

# Anaesthesia for patients with cardiac disease undergoing non-cardiac surgery

K Moyna Bill

## 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 optimisation 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

**Royal College of Anaesthetists CPD Matrix:** 2A03

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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## Learning objectives

After reading this article, you should be able to:

- identify factors which will 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

## Preoperative assessment

Preoperative assessment is important to:

- assess the risk to the patient
- optimize the patient's condition and identify risk factors requiring long-term management
- form a plan for perioperative management to minimize the risk of an adverse outcome
- inform the patient of the points above

Communication is the key to optimal management

## 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 multi-factorial 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 (RCRI) 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 2014, 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 to 2007). Clinical practice guidelines have also been produced by the European Society of Cardiologists and European Society of Anaesthesiology (ESC/ESA) and the recommendations are broadly in agreement with those from ACC/AHA. 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 definition of the urgency of the operation has been slightly modified (Box 3) as has the surgical risk in the ACC/AHA Guidelines (see below). A predictive model of Major Adverse Cardiac Event (MACE) which included death and myocardial infarction (MI) was developed in 2011 using the American College of Surgeons Quality Improvement Program database. They found five predictors of perioperative MI/cardiac arrest: type of surgery, functional status,

## 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<sup>2</sup>; 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

elevated creatinine (>130 µmol/litre or >1.5 mg/litre), ASA class and age. This combined with the RCRI model are complementary prognostic tools. 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
- severity, stability and previous treatment of the disease
- functional capacity of the patient
- 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 vascular surgical patients and therefore might not be representative of most patients having non-cardiac surgery.

## 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

### 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 14 days of balloon angioplasty, 30 days of bare-metal stent implantation (BMS) or within 12 months after drug-eluting stent (DES) implantation especially in those whose dual antiplatelet therapy will need to be discontinued perioperatively. Elective surgery after DES implantation may be considered after 180 days if the risk of further delay is greater than the risks of ischaemia and stent thrombosis. The presence of antiplatelet drugs, especially some of the newer ones, may provide a challenge for preventing blood loss. A cardiologist's opinion on the optimal time to schedule elective surgery and thus discontinuation of the antiplatelet agents should be sought.

**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

## Definition of urgency of operation

- Emergency – life or limb threatened if not operated on within 6 hours
- Urgent – should receive operation within 6–24 hours
- Time sensitive – operation could be delayed 1–6 weeks
- Elective – operation could be delayed up to 1 year

#### Box 3

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