

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Post-thoracotomy morbi-mortality: the effect of postoperative analgesic technique used

J. Prieto, P. Carmona, P. Piñeiro, B. Prada, J. Lopez, I. Garutti

Department Anesthesia of Hopsital Universitario Gregorio Marañón, Madrid, Spain

Background and Goal of Study: Patients undergoing thoracotomy associated with lung resection are thought to be at high risk for the development of postoperative complications. Many strategies to control post-thoracotomy pain (PTP) have been described. The aim of this study was to asses the effects of analgesic method used to management PTP on morbi-mortality.

Materials and Methods: We studied retrospectively 129 patients undergoing open thoracic surgery to lung resection. Patients were divided into three groups depending continuous postoperative analgesic technique: Thoracic epidural (TE group), thoracic paravertebral (TPV group), and intravenous analgesia with meperidine and ketorolac in continuous perfusion.(IV group). Parameters evaluated included: postoperative discharged days (PDD), postoperative cardiac (PCC), pulmonary (PPC) and kidney (PKC) complications. Furthermore, we collected stay in postoperative care unit (SPCU), fatal events (FE) and mortality in six months.

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Results and Discussions:

Group	N	PHS (days)	PCU (days)	PPC (%)	PCC (%)	PKC (%)	FE (%)	M6 (%)
TE	73	14,2	1.95	8	6	0	7	10
TPV	23	10,2	1.04	4	9	0	0	0
IV	33	14	1.24	6	9	6	6	10

There was significant statistical differences to compare TPV group with TE and IV groups in: PHS ($p < 0.05$), SPCU ($p < 0.01$), PPC ($p < 0.05$), EF ($p < 0.001$) and M6 ($p < 0.001$). Paravertebral blocks is related with less postoperative events non-fatal and mortality, perhaps this analgesic technique contribute to accelerated postoperative mobilisation regimes[(1)].

Conclusion(s): We conclude that with these postoperative analgesics regimens, continuous paravertebral block was superior (respect to postoperative hospital stay and morbi-mortality) to thoracic epidural block or intravenous opiates and AINEs.

Reference:

1 Karmakar MK. Thoracic Paravertebral Block Anesthesiology 2001; 95: 771–80.

A-680

A randomised study of the preoperative effect of 600 mg Gabapentin on preoperative anxiety and postoperative pain

J. Ohanlon, M. Sharma

Department of Anaesthetics, Mater Hospital Belfast, Belfast, United Kingdom

Background and Goal of Study: Pre-emptive analgesia has proved ineffective(1). Gabapentin, has proven effective for the treatment of neuropathic pain and an anxiolytic and peripheral antihyperalgesic action has been demonstrated(2). The aim of this study was to investigate the value of 600 mg gabapentin in reducing preoperative anxiety, anaesthetic induction agent and postoperative analgesia.

Materials and Methods: In a randomised double-blind placebo controlled study, 31 male patients undergoing elective inguinal hernia repair received 300 mg gabapentin or placebo 12 and 2 hours preoperatively. Preoperative anxiety was measured on a VAS scale. Anaesthesia was induced using TCI propofol at 6 mcg/kg/min, the dose at loss of eyelash reflex was recorded. Postoperative pain was assessed, VAS scale, at rest and movement in the first 24 hours postoperatively. Patients received patient controlled analgesia with morphine 1 mg lockout 5 min. The total 24 hour dose and the number of patient requests were recorded.

Results and Discussions: 14 patients in the placebo group and 17 in the gabapentin group completed the study. There was no diffence between the groups in preoperative anxiety or propofol required. Gabapentin however reduced postoperative mean morphine consumption from 51.64 mg to 25.4 mg ($p < 0.001$) and reduced patient demands from 92.6 to 36.9 ($p < 0.001$).

Conclusion(s): 600 mg gabapentin significantly reduced postoperative morphine consumption this is in keeping with other studies using larger doses(3). This would suggest that gabapentin may have a role in treating acute pain.

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Determination of MAC (minimum alveolar concentration of volatile anesthetic) as an objective tool to assess antinociception in animals?

M. De Kock, V. Collet. M.A. Docquier, P. Lavandhomme

Department of Anesthesiology, Catholic University of Louvain, St Luc Hospital, Brussels, Belgium

Background and Goals: In rodents, the MAC-sparing effect has been proposed as an objective evaluation of antinociceptive drugs (1). Our aim was to evaluate the reliability and the specificity of this parameter.

Methods: A first experiment used Wistar male rats under mechanical ventilation and sevoflurane anesthesia. Tail clamp and paw pressure (Randall Selitto) were applied and sevoflurane concentrations at which gross purposeful movements, paw withdrawal, and/or cardio-circulatory reactivity disappeared were recorded defining four different *MAC*, respectively: *MACclamp*, *MACpressure*, *MACbarclamp*, and *MACbarpressure*:. In a second experiment, spontaneously breathing animals were used and a thermal(2) was compared to a pressure stimulus. Four additional MAC were defined: the *MACthermal*, *MACpressure2*, *MACbarthermal*, *MACbarpressure2*. The MAC-sparing effect of sufentanil ($0.005\,\mu g\,kg^{-1}min^{-1}$ and $0.07\,\mu g\,kg^{-1}min^{-1}$) and clonidine (10 μg/kg) was evaluated. Five animals per groups were included. Statistical analysis was based on ANOVA. $P \leqslant 0.05$ was statistically significant.

Resuts: In the controls, *MACclamp* and *MACbarclamp* were significantly superior to *MACpressure* and *MACbarpressure* (1.81 ± 0.28 and 1.97 ± 0.29 *vs* 1.45 ± 0.22 and 1.58 ± 0.26 Vol%: $P < 0.05$). There was no difference between *MAC* and *MACbar*. Sufentanil at $0.005\,\mu g\,kg^{-1}min^{-1}$ had no effect on the *MACclamp* and the *MACpressure* but, surprisingly, increased both *MACbar* (3.47 ± 0.56 and 2.21 ± 0.17 Vol%: $P < 0.05$). Both Sufentanil at $0.07\,\mu g\,kg^{-1}min^{-1}$ and clonidine significantly reduced the different *MAC*. *MACpressure2* was significantly superior to *MACthermal* (1.93 ± 0.05 vs 1.53 ± 0.26 Vol%: $P < 0.05$). Sufentanil ($0.005\,\mu g\,kg^{-1}min^{-1}$) increased both *MAC* and *MACbarpressure2*.

Conclusion: The MAC–sparing effect allows accurate measurements of the antinociceptive potency of a substance. MACbar is a parameter easy to record. Nevertheless, it does not parallel the withdrawal reactions, at least where opioids are concerned.

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1 Gomez de Segura I. *Anesthesiology* 1998; 89: 1489–94.
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A-682

Spectral analysis of heart rate variability during acute pain

C. Coste, V. Martinez, B. Guignard, V. Joly, M. Chauvin

Service dAnesthésie Réanimation, Hôpital Ambroise Paré, Boulogne Billancourt, France

Background and Goal of Study: Spectral analysis of heart rate variability (HRV) has been recently used for pain assessment in newborn [1]. Aim of the study was to evaluate modifications of HRV during acute pain episodes as seen in extracorporeal shock wave lithotripsy (ESL).

Materials and Methods: After institutional approval and informed consent, 10 patients (ASA I,II) scheduled for ESL were included in this study. The power spectrum densities were estimated every 10 sec by the fast Fourier method from measures of 128 sec of ECG data recording. HRV can be described as partitioned into two components. The high-frequency component (HF: 0.15 to 0.4 Hz) is mediated solely by the parasympathetic nervous system, whereas the low-frequency component (LF: 0.04 to 0.15 Hz) reflects the effects of both sympathetic and parasympathetic nerve activity. LF/HF ratio is defined as sympatho-vagal index (SVI). During ESL VAS, HR, MAP and SVI were recorded every 5 min, and each time the patient expressed pain spontaneously. Whenever VAS > 3, a bolus of alfentanil was administered (250 mcg). Statistical analysis consisted in Spearman rank correlation (Rho) and prediction probability Pk [2], an equivalent of ROC curve for multiples categories. Data are shown as means ± SD. $P < 0.05$ is considered significant.

Results: At least 5 points per patients were recorded. 76 measures were obtained.

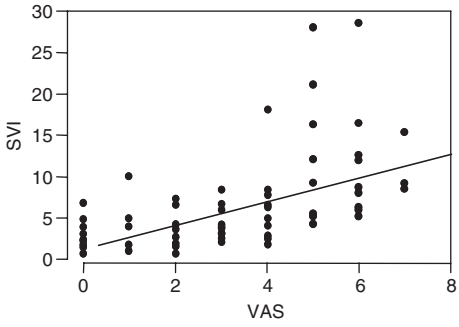

Figure1: correlation between VAS and SVI (Rho = 0.67 $p < 0.001$). Pk values were 0.48 ± 0.02, 0.52 ± 0.03, and 0.78 ± 0.09 for HR, MAP and SVI respectively.

Conclusion: Acute pain modifies HRV. Unlike others hemodynamic parameters, SVI seems to be an interesting index for evaluation of acute pain in awake patients.

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2 Smith WD et al. *Anesthesiology* 1996; 84: 38–51.

A-683

Systematic review of the efficacy and safety of peri-operative analgesic techniques in laparoscopic cholecystectomy

F. Bonnet[a], F. Camu[b], B. Fischer[c], H. Kehlet[d], R. McCloy[e], M. Puig[f], N. Rawal[g], C. Simanski[h], the PROSPECT Working Group

[a]*Paris, France;* [b]*Brussels, Belgium;* [c]*Redditch, UK;* [d]*Hvidovre, Denmark;* [e]*Manchester, UK;* [f]*Barcelona, Spain;* [g]*Örebro, Sweden;* [h]*Köln, Germany*

Background and Goal of Study: A systematic review was conducted to compare the efficacy and safety of analgesic, anaesthetic and operative techniques in influencing post-operative pain in adult patients undergoing laparoscopic cholecystectomy.

Materials and Methods: The review was conducted according to the methods of the Cochrane Collaboration. MEDLINE was searched from 1966–June 2002 and EmBASE from 1988–June 2002. A total of 59 studies was included in the review: randomised trials of peri-operative analgesia compared with either placebo or other methods of analgesia, and trials of anaesthesia and operative techniques conducted to examine their effect on post-operative pain. Visual analogues scores were pooled for meta-analysis. A comparison of pre- vs. post-operative administration was also conducted, pooling all modalities.

Results and Discussions: Meta-analyses for analgesic interventions are presented (Weighted mean difference [95% C.I.s]). *Intraperitoneal local anaesthetics (LA)*: VAS 0–6 hrs; −1.44 [−1.69, −1.18] $p < 0.00001$. VAS 6–12 hrs: −0.76 [−1.64, 0.11] $p = 0.09$. VAS 12–24 hrs: −0.52 [−1.55, 0.52] NS. *Incisional LA*: VAS 0–6 hr; s-1.06 [−1.65, −0.46] $p = 0.0005$. VAS 6–12 hrs; −1.10 [−1.52, −0.68] $p < 0.00001$. VAS 12–24 hrs; −1.47 [−1.92, −1.02] $p < 0.00001$. *NSAIDs (all routes of administration)*: VAS 0–4 hrs; −2.44 [−3.14, −1.75] $p < 0.00001$. *Pre-op. vs. post-op analgesia (all modalities).* (VAS)-0.94 [−3.01, 1.12] NS.

Conclusion(s): Intraperitoneal and incisional local anaesthetics, and NSAIDs, reduced pain scores significantly. Incisional LA were longer acting than intraperitoneal LA. Qualitative analysis demonstrated the benefit of epidural analgesia. Pre-operative analgesia did not offer a significant advantage over post-operative administration. There was no clear evidence of the role of anaesthetic regimes in reducing post-operative pain. A number of commonly used modes of anaesthesia have not been examined in randomised studies in laparoscopic cholecystectomy. Further data are needed on the combination of these techniques and the potential role of patient baseline and surgical factors in predicting post-operative pain outcomes.

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Adverse effects after intrathecal morphine for postoperative pain control – a meta-analysis

M. Gehling[1], H. Niebergall[2], M. Tryba[1]

[1]*Department of Anaesthesia, Intensive Care Medicine and Pain Therapy, Klinikum Kassel, Germany;* [2]*Department of Anaesthesia, University Hospital Freiburg, Germany*

Introduction: An increasing number of publications showed, that intrathecal morphine is an effective way of postoperative pain control. However, the risk of adverse events limits the routine application of intrathecal morphine. To obtain more detailed information of the dose-dependent incidence of adverse events, we conducted a meta-analysis.

Methods: In a medline®-search from 1980 to 2002 we retrieved randomised placebo-controlled studies of intrathecal morphine for postoperative pain management. Studies with a prospective evaluation of side effects and complication were included. We calculated the risk of adverse events as number needed to harm for low dose (LD = 0.125–0.2 mg), medium dose (MD = 0.25–0.4 mg) and high dose ((HD ⩾ 0.5 mg) intrathecal morphine. Results are given as NNH (95%-confidence interval).

Results: 35 publication met inclusion criteria. Patients in the placebo-groups received intravenous opioids. Therefore, our analysis compares the risk of intrathecal versus systemic opioid analgesia.

	Pruritus	Nausea	Vomiting	Urinary retention	Respiratory depression
LD	4.0	−25.3	10	−22.6	203
	(2.9–6.4)	(−6.25–∞)	(5.1–728.8)	(−3.7–∞)	(37–∞)
MD	3.4	−12.1	3.6	11.1	15.7
	(2.5–5.3)	(−4.5–∞)	(2.3–8.7)	(4.1–∞)	(7.7–∞)
HD	2.9	27.1	11	10	7.6
	(2.4–3.7)	(6.8–∞)	(5.1–11.9)	(3.9–∞)	(5.2–14.1)

Conclusions: The data of our meta-analysis show a significant increase of pruritus and vomiting even in LD intrathecal morphine, but a trend to reduced nausea and urinary retention. No clinically relevant increase of respiratory depression was observed in LD. However, increasing the dose of intrathecal morphine is associated with more frequently occurring adverse events. The results raise the question, whether or not special monitoring for adverse events after low dose intrathecal morphine is required.

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The reversal of central sensitisation by remifentanil in the rat spinal cord in vivo: effects of S(+)-ketamine and nifedipine

J. Benrath, C. Brechtel, H.G. Kress, J. Sandkühler

Department of Anaesthesia B and Brain Research Institute, Vienna Medical University, A-1090 Vienna, Austria

Background and Goals: Our recent data suggest that the μ-opioid receptor agonist remifentanil reverses central sensitisation in the rat spinal cord *in vivo.* For this reversal the elevation of intracellular Ca^{2+} is essential (1). Here the remifentanil-induced reversal of central sensitisation was investigated by the use of the NMDA-receptor antagonist ketamine and the Ca^{2+}-channel blocker nifedipine.

Materials and Methods: C-fibre-evoked field potentials were recorded in laminae I/II of the lumbar spinal cord with glass microelectrodes in response to electrical stimulation of the sciatic nerve (15–25 V, 0.5 ms, 5 min intervals) in isoflurane anaesthetised rats. Conditioning supramaximal high-frequency tetanic stimulation of the sciatic nerve (4 × 100 Hz, 40–50 V, 0.5 ms, 10 s intervals).

Results and Discussions: C-fibre-evoked potentials were potentiated in 7 rats to 144 ± 10% of control (mean ± SEM). Remifentanil was given as a bolus of 30 μg/kg followed by an infusion of 450 μg/kg/h 1 h after the induction of LTP and reduced potentiated C-fibre-evoked potentials to 40 ± 6 % of control. After stop of the remifentanil infusion the C-fibre-evoked potentials returned to control level. The depotentiation of C-fibre-evoked potentials were blocked in 3 out of 6 rats when the NMDA-receptor antagonist S(+)-ketamine was infused with a bolus of 5 mg/kg 15 min prior to the remifentanil infusion regime. Furthermore, the depotentiation of C-fibre-evoked potentials was blocked in 2 out of 5 rats by the L-type voltage-gated Ca^{2+} channel antagonist nifedipine when an infusion of 15 mg/kg/h was given 1 h prior to the remifentanil infusion regime. The depotentiation C-fibre-evoked potentials was blocked in 5 rats by the ryanodine-receptor blocker dantrolene when a bolus of 1.2 mg/kg followed by an infusion of 1.6 mg/kg/h was given 1 h prior to the remifentanil infusion regime.

Conclusions: The elevation of intracellular Ca^{2+} due to extracellular influx is not able to be blocked consistently neither by S(+)-ketamine nor by nifedipine. Therefore, release from intracellular stores is a major component in the reversal of central sensitisation by remifentanil.

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A-686

Determination of natural killer cytotoxic activity in rodents under different conditions and analgesic medications

V. Brouillard, V. Collet, P. Lavandhomme, M. De Kock

Department of Anesthesiology, Catholic University of Louvain, St Luc Hospital, Brussels, Belgium

Background and Goals: Natural killer (NK) cytotoxic activity is the first line innate defense against viral, bacterial or metastatic invasion. Both surgery and analgesics interfere with NK activity (1,2).

Material and Methods: After approval from the animal Ethics Committee, NK activity was studied in control (anesthetized, non operated) and in operated (anesthetized and operated: abdominal incision) male Wistar rats (±300 gr). Fentanyl, ketamine, clonidine or saline were randomly administered 60 min before NK assessments. In non-operated animals, measurements were performed one hour after anesthesia. In operated rats, they were performed at one hour in a first group and after 18 h in a second group. NK cytotoxic activity was determined on purified white cells based on YAC-1 target cells technique. Statistical analysis used ANOVA and Tukey's test for post-hoc comparison. A $P \pm 0.05$ was considered significant.

Results and discussion: Data (Mean ± SD) are shown in the table and expressed in % of cytotoxic activity. They were 5 animals per group.

	Non-op	Op 1 h	Op 18 h
Saline	15.9 ± 2.0	37.7 ± 3.1*	43.1 ± 1.6*
Fentanyl 40 μg/kg	5.1 ± 0.9*	0.6 ± 0.4*+	2.9 ± 1.1*+
Clonidine 10 μg/kg	6.3 ± 2.1*	9.7 ± 2.3*+	14.5 ± 4.4*+
Ketamine 10 mg/kg	3.4 ± 0.8*	27.3 ± 3.6*+	22.5 ± 3.3*+

*P < 0.05 *vs* non operated (op) saline , +P < 0.05 *vs* non-operated treated

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Conclusion: Surgery significantly increases cytotoxic NK activity that contrasts with current literature but can be explained by the methodology used. All the tested drugs decrease NK activity (Fentanyl > clonidine > ketamine).

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A-687

Preemptive analgesia with ketamine or tenoxicam before remifentanil anesthesia

C.O. Ögun, A. Duman, A. Erol, E.N. Kirgiz, S. Okesli, I. Duman

Department of Anaesthesiology and Intensive Care, Selcuk University, Faculty of Medicine, Konya, Turkey

Background and Goal of Study: Postoperative pain is a problem after remifentanil-based anaesthesia. The knowledge on using preemptive analgesia before remifentanil-based anaesthesia is lacking. We aimed to compare, the effectiveness of postoperative analgesia and side effects of preemptive ketamine and tenoxicam which were used before remifentanil-based anesthesia in patients undergoing gynecologic laparotomy.

