Complications

Complications in the early postoperative period include bleeding and acute gastric dilatation. Control dilatation by nasogastric suction. Later complications include wound infection and even dehiscence, pancreatitis, subphrenic abscess, and deep venous thrombosis. A long-term complication, especially in children, is the reduction of immunity.

Fig. 12.2. Splenectomy (continued). Continuing to divide the gastrosplenic omentum between pairs of artery forceps (F); the splenic vessels are then clamped, divided, and ligated (F, G).
Resection and end-to-end anastomosis

At the district hospital, the only indications for resection of the small intestine and end-to-end anastomosis are gangrene of the small intestine as a complication of intestinal obstruction, multiple traumatic perforations in a short segment of the intestine, and a tear of the mesentery with ischaemia of a loop of intestine. A decision to resect and anastomose the intestine will therefore be taken during laparotomy or a hernia operation. In the latter case, it is preferable to make a laparotomy incision before proceeding with resection.

Equipment
See tray for Laparotomy, Annex 1, and add a half-circle atraumatic needle.

Technique
The decision to resect part of the small intestine should be taken only after you have inspected the entire gut. A non-viable loop of intestine will be black or deep blue without peristalsis, and the mesenteric veins of the loop will appear thrombosed. There will be no arterial pulsation, and the serosa will have lost its shiny appearance.

Resection
Determine the extent of the loop to be resected, including a generous margin of about 2–3 cm of healthy gut on either side (Fig. 13.1A). Hold up the loop so that you can see the mesenteric vessels against the light. Plan to divide the mesentery of the loop in a V-fashion or separate it from the intestinal wall, depending upon the length of the mesentery. Isolate the mesenteric vessels by making blunt holes in the mesentery on either side of each vessel. Doubly ligate each vessel and then divide it between the ligatures (Fig. 13.1B,C). Continue dividing the mesentery until you have isolated the section of gut to be resected.

Apply crushing clamps to both ends of the isolated loop and gently “milk” the normal bowel above and below the loop to move the contents away from the planned points of resection. Once these sections of gut have been emptied, apply light occlusion clamps to the bowel 3–4 cm beyond the crushing clamps. Under the loop of bowel, place a swab that has been soaked in a bland antiseptic, such as cetrimide or acriflavine, and wrung out. Holding the knife blade against one of the crushing clamps, divide the gut (Fig. 13.1D). Clean the exposed part of the lumen and discard the used swab immediately. Temporarily release the occlusion clamp and check to see whether the cut ends of the bowel bleed freely. If so, reapply the clamp. If not, resect the bowel further until it bleeds freely, since the success of the procedure depends upon a good supply of blood to the cut ends of the bowel. Apply the same procedure to the section of gut between the second pair of clamps.

End-to-end anastomosis
A sound anastomosis is essential, requiring a careful two-layer technique. Make the anastomosis with continuous sutures of 2/0 chromic catgut on a half-circle
Fig. 13.1. Resection and end-to-end anastomosis of the small intestine. Gangrenous loop of intestine with line of resection (A); ligating the mesenteric vessels (B, C); resection (D); apposition of the two ends (E); inserting stay sutures (F); beginning the anastomosis with a posterior, continuous, all-coats suture (G-I).
Resection and end-to-end anastomosis of the small intestine (continued). Continuing the posterior all-coats suture (J); carrying the suture on to the anterior wall (K–P); burying the first layer of sutures with a second (Q); checking the patency and size of the anastomosis after closing the opening in the mesentery (R).

atraumatic needle. First bring together the occlusion clamps and hold them in position to appose the cut ends of the bowel (Fig. 13.1E). Check the proper orientation of the gut and steady the tissues by joining the cut ends with seromuscular stay-sutures of 2/0 chromic catgut at either end of the planned anastomosis (Fig. 13.1F).
Begin the anastomosis by inserting the inner layer of sutures. Start at one corner of the bowel, knotting the suture to anchor it (Fig. 13.1G,H). Leave one end long enough to be held with artery forceps. Carry along the other end with the needle as a continuous “over-and-over” stitch, taking up the full thickness of the wall of both gut ends (Fig. 13.1LJ). At the end of the posterior line, pass the needle and catgut out from the mucosa to the serosa on one side and then back from the serosa to the mucosa on the other (Fig. 13.1K). Invert the corner by applying traction in the axis of the suture line, and carry the all-coats stitch back along the anterior wall as an “under-and-under” stitch to invaginate the edge of the bowel (Fig. 13.1L–N). Continue the stitch right back to its origin and knot it to the end that has been left long (Fig. 13.1OP). The occlusion clamps can now be removed.

Start a new continuous suture near the stay stitch at one or other end of the anastomosis. Bring this along one side of the anastomosis, picking up serous and muscle coats of both pieces of bowel, while covering the previous all-coats suture (Fig. 13.1Q). Tie the continuous suture, if you wish, to the second stay suture, and then turn the bowel over and continue the seromuscular stitch along the other side of the anastomosis back to its origin. Tie it to the long end of the all-coats suture or to the stay suture; then cut the ends of this and the stay sutures. Close the opening in the mesentery with interrupted stitches of 2/0 catgut, taking care not to puncture the blood vessels. Check the adequacy of the stoma by palpation: it should admit at least the tip of the thumb and finger (Fig. 13.1R). Then close the laparotomy incision.

**Repair of typhoid perforation of the ileum**

In areas of high incidence of typhoid, a preoperative diagnosis of typhoid perforation of the ileum can be expected. Otherwise the diagnosis is likely to be made during laparotomy for peritonitis. Perforations are most likely to occur in the antimesenteric border of the ileum. They may be multiple, so it is important to examine the whole ileum.

**Equipment**


**Technique**

Perform a laparotomy with the patient under general anaesthesia.

Bring the affected loop of ileum out of the wound (Fig. 13.2A). “Freshen” the edges of the perforation by trimming, if necessary, and close it transversely with interrupted 2/0 chromic catgut (Fig. 13.2B,C). Insert a further layer of continuous suture of the same material to bury the first suture line (Fig. 13.2D).

Typhoid ulcers that are likely to perforate present as whitish patches on the antimesenteric border of the bowel (Fig. 13.2A). Such lesions should be oversewn with continuous 2/0 chromic catgut (Fig. 13.2E).

Aspirate the peritoneal exudate and insert a drain into the lower abdomen. Close the abdomen in layers, unless the wound is grossly contaminated, when the skin and the subcutaneous fat should be left unstitched for delayed primary closure.
Fig. 13.2. Suture of typhoid perforations of the ileum. A loop of the ileum with two perforations and an area of likely perforation (A); inserting sutures for transverse closure of the perforation after freshening the edges by trimming (B); suturing the perforation in two layers (C, D); oversewing an area of likely perforation with one layer of suture (E).
Appendix

Acute appendicitis

In acute appendicitis, the appendix becomes inflamed owing to bacterial invasion of its wall, usually distal to an obstruction of the lumen. Obstruction may be due to faecaliths, seeds, or worms in the lumen; to invasion of the wall by parasites such as amoebae or schistosomes; or even to lymphoid hyperplasia from viral infection. The condition spreads, producing local peritonitis that, without treatment, may progress to abscess formation, gangrene of the appendix, or perforation and general peritonitis.

The appendix may be subject to recurrent attacks of acute but less severe inflammation. The term “recurrent appendicitis” is sometimes used to refer to this condition, though the existence of a truly chronic form of the disease is doubtful.

Diagnosis

The patient presents with a rapidly progressive, central abdominal colic, which soon settles to a burning pain in the right iliac fossa. He or she usually experiences anorexia, nausea, vomiting, and fever. The most important signs are progressive tenderness with rigidity localized in the right iliac fossa. Rectal examination may indicate tenderness on the right side.

Differential diagnosis should include urinary tract infection, renal or ureteric calculi, ruptured ectopic pregnancy, pelvic inflammatory disease, twisted ovarian cyst, ruptured ovarian follicle, mesenteric adenitis, and the early stages of measles.

Measure the patient’s haemoglobin level, test the urine for sugar, protein, and red cells, and obtain white-cell and differential white-cell counts.

Treatment

Acute appendicitis is a surgical emergency; the appendix must be removed.

Appendicectomy

Preoperative management

Administer analgesics to relieve pain. If the patient has been vomiting, insert a nasogastric tube, aspirate the stomach contents, and begin intravenous infusion of an appropriate fluid while you make arrangements to operate.

Equipment

See tray for Appendicectomy, Annex 1.

Technique

Before anaesthesia is induced, make a mark on the patient’s skin over McBurney’s point\(^1\) or over the point of maximal tenderness, if this elsewhere.

\(^1\)McBurney’s point lies one-third of the way along a line from the anterior superior iliac spine to the umbilicus.
Fig. 14.1. Appendectomy. For details see page 132.
Fig. 14.1. Appendicectomy. Anatomy in the region of the appendix (A); possible variations in the position of the appendix (B); centring the incision over McBurney's point (C); incision of the external oblique aponeurosis (D); separating the muscles along the lines of their fibres (E); using the taeniae coli to locate the appendix (F); removing the appendix, starting with the division of the mesoappendix (G-L); invaginating the stump (M); closing the wound (N, O).
The patient should then be given a general anaesthetic with a muscle relaxant and should be placed in a supine position. Centre an 8–10 cm incision in a crease over the point you have marked on the skin (Fig. 14.1C). Deepen the incision to the level of the external oblique aponeurosis, and cut through this in line with its fibres (Fig. 14.1D). Split the underlying muscles along the lines of their fibres using blunt dissection with scissors and large straight artery forceps (Fig. 14.1E). Make a "gridiron" incision by splitting and retracting the muscle layers until the extraperitoneal fat and the peritoneum are exposed in the wound. Lift the peritoneum with two pairs of artery forceps to form a tent and squeeze this with the fingers, to displace and thus avoid injury to any underlying viscera. The peritoneum can now be incised between two pairs of artery forceps.

Aspirate any free peritoneal fluid, and take a specimen for bacteriological culture. If the appendix is visible, pick it up with non-toothed forceps (with care, as the inflamed appendix is friable) and deliver it into the wound. The position of the appendix will be variable (Fig. 14.1A,B), so it is most easily located by following the taeniae coli to the base of the caecum and then lifting both caecum and appendix into the wound (Fig. 14.1F). Blunt dissection may be necessary to expose the base of the appendix.

Divide the mesoappendix, which contains the appendicular artery, between artery forceps close to the base of the appendix. Ligate it with 0 chromic catgut (Fig. 14.1G–I). Clamp the base of the appendix to crush the wall and reapply the clamp a little further distally (Fig. 14.1J). Ligate the crushed appendix with 2/0 chromic catgut. Cut the ends of the ligature fairly short and hold them with forceps to help invaginate the appendix stump. Insert a purse-string suture of 2/0 catgut in the caecum around the base of the appendix (Fig. 14.1K). Divide the appendix between the ligature and the clamp, and invaginate the stump as the purse-string is tightened and tied over it (Fig. 14.1L,M).

Close the wound in layers, using continuous or purse-string 2/0 chromic catgut suture for the peritoneum; interrupted 0 chromic catgut stitches for the split muscle fibres; interrupted or continuous 0 chromic catgut stitches for the external oblique aponeurosis; and finally interrupted 2/0 nylon for the skin (Fig. 14.1N,O). If there is any doubt about the severity of inflammation or a possibility of wound contamination, close the external oblique aponeurosis with No. 1 nylon and lightly pack the skin and subcutaneous layers with dry gauze for delayed primary closure.
The problems encountered by the inexperienced doctor performing appendicectomy often result from too small an incision, which leads to inadequate exposure of the operating field. If delivery of the appendix and caecum through the wound is difficult, enlarge the incision by opening the edge of the rectus sheath medially or by cutting the fibres of the internal oblique and the transversus abdominis muscles laterally in the line of the incision.

If the appendix is adherent and retrocaecal, the caecum should be mobilized and the appendix excised in a retrograde manner: ligate and divide the base of the appendix first, invaginate the stump, ligate the vessels, and then remove the appendix.

**Appendicular abscess**

Appendicular abscess is a complication of acute appendicitis. The patient experiences lower abdominal pain, maximal on the right side, and fever. Locally there is a tense, tender, globular, and possibly fluctuant mass. Needle aspiration may confirm the presence of pus.

Carry out the blood and urine tests specified for patients with acute appendicitis.

Treat the abscess by incision and drainage as an emergency. Appendicectomy may later be necessary, but because postinflammatory scarring is likely to make the operation more difficult, the patient should be referred.

**Appendicular mass**

An appendicular mass is an inflammatory swelling of the appendix, caecum, omentum, and distal part of the terminal ileum. It is accompanied by a variable degree of inflammation of the local abdominal wall. A loop of small intestine may also be involved. The condition can either resolve slowly or spread with increased inflammation, pus formation, and peritonitis.

The patient suffers fever and pain localized in the right iliac fossa, where there is a rounded, firm, and tender mass. The overlying skin may be inflamed.

Carry out the blood and urine tests specified for patients with acute appendicitis.

**Treatment**

The aim of treatment is to rest the bowel and allow the inflammation to resolve. Conservative management consists of bed-rest and the administration of analgesics, antibiotics, and fluids. Start by giving clear fluids orally (or intravenously if the patient is nauseated or vomits), and then give fluid feeds as the patient’s condition improves.

A satisfactory response to treatment will be indicated by the patient’s general state: an improved appetite, the passage of flatus and stool, and the return of a normal pulse and temperature. The appendicular mass will become smaller, less tender, and better delineated.

If the patient’s condition grows worse, abandon conservative management. Perform a needle aspiration and, if pus is present, incise and drain the abscess. If no pus is found, either perform a laparotomy to make a diagnosis or refer the patient.
15

Colon

Colostomy

A colostomy is an artificial opening in the colon through which the intestine is made to discharge its contents at the skin surface. There are three main types:

- the loop colostomy, in which there is an opening in an exteriorized loop of colon (Fig. 15.1A);
- the double-barrelled colostomy, in which the two ends of colon remaining after resection have been brought to the skin surface, adjacent to each other (Fig. 15.1B);
- the end (terminal) colostomy, in which only the proximal cut end of the colon opens at the skin surface, the other end having been closed and left within the abdomen (Fig. 15.1C).

There are only a few indications for establishing a colostomy at the district hospital. A loop colostomy can be used to exteriorize an injured piece of colon or to relieve distal obstruction caused by a carcinoma or, in infants, by anorectal atresia or Hirschsprung's disease. A double-barrelled or terminal colostomy may be indicated after resection of a gangrenous loop of colon, for example in patients with sigmoid volvulus.

Equipment

For a planned procedure in neonates and infants suffering from anorectal atresia or Hirschsprung's disease, use the tray for Minor paediatric operations, Annex 1. Otherwise use the tray for Laparotomy, Annex 1. Add to both trays a catheter or a short length of polythene tubing, a piece of glass rod, and a colostomy bag if available.

Technique

The site of the colostomy should normally be decided at laparotomy, with the patient under general anaesthesia.

Loop colostomy

The colostomy incision is made separately from the main wound. Make a grid-iron incision (see page 133) in the quadrant of the abdomen nearest to the loop to be exteriorized. The incision should be large enough to accommodate the loop of colon comfortably. The greater omentum can usually be used as a guide to help you find the transverse colon, though in Hirschsprung's disease in children, the sigmoid colon may be so enlarged that it presents in the right upper abdomen.

Bring out the loop of colon without kinking or twisting it (Fig. 15.2A). Make an opening in the mesocolon just large enough to admit a piece of glass rod. Push the
After-care

Refer all patients for further management and closure of the colostomy. The doctor at the district hospital is unlikely to be involved in the long-term care of such patients, but colostomy bags, if available, can greatly ease even the short-term management of a stoma.
Fig. 15.2. Loop colostomy. Delivering the loop through the wound (A); passing a glass rod through the mesocolon (B); joining the ends of the rod with a rubber tube and closing the wound (C); opening the colon (D).

**Sigmoid volvulus**

Volvulus is the rotation of a loop of bowel on its mesenteric axis, resulting in a partial or complete obstruction of the lumen (Fig. 15.5A). The most common loop affected is the sigmoid colon. The disease may be acute or subacute and is often recurrent.
Diagnosis

The patient with acute volvulus experiences a sudden onset of abdominal pain associated with absolute constipation and rapidly progressive abdominal distension. The obstruction is total and, if unrelieved, can progress rapidly to strangulation and gangrene. Nausea and vomiting are late symptoms. The distended abdomen is tympanic and may have features of peritonitis. Hypovolaemic shock may also be present. The anus and rectum are empty.

The patient with subacute volvulus presents several days or weeks after the start of the disease. He or she experiences abdominal discomfort, rather than pain, with associated gross abdominal distension, visible peristalsis, and audible bowel sounds. There is little or no constitutional disturbance. The anus and rectum are empty. The patient may give a history of previous similar attacks.

If either acute or subacute volvulus is suspected, the most important investigation is a radiographic examination (Fig. 15.5B). Obtain a plain, abdominal radiograph with the patient supine. In cases of subacute volvulus, it will show gross distension of the affected loop of bowel with a loss of haustrations, the dilated loop pointing towards the pelvis in the form of a “bird’s beak”. Also measure the patient’s haemoglobin level and test the urine for sugar and protein.

Preoperative management

Preoperative management consists of the administration of fluids intravenously and nasogastric intubation with suction. In acute cases, resuscitation may be necessary.

Treatment

Acute volvulus is an indication for emergency laparotomy. Untwist the volvulus and, if the bowel is viable, instruct an assistant to pass a rectal tube into the sigmoid colon as you guide it along the distended colon. Fix the tube to the buttocks and close the abdominal wound. The tube should be removed after 3–4 days. In cases of gangrene of the colon, perform resection with double-barrelled or end colostomy (see page 136). After the patient’s recovery, arrange for referral for elective colectomy or closure of the colostomy, as appropriate.
Subacute volvulus does not require emergency reduction, but there should be no delay in treatment. Reduction by rectal tube should be attempted first. Carry out this procedure in the operating room with readiness to perform laparotomy if necessary.

**Non-operative reduction of subacute volvulus**

**Equipment**
See tray for Sigmoidoscopy, Annex 1, and add a long, large-bore, rectal tube and a large bucket.

**Technique**
Administer a basal sedative. An anaesthetic should not be given, since the patient's reaction to pain, should the scope be incorrectly placed, is a protection against traumatic perforation of the bowel wall. Put on a waterproof apron and place the patient face down in a knee–elbow position (which may itself cause derotation of the bowel) or in a left lateral position. Without using force, pass the well-lubricated sigmoidoscope as high as it can go into the colon (see page 145). Lubricate the rectal tube and introduce it through the sigmoidoscope until it meets the obstruction marking the lower part of the twisted loop. Gently rotate the tube, allowing its tip to slip into the distal limb. Keep your face well aside.
After-care

Chest, abdomen, and gastrointestinal tract

Fig. 15.5. Sigmoid volvulus. A clockwise twist (A); the radiographic appearance (B).

from the tube and the sigmoidoscope at this stage, as successful entry into the volvulus will be evidenced by a sudden profuse outpouring of foul-smelling liquid faeces mixed with gas.

