

Chapter 1

Anaesthetic assessment and preparation for surgery

The nature of anaesthetists' training and experience makes them uniquely qualified to assess the inherent risks of giving an anaesthetic. Ideally, every patient should be seen by an anaesthetist prior to surgery in order to identify, manage, and minimize these risks. Traditionally, this occurred when the patient was admitted, usually the day before an elective surgical procedure. However, if at this time the patient was found to have any significant co-morbidity, surgery was often postponed, and with no time to admit a different patient operating time was wasted. Recently, in an attempt to improve efficiency, there has been a move towards admitting a patient on the day of their planned surgical procedure. This makes the situation even more difficult by further reducing the opportunity for an adequate anaesthetic assessment. This has led to significant changes in the preoperative management of patients undergoing elective surgery, including the introduction of clinics specifically for anaesthetic assessment. A variety of models of 'preoperative' or 'anaesthetic assessment' clinic exist; the following is intended to outline their principle functions. Those who require greater detail are advised to consult the document produced by the Association of Anaesthetists of Great Britain and Ireland (AAGBI) (see Useful websites).

The preoperative assessment clinic

Stage 1

Although not all patients need to be seen by an anaesthetist in a preoperative assessment clinic, all patients do need to be assessed by an appropriately trained individual. This role is frequently undertaken by nurses, who may take a history, examine the patient, and order investigations (see below) according to the local protocol. The primary aim is to identify patients who:

- have no coexisting medical problems;
- have a coexisting medical problem that is well controlled, and does not impair daily activities, for example hypertension;
- do not require any, or require only baseline, investigations (see Table 1.1);
- have no history of, or predicted anaesthetic difficulties;
- require surgery for which complications are minimal.

Having fulfilled these criteria, patients can then be listed for surgery. At this stage, the patient will usually be given preliminary information about anaesthesia, often in the form of an explanatory leaflet.

Table 1.1 Baseline investigations in patients with no evidence of concurrent disease (ASA 1).

Age of patient	Minor surgery	Intermediate surgery	Major surgery	Major 'plus' surgery
16–39	Nil	Nil	FBC	FBC, RFT
Consider	Nil	Nil	RFT, BS	Clotting, BS
40–59	Nil	Nil	FBC	FBC, RFT
Consider	ECG	ECG, FBC, BS	ECG, BS, RFT	ECG, BS, clotting
60–79	Nil	FBC	FBC, ECG, RFT	FBC, RFT, ECG
Consider	ECG	ECG, BS, RFT	BS, CXR	BS, clotting, CXR
≥80	ECG	FBC, ECG	FBC, ECG, RFT	FBC, RFT, ECG
Consider	FBC, RFT	RFT, BS	BS, CXR, clotting	BS, clotting, CXR

FBC: full blood count; RFT: renal function tests, to include sodium, potassium, urea, and creatinine; ECG: electrocardiogram; BS: random blood glucose; CXR: chest X-ray. Clotting to include prothrombin time (PT), activated partial thromboplastin time (APTT), international normalized ratio (INR). Courtesy of National Institute for Health and Clinical Excellence.

On admission, these patients will need to be seen by a member of the surgical team, to ensure that there have not been any significant changes since attending the clinic, and by the anaesthetist who will:

- confirm the findings from the preoperative assessment;
- check the results of any baseline investigations;
- explain the options for anaesthesia appropriate for the procedure;
- have the ultimate responsibility for deciding it is safe to proceed;
- obtain consent for anaesthesia.

Stage 2

Clearly not all patients are as described above. Common reasons for patients not meeting the above criteria include:

- coexisting medical problems that are previously undiagnosed, for example diabetes, hypertension;
- medical conditions that are less than optimally managed, for example angina;
- abnormal baseline investigations.

These patients will need to be sent for further investigations, for example electrocardiography (ECG), pulmonary function tests and echocardiography, or be referred to the appropriate specialist for advice or further management before being reassessed. The findings of the further investigations

then dictate whether or not the patient needs to be seen by an anaesthetist.

Stage 3

Patients that will need to be seen by an anaesthetist in the preoperative clinic are those who:

- have concurrent disease, and are symptomatic despite optimal treatment;
- are known to have had previous anaesthetic difficulties, for example difficult intubation;
- are predicted to have the potential for difficulties, for example obesity;
- have a previous or family history of prolonged apnoea after anaesthesia;
- are to undergo complex surgery with or without planned admission to the intensive care unit (ICU) postoperatively.

The consultation will allow the anaesthetist to:

- make a full assessment of the patient's medical condition;
- evaluate the results of any investigations or advice from other specialists;
- request any additional investigations;
- review any previous anaesthetics given;
- decide on the most appropriate technique, for example general or regional anaesthesia;
- begin the consent process, explaining and documenting:
 - the anaesthetic options available and the potential side-effects;

- the risks associated with anaesthesia;
- discuss plans for postoperative care.

As before these patients will be seen by their anaesthetist on admission who will confirm that there have not been any significant changes since being seen in the clinic, answer any further questions that the patient may have about anaesthesia, and obtain informed consent.

The ultimate aim is to ensure that once a patient is admitted for surgery, their intended procedure is not cancelled as a result of them being deemed 'unfit' or because their medical condition has not been adequately investigated. Clearly the time between the patient being seen in the assessment clinic and the date of admission for surgery cannot be excessive; 4–6 weeks is usually acceptable.

