Colon

Introduction

The prevalence of diverticular disease in the western world is 60% over the age of 60 years. The condition is found in the sigmoid colon in 90% of cases, but the caecum can also be involved and, on occasion, the entire large bowel can be affected. Interestingly in South-east Asia, right-sided diverticular disease is twice as common as the left. The main morbidity of the disease is due to sepsis.

Aetiology

Diverticula of the colon are acquired herniations of colonic mucosa, protruding through the circular muscle at the points where the blood vessels penetrate the colonic wall. They tend to occur in rows between the strips of longitudinal muscle, sometimes partly covered by appendices epiploicae. The rectum with its complete muscle layers is not affected. It is thought to be related to reduced fibre in the western diet. This results in low stool bulk with resulting segmentation and hypertrophy of the colonic wall musculature, thus causing increased intraluminal pressure. Diverticular disease is rare in Africans and Asians, who eat a diet that is rich in natural fibre.

Diverticulosis

It is important to distinguish between diverticulosis, which may be asymptomatic, and clinical diverticular disease in which the diverticula are causing symptoms. On histological investigation, the diverticulum consists of a protrusion of mucous membranes covered with peritoneum. There is thickening of the circular muscle fibres of the intestine, which develops a concertina or saw-tooth appearance on barium enema (Fig. 65.12).

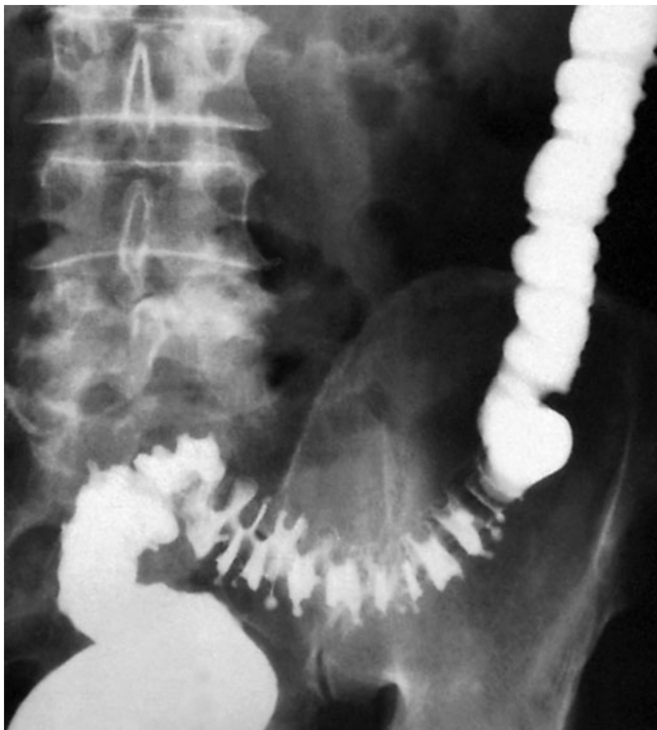

Figure 65.12 Barium enema showing sigmoid diverticular disease 'saw-teeth' and diverticula (courtesy of Dr D. Nolan, John Radcliffe Hospital, Oxford, UK).

Diverticulitis

Diverticulitis is the result of inflammation of one or more diverticula, usually with some pericolitis. It is not a precancerous condition, but cancer may coexist (Summary box 65.2).

Summary box 65.2

Complications of diverticular disease

- Diverticulitis
- Pericolic abscess
- Peritonitis
- Intestinal obstruction
- Haemorrhage
- Fistula formation

The complications are the following:

1. Recurrent periodic inflammation and pain – in some patients, these episodes may be clinically silent.
2. Perforation leading to general peritonitis or local (pericolic) abscess formation.
3. Intestinal obstruction:
   a. in the sigmoid as a result of progressive fibrosis causing stenosis;
   b. in the small intestine caused by adherent loops of small intestine on the pericolitis.
4. Haemorrhage: diverticulitis may present with profuse colonic haemorrhage in 17% of cases, often requiring blood transfusions.
5. Fistula formation (vesicocolic, vaginocolic, enterocolic, colocutaneous) occurs in 5% of cases, with vesicocolic being the most common.

Clinical features

Elective

In mild cases, symptoms such as distension, flatulence and a sensation of heaviness in the lower abdomen may be indistinguishable from those of irritable bowel syndrome.

