# Acute colonic diverticulitis: Triage and inpatient management

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Literature review current through: **Feb 2024.**
This topic last updated: **Mar 20, 2024.**

## INTRODUCTION

Diverticular disease of the colon is an important cause of hospital admissions and a significant contributor to health care costs in Western and industrialized societies [1,2]. In the United States, acute diverticulitis is the third most common gastrointestinal illness that requires hospitalization and the leading indication for elective colon resection [3,4].

The triage and inpatient management of patients with acute colonic diverticulitis is discussed in this topic. The discussion pertains mostly to the treatment of sigmoid diverticulitis; a brief discussion of diverticulitis of the right colon can be found at the end of the topic (see 'Right-sided (cecal) diverticulitis' below). Outpatient management and follow-up is the focus of another topic. (See "Acute colonic diverticulitis: Outpatient management and follow-up".)

The epidemiology, pathophysiology, clinical manifestations, diagnosis, complications, and surgical treatment of diverticulitis are discussed elsewhere:

- (See "Colonic diverticulosis and diverticular disease: Epidemiology, risk factors, and pathogenesis".)
- (See "Clinical manifestations and diagnosis of acute colonic diverticulitis in adults".)
- (See "Diverticular fistulas".)
- (See "Colonic diverticular bleeding".)
- (See "Acute colonic diverticulitis: Surgical management".)

## UNCOMPLICATED VERSUS COMPLICATED DIVERTICULITIS

Acute diverticulitis is suspected in patients with lower abdominal pain, abdominal tenderness with focal guarding (most typically in the left lower abdomen) on physical examination, and leukocytosis on laboratory testing. (See "Clinical manifestations and diagnosis of acute colonic diverticulitis in adults", section on 'Clinical manifestations'.)

The diagnosis is usually confirmed by an abdominopelvic computed tomography (CT) scan, which may also exclude alternative conditions (eg, perforated colon cancer, infectious or ischemic colitis) and distinguish complicated from uncomplicated disease by one of the following [5] (see "Clinical manifestations and diagnosis of acute colonic diverticulitis in adults", section on 'Acute complications'):

- Abscess
- Perforation
- Obstruction
- Fistulization

Acute uncomplicated diverticulitis can be treated nonoperatively in most patients (70 to 100 percent) [6-8], regardless of the treatment setting (out- versus inpatient) [9-13]. In systematic reviews of studies of uncomplicated diverticulitis, including a randomized trial (DIVER) [14], no differences in outcomes were found between outpatient and inpatient care [15,16]. However, acute complicated diverticulitis generally requires hospitalization and possibly interventional radiologic procedures and/or surgery. (See 'Treatment of complications' below.)

## TRIAGE

Based upon findings from the history, physical examination, laboratory studies, and CT scan, patients are triaged to either inpatient or outpatient treatment as discussed below and illustrated by the accompanying algorithm (      algorithm 1).

**Criteria for inpatient treatment** — Patients with acute diverticulitis should receive inpatient treatment if [10,12,17] (      table 1):

- CT shows **complicated** diverticulitis. (See 'Uncomplicated versus complicated diverticulitis' above.)

- CT shows **uncomplicated** diverticulitis, but the patient has one or more of the following characteristics [18]:

- Sepsis or systemic inflammatory response syndrome as defined by **more than one of the following**: Temperature >38 or <36°C, heart rate >90 beats per minute, respiration rate >20 respirations per minute, white blood cell count >12,000/mL or <4000/mL, C-reactive protein >15 mg/dL.

- Severe abdominal pain with failure to control abdominal pain in the emergency department to <5 on a visual analog scale.

- Age >70 years.

- Significant comorbidities (eg, diabetes mellitus with organic involvement [eg, retinopathy, angiopathy, nephropathy], a recent cardiogenic event [eg, acute myocardial infarction, angina, heart failure], or recent decompensation of chronic liver disease [≥Child B] or end-stage renal disease).

- Immunosuppression (eg, poorly controlled diabetes mellitus, chronic high-dose corticosteroid use, use of other immunosuppressive agents, advanced human immunodeficiency virus infection or acquired immunodeficiency syndrome, B or T cell leukocyte deficiency, active cancer of hematologic malignancy, or organ transplant).

- Intolerance of oral intake secondary to bowel obstruction or ileus.

- Noncompliance with care/unreliability for return visits/lack of support system.

