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Editorial

Cardiological aspects in preoperative anaesthesiological evaluation: old heroes, new shadows

Due to the recent improvements in surgical techniques on one hand and profound changes in the composition of the patient population on the other, more and more patients with multiple co-morbidity are undergoing more complex surgical procedures every year. Most of the accompanying morbidity is in the cardiovascular system, such as coronary heart disease with or without myocardial or prior cerebral infarctions (stroke), congestive heart failure, valvular dysfunction, cardiac dysrhythmias and others.

For the team of surgeons, anaesthesiologists and cardiologists treating these patients, the question (both from the medical point of view and also from the economic one) is, therefore, how can patients who are at increased surgical risk be adequately identified? In the first place, we can ill-afford a battery of preoperative diagnostic tests and secondly, there are no data to suggest that this would be helpful. Hence, if high-risk patients have been successfully identified, it remains a matter of discussion how to modify their risk.

Preoperative diagnosis

In addition to physical examination and history, there is a battery of diagnostic tools for assessing the cardiovascular status of a patient before operation; these tests include resting or exercise electrocardiography (ECG), numerous laboratory markers for different organ systems, transthoracic or transoesophageal echocardiography, stress echocardiography, radiographical examinations, single photon emission computed tomography (SPECT) for myocardial perfusion imaging and – last, but not least – left and right heart catheterization including coronary angiography. But what evidence do we have that these tests are really helpful from a prognostic perspective? In fact, Schein and colleagues demonstrated in a large-scale prospective trial that routine preoperative ECG, chest radiography and laboratory markers did not provide any significant additional information for perioperative complications and were not associated with any improvement in outcome [1]. This may not be a real surprise, since these tests are useful in determining an actual problem (e.g. myocardial ischaemia, congestive heart failure and renal or hepatic impairment), but have a low intermediate or long-term prognostic value. Although the study focused on patients undergoing ophthalmic surgery, which is much less invasive than other forms and where the underlying co-morbidity may play less of a role – a relevant proportion of these patients were relatively elderly and were suffering from numerous forms of co-morbidity. Other studies have reported that transthoracic echocardiography, which is non-invasive, also was not helpful in routine preoperative evaluation [2]. In contrast, stress echocardiography [3,4] and SPECT myocardial scans [2,4,5] provide useful prognostic information before operation in patients in whom non-cardiac surgery is planned. However, these procedures are associated with a certain amount of risk for the patients, although minor, and are time consuming and expensive. Finally, there are no data that demonstrate a potential benefit of the current gold standard in evaluation for coronary heart disease (i.e. left and/or right heart catheterization) on perioperative outcome in patients not presenting with acute coronary syndromes [6].

Risk stratification

In 2002, the American College of Cardiology and the American Heart Association published a very comprehensive and concise updated task force report, which should allow rational and effective risk stratification [6]. Briefly, the patient's history and physical examination represent the mainstay of this strategy; the patient and the planned intervention are classified into groups of different risks. The important patient-associated risk factors are shown in Table 1, and the intervention-associated risk factors in Table 2. In addition, the functional capacity is taken into consideration: patients who can climb two flights of stairs without angina or dyspnoea (Canadian Cardiovascular Society (CCS) class II or better; New York Heart Association (NYHA) class II or better) are

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Table 1. Patient-associated risk factors [6].

High risk	Intermediate risk	Low risk
• Unstable angina or myocardial infarction within last 30 days • PCI/stent implantation within last 4 weeks • Congestive heart failure with actual signs of decompensation • Dysrhythmias (2nd- or 3rd-degree AV block, supraventricular tachycardia with uncontrolled ventricular rate, non-sustained or sustained ventricular tachycardia) • Severe valvular dysfunction (aortic or mitral stenosis) • Pulmonary hypertension • Intracardiac shunts with right–left shunt and cyanosis	• Stable angina pectoris (CCS class I or II) • Compensated heart failure without actual decompensation • Previous myocardial infarctions (>30 days) • Serum creatinine $> 2.0\,mg\,dL^{-1}$ • Diabetes mellitus	• Higher age • Abnormal ECG • No sinus rhythm on ECG • History of stroke • Sub-optimally treated hypertension

AV: atrioventricular; PCI: percutaneous coronary intervention.