After decompression, withdraw the sigmoidoscope, but leave the rectal tube in position strapped to the perineum and buttock. It should be retained in this position for 3–4 days, if possible. Should the tube be expelled, gently reintroduce it without using the sigmoidoscope. Indeed, sigmoidoscopy is not essential even for the initial introduction of the tube, though it facilitates the procedure.

Should this manoeuvre fail to untwist the volvulus, perform laparotomy immediately.

After-care

After recovery, refer the patient for elective sigmoid colectomy.
Anus and rectum

Rectal examination

Digital examination of the rectum (Fig. 16.1) is unpleasant for the patient and extra trouble for the doctor, so it is often omitted from a physical examination — to the patient's disadvantage. The rectum must be examined if the patient has a disturbance of bowel motion such as diarrhoea, constipation, or tenesmus; a history of passing blood, melaena, or mucus through the rectum; discomfort or pain on defecation; or a history of anal swelling or of a feeling of incomplete defecation. Rectal examination should also be performed if the patient is undergoing a full medical check-up, or has gastrointestinal symptoms or signs (even if these are located in the upper abdomen), urinary symptoms (as in prostatic disease), or pyrexia of unknown origin.

Equipment

See tray for Rectal examination (digital), Annex 1.

Technique

Considerable tact is often needed to convince adults of the necessity for this type of examination. For this reason, the rectal examination should come at the end of the physical examination, which will give the patient time to develop confidence in the doctor. For female patients, it should follow the vaginal examination. Before proceeding, explain the purpose and nature of the examination to the patient. Emphasize that it does not usually hurt.

If the patient has a painful anal condition, apply lidocaine gel to the anal verge before examination. Rarely, regional or general anaesthesia may be necessary for an adequate assessment. If the patient is in pain and cannot cooperate during the examination, the findings may be unreliable.

Place the patient on a couch or bed in a left lateral position (or in a right lateral position if you are left-handed), with the hips fully flexed and both knees drawn up towards the chest. The patient's trunk should be inclined, but not bent, with the buttocks at the edge of the bed and projecting just beyond it (Fig. 16.1D).

Glove the index finger or hand and gently part the buttocks to inspect the perianal region, the natal cleft, and the anal margin. A tightly closed anus suggests spasm, probably due to a painful anal condition. Palpate any lesions in this area. If necessary, apply anaesthetic gel to the anal verge and, after a few minutes, gently introduce a small amount just into the anus. To distract the patient, instruct him or her to take deep breaths with the mouth open as you slowly introduce your lubricated, gloved finger into the anus with the palmar surface turned posteriorly.

Palpate the posterior anal wall and any anal contents against the curve of the sacrum. Rotate the finger anteriorly to allow the tip to detect any bulge or tenderness suggestive of a pelvic abscess (Fig. 16.1E,F). The prostate in the male
and the cervix in the female will be palpable anteriorly, against the anorectal wall. Determine the degree of mobility of the mucosa over the underlying tissues and structures. Withdraw the finger and inspect it for stains from anal contents, for example stool, mucus, or blood. Take specimens for examination.

On withdrawal of the examining finger there may be passage of watery or mucoid faeces. This is particularly noticeable in patients with Hirschsprung’s disease, when there can be a gush of profuse, foul-smelling, liquid faeces.
Anus and rectum

Fig. 16.2. Proctoscopy.

Proctoscopy

The indications for proctoscopy are the same as those for digital rectal examination. The advantage of proctoscopy is that it enables one to view the whole of the anal canal, although only a small part of the rectum is visible at its lower end. Technically, the procedure is really an "anoscopy". Tissue for biopsy may be obtained through the proctoscope if reliable facilities for specimen examination exist.

Equipment

See tray for Proctoscopy, Annex 1. Good lighting is essential.

Technique

It is helpful to obtain the patient's confidence and cooperation. Talk to him or her throughout the examination. Explain the procedure and its purpose, emphasizing that it should cause no discomfort. Do not administer an enema unless the patient is constipated or unless sigmoidoscopy is also required.

Perform a preliminary digital examination. Then, with the patient in the same position, proceed to the proctoscope to view any lesions that you have just felt. Lubricate and introduce the proctoscope, holding the handle with the fingers and pressing the thumb firmly on the head of the obturator (Fig. 16.2A). This grip will keep the two parts of the instrument assembled. The handle should point posteriorly.

While you introduce the scope to its full length (Fig. 16.2B), instruct the patient to take deep breaths with the mouth open. Remove the obturator and direct the light into the scope (Fig. 16.2C). Mop away or remove any fecal material, mucus, or blood. Align the scope so that the lumen of the gut just beyond is clearly visible. Slowly withdraw the instrument while maintaining its alignment in the gut so that you can view any mucosal lesions, including hemorrhoidal masses or polyps. Note the appearance of the mucosa and assess its integrity. If reliable facilities for specimen examination exist, take a biopsy sample from any obviously or possibly abnormal area under direct vision using special biopsy...
forceps. Remove the tissue sample through the proctoscope. Remember that taking a biopsy sample from the rectal mucosa causes some discomfort and that removal of tissue from the anal lining can produce severe pain. At this examination, tissue should not be taken from a haemorrhoidal mass or any other lesion that appears to be vascular.

Immediately after removal from the patient, the tissue sample should be fixed by total immersion in formaldehyde saline (10 ml of 37% formaldehyde solution + 90 ml of physiological saline); fixation takes about 48 hours. A plastic, capped bottle with a wide mouth is a suitable container. Write the name of the patient, the site of origin of the biopsy sample, and the date of collection in pencil on a stiff piece of paper, and place this in the specimen bottle. Secure the cap of the bottle with adhesive tape, and place the bottle in a metal tube (or box) together with a summary note containing particulars of the patient, his or her clinical state, the tentative diagnosis, the type of tissue sent, and the investigation requested. Place the tube in a wooden or cardboard box, packed well with non-absorbent cotton wool, and dispatch it. If properly prepared, the biopsy sample will not deteriorate even if it is a long time in transit.

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Fig. 16.3. Sigmoidoscopy. Schematic representation of the procedure (A-C); position of the patient and direction of the scope in the early stages of examination (D, E).
Sigmoidoscopy

Sigmoidoscopy is indicated in patients who have symptomatic colorectal disease but in whom proctoscopy has proved inconclusive or has not revealed any abnormalities. It is also indicated when abnormalities have been detected at proctoscopy, but when additional lesions are suspected, for example in patients with polyposis, or when a biopsy sample from the rectal mucosa is required for the diagnosis of schistosomiasis. In cases of amoebic colitis, sigmoidoscopy is useful in assessing the response of proctocolitis to treatment. It can also facilitate the introduction of a flatus tube to decompress and reduce sigmoid volvulus.

Equipment

See tray for Sigmoidoscopy, Annex 1.

Technique

This examination normally follows a rectal examination and a proctoscopy. Administer a preliminary enema or perform bowel washout. If the patient has "obstinate" constipation, administer a mild laxative 1-2 days before the examination. Check the equipment, particularly the light-head, the eyepiece fitting (window), and the inflation pump (bellows) to ensure that they fit together and that enough light reaches the end of the scope.

In its initial stages, sigmoidoscopy is similar to proctoscopy (Fig. 16.3A), but then the sigmoidoscope is pointed backwards and upwards as it is advanced (Fig. 16.3B,C). Lubricate the sigmoidoscope generously before you start and introduce it with the obturator in position. Hold the obturator firmly to prevent its being dislodged backwards (Fig. 16.3D,E).

After introducing the sigmoidoscope about 10 cm, remove the obturator (Fig. 16.3B). Should there be any obstruction before the sigmoidoscope has been inserted 10 cm, remove the obturator at this point. Then attach the eyepiece, which usually carries the light source and pump connections. To view the gut wall and the bowel lumen, introduce a little air and align the scope. Gently advance the instrument, keeping it accurately within the lumen of the bowel (Fig. 16.3C). Introduce air at intervals to open up the bowel lumen gradually beyond the scope. Should the view be obscured at any time by rectal contents, remove the eyepiece and evacuate the material using dental rolls held firmly with biopsy forceps.

Progressively change the direction of the scope to keep within the lumen. Do not advance the scope unless the lumen of the bowel is in view. The rectosigmoid junction may be difficult to traverse, so the procedure should not be rushed. The junction may relax, if the difficulty is due to spasm, but if it does not relax, make no further attempts to advance the scope.

Never use force in introducing the scope, or in using forceps to take a biopsy specimen from the wall of the bowel, since injury or even perforation of the rectal wall can result. If the patient experiences discomfort during the examination, check for proper alignment of the sigmoidoscope, release air by removing the eyepiece or by disconnecting the pump tubing, and then reassemble the instrument and continue the examination.

Further examination is possible while you withdraw the scope. If necessary, reintroduce the scope and repeat the examination. At the end of each examination, let out the air from the gut before withdrawing the scope.

Haemorrhoids

The main symptoms of haemorrhoids are bleeding on passing stool and prolapse of the varicose masses. Pain is not a significant feature. Haemorrhoids are graded
Treatment Manual dilatation of the anus

Many patients benefit from conservative management in the form of a high-fibre diet — to encourage regular, soft, bulky motions — and the local application of an analgesic ointment or suppository.

Patients whose haemorrhoids prolapse (and either return spontaneously or can be replaced) and patients in whom the above regimen has failed to give adequate relief can be treated by manual dilatation of the anus. This is the only form of surgical treatment recommended at the district hospital.

Before proceeding, empty the rectum by administering an enema.

Equipment See tray for Sigmoidoscopy, Annex 1.

Technique The patient should be given a general anaesthetic, but without a muscle relaxant, so that you can use the tone in the anal sphincter to judge the extent to which it should be stretched. Perform a digital and then proctoscopic examination to confirm the presence of haemorrhoids (Fig. 16.4A,B).

The success of the treatment depends largely on adequate dilatation of the anus in the region of the "constricting bands". This is achieved by applying pressure with the fingers, but to avoid over-dilatation and other complications, use no more than four fingers; do not employ any instruments. First insert the index and middle fingers of the left hand into the anus and press against the wall to assess the degree of constriction caused by the bands in the anal wall (Fig. 16.4C). Now dilate the anus by inserting the right index finger and pressing it against the anal wall in the opposite direction to the other two fingers (Fig. 16.4D). Insert the middle finger of the right hand and repeat the procedure. Finally insert into the anus a sponge or gauze swab, soaked in a non-irritating antiseptic or saline and wrung out, or a piece of petrolatum gauze. Leave one end of the sponge or gauze protruding.

After-care

Administer analgesics when indicated. Give the patient a mild laxative, such as liquid paraffin (mineral oil), to encourage the regular passing of soft, bulky stools. Instruct the patient to sit in warm water, preferably in which some salt has been dissolved, for about 15–30 min at least once a day for 14 days. Treatment with laxatives can be discontinued after about 30 days.

Complications

Complications can include haematoma formation, incontinence, and mucosal prolapse. Provided that no more than four fingers are used for dilatation, no significant complications should arise.

Perianal haematoma

Perianal haematoma is usually associated with considerable pain. The inflamed area is tense, tender, and easily visible upon inspection of the anal verge as a small, tender swelling about the size of a pea.

The main complications of haemorrhoids are anaemia and thrombosis.

Measure the patient's haemoglobin level, and test the urine for sugar and protein. Examine the patient's stool for parasites.

The main complications of haemorrhoids are anaemia and thrombosis.

Chest, abdomen, and gastrointestinal tract

according to whether they prolapse and, if so, whether the prolapsed mass reduces spontaneously or must be replaced manually. Rectal examination, proctoscopy, and sigmoidoscopy are necessary in diagnosing haemorrhoids and in checking for any associated rectal conditions, for example carcinoma of the rectum.

Perianal haematoma is usually associated with considerable pain. The inflamed area is tense, tender, and easily visible upon inspection of the anal verge as a small, tender swelling about the size of a pea.
Management consists mainly of relieving the pain by local or oral administration of analgesics and by helping the patient to avoid constipation. The lesion will resolve slowly over several days or weeks. Meanwhile the haematoma may spontaneously rupture through the overlying skin, discharging blood clots and providing some pain relief. In the early stages of haematoma formation, surgical evacuation of the clot under local anaesthesia can rapidly relieve pain and discomfort.
**Anal fissure**

An anal fissure is a tear in the mucosa of the lower anal canal, which is usually associated with intense pain, especially during and just after defecation. Hard stools precipitate and aggravate the condition. Anal fissures can be associated with certain colonic diseases, especially granulomata.

**Diagnosis**
The anus is tightly closed by spasm, so that the application of a local anaesthetic gel or occasionally even general anaesthesia is necessary to allow an adequate examination. The fissure may be acute or chronic, the latter having fibrotic margins.

Measure the patient's haemoglobin level, and test the urine for sugar and protein. Examine the patient's stool for parasites.

**Treatment**
Conservative management is recommended, especially for an acute fissure. It should include prescription of a high-fibre diet and administration of a local anaesthetic ointment or suppository.

A chronic fissure can be treated by manual dilatation of the anus, as described for haemorrhoids.

**Incision and drainage of perianal and ischiorectal abscesses**

Anorectal abscess is a common and painful condition. It is classified according to its location: perianal, ischiorectal, intersphincteric, submucous, or pelvic. Of these, the first two are the most common, affecting men more often than women.

**Assessment and preoperative management**
The main symptom is throbbing anal pain. Most patients are unable to sit as a result. A perianal abscess presents as an extremely tender, inflamed, localized swelling at the anal verge (Fig. 16.5A). An ischiorectal abscess is indicated by tenderness with a diffuse indurated swelling in the ischiorectal fossa. Fluctuation in either lesion is unusual at an early stage. In patients with perianal abscess, tenderness on rectal examination will be confined to the anal margin, whereas in patients with ischiorectal abscess, there will be deep tenderness.

Measure the patient's haemoglobin level, and test the urine for sugar and protein. If you are in doubt about the diagnosis, perform a diagnostic aspiration.

Begin parenteral antibiotic treatment and administer analgesics. Prepare the patient for incision and drainage of the abscess.

**Equipment**
See tray for Incision and drainage of abscess, Annex 1.

**Technique**
The patient should be given a general anaesthetic and be placed in the lithotomy position.

Centre a cruciate incision over the most fluctuant or prominent part of the abscess (Fig. 16.5B). Take a sample of pus for bacteriological examination. Introduce a finger to break down all loculi, and excise the corners of the incision.
Anus and rectum

Fig. 16.5. Incision and drainage of perianal abscess. The abscess (A); making a cruciate incision (B); breaking down all loculi to improve drainage (C); trimming the corners of the incision (D); packing the abscess cavity (E, F).

to deroof the cavity completely (Fig. 16.5C,D). Clean the cavity with gauze soaked in a mild antiseptic and wrung out. Pack the cavity loosely with petrolatum gauze, leaving it protruding slightly (Fig. 16.5E,F). Cover the wound with gauze soaked in a mild antiseptic and wrung out, then cotton wool, and finally a T-bandage.
After-care

Instruct the patient to bathe the area by sitting in warm saline for 15–30 min twice a day until the wound is healed, and to change the petrolatum pack or gauze after each bath. Do not allow the wound edges to close prematurely. Administer a mild laxative, such as liquid paraffin (mineral oil), daily and continue antibiotic treatment for 5 days. Analgesics are rarely needed after the first 72 hours.

Recurrence of the abscess is often due to inadequate drainage, to premature healing of the skin wound, or to the presence of an anal fistula. Patients with this last condition should be referred.

Rectal prolapse

Adults presenting with rectal prolapse should be referred (for children see page 197).
**Herniae**

**Inguinal hernia**

Inguinal hernia is more common in men than in women. There are many hernia sufferers in developing countries who could benefit from elective surgery to avoid the most important complication of hernia — strangulation. Without surgical treatment, strangulation can result in death. Ideally, a hernia should be diagnosed and treated by elective surgery at the district hospital before it becomes enlarged or strangulated. Treatment by the use of a truss is not recommended, as it cannot prevent strangulation.

Hernia repair, though usually straightforward, can be difficult, particularly when the hernia is recurrent or strangulated, but also when the hernia is simple, but large. For this reason, repair of recurrent herniae should not be attempted at the district hospital, except in emergency cases when the hernia is strangulated, and patients with simple hernia should be referred if the swelling is too large to be held in one hand. Also refer obese patients and patients with additional conditions requiring treatment, for example prostatic enlargement.

Inguinal hernia can be indirect or direct. An indirect hernia enters the inguinal canal through the internal ring, while a direct hernia does not. A hernia that reaches the scrotum is almost always indirect.

**Diagnosis**

Take the patient's history, noting any possible predisposing factors such as chronic cough, dysuria due to urethral stricture or prostatic enlargement, or manual work involving heavy lifting.

The general examination should include a careful assessment of the respiratory, cardiovascular, and urinary systems. Carry out a local examination with the patient both standing and lying down. The hernia presents as a soft swelling in the groin that becomes more prominent when the patient stands up, coughs, or strains; it is manually reducible or reduces itself when the patient assumes a horizontal position. An expansile impulse is evident when the patient coughs. Test for indirect hernia by blocking the internal inguinal ring with a finger and then asking the patient to cough. If the hernia still appears, it is of the direct type. Apart from producing a groin swelling, inguinal hernia may give rise to discomfort or pain.

A strangulated hernia has different features: the patient complains of pain and vomiting; the hernia is tense, tender, and irreducible; and there is no detectable impulse when the patient coughs. The patient may also have features of hypovolaemia.

Always examine the opposite inguinal region and all other orifices where herniae can develop.
Differential diagnosis

Femoral hernia, which is less common, will have its neck below and lateral to the pubic tubercle, whereas the neck of an inguinal hernia will be above and medial to the tubercle. Testicular swelling and hydrocele can be differentiated from an inguinoscrotal hernia in that the superior margins of the former lesions can be palpated in the upper part of the scrotum. These swellings also cannot be reduced and there is no detectable impulse when the patient coughs.

Surgical repair

Assessment and preoperative management

Patients for elective hernia repair should be selected carefully. Inform a patient who has been doing heavy manual work that the hernia can recur unless heavy work is stopped or unless the patient does not return to work for at least 6 weeks after the operation. Measure the patient's haemoglobin level, and test the urine for sugar and protein.

Strangulated hernia is an indication for emergency surgery. In a patient with strangulated hernia, first insert a nasogastric tube and aspirate the stomach contents. Take blood samples for grouping and cross-matching, measure the patient's haemoglobin level, and test the urine for sugar and protein. Administer analgesics and give fluids intravenously.

Equipment

See tray for Hernia operation, Annex 1.

