

# PRINCIPLES OF SURGERY

AN ILLUSTRATED TEXT  
FOR HEALTH PROFESSIONALS

F. J. GRAY



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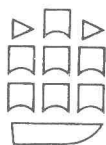
AN ILLUSTRATED TEXT  
FOR HEALTH PROFESSIONALS

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# Foreword

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Surgeons too often assume that the purpose of every operation is self-evident. This is, of course, a dangerous generalisation. It is, however, true that far too often even those who are concerned, in a responsible way, in the care of patients, both before and after operation, are ill-informed of the scope of a proposed operation, of the kind of problems that may arise later on, and of ways and means of anticipating and correcting them.

Many surgeons have long been painfully aware of this deficiency but few of us have made formal efforts to correct it. This is the task to which Mr Gray has applied himself. He is very aware of the difficulties, for he is a general surgeon of wide experience, who has practised surgery in a community close to general practice, in large metropolitan teaching hospitals, in a developing country, and now in a provincial city.

In compiling the book, he has shown that he is very conscious of the value of having well-informed auxiliary staff caring for surgical patients. He has taken pains to make his message as clear as possible, for the text is generously interspersed with illustrations, and the learning process should be easy.

I would have liked to have had such a book when I was an undergraduate and an eager surgical assistant. I will be surprised if the health professionals for whom this text has been prepared do not respond to its publication with enthusiasm. I am aware of no other similar surgical text, and congratulate Mr Gray on this original venture.

Melbourne, Australia 1981

M.E.

# Preface

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It is my hope that this book will serve to correct a deficiency in the existing range of surgical texts. It is not a textbook of surgery as that term is usually understood, nor is it an atlas of operative techniques or a procedural manual. My aim has been to cover a broad field of general surgery, to confine my writing to principles only of surgical operations, and to cover the pre-operative and postoperative period, in terms of management and possible complications. I have done this, first in general terms, and then in reference to particular operations.

The original concept, namely to cater for the nursing profession, has been expanded so that the book covers also the needs of those intimately and responsibly concerned with surgical patients in the fields of physiotherapy, social science, and occupational therapy. I believe also that it is not so basic as to fail to serve adequately the needs of the medical student, and the house surgeon. It should, moreover, be of considerable help to that bastion of health services, the general practitioner, one of whose important responsibilities is the counselling of those of his patients faced with a visit to the surgeon's stamping ground, and their rehabilitation after the return from that same scene, from which he has inevitably become further and further divorced.

Maitland, Australia 1981

F.J.G.

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# General information

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## PREPARATION OF THE PATIENT FOR ELECTIVE SURGERY

This chapter provides information concerning the preparation of the patient for operation. It illustrates the various incisions used in abdominal surgery. The usual techniques of suturing are also shown, and the principles of repairing incised wounds are outlined. Principles are discussed also in regard to drainage and dressings. Complications both general and local are considered in some detail as they relate to abdominal surgery.

### *General physical condition*

The general physical condition of the patient must be as good as possible under the circumstances of the operation to be performed. Attention is given to such aspects as excessive weight, malnutrition, disturbance of fluid and electrolyte balance, anaemia, diabetes, pulmonary and cardiac disabilities, and to pain. Intravenous therapy, antibiotics, provision of blood for transfusion, and chest physiotherapy may be necessary. The rationale for the latter is discussed in the section on general postoperative complications (p. 6).

### *Psychological state*

The patient finds himself or herself in a very strange environment, threatened by physical pain, possibly prolonged illness, separation from family, inability to earn and to enjoy life. He or she may not be entirely certain of the nature of the operation, the reasons for it, and the possible consequences. All this makes for insecurity and alarm.

The patient therefore has special need of comfort, encouragement, understanding, explanation and reassurance from all those in attendance.

### *Smoking*

Apart from the consideration of the opening section above, cessation of smoking lessens the difficulty of anaesthetic induction, the chances of postoperative lung problems, the extent of troublesome coughing which, in the case of abdominal operations, is not

only painful but carries some risk of wound disruption in the post-operative period.

