

Key points

- The incidence of diverticulosis increases with age, although the cause remains unclear.
- Diverticula are the most common finding in all patients at routine colonoscopy.
- In most cases, diverticulosis is asymptomatic. Complications of diverticular disease include diverticulitis, bleeding, abscesses, fistulas, strictures and diverticular colitis.
- There is no evidence that avoiding nuts, corn and seeds can prevent complications of diverticulosis.
- Fibre appears to be important in the prevention of diverticulitis episodes, but its role in preventing the development of diverticula is not clear.
- Although their use is contentious, antibiotics are still the mainstay of treatment for mild, uncomplicated cases of acute diverticulitis.
- There may be a role for anti-inflammatories and probiotics in the future management of patients with diverticulitis.

Diverticular disease

Picking the facts out of the pockets

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Diverticulosis is common and mostly asymptomatic. However, it can be complicated by inflammation, haemorrhage, fistulas and perforation. Colonoscopy is an important tool for investigation and diagnosis.

Diverticulosis refers to the presence of outpouchings of the intestinal wall called diverticula. It is the most common finding on routine colonoscopy, affecting up to 65% of adults. The cause remains unclear and, contrary to popular belief, the development of diverticula may not be prevented by a high-fibre diet.

Most affected patients will remain asymptomatic but complications can include diverticulitis, perforation, bleeding, colitis, strictures, abscesses and fistulas. There is no evidence that avoiding nuts, corn and seeds can prevent these complications.

PREVALENCE AND PATHOGENESIS

The incidence of diverticulosis increases with age. In Western societies prevalence rates of 5% are noted in people aged 40 years, whereas 30% of 60-year-olds and 65% of people over the age of 85 years are affected.^{1,2} Most patients are asymptomatic although about 1 to 4% will develop diverticulitis and 3 to 15% may experience bleeding.^{3,4} Symptomatic diverticulosis is referred to as diverticular disease and may be complicated or uncomplicated. Patients with uncomplicated diverticular disease, sometimes referred to as 'symptomatic uncomplicated diverticular disease' or SUDD, manifest with

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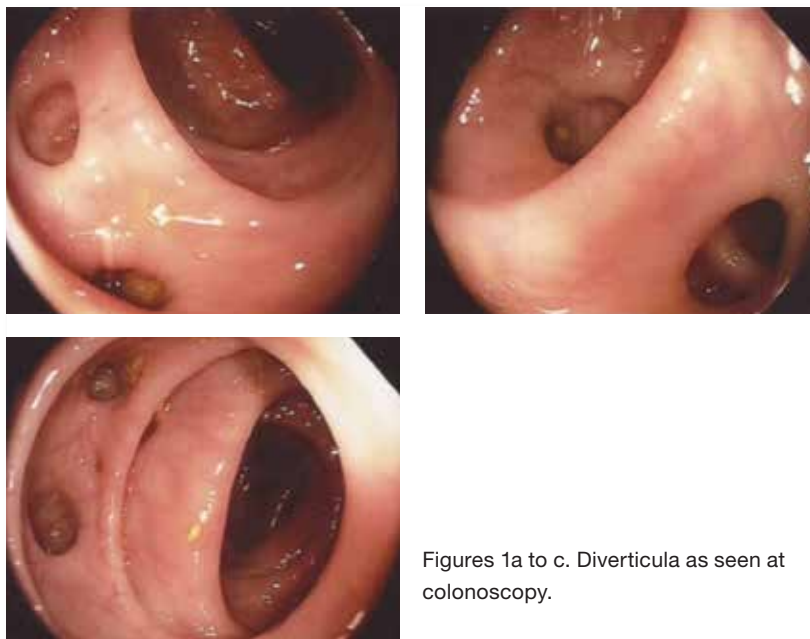
IMPORTANT DEFINITIONS

Diverticula = outpouchings of the intestinal wall

Diverticulosis = presence of diverticula

Diverticular disease = symptomatic diverticulosis

- Clinically significant diverticular disease
 - diverticulitis
 - perforation
 - bleeding
 - diverticular colitis
 - strictures
 - abscesses
 - fistulas
- Symptomatic uncomplicated diverticular disease (SUDD)



Figures 1a to c. Diverticula as seen at colonoscopy.

chronic abdominal symptoms but no evidence of overt diverticulitis or colitis (Box). Symptoms are often nonspecific and can include abdominal pain, bloating and/or an altered bowel habit. This condition may be in the spectrum of irritable bowel syndrome, given the similarity in symptomatology, and affected patients often respond to the same treatment measures.

In Western society, diverticula are more commonly found in the left side of the colon, especially the sigmoid. In Asian populations the right side of the colon is more frequently involved, although diverticulosis is seen much less frequently in this group. Right-sided diverticula are also more commonly seen in younger patients, suggesting a congenital cause.

