

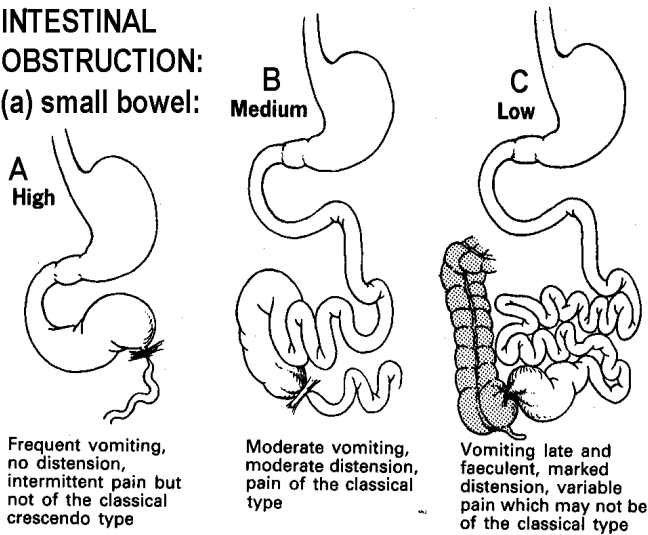
12 Intestinal obstruction

12.1 The acute abdomen

Any patient needing admission to hospital with acute abdominal pain has 'an acute abdomen', but you have to distinguish who has a serious illness which may be fatal if you don't operate, and who has a self-limiting complaint. You also must distinguish between peritonitis (10.1) and intestinal obstruction. Localized peritonitis may cause obstruction; intestinal obstruction can quickly lead to peritonitis if the bowel blood supply is cut off.

INTESTINAL OBSTRUCTION:

(a) small bowel:



(b) large bowel

The role of the ileocaecal valve

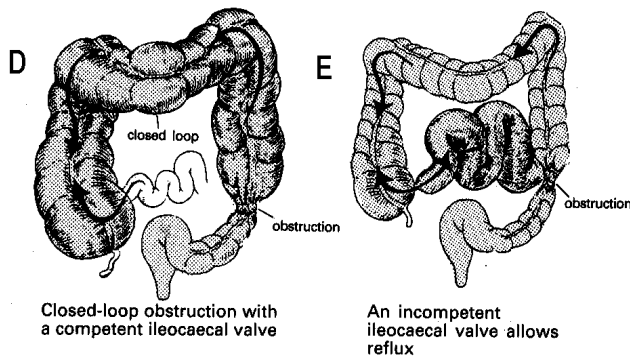


Fig. 12-1 INTESTINAL OBSTRUCTION.

A-C, small bowel obstruction. In A, the obstruction is high, there is frequent vomiting, no distension, and intermittent pain, which is not of the classical type. In B, the obstruction is in the middle of the small bowel. There is moderate vomiting, moderate distension, and intermittent pain of the classical, colicky, crescendo type with free intervals. In C, obstruction is low in the small bowel. Vomiting is late and faeculent, and distension is marked. Pain may or may not be classical. D-E, large bowel obstruction. In D, the ileocaecal valve is competent, and prevents distension spreading to the small bowel, so that there is a closed loop. In E, the valve is incompetent, so there is reflux into the small bowel which distends.

After Dunphy JE, Way LW. *Current Surgical Diagnosis and Treatment*. Lange 2nd ed 1975 Figs, 33-5, 34-5. with kind permission.

With peritonitis there is an urgency to deal with the source of peritoneal inflammation because of the danger of septicaemia and death; with intestinal obstruction where there is no peritonitis, the urgency is to correct fluid and electrolyte loss first. This allows reasonable time to make a diagnosis.

12.2 Causes of intestinal obstruction

Intestinal obstruction will be one of your major challenges. It is a common abdominal emergency, and in some communities the most common one. Some patients with simple obstruction resolve spontaneously, for example those with ascariasis (often) or tuberculous peritonitis (often) or non-specific adhesions (often if early, less often if late).

When you operate, you may only need to divide adhesions, or massage a ball of *ascaris* from a child's ileum on into the colon. But if you find that a segment of small bowel is gangrenous, you will have to resect it and consider joining the remaining ends. You cannot always safely do this in the presence of sepsis or soiling, especially with large bowel if it is loaded with loose faeces, because such an anastomosis may leak. So you may have to construct a stoma (11.6) or leave the bowel temporarily tied off if the patient is very sick indeed, and join up the bowel at a 2nd look laparotomy (10.1) at 48h when the condition has improved. Unfortunately, a patient with intestinal obstruction often presents late, when he may be severely dehydrated, hypovolaemic, oliguric, and shocked.

The causes of intestinal obstruction vary geographically. Find out the common causes in your area.

(a) Common causes

Incarcerated or irreducible external hernias (especially inguinal and femoral).

Volvulus of the sigmoid colon.

Ascariasis.

Intussusception.

Adhesions or bands

(following previous surgery, or abdominal sepsis).

Adhesions or fibrosis due to abdominal TB.

Simple constipation (including faecaloma).

(b) Uncommon causes

Volvulus of the small bowel.

Carcinoma of the large bowel.

Carcinomatosis of the peritoneum.

Amoebic granuloma or stenosis.

Intra-abdominal abscess (including retained swab).

Bilharzioma.

Mesenteric thrombosis.

Kaposi sarcoma of the small bowel.

Trichobezoar, phytobezoar (or other foreign body).

Intestinal paracoccidiomycosis.

(c) Rare causes

Primary tumours of the small bowel.
 Congenital bands, atresia and malrotation.
 Internal abdominal hernias.
 Lymphogranuloma.
 Abdominal ileal cocoon.
 Crohn's disease.
 Gallstone ileus.
 Diverticulitis.
 Radiation enteritis.
 Pseudo-obstruction (Ogilvie's syndrome).
 Rectal strictures.

WHAT IS THE PATTERN OF INTESTINAL OBSTRUCTION IN YOUR AREA?

12.3 The diagnosis of intestinal obstruction

There are several patterns of intestinal obstruction. They are determined by how the bowel is obstructed, and where it obstructs. Firstly, the obstruction can be simple or strangulated.

(a) Simple obstruction is caused by a mechanical blockage, without impairment of the blood supply of the bowel. It may resolve spontaneously. Operation is usually not urgent, and may be unnecessary. An obstructed bowel dilates above the obstruction, so that it may fill with several litres of fluid and gas. This makes the abdomen swell. Initially, the peristaltic activity of the dilating bowel increases to overcome the obstruction. This causes rushes of hyperperistaltic bowel sounds. Later, as fluid falls from one dilated loop to another, you may hear high-pitched tinkling bowel sounds before the abdomen becomes silent as ileus develops. Inadequate fluid intake combined with the loss of fluid into the lumen of the bowel and by repeated vomiting contribute to fluid depletion, so that dehydration, hypovolaemia, acidosis and shock follow. An adult secretes 7L of gastrointestinal juice in 24h; this fluid is lost in a so-called 'dead space' and so the degree of dehydration is soon serious.

(b) Strangulation obstruction occurs when there is a mechanical blockage and the blood supply to the bowel is impaired. Strangulated hernias and sigmoid volvulus are common causes. About 6h after interruption of its blood supply, the bowel becomes ischaemic and may perforate. If it perforates into the peritoneal cavity, there is spillage of intestinal content, by now heavily infected, resulting in generalized peritonitis which will end in septic shock. If it perforates into a hernial sac, the infection may be more localized. This condition is quickly critical. If you think that peritoneal irritation might be due to strangulation obstruction, operate soon!

Features of obstruction differ according to the levels at which it occurs:

(1) **Small bowel obstruction** is often quite dramatic. The higher the obstruction, the earlier and the worse the vomiting, and the greater the threat to life from electrolyte

imbalance, but the less the abdominal distension. Conversely, the lower the obstruction, the greater the distension, the greater the pain, and the later the vomiting.

(2) **Large bowel obstruction** follows a slower course. Because there is more bowel to dilate, there is more abdominal distension, which may be so severe as to interfere with breathing by pushing up the diaphragm. To begin with, only the colon dilates, but the ileocaecal valve usually becomes incompetent (in $\frac{2}{3}$ of patients), and allows the dilatation to progress proximally into the small bowel. The signs of dehydration are of slower onset, because the colon can still absorb fluid above the obstruction.

N.B. Simple constipation may occur in:

- (i) elderly sedentary people, especially if they are taking codeine-based drugs for pain, or many other types of drugs, especially anti-depressants
- (ii) shanty-town dwellers eating 'junk food'
- (iii) people who like to eat soil (pica), especially if pregnant or with iron-deficiency anaemia, or cassava or guava (especially with the stones) in large quantities, particularly with whole grasshoppers
- (iv) Chagas disease (trypanosomiasis)
- (v) Hirschsprung's disease. There may be 'spurious diarrhoea' where liquid faeces passes the impacted faeces: obviously giving antidiarrhoeals in this situation makes everything worse!
- (vi) Hypothyroidism.

(3) **'Closed-loop obstruction'** (*unusual*) is the result of the ileocaecal valve remaining competent. It is a double obstruction which shuts off a loop (12-1D). It can occur in volvulus especially with an ileosigmoid knot (12-14), and in neglected obstruction of the large bowel. Dilation of the closed loop quickly obstructs its blood supply and rapidly causes gangrene and peritonitis.

(4) **Pseudo-obstruction** (Ogilvie's syndrome), where the large bowel distends alarmingly, may occur after pelvic fractures (especially with retroperitoneal haemorrhage), burns, metabolic disturbances (especially hypokalaemia, uraemia, acidosis and hyperglycaemia), hypoxia, or with opiate or phenothiazine use; there is gas in the rectum unlike in true large bowel obstruction, and bowel sounds are high-pitched.

Common mistakes are:

- (i) Not spending enough time, both taking the history and sitting beside the patient watching, palpating, and listening to the abdomen.
- (ii) Not recognizing the possibility that obstructed bowel may strangulate, even when the signs of peritoneal irritation are minimal, for example in intussusception.
- (iii) Not making proper use of radiographs.
- (iv) Operating too early, before adequate rehydration.
- (v) Operating too late, after you have allowed the bowel to strangulate.
- (vi) Not emptying the stomach with a nasogastric tube.
- (vii) Doing a complicated operation when a simpler one would have been life-saving.

(viii) Using poor surgical technique: *open the abdomen with care, dissect dense adhesions gently, make anastomoses carefully, and don't soil the peritoneum with the contents of the obstructed bowel.*

(ix) Not washing out the peritoneal cavity when it is soiled.

(x) Not replacing blood, fluid and electrolytes lost.

(a) History

(1) **Pain** differs in large and small bowel obstruction.

If the pain is periumbilical and colicky, comes in spasms, builds up to a crescendo, and then tapers off, the small bowel is obstructed. Vomiting may relieve it temporarily. Sometimes there are regular pain-free periods at intervals of 2-5mins. This is the classical pain of small bowel obstruction. If peristalsis stops, colic stops, so its disappearance may be a bad sign.

If the pain is below the umbilicus and comes at intervals of 6-10mins, the large bowel is likely to be obstructed.

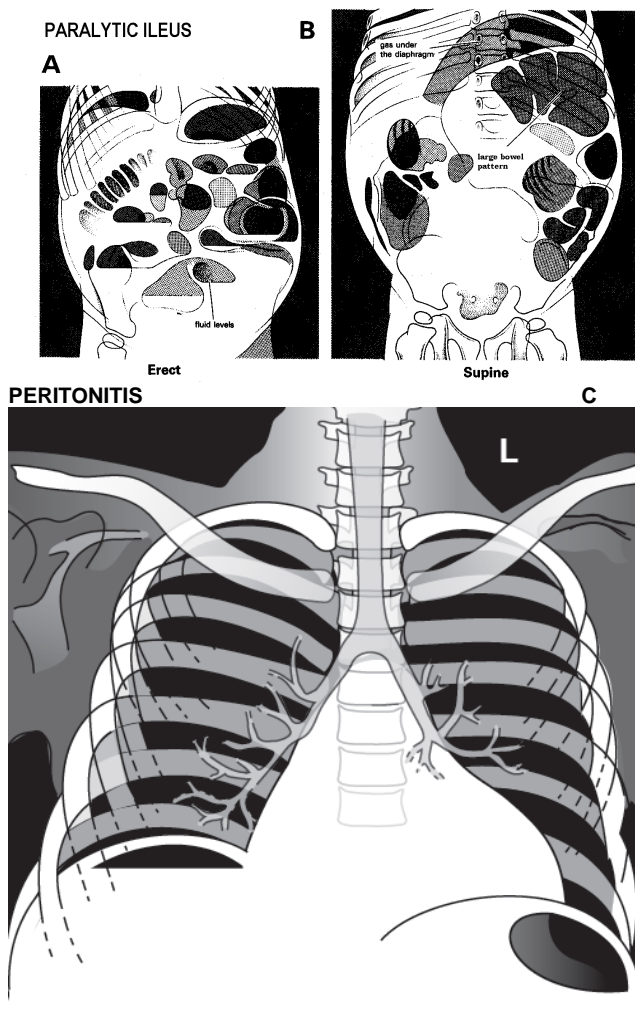


Fig. 12-2 PERITONITIS WITH DISTENDED BOWEL. A, erect abdominal film showing the multiple fluid levels of small bowel obstruction and gas under the diaphragm. B, supine film showing difference between small and large bowel shadows. C, erect chest film showing free air under the diaphragm (better seen than on an erect abdominal film).

If there is no pain, but only 'gurgling and bloating', the obstruction is incomplete in the large bowel or the distal small bowel.

SITA (8yrs) presented with vague abdominal tenderness and few other signs. She was not well, and the only striking sign was a pulse of 148/min. 12h were wasted while she was observed, before a laparotomy was done and 1m of gangrenous bowel was resected.

KRISHNA (45yrs) presented with abdominal distension, colicky pain, and vomiting. She was examined by a medical assistant who noted pain in her right lower quadrant and a 'lymph node' in her right groin, and diagnosed appendicitis. He rang up the doctor, who came in, made a cursory examination, and proceeded with an appendicectomy, using a 'gridiron' incision. Her appendix was normal. Later, she had to have an emergency operation for a strangulated femoral hernia.

LESSONS (1) Strangulation can be difficult to diagnose. Tachycardia is a useful sign. (2) "When acute abdominal pain presents, one maxim I enjoin, pray don't miss that tiny lump, in one or other groin." (*Zachary Cope*)

If the pain is severe and continuous, this suggests strangulation obstruction. There may be both continuous and colicky pain. For example, there may be continuous pain from a strangulated hernia at a hernial site, and colicky central abdominal pain. Nonetheless, if pain was colicky and is now constant and severe, this implies the bowel is in serious trouble.

If pain and fever preceded the symptoms of obstruction, suspect that it may be secondary to abdominal sepsis.

(2) **Vomiting.** The higher the obstruction, the worse this is. If it is high in the small bowel, vomiting is profuse and frequent; if it is low in the large bowel, there may be no vomiting at all. Initially the vomit is yellowish, then becomes green, and after about 3 days of complete obstruction, it becomes faeculent. If paralytic ileus develops, it becomes 'effortless'.

CAUTION! Look at the vomit (you may need to pass a nasogastric tube to be sure): if it is faeculent, the large bowel or lower small bowel are chronically completely obstructed. This means you need to intervene. Vomiting never becomes faeculent if only the upper small bowel is obstructed.

(3) **Abdominal fullness.** The more distal the obstruction, the more the distension. If large bowel obstruction has come on slowly, the complaint may simply be that the 'clothes fit tightly' or that there is much gas.

(4) **Constipation.** If the small bowel is obstructed, the colon may take a day or two to empty, after which 'nothing comes out'. The absence of flatus confirms the diagnosis, but is a late symptom. Constipation may be a major concern in a culture where regular bowel movements occur 2-3 times a day. Pain may be tolerable, but the absence of a decent bowel movement may not. *Beware questions about constipation:* make sure you get answers about the frequency or absence of bowel motions.

(5) **Previous operations or peritoneal sepsis.** Adhesions and bands can follow any operation or septic process in the abdomen. (The scars may be difficult to see, especially in an obese person or after laparoscopic surgery!) In a woman, enquire especially about a past history of PID (23.1).

(b) Examination

(1) **Distension and hyper-resonance.** If there is colic and vomiting, the bowel is obstructed until you have proved otherwise. Distension is not an essential part of the clinical picture. The earliest signs of it are a little fullness in the flanks, or an increased resonance to percussion.

If the percussion note over the abdomen is 'tympanitic', there are distended gas-filled loops of bowel.

If distension is conspicuous and other signs are minimal, suspect large bowel obstruction. If it is extreme, suspect sigmoid volvulus, or Hirschsprung's disease.

If you are not sure if the distension is caused by bowel obstruction or ascites, examine for shifting dullness. Remember that fluid and gas in a distended bowel can cause shifting dullness, but that it is less obvious than with ascites.

If you are not sure if true distension is present or not, particularly in the obese, measure the girth at some fixed place, and see if it increases. Also see if the trousers or skirt fit comfortably.

(2) **Obstructive bowel sounds.** Listen for these at the time pain appears, while you are taking the history. This is essential if you are going to pick up the critical sign of intestinal obstruction during the 30sec during which peristaltic waves make a ladder pattern on the abdominal wall, accompanied by a rush of high-pitched tinkles and splashes. If you miss this opportunity, it may not return for 15mins. So, if the patient loses interest in the conversation, and grimaces with pain, listen quickly. If you hear runs of *borborygmi* (audible rumblings), or a chorus of tinkling high-pitched musical sounds *at the same time that he grimaces with colic*, there is almost certainly obstruction present. *These are very useful early signs.*

N.B. Don't mistake them for the peristaltic rushes of gastroenteritis, or normal hyperactive bowel sounds.

(3) **Visible peristalsis.** In a thin patient, look for waves of peristalsis passing across the abdomen. If he is very thin, this may be normal, especially in a young child.

(4) **A tender mass at one of the hernial orifices.** If you find a painful tender mass, this is an incarcerated or strangulated hernia, until proved otherwise.

Always examine the inguinal and femoral orifices.

CAUTION!

(i) You can easily miss a strangulated femoral or umbilical hernia, especially under an apron of fat in an obese person: it may not be tender or painful.

(ii) Rarely, a hernia may have been reduced 'en masse' (18.3) by the patient or medical personnel!

N.B. ABDOMINAL TENDERNESS is not a prominent feature of uncomplicated obstruction. Obvious tenderness over part of the abdomen suggests bowel ischaemia. If there is peritonitis, this means the bowel is definitely necrotic.

(5) **An old laparotomy scar** (*even if very small or even invisible from laparoscopy*) suggests that the cause of an obstruction may well be a band, an adhesion, or an area of stenosis, but *this may not necessarily be the case.*

(6) **A palpable abdominal mass** is unusual, apart from a mass at a hernial orifice. Feel carefully, here are some of the masses you might find:

If, in a child, you feel an ill-defined mobile mass (or masses), usually in the umbilical region, sometimes in the iliac fossae, it is probably a mass of *ascaris* worms.

If there is a large, slightly tender, mobile sausage-shaped mass, some of the bowel may be caught in an intussusception. If the mass is rounder, it may be bowel infarcted due to torsion.

If the mass changes its position from one day to another, and is accompanied by colicky pain, this is probably recurrent intussusception, a mass of *ascaris* worms (12.5), or constipation.

If you feel an ill-defined lump or lumps in the right lower quadrant, this may be ileocaecal tuberculosis or carcinoma. You may also feel more central lumps caused by caseating tuberculous lymph nodes.

If there is a tender indurated mass, suspect that the obstruction is due to intraperitoneal sepsis (10.1), lymphoma or tuberculosis.

If you feel hard impacted compressible masses in the colon and rectally, they are masses of faeces, and may be causing the obstruction (not uncommon in the old and debilitated).

If there are one or more masses especially at the umbilicus and also ascites and cachexia, this is probably disseminated carcinoma.

(7) **Rectal examination** *must never be forgotten!*

If you find fresh blood and mucus on your finger, or on the toilet paper, there is probably an intussusception, a strangulating lesion higher up, or carcinoma of the large bowel. Occasionally, you may feel the tip of the intussusception or see it appear out of the anus. *Don't confuse this with rectal prolapse* (26.8).

If you feel a hard mass of faeces, suspect that constipation may be causing the obstruction. Ask about dietary habits, and causes listed above.

If the rectum is empty and even 'ballooned', you may be dealing with a pseudo-obstruction.

If you feel a tense, tender, possibly fluctuant mass bulging into the pouch of Douglas, it is probably a pelvic abscess. You may feel it more easily bimanually, with your other hand exerting pressure suprapubically (10.3).

If you find a hard mass in the recto-vesical pouch (a 'rectal shelf'), it is probably malignant. Tumour deposits here may be well-defined hard lumps, or a 'shelf' caused by tumour growing into the surrounding tissue.