The anaesthetic assessment

The anaesthetic assessment consists of taking a history from, and examining, each patient, followed by any appropriate investigations. When performed by non-anaesthetic staff, a protocol is often used to ensure all the relevant areas are covered. This section concentrates on features of particular relevance to the anaesthetist.

Present and past medical history

Within the patient's medical history aspects relating to the cardiovascular and respiratory systems are relatively more important to the anaesthetist than the other areas.

Cardiovascular system

Enquire specifically about symptoms of:

- ischaemic heart disease;
- heart failure;
- hypertension;
- valvular heart disease;
- conduction defects, arrhythmias;
- peripheral vascular disease, previous deep venous thrombosis (DVT) or pulmonary embolus (PE).

Patients with a proven history of myocardial infarction (MI) are at a greater risk of further

infarction perioperatively. The risk of re-infarction falls as the time elapsed since the original event increases. The point at which the risk has fallen to an acceptable level, or to that of a patient with no previous history of MI, varies between individual patients. For a patient with an uncomplicated MI and a normal exercise tolerance test (ETT), elective surgery may only need to be delayed by 6–8 weeks. The American Heart Association has produced guidance for perioperative cardiovascular evaluation (see Useful websites).

Heart failure is one of the most important predictors of perioperative complications, mainly as an increased risk of perioperative cardiac morbidity and mortality. Its severity is best described using a recognized scale, for example the New York Heart Association classification (NYHA) (Table 1.2).

Untreated or poorly controlled hypertension may lead to exaggerated cardiovascular responses during anaesthesia. Both hypertension and hypotension can be precipitated, which increase the risk of myocardial and cerebral ischaemia. The severity of hypertension will determine the action required:

- *Mild* (SBP 140–159 mmHg, DBP 90–99 mmHg) No evidence that delaying surgery for treatment affects outcome.
- *Moderate* (SBP 160–179 mmHg, DBP 100–109 mmHg) Consider review of treatment. If unchanged, requires close monitoring to avoid swings during anaesthesia and surgery.
- *Severe* (SBP >180 mmHg, DBP >109 mmHg) With a BP this high, elective surgery should be postponed due to the significant risk of myocardial ischaemia, arrhythmias, and intracerebral haemorrhage. In an emergency, it will require acute control in conjunction with invasive monitoring.

Respiratory system

Enquire specifically about symptoms of:

- chronic obstructive pulmonary disease (COPD);
- chronic bronchitis;
- emphysema;
- asthma;

Table 1.2 New York Heart Association classification of cardiac function compared with the Specific Activity Scale.

NYHA functional classification	Specific Activity Scale classification
Class I Cardiac disease without limitation of physical activity No fatigue, palpitations, dyspnoea or angina	Can perform activities requiring ≥ 7 METs Jog/walk at 5 mph, ski, play squash or basketball, shovel soil
Class II Cardiac disease resulting in slight limitation of physical activity Asymptomatic at rest, ordinary physical activity causes fatigue, palpitations, dyspnoea, or angina	Can perform activities requiring ≥ 5 but < 7 METs Walk at 4 mph on level ground, garden, rake, weed, have sexual intercourse without stopping
Class III Cardiac disease causing marked limitation of physical activity Asymptomatic at rest, less than ordinary activity causes fatigue, palpitations, dyspnoea, or angina	Can perform activities requiring ≥ 2 but < 5 METs Perform most household chores, play golf, push the lawnmower, shower
Class IV Cardiac disease limiting any physical activity Symptoms of heart failure or angina at rest, increased with any physical activity	Patients cannot perform activities requiring ≥ 2 METs Cannot dress without stopping because of symptoms; cannot perform any class III activities

- infection;
- restrictive lung disease.

Patients with pre-existing lung disease are at increased risk of postoperative chest infections, particularly if they are also obese, or undergoing upper abdominal or thoracic surgery. If an acute upper respiratory tract infection is present, anaesthesia and surgery should be postponed unless it is for a life-threatening condition.

Assessment of exercise tolerance

Exercise capacity has long been recognized as a good predictor of postoperative morbidity and mortality. This is because similar physiological responses can be observed during exercise and after surgery, namely an increase in cardiac output and oxygen delivery to meet the increase in tissue oxygen demand. An indication of cardiac and respiratory reserves can be obtained by asking the patient about their ability to perform everyday physical activities before having to stop because of symptoms of chest pain, shortness of breath, etc. For example:

- How far can you walk on the flat?
- How far can you walk uphill?
- How many stairs can you climb before stopping?
- Could you run for a bus?
- Are you able to do the shopping?

- Are you able to do housework?
- Are you able to care for yourself?

The problem with such questions is that they are very subjective, dependent on the patient's motivation, and patients often tend to overestimate their abilities!

The assessment can be made more objective by reference to The Specific Activity Scale (Table 1.2). Common physical activities are graded in terms of their metabolic equivalents of activity or 'METs', with 1 MET being the energy (or more accurately oxygen) used at rest. The more strenuous the activity, the greater number of METs. This is not specific for each patient but serves as a useful guide, and once again relies on the patient's assessment of their activity.

Cardiopulmonary exercise testing

Cardiopulmonary exercise (CPX) testing objectively determines each patient's ability to increase oxygen delivery under controlled conditions and thereby makes a preoperative assessment of their fitness. Consequently, high-risk patients can be identified, allowing appropriate preparation to be made for their perioperative management.

