



Diverticular disease

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BMJ Best Practice

Diverticular disease

The right clinical information, right where it's needed



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Summary

- ◇ Usually asymptomatic; may have constipation or nonspecific abdominal symptoms.
- ◇ Symptomatic acute diverticulitis presents with fever, leukocytosis, and left lower quadrant pain.
- ◇ Contrast enema and colonoscopy are common diagnostic tests; CT scan when diagnosis unclear.
- ◇ Treatment includes bowel rest, antibiotics, and surgical intervention.
- ◇ Complications include bleeding, segmental colitis, perforation, abscess, fistulas, and obstruction.
- ◇ Acute bleeding managed by IV fluids or blood transfusion, and radiologically directed hemostasis (embolization).

Definition

Colonic diverticulosis refers to herniation of mucosa and submucosa through the muscular layer of the colonic wall and may be the result of colonic smooth muscle over-activity. Diverticular disease may be defined as any clinical state caused by symptoms pertaining to colonic diverticula and includes a wide-ranging spectrum from asymptomatic to severe and complicated disease. Diverticulitis indicates inflammation of a diverticulum or diverticula and may be caused by infection. Other complications of diverticular disease include segmental colitis, lower gastrointestinal bleeding, infection, abscess, perforation, peritonitis, and fistula formation.

Epidemiology

The exact incidence of diverticular disease is difficult to determine because most patients are asymptomatic and many studies are retrospective by nature.^[3] However, it is known that the incidence increases with age, being <10% in those younger than 40 years of age, approximately 50% at 50 years of age, and 50% to 66% at over 80 years of age in developed countries. Vegetarians have been shown to have a lower incidence of diverticular disease.^[4] Right-sided diverticular disease, which is more common in Asia, is shown to be associated with meat consumption.^[5] One study reported an overall prevalence of 12% to 49%.^[6] There is no overall gender difference in prevalence of diverticular disease; however, in older adults, there is a female preponderance.^[7]

Prevalence of fever and leukocytosis in older patients with acute diverticulitis varies from 30% to 50%. Rarely, a more aggressive form of diverticular disease manifests in younger obese males (<40 years of age).^[8]

Although earlier studies have described diverticular disease being rare in rural Africa and Asia, with highest prevalence in the US, Europe and Australia, data indicate an overall increase in prevalence of diverticular disease even in African countries with a tendency to urbanization.^{[9] [10] [11]}

Etiology

Diverticular disease is thought to be of multifactorial etiology. Both genetic and environmental factors are described as causative, especially a low dietary fiber intake, which in Western populations is deemed as the predominant contributing factor.^[9] Other predisposing factors described include decreased physical activity, obesity, increased red meat consumption, excessive alcohol and caffeine intake, steroids, and NSAIDs.^[2] Other suggested etiologies include alterations in colonic wall structure (increased type III collagen synthesis, elastin deposition), abnormal colonic motility, and colonic neurotransmitter dysfunction (decreased choline acetyltransferase, increased serotonin expression).^{[5] [12] [13]} Connective tissue abnormalities, or herniosis, has been suggested as responsible for the constellation of disorders referred to as Saint's triad (hiatus hernia, colonic diverticulosis, gallstones). Infection of the diverticula may be the cause of inflammation that results in diverticulitis. There is no evidence to support the theoretical concern that ingested seeds and nuts could become trapped within a diverticulum and result in an episode of diverticulitis.

Pathophysiology

A low-fiber diet increases intestinal transit time and decreases the stool volume, resulting in increased intraluminal pressure and colonic segmentation, which predispose to diverticular formation. However, the precise mechanism is not completely understood and this concept does not easily explain the right-sided disease seen in the East. The sigmoid colon is commonly affected because of its small diameter.

Colonic diverticula are "pseudo diverticula" (consist of mucosa and muscularis mucosa) and commonly occur between the tenia coli at presumed sites of weakness where the vasa recti penetrate the colonic wall. Thickening of circular muscles and shortening of tenia without actual muscle hypertrophy are caused by increased elastin deposition between muscle cells and tenia coli. Nitric oxide, by influencing the compliance of the circular muscle layer, is thought to be responsible for the segmentation of colonic wall in diverticulosis.[14] Inspissated food particles or fecal material may contribute to the development of infection, which when combined with increased intraluminal pressure, may cause inflammation, ischemia, and necrosis of the wall of a diverticulum, leading to perforation. Acute diverticulitis is more common on the left side in the sigmoid region, whereas diverticular bleeding originates commonly from right-sided diverticula.[15] Microperforation of 1 or more diverticula may result in a localized phlegmon, a small confined abscess (stage I), a distant abscess (stage II), generalized peritonitis (stage III) or free perforation, and fecal peritonitis (stage IV).[16]

Classification

Clinical classification

Currently, there is no universally accepted clinical classification for diverticular disease. However, the following clinical distinctions are commonly used:[1] [2]

- Asymptomatic diverticulosis: usually an incidental finding on colonoscopy, barium enema, or CT scan.
- Symptomatic uncomplicated diverticular disease: also referred to as painful diverticular disease and often characterized by episodic left-lower abdominal colicky pain with or without other nonspecific symptoms of bloatedness, constipation, or diarrhea. The symptoms may become recurrent.
- Complicated diverticular disease: the most common complication is acute diverticulitis. Other complications include hemorrhage, abscess, segmental colitis, diverticular phlegmon, perforation, peritonitis, fistula, stricture, and obstruction.

The severity of acute diverticulitis is graded using Hinchey classification:

- Stage I: small or confined pericolic or mesenteric abscess.
- Stage II: large paracolic abscess often extending into pelvis.
- Stage III: perforated diverticulitis where a peridiverticular abscess has perforated resulting in purulent peritonitis.
- Stage IV: perforated diverticulitis where there is free perforation and is associated with fecal peritonitis.