(c) Has the bowel strangulated?

You may not be certain about this until you perform a laparotomy. Strangulation is easy to diagnose when it is advanced, unless it is so advanced that there is septic shock. Try to diagnose it early.

Individually, the features below are not diagnostic, but the bowel has probably strangulated if several of the following features are present:

- (1) Sudden onset of symptoms.
- (2) Severe continuous pain: this is the result of bowel ischaemia or irritation of the parietal peritoneum. If there is minimal discomfort and absence of pain between waves of hyperperistalsis, the bowel is probably not strangulated, but only obstructed (unless it is sealed off in a hernial sac or is an intussusception).
- (3) A fast pulse: this is perhaps the most reliable sign; if the pulse is $<88/\text{min}$, there is unlikely to be strangulated bowel present.
- (4) Fever: this suggests strangulation, or sepsis. *Simple obstruction does not cause fever!*
- (5) A low or falling blood pressure.
- (6) Localized tenderness, or rebound tenderness; this is a sign of peritoneal irritation, and can be caused by inflammation, blood in the peritoneal cavity, or strangulation. Tenderness may be masked by loops of normal bowel over the strangulated area, so its absence is not significant.
- (7) The passage of blood or blood and mucus rectally: this is typical of intussusception, but you may see it whenever the blood supply of the bowel is impaired.
- (8) Signs of generalized peritonitis (tenderness, guarding, and absent bowel sounds), prostration, and shock.

(d) Abdominal radiographs in intestinal obstruction

Take films in the erect and supine positions. They can usually give you the diagnosis, its site and chronicity, and sometimes its cause, for example, intussusception (12.7).

While the patient is lying down, take a supine AP film. If he is not well enough to sit up by himself, support him in the sitting position while you take an erect film. This will be more useful than the alternative, which is a lateral

decubitus film, taken from the side while he is lying down. Its purpose is to show fluid levels, and maybe gas under the diaphragm.

When you examine the films, first see if there is a distended large bowel shadow, and especially a caecal shadow. If there is, the large bowel is obstructed.

To distinguish large and small bowel shadows, remember that:

- (1) Fine folds or partitions (*valvulae conniventes*) extend right across a distended jejunum which is more central in the abdomen.
- (2) The ileum has no folds distally, and few proximally.
- (3) The caecum is a rounded mass of gas.
- (4) The *haustral* markings of obstructed large bowel are rounded and much further apart than the *valvulae conniventes* of the jejunum, and don't cross its full diameter.
- (5) The large bowel is more peripheral in the abdomen, whereas the small bowel is more central.

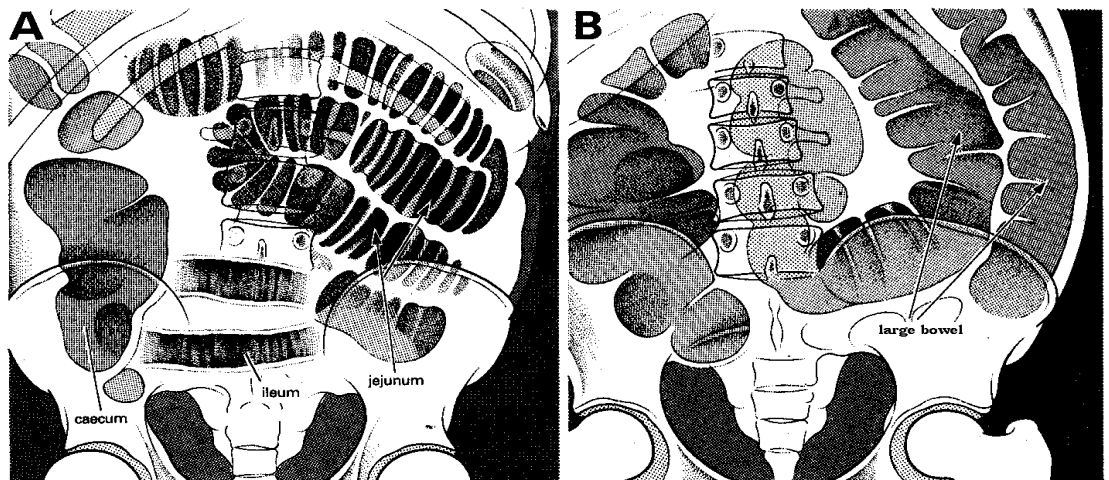
N.B. Free gas in the peritoneum is usually a reliable sign of perforation. You will see it better under the diaphragm in an erect chest film, and under the abdominal wall in a lateral supine film. (Free gas may occur from gas-forming organisms in the peritoneal cavity.) On an abdominal film, look for air *both outside and inside* the bowel wall, and air outlining the lateral wall of the liver.

N.B. Gas in the small bowel is always abnormal, except:

- (1) in the duodenal cap,
- (2) in the terminal ileum (rare),
- (3) in children $<2\text{yrs}$.

CAUTION! Never administer barium contrast media by mouth in intestinal obstruction.

INTESTINAL OBSTRUCTION



Both these are supine films

Fig. 12-3 INTESTINAL OBSTRUCTION.

Patient A has distended loops of small bowel. Note the different patterns of the jejunum and ileum: the jejunum has 'valvulae conniventes' (transverse bands across it), whereas the ileum is more featureless. The caecum and ascending colon are distended, but there are no signs of the transverse colon or rectum. (A barium enema showed a carcinoma just beyond the splenic flexure.)

Patient B's large bowel is distended down to the sigmoid colon, but there is no rectal bubble. This is typical of distal large bowel obstruction; there was a carcinoma of the sigmoid colon. These are supine films, so there are no fluid levels, but the *valvulae* and *haustra* show up well.

(1) **Fluid levels in the small bowel** are always abnormal except where there is no distension. Elsewhere, fluid levels in the small bowel indicate:

- (i) mechanical obstruction,
- (ii) paralytic ileus, or
- (iii) gastroenteritis.

Look for them in erect films. The larger and more numerous they are, the lower and the more advanced the obstruction.

(2) **Gas in the large bowel** is normal, but not if the bowel shadow is hugely distended.

If there are fluid levels in the large bowel, they may be:

- (i) normal (if there are only a few), or
- (ii) caused by gastroenteritis.

If the large bowel is also distended, there is:

- (i) a mechanical obstruction,
- (ii) paralytic ileus, or
- (iii) some other cause for the dilatation, such as amoebic colitis.

If there are distended loops of large and small bowel irregularly distributed with gas in the rectum, suspect paralytic ileus.

If there is no gas in the caecum (which normally contains some gas), suspect that the small bowel is completely obstructed.

If there are distended loops in the small bowel and minimal air in the colon, suspect partial small bowel obstruction.

If there is gaseous distension of the large bowel with minimal small bowel distension, suspect large bowel obstruction or the Ogilvie syndrome.

If there is much gas in the caecum (which may be huge), the large bowel is obstructed. As the pressure builds up, the small bowel often starts to distend, because the ileocaecal valve is incompetent (in $\frac{2}{3}$ of patients).

If you see a mottled opacity in the right lower abdomen, suspect a bezoar (13.12).

If you see a really massive gas bubble, the stomach may be dilated, or there may be volvulus of the sigmoid colon (12.9) or of the caecum and ascending colon (12.12).

If there is gas in the rectum and rectal examination is normal clinically, obstruction is unlikely; but if the large bowel is hugely distended, this suggests pseudo-obstruction.

If the large bowel is relatively empty, and the fluid levels in the erect film pass obliquely upwards from the right iliac fossa to the left hypochondrium, like a stepladder, they suggest volvulus of the small bowel.

If signs are uncertain, take more films a few hours later.

(e) Other investigations

A high Hb or haematocrit is some indication of the severity of dehydration. Urea and electrolyte measurements are very helpful. Expect a potassium deficit.

Ultrasound is usually unhelpful, but if there is a mass, it can show if this is solid, or contains worms, or gives the classic double ring appearance of intussusceptions.

(f) Difficulties in diagnosing intestinal obstruction

If there is excruciating abdominal pain, massive abdominal distension, and circulatory collapse, the possibilities include:

- (1) Volvulus of the sigmoid with gangrene.
- (2) Ileosigmoid knot (12-14).
- (3) Volvulus of the small bowel or caecum.
- (4) Perforation of a peptic ulcer presenting late.
- (5) Generalized peritonitis leading to ileus.
- (6) Typhoid fever with perforation.
- (7) Acute pancreatitis.

You may not be able to diagnose which of these there is until you operate. Rapid resuscitation and urgent surgery is necessary, but try to exclude pancreatitis first.

If there are obvious abdominal signs, but the patient looks comparatively well (and he has not been vomiting), suspect large bowel or incomplete small bowel obstruction.

If there are the other signs of obstruction, but loose stools are passed with or without flatus, there may be:

- (1) An incomplete large bowel obstruction.
- (2) A pelvic abscess.
- (3) A Richter's hernia (18.1).

If there is a history of several days of fever, anorexia and localized abdominal pain, followed by colicky pain and the other symptoms of obstruction, suspect that obstruction has followed intraperitoneal sepsis. Distension may mask the abdominal findings, but you may be able to elicit deep tenderness and induration in the right lower quadrant, suprapubically, rectally, or, in a woman, vaginally.

If the abdomen is distended and associated with vomiting but no typical colicky pain of obstruction, suspect ileus rather than obstruction, especially if there is toxæmia and dehydration. Obstruction appears spontaneously, whereas paralytic ileus usually follows some good reason for it, such as local or general peritonitis, a previous operation, or an intraperitoneal injury or haemorrhage.

If signs of obstruction develop after surgery, you will find it difficult to know if the obstruction is mechanical or due to the paralysis caused by ileus (12.16).

12.4 The management of intestinal obstruction

Operation is mandatory for ischaemic bowel; simple mechanical obstruction may resolve without operation, but if it fails to improve after 48h, operate. The detailed indications for operating are listed below. Operate at the optimum moment after you have rehydrated a patient, but *don't operate if the condition is hopeless.*

Rehydrate rapidly over a few hours. If you rehydrate energetically, you should be able to operate within 4h, and certainly within 6h. If you suspect strangulation obstruction, try to operate within 2h, and rehydrate as best you can before doing so. If the patient is conscious with a normal blood pressure and is passing urine, he is probably fit for operation.

At the same time pass a nasogastric tube and drain the fluid and gas from the dilated stomach and upper small bowel. This will stop vomiting, and may reduce the distension. Most importantly, it will reduce the danger of aspiration of stomach contents during induction of anaesthesia.

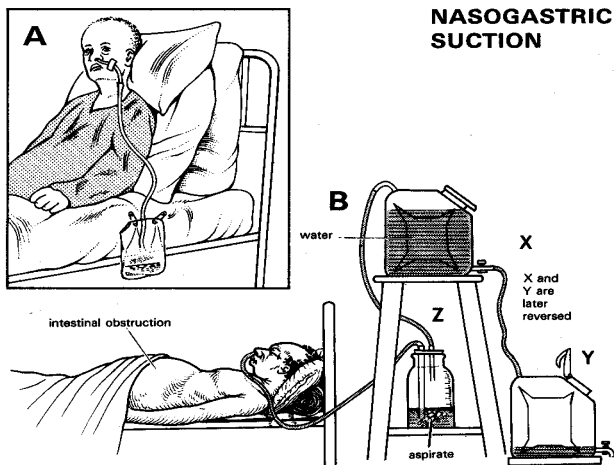


Fig. 12-4 NASOGASTRIC SUCTION.

A, pass a large (Ch16) nasogastric tube and aspirate it with a 20 or 50ml syringe $\frac{1}{2}$ hrly. Meanwhile, let it syphon freely into a drip bag beside the bed. Cut off the corner of the drip bag to let the air out. B, if you don't have an electric sucker, you may find this apparatus useful. X,Y are 2 jerry cans with pipes and taps soldered in. Water flows from X to Y, creating a negative pressure in X. When X is empty, reverse X and Y. Z collects the fluid and measures the flow.

After Les Agrégés du Pharo, Techniques Élémentaires pour Médecins Isolés. Diffusion Maloine, 1981 Fig. 168 with kind permission.

When you have resuscitated a patient, he may improve so much that you may wonder if he really needs a laparotomy. If so, try clamping the nasogastric tube to see if the signs and symptoms recur.

N.B. Small bowel obstruction de novo without previous recent surgery will usually recur because the underlying pathology has not been relieved.

Your primary task is to save life, so perform an operation which will achieve this. In desperate cases, removing the underlying cause is a secondary consideration, and that may have to wait until later. Sometimes, you can remove the cause quite easily: for example, you may be able to cut some easier adhesions.

Don't embark on complicated operations which need much dissection unless you are experienced and have good

back-up. Even then, always remember that a long operation in an acutely ill patient is not a good idea.

Open the abdomen with the greatest possible care: you can so easily perforate the bowel and flood the abdomen with small bowel fluid. Distended loops of bowel will bulge through the incision. Deliver them on to the surface, and *don't try to examine the depths of the abdomen until you have done so:* they will continually obscure your field.

Because distended loops of bowel are so difficult to work with, decompress them. Doing so makes distended bowel much easier to handle, makes the abdomen easier to close, reduces the risk of anastomotic leak if you have to resect bowel, and reduces the risk of post-operative vomiting and aspiration. The danger of decompression is that it inevitably contaminates the peritoneum a little, unless you use the retrograde method (via a nasogastric tube). But carefully opening distended bowel outside the abdomen, hanging over its edge, with the proper precautions causes much less contamination than an uncontrolled burst, which is the probable alternative. So, if bowel is greatly distended, decompress it.

IF THE PATIENT IS MORIBUND, RESUSCITATE AGGRESSIVELY FIRST, TO GET A URINE OUTPUT

(a) Pre-operative preparation

(1) **Nasogastric suction.** Pass a nasogastric tube of a suitable size, and aspirate it regularly (4.9). Make sure it reaches the stomach, and be sure it is draining properly. If you are not sure of its position, blow a little air down the tube and listen over the stomach, or use litmus paper to test for aspirated gastric acid content. If you are still unsure, get an abdominal radiograph. Aspirate actively to remove air and fluid before operating. Syphon the fluid into a bag hanging below the bed, and aspirate every 15-30mins with a syringe or suction machine. Empty the stomach thoroughly.

(2) Resuscitation

This is critical. If there is severe dehydration, and you fail to resuscitate, death is almost inevitable. If the obstruction has lasted >24h, dehydration is certain, especially if vomiting has been profuse.

Start a fluid balance chart, and rehydration. A 60kg adult will require 4-8L to correct moderate to severe dehydration; you can calculate a total loss of 3L per day of total obstruction and assume the correctable deficit is half of this. Infuse the first half of this correctable deficit as Ringer's lactate or saline and the second half alternating with 5% dextrose. Fluid replacement is more important than potassium replacement. In late cases add 20mmol of K^+ to each litre of fluid after the 1st litre. (Or you can use half-strength Darrow's solution, which has $[K^+]$ of 17mM, instead of 5% dextrose.)

Set up a central venous infusion for critically ill dehydrated patients, if you can do so.

If the patient is thirsty, and the lips and tongue are dry, dehydration is mild: use at least 4L of fluid.

If there are also sunken eyes and loss of skin elasticity, dehydration is moderate: use about 6L.

If there are also oliguria, anuria, hypotension, and clammy extremities, dehydration is severe: use about 8L.

If there is also weakness and disorientation, fluid loss is probably >8L. *Don't be afraid to infuse up to 4L for the first hour.* Set up a CVP line, if you can.

In the elderly or those with cardiac problems, check the lung bases for crepitations, and the jugular venous pressure or the CVP. IV fluid replacement *and* diuretics may be necessary.

If the bowel strangulates, its veins block before its arteries, so that blood is lost into the lumen, so transfuse 1 unit of blood per 50cm of strangulated bowel.

If you have corrected the hypovolaemia as shown by an adequate urine output, or a normal CVP, but there is still hypotension, this is probably due to septic shock.

(3) **Urethral catheterization.** This is necessary for a very ill patient to measure the urine volume hourly. If the patient is not very ill, its risks may outweigh its advantages. If an adult passes 35-60ml/hr, the kidneys are being adequately perfused, and the blood volume is becoming normal. For a man, use of Paul's tubing is often better. *Don't insert a catheter if no one will record the urine output!* However, if there is large bowel obstruction and you plan to operate in the pelvis, it is important that the bladder remain empty to give you more room to operate.

(4) **Antibiotics.** Use perioperative antibiotics (2.9): chloramphenicol 50mg/kg IV qds or gentamicin 3mg/kg IV od *plus* metronidazole 7.5mg/kg tds.

(b) Non-operative treatment of intestinal obstruction

INDICATIONS

- (1) A mass of *ascaris* worms (12.5).
- (2) Plastic tuberculous peritonitis (16.3).
- (3) A localized inflammatory mass, such as an appendix mass, a pyosalpinx, or PID.
- (4) A pelvic abscess which can be drained rectally or vaginally (10.3).
- (5) Some patients with adhesions (12.6) and incomplete obstruction.
- (6) Typhoid fever causing partial mechanical obstruction or ileus (not uncommon).
- (7) Constipation or ingestion of foreign material.
- (8) Crohn's disease.
- (9) *Oesophagostomiasis* ('Dapaong tumour', 'kounkoul').
- (10) Pseudo-obstruction.

N.B. Always operate if there is even a suspicion of strangulation obstruction.

METHOD. Continue nasogastric suction and IV infusions. Make careful observations. If you continue to restrict fluids orally for more than a few days, try to add at least 8.5MJ

(about 2,000kcal) of energy to the daily intake. If possible, administer this as 50% dextrose into a central vein. When the nasogastric aspirate has reduced, instil 15-30ml gastrografin, if you can, and see if this promotes a bowel action.

If you suspect simple constipation, instil a phosphate or soap-and-water enema. If the faeces are rock hard and fail to move, remove them manually under GA. A 'Murphy skid' (normally used to dislocate the hip) is a useful instrument to help you do this. Advise a short course of laxatives and a high-fibre diet: an instruction sheet is useful to give to patients. Chopped rice husks are ideal. *Don't use liquid paraffin:* aspiration causes severe pneumonitis, and if used with illicit drug 'body packers' it can cause the packets to dissolve and the opiate carried to be rapidly absorbed.

If you suspect *oesophagostomiasis* (especially in Northern Ghana and Togo), use albendazole 10mg/kg od for 5 days. Signs of improvement are:

- (1) Reduction in the gastric aspirate to <500ml/day.
- (2) Reduction in abdominal distension.
- (3) Return of bowel sounds to normal.
- (4) Less pain. No tenderness.
- (5) Finally, flatus and the passage of stools.

DECOMPRESSION OF LARGE BOWEL OBSTRUCTION (12.9)

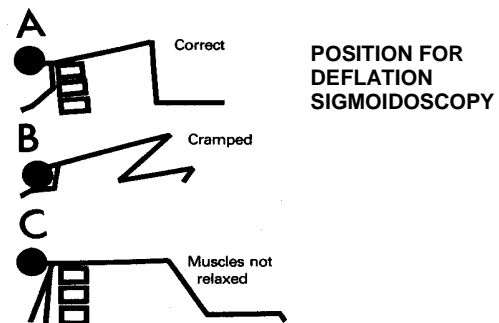


Fig. 12-5 THE KNEE-ELBOW POSITION FOR SIGMOIDOSCOPY FOR SIGMOID VOLVULUS.

A, correct position. B,C, two incorrect positions. *Don't anaesthetize the patient.* After Shepherd JJ. *Management of Sigmoid Volvulus. Tropical Doctor* 1971;1(4):174-6 with kind permission.

INDICATIONS

- (1) Sigmoid volvulus without peritonitis.
- (2) Pseudo-obstruction.

METHOD: DEFLATION BY SIGMOIDOSCOPY (GRADE 1.2)

Place the patient preferentially into the knee-elbow position (12-5). This is not very socially acceptable, and some elderly patients may not tolerate it, but you are more likely to be successful than with the left lateral position because the weight of fluid in the loop will pull the apex of the sigmoid out straight. Pass the sigmoidoscope (26.1).

If you don't have a sigmoidoscope, or its light does not work, you may succeed in deflating the colon with a soft rubber tube while in this position. The sigmoidoscope usually travels 20-25cm before it reaches the point where

the colon is twisted, but you may not be able to reach this point. If you do, look at the mucosa carefully. If it looks normal through the sigmoidoscope, hold the 'scope firmly, and pass a large (Ch36 or 12mm) well-lubricated soft rubber tube through it. With a gentle rotatory movement, ease the tube past the twist into the high-pressure area of the dilated sigmoid. *Don't use force or you may perforate the bowel!*

If you succeed in deflation, you will be rewarded by much flatus and some loose faeces. Both you and the patient will recognize that you have relieved the obstruction. Withdraw the sigmoidoscope, taking care *not to pull out the flatus tube when you remove the sigmoidoscope!* Using LA, suture the flatus tube to the anal margin, and leave it in place for 2 days. It may continue to discharge liquid faeces, so attach an extension tube to it, and lead this into a bucket beside the bed. If drainage stops, wash out the tube. *Don't leave the tube in for more than 72h*, or it may cause pressure necrosis.