Emergency

Persistent lower abdominal pain, usually in the left iliac fossa, with or without peritonitis, could be caused by diverticulitis. Fever, malaise and leucocytosis can differentiate diverticulitis from painful diverticulosis. The patient may pass loose stools or may be constipated; the lower abdomen is tender, especially on the left, but occasionally also in the right iliac fossa if the sigmoid loop lies across the midline. The sigmoid colon is often palpable, tender and thickened. Rectal examination may, but does not usually, reveal a tender mass. Any urinary symptoms may herald the formation of a vesicocolic fistula, which leads to pneumaturia (flatus in the urine) and even faeces in the urine.

Classification of contamination

Studies have shown that the degree of sepsis has a major impact on outcome. Those with inflammatory masses have a lower mortality than those with perforation (3% vs. 33%). Classification systems have been developed for acute diverticulitis, of which Hinchey is the most commonly used (Table 65.1).

E.F. Hinchey, P.G.H. Schaol and G.K. Richards. **Treatment of perforated diverticular disease of the colon.** *Adv Surg* **1978; 12: 85–109.**

Table 65.1 Classification of diverticulitis

Stage	Severity	Pain	Systemic	Investigation	Management
1	Pericolic abscess or phlegmon	LIF	Possibly no change	Delayed barium enema, endoscopy	Bowel rest, IV antibiotic, DVT prophylaxis and fluids
2	Pelvic or intra-abdominal abscess	Severe, fullness in LIF	Mild toxic	CT	Percutaneous drainage
3	Non-faeculent peritonitis	Peritonitis	Toxic	CT	Resuscitation + operation
4	Faeculent peritonitis	Peritonitis	Severe toxicity, shock	Proceed to operation	Resuscitation + immediate operation

DVT, deep venous thrombosis; IV, intravenous; CT, computerised tomography; LIF, left iliac fossa.

Diagnosis

Radiology

Although the diagnosis of acute diverticulitis is made on clinical grounds, it can be confirmed during the acute phase by computerised tomography (CT). It is particularly good at identifying bowel wall thickening, abscess formation and extraluminal disease. The specificity is high and it is able to demonstrate other pathology. It has revolutionised the assessment of complicated diverticular disease. On identification of abscesses in stable patients, drainage may be carried out percutaneously. Such an option may delay or postpone further operative procedures.

Barium enemas (Fig. 65.13) and sigmoidoscopy are usually reserved for patients who have recovered from an attack of acute diverticulitis, for fear of causing perforation or peritonitis. Water-soluble contrast enemas may, however, be helpful in sorting out patients with large bowel obstruction. In the acute situation, it is good at detecting intraluminal changes and leakage. The sensitivity for this is of the order of 90%. Barium radiology is carried out to exclude a carcinoma and to assess the extent of the disease.

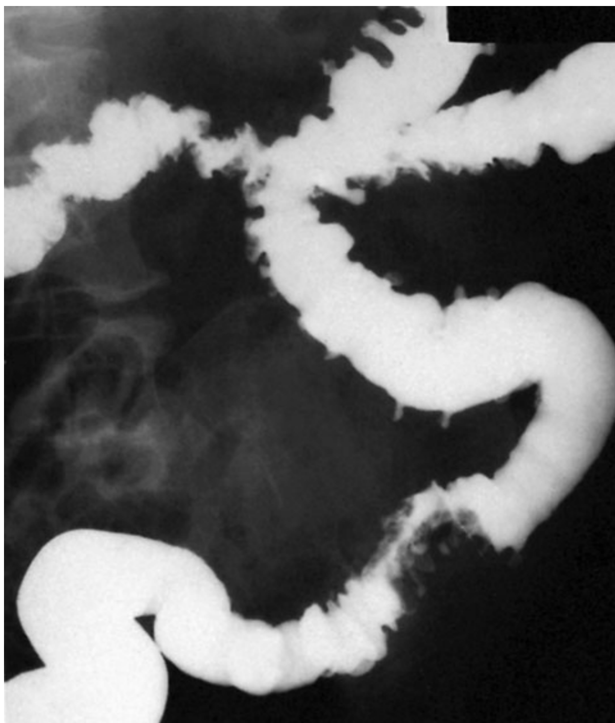

Figure 65.13 Barium enema showing a large filling defect in the sigmoid colon caused by a pericolic abscess (courtesy of Dr D. Nolan, John Radcliffe Hospital, Oxford, UK).

