TEXTBOOK OF SURGERY

FOURTH EDITION

EDITED BY
JULIAN A. SMITH | ANDREW H. KAYE
CHRISTOPHER CHRISTOPHI | WENDY A. BROWN

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Textbook of Surgery

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Preface

Medical students and trainees must possess an understanding of basic surgical principles, a knowledge of specific surgical conditions, be able to perform a few basic procedures and be part of a multidisciplinary team that manages the patient in totality. All students of surgery must also be aware of the rapid developments in basic sciences and technology and understand where these developments impinge on surgical practice.

The *Textbook of Surgery* is intended to supply this information, which is especially relevant given the current content of the surgical curriculum for undergraduates. Each topic is written by an expert in the field from his or her own wisdom and experience. All contributors have been carefully chosen from the Australasian region for their authoritative expertise and personal involvement in undergraduate teaching and postgraduate training.

In this textbook we have approached surgery from a practical viewpoint while emphasising the relevance of basic surgical principles. We have attempted to cover most aspects of general surgery including its subspecialties and selected topics of other surgical specialties, including cardiothoracic surgery, neurosurgery, plastic surgery, ophthalmology, orthopaedic surgery, otolaryngology/head and neck surgery, urology and vascular surgery.

Principles that underlie the assessment, care and treatment of surgical patients are outlined, followed by sections on various surgical disorders. The final section presents a practical problem-solving approach to the diagnosis and management of common surgical conditions. In clinical practice, patients present with symptoms and signs to the surgeon who then has to formulate care plans, using such a problem-solving approach. This textbook provides a good grounding for students in surgical diseases, problems and management. Apart from forming the core curriculum for medical students, surgical trainees will also find the *Textbook of Surgery* beneficial in their studies and their practice.

The fourth edition of the *Textbook of Surgery* includes new or extensively revised chapters on the assessment of surgical risk, the management of surgical wounds, introduction to the operating theatre, emergency general surgery, obesity and bariatric surgery, lower gastrointestinal surgery, endovascular therapies, benign urological conditions, genitourinary oncology, sudden-onset severe headache and the red eye.

With ever-expanding medical knowledge, a core amount of instructive and up-to-date information is presented in a concise fashion. Important leading references of classic publications or up-to-date literature have been provided for further reading. It is our aim that this textbook will stimulate students to refer to appropriate reviews and publications for additional details on specific subjects.

We have presented the textbook in an attractive and easily readable format by extensive use of tables, boxes and illustrations. We hope that this fourth edition will continue to be valuable to undergraduate, graduate and postgraduate students of surgery, and for general practitioners and physicians as a useful summary of contemporary surgery.

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The editors wish to dedicate this edition to two highly esteemed previous editors, the late Joe J. Tjandra and the late Gordon J.A. Clunie. Both were inspirational surgical educators who left an enduring legacy amongst the many students, trainees and colleagues with whom they interacted over many years.

Section 1
Principles of Surgery

1 Preoperative management

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Introduction

This chapter covers care of the patient from the time the patient is considered for surgery through to immediately prior to operation and deals with important generic issues relating to the care of all surgical patients. Whilst individual procedures each have unique aspects to them, a sound working understanding of the common issues involved in preoperative care is critical to good patient outcomes. The important elements of preoperative management are as follows.

- History taking: the present surgical condition and a general medical review.
- Physical examination: the present surgical condition and a general examination.
- Reviewing available diagnostic investigations.
- Ordering further diagnostic and screening investigations.
- Investigating and managing known or discovered medical conditions.
- Obtaining informed consent.
- Scheduling the operation and any special preparations (e.g. equipment required).
- Requesting an anaesthetic review.
- Marking the operative site/side.
- Prescribing any ongoing medications and prophylaxis against surgical site infection and deep venous thrombosis.
- Planning postoperative recovery and possibly rehabilitation.

Informed consent

Although often thought of in a purely medico-legal way, the process of ensuring that a patient is informed about the procedure they are about to undergo is a fundamental part of good-quality patient care. Informed consent is far more than the act of placing a signature on a form. That signature in itself is only meaningful if the patient has been through a reasonable process that has left them in a position to make an informed decision.

There has been much written around issues of informed consent, and the medico-legal climate has changed substantially in the past decade. It is important for any doctor to have an understanding of what is currently understood by informed consent. Although the legal systems in individual jurisdictions may differ with respect to medical negligence, the standards around what constitutes informed consent are very similar.

Until relatively recently, the standard applied to deciding whether the patient was given adequate and appropriate information with which to make a decision was the so-called Bolam test – practitioners are not negligent if they act in accordance with practice accepted by a reasonable body of medical opinion. Recent case law from both Australia and overseas has seen a move away from that position. Although this area is complex, the general opinion is that a doctor has a duty to disclose to a patient any material risks. A risk is said to be material if 'in the circumstances of that particular case, a reasonable person in the patient's position, if warned of the risk would be likely to attach significance to it or the medical practitioner is, or should reasonably be aware that the particular patient, if warned of the risk would attach significance to it'. It is important that this standard relates to what a person in the patient's position would do and not just any reasonable person.