CAUTION!

(1) *Don't anaesthetize the patient or use a heavy sedative.* Pain during or after sigmoidoscopy is a useful indication of trauma or gangrene.

(2) If the sigmoid is gangrenous, *trying to deflate it is dangerous*; you may perforate it.

(3) *Don't pass a sigmoidoscope using force or without seeing where you are going*: you may push it through the colon.

(4) Wear an apron and theatre boots, because a huge quantity of flatus and fluid may rush out. *Extinguish any cigarettes in the vicinity and stand well back!*

If you fail to pass the sigmoidoscope far enough, consider whether there might be a carcinoma. Try the knee-elbow position if you have been using the left lateral position.

If you see any discoloration through the sigmoidoscope, or any blood-stained fluid, or the patient cannot tolerate the procedure, suspect strangulation and prepare for an immediate laparotomy.

If the fluid which runs out is bloody, assume that the sigmoid has an area which is non-viable. Prepare for an immediate laparotomy. (*A smear of blood is not a sufficient indication.*)

METHOD: USE OF NEOSTIGMINE

This is *only* indicated for pseudo-obstruction, so perform a sigmoidoscopy as above to exclude volvulus or other causes of large bowel obstruction. The sigmoidoscopy may help to deflate the colon partially. Administer 2mg neostigmine IV slowly. Monitor the patient carefully. The bowel will usually deflate immediately. Repeat neostigmine after 1hr if the effect is only partially successful.

CAUTION! *Don't use neostigmine in asthmatics, epileptics, pregnancy or breastfeeding mothers, or if the blood pressure is low.* Have atropine 0.6mg IV ready as an antidote if bradycardia results.

N.B. Fashioning an ileostomy or colostomy is not helpful.

(c) Operative treatment for intestinal obstruction (GRADE 3.4)

(1) Incision

A midline incision, $\frac{1}{3}$ above the umbilicus and $\frac{2}{3}$ below it, is usually best. Start with a 10cm incision and enlarge it up or down as necessary. You will probably find that the posterior rectus sheath and the peritoneum will appear as 2 distinct layers, now that the abdominal wall is distended. Have moist packs (laparotomy pads) ready. Put them into warm water and then wring out most of the fluid. Use them to cover any bowel that bulges out of the wound, and to wall off any fluid that spills.

If there is an old scar, open the abdomen at one end of it to avoid a loop of bowel which may be adherent (11.2). This is safer than making a parallel incision, which may lead to necrosis of the abdominal wall between the 2 incisions.

If there is a strangulated external hernia, make the appropriate incision (18.6,8).

CAUTION!

Open the abdomen with the greatest care (11-2). Use your fingers! Distended loops of bowel will be pressing up against the internal abdominal wall, and the smallest nick of a scalpel will go straight into the bowel. You can so easily cut the thin wall of the distended colon and cause a fatal peritonitis.

Note which parts of the bowel are distended; you will need to know this later, to decide where the obstruction is.

(2) Handling the bowel

If it is very distended, decompress it before you do anything else, especially if there are multiple dense adhesions which prevent you lifting out the bowel from the abdominal cavity. If it is less distended, use a moist swab to lift the dilated loops from below gently out on to the surface of the abdomen.

Never pull on the bowel: it will tear! Handle bowel with the greatest care. If you handle it roughly, you will prolong the period of post-operative ileus. Be especially careful of the caecum. It is often greatly thinned, and if it does burst, soiling will be particularly dangerous.

Don't let loops of the bowel get dry: cover them with moist packs. If they are heavily laden with fluid, ask your assistant to support them.

If you make a very superficial cut only into the seromuscular wall of a loop of bowel, leave it alone. Close a deeper injury (you will notice the mucosa pouting out) with a purse-string suture or by sewing it up transversely in two layers, while trying to keep spills to a minimum.

If you soil the abdomen with faeces, suck them out immediately. Irrigate the peritoneal cavity thoroughly with liberal amounts of warm fluid.

(3) Decompression for intestinal obstruction

Be safe, and decompress the bowel if there is any risk of rupturing it:

- (i) if it gets in your way unduly,
- (ii) if dense adhesions prevent you lifting it out of the abdomen, or
- (iii) if it prevents you closing the abdomen.

If you have to open the bowel, pack off the remaining abdomen with moist swabs in order to limit contamination with bowel content.

Make sure your suction is connected and working well.

There are 5 ways to decompress the bowel:

(i) **RETROGRADE DECOMPRESSION** is the method of choice, provided the bowel is not too oedematous and friable. It is useful for the entire small bowel. Start at the jejuno-ileal junction, and milk the contents proximally between your straight index and middle fingers into the stomach. Palpate this from time to time if it gets full, in order to dislodge trapped air and thick fluid blocking the nasogastric suction tube. You may need some firm pressure on the proximal jejunum. When you have emptied enough fluid out of the jejunum, massage the fluid from the ileum into it and repeat the process. As you decompress, ask the anaesthetist to keep aspirating fluid from the stomach.

This is usually the best method, but make sure that suction through a *large bore* nasogastric tube is working properly, or the fluid may spill and your patient may aspirate it! It may prove difficult or impossible if the bowel content is very thick, as in distal small bowel obstruction or large bowel obstruction. *Don't use this method in children where the anaesthetist has put in an uncuffed endotracheal tube.*

(ii) **NEEDLE PUNCTURE**. Use a specially prepared spinal needle. This will remove gas, but is soon blocked by food particles when you try to remove liquid. A spinal needle, connected to a rubber tube, is especially useful for the sigmoid colon and the caecum, which are often distended only with gas. Its advantage is that there is no need to insert a purse string after removing the needle. Pack off the colon well. Push the needle through a *taenia coli*, and advance it longitudinally between the muscle coats for 3cm. Then angle it inwards through the circular muscle to reach the lumen. Keep its point in the gas and clear of the fluid. If it blocks, pinch the rubber tube connected to the needle, then pinch it again distally. This should provide enough pressure in the needle to free it. If you insert the needle obliquely, there is no need to close the hole, which should not leak.

(iii) **POOLE'S SUCTION**. Select a site in the bowel, and empty it of its content by manual massage externally, and then place two non-crushing bowel clamps on either side of the emptied portion. Insert a purse-string suture on the antimesenteric border, and make an incision in its centre into the lumen of the bowel, and push the Poole's sucker through. Release the proximal clamp.

The Poole's sucker has a guard with several holes. It blocks less easily than a needle, but the risks of a spill are greater. It always blocks eventually.

Removing it, unblocking it, and reinserting it may be necessary, but is likely to cause a spill. (A Yankauer sucker does not have a trocar, so it is difficult to use without spilling.)

CAUTION! After you have inserted a sucker, *don't remove it unless you have to*. If you have to remove it to clear it, pack off the peritoneal cavity to avoid spillage, and discard any contaminated packs.

Alternatively, you can use a large Foley catheter; insert it (with extra side holes cut close to the balloon) connected to the sucker. Suck the bowel empty. Then blow up the balloon and 'milk' it along the bowel, sucking as you go. If it blocks, inject some saline and start again. Withdraw it, sucking as you go, then close the purse string.

(iv) **USE OF THE SAVAGE DECOMPRESSOR**. Insert a purse-string suture on the antimesenteric border of the bowel as before, make an enterotomy incision in the centre of this, and push the decompressor with its trocar through. Withdraw the trocar and close the proximal opening of the decompressor with its threaded cap. With your thumb on the vent to control the degree of suction, start sucking out gas and fluid. *Make sure that intestinal fluid, which may come gushing out of the suction vent, pours into a bowl outside the abdomen!* Pass the decompressor proximally and distally, carefully threading the distended loops of bowel over it as you suck. To minimize clogging the holes, remove your finger from the vent from time to time. This will reduce the suction and let the food particles fall away. Or, more effectively, reintroduce the trocar. When you have decompressed enough bowel (there is no need to decompress it all), remove the decompressor, close the purse string, and put it in the 'dirty basin'. Reinforce the purse string with a second layer of sutures, 3 mm beyond the first, going through the seromuscular layer only.

(v) **FORMAL DRAINAGE**. Mobilize a suitable segment of bowel and make sure it can hang outside the abdomen; pack off the peritoneal cavity and other organs with swabs, and hold the bowel with Babcock forceps. Preferably place two non-crushing bowel clamps across the bowel and make a 1cm enterotomy on the antimesenteric surface between them. Release one clamp in turn and allow the bowel content to drain into large bowls held carefully to catch the fluid, as you massage the fluid from each end towards the hole you have made. Then close the hole in 2 layers (14.3).

This is the best method if you have to resect bowel anyway: drain the bowel contents from the open ends of bowel before anastomosis (11.3).

Measure the fluid you have aspirated to see how much has been lost. Record this in the notes.

DECOMPRESSING OBSTRUCTED BOWEL

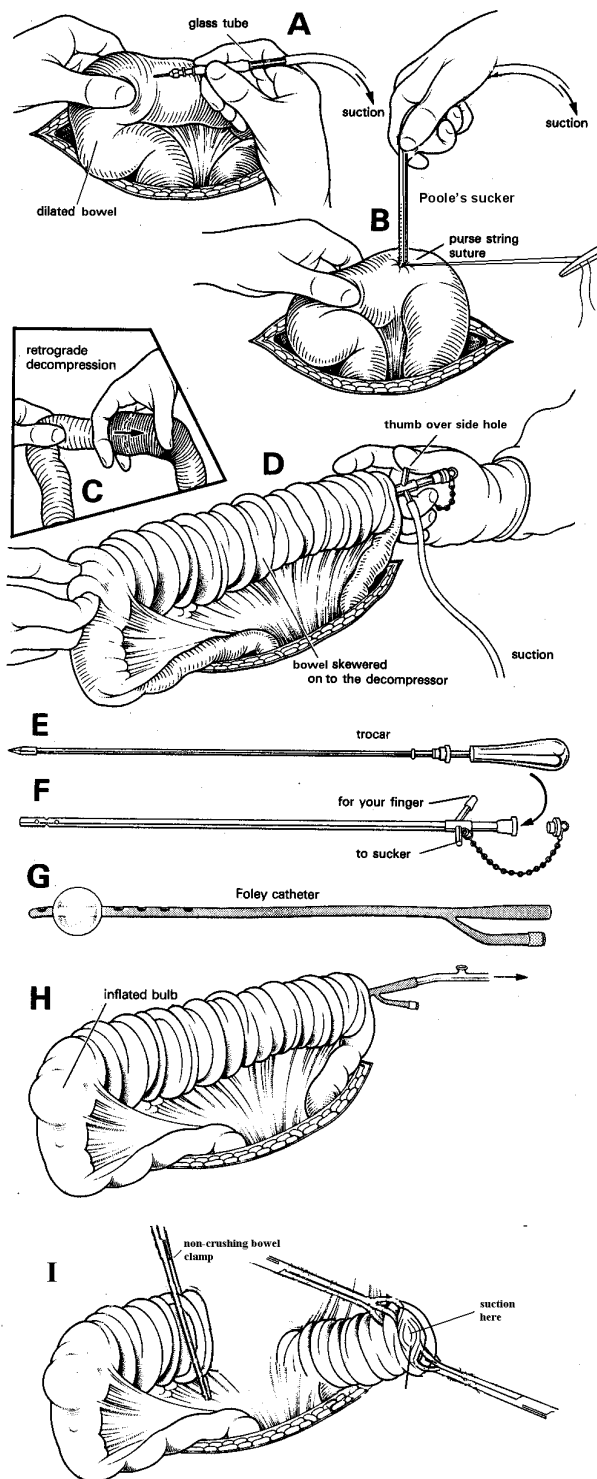


Fig. 12-6 DECOMPRESSING DILATED OBSTRUCTED BOWEL.
 A, using a needle. Note the glass tube, so that you can see what you are sucking. (This will only work well if the bowel is distended with air, not faecal matter.) B, using a Poole's sucker held in with a purse-string suture: *N.B.* You must hold the bowel away from the laparotomy wound to avoid dangerous spillage. C, by retrograde massage between your index and middle finger. D-F, Savage's decompressor. G,H, using a Foley catheter: blow up its bulb after introducing it, then milk the bulb along the bowel. I, decompressing the open bowel, using Babcock forceps to hold it open over the edges of the laparotomy opening, avoiding spillage into the abdominal cavity. Note the other loop is closed with a non-crushing clamp. First empty the proximal loop; then clamp this loop and then empty the distal loop, holding it outside the abdomen.

(4) Findings in the abdomen in intestinal obstruction

Here are some of the many things you might find, either immediately or after a careful search:

If there is straw-coloured fluid in the abdomen, there is probably only a simple obstruction.

If pus is present, there is an inflammatory lesion somewhere.

If loops of the bowel are red and congested, peritonitis is present.

If loops of the bowel are dusky and plum-coloured, they are strangulated.

If a huge purple mass fills the abdomen, it is likely to be a strangulated sigmoid volvulus.

If most of the small bowel is deeply congested and haemorrhagic, it has probably undergone volvulus.

If the fluid is bloody, very dark and foul-smelling, the bowel is probably necrotic, or recently perforated.

If much of the small bowel is purple or black, but is not twisted, there is mesenteric vascular thrombosis.

(5) Finding the cause of intestinal obstruction

First decide if the obstruction is proximal or distal to the caecum. Your task will be easier if you decompress the bowel and then lift as many of its loops on to the abdominal wall as you can. Protect them by wrapping them in a moist pack or in a sterile plastic bag.

If the caecum is distended when you open the abdomen, the obstruction is distal to it, so feel the upper rectum and sigmoid. Then raise the left side of the incision and feel the descending colon. Then feel the splenic flexure, the transverse colon, the hepatic flexure, and the ascending colon. You may need to extend the incision to feel the splenic flexure properly. Be very careful *not to rupture the caecum* especially if it is >12cm diameter.

If the caecum is collapsed, the obstruction must be in the small bowel. First look for a strangulated hernia by palpating the hernial orifices from inside the abdomen; you should of course have examined them earlier from outside. If these are clear, ask your assistant to retract the right side of the lower end of the wound. Pick up the last loop of the ileum, start at the ileocaecal junction, and run the small bowel through your fingers, loop by loop, and then return it to the abdomen. Try to handle only collapsed bowel distal to the obstruction, and not fragile distended bowel proximal to it. The place where collapsed bowel meets distended bowel is the site of the obstruction.

If you cannot find a collapsed loop, withdraw the distended loops and explore the pelvis and right iliac fossa.

If you find a loop which feels 'tethered', and you cannot lift it into view, it is probably the site of the obstruction. Expose this area well, by appropriate retraction, by packing bowel away, and by lengthening the incision. If the bowel is firmly stuck in the pelvis, *don't try to dissect it out when you can't see properly*: it is then best to pinch it firmly and extract it with your fingers, knowing you will have to resect that portion. *Be sure you have decompressed the proximal bowel before you do this!*

If the obstruction is difficult to find, remember that it is more likely to be in the small bowel.

If you are not sure if a piece of bowel is large or small, remember that large bowel has *taenia coli* running over its surface.

If you don't know which piece of bowel is proximal and which is distal, pass your hand down to the root of the mesentery, and remember that it runs obliquely downwards from left to right. Follow the bowel to its end.

If you really are lost as to which way the bowel goes, you have no alternative except to deliver the obstructed loops until you reach the duodenum proximally, or the obstructed focus distally. Check if the bowel is viable (11.3, 11-6).

CAUTION! Don't try to rely on the standard differences between ileum and jejunum. Obstructed bowel loses some of its characteristic features.

If you cannot find or release the cause of the obstruction, and yet the bowel is grossly distended, decompress it preferably as near proximal to the obstruction as possible. Search the length of the bowel again, including in the pelvis, for missed pathology. Could this be a pseudo-obstruction? Or a Chagas megacolon? Or a toxic megacolon from *amoebiasis* or ulcerative colitis?

If you find a mass within the bowel, but not attached to its wall, it is probably a foreign body (gallstone, bezoar, or other ingested foreign body): make a transverse enterotomy and remove the obstruction.

SPECIAL METHODS. See elsewhere for: obstruction due to bands and adhesions (12.6), inguinal hernias (18.6), femoral hernias (18.7), other hernias (18.10 to 18.14), *ascariasis* (12.5), intussusception (12.7), volvulus of the small bowel (12.8), sigmoid volvulus (12.9), volvulus of the caecum (12.12), and abdominal tuberculosis (16.1).

(6) Closing the abdomen after intestinal obstruction

Before you close the abdomen, have a last look at the bowel, check the anastomosis (if you have made one), and look for bleeding, and at the length of the proximal bowel (if you have decompressed this) for damage or leaks. Wash the abdominal cavity thoroughly. Handle the bowel carefully.

Now turn your attention to closing up: do this with particular care as a 'burst abdomen' is a major risk (11.14). Distension may also recur, hopefully only temporarily.

Remember to bring the omentum down over the bowel to separate it from the abdominal wall; this will often prevent adhesions, and is especially important if you have made an anastomosis. Close the abdomen by Everett's method (11.8).

If the abdomen is difficult to close, decompress the small bowel into the stomach, and again empty it by aspiration through the nasogastric tube. If necessary, use the 'fish' (11.8). If this fails, leave the incision open, and fix a vacuum dressing in place (11.10).

If you have had to resect bowel, or the peritoneum has been soiled, wash out the peritoneal cavity with warm sterile water.

If there has been significant soiling, leave the skin edges unsutured for delayed primary closure (11.8).

(7) Post-operative care for intestinal obstruction

Continue nasogastric suction until flatus is passed, the distension is becoming less, the bowel sounds are returning, and the nasogastric aspiration is ≤ 500 ml daily of light-green fluid, which is the normal gastric secretion. (If the aspirate is persistently large, but flatus is being passed, withdraw the drain 10cm: it might have slipped into the duodenum.) Commence free oral intake when faeces has been passed.

Continue to keep an accurate fluid balance chart. Measure the urine output, and when necessary the CVP. An adult in the tropics loses at least 3L of fluid a day (skin 1L, lungs 0.5L, urine 1.5L). Replace this with 1L of 0.9% saline and 2L 5% dextrose. In a hot humid environment increase these volumes by 50% after the first 24-48h. Monitor the urine output: this should be at least 1.5L by the 3rd post-operative day.

Replace the fluid you aspirate from the stomach in addition. You can usually replace it with IV 0.9% saline or Ringer's lactate.

As soon as a post-operative diuresis starts (at 24-60h), replace the potassium loss. Basic needs are about 40mmol/24h. But if IV fluids are still needed after 48h, up to 80mmol of potassium a day may be necessary, depending on the volume of secretions lost. Replace this loss either as a 1M solution added to the IV fluids, or as Ringer's lactate ($[K^+]=4$ mM), or as Darrow's solution ($[K^+]=34$ mM) or as half-strength Darrow's ($[K^+]=17$ mM).

(8) Difficulties with intestinal obstruction

If you don't know what to do about an obstruction, and the situation looks very complex, consider bypassing the obstruction by anastomosing a distended to a collapsed loop. Or, if you cannot do this, bring out the proximal loop of bowel as a stoma.

If the large or small bowel is not viable, but you are not sure how to make a safe anastomosis, exteriorize the bowel. Bring the non-viable bowel out through a stab wound which is big enough to accommodate it.

Suture its margins, at a point where it is healthy, to the skin of the wound, so that it won't slip back inside. Close the laparotomy wound carefully. The stoma will be of rather generous proportions, sticking out of a short wound in the flank. Then cut off the non-viable bowel about 3cm from the skin to form a double-barrelled stoma. You will have to replace orally the large volumes of small bowel fluid lost from an ileostomy or jejunostomy (11-12).

If the small bowel is not viable to within 5cm of the caecum, it is not safe to resect bowel without mobilizing the caecum, including this and making an ileocaecal resection. If you cannot do this, perform an end-to-side ileocolic anastomosis and close the distal ileal stump, or make an ileostomy (11-12).

If obstruction is clinically present, and yet you cannot find any cause for the obstruction, the only useful thing to do is to decompress the bowel. There may be just spasm or a pseudo-obstruction.

If post-operatively, the bowel sounds don't return, the fluid you aspirate does not decrease, and the abdomen becomes more distended, paralytic ileus is developing. Consider an anastomotic leak (12.16).