### *Oral nourishment*

Restriction of oral intake is important, to ensure that the stomach is empty at operation. A full stomach carries a risk of vomiting, which may result in the inhalation of gastric contents into the lungs, with serious pulmonary consequences or possibly death from asphyxia. Thus, ideally the last ordinary meal should be not less than eight hours before operation; it should be easily digested food. Liquids should be taken by mouth ideally no later than six hours before operation. When situations are less than ideal, a minimum time of four hours is accepted.

### *Bowel evacuation*

It is desirable that the intestines should not be overloaded at operation in the case of an abdominal operation, as subsequent straining at stool will produce unnecessary pain in the wound. It is customary, if the bowels have not been acting satisfactorily, for an aperient to be given some 10 hours before operation, or an evacuating suppository or micro-enema some six hours before.

### *Skin preparation*

Normally a good soap-down in a hot shower is advised. The field of operation is shaved, and in general terms, the shaved area should exceed in extent the incision to be used by 10 cm in all directions. Details for various operations are to be found in manuals of nursing procedures.

### *Premedication*

Drugs ordered by the anaesthetist are given by intramuscular injection half to one hour before operation. These are designed to relax the patient, to create drowsiness, to minimise respiratory tract secretions, and to complement the effect of anaesthetic agents which will be used.

### *Prophylactic anticoagulants*

In an effort to prevent the possible serious consequences of post-operative deep vein thrombosis (D.V.T.) there is a tendency now for surgeons to give the patient heparin by subcutaneous injection to cover the period of the operation and not less than five days thereafter. This is of particular importance in those patients considered more prone than normally to this complication.

*Note:* In the case of a surgical emergency, attention to some aspects of the patient's general condition may be precluded by the urgency of the problem.

In the chapters which follow, special preparation which may be necessary for particular operations will be indicated.



## ABDOMINAL INCISIONS

Figures 1.1 to 1.12 illustrate the location of incisions used for abdominal surgery.

*Note:* Technical details for making these incisions may be obtained from standard texts of operative surgery.

**Fig. 1.1** Median (midline).

**Fig. 1.2** Paramedian.

**Fig. 1.3** Oblique (muscle-splitting or -cutting).

**Fig. 1.4** Transverse.

**Fig. 1.5** Subcostal (Kocher).

**Fig. 1.6** Inverted V.

**Fig. 1.7** Hockey-stick.

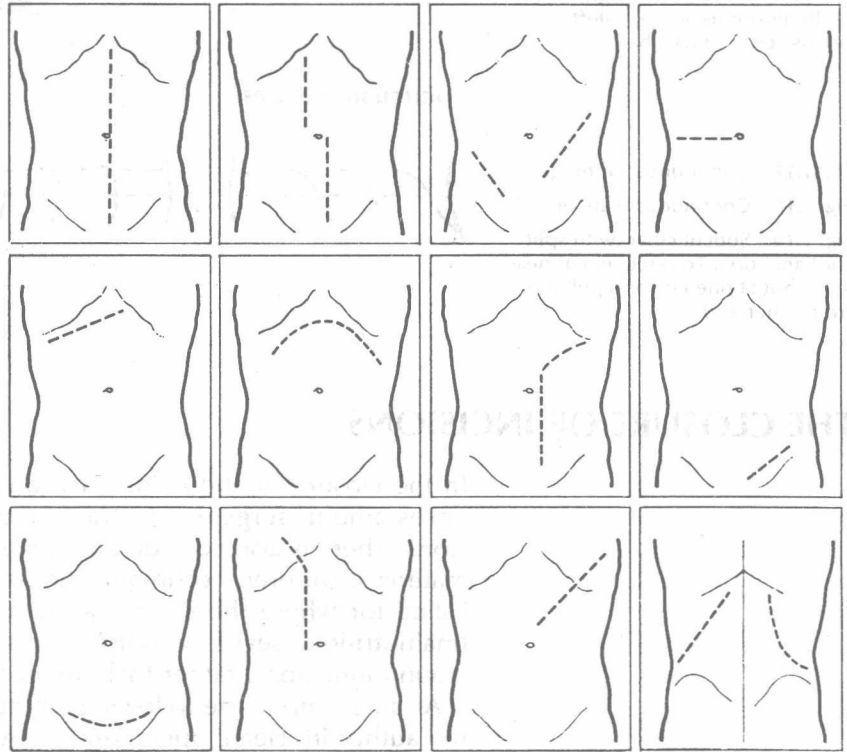
**Fig. 1.8** Inguinal.