- Failed outpatient treatment.

**Criteria for outpatient treatment** — Patients may be able to receive outpatient treatment for diverticulitis if they do not meet any of the criteria for inpatient treatment listed above. Outpatient management of diverticulitis is discussed in another topic. (See 'Criteria for inpatient treatment' above and "Acute colonic diverticulitis: Outpatient management and follow-up".)

## INPATIENT TREATMENT

Inpatient treatment of acute diverticulitis varies depending upon whether the patient has complicated or uncomplicated disease. All patients undergo treatment for diverticulitis with intravenous antibiotics, fluids, and pain medications. Patients with complicated diverticulitis must also undergo treatment specific to their complications ( algorithm 1). (See 'Uncomplicated versus complicated diverticulitis' above.)

**Treatment of diverticulitis** — Inpatient treatment of acute diverticulitis typically begins with administration of intravenous antibiotics, fluids, and pain medications. Patients can be made nil per os to allow for complete bowel rest or be offered a clear liquid diet depending upon their clinical status. Patients without complications typically show a clinical response within two to three days, at which point their diet can be advanced further. Patients who continue to improve are discharged to complete a course of oral antibiotics; those who fail to improve are referred for surgical evaluation.

**Intravenous antibiotics** — Patients requiring hospitalization should begin intravenous antibiotics with activities against gram-negative rods and anaerobic organisms. The choice of agents depends upon the severity of the illness (table 2 and table 3). In rare occasions when acute diverticulitis develops in patients who are already hospitalized or have undergone percutaneous drainage, antibiotic coverage should be broadened to also include nosocomial organisms (table 4). If a culture has been taken at the time of percutaneous abscess drainage or surgery, the antibiotic regimen should be revised based upon susceptibility results. Anaerobic coverage should be continued if polymicrobial infection is identified. Detailed discussion of antibiotic therapy for intra-abdominal infections can be found in another topic. (See "Antimicrobial approach to intra-abdominal infections in adults".)

Intravenous antibiotics should be continued until the inflammation is stabilized, evidenced by resolving abdominal pain and tenderness. This process typically takes three to five days. The patient is then transitioned to oral antibiotics (most commonly ciprofloxacin plus metronidazole or amoxicillin-clavulanate) to complete a 10 to 14 day course (inclusive of intravenous and oral antibiotic therapy). (See 'Oral antibiotics' below.)

The duration of intravenous antibiotic therapy in patients who undergo procedures for definitive source control (percutaneous abscess drainage or surgery) is discussed separately. (See "Antimicrobial approach to intra-abdominal infections in adults", section on 'Duration of therapy'.)

The need for intravenous antibiotics for acute uncomplicated diverticulitis treated as inpatient has been studied in two European trials and one Oceanic trial [19]:

- In the Swedish trial (AVOD), 623 patients with CT-confirmed uncomplicated left-sided diverticulitis were treated with or without antibiotics as inpatients [20]. Complication rates (1.9 versus 1.0 percent), hospital length of stay (three days in both groups), and recurrence rates (16 percent in both groups) were similar. Ten patients initially treated without antibiotics subsequently received antibiotics due to increasing abdominal pain, fever, or increasing C-reactive protein (CRP). A subsequent study, which followed 556 of the original

participants for a median of 11 years, reported similar outcomes between the antibiotic and no-antibiotic groups in the rates of recurrences, complications, surgery for diverticulitis, and colorectal cancer [21].

- A second Dutch trial (DIABOLO) randomly assigned 528 patients with first-episode, CT-proven, left-sided acute diverticulitis to observation or 10 days of antibiotics (Augmentin in most, ciprofloxacin plus metronidazole in the rest) [22]. Patients with complicated diverticulitis, with the exception of a small (<5 cm) abscess, were excluded. Most (93 percent) of the trial participants were admitted to the hospital. The median times to recovery without (14 [interquartile range 6 to 35] days) or with antibiotics (12 [7 to 30] days) were similar. At six months, the outcomes were similar in terms of complicated diverticulitis (3.8 percent observation versus 2.6 percent antibiotics), smoldering diverticulitis (7.3 versus 4.1 percent), recurrent diverticulitis (3.4 versus 3 percent), need for sigmoid resection (3.8 versus 2.3 percent), need for readmission (17.6 versus 12.0 percent), adverse events (48.5 versus 54.5 percent), or mortality (1.1 versus 0.4 percent).