Important factors when considering the kinds of information to disclose to patients include the following.

- The nature of the potential risks: more common and more serious risks require disclosure.
- The nature of the proposed procedure: complex interventions require more information as do procedures when the patient has no symptoms or illness.

Textbook of Surgery, Fourth Edition. Edited by Julian A. Smith, Andrew H. Kaye, Christopher Christophi and Wendy A. Brown.

- The patient's desire for information: patients who ask questions make known their desire for information and they should be told.
- The temperament and health of the patient: anxious patients and patients with health problems or other relevant circumstances that make a risk more important for them may need more information.
- The general surrounding circumstances: the information required for elective procedures might be different from that required in those conducted emergently.

Verbal discussions concerning the therapeutic options, potential benefits and risks along with common complications are often supplemented with procedure-specific patient explanatory brochures. These provide a straightforward illustrated account for the patient and their relatives to consider and may be a source of clarification and/or further questions about the proposed operation.

What does this mean for a medical practitioner? Firstly, you must have an understanding of the legal framework and standards. Secondly, you must document how appropriate information was given to patients – always write it down. If discussion points are not documented, it may be argued that they never occurred. On this point, whilst explanatory brochures can be a very useful addition to the process of informed consent they do not remove the need to undertake open conversations with the patient.

Doctors often see the process of obtaining informed consent as difficult and complex, and this view is leant support by changing standards. However, the principles are relatively clear and not only benefit patients but their doctors as well. A fully informed patient is much more likely to adapt to the demands of a surgical intervention, and should a complication occur, they and their relatives almost invariably accept such misfortune far more readily.

Preoperative assessment

The appropriate assessment of patients prior to surgery to identify coexisting medical problems and to plan perioperative care is of increasing importance. Modern trends towards the increasing use of day-of-surgery admission even for major procedures have increased the need for careful and systematic preoperative assessment, much of which occurs in a pre-admission clinic (PAC).

The goals of preoperative assessment are:

- To identify important medical issues in order to
  - optimise their treatment
  - inform the patient of additional risks associated with surgery
  - ensure care is provided in an appropriate environment.
- To identify important social issues which may have a bearing on the planned procedure and the recovery period.
- To familiarise the patient with the planned procedure and the hospital processes.

Clearly the preoperative evaluation should include a careful history and physical examination, together with structured questions related to the planned procedure. Simple questions related to exercise tolerance (such as 'Can you climb a flight of stairs without being short of breath?') will often yield as much useful information as complex tests of cardiorespiratory reserve. The clinical evaluation will be coupled with a number of blood and radiological tests. There is considerable debate as to the value of many of the routine tests performed, and each hospital will have its own protocol for such evaluations.

Common patient observations, investigations and screening tests prior to surgery include:

- vital signs (blood pressure, pulse rate, respiratory rate, temperature) and pulse oximetry
- body weight
- urinalysis
- full blood examination and platelet count
- urea and electrolytes, blood sugar, tests of liver function
- blood grouping and screen for irregular antibodies ('group and hold')
- tests of coagulation, i.e. international normalised ratio (INR) and activated partial thromboplastin time (APTT)
- chest X-ray
- electrocardiogram (ECG).

On the basis of the outcomes of this preoperative evaluation a number of risk stratification systems have been proposed. One in widespread daily use is the relatively simple ASA (American Society of Anesthesiologists) system (see Chapter 3, Table 3.3).

The preoperative assessment and work-up will be guided by a combination of the nature of the operation proposed and the overall 'fitness' of the patient. Whilst there are a number of ways of looking at the type of surgery proposed, a simple three-way classification has much to commend it.

- **Low risk**: poses minimal physiological stress and risk to the patient, and rarely requires blood transfusion, invasive monitoring or intensive care. Examples of such procedures would be groin hernia repair, cataract surgery and arthroscopy.
- **Medium risk**: moderate physiological stress (fluid shifts, cardiorespiratory effects) and risk.

Usually associated with minimal blood loss. Potential for significant problems must be appreciated. Examples would be laparoscopic cholecystectomy, hysterectomy and hip replacement.

- **High risk**: significant perioperative physiological stress. Often requires blood transfusion or infusion of large fluid volumes. Requires invasive monitoring and will often need intensive care. Examples would be aortic surgery, major gastrointestinal resections and thoracic surgery.

A low-risk patient (ASA I or II) will clearly require a far less intensive work-up than a high-risk patient (ASA III or IV) undergoing a high-risk operation.

