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MASTER MEDICINE

# Surgery 1
# 外科学 1

A core text with self-assessment covering general surgery, urology, cardiothoracic surgery, vascular surgery, plastic surgery and neurosurgery

EDITED BY
MICHAEL LAVELLE-JONES

北京大学医学出版社

英文影印版

# 外科学

# Surgery 1

## A core text with self-assesment, covering general surgery, urology, cardiothoracic surgery, vascular surgery, plastic surgery and neurosurgery

*Edited by*

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# Contents

# Using this book

## Philosophy of the book

How much do you know about gallstones? Do you know the right things? Can you answer exam questions on breast cancer? This book aims to help you with these and other similar questions.

In this book essential information is presented in a concise and ordered fashion. Principles are illustrated and mechanisms explained rather than simply giving you lots of facts to memorise. This book does not aim to offer a complete 'syllabus'. It is impossible to draw boundaries around medical knowledge and learning – this is really a continuous process carried out throughout your medical career. With this in mind, you should aim to develop the ability to discern knowledge that *must* be understood, from areas that you *need to know about*, and topics which you should simply *be aware of*. The aims of this introductory chapter are:

1. to help plan your learning
2. to show you how to use this book to increase your understanding as well as your knowledge
3. to realise how self-assessment can make learning easier and more enjoyable.

## Layout and contents

The main part of the text describes important topics in major subject areas. Within each chapter, essential information is presented in a set order with explanations and logical 'links' between topics. Where relevant, key facts about basic sciences/anatomy are outlined. The aetiology, pathological features, clinical features, differential diagnosis and an approach to investigation are then described. Finally, the principles of management and the prognosis are presented. It is recognised that at the level of an undergraduate or newly qualified doctor a detailed understanding is not required; instead the ability to set out principles is all that is expected.

You need to be sure that you are reaching the required standards, so the final section of each chapter is there to help you to check out your knowledge and understanding. The self-assessment is in the form of multiple choice questions, patient management problems, case histories, data interpretation, extended matching item (EMI) questions, viva questions and sample stations that might be included in objective structured clinical examinations (OSCEs). All of these are centred around common clinical problems that are important in judging your performance as a doctor. Detailed answers are given. These answers will also contain some information and explanations that you will not find elsewhere, so *you have to do the assessment to get the most out of this book.*

### *How to use this book*

I expect you are using this book as part of your exam preparations. Your first task is to map out on a sheet of paper a series of three lists dividing the major subjects (corresponding to the chapter headings) into an assessment of your strong, reasonable and weak areas. This gives you a rough outline of your revision schedule, which you must then fit in with the time available. Clearly, if your exams are looming large you will have to be ruthless in the time allocated to your strong areas. The major subjects should be further classified into individual topics. Encouragement to store information and to test your ongoing improvement is by the use of the self-assessment sections – you must not just read passively. It is important to keep checking your current level of knowledge, both strengths and weaknesses. This should be assessed objectively – self-rating in the absence of testing can be misleading. You may consider yourself strong in a particular area whereas it is more a reflection on how much you enjoy and are stimulated by the subject. Conversely, you may be stronger in a subject than you would expect simply because the topic does not appeal to you.

It is a good idea to discuss topics and problems with colleagues/friends; the areas which you understand least well will soon become apparent when you try to explain them to someone else.

## Approaching the examinations

The discipline of learning is closely linked to preparation for examinations. Many of us opt for a process of superficial learning that is directed towards retention of facts and recall under exam conditions because full understanding is often not required. It is much better if you try to acquire a deeper knowledge and understanding, combining the necessity of passing exams with longer term needs.

First, you need to know how you will be examined. Does the examination involve clinical assessment such as history taking and clinical examination? If you are sitting a written examination what are the length and types of questions? How many must you answer and how much choice will you have?

Now you have to choose what sources you are going to use for your learning and revision. Textbooks come in different forms. At one extreme, there is the large reference book. This type of book should be avoided at this stage of revision and only used (if at all) for reference, when answers to questions cannot be found in smaller books. At the other end of the spectrum is the condensed 'lecture note' format, which often relies heavily on lists. Facts of this nature on their own are difficult to remember if they are not supported by understanding. In the middle of the range are the medium-sized textbooks. These are often of the most use whether you are approaching final University examinations or the first part of professional examinations. My advice is to choose one of the several medium-sized books on offer on the basis of which you find the most readable. The best approach is to combine your lecture notes, textbooks (appropriate to the level of study) and past examination papers as a framework for your preparation.