- A double-blind, placebo-controlled Australian/New Zealand trial (STANDARD) randomly assigned 180 patients with CT-proven uncomplicated diverticulitis to either intravenous cefuroxime/Flagyl followed by Augmentin or placebo for seven days [23]. All patients were initially admitted to the hospital. There was no significant difference in hospital stay (40 hours antibiotics versus 46 hours placebo), adverse event rate, or 7 or 30 day readmission rate.

Given that these trials used different exclusion criteria, CT imaging is not perfect in detecting complicated diverticular disease, and most patients admitted for inpatient treatment of acute diverticulitis have either severe disease or serious comorbid conditions, we suggest treating all inpatients with antibiotics rather than selectively based on whether the disease is complicated. This issue remains controversial [24,25], however, particularly between providers based in Europe versus North America [26,27].

**Intravenous fluid** — Patients who are admitted for inpatient treatment of acute diverticulitis should be given intravenous fluid (eg, Ringer lactate or normal saline) to correct volume deficits. Intravenous fluid is typically continued until patients are tolerating adequate liquids.

**Pain control** — Patients who are admitted for acute diverticulitis often have severe abdominal pain from localized peritonitis. For such patients, parenteral analgesics (eg, acetaminophen, ketorolac, morphine, or hydromorphone) are administered when patients are taking nothing by mouth, while oral analgesics (eg, acetaminophen, ibuprofen, oxycodone) are appropriate when patients are consuming an oral diet.

**Inpatient diet** — Patients requiring hospitalization should initially be kept on complete bowel rest with intravenous hydration. Patients without complications typically show a clinical response within two to three days, at which point they can be started on a liquid diet and advanced as tolerated.

**Treatment of complications** — Of the acute complications of diverticulitis, abscesses and microperforations are quite common. Frank perforation is not common, and obstruction and fistulization are rare.

**Frank perforation** — Evidenced by free air under the diaphragm with or without extravasation of contrast or fluid, frank perforation of the colon results in diffuse peritonitis from intra-abdominal spread of feculent fluid and bacterial organisms. Acute diverticulitis that presents with frank perforation is life-threatening and mandates emergency surgery [28-31]. (See "Acute colonic diverticulitis: Surgical management", section on 'Free (frank) perforation'.)

**Microperforation** — Microperforation, also called contained perforation, is the presence of a small amount of air bubbles but no oral contrast outside of the colon on abdominopelvic CT imaging. Most patients who have microperforation should be treated initially with intravenous antibiotics (see 'Treatment of diverticulitis' above); the majority of them (94 percent) can be managed nonoperatively [32], but with the following caveats:

- Patients with pericolonic air bubbles only can be managed the same way as those with uncomplicated diverticulitis. The success rate of nonoperative management is from 85 to 99 percent [33,34]. (See 'Treatment of diverticulitis' above.)

- Patients with pericolonic air bubbles associated with an abscess should be managed according to the abscess. The expected success rate of nonoperative management is lower than that of uncomplicated diverticulitis. (See 'Abscess' below.)

- Patients with a small amount of distant intraperitoneal air bubbles (eg, over the liver, under the diaphragm) or distant retroperitoneal air bubbles require an individualized approach; those with a benign abdominal examination and absence of immunosuppression may be managed nonoperatively while those with peritonitis or on significant immunosuppression should undergo surgery. In these patients, the success rate of nonoperative management varies from 34 to 93 percent, depending on whether there is an associated abscess or pelvic fluid [7,33,35,36]. (See "Acute colonic diverticulitis: Surgical management", section on 'Free (frank) perforation'.)

**Abscess** — Abscesses occur in 16 to 40 percent of patients with complicated acute diverticulitis [37]. We suggest a stepwise approach to treating diverticular abscesses [27]:

- Antibiotics are the first-line treatment for all diverticular abscesses, particularly those <4 cm. (See 'Intravenous antibiotics' above.)

- Percutaneous drainage may be added, if feasible, for abscesses ≥4 cm, those that do not resolve with antibiotic therapy, or in the presence of clinical deterioration. (See 'Large abscess (≥4 cm)' below.)

The guidelines from the American Society of Colon and Rectal Surgeons (ASCRS) also advocate a stepwise approach to treating diverticular abscesses, but with a different cutoff size of 3 cm for recommending percutaneous drainage [12]. This discrepancy may not be clinically significant.

