Risk modification and preoperative optimization of vascular patients

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Learning objectives

After reading this article, you should:

- understand the value of targeted optimization of organ systems in vascular surgical patients
- be aware of the interventions that can reduce perioperative risk
- appreciate the importance of lifestyle and organizational risk modification strategies in this patient group

Abstract

Major vascular surgery is associated with a high risk of morbidity and mortality. Targeted optimization of organ systems most likely to suffer morbidity should be made prior to elective surgery. Risk modification can reduce both perioperative and long-term complications. This article summarizes currently accepted best practice for risk modification and preoperative optimization prior to vascular surgery.

Keywords Cardiovascular system; optimization; preoperative assessment; risk; vascular surgery

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

Background

Vascular surgery carries significant risks due to the nature of the surgery and the high incidence of co-morbid disease in this patient population. It is essential that risks are minimized, and patients optimized, prior to surgery in a bid to enhance patient care while delivering good surgical outcomes.

The preoperative assessment clinic can be used to establish optimal medical care to reduce postoperative complications and improve long-term outcomes through secondary risk factor modification. Ideally patients should be assessed well in advance of surgery to allow sufficient time for optimization, counselling and specialty referral if required.

This article will focus on risk modification and preoperative optimization in the elective setting only.

Risk modification strategies

Lifestyle modification

It is essential to recommend appropriate lifestyle changes in advance of potential surgery to reduce perioperative risk. A 4–6-week time window is often sufficient to enable appropriate changes, which may lead to clinically significant benefits. Such changes are generally also beneficial in the longer term in a bid to modify patient behaviour whilst facilitating secondary risk factor modification. Appropriate recommendations include:

- Nutritional advice – body mass index has a J-shaped relationship with morbidity following vascular surgery, with both under-weight and morbidly obese patients at risk.[1] Dietary advice or referral to a dietician may be of benefit in these individuals.
- Smoking cessation – minimum effective period is often quoted as being 4–6 weeks. The evidence base for this recommendation is not particularly extensive, and in reality cessation of smoking at any time prior to surgery is probably beneficial.
- Regular exercise – patients with reduced physical fitness have a higher incidence of perioperative morbidity and mortality following major surgery. Preoperative exercise training can improve objectively measured levels of fitness in vascular patients, but it is unclear whether this translates into improved outcome.[2] Current evidence suggests that higher intensity aerobic interval training strategies will deliver greater fitness improvements in a shorter timeframe, with 4–6 weeks of exercise prior to surgery probably the minimum effective duration. It is imperative to consider potential cardiovascular risk prior to any form of preoperative exercise prescription. Cardiopulmonary exercise testing provides a useful screening adjunct in this respect.

Reduction in surgical waiting times

Timeframes from referral to surgery should be minimized where possible to reduce risk from the vascular pathology. This is only appropriate where risks of surgery are considered to be lower than conservative management and pertains particularly to:

- Carotid surgery – current guidance recommends surgery within 2 weeks of first symptoms.[3] Surgery at more than 12 weeks beyond symptoms is generally no longer recommended.
- Aortic surgery – both the NHS national aortic screening programme and Abdominal Aortic Aneurysm Quality Improvement Pathway recommend a target of 8 weeks from referral to surgery. This is to reduce risk of aortic rupture in the lead-up to surgery.

Non-operative management

Under certain circumstances, the risks of surgery may be deemed to exceed those of conservative management. This is often the

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Pharmacological optimization