If there is diarrhoea post-operatively, this is common after any operation to relieve intestinal obstruction: it is a sign of recovery and usually clears up spontaneously if there is no persistent fever. Measure the stools and replace the volume accurately IV with Ringer's lactate or 0.9% saline with added potassium.

12.5 *Ascaris* obstruction

Obstruction of the bowel by *ascaris* worms is the classical indication for non-operative treatment. Heavy infestations can obstruct the bowel, usually in the distal jejunum and proximal ileum, partly or completely. The children of impoverished shanty-towns are most heavily infected, but in only a few of them is the infestation so heavy that it obstructs the bowel. The number of worms a child has is directly proportional to the number of ova he has swallowed. So the prevalence of *ascaris* obstruction is a sensitive indicator of very poor hygienic conditions indeed. Sadly, the environment of many cities is deteriorating, and *ascaris* obstruction is becoming more common.

A child between 2-14yrs, or occasionally a young adult, usually has several mild attacks of central abdominal pain and vomiting, before the small bowel finally obstructs. Often, he vomits worms, or they may come out of the nose, but this by itself is unimportant unless he becomes unconscious.

If obstruction is partial, as it usually is when it is caused by a bolus of living worms, non-operative treatment commonly succeeds. Even if a solid mass of tightly packed dead worms obstructs the bowel completely, you can usually treat this non-operatively.

INTESTINAL OBSTRUCTION caused by *Ascaris*

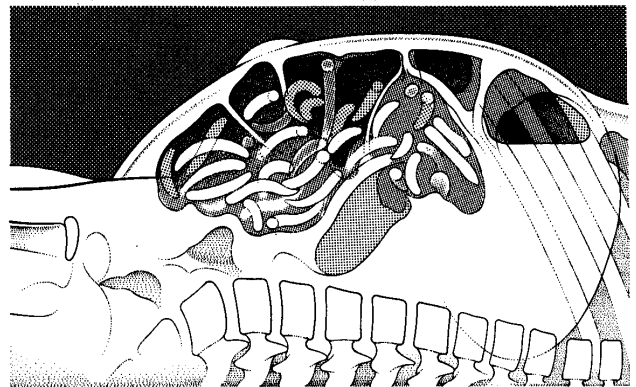


Fig. 12-7 INTESTINAL OBSTRUCTION caused by *ascaris* worms. This is a lateral radiograph in the supine position. Note the fluid levels and gas-filled coils of bowel. Rarely are worms seen quite as clearly as this! Typically, they are coiled in a mass, like 'Medusa's head'. Kindly contributed by John Maina.

Complete obstruction commonly follows an attempt to 'de-worm' a heavily infested child. It paralyzes the worms, and so makes them even more likely to form a ball and obstruct the bowel. So wait to 'de-worm' a child until the obstruction has passed. *Don't operate if you can avoid it*, but a child may deteriorate rapidly from volvulus (a closed loop obstruction) or a perforation. At operation, try not to open or resect healthy bowel. Instead, try to milk the worms through the small bowel into the large bowel, from where they will be expelled naturally. The danger of anastomosing small bowel is that worms find their way through the anastomosis out of the bowel causing a leak; the patient with the fistula (11-26) had bowel resected for *ascaris* obstruction. *Ascaris* worms occasionally obstruct the biliary tract and cause jaundice (15.6), or the appendix and cause appendicitis. Sometimes, they block drainage tubes. They may also be aspirated into the bronchi!

(a) History. Enquire about:

- (1) recent attacks of colicky abdominal pain.
- (2) vomiting worms, or passing them rectally or nasally.

(b) Examination. The child is unwell. Distension is mild to moderate. There may be visible peristalsis. Feel for a mobile irregular mass in the centre of the abdomen, 5-10cm in diameter, firm but not hard, and only moderately tender. This feels indeed like a mass of worms, and there may be more than one mass. It may change in position and you may feel the worms wriggling under your hand. If the abdomen is very distended, the mass will be difficult to feel. Signs of peritoneal irritation are absent, unless there is bowel perforation or a complication.

N.B. Examining stools for ova may not contribute to the diagnosis in a community where most children have worms.

(c) Abdominal radiographs show multiple fluid levels on an erect film, and you may see the worms (12-7). They may not be the cause of the symptoms. Radiographs are not necessary if you can make the diagnosis clinically.

(d) Ultrasound will demonstrate a mass filled with worms which you can see moving. Ascites is a bad sign.

DIFFERENTIAL DIAGNOSIS includes the other common causes of intestinal obstruction in childhood.

Suggesting intussusceptions: a more regular sausage-shaped mass, the passage of blood and mucus rectally, and tenderness which is more acute.

Suggesting an appendix abscess causing obstruction: the mass is not mobile, tenderness is more acute, a swinging temperature and toxæmia.

Suggesting Hirschsprung's disease: longstanding gaseous abdominal distension with chronic constipation.

N.B. Tapeworms don't cause obstruction.

(e) Non-operative treatment for *ascaris* obstruction

INDICATIONS. The child's general condition is good, the colic is intermittent, and the vomiting is mild. There are no signs of peritoneal irritation.

METHOD. Introduce 15-30ml of gastrografen through the nasogastric tube and clamp it for 4h: this often dehydrates and disentangles the worms.

CAUTION!

(1) *Don't try to 'de-worm' a child with partial or complete obstruction.* Wait until the obstruction has gone.

(2) *Don't use purgatives:* they may precipitate intussusception or volvulus.

(f) Operative treatment for *ascaris* obstruction

LAPAROTOMY FOR ASCARIS OBSTRUCTION (GRADE 3.4)

INDICATIONS. *A laparotomy is not often needed.*

Absolute indications are:

(1) Signs of perforation, which is caused by pressure necrosis from the obstructed mass of worms, which may lead to migration of a worm into the peritoneal cavity.

(2) Signs of peritonitis associated with intussusception, volvulus, appendicitis or, rarely, diverticulitis of a Meckel loop.

(3) Persistent abdominal pain with a tender palpable mass.

(4) Jaundice which you think might be caused by a worm in the bile duct (15.6).

Relative indications are:

(1) Toxaemia out of proportion to the severity of obstruction.

(2) Persistence of a worm mass at the same site, or its fixity.

(3) Rectal bleeding especially associated with abdominal pain.

(4) Increasing bowel distension or increasing evidence of free intra-peritoneal fluid.

PREPARATION. Correct any dehydration present. Insert a nasogastric tube.

INCISION. Make a transverse or midline incision and inspect the bowel.

If the mass of worms has thinned, devitalized, or eroded the bowel, or it is intussuscepted or twisted, resect it.

Decompress the remaining bowel and milk out all the worms you can feel. Instil piperazine intraluminally along the whole length of bowel and perform an end-to-end anastomosis. Try to cover your enterotomy closure or anastomosis with omentum in order to prevent any remaining live *ascaris* worms migrating through.

CAUTION! *If you have difficulty, don't be tempted to perform a bypass operation above the level of the worms.*

If there is severe contamination, leave the skin open (11.8).

If the bowel is healthy and you find a ball of worms blocking it, try, if possible, to break up the ball and milk the worms avoiding tearing the serosa, through to the caecum, where they will be safely expelled. If they are in the terminal ileum, this should be easy. If they are more proximal, *don't try to milk them up into the stomach:* they may then climb the oesophagus and be aspirated into the bronchus.

(g) Post-operative 'de-worming'

Don't 'de-worm' the child until 48-72h after all signs of obstruction have gone, and there are no palpable masses of worms. Then use a single dose of piperazine citrate 4g, which will paralyze the worms so that they pass rectally. Or, use mebendazole 100mg bd for 3 days.

(h) Difficulties with *ascaris* obstruction

If you cannot milk the worms downwards, and the wall of the bowel is healthy, try injecting 15-30ml of gastrografen into the lumen of the bowel proximally: this might break up the mass satisfactorily. Otherwise, isolate the mass carefully with abdominal packs. Resect the affected portion of bowel; then try to remove all the remaining worms in the bowel by milking them down through the open bowel ends. Most of them will probably be in the upper small bowel. If you can remove all of them, there will be no chance of them working their way through a suture line later. Nonetheless, make a careful anastomosis (11.3).

If you have difficulty milking all the worms out of the retroperitoneal duodenum or the rest of the bowel, construct an enterostomy (11.6). When bowel function has re-commenced, instil gastrografen into the bowel lumen. When you are satisfied that all the worms have been expelled, close the stoma. If you are unable to construct an enterostomy, leave a nasogastric tube in place till signs of obstruction have gone and then use piperazine as above; beware of worms migrating proximally and down into the bronchus! Check the airway by a laryngoscopy at the time of extubation to see if there are any worms present.

CAUTION! *Don't be tempted to make a bowel anastomosis if many worms are still present in the bowel.*

If you find a mass or fistula associated with worms, an *ascaris* has perforated through the bowel; often you won't be able to find the hole, and the worms will have caused an infected inflammatory mass. The worms may still be alive: remove them and drain the abscess. This is preferable to doing a resection.

If a worm has migrated into the biliary tree, try to manipulate it out. You won't often be able to do this and may have to explore the common bile duct (15.6).

N.B. *Anisakis* worms arrive in the human intestinal tract through the eating of raw fish. They are dead once they reach the small bowel. They can cause obstruction like the *ascaris* worm, but once a mass of them causes obstruction, unless you can flush them out with gastrografen, remove them *via* an enterotomy.

12.6 Obstruction by bands and adhesions

Bands and adhesions sometimes form in the peritoneal cavity and obstruct the bowel from outside. They are the result of some focus of inflammation being slowly converted into fibrous tissue, and can follow:

- (1) A previous abdominal operation, which may be followed by obstruction soon afterwards (12.16), or later, as described below. You can reduce the probability of this happening by not using powder in surgical gloves, handling tissues gently, and pulling the omentum down over the bowel, and particularly the site of an anastomosis. This will reduce the chances of the bowel sticking to the abdominal wall. Close the abdomen after a laparotomy leaving out the peritoneal layer, using non-absorbable sutures (11.8).
- (2) Abdominal sepsis of any kind, especially local peritonitis from PID (23.1), or an appendix abscess. In communities where there is much PID, obstruction due to adhesions is common, and is apt to recur, so that a woman who has had one attack is likely to have another.
- (3) Abdominal tuberculosis (16.3) or Crohn's disease which mimics it precisely but is rare.
- (4) A congenital anomaly: such bands are unusual and present in early childhood.

If a loop of bowel has stuck to the parietal peritoneum at the site of an old scar, you can usually free it without too much difficulty, but even this can be dangerous because you can easily damage it.

If PID has caused massive adhesions that have resulted in loops of bowel firmly stuck in the pelvis, releasing them may be very difficult. As you will soon learn, freeing them is an art.

Obstruction due to adhesions is less likely to strangulate than some other kinds of obstruction, and is more likely to be incomplete, self-limiting, and recurrent, so you *may* be able to treat it non-operatively, if you are sure of the diagnosis!

(a) Non-operative treatment for adhesions

INDICATIONS

The patient's condition remains good, there are active bowel sounds and minimal tenderness.

Administer 100ml of gastrografen via the nasogastric tube and 6h later, repeat an abdominal radiograph. If the contrast passes into the colon, the obstruction is no longer complete.

Continue a conservative approach and ensure there is insignificant nasogastric output, no abdominal tenderness, nor pain, and passage of flatus.

METHOD (12.4)

CAUTION! *Abandon the non-operative method if there is no steady improvement.* Generally, adhesion obstruction will not resolve if occurring >1yr after the initial abdominal problem.

N.B. *Don't operate for pain alone without signs of obstruction:* more adhesions will inevitably result. Beware the 'Münchhausen' patient (who shops from doctor to doctor) with many abdominal scars!

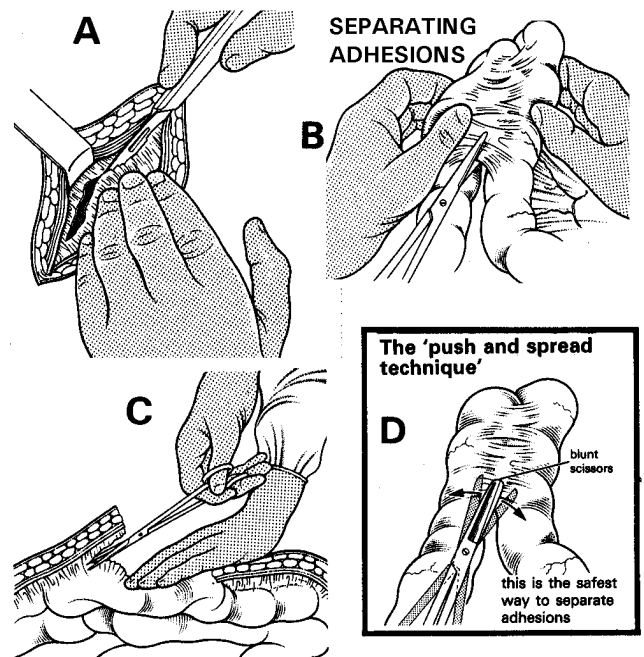


Fig. 12-8 SEPARATING ADHESIONS.

The great danger is that you may perforate the bowel: A, on entering the abdomen. B, on cutting adhesions between 2 loops of bowel. C, when freeing adhesions between the bowel and the abdominal wall, or when closing the abdomen in the presence of obstructed bowel. D, the safest way to separate adhesions is to use the 'push and spread technique' (4-9); preferably use Metzenbaum's or McIndoe's scissors, which are not so blunt as those shown here.

(b) Operative treatment for adhesions

LAPAROTOMY FOR ADHESION OBSTRUCTION

(GRADE 3.4)

INDICATIONS

- (1) Where non-operative treatment has failed, or there are signs of peritonitis.
- (2) Where adhesions formed >1yr beforehand. But remember the risk of re-obstruction is c.20% after a laparotomy to break down adhesions.
- (3) Where adhesions may not be the cause of obstruction at all.

INCISION

Open the abdomen with great care. Always dissect under direct vision: so get good exposure, and keep the field dry. Don't use diathermy close to the bowel wall: it too easily causes necrosis.

If there is a previous midline or paramedian incision, excise the scar and re-open the abdomen through it, unless this is difficult. Start above or below it in an area which is free of adhesions. Put a finger into the incision and explore the deep surface of the old scar.

Work slowly with a sharp scalpel and detach the adherent bowel from under it. *Don't make a midline incision parallel to a previous paramedian incision,* because the intervening skin may necrose. If you have to enter the abdomen through the site of multiple adhesions, dissect them away with the utmost care and patience. If the bowel has completely stuck to the abdominal wall, be prepared to excise a piece of the adherent peritoneum when necessary, rather than damage the bowel.

If there is a transverse or oblique incision, re-open this incision.

FREEING THE ADHESIONS

Look for the site of the obstruction, which may be a band with a knuckle or loop of bowel caught under it. This has a 95% chance of being in the small bowel and a 75% chance of being in the ileum. Use the 'push and spread technique' with blunt-tipped Metzenbaum's or McIndoe's scissors (4-9B, 12-8D). Use the outer sides of the blades to spread the tissues. If you work carefully, you can define tissues when they are matted together, by opening up tissue planes, and without injuring anything. You will see what is bowel and what is an adhesion, and will be able to cut in greater safety. Work away at one site and then at another until the adherent loops unravel. Go very gently and *be patient!*

Alternatively, use the 'pinching technique'. Pinch your index finger and thumb together between two loops of adherent bowel. *Don't pull on the bowel:* it may rupture; rather, try to lift it out from underneath. Grip the bowel firmly with moist gauze, and release it periodically, to help you to identify what you are cutting, and to control bleeding. When you have divided a band, you will want to know if the trapped bowel is viable or not: do this using the criteria described (11.3, 11-7). If you can squeeze bowel contents past a kink in the bowel, you can probably leave it safely. Make sure you decompress the bowel proximally (12.4).

If the obstructed part of the bowel is non-viable or strictured, resect this portion and make an end-to-end anastomosis (11.3), remembering to decompress the bowel content before you do so.

Don't necessarily try to divide every adhesion you find. Freeing adhesions can go on indefinitely, and can be dangerous. If there are adhesions between loops which are not causing obstruction, leave them alone.

CAUTION! Work slowly and carefully. Making a hole in the bowel wall increases greatly the post-operative morbidity, especially the risk of a fistula (11.15) and further adhesions.

DIFFICULTIES WITH INTESTINAL ADHESIONS

If bleeding obstructs your view, apply gentle pressure with a warm moist pack. Leave it alone for a few minutes,

and dissect somewhere else. Place a small figure-of-8 suture on a bleeding point if bleeding persists: *don't use diathermy!*

If you strip the serosa with some of the muscle layer, leave it. Apply a warm pack, and suture any bleeding points.

If distended loops of bowel obscure your vision, and you cannot release these, it is safer formally to decompress the bowel (12.4) instead of tearing it accidentally.

If you do open the bowel, apply non-crushing bowel clamps either side of the perforation, clean up any spillage and pack around the affected bowel. You can use this opportunity to decompress it of its contents (12.4).

If the opened bowel is still stuck, free it completely before trying to clamp it, otherwise you may cause more damage. Then finish releasing all the adhesions you need to free up. Then close any perforation transversely carefully in two layers.

If the edges of the defect are ragged, trim them neatly, so that you only use full-thickness bowel for closure: make sure that there is no obstruction distal to the point of repair! If there is, a fistula is sure to form.

If you make more than one hole in the bowel, aim to resect the affected portion as one piece if possible and make a formal anastomosis, unless you will have to sacrifice too much bowel.

If there is much soiling, make a temporary enterostomy (11.6) and have a second look 48h later.

If loops of bowel are firmly stuck down in the pelvis, usually in a female from PID or from TB, try carefully to pinch them off the pelvic wall from behind. If you fail, bypass them with an entero-enterostomy (11.4). This is a safe way out of a difficult problem, provided that too long a length of small bowel is not bypassed. Choose an easily accessible loop of bowel proximal to the obstruction, and anastomose it side-to-side with a collapsed loop distally. Some of the absorptive surface of the bowel will be lost, but this will be life-saving. If necessary, another operation can be done later when the condition has improved: you may well then find the adhesions are much less of a problem.

12.7 Intussusception

Telescoping of the bowel into itself takes several forms:

- (1) Ileocaecal, ileocolic and ileorectal, which occur in children, especially with *ascaris and coeliac disease*, but also in adults,
- (2) Caeco-colic,
- (3) Colo-colic,
- (4) Ileo-ileal, generally occurring in adults as a result of lymphadenopathy, especially with HIV disease, TB, amoebiasis, schistosomiasis or polypoid tumours.

The relative frequency of these varieties differs considerably from one area to another. It may be the result of intestinal tuberculosis, and occurs more frequently at Islamic festivals in periods of fasting and feasting.

The danger of any intussusception is that the bowel may strangulate: firstly the inner part (*intussusceptum*), but later also the outer part (*intussusciens*). However, the signs of peritoneal irritation are initially absent, because the gangrenous inner part is covered at first by the normal outer part. Occasionally, intussusception may occur in a reverse direction.

The child is usually between 6mths and 8yrs. He suddenly cries or screams for a few seconds every 10-30mins. This then stops as unexpectedly as it began. When it restarts, he draws up his knees in spasms of colicky pain. He vomits, and may pass bloody mucus stools. *Don't confuse this with dysentery!* You can usually feel a sausage-shaped abdominal mass in the line of the transverse or descending colon, above and to the left of the umbilicus, with its concavity directed towards the umbilicus. The right lower quadrant may feel rather empty. If the abdomen is much distended, the mass is not so easy to feel. Rarely, it is hidden under the right costal margin, or is in the pelvis, where you may be able to feel it bimanually. Sometimes, the telescoping bowel presents at the anus, or you may feel it rectally, and see blood and mucus on your finger afterwards.

If you notice a mass at the anus, be careful to distinguish an intussusception from a rectal prolapse (26.8). Occasionally, a small intussusception reduces itself.

In an adult, you rarely make the diagnosis pre-operatively; any type of intussusception is found: the colo-colic type will produce signs of *large* bowel obstruction, whilst the ileocolic or ileo-ileal types signs of *small* bowel obstruction.

N.B. Beware of confusing intussusception with dysentery!

COLIC, ABDOMINAL MASS, AND DIARRHOEA? THINK OF INTUSSUSCEPTION!

(a) Abdominal radiographs. You will see the ordinary signs of any small or large bowel obstruction: a dilated bowel with fluid levels. Very rarely will you see any specific features. A barium contrast enema is rarely needed to make the diagnosis.

(b) Ultrasound will demonstrate a typically crescent-shaped mass (pseudo-kidney) in the distended bowel lumen.

(c) Non-operative reduction using air

If, and only if, the history is <24h, and there is no sign of tenderness or gross abdominal distension, and no free gas seen on a radiograph, you can try to reduce an ileocaecal or ileocolic intussusception by an air enema.

