

Preoperative assessment of patients for major vascular surgery

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Abstract

Effective preoperative evaluation of patients prior to major vascular surgery remains a significant multidisciplinary challenge. Focussed preoperative evaluation targeted to organ systems can mitigate the combined effects of inherently high-risk surgical procedures undertaken in a patient population with well-recognized comorbidity. Careful history and examination, supported by appropriate investigations and specialist input, remains the cornerstone of this process, with risk increasingly quantified by dedicated scoring systems. In addition, the objective assessment of functional capacity is now common in UK units with cardiopulmonary exercise testing widely employed and considered a 'gold standard' by many. When employed in a timely manner, complete preoperative assessment allows more informed perioperative decision-making, frank discussion of risk with the patient and effective utilization of critical care resources if required.

Keywords Cardiopulmonary exercise testing; cardiovascular system; functional assessment; preoperative assessment; risk scoring; vascular surgery

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

Background

Major vascular surgery is associated with a higher risk of adverse outcome when compared to other forms of non-cardiac surgery. Published evidence from the recently established National Vascular Registry reports mortality rates of 4.1% for open aortic surgery in the UK with overall mortality for all major vascular procedures of 2.2%. This is coupled with frequent cardiorespiratory morbidity postoperatively.¹ A step-change in UK vascular care has been the introduction of the National Abdominal Aortic Aneurysm Screening Programme (NAAASP), with evidence building that otherwise asymptomatic patients identified through this route have more favourable postoperative outcomes.² In all cases, accurate preoperative risk assessment is of paramount importance to inform clinical decision-making, reduce risk and improve individual patient outcome following surgery.

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Learning objectives

After reading this article, you should:

- be aware of the comorbidities commonly encountered in the preoperative assessment of vascular surgical patients
- understand the importance of targeted assessment of organ systems
- understand the relevance of functional patient assessments, both subjective and objective

The preoperative assessment process is crucial in achieving this goal, with anaesthetists increasingly acting in the 'perioperative physician' role and coordinating this process. The major objectives of preoperative assessment of any surgical patient include: accurate risk assessment, optimization of comorbidities, targeted speciality referral, determining postoperative care facility, full patient counselling and consideration of non-operative management where appropriate. This can be achieved through:

- history, including clinical risk predictors
- physical examination with particular emphasis on the cardiorespiratory system
- objective assessment of functional capacity and aerobic fitness
- targeted investigations
- a validated scoring system to bring the above points together and accurately predict personalized risk.

Recognizing the high-stakes nature of vascular surgery and to facilitate this process, a preoperative assessment clinic with senior anaesthetic involvement was recommended by the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) 10 years ago.³ These increasingly sophisticated services now frequently feed into dedicated vascular multidisciplinary team meetings incorporating a full range of medical and non-medical personnel to plan care. Patients should be assessed at an appropriate time interval prior to elective surgery. It is vital that appropriate infrastructure, education and resources are made available locally to facilitate effective preoperative assessment. This article is not intended to cover preoperative optimization or modification of risk as this is covered in *Risk Modification and Preoperative Optimization of Vascular Patients* on pages 222–225 of this issue.

Cardiovascular system⁴

The prevalence of cardiac disease in vascular surgical patients is high (25–60%). Cardiac morbidity, specifically myocardial infarction, remains the commonest cause of death following vascular surgery with the American Heart Association (AHA) classifying major vascular procedures as 'high cardiac risk'. The perioperative period puts significant stress on the cardiovascular system through markedly increased systemic and myocardial oxygen demand. Commonly this occurs in the context of established coronary artery disease. Whilst careful history and examination remain vital to identifying cardiac comorbidity, functional assessment is now the established adjunct to this process (see below).

History and examination

Patients should be assessed for the following conditions.

Coronary artery disease (CAD)

CAD is present in up to 60% of patients undergoing vascular surgery and a particular association exists with abdominal aortic aneurysm. Of major concern are individuals who suffer from unstable coronary syndromes (myocardial infarction within 6 weeks or Canadian Cardiovascular Society (CCS) class 3 and 4 angina, Table 1), who generally warrant preoperative cardiological assessment. Chronic stable angina (CCS class 1 and 2) carries a minimally increased risk of perioperative events as long as the condition is medically optimized. Individuals with covert disease are often diagnosed in the preoperative setting, with rapid medical optimization critical in this group. In those patients suffering an established acute coronary syndrome a multidisciplinary decision is key; however, there are clear benefits in terms of postoperative outcome to delaying surgery beyond 60 days when no coronary intervention was performed, 14 days following primary angioplasty, 30 days following bare metal stent insertion and 365 days when a drug-eluting stent was utilized.⁴