Where the sigmoid colon is thickened and narrowed, a 'saw-tooth' appearance may be seen. Some strictures can be very difficult to distinguish by radiology alone and, in those circumstances, colonoscopy will be necessary to rule out a carcinoma. Vesicocolic fistulae should be evaluated with cystoscopy and biopsy in addition to colonoscopy. Contrast examinations may show the fistula itself. The differential diagnosis for vesicocolic fistulae (and other fistulae) includes cancer, radiation damage, Crohn's disease (CD), tuberculosis and actinomycosis.

Colonoscopy

Colonoscopy may reveal the necks of diverticula within the bowel lumen (Fig. 65.14). A narrowed area of diverticulitis can be entered but, on occasion, not passed because of the severity of disease. The differential diagnosis from a carcinoma can be impossible if a tight stenosis prevents colonoscopy. In equivocal cases, biopsies may be taken.

Management

Non-complicated

Diverticulosis should be treated with a high-residue diet containing roughage in the form of wholemeal bread, flour, fruit and vegetables. The evidence for this is not of a high quality. Bulk formers such as bran, Celevac, Isogel and Fybogel may be given

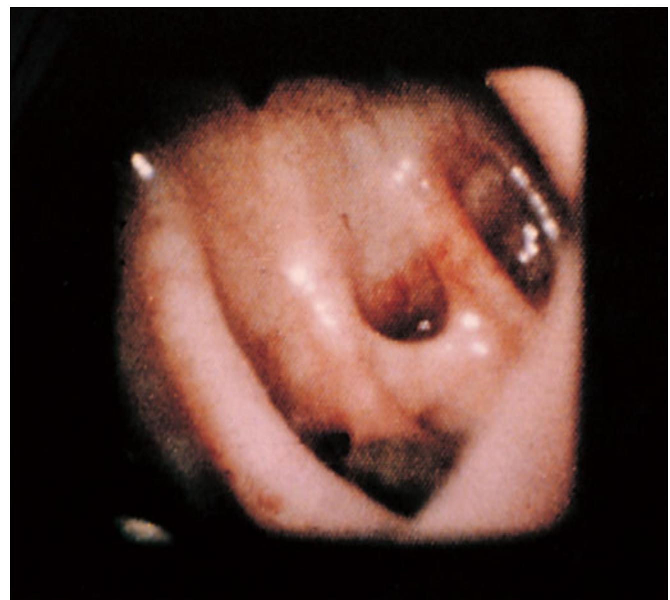

Figure 65.14 Colonoscopic view of sigmoid diverticula. Note the mouths of diverticula between the hypertrophied colonic walls.

until the stools are soft. Painful diverticular disease may require antispasmodics.

Acute diverticulitis is treated by bed rest and intravenous antibiotics (usually cefuroxime and metronidazole). After the acute attack has subsided, and if the diagnosis has not already been confirmed by CT, a barium enema should be administered (Summary box 65.3).

Summary box 65.3

Principles of surgical management of diverticular disease

- In elective cases with full bowel preparation, resection and primary anastomosis is usually possible
- If there is obstruction, oedema, adhesions or perforation, Hartmann's procedure is usually the operation of choice
- In selected cases, resection and anastomosis after on-table lavage may be possible
- Laparoscopic assessment has been described but is controversial
- In cases of minimal peritoneal contamination, peritoneal lavage followed by suture of a small perforation can also be performed

Operative procedures for diverticular disease

The aim of surgery is to control sepsis in the peritoneum and circulation. Indications for operation include general peritonitis and failure to resolve on conservative treatment. Surgery, especially in the acute setting, has considerable risk. Postoperative mortality and reoperation rate for elective resection are 5% and 12%, respectively, which compares with 17% and 16% for emergency surgery. There is controversy as to whether a more radical approach should be adopted. Historically, data have shown that mortality was lower in patients in whom the inflamed colon was resected. However, two randomised comparative trials have shown that mortality is lower in the group in which a proximal defunctioning stoma is performed. The decision needs to be made by the individual surgeon based on the general state of the patient.

