

# Diverticular Disease: Rapid Evidence Review

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Diverticulitis should be suspected in patients with isolated left lower quadrant pain, abdominal distention or rigidity, fever, and leukocytosis. Initial laboratory workup includes a complete blood count, basic metabolic panel, urinalysis, and C-reactive protein measurement. Computed tomography with intravenous contrast is the preferred imaging modality, if needed to confirm diagnosis and assess for complications of diverticulitis. Treatment decisions are based on the categorization of disease as complicated vs. uncomplicated. Selected patients with uncomplicated diverticulitis may be treated without antibiotics. Complicated diverticulitis is treated in the hospital with modified diet or bowel rest, antibiotics, and pain control. Abscesses that are 3 cm or larger should be treated with percutaneous drainage. Emergent surgery is reserved for when percutaneous drainage fails or the patient's clinical condition worsens despite adequate therapy. Colonoscopy should not be performed during the flare-up, but should be considered six weeks after resolution of symptoms in patients with complicated diverticulitis who have not had a high-quality colonoscopy in the past year. Diverticulitis prevention measures include consuming a vegetarian diet or high-quality diet (high in fruits, vegetables, whole grains, and legumes), limiting red meat and sweets, achieving or maintaining a body mass index of 18 to 25 kg per  $m^2$ , being physically active, and avoiding tobacco and long-term nonsteroidal anti-inflammatory drugs. Partial colectomy is not routinely recommended for diverticulitis prevention and should be reserved for patients with more than three recurrences or abscess formation requiring percutaneous drainage. (Am Fam Physician. 2022;106(2):150-156. Copyright © 2022 American Academy of Family Physicians.)

**A diverticulum** is a protrusion through the intestinal wall, and diverticulosis is the presence of multiple diverticula. Acute diverticulitis is inflammation of diverticula. Possible causes include abnormal colonic motility, colonic wall resistance, intraluminal pressures, and colonic wall defects.<sup>1,2</sup> Diverticular bleeding, the most common cause of lower gastrointestinal tract bleeding in adults, was reviewed previously in *American Family Physician* (<https://www.aafp.org/afp/2009/1101/p977.html>). The current article provides a summary of the best evidence on diagnosis and management of diverticular disease.

## Epidemiology

- Incidence of diverticulitis is increasing. From 1980 to 2007, the incidence increased from 115

per 100,000 person-years to 188 per 100,000 person-years.<sup>3</sup>

- Prevalence of diverticulitis is less than 10% in people older than 45 years vs. 80% in those older than 85 years.<sup>1,2</sup>
- Only 1% to 4% of patients with diverticular disease will develop diverticulitis in their lifetime.<sup>4</sup>

## WHAT'S NEW ON THIS TOPIC

### Diverticular Disease

From 1980 to 2007, the incidence of diverticulitis rose from 115 per 100,000 person-years to 188 per 100,000 person-years.

A high-fiber diet is associated with a lower incidence of diverticular disease, but evidence regarding whether it prevents the recurrence of diverticulitis is lacking.

A 2019 meta-analysis of nine randomized controlled trials showed that in patients with uncomplicated acute diverticulitis, those treated without antibiotics had shorter hospital stays than those treated with antibiotics, and there was no difference in complication or readmission rates.

**CME** This clinical content conforms to AAFP criteria for CME. See CME Quiz on page 126.

**Author disclosure:** Dr. Dattani reports serving as a proctor for Intuitive Surgical. Drs. Bailey and Jennings have no relevant financial relationships.