Resuscitate the child with IV fluids, and insert a nasogastric tube, leaving its end draining freely into a kidney dish below the level of the trunk. Use ketamine anaesthesia. Insert a Ch20 or 22 Foley catheter into the rectum and inflate its balloon fully within the rectum. Strap the buttocks together.

REDUCTION OF INTUSSUSCEPTION BY INSUFFLATING AIR



Fig. 12-9 AIR ENEMA REDUCTION OF INTUSSUSCEPTION.
A, Foley catheter inserted into the rectum. B, mechanical (aneroid) sphygmomanometer bulb and gauge attached. C, nasogastric tube draining freely into a kidney dish (placed below the level of the trunk).

Palpate the abdomen to locate the intussusception mass, or locate it by ultrasound (38.2). Attach a mechanical sphygmomanometer to the end of the Foley catheter and insufflate air into the rectum up to a maximum pressure of 120mm Hg. Follow the passage of air proximally in the bowel by palpation or ultrasound. When this is complete, confirm disappearance of the mass and continuous free flow of air through the nasogastric tube into the kidney dish. Deflate the balloon of the Foley catheter and remove it; feel that the abdomen is soft. You should notice some air escaping via the anus.

N.B. Don't try to reduce it with hydrostatic pressure using a saline or gastrografin enema unless you have an experienced radiologist available; never use barium.

If the mass remains, or there is no continuous free flow of air in the nasogastric tube, you can try again.

If the abdomen suddenly swells, or no air escapes from the anus, because of passage of air into the peritoneal cavity, administer IV gentamicin and metronidazole, and perform an immediate laparotomy.

(d) Operative reduction

LAPAROTOMY FOR INTUSSUSCEPTION (GRADE 3.4)

INDICATIONS. Any intussusception >24h old, which does not spontaneously resolve, or which cannot be reduced by an air enema, needs a laparotomy.

INCISION. Make a transverse supra-umbilical incision in a child (or a midline incision in an adult), and feel for the mass. Retract the edges of the wound and try to lift out the mass. Look at it to see which way the intussusception goes: backwards or forwards.

METHOD

If the outer layer of the intussusception looks viable, try to reduce it by manipulation. If the intussusception has not gone beyond the splenic flexure, manual reduction should not be too difficult. But if it has reached the sigmoid colon, or if it has been present >24h, it is likely to be non-viable.

INTUSSUSCEPTION

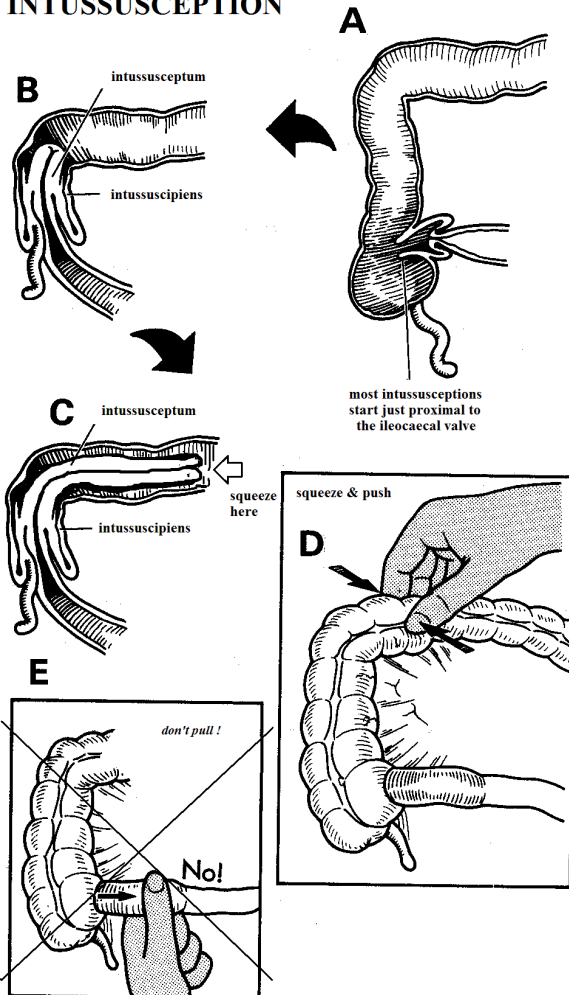


Fig. 12-10 INTUSSUSCEPTION.

A-C, stages in the development of the common ileocolic intussusception in children. D, squeeze the colon that contains the leading edge of the intussusception. E, don't try to reduce an intussusception by pulling. Partly after Ravitch MM, Paediatric Surgery Yearbook Medical 1979 Fig 93-3 with kind permission.

Using a thick, moist gauze swab between the thumb and index finger of your hand, apply gentle pressure to the part of the bowel which contains the leading edge of the intussusception. Reduce it from its apex proximally by pushing. Use the gauze to transmit the pressure to as wide an area of the bowel as you can. Squeeze it gently, so as to make the mass go proximally. Be patient, and change the position of your squeezing hand as necessary. The intussusception will usually reduce itself quickly.

Manual reduction will be most difficult near the end, and the seromuscular layers of the bowel usually split. Persist up to a point. Abandon reduction if:

- (1) splitting becomes deep.
- (2) you cannot reduce the intussusception any further.
- (3) you see a purplish or necrotic area of bowel emerging.

If you split the serous and muscular coats of the last few centimetres of the bowel as you reduce it, don't worry. This usually happens. Provided the mucosa is intact and the bowel is not gangrenous, it will heal.

An area of residual thickened bowel is common and *not* an indication for resection. *Don't perform an appendicectomy*, unless it is inevitably included in the bowel resection.

CAUTION!

- (1) Complete all the reduction by squeezing.
- (2) *Don't pull the proximal end.*
- (3) Reduce the last dimple, or the intussusception may recur.
- (4) Make sure the apex is viable, because this is the part which is most likely to become gangrenous.

You will often need to mobilize the ascending colon: stand on the left side and ask an assistant to retract the right side of the wound, so as to expose the caecum and ascending colon. Use a pair of long blunt-tipped dissecting scissors to incise the peritoneal layer 2cm lateral to the ascending colon. Free the colon using the 'push and spread technique' (4-9). Put a moist pack over the colon and draw it towards you, so as to stretch the peritoneum in the right paracolic gutter. As you incise the peritoneum, draw the entire colon medially, from the caecum to the hepatic flexure. Use a 'swab on a stick' to push away any structure which sticks to its posterior surface, especially the duodenum and the ureter, which runs downwards about 5cm medially to the colon, and which you should identify and preserve.

If, after manual reduction, any part of the terminal ileum, caecum, or colon is not viable, resect it and exteriorize the bowel or make an anastomosis. The danger is that death from peritonitis may ensue if you fail to remove all non-viable bowel.

If there is a gangrenous intussusceptum protruding from the anus, tie it off tightly and amputate it before opening the abdomen. You will then be able to reduce the remaining intussuscepted bowel easily from inside, and perform a resection of the affected portion with the ligature on.

Most cases in children will involve the ileum. It is rare that the intussusception only affects small bowel. *Don't resect terminal ileum and leave an anastomosis within 5cm of the caecum.*

Commonly you will need to perform an:

- (1) ILEOCAECAL RESECTION (GRADE 3.4)

As you lift the caecum and ascending colon medially, you will see the ileocolic vessels which supply them. Hold up the colon and try to see them against the light. Make windows in the peritoneum on the medial side of the colon, and clamp the branches of these vessels, one by one, 3cm medial to the wall of the colon. Insert two haemostats through each window and cut between them, leaving a cuff of tissue distal to the proximal haemostat. Then tie the vessels held in each haemostat with 2/0 or 3/0 suture, depending on the size of the child. Tie them twice on the proximal side for safety.

If you cannot find the blood vessels because strangulation has altered the anatomy, lift up the colon and apply haemostats to the mesentery close to the wall of the colon. Cut between them and the colon, until it is completely free.

Apply haemostats to the mesentery of the ileum 2cm from the bowel, and cut between them until you reach healthy bowel supplied by a visibly pulsating vessel. Raise the greater omentum towards the head, and use scissors to separate the filmy adhesions between it and the hepatic flexure.

Mobilize the hepatic flexure under direct vision. Cut peritoneum only and draw the flexure downwards and medially. Free the colon from the duodenum with a 'swab on a stick'.

You should now be able to lift the strangulated bowel out of the wound, free of all its peritoneal, mesenteric, and vascular attachments. As you lift it up, make sure that there is healthy bowel above skin level at both ends. Occasionally, you will have to mobilize the descending colon and splenic flexure.

Do this in the same way as for the opposite side, but take especial care not to damage the spleen, pancreas or stomach when you free the splenic attachments of the colon, which may be quite high under the rib cage.

Place non-crushing clamps across the bowel 2cm proximal and distal to the non-viable segment, and crushing clamps next to the ends of the non-viable segment of bowel; this will leave healthy portions of bowel between the crushing and non-crushing clamps. By drawing a knife along the crushing bowel clamps (on the side where the non-crushing clamps are), amputate the non-viable bowel. Decompress the bowel contents from the proximal end by suction or by drainage into a bowl after packing away the abdomen.

You now have the choice of either exteriorizing the bowel or doing an anastomosis.

(2) **EXTERIORIZATION** is a messy but life-saving procedure. By doing this, you may avoid contaminating the peritoneal cavity and improve the chances of survival. When you have done this, the patient will find himself with a temporary ileostomy and colostomy, but you will have saved his life. You will however have to replace the quantities of fluid lost from the stoma, and try later to get this closed.

Examine the proximal and distal ends of the strangulated bowel to find parts which you are sure are healthy. Protect the area with carefully applied towels. Make the proximal ileostomy and distal colostomy using a separate incision for the bowel and thread them through (11.6), next to each other as a type of 'double-barrelled' stoma (11-12D).

CAUTION!

- (i) Check again that viable bowel extends 2cm above the skin.
- (ii) Make sure that there is no tension on the ileum or colon inside the abdomen.

Manage the ileostomy by fitting a standard drainable ileostomy or makeshift (11-15) bag. Protect the skin with zinc oxide cream, barrier cream, or karyo gum powder. Use codeine phosphate orally to slow down peristalsis, so that a semisolid stool forms. If the effluent is copious and very liquid, nurse the patient in a prone position with the hips and chest supported on several pillows so as to allow the contents of the ileum to discharge by gravity (11-11). Replace the fluid and electrolyte losses orally.

(3) **ANASTOMOSIS** may be technically more demanding, but will save the child the fearsome problems of fluid and electrolyte loss, and re-operation. Make a careful end-to-end anastomosis preferably with one layer of long-lasting absorbable sutures for a small child (11.3, 11-7), taking care not to twist the mesentery of the bowel. Close the mesenteric defect with a continuous suture.

If a distal colo-colic intussusception requires resection, perform a Hartmann's operation (12.9).

12.8 Small bowel volvulus

This is seen at all ages, particularly in young men, often after a heavy meal after a prolonged period of fasting. The small bowel spontaneously rotates on its mesentery, or on a band 5-10cm from the ileocaecal valve, which tethers it to the posterior abdominal wall. As it rotates, it traps large volumes of blood and fluid. Most of the small bowel may rotate, apart from its top and bottom ends, or only a smaller part. Occasionally it is due to a congenital malrotation. Sometimes, an adhesion to a loop of small bowel starts the twist, or it occurs as a result of a mass of *ascaris* or *anisakis* worms impacted in the terminal ileum, or the patient may have a primary sigmoid volvulus, and loops of the small bowel may twist around this (12-14), producing an ileosigmoid knot (compound sigmoid volvulus).

Volvulus of the small bowel is a sudden deadly illness in which the bowel rapidly becomes ischaemic. As the mesenteric vessels occlude, the bowel strangulates and there is sudden severe diffuse abdominal pain. A typical history is of sudden abdominal colic, distension and vomiting, coming on after a large evening meal. Early on, the patient does not look particularly ill although he may have a tachycardia: his abdomen may be fairly relaxed and not particularly tender at this stage. You may feel an ill-defined mass, but high-pitched bowel sounds and radiographs showing a few distended loops of small bowel with a fluid level may be the only signs of a dangerous volvulus. A notable feature is the speed with which the abdomen distends. The pain persists and is followed by signs of peritonitis.

In theory, treatment is easy: untwist the bowel. One of your difficulties will be to make the diagnosis, when all you see at laparotomy are distended loops of small bowel.

Manipulating distended bowel is dangerous, whether or not it is strangulated. If a loop ruptures, survival is in doubt because of septic flooding of the peritoneal cavity that results. There is about a 30% chance of death when bowel is gangrenous but in a survivor, volvulus rarely recurs.

SMALL BOWEL VOLVULUS

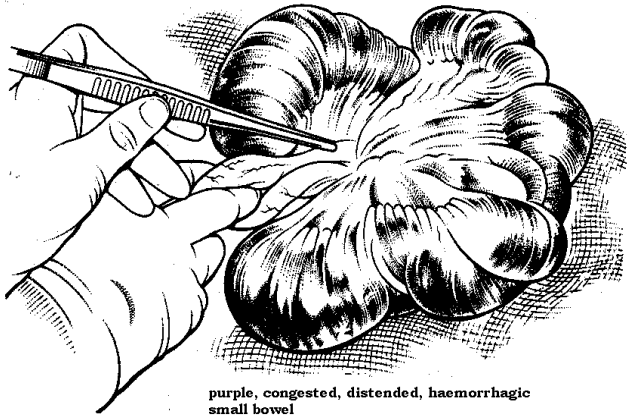


Fig. 12-11 VOLVULUS OF THE SMALL BOWEL is a sudden deadly illness in which the symptoms of obstruction progress rapidly to those of strangulation. *Kindly contributed by Gerald Hankins.*

(a) **Abdominal radiographs** early on show a few loops of distended small bowel with one or two fluid levels on erect films; later you will see the regular horizontal step-ladder pattern, and many fluid levels, although by this time the patient is usually moribund.

CAUTION! When a strangulated closed loop is distended with blood, there may be no fluid levels, so that the radiographs appear normal.

(b) Operative intervention

LAPAROTOMY FOR SMALL BOWEL VOLVULUS (GRADE 3.4)

Make a midline incision. You will find purple, congested, haemorrhagic, distended small bowel full of food and fluid. A collapsed caecum shows that the obstruction is in the small bowel.

Try to reach the base of the mesentery. Approach this by first putting your hand down into the pelvis, and then up along the posterior border of the abdominal wall. Often, the whole of the small bowel is twisted, except the first few centimetres of the jejunum and the terminal ileum. Rotate the whole mass until the volvulus is undone. If you find a band near the ileocaecal valve, dividing it may help you to reduce the volvulus. *Take great care doing this so you don't inadvertently puncture the bowel and spill large volumes of bowel contents!*

Deliver the bowel, untwist it, and cover it with warm moist abdominal swabs. Assess its viability.

If you have difficulty untwisting the bowel, decompress it first. Introduce the suction nozzle into a distended loop through a purse-string suture, and decompress it proximally and distally. Do this routinely if the bowel is obviously non-viable.

If the bowel is viable, decompress it by massaging the fluid proximally (12.4).

If you are not sure if the bowel is viable or not, assess it (11-6). Wait for at least 10mins before you make a decision.

If the bowel is not viable, and the gangrenous section ends well proximal to the ileocaecal valve, resect it and perform an end-to-end ileal anastomosis after decompressing the bowel (11.3). If the bowel is gangrenous down to the caecum, perform an ileocaecal resection (12.7).

If there are ascaris worms, resect any non-viable bowel, decompress the remainder and remove all palpable worms, irrigate the bowel with piperazine, and perform a secure end-to-end anastomosis, covered by omentum (12.5).

CAUTION! Be sure to select healthy bowel for the anastomosis, with obviously visible pulsations in the vessels that supply it: a serious and sometimes fatal complication is a leak due to necrosis of the bowel at the site of the anastomosis.

Continue nasogastric suction and IV fluids post-operatively till flatus is passed. You may need to transfuse blood.

12.9 Sigmoid volvulus

A long sigmoid colon distended with the gas of a high-fibre diet is more liable to twist on its mesentery. This is the commonest cause of large bowel obstruction in much of the world, particularly in the African continent, and is sufficiently characteristic to allow you to diagnose it easily. Occasionally, it resolves spontaneously. If sigmoid volvulus persists, ischaemia results and the colon becomes gangrenous and may perforate. Sigmoid volvulus is however less dangerous and more common than small bowel volvulus (12.8).

In a patient, normally male, with his first episode of volvulus, the colon may not be thickened, and the blood vessels thin. However, usually there have been many undiagnosed episodes of volvulus; the long mesentery is scarred, its vessels are enlarged, and the bowel wall is thickened as in Chagas disease (12.13). Occasionally, in younger adults, the small bowel is pulled round with the sigmoid and an ileosigmoid knot (compound sigmoid volvulus) (12-14) results.

Classically there is initially difficulty passing flatus. This is followed over a few days by increasing gaseous abdominal distension, tympanitic (like a drum), but without much pain or tenderness. There may be so great distension that breathing is severely impaired.

Vomiting is unusual, except when the colon presses severely on the stomach. The general condition is usually good: drinking is possible and dehydration not severe. The contrast between the satisfactory general state and the huge abdomen is striking.

If the twist in the sigmoid is $>180^\circ$, symptoms and signs will be more acute, with severe colicky pain, perhaps some bloody loose stool, abdominal distension, prostration and circulatory collapse. Likewise a patient whose volvulus persists will show similar signs of peritonitis.

(a) Abdominal radiographs are usually immediately diagnostic: in the erect film, there is a huge appearance of gas like an inverted 'U' ('the coffee bean sign') reaching from the pelvis to the upper abdomen, inclining right or left, often with smaller fluid levels proximal to the loop (12-12A). A supine film may show three dense curved lines converging on the left sacroiliac joint. The middle line is the most constant, and is caused by two walls of the distended loop lying pressed together (12-12B).

(b) Differential diagnosis

- (1) Carcinomatous obstruction of the left colon or rectum.
- (2) Caecal volvulus.
- (3) Megacolon.
- (4) Neglected short segment Hirschsprung's disease.
- (5) Pseudo-obstruction.

Suggesting carcinoma of the colorectum: a change from a normal bowel habit to constipation over a much longer period; a smoothly distended abdomen without obvious coils of colon; palpation of a rectal tumour; radiographs showing caecal distension, and not the characteristic signs of sigmoid volvulus.

Suggesting a caecal volvulus: radiographs show a huge appearance of gas centrally in the abdomen unlike the appearances in 12-12A,B.

Suggesting megacolon: long history of constipation with no acute signs.

Suggesting pseudo-obstruction: gas in the rectum.

MANAGEMENT

If the bowel is viable, you should be able to relieve obstruction by decompression with a flatus tube passed through a sigmoidoscope (12.4). This will relieve the immediate symptoms, but it is not sufficient treatment, because the volvulus has a $>30\%$ chance of recurring. After a 2nd attack, it has a 60% chance of doing so. If you succeed in relieving the volvulus, prepare for a definitive procedure. It will recur if the interval is too long: so give adequate warning. If you proceed to sigmoid colectomy, recommence oral fluids and provide bowel preparation with magnesium sulphate (or other laxatives) and rectal washouts on the 3rd and 4th days. Start gentamicin with metronidazole perioperatively. On the 5th day perform a laparotomy to resect the sigmoid colon. If the colon is nicely deflated, and you are experienced, you may be able to do this neatly through a left iliac fossa incision.

N.B. The main danger in using a sigmoidoscope is that you may perforate a gangrenous loop of bowel and cause catastrophic spillage of faecal material into the peritoneal cavity. This will depend on the acuteness of onset and delay in presentation.

(c) Operative intervention

EMERGENCY LAPAROTOMY FOR SIGMOID VOLVULUS (GRADE 3.4)

INDICATIONS

- (1) Failure to reduce the volvulus with a flatus tube.
- (2) The presence of bloody diarrhoea or infarcted mucosa on sigmoidoscopy.
- (3) Perforation of the colon at sigmoidoscopy or by passage of a flatus tube.
- (4) Signs of peritonitis.
- (5) (Elective procedure after successful deflation)

RESUSCITATION. Resuscitate vigorously. There may be large volumes of fluid lost into the sigmoid. If there is a compound volvulus, 2 or even 4 units of blood may be needed.

If respiration is very laboured because of enormous abdominal distension, you can buy time by puncturing the colon percutaneously and introducing a Foley catheter into the colon to decompress it, provided you have already started IV fluid resuscitation.

METHOD. Use the Lloyd-Davies stirrups. Catheterize the bladder. Add gentamicin 80mg and metronidazole 500mg IV when you start the operation if they have not been given already. Make a generous midline incision. You will see an enormously distended loop of colon. Gently lift it out of the abdomen from below.