Areas of specific relevance to perioperative care are cardiac disease and respiratory disease. It is important that pre-existing cardiorespiratory disease is optimised prior to surgery to minimise the risk of complications. Patients with cardiac disease can be stratified using a number of systems (New York Heart Association Functional Class for angina or heart failure; Goldman or Detsky indices) and this stratification can be used to guide work-up and interventions and provide a guide to prognosis. One of the most important respiratory factors is whether the patient is a smoker. There is now clear evidence that stopping smoking for at least 4 weeks prior to surgery significantly reduces the risk of respiratory specific or generic complications.

Evaluation of the healthy patient

Patients with no clinically detectable systemic illnesses except their surgical problem are classified into ASA class I. Mortality for low-risk surgical procedures in this group is very low and complications are likely to be due to technical errors. The mortality for major high-risk surgical procedures in such patients is also low, of the order of a few per cent.

All such patients require detailed systems review by history and physical examination prior to the operation. Preoperative special tests may be added in order to detect any subclinical disease that may adversely affect surgery and to provide baseline values for comparison in the event of postoperative complications. These tests should be sufficiently sensitive to detect an abnormality, yet specific enough to avoid the chances of over-diagnosis. The prevalence of the disease or condition being looked for is likely to be low in a healthy asymptomatic patient population. Thus, most tests are likely to be within the normal range. Inappropriate and excessive tests increase the likelihood of a false-positive result due to chance. With extensive multiphasic screening profiles of healthy individuals, about 5% of healthy normal people will show one abnormal result.

Evaluation of the elderly asymptomatic patient

Ageing increases the likelihood of asymptomatic conditions and screening investigations are therefore more stringently applied to older, apparently healthy patients. Elderly patients (aged over 70 years) have increased mortality and complication rates for surgical procedures compared with young patients. Problems are related to reduced functional reserve, coexisting cardiac and pulmonary disease, renal impairment, poor tolerance of blood loss and greater sensitivity to analgesics, sedatives and anaesthetic agents.

Complications of atelectasis, myocardial infarction, arrhythmias and heart failure, pulmonary emboli, infection and nutritional and metabolic disorders are all more frequent. Separation of the effects of ageing, frailty and of associated diseases is difficult. Most of the increased mortality and morbidity is due to associated disease.

Special attention needs to be paid to the assessment of cardiac, respiratory, renal and hepatic function along with patient frailty before operation in elderly patients.

Patient safety (see also Chapter 12)

Once in hospital, and particularly once under anaesthetic, patients rely upon the systems and policies of individuals and healthcare institutions to minimise the risk of inadvertent harm. Whilst every hospital will have slightly different policies the fundamental goals of these include the following.

- The correct patient gets the correct operation on the correct side or part of their body. An appropriate method of patient identification and patient marking must be in place. It must be clear to all involved in the procedure, particularly for operations on paired limbs or organs when the incorrect side could be operated upon.
- The patient is protected from harm whilst under anaesthetic. When under a general anaesthetic the patient is vulnerable to a number of risks. Important amongst these are pressure effects on nerves, for example those on the common peroneal nerve as it winds around the head of the fibula.
- Previous medical problems and allergies are identified and acted upon.
- Protocols for the prevention of perioperative infection and venous thromboembolism are followed.

Prophylaxis

Infection

Infections remain a major issue for all surgical procedures and the team caring for the patient needs to be aware of relevant risks and act to minimise such risks.

Before discussing the use of prophylactic antibiotics for the prevention of perioperative infection, it is very important that issues of basic hygiene are discussed (see also Chapters 9 and 12). Simple measures adopted by all those involved in patient care can make a real difference to reducing the risk of hospital-acquired infection. The very widespread and significant problems with antibiotic-resistant organisms such as meticillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Enterococcus faecalis* (VRE) have reinforced the need for such basic measures.

- Wash your hands in between seeing each and every patient.
- Wear gloves for removing/changing dressings.
- Ensure that the hospital environment is as clean as possible.

These measures, especially hand hygiene, should be embedded into the psyche of all those involved in patient care.

In addition to the very important matters of hygiene and appropriate sterile practice, antibiotics should be used in certain circumstances to reduce the risk of perioperative surgical site infection. Each hospital will have individual policies on which particular antibiotics to use in the prophylactic setting (see also Chapters 9 and 12). The antibiotics are usually administered at or shortly before the induction of anaesthesia and continued for no more than 24 hours postoperatively. It is also important to state that whilst the use of prophylactic antibiotics can, when used appropriately, significantly reduce infectious complications, inappropriate or prolonged use can leave the patient susceptible to infection with antibiotic-resistant organisms such as MRSA or VRE.

Factors related to both the patient and the planned procedure govern the appropriate use of antibiotics in the prophylactic setting.

