Anesthesia for Coronary artery disease in non-cardiac surgery

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Major surgery stresses the cardiovascular system in the perioperative period. This stress leads to an increase in cardiac output which can be achieved easily by normal patients, but which results in substantial morbidity and mortality in those with cardiac disease. Postoperative events which cause death include myocardial infarction (MI), arrhythmias, and multiple organ failure secondary to low cardiac output. If the different mechanisms involved in different cardiac disease states are understood, then the most suitable anesthetic can be given. The skill with which the anesthetic is selected and delivered is more important than the drugs used.

Assessment of Perioperative risk

The Goldman Cardiac Risk Index attempts to quantify the risk of adverse perioperative cardiac events (Table 1). The index scores each of a range of various conditions including cardiac disease, age and the nature and urgency of the proposed surgery. The total score predicts the likelihood of complications and death. For certain operations this risk can be minimized by avoiding general anesthesia and using local anesthetic techniques. Examples include peribulbar eye blocks for cataract surgery and brachial plexus blocks for upper limb surgery. There have been more recent indices of risk, including one study of patients undergoing major elective non-cardiac surgery. This identified **six independent predictors of complications:**

1-high-risk type of surgery

2- history of ischemic heart disease

3- history ofcongestive cardiac failure

4-history of cerebrovascular disease

5-preoperative treatment with insulin, and

6-a raised serum creatinine.

Table 1. Goldman Cardiac Risk Index

3rd heart sound / elevated JVP	11 points
MI within 6 months	10 points
Ventricular ectopic beats >5/min	7 points
Age > 70 years	5 points
Emergency operation	4 points
Severe aortic stenosis	3 points
Poor medical condition	3 points
Abdominal or thoracic operation	3 points

Score	Incidence of death	Incidence of severe CVS complications
< 6	0.2%	0.7%
< 26	4%	17%
> 25	56%	22%

All anesthetic techniques must aim to keep myocardial oxygen supply greater than demand, and therefore avoid ischemia. The essential requirements of general anesthesia for IHD are avoiding tachycardia and extremes of blood pressure, both of which adversely affect the balance between oxygen supply and demand. extremes of blood pressure, both of which adversely affect the balance between oxygen supply and demand.

Pre-medication.

A nervous patient may be tachycardic and require an anxiolytic premedication. Beta-blockers also reduce tachycardia, and prevent perioperative myocardial ischemia. A regime of intravenous atenolol followed by postoperative oral treatment resulted in a reduction in both morbidity and mortality for two years after surgery in IHD patients. In a similar fashion, alpha2-agonist drugs such as clonidine reduce noradrenaline release from synapses, causing both sedation and analgesia

Induction.

All intravenous anesthetic agents have a direct depressant action on the myocardium, and may also reduce vascular tone. This causes hypotension (especially in the hypovolemic patient), often with a compensatory tachycardia, which may cause myocardial ischemia.

in general, all agents can be used safely if given slowly in small increments. However, ketamine is unique in causing indirect stimulation of the sympathetic nervous system, leading to both hypertension (increased afterload) and tachycardia. This will bedangerous for a patient with IHD and should be avoided.

Intubation.

Laryngoscopy is a powerful stressor, causing hypertension and tachycardia. This can be avoided with a supplemental dose of intravenous induction agent or opioid eg alfentanil, just prior tolaryngoscopy.

maintenance.

Volatile agents have minimal effects on cardiac output, although they do reduce myocardial contractility, especially halothane. Theycause vasodilation, and isoflurane has been implicated in the 'Coronary steal' syndrome. The theory is that pre-stenotic vasodilation diverts blood away from already ischemic areas of the myocardium. However, there is doubt as to the clinical significanceof this phenomenon. Bradycardias can be beneficial by allowing greater coronary diastolic filling, providing blood pressure is maintained.

Analgesia.

High doses of opioids reduce the stressor response to surgery. Theoretically, non-steroidal anti-inflammatory drugs (NSAIDs) mayhave both a useful postoperative analgesic action and an anti- platelet effect which may reduce coronary thrombosis.

reversal and recovery.

Reversal of muscle relaxation with a combined anti- cholinesterase/anti-muscarinic causes tachycardias, and extubation in itself is a stressor. Problems in the recovery phase which can cause ischemia include; tachycardia, pain, hypothermia, shivering, hypoxia,and anemia. These should be treated not just in the immediate postoperative period, but throughout the hospital admission. The use of supplemental oxygen in the postoperative period is one of the simplest, yet most effective measures in preventing myocardialischemia.

monitoring.

As discussed above, the prime anesthetic goals are to avoid tachycardias and extremes of blood pressure. It follows that it is most useful to monitor heart rate and blood pressure, also pulse oximetry to detect hypoxia. An ECG, if available, will give indicationsof arrhythmias, and ST segment depression may indicate ischemia, although an observer will usually only detect the minority of such events. Rarely used techniques to detect ischemia involve intraoperative transesophageal echocardiography to assess ventricular wall motion abnormalities, and measuring serum troponin levels in the postoperative period.

The use of **regional anesthetic techniques** has theoretical **advantages:** epidural anesthesia reduces preload and afterload, coagulation responses, and in the case of thoracic epidurals, causes coronary vasodilation. These effects should reduce perioperative myocardial ischemia, but this is not supported by research. However, good epidural analgesia may reduce the incidence of tachycardias arising due to postoperative pain. In a patient with IHD, local anesthetic techniques such as brachial plexus block should be encouraged in order that the hemodynamic responses to general anesthesia are avoided. However, even under local anesthesia, the patient will be subject to the stresses of the surgical procedure itself, which can have marked hemodynamic effects.