**Fig. 1.9** Pfannensteil.

**Fig. 1.10** Abdomino-thoracic.

**Fig. 1.11** Thoraco-abdominal.

**Fig. 1.12** Lumbar (oblique and boomerang).



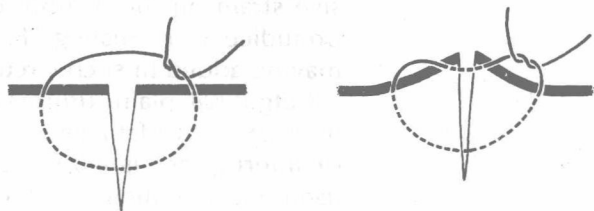
## SUTURES – Principles of technique

Figures 1.13 to 1.16 illustrate the types of interrupted sutures and Figures 1.17 to 1.19 indicate the types of continuous sutures. In general terms interrupted types are preferred if infection is anticipated.

### Interrupted sutures

**Fig. 1.13** Through and through (simple approximation).

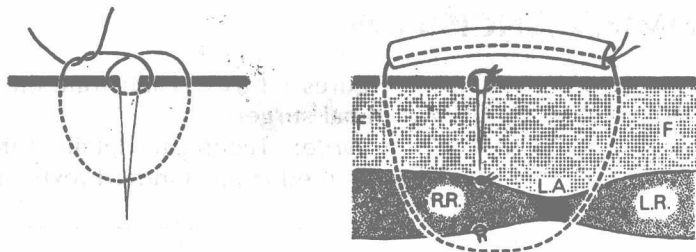
**Fig. 1.14** Vertical mattress (everting, for accurate edge to edge apposition).



## 4 Principles of Surgery

**Fig. 1.15** Near and far, also for accurate apposition.

**Fig. 1.16** Tension suture. This is shown supporting a sutured paramedian incision. It penetrates the full thickness of the abdominal wall, using no. 1 nylon, through a nylon tube to prevent cutting into the skin. F = fat; RR = right rectus abdominis muscle; LR = left rectus; LA = linea alba.

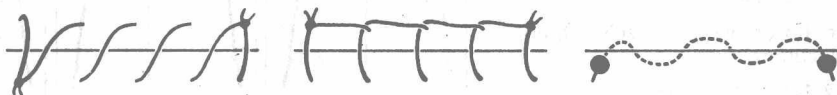


### Continuous sutures

**Fig. 1.17** Continuous running.

**Fig. 1.18** Continuous blanket.

**Fig. 1.19** Subcuticular (with split shot anchors). To remove, cut near split shot at one end and pull out from other end.



## THE CLOSURE OF INCISIONS

In the closure of abdominal incisions, there are individual preferences among surgeons, just as there are in the selection of incisions. There is also considerable variation in the selection of suture materials. Different technique and different suture material may be called for where there are reasons to anticipate impaired healing (malnutrition, severe abdominal distension, hacking cough, and wound infection), rather than unimpaired, healthy healing.

As an example, the following methods and materials are used by the author in 'clean' operations on healthy adult patients.

**Peritoneum:** Continuous running suture of polyglycolic acid (P.G.A.), size 1. This is an absorbable synthetic material often used now in preference to catgut.

**Linea alba (midline):** Continuous monofilament nylon, size 1, or interrupted P.G.A., size 1.

**Posterior and anterior layers of rectus sheath:** P.G.A., size 1, continuous for posterior but interrupted for anterior.

**Muscle split:** Interrupted P.G.A., size 1.

**Rectus muscle (and its sheath) in Kocher's incision:** Interrupted near and far' sutures (Fig. 1.15) P.G.A., size 1.

Catgut (plain or chromicised) is not favoured where there is excessive strain on the wound, or where there are other factors which prejudice firm healing. Full thickness tension sutures (Fig. 1.16) may be added in such circumstances (monofilament nylon, size 1).