Cardiac failure

Cardiac failure has long been recognized as a major cause of morbidity and mortality following surgery with a steadily increasing prevalence in the perioperative setting as general cardiovascular care improves.⁴ Optimized or non-decompensated ventricular dysfunction rarely requires cardiological referral. Individuals considered to have decompensated cardiac failure evidenced by positive findings on history, examination or chest X-ray must be referred for cardiological assessment and optimization prior to surgery. Echocardiographic evidence of an ejection fraction of less than 30% is an independent risk predictor, however there remains no established role for routine echocardiography in search of otherwise asymptomatic left ventricular dysfunction.

Valvular lesions

Aortic stenosis is the most common valve lesion in the UK. Severity of stenosis should be assessed, and if severe (gradient >60 mmHg, area <1 cm²) or symptomatic, consideration should be given to surgical correction prior to major surgery. Mitral stenosis carries an increased risk of heart failure and, if severe, consideration should be given to correction prior to major surgery.

Hypertension

Uncontrolled hypertension is a risk factor for both CAD and stroke. Current National Institute for Health and Care Excellence

(NICE) guidelines suggest a target blood pressure of less than 140/90 mmHg for secondary risk prevention. Diagnosis of hypertension is best undertaken utilizing serial readings in primary care (or 24-hour recording). Uncontrolled hypertension preoperatively is now considered a more minor risk factor than previously with debate continuing surrounding the perceived benefit of postponing surgery in order to confirm diagnosis or achieve control.⁵ Grade 3 hypertension (systolic >180, diastolic >110) or higher, necessitates consideration of surgical delay until optimization is achieved. Current evidence recommends continuing antihypertensive medication perioperatively in the majority of situations. Lability of blood pressure intraoperatively is common in hypertensive patients requiring knowledge of preoperative measurements to inform intraoperative management.

Arrhythmias

High-grade arrhythmias include complete heart block, Mobitz type II atrio-ventricular block and symptomatic ventricular arrhythmias. Patients with these conduction defects will require referral to cardiology for treatment prior to major surgery. Supraventricular arrhythmias (including atrial fibrillation) should be rate controlled to less than 100 beats per minute preoperatively to minimize the risk of perioperative cardiac ischaemia. In particular, presence of an isolated arrhythmia should raise the question of another underlying causative pathology such as ischaemic heart disease. Increasing numbers of patients are presenting with implantable cardiac devices (ICDs), key initial questions in these patients should include the type of device and programming as well as the underlying indication for its insertion.

Investigations

All patients should have a resting 12-lead electrocardiograph (ECG) to identify arrhythmias, conduction defects, or pre-existing cardiac pathology. Further cardiac investigations should be selective and done on the basis of clinical findings and functional assessment together with advice from cardiologists (Table 2).

Interest continues in the utility and significance of cardiac biomarkers in preoperative risk assessment and their supporting evidence is disputed. At the time of writing, several studies and two meta-analyses have highlighted the incremental predictive value of markers such as brain natriuretic peptide (BNP), pro-BNP and C-reactive protein, although how these might be practically incorporated into vascular pre-assessment, as an adjunct to the established risk scores, remains unclear.

Functional assessment

Assessment of functional capacity is now recommended prior to major vascular surgery. The American Heart Association (AHA)/ American College of Cardiology (ACC) continues to recommend assessment of metabolic equivalents (METs)⁴ (Table 3). A score of less than 4 METs has been identified as the level below which cardiac risk is increased. Assessment of METs based on ‘subjective’ patient reporting of exercise capacity carries an inherent risk of inaccuracy and there is evidence that high-risk individuals may not be identified relying on such a system alone.

Many authorities recommend objective assessment of functional capacity prior to major vascular surgery. Observing exercise capacity directly, for example stair climbing, has some evidence base but gives limited information. Cardiopulmonary

Canadian Cardiovascular Society (CCS) angina classification

CCS class	Symptoms
1	Angina with strenuous exercise (e.g. rapid stair climbing)
2	Angina with moderate exertion (e.g. long-distance walking, walking on an incline)
3	Angina with mild exertion (e.g. climbing one flight of stairs at normal pace)
4	Angina at rest or on minimal exertion

Table 1

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