

# Colonic diverticulosis

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## Abstract

Colonic diverticulosis is small outpouchings from the colonic lumen. Prevalence of diverticulosis increases with age and there is considerable geographic variation. Diverticulosis is seen mainly in the distal colon in western populations, whereas right-sided involvement is more prominent in Asia. Most patients with diverticulosis coli will remain asymptomatic and the diagnosis is frequently an incidental finding. Symptoms of uncomplicated diverticular disease are non-specific and similar to those of irritable bowel syndrome. Acute diverticulitis is the commonest complication of diverticular disease, affecting up to 25% of patients. Patients should be treated with bowel rest, analgesia and appropriate antibiotics (i.v.). Diverticular perforations may be contained locally as peridiverticular, mesenteric or pericolic abscesses. Small pericolic abscesses can often be treated conservatively. Larger abscesses may be drained percutaneously under ultrasound or CT guidance. Some abscesses are not amenable to, or fail to settle with, percutaneous drainage and surgery is indicated. Perforation into the peritoneal cavity causes purulent or faecal peritonitis with the attendant signs of shock. Patients require active resuscitation before emergency laparotomy. A fistula can result if a phlegmon or diverticular abscess extends or ruptures into an adjacent organ. Other complications include obstruction of the small or large bowel, and rectal bleeding.

**Keywords** colonic diverticulosis; diverticulitis; diverticular abscess; diverticular perforation; diverticular bleeding; fistulas; intestinal surgery

Colonic diverticulosis is the presence of small outpouchings from the colonic lumen due to mucosal herniation through the colonic wall at sites of vascular perforation.

## Epidemiology

The prevalence of diverticulosis coli is difficult to measure because symptomatic complications occur in only 10–30% of patients. Postmortem evidence suggests a significant rise in prevalence over the last 60–80 years in the UK. Prevalence of diverticulosis increases with age; it is:

- < 10% in those aged < 40 years
- about 30% in those aged > 60 years
- > 50% in those aged > 80 years.

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## Aetiology

Acquired sigmoid diverticulosis is thought to result from increased intraluminal pressure from straining to pass stool due to a deficiency in vegetable fibre in the diet. Increased intraluminal pressure causes mucosal 'blowouts' through weak points in the bowel muscle. (They are pseudo-diverticula because they comprise mucosa, submucosa and a thin layer of submucosal connective tissue that evaginates through the circular muscle at the point of entry of nutrient vessels to the mucosa and submucosa.) The marked hypertrophy of the circular muscle and shortening of the taenia coli is further evidence of the increased pressure within the colon on straining.

With increasing age, structural changes in the connective tissue of the bowel wall occur due to reduced deposition of collagen and elastin, leading to a reduction in tensile strength and facilitating formation of diverticula at times of high intraluminal pressure. Consistent with this, diverticulosis develops at a younger age in patients with disorders of connective tissue (e.g. Marfan's syndrome, Ehlers-Danlos syndrome). In 'developed' countries, diverticulosis is seen in the distal colon, with 90% having involvement of the sigmoid colon and only 15% having caecal or right-sided involvement.

## Uncomplicated diverticular disease

Most patients with diverticulosis are asymptomatic and the diagnosis is usually an incidental finding. Symptoms of uncomplicated diverticular disease are non-specific and similar to those of irritable bowel syndrome (e.g. lower abdominal colic, bloating and constipation, diarrhoea). Patients may have tenderness and fullness in the left iliac fossa, but peritonism and signs of sepsis should be absent. Laboratory investigations should be normal. The use of a high-fibre diet in symptomatic diverticulosis is controversial. Anti-spasmodic agents (e.g. mebeverine) may be beneficial in some patients.

## Complicated diverticular disease

**Acute diverticulitis** is the development of inflammation in one or more diverticula. It is the most common complication of diverticular disease. Diverticulitis arises when inspissated stool obstructs the neck of a diverticulum, rubbing the mucosa and causing inflammation and localized ischaemia. Bacteria may breach the mucosa and the remainder of the wall.

**Presentation** is with abdominal pain (usually in the left iliac fossa), fever and malaise. Anorexia, nausea, vomiting and a change in bowel habit may be present. Rectal bleeding is rare. Typically, abdominal examination shows localized tenderness with no peritonism. There may be a palpable mass in the left iliac fossa. Rectal examination is often unremarkable; occasionally, tenderness or a mass is present. Pyrexia is common, but shock and hypotension are rare. A leukocytosis is present in most patients, but it may be absent in the elderly or those taking corticosteroids.

**Imaging** – most patients with acute diverticulitis present with sufficient signs and symptoms to justify empirical treatment. An erect radiograph of the chest should be done to exclude free gas under the diaphragm. Plain radiographs of the abdomen can show more severe complications, including:

- dilation of the small or large bowel (suggesting bowel obstruction or ileus)

- soft-tissue densities (suggesting intra-abdominal collections, localized perforations and abscesses)
- fistulas (see ‘Intestinal fistulas’).