Clinical recommendation	Evidence rating	Comments
Avoiding popcorn, nuts, or seeds does not decrease the risk of diverticulitis or diverticular complications. <sup>7</sup>	B	Prospective cohort study
Tobacco cessation, reduced meat intake, physical activity, and weight loss are recommended interventions to decrease the risks of diverticulitis recurrence. <sup>8-11</sup>	C	Practice guideline and two prospective cohort studies
Computed tomography of the abdomen and pelvis is the most appropriate initial imaging modality in the assessment of suspected complicated diverticulitis. <sup>8,9,15-17</sup>	C	Practice guidelines and American College of Radiology Appropriateness Criteria
Selected patients with uncomplicated diverticulitis can be treated without antibiotics. <sup>8,9,16,20-24</sup>	A	Practice guideline, multiple randomized controlled trials, and a meta-analysis
Imaging-guided percutaneous drainage is recommended for stable patients with abscesses $\geq 3$ cm in size. <sup>8,9,29-33</sup>	B	Practice guideline, systematic review, multicenter cohort study, retrospective cohort study, and population-based study
Prophylactic partial colectomy should be considered in patients who had an abscess requiring drainage. <sup>8,38,39</sup>	B	Practice guideline, retrospective cohort study, and retrospective review
Colonoscopy should be considered six to eight weeks after resolution of a complicated case of diverticulitis unless the patient has had a high-quality colonoscopy in the past year. <sup>8,9,41,42</sup>	C	Practice guideline, expert consensus, systematic review, and meta-analysis with disease-oriented outcomes

**A** = consistent, good-quality patient-oriented evidence; **B** = inconsistent or limited-quality patient-oriented evidence; **C** = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to <https://www.aafp.org/afpsort>.

- Risk factors for diverticulitis include increasing age, constipation, low-fiber diet, smoking, red meat consumption, obesity, weight gain, lack of exercise, genetic susceptibility, and nonsteroidal anti-inflammatory drug and aspirin use.<sup>1,5,6</sup>
- Consumption of popcorn, nuts, and seeds is not a risk factor for developing diverticulitis.<sup>7</sup>

## Screening and Prevention

- Screening for diverticular disease is not recommended. It is often found incidentally on screening colonoscopy or imaging studies performed for other reasons.
- Measures for preventing recurrence of diverticulitis include consuming a vegetarian diet or high-quality diet (high in fruits, vegetables, whole grains, and legumes), limiting red meats and sweets, achieving or maintaining a body mass index of 18 to 25 kg per  $m^2$ , being physically active, and avoiding tobacco and long-term nonsteroidal anti-inflammatory drugs.<sup>8-11</sup>
- A high-fiber diet is associated with a lower incidence of diverticular disease, but evidence regarding whether it prevents the recurrence of diverticulitis is lacking.<sup>12</sup>

## Diagnosis

### SIGNS AND SYMPTOMS

- Tenderness to palpation located only in the left lower quadrant of the abdomen is the most specific finding for

TABLE 1

### Accuracy of Signs and Symptoms for the Diagnosis of Acute Diverticulitis

Signs and symptoms	LR+	LR-
Localized tenderness only in the left lower quadrant	10.4	0.7
History of left lower quadrant pain	3.3	0.5
Absence of vomiting	1.4	0.2
History of fever	1.4	0.8
Laboratory or imaging findings		
Computed tomography*	94	0.1
Ultrasonography*	9.2	0.09
Magnetic resonance imaging*	7.8	0.07
C-reactive protein level $> 5$ mg per dL (50 mg per L)	2.2	0.3
Combination of left lower quadrant pain, the absence of vomiting, and a C-reactive protein level $> 5$ mg per dL	18	0.65

LR- = negative likelihood ratio; LR+ = positive likelihood ratio.

\*—LR+ relates to positive findings on imaging and LR- relates to negative findings on imaging.

Adapted with permission from Wilkins T, Embry K, George R. Diagnosis and management of acute diverticulitis. *Am Fam Physician*. 2013;87(9):614.

diverticulitis (likelihood ratio [LR] = 10.4). Tenderness in the left lower quadrant plus other locations is less useful (LR = 3.4).<sup>13</sup>

- History of left lower quadrant tenderness (LR = 3.3), fever (LR = 1.4), and absence of vomiting (LR = 1.4) also support the diagnosis<sup>13</sup> (*Table 1*).
- Other nonspecific signs and symptoms may include abdominal rigidity, anorexia, dysuria, hypoactive bowel sounds, rectal bleeding, or tenderness on rectal examination.<sup>1,13</sup>
- Fecaluria, pneumaturia, pyuria, and stool per vagina should raise suspicion for fistula formation.<sup>8</sup>
- Studies have found that right-sided diverticulitis is more common in Asian countries.<sup>14</sup>
- The differential diagnosis of diverticulitis is shown in *Table 2*.<sup>1</sup>