Patient-related factors

Patients with immunosuppression and pre-existing implants and patients at risk for developing infective endocarditis must receive appropriate prophylaxis even when the procedure itself would not indicate their use.

Procedure-related factors

Table 1.1 indicates the risk of postoperative surgical site infections with and without the use of prophylactic antibiotics. In addition to considering the absolute risk of infection, the potential consequences of infection must also be considered; for example, a patient undergoing a vascular graft (a clean procedure) must receive appropriate antibiotic cover because of the catastrophic consequences of graft infection.

Venous thromboembolism

Deep vein thrombosis (DVT) is a not uncommon and potentially catastrophic complication of surgery. The risk for developing DVT ranges from a fraction of 1% to 30% or greater depending on both patient- and procedure-related factors. Both patient- and procedure-related factors can be classified as low, medium or high risk (Table 1.2). High-risk patients undergoing high-risk operations will have a risk for DVT of up to 80% and a

Table 1.1 Risks of postoperative surgical site infection.

		Wound infection rate (%)	
Type of procedure	Definition	Without prophylactic antibiotics	With prophylactic antibiotics
Clean	No contamination; gastrointestinal, genitourinary or respiratory tracts not breached	1–5	0–1
Clean-contaminated	Gastrointestinal or respiratory tract opened but without spillage	10	1–2
Contaminated	Acute inflammation, infected urine, bile, gross spillage from gastrointestinal tract	20–30	10
Dirty	Established infection	40–50	10

Table 1.2 Prevention of deep vein thrombosis.

		Operative risk factors		
		Low (e.g. hernia repair)	Medium (e.g. general abdominal surgery)	High (e.g. pelvic cancer, orthopaedic surgery)
Patient risk factors	Low (age <40, no risk factors)	No prophylaxis	Heparin	Heparin and mechanical devices
	Medium (age >40, one risk factor)	Heparin	Heparin	Heparin and mechanical devices
	High (age >40, multiple risk factors)	Heparin and mechanical devices	Heparin and mechanical devices	Higher-dose heparin, mechanical devices

pulmonary embolism risk of 1–5% when prophylaxis is not used. These risks can be reduced by at least one order of magnitude with appropriate interventions.

Whilst a wide variety of agents have been trialled for the prevention of DVT, there are currently only three widely used methods.

- Graduated compression stockings: these stockings, which must be properly fitted, reduce venous pooling in the lower limbs and prevent venous stagnation.
- Mechanical calf compression devices: these work by intermittent pneumatic calf compression and thereby encourage venous return and reduce venous pooling.
- Heparin: this drug can be used in its conventional unfractionated form or as one of the fractionated low-molecular-weight derivatives. The fractionated low-molecular-weight heparins offer the convenience of once- or twice-daily dosing for the majority of patients. It must however be remembered that the anticoagulant effect of the low-molecular-weight heparins may not easily be reversed, and where such reversal may be important, standard unfractionated heparin should be used.

The three methods are complementary and are often used in combination, depending on the patient and operative risk factors (Table 1.2).

The systematic use of such measures is very important if optimal benefit is to be gained by the potential reduction in DVT.

Preoperative care of the acute surgical patient

A significant number of patients will present with acute conditions requiring urgent or emergency surgical operations. There may be little time for an in-depth preoperative preparation. Whilst the principles already outlined are still valid, a number of additional issues are raised.

Informed consent

Whilst there is still a clear need to ensure that patients are appropriately informed, there are fewer opportunities to discuss the options and potential complications with the patient and their family. In addition, the disease process may have resulted in the patient being confused. The team caring for the patient needs to judge carefully the level of information required in this situation. Although it is very important that family members are kept informed, it has to be remembered that the team's primary duty is towards the patient. This sometimes puts the team in a difficult position when the views of the patient's family differ from those which the team caring for the patient hold. If such an occasion arises then careful discussion and documentation of the decision-making process is vital. Increasingly, patients of very advanced years are admitted acutely with a surgical problem in the setting of significant additional medical problems. It is with this group of patients that specific ethical issues around consent and appropriateness of surgery occur. It is important that as full as possible a picture of the patient's overall health and quality of life is obtained and that a full and frank discussion of the options, risks and benefits takes place.

Preoperative resuscitation

It is important that wherever possible significant fluid deficits and electrolyte abnormalities are corrected prior to surgery. There is often a balance to be made between timely operative intervention and the degree of fluid resuscitation required. An early discussion between surgeon, anaesthetist and, when required, intensivist can help plan the timing of surgical intervention.

Pre-existing medical comorbidities

There is clearly less time to address these issues and it may not be possible to address significant ongoing medical problems. Clearly such comorbidities should be identified, and all involved with planning the operation should be informed. The issues are most acute for significant cardiac, respiratory, hepatic or renal disease.