Technique

The technique described here for the repair of inguinal herniae applies to male patients. In female patients the procedure is similar but less complex.

Indirect hernia

The aim of the operation is to reduce the hernia, excise its sac, and repair any defect in the abdominal wall. Just before the patient is anaesthetised, confirm the diagnosis and note on which side of the body the hernia is located. Once anaesthesia has been established, make an incision in the inguinal region in a skin crease 1–2 cm above the inguinal ligament, centring it midway between the deep ring and the pubic symphysis. As an alternative, the incision can be made about 1–2 cm above and parallel to the inguinal ligament, extending from just lateral to the deep ring to the pubic tubercle (Fig. 17.1A). Divide and ligate the veins in the subcutaneous tissue.

At this point, the external oblique aponeurosis will be displayed with its fibres running in a downward and medial direction. Incise the aponeurosis along its fibres, holding the cut margins with forceps. Use these forceps to lift and retract the edges while extending the incision to the full length of the wound (Fig. 17.1B,C). (The process of extending the wound also opens the external ring.) Identify the ilio-inguinal nerve and protect it during surgery by holding it away from the operating field.

Using blunt dissection (Fig. 17.1D), deliver the spermatic cord together with the hernial sac as one mass and pass a finger around it. Secure the mass with tape or gauze. Using sharp and blunt dissection, separate the sac from the cord (vas deferens and vessels) layer by layer (Fig. 17.1E). Extend the dissection to the neck of the sac at the internal ring, thus exposing the extraperitoneal fat. Open the sac between two pairs of small forceps and confirm its communication with the abdominal cavity by introducing a finger into the opening (Fig. 17.1F).

Twist the sac to ensure that it is empty (Fig. 17.1G). Transfix the neck with 2/0 thread, hold the ligature, and excise the sac (Fig. 17.1H–J). Inspect the stump to be sure that it is adequate to prevent partial slipping of the ligature. When the ligature is finally cut, the stump will recede deeply within the ring and out of view.

The aim of the repair procedure (Bassini) is to strengthen the posterior inguinal wall by stitching the conjoined muscle and tendon to the inguinal ligament. The process also narrows the internal ring.
Fig. 17.1. Repair of indirect inguinal hernia. Site of incision (A); incising the external oblique aponeurosis in the direction of its fibres (B, C); delivering the hernial sac and spermatic cord by blunt dissection (D); separating the sac from the cord by combined blunt and sharp dissection (E); opening the sac (F).
Begin the repair medially using No. 1 thread. The stitches should be inserted through the inguinal ligament at different fibre levels, as the fibres tend to split along the line of the ligament. Insert the first stitch to include the pectineal ligament (Fig. 17.1K); insert the next stitch through the conjoined tendon and the inguinal ligament; and continue laterally to insert stitches in this manner. Leave the stitches untied until all have been inserted (Fig. 17.1L). Test the final stitch adjacent to the ring before you start to tie the stitches; it should just allow the tip of the little finger to be passed through the ring along the cord. Then tie the stitches, beginning medially, and cut the loose ends (Fig. 17.1M). As the final stitch is tied, adjust its tension so that the internal ring just admits the tip of your little finger (Fig. 17.1N). Finally, check the soundness of the repair, inserting additional stitches where necessary.

Close the external oblique aponeurosis with continuous 0 chromic catgut or interrupted 0 thread (Fig. 17.1O). Stitch the skin with interrupted 2/0 thread.
Fig. 17.1. Repair of indirect inguinal hernia (continued). Inserting repair sutures so that the first stitch includes the conjoined tendon and the pectineal ligament (K); stitching the inguinal ligament to the conjoined tendon and muscle (L); tying the stitches, beginning medially after all have been inserted (M); the internal ring should just admit the tip of the little finger (N); closing the wound (O, P).
A direct hernia will appear as a bulge, often covered by fascia transversalis and with a wide neck in the posterior inguinal wall (Fig. 17.2A). Once recognized at operation, the hernia should be reduced, but the sac should not be opened or excised. Cover the reduced sac by completing the repair of the posterior wall of the inguinal canal as described above for indirect hernia (Fig. 17.2B).

A sliding hernia can be encountered in either groin. It is not easy to make a preoperative, clinical diagnosis, but the hernia will become apparent once you open the inguinal canal and the hernial sac. In cases of sliding hernia, part of the gut will appear to be adherent to the inside wall of the sac (Fig. 17.3A) — the caecum and appendix if the hernia is in the right groin, and the sigmoid colon if the hernia is on the left. The colon or caecum (depending on where the hernia is located) actually forms part of the posterior wall of the hernial sac. Rarely the bladder slides to one side.

Excise most of the sac, leaving a rim below and lateral to the bowel (Fig. 17.3B). Close the sac with a purse-string suture (Fig. 17.3C,D). While tying the suture, push the hernial mass up within the deep inguinal ring. If the hernia fails to reduce completely, make a curved incision below and lateral to the caecum to allow the mass to slide back (Fig. 17.3D). The skin incision may have to be extended laterally to improve access. Repair the posterior inguinal wall as described for indirect hernia.

Attempts to excise the scrotal part of the sac can predispose the patient to developing scrotal haematoma, so it may be safer to transect the sac in the inguinal canal and deal with the proximal part as described for indirect inguinal hernia. For the distal cut edge, merely ensure haemostasis.
Fig. 17.3. Repair of sliding hernia. The cecum appears adherent to the inside wall of the sac (A); excising the sac (B); inserting and tying a purse-string suture (C, D; dotted line shows site for extra incision to allow mobilization of the cecum).
**Recurrent hernia**

Operate to repair a recurrent hernia only if the hernia is strangulated and the patient’s life is in danger; otherwise, refer the patient. Because of previous operations, the inguinal anatomy is often distorted, which complicates repair and makes further recurrence likely.

Open the inguinal canal and relieve the obstruction. Inspect the hernia to assess the viability of the bowel, and proceed accordingly (see section on strangulated groin hernia, page 160). Define tissue planes as clearly as possible by dissection and repair the weak posterior wall of the inguinal canal as described above for indirect hernia. If tissue planes cannot be defined clearly enough for an effective repair, close the wound and refer the patient for elective repair.

**Complications**

The most important complication of hernia repair is recurrence. Numerous factors contribute to recurrence, including a raised intra-abdominal pressure, inadequate previous repair, haematoma, and wound infection.

**Femoral hernia**

This hernia occurs through the femoral canal and is more common in women than in men. The neck of the hernia lies below and lateral to the pubic tubercle. Inguinal hernia is the main possibility to consider in differential diagnosis. Femoral hernia is far less common than inguinal hernia, but it is an important condition to recognize because it can pass readily to strangulation without complete bowel obstruction, only part of the circumference of the bowel being caught in the femoral canal.

Preoperative investigations should be the same as for inguinal hernia.

**Surgical repair**

**Equipment**

See tray for Hernia operation, Annex 1.

**Technique**

The patient should be given a general or spinal anaesthetic. Centre the incision in the groin over the hernia in a crease about 2 cm below the inguinal ligament (Fig. 17.4A). Deepen the incision through the cribriform fascia, maintaining haemostasis throughout the procedure. The extraperitoneal fat covering the hernial sac will appear under the cribriform fascia. To expose the neck of the hernia, separate the fat from the sac by blunt dissection (Fig. 17.4B).

Define the margins of the femoral canal, but carefully avoid sharp dissection in the region of the lateral margin near the femoral vein. Keep all dissection activity close to the neck of the hernial sac. Open the lateral part of the fundus of the sac between two pairs of forceps (Fig. 17.4C), inspect its contents, and confirm its communication with the abdominal cavity by introducing a finger into the opening. Reposition the contents of the sac in the abdominal cavity (Fig. 17.4D). Excise and transfix the empty and isolated sac at its neck using 2/0 chromic catgut (Fig. 17.4E). Leave an adequate stump, to avoid slipping of the ligature. Inspect the stump and then cut the suture, allowing the stump to recede into the pelvis.

Close the femoral canal with interrupted 0 thread by stitching the inguinal ligament to the pectineal ligament laterally and to the lacunar ligament medially (Fig. 14.4F). Be sure to avoid the femoral vein in the lateral part of the wound. Close the cribriform fascia with 2/0 chromic catgut and the skin with 2/0 interrupted thread (Fig. 17.4G,H). Then apply a single layer of gauze dressing.
Fig. 17.4. Repair of femoral hernia. Site of incision in the groin crease (A); separating the extraperitoneal fat from the hernial sac (B); opening the lateral part of the fundus of the sac (C); exploring the sac and reducing its contents (D); transfixing the neck of the sac (E); after excision of the sac, the femoral canal is closed with a series of stitches between the inguinal ligament and the pectineal and lacunar ligaments (F).
If a strangulated loop of intestine is found to be gangrenous, it must be resected and an anastomosis constructed. This procedure, particularly the anastomosis, may be difficult via the groin incision, so that an additional lower paramedian laparotomy may be necessary. The femoral canal should be repaired as described above.

**Strangulated groin hernia**

Patients with strangulated groin hernia should receive immediate treatment to relieve the obstruction.

**Surgical repair**

**Equipment**

See tray for *Hernia operation*, Annex 1.

**Technique**

The patient should be anaesthetized, and an appropriate incision made. Open the hernial sac and aspirate any serous or blood-stained fluid. Take a specimen for bacteriological examination. Carefully inspect the contents of the sac (gut or omentum) for viability, giving particular attention to the constriction rings.

Apply warm, wet packs to the gut for a few minutes. Gangrenous or non-viable gut will be black or deep blue without peristalsis. The mesenteric veins of the loop will appear thrombosed. There will be no arterial pulsation, and the serosa will have lost its shiny appearance. Resect any gangrenous loop of bowel and make an end-to-end anastomosis (see page 125). Then excise the hernial sac and complete the repair as appropriate.

**Alternative management**

Operation for strangulation can be difficult in children, in patients with recurrent herniae, and in those with large, inguinoscrotal herniae. The following alternatives to standard management may be useful at the district hospital.

**Non-operative reduction**

Consider non-operative reduction for patients who present early and who have no significant constitutional disturbance or signs of inflammation in the region of the hernia. Management consists of the administration of analgesics, bed-rest, and sedation with diazepam given intramuscularly or intravenously. If the patient is an adult, raise the foot of the bed to aid reduction; if the patient is a child, lift the child’s bottom. Failure of reduction within 4 hours is an indication for operation. Observe the patient for at least 12 hours after a successful non-operative reduction.
Simple division of the obstructing ring

It may sometimes be prudent simply to divide the obstructing ring, making no further repair (Fig. 17.5). This procedure is advisable in children, but can also be of use in adults with strangulated recurrent or inguinoscrotal herniae. The obstructing ring in children is often the external inguinal ring, while in adults it is usually the internal ring. All such patients should then be referred for definitive surgery.

Umbilical and paraumbilical hernia

Umbilical hernia is common in children but usually closes spontaneously; surgical closure of the defect is therefore rarely necessary. Surgical repair of umbilical (and paraumbilical) hernia is, however, indicated in adults, since strangulation is always a possibility.

Surgical repair

Equipment See tray for Hernia operation, Annex 1.

Technique The patient should be given a general anaesthetic. Make a transverse incision over the hernia, sparing the umbilicus (Fig. 17.6A).

Clearly define the neck of the sac as it emerges through the linea alba and make an opening in the neck (Fig. 17.6B,C). Check for adhesions between the herniated mass and the inside of the sac using a finger. Complete the division of the neck of the sac while protecting its contents. Carefully examine the contents of the sac (the gut and omentum) and reduce them (Fig. 17.6D,E). If the herniated mass consists of omentum alone you may divide it in small segments between artery forceps and transfix the remaining tissue. Excise the sac (with any attached omentum) from under the skin at this stage or after repair of the defect (Fig. 17.6I).
Fig. 17.6. Repair of paraumbilical hernia. Transverse incision (A); dissection to define the herniated mass (B); opening the sac at its neck (C) and reducing the contents (D, E); enlarging the defect laterally (F).
Repair of the defect by overlapping the edges (G, H); excising the sac together with extraperitoneal fat from the undersurface of the skin (I); closing the wound (J).

Using blunt dissection clearly define the fibrous margins of the defect and enlarge it laterally (Fig. 17.6F). Make the repair by inserting mattress stitches of 0 thread through all layers of the wound so that the edges overlap (Fig. 17.6G); the peritoneum need not be closed separately. Apply a further row of stitches to approximate the overlapping edge to the linea alba (Fig. 17.6H). Complete closure by stitching the skin with 2/0 thread (Fig. 17.6J). Then apply a single layer of gauze dressing.

Use the same procedure in children, but make a curved incision above or below the umbilicus. Small defects can be closed by purse-string suture.
Diagnosis

Symptoms of epigastric hernia vary, presenting a diagnostic problem. The patient may discover a subcutaneous swelling. He or she may complain of epigastric pain radiating to the back, especially after meals, and of heartburn, vomiting, flatulence, and indigestion.

Local examination reveals one or more subcutaneous, firm, rubbery, or soft epigastric swellings of variable tenderness. The swelling(s) may be reducible.

It is important to exclude gallbladder disease, pancreatitis, and especially peptic ulcer and hiatus hernia before you accept the diagnosis of an epigastric hernia. Indeed, epigastric hernia may coexist with one of these conditions. The local features can also be confused with those of other subcutaneous soft-tissue swellings, particularly lipoma and fibroma.

Surgical repair

Assessment and preoperative management

Preoperative investigations should be the same as for inguinal hernia.

Equipment

See tray for Hernia operation or for Laparotomy, Annex 1. The choice of tray should depend on the type of incision to be made.

Technique

The patient should be given a general anaesthetic. If intra-abdominal lesions have been excluded and the hernia is single, make a transverse incision over the swelling. Otherwise make a midline laparotomy incision and open the abdomen.

If you have made a transverse incision, dissect the herniated fatty mass down to its neck and make an opening in the neck. Reduce the peritoneal contents in the hernial sac and excise both the sac and the extraperitoneal fat. Define the fibrous margins of the defect and make the repair as described for paraumbilical hernia.

If laparotomy is necessary, open the abdomen through a midline incision, simultaneously opening up the epigastric hernia and any other midline herniae. Excise the fatty hernial mass. Inspect and palpate the abdominal viscera. Then close the wound, as described for laparotomy, page 102. As this incision is closed, the hernial defect is also repaired.

Incisional hernia

Patients with incisional hernia should normally be referred. Rarely, the hernia strangulates. If this happens, operate to save the patient’s life by relieving the obstruction, rather than to effect a sound repair. Close the incision as well as possible and refer the patient for repair.
UROGENITAL SYSTEM
18

Urinary bladder

Drainage

Acute retention of urine is an indication for emergency drainage of the bladder. Common causes are stricture of the male urethra or the complications of stricture; prostatic disorders (benign hypertrophy, carcinoma, prostatitis, or abscess); fractured pelvis with rupture of the urethra; and paraplegia, notably that associated with a fractured spine.

If there is chronic retention of urine, bladder drainage is not urgent, but can be useful for measuring the volume of residual urine or treating renal failure associated with retention. Patients suffering chronic retention should generally be referred.

There are three methods of draining the bladder: urethral catheterization, suprapubic puncture, and cystostomy. Urethral catheterization or bladder puncture is usually sufficient, but cystostomy may become necessary for the removal of a bladder stone or foreign body, or for more prolonged drainage, for example after rupture of the posterior urethra or if there is a urethral stricture with complications.

Urethral catheterization

Urethral catheterization is the most commonly used method of bladder drainage. Only the procedure for the male patient is described here; catheterization is much simpler in the female patient because the urethra is very short.

Equipment

See tray for Bladder catheterization, Annex 1.

Technique

First reassure the patient that catheterization is atraumatic and usually painless. Explain the procedure, and administer a basal sedative. Proper skin preparation is essential, especially since suprapubic puncture may become necessary if catheterization fails. In addition to taking the usual aseptic precautions, clip the hair of the pubis and external genitalia. Wash the area with soap and water, retracting the prepuce to clean the furrow between it and the glans. Put on sterile gloves and, with sterile swabs, apply a bland antiseptic to the skin of the genitalia. Isolate the penis with a perforated sterile towel. Instil lidocaine gel into the urethra and retain it for about 5 min.

Check the integrity of the Foley catheter balloon and then lubricate the catheter with sterile liquid paraffin (mineral oil). If you are right-handed, stand to the patient’s right, hold the penis vertically and slightly stretched with the left hand, and introduce the Foley catheter gently with the other (Fig. 18.1B). At 12–15 cm, the catheter may stick at the angle of the bulb of the penis, in which case angle it downwards to allow it to enter the posterior urethra. A few centimetres further, there may be resistance caused by the external bladder sphincter, which
Fig. 18.1. Urethral catheterisation in the male patient. Anatomy of the lower urinary tract (A); stretching the penis as the catheter is introduced (B); withdrawing the catheter until the inflated balloon abuts on the bladder neck (C); closed drainage is established (D).
Fixation of the catheter

Urinary bladder

Fig. 18.2. Fixation of a non-balloon catheter with ligature and strapping.

can be overcome by a gentle push. Urine escaping through the catheter confirms entry into the bladder.

If the catheter fails to pass the bulb of the penis and the membranous urethra, try a semi-rigid coudé catheter, or test the urethra with medium-size bougies and try the balloon catheter again.

Pass a coudé catheter in three stages: with one hand hold the penis stretched, and with the other hold the catheter parallel to the fold of the groin; introduce the catheter into the urethra, and bring the penis to the midline against the patient’s abdomen as the “beak” of the catheter approaches the posterior urethra; finally position the penis horizontally between the patient’s legs as the catheter passes up the posterior urethra over the lip of the bladder neck. At this point, urine should flow from the catheter.

If you fail to pass a catheter, abandon this method in favour of suprapubic puncture. Forcing a catheter can create a false passage, causing urethral bleeding and intolerable pain, and increasing the risk of infection.

Fixation of the catheter

If you are using a Foley catheter, inflate the balloon with 10–15 ml of air or sterile water. Partially withdraw the catheter until its balloon abuts on the bladder neck (Fig. 18.1C). If the catheter has no balloon, knot a ligature around the catheter just beyond the external meatus and carry the ends along the body of the penis, securing them with a spiral of strapping brought forward over the glans and the knot (Fig. 18.2).
Fig. 18.3. Bladder puncture with trocar and cannula. Site of puncture (A); making a small incision after injecting local anaesthetic (B); introducing the trocar and cannula through the abdominal wall into the bladder (C); withdrawing the trocar and inserting a de Pezzer catheter stretched over an introducer (D); head of the de Pezzer catheter before stretching (E); withdrawing the cannula (F); the catheter is fixed with the skin stitch used to close the wound (G).
After-care

Administer a urinary antiseptic such as co-trimoxazole (sulfamethoxazole + trimethoprim).