Material and Method: Before anesthesia induction, 4 ml saline iv was administered to group P (n = 28), 1 mg/kg ketamine to group K (n = 29) and 40 mg tenoxicam to group T (n = 30). Anesthesia was induced with 1–1.5 mg/kg propofol and rocuronium and maintaned with 0.2 $\mu g\,kg^{-1}\,hour^{-1}$ remifentanil and 67% nitrous oxide and sevoflurane (0.5 MAC). Aldrete Postanaesthesia recovery score, Ramsay sedation score and visual analog pain scale (VAS) were used and recovery, sedation, VAS scores as well as meperidine consumptions (after extubation, 3,6,12,24, 48 h) were recorded. One-way ANOVA, T-tests, Kruscal Wallis and χ^2 and Tukey-HSD were used for statistics and $p < 0.05$ was accepted as significant.

Results: Hemodynamic and respiratory variables were similar in all groups. Sedation level was higher in ketamine group than placebo ($p < 0.05$). Pain scores were lower in group K than placebo at first 6 hour and at 48th hour, but pain scores were lower in group T than placebo at all times ($p < 0.05$). Meperidin consumption was lower at 6,12, 24th hours than the other groups in group T, it was similar between tenoxicam and ketamine group in 3rd, 48th hour and totally ($p < 0.05$). It was thought that preincisional tenoxicam has effectiveness preemptively but ketamine has not produced preemptive effectiveness although it has short-live analgesia and likely prevent hyperalgesia.

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Reducing venipuncture pain by a "Cough-Trick": a randomised cross-over study

T.I. Usichenko, D. Pavlovic, S. Foellner, M. Wendt

Department of Anaesthesiology and Intensive Medicine, Ernst Moritz Arndt University, Greifswald, Germany

Background and Goal of Study: Existing methods to reduce venipuncture pain are not free from drawbacks like additional costs, efforts of the staff and pain on application of local anaesthetics (1,2). We tested the effectiveness of cough-trick (CT, coughing on command simultaneously with puncture) as a pain reducing method for peripheral venipuncture in a randomised cross-over study.

Materials and Methods: Twenty healthy male volunteers (mean age 29.2 years) recruited according to inclusion criteria were punctured twice into the same vein of the hand with 20G cannula, once with CT procedure and once without it within an interval of 2 weeks. The intensity of pain during the venipuncture according to 100-mm visual analogue scale (VAS-100) was the primary outcome measure. The intensity of pain on subsequent catheter insertion, hand withdrawal, palms sweating, blood pressure, heart rate and blood sugar were also recorded.

Results and Discussions: The intensity of pain on venipuncture with CT procedure was lower, than without it (VAS median: 31 vs. 46; $p < 0.05$; Wilcoxon sign rank test). Hand withdrawal reaction, incidence of sweating and blood sugar level did not change. Heart rate and blood pressure decreased insignificantly (paired Student's t-test).

Conclusion: Easy–performed "cough-trick" was found to be effective in pain reduction during venipuncture, although the mechanism remains unclear.

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A-689

Postoperative wound infiltration with chirocaine plus lornoxicam for pain relief after cholocystectom

Th. Georgiadou, E. Sfyra, M. Georgiou, A. Foulidou, V. Papaioannou, F. Kanakoudis

Department of Anaesthesia, "G. Gennimatas" Hospital, Thessaloniki, Greece

Background and Goal of Study: Wound infiltration with local anaesthetics is an acceptable method for the management of postoperative pain. The aim of this study was to compare the analgesic efficacy after cholecystectomy of local tissue infiltration with plain chirocaine or with another regimen of chirocaine enriched with the NSAID lornoxicam.[1]

Materials and Methods: Forty adults without any coagulation problems, scheduled for open cholocystectomy, were included in the study. General anesthesia (propofol, fentanyl, rocuronium, sevoflurane and N_2O/O_2) was similar in both groups. Before the wound closure, local tissues were infiltrated: in group A (n = 20) with 20 ml of chirocaine 0,5% and in group B (n = 20) with 20 ml of a mixture with the same dose of chirocaine plus lornoxicam 8 mg. VAS (0–10), PHS (0–4) and analgesic requirements were evaluated at 30 min, 3 h, 6 h & 24 h postoperatively. Statistical analysis was performed in each time with t-test ($p < 0,05$).

Results and Discussions: Demographic data were similar among groups. VAS and PHS mean values are shown in the table.

VAS	30 min	3 h	6 h	24 h
Group 1	1,7	2,85	2,6	2,2
Group 2	0,6*	1,9*	1,9	1,55
PHS	30 min	3 h	6 h	24 h
Group 1	2,2	2,3	2,2	2,05
Group 2	1,1*	1,85	1,7	1,35*

*$P < 0.05$

Total analgesic requirements of group B were less than group A during the first 24 hrs ($p < 0.05$).

Conclusion(s): Would infiltration with chirocaine 0.5% plus lornoxicam provides better postoperative pain relief than chirocaine alone after cholecystectomy.

Reference:
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A-690

The effects of transcranial electrical stimulation and opioid using on anaesthesia and analgesia

A. Kabalak, M. Akcay, A. Ceylan, N. Gögüs

Department of Anaesthesiolgy and Reanimation, Ankara Numune Training and Research Hospital, Ankara, Turkey

Background and Goal of Study: Recent experiments have shown that TCES significantly potentiates the analgesic effects of opioids and the anesthesic effect of anesthesics in rats (1). In this study, we aimed to determine the effects of transcranial electrical stimulation on anaesthesia, analgesia and time of recovery.

Materials and Methods: Experiments were performed on 120 albino male wistar rats weighing 140–180 g. Rats were divided into four random groups equally. Animals were anaesthetized by sodium thiopental (P) and the electrodes were inserted to all of them. Remifentanil (R) was administered to the second and fourth groups and 15 minutes later, TCES was started in group 3 and 4 (Limoge current;100 Hz electric pulses,116 kHz burst, 0.5 mA intensity, 2 msec duration). (1st group; P, 2nd group; P + R, 3rd group; P + TCES, 4th group; P + R + TCES). Analgesia was assessed using the wet tail flick latency (TFL) test. TCES was stopped after 15 minutes and TFL test was performed and this cycle was repeated six times. The differences between the groups were detected by Kruskall-Wallis variance analysis and differences in the groups were detected by Friedman two-way variance analysis.

Results and Discussion: In TCES groups, analgesic efficiancy continued during stimulation and the difference between the other two groups were significant ($p < 0.001$). In R and TCES administration, analgesic response after stimulation was earlier and opioid effect was potentialised.. The difference between other groups on 15th ,30th ,45th ,60th ,75th and 90th minutes were significant ($p < 0.001$). Effective analgesia was also obtained in P + TCES group but maximum effect occured on 30th minute. In TCES groups, TFL test results were normal 15 minutes after the stimulation was finished.

Conclusion: TCES markedly decreases the anaesthetic/analgesic requirements and facilitates the recovery from anaesthesia. This effect appears to be related to the release of enkephalins from brain structures, thus enhancing opioid analgesia. The clinical relevance of these findings requires further investigation in humans.

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A-691

Does pain reduction improve the quality of life in chronic pain patients?

S.M. Sator-Katzenschlager[1], A.W. Schiesser[2], S.A. Kozek-Langenecker[1], H.-G. Kress[1]

[1]Department of Anesthesiology and Intensive Care B, Outpatient Pain Center; [2]Ludwig Boltzmann Institute of Consciousness Psychology and Transculture Psychotherapy, University of Vienna, Vienna, Austria

Background: Chronic pain is a subjective experience, including not only physical, but also psychological and social dimensions, all of which affect the quality of life (1). The aim of the present study was to test the hypothesis that effective pain reduction enhances quality of life in chronic pain patients.
Materials and Methods: 477 patients entering pain therapy at our university outpatient pain center were studied during the first year of treatment in a prospective study. Treatment was performed according to the pain center protocol and included pharmacotherapy, acupuncture, transcutaneous nerve stimulation, physiotherapy, and invasive pain treatment. Intensity and quality of pain were assessed by using visual analogue scale (VAS) and Multidimensional Pain Scale (MPS). Social and psychological aspects were evaluated by using the Pain Behavior Questionnaire (PBQ) and the Profile of Mood States (POMS) questionnaire. Assessments were performed before initiation of pain therapy (pre-treatment), as well as 1, 3, 6 and 12 months thereafter.
Results and Discussion: Significant reductions in pain intensity (VAS: 7.35 at pre-treatment, 1.03 after 12 months; $p = 0.01$. MPS: $F = 6.185$; $p = 0.000$) were paralleled by improvements in social integration (PBQ: $F = 9.483$; $p = 0.002$ after 12 months). However, psychological well-being was not improved during the study period (POMS: $F = 0.416$, $p = 0.551$ after 12 months). There were no statistically significant differences in POMS scores between diagnosis groups.

These results suggest that state-of-the-art pain therapy reduces pain intensity and improves social dimensions of chronic pain, such as avoidance behavior, cognitive control, social support, and patient activity, but is insufficient to improve psychological well-being.
Conclusion: Further studies have to determine whether a multimodal approach including psychological support may increase quality of life in chronic pain patients.
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A new approach to opioid testing in out-patients with chronic non-tumor pain

B. Gustorff, E. Felouzis, A. Kober, K. Hoerauf*, H.G. Kress

*Department of General Anaesthesia & Intensive Care B; *A, University of Vienna, Austria*

Background and Goal: Opioid responsiveness in patients with chronic non-tumor pain is highly variable. Therefore iv opioid testing has been suggested before opioid therapy [1]. However, at date no rapid iv opioid test is available for the ambulatory setting. It was the aim to study our recently developed remifentanil test [2] in relation to responsiveness and discharge after testing.
Methods: After approval by the ethics committee 24 patients with severe chronic non-tumor pain (>50 mm on the visual analog scale (VAS:0–100 mm)) were included in this prospective, placebo-controlled, double-blinded cross-over study. In 2 different sessions an ascending infusion of remifentanil or saline, respectively, was started at 0.04 $\mu g\,kg^{-1}\,min^{-1}$ and increased every 3 minutes by steps of 0.04 $\mu g\,kg^{-1}\,min^{-1}$ until reach of endpoint. Endpoints were defined as opioid responsiveness (VAS $\leq$ 30 mm or reduction of pain intensity from baseline $\geq$50%) or non-responsiveness in case of fall below safety parameters. Vital parameters were monitored. Time to complete recovery (modified Aldrete score) for discharge was assessed after stop of infusion.
Results and Discussion:

Table: Number of patients responding to infusion (*$p < 0.05$).

	Responder	Non-responder
Remifentanil	11*	13
Saline	5	19

Remifentanil lead to a significant opioid response in 11 patients compared to saline. 13 patients presented as opioid non-responders.

All patients reached complete recovery after 25 minutes and qualified for discharge.
Conclusion: This remifentanil test detects significant opioid responsiveness compared to saline and is the first ambulatory opioid test with rapid discharge conditions within 25 minutes in all patients.
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Repeated perineural injections of alpha2-adrenergic agonist clonidine (CLO) delays the development of hypersensitivity after nerve injury by decreasing local TNFalpha release

P. Lavandhomme*, J.C. Eisenach

**Department of Anesthesiology, St Luc Hospital, Brussels, Belgium; WFUBMC, Winston Salem, NC, USA*

Background and Goal of Study: Proinflammatory cytokine TNFα is involved into early degenerative changes and pain after peripheral nerve injury (1). Partial sciatic nerve ligation (PSNL) in rats induces a build up of α2A-adrenergic receptors on inflammatory cells close to the lesion (2). The study assess the effect of perineural CLO on TNFα release and neuropathic pain development.
Materials and Methods: Adult male SD rats (n = 6 per group) underwent PSNL. Before wound closure, animals received perineural injection with saline (Sal) or clonidine 30 μg (CLO). In different groups, repeated (before wound closure, and then at 24 h and 48 h post-surgery by percutaneous sciatic nerve blocks) perineural CLO 30 μg (R-CLO) or CLO 30 μg with α2A-antagonist BRL44408 30 μg (CLO-BRL) were realized. Repeated IM CLO 30 μg was also evaluated. Paw Withdrawal Threshold (PWT, g) was assessed by application of Von Frey filaments. At day7, ispilateral sciatic nerve, DRG L4-L6 and spinal cord were harvested and TNFα level (ng/g tissue wet weight) was measured by ELISA. TNFα levels in non-injured animals (n = 3) were also run as control values. Results are expressed as mean $\pm$ SD. Statistical analysis used ANOVA, $P < 0.05$ significant with Sal*, with Controls‡.
Results and Discussions: See Table (day7 post-PSNL)

	C	Sal	CLO	R-CLO	BRL
PWT	26.9 ± 6.2	4.1 ± 0.7‡	3.2 ± 0.5	14.8 ± 4.5*	1.6 ± 0.2
TNFα nerve	0.6 ± 0.3	1.2 ± 0.4‡	1.6 ± 0.8	0.06 ± 0.1*	1 ± 0.2
DRG	0.6 ± 0.2	4.4 ± 0.8‡	2.9 ± 1.6	0.32 ± 0.3*	4 ± 0.3
cord	0.3 ± 0.3	0.2 ± 0.6	0.4 ± 0.2	0.11 ± 0.1*	0.5 ± 0.1

IM CLO was ineffective. After PSNL, perineural CLO delays hypersensitivity development by reducing TNFα release. This effect involves a local α2A-adrenergic mediated mechanism which regulates macrophage-derived TNFα production.
Conclusion(s): Clonidine can be useful as an adjuvant to continuous peripheral nerve blocks for major limbs surgery (i.e. amputations).
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Electrical stimulation of auricular acupuncture points improves the treatment of chronic cervical pain

S.M. Sator-Katzenschlager, A. Michalek-Sauberer, G. Scharbert, S.A. Kozek-Langenecker

Department of Anaesthesiology and Intensive Care B, Outpatient Pain Centre, University of Vienna, Vienna, Austria

Background and Goal of study: The present study was performed to test the hypothesis that electrical stimulation of auricular acupuncture (EA) points is more effective than conventional manual auricular acupuncture (sham-EA, needles without electrical stimulation) in these patients.
Materials and Methods: 21 adults with chronic cervical pain without radicular symptoms were investigated in a double-blind, prospective, randomized study. All patients received disposable acupuncture needles on the dominant side on the acupuncture points: cervical spine (37) shen men (55), and cushion (29). In 10 patients, needles were continuously stimulated with 2 mA constant current at a low frequency of 1 Hz for 48 h using the electrical point stimulation device P-stim™ (Fa. Biegler GmbH, Mauerbach, Austria).

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In 11 control patients no electrical stimulation was administered. All needles were withdrawn 48 h after insertion. Acupuncture was performed once a week for 6 weeks. Patients had to fill in a questionnaire assessing pain intensity, psychological well-being, activity, sleep, and the demand of rescue medication (lornoxicam and tramadol).

Results and Discussion: The reduction in pain scores was significantly higher in the electrical acupuncture group (EA: $\Delta 5.5 \pm 0.1$ vs. Placebo-EA: $\Delta 1.8 \pm 0.1$; 1 month follow-up: 2.3 ± 0.8vs. 6.5 ± 0.6 $P < 0.05$). Similarly, psychological well-being, activity, and sleep were significantly improved in patients receiving electrical acupuncture, and consumption of rescue medication was significantly lower ($P < 0.05$). These results demonstrate that electrical stimulation of auricular acupuncture points using the new point stimulation device P-stim™ improves the treatment of chronic cervical pain. Cumulative analgetic effects may be achieved by longer electrical stimulation periods (1).

Conclusion: Further studies have to determine, whether a stimulation period exceeding 2 days further improves treatment of chronic cervical pain.

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A-695

In contrast with opioids, antiallodynic treatment with clonidine does not interfere with Natural Killer (NK) cell cytotoxic activity in neuropathic rat

P. Lavandhomme, M. De Kock, V. Collet,

Department of Anesthesiology, St Luc Hospital, Université Catholique de Louvain, Brussels, Belgium

Background and Goals: NK cell activity represents non specific cellular immunity and innate defense against infectious agents. Chronic analgesic treatments, i.e. morphine, suppress NK activity (1). The study evaluates the effect of potent μ-agonist fentanyl (fent) and α-2 adrenergic agonist clonidine (clo), commonly used to relieve chronic pain, on NK activity in neuropathic rats.

Material and Methods: Adult male Wistar rats underwent partial sciatic nerve ligation. When mechanical allodynia, assessed by application of von Frey filaments, had fully developped, fentanyl and clonidine were administered by either intrathecal (i.t.), systemic (SC) or perineural (percutaneous sciatic block, SB) route. Maximal antiallodynic effect was recorded after injection and the corresponding % NK cytotoxic activity ($n = 4$-5 rats per group; expressed as % lysis, mean $\pm$ SD) was determined on purified white cells using YAC-1 target cells technique (2). Statistical analysis used ANOVA, $P < 0.05$ was significant.

Results and Discussion: Data are expressed in table (*$P < 0.05$ with controls).

	% lysis	antiallodynic effect (%)
Neuropathic rats (controls)	13.3 ± 6.0	–
i.t. fent 1.5 μg (30 min)	10.9 ± 6.6	35 ± 10
SC fent 10 μg (120 min)	6.3 ± 3.0*	52.3 ± 14
SB fent 10 μg (120 min)	3.3 ± 1.6*	68 ± 33
i.t. clo 30 μg (30 min)	9.7 ± 7.0	50 ± 12
SC clo 30 μg (60 min)	8.9 ± 2.3	15.9 ± 10
SB clo 30 μg (day 7)	12.3 ± 6.5	70.3 ± 33

Systemic fentanyl after SC or SB suppress NK activity which parallels its antiallodynic effect. Spinal fentanyl remains less effective but does not interfere with NK activity. In contrast, clonidine modestly affects NK activity while providing effective relief of neuropathic pain, especially after perineural administration.

Conclusion: Clonidine and (2-adrenergic agonists are recommanded to alleviate neuropathic pain for their efficacy and their lack of suppressive effect on NK activity.

References:

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A-696

Chronic postoperative pain following inguinal hernia repair – a prospective study

S. Gupta, V. Palit, J. Richardson, C.J. Percy Clark, J. Lane, R. Iqbal

Department of Anaesthesia, surgery and Clinical Governance, Bradford Teaching Hospitals NHS Trust, Bradford, United Kingdom

Background and Goal of Study: Chronic pain after surgical procedures is being increasingly recognised[1,2]. The purpose of the study was to find out if the way the ilioinguinal nerve was treated during elective inguinal hernia repair had any bearing on chronic pain afterwards.

Materials and Methods: In this prospective study, surgeons completed a questionnaire after inguinal herniorraphy indicating if local anaesthesia was used during the operation and whether the ilioinguinal nerve was cut, cauterised or left alone. 192 patients were sent a questionnaire six months after their operation. 138 replied, 121 of whom had had their ilioinguinal nerve identified during the operation. Among other questions, they were asked if they had pain in the operative area.

Results and Discussions: Of 121 patients who replied and had their ilioinguinal nerve identified, 51 (42%) had pain lasting for more than 3 months. 40 (33%) had moderate to severe pain. 50 patients gave a pain score. The averages were: mean $\pm$ SD = 5.07 ± 2.18; median = 4.5. There was a higher incidence of chronic pain where the nerve was left alone and not cauterised or cut. However, the difference was not statistically significant. The table below shows numbers (No.) of patients who had chronic pain for each type of treatment of the ilioinguinal nerve.