Catgut (2/0 plain sutures) may be used to prevent shearing strains in an excessive fat layer. A very satisfactory skin suture (continuous or interrupted) is 4/0 braided Dacron. Monofilament nylon 4/0 is used if a subcuticular suture is indicated cosmetically (Fig. 1.19).

### **Drains**

Drainage tubes of various types are used when infected fluid would otherwise collect in the body cavities or tissue spaces. Likewise, drainage is indicated when blood, serum, or lymph is likely to collect and become infected. It is essential also to drain away fluid which has a digestive action, such as pancreatic or intestinal juice.

#### **Open drainage**

Individual preference dictates the type of drain. Many surgeons prefer a corrugated type; others a Yeates' drain. Some like a hollow tube (polyethylene, Silastic, or Portex) with side holes and still others prefer a 'sump' drain. Penrose and 'glove' drains, etc., are usually reserved for subcutaneous drainage (including the breast).

#### **Closed drainage**

There is an increasing tendency to use 'closed' drainage. In this case drains are connected to sealed collecting systems, using gentle electrically operated suction, or some mechanically operated vacuum-producing apparatus, or adherent disposable plastic 'ostomy' bags. These methods allow the volume of discharge to be measured, they decrease the frequency and the volume of dressings, eliminate mess, and are calculated to minimise cross-infection. They have, in fact, greatly improved standards in dressing techniques.

Drains are inserted usually through a 'stab' wound which is somewhat removed from the main wound, in order to minimise infection in the latter and thus to facilitate its healing.

It is important that the drain does not disappear or fall out prematurely. A good method for preventing this is to insert a 'loop' cutaneous suture, and to take a safety-pin first through the drain (provided of course that it is not a 'vacuum' drain), and then also through the loop.

In regard to the removal of drains, individual preference varies, but a good working rule is that a drain should be shortened and finally removed according to the decrease in the volume of discharge; this may be after two to three days, or even up to 10 days.

#### **Dressing the surgical wound**

As with incisions, sutures and drains, there is much variation among surgeons on the subject of wound dressing. There have in recent times been considerable advances in this field. The following comments represent the author's views.

#### **Dressing the repaired elective incision**

To lessen the risk of contamination and infection of the repaired incision from such sources as unclean fingers, airborne and drop-let infection, urine and faeces, the dressing should effectively seal the wound until it is time for the sutures to be removed. It should

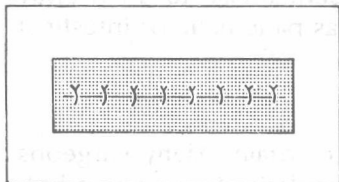


Fig. 1.20a Hansapor dressing.

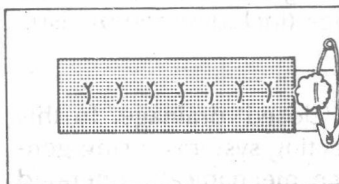


Fig. 1.20b Hansapor dressing and wound drain.

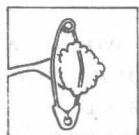


Fig. 1.21 Melolin under safety-pin through drain.



Fig. 1.22 Gate dressing.

not move on the wound or adhere to the sutures, nor should it cause skin irritation. It should be as comfortable as possible under clothing. A certain degree of transparency has, generally speaking, distinct advantages. Preferably also its aseptic barrier function should not be prejudiced by the patient taking a shower and wetting it.

If the repaired incision is quite separate from the drain (should one have been used), sealing can be complete. In those instances where a drain is brought out at one end of an incision, sealing should be complete except for the site of the drain.

A very satisfactory cover for 'clean case' incisions is Hansapor. This dressing has a non-adherent absorptive inner portion, and an adhesive outer portion (Fig. 1.20a). It permits transpiration of skin moisture, and as it is relatively impermeable to water entry, the patient can, with care, have a shower with minimal risk of contamination of the wound. This is very helpful from the point of view of morale.

In Fig. 1.20b the wound seal is complete except for the drain. This is covered with a 'combine' dressing.

