PERIOPERATIVE CARDIAC RISK

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Introduction

Cardiac complications of anaesthesia and surgery occur in approximately one in thirty patients in the USA[1]. The majority of complications relate to coronary artery disease, as 60% of patients who die within 30 days of surgery have evidence of coronary heart disease[2]. Worldwide, approximately 100 million surgical operations are carried out annually. It can be estimated that approximately 500,000 patients die from a cardiac event and at least 1,000,000 suffer non-fatal perioperative myocardial infarction[3,4].

The mechanisms of these complications include, probably in equal parts[5]: significant coronary artery stenoses and unstable coronary artery plaques. In the presence of significant coronary artery stenoses, myocardial ischaemia and damage generally result from an imbalance between oxygen demand and oxygen supply caused by tachycardia, hypotension, hypertension, or left ventricular distension. In addition anaemia and hypoxia play a role. Tachycardia is also known to reduce the calibre of coronary arteries[6]. In the presence of unstable plaques, complications occur because the intra- and perioperative release of inflammatory mediators promotes plaque disruption with fissure and haemorrhage leading to temporary or permanent occlusion. Tachycardia and hypertension also contribute to the risk of plaque rupture because of the mechanical stress imposed on the coronary arteries. Note than unstable plaques may not be evident on coronary angiography.

Prevention of cardiovascular complications of anaesthesia and surgery includes:

1. Identification of high risk patients.
2. Monitoring and active treatment of perioperative haemodynamic changes.
3. Coronary revascularisation in selected groups of patients.
4. Prophylactic pharmacological protection.

Identification of high risk patients. Medical history and clinical examination are central to the identification of high risk patients. Often a dynamic test of the coronary reserve is necessary to decide on the need for coronary angiography. ECG, echocardiography, radionuclide angiography and myocardial scintigraphy need to be carried out with a physical or pharmacological stress to reveal the presence of reversible myocardial ischaemia. Significant reversible ischaemia is a clear indication for coronary angiography. The preoperative plasma brain natriuretic peptide (BNP) concentration may, once more studies have been carried out, contribute significantly to the evaluation of the cardiac risk of anaesthesia and sugery[7-10].

Haemodynamic management. In patients with coronary heart disease close attention needs to be paid to heart rate and blood pressure. This, for major surgery, includes invasive arterial and central venous pressure monitoring. Keeping heart rate and blood pressure within ±20% of their initial values is generally recommended.

Coronary revascularisation. Over the past ten years it has become clear that coronary revascularisation should *precede* non-cardiac surgery where revascularisation is needed in its own right. The indications are:

a. poorly controlled angina;
b. high-risk coronary anatomy (significant (>50%) main stem stenosis; severe (>70%) two or three vessel disease including the proximal left anterior descending coronary artery);
c. significant inducible ischaemia on stress test;
d. coronary lesions associated with significant left ventricular systolic dysfunction[11].

Prophylactic coronary revascularization is limited to patients with lesions of lesser magnitude who present for high risk surgery. This would apply to major thoracic and vascular surgery, major head and neck surgery[12], and generally procedures likely to be associated with major haemodynamic alterations during and after surgery.

While coronary bypass surgery (CABG) has been shown to offer protection that last for several years in patients who remain asymptomatic[13], there is, to date no evidence that percutaneous coronary interventions, by contrast with CABG offer protection against perioperative cardiac events. Currently most of these interventions include the insertion of drug-eluting stents followed by prolonged dual anti-platelet therapy (aspirin and clopidogrel) for a year or more. This carries the risk of excessive bleeding if continued and stent thrombosis if stopped perioperatively. The risk of stent thrombosis appears to be greater than the risk of excessive bleeding[14]. Currently, it is recommended to delay surgery as long as possible and to continue the anti-platelet therapy unless excessive bleeding would frustrate the object of surgery (neurosurgery for example)[15]. The balance of risk of bleeding and stent thombosis means that the management of dual antiplatelet therapy should be discussed, for each individual patients, with Anaesthetist, Cardiologist and Surgeon[16].

Pharmacological protection. Beta-blockers and statins are currently the classes of drugs that are considered, and studied, the most frequently.

Beta-blockers are the most effective drugs to make the circulation more stable during the perioperative period[17]. However, the most recent systematic reviews have not confirmed an improvement in perioperative cardiac outcome in patients deliberately prescribed perioperative beta-blockers[18,19]. Some randomized controlled trials have shown considerable benefits[20,21] while others have not[22]. It may be that some groups of patients are more likely to benefit than others: those at high cardiac risk undergoing vascular surgery in particular (unless they need coronary revascularisation). The latest American College of Cardiology/American Heart Association guideline[23] indicates that patients on beta-blockers should have their treatment maintained. Patients at high cardiac risk should be started on a beta-blocker. In this case it is probably best to start several days before surgery and to titrate beta-blockade to a slow heart rate (60-70 bpm). The PeriOperative ISchemia Evaluation (POISE) trial will soon report on over 8,000 patients and, hopefully, will make it possible to define the role of beta-blockade and its specific indications.

Statins have been shown to offer protection against perioperative cardiac events, based essentially on observational studies with only two small randomized controlled trials. The anti-inflammatory effects of statins are likely to explain the reported

cardiac protection in surgical patients. A systematic review[24] has concluded that patients who would benefit from long-term statin therapy should receive them, starting before surgery. Otherwise there is not enough evidence from randomized controlled trial to initiate statin therapy in large groups of patients simply to reduce the risk of perioperative complications of anaesthesia and surgery. Note that there is a significant risk of cardiovascular events if statins are stopped during the perioperative period[25].

Conclusions

In order to reduce the risk of cardiac complications of anaesthesia and surgery a strategy that includes careful cardiovascular monitoring with control of the circulation to prevent and treat large haemodynamic changes is necessary. Coronary revascularisation is indicated in some patients and if indicated should precede non-cardiac surgery. Beta-blockers are probably beneficial in high risk patients and in some patients at relatively high risk but not in those at low risk. The place of statins is still unclear but observational studies suggest that statins may play an important role once their benefits have been confirmed in more randomized controlled studies.

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