The transarterial brachial plexus block for hand and forearm surgery: a review of 1062 cases

doi: 10.1017/S0265021506002110

EDITOR:

The transarterial approach to the brachial is one of the many methods available for axillary brachial plexus blockade [1]. There is a relative dearth of literature available on this method as most axillary plexus blockades are currently performed using a perivascular technique (with or without nerve stimulation or ultrasound guidance). The transarterial approach is widely used in our hospital with very good success and patient satisfaction. We have a low incidence of serious complications. Given the large number of patients in this series, we wish to report our experience and results.

We performed a prospective audit of all patients undergoing transarterial axillary plexus blockade over a 15-month period at St. Andrew's Centre for Plastics and Burns (July 2001 to September 2002 inclusive). The operator completed an audit form describing the grade and experience of the anaesthetist performing the block, patient characteristics, timing of block insertion, surgical start and finish times, type and volumes of local anaesthetic used, site of surgery, outcome of the block and any complications. After surgery and prior to leaving the recovery room, all patients were asked to fill in a patient satisfaction survey stating whether they had had a prior brachial block, whether they felt the procedure was better or worse than anticipated, whether they had felt any intra-operative discomfort and whether they would be happy for a subsequent brachial block. Success was determined by the avoidance of unplanned general anaesthesia or use of supplementary analgesia (local anaesthetic infiltration or intravenous (i.v.) analgesia).

All blocks were performed in an anaesthetic room by one or more anaesthetists with assistance from an operating department assistant. All patients were starved as if for general anaesthesia (i.e. for a minimum 6 h period for food, 2 h for clear liquids). The procedure was explained and informed verbal consent was obtained after the patient had read an information leaflet. The patient was warned of symptoms that could indicate intra-arterial or intraneural injection, e.g. paraesthesia. Patients with contraindications to the block or allergies to local anaesthetics were excluded. An i.v. cannula was placed on the contralateral side and full monitoring (electrocardiogram (ECG), S_PO_2 and non-invasive blood pressure (BP)) instituted. Midazolam sedation (up to 0.03 mg kg^{-1}) was given only on patient request or if the patient seemed particularly anxious. Volumes of lidocaine 1% 30 mL and bupivacaine 0.5% 20 mL with 1 : 200 000 epinephrine were mixed together and drawn up in 10 and 20 mL syringes, which were connected to a 23-G needle (via a short extension tube). Some variation in volume and strength of the above solution was allowed to compensate for patient characteristics and an individual anaesthetist's choice. Some anaesthetists chose to use ropivacaine for their blocks once this agent became available at our institution. Variation in volume and strength was also allowed with ropivacaine.

With the patient lying flat, the arm and forearm were supported; the arm was passively abducted to 90° with the forearm passively flexed to 90°. The axillary artery was palpated high in the axilla as it lies in the axillary groove between the pectoralis major and latissimus dorsi muscles. Some active rotation of the arm at the shoulder joint was performed by the assistant if the artery was difficult to palpate. The patients were warned that they would feel a pinprick in the axilla; during the procedure they were asked to inform the anaesthetist if they felt any symptoms. Voice contact was maintained throughout.

The needle was directed towards the artery; when correctly placed, blood was seen pulsating in the tubing. Upon transfixion of the artery, no further pulsation was seen and no more blood could be aspirated. The local anaesthetic was then injected, aspirating every 2–5 mL to minimize the risk of intravascular injection. Half the volume of local anaesthetic was deposited behind the artery and the other half in front of the artery.

After the injection was completed, the upper limb was raised and rested on the torso. Pressure was applied to the injection site for 5 min. The patient was then transferred to the recovery room,

Poster Presentation at European Society of Regional Anaesthesia Winter Meeting, Santiago, Chile, February 2004.

Correspondence to: Dr Sonia Jane Hudson, Department of Anaesthesia, St Andrew's Centre for Plastics and Burns, Broomfield Hospital, Chelmsford, Essex CM1 7ET, UK. E-mail: sonia@sjhudson.freeserve.co.uk

Accepted for publication 15 August 2006 EJA 3941
First published online 8 January 2007

where checks were made on BP, S_PO_2, ECG, conscious level and the appearance of the hand. The patient remained in recovery until the block had taken effect and until the theatre was available. Prior to surgery, the quality of the block was assessed by pinprick and loss of cold sensation. If the proximal part of the arm was thought to be inadequately anaesthetized, some operators performed a musculocutaneous nerve block using bupivacaine 0.25% 10 mL in an attempt to minimize tourniquet pain.