#### Alternative wound dressings:

1. 'Plastic skin'
2. Melolin (2.5 cm wide strip), with Micropore seal (7.5 cm wide)
3. Tulle gras covered by 'combine', secured with Micropore.

#### Dressing the 'stab' drain

The use of a 'stab' drain has been described on page 5. The following dressing technique is recommended.

In Fig. 1.21 a gauze square with a re-entrant cut is shown placed around the drain, between the safety-pin and the skin.

The drain is then covered with sufficient 'combine' dressing to absorb the discharge adequately for a number of hours. This is held in place by Micropore, or a 'gate' dressing (Fig. 1.22). It goes without saying that dressings must be changed aseptically at intervals, and certainly before they become saturated.

#### Dressing the infected repaired incision

Aseptic methods are again essential for changes of dressings. It may be necessary to remove one or more sutures to allow adequate drainage of pus. The 'gate' principle of dressing is then applied as above. Swabbings of the pus are taken for culture and antibiotic sensitivity tests.

## POSTOPERATIVE CARE AND GENERAL COMPLICATIONS

In this section the discussion applies particularly to abdominal operations.

The comments which follow are not intended to include care of

the patient whilst still in the theatre or the intensive care area. That is to say, they apply to the patient who has recovered consciousness and respiratory control, and has been returned to the ward. Recorded postoperative instructions must be studied and clearly understood.

### **Cardio-respiratory state**

Regular observations are made of colour, respiratory rate and depth, temperature, pulse rate and blood pressure. The ability of the patient to cough effectively is also an important observation of pulmonary function, giving an indication as to whether pulmonary atelectasis (collapse) is likely to be a problem.

Atelectasis results from blockage of respiratory passages in the lungs by sputum (sometimes infected) as a result of a period of time under general anaesthesia, during which the cough reflex is lost; or in the postoperative phase when deep breathing is impeded and the cough reflex cannot be utilised to the full, because both of these latter activities cause pain in patients who have had an abdominal operation. Atelectasis results in impaired oxygenation of the blood, which even in mild degree may have serious consequences (particularly in the patient with already serious impairment of lung function, cardiac incompetence, or severe anaemia). If atelectasis is followed by infection the problem is compounded by bronchopneumonia.

Thus it is important, not only that the above observations are made and their significance recognised, but also that appropriate steps are taken to correct the situation. This involves the addition of oxygen to the inspired air; the giving of analgesics to permit less painful coughing; encouragement of the patient to breathe deeply and to cough from time to time. Physiotherapy techniques include controlled breathing, chest percussion (to dislodge sputum from the alveoli of the lungs), postural drainage, and the use of 'sputum loosening' drugs in nebuliser form. However, the physiotherapist cannot be present all the time, so this facet of care is also an important nursing function.

When these points are realised, the importance of pre-operative cessation of smoking (which increases respiratory secretions and causes bronchospasm), of eradication of bronchial infection, and of pre-operative instruction in deep breathing and coughing by the physiotherapist becomes clear.

### **Thrombo-embolism**

Patients undergoing operation may develop thrombosis in the deep veins of the legs, or in the abdomen (especially at the site of operative trauma). Clots so formed may be small or large, and are loosely attached to the walls of the veins in which they occur. Thus they may become detached, travel through the venous side of the circulation to the heart, and then lodge in the branches of the pulmonary artery in the lungs. This occurrence is known as thrombo-

embolism (pulmonary embolism). It may, depending on its magnitude, be fatal.

Pulmonary embolism should be suspected if the patient complains of chest pain, especially if associated with increased respiratory rate and cyanosis; sputum may be blood-stained; the pulse rate rises and blood pressure falls. All of these are marked if the embolus is large. Treatment includes the giving of oxygen, heparin, analgesics and corticosteroids, and in some serious cases, operation for the removal of the clot from the pulmonary artery.

The surgeon recognises, prior to operation, that some patients are more prone to this complication than others, and may then take precautions such as regular doses of subcutaneous heparin commenced before operation. He may employ some means of maintaining calf muscle activity during operation (calf muscle pump or electrical stimulator), and thus eliminate deep venous stasis in these muscles. After operation blood flow in the veins is encouraged by such measures as deep breathing, frequent movements of all joints of the lower limbs, elastic stocking compression, and early ambulation.