To perform a CPX test, patients exercise using a bicycle ergometer, against an increasing resistance (like peddling uphill), whilst breathing through a mouthpiece. The volume and composi-

tion of inhaled and exhaled gases are monitored and analysed to determine oxygen uptake, carbon dioxide production, respiratory rate, tidal volume, and minute ventilation. The patient's oxygen saturation and ECG are also usually monitored. The principle of the test is that during exercise, oxygen consumption (VO_2 , mL/min/kg) is the same as carbon dioxide production (VCO_2). As the intensity of exercise increases, a point is reached where oxygen delivery can no longer meet metabolic demand, and anaerobic metabolism starts. At this point, CO_2 production exceeds oxygen consumption; this is termed the 'anaerobic threshold' (AT). If the intensity of exercise increases further, the oxygen consumption will eventually plateau (VO_2 max), which equates to the peak aerobic capacity. Many assessments of fitness measure the AT as it occurs before VO_2 max, is more easily achieved by the elderly, and is less influenced by patient motivation. The lower the AT, the less cardiopulmonary reserve the patient has and the greater risk of postoperative morbidity and mortality. Table 1.3 shows values that have been used to predict risk and the need for an increased level of care postoperatively.

Unfortunately, not all patients can be assessed in this way; for example, those with severe musculoskeletal dysfunction may not be able to exercise to the limit of their cardiorespiratory reserve. In such circumstances, further investigations will be required. The most readily available method of non-invasive assessment of cardiac function in patients is some type of echocardiography (see below).

Other conditions in a patient's medical history which are of importance include:

- *Indigestion, heartburn, and reflux* Possibility of a hiatus hernia. If exacerbated on bending forward or lying flat, this increases the risk of regurgitation and aspiration.
- *Rheumatoid disease* Limited movement of joints makes positioning for surgery difficult. Cervical

spine and temporo-mandibular joint involvement may complicate airway management. There is often a chronic anaemia.

- *Diabetes* An increased incidence of ischaemic heart disease, renal dysfunction, and autonomic and peripheral neuropathy. Increased risk of intra- and postoperative complications, particularly hypotension and infections.
- *Neuromuscular disorders* Poor respiratory function (forced vital capacity (FVC) <1 L) predisposes to chest infection and the possibility of the need for ventilatory support postoperatively. Poor bulbar function predisposes to aspiration. Care when using muscle relaxants. Consider regional anaesthesia.
- *Chronic renal failure* Anaemia and electrolyte abnormalities. Altered drug excretion restricts the choice of anaesthetic drugs. Surgery and dialysis treatments need to be coordinated.
- *Jaundice* Altered drug metabolism, coagulopathy. Care with opioid administration.

Previous anaesthetics and operations

These have usually occurred in hospitals or, occasionally in the past, dental surgeries. Enquire about any perioperative problems, for example nausea, vomiting, dreams, awareness, jaundice. Ask if any information was given postoperatively, for example difficulty with intubation, delayed recovery. Whenever possible, check the records of previous anaesthetics to rule out or clarify problems such as difficulties with intubation, allergy to drugs given, or adverse reactions (e.g. malignant hyperpyrexia, see below). Some patients may have been issued with a 'Medic Alert'-type bracelet or similar device giving details or a contact number. Details of previous surgery may reveal potential anaesthetic problems, for example cardiac, pulmonary, or cervical spine surgery.

Table 1.3 Anaerobic threshold (AT) values used to predict risk and the need for an increased level of care postoperatively.

AT >14 ml/min/kg	No specific risk, ward-based care
AT 11–14 ml/min/kg	Low risk, requires HDU care postoperatively
AT <11 ml/min/kg	High risk, requires ITU care postoperatively
Basal oxygen consumption	3.5 ml/kg/min

Family history

All patients should be asked whether any family members have experienced problems with anaesthesia; for example, a history of prolonged apnoea suggests pseudocholinesterase deficiency (see page 39), and an unexplained death suggests malignant hyperpyrexia (MH; see page 84). Elective surgery should be postponed if any conditions are identified while the patient is investigated appropriately. In the emergency situation, anaesthesia must be adjusted accordingly, for example by avoidance of triggering drugs in a patient with a potential or actual family history of MH.

Drug history and allergies

Identify all medications, both prescribed and over the counter (OTC), including complementary and alternative medicines. Patients will often forget to mention the oral contraceptive pill (OCP) and hormone replacement therapy (HRT) unless specifically asked. On the whole, the number of medications taken rises with age. Many commonly prescribed drugs, for example beta-blockers, have important interactions with drugs used during anaesthesia. These can be identified by consulting a current British National Formulary (BNF), or the BNF website. Allergies to drugs, topical preparations (e.g. iodine), adhesive dressings, and foodstuffs should be noted.

Social history

- *Smoking* Ascertain the amount of tobacco smoked. This is usually calculated as the number of pack years; number of packs smoked each day × number of years smoked. This gives an idea of the total amount smoked and allows comparison from one person to another. Carboxyhaemoglobin reduces oxygen carriage, and nicotine stimulates the sympathetic nervous system causing tachycardia, hypertension, and coronary artery narrowing. As well as the long-term risks of smoking, i.e. chronic lung disease and carcinoma, smokers also have a significantly increased risk of postoperative chest infections. Stopping smoking before anaesthesia

reduces the risk of perioperative complications; the further in advance, the better. As a guide, stopping for 8 weeks improves the airways; for 2 weeks reduces their irritability; and for as little as 24 h before anaesthesia decreases carboxyhaemoglobin levels. Help and advice should be available at the preoperative assessment clinic.