The overall success rate of nonoperative management for diverticular abscess is approximately 80 percent regardless of approach (antibiotics, percutaneous drainage, or both) [37]. The remaining 20 percent need surgery [38].

The recurrence rate after successful nonoperative management is 15 to 25 percent [37,39] and is higher for abscesses >5 cm [40]. Whether all asymptomatic patients with a healed diverticular abscess require elective surgery is controversial and discussed elsewhere. (See "Acute colonic diverticulitis: Surgical management", section on 'Healed diverticular abscess'.)

**Small abscess (<4 cm)** — For smaller abscesses, antibiotic therapy alone and percutaneous drainage have similar success rates, morbidity, and mortality [37]. One study that treated 23 abscesses <3 cm with antibiotics alone reported a treatment failure rate of 0 percent [38]. In another study, 93 of 107 diverticular abscesses <4 cm were successfully treated with antibiotics alone [41].

Patients who respond to antibiotics are followed with serial CT scans until the resolution of the abscess; patients who deteriorate or fail to improve after two to three days of antibiotic therapy may require surgery if percutaneous drainage is not an option.

Abscesses may not be amenable to percutaneous drainage because they are too small (ie, <2 cm) or there are important structures (eg, small bowel) adjacent to them that preclude percutaneous access [38,40,42].

**Large abscess (≥4 cm)** — The benefit of percutaneous drainage is greater for larger abscesses. As the size of the abscess increases from ≤3 cm to 3 to 10 cm and 3 to 18 cm, the success rate of antibiotics-alone therapy decreases from 100 to 82 and 66 percent, respectively [37]. By contrast, 80 percent of diverticular abscesses >4 cm resolve after percutaneous drainage [27]. In order to maximize the success rate of nonoperative management, we suggest

percutaneous drainage of diverticular abscesses ≥4 cm, whenever feasible, in addition to antibiotic therapy.

CT-guided drainage is performed for abscesses that are amenable to percutaneous drainage. An approach through the anterior abdominal wall is favored for most abscesses, while abscesses deep in the pelvis or obscured by other organs are drained transgluteally. Transrectal or transvaginal approaches to abscess drainage have also been described but are rarely used [43,44]. Once a drainage catheter is placed, it is left until the output is minimal, a process that can take a longer course [45].

After percutaneous drainage of a diverticular abscess, patients typically defervesce within 24 to 48 hours. Surgical intervention should be considered for patients who do not improve within 48 hours. (See "Acute colonic diverticulitis: Surgical management".)

**Obstruction** — Patients with acute sigmoid diverticulitis can present with large bowel obstruction at the site of the acute inflammation. Rarely, the phlegmonous or abscess cavity can secondarily involve the small bowel causing a complete small bowel obstruction. (See "Acute colonic diverticulitis: Surgical management", section on 'Obstruction'.)

**Fistula** — A fistula can develop between the colon and bladder, vagina, uterus, other bowel segments, and abdominal wall. Diverticular fistulas rarely close spontaneously, and a resection of the affected bowel segment is generally required. Though fistulization may also lead to intra-abdominal abscesses, these typically do not usually present acutely. The management of a diverticular fistula is discussed separately. (See "Diverticular fistulas".)

**Subsequent care** — Patients are assessed daily and typically show improvement after two to three days of antibiotics. Patients who show continued improvement can be discharged. Failure to improve should prompt repeat imaging.

**Repeat imaging** — Disease progression with or without new complications should be suspected in patients with clinical deterioration and those who fail to improve after two to three days of intravenous antibiotic therapy. Repeat imaging may be required in such patients.

The purpose of repeat imaging, typically with an abdominopelvic CT scan, is to look for new complications (eg, abscess or perforation) that may require further intervention (eg, percutaneous drainage or surgery).