The risk of recurrence in patients with moderate diverticulitis is only 14%. This compares with 39% for severe diverticulitis. Therefore, a policy of monitoring can be used in elderly patients following an acute attack that settles. Younger patients unfortunately have a higher risk of recurrence (below the age of 50 years, the risk of recurrence is 25%). Surgery may be indicated for young patients with more than two attacks of inflammation. Some 10% of patients require an operation either for recurrent attacks, which make life a misery, or for the complications of diverticulitis.

1. The ideal operation carried out as an interval procedure after careful preparation of the gut is a one-stage resection. This involves removal of the affected segment and restoration of continuity by end-to-end anastomosis. Careful dissection will allow eventual mobilisation of the rectosigmoid out of the pelvis exposing the normal rectum, and greater mobility will allow an easier anastomosis.
2. If there is obstruction, inflammatory oedema and adhesions or the bowel is loaded with faeces, a Hartmann's operation is the procedure of choice (Fig. 65.15). This removes the risk of anastomotic leak. However, complications may ensue if the stoma is under tension, or the rectal stump breaks down. The involved area is resected. The rectum is closed at the peritoneal reflection, and the left colon brought out as a left iliac fossa colostomy. The once popular staged procedures using a preliminary transverse colostomy are now rarely used except by inexperienced surgeons because of the high mortality associated with them. In selected obstructed cases, the bowel can be cleaned by on-table lavage, making anastomosis much safer.
3. In acute perforation, peritonitis soon becomes general and may be purulent, with a mortality rate of about 15%. Gross faecal peritonitis carries a mortality rate of more than 50% and pneumoperitoneum is usually present; the diagnosis may not be confirmed until emergency laparotomy. There is a choice of procedures:
   a. primary resection and Hartmann's procedure (see above);
   b. primary resection and anastomosis after on-table lavage in selected cases;
   c. exteriorisation of the affected bowel, which is then opened as a colostomy, a procedure now rarely used.
4. Fistulae can be cured only by resection of the diseased bowel and closure of the fistula. In the case of a colovesical fistula, it

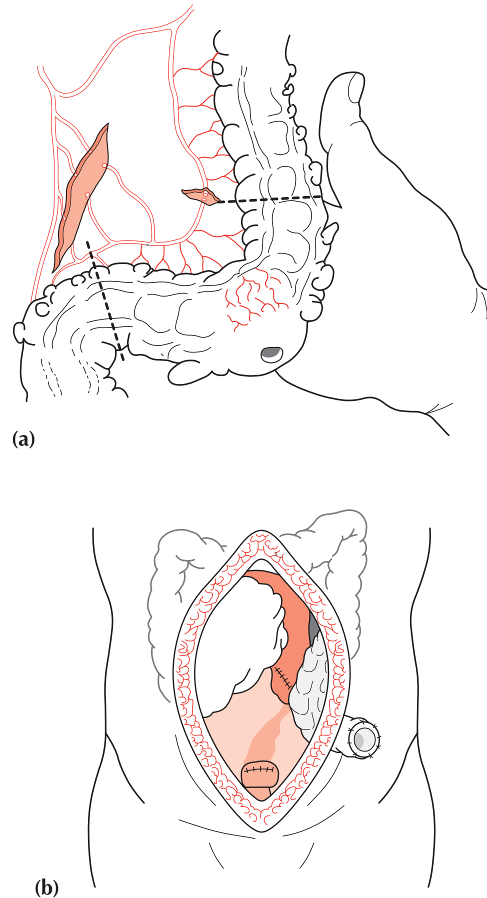

Figure 65.15 (a) Perforated sigmoid diverticular disease. (b) The Hartmann procedure – oversewn rectal stump and left iliac fossa colostomy.

Henri Albert Charles Antoine Hartmann, 1860–1952, Professor of Clinical Surgery in the Faculty of Medicine, University of Paris, France.

is usually possible to 'pinch off' the affected bowel from the bladder, close it and then resect the sigmoid. In very difficult cases, a staged procedure with a preliminary defunctioning stoma may be necessary.

5 Haemorrhage from diverticulitis must be distinguished from angiodysplasia. It usually responds to conservative management and occasionally requires resection. On-table lavage and colonoscopy may be necessary to localise the bleeding site. If the source cannot be located, then subtotal colectomy and ileostomy is the safest option.

