PART 2

Cardiac surgery

by Avril Lowry

THE MANAGEMENT of coronary heart disease has evolved significantly in recent years due to developments in both surgical and percutaneous revascularisation techniques. The majority of patients with chronic stable angina are still treated with medical therapy, however revascularisation with either coronary artery bypass grafting or percutaneous coronary intervention is necessary in several subgroups.

Although percutaneous coronary intervention (PCI) has relieved many patients of the symptoms of ischaemic heart disease and reduced the number of people currently awaiting cardiac surgery, there are still numerous patients who will benefit from coronary artery bypass grafting (CABG). The principle of CABG is to provide blood supply to sections of the heart muscle currently restricted by a blocked artery. The benefits of surgery are magnified in patients with more severe disease, certain anatomical patterns of disease and those with impaired left-ventricular disease.

Survival for patients with poor left ventricular function in association with vessel disease was significantly improved with CABG – 88% versus 66%. Improved ventricular function may reflect hibernating myocardium, which refers to an ischaemia-induced decline in cardiac contractility that can be reversed over several days or weeks following revascularisation.

The conduit that supplies the new blood supply can be an internal mammary artery, radial artery or a section of saphenous vein removed from the leg. Studies show that 90% of internal mammary artery grafts are patent after 10 years in comparison to only 60% of grafts using saphenous vein (SVG). Graft patency is dependent on a number of factors including the type of graft used, the size of the coronary artery that the graft is anastomosed with, and the skill of the operator performing the procedure. Furthermore, enhanced perioperative mortality can be associated with coronary artery diameter. This fact may explain the increased risk that has been observed in women, particularly those less than 50 years of age, as the diameter of women’s vessels is known to be smaller than those of men.

Pre-operative assessment

Ideally a multidisciplinary team should evaluate patients at a pre-admission clinic four to six weeks prior to surgery. This assists in streamlining services and provides education to patients and families regarding their cardiac condition and proposed surgery. This is an ideal time to refer patients to other disciplines for further workup or management of existing conditions, which may complicate post-operative recovery.

Patients’ risk factors are evaluated using the Euroscore algorithm; a prediction for cardiac surgical mortality. Other factors which must be taken into consideration pre-operatively include:

• Carotid screening – patients with evidence of vascular disease should have a carotid duplex ultrasound carried out prior to surgery. If there is stenosis > 80% then referral to a vascular surgeon is recommended. Combined carotid endarterectomy and cardiac surgery may be advised. There is an increased risk of neurological complications associated with carotid stenosis.

• MRSA screening – All patients are screened prior to surgery for MRSA, if found positive, elective cases are treated pre-operatively.

• Renal – Patients with creatinine levels > 200umol/L should be reviewed by the nephrologist and are administered IV fluids overnight prior to surgery to optimise post-operative recovery.

• Aspirin – The administration of aspirin to patients undergoing CABG has been a concern in the past. The Society of Thoracic Surgeons guidelines 2005 recommends that aspirin should be given before and after surgery in patients with urgent and emergency surgery. In elective cases all patients can remain on aspirin prior to surgery unless they are at high risk for bleeding.

• Clopidogrel – Although clopidogrel therapy is desirable with stenting to prevent stent thrombosis this may increase the risk of bleeding in patients who require surgery. The recommendation is to discontinue clopidogrel at least five to seven days prior to surgery, unless otherwise stated.

• Beta-blockers – It has been shown that the administration of a beta-blocker can reduce the incidence of atrial fibrillation following CABG, and also the ventricular rate if atrial fibrillation does occur. It is therefore advised to continue all beta-blockers.
pre-operatively and to restart 12-24 hours post-operatively as long as inotropic support is discontinued.

**Intra-operative procedure**

Improvements in surgical techniques, cardiopulmonary bypass and anaesthesia have led to a significant reduction in morbidity after CABG. Despite these advancements patients undergoing CABG currently have higher risk factors than those in the past. The procedure takes approximately four to five hours.

Following line insertion and intubation by the anaesthetist the patient undergoes a procedure in four stages:

- Harvesting of conduits
- Initiating cardiopulmonary bypass – the modality whereby a patient’s systemic circulatory and oxygenation requirements are supplied using extracorporeal means
- Grafting
- Terminating bypass and closing the chest.