Armed with information about the format of the exams, a rough syllabus, your own lecture notes and some books that you feel comfortable in using, your next step is to map out the time available for preparation. You must be realistic, allow time for breaks and work *steadily*, not cramming. If you do attempt to cram, you have to realise that only a certain amount of information can be retained in your short-term memory, so as the classification of jaundice moves in, the treatment of acute pancreatitis moves out! Cramming simply retains facts. If the examination requires understanding you will be in trouble.

It is often a good idea to begin by outlining the topics to be covered and then attempting to summarise your knowledge about each in note form. In this way your existing knowledge will be activated and any gaps will become apparent. Self-assessment also helps determine the time to be allocated to each subject for exam preparation. If you are consistently scoring excellent marks in a particular subject it is not cost effective to spend a lot of time trying to achieve the 'perfect' mark.

In an essay, it is many times easier to obtain the first mark (try writing your name) than the last. You should also try to decide on the amount of time assigned to each subject based on the likelihood of it appearing in the exam! Commonest things are usually commonest!

## The main types of examination

### *Multiple choice questions*

Unless very sophisticated, multiple choice questions test your recall of information. The aim is to gain the maximum marks from the knowledge that you can remember. The stem statement must be read with great care highlighting the 'little' words such as *only, rarely, usually, never* and *always*. Overlooking negatives, such as *not, unusual* and *unsuccessful* often causes marks to be lost. *May occur* has an entirely different connotation to *characteristic*. The latter may mean a feature which should be there and the absence of which would make you question the correctness of the diagnosis.

Remember to check the marking method before starting. Most multiple choice papers employ a negative system in which marks are lost for incorrect answers. The temptation is to adopt a cautious approach, answering a relatively small number of questions. However, this can lead to problems, as we all make simple mistakes or even disagree vehemently with the answer in the computer! Caution may lead you to answer too few questions to obtain a pass after the marks have been deducted for incorrect answers.

### *Short notes*

Short notes are not negatively marked. Predetermined marks are given for each important key fact. Nothing is gained for style or superfluous information. The aim is to set out your knowledge in an ordered *concise* manner. Do not devote too much time to a single question thereby neglecting the rest, and remember to limit your answer to the question that has been set.

### *Essays*

Similar comments apply to essays, but marks may be awarded for logical development of an argument or theme. Conversely, good marks will not be obtained for an essay that is a set of unconnected statements. Always plan your essay answer. Length matters little if there is no cohesion. It is even more important in an examination based on essays to manage your time carefully. *All* questions must be given equal weight. A brilliant answer in one essay will not compensate for not attempting another because time runs out.

### *Data interpretation*

Data interpretation involves the application of knowledge to solve a problem. In your revision you should

aim for an understanding of principles; it is impossible to memorise all the different data combinations. In an exam, a helpful approach is to translate numbers into a description; for example, a serum potassium of 2.8 mmol/litre is *low* and the ECG tracing of a heart rate of 120/min shows a *tachy*cardia. This type of question is usually not negatively marked so put down an answer even if you are far from sure that it is right.

### *Extended matching item questions (EMIs)*

In this second edition, we have included examples of extended matching item questions (EMIs) as these are becoming increasingly common in undergraduate and postgraduate examinations. They consist of a theme (e.g. abdominal pain), a series of options and then a question (e.g. 'For each patient, select from the list of options, the most likely diagnosis.'). You then have to read each patient vignette and decide which is the most likely cause. EMIs test your ability to recall knowledge and apply it to a clinical problem. EMIs seem to separate out those students who can use their knowledge from those who have simply learned facts by route.

### *Constructed response questions (CRQs)*

A more sophisticated form of examination question is an evolving case history with information being presented sequentially; you are asked to give a response at each stage. Constructed response questions (CRQs) are structured so that a wrong response in the first part of the question still means that you can obtain marks from the subsequent parts of the question. These questions, usually based on patient management problems, are designed to test recall and application of knowledge through an understanding of the principles involved.

### *Objective structured clinical examinations (OSCEs)*

Although clinical examinations are not the main focus of this book, some examples of objective structured clinical examination (OSCE) questions have been included. By using a predetermined structured marking regime, an OSCE aims to standardize what you are asked and the way that you are marked. In practice, you may be asked to undertake part of a physical examination (e.g. inspection of a limb for signs of ischaemia) or, you may be asked to interpret an X-ray. In either case, the examiner, for example, will ask you a preset series of questions aiming to eliminate 'bias' between candidates and to provide a fairer examination.

### *Vivas*

The viva examination can be a nerve-racking experience. You are normally faced with two examiners who may react with irritation, boredom or indifference to what you say. You may feel that the viva has gone well and yet you fail, or more commonly, you think that the exam has gone terribly simply because of the apparent attitude of the examiners.