Primary prevention

Increasing dietary fiber intake by generous consumption of fruits and vegetable, limiting red meat and salt consumption, and undertaking regular physical activity to maintain ideal body weight and avoid obesity may help prevent diverticular disease.

Secondary prevention

No established guidelines are available for secondary prevention of diverticular disease. However, promoting general health measures such as regular physical activity,^[61] increasing consumption of fruits and vegetables, and decreasing consumption of saturated fats, red meats, and sugar will improve cardiovascular health and may decrease prevalence of diverticular disease.

Case history

Case history #1

A 57-year-old woman with history of hypertension and hypercholesterolemia presents to the emergency department with a 24-hour history of gradually worsening left-lower quadrant abdominal pain associated with nausea and vomiting. Prior to this episode, the patient did not have any significant GI problems, except slight constipation and occasional dyspepsia after heavy meals. She felt feverish but did not take her temperature. Her family history is negative for GI disorders.

Case history #2

A 32-year-old obese, but otherwise healthy, man presents to the emergency department with onset of acute right-lower abdominal pain of 2-hour duration. There is no history of any previous significant illness, except loud snoring, possible sleep apnea, and being overweight.

Step-by-step diagnostic approach

Diverticular disease should be considered in patients, usually over 40 years, presenting with left lower quadrant abdominal pain and tenderness, with or without pyrexia. Atypical presentation includes right-sided lower abdominal pain associated with right-sided colonic diverticular disease, and in younger, obese patients presenting with lower abdominal pain. Physical findings depend on the clinical type and severity of diverticular disease. In complicated diverticular disease, especially with diverticulitis and or abscess, patients will have signs of peritonism (rebound tenderness, rigidity) and may have a palpable, tender abdominal mass.

All patients require CBC, looking for neutrophilia, hemoglobin measurement to rule out anemia, and measurement of markers of inflammation including CRP. Blood culture should be considered in patients with signs or symptoms of systemic sepsis, those who are severely ill, or those who have complications (e.g., perforation, fistula, phlegmon). CT scan of the abdomen is the imaging modality of choice and helps to confirm the presence of diverticulosis. CT may reveal signs of inflammation, including pericolic fat stranding in acute diverticulitis, and helps to rule out complications including pericolic and paracolic abscess and diverticular phlegmon. An early colonoscopy or flexible sigmoidoscopy may be required in patients presenting with rectal bleeding.

Asymptomatic patients

Asymptomatic diverticulosis is often diagnosed incidentally, during screening colonoscopy or barium enema for other indications. Physical exam and blood tests are usually normal in asymptomatic patients.

Symptomatic non-acute patients

Patients with symptomatic diverticular disease may have recurrent left lower quadrant abdominal pain, fever, bloating, constipation, or diarrhea.^[19] In uncomplicated symptomatic diverticular disease, blood tests are usually normal.

Acute abdomen/pain

Right-sided diverticulitis may mimic acute appendicitis. In patients with acute diverticulitis, tenderness, rebound, and guarding may be present in the left lower quadrant of abdomen. Patients with free perforation and generalized peritonitis may have diffuse abdominal tenderness. A mass may be palpable in cases of abscess formation. Pelvic tenderness on digital rectal exam is also a helpful sign. In acute diverticulitis, a CBC with differential usually reveals

polymorphonuclear leukocytosis. When leukocytosis is present in older patients with a history of diverticulosis, the diagnosis is most probably acute diverticulitis.

Imaging in acute abdomen/pain

In suspected cases of acute diverticulitis, CT scan is the standard diagnostic test to confirm a clinical suspicion and to rule out diverticular complications.^[2] If CT scan cannot be obtained, abdominal ultrasound or single contrast enema can be used as an alternative. Another option is an abdominal x-ray, which may show pneumoperitoneum, ileus, and soft tissue densities. Abdominal and CXRs are useful to exclude other conditions mimicking acute abdomen and will show free air in the abdomen if perforation of bowel is present.

A limited flexible sigmoidoscopy without air insufflation will help identify a perforated rectosigmoid carcinoma mimicking acute diverticulitis. Flexible sigmoidoscopy or colonoscopy can be considered when diagnosis of diverticular disease is unclear or when cancer or bowel ischemia is suspected. Great care is necessary during these endoscopic procedures to avoid perforation.

Acute bleeding

Diverticular bleeding is usually abrupt, painless, profuse arterial lower GI bleeding. Diverticular bleeding is the most common cause of lower GI bleeding in older patients and usually originates from right-sided diverticula, especially in Asian patients.

Colonoscopy or sigmoidoscopy can be used for accurate diagnosis during acute bleeding.^[24] If bleeding is too profuse to enable identification using colonoscopy, an angiogram or isotope-labeled red blood cell nuclear scan should be considered.

Diagnostic laparoscopy

If the primary diagnosis is still unclear, a diagnostic laparoscopy should be considered that may also provide therapeutic options.

Exploratory laparotomy

Exploratory laparotomy may sometimes be required in diagnostic uncertainty.

