Preoperative assessment and investigation

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Abstract

Preoperative assessment forms an integral precursor to the surgical process. It provides the opportunity to assess acute illness, optimize chronic disease where appropriate, assess risk and structure perioperative management. During the assessment process, consideration should be made of surgical complexity, the severity of specific co-morbidities and an individual's functional capacity. The process of assessment requires the adoption of basic clinical skills, targeted investigations and also the use of functional assessment tools, including cardiopulmonary exercise testing.

Keywords Cardiopulmonary exercise testing; investigations; preoperative assessment; surgical risk

Introduction

Although the concept of preoperative assessment (POA) has been established for many years, more recently it has become embodied within the surgical pathway through the preoperative assessment clinic (PAC).

The ultimate aim of POA is to facilitate thorough risk assessment of the individual surgical patient through targeted investigation leading to appropriate decision-making and allocation of perioperative resources to benefit recovery from surgery and long-term outcome. These aims make up the key recommendations in recent National Confidential Enquiry into Patient Outcome and Death (NCEPOD) publications.[1] The added benefit is the improvement of institutional efficiency, by, for example, reducing late or day of surgery cancellations.[2]

The American College of Cardiology (ACC) and American Heart Association (AHA) joint guidelines on cardiac risk stratification for non-cardiac surgery[3] identify three areas in assessment:

- surgery-specific risk
- patient-specific variables
- exercise capacity.

Although this guideline is targeted specifically to cardiac risk stratification, these broad categories can be used to define an effective POA structure through which targeted investigations can be used to facilitate a complete patient assessment.

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Surgery-specific risk – the influence of surgical complexity

Surgical patient risk for any given patient will increase, with increasing surgical complexity. A recent report of 2.5 million patients in the Netherlands between 1991 and 2005 has shown significant variability between mortality rates for different surgical operations.[4] The introduction of newer, minimally invasive, surgical techniques aimed at improving outcome by reducing surgical insult will further increase outcome variability.

The level of investigation into any patient's risk should reflect this variability. For example, the assessment required for a peripheral lipoma excision would be different from that required from an open abdominal aortic aneurysm repair, since the increased surgical stress will impose an increased risk in the latter procedure. In this context, the National Institute for Health and Care Excellence (NICE) has developed a surgical grading system shown in Table 1.

Patient-specific risk – existence of coexisting disease

Modern medical teaching has adopted a system-based approach to disease. The severity of individual chronic medical conditions (whether overt, uncontrolled or asymptomatic) is important to POA. The potential effect a single disease may have on other systems due to close system inter-relationship, especially concerning the cardiorespiratory system, is also a prime consideration for POA.

Simple grading systems, such as the American Society of Anesthesiologists (ASA) classification (Table 2) attempt to provide an overall summary of the severity of multiple system comorbidity. This particular system is used worldwide and gives an immediate indication of a patient's clinical state that in some studies have demonstrated prognostic relevance.

In contrast, the Association of Anaesthetists of Great Britain and Ireland (AAGBI) have identified nine specific factors, that provide independent prognostic information regarding perioperative risk:[5]

- age
- sex
- socioeconomic status
- aerobic fitness
- ischaemic heart disease (IHD)
- heart failure
- ischaemic brain disease
- kidney failure
- peripheral arterial disease.

As shown, specific disease is seen to be of prognostic relevance, but other factors including environmental factors and physical activity also play an important role in determining perioperative risk. There are also some notable omissions from this list that are identified by others as important factors of perioperative morbidity and mortality such as diabetes[6] and respiratory disease.[7]

In summary, optimization of chronic specific disease entities, together with appreciation of the combined multisystem effects of multiple co-morbidities, will provide a more consistent approach to preoperative risk assessment.

The next section defines the relevance of specific system disorders to the preoperative setting, with guidance on investigative issues where the disorder is seen to be a priority. The NICE

Surgical severity grading system (NICE)

Surgical severity	Type of surgery (example)
1	Excision of lesion
2	Inguinal hernia repair
3	Total abdominal hysterectomy
4	Colonic resection

Table 1

guidance on the use of routine preoperative tests for elective surgery[8] is mentioned where appropriate and is outlined in Table 3.