Your main aim during the viva should be to control the examiners' questioning so they constantly ask you about things you know. Despite what is often said, you can prepare for this form of exam. Questions are liable to take one of a small number of forms centred around subjects that cannot be examined in a traditional clinical exam.

During the viva there are certain techniques which help in making a favourable impression. When discussing patient management, it is better to say 'I would do this' rather than 'the book says this'. You should try and strike a balance between saying too little and too much. It is important to try not to go off the topic. Aim to keep your answers short and to the point. It is worthwhile pausing for a few seconds to collect your thoughts before launching into an answer. Do not be afraid to say 'I don't know'; most examiners will want to change tack to see what you do know about.

## Conclusions

You should amend the framework for using this book according to your own needs and the examinations you are facing. Whatever approach you adopt your aim should be for an understanding of the principles involved rather than rote learning of a large number of poorly connected facts.

# 1 Surgical principles



## CHAPTER OVERVIEW

This chapter outlines the principles of management that are common to all patients requiring surgical intervention. Surgical disease and its treatment cannot be considered in isolation. Take account of any coexisting medical conditions or previous surgical intervention which may affect the patient's management. Many surgical procedures disturb the gastrointestinal tract and all patients undergoing general anaesthesia will require a period of starvation. A thorough understanding of the theory and practice of fluid balance is essential. Most surgical procedures will cause pain and effective postoperative pain management is vital and assists recovery during the postoperative period. Although most patients will recover uneventfully after surgery a few will develop complications which may range from a minor wound infection to a life-threatening pulmonary embolus. The management of postoperative complications that are common to all surgical procedures is also described.

## 1.1 Pre- and postoperative management

### Learning objectives

You should:

- be able to recognise any risk factors in patients undergoing surgery and instigate a management plan
- understand the principles and importance of careful fluid balance in surgical patients
- be able to choose an analgesic of appropriate strength and route of delivery according to a patient's needs.

### Preoperative preparation

**History and physical examination**

A thorough history and physical examination are the key initial steps in the preoperative work-up of any surgical patient. Although the presenting complaint is of prime importance, any previous medical or surgical history, drug history or allergies must be sought as they may influence the choice of operation, anaesthetic or perioperative care.

**Laboratory investigations**

Biochemical and haematological screening are important in all patients undergoing major surgery and in older patients undergoing minor surgery. These tests can detect an unsuspected metabolic abnormality or anaemia that would require investigation and correction prior to surgery.

**Diagnostic radiology**

Many patients will have undergone diagnostic radiology prior to surgery and often prior to hospital admission. These films must be available and have been reviewed prior to operation.

**Preoperative chest X-ray and ECG**

Patients over 50 years of age and younger patients with respiratory or cardiovascular abnormalities detected on history and examination should have a preoperative chest X-ray and/or ECG.

**Blood cross-match**

Blood samples either for grouping and serum saving or for cross-matching should be taken according to the magnitude of the intended operation.

**Informed consent**

Obtaining consent should not be delegated to the most junior member of the surgical team. Instead, a careful,

logical explanation of the planned operation and any alternatives should be given to the patient, preferably by the surgeon who is to perform the operation.

## Medical problems in surgical patients

Many medical disorders can influence the management of the surgical patient. The three most commonly encountered groups of problems are:

- respiratory disease
- cardiovascular disease
- diabetes mellitus.

### *Respiratory disease*

**Upper respiratory tract infection**
Any patient with evidence of an upper respiratory tract infection should have *elective* surgery postponed until the infection has cleared. Although most of these infections are viral in origin, manipulation of the airway during induction and maintenance of anaesthesia render these patients prone to a serious secondary bacterial respiratory tract infection in the postoperative period.

**Chronic obstructive airways disease and asthma**
Patients known preoperatively to have chronic pulmonary disease must stop smoking 1–2 weeks prior to surgery and should be admitted in advance of their operation to enable the following measures to be undertaken:

- full evaluation of respiratory system: both pulmonary function testing and arterial blood gases
- preoperative physiotherapy
- sputum culture and treatment of any infection
- anaethestic consultation: regional anaesthesia (spinal or epidural) may be more appropriate than general anaesthesia in certain cases.

### *Cardiovascular disease*

Patients with cardiovascular disease are at risk during surgery and in the immediate postoperative period, when fluctuations in blood pressure and fluid balance can compromise a limited cardiac reserve. The decision to operate in this group of patients is a balance of risks which requires close cooperation between surgeon, cardiologist and anaesthetist.

**Myocardial infarction and angina**
The risks of reinfarction are minimised if surgery can be delayed until at least 6 months after a previous myocardial infarction. Patients with angina should be symptomatically well controlled before undergoing surgery.