Risk factors

Strong

low dietary fiber

- The evidence is mostly based upon observational studies.^{[17] [3]}

age >50 years

- This is the strongest risk factor. Incidence of diverticular disease increases in older people and is extremely rare in children. It may be due to decreasing mechanical strength of the colonic walls. Changes in collagen structure may cause age-associated decreases in the colonic wall strength.^[20]

Weak

Western diet

- Fiber-deficient, salt-, meat-, and sugar-rich Western diets are associated with increased incidence of diverticulosis. Western diet consumption results in low stool weight and increased transit time,^[18] which in turn results in increased segmental pressure in the colon leading to diverticuli formation.^[19]

obesity (BMI >30)

- Perforations and recurrent diverticulitis are more common in obese people.^[21]

Nonsteroidal anti-inflammatory drug (NSAID) use

- There is a strong association between NSAID use and perforation of colonic diverticuli.^[22] NSAIDs are also associated with diverticular bleeding.^[23]

History & examination factors

Key diagnostic factors

left lower quadrant abdominal pain (common)

- May be mild in uncomplicated diverticular disease.
- Present in approximately 70% of patients with acute diverticulitis.^[19]

leukocytosis (common)

- When present in older patients with a history of diverticulosis, the diagnosis is most probably acute diverticulitis.

fever (common)

- A low grade fever frequently accompanies episodes of diverticulitis.

rectal bleeding (uncommon)

- Usually abrupt, painless, profuse arterial lower GI bleeding; complication of acute diverticular disease.

Other diagnostic factors

guarding in left lower quadrant (common)

- In acute diverticulitis.

tenderness in left lower quadrant (common)

- In acute diverticulitis.

bloating (common)

- Abdominal bloating is a frequent complaint of patients with diverticular disease.

constipation (common)

- Patients with diverticular disease often experience periods of constipation, which may alternate with episodes of diarrhea.

pelvic tenderness on digital rectal exam (common)

- This may be detected, particularly if there is acute diverticulitis.

diffuse abdominal tenderness (uncommon)

- In cases of free perforation and generalized peritonitis.

diarrhea (uncommon)

- Patients with diverticular disease often experience episodes of diarrhea, which may alternate with periods of constipation.

palpable abdominal mass (uncommon)

- May indicate abscess.

Diagnostic tests

1st test to order

Test	Result
CBC with differential <ul style="list-style-type: none"> • Polymorphonuclear leukocytosis is present in acute diverticulitis. When leukocytosis is present in older patients with a history of diverticulosis, the diagnosis is most probably acute diverticulitis. CBC results should be considered at first encounter with patient when diverticulitis suspected. 	polymorphonuclear leukocytosis
CXR <ul style="list-style-type: none"> • Used to exclude other conditions mimicking acute abdomen. In cases of pneumoperitoneum, air may be seen under diaphragm. 	normal
CT scan of abdomen <ul style="list-style-type: none"> • The imaging modality of choice to confirm suspicion of acute diverticulitis or other causes of acute abdomen,^[25] if not confirmed by physical exam and abdominal x-ray. Helpful to select patients for medical rather than surgical treatment, and to determine if hospitalization is required.^[25] Also helps rule out complications of acute diverticulitis.^{[2] [25]} 	thickening of bowel wall, mass, abscess, streaky mesenteric fat; may show gas in the bladder in cases of fistula

Other tests to consider

Test	Result
abdominal x-ray <ul style="list-style-type: none"> • Considered when acute diverticulitis is suspected. 	pneumoperitoneum, ileus, soft tissue densities; free air in bowel perforation
abdominal ultrasound (graded-compression) <ul style="list-style-type: none"> • Considered if CT scan cannot be obtained. 	signs of abscess, perforation, obstruction
contrast enema <ul style="list-style-type: none"> • Use in acute diverticulitis when initial acute symptoms have resolved to confirm diagnosis. Water-soluble contrast enema is preferred to conventional barium. 	diverticuli, abscess, perforation, obstruction, fistula

Test	Result
<p>colonoscopy</p> <ul style="list-style-type: none"> Used when diagnosis of diverticular disease is unclear and cancer or bowel ischemia is suspected. Can be used for accurate diagnosis in acute bleeding. 	<p>single, multiple, or scattered diverticulae, with or without acute mucosal inflammation; in acute bleeding, might identify source of segmental bleeding or proximal extent of bleeding; if coexistent, mucosal pathology such as ischemia, inflammatory bowel disease, and neoplasm may be seen</p>
<p>sigmoidoscopy</p> <ul style="list-style-type: none"> Used when diagnosis of diverticular disease is unclear and cancer or bowel ischemia is suspected. Can be used for accurate diagnosis in acute bleeding. 	<p>mucosal pathology such as ischemia, inflammatory bowel disease, and neoplasm</p>
<p>angiogram</p> <ul style="list-style-type: none"> Used in acute bleeding. Considered if bleeding is too profuse to enable identification using colonoscopy. 	<p>etiology of bleeding identified</p>
<p>isotope-labeled RBC nuclear scan</p> <ul style="list-style-type: none"> Used in acute bleeding. Considered if bleeding is too profuse to enable identification using colonoscopy. 	<p>etiology of bleeding identified</p>
<p>diagnostic laparoscopy/exploratory laparotomy</p> <ul style="list-style-type: none"> Considered if primary diagnosis is unclear. 	<p>diverticuli, abscess, perforation, obstruction, fistula</p>
<p>blood culture</p> <ul style="list-style-type: none"> Should be considered in patients with signs or symptoms of systemic sepsis, those who are severely ill, or those who have complications (e.g., perforation, fistula, phlegmon). 	<p>usually gram negative rods, and anaerobic bacteria; obtain prior to administration of antibiotics</p>

Differential diagnosis

Condition	Differentiating signs / symptoms	Differentiating tests
Colorectal cancer	<ul style="list-style-type: none"> History of altered bowel habits, anemia, colonic polyps, and positive FHx are suggestive of colorectal cancer. 	<ul style="list-style-type: none"> CT scan features of carcinoma include mass, stricture, and obstruction. Anemia is frequent in colon cancer, whereas polymorphonuclear leukocytosis is a feature of acute diverticulitis.
Appendicitis	<ul style="list-style-type: none"> Patients with acute appendicitis are usually younger than those with acute diverticulitis. Pain localizes to right lower quadrant in appendicitis and to left lower quadrant in diverticulitis, with exception of less common right-sided diverticulitis. 	<ul style="list-style-type: none"> CT scan may reveal characteristic changes of acute appendicitis. This may be enlarged diameter of appendix >6 mm with associated periappendiceal inflammation.