Preoperative nutrition

An awareness of the nutritional status of patients is important and such awareness should guide the decisions about nutritional support (see Chapter 7). The well-nourished adult patient should be fasted for at least 6 hours prior to anaesthesia to minimise the risk of aspiration. Where possible regular medications, especially those for cardiovascular and respiratory conditions, should be continued.

Before an operation the malnourished patient should, whenever possible, be given appropriate nutritional support. There is no doubt that significant preoperative malnutrition increases the risk of postoperative complications (>10–15% weight loss). If possible, such nutrition should be given enterally, reserving parenteral nutrition for the minority of patients in whom the gastrointestinal tract is not an option. Parenteral nutrition is associated with increased costs and complications and is of proven benefit only in the seriously malnourished patient, when it should be given for at least 10 days prior to surgery for any benefits to be seen. There is increasing evidence that enteral feeds specifically formulated to boost certain immune parameters offer clinical benefits for patients about to undergo major surgery.

After operation any patient who is unable to take in normal diet for 7 days or more should receive nutritional support, which as before operation should use the enteral route whenever possible.

Specific preoperative issues

Allergies

A history of adverse or allergic reactions to medications or other substances must be documented and repeat administration and/or exposure avoided as a life-threatening anaphylaxis may result. Examples of allergens within surgical practice include antibiotics, skin preparations (e.g. iodine), wound dressing adhesives and latex. A complete latex-free environment is required for those patients with a known latex allergy.

Diabetes mellitus

Diabetes mellitus is one of the most frequently seen medical comorbidities that complicate perioperative care. It is clearly important that patients with diabetes mellitus are appropriately worked up for surgery.

In the weeks leading up to elective surgery the management of the diabetes should be reviewed and blood glucose control optimised. Particular attention should be paid to HbA1c levels as an index of diabetic control as well as cardiovascular and renal comorbidities during the preoperative assessment.

Generally, patients with diabetes should be scheduled for surgery first case in the morning. Diet-controlled patients require no special preoperative preparation. For patients taking oral hypoglycaemic drugs, the drugs should be stopped the night before surgery and the blood glucose monitored. Patients with insulin-dependent diabetes should receive a reduced dose of insulin and/or a shorter-acting insulin or be commenced on an intravenous insulin infusion. There are two approaches to this.

- Variable-rate insulin infusion: the patient's blood glucose levels are monitored regularly and the rate of insulin infusion adjusted. An infusion of dextrose is continued throughout the period of insulin infusion.
- Single infusion of glucose, insulin and potassium (GIK): whilst this method has the advantage of simplicity, it is not possible to adjust the rates of glucose and insulin infusion separately and the technique can lead to the administration of excessive amounts of free water.

The variable-rate infusion is the most widespread approach and although more involved in terms of monitoring offers better glycaemic control. This in itself is associated with better patient outcomes.

Cardiac disease

Surgical risk is increased in the presence of cardiac disease. Consideration must be given to balancing the risk to the patient if the procedure is abandoned or delayed with the additional risk caused by the presence of cardiac disease. Emergency operations for life-threatening conditions should proceed regardless but elective surgery should be deferred in the presence of recent-onset angina, unstable angina, recent myocardial infarction, severe aortic valve stenosis, high-degree atrioventricular block, severe hypertension and untreated congestive cardiac failure. Time should be spent investigating the condition and optimising therapy, frequently with

cardiological assistance. The introduction of beta-blocker therapy to slow heart rate and occasionally myocardial revascularisation (by percutaneous coronary intervention or coronary artery bypass grafting) may be required in advance of surgery on another system.

Anticoagulant or antiplatelet therapy

Patients on warfarin should be transferred to heparin or enoxaparin well in advance of surgery to ensure that the warfarin effect has worn off. Heparin can be ceased for a short time in the perioperative period: withhold an infusion 4 hours before surgery and recommence once the risk of postoperative bleeding is low. Subcutaneously administered heparin or enoxaparin is withheld the day or evening before surgery and recommenced later that day or the day after. Warfarin recommences once the patient can take oral medication. Rapid reversal of warfarin prior to an emergency operation may be achieved with vitamin K, pooled fresh frozen plasma or clotting factors.

The new oral anticoagulants (dabigatran, apixaban or rivaroxaban) are difficult to reverse acutely and need to be ceased 2–5 days preoperatively. A specific dabigatran reversal agent has recently become available. A bridging regimen such as that described above is also required.

The antiplatelet agents (aspirin, clopidogrel or ticagrelor) taken alone or in combination should be ceased at least 5 days prior to an operation. Bleeding will be highly problematic at the time of surgery especially if multiple antiplatelet agents are continued. Combined usage often follows coronary artery stenting and so their withdrawal in the context of surgery should be discussed with the treating interventional cardiologist. Elective surgery may need to be postponed if dual antiplatelet therapy cannot be safely ceased.