Ilioinguinal nerve	No. of patients who replied	No. of patients with chronic pain	% with chronic pain
Left alone	84	40	48
Cauterised	27	9	33
Cut	4	1	25
Cut & Cauterised	6	1	17
Totals	121	51	42

Conclusion(s): Chronic pain appears to be a significant problem after inguinal hernia repair. The incidence of chronic pain appears to be less if the ilioinguinal nerve is cut or cauterised rather than left alone.

References:

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A-697

Can subcutaneous microdialysis be used to assess therapeutic interventions in chronic CRPS patients?

L. Dick, C. De Deyne, I. Baekelmans, K. Vissers, F. Camu*,R. Heylen

*Department of Anesthesia and Chronic Pain Therapy, ZOL Genk, Belgium; *Department of Anesthesia, University Hospital Brussels, Belgium*

Backgrounds and Goals: The absence of any diagnostic test or biochemical marker renders it very difficult to assess different therapeutic interventions in Complex Regional Pain Syndromes (CRPS). Subcutaneous microdialysis (MD) allows in vivo sampling of biochemical markers in peripheral tissue. The sympathetic nervous system, largely implicated in CRPS, influences lipolysis and the local release of glycerol. Therefore, we analysed whether MD monitoring of local glycerol release in the affected region could be of any objective value in determining the effects of different therapeutic interventions used for CRPS.

Material and Methods: With informed consent, 6 pts received two subcutaneous MD (CMA 60) catheters for a 90 hrs period: one in the affected region (arm) and one in the abdominal wall (control). A MD pump set at a fixed rate of 0.3 μl/min perfused the MD catheter and dialysates were collected every 2 hrs and analysed for glucose, lactate, pyruvate and glycerol. In all pts, we consecutively monitored the effects on MD metabolites of physiotherapy, iv mannitol infusion, stellatum block and iv lidocaine infusion. VAS scores and subcutaneous temperatures (affected limb and abdominal wall) were measured and compared to MD metabolites.

Results and Discussion: In resting conditions, we observed a close correlation between metabolites monitored in the affected region and in the control region. Physiotherapy consistently increased lactate, pyruvate and especially glycerol concentration, and this increase was in some pts more marked in the affected region. Mannitol iv infusion did not result in any significant change in local metabolites, nor in the affected region nor in the control region. Stellatum block resulted in a temporary increase in temperature of the affected limb, but did not result in any significant change of local metabolism, in none of the pts. Finally, iv lidocaine infusion resulted in a marked increase in VAS score in two pts, accompanied by a marked increase in local glycerol release in the affected region.

Conclusion: Subcutaneous MD can be a valuable tool for objective evaluation of therapeutic interventions in CRPS. Especially, monitoring of glycerol release, mediated by sympathetic activity, may be of interest.

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The Effects of injury to the sciatic nerve branches in streptozotocin-induced diabetic rats

H.K. Kim, Y.S. Lee, C.H. Kim, K.H. Kim, S.W. Baik

Department of Anesthesia and Pain Medicine, College of Medicine, Pusan National University, Pusan, Korea

Background and Goal of Study: In recent years the model of streptozotocin-induced diabetes in the rat has been increasingly used in an attempt to provide information on underlying processes but there was little investigation about the nerve injury in diabetic rats. This study was done to investigate the effect of nerve injury on painful diabetic neuropathy in the rat.
Materials and Methods: Male Sprague-Dawley rats weighing 200–230 g were injected with streptozotocin (65 mg/kg i.p.). These rats were undergone injury to the sciatic nerve branches, sural nerve and tibial nerve, at 2 days after streptozotocin injection. We measured hindlimb withdrawal thresholds to mechanical and thermal stimulation.
Results and Discussions: The tactile threshold of the uninjured, contralateral paw was significantly decreased from 2 days after nerve injury. In contrast, the tactile threshold of the injured, ipsilateral paw was not significantly decreased and it was soon returned to normal level at 6 days after injury. Thermal threshold was also significantly decreased in the contralateral paw but not in the ipsilateral paw.

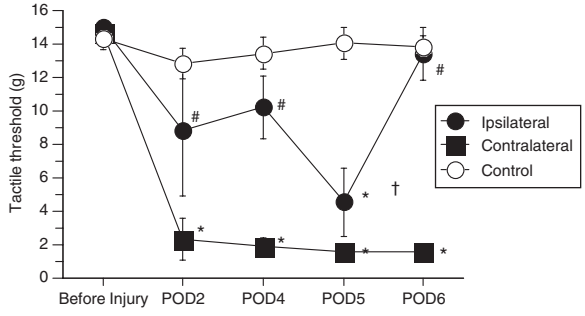

Fig. 1. The changes of tactile threshold after nerve injury in streptozotocin-induced diabetic rats. *Was $p < 0.01$ vs. control group. #Was $p < 0.01$ compared with contralateral side. †Was $p < 0.05$ compared with contralateral side.

Conclusion(s): This result was suggested that spared nerve injury of sciatic nerve branches might attenuate a development of tactile or thermal allodynia in streptozotocin-induced diabetic rats instead of additive tactile or thermal allodynia.

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New strategy for anthalgic treatment of intractable pain due to the vulvar vestibulitis syndrome: preliminary results with a combination of peripheral blocks

E. Vincenti*, A. Graziottin°

**Department of Anesthesia and Intensive Care, Dolo Hospital, Venice; °Center of Gynecology and Medical Sexology, H. San Raffaele Resnati, Milan, Italy*

Backgroung and Goal of Study: Vulvar Vestibulitis Syndrome (VVS) is a multisystemic and multifactorial disease which involves biological, psychosexual and relational factors. Treatment is addressed to reduce precipitating infectious diseases, the myalgic tension of the pelvic floor and pain. Pain relief is based on antidepressants and surface electroanalgesia, as first line treatment. However, peripheral anaesthetic blocks have not been proposed yet in VVS. Therefore we planned a new strategy by associating blocks of the ganglion impar (GI), S3 and S4 nerves and pudendal nerves (PN) with oral administration of gabapentin (GP).
Material and Methods: Only women affected by severe pain (lasting more than 24 months), in whom all previous treatment had failed, were admitted. 0.25% bupivacaine was used. Anthalgic treatment was employed every three weeks. During the first two or three sessions, every patient was submitted only to anaesthetic block (10 ml) of GI, which is a solitary retroperitoneal structure located just at the level of the sacrococcygeal junction and marks the termination of the paired paravertebral sympathetic chains. Initially, only this block was performed in order to evaluate its role in chronic visceral pain maintaining. As ancillary therapy, GP (from 300 to 1200 mg/die) was orally administered when well tolerated. In the successive sessions, both S3 and S4 and PN blocks (20 ml as total) were associated with the GI block. VAS scale (0–100 points) was adopted for pain evaluation. Six months of treatment were planned. 13 patients were submitted to this therapy.
Results: After the first month of treatment, a mean reduction of 30% of the initial vulvodynia was reached. Following repeated blocks of GI associated with sacral and PN blocks (and oral GP), initial pain was reduced from 30% up to 90% in 6 pts. Five pts had complete disappearance of pain in three–six months. In two cases pain relief was less than 30%.
Conclusion: Our experience suggests that GI block associated with sacral and pudendal nerves blocks, integrated by oral gabapentin, may be considered as an useful second line treatment for pain control in severe VVS patients who failed all available treatments.

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Combination of IV small-dose ketamine with NSAIDs in patients undergoing breast surgery. Does preincisional administration of ketamine make a difference?

M. Vassiliadis, A. Vahlioti, A. Mitragas, S. Anisoglou, A. Konstantinidou

Department of Anesthesiology, "Theagenio" Anticancer Hospital of Thessaloniki, Thessaloniki, Greece

Background and Goal of Study: Ketamine and NSAIDs have been used for preemptive analgesia[1]. Aim of this double-blind study was to estimate the efficacy of pre- and postincisional ketamine IV when combined with NSAIDs on postoperative opioid requirements.
Materials and Methods: Fifty-four consecutive female patients undergoing surgery for breast cancer were randomly allocated in three groups. In the two study groups ketamine 0,3 mg/kg IV was administered either with the induction of anaesthesia (group 1: n = 16) or 30 min after surgical incision (group 2: n = 17). Control group (n = 21) did not receive any ketamine. All the patients received diclofenac 75 mg IM or lornoxicame 8 mg IV 15–20 min before the surgical incision. Induction and maintenance of anaesthesia was achieved with propofol, N_2O and remifentanil. In the post-anaesthetic care unit, remifentanil consumption, Ramsay sedation score, visual analog scale (VAS) and rescue analgesia (morphine), if VAS > 4, were recorded. Also time to first request for analgesics in the ward was noted. One-way ANOVA (Bonferroni post-test) and Fisher's exact test were applied for comparisons between groups. P < 0,05 was considered as statistically significant.
Results and Discussions: The number of patients who required rescue analgesia is seen in Table 1. Ramsay scores and remifentanil consumption were similar between groups. Time to first request (TFR) for additional analgesia in the ward, in patients who did not receive morphine in the PACU is seen in Table 2 (mean value ± SD).

Table 1

	1	2	Control
Morphine	4*	6^	16
No Morphine	12	11	5
Total	16	17	21

(*p < 0,003, ^p < 0,02)

Table 2

	TFR (hours)
1	6,3 ± 1,5+
2	5,1 ± 1,7

(+p < 0,04)

Conclusion(s): Ketamine combined with NSAIDs reduced opioid requirements in the PACU in a statistically significant manner, whether it was given preincisionally or postincisionally. The duration of analgesia was longer when ketamine was given preincisionally.
References:

1 Schmid R et al. *Pain* 1999; 82: 111–25.

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Ketamine enhances postoperative morphine analgesia in patients undergoing unilateral lobectomy

A.A. Weinbroum, Y. Paz, N. Sheinberg, A. Freedman, N. Marouani, V. Rudick, S. Chazan, G. Uretzky

Post-Anesthesia Care Unit, Departments of Cardiothoracic Surgery & Anesthesia, Tel Aviv Sourasky Medical Center, Tel Aviv, Israel

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Background and Goals: The use of opioids postoperatively is limited, mainly due to respiratory and hemodynamic complications. Pulmonary lobectomy is a painful procedure. Ketamine is of analgesic potentials (1–3). We hypothesized that the combination of morphine and ketamine could optimally control immediate post-lobectomy pain without accentuation of untoward side effects.
Materials and methods: The study had been approved by the institutional ethics committee; 3-month-prime-shift patients undergoing unilateral lobectomy were enrolled, all signing a Helsinki-approved informed consent. All were anaesthetized and operated upon by the same teams. In PACU, when objectively evaluated awaken (⩾ 5/10 visual analog scale [VAS]) but lamented of pain (⩾4/10 VAS), patients were connected to an IV-PCA device delivering 1.5-mg morphine/bolus (MS group) or 1.0-mg morphine + 5-mg ketamine/bolus (MK group) in a double-blind manner. Boluses were self-administered with 7-min lock-out time. Evaluation lasted 24 h.
Results and Discussion: Thirty patients (15/group) were enrolled; one patient/group was excluded because of prolonged ventilation. The mean hourly morphine consumed by the MS patients amounted at 4.0 ± 1.9 mg (SD) compared to 1.7 ± 1.2 mg ($p < 0.05$, ANOVA) in the MK group. The mean pain VASs were 5.2 ± 1.9 [MS] and 3.8 ± 0.9 [MK] ($p < 0.05$, ANOVA). SpO_2 was never < 94% (under 40% facemask O_2) in the MK but was in 5-MS patients ($p < 0.05$, Fisher Exact Test) of whom two required artificial ventilation. Mean $EtCO_2$ during the first 4 postoperative hours was 34 ± 4 [MK] and 41 ± 7 [MS] ($p < 0.05$, ANOVA). Level of wakefulness was better in the MK patients [5 ± 1.2] than in the MS [3.7 ± 1.1] ($p < 0.05$, ANOVA). One MK patient sensed lightheadedness. 3 MS vs. no MK patients (p = NS) reported nausea/vomiting that responded to treatment.
Conclusions: Post-thoracotomy pain is effectively and better controlled by the combination of morphine + ketamine than by morphine alone; it reduces the amount of morphine by ~50% and is associated with lower incidences of blood desaturation and artificial ventilation.
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Low dose ketamine reduces morphine use after total knee arthroplasty

K.J. Anderson, V. Lash, F. Asenjo, F. Carli

Department of Anaesthesia, Montreal General Hospital, McGill University, Montreal, Canada

Background and Goal of Study: Sub-anaesthetic doses of ketamine offer analgesic and morphine sparing effects without increasing reported side effects when given intraoperatively[1–2], or added to post-operative PCA morphine[3]. The objective of this study was to study the effect on analgesia and use of PCA morphine postop of a single pre incision dose of ketamine, with and without ketamine added to the post-operative morphine PCA.
Materials and Methods: Ethical approval was obtained, 60 patients for total knee arthroplasty recruited and randomized to one of three double-blinded groups. 1. Control: spinal anaesthetic, i.v. placebo given pre-incision, morphine PCA 1 mg/5minutes postoperatively. 2. pre: control treatment but 0.15 mg/kg ketamine given preincision 3. Pre & post: pre treatment but with 1 mg morphine and 1 mg ketamine/5minutes PCA postop. We measured pain scores (rest and movement) by VAS, morphine consumption and the presence of dysphoria (strange feeling or hallucinations), nausea and vomiting for 48 hours postop. Data was analysed by ANOVA, for normal data, Kruskal Wallis for non-normal data and Chi-squared test for categorical data.
Results: 57 patients completed study. Groups were comparible for age, sex and preop analgesic use. There were no significant differences in pain scores at movement or rest postoperatively. PCA morphine use is shown as mg and are median (IQR).

Parameter	Control	Pre	Pre & post	p
PCA use 0–24 h	72 (57–85)	41 (37–59)	55 (26–85)	0.04
PCA use 24–48 h	31 (19–54)	23 (9.5–34)	24 (17–42)	0.08
% nausea	47.6	47.1	52.6	0.93
% dysphr	23.8	17.6	15.8	0.80

Conclusions: A small dose of ketamine (0.15 mg/kg) reduces morphine use for the 1st 24 hours after knee replacement. Adding ketamine to the pca does not confer any additional benefit to this. The use of ketamine does not increase dysphoria or nausea postop.
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A comparative study on the analgesic effect of intra-articular ketamine, morphine and ketamine plus morphine for postoperative pain management after arthroscopic surgery

O. Tarhan, H. Ozbek, M. Gunduz, D. Ozcengiz, Y. Sarpel, G. Isik

Departments of Anesthesiology and Orthopedia, Cukurova University, Faculty of Medicine, Adana, Turkey

Background and Goal of Study: Intra-articular local anaesthetics and opioids are commonly used for the management of postoperative analgesia after arthroscopic knee surgery. The aim of this study was to compare the analgesic effectiveness of intra-articular ketamine with intra-articular morphine for the management of postoperative pain after arthroscopic surgery.
Materials and Methods: Seventyfive healthy patients undergoing knee arthroscopic surgery were randomly assigned to one of the three treatment groups. Group K (n = 25) received 0.7 mg/kg ketamine intra-articularly, Group M (n = 25) received 5 mg morphine intra-articularly and Group MK (n = 25) received 2.5 mg. morphine and 0.7 mg/kg ketamine intra-articularly 10 minutes before the deflation of tourniquet. All drugs were diluted with saline up to 20 mL. In all groups, 1 mg kg^{-1} tramadol were prescribed intravenously on request as the rescue analgesic. After surgery, patients were evaluated for pain, sedation, the number of the patients requiring additional tramadol dose, haemodynamic parameters and side effects were recorded at 5, 10, 30, 60 minutes and 2, 6, 12 and 24 hours postoperatively.
Results and Discussion: There were no statistically significant differences in demographic data between groups, and no great variations or differences in the haemodynamic data. No statistically significant differences were found among the three groups in sedation scores at any time after postoperative period. Pain scores were lower in groups MK during the first 6 hours than in group K and M ($P < 0.05$). They were similar in groups K and M. The number of the patients requiring additional tramadol dose was found statistically significantly higher in K (6/25) and M (8/25) groups than in MK (1/25) group ($P < 0.05$).
Conclusion: Intra-articular morphine (2.5 mg) and ketamine (0.7 mg kg^{-1}) combination appears to be most beneficial due to its low supplemental analgesic requirements postoperatively.
Reference:
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A-705

Does intra-operative ketamine effect postoperative analgetic consumption in radical prostatectomy under CSE?

M. Wille°, B. Vanacker°, E. Vandermeulen°, J. Van Hemelrijck°, E. Vandermeersch°, H. Van Poppel*

Department of Anesthesiology/Urology, Catholic University of Leuven/UZ Gasthuisberg, Leuven, Belgium

Background and Goal of Study: A preemptive analgesic effect of low dose ketamine was described after abdominal surgery (1). This study investigates a potential preemptive analgesic effect of low dose ketamine after radical prostatectomy.
Materials and Methods: Sixty consenting patients were allocated into one of two treatment groups of 30 patients. Both groups received a standardized lumbar sequential spinal-epidural anesthesia technique, combined with a propofol target-controlled infusion. Patients in the ketamine-group received an intravenous (IV) ketamine bolus of 0.15 mg/kg followed by a continuous infusion of 100 μg/kg/h until the end of the procedure. Control patients received a saline bolus and infusion. Postoperative analgesia was provided by patient-controlled epidural analgesia (PCEA) with bupivacaine 0.03% with sufentanil 1 μg/ml. Visual analog pain scores (VAPS) during mobilisation, the total consumption of the epidural analgesic mixture and the number of PCEA-demands were recorded at regular intervals. All data were analysed by means of a Chi-square or Fisher exact analysis, and a two-way analysis of variance (ANOVA) for repeated measures, where appropriate. A P-value < 0.05 was considered statistically significant.
Results and Discussions: Both groups were comparable in terms of demographic data, painscores, total volume of analgesic mixture used (Fig. 1), and number of PCEA-demands.

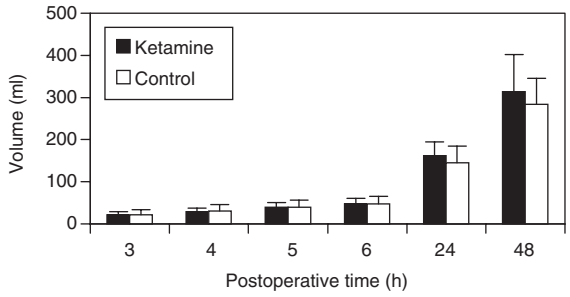

Figure 1. Total volume of analgesic mixture.

Conclusion(s): The intravenous use of perioperative low-dose ketamine in combination with CSE did not produce a preemptive analgesic effect after radical prostatectomy.

Reference

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A-707

Grip strength in complex regional pain syndrome type I. Relationships with pain and active range of motion

R.S.G.M. Perez, S. Greuters, W.W.A. Zuurmond J.J. De Lange

Department of Anesthesiology, VU medical center, Amsterdam, The Netherlands

Background and Goal of Study: Loss of grip strength is a common feature of Complex Regional Pain Syndrome type I (CRPS I)[1]. However, the relationship between grip strength and other prominent symptoms, such as range of movement and pain has had little attention.