DIAGNOSIS

Condition	Differentiating signs / symptoms	Differentiating tests
Ulcerative colitis	<ul style="list-style-type: none"> Usually presents at a younger age, but incidence increases again at about 70 years of age.[26] Family history and white ethnicity common.[26] [27] 	<ul style="list-style-type: none"> Limited flexible sigmoidoscopy in early stages reveals diffuse inflammation and ulceration in cases of acute ulcerative colitis.[28] Colonoscopy and biopsy performed subsequently. Antineutrophil cytoplasmic antibodies in antibody test are present in >65% cases of ulcerative colitis.
Crohn disease	<ul style="list-style-type: none"> Usually presents at a younger age, but incidence increases again at about 70 years of age.[26] Family history and white ethnicity common.[27] [26] 	<ul style="list-style-type: none"> Anti-<i>Saccharomyces cerevisiae</i> in antibody blood test may indicate Crohn disease; present in >65% of patients. Colonoscopy and biopsy performed subsequently.
Urinary tract infection	<ul style="list-style-type: none"> Frequency, urgency, burning, dysuria, lower abdominal pain. 	<ul style="list-style-type: none"> Urinalysis with UTI will show increased leukocyte count, bacteria, and presence of nitrites.
Pyelonephritis	<ul style="list-style-type: none"> Fever, chills, leukocytosis, flank pain, and renal tenderness. 	<ul style="list-style-type: none"> Urinalysis with pyelonephritis will show increased leukocyte count, bacteria, and presence of nitrites.
Ischemic colitis	<ul style="list-style-type: none"> Usually occurs in older people with evidence of generalized atherosclerosis, and presents with abdominal pain and rectal bleeding. 	<ul style="list-style-type: none"> Abdominal radiographs may show edema of bowel wall and minute ulcers thumb printing in the right colon with ischemic colitis. CT scan with ischemic colitis shows similar changes in a more precise fashion and angiography confirms the diagnosis. Limited flexible sigmoidoscopy without air insufflation may be helpful in identifying ischemic mucosa.
Pelvic inflammatory disease	<ul style="list-style-type: none"> Urethral/vaginal discharge evidence of STD; cervical motion tenderness. 	<ul style="list-style-type: none"> Isolation of organisms in urethral/vaginal swabs by direct microscopy, culture, or other available tests.
Irritable bowel syndrome	<ul style="list-style-type: none"> Usually occurs in younger patients with presence of Rome III criteria and absence of evidence of systemic illness.[29] 	<ul style="list-style-type: none"> Normal laboratory tests and imaging studies.

Step-by-step treatment approach

Asymptomatic diverticulosis

Colonic diverticulosis refers to herniation of mucosa and submucosa through the muscular layer of the colonic wall and may be the result of colonic smooth muscle overactivity. Asymptomatic diverticulosis discovered incidentally requires no treatment. There is weak evidence to suggest that these patients might benefit from increasing dietary fiber, including fruit and vegetables.[31]

Symptomatic diverticular disease

Diverticular disease may be defined as any clinical state caused by symptoms pertaining to colonic diverticula and includes a wide-ranging spectrum from asymptomatic to severe and complicated disease. For patients with mild symptoms, treatment includes dietary modification, especially increasing fiber supplementation over weeks and increasing hydration.[32] If there is evidence of infection and/or suspicion of bacterial overgrowth, then a broad spectrum antibiotic covering both gram-positive and gram-negative aerobic and anaerobic bacteria may be initiated, although there is a risk of inducing pseudo-membranous colitis.[33]

Complications of diverticular disease include segmental colitis, lower gastrointestinal bleeding, infection, abscess, perforation, peritonitis, and fistula formation.

Symptomatic diverticulitis (uncomplicated)

Diverticulitis indicates inflammation of a diverticulum or diverticula, and may be caused by infection. The main goals of treatment of symptomatic diverticulitis include elimination of the infection and prevention of complications. A low-residue diet and oral antibiotics on clinical diagnosis can manage uncomplicated diverticulitis that does not present with any symptoms of an acute abdomen (i.e., with signs of acute severe abdominal pain, abdominal tenderness with or without guarding suggesting peritonism, abdominal distension). A low-residue diet is a diet low in fibers and undigested material that leave a minimal residue after digestion and absorption in gut (e.g., refined bread, cereals, white rice, vegetable and fruit juice without pulp, dairy products). Antibiotics should be given for 7 to 10 days.[33] [34]

Patients with abdominal pain, fever, or leukocytosis should first be considered for oral antibiotics and can be safely treated at home, provided the CT scan rules out any complications.[35] If fever and leukocytosis persist after 72 hours, or symptoms of acute diverticulitis or acute abdomen present, the patient is hospitalized and intravenous antibiotics used until clinical improvement.[33] Bowel rest using a low-residue diet is considered. Imaging studies such as CT scan are done to rule out any complications.

Symptomatic diverticulitis (complicated)

Complications requiring further investigation and treatment include bleeding, abscess, obstruction, perforation, and fistulae. The presence of complications warrants surgical consult.