Active smoking and respiratory disease

All active smokers should be encouraged to cease for at least 4 weeks in advance of elective surgery in order to lessen the risk of respiratory problems (atelectasis, acute pneumonia and respiratory failure) in the postoperative period. Patients unwilling or incapable of stopping smoking should be referred to a dedicated support service to assist with such.

Patients with chronic obstructive pulmonary disease (COPD), asthma and obstructive sleep apnoea require a detailed respiratory assessment (including peak flow, spirometry and arterial blood gas estimation) especially if the patient reports significant exercise limitation. Elective surgery should be deferred in the presence of an active respiratory infection or an acute exacerbation of asthma or COPD.

Additional respiratory preparation may include chest physiotherapy, postural drainage, antibiotics for an acute infection with a positive sputum culture and inhaled bronchodilators or corticosteroid therapy. A formal preoperative pulmonary rehabilitation program may be indicated. Regional anaesthesia is frequently preferred in patients with severe respiratory dysfunction.

Long-term corticosteroid therapy

Long-term corticosteroid therapy results in adrenal suppression and an impaired response to surgical stress. High-dose intravenous hydrocortisone administration (100 or 250 mg every 6 hours) will be required during the perioperative period and when the patient is unable to take their regular medication or in the presence of postoperative complications especially infection.

Cerebrovascular disease

Stroke may complicate major surgery especially in elderly patients with severe intracranial or extracranial atherosclerotic disease faced with fluctuations in blood pressure or cerebral blood flow. An asymptomatic carotid bruit related to an internal carotid artery stenosis confirmed with Doppler ultrasonography may be the first indicator of such disease. Patients with symptomatic carotid disease (e.g. transient ischaemic attacks) should undergo carotid endarterectomy prior to the planned surgery. However, there is no evidence that a prophylactic carotid endarterectomy is of benefit in the asymptomatic patient.

Chronic liver disease and obstructive jaundice

Chronic liver disease of any cause may predispose the patient to surgical complications such as poor wound healing, sepsis, excessive bleeding, renal impairment and acute delirium. Each of the previously discussed screening investigations will be required in addition to specific liver and biliary tree imaging and possibly liver biopsy. The decision to operate on a patient with severe liver insufficiency must be carefully considered. Elective surgery should be deferred whilst liver function is optimised. Emergency surgery can often result in acute liver decompensation especially in the presence of sepsis, haemorrhage, electrolyte disturbances, hypoxia and hypoglycaemia.

Patients with obstructive jaundice (see Chapter 67) frequently have an abnormal coagulation profile and require vitamin K, coagulation factors or pooled fresh frozen plasma to correct the defect. Close attention needs to be paid to the patient's fluid and electrolyte status in order to prevent acute renal failure. The hepatic clearance of some commonly administered medications may be impaired.

Chronic kidney disease

All patients aged over 40 years should have their kidney function evaluated (urinalysis, serum creatinine, estimated glomerular filtration rate and serum albumin) when major surgery is planned. Documented chronic kidney disease does not mandate deferral of elective surgery. Patients with chronic kidney disease may experience an acute deterioration in kidney function if they become water or saline depleted. Acute kidney failure is the most significant complication of chronic kidney disease: prevention demands strict attention to fluid and electrolyte balance (especially avoiding dehydration and maintaining a stable level of serum potassium), maintaining kidney perfusion and accurate replacement of blood loss during surgery. Apart from acute kidney failure, the main complications of surgery in patients with chronic kidney disease are sepsis (including urinary tract infection), poor wound healing and cardiovascular complications (myocardial infarction and stroke).

Anaemia

As a general rule mild anaemia does not increase the risk of surgery. However, if time permits the cause of the anaemia should be identified before elective surgery. Iron deficiency anaemia is best detected early and treated by oral or intravenous iron. Patients with the anaemia of renal injury are an exception to the general rule and can cope with quite low haemoglobin levels, due to an increase in red cell 2,3-diphosphoglycerate (2,3-DPG) that promotes better transfer of oxygen at the tissue level. However, in all patients the combination of any degree of anaemia with decompensated cardiovascular disease (e.g. angina or obstructive airways disease) warns that intensive perioperative care will be necessary.

Preoperative haemoglobin measurement should be performed as a routine examination in all patients. Patients may have significant anaemia but no symptoms if the anaemia has developed slowly over a period of months and the body has compensated for the decreased oxygen-carrying capacity through such physiological mechanisms as increased cardiac output. The signs and symptoms of anaemia vary with its severity and are more marked if the anaemia has developed over a short period. Symptoms of weakness and tiredness, breathlessness, palpitations and angina can occur with moderate or severe anaemia. Pallor is the outstanding physical sign. Pallor of the conjunctiva and the palmar creases becomes apparent when the haemoglobin level falls below 10 g/dL. Tachycardia and cardiac failure may accompany severe anaemia. Patients with significant or symptomatic anaemia should be evaluated by a specialist physician or haematologist, frequently in a dedicated anaemia clinic.