CAUTION! Open the tense distended abdomen with the greatest care: it is easy to perforate the bloated sigmoid! Pack the sigmoid off well and decompress it (12-6B).

If the sigmoid loop is of normal colour, gently introduce the rectal tube into it. Ask your (suitably clothed) assistant to get under the drapes and pass it further up the rectum. As he does this, guide it manually past the twist. The loop will deflate and allow you to untwist it. Get your assistant to suture the tube to the anus so that it acts as an internal splint.

Alternatively, find the pedicle and see which way it is twisted. Using both hands, try to untwist it. This will be safe provided it is not gangrenous. The loop seldom rotates by more than 360° . If you succeed in untwisting it, flatus will discharge through the rectal tube. If you cannot find the pedicle and don't know which way it is twisted, twist it first one way and then the other.

What you should do next depends on your experience:

- (1) If you are not at all experienced, deflation alone without resection will be wiser. The problem of the patient returning to have an interval resection is, however, a very real one. You can reduce this risk (but not abolish it) by fashioning a temporary tube colostomy to fix the colon to the abdominal wall.

(2) If an anastomosis is out of the question, you may perform a mesosigmoidoplasty. *Fixing the colon to the lateral abdominal wall by means of a colopexy results in too many cases of recurrence to be worthwhile.*

(3) If you are experienced, resect the sigmoid colon loop and perform an end-to-end anastomosis.

In all these operations you will have to mobilize some of the descending colon by incising the peritoneum 2cm lateral to it, followed by blunt dissection.

If the loop is obviously gangrenous, assume that the area of the twist is likely to be even more unhealthy. Pack it off (it may pop like a balloon). Clamp the bowel proximal and distal to the twist. Very cautiously decompress it (12-6B), making sure you drain bowel content outside the abdomen.

Don't try to untwist the bowel. You will have to resect the colon. You need to decide either to perform a Hartmann's procedure (12-13C), or alternatively perform an anastomosis if you are very experienced, the patient is in good condition and there is minimal soiling of the peritoneal cavity. If you fear that the anastomosis may leak (which is still a possibility in the presence of gross soiling, even if your anastomosis is immaculate), it is best to fashion a proximal defunctioning loop colostomy (11.6) to minimize complications should a leak occur.

Exteriorizing the whole segment of dubious or necrotic bowel is difficult and rarely possible.

(1) MESOSIGMOIDOPLASTY (GRADE 3.3)

This may seem a lesser procedure, but runs the risk of recurrence, and *is not easy to perform*. It is only indicated where an anastomosis is out of the question. It aims to shorten the long mesosigmoid.

Lift up the distended sigmoid loop, and divide its mesentery on both sides preserving the most peripheral and most central vascular arcades. Then close the longitudinal defect, thus created, transversely on each side of the mesentery with a continuous suture, taking care only to pick up the peritoneal surface (12-13E).

(2) HARTMANN'S OPERATION (GRADE 3.4)

Consider carefully if you cannot *safely* do the easier operation of sigmoid colectomy. Reversal of a Hartmann's operation (12.10) is difficult and may prove impossible, so your patient may be left with a permanent colostomy. An anastomotic leak complicating reversal of a Hartmann's operation will mean re-establishing the colostomy, almost certainly permanently.

Mobilize enough of the descending colon to bring healthy bowel out to the surface as a colostomy. You will have to go higher than you think initially: *don't allow any tension on the bowel*. Ask your assistant to retract the left side of the abdominal wall, so as to expose the junction of the descending and sigmoid colon. Incise the peritoneum in the left paracolic gutter (12-13A), and carefully displace the mobilized colon medially and upwards. Draw the whole loop of sigmoid colon out of the abdomen, so that you can transilluminate the mesocolon.

CAUTION! Remember that the inferior mesenteric vessels and ureter may take a looping course near the sigmoid colon (12-13A).

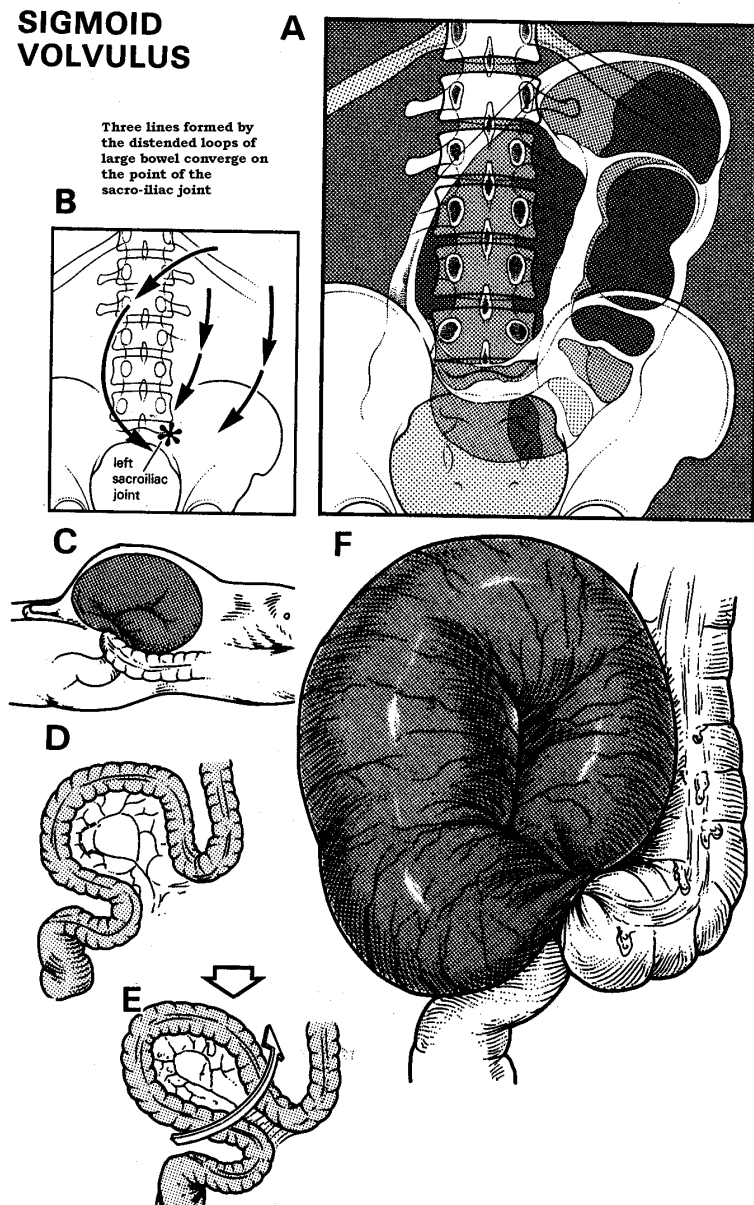


Fig. 12-12 SIGMOID VOLVULUS.

A, supine radiograph showing a huge distended inverted loop of sigmoid. B, diagrammatic version of A to show three lines formed by the walls of the sigmoid converging on the left sacroiliac joint. C, abdominal distension caused by sigmoid volvulus. D-F, show the mechanism of sigmoid volvulus.

Partly adapted from drawings by Frank Netter, with the kind permission of CIBA-GEIGY Ltd, Basle, Switzerland.

If you are not sure if the colon is viable or not, proceed with resection if you can. *Don't leave non-viable colon in the abdomen!*

Shine a laterally placed light behind the bowel to reveal the mesenteric vessels and divide them well out towards the bowel wall, so that you avoid injuring the left ureter or the superior rectal vessels.

Unless you have special small bowel clamps which can pass through the opening, you are liable to spill bowel content at this stage; it is best to tie a strong ligature round the end of the bowel (tight enough to prevent spillage of faeces, but not too tight to cause ischaemia).

OPERATIONS FOR SIGMOID VOLVULUS

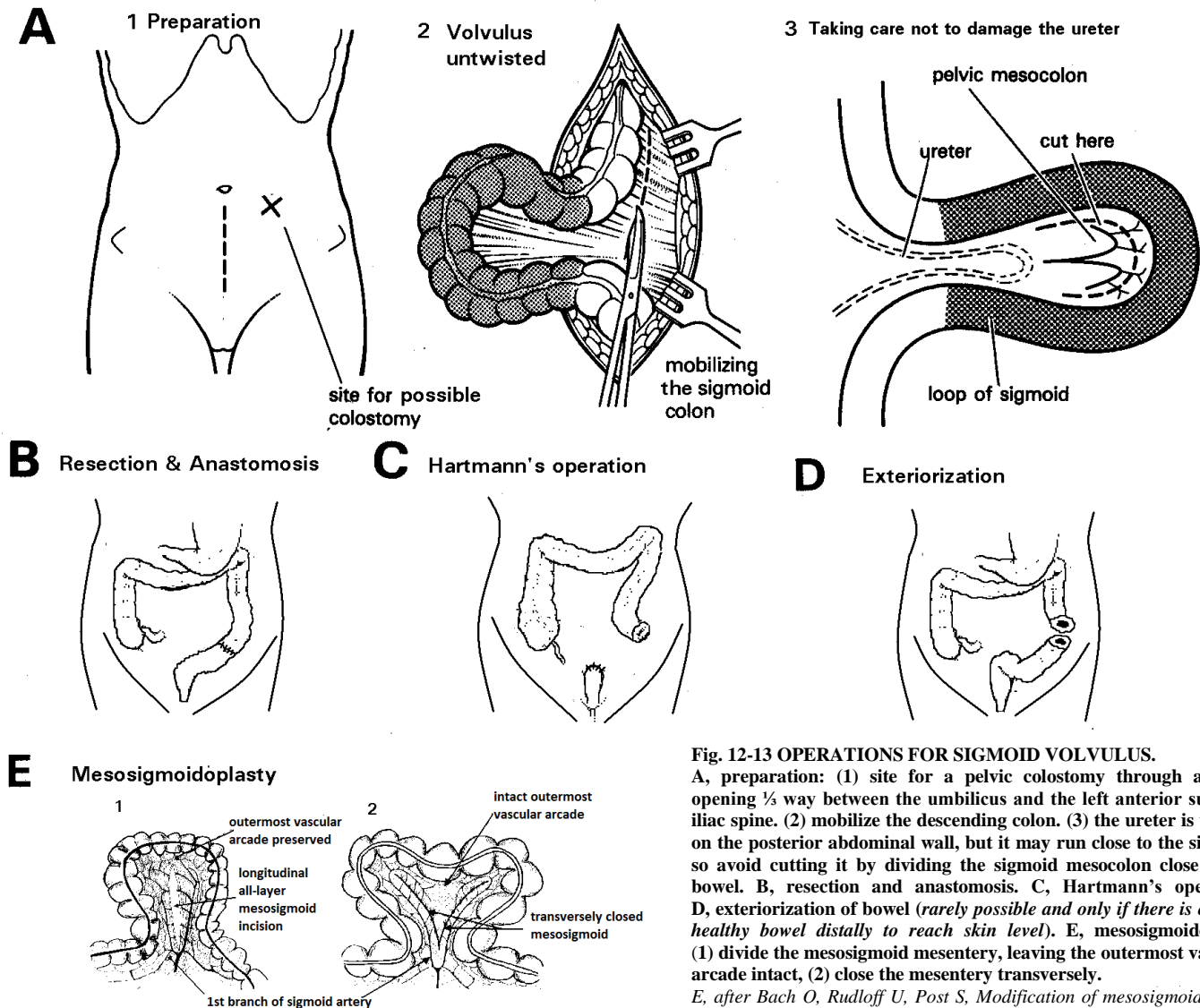


Fig. 12-13 OPERATIONS FOR SIGMOID VOLVULUS.

A, preparation: (1) site for a pelvic colostomy through a small opening $\frac{1}{3}$ way between the umbilicus and the left anterior superior iliac spine. (2) mobilize the descending colon. (3) the ureter is usually on the posterior abdominal wall, but it may run close to the sigmoid, so avoid cutting it by dividing the sigmoid mesocolon close to the bowel. B, resection and anastomosis. C, Hartmann's operation. D, exteriorization of bowel (rarely possible and only if there is enough healthy bowel distally to reach skin level). E, mesosigmoidoplasty (1) divide the mesosigmoid mesentery, leaving the outermost vascular arcade intact, (2) close the mesentery transversely.

E, after Bach O, Rudloff U, Post S, Modification of mesosigmoidoplasty for nongangrenous sigmoid volvulus *World J Surg* 2003; 27(12):1329-32.

Resect the twisted sigmoid colon between the bowel clamps, making sure there is viable colon at the point of division. Close the rectal stump, starting at one end with a continuous suture of 2/0 long-acting absorbable, and then bury this suture with another continuous non-absorbable suture. Leave one end of this suture long: this will make finding the stump easier, when you come to perform a re-anastomosis.

Mobilize enough of the descending colon to bring healthy bowel to the surface as a terminal colostomy. Make the opening at a point in the left iliac fossa $\frac{1}{3}$ from the umbilicus to the antero-superior iliac spine, and draw the end of the descending colon through.

The exteriorized bowel must lie comfortably; if it doesn't, mobilize more of the descending colon.

While your assistant retracts the abdominal wall to the left, close the space between the colostomy and the parietal peritoneum if there will be a significant delay before you can arrange to re-anastomose the bowel, because this is a space into which loops of bowel can herniate and obstruct. Do this with 3 or more interrupted sutures between the parietal peritoneum and the seromuscular layer of the colon. Have a final look at the colostomy from within, to make sure the bowel is lying nicely. Then wash out the abdomen with warm fluid and close it (11.8).

Fashion the stoma (11.6) and check the width of the colostomy lumen with a finger. Apply a colostomy device.

(3) EXTERIORIZATION (GRADE 3.5)

Proceed as for the Hartmann's operation. Carry the dissection back to the point where the proximal and distal colon are viable. Bring the sigmoid colon outside the abdomen, through a separate incision. Wash out the abdomen with warm fluid and close the main laparotomy incision (11.8).

Place a small crushing clamp just beyond the two ends where the colon is not viable. Apply non-crushing clamps proximally and distally, and divide healthy bowel between the crushing and non-crushing clamps, and remove the gangrenous loop. If possible, make a colostomy (11-14), and suture the everted colon mucosa to the skin.

N.B. In practice, the distal end is usually too short to pull out as a stoma, so you will be forced to perform a Hartmann's operation.

(4) SIGMOID COLECTOMY (GRADE 3.4)

Resect the redundant sigmoid, taking care not to rupture the large mesenteric vessels: if the colon is viable, *be careful not to remove too much bowel distally* because this will make your anastomosis more difficult. Make sure the proximal colon is mobilized well enough to reach the distal colon.

Make a small opening in the redundant sigmoid loop that you will resect after untwisting it, and decompress the bowel proximally by emptying its content into a large bowl: make sure the bowel hangs nicely outside the abdomen so as not to cause spillage, and place a non-crushing clamp distally. Make an end-to-end anastomosis in two layers (11.3). Check for leaks by placing a non-crushing bowel clamp proximal to the anastomosis, and filling the pelvis with water; then blow air or irrigate diluted methylene blue dye through the rectum with a bladder syringe.

Fashioning a defunctioning proximal transverse colostomy does not prevent the column of faeces distal passing the anastomosis, so a proximal descending colostomy is better; the security of your anastomosis, however, is more likely to depend on accurate technique, a properly cleaned bowel and suitable suture material. Long-lasting absorbable sutures are ideal, and it is then probably not absolutely necessary to have a whistle-clean bowel, but cleaning the bowel of faecal content is very worthwhile. If you only have catgut and silk, however, you can try to get the bowel absolutely clean by an on-table washout by passing fluid through from the appendix or caecum, via a Foley catheter, out of the proximal resected end of the colon, attached to wide anaesthetic tubing. This is, however, messy unless you are very careful; *if you still have improperly prepared bowel, you should avoid an anastomosis using catgut.*

(d) Difficulties with sigmoid volvulus

If a loop of ileum is twisted in with the sigmoid colon (ileosigmoid knot, compound sigmoid volvulus), you may not be able to untwist both loops. Puncture and deflate the colon, and then clamp it before you unravel the knot. If both loops are gangrenous, resect them *before you try to unravel the knot*. Anastomose the small bowel end-to-end, and deal with the large bowel depending on experience as above.

If the lower limit of the gangrene on the ileum is close to the ileocaecal valve, you may need to resect the ileocaecal segment as for intussusception (12.7).

If you decide to make a stoma, fashion an ileostomy rather than a colostomy distal to a small bowel anastomosis. Rarely, one loop is viable: if it is the small bowel, leave it alone; if it is the sigmoid, perform a resection.

COMPOUND SIGMOID VOLVULUS

(Ileosigmoid Knot)

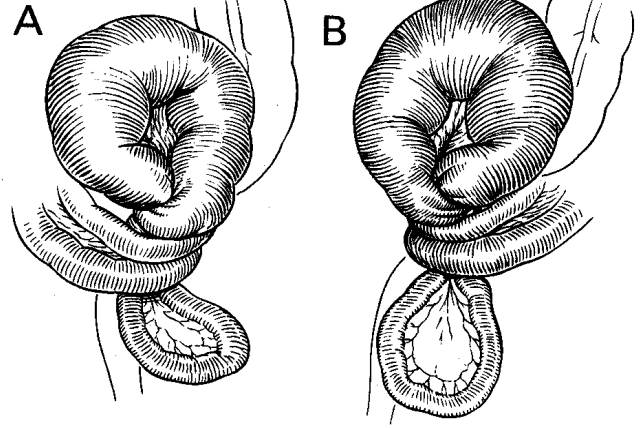


Fig. 12-14 COMPOUND SIGMOID VOLVULUS (ileosigmoid knot) is found where simple sigmoid volvulus is common. A loop of the ileum is twisted with the sigmoid. The twist in the bowel may be left-handed (A) or right-handed (B). If you cannot untwist it, you will have to deflate it and resect it. *Don't try to untwist it if its circulation is impaired.*

12.10 Reversing Hartmann's operation

(GRADE 3.5)

This is one of the more difficult operations described. *Never let the patient or his relatives persuade you to do this operation if you are inexperienced: the penalty is the death of the patient and your reputation!* There may be very dense adhesions in the pelvis making the operation extremely difficult for you and hazardous for the patient. Even if you are confident with fashioning a low anastomosis, this may prevent you from proceeding. So, think very carefully before you promise to reverse a Hartmann's operation. (This procedure exteriorizes the proximal colon as an end-colostomy, closing the rectal stump with the anal canal left open.)

You will have to divide the adhesions, find the rectal stump, mobilize the proximal colon, open the rectal stump, and bring the proximal colon down to meet it, and make a neat leak-proof anastomosis!

TIMING. As soon as your patient has recovered from the operation, is eating and can have bowel preparation; *the classic wait of 6-12wks does not necessarily reduce the adhesions.*

PREPARATION. Administer magnesium sulphate (Epsom salts) 10g orally (or other available laxatives) the evening before the operation, and again early in the morning on the day of operation to clear the bowel. Meanwhile provide plenty of oral fluids to avoid dehydration.

Start metronidazole 400mg tds, and restrict intake to oral fluids only on the evening before operation. On the day before the operation, wash out the proximal loop, and administer an enema up the rectal stump. Cross-match 2 units of blood. Add gentamicin 240mg IV when you start the operation.

METHOD. Use the supine position and put the legs in Lloyd-Davies stirrups. Catheterize the bladder. Tilt the head down to give you better access to the pelvis. Excise the previous wound. Using scissors and gentle blunt dissection, carefully separate any adhesions between the bowel and the abdominal wall, and between loops of bowel.

Pack off the small bowel inside the upper abdomen (a three-bladed abdominal or universal Dennis-Browne retractor is useful for this, 4-5). Infiltrate lignocaine with adrenaline (1:200000) around the colostomy to reduce bleeding. Hook up the bladder to the pubic symphysis with a temporary stay suture.

Start by finding the distal rectal stump: if you fail to do so, you will not have disturbed the proximal colostomy, and can close up, and try again later. Put a long blunt instrument into the rectum through the anus to help identify the stump.

Then start to dissect it out (the non-absorbable suture placed earlier will also help to find it). Dissect across the top and about 5cm down each side (12-15B). Remove the instrument in the rectal stump and cut it across 1cm from its blind end, so a clean bowel lumen becomes visible. *Don't be tempted to leave a swab in the distal rectum:* you may forget it or be unable to retrieve it post-operatively.

Make an elliptical incision around the colostomy; dissect down to the rectus sheath. Control bleeding carefully so you can see where you are. Free the bowel from the anterior and posterior rectus sheaths; a finger inside the stoma will help show you where to dissect without cutting into the bowel lumen (11.6). If there are adhesions to the stoma site, free them from the proximal colon from inside the abdomen; apply a non-crushing clamp across it from inside just adjacent to the abdominal wall, and amputate it.