Drug class	Recommendations
β-blockers	Continue pre-existing β-blockers Initiation of β-blockers should be considered in the following patient groups undergoing vascular surgery:[7,8] • coronary artery disease or the finding of cardiac ischaemia on preoperative testing • high cardiac risk, as defined by the presence of ≥3 clinical risk factors If started, β-blockers should be started 4 weeks before surgery at a low initial dose and titrated to achieve a heart rate of 60–70 bpm. Bisoprolol is considered the agent of choice
Statins	All patients with established vascular disease should be commenced on statin therapy ideally ≥2 weeks prior to surgery Established statin therapy should be continued perioperatively
Antiplatelet agents	Aspirin should be continued perioperatively Consider starting low-dose aspirin (75 mg) in individuals with established vascular disease not on treatment Clopidogrel and prasugrel should be stopped for at least 7 days and ticagrelor 5 days prior to surgery to minimize bleeding risk. However, following coronary interventions, dual antiplatelet therapy may need to be continued perioperatively (Table 3). A consensus decision between the cardiologist, surgeon and anaesthetist can be helpful
Anticoagulants	Thromboembolic and bleeding risk should be assessed prior to surgery If there is a high risk of bleeding, warfarin should be stopped 5 days before surgery. INR should be ≤1.4 immediately prior to major surgery or if central neuraxial blockade is planned. INR <2 is generally considered safe for infrainguinal arterial procedures under general anaesthesia alone Perioperative management of NOACs prior to central neuraxial blockade is dependent on the indication (prophylaxis or treatment) and the creatinine clearance[9] Patients at high risk of thromboembolic events should be treated with bridging therapy with unfractionated or low-molecular-weight heparin[7,8]
Other medication	Consideration should be given to stopping ACEI and AT2 receptor antagonists 12–24 hours prior to surgery unless treatment is for heart failure. Other established regular medication should be continued in the perioperative period unless continuation may lead to adverse events

ACEI, Angiotensin-converting enzyme inhibitor; ASA, American Society of Anesthesiology physical status; AT2, Angiotensin 2, INR, International normalized ratio; NOAC, non-vitamin K antagonist anticoagulant.

Table 1

situation in high-risk individuals. Ideally a multidisciplinary vascular team should discuss these patients before a decision is made for conservative management or best medical therapy alone.

Preoperative optimization strategies

Optimization is clearly appropriate where a decision to proceed with surgery is made following a full preoperative risk assessment. The preoperative assessment clinic is pivotal in this process. This will be considered under the following headings:

- specific co-morbid conditions
- medical optimization
- interventional optimization.

Specific co-morbid conditions

Cardiovascular disease: patients with active cardiac conditions should be referred to cardiology services for medical and/or interventional optimization prior to elective surgery (see below).

Generally heart failure is known to carry the highest risk of adverse perioperative outcome in this setting.[4] Optimization of patients with new or unstable heart failure should be done in conjunction with a cardiologist. Treatment with angiotensin-converting enzyme inhibitors, β-blockers, aldosterone antagonists, diuretics and cardiac resynchronization may be indicated.

Respiratory disease: preoperative interventions which have been demonstrated to reduce risk are:

- smoking cessation for more than 4–6 weeks prior to surgery (see above)
- bronchodilator optimization in individuals with reversible airways disease
- eradication of active infection
- steroid treatment – reduces perioperative bronchospasm in individuals with reactive airways
- physiotherapy – instruction in postoperative breathing exercises.

It may be necessary to admit some individuals with severe pre-existing respiratory disease to hospital 24–48 hours in advance of surgery to achieve optimization.

Renal disease: in the face of a limited evidence base the following may need to be carefully considered where renal dysfunction is identified prior to vascular surgery:

- overnight intravenous crystalloid hydration prior to aortic surgery
- renal assessment and consideration of renal artery stenting where significant renal artery stenosis is identified as a cause of renal dysfunction
- preoperative dialysis – an appropriate time interval should be allowed for patients to undergo dialysis prior to vascular surgery
- post-dialysis bloods should be available prior to subsequent surgery.

Diabetes: patients with HbA_{1c} over 69 mmol/mol (8.5%) and those with hypoglycaemia unawareness should be referred to the diabetes specialist team to optimize control. Specific recommendations for preoperative pharmacological management are

beyond the scope of this article and are covered elsewhere.[5] The following are recommended:

- a written perioperative plan should be developed for each patient before admission based on local guidelines
- where possible, diabetic patients should be placed first on an operating list to minimize fasting and allow resumption of normal diet and diabetic medications
- when the anticipated period of starvation is more than one missed meal, most patients will require a variable-rate insulin infusion preoperatively
- patients with poor diabetic control or those undergoing major surgery may benefit from overnight preoperative admission.