Initial management of bleeding when there is evidence of volume depletion or shock is to maintain hemodynamic stability by infusions of crystalloids, colloids, and blood. Colonoscopy can be used for accurate diagnosis and endoscopic hemostasis can be achieved for the majority of patients. This significantly reduces the need for surgery;[24] however, its value in prevention of subsequent bleeding is unclear.[36] If bleeding is too profuse to enable identification using colonoscopy, an angiogram or isotope-labeled red blood cell nuclear scan should be obtained and angiographic embolization attempted. Surgery should be considered if significant bleeding continues despite attempted endoscopic and angiographic hemostasis.

A localized abscess <3 cm in diameter would not warrant any drainage and could be treated with antibiotics. However, when the abscess is >3 cm in diameter, it is best drained under CT scan or ultrasound guidance and, in cases where this cannot be accomplished, surgery is necessary.[2] A CT scan of the abdomen with contrast is the imaging of choice for percutaneous drainage of abscess.

Diagnostic laparoscopy should be considered prior to exploratory laparotomy if primary diagnosis is uncertain.

Early laparoscopic washout is increasingly adopted as a surgical strategy for acute diverticulitis (Hinchey grades I, II, and III) and for cases when medical treatment and percutaneous drainage have failed to contain sepsis.[36] [37] [38] In cases with severe or diffuse peritonitis, emergency colectomy, a Hartmann procedure, or colectomy with primary anastomosis, may be necessary.[39] A laparoscopic colectomy with primary anastomosis and/or a laparoscopic Hartmann procedure for selected patients (Hinchey I, II, and III) in experienced hands is entirely safe and may improve postoperative outcomes.

Patients should continue on intravenous antibiotics completing a course of 7 to 10 days depending on clinical recovery.

Elective surgery for recurrent diverticular disease

Criteria for recommending elective colectomy for recurrent disease are not clear cut and should not be based on the number of previous attacks alone. Any judgement should be made on an individual basis depending on age, frequency, and severity of recurrent symptoms, previous complications, and presence of comorbidities.[40] [41] In elective settings, laparoscopic colonic resection is feasible and safe, may hasten postoperative recovery, and is shown to have fewer postoperative complications, including surgical site infections.[42] [43]

Treatment details overview

Consult your local pharmaceutical database for comprehensive drug information including contraindications, drug interactions, and alternative dosing. (see [Disclaimer](#))

Acute		(summary)
Patient group	Tx line	Treatment
asymptomatic diverticulosis	1st	no treatment required
symptomatic diverticular disease	1st	dietary modification + fiber supplementation
	adjunct	oral antibiotic therapy
symptomatic diverticulitis (uncomplicated)	1st	oral antibiotic therapy
	plus	analgesia
	adjunct	low-residue diet
	2nd	intravenous antibiotic therapy
	plus	analgesia
	adjunct	low-residue diet
symptomatic diverticulitis (complicated)		

Acute		(summary)			
■	with acute rectal bleeding	1st	endoscopic hemostasis/angiographic embolization		
		plus	supportive therapy + antibiotics		
		plus	analgesia		
		plus	low-residue diet		
		2nd	surgery		
		plus	supportive therapy + continued antibiotics		
		plus	analgesia		
		plus	low-residue diet		
		■	unresponsive to IV antibiotics or with abscess >3 cm diameter, perforation, fistulae, or obstruction	1st	drainage/surgery
				plus	intravenous antibiotic therapy
plus	analgesia				
plus	low-residue diet				

Ongoing		(summary)	
Patient group	Tx line	Treatment	
recurrent diverticulitis	1st	elective surgery	

Treatment options

Acute

Patient group	Tx line	Treatment
asymptomatic diverticulosis	1st	<p>no treatment required</p> <p>» Colonic diverticulosis refers to herniation of mucosa and submucosa through the muscular layer of the colonic wall and may be the result of colonic smooth muscle overactivity. Asymptomatic diverticulosis discovered incidentally requires no treatment. There is weak evidence to suggest that these patients might benefit from increasing dietary fiber, including fruit and vegetables.[31]</p>
symptomatic diverticular disease	1st	<p>dietary modification + fiber supplementation</p> <p>» Diverticular disease may be defined as any clinical state caused by symptoms pertaining to colonic diverticula. For patients with mild symptoms, treatment includes dietary modification, especially gradually increasing the fiber content over weeks and increasing hydration.[32]</p>
	adjunct	<p>oral antibiotic therapy</p> <p>» If there is evidence of infection and/or suspicion of bacterial overgrowth, often a broad spectrum antibiotic covering both gram-positive and gram-negative aerobic and anaerobic bacteria may be initiated; although, there is a risk of inducing pseudo-membranous colitis.[33]</p> <p>Primary options</p> <p>» amoxicillin/clavulanate: 500 mg orally every 8 hours for 7 days Dose refers to amoxicillin component.</p> <p>OR</p> <p>» ciprofloxacin: 500 mg orally every 12 hours for 7-10 days -and- » metronidazole: 500 mg orally every 8 hours for 7-10 days</p>
symptomatic diverticulitis (uncomplicated)	1st	<p>oral antibiotic therapy</p> <p>» Diverticulitis indicates inflammation of a diverticulum or diverticula, and may be caused by infection. In uncomplicated diverticulitis, oral antibiotics are used on clinical diagnosis.[33] If there is no improvement in 72 hours and/or fever and leukocytosis persist, patient should be hospitalized and intravenous antibiotics used until clinical improvement.1[C]Evidence</p>

Acute

Patient group

Tx line

Treatment

Primary options

» **amoxicillin/clavulanate**: 500 mg orally every 8 hours for 7 days
Dose refers to amoxicillin component.

OR

» **ciprofloxacin**: 500 mg orally every 12 hours for 7-10 days
-and-
» **metronidazole**: 500 mg orally every 8 hours for 7-10 days

plus

analgesia

» Simple analgesia is preferred starting with oral acetaminophen. Depending on the severity of pain, analgesia can be escalated using tramadol and, if necessary, escalating to opioids including morphine in a titrated fashion. However, in general, analgesic drugs that cause constipation should be avoided.

