Anaesthesia for patients with cardiac disease undergoing non-cardiac surgery

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Abstract

One of the biggest challenges for anaesthetists today is the safe conduct of anaesthesia for patients who might be elderly, have pre-existing cardiac disease and are scheduled to undergo non-cardiac surgery. Within the financial constraints of today's health services, the appropriate investigations need to be decided and performed for these patients in order to inform the anaesthetist, surgeon and the patient of the risk of surgery. These should be undertaken only if they will influence management of the patient. The preoperative assessment will help with the formation of a perioperative management plan, including preoperative optimization and postoperative care, in order to minimize the risk of an adverse outcome. The most recent guidelines for preoperative cardiovascular evaluation for non-cardiac surgery are discussed in detail, including assessment of risk factors and cardiac investigations. Current thinking in preoperative therapy, intraoperative management and postoperative management is discussed. Although most patients with cardiac disease have ischaemic heart disease, other specific cardiac conditions and the principles of their management are discussed briefly.

Keywords cardiac disease; cardiac investigations; non-cardiac surgery; preoperative assessment; preoperative optimization; risk assessment; risk factors

Learning objectives

After reading this article, you should be able to:

- identify factors that lead to increased cardiovascular risk for patients undergoing non-cardiac surgery
- decide which patients require further cardiovascular testing prior to non-cardiac surgery
- understand the principles of anaesthesia for patients with cardiac disease.

The number of patients with cardiac disease presenting for anaesthesia to facilitate non-cardiac surgery is increasing. These patients present some of the greatest anaesthetic challenges because their cardiac lesions will still exist after the operation, unlike patients undergoing cardiac surgery. Perioperative cardiac morbidity (myocardial ischaemia, infarction, arrhythmias) is the most common cause of death after anaesthesia and surgery. Those who develop cardiac complications are more likely to have non-cardiac complications and vice versa. Despite improvements in anaesthetic technique, the mortality associated with a perioperative myocardial infarction is 40–70%. The prevalence of coronary artery disease increases with increasing age, and it is estimated that about 33% of patients undergoing non-cardiac surgery are at risk of having cardiovascular disease. In many patients, this might not have been diagnosed or quantified; therefore, preoperative assessment is important to identify the disease and its attendant risks. Other forms of cardiac conditions (valvular and congenital heart disease or patients with heart transplant) should also be considered.

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Preoperative assessment

Preoperative assessment is important to:

- assess the risk to the patient
- optimize the patient's condition
- form a plan for perioperative management to minimize the risk of an adverse outcome
- inform the patient of the points above.

Assessment of risk

The best known scoring system for estimating the risk of surgery for patients with cardiac disease was developed by Goldman in 1977, and modified by Detsky in 1986. This system is a multifactorial risk analysis that combines clinical and investigative parameters and allows patients to be grouped into four risk categories, for major complications or cardiac death. In 1999, Lee proposed a Revised Cardiac Risk Index that identifies six independent risk factors and has become one of the most widely used risk indices along with the physical status system produced by the American Society of Anesthesiologists (ASA). The latter is somewhat subjective and lacks specificity.

In 2007, the American College of Cardiology and American Heart Association (ACC/AHA) produced updated guidelines for perioperative evaluation and care for non-cardiac surgery (superseding those from 1996 and 2002). These guidelines divide clinical predictors of increased perioperative cardiac risk into three categories (Box 1). Recognition of these factors, the functional capacity (Box 2) and the type of surgery are then used to inform the anaesthetist about the need for further cardiac investigation. The guidelines propose a stepwise approach to decision-making regarding the need for detailed cardiac investigation (Figure 1).

The history, physical examination, basic haematological tests, 12-lead ECG and chest radiograph should be carried out to identify:

- the presence of heart disease
- the severity, stability and previous treatment of the disease
- the functional capacity of the patient
- the presence of co-morbid conditions.