Always decompress a distended bladder slowly. Connect the catheter through a closed system to a disposable plastic bag or to a sterile bottle (Fig. 18.1D). The penis and catheter should be strapped laterally to the abdominal wall; this will avoid a bend in the catheter at the penoscrotal angle and help to prevent compression ulceration. Change the catheter if it becomes blocked or infected, or as otherwise indicated, but allow the urethra to rest for an hour or so before the new catheter is inserted. To prevent calculus formation in recumbent patients, who frequently have urinary infections (especially in tropical countries), ensure a generous fluid intake.

Suprapubic puncture

Bladder puncture may become necessary if urethral catheterization fails.

Equipment

See tray for Suprapubic puncture, Annex 1.

Technique

Assess the extent of bladder distension by inspection and palpation.

If you are proceeding to suprapubic puncture immediately after catheterization has failed, remove the perforated sheet that was used to isolate the penis and centre the opening of a new sheet over the midline above the pubis.

Simple puncture with a wide-bore intramuscular needle connected to a 50 ml syringe will afford the patient immediate relief, but the puncture must be made again after some hours if the patient does not pass urine.

It is preferable to perform a suprapubic puncture with a trocar and cannula, and subsequently to insert a de Pezzer catheter. Raise a wheal of local anaesthetic in the midline, midway between umbilicus and pubis, and then continue with deeper infiltration. Once anaesthesia is accomplished, make an incision with the point of a scalpel (Fig. 18.3A,B). Introduce the trocar and cannula and advance them vertically with care (Fig. 18.3C). After meeting some resistance they will pass easily into the cavity of the bladder, as confirmed by the flow of urine when the trocar is withdrawn from the cannula. Introduce the de Pezzer catheter well into the bladder (Fig. 18.3D,E). Once urine flows freely from the catheter, withdraw the cannula (Fig. 18.3F). Fix the catheter to the skin with the stitch used to close the wound (Fig. 18.3G) and connect it to a bag or bottle. Take care that the catheter does not become blocked, especially if the bladder is grossly distended. If necessary, clear the catheter by syringing with saline.

This type of drainage allows later investigation of the lower urinary tract, for example by urethrocystography, to determine the nature of any obstruction.

Suprapubic cystostomy

The purpose of suprapubic cystostomy is to expose and, if necessary, allow exploration of the bladder; to permit insertion of a large drainage tube, usually a self-retaining catheter; or to allow more prolonged drainage than is possible after urethral catheterization or suprapubic puncture.

Equipment

See tray for Laparotomy, Annex 1, and add a sterile, closed drainage system, a de Pezzer or Foley catheter, and lidocaine 1%.

Technique

If in poor condition, the patient should be given a local anaesthetic, for example 30–40 ml of 1% lidocaine for layer-by-layer infiltration of the tissues. Otherwise general anaesthesia is preferable.
Fig. 18.4. Suprapubic cystostomy. Site of incision (A); splitting the muscles (B); sweeping the prevesical fascia and the peritoneum upwards from the bladder surface (C); inserting stay (traction) sutures (D) and opening the bladder between them (E); suction (F); exploring the cavity of the bladder with a finger (G); holding the margins of the bladder opening with tissue forceps while inserting a de Pezzer catheter (H); closing the bladder opening against the catheter with a purse-string suture (I); fixing the bladder wall to the rectus sheath with stay sutures (J); closing the wound in layers (K, L).
Place the patient supine. Centre a midline suprapubic incision between the umbilicus and the symphysis pubis (Fig. 18.4A), and divide the subcutaneous tissues. Achieve haemostasis by forcipressure and ligation. Open the rectus sheath, starting in the upper part of the wound. Continue dissection with scissors to expose the gap between the muscles (Fig. 18.4B). (In the lower part of the incision the pyramidalis muscles will obscure this gap.) Finally, expose the extraperitoneal fat.

Carry the incision in the linea alba down to the pubis, splitting the pyramidalis muscles. With a finger, break through the prevesical fascia behind the pubis; then sweep the fascia and peritoneum upwards from the bladder surface (Fig. 18.4C). Take care not to open the peritoneum. The distended bladder can be recognized by its pale pink colour and the longitudinal veins on its surface. On palpation, it has the resistance of a distended sac. Insert a self-retaining retractor to hold this exposure.

Insert stay sutures of No. 1 catgut into the upper part of the bladder on either side of the midline (Fig. 18.4D). Puncture the bladder between the sutures and empty it by suction (Fig. 18.4E,F). Explore the interior of the bladder with a finger to identify any calculus or tumour (Fig. 18.4G). Note the state of the internal meatus, which may be narrowed by a prostatic adenoma or a fibrous ring.

If the bladder opening must be enlarged to allow you to remove a loose stone, open it 1–2 cm inferiorly, inserting a haemostatic stitch of 2/0 catgut in the cut edge if necessary. Close the extended incision partially with one or two stitches of No. 1 chromic catgut, picking up only the bladder muscle. Inspect the interior of the bladder for retained swabs before you introduce the de Pezzer catheter.

For insertion of the catheter, hold the edges of the incision with two pairs of tissue forceps, making sure that the mucosa is included so that the catheter does not snip beneath the mucosa. If you are using a de Pezzer catheter, stretch its head with forceps and introduce the catheter into the bladder between the two pairs of tissue forceps (Fig. 18.4H). If you are using a Foley catheter, introduce it into the bladder and inflate the balloon. Insert a purse-string suture of 2/0 chromic catgut in the bladder muscle to ensure a water-tight closure around the tube (Fig. 18.4J) or, if you have made an extended incision in the bladder, secure the catheter with the final stitch need to close the incision.

If drainage is to be continued for a long period, fix the bladder to the abdominal wall so that the catheter can be changed. Otherwise, omit this step to allow more rapid healing of the bladder wound. To fix the bladder, pass the traction stitches in the bladder wall out through the rectus sheath (Fig. 18.4J). Tie them together after closing this layer.

Close the linea alba with 0 chromic catgut and the skin with 2/0 thread (Fig. 18.4K,L). Connect the tube to a sterile, closed drainage system. Dress the wound every second day until it is healed.

**Management of ruptured bladder**

Bladder rupture, usually due to trauma, can be extraperitoneal or intraperitoneal (Fig. 18.5A,B). Extraperitoneal rupture is most commonly associated with a fracture of the pelvis, resulting in extravasation of urine. Intraperitoneal rupture is often caused by a direct blow to the bladder or a sudden deceleration of the patient when the bladder is distended, for example in a road traffic accident. Intraperitoneal rupture presents as an “acute abdomen”.

Any patient with rupture of the bladder should be referred within 24 hours. If this is not possible, undertake to close the rupture and to drain the bladder with a
Assessment and preoperative management

urethral catheter in patients with intraperitoneal rupture, and to construct a suprapubic cystostomy in patients with extraperitoneal rupture.

The patient usually has a history of trauma, and complains of inability to void urine or of passing only small quantities of urine or drops of blood. The patient suffers suprapubic pain with tenderness and rigidity. The skin of this area may show evidence of bruising. In cases of extraperitoneal rupture, extravasation into the suprapubic tissues may be evident.

X-ray the pelvis, determine the patient's haemoglobin level and erythrocyte volume fraction, and carry out other tests as indicated. Resuscitate the patient, if necessary, before surgery.

Fig. 18.5. Management of ruptured bladder. Extraperitoneal rupture (A); intraperitoneal rupture (B); repairing an intraperitoneal tear with seromuscular stitches, taking care not to include the mucosa (C, D); burying the first layer of seromuscular stitches with a second (E).
Equipment

See tray for Laparotomy, Annex 1, and add a Foley catheter.

Technique

The patient should be given a general anaesthetic with a muscle relaxant. Expose the bladder as in the initial stages of cystostomy. Cautiously aspirate any blood or urine in the retropubic space, but leave the area unexplored, as uncontrollable bleeding can result.

In a patient with intraperitoneal rupture the bladder will be empty. The site of the tear is usually in the fundus of the bladder. Open the peritoneum, inspect the site of the rupture, and aspirate the fluid in the peritoneal cavity. Introduce a Foley catheter into the bladder through the urethra and then suture the tear with two layers of seromuscular stitches of 0 chromic catgut. Do not include the mucosa in the first layer (Fig. 18.5C–E). After inspecting the other viscera, close the abdomen.

Extraperitoneal rupture is usually associated with bladder distension and extravasation, which become obvious when you expose the bladder. Open the bladder, and look for the site of the tear. It may be difficult to find, but if it is clearly visible, close it from within with 2/0 plain catgut and insert a suprapublic catheter. If no tear is apparent, simply insert a suprapublic catheter. Close the opening in the bladder to construct a suprapubic cystostomy, as described on page 171. Insert a corrugated drain into the retropubic space and close the wound in layers.

After-care

Administer antibiotics for the first 5 days and give adequate fluids to maintain the urinary output. A corrugated drain can be removed after 24–48 hours.

Clamp the catheter for increasing periods of time, beginning on about the fifth day. The patient with a suprapubic catheter may start passing urine during this period, in which case the catheter should be removed. In cases of intraperitoneal rupture, remove the urethral catheter after about 2 days of intermittent clamping, provided that no problems result.

The patient may still require treatment for any associated injuries, such as fracture of the pelvis.
Male urethra

Urethral dilatation

Urethral stricture is still a common problem in certain parts of the world. The condition can be treated by regular dilatation of the urethra with bougies, but this procedure can be dangerous if the doctor is inexperienced. Every doctor destined for service in an isolated post must therefore be properly trained to pass bougies.

Before proceeding with dilatation, measure the patient's haemoglobin level and test the urine for sugar and protein.

**Equipment**

See tray for *Urethral dilatation*, Annex 1. Several different types of bougies are available (Fig. 19.1F). Curved bougies are tapering metal rods adapted to the curves of the male urethra; straight bougies, also made of metal, have a blunt tip and are generally only slightly tapered; filiform bougies have a smaller diameter and are made of softer material.

**Technique**

Administer a basal sedative before beginning the procedure and start antibiotic treatment, to be continued for 3 days. Carefully clean the glans and meatus, and prepare the skin with a bland antiseptic. Instil lidocaine gel into the urethra and retain it for 5 min. Drape the patient with a perforated towel to isolate the penis.

If the stricture is highly irregular, begin by introducing a filiform bougie; leave it in the urethra and continue to insert filiform bougies until one passes the stricture (Fig. 19.1A–D). Then progress to dilatation with straight bougies (Fig. 19.1E). If the stricture is less irregular, begin with a medium-size straight or curved bougie and gradually work up in size. For a postinflammatory stricture that starts in the anterior urethra, always introduce a straight bougie first; this will minimize the risk of urethral damage (Fig. 19.1G). Continue dilatation with straight bougies of increasing size, and finally introduce a curved bougie. Remember that the smallest sizes of metal bougies are the most likely to lacerate the urethra.

Introduce a curved bougie in three stages (Fig. 19.1H–J):

- bring the bougie parallel to the crease of the groin and hold the penis taut;
- while raising the taut penis to the midline towards the patient's abdomen, slip the bougie into the posterior urethra and let it progress by its own weight;
Complications

Diagnosis
Fig. 19.1. Urethral dilatation in the male patient (continued). A straight and a curved bougie (F); dilatation of an anterior stricture with a straight bougie (G); dilatation with a curved bougie (H-J).
can appear in the form of a few drops of blood at the meatus, rather than profuse bleeding. The perineum and penis become swollen with haematoma and there is acute retention of urine.

Examine the patient for possible concomitant injuries.

Measure the patient's haemoglobin level and X-ray the pelvis. A urethrogram, obtained after 20 ml of a contrast material (of the type usually given intravenously) has been instilled into the urethra, can be useful in determining whether the rupture is partial or complete. However, this information will not influence treatment at the district hospital and is therefore not immediately required. Avoid diagnostic catheterisation.

**Treatment**

Resuscitate and reassure the patient. Administer analgesics. Discourage him from attempting to pass urine.

Prepare the skin of the lower abdomen and perineum. If the bladder is obviously distended, perform a suprapubic cystostomy (see page 171). If there is an open perineal wound or if the perineal haematoma has become so tense as to require incision, open and then lightly pack the perineal haematoma during suprapubic cystostomy. Refer the patient as soon as possible.

Maintain the patient on a high fluid intake. Administer antibiotics for 5 days after the operation.
Male genital organs

Scrotal hydrocele

Scrotal hydrocele is an abnormal accumulation of fluid in the tunica vaginalis sac (Fig. 20.1A). The swelling that results is often enormous and always uncomfortable.

In adults, the hydrocele fluid is located entirely within the scrotum; the surgical treatment described here is straightforward, even for the doctor without formal training in surgery, and the operation is relatively safe for the patient. In children, however, the hydrocele communicates with the peritoneal cavity and is often associated with a hernia; the treatment described in this section is therefore inappropriate.

Diagnosis

Palpation will confirm that the swelling is scrotal; it will be soft or tense, and fluctuant, and may mask the testis and epididymis. A transillumination test will be positive. If you are in doubt about the diagnosis, perform aspiration. The hydrocele fluid is often the colour of normal urine. After aspiration, palpation of the testis and the epididymis will be possible.

Diagnosis can be difficult when there is a hydrocele and a hernia on the same side. However, an inguinoscrotal hernia can be distinguished because it is softer, and is partially or completely reducible, and an impulse will be detectable when the patient coughs. Lymphoedema of the scrotum, which should also be considered in differential diagnosis, is characterized by thickened skin.

Treatment

Aspiration is not recommended as a method of treatment, as the relief it provides is only temporary, and repeated aspirations risk infection of, or trauma to, the testis. Injection of sclerosants is also not recommended, as it can cause painful inflammation without effecting a cure. Surgery remains the most effective form of treatment. Of the various alternative operations, eversion of the tunica vaginalis is one of the simplest, though recurrences are still possible.

Wash the skin and treat any lesions, for example wounds made by traditional healers, with saline dressings. The presence of skin lesions is not a contraindication to surgical treatment as long as there are healthy granulations with little or no infection. Administer tetanus prophylaxis.

Eversion of the tunica vaginalis

Before surgery, measure the patient's haemoglobin level and test the urine for sugar and protein.

Equipment

See tray for Minor operations, Annex 1.
Fig. 20.1. Treatment of hydrocele by eversion of the sac. Anatomical site of the hydrocele within the scrotum (A); draping (B); incision in a skin crease as the hydrocele is held tense (C); ligation of the vessels of the scrotal wall (D); blunt dissection between the sac and its fibrous coverings (E, F).
Fig. 20.1. Treatment of hydrocele by eversion of the sac (continued). Puncturing the sac (G) and enlarging the opening (H); evverting the testis through the incision and reuniting the edges of the sac behind the cord and epididymis (I); inserting a corrugated drain (J, K); repositioning the testis within the scrotum (L); closing the wound (M).
Technique

Ideally, the patient should be given a general anaesthetic. It is also possible to use infiltration anaesthesia, produced by injecting 1% lidocaine at the neck of the scrotum into the tissues of the cord and along the line of the incision. Spinal anaesthesia is a convenient and effective alternative.

Lay the patient supine and prepare the skin widely with a bland antiseptic. Place a sterile towel under the scrotum (Fig. 20.1B). (Elevating the scrotum with tissue forceps will facilitate this.) Then stand on the side of the lesion with an assistant opposite.

As the assistant presses on the hydrocele to render it tense, make an oblique incision over the hydrocele in a skin crease (Fig. 20.1C). Continue incising through the layers of the scrotal wall down to the tunica vaginalis. This can normally be recognized by a lattice of fine blood vessels in a thin translucent membrane, although sometimes the membrane will have been thickened by previous infection or trauma. Ligate all vessels encountered with 2/0 chromic catgut (Fig. 20.1D).

By means of blunt dissection with scissors, find a plane of cleavage between the sac and the fibrous coverings. With gauze and scissors, continue separation to the termination of the spermatic cord, where it is attached to the hydrocele (Fig. 20.1E,F). If the sac is inadvertently opened, catch the edges of the opening with forceps and introduce a finger into the sac to stretch it and the overlying tissues as an aid in dissection.

Puncture the sac and instruct your assistant to collect the jet of fluid in a dish as you squeeze the swelling (Fig. 20.1G). Catch the edge of the hole with forceps and slit the sac vertically with scissors, after making sure that the epididymis is not adherent to its posterior surface (Fig. 20.1H).

Evert the testis and the epididymis through the hole, and inspect them for tuberculosis, schistosomiasis, and cancer (which would necessitate referral of the patient). Then reunite the edges of the everted sac behind the cord and epididymis with a few interrupted stitches of 2/0 chromic catgut (Fig. 20.1I). Maintain careful haemostasis throughout; it is important to stop even the slightest bleeding, to minimize the risk of haematoma formation.

Insert a corrugated drain, bringing it out inferiorly through a counter-incision, and fix it to the skin with a stitch (Fig. 20.1J,K).

Replace the testis and the cord. Close the dartos muscle with interrupted 2/0 chromic catgut and the skin with interrupted 2/0 thread (Fig. 20.1L,M). Apply a compression dressing of gauze and then a T-bandage.

After-care

Support the scrotum in an elevated position. Remove the drain after 24–48 hours.

Complications

Possible complications include haematoma formation, infection, and recurrence. If haematoma develops despite every care having been taken to stop bleeding during surgery, remove a few stitches from the wound, open the edges with a pair of large artery forceps, and express the clots from the wound. This procedure may need to be repeated over several days. Antibiotics do not always prevent infection; if it does occur, give appropriate antibiotic therapy and drain the wound. Even with treatment, however, an infection may take up to 2 months to clear.

Circumcision

Circumcision in the male patient is the surgical resection of the prepuce. It is indicated in cases of phimosis, paraphimosis, and recurrent balanitis, and when there has been an injury to the foreskin.
The purpose of the operation is to resect the prepuce obliquely at the level of the corona of the glans, allowing the glans to be fully exposed while preserving enough of the frenulum to permit erection.

Preoperative investigations are not required unless physical examination suggests that the patient is anaemic or suffering from a major illness.

**Equipment**

See tray for Minor operations, Annex 1. The ligatures and sutures used throughout the procedure should be of 3/0 chromic catgut.

**Technique**

Conduction anaesthesia can be used for circumcision, but general anaesthesia is preferable. Infiltration of the prepuce with local anaesthetic simply obscures the line of section. Nerve block, accomplished by injecting 1% lidocaine at the base of the penis on either side of the midline, just beyond the pubis, is a useful supplement to a general anaesthetic. However, if used without general anaesthesia, nerve block must be reinforced by further infiltration of the underside of the penis between the corpus spongiosum and the corpora cavernosa.

Prepare all the external genitalia with a bland antiseptic. If the prepuce can be retracted, carefully clean the glans and the preputial furrow with soap and water. If the prepuce cannot be retracted, gently stretch the preputial opening by inserting the blades of a pair of artery forceps and slowly opening them until the area can be properly cleaned (Fig. 20.2A). Break down any fine adhesions between the glans and prepuce, and replace the prepuce. Isolate the penis with a perforated towel.