Primary options

» **acetaminophen**: 325-1000 mg orally every 4-6 hours when required, maximum 4000 mg/day

Secondary options

» **tramadol**: 50-100 mg orally (immediate-release) every 4-6 hours when required, maximum 400 mg/day

Tertiary options

» **morphine sulfate**: 5-10 mg subcutaneously/intramuscularly every 4 hours when required

adjunct

low-residue diet

» A low-residue diet reduces the frequency and volume of stools while prolonging intestinal transit time. It typically restricts foods that increase bowel activity and are low in fibers and undigested material that leave a minimal residue after digestion and absorption in gut (e.g., refined bread, cereals, white rice, vegetable and fruit juice without pulp, dairy products).

2nd

intravenous antibiotic therapy

» Intravenous antibiotics are used if there is no improvement in 72 hours after oral antibiotics have been started or symptoms of acute diverticulitis or

Acute

Patient group

Tx line

Treatment

acute abdomen present, and/or fever and leukocytosis persist.[33] 1[C]EvidenceHospitalization should be considered until clinical improvement.

Primary options

- » **ceftriaxone**: 1-2 g intravenously every 24 hours
- and-**
- » **metronidazole**: 500 mg intravenously every 8 hours

OR

- » **piperacillin/tazobactam**: 3.375 g intravenously every 6 hours
- Dose consists of 3 g of piperacillin plus 0.375 g of tazobactam.

plus

analgesia

» Simple analgesia is preferred, starting with oral acetaminophen. Depending on the severity of pain, analgesia can be escalated using tramadol and, if necessary, escalating to opioids, including morphine in a titrated fashion. However, in general analgesic drugs that cause constipation should be avoided.

Primary options

- » **acetaminophen**: 325-1000 mg orally every 4-6 hours when required, maximum 4000 mg/day

Secondary options

- » **tramadol**: 50-100 mg orally (immediate-release) every 4-6 hours when required, maximum 400 mg/day

Tertiary options

- » **morphine sulfate**: 5-10 mg subcutaneously/intramuscularly every 4 hours when required

adjunct

low-residue diet

» A low-residue diet reduces the frequency and volume of stools while prolonging intestinal transit time. It typically restricts foods that increase bowel activity and is low in fibers and undigested material that leave a minimal residue after digestion and absorption in gut (e.g., refined bread, cereals, white rice, vegetable and fruit juice without pulp, dairy products).

Acute

Patient group	Tx line	Treatment
symptomatic diverticulitis (complicated)		
<ul style="list-style-type: none"> with acute rectal bleeding 	1st	<p>endoscopic hemostasis/angiographic embolization</p> <ul style="list-style-type: none"> » Initial management of bleeding when there is evidence of volume depletion or shock is to maintain hemodynamic stability by infusions of crystalloids, colloids, and blood. » After this, colonoscopy is considered, not only for accurate diagnosis, but also for endoscopic hemostasis. If bleeding is too profuse for identification using colonoscopy, an angiogram or isotope-labeled RBC nuclear scan may be considered, and angiographic embolization attempted. » Surgery may be considered if significant bleeding continues despite attempted endoscopic and angiographic hemostasis. <p>Primary options</p> <ul style="list-style-type: none"> » endoscopic hemostasis <p>OR</p> <ul style="list-style-type: none"> » angiographic embolization
	plus	<p>supportive therapy + antibiotics</p> <ul style="list-style-type: none"> » Initial management of bleeding when there is evidence of volume depletion or shock is to maintain hemodynamic stability by infusions of crystalloids, colloids, and blood. » A 7 to 10 day course of antibiotics is often recommended on the premise that there is background acute inflammation/infection accounting for the bleeding. <p>Primary options</p> <ul style="list-style-type: none"> » amoxicillin/clavulanate: 500 mg orally every 8 hours for 7 days Dose refers to amoxicillin component. <p>OR</p> <ul style="list-style-type: none"> » ciprofloxacin: 500 mg orally every 12 hours for 7-10 days -and- » metronidazole: 500 mg orally every 8 hours for 7-10 days
	plus	analgesia

Acute

Patient group

Tx line

Treatment

» Simple analgesia is preferred, starting with oral acetaminophen. Depending on the severity of pain, analgesia can be escalated using tramadol and, if necessary, escalating to opioids, including morphine in a titrated fashion. However, in general analgesic drugs that cause constipation should be avoided.

Primary options

» **acetaminophen**: 325-1000 mg orally every 4-6 hours when required, maximum 4000 mg/day

Secondary options

» **tramadol**: 50-100 mg orally (immediate-release) every 4-6 hours when required, maximum 400 mg/day

Tertiary options

» **morphine sulfate**: 5-10 mg subcutaneously/intramuscularly every 4 hours when required

plus

low-residue diet

» A low-residue diet is recommended for these patients during the acute phase until recovery.

» A low-residue diet reduces the frequency and volume of stools while prolonging intestinal transit time. It typically restricts foods that increase bowel activity and is low in fibers and undigested material that leave a minimal residue after digestion and absorption in gut (e.g., refined bread, cereals, white rice, vegetable and fruit juice without pulp, dairy products).

2nd

surgery

» Surgery may be required for patients in whom major hemorrhage is not controlled by endoscopic and angiographic treatment.

plus

supportive therapy + continued antibiotics

» Initial management of bleeding when there is evidence of volume depletion or shock is to maintain hemodynamic stability by infusions of crystalloids, colloids, and blood.

» A 7 to 10 day course of antibiotics is often recommended on the premise that there is background acute inflammation/infection accounting for the bleeding.