Materials and Methods: Patients with CRPS I of one upper extremity participating in a RCT were assessed on the severity of pain, active range of motion (AROM), and grip strength (GRS). Assessments took place at 0 (T0), 6 (T1), 17 (T2), 32 (T3) and 52 weeks (T4). GRS was measured with a Jamar® dynamometer, severity of pain by using the VAS during exercise (VAS-e) and McGill (NWCt) and AROM with universal goniometers. Patients were treated with either DMSO 50% or NAC 600 mg, and received occupational therapy and pain treatment according to protocol. The percentage of affected GRS versus unaffected GRS (GRS%) and AROM (converted 1–10) (Table 1), as well as absolute differences for affected GRS, VAS-e, NWCt and AROM between time points were calculated. Spearman's *r* was used to assess relationships between GRS and other outcomes.

Results and Discussions: 102 patients (mean age 51.9, SD 14.1 years; median duration of CRPS I 80, IQR 54–116 days) were evaluated. No differences in GRS were found for prognostic variables (affected side, hand dominance, gender, treatment) at different time points.

Table 1.

	T = 0	T = 1	T = 2	T = 3	T = 4
GRS%[A]	81.1	68.0	51.6	42.9	28.2
VAS-e[B]	72.5	56.0	37.0	29.0	21.0
NWCt[C]	14.5	13.0	11.5	8.0	7.0
AROM[D]	7.0	6.0	5.0	4.0	4.0

Median values for all outcome measures, [A] = Kg, [B] = cm, [C] = number of words, [D] = for 5 joints combined.

At every time point, highest *r*'s were found between GRS% and AROM (r, range 0.529–0.772), followed by GRS%0-VAS (r, range 0.387–0.588) and GRS%-NWCt (r, range 0.239–0.406) respectively. This was also found for the difference scores.

Conclusions: AROM appears to have a stronger relationship with GRS than pain, and may be a bigger influence on GRS than pain in these CRPS I patients.

Reference:

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A-708

The safety and effectiveness of the trans-intervertebral disc (transdiscal) approach for superior hypogastric plexus block

H. Ina, M. Narita, Y. Kojima, S. Yokota, Y. Ofusa, M. Kobayashi, K. Kobayashi, S. Imai

Department of Anesthesiology, Suwa Red Cross Hospital, Suwa, Nagano,Japan; Departments of Anes.and Resusci., Shinshu University, Nagano, Japan

Background and Goals: Superior hypogastric plexus block (SHPB) is one of the effective methods in treating pelvic cancer pain. We already have reported the safety and effectiveness of the transdiscal approach for celiac plexus block (1), inferior mesenteric plexus block (2) and superior hypogastric plexus block (3). The purpose of the present study is to evaluate the safety and effectiveness of the transdiscal approach for SHPB in a large and well-documented case series.

Material and Methods: With IRB approval and written informed consent, 77 patients received SHPB using transdiscal approach that we have already reported. Under CT scan guidance with patients in the prone position, one or two 23-gauge 15 cm needle was inserted through the predetermined sites and direction toward the intervertebral disc at level of L4-5 or L5-S1.After penetrating the disc, the needle tip was verified by CT scan before and after instillation of lidocaine with contrast medium. If satisfactory pain relief and adequate spread of contrast medium were obtained, 30 min. later 5 to 10 ml of 99.5% ethyl alcohol was injected through each needle.

Results: There was no technical difficulties in transdiscal SHPB. The total amount of injected alcohol was 5–10 ml (mean 7.9 ml). Visual analogue pain scores (VAPS:0–10) and the daily doses of morphine mg) significantly decreased even 6 months after the block (8.5 ± 1.5 vs 4.4 ± 3.2*, 101 ± 141 mg vs 72 ± 69 mg* respectively. Statistical analysis: Wilcoxon's matched pairs rank-sum test. *$P < 0.05$). After the block, hypotension occurred in 7 patients (9.1%), diarrhoea in 10 patients (13.0%) for several days and acute alcohol intoxication was in 8 patients (10.4%). There were no technical and serious complications such as organ punctures, motor or sensory disturbance, rectovesical disturbance, sexual impotence, disc herniation or discitis.

Conclusions: The success rate of our technique using transdiscal approach was 100% with no severe complications. In conclusion, the transdiscal approach for SHPB is effective, easy and safe without encountering technical difficulties and without serious complications.

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A-709

Ultrasound guided lumbar facet nerve block: a feasibility study of a new methodological approach

M. Greher, G. Scharbert, L. Kamolz, H. Beck, B. Gustorff, S. Kapral

Departments of Anesthesiology and General Intensive Care B, Department of Reconstructive Surgery, Department of Anatomy, University of Vienna, Vienna, Austria

Background and Goal of Study: Facet nerve block for pain relief in lumbar facet syndrome is currently performed under fluoroscopic or CT scan guidance (1). We tested the feasibility of ultrasound (US), useful for guidance in other nerve blocks (2), for this new approach and described the relevant US landmarks in cadavers and human volunteers.

Materials and Methods: In a pilot cadaver study with high resolution US (15 MHz) a cross axis plane was defined to guide the needle to the target, where the facet nerve traverses the transverse process at the base of the superior articular facet (US landmarks) (Fig. 1). Subsequently, the lumbar region of 20 volunteers (f/m: 9/11; age 37 ± 11 yrs; BMI 24 ± 4) in prone position were studied with US (3,5 MHz) to determine the clinical reproducibility of these US landmarks and to measure skin-target distances.

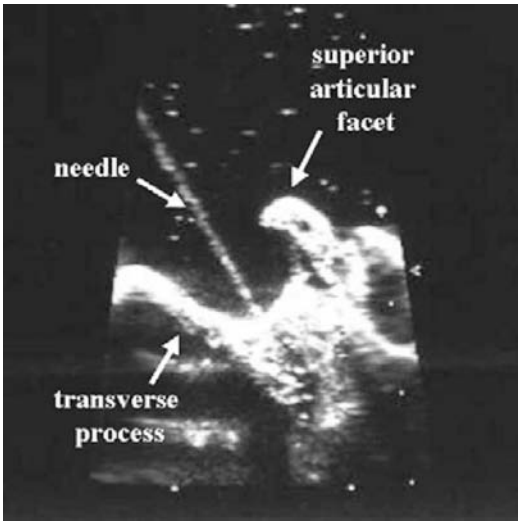

Fig. 1

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Results and Discussions: Relevant US landmarks were reproducible in cadavers and in all 20 human volunteers. Good quality US results were achieved in 19 (95%) volunteers, sufficient in 1 (5%). Mean skin-target distances were 44 ± 6 (L3), 47 ± 6 (L4) and 50 ± 6 (L5) [mm].
Conclusion(s): US guidance appears to be a promising new technique with the potential of simplification and avoidance of radiation in lumbar facet nerve block.
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A-710

Intraperitoneal bupivacaine in a multimodal perioperative management for laparoscpic cholecystectomy

A. Radan, A. Moldovan, H. Popescu, D. Tulbure

Department of Anaesthesia and Intensive Care Centre, Fundeni Clinical Institute, Bucharest, Romania

Goal of Study: A randomized, prospective study to evaluate the efficiency of intraperitoneal bupivacaine in patients undergoing laparoscopic cholecystectomy.
Materials and Methods: After consensus was obtained, 200 patients, aged 57.18 ± 15.50, ASA I-III, were randomly divided into two groups: B (n = 100) with intraperitoneal bupivacaine and C (n = 100), control group. All patients received 4 mg. of dexamethasone and 60 mg of ketorolac i.v., 30 min before surgery. Procedure was done under balanced general anesthesia. In B group 60 ml of 0.25% bupivacaine were instillated intraperitonealy at the end of surgery. Postoperatively outcome and pain scores, at rest and motion on VAS, at 4 hours (hrs) intervals, during 48 hrs were evaluated. Data were statistically analyzed, $p < 0.05$ considered significant.
Results: Table 1.

Table 1.

Parameters	Group B	Group C
Pain scores rest/motion	0.75 ± 0.46/1.47 ± 0.67	4.32 ± 0.91/5.74 ± 1.02
Analgesic requirements (%)	0	78
Mobilization (hrs)	4.3 ± 1.45	15.45 ± 9.56
Fluid intake (hrs)	5.05 ± 1.25	16.48 ± 8.52
Ileus (hrs)	12.5 ± 4.21	34.64 ± 10.57
PONV (%)	0	42
Pruritus (%)	0	23
Morbidity (%)	3	18
Length of		
PACU stay (hrs)	4.57 ± 1.58	18.45 ± 10.53
Hospitalisation (days)	2 ± 1	7 ± 2
Patients satisfied (%)	100	68
not satisfied (%)	0	32

Conclusion: Intraperitoneal bupivacaine seems to be effective in a multimodal perioperative management in patients with laparoscopic cholecystectomy.

A-711

Comparison of different concentrations of levobupivacaine in continuous epidural analgesia

M. Dernedde, M. Stadler, F. Bardiau, J. Boogaerts

Department of Anaesthésiologie, University Hospital Centre of Charleroi, Charleroi, Belgium

Background: Epidural local anaesthetics administered by continuous infusion maintain prolonged analgesia postoperatively. This study evaluated the quality of analgesia induced by 3 different concentrations 0.15, 0.5 and 0.75% of epidural plain Levobupivacaine (LB) after abdominal surgery.
Materials and Methods: After Ethical Committee approval and informed consent, 90 patients undergoing major abdominal surgery were randomly assigned to three groups: 0.75% LB (n = 31) at 2 ml/h, 0.5% LB (n = 33) at 3 ml/h and LB 0.15% (n = 26) at 10 ml/h. Epidural catheter was inserted appropriate to site of surgery. Bromage scale score, sensory block, haemodynamics, sedation, pruritus, nausea and vomiting (PONV), morphine consumption (PCA), and patient satisfaction were recorded within 48 h. Data are presented as mean ± SD. ANOVA, Chi-2 tests and generalised linear mixed model with $p < 0.05$ significant.
Results and Discussion: The 3 groups were similar in demography, ASA status and analgesics given during the surgical procedure. Mean VAS was 0.53 ± 0.70 cm in the 0.15% LB group, 0.59 ± 0.62 cm in the 0.5% and 0.68 ± 0.75 cm in the 0.75% LB groups ($p = 0.70$). Within the first 24 h morphine consumption was amounted to 11 ± 10 mg in 0.15% group, 13 ± 12 mg in 0.5% and 16 ± 12 mg in the 0.75% groups ($p = 0.16$). No difference was found in the Bromage scores and the incidence of motor blockade was very low in the 3 groups. The median level of sensory blockade during the first 24 h was Th 7 in the 0.15% group compared to Th 9 in the 0.5% and 0.75% groups. Blood pressure was lower in the 0.15% population during the first 24 h ($p < 0.001$). Bradycardia, pruritus and sedation episodes were equal but PONV was more frequent in the 0.15% group ($p = 0.028$). All the patients were very satisfied.
Conclusion: Given the same dose of local anaesthetic, the quality of analgesia is equal in low- and high-volume continuous epidural infusion. This is in line with the statement, that the total dose of local anaesthetic determines the spread and quality of analgesia and not the volume.

A-712

Postoperative analgesia: wound infiltration with different concentrations of bupivacaine

T.E. Bilgin*, E. Erdem**, N. Doruk*, A.A. Altunkan*, H. Çamdeviren***, U. Oral*

**Department of Anesthesiology and Reanimation; **Department of Urosurgery; ***Department of Biostatics, School of Medicine, Mersin University, Turkey*

Background and Goal of Study: Infiltrative blockade method seems simple, safe and efficient in controlling postoperative pain. The goal of the study is to stress postoperative analgesic effect of Bupivacaine diluted in different concentrations.
Materials and Methods: After obtaining local institutional Research Ethics Committee approval and informed patient consent, 40 ASA physical status I-II patients elective varicoselectomy were entered into the study. The general anaesthetic technique, postoperative analgesia and wound infiltration technique were standardized. All of the operations and infiltrations was performed by the same surgeon.

Patients were randomly divided in to two groups of 20 patients. At the end of the operation, before the wound closure patients in group I received 20 ml of 0.5% Bupivacaine hydrochloride and the patients in group II received 20 ml of 0.25% Bupivacaine hydrochloride via infiltration to fascia and subcuticuler tissue. Postoperative pain was assessed with a visual analog scale (VAS) during 1, 15, 30, 45 minutes and 1, 2, 6, 12, 24 hours postoperatively. Supplementary analgesics (Pethidine 1 mg/kg intramuscular) was applied to the patients if their VAS is higher than 4.
Results and Discussions: There was no statistically significant differences in demographic and hemodynamic data, duration of surgery among the groups ($p > 0.05$).

There was a significant difference between postoperative pain score at 1, 15, 45 minutes and 6 hours ($p < 0.05$). 20 ml of 0.5% Bupivacaine hydrochloride more effective than 20 ml of 0.25% Bupivacaine hydrochloride reducing postoperative pain.

The median time to first request for postoperative analgesics was significantly shorter in the Group II than in the Group I ($p < 0.001$).
Conclusion(s): For efficient analgesia and reducing additional analgesic requirement, 0.5% Bupivacaine hydrochloride is better choice than 0.25% Bupivacine hydrochloride.
References:
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A-713

Combined spinal-epidural analgesia after colorectal surgery: two intrathecal combinations

D. Stamenkovic, Z. Jankovic, M. Basic, I. Palibrk, D. Bilanovic, S. Petrovic

Department of Anaesthesia, Medical Center Bezanijska Kosa, Belgrade, Yugoslavia

Background: The effects of intrathecal fentanyl added to bupivacaine and morphine were compared with morphine and bupivacaine as spinal part of combined spinal epidural analgesia (CSE) in patients after colorectal surgery.
Methods: Prospective, randomized, double blind study was designed to compare two intrathecal combinations as part of CSE which was performed in patients (pts) undergoing colorectal surgery in L 2–3 interspinous space using needle through needle technique. Intrathecal injection contained either fentanyl 50 μg (1 ml), bupivacaine 2 mg and morphine 200 μg (G1, n = 15 pts) or bupivacaine 2 mg, morphine 200 μg and 1 ml of normal saline (G2, n = 15 pts). Epidural bupivacaine 0.25% was started preoperatively (10 ml) and was continued during surgery. We measured sedation score, blood pressure (BP), heart rate (HR), extubation time, pain intensity in rest (visual analogue scale (VAS)

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(0–100 mm) and movement (VASm) at regular time intervals for the first 72 postoperative hours. The intrathecal analgesia duration, number of analgesia requests (paracetamol) (VAS > 30 mm), side effects and patients satisfaction were recorded. Data analysis included t-test, Chi-square test, repeated-measure ANOVA and U-test. $P < 0.05$ was considered as significant.

Results: The groups were comparable with regard to patints' characteristics, operation and anaesthesia related factors. There were no intergroup difference in sedation score, number of extubated pts and extubation time, in the duration of intrathecal analgesia and number of pts which need supplemental analgesia during first 24 hours and number of analgesia requests during 72 hours. There were no intragroup and intergroup difference in VAS and VASm. Higher systolic BP was measured in group G2 at third postoperative hour (G1 vs G2 = 123.4 (18.8) vs. 139.3 (22.1)) ($p = 0.04$). There were no significant intergroup differences in HR. The incidence of vomiting was 20% in both groups and hypotension 13% in G1 and 7% in G2. Very satisfied with analgesia were 53% pts in G1 and 42% pts in G2. This form of analgesia will choose in future 86% pts in G1 and 90% pts in G2.

Conclusion: There were no advantages of fentanyl addition to morphine and bupivacaine for intrathecal use on postoperative analgesia in CSE.

A-714

Combined spinal-epidural anaesthesia for colorectal surgery: intrathecal fentanyl with morphine and bupivacaine

D. Stamenkovic, S. Zoric, V. Geric, T. Randjelovic, B. Djukanovic, M. Ostojic

Department of Anaesthesia, Medical Center Bezanijska Kosa, Belgrade, Yugoslavia

Background: The study examines the influence of fentanyl addition to bupivacaine and morphine for intrathecal use as part of combined-spinal epidural anaesthesia (CSE) [1].

Materials and Methods: Randomised, double-blind study was designed to compare two intrathecal combinations: group 1 (G1): 15 patients (pts) receiving fentanyl 50 μg (1 ml), bupivacaine 2 mg and morphine 0.2 mg, and group 2 (G2): 15 pts receiving bupivacaine 2 mg, morphine 0.2 mg and 1 ml of normal saline. CSE was performed in pts planned for colorectal surgery in L2-3 interspinous space using needle through needle technique. Epidural 0.25% bupivacaine was started preoperatively (10 ml) and was continued during surgery (5 ml every hour). We measured fentanyl (intravenous), bupivacaine and pancuronium requirements, blood pressure (BP), heart rate (HR) and volume replacement. Postoperative sedation score, pain intensity (visual analogue scale (VAS) (0–100 mm) and the time of the first analgesia request (VAS > 30 mm) was recorded. Data analysis included t-test, Chi-square test, repeated-measure ANOVA and U-test. $P < 0.05$ was considered as significant.

Results and Discussion: The groups were comparable according to patients' characteristics, the duration of operation, the amounts of fluid infusion and blood transfusion. There were no intergroup differences in intravenous fentanyl consumption (G1 vs. G2 = 186.1 (80.1) vs. 260.0 (133.9) μg) ($p > 0.05$),epidural bupivacaine (G1 vs. G2 = 21.6 (6.6) vs. 26.1 (5.5) ml) ($p > 0.05$)) and pancuronium consumption (G1 vs. G2 = 12.4 (4.1) vs. 10.8 (4.3) mg) ($p > 0.05$)). BP and HR didnot show intragroup and intergroup differences. In G1 10 pts were extubated in operating room and in G2 11 pts. There were no intergroup differences in sedation scores, time for the first analgesia request (G1 vs. G2 = 346.5 (354.6.4) vs. 163.8 (215.8) min) ($p > 0.05$) and VAS pain intensity (G1 vs. G2 = 4.7 (13.28) vs. 2.9 (10.7) mm) ($p > 0.05$).

Conclusion: The results indicate that intrathecal addition of fentanyl to 0.25% bupivacaine and morphine did not show any advantages compared with morphine and bupivacaine combination as spinal component of CSE.

Reference:

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A-716

Health technology assessment of patient controlled epidural analgesia

M.E. Crawford, K. Riisberg, J. Skiveren, F.M. Borgbjerg, G. Soegaard, I.W. Moeller, T. Thorsen, J. Erler-Rohde

Department of Anaesthesiology, Bispebjerg University Hospital, DK 2400 Copenhagen, Denmark

Background and Goal of Study: The aim of the present health technology assessment protocol was to determine the clinical, economical and organizational consequences of the introduction of patient controlled epidural analgesia (PCEA) for postoperative pain relief in major surgery in a large Danish university hospital.

Materials and Methods: Study design was based upon prospective time period randomization of 1.059 patients matching conventional parenteral opioid treatment with continuous epidural infusions of local anaesthetics and opioids and patient controlled epidural regimens. Primary efficacy parameters were patient satisfaction, pain relief during rest, coughing and mobilization. Secondary were degrees of patient control, duration of hospitalization, side effects, degree of mobilization, consumption of staff time and technical complications.