Take hold of the prepuce dorsally in the midline with two pairs of forceps and cut down between the forceps with scissors until the blades nearly reach the corona (Fig. 20.2B–E). Check that the lower blade really is lying between the glans and prepuce and has not been inadvertently passed up the external meatus. Then excise the prepuce by extending the dorsal slit obliquely around on either side to the frenulum, and trim the inner preputial layer, leaving at least 3 mm of mucosa (Fig. 20.2F,G).

Catch the cut edges of the frenulum and the bleeding artery of the frenulum with a catgut suture, leaving the suture long as a traction stitch to steady the penis (Fig. 20.2H). Insert a similar traction stitch to unite the edges of the prepuce dorsally (Fig. 20.2I). Catch and tie any bleeding vessels on either side of the raw area. Unite the edges of the prepuce with interrupted stitches and cut the stitches short (Fig. 20.2J,K).

**After-care**

Dress the penis in loose layers of petrolatum gauze covered with dry gauze. Retain this dressing for 24 hours, thereafter providing only protection from rubbing against clothes, until healing is complete. The stitches will separate in 10–15 days.

**Complications**

The most serious complication of operation is haematoma due to failure to secure the artery of the frenulum sufficiently or to dehiscence of the stitches as a result of an early morning erection (which can be avoided by administration of a sedative).

**Vasectomy**

Vasectomy is a method of contraception. Make it clear to the patient that the operation is irreversible and that its effects are permanent (do not mention the
Fig. 20.2. Male circumcision. Stretching the opening of the prepuce (A); holding the prepuce with two pairs of forceps (B) and cutting down the midline dorsally (C-E); excising the prepuce (F); inner layer of the prepuce to be trimmed (G, dotted line); ligating the artery of the frenulum (H).
possibility of re-anastomosis). Emphasize that the operation is almost always successful, but that sterility cannot be guaranteed since there is a small chance of failure, for example resulting from spontaneous recanalization, even after meticulous surgery. Stress that sterility will not be immediate; indeed, it can take up to 8 weeks for the patient to become completely sterile. Observe any legal formalities.

Preoperative investigations are not essential.

Equipment
See tray for Minor operations, Annex 1.

Technique
Vasectomy is usually carried out with the patient under local anaesthesia, but general anaesthesia is preferable if the patient is nervous or has undergone inguinoscrotal surgery.

Place the patient in a supine position. Cleanse and shave the pubis and external genitalia. If you are using local anaesthesia, inject a wheal of 1% lidocaine and make an incision of 2–3 cm in the scrotal raphe (Fig. 20.3A–C). Infiltrate the deeper tissues, picking up each layer in turn to inject anaesthetic. At each stage, allow a few minutes for the local anaesthetic to take effect. Hold up the vas from one side with a pair of tissue forceps and infiltrate its connective tissue sheath with lidocaine (Fig. 20.3E). Open the sheath, isolate the vas with artery forceps, and excise about 1 cm (Fig. 20.3F–H). The cut ends will be characteristically conical, with the outer fibromuscular tissues retracting from the lumen. Ligate the testicular end and replace it within the connective tissue sheath. Turn the proximal end back on itself and ligate it so that it lies outside the sheath (Fig. 20.3I). Repeat the procedure on the other vas (Fig. 10.3J). Close the scrotal wound with a few 2/0 catgut stitches, making sure to include the dartos layer (Fig. 20.3K).

This technique is widely used and allows a rapid turnover of patients in outpatient clinics. The less experienced surgeon may find it easier to identify the vas by pinching it between the thumb and finger at the lateral side of the neck of the scrotum and then to incise the skin directly above it, catching the vas with a pair of tissue forceps before it slips away. This procedure is best done with the patient under general anaesthesia.
Fig. 20.3. Vasectomy. Injecting local anaesthetic (A, B); incision (C); alternative sites for infiltration and incision (D); infiltrating the tissue around the vas with local anaesthetic (E); opening the sheath and isolating the vas between clamps (F, G); excising a segment (H); ligating the cut ends of the vas (I); the other vas is dealt with similarly (J) and the wound is closed (K).
As an alternative, fix each vas under the skin by inserting a hypodermic needle, after effecting local anaesthesia with 1% lidocaine. Make a vertical incision 1 cm long over the vas on one side (Fig. 20.3D), and hook it out with forceps. Proceed to divide and ligate the vas as described above. Then make an incision over the other vas and repeat the procedure.

After-care

The patient should wear a scrotal support for 48 hours after the operation. Carry out a semen analysis at 6–8 weeks to confirm sterility.

**Exploration of scrotal contents**

At the district hospital, exploration of scrotal contents should be confined to patients with acutely painful scrotal swelling, as described in the section on paediatric surgery, page 201. A scrotal incision is normally used; however, if a testicular tumour is suspected in the adolescent or adult, it is best to explore the testis through an inguinal incision, drawing the parts into the wound at the neck of the scrotum. Should a tumour be found, open the external oblique aponeurosis, clamp and doubly ligate the spermatic cord near the deep inguinal ring, and then remove the testis.
PAEDIATRIC SURGERY
21

General principles for paediatric surgery

Special considerations

In general, the basic principles of surgery and care for adults can be applied to children aged 10 years and over. Infants and younger children, however, have important physiological differences that influence the way in which they should be cared for before, during, and after surgery.

Nutrition

Infants and children are at special risk of becoming malnourished because of the volume of material and energy they need for rapid growth. Malnourishment also affects their response to injury, so ample nutrition forms part of their preoperative and postoperative care.

Temperature control

Infants and young children, especially those with diminished amounts of subcutaneous fat, are unable to maintain a normal body temperature when there are wide variations in the ambient temperature. Special care is needed during general anaesthesia, when they may be even less able to regulate body temperature adequately.

Fluid and electrolytes

Infants and small children have a much smaller pool of fluids and electrolytes than adults. As a result, minor departures from normal levels require early attention. Continued abnormal losses of both fluid and electrolytes must be corrected promptly.

Blood loss

Replacement is needed whenever blood loss exceeds 10% of blood volume. Chronic anaemia should be investigated and treated as part of the preparation for operation.

Anaesthesia

See Dobson, M.B., Anaesthesia at the district hospital (Geneva, World Health Organization, 1988) for discussion of the anatomical, physiological, and technical considerations relevant to paediatric anaesthesia.

Cut-down to umbilical vein

This procedure is indicated for the intravenous administration of fluids in neonates when a peripheral vein cannot be easily found, and for exchange transfusion.

Equipment

See tray for Cut-down (paediatric), Annex 1.
Fig. 21.1. Cut-down to umbilical vein. Infiltrating the skin and subcutaneous fat with local anaesthetic (A); site of curved incision just above the umbilicus (B); blunt dissection to isolate the umbilical vein (C); opening the umbilical vein, the largest of the three vessels (D); cannulating the vein (E, F); closing the wound in one layer (G); applying a dressing (H); fixing the cannula to the skin with adhesive tape (I).

**Technique**

Sedate the child, prepare the skin of the umbilical region with antiseptic, and infiltrate a small amount of local anaesthetic (Fig. 21.1A). Make a curved incision...
sion just above the umbilicus, keeping close to the umbilicus to avoid injury to the peritoneum (Fig. 21.1B).

Deepen the incision vertically by blunt dissection with scissors (Fig. 21.1C). Cannulate the vein, which can be identified as the largest of the three cord vessels, and secure the cannula in the vein with a ligature (Fig. 21.1D–F). Close the wound in one layer with 3/0 thread, apply a dressing, and fix the cannula to the skin with adhesive tape (Fig. 21.1G–I).

Should the peritoneal cavity be opened inadvertently, close the breach with catgut.
Abdominal wall and gastrointestinal tract

Operative reduction of intussusception

Intussusception is a form of intestinal obstruction in which one segment of the intestine telescopes into the next (Fig. 22.1A).

Assessment and preoperative management

The patient is usually less than 2 years of age, but intussusception in older children is not infrequent. The symptoms are intermittent crying and the passing of blood and mucus. A mass in the line of the large bowel will be detected on abdominal examination, and rectal examination will reveal blood and mucus.

Intussusception can be mimicked by dysentery or, less often, by a bolus of roundworms. It can be distinguished from rectal prolapse by rectal examination.

Before surgery, pass a nasogastric tube and begin suction. Give fluids intravenously.

Equipment

See tray for Major paediatric operations, Annex 1.

Technique

The patient should be given a general anaesthetic with a muscle relaxant. Place the child supine and prepare the skin with antiseptic. Open the abdomen through a midline incision centred at the umbilicus; the incision may be made either through or around the umbilicus (Fig. 22.1B).

After opening the peritoneum, locate and examine the intussusception. Make no attempt to reduce the telescoped bowel by pulling on its proximal end, but instead "milk" it in a retrograde manner with the fingers of one hand inside the abdomen pressing against the fingers of the other hand outside the abdomen (Fig. 22.1C,D). Once the bowel has been reduced into the ascending colon, deliver the colon through the wound and reduce the remaining intussusception slowly, inspecting the ensheathing layer for serosal and muscular tears (Fig. 22.1E).

If the intussusception is not fully reducible or if the bowel is gangrenous, resect the section of bowel involved and construct an anastomosis. Should anastomosis prove too difficult, exteriorize the two cut ends of bowel through the abdominal wall.

Close the wound in layers using catgut for the peritoneum and muscle, and thread for the skin. If the bowel ends have been exteriorized, arrange to refer the patient.

Complications

Possible complications include recurrence, and leakage from an anastomosis.
Fig. 22.1. Operative reduction of intussusception. Ileocolic intussusception (A); site of incision (B); "milking" the intussusception in a retrograde manner while supporting the abdominal wall with the other hand (C, D); delivering the colon through the wound and completing reduction (E).

**Rectal prolapse**

Rectal prolapse can occur in healthy children, but may also be associated with disturbed bowel action (caused by chronic malnutrition, diarrhoea, or constipation that necessitates straining on defecation), worms, or debility arising from some other illness. Rarely is it due to polyps.
Fig. 22.2. Operative reduction of strangulated inguinal hernia. Position of the patient with the lumbar spine hyperextended (A); site of incision in the groin crease (B); blunt dissection to expose the external oblique aponeurosis and the external inguinal ring (C); dividing the anterior margin of the external inguinal ring to relieve the obstruction (D, E); opening the sac and inspecting the gut (F); site for resection of gangrenous gut and end-to-end anastomosis (G); closing the sac (H).
## Abdomen and gastrointestinal tract

### Diagnosis

The prolapse occurs on defecation. Initially the prolapsed section of the rectum reduces spontaneously, but later it requires manual reduction; a prolapse may still occur immediately after such reduction. Rectal prolapse may be complicated by mucosal bleeding or even by strangulation with gangrene.

Differential diagnosis should include large rectal polyps and submucosal venous congestion caused by excessive straining during defecation, although the latter condition is rare. A loose intussusception that appears at the anus may closely resemble a prolapsed section of rectum, but can be differentiated upon rectal and abdominal examination.

Examine the stool for parasites. Other investigations should be carried out as indicated.

### Treatment

Correct any diarrhoea, constipation, or malnutrition. Provided that there are no complications, control the prolapse by prompt manual reduction and by strapping the child's bottom, if necessary. If the prolapse is complicated by strangulation with gangrene, perform a laparotomy, resect the gangrenous section of the rectum, construct a colostomy, and then refer the patient.

### Relief of strangulated inguinal hernia

The relief of strangulated inguinal hernia is more difficult in young children than in adults because the tissues are smaller and more delicate, and the inguinal canal is extremely short. The obstructing ring is usually the external rather than the internal inguinal ring.

#### Non-operative reduction

See page 160.

#### Operative reduction

#### Equipment


#### Technique

The patient should be given a general anaesthetic. Place a roll of 7–12 cm diameter (depending on the size of the patient) under the pelvis to hyperextend the lumbar spine (Fig. 22.2A). Prepare the skin over the lower half of the abdomen, including the groin, with a bland antiseptic such as cetrimide.

In the male patient, palpate the spermatic cord as it passes over the pubic bone and make an incision in the groin crease just above this point (Fig. 22.2B); in the female patient, make a groin incision in a skin crease over the swelling. Extend the incision laterally, dividing only the skin.

Continue with blunt dissection using scissors held at right angles to the skin incision. Expose the external oblique aponeurosis and external inguinal ring and divide the anterior margin of the ring with scissors, taking care not to puncture the herniated mass (Fig. 22.2C–E). This will relieve the obstruction.

If the bowel in the hernial sac appears dark, open the sac and inspect the bowel (Fig. 22.2F). If normal colour returns, reposition the gut in the abdomen and close the sac with continuous catgut suture. A gangrenous section of bowel will be very dark in colour, with a dull surface and an absence of peristalsis or arterial pulsation. In such cases, extend the exposure of the inguinal canal and pull down some healthy bowel. Then resect the gangrenous bowel (Fig. 22.2G), make a one-layer anastomosis using 3/0 thread, and close the hernial sac with continuous catgut suture.
Whether or not the hernial sac has been opened, it should not be removed. Simply reduce the hernia and close the wound in two layers, suturing the deeper layer of subcutaneous fat with interrupted 2/0 or 3/0 chromic catgut. In the male patient ensure that the testis remains in the scrotum throughout wound closure. It may have become infarcted, but should not be removed. Apply a single layer of gauze dressing once the wound is closed.

**After-care**

Continue nasogastric suction and the intravenous administration of fluids until normal peristalsis has returned. Make arrangements to refer the child for elective herniotomy.
Urethra and genital organs

Meatal dilatation

Meatal dilatation is used to treat meatal stricture in young boys. This condition is most common when the glans has been uncovered in infancy by circumcision or when the foreskin is of insufficient length to cover the meatus. Indeed, it is a common complication of infantile circumcision. Most affected children require no treatment, but dilatation is indicated if there is difficulty or pain on passing urine.

The child often complains of pain at the tip of the penis when urinating. The urinary stream is thin, under high pressure, and goes farther than normal. The child is unable to urinate into a container without holding his penis. Physical examination will reveal a narrow, circular, external urethral meatus, the opening of which may be a mere pin-hole (Fig. 23.1A). There is usually evidence of circumcision or a foreskin too short to cover the glans.

Before proceeding, examine the urine to rule out the possibility of infection.

Equipment

See tray for Meatal dilatation (paediatric), Annex 1.

Technique

Dilatation should be done gently to avoid tearing the tissue of the stricture. Such tears heal with fibrous tissue, which can aggravate the stricture.

The patient should be given a general anaesthetic. Prepare the external genitalia and the perineum with a bland antiseptic and apply a perforated towel. Holding the penis erect, insert the tip of a pair of lubricated artery forceps (small mosquito type) as a dilator. Allow the tip of the forceps to enter the urethra largely under gravity; apply only very light pressure. The dilator should not pass beyond the middle of the shaft of the penis (Fig. 23.1B,C). When it stops, leave it for 3 min, and then remove it. Repeat the procedure twice.

After-care

If the stricture is very tight, repeat dilatation at least once a week for 1 month and then once a month for 6 months, until the meatus is of normal size.

Exploration of scrotal contents

At the district hospital, exploration of the scrotal contents should be confined to patients with an acutely painful scrotal swelling, when it is necessary to explore the testis, the epididymis, or the distal part of the spermatic cord. Suspected torsion of the testis requires immediate exploration.
Fig. 23.1. Meatal dilatation. Pin-hole meatus (A); dilatation with the lubricated tip of a pair of artery forceps: the forceps enter the urethra largely under gravity (B) and should not pass beyond the middle of the shaft of the penis (C).

Differential diagnosis includes torsion of the testis and acute epididymo-orchitis, which can also occur in adults. The latter (which can be difficult to confirm clinically) does not require operation.

**Equipment**  

**Technique**  
The patient should be given a general anaesthetic. Prepare the external genitalia and adjacent perineum with a bland antiseptic. Make a scrotal incision to expose the testis, and continue through the tunica vaginalis (Fig. 23.2A,B).

If torsion is confirmed, untwist the testis (Fig. 23.2C) and wait at least 5 min to see whether circulation will return. If the testis was black before being untwisted and remains black even after this time has elapsed, doubly ligate the spermatic cord and remove the testis (Fig. 23.2D). If the testis is plum-coloured, but not definitely gangrenous, or if it is clearly viable, fix the tunica albuginea to the scrotal septum with two stitches (Fig. 23.2E) and, through a separate incision, fix the other testis similarly. Repair the scrotum in two layers with fine catgut (Fig. 23.2F) and apply a firm dressing to hold it elevated.

Torsion of an appendix testis presents a milder clinical picture. At operation, the testis appears normal with a small, dark, berry-like lesion on the surface near its superior pole. This small lesion can be easily removed.

If epididymo-orchitis is found in the course of exploration, reposition the scrotal contents, repair the wound, and administer co-trimoxazole (sulfamethoxazole + trimethoprim).
Complications

Avoid haematoma by careful two-layer repair. Minimize the use of scrotal drains to reduce the risk of infection. To reduce scrotal swelling and pain, support the scrotum by bandaging it first against the lower abdomen.

Treatment of paraphimosis

In this condition the penile foreskin is retracted, swollen, and painful. The glans penis is visible, surrounded by an oedematous ring with a proximal constricting band (Fig. 23.3A).

Differential diagnosis should include inflammation of the foreskin (balanitis), for example due to infection, and swelling caused by an insect bite. In such cases, the glans penis is not visible.

Treat paraphimosis by reduction of the foreskin or, should this fail, by circumcision.

Equipment

See tray for Minor paediatric operations, Annex 1, and add 1% lidocaine.
Technique

Sedate the child and prepare the skin of the genitalia with a bland antiseptic. Isolate the penis with a perforated towel and inject local anaesthetic in a ring around its base (Fig. 23.3B). Once local analgesia is achieved, take hold of the oedematous part of the penis in the fist of one hand and squeeze firmly; a gauze swab may be necessary for a firm grip (Fig. 23.3C,D). Exert continuous pressure, changing hands if necessary, until the oedema fluid passes proximally under the constricting band to the shaft of the penis. The foreskin can usually then be pulled over the glans (Fig. 23.3E,F). If this manoeuvre fails to reduce the foreskin, carry out circumcision with the patient under general anaesthesia.

Fig. 23.3. Reduction of paraphimosis. The affected penis (A); injecting local anaesthetic in a ring around the base (B); squeezing the oedematous part of the penis (C, D); the foreskin (E) is pulled over the glans (F).
Annex 1

Surgical trays

This annex lists the instruments, equipment, and materials that should be included, as a minimum, on the surgical trays used for the procedures described in this handbook. These items (with certain exceptions, such as head mirrors and torches) must be sterilized before use. For most procedures, dressings and drugs, apart from local anaesthetics, are not listed.