- *Alcohol* This is measured as units consumed per week: >50 units/week causes induction of liver enzymes and tolerance to anaesthetic drugs. The risk of alcohol withdrawal syndrome postoperatively must be considered.

- *Drugs* Ask specifically about the use of drugs for recreational purposes, including type, frequency, and route of administration. This group of patients is at risk of infection with hepatitis B and human immunodeficiency virus (HIV). There can be difficulty with venous access following IV drug abuse due to widespread thrombosis of veins. Withdrawal syndromes can occur postoperatively.

- *Pregnancy* The date of the last menstrual period should be noted in all women of childbearing age. The anaesthetist may be the only person in theatre able to give this information if X-rays are required. Anaesthesia increases the risk of inducing a spontaneous abortion in early pregnancy. There is an increased risk of regurgitation and aspiration in late pregnancy. Elective surgery is best postponed until after delivery.

The examination

This concentrates on the cardiovascular and respiratory systems; the remaining systems are examined if problems relevant to anaesthesia have been identified in the history. At the end of the examination, the patient's airway is assessed to try and identify any potential problems. If a regional anaesthetic is planned, the appropriate anatomy (e.g. lumbar spine for central neural block) is examined.

Cardiovascular system

Examine specifically for signs of:

- arrhythmias;
- heart failure;

- hypertension;
- valvular heart disease;
- peripheral vascular disease.

Don't forget to inspect the peripheral veins to identify any potential problems with IV access.

Respiratory system

Examine specifically for signs of:

- respiratory failure;
- impaired ventilation;
- collapse, consolidation, pleural effusion;
- additional or absent breath sounds.

Nervous system

Chronic disease of the peripheral and central nervous systems should be identified, and any evidence of motor or sensory impairment recorded. It must be remembered that some disorders will affect the cardiovascular and respiratory systems, for example dystrophia myotonica and multiple sclerosis.

Musculoskeletal system

Note any restriction of movement and deformity if a patient has connective tissue disorders. Patients suffering from chronic rheumatoid disease frequently have a reduced muscle mass, peripheral neuropathies, and pulmonary involvement. Particular attention should be paid to the patient's cervical spine and temporo-mandibular joints (see below).

The airway

The airway of all patients must be assessed, in order to try to predict those patients who may be difficult to intubate.

Observation of the patient's anatomy

Look for:

- limitation of mouth opening;
- a receding mandible;
- position, number, and health of teeth;

- size of the tongue;
- soft tissue swelling at the front of the neck;
- deviation of the larynx or trachea;
- limitations in flexion and extension of the cervical spine.

Finding any of these suggests that intubation may be more difficult. However, it must be remembered that all of these are subjective.

Simple bedside tests

- *Mallampati criteria* The patient, sitting upright, is asked to open their mouth and maximally protrude their tongue. The view of the pharyngeal structures is noted and graded I–IV (Fig. 1.1). Grades III and IV suggest difficult intubation.

- *Thyromental distance* With the head fully extended on the neck, the distance between the bony point of the chin and the prominence of the thyroid cartilage is measured (Fig. 1.2). A distance of <7 cm suggests difficult intubation.

- *Wilson score* Increasing weight, a reduction in head and neck movement, reduced mouth opening, and the presence of a receding mandible or buck-teeth all predispose to increased difficulty with intubation.

- *Calder test* The patient is asked to protrude the mandible as far as possible. The lower incisors will lie either anterior to, aligned with, or posterior to the upper incisors. The latter two suggest a reduced view at laryngoscopy.

None of these tests, alone or in combination, will predict all difficult intubations. A Mallampati grade III or IV with a thyromental distance of <7 cm will predict 80% of difficult intubations. If problems are anticipated, anaesthesia should be planned accordingly. If intubation proves to be difficult, it must be recorded in a prominent place in the patient's notes and the patient informed.

Investigations

There is little evidence to support 'routine' investigations, and so an investigation should only be ordered if the result would affect the patient's management. *In patients with no evidence of concurrent disease* (ASA 1, see below), preoperative

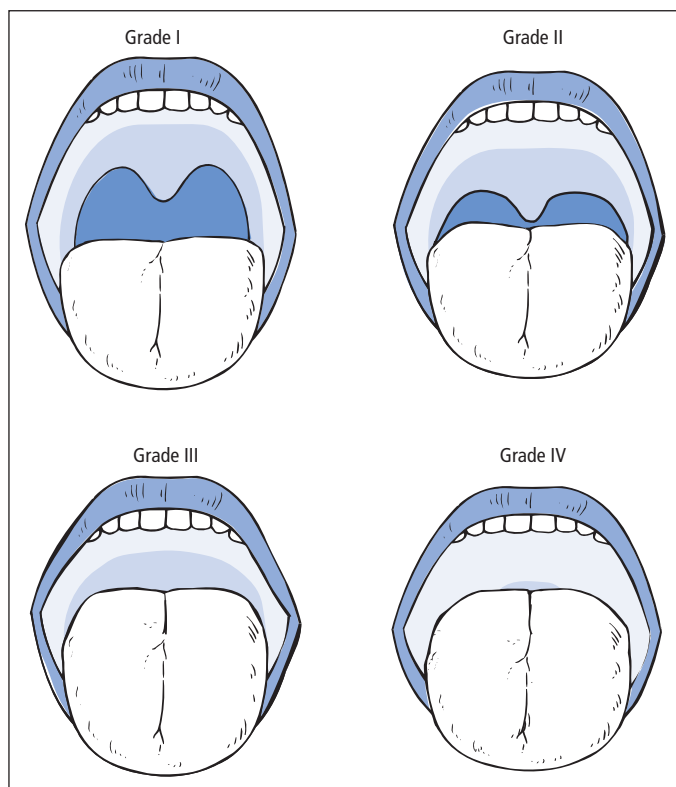


Figure 1.1 The pharyngeal structures seen during the Mallampati assessment.

investigations will depend on the extent of surgery and the age of the patient. A synopsis of the current guidelines for these patients, issued by the National Institute for Health and Clinical Excellence (NICE), is shown in Table 1.1. For each age group and grade of surgery, the upper entry shows 'tests recommended' and the lower entry 'tests to be considered' (depending on patient characteristics). Dipstick urinalysis needs only to be performed in symptomatic individuals.