Diverticula are thought to result from increased colonic luminal pressure at weak points in the circular muscle layer, which then leads to herniation or outpouching of the mucosa and submucosa. These weak points are positioned where blood vessels that supply the mucosa (vasa recta) penetrate the muscle layer.

Risk factors for the development of diverticulosis include advancing age, physical inactivity, obesity, smoking and chronic alcohol abuse. The long-held belief that a high-fibre diet may prevent diverticulosis has been questioned. A recent study has shown that the prevalence of diverticulosis was actually higher in those eating

a high-fibre diet.⁵ In addition, constipation was not found to be a risk factor for the development of diverticula. However, there is some evidence that a diet high in fibre may be protective against the development of diverticular complications. Also, a high-fibre diet may be beneficial for other reasons, particularly with regard to the prevention of cardiovascular disease and certain cancers.

DIAGNOSIS

Diverticulosis is usually diagnosed endoscopically, with diverticula being the most commonly reported finding during routine colonoscopy (Figures 1a to c). It can also be detected on imaging such as CT or MRI scans as well as barium studies, although the latter are not often performed. The sensitivity and specificity for a diagnosis of diverticulitis from CT scanning are 69 to 95% and 75 to 100%, respectively.⁶

COMPLICATIONS

The main complications of diverticular disease include diverticulitis, perforation, bleeding, diverticular colitis, strictures, abscesses and fistulas.

Diverticulitis

Diverticulitis was previously thought to occur in up to 25% of people with diverticulosis;



Figure 2. Faecaloliths obstructing diverticula.

however, more recent evidence suggests that this figure is an overestimate and the true incidence may only be 1 to 4% over seven to 11 years of follow up from initial diagnosis.^{7,8} The risk in younger patients (aged 40 to 49 years) appears to be significantly higher, at 11% over the same time period.^{7,8} Diverticulitis is commonly thought to result from obstruction of a diverticulum (Figure 2) with resultant micro-perforation, mucosal injury and inflammation, and bacterial translocation leading to infection. The extent and localisation of the perforation will determine the severity of disease.

Classically, patients with diverticulitis present with abdominal pain, generally on the left side or in the back, a low-grade fever and constipation or diarrhoea. Laboratory tests may show an elevated white blood cell count and raised inflammatory markers. An abdominal CT scan may reveal wall thickening and peri-colic fat stranding, and even abscesses and fistulas in severe cases. Unless it has been undertaken in the preceding 12 months, a colonoscopy should be performed six weeks after resolution of the diverticulitis episode to exclude other pathology, particularly a colonic malignancy. Colonoscopies performed earlier than this period carry an increased risk of perforation.

The role of antibiotics has been questioned in mild cases of acute, uncomplicated diverticulitis given that 'inflammation' rather than infection per se is thought to be the underlying pathology.⁹ In the presence of complications such as an abscess, the use of antibiotics is more clear cut. Although



Figures 3a and b. a (left). A bleeding diverticulum with fresh blood in the orifice. b (right). The same patient with a clip applied to arrest bleeding.



this issue is still contentious, antibiotics remain the mainstay of treatment for patients with diverticulitis. For mild cases, either the combination of amoxycillin and clavulanic acid or cephalexin and metronidazole may be given orally for five days. Improvement should be seen within two to three days. In more severe cases (i.e. high fevers, marked rebound tenderness) or mild cases that fail to respond to outpatient management, the patient should be hospitalised for treatment with intravenous antibiotics and further inpatient care. An abdominal CT scan would be recommended in order to exclude complications such as an intra-abdominal collection, abscess formation or peritonitis with perforation, which would mandate further surgical involvement.

Bleeding

In adults, diverticula are the most common cause of overt, painless bleeding from the lower gastrointestinal tract (Figure 3a). Bleeding stops spontaneously in most cases (>90%). The risk of bleeding from diverticulosis has been reported to be as high as 15%,^{3,4} with about 5% of these being massive bleeds. In up to 90% of affected patients, bleeding is from the right side of the colon, perhaps related to the fact that the colonic wall is thinner on this side. Another contributing factor is that diverticula on the right side tend to have wider necks, leaving a greater length of vasa recta exposed to injury.

Colonoscopy is the investigation of choice when patients present with intermittent, low-volume bleeding, especially

given the added advantage that therapeutic endoscopic manoeuvres can be performed during the procedure. This may involve clipping bleeding vessels (Figure 3b), injecting adrenaline and coagulation. In the presence of profuse haemorrhage, identification of the bleeding diverticulum may be difficult, particularly when multiple diverticula are present. In such cases angiography may be necessary and the offending vessel can be embolised or a vasoconstricting agent can be instilled. For angiography to be successful, bleeding must be active. Recurrent diverticular bleeding has been reported in up to 50% of cases following an index bleed.¹⁰ Risk factors for recurrent bleeding include advanced age, and concurrent peripheral vascular and chronic renal diseases.¹⁰ In cases where bleeding continues in spite of attempts at endoscopic and angiographic therapy, surgery such as segmental colectomy may be required.