Results and Discussions: Median age in all groups was between 70 and 73 years. ASA groups II-IV comprised 64–74% of all patients. Significant reduction of postoperative pain intensity was observed with PCEA ($p < 0.0001$) parallel to increased level of side effects. With time, patient activation increased and patient satisfaction rates were significantly higher with PCEA during rest and mobilization ($p < 0.001$). Hospitalization periods remained unchanged and staff time consumption increased during the recovery period and postoperative day 1. No critical technical incidents were reported and elderly patients had few problems when dealing with infusion pumps. "Minimum security measures" are proposed to avoid serious side effects.

Conclusion(s): In a government financed health technology assessment trial of PCEA pain intensity was reduced significantly, patient satisfaction improved whereas the number of side effects were increased without affecting the hospitalization period.

Acknowledgements: The Danish Board of Health, Institute of Health Technology Assessment sponsored this trial.

A-717

Beneficial effects of single dose multimodal epidural analgesia on relief of postoperative microdiscectomy pain

A. Kararmaz, S. Kaya, S. Turhanoglu, M.A. Ozyilmaz

Department of Anaesthesiology, Dicle University Hospital, Diyarbakir, Turkey

Background and Goal of Study: Due to the introduction of microsurgical techniques, postoperative pain is still a problem after lumbar discectomy. We aimed to assess the efficacy of multimodal epidural analgesia in decreasing postoperative pain after microdiscectomy.

Materials and Methods: Forty patients, 27 men and 13 women, aged 25- to 56-years, ASA physical status I or II, undergoing microsurgical lumbar discectomy were enrolled in this prospective, randomised, controlled, double-blinded study. Ten-millilitre study solution including 2 mg of morphine, 15 mg of bupivacaine, 80 mg of methylprednisolone, and 0.05 mg of adrenaline were prepared for epidural administration. At conclusion of the operative procedure but prior to wound closure, the surgeon passed an 18-gauge epidural catheter. After closure of incision, patients were assigned to receive either study solution (Group E) or saline (Group C). The epidural catheter was then removed. Patient controlled analgesia device containing morphine was used for postoperative analgesia. The Student's t-test, the Mann–Whitney U-test, and χ^2 test were used for statistical analysis.

Results and Discussions: Data (mean ± SD or n(%)) are shown in the table.

	Group E	Group C	P
Morphine consumption (mg)	13 ± 4.8	22.3 ± 8.9	0.0001
Time to first ambulation (h)	10.1 ± 3.6	13.4 ± 3	0.004
Patient satisfaction	19 (95%)	12 (60%)	0.01
Nausea	1 (5%)	6 (30%)	0.046
Pruritus	1 (7%)	7 (35%)	0.022

Four patients in the Group C reported urinary retention.
VAS scores (median [range]) are shown in the table:

	1 h	6 h	12 h	24 h
Group E	1 [1–3]	1 [0–2]	1 [0–2]	1 [0–2]
Group C	3 [2–5]	2 [1–5]	2 [1–3]	1 [1–2]
P	0.0001	0.0001	0.003	0.019

Conclusion(s): Single dose multimodal epidural analgesia administered after wound closure provided better postoperative analgesia after lumbar microdiscectomy.

A-718

The addition of morphine to epidural ropivacaine does not improve postoperative pain when preemptive epidural analgesia with morphine is used

C. Bosch, A. Mora, A. Camps, C. Cortés, M.J. Valencia, V.A. Gancedo

Department of Anesthesiology, Vall dHebron University Hospital, Barcelona, Spain

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Background and Goal of Study: Epidural local anaesthetics administered by continuous infusion are used for postoperative analgesia (1,2). The aim of this study was to compare the analgesic efficacy and side effects of ropivacaine *vs* ropivacaine plus morphine for postoperative pain management after major abdominal surgery.
Material and Methods: Forty adult patients ASA I-III scheduled for elective abdominal surgery were included. An epidural catheter was inserted preoperatively between T8-T11. Before anesthetic induction, all patients received a epidural bolus of 50 mg 0.5% ropivacaine with 3 mg (>70 years) or 4 mg morphine (<70 years). Bolus of 50 mg ropivacaine were repeated every two hours during surgery. Patients were randomized in two groups: group R: postoperative epidural infusion of 0.2% ropivacaine at a rate of 7 ml/h and group M: postoperative 0.2% ropivacaine with 0.03% morphine at a rate of 7 ml/h. In both groups and as supplementary analgesia metamizol 2 gr iv/8 hours was administered. Measurements were recorded at admission in the recovery room (0h) and at 1, 6, 24 and 48 hours after extubation and included: visual analog scale at rest and on coughing (VAS 1–100), respiration rate, sedation scale (0–3), and the incidence of nausea/vomiting (PONV) and pruritus. Statistic analysis included Fisher´s exact test, χ^2 and ANOVA.
Results: Demographic variables and duration of surgery were similar in both groups. In any measurement, mean VAS at rest and with coughing did not differ between groups. No important side effects were observed in any group and the incidence of PONV and pruritus was similar in both groups.
Conclusion: In our patients, adding morphine to 0.2% ropivacaine epidural continuous infusion does not improve postoperative pain after major abdominal surgery. This results are probably explained by the use of preoperative epidural morphine and supplemental metamizol regimen in all patients.
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2 Kehlet H. *Am J Surg.* 2002; 183: 630–641.

A-719

Lidocaine vs mepivacaine for peribulbar block: a randomised double-blinded study

M. Borel, L. Ousmane, J. Guilley, D. Cantineau, C. Metais, E. Wiel, G. Lebuffe, J.F. Rouland, P. Scherpereel

Departement d Anesthésie-Réanimationz, Centre Hospitalier Regional de Lille, Lille, France

Goal of the study: Lidocaine (L) and Mepivacaine (M) are indifferently used for peribulbar block (PB). This prospective double-blinded study was conducted to evaluate degree of akinesia and impact on intraocular pressure (IOP) after L 2% or M 2% infratemporal injection for cataract surgery.
Materials and methods: After ethic committee approval and obtained written consent, 60 patients scheduled for elective cataract phacoemulsification were randomised to receive peribulbar block with either L (n = 30) or M (n = 30). The anaesthetic injection was performed until lid occlusion. The efficacy was assessed by a 12 points scale akinesia score: absence (0), partial (1) and complete akinesia (2) evaluated in the 4 gaze directions and opening and closing lid. A supranasal injection was added 10 min later if akinesia score remained under 7. This score was registered in both groups at 1, 5, 10, 60, 120, and 180 min after injection. Intraocular pressure was measured before (IOP0) and 10 min after injection (IOP10). A the end of surgery, the patient satisfaction of anaesthetic procedure was assessed by a visual analogical scale ranged from 0 for no satisfaction to 10 for complete satisfaction. The difference between L and M was assessed by ANOVA. $P < 0.05$ was considered as significant.
Results: Data (means ± SD) are shown in table.

	L	M
Akinesia 1 min	5.9 ± 3	6.0 ± 3
Akinesia 5 min	9.2 ± 3	9.0 ± 3
Akinesia 10 min	10.2 ± 2	10.0 ± 2.6
Akinesia 60 min	8.1 ± 2	8.8 ± 2.6
Akinesia 120 min	4.8 ± 3	6.8 ± 3
Akinesia 180 min	3.0 ± 3	4.4 ± 3
IOP0 (mmHg)	16.3 ± 3	15.9 ± 2
IOP10 (mmHg)	17.7 ± 5	16.6 ± 5
Patient satisfaction	8.9 ± 1.6	8.1 ± 1.9

Conclusion: In cataract surgery under peribulbar block L and M provide similar quality of akinesia without consequences on IOP. They provide particularly similar reliability of visual function for ambulatory surgery.

A-720

Valdecoxib, a potent COX-2 specific inhibitor, was an opioid-sparing, effective analgesic in two models of orthopedic surgery

M. Puig[1], F. Camu[2], L. Reynolds[3], M. Hale[4], J. North[5], Verburg[5]

[1]Hosp. Uni. del Mar, Spain; [2]Flemish Free Uni., Belgium; [3]Loma Linda Uni., USA; [4]Gold Coast Research, USA; [5]Pharmacia, USA

Background/Goal of Study: Postoperative pain is commonly treated with opioids. However, opioid side effects often limit the dose administered for pain control and may impede rehabilitation and recovery. Multimodal pain therapy can enhance analgesic efficacy and decrease incidence of opioid-related adverse events. In this context, the analgesic efficacy and opioid-sparing effects of valdecoxib, a potent, COX-2 specific inhibitor, were evaluated in two orthopedic surgery models.
Materials and Methods: In two multicenter, multidose, randomized, double-blind, placebo-controlled, parallel-group trials, patients who had undergone replacement of either the hip or knee received morphine by patient controlled analgesia (PCA) and supplemental bolus PRN, plus either valdecoxib 20 mg bid (n = 143), valdecoxib 40 mg bid (n = 143), or placebo (n = 140) for up to two days postoperatively. The first dose of study medication was administered preoperatively in the hip replacement study, and postoperatively in the knee replacement study. Efficacy was assessed by total morphine consumption (PCA and bolus), pain intensity difference (categorical scale), and patient's global evaluation of study medication.
Results and Discussion: Over the 48 h postoperative study period, patients receiving valdecoxib 20 mg and 40 mg bid used 16% and 24% less total morphine (respectively) in the hip replacement study, and 41% and 43% less total morphine (respectively) in the knee replacement trial ($P < 0.05$). Pain intensity scores improved in the valdecoxib/morphine treated patients in both studies, compared with placebo/morphine ($P < 0.05$). Significant improvements were also observed in the patient's global evaluation of study medication in both surgical models. For example, in the hip replacement model 23% of patients receiving morphine/placebo described their study medication as poor or fair, compared with only 3–4% of patients receiving morphine plus valdecoxib ($P < 0.001$). Valdecoxib was well tolerated in both surgical models.
Conclusions: Valdecoxib in addition to morphine significantly reduced morphine consumption and improved analgesic efficacy in two major orthopedic surgical models, when compared with morphine treatment alone.
Acknowledgements: Sponsored by Pharmacia Corporation and Pfizer Incorporated.

A-721

Intraperitoneal levobupivacaine and ropivacaine infusion for reduction of postoperative pain after laparoscopic cholecystectomy

D. Ioannidou, A. Margaritou, A. Filosoglou, A. Zambouri, M. Nastou, P. Petropoulou

Department of Anaesthesiology, Papageorgiou General Hospital, Thessaloniki, Greece

Background and Goal of Study: As the origin of pain in Laparoscopic Cholecystectomy (LC) is multifactorial and patients appear to suffer from visceral, parietal and shoulder tip pain, we designed a clinical study to determine whether pre-incisional wound infiltration and intraperitoneal instillation of levobupivacaine (levo) 0.5% or ropivacaine (ropi) 0.2% could relieve postoperative pain.
Materials and Methods: During elective LC, 60 patients (ASA I–III) received the same anaesthetic agents for premedication, induction and maintenance of anaesthesia. Patients were randomly assigned to one of three groups of 20 pts each. Group C received 80 ml NaCl 0.9% sub-hepaticaly, after gallbladder removal. Group L received samewise, levo 150 mg (in total volume 80 ml) and another 50 mg (10 ml) was preincisionaly infused at the sites of the trocar wounds, while in group R, 150 mg of ropivacaine 0.2% was intraperitonealy installed and the trocar wounds were infiltrated with 50 mg ropi. Ondasentron was given against vomiting and 2 suppositories Lonarid-N by the end of surgery. Pain intensity was assessed using a visual analogue scale (VAS, endpoints 0–10) at 1, 2, and 6hrs after surgery and postop analgesic consumption on patients' request was also recorded in all groups. VAS pain scores refered to measurement of visceral, parietal and shoulder tip pain. Statistical analysis: Mann–Whitney test, Kruskal-Wallis test.
Results and Discussion: Group demographics were similar. Visceral pain scores were significantly reduced ($p < 0.05$) during the 1st and 2nd postoperative hour for the groups L and R, receiving local anaesthetic (LA) for intraperitoneal instillation and skin infiltration, compared to control group. Although abdominal pain scores were less for the local anaesthetic treated groups, no

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statistical significance was recorded between groups regarding neither parietal nor shoulder tip pain scores.
Conclusion: Either levobupivacaine or ropivacaine used in LC for intraperitoneal instillation and wound infiltration, offer significant postop pain relief compared to a placebo treated condition.
Reference:
1 Goldstein A, Grimault P, Henique A, et al. *Anesth.Analg*.2000; **91**: 403–407.

A-722

Effect of celecoxib on bleeding and pain after thyroidectomy

J.P. Galeazzi, M. Braccio, M. Meurisse, E. Hamoir, T. Defechereux, M. Lamy, J. Joris

Department of Anesthesia and Intensive Care Medicine, Department of Endocrine Surgery, University Hospital of Liege, Liege, Belgium

Background and Goal of Study: Non steroidal anti-inflammatory drugs (NSAID) are effective for treating pain after thyroidectomy (1). NSAIDs increase, however, the risk of postoperative bleeding which can be harmful in case of cervical surgery. Selective anti-cyclooxygenase 2 (COX-2) NSAIDs do not affect hemostasis (2). We therefore investigated the effect of celecoxib, an COX-2 inhibitor, on pain and bleeding after thyroidectomy.
Materials and Methods: After approval of our Ethics Committee and informed consent, 60 patients scheduled for thyroidectomy were included in this double blinded study. Patients were randomly allocated to receive 400 mg of celecoxib or placebo p.o. 1 h before surgery. Anesthesia and postoperative analgesia (propacetamol + tramadol) were standardized. Pain scores were measured on a 100 mm visual analog scale 1, 2, 6 and 24 h after surgery. The following pain modalities were assessed: global pain, superficial pain, deep pain, neck pain and pain on swallowing. Analgesic consumption was also recorded. Intraoperative bleeding was rated by the surgeons. Postoperative bleeding was assessed by measuring cervical circumference and skin fold (using a caliper) at the level of the cervicotomy. These parameters were measured before and 24 h after surgery. Results (mean ± SEM) were analysed using ANOVA or chi square when appropriate.
Results and Discussions: Morphometric characteristics and intraoperative data including intraoperative bleeding scores were similar in the 2 groups. Celecoxib (400 mg) did not reduce significantly any of the different postoperative pain modalities. Analgesic consumption was similar in the 2 groups. Skin fold and cervical circumference did not differ significantly in the 2 groups: skin fold on day 1: +5.1 ± 1.1 mm vs +4.1 ± 1.0 mm; circumference on day 1.: +2.1 ± 0.4 cm vs +2.8 ± 0.4 cm for celecoxib and placebo respectively.
Conclusion(s): These results suggest that 400 mg celecoxib given orally preoperatively has no additional effect as compared to standard schedule. This dose of celecoxib increases neither intraoperative nor postoperative bleeding.
References:
1 Anesth Analg 2001; 92 : 1052–7.
2 J Clin Pharmacol 2000; 40 : 124–132.

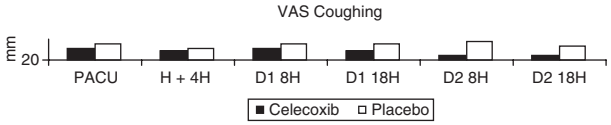
A-723

Efficacy of perioperative celecoxib in a multimodal analgesia protocol for lung surgery with thoracotomy

P. Vauchel, M. Senard, K. Razzouk, L. Roediger, E. François, B. Hubert, R. Larbuisson

Department of Anesthesia and Intensive Care Medicine, University Hospital of Liege, Liege, Belgium

Background and Goal of Study: Postero-lateral thoracotomy is one of the most painful surgical procedures. Thoracic epidural analgesia provides superior analgesia than IV sequence (1). High quality of postoperative analgesia results in decreased postoperative morbidity (2) and long-term post-thoracotomy pains (3). We assessed the potential benefits of celecoxib, a selective cyclo-oxygenase 2 inhibitor, in a multimodal analgesia protocol using thoracic epidural analgesia, after thoracotomy.
Materials and Methods: After IRB approval and informed consent, 30 (ASA I–III) patients scheduled for lung surgery were included in this randomised double-blind study. Celecoxib or placebo was given po the evening before surgery, 1 h before surgery, and then twice a day during 48 h after surgery. General anaesthesia combined with epidural anaesthesia (T4–T5), and epidural analgesia with PCEA (ropivacaine 0.2% with 0.5 $\mu g.ml^{-1}$ sufentanil) were standardized for both groups. Pain scores on a 100 mm VAS at rest, during coughing and mobilisation, PCEA consumption, satisfaction score, blood loss and renal function were assessed for 3 days postoperatively. ANOVA, Student's t test and Fischer exact test were used as appropriate.
Results: Patient data, postoperative blood loss and renal function were not different in the 2 groups. Postoperative local anaesthetic consumptions were similar in the 2 groups. Pain scores were significantly decreased at rest ($p < 0.001$) during coughing ($p < 0.001$) and mobilisation ($p < 0.05$) in the celecoxib group. Satisfaction scores were also improved ($p < 0.05$).



Conclusion: Celecoxib improves pain relief provided by thoracic epidural analgesia after thoracotomy both during static and dynamic conditions. No NSAID-related side effects were observed.
References:
1 Sentürk M et al. *Anesth Analg* 2002; 94: 11–5.
2 Ballantyne JC et al. *Anesth Analg* 199; 86: 598–612.
3 Katz J et al. *Clin J Pain* 1996; 12: 50–5.

A-724

Postoperative analgesic effects of celecoxib and rofecoxib in total abdominal hysterectomy

M. Durmus, A. Koroglu, S. Demirbilek, U. Ozgul, M.O. Ersoy

Department of Anaesthesiology, Inonu University, School Of Medicine, Malatya, Turkey

Background and Goal of the Study: Celecoxib and rofecoxib that have been used for treatment of osteoarthritis and rheumatoid arthritis are two COX-2 selective inhibitor non-steroidal antiinflammatory drugs[1]. The aim of this study is to investigate postoperative analgesic and morphine sparing effects of single dose celecoxib or rofecoxib which were given before surgery in patients undergoing total abdominal hysterectomy.
Materials and Methods: After obtaining approval from Ethics Committee, we studied 60 ASA I–II females undergoing total elective abdominal hysterectomy in a randomised, placebo controlled, double blind study. Patients were divided into 100 mg celecoxib (group I, n = 20), 50 mg rofecoxib (group II, n = 20) and placebo (group III, n = 20) groups. Anaesthesia was induced with 1.5 μg/kg fentanyl, 4–6 mg/kg thiopental and 0.1 mg/kg vecuronium. Morphine consumption, VAS scores at rest, on movement and on coughing and degree of sedation were evaluated during postoperative 2, 4, 8, 12, and 24 h.
Results: Total morphine consumption was lesser in group II at 8 h compared to group III and at 12 and 24 h compared to group I and III ($p < 0.05$). VAS scores at rest, on movement and on coughing in group I and II were significantly decreased during the first 24 h. There is no statistically significant difference between three groups regarding adverse effects.
Conclusions: Although both celecoxib and rofecoxib produced a significant decrease in morphine consumption and VAS scores at rest, on movement and on coughing, we concluded that rofecoxib could produce better analgesia in early postoperative period and could decrease morphine consumption after 12 h with its long term effect.
Reference:
1 *Lancet* 1999; 353: 307–14.