Appendicectomy

Sponge forceps, 4 pairs
Scalpel handle with blade, 1
Small, curved artery forceps, 3 pairs
Small, straight artery forceps, 3 pairs
Large, straight artery forceps, 2 pairs
Large, curved artery forceps, 2 pairs
Dissecting scissors, 1 pair
Stitch scissors, 1 pair
Needle holder, 1
Dissecting forceps, toothed, 1 pair
Dissecting forceps, non-toothed, 1 pair
Retractors (Langenbeck), narrow, 2
Tissue forceps (Allis), 2 pairs
Suction nozzle, 1
Diathermy electrode, 1
Sutures, 0 and 2/0 thread, ties and with needles
Sutures, 0 and 2/0 chromic catgut, ties and with needles
Sutures, No. 1 nylon, ties and with needles
Kidney dishes, 2
Gallipots, 2
Linens tape, 1 piece, 20–30 cm long
Gauze swabs
Antiseptic solution
Sterile drapes
Sterile gloves, 2 pairs

Bladder catheterization

Catheters (for example Foley or similar type), several different sizes
Catheter, coudé, 1
Urinary bag or bottle, 1, with connecting tube and tube-connection piece, containing antiseptic solution, sterile water, or sterile saline
Lubricant
Lidocaine gel
Gauze swabs
Large, curved artery forceps, 1 pair
Syringe, 10 ml, 1
Sterile water in a gallipot
Kidney dish, 1
Antiseptic solution
Annex 1

Cataract operation
- Scalpel handle with No. 11 blade (or a keratome, if available), 1
- Spring scissors (Westcott), 1 pair
- Straight ring scissors, 1 pair
- Corneal scissors, right and left, 1 pair of each
- Dissecting forceps, toothed with tying platform, 0.5 mm, 1 pair
- Dissecting forceps, toothed with tying platform, 0.9 mm, 1 pair
- Syringe, 2 ml, 1, with 23- and 19-gauge needles
- Syringe, 10 ml, 1, with 23- and 19-gauge needles
- Needle holder for fine suture, curved with lock (Castroviejo), 1
- Muscle hooks, 2
- Eyelid speculum, 1
- Sutures, 3/0, 4/0, and 8/0 thread, ties and with needles
- Irrigating cannula, 1
- Ophthalmic swabs
- Eye pad, 1
- Lidocaine 2%
- Tetracaine 0.5% eye drops
- Sterile saline
- Cetrimide 1%
- Adhesive tape
- Conjunctival scissors
- Iris forceps, 1 pair
- Iris scissors, 1 pair
- Capsule forceps, non-toothed, 1 pair
- Vectis, 1
- Cystotome, 1
- Iris spatula (repositor), 1
- Iris retractor, 1
- Needle, 28-gauge, 1
- Sterile drapes
- Sterile gloves, 2 pairs
- Hot-point cautery and spirit lamp, 1

Control of epistaxis
- Good light source and reflecting head mirror
- Nasal speculum, 1
- Gauze swabs
- Cotton wool
- Ice
- Angled dressing forceps, 1 pair
- Clothes-peg, 1
- Suction nozzle, 1
- Catheter, Foley, size 16 Ch., 1

Cut-down (paediatric)
- Intravenous cannula, paediatric size, 1
- Small artery forceps, 6 pairs
- Small dissecting scissors, 1 pair
- Stitch scissors, 1 pair
- Small dissecting forceps, toothed, 1 pair
- Small dissecting forceps, non-toothed, 1 pair
- Needle holder, 1

Adhesive tape
Sutures, 2/0 thread, ties
Sterile drapes (perforated towel)
Sterile gloves, 1 pair
Set of bougies
Enucleation of the eye

- Small artery forceps, 6 pairs (3 straight, 3 curved)
- Eyelid speculum, 1
- Eyelid retractors, 2
- Dissecting forceps, toothed, 0.5 mm, 1 pair
- Dissecting forceps, toothed, 0.9 mm, 1 pair
- Conjunctival scissors, 1 pair
- Stitch scissors, 1 pair
- Needle holder, 1
- Scalpel handle, 1, with No. 11 and 15 blades
- Muscle hooks, 2
- Enucleation scissors, 1 pair
- Lidocaine 2%
- Tetracaine 0.5% eye drops
- Syringe, 10 ml, 1, with 23- and 19-gauge needles
- Tetracycline 1% eye ointment
- Irrigating cannula, 1
- Sterile saline
- Ophthalmic swabs
- Eye pad, 1
- Sutures and ligatures, 4/0, 5/0, and 6/0 plain and chromic catgut, ties and with needles
- Sterile drapes
- Sterile gloves, 2 pairs

Excision of pterygium

- Eyelid speculum, 1
- Conjunctival forceps, 1 pair
- Conjunctival scissors, 1 pair
- Scalpel handle with No. 15 blade, 1
- Tetracaine 0.2% eye drops
- Lidocaine 2%
- Hot-point cautery and spirit lamp, 1
- Pterygium knife, 1
- Syringe, 5 ml with needle, 1
- Ophthalmic swabs
- Sterile drapes
- Sterile gloves, 1 pair

Extraction of teeth

- Dental probe/spoon, 1
- Straight elevator, 1
- Curved elevators, 2 (right and left)
- Dental forceps, universal upper, 1 pair
- Dental forceps, universal lower, 1 pair
- Syringe, 5 ml with 25-gauge/25 mm needles
Hernia operation

- Sponge forceps, 4 pairs
- Scalpel handle with blade, 1
- Needle holder, 1
- Small, straight artery forceps, 4 pairs
- Small, curved artery forceps, 4 pairs
- Large, straight artery forceps, 3 pairs
- Large, curved artery forceps, 3 pairs
- Tissue forceps (Allis), 2 pairs
- Curved dissecting scissors, 1 pair
- Stitch scissors, 1 pair
- Retractors (Langenbeck), narrow, 2
- Rake retractors, 2 (or self-retaining type, 1)
- Dissecting forceps, toothed, 1 pair
- Dissecting forceps, non-toothed, 1 pair
- Sutures, 0 and 2/0 chromic catgut, ties and with needles
- Sutures, No. 1, 0, and 2/0 thread, ties and with needles
- Gauze swabs
- Gallipots, 2
- Kidney dishes, 2
- Adhesive tape
- Linen tape
- Antiseptic solution
- Adhesive tape
- Diathermy electrode, 1
- Crushing clamps, 2
- Occlusion clamps, 2
- Sterile drapes
- Sterile gloves, 3 pairs

Incision and drainage of abscess

- Sponge forceps, 4 pairs
- Scalpel handle with blade, 1
- Lidocaine 1%
- Syringe, 5 ml with needle, 1
- Dissecting scissors, 1 pair
- Stitch scissors, 1 pair
- Needle holder, 1
- Small, curved artery forceps, 3 pairs
- Large, curved artery forceps, 2 pairs
- Large, straight artery forceps, 2 pairs
- Sinus forceps, 1 pair
- Grooved director, 1
- Flexible probe, 1
- Corrugated drain
Incision and drainage of peritonsillar/retropharyngeal abscess

- Sponge forceps, 4 pairs
- Good light source
- Long, narrow (No. 5) scalpel handle with a narrow (No. 11) blade, 1
  (most of the blade should be covered with adhesive tape, to leave only a small cutting portion at the tip)
- Syringe, 10 ml with wide-bore needle, 1
- Local (surface) anaesthetic spray, e.g. lidocaine 2–4%
- Gauze swabs
- Cotton wool
- Artery forceps with fine-pointed jaws or sinus forceps, 1 pair
- Suction nozzle, 1
- Tongue depressor, 1
- Sterile drapes
- Sterile gloves, 1 pair

Intercostal nerve block

- Lidocaine 1% with epinephrine or bupivacaine 0.25% with or without epinephrine
- Syringe, 10 ml, 1, with hypodermic and intramuscular (long) needles
- Gauze swabs
- Antiseptic solution
- Kidney dish, 1
- Gallipot, 1
- Sterile drapes
- Sterile gloves, 1 pair

Interdental wiring

- Straight artery forceps, 1 pair
- Strong scissors (or wire cutters), 1 pair
- Large kidney dish, 1
- Soft, stainless-steel wire, 0.35 mm thick
- Gauze swabs
- Warm saline
- Lidocaine 2% with epinephrine 10 or 12.5 µg/ml (1:100 000 or 1:80 000)
- Syringe, 5 ml with needle, 1

Laparotomy

- Curved dissecting scissors, 1 pair
- Scalpel handle and blade, 1
- Short dissecting scissors, 1 pair
Annex 1

Long dissecting scissors, 1 pair
Stitch scissors, 1 pair
Small, curved artery forceps, 6 pairs
Small, straight artery forceps, 6 pairs
Large, curved artery forceps, 6 pairs
Large, straight artery forceps, 6 pairs
Needle holder, long, 1
Needle holder, short, 1
Retractors (Langenbeck), medium, 1; narrow, 1
Retractors (Deaver), medium, 1; narrow, 1
Self-retaining retractor, 1
Dissecting forceps, toothed, 1 pair
Long dissecting forceps, non-toothed, 1 pair
Tissue forceps (Allis), 2 pairs
Tissue forceps (Duval), 2 pairs
Tissue forceps (Babcock), 2 pairs
Sponge forceps, 4 pairs
Malleable copper retractors (spatulae), 2
Oclusion clamps, straight, 2; curved, 2
Crushing clamps, large, 2; small, 2
Syringe, 10 ml with needle, 1
Syringe, 20 ml with needle, 1
Sutures, No. 1, 0, and 2/0 chromic catgut and 2/0 plain catgut, ties and with needles
Sutures, No. 1, 0, 2/0, and 3/0 thread, ties and with needles
Sutures, No. 1, 0, and 2/0 nylon, ties and with needles
Suction nozzle, 1
Diathermy electrode, 1
Flexible probe, with round point, 1
Grooved director, 1
Nasogastric tube, 1
Towel clips, 6
Stainless-steel bowls, 2
Kidney dishes, 2
Gallipots, 2
Linen tape
Gauze swabs
Abdominal packs, 5
Dissecting gauze rolls, 10
Antiseptic solution
Adhesive tape
Tubing for tension sutures
Drainage tubes
Safety pin, 1
Colostomy bags (optional)
Sterile drapes
Sterile gloves, at least 3 pairs

**Major paediatric operations**

Add the following to the tray for *Minor paediatric operations*:

Small, straight artery forceps, 2 pairs
Small, curved artery forceps, 2 pairs
Large, straight artery forceps, 4 pairs
Large, curved artery forceps, 4 pairs
Occlusion clamps, 2
Crushing clamps, 2
Retractor (Deaver), narrow, 1
Meatal dilatation
(paediatric)

- Small, straight artery forceps, mosquito, 1 pair
- Lubricant
- Gauze swabs
- Kidney dish, 1
- Gallipot, 1
- Antiseptic solution
- Sterile drapes (perforated towel)
- Sterile gloves, 1 pair

Minor operations

- Sponge forceps, 4 pairs
- Tissue forceps
- Scalpel handle and blade, 1
- Small dissecting scissors, 1 pair
- Stitch scissors, 1 pair
- Sutures, 2/0, 3/0, and 4/0 chromic catgut, ties and with atraumatic needles
- Sutures, 2/0 and 3/0 thread, ties and with cutting needles
- Small, curved artery forceps, 3 pairs
- Small, straight artery forceps, 3 pairs
- Large, curved artery forceps, 2 pairs
- Needle holder, 1
- Rake self-retaining retractor, 1
- Dissecting forceps, toothed, 1 pair
- Dissecting forceps, non-toothed, 1 pair
- Syringe, 5 ml with needle, 1
- Syringe, 10 ml with needle, 1
- Lidocaine 1%
- Gallipot, 1
- Kidney dish, 1
- Skin hooks, 2
- Towel clips, 4
- Corrugated drain
- Petrolatum gauze
- Gauze swabs
- Antiseptic solution
- Adhesive tape
- Sterile drapes
- Sterile gloves, 2 pairs

Minor paediatric operations

- Sponge forceps, 4 pairs
- Scalpel handle with blade, 1
- Small dissecting forceps, toothed, 1 pair
- Small dissecting forceps, non-toothed, 1 pair
- Towel clips, 6
- Dissecting scissors, 1 pair
- Stitch scissors, 1 pair
- Small, straight artery forceps, 4 pairs
- Small, curved artery forceps, 4 pairs
- Tissue forceps (Allis), 2 pairs
- Short needle holder, 1
- Long needle holder, 1
- Large, straight artery forceps, 2 pairs
- Large, curved artery forceps, 2 pairs
- Intestinal tissue-holding forceps (Babcock), 2 pairs
- Rake retractors, 2
- Hook retractors, 2
- Retractors (Langenbeck), narrow, 2
Annex 1

Myringotomy
Suction nozzle, 1
Diathermy electrode, 1
Stainless-steel bowl, 1
Kidney dishes, 2
Gallipots, 2
Sutures, 2/0 and 3/0 chromic catgut, ties and with needles
Sutures, 2/0, 3/0, and 4/0 thread, ties and with needles
Gauze swabs
Antiseptic solution
Syringes, 5 ml and 10 ml with needles
Lidocaine 1%
Adhesive tape
Sterile drapes
Sterile gloves, 2 pairs

Myringotomy
Sponge forceps, 4 pairs
Good light source and reflecting head mirror
Auriscope, 1, and aural specula
Lidocaine 1%
Antiseptic solution
Gauze swabs
Cotton wool
Long, narrow (No. 5) scalpel handle with a narrow (No. 11) blade, 1
(most of the blade should be covered with adhesive tape, to leave only a small cutting portion at the tip)
Syringe, 5 ml with needle, 1
Sterile drapes
Sterile gloves, 1 pair

Proctoscopy
Proctoscope, 1
Lubricant
Biopsy forceps, 1 pair
Torch
Gauze swabs
Small cotton swabs (dental rolls)
Specimen bottles, 2
Glass slides, 4
Clean gloves, 1 pair

Rectal examination (digital)
Swabs
Lubricant
Torch
Stool specimen container
Clean glove (or finger glove), 1
Lidocaine gel

Removal of chalazion
Syringe, 5 ml with needle, 1
Chalazion clamp, 1
Scalpel handle with blade, 1
Chalazion curettes, 1 set of 3 sizes
Lidocaine 2%
Tetracaine 0.5% eye drops
Ophthalmic swabs
Eye pad
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<th>Equipment and Tools</th>
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<td>Sterile drapes, Sterile gloves, 1 pair</td>
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<tr>
<td>from the ear</td>
<td>Good light source and reflecting head mirror</td>
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<tr>
<td></td>
<td>Auriscope, 1</td>
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<td>Syringe, 1</td>
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<td>Aural curette and hook, 1 set</td>
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<td>Water</td>
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<td>Glycerol</td>
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<td>Piece of soft rubber tubing</td>
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<td><strong>Removal of nasal foreign body</strong></td>
<td>Nasal speculum, 1</td>
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<td>Good light source and reflecting head mirror</td>
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<td></td>
<td>Small hook on long handle (aural hook), 1</td>
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<td>Angled dressing forceps, 1 pair</td>
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<td>Gauze swabs</td>
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<td>Cotton wool</td>
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<td></td>
<td>Piece of soft rubber tubing</td>
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<tr>
<td><strong>Sigmoidoscopy</strong></td>
<td>Sigmoidoscope, with rubber pump, 1</td>
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<td>Light source with cable to fit sigmoidoscope, 1</td>
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<td></td>
<td>Proctoscope, 1</td>
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<td></td>
<td>Biopsy forceps (of correct length for sigmoidoscope), 1 pair</td>
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<tr>
<td></td>
<td>Lubricant</td>
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<td>Torch</td>
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<td>Gauze swabs</td>
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<td>Small cotton swabs (dental rolls)</td>
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<td>Stool specimen bottle, 1</td>
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<td>Glass slides, 4</td>
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<td></td>
<td>Biopsy specimen bottle, 1</td>
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<td>Clean gloves, 1 pair</td>
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<tr>
<td><strong>Skin grafting</strong></td>
<td>Skin-grafting knife, Humby, with blade, 1</td>
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<td></td>
<td>Scalpel handle with No. 10 blade, 1</td>
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<td></td>
<td>Razor blade, 1</td>
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<td>Sponge forceps, 2 pairs</td>
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<td>Towel clips, 4</td>
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<td>Small, straight artery forceps, 6 pairs</td>
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<td>Dissecting forceps, non-toothed, 2 pairs</td>
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<td>Dissecting forceps, toothed, 2 pairs</td>
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<td>Dissecting scissors, straight, 1 pair</td>
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<td>Dissecting scissors, curved, 1 pair</td>
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<tr>
<td></td>
<td>Dissecting scissors (Metzenbaum), 1 pair</td>
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<tr>
<td></td>
<td>Hook retractors, small, 2 pairs</td>
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<td></td>
<td>Stitch scissors, 1 pair</td>
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<td></td>
<td>Tissue forceps (Allis), 2 pairs</td>
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<td>Skin hooks, 4</td>
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<td></td>
<td>Gallipots, 2</td>
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<td>Ruler, 1</td>
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<td>Petrolatum gauze</td>
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<td>Wooden boards with bevelled edges, 4</td>
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<td>Antiseptic solution</td>
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</tbody>
</table>
Suprapubic puncture

Add the following to the tray for Bladder catheterization:

- Syringe, 50 ml with wide-bore intramuscular needle, 1
- Syringe, 10 ml, 1, with hypodermic and intramuscular needles
- Lidocaine 1%
- Suprapubic trocar and cannula, 1
- Scalpel handle with blade, 1
- Needle holder, 1
- Stitch scissors, 1 pair
- Suture, 2/0 thread, with needle
- Catheter introducer, 1
- Catheter, de Pezzer, 1

Tarsorrhaphy

- Tetracaine 0.5% eye drops
- Lidocaine 2%
- Syringe, 5 ml with needle, 1
- Eyelid speculum, 1
- Dissecting forceps, toothed, 2 pairs
- Straight scissors, 1 pair
- Stitch scissors, 1 pair
- Needle holder, 1
- Scalpel handle with No. 15 blade, 1
- Suture, 4/0 thread, with needle
- Soft rubber tubing
- Sterile saline
- Ophthalmic swabs
- Eye pads
- Sterile drapes
- Sterile gloves, 1 pair

Tracheostomy

- Sponge forceps, 4 pairs
- Metal tracheostomy set (with inner and outer tubes and obturator), 1
- Lidocaine 1%
- Scalpel handle with blade (preferably No. 11), 1
- Syringe, 5 ml with needle, 1
- Suction nozzle, 1
- Sutures, 2/0 chromic catgut, ties and with needles
- Sutures, 2/0 thread, ties and with needles
- Linen tape
- Gauze swabs
- Small artery forceps, 4 pairs
- Large artery forceps, 2 pairs
- Small hook retractors, 2
- Small skin hooks, 2
- Needle holder, 1
- Dissecting forceps, toothed, 1 pair
- Antiseptic solution
- Sterile drapes
- Sterile gloves, 2 pairs
- Stethoscope with bell attachment
Treatment of entropion
- Eyelid retractor, 1
- Eyelid clamp or Trabut plate, 1
- Scalpel handle with No. 15 blade, 1
- Dissecting forceps, toothed, 1 pair
- Fine ophthalmic scissors, 1 pair
- Needle holder, 1
- Suture, 4/0 thread, with needle
- Stitch scissors, 1 pair
- Ophthalmic swabs
- Eye pad, 1
- Adhesive tape
- Syringe, 5 ml with needle, 1
- Lidocaine 2%
- Sterile saline
- Tetracaine 0.5% eye drops
- Sterile drapes
- Sterile gloves, 1 pair

Underwater-seal chest drainage
- Sponge forceps, 4 pairs
- Chest-drainage tube, 1
- Sterile tubing with connector
- Calibrated chest-drainage bottle with appropriate fittings, containing sterile water, saline, or antiseptic solution, 1
- Large, curved artery forceps, 1 pair
- Large, straight artery forceps, 1 pair
- Small, curved artery forceps, 3 pairs
- Scalpel handle with blade, 1
- Needle holder, 1
- Suture, 2/0 thread on a cutting needle
- Syringe, 10 or 20 ml with needle, 1
- Syringe, 5 ml with needle, 1
- Stitch scissors, 1 pair
- Dissecting forceps, toothed, 1 pair
- Lidocaine 1%
- Antiseptic solution
- Gauze swabs
- Gallipot, 1
- Kidney dish, 1
- Face mask, 1
- Adhesive tape
- Sterile drapes
- Sterile gloves, 2 pairs

Urethral dilatation
Add the following to the tray for Bladder catheterization:
- Curved bougies, 1 set
- Straight bougies, 1 set
- Filiform bougies, 1 set
- Soft penile clamp, 1
- Lidocaine gel
Essential surgical instruments, equipment, and materials for the district hospital

This annex lists the instruments, equipment, and materials needed, as a minimum, for the practice of general surgery in the district hospital. It contains all the items listed in Annex 1, with the exception of local anaesthetics, containers for laboratory specimens, and chemical products such as antiseptics and lubricants. It also includes operating-room and anaesthetic equipment, and instruments required for the surgical procedures described in Surgery at the district hospital: obstetrics, gynaecology, orthopaedics, and traumatology (Geneva, World Health Organiza tion, in preparation).