Acute

Patient group

Tx line

Treatment

unresponsive to IV antibiotics or with abscess >3 cm diameter, perforation, fistulae, or obstruction

plus

analgesia

» In acutely ill patients, parenteral analgesia is often preferred, usually in the form of acetaminophen or morphine.

Primary options

» **acetaminophen**: 650-1000 mg intravenously every 4-6 hours when required, maximum 4000 mg/day

Secondary options

» **morphine sulfate**: 5-10 mg subcutaneously/intramuscularly every 4 hours when required

plus

low-residue diet

» A low-residue diet is recommended for these patients during the acute phase until recovery.

» A low-residue diet reduces the frequency and volume of stools while prolonging intestinal transit time. It typically restricts foods that increase bowel activity and is low in fibers and undigested material that leave a minimal residue after digestion and absorption in gut (e.g., refined bread, cereals, white rice, vegetable and fruit juice without pulp, dairy products).

1st

drainage/surgery

» Surgical intervention may be considered for diverticular disease that fails to respond to medical management. Surgery may be required for complications, including recurrent diverticulitis, abscess, perforation, fistulae, and obstruction.^{2[C]}**Evidence**

» A localized abscess may be drained under CT scan or ultrasound guidance and, in cases where this cannot be accomplished, surgery is necessary.^[2] A CT scan of the abdomen with contrast is the imaging of choice for percutaneous drainage of abscess.

» Diagnostic laparoscopy should be considered prior to exploratory laparotomy if primary diagnosis is uncertain. Laparoscopic peritoneal irrigation is increasingly used as a management option in sealed perforation with purulent peritonitis.^[38]

» Exploratory laparotomy may still be required in cases where primary diagnosis remain uncertain.

Acute

Patient group

Tx line

Treatment

» Patients should continue on intravenous antibiotics completing a course of 7 to 10 days depending on clinical recovery.

Primary options

» radiological drainage

OR

» surgical management

plus

intravenous antibiotic therapy

» Patients should continue on intravenous antibiotics completing a course of 7 to 10 days depending on clinical recovery.

Primary options

» ceftriaxone: 1-2 g intravenously every 24 hours
-and-
» metronidazole: 500 mg intravenously every 8 hours

OR

» piperacillin/tazobactam: 3.375 g intravenously every 6 hours
Dose consists of 3 g of piperacillin plus 0.375 g of tazobactam.

plus

analgesia

» This group of patients often require parenteral analgesia, usually in the form of acetaminophen or morphine.

Primary options

» acetaminophen: 650-1000 mg intravenously every 4-6 hours when required, maximum 4000 mg/day

Secondary options

» morphine sulfate: 5-10 mg subcutaneously/intramuscularly every 4 hours when required

plus

low-residue diet

» A low-residue diet is recommended for these patients during the acute phase until recovery.

Acute

Patient group	Tx line	Treatment
		» A low-residue diet reduces the frequency and volume of stools while prolonging intestinal transit time. It typically restricts foods that increase bowel activity and is low in fibers and undigested material that leave a minimal residue after digestion and absorption in gut (e.g., refined bread, cereals, white rice, vegetable and fruit juice without pulp, dairy products).

Ongoing

Patient group	Tx line	Treatment
recurrent diverticulitis	1st	<p>elective surgery</p> <p>» Criteria for recommending elective colectomy for recurrent disease are not clear cut and should not be based on the number of previous attacks alone. Any judgement should be made on an individual basis depending on age, frequency, and severity of recurrent symptoms, previous complications, and presence of comorbidities.[40] [41] In elective settings, laparoscopic colonic resection is feasible and safe, may hasten postoperative recovery, and is shown to have fewer postoperative complications, including surgical site infections.[42]</p>

Emerging

Mesalamine

Mesalamine, an anti-inflammatory drug, inhibits some key factors of inflammatory cascade and has intrinsic antioxidant activity. Rationale for use in diverticular disease is similar to that for the use in inflammatory bowel disease, although the exact mechanism of action is not known. Although early trials have shown a decrease in the incidence of recurrent acute diverticulitis,[44] [45] [46] [47] 3[C]Evidence a large multicenter RCT failed to show any benefit in preventing either recurrent diverticulitis or the need for further surgery.[48] However, it may be suitable for patients who are having recurrent bouts of acute diverticulitis, particularly those in whom surgery is not feasible or desirable.

Rifaximin

Rifaximin is an antibiotic used for GI tract infections. Trials have shown a decrease in the incidence of recurrent acute diverticulitis.[49] Rifaximin may be given with mesalamine. There is emerging evidence that treatment with rifaximin plus fiber supplementation may provide symptom relief and may prevent further complications in patients with uncomplicated disease.[50] 4[C]Evidence

Probiotics

Probiotics are live microbial agents which alter the enteric microflora exerting beneficial health effects. Probiotics such as *Lactobacillus* and nonpathogenic *Escherichia coli* have been used to effect a decrease in symptoms and to prolong remission in uncomplicated diverticular disease, although the evidence base is weak.[51]

Recommendations

Monitoring

No routine follow-up is recommended. Although there is no established association between diverticular disease and colorectal neoplasia, screening colonoscopy for colorectal cancer should be considered in patients older than the age of 50 years at normal risk and earlier in those at high risk of colorectal cancer.

Patient instructions

Patients are instructed to increase dietary fiber intake by generous consumption of fruits and vegetables, undertake regular physical activity, and to maintain ideal body weight.