**Criteria for discharge** — Most patients with uncomplicated diverticulitis have significant clinical improvement after two to three days of intravenous antibiotics. They are then

reassessed daily to determine if they are eligible to be discharged from the hospital. The patient must meet all criteria listed below before they can be discharged:

- Normalization of vital signs (ie, resolution of high fever, tachycardia, or hypotension)
- Resolution of severe abdominal pain
- Resolution of significant leukocytosis
- Tolerance of oral diet
- Resumption of bowel movements

**Oral antibiotics** — Patients are discharged with oral antibiotics to complete a course of 10 to 14 days (inclusive of both intravenous and oral antibiotics). We use one of the following oral antibiotic regimens in adult patients with normal renal and hepatic function ( table 5):

- Ciprofloxacin (500 mg every 12 hours) plus metronidazole (500 mg every 8 hours)

- Levofloxacin (750 mg daily) plus metronidazole (500 mg every 8 hours)

- Trimethoprim-sulfamethoxazole (1 double-strength tablet [sulfamethoxazole 800 mg; trimethoprim 160 mg] every 12 hours) plus metronidazole (500 mg every 8 hours)

- Amoxicillin-clavulanate (1 tablet [875 mg amoxicillin; 125 mg clavulanic acid] every 8 hours) [14,46,47] or Augmentin XR (2 tablets [each tablet containing 1 g amoxicillin; 62.5 mg clavulanic acid] every 12 hours)

The local antibiogram should be consulted to avoid prescribing a regimen to which bacterial resistance exceeds 10 percent. As an example, in areas where the prevalence of *Escherichia coli* resistance to fluoroquinolones exceeds 10 percent, amoxicillin-clavulanate or trimethoprim-sulfamethoxazole plus metronidazole are the preferred agents. Moxifloxacin is reserved for those who cannot use the other regimens because of high rates of resistance among anaerobes [48]. There is also clinical evidence that fluoroquinolones plus metronidazole were associated with a higher rate of *Clostridioides difficile* than amoxicillin-clavulanate at one year [49].

After discharge, patients should be reassessed within one week and then weekly until all symptoms have resolved. In a retrospective cohort study of over 200,000 patients, the readmission rate for treatment failure was 6.6 percent, with complicated diverticulitis being the strongest predictor of readmissions [50]. (See "Acute colonic diverticulitis: Outpatient management and follow-up".)

**Failure of inpatient medical treatment** — Surgical evaluation is indicated at any point during admission if the patient's condition deteriorates (eg, increased abdominal pain or leukocytosis, or development of diffuse peritonitis). (See "Acute colonic diverticulitis: Surgical management".)

Patients who fail to improve with two to three days of intravenous antibiotics should undergo repeat imaging to identify new-onset complications of diverticulitis (eg, abscess or perforation). Certain complications may require surgery. (See 'Repeat imaging' above and 'Treatment of complications' above.)

In addition, surgery may be warranted in patients who fail to improve after another one to two days of medical management, even if no complications are identified with repeat imaging.

## SPECIAL PATIENT GROUPS

**Young patients (age <40)** — Although some studies have reported more frequent and severe recurrences in patients younger than 40 years of age and some have advocated early elective surgery in such patients [51-55], other studies have suggested that the risk of recurrence is better predicted by the severity of the initial attack than the age of onset [56,57]. In concordance with the American Society of Colon and Rectal Surgeons (ASCRS) practice parameters for sigmoid diverticulitis, we do not offer elective surgery to patients who have a history of diverticulitis simply because they are young [12].

**Right-sided (cecal) diverticulitis** — In Western countries, acute colonic diverticulitis is primarily left sided (72 percent sigmoid, 33 percent descending, 3 percent transverse, 5 percent ascending colon). Right-sided (cecal) diverticula account for only 1.5 percent of diverticulitis cases in Western countries but 38 to 75 percent of diverticulitis cases in Asian countries [58].

Patients with right-sided diverticulitis tend to be younger than those with left-sided disease [59]. Right-sided diverticulitis is less likely to be complicated. Several studies from both Western and Asian countries have reported lower complication rates, lower mortality rates, and lower recurrence rates to be associated with right-sided, as compared with left-sided, diverticulitis [59,60].

The management of right-sided diverticulitis ranges from medical therapy to surgery, depending upon patient presentation. When the diagnosis is made nonoperatively, medical management with antibiotics is usually sufficient. In a systematic review and meta-analysis of 11 studies, the pooled recurrence rate after nonoperative management was 12 percent (95% CI 10 to 15 percent) with a median follow-up of 34 months [61]. Only 10 percent of those who recurred required urgent surgery at the first recurrence, and there was no mortality.