## DIAGNOSTIC EVALUATION

- Initial tests include complete blood count (white blood cell count may be normal in 45% of patients), basic metabolic panel to evaluate electrolyte and renal status, urinalysis to rule out urinary tract infection, and C-reactive protein (level greater than 20 mg per dL [200 mg per L] is suggestive of perforation).<sup>13</sup>
- Other tests to consider in selected patients include a beta-human chorionic gonadotropin test to rule out ectopic pregnancy and if surgery is needed in a patient who could become pregnant, and a lipase test to rule out acute pancreatitis (mild elevation of lipase may occur with perforation).
- Imaging should be considered if the diagnosis is uncertain or there is concern for complicated diverticulitis.
- If imaging is performed, computed tomography with contrast is the diagnostic test of choice because of its availability and high sensitivity (94%) and specificity (99%).<sup>8,9,15,16</sup>
- Magnetic resonance imaging has good diagnostic accuracy and avoids radiation exposure but may not be as readily available as computed tomography.<sup>8,17</sup>
- Ultrasonography can be effective in the diagnosis of diverticulitis, but operator experience affects accuracy. Its ability to assess for free air or the extent of large abscesses is limited.<sup>8,17</sup>

## CLINICAL PREDICTION RULES

- The combination of a C-reactive protein level greater than 5 mg per dL (50 mg per L), isolated left lower quadrant tenderness, and absence of vomiting has a positive LR of 5.3 to 18 for diverticulitis (sensitivity = 36% to 37%; specificity = 93% to 98%).<sup>13,18</sup>
- A clinical prediction rule that includes abdominal guarding, white blood cell count, and C-reactive protein

TABLE 2

### Differential Diagnosis of Diverticulitis

Gastrointestinal	Gynecologic	Urinary
Bowel obstruction	Ectopic pregnancy	Nephrolithiasis
Colitis (infectious and ischemic)	Endometriosis	Urinary tract infection
Colon cancer	Ovarian cyst	
Inflammatory bowel disease	Pelvic inflammatory disease	
Irritable bowel syndrome	Torsion	
Perforation	Tubo-ovarian abscess	

Information from reference 1.

level can be used to predict the likelihood of complicated diverticulitis.<sup>19</sup>

## Treatment

### UNCOMPLICATED ACUTE DIVERTICULITIS

- For patients who have normal vital signs, are able to maintain oral intake, and have no signs of complications (e.g., peritonitis, fever), outpatient management is appropriate.
- Antibiotics should not be used routinely in the treatment of uncomplicated diverticulitis.<sup>8,9,16,20-24</sup> A meta-analysis of nine randomized controlled trials with 2,505 patients showed that those treated without antibiotics had shorter hospital stays than those treated with antibiotics, and there was no difference in complication or readmission rates.<sup>20</sup>
- If symptoms do not improve after 48 to 72 hours, a broad-spectrum antibiotic against anaerobic and gram-negative rods should be initiated and typically continued for seven to 10 days (*Table 3*).<sup>25,26</sup>
- In one study, patients were given four days of ertapenem (Invanz) for uncomplicated acute diverticulitis. If symptoms improved, they were randomized to three additional days of treatment or no further antibiotics. The cure rate was 98% in both groups.<sup>27</sup>
- Although bowel rest is typically recommended, there is no evidence to support it over a modified diet (e.g., a clear liquid or soft mechanical diet as tolerated) for uncomplicated disease.<sup>28</sup>
- Follow-up is recommended two or three days after diagnosis to assess improvement.