Diverticular colitis

Rarely, patients with diverticulosis can develop patchy, chronic inflammation, particularly in the affected sigmoid colon. This condition has been described relatively recently and has been termed diverticular colitis. Endoscopically and histologically, the features range from mild peri-diverticular submucosal haemorrhage (Figure 4) to marked inflammation, which can appear similar to true inflammatory bowel disease. The cause is unknown although it is possibly related to a combination of faecal stasis, ischaemia and mucosal prolapse. Symptoms may include



Figure 4. Diverticular colitis demonstrating peri-diverticular submucosal haemorrhage.

abdominal pain, diarrhoea, urgency and rectal bleeding, but many patients remain asymptomatic.

During colonoscopy, mucosal inflammation is characteristically noted in the interdiverticular spaces, as opposed to cases of acute diverticulitis where the diverticular orifices and immediate peri-diverticular areas are predominately affected. Also, in patients with inflammatory bowel disease in whom diverticulosis is also present, the inflammation tends to involve both the colonic mucosa and diverticular orifices, and is limited to the segment of diverticulosis while sparing other parts of the colon. Other conditions that can mimic diverticular colitis include infections, ischaemia and NSAID-induced colitis.

The treatment of patients with diverticular colitis is unclear although a high-fibre diet appears to be important. Antibiotics such as ciprofloxacin and metronidazole have been reported to be of benefit but unfortunately data on their use are lacking. Oral 5-aminosalicylic acid (5-ASA) agents such as mesalazine have also been used, as have corticosteroids, but again evidence for their use is poor. Rarely, in cases of chronic relapsing disease where medical therapy has failed, surgical resection of the diseased segment may need to be considered.

Other complications

Rare complications of diverticular disease include strictures, abscesses and fistulas. Fistulas can occur between the colon and bladder, small bowel or vagina. Symptoms

suggestive of a vesico-colonic fistula include pneumaturia and recurrent urinary tract infections. A faeculent vaginal discharge and/or vaginal passage of flatus should raise the possibility of a fistula between the colon and vagina. Diagnosis is based on history and physical examination as well as further investigations including abdominal imaging, a midstream urine test and vaginal swabs. The growth of colonic flora on a vaginal swab is in keeping with a fistula. The management of patients with complications such as abscesses or fistulas should be individualised, with colorectal referral and involvement. Some fistulas may be managed conservatively, whereas abscesses more often require CT-guided drainage and/or surgical intervention.

EMERGING CONCEPTS

Emerging evidence suggests that inflammation and the gut microbial environment ('microbiome') may have more distinct roles in the pathogenesis of diverticulitis, and even perhaps the development of diverticula. One hypothesis points to faecal stasis as contributing to chronic dysbiosis of the gut microbiome, which in turn promotes the formation of abnormal metabolites and stimulates ongoing inflammation. Several new therapies targeting these pathogenic factors have therefore been proposed as potential new treatments for patients with symptomatic diverticulitis. The 5-ASA derivative, mesalazine, has shown benefit over placebo in preventing recurrent attacks following routine treatment of acute diverticulitis, as well as benefits for the treatment of patients with symptomatic uncomplicated diverticular disease.^{11,12}

New antibiotics such as rifaximin and probiotics are also thought to modulate the gut microbiome, potentially inhibiting pathogen translocation and suppressing inflammation. Some trials have shown improved outcomes with rifaximin and mesalazine in preventing recurrent attacks of diverticulitis when given in combination.¹³ Probiotics containing *Lactobacillus acidophilus* and *Bifidobacterium* species have also shown benefit in the treatment

of patients with abdominal symptoms associated with symptomatic uncomplicated diverticular disease.¹⁴

CONCLUSION

Diverticulosis is common and the cause remains unclear. Most patients are asymptomatic but complications can occur and include diverticulitis, perforation, haemorrhage, colitis, strictures, abscesses and fistulas. Current evidence does not support the assumption that nuts, corn and seeds increase the risk of diverticulitis, thus they do not need to be avoided once diverticulosis is suspected or diagnosed. Although a high-fibre diet does not appear to protect against the development of diverticula, it may prevent the onset of diverticular complications. With emerging evidence that inflammation and the gut microbiome may play key roles in the development of diverticulitis, anti-inflammatories, antibiotics and probiotics may offer additional therapies for disease management in the future.

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A list of references is included in the website version (www.medicinetoday.com.au) and the iPad app version of this article.

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