Surgical instruments

<table>
<thead>
<tr>
<th>General instruments</th>
<th>Quantity</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sponge forceps (Rampley)</td>
<td>4</td>
<td>25 cm</td>
</tr>
<tr>
<td>Instrument pins (Mayo)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Towel clips (Backhaus)</td>
<td>6</td>
<td>11 cm</td>
</tr>
<tr>
<td>Artery forceps (Crile): straight</td>
<td>6</td>
<td>16 cm</td>
</tr>
<tr>
<td>Artery forceps (Crile): curved</td>
<td>6</td>
<td>16 cm</td>
</tr>
<tr>
<td>Artery forceps (mosquito): straight</td>
<td>6</td>
<td>13 cm</td>
</tr>
<tr>
<td>Artery forceps (mosquito): curved</td>
<td>6</td>
<td>13 cm</td>
</tr>
<tr>
<td>Curved artery forceps (Mayo or Kelly)</td>
<td>6</td>
<td>20 cm</td>
</tr>
<tr>
<td>Straight artery forceps (Spencer Wells)</td>
<td>6</td>
<td>20 cm</td>
</tr>
<tr>
<td>Tissue forceps (Allis)</td>
<td>4</td>
<td>15 cm</td>
</tr>
<tr>
<td>Standard dissecting forceps: toothed</td>
<td>2</td>
<td>14.5 cm</td>
</tr>
<tr>
<td>Standard dissecting forceps: non-toothed</td>
<td>2</td>
<td>14.5 cm</td>
</tr>
<tr>
<td>Long dissecting forceps, toothed</td>
<td>1</td>
<td>25 cm</td>
</tr>
<tr>
<td>Long dissecting forceps, non-toothed</td>
<td>1</td>
<td>25 cm</td>
</tr>
<tr>
<td>Straight dissecting scissors (Mayo)</td>
<td>2</td>
<td>17 cm</td>
</tr>
<tr>
<td>Curved dissecting scissors (Mayo)</td>
<td>1</td>
<td>23 cm</td>
</tr>
<tr>
<td>Dissecting scissors (Metzenbaum)</td>
<td>1</td>
<td>18 cm</td>
</tr>
<tr>
<td>Stitch scissors, with blunt ends</td>
<td>2</td>
<td>15 cm</td>
</tr>
<tr>
<td>Rake retractors (Volkman), 4-toothed</td>
<td>2</td>
<td>22 cm</td>
</tr>
<tr>
<td>Rake self-retaining retractors</td>
<td>2</td>
<td>21 cm</td>
</tr>
<tr>
<td>Retractors (Langenbeek): narrow</td>
<td>2</td>
<td>6.0 mm wide</td>
</tr>
<tr>
<td>Retractors (Langenbeek): medium</td>
<td>2</td>
<td>9.5 mm wide</td>
</tr>
<tr>
<td>Retractors (Deaver): medium</td>
<td>1</td>
<td>25 mm blade</td>
</tr>
<tr>
<td>Retractors (Deaver): large</td>
<td>1</td>
<td>75 mm blade</td>
</tr>
<tr>
<td>Hook retractors</td>
<td>2</td>
<td>15 cm</td>
</tr>
<tr>
<td>Needle holders (Mayo): medium</td>
<td>2</td>
<td>15 cm</td>
</tr>
<tr>
<td>Needle holders (Mayo): large</td>
<td>2</td>
<td>17.5 cm</td>
</tr>
<tr>
<td>Scalpel handles No. 3 (Bard-Parker)</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Scalpel handles No. 4 (Bard-Parker)</td>
<td>12</td>
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</tr>
<tr>
<td>Scalpel handles No. 5 (Bard-Parker)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Suction nozzle (Yankauer)</td>
<td>1</td>
<td>28.5 cm</td>
</tr>
<tr>
<td>Nozzie (Poole-Wheeler)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
### Annex 2

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diathermy electrodes, coagulating and fulgurating</td>
<td>2</td>
</tr>
<tr>
<td>Flexible probe, with round point</td>
<td>1</td>
</tr>
<tr>
<td>Grooved director (Kocher)</td>
<td>1</td>
</tr>
<tr>
<td>Stainless-steel sponge bowls: small</td>
<td>6</td>
</tr>
<tr>
<td>medium</td>
<td>6</td>
</tr>
<tr>
<td>large</td>
<td>6</td>
</tr>
<tr>
<td>Stainless-steel kidney dishes: small</td>
<td>4</td>
</tr>
<tr>
<td>medium</td>
<td>4</td>
</tr>
<tr>
<td>large</td>
<td>4</td>
</tr>
<tr>
<td>Stainless-steel gallipots</td>
<td>2</td>
</tr>
<tr>
<td>Sinus forceps</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Abdominal instruments

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-retaining retractor with 3 blades (Balfour)</td>
<td>1</td>
</tr>
<tr>
<td>Proctoscope (anal speculum, Goligher):</td>
<td>1</td>
</tr>
<tr>
<td>child-size</td>
<td></td>
</tr>
<tr>
<td>adult-size</td>
<td>1</td>
</tr>
<tr>
<td>Sigmoidoscope, complete with pump: child-size</td>
<td>1</td>
</tr>
<tr>
<td>adult-size</td>
<td>1</td>
</tr>
<tr>
<td>Light source with cable, to fit sigmoidoscopeoscope</td>
<td>1</td>
</tr>
<tr>
<td>Biopsy forceps</td>
<td>2</td>
</tr>
<tr>
<td>Clamps (Moynihan), box-joint</td>
<td>6</td>
</tr>
<tr>
<td>Gallbladder trocar and cannula (Ochsner)</td>
<td>1</td>
</tr>
<tr>
<td>Gallstone forceps (Desjardin)</td>
<td>1</td>
</tr>
<tr>
<td>Malleable probe and scoop (Moynihan)</td>
<td>1</td>
</tr>
<tr>
<td>Lacrimal probes, set of 3</td>
<td>1</td>
</tr>
<tr>
<td>Tissue forceps (Duval): medium</td>
<td>2</td>
</tr>
<tr>
<td>large</td>
<td>2</td>
</tr>
<tr>
<td>Crushing clamps (Payr): small</td>
<td>2</td>
</tr>
<tr>
<td>large</td>
<td>2</td>
</tr>
<tr>
<td>Crushing clamps (Schoemaker): small</td>
<td>2</td>
</tr>
<tr>
<td>large</td>
<td>2</td>
</tr>
<tr>
<td>Malleable copper retractors (spatulae)</td>
<td>2</td>
</tr>
<tr>
<td>Occlusion clamps (Doyen): straight</td>
<td>2</td>
</tr>
<tr>
<td>curved</td>
<td>2</td>
</tr>
<tr>
<td>Twin occlusion clamps (Lane)</td>
<td>1</td>
</tr>
<tr>
<td>Intestinal tissue-holding forceps (Babcock)</td>
<td>4</td>
</tr>
<tr>
<td>Glass rods</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Chest instruments

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest-drainage set, including tube and calibrated bottle</td>
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</tr>
</tbody>
</table>

#### Craniotomy instruments

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-retaining rake retractors (West)</td>
<td>2</td>
</tr>
<tr>
<td>Periosteal elevator (Farabeuf)</td>
<td>1</td>
</tr>
<tr>
<td>Dissector (Macdonald)</td>
<td>1</td>
</tr>
<tr>
<td>Brace (Hudson), burrs and perforators with 3 sizes of bits</td>
<td>1 set</td>
</tr>
<tr>
<td>Bone forceps (De Vilbis)</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Dental, plastic surgery, and maxillo-facial instruments

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard skin-grafting knife (Humby), with spare blades</td>
<td>1</td>
</tr>
<tr>
<td>Electric dermatome</td>
<td>1</td>
</tr>
<tr>
<td>Wooden skin-grafting boards</td>
<td>4</td>
</tr>
<tr>
<td>Pin-cutting forceps</td>
<td>1</td>
</tr>
<tr>
<td>Straight bone-awl (Kelsey Fry)</td>
<td>1</td>
</tr>
</tbody>
</table>
### Essential Surgical Equipment

<table>
<thead>
<tr>
<th>Instrument Description</th>
<th>Quantity</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight elevator (Warwick James or modified Kelsey Fry)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Curved elevators: right</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>left</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Dental mirror</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Dental forceps: universal upper</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>universal lower</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Wire cutters</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Skin hooks (Gillies)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Small hook retractors</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Fine dissecting forceps: toothed</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>non-toothed</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Curved artery forceps (Crile)</td>
<td>6</td>
<td>14 cm</td>
</tr>
<tr>
<td>Handle holder (Mayo-Hegar) or needle holder (Gillies)</td>
<td>1</td>
<td>15 cm</td>
</tr>
<tr>
<td>Dental probes/spoons</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

### Gynaecology Instruments

<table>
<thead>
<tr>
<th>Instrument Description</th>
<th>Quantity</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal specula (Sims): small</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>large</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Weighted vaginal speculum (Auvard)</td>
<td>1</td>
<td>38 x 75 mm</td>
</tr>
<tr>
<td>Vulsellum forceps (Teale or Duplay)</td>
<td>2</td>
<td>28 cm</td>
</tr>
<tr>
<td>Episiotomy scissors</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Vacuum extraction apparatus</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Amniohook</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Uterine sound (Simpson)</td>
<td>1</td>
<td>30 cm</td>
</tr>
<tr>
<td>Double-ended uterine dilators, set of 6</td>
<td>1 set</td>
<td>26 x 7 mm to 26 x 14 mm (various sizes)</td>
</tr>
<tr>
<td>Uterine curettes (Sims)</td>
<td>6</td>
<td>22.5 cm</td>
</tr>
<tr>
<td>Ovum forceps (de Lee)</td>
<td>1</td>
<td>24 cm</td>
</tr>
<tr>
<td>Cranial perforator</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Straight hysterectomy forceps (Pean)</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Craniotomy forceps</td>
<td>2</td>
<td>20 cm</td>
</tr>
<tr>
<td>Uterine haemostasis forceps (Green Armytage)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Obstetric forceps: low midcavity</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Retractor (Doyen)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Anterior vaginal-wall retractors</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Punch biopsy forceps</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Endometrial biopsy cannula</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Suction cannulas, set of 4</td>
<td>1 set</td>
<td></td>
</tr>
<tr>
<td>Colposcope</td>
<td>1</td>
<td></td>
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### Ophthalmic Instruments

<table>
<thead>
<tr>
<th>Instrument Description</th>
<th>Quantity</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyelid speculum (Clark)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Eyelid retractors (Desmarres)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Small rake retractors</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Pterygium knife</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Dissecting forceps, toothed</td>
<td>1</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>1</td>
<td>0.9 mm</td>
<td></td>
</tr>
<tr>
<td>Dissecting forceps, non-toothed</td>
<td>1</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>1</td>
<td>0.9 mm</td>
<td></td>
</tr>
<tr>
<td>Conjunctival scissors</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Conjunctival forceps</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Extracapsular forceps</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Chalazion clamp</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Chalazion curettes, set of 3 sizes</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Enucleation scissors</td>
<td>1</td>
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</table>
Orthopaedic instruments

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>Straight ring scissors</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Spring scissors (Westcott)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Corneal scissors (Castroviejo): right</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Corneal scissors (Castroviejo): left</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Iris scissors</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Iris forceps</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Needle holder, curved with lock (Castroviejo)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Operating loupe (or similar magnifying device)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Capsule forceps, non-toothed</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Simple ball-type cautery</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Muscle hooks</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Strabismus hooks</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Cystotome</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Vectis</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Periosteal elevator</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Iris retractor</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Iris spatula (repositor)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Irrigating cannula</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Meibomian curette</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Eyelid clamp (and/or Trabut plate)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Flat cataract curette</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Knife needle</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Spirit lamp with hot-point cautery</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Punctum dilator</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tear-duct probes</td>
<td>1 set</td>
<td>4/0–4</td>
</tr>
<tr>
<td>Irrigating cannula</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Air cannula</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Eye spud (Walton)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Plaster instruments:
- plaster saw (tenon)                                                | 1        |            |
- plaster saw (Engel)                                                | 1        |            |
- shears (Stille)                                                    | 1        | 46 cm      |
- scissors (Böhler)                                                   | 1        | 25 cm      |
- opening shears (Daw)                                                | 1        |            |
- bandage scissors (Lister)                                           | 1        |            |
- Pneumatic tourniquet                                                | 1        |            |
- Rubber bandages (Esmarch)                                           | 2        |            |
- Pins (Steinmann), with covers for ends                              | 1        |            |
- Hand chuck for introducing pins (T-handle)                          | 1        |            |
- Stirrups (Böhler)                                                   | 1        |            |
- Wires (Kirschner)                                                   | 1        |            |
- Wire stirrups (Kirschner)                                           | 6        |            |
- Hand drill and drill bits (Zimmer)                                 | 1 set    |            |
- Mallet (Heath)                                                      | 1        | 38 mm head |
- Small mallet                                                        | 1        |            |
- Straight osteotomes (Stille): broad                                 | 2        | 18 × 160 mm|
- Straight osteotomes (Stille): narrow                                | 2        | 6 × 160 mm |
- Straight chisels (Stille)                                           | 2        |            |
- Straight gouges                                                     | 2        |            |
- Orthopaedic self-retaining retractor                               | 1        |            |
- Tissue forceps (Lane)                                               | 2        |            |
- Spoons (Volkmann): small                                            | 1        | 17 cm      |
- Spoons (Volkmann): medium                                           | 1        | 21 cm      |
- Amputation knife                                                    | 1        | 20 cm      |
- Amputation saw (Satterlee)                                          | 1        |            |
- Finger saw                                                          | 1        |            |
- Bone-holding forceps (Fergusson or Lane)                            | 2        |            |
Essential surgical equipment

<table>
<thead>
<tr>
<th>Instrument Type</th>
<th>Quantity</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone levers (Lane)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Rugine (Farabeuf)</td>
<td>1</td>
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<tr>
<td>Compound-action bone nibbler (rongeur)</td>
<td>1</td>
<td>19 cm</td>
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<tr>
<td>Compound-action bone-cutting forceps</td>
<td>1</td>
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<tr>
<td>Bone file</td>
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<tr>
<td>Skull callipers (Crutchfield)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Skull callipers (Cone), with spanner</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Bone file</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Skull callipers (Crutchfield)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Skull callipers (Cone), with spanner</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Auriscope and aural specula</td>
<td>1 set</td>
<td></td>
</tr>
<tr>
<td>Ear syringe</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Head mirror</td>
<td>1</td>
<td></td>
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<tr>
<td>Nasal specula (Thudicum), set of 4 sizes</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Angled dressing forceps (Tilley)</td>
<td>2</td>
<td></td>
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<tr>
<td>Self-retaining retractor (West)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Aural probe, hook, and curette</td>
<td>1 set</td>
<td></td>
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<tr>
<td>Myringotome</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mouth gag (Boyle-Davis): child-size</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>adult-size</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Angled tongue depressors</td>
<td>2</td>
<td></td>
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<tr>
<td>Small suction tubes</td>
<td>2</td>
<td></td>
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<tr>
<td>Small catspaw retractors (Kilner)</td>
<td>2</td>
<td></td>
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<tr>
<td>Tracheal dilator (Boviby)</td>
<td>1</td>
<td></td>
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<tr>
<td>Assorted tracheostomy tubes or tracheostomy sets (Chevalier Jackson): child-size adult-size</td>
<td>1 set 2 2</td>
<td></td>
</tr>
<tr>
<td>Urological instruments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curved urethral bougies (Clutton)</td>
<td>2 sets</td>
<td>10–24 Ch.</td>
</tr>
<tr>
<td>Straight bougies (Powell)</td>
<td>2 sets</td>
<td>10–24 Ch.</td>
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<tr>
<td>Filiform bougies</td>
<td>2 sets</td>
<td>33 cm long</td>
</tr>
<tr>
<td>Bougies, 5/8 of a circle, olive-tipped (Hey Grove), set of 3</td>
<td>2</td>
<td>12 Ch.</td>
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<tr>
<td>Soft penile clamps</td>
<td>2</td>
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<tr>
<td>Suprapubic trocars and cannulas</td>
<td>1</td>
<td>25 Ch.</td>
</tr>
<tr>
<td>1</td>
<td>30 Ch.</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>30 Ch.</td>
<td></td>
</tr>
<tr>
<td>Catheter introducer (Malecot)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Catheter introducer (Foley)</td>
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<tr>
<td>Vascular instruments</td>
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<td></td>
</tr>
<tr>
<td>Bulldog clamps</td>
<td>4</td>
<td>22 mm</td>
</tr>
<tr>
<td>Clamps (Satinsky), with 3 different blade shapes</td>
<td>1 set</td>
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<tr>
<td>Narrow-jaw needle holders (Hegar)</td>
<td>1</td>
<td>17.5 cm</td>
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Operating-room equipment