### COMPLICATED ACUTE DIVERTICULITIS

- Diverticulitis is considered complicated in patients with abnormal vital signs, signs of perforation with or without

**TABLE 3****Antibiotic Treatment Guidelines for Diverticulitis**

**Outpatient:** Oral antibiotics should be considered for uncomplicated diverticulitis only if symptoms persist or worsen after 48 to 72 hours

Trimethoprim/sulfamethoxazole, 160 mg/800 mg orally twice daily + metronidazole, 500 mg orally three times daily

Amoxicillin/clavulanate (Augmentin), 875 mg/125 mg orally (extended-release formulation twice daily, regular formulation three times daily)

Ciprofloxacin, 500 mg orally twice daily + metronidazole, 500 mg orally three times daily

Moxifloxacin (Avelox), 400 mg orally once daily\*

Levofloxacin, 750 mg orally once daily + metronidazole, 500 mg orally three or four times daily

**Inpatient:** Complicated diverticulitis is initially treated with intravenous antibiotics, transitioned to oral antibiotics after patient shows improvement (usually two to four days)

Piperacillin/tazobactam (Zosyn), 3.375 g IV every six hours or 4.5 g every eight hours

Ticarcillin/clavulanate (not available in the United States), 3.1 g IV every six hours

Ertapenem (Invanz), 1 g IV once daily

Moxifloxacin, 400 mg IV once daily

Cefazolin, 1 g to 2 g IV every eight hours + metronidazole, 500 mg IV every eight hours

Cefuroxime, 1.5 g IV every eight hours + metronidazole, 500 mg IV every eight hours

Cefotaxime, 1 g to 2 g IV every eight hours + metronidazole, 500 mg IV every eight hours

Levofloxacin, 750 mg IV once daily + metronidazole, 500 mg IV every eight hours

Ciprofloxacin, 400 mg IV every 12 hours + metronidazole, 500 mg IV every eight hours

**Severe, life-threatening:** Patients with severe sepsis or admitted to intensive care

Imipenem/cilastatin (Primaxin), 500 mg IV every six hours

Meropenem (Merrem), 1 g IV every eight hours

Ertapenem, 1 g IV once daily

Doripenem (not available in the United States), 500 mg IV every eight hours

Piperacillin/tazobactam, 4.5 g IV every six hours

Cefepime, 2 g IV every eight hours + metronidazole, 500 mg IV or orally every eight hours

Ceftazidime (Fortaz), 2 g IV every eight hours + metronidazole, 500 mg IV or orally every eight hours

Ampicillin, 2 g IV every six hours + metronidazole, 500 mg IV or orally every eight hours + ciprofloxacin, 400 mg IV every 12 hours (or levofloxacin, 750 mg IV once daily)

IV = intravenously.

\*—Second-line in patients who are unable to tolerate beta-lactam antibiotics and metronidazole.

Information from references 25 and 26.

abscess, fistula or obstruction, or the inability to maintain oral intake.

- Patients with complicated acute diverticulitis should be admitted to the hospital. Computed tomography with intravenous contrast should be obtained for patients with vital sign abnormalities or if there is a concern for abscess, perforation, or fistula.<sup>8,9,17</sup>

- Intravenous antibiotics should be initiated (*Table 3*).<sup>25,26</sup>

- Bowel rest or clear liquid diet is recommended if the patient is able to tolerate oral intake, nothing by mouth if not.

- Abscesses smaller than 3 cm should be treated with intravenous antibiotics, and reevaluation if there is clinical deterioration. Imaging-guided percutaneous drainage is recommended for abscesses that are 3 cm or larger, with surgical consultation if needed. Surgical consultation is required for management of bowel perforation (*Table 4*).<sup>8,9,29-33</sup>

- The patient may be discharged home when vital signs normalize, pain is resolved or improving and can be controlled with oral medications, and the patient can tolerate oral intake.

### SURGICAL MANAGEMENT: ACUTE MANAGEMENT

- The Hinckley classification can be used to guide acute surgical management.<sup>34,35</sup>
- Stage 1 (pericolic or mesenteric abscess) or stage 2 (walled-off pelvic abscess) is initially managed nonoperatively. If the patient does not improve, surgical intervention should be considered.
- For stages 3 or 4 (generalized purulent or feculent peritonitis), surgical consultation is needed if hemodynamically stable.
- Surgical approaches vary based on intraoperative findings and surgeon preference.<sup>9,36</sup>

### SURGICAL MANAGEMENT: PREVENTION OF RECURRENCE

- Surgical intervention is based on recurrence risk and the patient's overall health status. Considerations for surgical referral include severity of pain or symptoms, complicated disease, potential for poor outcome, and the medical needs of the patient.<sup>8,9</sup>
- Surgical referral for partial colectomy after the third reoccurrence appears to be most cost-effective.<sup>37</sup>