**Hypertension**
Medical therapy and control should be optimised before surgery.

**Congestive heart failure**
Surgery is likely to aggravate heart failure in these patients when they lie flat on the operating table, particularly if intravenous fluid therapy is needed. Diuretic therapy and cardiac inotropic support should be optimised prior to surgery.

**Valvular heart disease**
These patients require special precautions to prevent fluid overload as their cardiac reserve may be limited. Many patients will be taking long-term anticoagulation therapy, which will need to be temporarily withdrawn or reduced, and the patient will need to be closely monitored to allow surgery to be undertaken without risk of major bleeding. Antibiotic prophylaxis is essential to prevent endocarditis.

### *Diabetes mellitus*

Glucose, potassium ($K^+$) and insulin (GKI) continuous infusion regimens have revolutionised the management of diabetic patients undergoing surgery. The amount of insulin added to the 10% dextrose (glucose) solution is varied depending upon the patient's blood sugar level, which is regularly monitored. An insulin-induced hypokalaemia is prevented by continuous potassium supplementation.

This regimen is established on the morning of surgery for insulin-dependent diabetics and also for those non-insulin-dependent diabetics who usually use oral hypoglycaemic agents. It is continued until patients resume their normal diet after surgery. Special measures are rarely required for diabetics who are normally adequately controlled by dietary measures alone.

## Fluid balance and nutrition

Surgery profoundly affects the whole body balance and distribution of fluids and electrolytes. The principles of fluid management in the surgical patient depend upon an understanding of the baseline daily fluid requirements plus a knowledge of the effects of surgical procedures and disease on normal metabolism.

**Fluid and electrolyte balance in the surgical patient**
The three most important components are water, sodium and potassium. The normal water and electrolyte turnover in a healthy individual is summarised in Table 1. Fluid and electrolyte therapy depends upon:

- maintenance of daily requirements

- replacement of ongoing fluid losses
- replacement of long-standing fluid deficits.

**Maintenance of daily requirements**

A healthy 70 kg person needs 2500 ml water plus 100 mmol sodium plus 40 mmol potassium each day. This is equivalent to 2 l of 5% dextrose with 40 mmol added potassium plus 500 ml 0.9% (normal) saline solution. This fluid regimen will maintain the baseline fluid requirements in most patients.

**Replacement of ongoing losses**

A daily fluid balance chart has a central role to play in managing each patient's fluid requirements. It is especially important to record fluid losses from:

- nasogastric aspiration
- vomit
- stoma output
- fistula output
- drain output
- urine output.

These volumes should be considered together with the daily urine, stool and insensible losses (see Table 1) and should be replaced volume for volume in the following 24 hours with either normal saline or a balanced salt solution (Ringer's solution or Hartmann's solution).

*Insensible losses.* If a patient is febrile, excess water will be lost through sweating and evaporation and this should be replaced with an extra 500 ml of 5% dextrose solution.

**Replacement of long-standing fluid deficits**

This is a difficult concept to grasp. In patients who, for example, have had a long-standing bowel obstruction or who have had severe burns, large volumes of fluid will be sequestered either in the intestinal lumen or in the interstitial fluid. This fluid, which has been 'lost' from the circulation and from the intracellular and extracellular fluid spaces, can amount to several litres and if replaced too rapidly would overexpand the circulating plasma volume causing heart failure and gross oedema.

Complex formulae exist that help estimate these losses, which should be replaced slowly over a period of days. As a general rule, not more than one half of the long-standing fluid deficit should be replaced in any 24-hour period.

**Surgical nutrition**

A good nutritional status is vital to ensure repair and healing after surgery. Wherever possible, elective surgery should be postponed until nutritional deficiencies have been corrected.

The key factors that determine a patient's nutritional status are:

- dietary history
- weight loss (>5 kg is significant)
- anthropomorphic measurements of muscle and fat stores
- serum albumin level.

The optimum diet includes an adequate number of calories, protein, fat, minerals and vitamins to meet the energy and growth and repair demands of daily activities. These requirements are summarised in Table 2. Calories and nitrogen should be given simultaneously to achieve a positive nitrogen balance (a net synthesis of protein). The optimum ratio is 150 kcal for every gram of nitrogen. At least one half of the calories must be given as glucose (in order to stimulate insulin secretion which in turn facilitates protein synthesis). The remaining calories can be given as fat, which will have the added benefit of providing the essential fatty acids necessary for a balanced diet.