Patients who are diagnosed with right-sided diverticulitis during exploratory operations for abdominal discomfort can undergo an appendectomy if the base of the appendix and the cecum are not inflamed [62-64]. This is then followed by antibiotic therapy. Diverticulectomy can

be performed if there is a localized perforation of the involved diverticulum [62,65]. One prospective nonrandomized study associated diverticulectomy with similar success and complication rates but lower recurrence rates than medical management [66]. Most commonly, a right hemicolectomy is performed if there is inflammation of the area or a mass suggestive of a carcinoma [64].

## SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Colonic diverticular disease" and "Society guideline links: Intra-abdominal infections in adults".)

## INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topics (see "Patient education: Diverticulitis (The Basics)")

- Beyond the Basics topics (see "Patient education: Diverticular disease (Beyond the Basics)")

## SUMMARY AND RECOMMENDATIONS

- **Complicated versus uncomplicated diverticulitis** – Acute complications of colonic diverticulitis include:

  - Abscess (common)
  - Perforation (common)

- Obstruction (rare)
- Fistulization (rare)

The need for surgical intervention is much higher for complicated diverticulitis than for uncomplicated diverticulitis. (See 'Uncomplicated versus complicated diverticulitis' above.)

- **Decision on outpatient versus inpatient care** – Based upon findings on the history, physical examination, laboratory tests, and abdominopelvic CT scan, patients with acute colonic diverticulitis are triaged to either inpatient or outpatient treatment. Inpatient care is indicated for those with (algorithm 1):

  - Complicated diverticulitis (ie, perforation, abscess, obstruction, or fistula), and/or

  - Risk factors for worse outcomes as an outpatient (table 1)

  Patients without these risk factors have similar outcomes regardless of care setting. (See 'Triage' above.)

- **Treating diverticulitis** – For patients in whom inpatient management of acute colonic diverticulitis is appropriate, we suggest administering intravenous antibiotics (**Grade 2C**). Some of these patients have clear indications for antibiotics (eg, abscess), and there is no evidence that uncomplicated but severe diverticulitis can be treated without antibiotics.

  The choice of agents depends on disease severity and risk factors for antibiotic resistance or treatment failure (eg, advanced age, major medical comorbidities, immunocompromise, travel to areas with resistant organisms):

  - Mild to moderate symptoms without risk factors (table 2)

  - Severe symptoms and/or risk factors (table 3)

  - Hospital-acquired infection (table 4)

  Patients should initially be kept on complete bowel rest. Clinical response is typically seen within two to three days, at which point a liquid diet can be started and advanced as tolerated. Patients who continue to improve are discharged with oral antibiotics to complete a total of 10 to 14 days of antibiotic therapy (table 5). (See "Acute colonic diverticulitis: Outpatient management and follow-up".)

  Patients who fail to improve with inpatient treatment may require repeat imaging and/or surgical evaluation. (See 'Treatment of diverticulitis' above and "Acute colonic diverticulitis: Surgical management".)

- **Treating complications** – Patients with complicated diverticulitis must receive intravenous antibiotics and undergo treatments specific to their complications. Diverticular abscesses ≥4 cm require percutaneous drainage if feasible; smaller abscesses may respond to antibiotics alone. Sigmoid colectomy is the preferred treatment for frank perforation, obstruction, or fistulization. (See 'Treatment of complications' above and "Acute colonic diverticulitis: Surgical management".)