Complications

Complications	Timeframe	Likelihood
fistula	long term	low
<p>Formed when diverticular abscess ruptures into adjacent organ such as urinary bladder in men and vagina in women.[57]</p> <p>Colovesical fistulae usually present with pneumaturia, fecaluria, and recurrent UTIs.[58]</p> <p>Passage of feces or flatus from vagina is diagnostic of colovaginal fistula.</p> <p>Less common fistulas include coloenteric, colouterine, and colourethral.</p> <p>Diagnostic modalities include cystoscopy, cystography, methylene blue studies, and contrast radiographs.</p> <p>Surgical repair is the treatment of choice.[57] [58]</p> <p>If perforation has occurred, antibiotics should be used to prevent generalized peritonitis and septicemia.</p>		
colorectal neoplasm	long term	low
<p>Although there is no established association between diverticulosis and colorectal neoplasia, one study revealed that women with extensive distal diverticulosis were more likely to have advanced distal neoplasia.[60]</p> <p>High index of suspicion and a low threshold for screening colonoscopy is recommended for an early detection and possible curative treatment of colorectal neoplasia in these patients.</p>		
abscess	variable	medium

Complications	Timeframe	Likelihood
<p>Most small pericolic abscesses respond to bowel rest and broad-spectrum antibiotics. CT-guided percutaneous drainage of abscesses can accelerate healing and eliminate the need for surgery.[55]</p> <p>Surgery is required when medical treatment and percutaneous drainage does not result in clinical improvement. Surgery should also be considered in cases of multiloculated or inaccessible abscesses. An abscess at a remote site in the abdomen may still be a complication of diverticulitis even in absence of significant left lower abdominal symptoms. Early laparoscopic drainage and peritoneal washout is a therapeutic option that is gaining increasing acceptance and has been subjected to RCTs.[38] However, one clinical trial reported inferior outcome with laparoscopic lavage compared with sigmoidectomy.[56]</p> <p>Diagnostic laparoscopy/exploratory laparotomy should be considered early if primary diagnosis is unclear.</p>		
perforation	variable	medium
<p>Microperforation is usually self-contained and conservative treatment including antibiotics, IV fluids, and bowel rest result in complete healing. However, free air perforation is a surgical emergency, as untreated it may result in generalized peritonitis associated with significant morbidity and mortality. Although CT scan is helpful as a confirmatory test, presence of free air on abdominal series radiograph along with high index of clinical suspicion justify exploratory laparotomy. When expertise is available, laparoscopy and laparoscopic peritoneal lavage may be an alternative option.[38]</p>		
strictures, obstruction	variable	medium
<p>Inflammation and fibrosis may result in strictures, which in turn may cause partial or complete obstruction. Bowel obstruction may also result from pressure of inflamed bowel loop or small intestinal loop(s) being entangled in the inflammatory process. Ileus and pseudo-obstruction is also seen.</p> <p>In cases of stricture, differentiation should be made from an obstructing neoplasm; colonoscopic biopsy will be required in this scenario.</p> <p>Balloon dilation and stent placement may be considered as treatment.[59] Failure of dilation or inability to rule out malignancy mandates surgical resection.</p> <p>Bowel rest, nasogastric suction, and intravenous antibiotics may result in resolution of partial obstruction. Serial plain abdominal radiographs should be done to assess progression of obstruction and to recognize early signs of bowel ischemia. If condition does not improve by conservative management or bowel ischemia is evident, surgical intervention is indicated.</p> <p>Pseudo-obstruction should be managed conservatively by correcting predisposing causes such as sepsis, electrolyte disorders, administering IV fluids, and nasogastric suction.</p>		

Prognosis

Most patients with uncomplicated diverticulitis recover following medical treatment and do not require surgical intervention.

Recurrent disease

A recurrence of the disease occurs in one third of patients following response to medical treatment, mostly within 5 years.^{[17] [52]} Recurrent disease is associated with high mortality, and response to therapy is less favorable.

Post-surgery

Approximately one fourth of all patients following surgical treatment continue to remain symptomatic.^{[53] [54]}

Diagnostic guidelines

International

Practice parameters for the treatment of sigmoid diverticulitis

Published by: American Society of Colon and Rectal Surgeons

Last published: 2014

Summary: Provides guidance on the diagnosis of diverticulitis.

Treatment guidelines

International

Practice parameters for the treatment of sigmoid diverticulitis

Published by: American Society of Colon and Rectal Surgeons

Last published: 2014

Summary: Provides guidance on the treatment of acute diverticulitis.

Evidence scores

1. Cure rates: there is poor-quality evidence that intravenous cefoxitin is as effective as intravenous gentamicin plus intravenous clindamycin at increasing cure rates in people with acute diverticulitis.

Evidence level C: Poor quality observational (cohort) studies or methodologically flawed randomized controlled trials (RCTs) of <200 participants.

[More info from BMJ Clinical Evidence](#)

2. Mortality rates: there is poor-quality evidence that mortality rates at 30 days and postoperative complications are the same for acute sigmoid colonic resection and no acute resection.

Evidence level C: Poor quality observational (cohort) studies or methodologically flawed randomized controlled trials (RCTs) of <200 participants.

[More info from BMJ Clinical Evidence](#)

3. Recurrence: there is poor-quality evidence that mesalamine may be more effective than no treatment at 4 years at reducing recurrence of symptoms in people previously treated for an episode of acute diverticulitis.

Evidence level C: Poor quality observational (cohort) studies or methodologically flawed randomized controlled trials (RCTs) of <200 participants.

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4. Symptom relief: there is poor-quality evidence that rifaximin plus glucomannan, a dietary fiber supplement may be more effective than dietary fiber supplements alone at relieving symptoms of acute diverticulitis.

Evidence level C: Poor quality observational (cohort) studies or methodologically flawed randomized controlled trials (RCTs) of <200 participants.

[More info from BMJ Clinical Evidence](#)

Key articles

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