TABLE 4

## Management of Diverticulitis Complications

Complication	Diagnosis	Management
Fistula	Can develop between bowel, bladder, vagina, uterus	Surgical consultation
Microperforation	Small air bubbles in gastrointestinal wall or adjacent to it, but no oral contrast seen outside of the bowel	IV antibiotics and inpatient observation; consider surgical consultation
Obstruction	Appearance of obstructive diverticulitis and colon cancer are very similar on computed tomography	Surgical resection to relieve obstruction and pathology to confirm diagnosis
Perforation	Free air under diaphragm	Surgical consultation; can be life-threatening
Small abscess (< 3 cm)	Abscess seen on computed tomography	IV antibiotics and inpatient observation; percutaneous drainage or surgery if symptoms worsen
Large abscess (≥ 3 cm)	Abscess seen on computed tomography	IV antibiotics and percutaneous drainage is first-line treatment; surgery if symptoms worsen (e.g., continued fever after 24 to 48 hours, worsening pain) or location not amenable to percutaneous drainage

IV = intravenous.

Information from references 8, 9, and 29–33.

- Abscess formation requiring drainage increases the risk of recurrence, and prophylactic partial colectomy should be considered.<sup>8,38,39</sup>
- Risk factors for recurrence include age older than 50 years, tobacco use, obstruction, peritonitis, and fistula formation.<sup>8,38</sup>
- Elective partial colectomy is no longer recommended in patients younger than 50 years at first occurrence of diverticulitis.<sup>40</sup>

## AFTERCARE

- Colonoscopy should be considered six to eight weeks after symptom resolution in patients with complicated diverticulitis unless the patient has had a high-quality colonoscopy in the past year (colorectal cancer risk is 1.3% in uncomplicated diverticulitis and 7.9% in complicated diverticulitis).<sup>8,9,41,42</sup>
- If a patient with a history of diverticulitis has persistent pain, fecal calprotectin measurement (or C-reactive protein if unavailable), colonoscopy, or imaging should be considered to evaluate for ongoing inflammation.<sup>8,9,43</sup>
- Fecal calprotectin measurement may be useful for differentiating chronic inflammation from visceral hypersensitivity. One endoscopically confirmed case-control study ( $n = 48$ ) showed 100% of patients with irritable bowel syndrome had a fecal calprotectin level less than 15 mcg per g, whereas 90% of patients with chronic diverticular inflammation had elevated fecal calprotectin (15 to 60 mcg per g).<sup>44</sup>

- Mesalamine has not shown benefit in the prevention of inflammation or diverticulitis recurrence and should not be used prophylactically.<sup>9,45</sup>
- Irritable bowel syndrome should be diagnosed in patients with persistent symptoms and a workup negative for chronic inflammation.<sup>9,46</sup>

## Prognosis

- Most cases of diverticula are asymptomatic. The incidence is 0.46 per 1,000 person-years for diverticular bleeding and 1.5 to 6 per 1,000 person-years for diverticulitis.<sup>47</sup>
- Most cases of diverticulitis/diverticular disease will be uncomplicated (88%), and 12% will be complicated (abscess formation, fistula, obstruction).<sup>3,47</sup>
- After an initial episode of diverticulitis, the risk of having a second flare-up is 22% at 10 years. If a patient has a second occurrence, they have a 55% chance of a third occurrence in the next 10 years.<sup>3,9</sup>
- The overall risk of developing a complicated flare-up does not increase with subsequent flare-ups.<sup>9</sup>

This article updates previous articles on this topic by Wilkins, et al.,<sup>1</sup> and Salzman and Lillie.<sup>48</sup>

**Data Sources:** A PubMed search was completed in Clinical Queries using the key terms diverticulitis and diagnosis, medical and surgical treatment, and prevention. The search was limited to meta-analyses, randomized controlled trials, clinical trials,

reviews, and clinical guidelines. We also searched Essential Evidence Plus, the Agency for Healthcare Research and Quality evidence reports, Clinical Evidence, the Cochrane database, and DynaMed. Search dates: July 2021 and April 2022.

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## DIVERTICULAR DISEASE

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