In the surgical patient, it is often possible to institute iron therapy prior to admission to hospital. Anaemia is thus always best diagnosed and its cause determined during the first office consultation in patients needing elective surgery. For iron deficiency anaemia caused by blood loss, oral iron therapy begins immediately so that anaemia can be safely corrected prior to surgery. Patients with moderate iron deficiency or haemolytic anaemias do not pose an excessive risk provided the haemoglobin level and the blood volume are adequate (>10 g/dL) and cardiorespiratory function is normal.

In patients with megaloblastic anaemia surgery should be deferred, if possible, until specific therapy such as vitamin B_{12} or folic acid has repaired the generalised tissue defect. In these cases, transfusion alone may not render surgery safe, as protein metabolism of all cells is affected by the vitamin deficiency that causes the macrocytic anaemia. Adequate tissue levels can be achieved with 1–2 weeks of oral treatment with vitamin B_{12} or folic acid or both.

If it is not possible to correct the anaemia in a timely manner, the patient may be given concentrated red cells prior to surgery. A period of 3 days should be allowed to elapse before operation as the transfused blood will not reach its maximum oxygen-carrying capacity until at least 2 days following transfusion. This period allows the transfused red cells to accumulate normal levels of 2,3-DPG, necessary for efficient delivery of oxygen to the tissues, and allows plasma dispersal restoring normovolaemia. Elective surgery should seldom be undertaken when the haemoglobin concentration is less than 9–10 g/dL. Patients with long-standing anaemia are able to tolerate a reduced level of haemoglobin better than those who have become acutely anaemic. This tolerance in chronic anaemia is a result of altered 2,3-DPG concentration in the red cells, with a favourable shift in the oxyhaemoglobin dissociation curve to the right.

Psychological preparation and mental illness

All surgical patients must be in a relaxed state of mind irrespective of the nature of the procedure they are about to undergo. Anxiety and a fear of the unknown or of the potential complications of surgery are common, especially in the context of life-threatening illnesses or procedures. Reassurance can be achieved by empathetic surgeon communication with the patient and their relatives and, in certain instances, by the provision of specialised input from other healthcare professionals such as support nurses or psychologists.

Patients with pre-existing mental illness such as anxiety, depression, psychoses, substance abuse or dementia who are preparing for an operation require guidance from their treating healthcare professionals such that their condition is optimally managed in the perioperative period. The stress of surgery may worsen or unmask any pre-existing mental condition. Care must be taken in the prescription of analgesics, anxiolytics, sedatives, antidepressant and antipsychotic medications in these patients.

Further reading

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MCQs

Select the single correct answer to each question. The correct answers can be found in the Answers section at the end of the book.

1 Without the use of prophylaxis the risk of deep calf vein thrombosis in a patient undergoing an anterior resection for rectal cancer is likely to be at least:
- **a** 10%
- **b** 20%
- **c** 30%
- **d** 50%

2 Which of the following measures is most likely to reduce the risk of postoperative wound infection with MRSA?
- **a** 5 days of broad-spectrum prophylactic antibiotics
- **b** ensuring the patient showers with chlorhexidine wash prior to surgery
- **c** a policy of staff hand washing between patients
- **d** screening patients for MRSA carriage prior to surgery

3 Which of the following constitutes the legal standard for the information that should be passed to a patient to meet the requirements of 'informed consent'?
- **a** what a patient in that position would regard as reasonable
- **b** what a reasoned body of medical opinion holds as reasonable
- **c** a list of all possible complications contained within a patient explanatory brochure
- **d** all serious complications that occur in more than 1% of patients

2 Assessment of surgical risk

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Introduction

This chapter reviews the assessment of risk for patients being considered for surgery or other invasive interventions.

Surgical risk

The definition of surgical risk is complex and differs depending on the point of view of the assessor. The risks of a particular surgical procedure may have a different value when considered by the surgeon, anaesthetist, intensivist, patient or family member.

What a surgeon may consider to be a small complication may be devastating to a patient depending on their personal circumstances. For example, a very rare risk of a unilateral recurrent laryngeal nerve injury leading to vocal cord palsy is well tolerated by the majority of patients but is a disaster for a professional singer. From a patient's perspective surgical risk encompasses the mortality and morbidity relevant to their circumstances as well as the chance of successfully achieving the desired outcome.

The General Medical Council (GMC) of the UK defines the risk of a proposed investigation or treatment using three criteria as well as the potential outcome of taking no action (Box 2.1). This is an integral component of the consent process required for each intervention or surgical procedure and allows the patient and clinician to make a consensual decision after considering the benefits of a procedure balanced against the associated risks. However, there may be a number of treatment options for each surgical pathology so the assessment of surgical risk also facilitates surgical decision-making.