**Table 1** Normal daily turnover of water and electrolytes

| | Intake | | Output | |
|---|---|---|---|---|
| Water (ml) | Food and liquid | 2000 | Urine | 1000 |
| | Internal metabolism | 500 | Sweat | 500–750 |
| | | | Expired air | 250 |
| | | | Stools | 250 |
| Total water (ml) | | 2500 | | 2500 |
| Sodium (mmol) | Diet | 100 | Urine | 100 |
| Potassium (mmol) | Diet | 100 | Urine | 60 |
| | | | Internal metabolism | 40 |

**Table 2** Essential dietary components

- 2500 kcal/day caloric intake for a 70 kg human
- 1 g/kg protein to supply essential amino acids
- Fat-soluble vitamins: vitamins A, D, K, E
- Water-soluble vitamins: vitamin B group, vitamin C
- Essential fatty acids
- Trace elements: copper, zinc, iron, manganese

The two main forms of surgical nutrition are:

- enteral nutrition
- parenteral nutrition.

Enteral nutrition, which uses the patient's own gastrointestinal tract for nutrient absorption, is preferable to the parenteral (intravenous route), which is prone to serious complication and is more expensive.

### Enteral nutrition

There are three main types of enteral nutrition:

- oral supplementation: using high-calorie/high-protein drinks to supplement oral intake
- nasogastric or nasojejunal tube feeding: using fine-bore silastic tubes to deliver enteral nutrition direct to the small bowel
- feeding gastrostomy or jejunostomy: exteriorising part of the stomach or proximal jejunum as a conduit for feeding.

Enteral nutrition is most useful in patients who have an intact, functioning full-length gastrointestinal tract or at least 300 cm of small bowel. Abdominal cramps, diarrhoea and vomiting are the major side effects and are caused by the delivery of hypertonic enteral feeds directly to the small intestine.

### Parenteral nutrition

The composition of parenteral nutrition can be individualised to the nutritional requirements of each patient. Each pharmacy-prepared nutrition bag contains enough nutrients for a 24-hour period and consists of:

- amino acids
- dextrose
- lipids
- vitamins, minerals and trace elements.

This solution is thrombogenic and has to be administered via a large central vein to avoid thrombosis. The catheter tip should lie in the superior vena cava just above the right atrium. The silastic feeding catheters used are tunnelled subcutaneously from the vein to an exit point usually on the chest wall. Strict aseptic technique must be used when changing the nutrition bag to prevent introducing sepsis.

Parenteral nutrition is best restricted to those patients whose intestinal tract cannot cope with enteral nutrition. Typically this includes:

- patients with Crohn's disease
- patients with high small bowel fistulae
- patients with short gut syndrome following major small bowel resection
- catabolic postoperative patients with septic complications.

## Analgesia

Adequate pain control is vital to allay anxiety pre- and postoperatively and to allow patients to rest, recuperate and sleep. Three groups of drugs are used:

- opioids (usually morphine)
- non-steroidal anti-inflammatory agents (NSAIDs)
- mild oral analgesics.

### Opioids

These drugs are the most potent analgesics and form the cornerstone of treatment in postoperative analgesia. Newer methods of delivery have supplanted intramuscular and subcutaneous routes, which are prone to unpredictable absorption and may subject patients to overdose, causing respiratory depression, or underdose, causing inadequate pain control.

### Patient-controlled analgesia

This is the optimum technique for pain management after major surgery. A predetermined bolus of morphine is delivered intravenously from a special pump that is activated by the patient. Overdosage is prevented by a 'lock-out' mechanism that prevents the patient reactivating the pump until a set time has elapsed. In each case, the bolus dose and lock-out time can be adjusted to suit the individual patient's needs.

### Epidural opioids

Opioids or local anaesthetic agents (e.g. bupivacaine) can be infused into the epidural space through a suitably postioned catheter. This technique blocks the afferent nerves and effectively controls pain. It is a type of regional anaesthesia. Respiratory depression is less in comparison with opiates which have been administered systemically. Because the vasomotor nerves are also blocked epidural analgesia can cause severe orthostatic hypotension and these patients require careful monitoring of their blood pressure.

### Non-steroidal anti-inflammatory drugs

These agents can be administered by intramuscular, rectal or oral routes. They are effective in relieving pain

after minor surgery or for patients who have had major surgery and no longer require opioid therapy. They can be used in combination with opioids to reduce the dose of opioid required to relieve pain.

**Mild oral analgesics**

Many of these are non-opioid analgesics. They occupy the bottom rung of the prescription ladder for pain relief. Paracetamol is the usual starting drug and should be administered on a regular rather than 'as required' basis to provide the maximum benefit. If this is ineffective, weak opioid analgesics such as dihydrocodeine should be used either alone or as a compound analgesic preparation with paracetamol.

