Postoperative care and analgesia in vascular surgery

Rachael Bird

Ian Nesbitt

Abstract

Patients undergoing major vascular surgery are at high risk for myocardial infarction, renal failure, respiratory complications and death. Invasive procedures confer greater risk of complication, with patients undergoing open aortic surgery being at highest risk. Reduction of myocardial oxygen demand is key: stabilizing cardiovascular parameters, maintaining normothermia, adequate volume resuscitation and effective analgesia. Preoperative risk reduction strategies including aspirin, β-blockers and statin therapies are critical, and should be continued in the postoperative period. Maintaining a high index of suspicion for procedure-specific complications will reduce morbidity and mortality in these patients.

Keywords Vascular surgery; pain relief; postoperative care

Royal College of Anaesthetists CPD Matrix: 1A01, 2A03, 3A05

Learning objectives

After reading this article, you should be able to:

- recognize the factors involved when considering the most appropriate site of postoperative care for vascular patients
- list the common postoperative complications of vascular surgery
- be aware of the analgesic options available to patients having vascular surgery

Postoperative sites of care

Vascular surgery is associated with high rates of perioperative morbidity and mortality, so patients undergoing vascular surgery need close postoperative monitoring. It is necessary to identify the most appropriate environment for early recognition and treatment of postoperative complications. The site of care should be equipped with staff familiar both with the operative procedures, and their associated complications. An appropriate level of monitoring and nursing care should be applied.

The major factors to consider when determining the most appropriate postoperative site of care are outlined in Table 1.

The risk of postoperative complications can be quantified using scoring systems such as the American Society of Anesthesiologists (ASA) classification, and the Lee Revised Cardiac Index; however they are most useful in identifying low risk patients, rather than stratifying medium and higher risk patients (see *Preoperative assessment of patients for vascular surgery* on pages 180–183 of this issue).

Appropriate decisions relating to the need for intensive care after surgery are key to high-quality patient care. Accurately identifying which patients are at high risk of complications or death after major surgery remains difficult, although is subject to significant active research (e.g. cardiopulmonary exercise testing (CPET)).

Rachael Bird *BSc MBChB is an ST3 in Anaesthesia in the Northern Region. Conflicts of interest: none declared.*

Ian Nesbitt *MBBS FRCA DICM FFICM is a Consultant in Anaesthesia and Critical Care at the Freeman Hospital, Newcastle upon Tyne. Conflict of interest: none declared.*

General postoperative considerations

The primary objective in the postoperative management of the vascular patient is decreasing myocardial oxygen demand through stabilization of haemodynamics, haemostasis, rewarming, and control of pain. It is therefore essential to know the preoperative blood pressure, cardiac function, and nature or presence of any valvular disease or pulmonary hypertension, in order to guide the postoperative management of the individual.

Myocardial ischaemia

Myocardial infarction (MI) is the most common cause of death following vascular surgery, and occurs in 3.1% of patients.[3] This is likely related to the high prevalence of asymptomatic coronary artery disease in this patient population. Although perioperative MI is a significant cause of mortality following vascular surgery, an isolated troponin leak following vascular surgery is also strongly associated with a significant increase in 30-day mortality risk (Table 2). This analysis supports the consideration of routine troponin testing postoperatively in all vascular patients.[4]

The pathophysiology of perioperative MI is complex and poorly understood. Perioperative tachycardia plays a role in the development of perioperative ischaemia. It is also hypothesized that in the early postoperative period patients probably have a flow-mediated hypoperfusion, exacerbated by hypotension and thrombosis, secondary to hypercoagulability and inflammation.[5]

A reduction in myocardial oxygen demand is key to reducing the incidence of postoperative myocardial events. Patients should be normothermic, and control of haemodynamics and pain is crucial. Patients should be maintained on their usual cardiac medications perioperatively, and consideration of routine use of β-blockers in patients undergoing vascular surgery should be made; evidence has shown that their use is associated with a 75–90% reduction in mortality, although the picture is less clear for starting β-blockers *de novo* immediately preoperatively. Furthermore perioperative withdrawal of β-blockers in patients on long-term therapy is associated with increased mortality. Similarly the discontinuation of statins postoperatively is a predictor of adverse postoperative cardiac events.[6] Antiplatelet therapy requires individualized consideration, particularly in the presence of coronary artery stents.

Factors influencing site for postoperative care

Factor	
Type and extent of surgery	The extent of perioperative physiological insult and the requirement for surgery-specific monitoring of potential postoperative complications influence choice of site of postoperative care.
Age and comorbidities	Chronic heart failure, chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD) and chronic renal failure are all predictors of increased mortality in surgical vascular patients.[1]
Cardiopulmonary functional capacity of the patient	Perioperative haemodynamic stability must be considered. Pre-operative cardiopulmonary exercise testing (CPET) can be used to triage patients' postoperative care facility, rationalizing the use of critical care beds. Patients with an anaerobic threshold (AT) of <11 ml/kg/minute may benefit from postoperative critical care.[2]
Emergency versus elective surgery	Emergency operations independently increased perioperative morbidity and mortality risk.[1] These patients may be physiologically and haemodynamically compromised, and therefore at higher risk.