### Analgesia

Pain relief is all-important to the patient. Astute nursing recognises the need to find a happy medium between insufficient analgesia with consequent preservation of an efficient coughing mechanism on the one hand; or very good pain relief and sedation, but over-depression of breathing and coughing on the other. It is of course essential for the patient to get a reasonable amount of sleep.

Pethidine, morphine, Omnopon are the most commonly used drugs. All have unpleasant side effects in the form of nausea and vomiting. They are given by hypodermic or intramuscular injection, usually with an anti-emetic drug such as prochlorperazine.

When oral intake of liquids is established, analgesics may then preferably be given by mouth.

### Provision of nutrition

For the most part, the insertion of a vein cannula and the giving of venous infusions in the theatre are now a regular part of general anaesthesia, at least for major surgery. Thus the stage is set for the continuance of fluids intravenously after operation and until such time as it can be superseded by resumption of oral intake. There is a temporary state of intestinal paralysis after abdominal operations which precludes normal intake of fluids and food by mouth; this lasts for up to 24 or 48 hours as a rule (see paralytic ileus, p. 12).

In uncomplicated operations, a common daily order of I.V. fluids is two or three litres, consisting, for example, of isotonic sodium chloride (or Hartmann's solution), alternating with dextrose 5 per cent.

Unless there is some contra-indicating problem, oral fluids may be commenced about four hours after surgery (25 ml per hour if



desired at first), increasing at intervals of six hours to 50, then 100 ml per hour, depending on tolerance – this is known as ‘graduated fluids’. The fluids may be ice, water, cordial, lemonade, weak tea.

As the patient is found to cope with this oral fluid regime, intravenous fluids are slowed, and finally discontinued. When a volume of 100 ml per hour by mouth is tolerated, fluids can be taken as desired, and light (low-residue) foods may be commenced.

Until this critical period is assuredly passed, an accurate fluid balance chart is required showing all fluids taken in and all those lost by whatever route. The losses must include those by drainage, from the skin (either by visible sweating or evaporation), and from the lungs as expired water vapour. For an adult, 800 ml daily represents an average loss from those two routes in temperate climates. If a nasogastric tube is being used, there will necessarily be an additional fluid loss from gastric aspiration.

The regulator or key of the fluid balance chart may be said to be the urinary output, which in an adult with normal urinary excretory function should amount to 1000–1500 ml for a 24 hour period.

The electrolyte, caloric, and protein content of intravenous fluids will be determined by the doctor in charge of treatment. In uncomplicated operations, provision of these requirements is readily attained by oral intake within three to four days of operation.

### **Excretion**

The evacuation of urine, flatus and faeces, unpleasant as this may be at times, is an important guide to progress in the surgical case. Failure on the part of the patient to pass urine within a reasonable time suggests the possibility of insufficient urine formation by the kidneys (oliguria or anuria), indicating either inadequate hydration or impaired renal function, or the possibility of urinary retention. A full bladder may be reflected in discomfort, or in suprapubic tenderness (or dullness on percussion). The presence of this condition is established by the passage of a catheter. Retention may respond to adequate screening, standing up, or taking the patient to the bathroom in a wheel chair. At times a urinary evacuating drug such as bethanechol may be effective. The technique of catheterisation will not be described here (see nursing manuals).

The detection of bowel sounds by auscultation, and the passage of flatus after operation are usually correctly taken as the sign to allow intake of food. On occasion it may be necessary to promote bowel emptying by a mild aperient, a suppository, or a ‘micro’ enema.

### **Mobilisation**

From all points of view, persuading the patient to be out of bed early after operation is good treatment – speeding the flow in clot-prone veins, prevention of leg weakness, easing the discomfort of

buttock pressure, and above all improving morale – these are all bonuses.