A-725

Parecoxib sodium 40 mg IM is as effective as morphine 12 mg IM following gynecologic laparotomy

T.P. Malan[1], S. Gordon[2], L. Traylor[3], M. Snabes[3], R. Hubbard[3]

[1]University of Arizona Health Sciences Center, USA; [2]ISCL Clinical Studies, Atlanta, USA; [3]Pharmacia Corp., Skokie, USA

Background/Goals: To compare the single-dose analgesic efficacy and safety of parecoxib sodium (parecoxib), the parenterally administered prodrug of the cyclooxygenase-2 (COX-2) specific inhibitor valdecoxib, with morphine and placebo following elective gynecologic laparotomy.
Methods: In this single-dose, randomized, double-blind trial, patients recovering from gynecologic laparotomy with moderate to severe pain <6 h after discontinuing PCA (on morning following surgery) received morphine 6 mg or 12 mg IM, parecoxib 40 mg IM, or IM placebo treatment. Pain intensity difference (PID) (categorical and VAS) was assessed over 12 h. A higher PID score indicates greater pain relief. Patient's global evaluation of study medication was recorded, and time-weighted sum of pain relief (TOTPAR), and time to rescue medication estimated.
Results: PID (VAS) scores were significantly higher in the parecoxib 40 mg group than with morphine 12 mg from 4 h to 10 h ($P < 0.05$), and similar at all other time points. PID (categorical) scores were significantly higher in the parecoxib 40 mg group than with morphine 12 mg at 5 h and 7 h, and similar at all other time points. PID scores (both VAS and categorical) were significantly

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higher in the parecoxib 40mg group compared with morphine 6 mg (3 h to 12 h) and placebo (1 h to 12 h). In addition, parecoxib 40 mg provided significantly greater pain relief (TOTPAR analysis) than placebo and morphine 6 mg at 4 h, 6 h, 8 h, and 12 h, and morphine 12 mg at 8 h ($P < 0.05$). Parecoxib 40 mg had a statistically significantly longer median time to rescue medication than morphine 12 mg, morphine 6 mg, and placebo ($P < 0.05$). Patients' global evaluation of parecoxib 40 mg was significantly higher than morphine 6 mg and placebo ($P < 0.05$), and numerically higher than that of morphine 12 mg. Adverse event trends favored parecoxib sodium 40 mg with regard to nausea, vomiting, headache, fever, and respiratory system disorders.

Conclusions: Parecoxib 40 mg IM provided analgesia that was at least as effective as morphine 12 mg, superior to morphine 6 mg and placebo, and had a longer duration of action following gynecologic laparotomy. Since parecoxib sodium provides pain relief similar to morphine 12 mg in this model, this new agent may be useful in early discontinuation of opioids after major surgery, thus avoiding disabling opioid-related side effects.

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A-727

Comparison of post-operative analgesia using anterior or posterior lumbar plexus block in total knee replacement surgery using levobupivacaine

D. Mitra, M.W. Watson, S. Grant, T. McLintock

University Department of Anaesthesia, University of Glasgow, Glasgow, UK

Background and Goal of Study: Lumbar plexus block by anterior approach may produce incomplete 3-in-1 block (1) and may provide poorer post-operative analgesia than with the posterior approach. We compared the analgesic effect of these two techniques along with sciatic nerve block in total knee replacement (TKR) surgery.

Materials and Methods: In a prospective single-blind randomised controlled trial, 32 ASA I-III patients undergoing unilateral TKR were randomized into 2 groups, to have lumbar plexus block by either anterior approach, or posterior approach using Dalens' modification of Winnie's technique (2). Each group also received sciatic nerve block using Labat's technique (3). A nerve stimulator was used at 0.5 mA at 1 Hz to locate the neural structures and 40 ml 0.5% levobupivacaine with 1 in 200,000 adrenaline was injected (25 ml for lumbar plexus and 15 ml for sciatic nerve block). The patients received spinal anaesthetic using 0.5% heavy bupivacaine and 10 mcg fentanyl, with PCA morphine for post-operative analgesia. The time to perform the blocks was noted. Morphine consumption, pain scores, nausea and vomiting were recorded on arrival on the ward, and at 4, 8, 12, 24, 36 and 48 hours after the start of surgery. Morphine consumption was compared by Student's t-test and pain scores by Mann Whitney U-test.

Results and Discussions: The patients in the posterior group used significantly less morphine from 24 hours onwards, total morphine consumed at 48 hours being 16 mg (SD 9) (posterior $n = 15$) and 46 mg (SD34) (anterior $n = 17$), $p < 0.02$. No significant difference in pain scores was noted. No patients with posterior block developed an epidural spread.

Conclusion: A combined posterior lumbar plexus and sciatic nerve block using levobupivacaine produces more effective post-operative analgesia in TKR patients, compared to a combined block with an anterior approach.

References:

1 Marhofer et al: *Anesth Analg*. 2000; **90(1)**: 119–24.
2 Dalens et al. *Anesth Analg*. 1988; **67**: 750–8.
3 Labat G. Regional Anesthesia – Its Technique and Clinical Application. 2nd ed. W.B. Saunders, 1929.

A-728

Patient controlled epidural analgesia with levobupivacaine 0,0625% – clonidine or levobupivacaine 0,0625% – morphine in orthopaedic surgery

M. Atsalou, C. Soilemezidou, E. Christidou, E. Blougoura, A. Beletsiotis, P. Petropoulou

Department of Anaesthesiology, Papageorgiou General Hospital, Thessaloniki, Greece

Background and Goal of Study: Comparison of the effectiveness of the two regimens for postoperative analgesia, namely levobupivacaine 0,0625% plus clonidine (0,6 μg/ml) and levobupivacaine 0,0625% plus morphine (0,006 mg/ml) as patient controlled epidural analgesia (PCEA) after orthopaedic surgery.

Materials and Methods: 26 orthopaedic patients under combined epidural-spinal anaesthesia, classified preoperatively in ASA I-III were randomly allocated into two groups LC ($n = 11$) and group LM ($n = 15$). Postoperatively, after sensory and motor block release the epidural catheter was connected to an electronic pump for about 48 hours period with settings: continuous rate 6 ml/h, bolus 2 ml, lockout period 10 minutes and 1 hour limit 10 ml. Additional intramuscular rescue analgesia was given in case of inadequate analgesia. Recordings of rescue analgesia, infusions consumption, bolus amounts, duration of infusion consumption, adverse reactions (nausea, vomiting, sedation, pruritis), and hemodynamic parameters measured the 1st, 4th, 8th, 12th,24th,48th hour were evaluated. Student t-test with statistical analysis 95% confidence interval was used .

Results: Patients had similar demographic data in both groups. The LC group required more additional analgesia 3/11 (27,27%) than the LM group 1/15 (15,38%).

	Groups		
Variable	LC (mean)	LM (mean)	P
Analgesia	1,727273	1,933333	0,005
Bolus amount	77,09091	64,4	0,628
Bolus delivery	38,54545	32,26667	0,618
Duration infus.	44,71364	47,94333	0,362
Amount infused	332,7273	324,7333	0,192

Duration of infusion consumption, amount infused, bolus amount, bolus infused and delivery were not statistically differed among the groups. Hypotension, or bradycardia, or any other adverse reaction were not recorded in both groups.

Conclusion: The combination of levobupivacaine 0,0625% plus morphine provided effective postoperative analgesia.

Reference:

1 Milligan R.K, Convery N.P, Weir P et al. *Anaesth Analg*. 2000; 91: 393–7.

A-729

Transdermic fentanyl in neuropathic pain

F. Peramo, J. Caballero, R. Gonzalez-Fernandez, V. Montero, R. Carlos

Hospital Clinico Universitario "San Cecilio", Granada, Spain

Background and Goal of Study: Animal studies have shown that the combination of morphine and gabapentin is effective in the treatment of neuropathic pain[1]. The aim of this study was to compare the effectivity of gabapentin with or without transdermic fentanyl in patients with neuropathic pain.

Materials and Methods: 60 patients with neuropathic pain (allodynia, burning/electrical or constant pain) were randomly allocated to 2 groups. In group 1 patients increasingly received gabapentin, 900–1200 mg/day and in group 2 patients also received transdermic fentanyl 50–75 μg/72 h. In every patient we measured pain intensity (VAS) each month. At the same time we evaluated the appearing of side effects (nausea/vomiting, constipation, pruritus, urinary retention, respiratory depression, drowsiness and dizziness) and at which moment pain relief (VAS) was greater than 50%. Data were evaluated using SPSS for windows (ANOVA Repeated measures, t-test, Fisher exact test and Chi squared as required) and $p < 0.05$ was considered significant.

Results: Patient's characteristics and etiology of pain (postherpetic neuralgia, cancer-related neuropathy and lumbar root compresion) were similar in both groups. Pain relief geater than 50% appeared sooner in group 2 (25 ± 7 days) than in group 1 (35 ± 9 days) $p < 0.05$, without significant differences between constant and electrical pain. Allodynia didn't show significant differences between groups. Nausea/vomiting, constipation and pruritus were more common in group 2 than in group 1 (8/4 patients, respectively), $p < 0.05$ and drowsiness/dizziness were more common in group 1 than in group 2 (9/3 patients), $p < 0.05$, although nobody stopped the treatment.

Conclusions: The association of gabapentine and transdermic fentanyl is more effective than gabapentine in alleviating constant and electrical neuropathic pain. The evolution of allodynia isn't different in patient with fentanyl and patients prefer some degree of discomfort to the existence of this type of pain.

References:

1 Mattews EA et al. *Anesthesiology* 2002; **96**: 633–640.

A-731

The preoperative administration of metamizol decreases intraoperative alfentanil requirements during spinal arthrodesis

S. Fernandez Galinski, O. Comps, S. Bermejo, R. Mansilla, F. Escolano, M.M. Puig

Department of Anaesthesiology, Hospital Universitario del Mar, UAB, Barcelona, Spain

Background & Goals: Metamizol is an effective analgesic that produces a weak inhibition of the COX enzymes and has a poor anti-inflammatory

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effect. We have evaluated if the administration of metamizol before or during surgery, could alter processing of nociceptive input and provide intraoperative analgesia and to improve the postoperative pain.

Material and Methods: The protocol was approved by the Ethic Committee of the Institution, and all patients gave informed consent. Twenty-nine, ASA I-III patients undergoing vertebral arthrodesis, were randomly distributed to receive (double-blind) 2 g of IV metamizol: as a bolus before induction of anaesthesia (Group I), infused over the duration of surgery (Group II) or as a bolus, at wound closure (GroupIII). Saline boluses and infusions were used as controls. During induction all patients received: midazolam 2 mg, alfentanil 30 ug kg^{-1}, cis-atracurium 0.1 mg kg^{-1} and propofol, at the dose required to abolish the eyelid reflex. Anaesthesia was maintained with a fixed concentration of sevoflurane (0.8% end tidal), in 40:60 O_2: N_2O and an IV infusion of alfentanil (200 μg/ml) adjusted to maintain the mean arterial pressure within 30% of baseline, and the BIS $<$ 60. Measured variables were: intra-operative alfentanil requirements, and in the PACU: VAS (1–10), Ramsay (0–5) and the dose of morphine required to obtain a VAS $<$ 3. For statistics ANOVA and χ^2 test were used.

Results: Groups were comparable regarding ASA, baseline MAP, duration of surgery and propofol requirements. Data shown as means ± SD.

Groups	Alfentanil μg kg^{-1} min^{-1}	Ramsay	VAS on arrival PACU
I (n = 8)	0,41 ± 0,27*	2,43 ± 0,79	3,43 ± 2,51
II (n = 12)	0,72 ± 0,50	2,45 ± 0,82	4,00 ± 2,40
III (n = 9)	1,07 ± 0,43	1,75 ± 0,89	3,00 ± 2,83
p values	0.011	NS	NS

*indicates a $p < 0.01$ between Group I and III. Morphine requirements in PACU were lower in Group III, but differences were not statistically significant.

Conclusions: The administration of metamizol before induction of general anaesthesia reduces the intraoperative alfentanil requirements.

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A-732

Reduction of intrathecal opioid-induced pruritus: a comparison between rofecoxib – a specific cyclooxygenase-2-inhibitor – and diclofenac

S. Szarvas, S. Harte, A. Niazi, D. Murphy, G. Shorten

Department of Anaesthesia and intensive care unit, Cork University Hospital, Cork, Ireland

Background and Goal of Study: The incidence of pruritus in patients receiving intrathecal opioids is 50–80% (1,2). Diclofenac, a non-specific COX inhibitor has been reported to decrease the incidence of pruritus associated with intrathecal morphine (3). In this study we compared the efficacy of specific COX-2 *vs* non-specific COX inhibitor in this setting.

Materials and Methods: We studied 40 adult ASA I–II patients undergoing elective cesarean section with spinal bupivacaine (12.5 mg) and fentanyl (25 μg). Patients were randomized to one of two treatment regimens: Group R received oral rofecoxib 25 mg, concomitantly with rectal glycerin suppository; Group D received rectal diclofenac 100 mg, concomitantly with oral placebo at the end of the surgery. The severity of pruritus and pain was assessed via a visual analogue scale (VAS) at 2, 6 and 24 h after surgery.

Results and Discussions: There was no significant difference between the two groups in terms of the incidence of pruritus (85% in Group R vs 75% in Group D). There were significant differences in pain scores at every assessment time point. Data (mean ± SD) are shown in the table.

	VAS scores	
Time (h)	Group R	Group D
2	3 ± 3.3	0.6 ± 1.2*
6	5.1 ± 1.8	2.9 ± 2.3†
24	5.2 ± 1.6	2.2 ± 2.7†
Rescue analgesic requirement (morphine, mg)	49.5 ± 13	39 ± 16

† $p < 0.01$; * $p < 0.05$

Conclusion(s): In the first 24 hour postoperatively, diclofenac provides better additional analgesia than rofecoxib for parturients undergoing elective cesarean section under spinal anaesthesia with fentanyl. Both drugs had similar antipruritic efficacy.

References:

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2 Camman WR. *Anaesth* 1993; 78: 870–4.
3 Colbert S. *Anaesth* 1999; 54: 76–80.

A-723

A comparison of two doses of fentanyl in high thoracic epidural bupivacaine for postthoracotomy analgesia

J. Busquets, R. Garcia-Guasch, S. Muñoz, M. Hinojosa, I. Bruy, E. Vela, R. Gadea, P. López de Castro

Servei dAnestesiologia,Reanimació i Terapèutica del dolor, Hospital Universitari Germans Trias i Pujol, Badalona, Spain

Background and Goal of Study: The side effects of fentanyl used for epidural anaesthesia may delay postoperative recovery in thoracic surgery. The aim of our study was to compare the level of analgesia and the side effects of two different regims of fentanyl in patients receiving high thoracic epidural analgesia.

Material and Methods: Sixty six patients scheduled for elective posterolateral thoracotomy were included in our study and were divided in two groups: Group Fenta3 received a regime of lower dose of epidural fentanyl (3 μg.ml^{-1}) at a higher rate of infusion (5 ml/h) along with bupivacaine 0.125% whereas the Fenta6 group received a regime of higher dose of epidural fentanyl (6 μg.ml^{-1}) at a lower rate (3 ml/h) along with bupivacaine 0.125%. Both groups received patient-controlled analgesia (PCA) infusion for 4–5 days. With the PCA delivery system set to deliver 3 boluses of 0.5 ml per hour with a 20-minute lockout period. Three measurements of pain were made daily using a visual analogue scale: at rest, with movement and on coughing. The following side effets were also recorded daily: nausea, vomiting, inability to walk and itching. Anova and two tailed Fisher exact test were used as statistical analysis.

Results and discussions: Twenty six cases of Fenta3 and 40 cases of Fenta6 were recorded, 52 men and 14 women, age 56.47 (SD 12.25). No differences on age and sex were found among groups. The Fenta6 group consumed significantly more fentanyl and less local anesthetic than the Fenta3 group. The frequency of the side effects was low and similar in the two groups.

As shown in the table, VAS (mean ± SD) at rest was lower in Fenta6. VAS at movement and cough was not significantly different.

	Fenta6	Fenta3	p
1st day	1.8 ± 1.72	2.48 ± 1.9	ns
2nd day	0.76 ± 1.58	1.73 ± 1.58	<0.02
3rd day	0.56 ± 0.89	1.24 ± 1.45	<0.03
4th day	0.25 ± 0.55	0.55 ± 0.72	ns

Conclusion(s): Fentanyl 6 μg · ml^{-1} provides better analgesia than 3 μg · ml^{-1} in a PCA infusion with bupivacaine without increasing the side effects.

A-734

Use of TCI Remifentanil for testing opioid sensitivity in pain analysis

A. Rhodin, G. Ordeberg, M. Cornefjord, M. Nyman, M. Enlund

Departments of Anesthesia and Orthopedics Uppsala and Department of Anesthesia Västerås, Uppsala, Sweden

Background and Goal of Study: Intravenous pain analysis with morphine or alfentanil is time consuming, only 2–3 doses may be tested, and side effects may be pronounced. Remifentanil is a short acting opioid. It should therefore be possible to test several doses in a short time span. Side effects would wear off quickly. Also, it would be possible to adapt more exact dosing with the target control infusion technique (TCI). We tested the usefulness of TCI remifentanil for pain analysis. The number of concentration levels used, side effects, the possibility to judge opioid sensitivity, the time consumed, and the time to street-fitness were assessed.

Materials and Methods: Ten patients with low back pain were tested in a double-blind manner. Remifentanil and placebo were administered randomly to each patient with the TCI technique (G. Kenny, Glasgow, UK). The predicted concentration was increased stepwise from 0,5 ng/ml to 5,0 ng/ml. Measurements were made at baseline and at each concentration. Pain was measured with visual analogue scale (VAS) 0–100 mm, and pain threshold was measured by use of an Algometer® at maximum pain in a lumbar vertebra interspace, a lumbar muscle tender point, and a control point in a thenar muscle. Side effects, ECG, NIBP, and SaO_2 were monitored. Sedation was evaluated with the Ramsey scale. Cut off points was 50% pain reduction of the VAS, and 50% increase of pain threshold in area of pain, or severe side effects, including Ramsey 3.

Results and Discussions: Seven of the ten patients, aged 35–58, were found opioid sensitive. The median effective predicted remifentanil concentration was 2.7 ng/ml (1.5–4.0), the median number of concentrations steps was 6 (3–9). Two patients were over sedated with remifentanil (Ramsay 3). They were in a normal state within minutes after cessation. One patient was a placebo responder. She was in panic at 2,9 ng/ml remifentanil, and her

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peripheral saturation decreased to 88%. Otherwise there were no major side effects in any patient. Hemodynamics were stable. The median duration of investigation was 113 min (59–165 min). Street-fitness was recognised for all patients within minutes after the end of infusion.

Conclusion: Pain analysis based on TCI remifentanil seems promising with a better "resolution" in opioid sensitivity analysis, but with less time spent, and with a low risk of side effects.

A-735

Surgical incision prevents the development of acute opioid hyperalgesia in rats

M.A. Docquier, V.Collet, P.Lavandhomme

Department of anesthesiology, Université Catholique de Louvain, St-Luc Hospital, Brussels, Belgium

Background: Acute opioid administration induces hyperalgesia mediated by NMDA receptors (1). Using the MACbar of sevoflurane (SEVO) as an objective measure of the antinociceptive potency of opioids, we have shown that low dose of sufentanil (SUF) surprisingly induces hyperalgesia in uninjured animal, i.e. increases the MACbar SEVO instead of reduce it (2). The present study evaluates the interactions of SUF with the MACbar SEVO in the presence of acute pain (perioperative) conditions.