Additional investigations

The following is a guide for when to request some of the common preoperative investigations. Again the need for these will depend on the grade of surgery and the age of the patient. Further information can be found in Clinical Guideline 3, published by NICE (see Useful websites).

- *Urea and electrolytes:* patients taking digoxin, diuretics, steroids, and those with diabetes, renal disease, vomiting, diarrhoea.
- *Liver function tests:* known hepatic disease, a history of a high alcohol intake (>50 units/week), metastatic disease, or evidence of malnutrition.
- *Blood sugar:* diabetics, severe peripheral arterial disease, or taking long-term steroids.
- *ECG:* hypertensive, with symptoms or signs of ischaemic heart disease, a cardiac arrhythmia, or diabetics >40 years of age.
- *Chest X-ray:* symptoms or signs of cardiac or respiratory disease, or suspected or known malignancy, where thoracic surgery is planned, or in those from areas of endemic tuberculosis who have not had a chest X-ray in the last year.
- *Pulmonary function tests:* dyspnoea on mild exertion, COPD, or asthma. Measure peak expiratory flow rate (PEFR), forced expiratory volume in 1 second (FEV₁), and FVC. Patients who are dyspnoeic

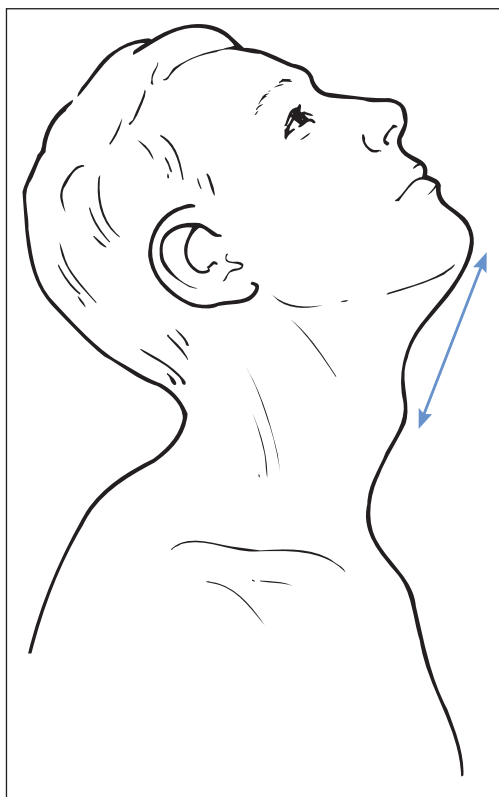


Figure 1.2 The thyromental distance.

or cyanosed at rest, found to have an $FEV_1 < 60\%$ predicted, or are to have thoracic surgery, should also have arterial blood gas analysed while breathing air.

- *Coagulation screen*: anticoagulant therapy, a history of a bleeding diatheses, or a history of liver disease or jaundice.
- *Sickle-cell screen (Sickledex)*: a family history of sickle-cell disease or where ethnicity increases the risk of sickle-cell disease. If positive, electrophoresis will be required for definitive diagnosis.
- *Cervical spine X-ray*: rheumatoid arthritis, a history of major trauma or surgery to the neck, or when difficult intubation is predicted.

Echocardiography

This is becoming increasingly recognized as a useful tool to assess left ventricular function in

patients with ischaemic or valvular heart disease, but whose exercise ability is limited, for example by severe osteoarthritis. The left ventricular ejection fraction can be calculated, and contractility and ventricular wall motion abnormalities identified. Similarly, ventricular function post-MI can be assessed. In patients with valvular lesions, the degree of dysfunction (regurgitation and/or stenosis) can be assessed. In aortic stenosis, the valve (aperture) area can be measured and the pressure gradient across the valve, which is a good indication of the severity of the disease, can be calculated. As an echocardiogram is performed in patients at rest, it does not give any indication of what happens when metabolic demand is increased. A stress echocardiogram can be performed to simulate exercise and hence the conditions a patient may encounter during anaesthesia or after surgery. This is often achieved by administering an inotrope, for example dobutamine, which increases the heart rate and myocardial work while any changes in myocardial performance are monitored (dobutamine stress echocardiography).

Medical referral

Patients with significant medical (or surgical) comorbidities should be identified in the preoperative assessment clinic, not on the day of admission, to allow time for adequate investigation and management. Clearly a wide spectrum of conditions exists; the following are examples of some of the more commonly encountered that may need specialist advice.

Cardiovascular disease

- Untreated or poorly controlled hypertension or heart failure.
- Symptomatic ischaemic heart disease, despite treatment (unstable angina).
- Arrhythmias: uncontrolled atrial fibrillation, paroxysmal supraventricular tachycardia, and second and third degree heart block.
- Symptomatic or newly diagnosed valvular heart disease, or congenital heart disease.