Diverticular disease and carcinoma coexist in 12% of cases. Exploration may be necessary but, even then, differentiation may be difficult until histological investigations are available (Table 65.2). Weight loss, falling haemoglobin and persistently positive occult blood are sinister features.

Solitary diverticulum of the caecum and ascending colon is rare and congenital, and may present with symptoms and signs identical to those of acute appendicitis.

Laparoscopic surgery

In selected cases, laparoscopic surgery has been used for sigmoid resection. This has the benefit of decreased hospital stay and costs. However, there is little high-quality research in the field to advocate its true merits.

ULCERATIVE COLITIS

Aetiology

The cause of UC is unknown. There is probably a genetic contribution with no clear Mendelian pattern of inheritance. It has been shown that 15% of patients with UC have a first-degree relative with inflammatory bowel disease. UC is more common in Caucasians than in blacks or Asians. In spite of intensive bacteriological studies, no organisms or group of organisms can be incriminated. Relapse of colitis has, however, been reported in association with bacterial dysenteries. Smoking seems to have a protective effect. Patients often comment that relapses are associated with periods of stress at home or at work, but personality and psychiatric profiles are the same as those of the normal population.

Studies show that mucosal permeability increases with the presence of inflammation. This may be due to a combination of genetic susceptibility or damage by toxins. The resulting passage of antigens that trigger inflammation may cause an influx of neutrophils and lymphocytes. This inflammation is usually dampened down in normal tissue, but this is lost in UC. There may be loss of tolerance to self-antigens. UC is thought to be an immune disorder in individuals with yet unknown susceptibility genes or a hypersensitivity reaction to an external antigen.

Epidemiology

There are 10–15 new cases per 100 000 population a year in the UK. This is higher in people of Jewish origin. The prevalence is 160 per 100 000 population. There are approximately 96 000 people with UC in the UK. The incidence has not changed over the last 20 years. The disease has been rare in eastern populations but is now being reported more commonly, suggesting an environmental cause that has developed as a result of an increasing 'westernisation' of diet and/or social habits and better diagnostic facilities. The sex ratio is equal in the first four decades of life. From the age of 40 years, the incidence in females falls whereas it remains the same in males. It is uncommon before the age of 10 years, and most patients are between the ages of 20 and 40 years at diagnosis.

Pathology

In 95% of cases, the disease starts in the rectum and spreads proximally. The rectum is involved in all circumstances except in those using topical rectal preparations (rectal sparing). It is a diffuse inflammatory disease, primarily affecting the mucosa and superficial submucosa, and only in severe disease are the deeper layers of the intestinal wall affected. There are multiple minute ulcers, and microscopic evidence proves that the ulceration is almost always more severe and extensive than the gross appearance indicates. When the disease is chronic, inflammatory polyps (pseudopolyps) occur in up to 20% of cases and may be numerous. In severe fulminant colitis, a section of the colon, usually the transverse colon, may become acutely dilated, with the risk of perforation ('toxic megacolon'). On microscopic investigation, there is an increase in inflammatory cells in the lamina propria, the walls of crypts are infiltrated by inflammatory cells and there are crypt abscesses. There is depletion of goblet cell mucin. With time, these changes become severe, and precancerous changes can develop (= severe dysplasia or carcinoma *in situ*).

Symptoms

The first symptom is watery or bloody diarrhoea; there may be a rectal discharge of mucus that is either blood-stained or purulent. Pain as an early symptom is unusual. In most cases, the disease is

Table 65.2 Differentiation of diverticulitis from carcinoma of the colon

	Diverticulitus	Carcinoma
History	Long	Short
Pain	More common	25% painless
Mass	25% have tenderness	
Bleeding	17% often profuse, periodic	65% – usually small amounts persistently
Radiograph	Diffuse change	Localised: no relaxation with propantheline bromide
Sigmoidoscopy	Inflammatory change over an area	No inflammation until ulcer reached
Colonoscopy	No carcinoma seen	Carcinoma seen and biopsied

Gregor Johann Mendel, **1822–1884, an Austrian monk and naturalist who became Abbott of the Augustinian Monastery at Brunn, Czechoslovakia, and discovered the laws of inheritance by studying the edible pea.**