Materials and Methods: Adult male Wistar rats (controls; n = 10) were anesthetized with SEVO in oxygen and the MACbar SEVO was determined from end-expiratory gas samples according to an up and down technique. A 10% increase of systolic arterial blood pressure at the time of the tail clamp was considered as a positive answer. MACbar SEVO was then evaluated with SUF infusion $0.005\,\mu g\,kg^{-1}h^{-1}$ or $0.07\,\mu g\,kg^{-1}h^{-1}$. Other rats underwent either a paw (3) (n = 12) or an abdominal incision (n = 8). Rats were re-anesthetized 30 min or 24 h later and MACbar SEVO assessed as previously described. Statistical analysis used ANOVA and repeated measures, $P < 0.05$ was significant (* with controls).

Results and Discussion: MACbar SEVO are expressed in Table (%; mean ± SD), †significant with 30 min value.

	SEVO	SEVO + SUF 0.005	SEVO + SUF 0.07
Controls	1.9 ± 0.7	3.1 ± 0.6*	1.4 ± 0.4
Paw			
At 30 min	1.5 ± 0.2	1.7 ± 0.8	2.2 ± 0.6
At 24 h	1.3 ± 0.3	1.4 ± 0.2†	1.4 ± 0.4†
Abdominal			
At 30 min	2.1 ± 0.3	2.5 ± 0.5	1.9 ± 0.2
At 24 h	2.0 ± 0.5	2.3 ± 0.6	1.8 ± 0.4

Conclusion: In contrast with uninjured rats, operated rats did not display SUF hyperalgesia in this model. Halogened vapor increases imbalance between inhibitory and excitatory systems modulating pain, unmasking hyperalgesia. After tissue injury, spinal release of excitatory amino acid (maximal at 1 h) might have already triggered the pain facilitatory processes and therefore masked opioid hyperalgesia development (3).

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A-737

Postoperative morphine consumption in the elderly patient

D. Bunge*, F. Aubrun*, O. Langeron*, P. Coriat*, B. Riou#

**Department of Anesthesiology and critical care; #Department of emergency medicine and surgery, Paris, France*

Objective: It has been suggested that the dose of intravenous (IV) morphine used during postoperative titration is not modified by aging (1). We have therefore studied morphine requirements in patients undergoing total hip surgery.

Methods: IV morphine titration was administered as boluses of 2 or 3 mg/5 min without dose limitation, then subcutaneous (SC) morphine was administered every 4 hours over 1 day. Pain was assessed using the visual analogue scale, the threshold required to administer morphine was 30. Young and elderly (⩾70 year-old) patients were compared. Data are mean ± SD or odds ratio (OR) [95% confidence interval].

Results: Only a severe pain (VAS ⩾ 70, OR: 10.5 [4.5–24.8]) was significantly associated with a high dose (>0.15 mg/kg) of IV morphine whereas severe pain (OR: 2.5 [1.6–4.0] and age < 60 years (OR: 2.3 [1.4–3.8] were significantly associated with a high dose (>0.12 mg/kg) of SC morphine.

	Young (224)	Elderly (105)	P
Sufentanil (μg)	67 ± 30	57 ± 21	<0.1
IVmorphine (mg)	10.3 ± 7.5	8.9 ± 6.9	NS
IVmorphine (mg/kg)	0.15 ± 0.1	0.14 ± 0.1	NS
SCmorphine (mg)	12.5 ± 12	7.3 ± 7.1	<0.001
SCmorphine (mg/kg)	0.18 ± 0.1	0.11 ± 0.1	<0;001
Adverse effects	29 (13%)	14 (13%)	NS

Conclusion: the dose of IV morphine during titration is not modified in elderly patients, in contrast to the dose administered subcutaneously over a prolonged period.

Reference:

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A-738

Spinally mediated analgesic effects of a free radical scavenger, edaravone in rats

T. Nishiyama, K. Hanaoka

Department of Anesthesiology, The University of Tokyo, Bunkyo-ku, Japan

Background and Goal of Study: Free radicals might have some roles in acute and chronic pain (1). Many receptors and neurotransmitters in the spinal cord have been reported to be important in pain mechanism. However, there are no studies of the relation between free radicals and pain in the spinal cord. We investigated spinally mediated analgesic effects of a free radical scavenger, edaravone on two different types of pain using rats.

Materials and Methods: Sprague-Dawley rats with lumbar intrathecal catheters were tested for their thermal tail withdrawal response using the tail flick test (TF) and for their paw flinches by formalin injection into the hindpaw (FOR) after intrathecal administration of edaravone (0.1, 0.5, or 1 mg/20 μL in TF, 0.05, 0.1, 0.5, or 1 mg/20 μL in FOR. Saline was used as a control. Motor disturbance and other behavioral side effects were also examined. Eight rats were used in each dose group.

Results and Discussion: Even the maximum available dose of intrathecal edaravone (1 mg/20 μL) did not have analgesic effects in TF. In FOR, intrathecally administered edaravone induced dose dependent decrease of the flinch response in both phase 1 and phase 2. The 50% effective doses (ED_{50}) were 0.25 mg (95% confidence interval (CI): 0.11–0.56 mg) in phase 1 and 0.25 mg (95%CI: 0.061–1.048 mg) in phase 2. With the doses used in this study, no motor disturbance or behavioral side effects were observed. In the spinal cord, free radical might have some roles in inflammatory induced pain but not in thermal induced acute pain.

Conclusions: Intrathecal administration of edaravone, a free radical scavenger had analgesic effects on inflammatory induced acute and facilitated pain but not on thermal induced acute pain.

Reference:

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A-739

Interaction between midazolam and serotonin in spinally mediated analgesia in rats

T. Nishiyama, K. Hanaoka

Department of Anesthesiology, The University of Tokyo, Bunkyo-ku, Japan

Background and Goal of Study: Midazolam has spinally mediated analgesic effects through γ-aminobutyric acid $(GABA)_A$ receptor (1). Serotonergic descending inhibitory neuron also acts on $GABA_A$ receptors in the spinal cord (2). We investigated the analgesic interaction between spinally administered midazolam and serotonin using rats.

Materials and Methods: Sprague-Dawley rats with lumbar intrathecal catheters were tested for their thermal tail withdrawal response using the tail flick test and for their paw flinches by formalin injection after intrathecal administration of midazolam or serotonin. The effects of the combination were tested by an isobolographic analysis using ED_{50} (50% effective dose) values. Behavioral side effects were also examined. Eight rats were used in each dose group.

Results and Discussion: ED_{50} values (μg) are shown. (): 95% confidence interval.

Motor disturbance and agitation seen in each single agent were not observed in the combination.

	Tail flick	Formalin phase 1	Formalin phase 2
Midazolam	1.6 (0.4–5.1)	1.3 (0.3–3.2)	1.2 (0.3–4.2)
Serotonin	34.4 (21.3–55.6)	12.6 (5.5–31.0)	1.3 (0.04–8.2)
Combination (Midazolam)	0.7 (0.4–1.4)	0.1 (0.03–0.3)	1.2 (0.3–4.5)
Combination (Serotonin)	16.3 (8.8–28.3)	0.1 (0.04–0.8)	1.3 (0.3–6.6)

Conclusions: The analgesic effects of intrathecal midazolam and serotonin were additive on thermal acute pain, synergistic on inflammatory acute pain, but inhibitory on inflammatory facilitated pain.

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A-740

The comparison of remifentanil and fentanyl regarding the development of acute opioid tolerance

N. Aydin, A. Ceyhan, N. Özcan, F. Misirlioglu, B. Baltaci

Department of Anesthesiology, Ankara Training and Research Hospital, Ministry of Health, Ankara, Turkey

Background and Goal of Study: We purposed to see whether intraoperative opioid administration causes the development of acute opioid tolerance or not and also different opioids causes differences of tolerance development or not (1).
Materials and Methods: We studied 34, ASA I–III patients between the ages of 18–70, who were scheduled for major orthopedic surgery lasting at least 2 hours. After aneshesia induction with thiopental 7 mg kg^{-1} and vecuronium bromide 0.1 mg kg^{-1}, patients were randomly allocated in to 3 groups. During ventilation with 100% O_2 , a remifentanil infusion was started in group R at a rate of 0.1 $\mu g\,kg^{-1}min^{-1}$and 1 $\mu g\,kg^{-1}$ fentanyl was given to group F. No opioid was given to group K. Anesthesia maintained with 1.5 % isoflorane in 50% O_2 and 50% N_2O with 6 L flow. According to autonomic responses, remifentanil subsequently increased stepwise by 0.05 $\mu g\,kg^{-1}min^{-1}$ increments with a maximum of 2 $\mu g\,kg^{-1}min^{-1}$ in group R. If needed 1 μgkg^{-1} fentanyl was administrated in group F. Remifentanil infusion was continiued until skin closure. Fentanyl was not repeated during the last 30 minutes of operation. 30 minutes before the end of the surgery, 0.15 $mgkg^{-1}$ morphine was given to all patients. Postoperatively, when behavioral pain score was 1(behavioral or verbal expression of pain), 5 mg morphine was given i.v. and patients were connected to a PCA device during the postoperative 24 hours. The time interval from end of the operation to the first onset time of pain and cumulative 24-hr postoperative morphine consumption of the patients were recorded. For statistical analysis, Kruskal Wallis variance analysis was used.
Results and Discussions: Postoperatively K, F and R groups required morphine at 55.00 $\pm$ 21.79., 32.92 $\pm$ 7.82., 12.73 $\pm$ 4.67. minutes respectively ($p < 0.001$). Total 24-hr morphine dose of K, F and R groups were 29.80 $\pm$ 11.3, 43.7 $\pm$ 7.0, 51.6 $\pm$ 5.4 mg respectively ($p < 0.001$).
Conclusion(s): As a result of acute opioid tolerance, opioids that were used during the operation, shortened the first onset time of pain postoperatively, increased postoperative morphine consumption and those effects were even more with short-acting opioids.
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A-741

A randomised, double-blind comparison of the efficacy and tolerability of i.v. PCA oxycodone with i.v. PCA morphine in patients with pain after surgery

L. Morrison, A. Binning, M. Hill

Department of Anaesthetics, Western Infirmary, Glasgow, United Kingdom

Background and Goal of Study: In the UK, morphine is the standard opioid analgesic used in i.v. patient-controlled analgesia (PCA) for acute postoperative pain. This study compared the efficacy, tolerability, and safety of i.v. PCA oxycodone with i.v. PCA morphine in patients who had undergone general surgery.
Materials and Methods: Patients were allocated to treatment with oxycodone 1 mg/ml (n = 64) or morphine 1 mg/ml (n = 69). Patients were stabilised with i.v. bolus doses of their study medication (2 mg), before being transferred to i.v. PCA (1 mg bolus doses with a 5-minute lockout) for 24 to 72 hours after surgery. The primary efficacy endpoint was the box scale-11 (BS-11) pain scores on movement or deep breathing at 24 hours after surgery in the per-protocol (PP) population.
Results and Discussions: Mean BS-11 pain scores on movement or deep breathing and at rest showed a general decreasing trend over time. At 24 hours after surgery, the mean (standard deviation) pain scores in the PP population were 4.6 (2.64) in the oxycodone group and 4.1 (2.02) in the morphine group. The mean treatment difference (95% confidence interval) for this was 0.55 (−0.37, 1.48), which was within the (−1.5, 1.5) limits defined for equivalence (ANOVA). The median (range) total use of study medication was 69.0 (12–336) mg in the oxycodone group and 54.0 (7–212) mg in the morphine group ($P = 0.086$; Wilcoxon rank sum test). In the first night after surgery, 25 patients (54%) in the oxycodone group and 28 (53%) in the morphine group did not wake because of pain. The most common adverse drug reactions (those reported by at least 10% of patients in either group) were nausea, vomiting, constipation, and pruritus. There were no statistically significant treatment differences in the frequencies of these events (Chi-square test).
Conclusion(s): Oxycodone and morphine administered by i.v. PCA were equally effective in controlling patients' pain, and the tolerability profile of the two treatments was similar. We therefore conclude that i.v. PCA oxycodone would be an effective alternative to i.v. PCA morphine for treating pain in the immediate postoperative period.
Acknowledgements: Napp Pharmaceuticals Limited sponsored the study.

A-742

Survey of intrathecal diamorphine use in lower limb joint replacement surgery in one UK hospital. What is best for the patient?

M. Natarajan, P. Warwick, M. Curtis, M. Watters

Department of Anaesthesia, Great Western Hospital, Swindon, United Kingdom

Background and Goal of Study: Intrathecal diamorphine is used for postoperative analgesia in lower limb joint replacement surgery in some units but not others [1]. Diamorphine has theoretical safety benefits over morphine in that its greater lipophilicity means it is removed from the cerebrospinal fluid quicker and is therefore less likely to cause respiratory depression [2]. We surveyed intrathecal diamorphine practice in our hospital, charting current practice.
Materials and Methods: 116 patients receiving intrathecal diamorphine as part of a regional anaesthetic technique for lower limb orthopaedic surgery were prospectively surveyed over a 6 month period. Dose of diamorphine, time to first Patient Controlled Analgesia (PCA) use, mean total PCA use, maximum pain score and side effects were recorded.
Results and Discussions: No patient received naloxone for respiratory depression.

Intrathecal dose	<300 mcg	400–500 mcg	600–1 mg
No: of patients	63 (54%)	44 (38%)	9 (8%)
Time to 1st PCA dose hrs (range)	2–7	6–8	6–14
Mean PCA dose in first 24 hrs	64 mg	34 mg	13 mg
Nausea score of 2–3 at any time	14 (22.2%)	11 (13.8%)	1 (11%)
Pain score > 3 at any time	14 (22.2%)	7 (15%)	0

Conclusion(s): There is wide variability of the dose of intrathecal diamorphine used within a single anaesthetic department. It appears to be a safe and effective technique. Higher doses seem to provide excellent prolonged analgesia and fewer side effects due to less PCA use but are currently not being widely used. This warrants further investigation.
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Acknowledgements: Audit Department, Great Western Hospital, Swindon.

A-744

Effective dose (ED_{50}) of tramadol and morphine in postoperative patients: a study of interaction using isobolographic analysis

T.A. Marcou, S. Marque, J.X. Mazoit, D. Benhamou

Departement dAnesthésie, Hôpital Bicêtre, F-94275 Le Kremlin-Bicêtre, France

Background and Goal of Study: Tramadol (T) is a centrally acting analgesic drug. One enantiomer has a predominantly weak μ opioid effect, whereas the other enantiomer principally inhibits noradrenaline and serotonine reuptake (1). In a search of an effective multimodal analgesia technique with a morphine (M) sparing component, we studied the median effective analgesic doses (ED_{50}) of T, of M and of their combination (T + M) to determine the nature of their interaction using an isobolographic analysis (2).
Materials and Methods: In this double blind, randomized, two stage prospective study, 90 postoperative patients were enrolled in one of three groups. The dose of T and of M received by a particular patient was determined using an up-down allocation technique (3). Initial doses and testing interval were respectively 100 mg and 10 mg in group T and 5 mg and 1 mg in group M. In the second part, a 40/3 (T/M) dosing ratio was used. The threshold of effective analgesia was defined at three or less on a numerical pain score (0–10). Isobolographic analysis was subsequently applied.
Results: The ED_{50} (95% confidence interval) of T and M were respectively 80 mg (70–90 mg) and 6 mg (5–7 mg). The ED50 of the combination was 67 mg (55–80 mg) for T and 5 mg (4–6 mg) for M.

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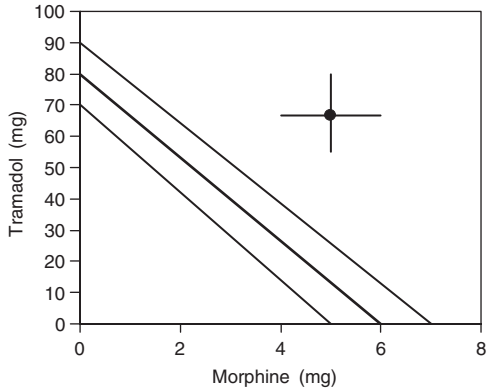

Conclusion: The combination of tramadol and morphine was found infra-additive.

References:

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A-745

Efficacy and safety of continuous background infusion during intravenous PCA with low-doses of morphine for patient undergoing abdominal surgery

A. Clemente, P. Aceto, G. De Cosmo

Department of Anesthesiology and Intensive Care, Catholic University of Sacred Heart, Rome, Italy

Background and Goal of Study: Patient-controlled analgesia (PCA) is recognised as an important advance in the management of postoperative pain. Some studies suggest that analgesic doses of tramadol, a centrally acting drug with both opioid and non-opioid modes of action, don't cause the adverse effects commonly caused by morphine(1). Other studies found that the combination of ketorolac and opioids may decrease morphine consumption(2). The purpose of this study was to evaluate postoperative pain and morphine consumption using PCA with low-doses of morphine in association with continuous IV infusion of tramadol or tramadol + ketorolac.

Materials and Methods: 30 patients undergoing general anesthesia for abdominal surgery, were randomly assigned to two groups. At the end of surgery, group A was given tramadol (6.25 mg/ml) + ketorolac (1.875 mg/ml) and group B tramadol (6.25 mg/ml), administered in continuous infusion at 2 ml/h during postoperative 48 h. After awakening PCA was started using Vygon Freedom pump with morphine 0.6 mg/ml, boluses of 1 ml per demand and 7-min of lock-out interval. Pain was assessed using visual analogue scale at rest (VASr) and during movements (VASi) within 48 h of awakening. We also registered, during this period, vital parameters and influence of pain on different daily activity of all patients using a "Brief Pain Inventory" (BPI) protocol. Analysis of variance (Anova) was used for statistical purpose.

Results and Discussions: In both groups an effective control of postoperative pain was obtained during the period of study (VASr < 3; VASi < 4). In group A VASr values were always lower than those in group B, particularly at 24 h ($p < 0.05$). The BPI score was similar in both groups. Mean morphine consumption was always greater in group B than in group A ($p < 0.05$ at 24 h). No postoperative adverse effects were registered.

Conclusion(s): The combination of I.V. PCA with background infusion of tramadol + ketorolac or tramadol alone provides an effective control of pain without adverse effects. Moreover, the association of tramadol + ketorolac permitted a better pain relief with reduction in morphine consumption.

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A-746

Prehospital analgesia: morphine versus fentanyl in emergency severe acute pain

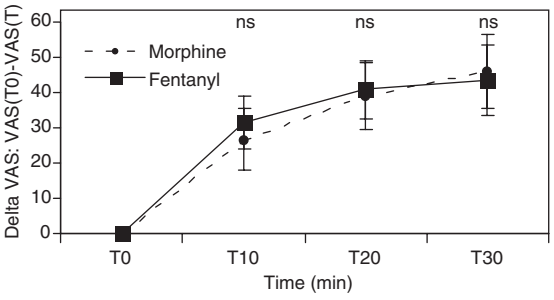
M. Galinski, F. Dolveck, L. Tual, T. Houssaye, M. Ruscev, B. Garrigue, F. Lapostolle, F. Adnet

Department of Prehospital Emergency, Avicenne Hospital, Bobigny, France

Background and Goals: The initial treatment of severe acute pain needs opioïds administration. Fentanyl (F) has got a theoretical faster onset of action than morphine. However, French guidelines recommend use of morphine in this setting (1). The aim of this study was to compare in a randomized double blind method Morphine (M) and Fentanyl in prehospital setting.