Anaemia: even mild preoperative anaemia is associated with increased risk of morbidity and mortality following major surgery. Investigation of the cause and correction prior to surgery is therefore essential. Such treatment may include iron or erythropoietin for example. A comprehensive overview of this important area can be found elsewhere.[6] In the face of a lack definitive evidence, consensus opinion recommends establishing preoperative haemoglobin levels within the normal range prior to elective surgery: more than 12 g/dl for females and more than 13 g/dl for males.

Medical optimization

It is essential that all co-morbid medical diseases be optimized in advance of surgery to reduce perioperative risks. This constitutes 'medical optimization' and encompasses disease processes such as cardiac disease, diabetes, chronic respiratory disease and renal dysfunction. Specialist referral or advice may be required preoperatively to achieve this goal. In conjunction with the assessment of specific medical conditions there is now evidence that a comprehensive geriatric assessment (CGA) is beneficial to patients undergoing vascular surgery.[11] The CGA is a method that also includes the assessment and evaluation of psychological, social and functional issues including the evaluation of frailty. The CGA provides individualised care plans which incorporate the most appropriate investigation, treatments and rehabilitation programmes. Evidence of reductions in length of hospital stay, complication rates and better outcomes (at discharge) from hospital have been widely reported. Elderly vascular patients undergoing urgent intervention for critical limb ischaemia and/or major lower limb amputation appear to benefit the most from specialist input from geriatricians. It is important that vascular anaesthetists and vascular surgeons create local pathways that can allow individuals to have access to CGA where appropriate.

Specific recommendations for preoperative medication are provided in Table 1.

Interventional optimization

Cardiac revascularization prior to vascular surgery is now rarely performed. Large prospective studies have demonstrated no outcome benefit in cardiac revascularization prior to vascular surgery in patients with chronic stable angina.[10] It is therefore not recommended to seek specialist cardiology opinion in such individuals prior to non-cardiac surgery.

Specific circumstances where referral and interventional optimization may be required are shown in Table 2. In these situations the interventional cardiac procedure is undertaken prior to non-cardiac surgery in order to afford risk reduction. Specific interventions and recommendations prior to vascular surgery are provided in Table 3.

Active cardiac conditions requiring preoperative referral[7,8]

Condition	Examples
Unstable coronary syndromes	Canadian classification system III or IV angina Recent myocardial infarction (within 30 days) Deterioration of symptoms in previously well-controlled angina
Decompensated heart failure	NYHA class IV (symptoms at rest), new-onset or worsening heart failure
Significant arrhythmia	High-grade atrio-ventricular block Supraventricular arrhythmia with heart rate >100 bpm Symptomatic arrhythmia
Severe valvular heart disease	Aortic stenosis with valve area <1 cm^2 Symptomatic valve disease

NYHA — New York Heart Association.

Table 2

Enhanced recovery strategies

Recently evolving evidence has emerged regarding the role of 'enhanced recovery' strategies to improve patient outcome. Mortality benefits are yet to be firmly established; however, several heterogeneous studies have demonstrated benefits from reduced morbidity and hospital length of stay. In the preoperative period strategies including carbohydrate loading have been shown to be beneficial as part of a multimodal care pathway.

Vascular surgery following coronary interventions[7,8]

Condition	Recommendations
Balloon angioplasty	Non-cardiac surgery should be delayed for a minimum of 14 days following procedure Continue aspirin perioperatively
Bare-metal stent	Non-cardiac surgery should be postponed for a minimum of 30 days following stent insertion Continue aspirin perioperatively
Drug-eluting stent	Ideally non-cardiac surgery should be postponed for 12 months following insertion This delay may be reduced to 6 months if the risk of delay is greater than the risk of stent thrombosis Where surgery cannot be delayed by 12 months, dual antiplatelet therapy should be continued perioperatively

Table 3

Evidence within vascular surgery specifically however remains limited.

Discussion

Major vascular surgery provides a multidisciplinary challenge to vascular teams involved in patient management. The above guidance provides an overview of the current evidence base for preoperative optimization of vascular patients. As part of the decision-making process it should always be considered that on occasions the risk of surgery may be excessive, and conservative management may be in the patient's best interests. ◆

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