Respiratory disease

- COPD, particularly if dyspnoeic at rest.
- Bronchiectasis.
- Asthmatics who are unstable, taking oral steroids or have an FEV₁ <60% predicted.

Endocrine disorders

- Insulin-dependent and non-insulin dependent diabetics who have ketonuria, glycated haemoglobin (HbA1c) >10%, or a random blood sugar >12 mmol/L. Local policy will dictate referral of stable diabetics for perioperative management.
- Hypo- or hyperthyroidism symptomatic on current treatment.
- Cushing's or Addison's disease.
- Hypopituitarism.

Renal disease

- Chronic renal failure.
- Patients undergoing renal replacement therapy.

Haematological disorders

- Bleeding diatheses, for example haemophilia, thrombocytopenia.
- Therapeutic anticoagulation.
- Haemoglobinopathies.
- Polycythaemia.
- Haemolytic anaemias.
- Leukaemias.

Risk associated with anaesthesia and surgery

One of the most commonly asked questions of anaesthetists is 'What are the risks of having an anaesthetic?' These can be divided into two main groups.

Minor

These are not life threatening and can occur even when anaesthesia has apparently been uneventful. Although classed as minor, the patient may not share this view. They include:

- failed IV access;
- cut lip, damage to teeth, caps, crowns;
- sore throat;

- headache;
- postoperative nausea and vomiting (PONV);
- retention of urine.

Major

These may be life-threatening events. They include but are not limited to:

- aspiration of gastric contents;
- hypoxic brain injury;
- MI;
- cerebrovascular accident;
- nerve injury;
- chest infection;
- renal failure;
- death.

In the UK, the Confidential Enquiry into Perioperative Deaths (CEPOD 1987) revealed an *overall* perioperative mortality of 0.7% in approximately 500 000 operations. Anaesthesia was considered to have been a contributing factor in 410 deaths (0.08%), but was judged *completely* responsible in only three cases—a primary mortality rate of 1:185 000 operations. Upon analysis of the deaths where anaesthesia contributed, the predominant factor was human error.

Clearly, anaesthesia itself is very safe, particularly in those patients who are otherwise well. Apart from human error, the most likely risk is from an adverse drug reaction or drug interaction. However, anaesthesia rarely occurs in isolation and, when the risks of the surgical procedure and those due to pre-existing disease are combined, the risks of morbidity and mortality are increased. Not surprisingly, a number of methods have been described to try and quantify these risks.

Risk indicators

The most widely used scale for estimating risk is the American Society of Anesthesiologists (ASA) classification of the patient's physical status. The patient is assigned to a category from 1 to 5 depending on any physical disturbance caused by either the disease process for which surgery is being performed or any other pre-existing disease. It is relatively subjective and does not take into

Table 1.4 ASA physical status scale.

Class	Physical status	Absolute mortality (%)
I	A healthy patient with no organic or psychological disease process. The pathological process for which the operation is being performed is localized and causes no systemic upset	0.1
II	A patient with a mild to moderate systemic disease process, caused by the condition to be treated surgically or another pathological process, that does not limit the patient's activities in any way, e.g. treated hypertensive, stable diabetic. Patients aged >80 years are automatically placed in class II	0.2
III	A patient with severe systemic disease from any cause that imposes a definite functional limitation on activity, e.g. ischaemic heart disease, chronic obstructive lung disease	1.8
IV	A patient with a severe systemic disease that is a constant threat to life, e.g. unstable angina	7.8
V	A moribund patient unlikely to survive 24 h with or without surgery	9.4

Note: 'E' may be added to signify an emergency operation.

account the type of surgery being undertaken, which leads to a degree of variability between scorers. However, patients placed in higher categories are at increased overall risk of perioperative mortality (Table 1.4).

Multifactorial risk indicators

The leading cause of death after surgery is MI, and significant morbidity results from non-fatal

infarction, particularly in patients with pre-existing heart disease. Attempts have been made to identify factors that will predict those at risk. One system is the Goldman Cardiac Risk Index, used in patients with pre-existing cardiac disease undergoing non-cardiac surgery. Factors in their history, examination, ECG, general status, and type of surgery are awarded points (Table 1.5).

The points total is used to assign patients to a class from I to IV according to their risk of a

Table 1.5 Goldman Cardiac Risk Index.

	Points
<i>History</i>	
Age >70 years	5
Myocardial infarction within 6 months	10
<i>Examination</i>	
Third heart sound (gallop rhythm), raised JVP	11
Significant aortic stenosis	3
<i>ECG</i>	
Rhythm other than sinus, or presence of premature atrial complexes	7
>5 ventricular ectopics per minute	7
<i>General condition</i>	
PaO ₂ <8 kPa or PaCO ₂ >7.5 kPa on air	
K ⁺ <3.0 mmol/L; HCO ₃ ⁻ <20 mmol/L	
Urea >8.5 mmol/L; creatinine >200 mmol/L	
Chronic liver disease	
Bedridden from non-cardiac cause	
<i>For each criterion</i>	3
<i>Operation</i>	
Intraperitoneal, intrathoracic, aortic	3
Emergency surgery	4

JVP, jugular venous pressure.

perioperative cardiac event, namely MI, pulmonary oedema, significant arrhythmia, and death:

- Class I (0–5 points) 1%
- Class II (6–12 points) 5%
- Class III (13–25 points) 16%
- Class IV (≥26 points) 56%

This has been shown to be a more accurate predictor of postoperative morbidity than the ASA classification.