Table 2. Intervention-associated risk factors [6].

High risk	Intermediate risk	Low risk
• Emergency major operation, especially in older patients • Surgery of the aorta or other major vessels • Peripheral vascular surgery • Prolonged surgical procedures with large fluid shifts or blood losses	• Carotid endarterectomy • Head and neck surgery • Intraperitoneal or intrathoracic surgery • Orthopaedic surgery • Prostate surgery	• Endoscopic interventions • Superficial procedures • Ophthalmic surgery • Breast surgery

Table 3. Synopsis of patient-associated and intervention-associated risk factors, and risk stratification algorithm of the American Heart Association Task Force report [6].

Intervention-associated risk	Patient-associated risk		
	Low	Intermediate	High
Low	Surgery OK	Surgery OK	Surgery OK*
Intermediate	Surgery OK	Surgery OK*	**Further diagnosis**
High	Surgery OK*	**Further diagnosis**	**Diagnosis + treatment**

*If the functional capacity is acceptable.

considered to have an acceptable functional capacity. The task force committee then suggested an algorithm of eight consecutive steps, including considerations on the priority of the surgical procedure and possible consequences of delaying it, as well as patient-associated and procedure-associated risk factors. Table 3 shows a condensed summary of these steps, also taking into account functional capacity. Thus, these considerations and the algorithm for risk stratification allow an assessment of the perioperative risk. But what approaches are now possible to modify this risk?

Percutaneous coronary interventions – new shadows?

Percutaneous coronary interventions include balloon angioplasty, implantation of balloon-mounted stents and other less frequent interventions, such as rotablation, atherectomy or laser revascularization of an occluded coronary artery. The positive impact of percutaneous coronary intervention on prognosis has clearly been shown in numerous studies of patients with unstable angina or acute coronary syndromes [7]. However, in patients with stable angina without the presence of several high-risk factors (e.g. diabetes mellitus, large area of viable but ischaemic myocardium, extensive ischaemia during stress echocardiography or SPECT), a possible benefit of percutaneous coronary intervention for improved survival has not been demonstrated, apart from symptomatic therapeutic effects (e.g. pain relief) [7].

Data on percutaneous coronary intervention performed before non-cardiac surgery are limited. Several studies have suggested that a previous percutaneous coronary intervention is significantly associated with

a higher perioperative complication rate because it is an indicator of significant coronary heart disease [6,8,9]. In two previous studies of non-cardiac surgical procedures after coronary angioplasty (only balloon angioplasty, no stent implantation), the risk of complications was found to be acceptable if angioplasty had been performed more than 3 months previously [8,9]. In one non-randomized study, patients with previous coronary angioplasty (>90 days) were found to have a significantly lower complication rate than those with coronary heart disease without previous percutaneous coronary intervention [9]. In contrast, a more recent observational analysis of 40 patients with percutaneous coronary intervention and coronary stent implantation demonstrated a 'catastrophic outcome'. During the first 4 weeks after stenting, eight myocardial infarctions due to acute stent thrombosis, 11 major haemorrhages and seven deaths overall occurred [10]. These authors, and the American College of Cardiology/American Heart Association (ACC/AHA) Task Force [6], therefore, suggest a delay of 4–6 weeks after stenting. Their reasoning was that after this period, the intensive antiplatelet therapy with acetylsalicylic acid (in combination with clopidogrel or ticlopidine, which account for the bleeding), given after percutaneous coronary intervention had been finished and re-endothelialization of the stent (accounting for the myocardial infarctions) should be almost complete.