Material and Methods: Consecutive patients with severe acute pain defined with Visual Analogic Scale equal or upper than 60/100 were included. M group was defined by initial intravenous injection of 0.1 mg/kg, then 3 mg every 5 minutes; F group was defined by initial intravenous injection of 1microg/kg then 30 micrograms every 5 minutes. Analgesia measured by AVS equal or lower than 30/100 defined efficient analgesia.

Results: 26 patients were included in M group and 28 in F group. Evolution of VAS variations (Delta VAS; mean ± 95% Confidence Intervals (CI)) between VAS (T0) and VAS (T) are shown in the figure. Initial VAS (TO) and VAS (T30) (mean ± 95% CI) were 83 ± 5 and 40 ± 12 in M group and 77 ± 5 and 35 ± 8 in F group (p = NS). Sixty two per cent patients in M group described analgesia as excellent or good versus 76% in F group (p = NS). We found 6 side effects in M group (Nausea (1), Emesis (1), Dysphoria (1), Pruritus (2), Dizzy (1)) and 8 in F group (Nausea (5), Emesis (2), dysphoria (1)) (p = NS).



Conclusion: There was no difference for evolution of pain intensity between the 2 groups.

Reference:

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Education, Research and Presentation

A-747

Problem based learning in undergraduate teaching of anaesthesiology: a survey of two years experience

R. Garcia-Guasch, R. Rincón, A. Melero, M. Lucas, J.E. Baños

Facultat de Medicina, Universitat Autónoma de Barcelona, Servei dAnestesiologia, Hospital Universitari Germans Trias i Pujol ,Badalona, Spain

Introduction and Aim of the Study: Problem based learning (PBL) is one of the best described methods of interactive learning. The aim of the study was to analyse the undergraduate students' evaluation of whether PBL helped them to understand Anaesthesiology better in comparison to other methods of learning.

Material and Methods: The study covered two consecutive academic years (2000–2002). The teaching programme combined three different methods of learning: classroom lectures, practical training in the operating theatre and PBL seminars. Three PBL problems were presented: general anaesthesia, regional anaesthesia and critical care. The students were divided into groups of 10. They searched for the relevant information, solved the problems and discussed them under the guidance of a tutor. At the end of the teaching programme the students filled in a questionnaire to evaluate the PBL seminars. It contained the following items: age, sex, academic year, advantages, disadvantages, problems, difficulties and suggestions for the next year. The three methods were scored from 0 (not useful at all) to 10 (very useful).

Results: Seventy five students (22 men and 53 women; mean age 23.52; standard deviation (SD) 2.73) filled in the questionnaire. Fifty one (68%) had never heard of PBL before. All of them (100%) considered PBL a positive experience. However, only 34 (45%) thought that the whole syllabus of

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Anaesthesiology should be taught using PBL. Practical training in the operating theatre got the highest score (mean 9.02; SD 1.07), whereas the classroom lectures got the lowest score (mean 6.58; SD 1.46). PBL seminars got an intermediate score (mean 8; SD 0.9). Ninety percent showed clear preference for PBL over classroom lectures. The students evaluated PBL positively in terms of participants' knowledge, clinical reasoning, bibliographic search, satisfaction and fun. However, they complained that PBL is time consuming, lacks theoretical basis and written texts, and does not cover the whole syllabus for the medical licensure examination.
Conclusions: Students consider PBL a useful method of learning for a better understanding of Anaesthesiology and Critical Care. However, the nature of the medical licensure examination in our country limits its use during the undergraduate medical training.

A-748

Development and validation of the Anaesthetic Trainee Theatre Educational Environment Measure (ATEEM)

M. Holt

Department of Anaesthetic, Developed with the Centre for Medical Education, University of Dundee whilst at Coventry University Hospital, Whangarei, New Zealand

Background and Goal of Study: The importance of the educational environment has clearly been established[1]. In order to measure the educational environment for trainee anaesthetists in the theatre setting a sensitive and robust diagnostic tool has been developed and validated.
Materials and Methods: 156 items for inclusion in the Anaesthetic Trainee Theatre Educational Environment Measure (ATEEM) were obtained from a literature search and focus groups of 14 anaesthetic trainees, 32 educational supervisors and 3 regional programme directors. Further refinement and validation was done by ratings from trainee anaesthetists using a Likert-type scale of 0–4 according to how important they felt each item was in creating a good learning environment for "In Theatre Anaesthetic Teaching". Items that averaged 3.5 or more were subjected to qualitative analysis for group clustering and the removal of those that were repetitious or poorly worded. The final 40 items were randomized to form the ATEEM which was then administered to 271 anaesthetic trainees within the West Midlands.
Results and Discussions: 218 questionnaires were returned. Problems were identified at various levels. Individuals who were having problems were highlighted and located with anonymity. Areas were highlighted that could be improved by intervention at individual hospitals for specific items and subscales. The ATEEM successfully distinguished statistically significant differences in mean scores between the years of training at regional, school and individual hospital levels using the t test ($p < 0.05$). The ATEEM demonstrated the capacity to distinguish differences between schools and individual hospitals for both different grades and gender. The ATEEM enabled comparisons between schools of anaesthesia and individual hospitals.
Conclusion(s): The ATEEM identifies and compares the theatre educational environment for anaesthetic trainees. It has shown that the environments do vary and will enable trainers to identify problem areas and put into place measures to remedy them. The information provided by the ATEEM will be of high value in educational planning especially in view of the results obtained and should be an integral part of validating the educational environment.
Reference:
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A-749

Anaesthesia research in Northern Europe 1981–2000: visibility and impact in EU context

U. Skram*, B. Larsen, P. Ingwersen, J. Viby-Mogensen*

**Academic Department of Anaesthesia, Rigshospitalet, Copenhagen; Royal School of Library and Information Science, Copenhagen*

Goal of Study: To assess the volume and impact of research in anaesthesiology and intensive care medicine over a 20-year period in the Northern European countries: Sweden, Norway, Finland, Denmark, the UK, and the Netherlands, relative to each other and to the European Union (EU).
Methods: Publication and citation data 1981–2000 extracted from the database National Science Indicators (NSI) 2001, covering the 33 anaesthesia and intensive care journals indexed in Current Contents. Data were analysed as time series in running 5-year periods.
Results:
Publication analysis: The Danish research output did not increase over the 20-year period. Sweden increased its production by 35%, while the remaining four countries showed increases from 100% to 146%. The EU increase was 148%. Sweden and Denmark lost visibility within the EU, while the other countries largely kept their positions.
Citation analysis: Sweden and Denmark showed a significant decline in EU citation shares (14,9% to 8,0% and 6,2% to 4,0%, respectively), whereas Finland (4,6% to 4,9%) and Norway (1,7% to 2,1%) presented slight increases. The Netherlands declined from 7,4% to 5,5%, and the UK from 46,2% to 31,0% of the total EU citations.
Citation impact analysis: The absolute citation impact (ACI, *average* number of citations received per publication for each running 5-year period) increased for all the four Nordic countries. The ACI of the Netherlands did not change and was surpassed by all the Nordic countries by 1994–1998. The UK finished below the other five countries. The relative citation impact (RCI, number of citations per publication relative to the EU baseline) increased for Denmark, Finland, and Norway, remained unchanged for Sweden, and decreased significantly for the Netherlands and the UK.
Conclusions: (1) The annual number of publications from Denmark has declined since the late eighties, as opposed to the other five countries and the EU; (2) the international publication and citation visibility of Finland and Norway has increased slightly over the last twenty years, as opposed to the significant decrease seen by the other investigated countries; (3) judging from the increase in ACI and RCI, the recognition of publications from the Nordic countries has increased over the last twenty years.

A-750

Transatlantic experiences: Sir Robert, Sir Ivan, John, Ralph and the creation of anesthesiology in the 1920s and 30s

D.R. Bacon, R.A. MacKenzie

Department of Anesthesiology, Mayo Clinic, Rochester, Minnesota

Background and Goal of Study: Reviewing existing documents amongst four major figures in anesthesiology in the 1920s and 30s in the United States and in the United Kingdom, clearly demonstrates the transatlantic flow of ideas that helped define anesthesiology as a medical specialty.
Materials and Methods: Correspondence between Sir Robert Macintosh (1), Sir Ivan Magill, John Lundy (2), and Ralph Waters (3) as well as their publications have been consulted. Manuscripts written by other authors describing the contributions of the "big four" have also been reviewed, looking for evidence of influence across the Atlantic.
Results and Discussions: These four men were personal friends with a correspondence of several decades between them. Magill taught Lundy how to intubate the trachea; Lundy reciprocated by teaching Magill intravenous barbiturate anesthesia. Macintosh and Waters maintained a close person friendship. Sir Robert visited Waters prior to setting up the Nuffield department in Oxford, and influences in departmental structure and organization can be seen. Waters and Macintosh were drawn together by an appreciation of history and an interest in John Snow. (1) Waters visited Oxford in the late 1930s, as did Lundy. The odd man out, Lundy seemed to enjoy less of a personal relationship with his British counterparts. Correspondence with Lundy is more formal and scientific.
Conclusion(s): It is clear that there was an exchange of ideas between these four "giants" of anesthesia. Magill's method of intubation was modified by Lundy to include a lighted forceps. Macintosh used Waters' department as a model for setting up the Nuffield Department at Oxford.
References:
1 Collected Papers of Sir Robert Macintosh, Wellcome Institute, London.
2 Collected Papers of John Lundy, Mayo Foundation Archive, Rochester, MN.
3 Collected Papers of Ralph Waters, University of Wisconsin Madison Archive, Madison, WI.

A-751

Vapors of chloroform, drops of ether, and laughing gas: The practice of anesthesia at the Mayo Clinic 1901

R.A. MacKenzie, D.R. Bacon, C.J. Jankowski

Department of Anesthesiology, Mayo Clinic, Rochester, MN, USA

Background and Goal of Study: One of the greatest challenges in anesthesia is matching the anesthetic to the patient. In early twentieth century practice, ether, chloroform, nitrous oxide and local anesthesia were the main options available. What variables influenced the choice of anesthetics at the turn of the century?
Materials and Methods: Using the Surgical Log Book of St. Mary's Hospital (1) in Rochester, Minnesota (affiliated with the Mayo Clinic), the operation, anesthetic choice and age of the patient was analyzed for the month of January 1901. We also noted any entry that denoted complications specific to the anesthetic.

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Results and Discussions: Of the 161 cases, 7 did not have a legible notation about choice of anesthetic. Chloroform was used in 38 cases (23.6%), chloroform and N_2O in 1 case (0.06%), ether alone in 6 cases (0.3%), ether and N_2O in 74 cases (46%), ether, N_2O and chloroform in 16 cases (0.9%), ether and chloroform in 6 cases (0.3%), N_2O in 2 cases (0.1%), cocaine in 8 cases (0.4%), local in 2 cases (0.1%) and ethyl chloride in 1 case (0.06%). There was one intraoperative death and it followed the administration of chloroform. The log book notes "Patient died before narcosis was complete. Heart and respiration stopped simultaneously. Mitral disease." When used alone, the average age of the chloroform patients was 20.5 years, while the average age of the entire group was 31.7 years.

Conclusion(s): Surprisingly, ether and N_2O were the most common anesthetic. Given the reputation of the Mayo Clinic anesthetists'(2) at the time as masters of open drop ether, the combination with nitrous oxide is surprising. The death of the patient under chloroform is consistent with other reported chloroform deaths (3).

References:

1 Surgical Log Book, Volume II. Mayo Foundation Archives, Rochester, Minnesota.
2 Clapesattle H. The Doctors Mayo. Minneapolis: Univ. of Minnesota Press 1941 pp 430–431.
3 Knight PR, Bacon DR. An unexplained death. Anesthesiology 2002; 96:1250–3.

A-752

The Centennial of inhalative Oxygen-Therapy (1902–2002) – a reassessment of the history of the most basic therapeutic agent in modern medicine

M. Strätling, P. Schmucker

Universitätsklinikum Schleswig-Holstein, Klinik für Anaesthesiologie der Universität zu Lübeck, Germany

This survey analyses the history of inhalative oxygen therapy and its interactions with the history of anaesthesiology. For this purpose, we will start with illustrating "the long way of oxygen" from its first isolation by Carl Wilhelm Scheele (1772) and Joseph Priestley (1774) to its breakthrough for therapeutic application in the 20th century. We will show that the two main factors delaying the successful implementation of a truely rational oxygen therapy were of technical nature [1]: The complicated and costly production of the gas and insufficient means to apply it continuously and with reliable and sufficient dosages to the patients. Both problems could not be satisfactorily solved until 1902. From this year on, however, the "Linde Process" allowed cheap mass-production of oxygen. Simultaneously, various inventions of modern pressure gas technology allowed to solve the application problems. Here, a special importance is to be awarded to pressure reducing valves. These were first introduced into medical technology by Draeger Inc. (Lübeck/Germany) on a significant scale, proving particularly successful in anaesthesia and rescue-devices e.g. in the "Roth-Draeger Anaesthesia Apparatus" (1902).

Therefore, our survey will also illustrate that the "breakthrough" of inhalative oxygen as a rational therapy truely "succeded" first on a significant scale in Anaesthesia and Emergency-Medicine [1].

Critically discussing earlier research, which assumes that "modern oxygen therapy" was "founded" by the physiologist J.S. Haldane (1860–1936) in 1917, we propose a historical reassessment, accepting the year 1902 as the internationally decisive "turning point" towards the development of modern oxygen therapy.

Literature: 1. Strätling M, Schmucker P. 100 Jahre Sauerstofftherapie (1902–2002) – Eine medizinhistorische Neubewertung – Teil I/Teil II. Anästhesiol. Intensivmed. Notfallmed. Schmerzther. (ains) 2002/2003; 37/38: In Print (12/2002, 1/2003).

Ethics

A-753

The view of the patients on informed consent

J. Castaño, J. Castillo, R. López, X. Santiveri

Department of Anestesiologia, Hospital Mar-Esperança, IMAS, Barcelona, Spain

Background and Goal of Study: In our Country each anaesthetic department produces its own information material. The aims of this study were to explore patients's views on the informed consent, and assess the impact of the information on the psychological state of the patients.

Materials and Methods: 100 adult surgical patients received the usual written information and the preanaesthetic visit two weeks before surgery and the consent was obtained. The day after the operation, they were asked to answer the following questions: (a) Did you receive written information on the anaesthetic procedure? (b) Did you read it carefully? (c) Do you know the purpose of this document? (d) How much information would you like to receive? (e) Did the information affect your psychological state? (f) What do you think about signing the informed consent? (g) Are you satisfied with the information received?

Results and Discussions: The answers were: (a) Only 3 patients answered no. (b) 52 read it carefully, 19 without attention, 24 did not read it and 5 did not understand it. (c) 26 thought it was to comply with the rights of the patients, 60 to protect the anaesthesiologists and 14 answered that the document was useless. (d) 44 wanted maximum information, 22 only the most important, 16 no information at all and 18 indifferent. (e) 75 were unnaffected, 14 enhanced anxiety, 8 asked for specific information at the preanesthetic visit, which decreased their anxiety and 3 were about to postpone the procedure. (f) 48 in favour, 34 against and 18 indifferent. (g) 72 yes, 7 no and 21 no answer.

Conclusion(s): Our results suggest that the written information produces a negative influence in some patients. Therefore such information should be carefully produced and verbally discussed during the preanesthetic visit.

A-754

Practical experiences with teaching ethics and law in emergency medicine

M. Strätling, V.E. Scharf, D. von Engelhardt, P. Schmucker

Universitätsklinikum Schleswig-Holstein, Lübeck/Kiel, Germany, Akademie für Ethik in der Medizin, Göttingen, Germany

Medical students in Germany are expected to participate in two mandatory courses on emergency medicine. Additionally our universities offer non-compulsory courses for further training under realistic conditions. Also ethical and legal issues – and uneasiness and controversy arising from them – were increasingly raised by our students or tutors (often younger collegues). This experience lead us to faciliate discussing ethical and legal key-issues on an increasingly regular base. Analysing these, our students were encouraged to employ three main systematologies, which base ethics and law in medicine predominantly either on moral philosophic principles, christian-occidential virtues or within their socio-cultural network [1].

Selected Results:

1. The majority of our students preferred the "straight" principle-systematology to the systematology of the often comparatively complex socio-cultural network.
2. The concepts of virtues in medicine were primarily rejected by the majority of students. They gained ground again, as soon as the students tried to normatize general maxims, algorithms or "golden rules" of conduct.
3. Our Experiences illustrate the necessarily complimentary nature of the three main theoretic systematologies for analysing and teaching ethics and law in (emergency) medicine, the capability of very heterogenious groups of tutors and students to successfully combine these different approaches and a very clear preference of medical students and teachers to a normativistic rather than an analytic approach.

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4. The increasing interest of our students to discuss ethical and legal issues even in courses on the practically, "straightforward medically" dominated discipline of emergeny-medicine suggests, that these issues are often still quite underrepresented in the clinical curricula.

Literature: M. Strätling et al., European Philosophy Of Health Care And Bioethics – providing a complementary systematology for teaching emergency medicine; XVI European Conference on Philosophy of Medicine and Health Care, Malta, August 2002.

A-755

The anaesthesiologist in the "Integral care programme for sick physicians (PAIMM) in Catalonia

J. Roige, J. Padros, A. Arteman, P. Lusilla, M. Casas, M. Bruguera

Integral care program for sick physicians (PAIMM), Col.legi de Metges de Barcelona, Barcelone, Catalonia Spain

Background and Goal of Study: PAIMM is a program devoted to assisting physicians who suffer mental disorders and/or addictive behaviors to alcohol, and/or other drugs, including psycho-pharmaceutical products. The program exists because these sick physicians hide their illnesses and do not go to the Health System seeking help, like the rest of the population, and can easily jeopardize the health of their patients. The aim of this paper is to study the number and aspects of sick anesthesiologists affected.

Materials and Methods: We studied all recorded cases of the program from November 1998 until June 2002 and anesthesiologists were identified. Delivery of services was made always with Informed Consent at the beginning, and/or Therapeutic Contracts: –Type I: only between patient and therapist and Type II: with Medical Association for the most difficult cases. In Catalonia, there are 27,000 physicians and 500 anesthesiologists.

Results and Discussions: 415 patients were admitted into the PAIMM. Gender: 55% males 45% females Age average: 75% between ages 35–55. 50% between ages 40–50. 35 Therapeutic Contracts with Medical Association participation. 13 patients were anesthesiologists. 5 with Therapeutic Contracts with Medical Association. 7 were addicts to some drug, 3 to alcohol and 3 had mental disorders. There was one dead by overdose in the anesthesiologists.

Conclusion(s): The incidence of severe drug or alcohol abuse is high in the anesthesiology group. Characteristics of patients are also more severe than the rest.

References:

1 American Medical Association Council on Mental Health. JAMA 1973; 223: 684–687.
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