Analysis of our results showed that 30% of the blocks were performed for elective surgical cases and 70% for urgent or emergency cases. Eighty-five percent of blocks were required for hand or wrist surgery, 13% for surgery to the forearm and 2% for both. Mean tourniquet time was 58 min, and mean (SD) time from block insertion to surgery was 77 (42) min.

Of the 1062 cases audited, 93% of the blocks were considered successful, i.e. no general anaesthetic was required. This result was independent of operator experience. Eighty-three percent required no supplementation whatsoever; 10% required local anaesthetic or i.v. analgesia supplementation. Of the 7% that went on to have a general anaesthetic, four patients (0.4%) required grafts to be taken from distant sites and 2.2% were planned combined general anaesthetic/regional blocks. Therefore, only 4.4% were converted to general anaesthetic due to failure of the block. This success rate is very similar to those reported with other methods [2–4].

Complications were reported in only 34 (3.2%) patients. The most serious complications were tonic–clonic seizures in two patients, one of whom was known to be epileptic. Both the patients recovered fully. The commonest complications were paraesthesia on block insertion (17 patients) and haematoma formation in nine patients. Cardiovascular signs (hypotension, dysrhythmias) were observed in three patients. An additional three patients described central nervous system symptoms such as a tingling tongue.

Seven hundred and fifty-five patients completed satisfaction surveys immediately after surgery. Of these, 88% agreed to have a brachial plexus block again, with 75% considering the experience to be better than expected. Eighty percent of the patients experienced no pain at all during the operation; just 3.2% reported moderate to severe discomfort, mostly related to tourniquet pain.

This large study demonstrates the safety and efficacy of the transarterial approach to axillary brachial plexus blockade. In our study we did not directly measure the time to surgical anaesthesia as we felt this time point was not relevant to our clinical practice. In reality, the block is well established by the time the theatre suite is ready to accommodate the patient. The operating list is organized such that the first block of the day is inserted prior to the first theatre case (a local anaesthetic or general anaesthetic case), allowing time for the block to develop in recovery. Further blocks are performed well before the expected available theatre time slot. Our recovery room is accustomed (and appropriately staffed) to care for patients while their block takes effect.

Our complication rate was 3.2%, slightly higher than previously reported. However, this figure includes the unintentional eliciting of paraesthesia. Because paraesthesia is used as a defined end-point in some methods of brachial plexus blocks, many would not consider it a complication. If this was excluded, our complication rate would have been 1.5%, which compares very favourably with other studies. Stan and colleagues reported a 1% failure rate using a similar method [5]. We had three patients who presented with persistent neuropraxia: all three had complete symptom resolution by 3 months. We did not find arterial spasm to be a reported problem.

We believe that the low complication rate and overall success rate of 93% (with only 4.4% requiring conversion to general anaesthesia due to block failure) provide compelling evidence for the use of this technique. The success rate was independent of operator experience, with similar success rates being reported by trainees under supervision and experienced operators alike. It is an easy technique to learn, and we believe this report illustrates the safety of this approach. This technique should be considered a safe alternative in situations where nerve stimulators or trained anaesthetists are scarce, e.g. in third-world countries. It can also be a useful rescue technique when other methods fail or when the axillary artery is inadvertently punctured.