#### Care of pressure areas

In healthy young and middle-aged patients undergoing surgery, there is little need to worry about pressure areas, that is to say those areas of skin over bony prominences which bear weight in bed. But with elderly persons or those who are very thin, for one reason or another, these areas must be protected from excessive pressure. The areas of skin at risk overlie the heels, the lateral malleoli, the trochanteric regions, the ischial tuberosities and the sacrum. If the pressure in these areas is allowed to extend beyond a certain critical time period, the blood flow to the skin is jeopardised, resulting in partial or complete necrosis. Partial necrosis causes inflammation in the skin; complete necrosis results in a patch of gangrene.

After an uncomplicated operation change of posture is mandatory at intervals not exceeding two hours. The skin in these areas should be washed and powdered daily. Should there be urinary incontinence the bladder is catheterised, and silicone-based cream is used on the skin.

In thin, elderly inactive patients, particularly if there is mental deterioration, impaired sensation in the feet, or arterial ischaemia, protective measures such as sheepskin boots, ripple mattresses, etc., have much to commend them.

Impaired sensation due to nerve dysfunction likewise calls for special care of pressure areas.

## LOCAL COMPLICATIONS

#### Postoperative haemorrhage and infection

It goes without saying that when haemorrhage occurs after operation, it may be apparent as surface bleeding, as haematemesis and melena after gastric surgery, as bleeding after haemorrhoidectomy, etc. On the other hand, it may not be apparent. Occult bleeding is to be suspected firstly by rising pulse rate, pallor, and fall in blood pressure.

If infection occurs at the site of operation it may similarly be evident in and around the sutured wound, as local pain, tenderness, redness, swelling, heat, discharge of pus; or it may not be apparent when it occurs on a deeper plane, such as the pelvic cavity or subphrenic spaces. In either case systemic evidence of infection is the rule – elevated temperature with raised pulse rate, sweating, malaise, anorexia. Fever after operation may, however, be an index of some infection quite separate from the operation site, such as urinary or chest infection, entero-virus infection or other infectious disease.

Thus the importance, at all times, of close and critical observation of the patient cannot be too strongly stressed. A rise in pulse rate or of temperature should not occur without the question being asked: 'What is the reason for this?'

### **Abdominal wound dehiscence**

This complication, known also as burst abdomen or wound disruption, is fortunately not common; it is nevertheless serious. It occurs usually several days after operation and may become evident slowly or suddenly. The wound that gives way slowly allows leakage of serous (peritoneal) fluid. Removal of the dressing discloses intestine underneath a breach in the wound. On the other hand the patient may cough, burst the wound suddenly and force a loop or loops of intestine out of the abdominal cavity. When this occurs it is necessary to return the patient to the theatre for secondary repair of the wound without delay. In fact, any degree of dehiscence calls for secondary repair.

The reasons for wound dehiscence (apart from faulty technique) are malnutrition resulting in poor healing, excessive tension on weak tissues (such as obesity, coughing or postoperative distension). It occurs particularly in fragile elderly people, in patients debilitated by malignant disease, peritonitis, and other infections. Wound infection may play a part, but generally of itself it does not.

### **Sinus or fistula**

A sinus is a blind track lined by granulation tissue, discharging pus on to the skin surface. An infected foreign body such as a ligature, or a suture used in repairing the wound is often responsible, particularly if it is non-absorbable. The sinus may however be an expression of an abscess within the abdominal cavity.

External fistula is a term used to denote a communication between some internal organ and the skin, resulting in discharge of its secretion (or excretion) on the skin surface. Thus, for example, there may be an external discharge of bile after an operation on the gall bladder or bile ducts; gastric juice after operation on the stomach or duodenum; intestinal juice or faecal material after operations on the small or large intestine respectively.

The application of the principles of stoma therapy to the management of fistulas has been a big advance. The advantages have already been stressed in the section on drains (see p. 5). In principle, a stomahesive wafer is applied to the skin with a central hole closely fitting the fistula opening; an adherent collecting bag also with a central hole is then applied to the outer surface of the wafer (See Fig. 8.13). The volume of discharge is recorded, the bag being emptied or changed from time to time. Apart from the obvious collecting advantages of 'ostomy' appliances, they have an important role in preventing excoriation of the skin when the fistula fluid has digestive properties.