Percutaneous coronary intervention in patients before operation should, therefore, be considered carefully, since the perioperative risk within the first weeks after such treatment appears to be higher than that if a high-grade stable coronary stenosis, associated with stable angina (CCS II or better), remains untreated. However, delaying the operation might also cause relevant disadvantages for the patient.

β-adrenoceptor blocking medication – old heroes?

Some recent and very consistent randomized prospective trials have assessed the value of β-adrenoceptor blockade before and during non-cardiac surgery. A significant and marked reduction in inhospital mortality of about 50% or more was found [11–13], which persists for at least 2 years after the index operation [11,14]. The drugs used were: oral bisoprolol in the Dutch echocardiographic cardiac risk evaluation applying stress echocardiography (DECREASE) study [12,14]; oral atenolol in the multicenter study of perioperative ischaemia (MCSPI) trial [11] and parenteral esmolol [13] which, in the latter study, was initiated in the operating room. On the basis of these reports, perioperative β-adrenoceptor blockade is considered to be useful and effective by the ACC/AHA guidelines; a given medication should be continued perioperatively and starting a new medication is recommended in high-risk patients.

In a more recent analysis of the DECREASE study [15], routine administration of β-adrenoceptor blocking drugs in patients with at least one of the following risk factors was evaluated: age 70 yr or older, angina, prior myocardial infarction, congestive heart failure, treatment for ventricular dysrhythmias or for diabetes mellitus or limited exercise capacity. Again, bisoprolol was found to reduce the perioperative mortality significantly, even based on such simple, non-technical parameters. Nevertheless, dobutamine stress echocardiography provided additional prognostic information in these patients. Thus, routine use of β-adrenoceptor blocking drugs appears to be safe and reasonable and should be taken into consideration for all patients with one of the risk factors mentioned above.

From the cardiological point of view, β-adrenoceptor blocking drugs are even the therapy of choice in patients with severe heart failure (NYHA class I–III) [16] and diabetes mellitus [17]. Asymptomatic bradycardia (e.g. during sleep <40 beats min^{-1}) or a low-systolic blood pressure of 100 mmHg in patients with congestive heart failure do not represent a reason to discontinue medication. Carefully selected patients, even those with bronchial asthma or chronic obstructive lung disease, may tolerate a cardioselective β-adrenoceptor blocking drug, e.g. bisoprolol, without suffering a relevant impairment of pulmonary function if a high-cardiovascular risk is judged to be present.

Thoracic epidural analgesia

Interestingly, there are increasing data suggesting that regional analgesia using a thoracic epidural block in combination with general anaesthesia also provides beneficial effects. The underlying mechanism is probably similar to blockade of the β-adrenergic receptors by very effective inhibition of sympathetic activation [18,19]. In a meta-analysis, regional analgesia in addition to general anaesthesia was found to be associated with a 30% reduction in total mortality, a 33% reduction in myocardial infarction, a 40% reduction in deep venous thrombosis and a 55% reduction in pulmonary embolism [19]. Thus, thoracic epidural analgesia (TEA) should be considered as an effective alternative for reducing the surgical cardiovascular risk in patients who are not eligible for β-adrenceptor blockade, or in very high-risk patients [20].

In conclusion, cardiovascular risk stratification of patients undergoing non-cardiac surgery does not

depend on expensive or time-consuming procedures, but can effectively be performed with the ACC/AHA algorithm on the basis of the patient's history and physical examination, with special regard to functional capacity. As one editorial put it, 'more preoperative assessment by physicians and less by laboratory tests' [21]. There is increasing evidence that β-adrenoceptor medication indeed provides substantial benefits for perioperative outcome in patients with an increased risk or even a few risk factors. In addition, regional analgesia with a thoracic epidural in addition to general anaesthesia also appears to effective and safe in reducing the surgical risk in selected cases. Finally, the conclusion of the ACC/AHA task force committee was that cardiovascular interventions before non-cardiac surgery, to enable the patient to 'get through' the operation, are appropriate only in a small subset of patients who are at very high risk.

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