For most surgical procedures the benefits of performing surgery far outweigh the risks and the decision is easier, but for complex surgical procedures the risks may outweigh any benefit. As outlined by the General Medical Council document the risks of not performing surgery also need to be considered. Another important aspect is the likely outcome from surgery. For example, most patients with adenocarcinoma of the head of the pancreas are not suitable for surgical management due to the presence of metastatic disease or involvement of the major adjacent blood vessels. After appropriate preoperative staging only 5–10% of patients are suitable for surgery. Resection of the pancreatic head (pancreaticoduodenectomy or Whipple's procedure) had a mortality of 50% in the 1950s, whereas in 2018 the reported mortality in specialist centres was 0.0–6.0%. Furthermore, operative morbidity is close to 50%. Despite the high morbidity and mortality, the median survival for those patients undergoing successful resection is only 14–24 months even in high-volume centres. Clearly any patient being considered for surgery needs also to understand the likelihood of successful treatment and to be able to balance this against their own personal circumstances as well as the likelihood of morbidity and mortality.

Another reason to assess surgical risk is identification of high-risk patients who may benefit from risk reduction measures such as preoperative and intraoperative optimisation as well as postoperative management in intensive care or high-dependency units.

Assessment of surgical risk

There are three components to assessment of surgical risk. The first is the associated mortality and morbidity of all surgical procedures. This can be

Textbook of Surgery, Fourth Edition. Edited by Julian A. Smith, Andrew H. Kaye, Christopher Christophi and Wendy A. Brown.

Box 2.1 GMC-UK definition of risk of investigation/treatment

1 Side effects
2 Complications
3 Failure of an intervention to achieve the desired outcome
4 The potential outcome of taking no action

Source: https://www.gmc-uk.org/ethical-guidance/ethical-guidance-for-doctors/consent/part-2-making-decisions-about-investigations-and-treatment#paragraph-28

obtained from multiple data sources that include personal audit, hospital audit, regional health data or specialty group audits. Furthermore, there is extensive published data available detailing the mortality and morbidity of surgical procedures or interventions, although this is often reflective of leading high-volume centres. Therefore, publications that report pooled data from all possible sources may offer a clearer representation of surgical risks. A brief overview of surgical risk is outlined in Table 2.1.

The next two components of surgical risk assessment involve both subjective and objective parameters. Subjective assessment includes information taken from the history and examination of a patient as well as recognition of patterns, clinical experience and intuition of the assessor. Often the experience of the assessor in surgical practice may be pivotal in identifying those patients at greater risk. Objective risk assessment includes biochemical and haematological testing as well as assessment of physiological function, particularly cardiac and respiratory function. Assessment of comorbidities also plays a role. There are also many risk prediction models and scoring systems available that can be general or surgery specific.

Discussing the risks of surgery

The General Medical Council of the UK has published guidance on the consent process and in particular on the discussion of the side effects, complications and other risks of surgery or interventions. It details the need for clear, accurate information about the risks of a proposed procedure being presented in a way that the patient understands to enable them to make an informed decision. It is important to understand the patient's views and preferences as well as the adverse outcomes that they are most concerned about. It is impossible to cover every possible side effect or adverse outcome for each procedure but discussion of the common adverse outcomes whether severe or less serious is required as well as any possible serious adverse outcomes.

There are a number of resources available to aid in the discussion, such as procedure-specific information pamphlets produced at a hospital level, surgical regulatory authorities or government agencies.

Risk scoring systems

Many tools have been developed to estimate both mortality and morbidity rates for individual patients prior to a surgical procedure or intervention. Most are scoring systems that estimate risk for all patients whilst others are specific for high-risk patients or particular surgical procedures or disciplines. Like all tools they only provide an estimated risk and none are perfect. Most incorporate both physiological and comorbid data selected from large databases of patients. These have then been analysed with regression techniques to identify the key variables. Often a weighting is added to each of the variables. Ideally these scoring systems should be validated in multiple other centres to analyse their usefulness for particular patient groups.

ASA

One of the first scoring systems developed was by the American Society of Anesthesiologists (ASA) in 1963. It was a five-point classification system for assessment of a patient prior to surgery. It was

Table 2.1 Overview of the morbidity and mortality of common surgical procedures.

Surgical procedure	Morbidity (%)	Mortality (%)
Inguinal hernia repair	8–32	0–0.5
Appendicectomy	3.0–28.7	0.9–2.8
Laparoscopic cholecystectomy	14.7–21.4	0.3
Pancreaticoduodenectomy	20–54	0–6.0
Oesophagectomy	25–45	0.7–10.0
Coronary artery bypass grafting	30	1.5–2.5