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Fixed equipment</td>
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</tr>
<tr>
<td>Fixed operating-room light</td>
<td>1</td>
</tr>
<tr>
<td>Ultraviolet light source</td>
<td>1</td>
</tr>
<tr>
<td>Scrub basins with hot and cold running water</td>
<td></td>
</tr>
<tr>
<td>Exhaust fans</td>
<td>1</td>
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<tr>
<td>Electric autoclave with horizontal drum</td>
<td>1</td>
</tr>
<tr>
<td>Electric or kerosene sterilizer for boiling instruments</td>
<td>1</td>
</tr>
<tr>
<td>Other equipment</td>
<td>Quantity</td>
</tr>
<tr>
<td>----------------</td>
<td>---------</td>
</tr>
<tr>
<td>Operating table, universal frame-type with headpiece</td>
<td>1</td>
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<tr>
<td>Plaster, orthopaedic fracture table (modified Watson-Jones)</td>
<td>1</td>
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<tr>
<td>Utensil sterilizer for bowls, boiling-type</td>
<td>1</td>
</tr>
<tr>
<td>Electric or kerosene hot-air sterilizer</td>
<td>1</td>
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<tr>
<td>Forceps sterilizers (Cheatle), heavy-duty</td>
<td>2</td>
</tr>
<tr>
<td>Forceps sterilizers (Harrison)</td>
<td>2</td>
</tr>
<tr>
<td>Instrument trolleys</td>
<td>4</td>
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<tr>
<td>Anaesthetic trolleys</td>
<td>2</td>
</tr>
<tr>
<td>Instrument stands with trays (Mayo)</td>
<td>4</td>
</tr>
<tr>
<td>Instrument stands with bowls: single</td>
<td>2</td>
</tr>
<tr>
<td>double</td>
<td>2</td>
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<tr>
<td>Stands for swabs</td>
<td>2</td>
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<tr>
<td>Portable aspirating surgical suckers, electric</td>
<td>2</td>
</tr>
<tr>
<td>Portable aspirating surgical suckers, foot-operated</td>
<td>2</td>
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<tr>
<td>Cylindrical sterilizing drums: 24 cm diameter</td>
<td>4</td>
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<tr>
<td>29 cm diameter</td>
<td>4</td>
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<tr>
<td>34 cm diameter</td>
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<tr>
<td>Stainless-steel buckets with covers</td>
<td>4</td>
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<tr>
<td>“Kick-about” receptacles, on frames with roller casters</td>
<td>4</td>
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<tr>
<td>Revolving operating stools of adjustable height (enamel finish)</td>
<td>4</td>
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<tr>
<td>Footstools</td>
<td>2</td>
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<tr>
<td>Dressing trays: small</td>
<td>4</td>
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<tr>
<td>medium</td>
<td>4</td>
</tr>
<tr>
<td>large</td>
<td>4</td>
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<tr>
<td>Portable operating-room lights, with stands</td>
<td>2</td>
</tr>
<tr>
<td>Diathermy machine</td>
<td>1</td>
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<tr>
<td>Radiograph viewing boxes</td>
<td>2</td>
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<tr>
<td>Dispensers for hot and cold sterile distilled water (4 litres/hour)</td>
<td>2</td>
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<tr>
<td>Stretchers with combination wheel and adjustable sides</td>
<td>4</td>
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<tr>
<td>Labour and delivery beds, with two-piece mattresses</td>
<td>2</td>
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<tr>
<td>Folding stretchers</td>
<td>4</td>
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<tr>
<td>Covered instrument trays</td>
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<tr>
<td>Covered instrument/dressing trays</td>
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<tr>
<td>Instrument trays with handles</td>
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<tr>
<td>Instrument and catheter trays</td>
<td>4</td>
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<tr>
<td>Stainless-steel jugs: 3 litre</td>
<td>2</td>
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<tr>
<td>4 litre</td>
<td>2</td>
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<tr>
<td>Stainless-steel funnels, 200 ml</td>
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<tr>
<td>Stainless-steel graduated measures with handles, 1 litre</td>
<td>2</td>
</tr>
<tr>
<td>Utility basins, 3 litre</td>
<td>2</td>
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<tr>
<td>Self-retaining 4-wing catheters (de Pezzer), sizes 8, 14, 16, and 18 Ch.</td>
<td>4</td>
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<tr>
<td>Self-retaining balloon catheters (Foley), sizes 8, 14, 16, 18, and 22 Ch.</td>
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</tr>
<tr>
<td>Urethral catheters (Nelaton), solid-tip, sizes 8, 10, 12, and 14 Ch.</td>
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</tr>
<tr>
<td>Urethral catheters, coudé, sizes 8, 10, 12, 14, and 16 Ch.</td>
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<tr>
<td>Urinary bags</td>
<td>2</td>
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<tr>
<td>Graduated drainage (collecting) bottles, glass, 1.5 litre</td>
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<tr>
<td>Surgeon’s latex gloves, sizes 6, 6.5, 7, 7.5, 8</td>
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</table>
### Essential Surgical Equipment

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Rubber rectal tubes, funnel-end, 20 Ch., 50 cm long</td>
<td>1</td>
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<tr>
<td>Rubber rectal tubes, funnel-end, 28 Ch., 50 cm long</td>
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<tr>
<td>Colostomy bags</td>
<td>100</td>
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<tr>
<td>Nasogastric tubes (Levin), 12 Ch.</td>
<td>1</td>
</tr>
<tr>
<td>Polythene nasal feeding tubes:</td>
<td></td>
</tr>
<tr>
<td>- infant-size, 8 Ch., 38 cm long</td>
<td></td>
</tr>
<tr>
<td>- adult-size, 16 Ch., 80 cm long</td>
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<tr>
<td>Metal irrigating syringe (Kramer), 90 ml</td>
<td>1</td>
</tr>
<tr>
<td>Glass irrigating syringes, 100 ml</td>
<td>2</td>
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<tr>
<td>Syringes:</td>
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<tr>
<td>- insulin, 1 ml</td>
<td>1</td>
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<tr>
<td>- tuberculin, 1 ml</td>
<td></td>
</tr>
<tr>
<td>- hypodermic, 2, 5, 10, 20, and 50 ml</td>
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</tr>
<tr>
<td>Hypodermic needles, gauges 18-25, 27, and 28</td>
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</tr>
<tr>
<td>Stomach tubes, 24 Ch., 150 cm long</td>
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<tr>
<td>Face masks and caps</td>
<td></td>
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<tr>
<td>Washable footwear, antistatic</td>
<td></td>
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<tr>
<td>Drapes</td>
<td></td>
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<tr>
<td>Gowns</td>
<td></td>
</tr>
<tr>
<td>Surgeon’s handbrushes with nylon bristles</td>
<td></td>
</tr>
<tr>
<td>Sutures/ligatures:</td>
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</tr>
<tr>
<td>- chromic catgut and plain catgut, 6/0, 4/0, 3/0, 2/0,</td>
<td></td>
</tr>
<tr>
<td>- with and without needles</td>
<td></td>
</tr>
<tr>
<td>- nylon and silk, 18/0, 6/0, 5/0, 4/0,</td>
<td></td>
</tr>
<tr>
<td>- with and without needles</td>
<td></td>
</tr>
<tr>
<td>- soft, stainless-steel wire, 0.35 mm thick (about size 0)</td>
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</tr>
<tr>
<td>Regular-eye needles, assortment of different types and sizes</td>
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<tr>
<td>Scalpel blades, No. 10, 11, 12, 15, 21, 22, 23</td>
<td>100</td>
</tr>
<tr>
<td>Aneurysm needles: right</td>
<td>3</td>
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<tr>
<td>- left</td>
<td>3</td>
</tr>
<tr>
<td>Stitch removal scissors</td>
<td>2</td>
</tr>
<tr>
<td>Heavy-duty “counter” scissors</td>
<td>2</td>
</tr>
<tr>
<td>Cannulas:</td>
<td>2</td>
</tr>
<tr>
<td>- stainless-steel</td>
<td></td>
</tr>
<tr>
<td>- curved intravenous (Webster Luer)</td>
<td>2</td>
</tr>
<tr>
<td>- transfusion (Luer), 1.25 x 41 mm (gauge 18)</td>
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</tr>
<tr>
<td>- transfusion (Luer), 0.90 x 41 mm (gauge 20)</td>
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</tr>
<tr>
<td>- transfusion (Luer), 0.70 x 41 mm (gauge 22)</td>
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</tr>
<tr>
<td>Disposable scalp-vein infusion sets</td>
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<tr>
<td>Polythene tubing, 0.86 mm inner diameter, 1.27 mm outer diameter</td>
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<tr>
<td>Polythene tubing, 1.40 mm inner diameter, 1.90 mm outer diameter</td>
<td>2</td>
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<tr>
<td>Polythene tubing, 1.67 mm inner diameter, 2.42 mm outer diameter</td>
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<tr>
<td>Latex tubing: has 6.32 mm inner diameter</td>
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</tr>
<tr>
<td>- 7.5 mm inner diameter</td>
<td>2</td>
</tr>
<tr>
<td>- 10.0 mm inner diameter</td>
<td>2</td>
</tr>
<tr>
<td>Soft rubber tubing, 2.0 mm inner diameter</td>
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</tr>
<tr>
<td>Connectors for tubing, assorted, including T-shape and Y-shape</td>
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</tr>
<tr>
<td>Utility apron, opaque plastic 90 cm x 100 cm</td>
<td>1</td>
</tr>
<tr>
<td>Plastic sheeting, clear vinyl, 91 cm wide</td>
<td>1</td>
</tr>
<tr>
<td>Rubber sheeting, double-coated, 91 cm wide</td>
<td>1</td>
</tr>
</tbody>
</table>

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### Annex 2

**Foam rubber**

**Corrugated latex drain**

Gauze bandage: 25 mm × 9 m  
50 mm × 9 m  
75 mm × 9 m

Absorbent gauze (for dressings, swabs, abdominal packs, petrolatum gauze, etc.): 20 cm × 6 m  
1 m × 100 m

**Linen tape:** 5 mm wide  
10 mm wide

**Surgical adhesive tape,** 25 mm × 10 m

**Adhesive zinc oxide tape,** 75 mm × 5 m

**Non-adhesive elastic bandage,** 75 mm × 5 m

**Absorbent cotton wool**

**Eye pads**

**Eye shields**

**Umbilical tape,** 3 mm wide

**Indelible pencils**

**Safety pins, medium size**

**Rubber bands, assorted**

**Garters, elasticated**

**Manually operated hair clippers, narrow**

**Clipboards,** 23 × 32 cm

**All-metal safety razors,** 3-piece

**Double-edged safety-razor blades**

**Battery-operated wall clock,** with hands showing time in seconds, minutes, and hours

**Laboratory balance,** 2 kg capacity

**Sandbags**

**Stainless-steel rulers**

**Aneroid sphygmomanometer,** range 0–300 mmHg, with cuff

**Stethoscopes, binaural (bell and diaphragm)**

**Oesophageal stethoscope**

**Fetal stethoscope**

**Tape measure,** 1.5 m

**Clinical thermometers:** oral  
rectal

**Shiōzō tonometer**

**Torch,** battery-operated

**Clothes-pegs**

**Wooden spatulae**

**Orthopaedic equipment**

Gauze bandages, 10 cm and 15 cm wide

Crêpe bandages

Stockinet, assorted sizes

Plaster of Paris powder (anhydrous calcium sulfate)

Triangular cloth bandages (for arm slings)

Thomas splints: child-size  
medium-size  
adult-size

Pearson attachments for Thomas splints: child-size  
medium-size  
adult-size

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>Foam rubber</td>
<td>2</td>
</tr>
<tr>
<td>Corrugated latex drain</td>
<td>2</td>
</tr>
<tr>
<td>Gauze bandage, 25 mm × 9 m</td>
<td>1</td>
</tr>
<tr>
<td>Gauze bandage, 50 mm × 9 m</td>
<td>1</td>
</tr>
<tr>
<td>Gauze bandage, 75 mm × 9 m</td>
<td>1</td>
</tr>
<tr>
<td>Absorbent gauze</td>
<td>1</td>
</tr>
<tr>
<td>Linen tape, 5 mm wide</td>
<td>1</td>
</tr>
<tr>
<td>Linen tape, 10 mm wide</td>
<td>1</td>
</tr>
<tr>
<td>Surgical adhesive tape, 25 mm × 10 m</td>
<td>1</td>
</tr>
<tr>
<td>Adhesive zinc oxide tape, 75 mm × 5 m</td>
<td>1</td>
</tr>
<tr>
<td>Non-adhesive elastic bandage, 75 mm × 5 m</td>
<td>1</td>
</tr>
<tr>
<td>Absorbent cotton wool</td>
<td>1</td>
</tr>
<tr>
<td>Eye pads</td>
<td>1</td>
</tr>
<tr>
<td>Eye shields</td>
<td>1</td>
</tr>
<tr>
<td>Umbilical tape, 3 mm wide</td>
<td>1</td>
</tr>
<tr>
<td>Indelible pencils</td>
<td>1</td>
</tr>
<tr>
<td>Safety pins, medium size</td>
<td>1</td>
</tr>
<tr>
<td>Rubber bands, assorted</td>
<td>1</td>
</tr>
<tr>
<td>Garters, elasticated</td>
<td>1</td>
</tr>
<tr>
<td>Manually operated hair clippers, narrow</td>
<td>1</td>
</tr>
<tr>
<td>Clipboards, 23 × 32 cm</td>
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</tr>
<tr>
<td>All-metal safety razors, 3-piece</td>
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</tr>
<tr>
<td>Double-edged safety-razor blades</td>
<td>1</td>
</tr>
<tr>
<td>Battery-operated wall clock, with hands showing time in seconds, minutes, and hours</td>
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</tr>
<tr>
<td>Laboratory balance, 2 kg capacity</td>
<td>1</td>
</tr>
<tr>
<td>Sandbags</td>
<td>1</td>
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<tr>
<td>Stainless-steel rulers</td>
<td>1</td>
</tr>
<tr>
<td>Aneroid sphygmomanometer, range 0–300 mmHg, with cuff</td>
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</tr>
<tr>
<td>Stethoscopes, binaural (bell and diaphragm)</td>
<td>1</td>
</tr>
<tr>
<td>Oesophageal stethoscope</td>
<td>1</td>
</tr>
<tr>
<td>Fetal stethoscope</td>
<td>1</td>
</tr>
<tr>
<td>Tape measure, 1.5 m</td>
<td>1</td>
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<tr>
<td>Clinical thermometers: oral</td>
<td>1</td>
</tr>
<tr>
<td>Clinical thermometers: rectal</td>
<td>1</td>
</tr>
<tr>
<td>Shiōzō tonometer</td>
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</tr>
<tr>
<td>Torch, battery-operated</td>
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</tr>
<tr>
<td>Clothes-pegs</td>
<td>1</td>
</tr>
<tr>
<td>Wooden spatulae</td>
<td>1</td>
</tr>
<tr>
<td>Orthopaedic equipment</td>
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</tr>
<tr>
<td>Gauze bandages, 10 cm and 15 cm wide</td>
<td>1</td>
</tr>
<tr>
<td>Crêpe bandages</td>
<td>1</td>
</tr>
<tr>
<td>Stockinet, assorted sizes</td>
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<tr>
<td>Plaster of Paris powder (anhydrous calcium sulfate)</td>
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<tr>
<td>Triangular cloth bandages (for arm slings)</td>
<td>1</td>
</tr>
<tr>
<td>Thomas splints: child-size</td>
<td>1</td>
</tr>
<tr>
<td>Thomas splints: medium-size</td>
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</tr>
<tr>
<td>Thomas splints: adult-size</td>
<td>1</td>
</tr>
<tr>
<td>Pearson attachments for Thomas splints: child-size</td>
<td>1</td>
</tr>
<tr>
<td>Pearson attachments for Thomas splints: medium-size</td>
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</tr>
<tr>
<td>Pearson attachments for Thomas splints: adult-size</td>
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</tr>
</tbody>
</table>
Essential surgical equipment

Half-ring Thomas splints: right side
left side
Multi-purpose board splints, 3 sizes
Cramer wire splints: narrow, medium, and wide
Frames with pulleys (Böhler–Braun)
Pulley systems: free
in frames
Wooden spreader bars, square: 7 × 7 cm
10 × 10 cm
'Non-elastic traction cord
Blocks (for elevating bed), 22 cm and 30 cm high
Overhead traction suspension frames
Weights for traction

Anaesthetic equipment

Anaesthetic face masks, infant-size to large adult-size
Oropharyngeal airways, sizes 00 to 5
Laryngoscopes
Spare bulbs for laryngoscopes
Batteries for laryngoscopes
Endotracheal tubes, sizes 2.5–10 mm (internal diameter) in 0.5 mm steps, Oxford or Magill or similar, with cuffs only on sizes > 6 mm
Urethral bougies, for use as intubating stylets
Magill’s intubating forceps (in an emergency, ovum forceps can be used instead)
Endotracheal tube connectors, 15 mm plastic (can be connected directly to the breathing valve)
Catheter mounts (sometimes also called endotracheal tube connectors), antistatic rubber
Breathing hose and connectors:
lengths of 1 metre antistatic tubing
lengths of 30 cm tubing for connection of vaporizers
T-piece for oxygen enrichment
Breathing valves (universal non-rebreathing type): child-size
adult-size
Breathing systems (for continuous-flow anaesthesia):
Ayre’s T-piece system
Magill breathing system
Self-inflating bellows or bags: child-size
adult-size
Anaesthetic vaporizers, for ether, halothane, and trichloroethylene (draw-over type)
Needles and cannulas for intravenous use, including paediatric sizes and an umbilical vein catheter
Intravenous infusion sets
Spinal needles, range of sizes, 18-gauge to 25-gauge

Quantity

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
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<tr>
<td>Half-ring Thomas splints: right side</td>
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<td>left side</td>
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<tr>
<td>Multi-purpose board splints, 3 sizes</td>
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<td>Cramer wire splints: narrow, medium, and wide</td>
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<td>Frames with pulleys (Böhler–Braun)</td>
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<td>Pulley systems: free in frames</td>
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<td>Wooden spreader bars, square: 7 × 7 cm</td>
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<td>10 × 10 cm</td>
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<td>‘Non-elastic traction cord</td>
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<td>Blocks (for elevating bed), 22 cm and 30 cm high</td>
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<td>Overhead traction suspension frames</td>
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<td>Anaesthetic face masks, infant-size to large adult-size</td>
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<td>Oropharyngeal airways, sizes 00 to 5</td>
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