## Postoperative monitoring

Close observation of a patient's vital signs (pulse/blood pressure/temperature/respiration rate) and careful fluid balance will optimise recovery and enable early detection of impending complications.

In most surgical units there are three levels of postoperative monitoring activity and care:

- general surgical ward
- high dependency unit
- intensive care unit.

The majority of patients undergoing routine elective surgery will be recovered satisfactorily in an ordinary surgical ward. Others with intercurrent medical problems (see p. 6), undergoing epidural anaesthetic techniques (see p. 8) or who have undergone emergency major surgery may require more intensive monitoring. Many of these patients can be effectively managed on a high dependency surgical unit, which provides continuous pulse, blood pressure and oximetry measurements together with hourly fluid balance. The high dependency unit provides a higher nurse/patient ratio than the general surgical ward.

Intensive care is reserved for those patients who require ventilation after surgery or who develop serious respiratory, cardiac or septic complications.

# 1.2 Postoperative complications

## Learning objectives

You should:

- recognise that prevention is better than cure. Many postoperative complications can be *avoided* by meticulous pre- and perioperative care
- be able to diagnose and initiate primary treatment in any of the common postoperative surgical complications. Remember, prompt diagnosis and early intervention can prevent minor complications becoming catastrophes.

For most patients, postoperative recovery is uneventful and is characterised by a systematic return to normal function. Any deviation from this predicted course is a postoperative complication. Complications are sometimes unavoidable in critically ill patients who undergo urgent surgery. In healthy patients who undergo elective surgery, complications should be rare and may be avoided with careful pre- and perioperative care.

## Pulmonary problems

Respiratory complications are the most frequent and are common to all surgical procedures.

### *Atelectasis and pneumonia*

Inadequate ventilation of small pulmonary airways plus retention of respiratory secretions leads to alveolar collapse and atelectasis. If untreated, a secondary bacterial infection will supervene causing lobar or bronchopneumonia. The most important predisposing factors are:

- smoking
- chronic obstructive airways disease (COAD)
- postoperative pain (inhibits respiratory effort and coughing).

Onset of these complications can be prevented preoperatively by:

- stopping smoking before surgery
- preoperative physiotherapy for patients with COAD
- deferring elective surgery for at least 2 weeks in patients with a chest infection.

An important intraoperative measure is the choice of incision. Respiratory complications are more frequent after vertical midline abdominal incisions than after transverse abdominal incisions.

Important postoperative measures are:

- intensive physiotherapy
- adequate pain relief.

**Diagnosis and treatment**

An early postoperative fever is caused by a respiratory complication until proved otherwise. It is confirmed on physical examination of the chest or by chest X-ray.

Sputum culture and broad-spectrum antibiotic cover should be instituted in addition to the above measures.

*Pulmonary aspiration.* Supine posture and the absence of the normal protective reflexes during general anaesthesia predispose surgical patients to pulmonary aspiration. Regurgitated gastric contents usually enter the right main bronchus. Three groups are especially at risk:

- pregnant women
- patients with bowel obstruction
- non-fasted patients requiring urgent surgery.

The most important preventative measures are:

- preoperative nasogastric drainage
- an adequately-fasted patient
- anaesthetic care using cricoid pressure to prevent aspiration during intubation and use of a cuffed endotracheal tube to prevent aspiration while the patient is paralysed and ventilated.

### *Postoperative respiratory depression*

Immediate respiratory depression is caused by the persistent action of opiates or muscular relaxants administered during surgery, or by a massive pulmonary collapse. Respiratory depression later on in the postoperative period is usually caused by oversedation with opioid analgesic agents.

These complications can be prevented by careful prescribing practice and close monitoring of the conscious level and postoperative respiratory effort. A pulse oximeter will give an early indication of arterial desaturation.

### *Postoperative respiratory failure*

Patients with severe intra-abdominal sepsis, fat embolus or those who have had a massive blood transfusion are at risk of developing adult respiratory distress syndrome (ARDS). Untreated, arterial hypoxaemia and carbon dioxide retention will be accompanied by a progressive radiological opacification of the lung fields (Fig. 1). Without treatment these patients will develop irreversible pulmonary failure and will die. Their management is complex and depends upon:

- identifying and eliminating any treatable underlying cause
- intubation and mechanical ventilatory support.

## Postoperative shock

Shock is defined as a failure to maintain adequate tissue perfusion. Hypotension, tachycardia, sweating, pallor and peripheral vasoconstriction are the hallmarks of hypovolaemic and cardiogenic shock. Without treatment, oliguria and multisystem organ failure develop and lead to death.