As well as the risks of perioperative complications varying with the type and severity of pre-existing cardiac disease, different operations also carry their own varying levels of inherent risks, for example carpal tunnel decompression carries less risk than a hip replacement, which in turn carries less risk than aortic aneurysm surgery. This is clearly demonstrated in Table 1.6 where overall risk of cardiac complications is calculated based upon the Goldman score and grade of surgery. Basically this can be summarized as ‘the sicker the patient and the bigger the operation, the greater the risk’. Major cardiac complications include MI, cardiogenic pulmonary oedema, ventricular tachycardia, or cardiac death.

Assessing patients as ‘low risk’ is no more of a guarantee that complications will not occur than ‘high risk’ means they will occur; it is only a guideline and indicator of probability. For patients who suffer a complication, the rate is 100%! Ultimately the risk/benefit ratio must be considered for each individual patient. If a patient has a certain predicted risk of complications, an operation with the potential to offer only a small benefit may be deemed not worth the risk, whereas one with the

potential to offer a large benefit may in fact be undertaken. Clearly this is a decision which can only be reached after careful and thorough discussion with a patient who has been given all the relevant information.

Improving preoperative preparation by optimizing the patient’s physical status, adequately resuscitating those who require emergency surgery, monitoring appropriately intraoperatively, and providing suitable postoperative care, in a high dependency unit (HDU) or ICU, has been shown to reduce patients perioperative mortality further.

Classification of operation

Traditionally, surgery was classified as being either elective or emergency. Recognizing that this was too imprecise, the National Confidential Enquiry into Perioperative Outcome and Death (NCEPOD) has identified four categories:

1 Immediate: to save life, limb, or organ. Resuscitation is simultaneous with surgery. The target time to theatre is within minutes of the decision that surgery is necessary, for example major trauma to the abdomen or thorax with uncontrolled haemorrhage, major neurovascular deficit, ruptured aortic aneurysm.

2 Urgent: acute onset or deterioration of a condition that threatens life, limb, or organ. Surgery normally takes place when resuscitation is complete. This category is subdivided into:

- Target time to theatre within 6 h of the decision to operate

Table 1.6 Overall approximate risk (%) of a major cardiac complication based on the type of surgery and the patient’s cardiac risk index.

Grade of surgery	Patient risk index score			
	Class I (0–5 points)	Class II (6–12 points)	Class III (13–25 points)	Class IV (≥26 points)
Minor surgery	0.3	1	3	19
Major non-cardiac surgery, >40 years	1.2	4	12	48
Major non-cardiac surgery, >40 years, significant medical problem requiring consultation before surgery	3	10	30	75

- Target time to theatre within 24 h of the decision to operate.
- 3** Expedited: stable patient requiring early intervention. Condition not an immediate threat to life, limb, or organ. Target time to theatre is within days of the decision to operate.
- 4** Elective: surgery planned and booked in advance of admission to hospital. This category includes all conditions not covered in categories 1–3.

All elective and the majority of expedited cases can be assessed as previously described, but in urgent and emergency cases this will not always be possible. As much information as possible should be obtained about allergies, the patient's medical history, drugs taken regularly, and previous anaesthetics. In the trauma patient, enquire about the mechanism of injury. This may give clues to unsuspected injuries. Details may only be available from relatives and/or the ambulance crew. The cardiovascular and respiratory systems should be examined and an assessment made of any potential difficulty with intubation. Investigations should only be ordered if they would directly affect the conduct of anaesthesia. When life or limb is at stake, there will be even less or no time for assessment. All emergency patients should be assumed to have a full stomach.

Obtaining informed consent

What is consent?

Consent is an agreement by the patient to undergo a specific procedure. Even though the doctor will advise on what is required, it is only the patient who can make the decision to undergo the procedure. Although the need for consent is usually thought of as applying to surgery, it is in fact required for any breach of a patient's personal integrity, including examination, performing investigations, and administering an anaesthetic. Touching a patient without consent may lead to a claim of battery. For a patient to have capacity to give valid consent there are five prerequisites: they must have been given all the information; understand and retain it; believe it; weigh it in the balance; and then communicate their decision. The

decision the patient makes does not have to appear sensible or rational to anybody else. However, every effort must be made to ensure that a highly irrational decision is not the result of a lack of, or misinterpretation of, the information given. It may of course also indicate that the patient is suffering from a mental illness. Determining capacity on these grounds is probably best placed in the hands of the courts.

Refusal of treatment by a competent adult is legally binding, even if refusal is likely to lead to the patient's death (e.g. a Jehovah's Witness refusing a blood transfusion). Although a patient can refuse treatment or choose a less than optimal option, they cannot insist on a treatment that has not been offered.

What about an unconscious patient?

This usually arises in the emergency situation, for example a patient with a severe head injury. Asking a relative or other individual to sign a consent form for surgery on the patient's behalf is not appropriate, as no one can give consent on behalf of another adult. Under these circumstances, medical staff are required to act 'in the patient's best interests'. This will mean taking into account not only the benefits of the proposed treatment, but also personal and social factors. Such information may necessitate a discussion with relatives, and the opportunity should be used to inform them of the proposed treatment and the rationale for it. The basis for any decision and how it is in the patient's best interests must be clearly documented in the patient's notes. Where treatment decisions are complex or not clear-cut, it is advisable, although not a legal requirement, to obtain and document independent medical advice.

What constitutes evidence of consent?