The role of contrast enemas is limited because acute diverticulitis is a mainly extraluminal process. Ultrasound has been advocated in the diagnosis of acute diverticulitis, but is operator-dependent and results are very variable. Careful endoscopic examination of the sigmoid colon shows oedema, purulent discharge and inflammation of the mucosa. CT of the abdomen and pelvis can be done with intravenous, oral and rectal contrast and is the first-line diagnostic procedure.

**Treatment** is bowel rest (clear fluids p.o. or i.v.), analgesia, and antibiotics (i.v.) suitable to cover aerobic and anaerobic organisms. If symptoms do not resolve within 48–72 hours, further investigation is required to confirm the diagnosis and elucidate if there are complications (e.g. abscess formation). If the diagnosis of diverticulitis has been made on clinical grounds, further evaluation will be required on resolution of the acute episode to confirm diverticular disease.

**Prognosis** – about one-third of patients with a confirmed episode of diverticulitis will have recurrent episodes. Recurrent attacks are less likely to respond to conservative medical therapy: response rates fall from about 70% after the first episode to <10% after a third episode. Many authors recommend prophylactic elective resection of the diseased segment after two confirmed episodes of uncomplicated diverticulitis. This recommendation should be tailored according to comorbidity and relative risk of resection. The increasing role of laparoscopic colonic resection may be important in altering the balance of risk and benefit in such patients.

Acute diverticulitis in patients aged <40 years is a more aggressive entity, with response rates to conservative therapy of <50%, and an increased risk of recurrence and complications. Resection has been advocated after one confirmed episode of acute uncomplicated diverticulitis in this group.

**Diverticular abscess**

Diverticular perforations may be contained locally as peridiverticular, mesenteric or pericolic abscesses or may be ‘walled off’, creating a pelvic abscess. Generalized peritonitis results if the perforation is not localized.

**Presentation** is similar to acute diverticulitis, although sepsis and local peritonism may be present. There may be an abdominal mass and a pelvic abscess may be palpable rectally.

**Imaging** – plain radiographs and ultrasound of the abdomen may help with the diagnosis, but contrast-enhanced CT is usually required (Figure 1).

**Treatment** – small pericolic abscesses can often be treated conservatively with bowel rest, analgesia and appropriate antibiotics. Larger abscesses may be drained percutaneously under guidance (ultrasound, CT). Percutaneous drainage allows the patient to stabilize before surgery, converting an emergency procedure into an elective one (with an attendant reduction in morbidity and mortality and the requirement of a two-stage operation). Some abscesses are not amenable to (or fail to settle with) percutaneous drainage, and these patients should be treated surgically.

There is a survival benefit for patients who undergo resection of the affected segment of bowel and drainage of the abscess



**Figure 1** CT using oral and intravenous contrast showing diverticular abscess. There is thickening of the sigmoid colon **S** with adjacent inflammatory change and stranding of the pericolic fat. A 4 cm abscess \* is between the bladder **B** and sigmoid colon.

over patients who undergo drainage with or without formation of a defunctioning stoma. The recommendation in these patients is resection (usually of the sigmoid colon) and drainage of intraperitoneal collections.

In some cases (e.g. elderly patients with comorbidity), a Hartmann’s procedure is indicated, but a stoma is not essential. In many cases, resection and primary anastomosis with or without a defunctioning stoma can be done. There is no evidence to substantiate the benefits of on-table colonic lavage before anastomosis in these patients.

**Perforated diverticulitis**

Perforated diverticulitis is one of the most common causes of death from benign disease in the UK. Free perforation of a non-inflamed diverticulum is rare and perforation is usually due to rupture of a previously localized abscess. Small perforations are contained by surrounding fat and mesentery, leading to small pericolic abscesses. Large perforations cause extensive abscess formation or development of an inflammatory phlegmon. Perforation into the peritoneal cavity causes purulent or faecal peritonitis with the attendant signs of shock. A classification of the severity of diverticulitis at surgery is shown in Table 1.

**Hinchey classification of the severity of diverticulitis**

Stage 1	Pericolic or mesenteric abscess
Stage 2	Walled-off pelvic abscess
Stage 3	Generalized purulent peritonitis
Stage 4	Generalized faecal peritonitis

**Table 1**

**Treatment** – active fluid resuscitation, together with antibiotics (i.v.) and analgesia, are required before emergency laparotomy. Wedge excision of the perforation is not appropriate; the extent of resection is determined by the extent of disease and adequacy of blood supply at the point of division. Mobilization of the left colon is similar to radical cancer surgery, with routine (though not invariable) mobilization of the splenic flexure to allow for a tension-free anastomosis or stoma. The advantages of radical resection are that unexpected malignancy is treated appropriately and healthy bowel is obtained for potential anastomosis. Hartmann’s procedure is a safe procedure for managing left-sided colonic emergencies, but it has disadvantages:

- avoiding an anastomosis requires formation of a colostomy along with closure or exteriorization of the rectal stump, procedures requiring similar levels of skill to anastomosis in unfavourable circumstances.
- stoma complications (ischaemia, retraction, stenosis) and breakdown of the suture line of the rectal stump are significant problems that are not uncommon.
- up to 50% of Hartmann’s procedures are never reversed.