Mobilize the proximal descending colon by incising its lateral peritoneal reflection, and using a 'swab on a stick' to peel the bowel away from its attachments (12-15A).

Mobilize it sufficiently, so that it reaches the distal stump without tension. This may mean mobilizing the splenic flexure.

Perform an end-to-end anastomosis. Put stay sutures at the left and right edges, holding both ends together. Start the anastomosis at the back (posteriorly) in the middle *instead of the antimesenteric border* with two separate long-acting absorbable or silk sutures, placing the knots outside the bowel wall, and leaving the ends left long (12-15C).

Continue these as a continuous seromuscular Lembert suture and work round on the outside towards the left and right sides in turn. Starting at the same point inside the lumen in the middle posteriorly, insert an all-coats over-and-over inner layer long-acting absorbable suture, working round towards left and right as before (12-15D), and continue as an inverting Connell suture finishing at the front (anteriorly). Then complete the outer layer seromuscular suture to bury the inner layer.

Check the soundness of the anastomosis and the size of the lumen by pinching it between your thumb and finger (11-7Q). You can further check the anastomosis by filling the pelvis with water and blowing air up through the anus with a bladder syringe. There is a leak if you see bubbles in the water!

Remove the stay suture hitching up the bladder. Close the pelvic peritoneum over the anastomosis and close any defect through which a loop of small bowel might prolapse, preventing its fall into the pelvis.

DIFFICULTIES REVERSING HARTMANN'S OPERATION

If you cannot bring the ends of the bowel together easily, mobilize more of the descending colon proximally by incising the lateral peritoneal reflexion further, and raising more of the mesentery. You can always bring the bowel ends together if you mobilize enough mesentery. You may, rarely, need to mobilize the splenic flexure; make sure you fix the colon to the posterior peritoneum to prevent it twisting on an axis from the transverse colon to the rectum.

If the ends of the bowel are different sizes (the proximal end is usually bigger), place the sutures on the wider end further apart from each other, so that you meet at the same place on each lumen.

If the lumen is too narrow, or there is a 'dog ear' at the anastomosis, undo it and start again. *If you leave it, obstruction or a leak are inevitable.*

If there is a small leak, evidenced by bubbles from insufflations of the anus, at the anastomosis, identify the defect carefully, and invaginate it. Re-check if there is still a leak. If so, try again, but if there remains a leak, undo the anastomosis and start again.

If the ends of the bowel bleed, press them firmly for up to 5mins. If there is a bleeding vessel beside the bowel, clip and tie it.

If you cannot get access to the rectal stump to make an anastomosis by hand, extend the incision, make sure you have good abdominal relaxation, the small bowel is packed out of the way, and get another assistant to retract.

REVERSING HARTMANN'S OPERATION

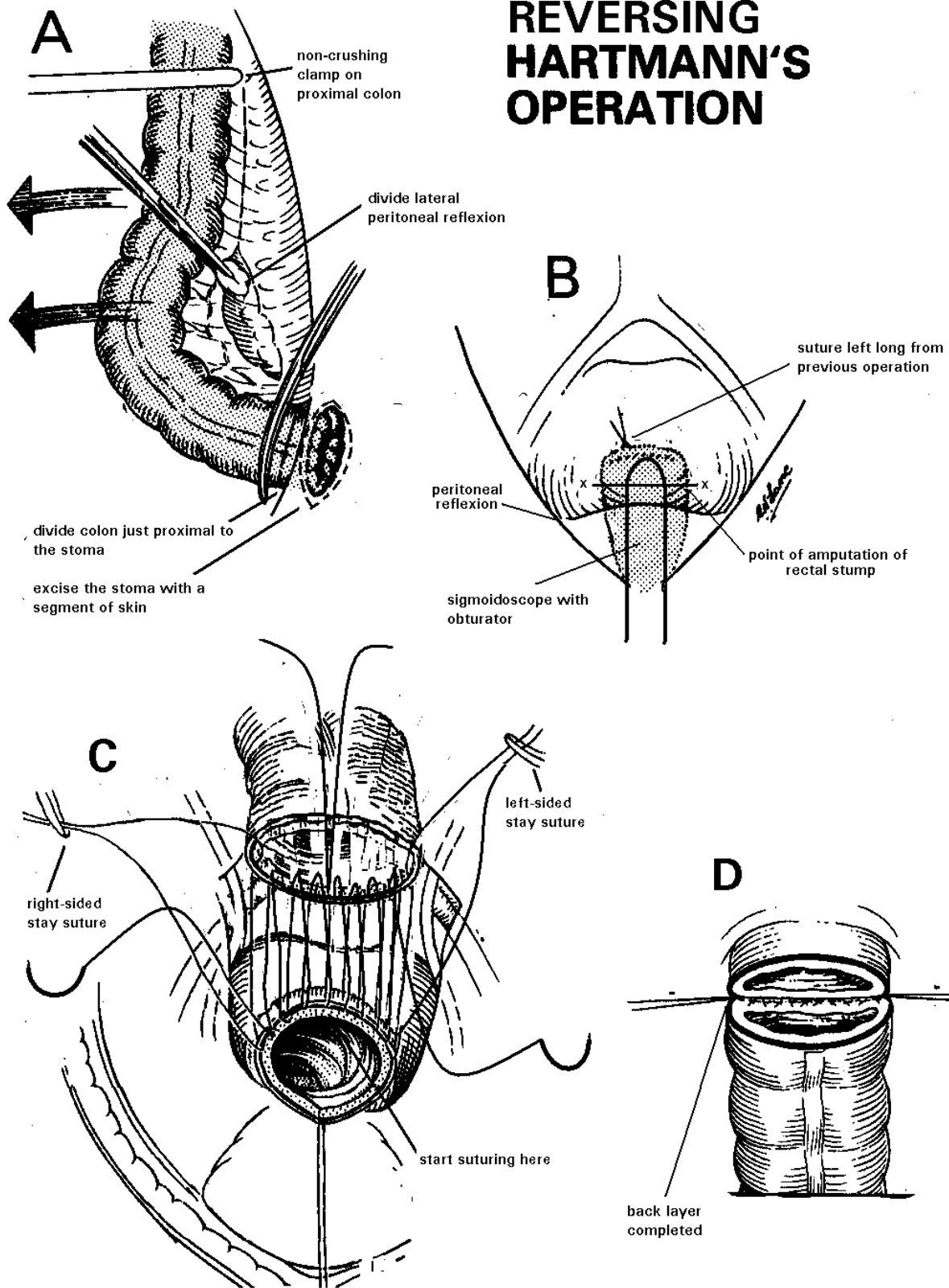


Fig. 12-15 REVERSING HARTMANN'S OPERATION.
The distal bowel is usually deeper in the pelvis, even than shown here. A, mobilize the colon. B, free the rectal stump and cut off the top of the rectal stump. C, place the seromuscular (Lembert) sutures that will draw the 2 ends of the bowel together. D, pull tight the sutures placed in C. Note that the 2 ends have been left long.

If you have an ANASTOMOSIS STAPLE GUN (4.10), it is especially useful here: make sure the bowel ends are clear of excess fatty tissue. Insert the instrument through the anus and make it come out lateral to the rectal closure rather than out in the middle of the closed lumen. Make sure that a monofilament purse string holds the rectal end snugly round the shaft of the instrument above the cartridge. Introduce the colonic end over the top of the anvil and secure it tightly below with another purse string. Screw the instrument so that cartridge and anvil come close together and a mark on the instrument appears to show they are close enough. Then release the safety catch and fire the instrument in one clean movement. Open the gun slightly to separate anvil and cartridge, and twist and turn the instrument gently to remove it from the anus. Examine the cartridge: if you find 2 complete doughnuts of bowel, the anastomosis is complete; if not, reinforce it by hand, which should now be possible as the rectum will be drawn up.

12.11 Colorectal carcinoma

Carcinoma of the large bowel is usually a slow-growing adenocarcinoma. It may project into the lumen like a cauliflower, or form a stricture (long or short), or an ulcer (which may not penetrate the bowel for about 18 months). It invades locally, spreads to the regional nodes or the liver (usually late), or through to the peritoneal cavity (late and uncommon). Tumours of the rectum spread upwards, whilst those of the anal canal (26.7) spread to the inguinal nodes.

Colorectal carcinoma is related to a low-fibre and high-fat diet, which is increasingly common in many affluent parts of the world but also in shanty-towns. Another factor is exposure to organochlorine pesticides. Endemic *schistosoma mansoni* predisposes to rectal carcinoma, and multiple familial polyposis likewise.

The patient is usually male, >45yrs, but is occasionally a young adult, who presents with:

- (1) Blood and mucus mixed within the stools.
- (2) An alteration in bowel habit.
- (3) A sense of incomplete defecation (tenesmus).
- (4) Colicky abdominal pain (incomplete obstruction).
- (5) Intestinal obstruction.
- (6) A fixed mass.
- (7) An anorectal, recto-vesical or recto-vaginal faecal fistula which appears spontaneously.

You are most likely to meet carcinoma of the large bowel when you operate for obstruction, and have to relieve it. This is why this topic is described here, although you may find a colorectal carcinoma without obstruction. Carcinoma of the rectum usually presents late, because it causes little pain in the early stages. You can feel most rectal carcinomas with your finger – either as a firm raised plaque, or an ulcer with hard rolled edges, leaving blood on your glove afterwards.

Don't mistake it for a fissure or haemorrhoids! You can detect probably c.50% of colon carcinomas with a simple rigid sigmoidoscope.

(a) History and examination

Symptoms have usually been present for several months. Look for:

- (1) Signs of loss of weight, anaemia and jaundice.
- (2) A primary mass, ascites, a hard craggy liver with metastatic tumour, or a hard umbilical (Sister Joseph's) nodule.
- (3) A rectal mass.

Get an idea of the site of the lesion by the symptoms:

Suggesting a lesion in the right colon: anaemia, a mass, caecal pain, weight loss, small bowel obstruction.

Suggesting a lesion in the left colon: colicky abdominal pain, alteration of bowel habit (diarrhoea alternating with constipation), blood mixed with stools, large bowel obstruction.

Suggesting a lesion in the rectum: rectal bleeding, diarrhoea, a feeling of incomplete evacuation.

(b) Assessment

SIGMOIDOSCOPY (GRADE 1.2)

If you feel a rectal mass, examine the lesion under GA in the lithotomy position (26-4B). Feel if the tumour is mobile or fixed. Take a biopsy from its edge: not all rectal strictures are malignant! Pass a sigmoidoscope (26.1) to look for other tumours: *most adenocarcinomas of the colorectum are accessible to the finger or sigmoidoscope!*

(c) Radiographs

If the above investigations are negative and you still suspect a carcinoma, if there is no colonoscope to hand, perform a barium enema. This is not easy, but it can be done in a district hospital. Use barium and air phase contrast (38.1). Avoid a barium enema when there is complete or partial obstruction. Get a chest radiograph to exclude pulmonary metastases.

(d) Ultrasound is very useful to detect liver metastases (38.2b). If there is a palpable mass, it might give details of its nature, size, and involvement of other structures.

(e) Differential diagnoses include:

- (1) Other causes of blood in the stools (haemorrhoids, amoebiasis, and dysentery) (26.4).
- (2) Other causes of altered bowel habit (bowel infections, poor food supply, upper abdominal malignancy).
- (3) Other causes of acute-on-chronic obstruction (sigmoid volvulus, amoebic stricture, Chagas disease).
- (4) Other causes of rectosigmoid strictures (amoebiasis, lymphogranuloma venereum (especially in women), schistosomiasis, herbal enemas).

(f) Management depends on how skilled you are and:

- (1) Confirmation of malignancy.
- (2) Where the tumour is.
- (3) Its staging.
- (4) If the bowel is obstructed or not.

(g) Preparation. If there is no obstruction, you will be able to perform a planned elective operation. Try to empty the colon first.

Enemas only clear the distal part, so you can use magnesium sulphate (Epsom salts) 10g (or other available laxatives) the evening before operation, and again early in the morning on the day of operation to clear the bowel.

N.B. Evidence now suggests that total bowel preparation may be unhelpful, although an obviously full colon must increase the risk of infection if there is spillage. This spillage will be worse, though, if the bowel content is liquid. It may just be simpler to restrict the diet to yoghurt and foods of low residue 1wk pre-operatively. If you use bowel preparation, you must replace fluid lost by osmosis into the bowel by plenty of oral fluids.

Start metronidazole 400 mg tds, and restrict to oral fluids only on the evening before operation. Cross-match 2 units of blood. Add gentamicin 120mg IV timed 30-60mins before you start the operation.

(h) Operation

LAPAROTOMY FOR COLORECTAL CARCINOMA (GRADE 3.4)

Make a long midline incision, or a long transverse subumbilical incision. Palpate the tumour for staging. It is a firm mass involving the colon; an inflammatory mass may look and feel the same, so keep an open mind! A tumour can be mobile, tethered to surrounding structures, or fixed.

It may be unresectable if it is fixed to the pelvic wall, the abdominal wall, or the bladder. *You will have to assess how readily you can resect the tumour: a more experienced surgeon may manage a more extensive resection, but the prognosis may not necessarily be improved thereby.* If chemotherapy (cisplatin, fluorouracil and folinic acid) is available, it may shrink an unresectable tumour and make it resectable.

It is inoperable if there are palpable masses in the liver, widespread metastatic mesenteric lymphadenopathy, or malignant ascites (or of course metastases elsewhere outside the abdomen).

If the bowel is obstructed (much the most likely occasion on which you will meet this tumour), to relieve the obstruction you can fashion a proximal defunctioning colostomy, or perform a resection and colostomy, or a resection and anastomosis.

CAUTION! The contents of the large bowel are always loaded with bacteria, so when you have to operate in an emergency for obstruction, avoid contaminating the peritoneal cavity, and try to decompress the proximal colon as much as you can.

If the tumour is proximal to the mid-transverse colon (12-16A):

(1) **If the tumour is resectable**, resect the caecum; this is major surgery (12-16G). If the ileum is not the same size as the colon, you can make a cut on the antimesenteric border to enlarge it (11-6). When you anastomose the ileum to the transverse colon, remember to save as much ileum as

you can, because its last few centimetres are the site of absorption of vitamin B12.

N.B. Don't fashion a colo-caecal anastomosis: the resection is inadequate and will not have a good blood supply.

LARGE BOWEL CARCINOMA

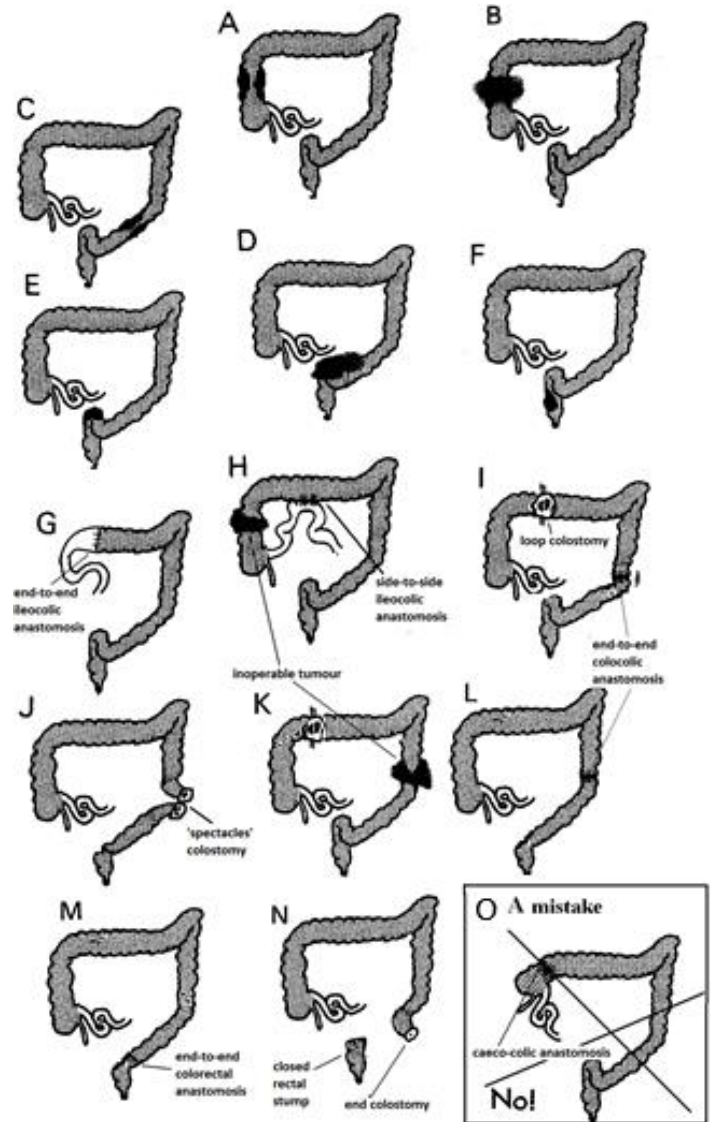


Fig. 12-16 LARGE BOWEL CARCINOMA.

Carcinomas in various sites: A, ascending colon operable. B, inoperable. C, descending/sigmoid colon operable. D, inoperable. E, upper rectum. F, lower rectum.

Solutions: G, right hemicolectomy with an end-to-end ileocolic anastomosis. H, side-to-side ileocolic bypass anastomosis. I, excision of tumour of the left colon with protective loop colostomy. J, excision of tumour of the left colon with adjacent colostomy. K, colostomy to relieve obstruction by tumour of the descending colon. L, primary resection with colo-colic anastomosis. M, primary resection with colorectal anastomosis. N, Hartmann's operation.

N.B. don't fashion a colo-caecal anastomosis (O).

(2) **If the tumour is not resectable** (12-16B), bypass the obstruction with a side-to-side ILEOTRANSVERSE ANASTOMOSIS (GRADE 3.4) (11-10, 12-16H).

(3) If the colon is obstructed:

- (i) If the condition is good and you are experienced, perform a right hemicolectomy, as in (1).
- (ii) If the condition is poor or you are inexperienced, make a bypass, as in (2). This might thereby mean missing the opportunity of a curative resection, however.

If the tumour is between the mid-transverse colon and the sigmoid colon (12-16C):

(1) **If the tumour is resectable**, resect the involved bowel with its associated mesentery, leaving a margin at least 5cm proximal to the tumour. Perform an end-to-end anastomosis (12-16M). The bowel ends must have a good blood supply. If not, resect more bowel, but not more mesentery. The extent of this operation varies from being a LIMITED COLECTOMY (GRADE 3.2) to being a LEFT HEMICOLECTOMY (GRADE 3.5). Try to remove the tumour and its lymphatic drainage area to make a satisfactory oncologic resection, but *don't compromise the patient's survival by being too heroic!* If necessary, try to get a more experienced colleague to perform a wider resection if that would be possible.

Beware of the left ureter, which is easily reflected with the descending and the sigmoid mesentery (12-13A) and *the spleen*, if you need to mobilize the splenic flexure. Make the anastomosis in 2 layers, as for small bowel, preferably with a non-absorbable suture for the outer layer. *Make sure the anastomosis is not under tension.*

(2) **If the tumour is not resectable** (12-16D), bypass the obstruction with a side-to-side COLO-COLIC ANASTOMOSIS (GRADE 3.4) or make a defunctioning right transverse loop colostomy (11-14, 12-16I).

(3) If the colon is obstructed:

- (i) If the condition is good and you are experienced, proceed as (1) provided the bowel ends have a good blood supply and you can satisfactorily clean the bowel.
- (ii) If not, as this is rarely possible, resect the bowel and bring the two cut ends out as a double-barrelled colostomy (11-12D, 12-16J). Close this electively later.

If the tumour is in the sigmoid or upper rectum (12-16E):

(1) **If the tumour is resectable**, resect the SIGMOID (GRADE 3.4) or upper rectum, leaving 5cm margins clear of the tumour, as for a sigmoid volvulus (12.9). *Beware of the left ureter.* You may need to mobilize the proximal colon to make sure it reaches the distal end without tension. Perform an end-to-end anastomosis (12-16M). If access to the anastomosis is difficult, start it at the back (posteriorly) in the middle with 2 separate sutures knotted together and work round towards the left and right sides in turn, finishing at the front (anteriorly). If you cannot make a safe anastomosis, bail out and fashion a colostomy and mucous fistula or perform a Hartmann's operation (12.9).

If you have made an anastomosis which you think may leak, make a defunctioning proximal colostomy in addition. This won't have any effect on the risk of an anastomotic leakage, but will make it less dangerous for the patient.

(2) **If the tumour is not resectable** (12-16D), make a defunctioning right transverse loop colostomy (11-13): this is preferable to a sigmoid colostomy which may later be encroached by spreading tumour.