Most patients will be asked to sign a consent form before undergoing a procedure. However, there is no legal requirement for such before anaesthesia or surgery (or anything else). Consent may be given verbally, and this is often the case for anaesthesia; however, it is recommended that a written record

of the content of the conversation be made in the patient's case notes.

What do I have to tell the patient?

Although the anaesthetist is the best judge of the type of anaesthetic for each individual, patients should be given an explanation of the choices, along with the associated risks and benefits. The amount of information will vary depending on the procedure, and should be determined by asking oneself 'what would this patient regard as relevant when coming to a decision about which, if any, of the available options to accept?' Typical information given may be:

- The environment of the anaesthetic room and who they will meet, particularly if medical students or other healthcare professionals in training will be present.
- Establishing IV access and IV infusion.
- The need for, and type of, any invasive monitoring.
- What to expect during the establishment of a regional technique.
- Being conscious throughout surgery if a regional technique alone is used, and what they may hear.
- Preoxygenation.
- Induction of anaesthesia. Although most commonly IV, occasionally it may be by inhalation.
- Where they will 'wake up'. This is usually the recovery unit, but after some surgery it may be the ICU or HDU. In these circumstances, the patient should be given the opportunity to visit the unit a few days before and meet some of the staff.
- Numbness and loss of movement after regional anaesthesia.
- The possibility of drains, catheters, and drips. Patients may misinterpret their presence as indicating unexpected problems.
- The possibility of a need for blood transfusion.
- Postoperative pain control, particularly if it requires their cooperation, for example a patient-controlled analgesia device (PCA; see pages 102–104).
- Information on any substantial risks with serious adverse consequences associated with the anaesthetic technique planned.

- Risks associated with the anaesthetic technique (see above).

Most patients will want to know the latest time that they can eat and drink before surgery, if they should take their medications as normal, and how they will manage without a drink. Some will expect or request a premed and, in these circumstances, the approximate timing, route of administration, and likely effects should be discussed. Finally, before leaving, ask if the patient has any questions or wants anything clarified further.

Having given the patient the information considered relevant to them, they must have sufficient time to think it through and come to a decision. Consequently, the process of informed consent cannot occur solely at the point of admission or, even worse, in the anaesthetic room immediately before surgery! As a result, the process usually starts in the preoperative assessment clinic when information is often given to the patient in the form of a leaflet.

Who should get consent?

From the above it is clear that the individual seeking consent must be able to provide all the necessary information for the patient and be able to answer the patient's questions. This will require the individual to be trained in, and familiar with, the procedure for which consent is sought, and is best done by a senior clinician or the person who is to perform the procedure. Complex problems may require a multidisciplinary approach to obtaining consent.

The issues around consent in children and adults who lack capacity are more complex. Further information is available in the document 'Consent for Anaesthesia' published by the AAGBI (see Useful websites section for more information).

Useful websites

<http://www.aagbi.org/publications/guidelines/docs/preoperativeass01.pdf>

[Preoperative assessment. The role of the anaesthetist. The Association of Anaesthetists of Great Britain and Ireland. November 2001.]

- <http://www.circ.ahajournals.org/cgi/content/full/116/17/1971>
[ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery: Executive Summary]
- <http://www.americanheart.org/downloadable/heart/1142081026765PeriopFinal.pdf>
[ACC/AHA 2006 Guideline Update on Perioperative Cardiovascular Evaluation for Noncardiac Surgery: Focused Update on Perioperative Beta-Blocker Therapy. A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Update the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery)]
- <http://www.nice.org.uk/guidance/index.jsp?action=byID&r=true&o=10920>
[National Institute for Health and Clinical Excellence (NICE) guidance on preoperative tests. June 2003.]
- <http://info.med.yale.edu/intmed/cardio/imaging/contents.html>
[Chest X-ray interpretation.]
- <http://www.ncepod.org.uk/>
[The National Confidential Enquiry into Patient Outcome and Death (NCEPOD).]
- <http://www.dh.gov.uk/en/Publichealth/Scientificdevelopmentgeneticsandbioethics/Consent/index.htm>
[Department of Health (UK) guidance on consent.]
- <http://www.bma.org.uk/ap.nsf/Content/consenttk2>
[BMA consent toolkit, second edition. February 2003.]
- <http://www.aagbi.org/publications/guidelines/docs/consent06.pdf>
[Consent for anesthesia. Revised edition 2006. The Association of Anaesthetists of Great Britain & Ireland]
- <http://www.dca.gov.uk/menincap/legis.htm>
[Mental Capacity Act 2005. Department of Constitutional Affairs.]
- <http://www.youranaesthetic.info/>
- http://www.aagbi.org/pub_patient.html#KNOW
[Patient information guides from the Association of Anaesthetists of Great Britain and Ireland and The Royal College of Anaesthetists.]
- <http://www.pre-op.org/index.html>
[The Preoperative Association]
- All websites last accessed April 2008.*

Self-assessment

- 1.1 Describe three methods of assessing a patient's exercise capacity preoperatively.
- 1.2 Describe what bedside assessments you could use to try and predict difficulty with tracheal intubation.
- 1.3 Describe the health characteristics that define each of the five ASA grades. What ASA grade would you assign to a 67-year-old woman with type II diabetes, hypertension, a BMI of 38 and exercise tolerance of 100 m on the flat, and why?
- 1.4 In the preoperative assessment clinic, what investigations would you do on a 70-year-old woman, with controlled hypertension and COPD from smoking 20 cigarettes per day for 50 years, who is scheduled for a total hip replacement and why?