S. J. Hudson, R. I. Emamdee, Y. Htut, S. K. Pal
Department of Anaesthesia
St Andrew's Centre for Plastics and Burns
Broomfield Hospital
Chelmsford, Essex, UK

References

1. De Jong RH. Axillary block of the brachial plexus. *Anesthesiology* 1961; 22: 215–225.
2. Goldberg M, Gregg C, Larigani G, Norris M. A comparison of three methods of axillary approach to brachial plexus blockade for upper extremity surgery. *Anesthesiology* 1987; 66: 814–816.

https://doi.org/10.1017/S0265021506002110 Published online by Cambridge University Press

3. Koscielniak-Nielsen ZJ, Hesselbjerg L, Fejlberg V. Comparison of transarterial and multiple nerve stimulation techniques for an initial axillary block by 45 mL of mepivacaine 1% with adrenaline. *Acta Anaesthesiol Scand* 1998; **42**: 570–575.
4. Koscielniak-Nielsen ZJ, Nielsen PR, Nielsen SL, Gardi T, Hermann C. Comparison of transarterial and multiple nerve stimulation techniques for axillary block using a high dose of mepivacaine with adrenaline. *Acta Anaesthesiol Scand* 1999; **43**: 398–404.
5. Stan TC, Krantz MA, Solomon DL, Poulos JG, Chaouki K. The incidence of neurovascular complications following axillary brachial plexus blocks using a transarterial approach. A prospective study of 1000 consecutive patients. *Reg Anesth* 1995; **20**: 482–485.

Bivona® Hyperflex tracheostomy tube occlusion causing spurious tachypnoea and tracheal ulceration

doi: 10.1017/S0265021506001992

EDITOR:
Tracheostomy tube placement may lead to erosive ulceration and bleeding of the posterior trachea in addition to ventilatory difficulties with tube abutment against the tracheal wall. We report the occurrence of spurious tachypnoea and a posterolateral tracheal wall ulceration using a Bivona® Hyperflex tracheostomy tube (Smiths Medical International Ltd, Hythe, Kent, UK).

Case report

A 38 yr old, 178 cm tall, 130 kg male was admitted to our institution with diabetic ketoacidosis secondary to acute pancreatitis. His past history was significant for type II diabetes mellitus, hypertension, morbid obesity, renal insufficiency, reactive airway disease, tobacco use and allergy to penicillin. He took no medications at home. While in hospital, he developed systemic inflammatory response syndrome and became hypotensive. He subsequently needed an exploratory laparotomy for a small bowel perforation that occurred secondary to the hypotension and hypoperfusion. This resulted in a prolonged and complicated course of treatment in the intensive care unit. He developed respiratory failure due to pancreatitis-associated acute lung injury [1], necessitating controlled ventilation and the placement of a tracheostomy tube (Bivona® Hyperflex size 7.0).

Ten days after tracheostomy tube placement, he had an episode of aspiration in conjunction with a report of increasingly bloody tracheal aspirates upon suctioning. He had bilateral coarse breath sounds and the chest X-ray revealed bilateral pleural effusions with increased pulmonary markings in both lung fields. He was observed to have a respiratory rate of 48 breaths min^{-1} with bilevel mode of ventilation; however, the ventilator indicated a respiratory rate of only 16 breaths min^{-1}. He was receiving 50% oxygen and a positive end expiratory pressure (PEEP) of 10 cm H_2O. At this time, his blood pressure was 142/88 mmHg, pulse 104 beats min^{-1} and oxygen saturation (pulse oximeter) 97%. The ventilator setting was changed to the assist control mode with the F_iO_2 and PEEP remaining unchanged, but this changed neither the respiratory rate difference observed between the ventilator and the physical examination, nor his vital signs.

Fibreoptic bronchoscopy was performed to evaluate his bronchial tree regarding aspiration and bleeding, and to ascertain a potential cause for the discrepancy between the respiratory rate observed on physical examination and that indicated on the ventilator. Upon successfully traversing the tracheostomy tube with the fibreoptic bronchoscope, the carina was not initially seen; instead a bloody, erosive, ulcerative lesion was immediately evident. The lesion was located above and lateral to the right mainstem bronchus. The tracheostomy tube was readjusted outward and rotated counter-clockwise to relieve the pressure on the tracheal mucosa.

Correspondence to: Thomas J. Papadimos, Department of Anaesthesiology, Medical University of Ohio, 3000 Arlington Avenue, Toledo, Ohio 43614, USA. E-mail: tpapadimos@meduohio.edu; Tel: +419 383 3556; Fax: +419 383 3550

Accepted for publication 13 October 2006 EJA 3894
First published online 8 Janaury 2007