More detailed cardiac investigations might be appropriate in patients who are awaiting elective or, on occasions, urgent surgery. In the emergency situation, patients with cardiac risk factors and reduced functional capacity have a high perioperative risk, but delaying surgery for detailed investigation does not benefit the patient. Most of the literature concentrates on

Clinical predictors for increased perioperative cardiac risk

Active cardiac conditions (major risk factors)

- Unstable coronary syndromes
  Unstable or severe angina (CCS class III or IV)
  Recent myocardial infarction (<30 days)
- Decompensated heart failure (NYHA class IV; worsening or new-onset heart failure)
- Significant arrhythmias (including atrioventricular heart blocks, symptomatic ventricular arrhythmias, supraventricular arrhythmias with uncontrolled ventricular rate, symptomatic bradycardia, newly recognized ventricular tachycardia)
- Severe valvular disease
  Severe aortic stenosis (mean pressure gradient >40 mm Hg; aortic valve area <1 cm^2; symptomatic)
  Symptomatic mitral stenosis

Intermediate factors (from the Revised Cardiac Risk Index)

- History of ischaemic heart disease
- History of compensated or previous heart failure
- History of cerebrovascular disease
- Diabetes mellitus
- Renal insufficiency

Minor factors

- Age (physiological) >70 years
- Abnormal ECG (left ventricular hypertrophy, left bundle-branch block, ST abnormalities)
- Rhythm other than sinus (e.g. atrial fibrillation)
- Uncontrolled systemic hypertension

CCS, Canadian Cardiovascular Society; NYHA, New York Heart Association.

Box 1

Estimated energy requirements for various activities

Poor functional capacity (1–4 MET)

- Light housework
- Shower or dress without stopping
- Walk at 2–3 mph on level ground

Moderate functional capacity (5–7 MET)

- Climb a flight of stairs without stopping
- Walk briskly (>4 mph) on flat
- Light gardening

Excellent functional capacity (>7 MET)

- Digging in garden
- Carrying shopping upstairs
- More strenuous sports (e.g. cycling uphill, jogging)

MET, metabolic equivalents.

Box 2

vascular surgical patients and therefore might not be representative of most patients having non-cardiac surgery.

Patient risk factors

Previous coronary revascularization – patients who have undergone coronary artery bypass grafting (CABG) or percutaneous transluminal coronary angioplasty (PTCA) with or without stent insertion in the previous 5 years, and who have had no recurrence of symptoms with a return to an active lifestyle, do not need further testing. Elective non-cardiac surgery, in which the antiplatelet drugs required to prevent in-stent stenosis might need to be discontinued to prevent bleeding, is not recommended within 4–6 weeks of bare-metal stent implantation or within 12 months of drug-eluting stent implantation.

Previous coronary evaluation – those who have had cardiac evaluation in the previous 2 years should need no further investigation providing their symptoms have not changed and their activity levels have not deteriorated.

Myocardial infarction and ischaemia – advances in the treatment of myocardial infarction (thrombolysis, PTCA with or without stent) have meant that the traditional high-risk period of 6 months following infarction may be reduced, providing there is evidence that no further myocardium is at risk. This is assessed by stress testing (discussed below). The heart takes 4–6 weeks to remodel and heal following infarction, during which time it is more vulnerable to arrhythmias and myocardial stunning. The haemodynamic stresses and hypercoagulability associated with surgery can also lead to extension of the infarct. Patients who have unstable or severe angina (Canadian Cardiovascular Society (CCS) class III or IV) also have a high probability of continuing plaque rupture and thrombosis. Although it is common practice to postpone truly elective surgery until 6 months after a myocardial infarction, patients who have had a myocardial infarction over 6 weeks previously and show no evidence that further myocardium is at risk can proceed with urgent surgery with perioperative cardiac risk-reduction strategies. When at least 6 months have elapsed, those who have resumed normal daily activity and have no post-infarction angina should not need further testing, unless the risk of surgery or the functional capacity warrants it.

Arrhythmias – the cause should be identified and treatment begun, especially for arrhythmias that are symptomatic and cause hypotension. Indications for antiarrhythmic drugs and cardiac pacing are the same as in the non-surgical patient.

Decompensated congestive heart failure – these patients should have their medical therapy optimized to minimize the risk of worsening their pulmonary oedema. If ischaemia is the cause, they are also at risk of developing a perioperative myocardial infarction.

Compensated congestive heart failure – patients with a left ventricular ejection fraction less than 35% are at particular risk of perioperative complications.

Diabetes mellitus – there is a high incidence of silent ischaemia associated with diabetic neuropathy, making the lack of angina with exercise a less reliable symptom. Dyspnoea, especially with minimal exertion, can be a more important symptom. There is proof of increased risks only in those patients on insulin.

Hypertension – inclusion of hypertension as an intermediate or minor risk factor remains controversial. There is some evidence that, if left ventricular hypertrophy is present and blood pressure is not well controlled, the risk is more significant because the increase in left ventricular mass makes it more