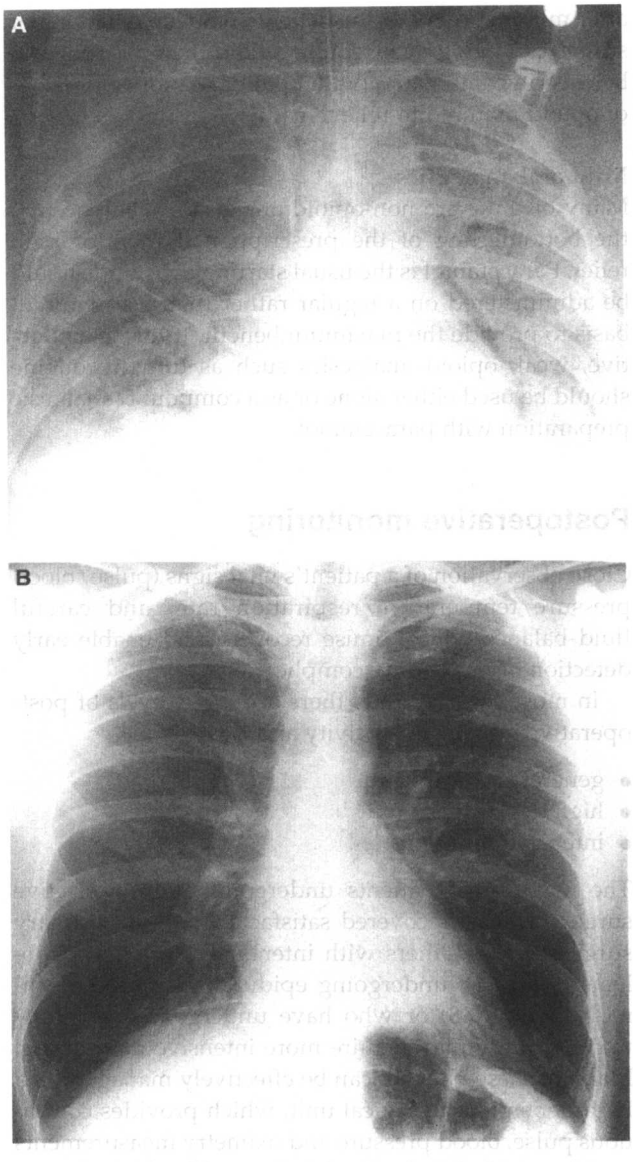


**Fig. 1** Adult respiratory distress syndrome (**A**); and a normal chest X-ray (**B**) for comparison.

The precise clinical picture (Table 3) will depend on the underlying cause. The three main types of postoperative shock are:

- hypovolaemic
- septic
- cardiogenic.

### *Hypovolaemic shock*

This is the most common type of postoperative shock. It may be caused by:

- inadequate replacement of pre- or perioperative fluid losses
- continued haemorrhage in the postoperative period.

**Table 3** A comparison of the key clinical features in hypovolaemic, cardiogenic and septic shock

| | Normal | Hypovolaemic shock | Cardiogenic shock | Septic shock | |
|---|---|---|---|---|---|
| | | | | Early | Late |
| Pulse rate (beats/min) | 72 | >100 | 40–120, regular or irregular | >100 | >100 |
| Jugular venous pressure (cm $H_2O$) | 5–10 | 0–5 or negative | >10 | 0–5 or negative | 0–5 or negative |
| Skin | – | Cold, clammy | Cold, clammy | Warm | Cold, clammy |
| Blood pressure (mm $H_g$) | 120/80 | <100 systolic | <100 systolic | Normal, or <100 systolic | <100 systolic |
| Urine output (ml/hours) | 30 | <30 | <30 | 30 | <30 |

**Treatment**

Careful fluid balance will prevent most cases of hypovolaemic shock. Ongoing haemorrhage may be obvious from a chest drain but is less clear after abdominal surgery, when large volumes of blood can collect unnoticed in the abdomen. A careful judgement may be required by the surgeon with regard to the need for reoperation.

The essential management points are:

***Replacement.*** Replace the circulating volume and extracellular fluid losses with a combination of whole blood and a balanced salt solution.

***Monitor.*** Monitor the response:

- blood pressure and pulse rate (aim to restore preoperative values)
- urine output (keep at 30 ml/hour; 0.5–1 ml/kg/hour)
- establish central venous pressure measurement (aim for values between 5–10 cm water).

***Appraisal.*** Think about reoperation if ongoing haemorrhage is suspected.

## Septic shock

The most frequent causes of septic shock in the postoperative patient are listed in Table 4. Early septic shock is characterised by a hyperdynamic circulation with fevers, rigors, a warm vasodilated periphery and a bounding pulse. Untreated, late septic shock supervenes with hypotension, peripheral vasoconstriction and anuria.