Specific disease investigation

Cardiovascular disease: at rest, provision of an adequate oxygen delivery to the peripheral organ microvascular beds relies on a functional, perfused myocardium. Surgically induced stress such as hypotension from blood loss, tachycardia from a painful stimulus and development of a hypercoagulable state, may expose coexisting cardiovascular disease, leading to deleterious cardiac decompensation or ischaemia.

The Revised Cardiac Risk Index[6] has been used to assess the preoperative integrity and relevance of cardiovascular system (CVS) disease. The key areas are identified in Box 1. Lee and colleagues reported that having no risk factors corresponded to a 0.4% rate of major cardiac complications while three or more gave an 11% rate.[6]

The more recent AAGBI guidelines[5] identify similar risk factors.

More detailed disease-specific classifications may enable a clinical impression of disease severity and may guide further investigations. Two such classifications are the Canadian Cardiovascular Society (CCS) grading of angina pectoris and the New York Heart Association (NYHA) functional classification or heat failure Table 4.

The AHA/ACC[3] identify four areas where further investigation, evaluation and optimization are recommended. These are:

- decompensated heart failure (NYHA class IV, or worsening new onset heart failure)
- unstable coronary syndromes (unstable or severe angina, recent myocardial infarction)
- significant arrhythmias
- severe valvular disease.

American Society of Anesthesiologists (ASA) grading system

ASA grade	Physical status
1	Healthy patient — no systemic illness
2	Mild systemic disease
3	Severe systemic disease
4	Severe systemic disease that is a constant risk to life
5	Moribund patient
6	Declared brain dead

Table 2

Investigation in preoperative assessment, including adaptation from AAGBI and NICE guidance[4,8]

Investigation	Application
ECG	All 80 years and over
	All 60 years and over SS 3+
	History CVS or renal disease
Full blood count	60 years and over and SS 3+
	History of renal disease
Renal function tests	60 years and over SS 3+
	All SS 4
	History of renal disease or severe CVS
Coagulation	Anti coagulated
	Dialysis patient
	Specific surgery — e.g. liver resection, neurosurgery
Arterial blood gases	Not routine. Case-specific consideration
Lung function tests	Not routine. Case-specific consideration
Echocardiography	Structural cardiac disease
Pregnancy test	All women who may be pregnant
Sickle cell test	Family history homo-or heterozygous trait
	Ancestry — African, Afro-Caribbean, Asian, Middle eastern or east Mediterranean
Thyroid function test	On thyroid replacement or treated hyperthyroidism
CXR	Planned critical care admission

SS, surgical severity grade.

Table 3

This list is not mutually exclusive. Indeed, patients with non-cardiac vascular disease are more likely to have coronary artery disease and have been shown to be up to five times more likely to have left ventricular systolic dysfunction.[9]

Importantly, heart failure is being increasingly recognized as more important to postoperative outcome than ischaemic heart disease. Heart failure is a complex disease and has challenges both in understanding its cause and in its diagnosis. IHD is itself a common cause of heart failure but hypertension, valvular disease, respiratory disease, obstructive sleep apnoea, diabetes mellitus, substance misuse and previous viral infections may also precipitate heart failure. The European Society of Cardiology (ESC) defines systolic heart failure as a left ventricular ejection fraction of less than or equal to 35%.[10] However there is an accepted 'grey area' of 35–50% for which the prognostic implications are less well identified. Furthermore, a normal ejection fraction does not exclude diastolic dysfunction or heart failure with preserved ejection fraction.

The only specific cardiac test is an ECG, recommended for all patients over 80, over 60 with a surgical severity (SS) score 3 or more and those with a history of cardiovascular disease and renal disease. An ECG should be used to identify previous ischaemia, significant arrhythmias such as Mobitz type 2, third-degree heart block, trifascicular block and supraventricular arrhythmias that may require further management. In those patients with an ASA 2 or above, with cardiovascular disease, a full blood count (FBC)