There is increasing evidence that primary anastomosis with or without proximal ileostomy is safe in selected patients with perforated diverticular disease. Important factors to consider before primary anastomosis are shown in Table 2. The distal resection should be to the upper rectum to exclude high pressure distal to the anastomosis (which also reduces the risk of recurrence). Anastomosis should be deferred and a Hartmann’s procedure done if circumstances are unfavourable.

**Diverticular fistulas**

A fistula can result if a phlegmon or diverticular abscess extends or ruptures into an adjacent organ. Colovesical and colovaginal fistulas are commonly encountered (the latter are more common after hysterectomy). Coloenteric, colouterine, coloureteric and colocutaneous fistulas are much less common. Malignancy, inflammatory bowel disease and radiation therapy must be excluded before treatment (if possible).

**Presentation** may be with a history of recurrent urinary sepsis, pneumaturia, vaginal discharge or passing faeces *per vagina*.

Important factors to consider before primary anastomosis for perforated diverticular disease	
Preoperative	Full resuscitation Adequate nutrition No significant comorbidity No history likely to preclude good healing (e.g. corticosteroids)
Intraoperative	Treatment of sepsis with resection Limited contamination Anastomotic (good blood supply, tension-free) No hypoxia/hypotension, myocardial instability
Postoperative	High level of monitoring (ideally HDU or ICU)

**Table 2**

**Imaging** confirms the diagnosis of a fistula, identifies the underlying cause and clarifies the anatomy. Flexible sigmoidoscopy, cystoscopy, contrast enemas (Figure 2) and contrast-enhanced CT have a part to play.

**Treatment** – patients unfit for major surgery may warrant formation of a defunctioning colostomy. However, in most cases treatment is elective single-stage resection of the diseased segment with fistula closure. Patients waiting for surgery for a colovesical fistula should be considered for antibiotic prophylaxis until the time of surgery to minimize the risk of pyelonephritis.

**Obstruction**

Obstruction is a complication of diverticulitis and may manifest as obstruction of the small bowel due to an inflammatory mass. Acute obstruction of the colon may occur due to narrowing of the lumen secondary to pericolic inflammation or extrinsic compression from an abscess. These conditions usually settle with conservative treatment of the underlying condition.

Recurrent diverticulitis (which can sometimes run a subclinical course) can cause progressive fibrosis and, ultimately, stricture of the colon in the absence of inflammation. These may present with acute (or more commonly) subacute obstruction.

**Imaging** – in the acute setting, CT or a contrast enema confirms mechanical obstruction and excludes pseudo-obstruction. Differentiating between a benign diverticular stricture and a stenosing malignancy is not always possible, even after endoscopy.

**Treatment** – endoscopic balloon dilation can be attempted if malignancy has been excluded. Some centres advocate self-expanding metal stents, but the results in benign disease are poor. They may have a role to play as a bridge to surgery, converting an emergency case into an elective one. Surgery is usually required



**Figure 2** Fluoroscopy showing a colovaginal fistula. Contrast fills the rectum and sigmoid colon. Extensive sigmoid diverticular disease is present. The arrow marks the site at which contrast delineates a fistula from the sigmoid colon into the vagina.

in the acute setting. Often, this takes the form of a resection and primary anastomosis with or without proximal ileostomy. A Hartmann's procedure (or stoma formation) may be required if circumstances are less favourable. An elective resection with primary anastomosis is adequate for subacute obstruction. A stoma may suffice if the patient is not fit for a major procedure.

### Bleeding

Diverticular disease is the most common cause of haemorrhage of the lower gastrointestinal tract. Changes in the lumen of the arteries within diverticula predispose to rupture. Causes of these changes are unknown, but inflammation does not seem to be a factor—hence diverticulitis is rarely complicated by bleeding. The use of NSAIDs is associated with an increased risk of bleeding in diverticular disease.

**Presentation** – bleeding is usually painless, of sudden onset, and red or maroon in colour. Clots may be present, but melaena is uncommon. Most patients (70–80%) settle spontaneously, but rebleeding occurs in about one-third.

**Treatment** – initial assessment and appropriate fluid resuscitation are the first steps in managing haemorrhage of the lower gastrointestinal tract. Initial investigations include routine haematology, biochemistry and coagulation studies. Exclusion of an upper gastrointestinal source by oesophago-gastroduodenoscopy is warranted because 10% of these patients will have a source proximal to the ligament of Treitz. Flexible sigmoidoscopy or colonoscopy may identify the bleeding source (e.g. diverticular colitis, angiodysplasia, neoplasm) and proctoscopy should be done to exclude an anorectal cause. Other imaging methods may be required if endoscopy is unsuccessful.

Scintigraphy is a simple, non-invasive, sensitive test for colonic bleeding, but it shows only the site (and not the cause) of the bleeding, and does not have therapeutic potential. Angiography has therapeutic potential with the use of intra-arterial vasopressin or embolization. It may also allow selective hemicolectomy rather than empirical subtotal colectomy. However, angiography is an invasive procedure requiring skilled staff and is not always readily available in UK centres. Colonoscopy with endoluminal clipping has been used successfully. ◆