**Table 4** Major causes of postoperative fever and sepsis

| | |
|---|---|
| Day 1 | Atelectasis, chest infection |
| Day 5 | Wound infection |
| Days 7–10 | Intra-abdominal sepsis<br>Thromboembolism |
| Any day | Catheter or i.v. line sepsis |

The essential points of management are:

***Assessment.*** Identify and remedy any underlying cause: this may involve anything from changing an infected central venous line to re-operation for intra-abdominal sepsis.

***Antibiotic therapy.*** Implement broad-spectrum aerobic and anaerobic antibiotic therapy after an infection screen and blood/sputum/urine culture.

***Monitor and support.*** Instigate intensive monitoring plus fluid therapy and respiratory and renal function support to prevent multisystem organ failure.

## Cardiogenic shock

This is usually secondary to acute myocardial ischaemia or infarction causing left ventricular failure or a rhythm disturbance. In patients with pre-existing cardiac disease, fluid overload may induce cardiac failure.

In addition to poor peripheral perfusion, these patients will have an elevated jugular venous pressure, basal crepitations and a gallop cardiac rhythm plus acute electrocardiographic changes.

The essential management points are:

***Control fluid overload.*** Establish a diuresis to remove fluid overload.

***Monitor.*** Instigate invasive monitoring of cardiac function (CVP or Swann–Ganz catheter).

***Therapy.*** Use vasoactive or inotropic drugs to optimise myocardial efficiency.

# Wound complications

The two most important wound complications are:

- wound infection
- wound dehiscence.

## Wound infection

This is one of the most frequent surgical postoperative complications. It is seen least in clean elective surgical wounds (e.g. inguinal hernia repair) and most often in contaminated wounds (e.g. perforated diverticular disease).

The main factors in reducing the risk of wound infection are surgical technique and aseptic care.

**Meticulous surgical technique:**

- minimise tissue trauma
- preserve wound blood supply
- prevent wound haematoma.

**Prevention of wound contamination:**

- preoperative bowel preparation
- perioperative antibiotic prophylaxis
- good surgical technique.

Wound infections present with a fever on about the fifth postoperative day. Inspection of the wound site reveals tenderness, erythema and induration. An infected wound should be opened widely to enable release of any contained pus and the wound packed loosely with gauze to ensure adequate drainage. Antibiotics have only a secondary role in wound sepsis and are not a substitute for surgical drainage. After treatment, these wounds should be left to heal by secondary intention.

## Wound dehiscence

A wound dehiscence is a failure of wound healing. Although any wound can dehisce, it usually affects abdominal wounds (burst abdomen), which disrupt usually 7–10 days after surgery, leaking serosanguinous fluid and then revealing the viscera.

The two most important groups of factors predisposing to wound dehiscence are poor surgical technique and impaired wound healing.

**Iatrogenic (poor surgical technique):**

- tight sutures causing wound ischaemia
- suture breakage.

**Patient-related (poor wound healing):**

This occurs more often in patients at increased risk:

- malnourished patients
- septic patients
- patients with inoperable malignancy
- morbidly obese patients
- jaundiced patients.

*Treatment.* Re-exploration and resuture of the wound under general anaethesia is essential. Dehiscence rarely recurs.

# Urinary problems and postoperative renal failure

Acute urinary retention and urinary tract infection are the most common postoperative urinary complications.

## Acute urinary retention

There are three major predisposing factors:

- preoperative history of symptoms of bladder outflow obstruction
- postoperative immobility
- postoperative pain.

Retention may be prevented by selective perioperative catheterisation of at-risk patients, e.g. those with symptoms of prostatic outflow obstruction or who are undergoing major abdominal or perineal surgery.

## Urinary tract infection

Postcatheterisation urinary tract infection is usually caused by:

- a breakdown in sterile technique during catheter insertion
- contamination of the catheter drainage system.

Infection can be difficult to eradicate. The choice of antibiotics is dictated by the results of urine culture. Prompt removal of the catheter as soon as the patient is ambulant will reduce the frequency of infection.

## Postoperative renal failure

Acute renal failure can be:

- prerenal
- renal
- postrenal.

**Prerenal failure**
Underperfusion of the kidneys is the final common pathway. This is usually caused by inadequate fluid balance during the pre- and perioperative period or by continued haemorrhage and fluid losses that have been overlooked. The management is outlined on page 10.

**Renal failure**
Uncorrected prerenal failure will eventually cause acute parenchymal renal failure. Other important causes are:

- incompatible blood transfusion