(3) If the colon is obstructed:

- (i) Resect as above in (1) and make a colostomy proximally and a mucous fistula distally, or
- (ii) Perform a Hartmann's operation: resect the sigmoid, bring out the proximal bowel as an end-colostomy, and close the rectal stump (12.9, 12-16N). If you are confident with bowel anastomoses, you can clean out the bowel by decompressing it proximally, or doing an intra-operative washout (12.9), and make a primary anastomosis; make sure you test it afterwards by filling the pelvis with water and blowing air up the rectum (12.10).

If the tumour is in the middle or lower rectum (12-16E):

(1) **If the tumour is resectable**, you should not have proceeded unless you can perform an anterior or abdomino-perineal resection of the rectum, or, better, a rectal resection with a colonic pull-through and colo-anal anastomosis. Biopsy the tumour through a proctoscope or sigmoidoscope if this was not already done. If the tumour is stenosing and likely to obstruct, make a sigmoid loop colostomy (11.6).

(2) **If the tumour is not resectable**, make a sigmoid loop colostomy (11.6) unless you think he will die before he becomes obstructed. Radio- or chemotherapy (as before) may shrink the tumour and make it resectable.

(3) **If the colon is obstructed**, make a transverse colostomy, if you think he could have definitive surgery later, or a sigmoid loop colostomy if this is unlikely.

CAUTION! If there are liver metastases or a fixed tumour, think hard before you make a colostomy. The patient may live a few more months, but dying with a colostomy will be miserable, especially if colostomy care is poor. If the tumour is not resectable, it is better to perform a bypass operation, an ileotransverse or colo-colic anastomosis. This is possible for lesions of the ascending, transverse, or descending colon, but not the distal sigmoid or the rectum.

If a bypass is impossible, however, a colostomy is better than dying in obstruction.

(i) Lavage. When the operation is over, wash out the peritoneal cavity with warm fluid; *don't insert drains.*

12.12 Caecal volvulus

Rarely, the caecum, ascending colon and ileum may all twist. This can only happen if they are all free to rotate as the result of a rare anomaly of the mesentery. This is more common during pregnancy. Twisting causes sudden severe pain and vomiting. The abdomen distends and becomes tender centrally and in the right lower quadrant. Signs of strangulation develop quickly.

(a) **Abdominal radiographs** show a huge appearance of gas which is not where the caecum should be, but is central, or even in the left upper quadrant where it may mimic the stomach. Unlike a sigmoid volvulus (12-12B), this radiological appearance does not have 2 limbs descending into the pelvis.

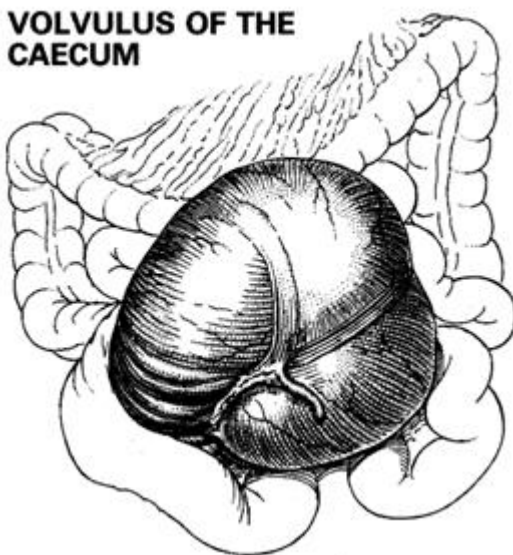


Fig. 12-17 VOLVULUS OF THE CAECUM can only happen if the caecum, ascending colon and ileum are all free to rotate as a result of a rare anomaly of the mesentery.

Adapted from a drawing by Frank Netter, with the kind permission of CIBA-GEIGY Ltd, Basle, Switzerland.

(b) Operation

Make a midline laparotomy incision. A huge drum-like structure seems to fill the entire abdominal cavity. Decompress it (12-6). When you inspect the right lower quadrant, you will find that the caecum is not in its normal place. Untwist the caecum.

If it is viable, ask your assistant to retract the right side of the abdominal incision. Anchor the caecum to the peritoneum to the right of it with several seromuscular non-absorbable sutures, passed through its taenia. *Don't complicate this procedure by fashioning a caecostomy, or adding an appendectomy, which may contaminate a previously clean operation.*

If it is not viable, and you are skilled, perform a right hemicolectomy (12.11). If you are less skilled, exteriorize it, as for an ileocolic intussusception (12.7).

12.13 Chagas megacolon

In South America, almost 20% of the adult rural population may be infected by the parasite *trypanosoma cruzi*, which is deposited in insect faeces on the skin and introduced into the circulation by scratching. The parasite is carried by a bug, *triatoma infestans*, which lives in cracks in walls and in thatch, and can be killed by insecticide spraying.

A neurotoxin released and inflammatory reactions cause destruction of the Meissner and Auerbach neural plexuses in the colon, resulting in uncoordinated peristalsis especially in the distal colon; this is exactly the same picture as in Hirschsprung's disease in the baby.

The result is tenesmus, progressive constipation, difficulty evacuating flatus, abdominal distension and spurious diarrhoea. Faecal loading may result in sigmoid volvulus (12.9). The usual picture is a megacolon. *Trypanosoma* may also affect the heart and oesophagus, giving a picture like achalasia (30.6). HIV may cause reactivation of dormant infection, so you should screen for HIV.

(a) **Blood films.** Fix thin capillary blood films in methanol and stain both thin and thick films by Giemsa, immersing the thick films beforehand for 1sec in 0.5% aq. methylene blue. Microfilariae can be seen at x100 or x400 magnification. (More sophisticated haemagglutination or immuno-fluorescence tests are also available.)

(b) **Abdominal radiographs.** Faecal loading results in dilation of the colon, initially distally. Appearances of sigmoid volvulus may develop.

(c) **Management.** Advice on hygiene and high-fibre diet is all that is needed for early cases; enemas may need saline drip irrigation in addition to soften faecalomas. You may have to effect a manual evacuation.

You are unlikely to offer a definitive surgical solution, which involves either a low anterior resection of the rectosigmoid, or an abdomino-perineal pull-through resection with delayed anastomosis.

12.14 Mesenteric thrombosis

If the mesenteric blood supply is compromised, patches or whole segments of small bowel may become ischaemic. Chronic arterial insufficiency can produce longstanding discomfort ('intestinal angina'), but there is usually a dramatic acute vascular event.

If this is arterial from an embolus, the result is sudden ischaemia of the small bowel which rapidly becomes necrotic.

If the thrombosis is venous, there is infarction of bowel but because of the vascular arches this may be incomplete and patchy. Venous thrombosis occurs especially in HIV disease, in *angiostrongylus costaricensis* infestation (seen

in Central and South America), in *clostridium perfringens* infection (14.4) and after radiation damage.

The result is, in both cases, peritonitis as bowel organisms translocate through the ischaemic bowel wall. This may be difficult to distinguish from pancreatitis and amylase levels may be raised.

(a) Abdominal radiographs

Featureless bowel gives no clue towards the diagnosis initially, but thickened bowel wall with air within the wall develops later; occasionally you can see air in the intrahepatic portal veins!

(b) Management. Often you only discover the problem at laparotomy.

If bowel is frankly necrotic, resect the affected portion.

If the bowel is suspicious, apply warm packs, and if after 5mins the bowel remains suspicious, lavage, close the abdomen and plan an elective re-laparotomy after 48h. Administer heparin. A defunctioning ileostomy is no real benefit.

If there is patchy necrosis, resect affected portions, but try to limit the number of anastomoses to 2 or 3 at maximum; you may have to sacrifice normal bowel to do this. If you are uncertain about the blood supply around an anastomosis, make an ileostomy or plan a re-laparotomy after 48h.

If there is an obvious embolus in a mesenteric artery, try to remove it using a Fogarty embolectomy balloon catheter after isolating the artery segment with bulldog clamps, if the bowel is still viable. If you fail, resect the non-viable bowel.

12.15 Other causes of intestinal obstruction

You are unlikely to make the diagnosis of rarer causes of intestinal obstruction before operation; even to the experienced surgeon, the abdomen is full of surprises. Here are some guidelines:

If there is widespread carcinoma, avoid a stoma. Try to perform a bypass operation (12.11).

If you find an inflammatory swelling in the caecum or colorectum, it may be an amoeboma (14.5), a bilharzioma, actinomycosis, paracoccidiomycosis (14.1), Crohn's disease (14.2) or TB (16.3). You may not be able to make a diagnosis without histology, so take a biopsy. If there is incomplete obstruction, continue nasogastric drainage and IV fluids post-operatively, providing medical treatment for whatever is most likely in your region. If there is complete obstruction, perform a colostomy or bypass, take a biopsy of inflammatory tissue taking care not to perforate bowel, and start medical treatment.

If an intra-abdominal abscess is causing obstruction, drain the abscess: this will usually be enough to relieve the

obstruction. If there is a retained swab, it may have eroded into bowel. Remove it carefully, and examine the bowel very carefully for perforations; if you find it is damaged, *don't try to repair holes* but perform a formal resection.

If you feel a solid object at the point where the distended loops join the collapsed ones, decompress the obstructed bowel proximally and apply non-crushing clamps to the empty segment. If you can easily move the solid object to another site in the bowel where the mucosa will not have been ulcerated, do so. Isolate the segment with packs and make a longitudinal incision in its antimesenteric border. Remove the foreign body and repair the bowel transversely. If it is a gallstone, it has come through a fistula from an inflamed gallbladder. Extract the stone, look for a second one if the first is faceted, and leave the gallbladder alone.

If it is a food bolus that has impacted in the small bowel especially if there is a gastrojejunostomy (13.7), try to break it up and massage down into the caecum. If you fail, perform an enterotomy as above. Sometimes narcotics smugglers ingest packets of drugs and these obstruct. Be careful not to spill their contents as sudden absorption of cocaine, for example, may be fatal.

If you find a tumour in the small bowel causing obstruction, look for other such tumours (especially purplish Kaposi sarcoma lesions). Resect the affected portion of small bowel.

If there are many inflammatory adhesions between loops of bowel, *don't try to resect bowel*. This may be Crohn's disease. Take a biopsy of a node to check for TB. Continue nasogastric suction and IV fluids till the inflammation settles.

If there is atresia of the jejunum in a neonate (33.2), much of the proximal bowel is diseased, and it is inevitably hugely distended compared with the distal bowel. Check for more areas of atresia distally by injecting saline into the distal bowel. Resect as much proximal bowel as possible and perform an end-to-back anastomosis, opening the distal bowel on its antimesenteric border.

If an internal hernia is obstructing the bowel, it will probably be of the closed loop variety. You can usually divide the obstructing structure quite safely, but be careful with a hernia into the recess formed by the paraduodenal fold at the duodeno-jejunal flexure, because you can easily cut the inferior mesenteric vein. If bowel is strangulating through a hole in the mesentery, *don't cut the neck of the constricting ring*, or it will probably bleed severely. Instead, decompress the distended loop (12-6), withdraw it, and close the defect in the mesentery, carefully avoiding its blood vessels.

If you find the ileum encased in a membrane in a woman, carefully open this 'cocoon' and free the bowel. *Don't perform an ileocaecal resection*.

If there is an inflammatory mass or abscess around colonic diverticular disease, drain it. If inflammation is

severe or extensive, or there is evidence of perforation or spillage (you will be able to smell it!), perform a proximal defunctioning colostomy, and leave a drain. *Don't try to resect the inflamed colon, unless you are experienced!*

If there is radiation damage to bowel, it will not hold sutures well. Bypass the obstruction.

If there is a submucosal haematoma in the ileum, and the patient was taking anticoagulants, administer vitamin K 10mg IM stat and leave the haematoma alone. Rest the bowel by nasogastric suction.

12.16 Ileus and obstruction following abdominal surgery

After a laparotomy, the normal muscular action of the bowel is usually absent for 6-72h. The return of normal bowel sounds is a sign that the bowel is starting to work properly again. The presence of a nasogastric tube and the use of opioids inhibit the return of bowel action, which is stimulated by early nutrition, mobilization out of bed, and the use of epidural analgesics.

The bowel may fail to function as a result of:

- (1) Paralytic ileus, which is a prolongation of the normal post-operative inactivity of the bowel. This is the commonest cause, especially after an operation for abdominal sepsis.
- (2) Persistent sepsis, either inadequately dealt with or from a new cause.
- (3) Hypokalaemia or hypo-albuminaemia.
- (4) Mechanical obstruction due to adhesions or, more rarely, intussusception or an internal hernia.
- (5) Constipation as a result of long immobility in bed.

Distinguishing between these causes is difficult because:

- (a) post-operative obstruction may cause little or no pain;
- (b) a recent abdominal incision makes careful abdominal palpation more difficult.

If there are no bowel sounds in the abdomen and it steadily distends after an abdominal operation, make meticulous observations of the vital signs.

Administer an enema if there is faecal residue in the rectum. Mobilize the patient. Encourage him to chew gum. Observe for signs of peritonitis: unless there is deterioration, treat symptomatically for ileus and obstruction, and *don't re-operate*. This will allow an inflammatory mass time to resolve.

However, you should re-operate if there are signs of peritoneal irritation (which could be due to a leaking anastomosis, iatrogenic bowel damage, haemorrhage or new infection), or some mechanical obstruction unrelated to the original operation.

An ultrasound may detect a localized abscess (38.21), but this will usually take 5 days to form.

Don't wait too long; if there is no improvement within 48-72h of a laparotomy for serious sepsis, perform a second-look laparotomy (10.1), especially if the patient is HIV+ve. You will be able to wash out further sepsis, clean out any cavities you have missed, check for viability of bowel or leak from anastomoses.

NJORGE (10yrs) had a splenectomy for a ruptured spleen. On the 3rd post-operative day he was clearly not well. He had obstructive bowel sounds, some colicky pain, and a moderate amount of fluid was coming up the nasogastric tube. He was immediately operated on and an intussusception was found. *LESSON Don't wait too long before you re-open an abdomen*; be guided by the whole clinical picture. Early mechanical obstruction such as this is rare; ileus is more usual.

DISTINGUISH BETWEEN POST-OPERATIVE BOWEL OBSTRUCTION AND PARALYTIC ILEUS

After a messy operation with much pus, bleeding or spillage, expect ileus with *absent* bowel sounds. After a clean operation, severe ileus is unlikely; if present, it therefore points to a serious problem. Mechanical obstruction results in *increased* bowel sounds. Ileus tends to occur *earlier* and mechanical obstruction *later*.

Examine the patient frequently, asking these questions: Has he any pain? Is he passing any flatus? Is abdominal distension increasing or decreasing? How much nasogastric fluid is being aspirated? Have the bowel sounds returned? Does he have signs of peritonitis? Is there pyrexia, tachycardia, tachypnoea? Is the general condition deteriorating? *Frequent re-assessment of a patient is more valuable than any single symptom, sign or test.*

Typically, absent bowel sounds indicate ileus, and 'tinkling' ones indicate mechanical obstruction: these are late signs, however. If there is little pain, and radiographs show gas-filled loops with fluid levels all through the large and small bowel, ileus is more likely.

A patient who has passed flatus, and even stool, who then starts to distend and vomit, is more likely to have a significant problem. Unless frank signs of obstruction ensue, you should be able to treat him conservatively with nasogastric suction. If you can, try a gastrografin (*not barium*) challenge to see if there is a leak, and if contrast reaches the rectum.

Assess if the case is one where small bowel obstruction is likely, *viz.* multiple adhesions, not all released; hernia orifices unchecked; appendicectomy phlegmon or stump remaining; or where a re-laparotomy is going to be very difficult, *e.g.* a 'frozen abdomen' due to adhesions or radiation damage; carcinomatosis.

If distension progresses from Day 1 and is still present on Day 5 but the abdomen is not tender, there is probably a simple ileus. The normal post-operative muscular inactivity usually starts to resolve after 72h, but may last 7-14 days or more in the presence of infection, metabolic imbalance, impaired renal function or severe general illness.

INTESTINAL OBSTRUCTION AND PARALYTIC ILEUS

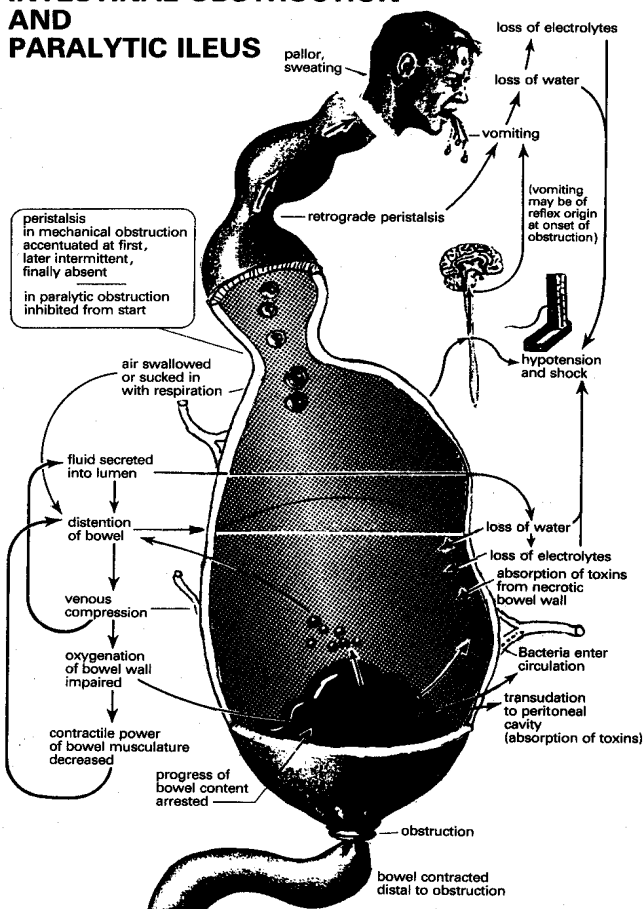


Fig. 12-18 **INTESTINAL OBSTRUCTION AND PARALYTIC ILEUS.** The passage of intestinal contents down the bowel can be prevented by a mechanical obstruction, or by a functional disturbance of the motility of the bowel (paralytic ileus). The physiological effects are much the same in both and are shown here.

Adapted from a drawing by Frank Netter, with the kind permission of CIBA-GEIGY Ltd, Basle, Switzerland.

If the recovery was good until Day 5, and then distension starts, there is probably a mechanical obstruction, especially if there is colic, 'tinkling' bowel sounds, distension, vomiting, but no fever. The tinkling bowel sounds may be intermittent, so you may have to listen for a long time.

If, at Day 5, the abdomen is silent and painless, with fever and a raised white count, this is probably an ileus. Suspect residual septic fluid collections and get an ultrasound scan (38.21). Aspirate fluid and test for bile with a urine dipstick: if present, this strongly suggests a bowel leak, needing an urgent re-laparotomy.

If normal bowel function starts, and then stops again, or there is vomiting or distension, or you aspirate progressively more fluid, even >3L/day, suspect mechanical obstruction. If at the same time there is diarrhoea, there may be a pelvic abscess or, uncommonly, staphylococcal enterocolitis, or a partial obstruction, which allows some fluid to pass and obstructs the rest. Maintaining the fluid balance will be difficult.

If you have excluded enterocolitis, and ultrasound scans suggest fluid collections (38.21), re-open the abdomen.

If there is no flatus for some hours when previously present, colicky pain, or radiographs show distended small bowel and collapsed large bowel, no fever and tinkling bowel sounds, suspect mechanical obstruction.

(a) Non-operative treatment

Continue nasogastric suction, administer IV 0.9% saline and replace electrolytes (11.9). Hypokalaemia aggravates ileus, so take care to add supplements to replace the potassium lost in the intestinal secretions. About 40mmol/day at least is needed.

(b) Operation

RE-LAPAROTOMY FOR POST-OPERATIVE BOWEL OBSTRUCTION (GRADE 3.4)

Proceed as for obstruction due to adhesions (12.6). If you do decide to re-open the abdomen, do so *very carefully*, so as not to make more damage in the bowel and create a situation far worse than before.

Take great care not to exert traction on previous anastomoses. Always decompress distended small bowel before you re-close the abdomen.

If you find much sepsis, wash out the abdomen thoroughly and look for a bowel leak.

If this is in the small bowel or is a small leak in the large bowel, close it with interrupted non-absorbable sutures, and exteriorize that portion of bowel, or fashion an enterostomy.

If this is in the proximal jejunum, introduce a feeding tube in the distal part of the bowel. You can also put a tube inside the bowel proximal to the leak, and drain this into the bowel distal to the leak: make sure you anchor this tube firmly, and make it pass outside the abdomen so you can monitor what is passing through it.

If there is a large leak in the colon, resect the affected portion, close the distal stump and bring the proximal colon out as an end-colostomy (like a Hartmann's operation: 12.9).

If there is minimal contamination within 48h of the previous operation, you will be justified in repairing the leak with interrupted transverse invaginating sutures.