Table 1

Mortality associated with isolated postoperative troponin leak

	30-day mortality
No troponin elevation	2.3%
Isolated troponin leak	11.6%
Perioperative MI[a]	21.6%

[a] A myocardial infarction (MI) is defined as a troponin elevation with one reading >99th percentile of the upper reference limit, with at least one of the following: symptoms of ischaemia; electrocardiography changes of new ischaemia; or development of new pathological Q waves or evidence of new regional wall motion abnormality on echocardiography. Absence of these signs or symptoms but a level of troponin detected in the blood above the lower limit of reliable detection is termed an isolated troponin leak.[4]

Table 2

Renal complications

Factors associated with increased risk of acute kidney injury (AKI) in the postoperative period include:

- pre-existing renal failure
- emergency surgery
- peripheral vascular occlusive disease
- suprarenal aortic clamp
- ruptured aneurysm
- radiological contrast
- use of vasopressors.[7]

Development of this complication carries with it a 60–80% mortality rate in vascular patients.[8] The above risk factors are often unavoidable, but a major contributor to the development of AKI is hypotension and renal ischaemia. The postoperative strategy should therefore, be to ensure adequate intravascular volume and renal perfusion, and where possible avoidance of nephrotoxic agents.

Pulmonary complications

Postoperative respiratory failure is associated with an increased mortality both in the short (30-day mortality of 36.5%) and long term.[6] Pulmonary complications are a significant cause of morbidity after vascular surgery, and cause significant prolongation of intensive care unit and hospital stay.[9]

Advanced age, smoking and associated chronic lung disease, frequently accompany vascular disease. The incidence of pulmonary complications is largely dependent upon the type of surgery performed. Open repair of aortic aneurysms requires a laparotomy and/or thoracotomy and therefore carries a more significant risk than for those undergoing surgery for peripheral occlusive disease or carotid artery disease.

Typical pulmonary complications that may occur following vascular surgery include:

- prolonged mechanical ventilation
- the requirement for reintubation
- respiratory failure
- pneumonia
- atelectesis
- acute respiratory distress syndrome (ARDS).

In postoperative patients in general there have been few interventions that have demonstrated a reduction in pulmonary complications. Anecdotal evidence suggests that incentive spirometry and deep-breathing exercises can reduce pulmonary complications following open abdominal surgery. Patients at greatest risk of ARDS are those who have undergone repair of a ruptured abdominal aortic aneurysm (AAA). Patients with ARDS will benefit from protective lung ventilation strategies.

Gastrointestinal complications

Gastrointestinal complications are most commonly encountered in patients who have undergone surgery for a ruptured AAA (rates of 15–16%). Potentially lethal complications include bowel ischaemia and abdominal compartment syndrome. Colonic ischaemia affects less than 2% of patients undergoing elective AAA repair but carries a mortality rate of 40–65%.[6] A high index of suspicion should be maintained in the presence of a persistent acidosis, high fluid requirements and refractory shock.

If diagnosis is delayed there may be progression to full transmural ischaemia, with a mortality of 80–100%.

Patients who are particularly at risk of abdominal compartment syndrome are those who have received large volume fluid resuscitation and blood products. The syndrome is described as:

- global hypoperfusion and oliguria
- low cardiac output
- hypotension
- high ventilatory pressures (caused by reduced pulmonary compliance).

Intra-vesical pressure can be measured to aid diagnosis; high intra-abdominal pressures, or low abdominal perfusion pressures place patients at high risk of compartment syndrome. Decompressive laparotomy should be considered, although the resulting open abdomen (laparostomy) presents a significant management challenge due to ongoing losses of volume and protein, along with increased risks of bowel injury and fistula.

Thromboembolism

Patients undergoing vascular surgery are at increased risk of developing venous thromboembolism. Potential risk factors include advancing age, limb ischaemia, venous injury and lengthy surgery. This group of patients are often hypercoagulable, increasing their risk of deep vein thrombosis or arterial graft occlusion and should receive antithrombotic measures postoperatively. Regional anaesthesia is an option for postoperative analgesia, and reduces the risk of thromboembolism.

Haemorrhage

Postoperative haemorrhage following vascular surgery may be torrential and life-threatening. Immediate management should consist of direct pressure to the area and restoration of an adequate circulating volume. Measures should be taken to ensure that coagulation studies are within normal limits, and corrected with appropriate blood products as necessary.

Analgesia

Provision of high-quality postoperative analgesia has become recognized as an important goal in modifying the risk of major postoperative complications. Postoperative pain is recognized as one of many factors contributing to the surgical stress response, and pain control is known to reduce myocardial oxygen demand. There is evidence that pain-free patients have lower rates of myocardial ischaemia despite having no differences in vital signs compared to those patients with poor analgesia.[10]

In addition to implementation of the WHO analgesic ladder, options available for postoperative analgesia depend on the type of surgery. Controversy surrounds the choice of postoperative analgesia in open aortic surgery. Epidural analgesia provides better analgesia when compared to use of intravenous opiates, especially during movement, for the first three postoperative days. There is also evidence to show that the occurrence of prolonged postoperative mechanical ventilation, MI, gastric complications and renal complications are reduced by epidural analgesia. There is no current evidence to confirm a mortality benefit compared to use of opiate analgesia however.[11]

Peripheral vascular surgery and perhaps carotid surgery, lends itself to the use of regional anaesthesia either alone or in combination with general anaesthesia or sedation. Nerve blocks can avoid many of the disadvantages of both general and neuraxial anaesthesia. The technique chosen will depend on the site of surgery. There is no evidence of overall patient benefit from local anaesthesia compared to general anaesthesia for carotid surgery. Likewise, there is little evidence to demonstrate a reduction in phantom limb pain by using epidural analgesia for peripheral surgery.

Patients undergoing vascular surgery may present with contraindications to many of these methods of analgesia, particularly if anticoagulants and antiplatelet agents are used. The decision making process about the optimal approach should be a combined one between surgeon, anaesthetist, patient, and cardiologist. ◆

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