An optimal surgical result depends on protecting the heart from damage that might ensue during a corrective operation. Protective methods include hypothermia which lowers cellular energy requirements during ischaemia and the administration of cardioplegia. Cardioplegia is a high concentration of potassium delivered to the heart which arrests the heart during diastole.

**Post-operative complications**

The major complications following CABG include low cardiac output, cardiac complications, bleeding, pericardial effusions, pleural effusion, stroke and wound infection.

**Low cardiac output**

Low cardiac output is a frequent complication post-operatively, primarily due to left ventricular dysfunction, which can result from:

- Cardioplegic arrest and ischaemic injury
- Reduced preload which, in the immediate post-operative period, can be induced by loss of vasomotor tone
- Excessive afterload due to hypertension
- Arrhythmias
- Perioperative MI.

This complication is often transient and responds to fluid replacement and or inotropic support.

**Cardiac complications**

Perioperative MI diagnosis is difficult to make following CABG as cardiac enzymes will automatically be elevated and ECG changes may reflect post-operative pericardial inflammation. A new Q wave on the post-operative ECG is strongly suggestive of a new MI with a poor outcome.

**Arrhythmias**

Arrhythmias, most often tachyarrhythmias are common after CABG. Atrial fibrillation (AF) and atrial flutter occur frequently after most types of cardiac surgery. AF has been reported in up to 15%-40% of patients in the early post-operative period following CABG, and 60% undergoing valve replacement plus CABG. The initial treatment of AF is beta-blockers and/or amiodarone to control rate. AF that develops following CABG is usually self-limiting in patients without a prior history, and reverses spontaneously to sinus rhythm within 24 hours in 80% and six to eight weeks in 90% of patients.

**Bleeding**

Some blood loss is anticipated following CABG. Excessive bleeding requiring reoperation can occur in 4% of the population. Anti-platelet agents such as clopidogrel have a variable effect on bleeding risk. Clopidogrel therapy administered within five days of the procedure appears to be associated with an increased bleeding risk.

**Pericardial effusion**

Post-operative pericardial effusion is more common although many patients are asymptomatic. The effusion is usually present by the second post-operative day, but may not occur until day 10. In most cases, the effusion is small and clinically insignificant, however if large it may result in tamponade and haemodynamic instability, requiring urgent reoperation.

**Pleural effusion**

Pleural effusions are common post-operatively, occurring in up to 90% of patients who have undergone CABG. Most effusions develop as a consequence of the surgical procedure itself and follow a benign course. The effusions are usually small, left sided and don’t require treatment.

**Neurological complications**

Neurological complications are an important cause of morbidity and mortality following CABG. The major neurological complications include stroke, neuropsychiatric abnormalities such as cognitive dysfunction, and peripheral neuropathy. This is a risk factor which increases with the patient’s age.

**Sternal wound infection**

Sternal wound infection (mediastinitis) following CABG has been reported in 0.9%-1.3% of patients. It is usually detected within the first two weeks, but the onset can be delayed for more than one month. Streptococcus and staphylococcus are the most frequent organisms cultured. A number of risk factors have been identified for the development of mediastinitis after CABG, although the same risk factors were not noted in all studies. These include:

- Obesity
- Diabetes mellitus
- Prolonged duration of surgery
- Prior cardiac surgery
- Underlying obstructive airways disease.

**Leg wound complications**

The reported incidence of leg wound complications after SVG harvesting varies widely, ranging from 3%-24%. The most common manifestations are usually minor and do not require surgery.

**Recovery**

Cardiac surgery is not without its risks but improvements in surgical technique have led to a steady reduction in morbidity following CABG, despite the fact that patients currently undergoing the procedure have a higher risk profile due to associated comorbidities. The perioperative and in-hospital mortality rate following CABG averages about 1% for the lowest risk elective patients and 2%-5% for all patients. The majority of patients who undergo uncomplicated CABG are discharged within five to seven days post-operatively and recover well at home with family and public health nurse support.

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Next month: A focus on the role of the cardiothoracic advanced nurse practitioner

**References on request from nursing@medmedia.ie (quote: Lowry A. WIN 2007; 15(2): 41-42)**