## ACKNOWLEDGMENT

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Topic 1380 Version 77.0

## Management of acute colonic diverticulitis

```
                    ┌─────────────────────────────────────────┐
                    │ Acute colonic diverticulitis diagnosed by CT │
                    └─────────────────────────────────────────┘
                                      │
        ┌─────────────────────────────┼─────────────────────────────┐
   Uncomplicated              Complicated                    Complicated by:
                              by abscess                     ▪ Frank perforation or
                                                             ▪ Obstruction or
                                                             ▪ Fistulization
        │                             │                             │
        ▼                             ▼                             ▼
┌───────────────────┐        ┌──────────────────┐        ┌──────────────────┐
│ Does the patient  │        │ Is the abscess   │        │ Surgical evaluation │
│ meet criteria for │        │    ≥4 cm?        │        │                  │
│ hospital admission?* │     └──────────────────┘        └──────────────────┘
└───────────────────┘
     │         │                 │          │
    No        Yes               No         Yes
     │         │                 │          │
     ▼                                      ▼
┌───────────────────────────┐      ┌──────────────────┐
│ Outpatient treatment with: │      │                  │
│ ▪ Oral pain medication     │      │  Percutaneous    │
│ ▪ Liquid diet              │      │  drainage if feasible │
│                            │      │                  │
│ Clinical reassessment within 1 week │ └──────────────┘
│                            │
│ Any Improvement?           │
└───────────────────────────┘
     │          │
    Yes        No
     │          │
     ▼          ▼
┌──────────────────────┐  ┌──────────────────────────────────┐
│ ▪ Advance diet       │  │ Inpatient treatment with:        │
│ ▪ Weekly clinical    │  │ ▪ Intravenous antibiotics ¶      │
│   reassessment       │  │ ▪ Intravenous fluids             │
│   until resolution   │  │ ▪ Intravenous analgesics         │
│                      │  │ ▪ NPO or liquid diet             │
│ Colonoscopy after    │  │                                  │
│ 6 to 8 weeks         │  │ Daily clinical reassessment       │
│                      │  │                                  │
│                      │  │ Improvement within 2 to 3 days?  │
└──────────────────────┘  └──────────────────────────────────┘
                              │                    │
                             Yes                   No
                              │                    │
                              │                    ▼
                              │   ┌──────────────────────────────────┐
                              │   │ ▪ Repeat CT scan                 │
                              │   │ ▪ Treat any new complication     │
                              │   │ ▪ Otherwise, continue same treatment │
                              │   │                                  │
                              │   │ Improvement within another 2 to 3 days? │
                              │   └──────────────────────────────────┘
                              │         │                 │
                              │        Yes                No
                              ▼         ▼                 ▼
┌──────────────────────────────────────────────┐  ┌──────────────────┐
│ Advance diet                                 │  │                  │
│                                              │  │                  │
│ Discharge when meeting all of the following: │  │                  │
│ ▪ Normalization of vital signs               │  │                  │
│ ▪ Resolution of severe abdominal pain        │  │ Surgical evaluation │
│ ▪ Resolution of leukocytosis                 │  │                  │
│ ▪ Tolerance of oral diet                     │  │                  │
│ ▪ Resumption of bowel movement               │  │                  │
│                                              │  │                  │
│ Patient should transition to oral antibiotics△ upon │ │          │
│ discharge to complete a total of 10 to 14 days │  │                │
│                                              │  │                  │
│ Colonoscopy after 6 to 8 weeks               │  │                  │
└──────────────────────────────────────────────┘  └──────────────────┘
```

CT: computed tomography; NPO: nil per os.

* Criteria for inpatient management (only need to meet one):
  - Complicated diverticulitis
  - Sepsis or systemic inflammatory response syndrome evidenced by more than one of the following: Temperature >38°C or <36°C, heart rate >90 beats per minute, respiration rate >20 respirations per minute, white blood cell count >12,000/mL or <4000/mL, C-reactive protein >15 mg/dL
  - Severe abdominal pain or diffuse peritonitis, and/or failure to reduce abdominal pain in the emergency department to <5 on a visual analog scale
  - Microperforation (eg, a few air bubbles outside of the colon without contrast extravasation or phlegmon)
  - Age >70 years
  - Significant comorbidities (eg, diabetes mellitus with organic involvement [eg, retinopathy, angiopathy, nephropathy], a recent cardiogenic event [eg, acute myocardial infarction, angina, heart failure], or recent decompensation of chronic liver disease [≥Child B] or end-stage renal disease)
  - Immunosuppression (eg, poorly controlled diabetes mellitus, chronic high-dose corticosteroid use, use of other immunosuppressive agents, advanced human immunodeficiency virus infection or acquired immunodeficiency syndrome, B or T cell leukocyte deficiency, active cancer of hematologic malignancy, or organ transplant)
  - Intolerance of oral intake secondary to bowel obstruction or ileus
  - Noncompliance with care/unreliability for return visits/lack of support system
  - Failure of outpatient treatment

¶ The choice of intravenous antibiotics depends on disease severity. Refer to UpToDate topic for details.

Δ Oral antibiotics for diverticulitis include amoxicillin-clavulanate, ciprofloxacin/metronidazole, levofloxacin/metronidazole, or trimethoprim-sulfamethoxazole/metronidazole. Refer to UpToDate topic for dosages.

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Graphic 107989 Version 8.0

# Indications for hospital admission for acute colonic diverticulitis

- Complicated diverticulitis (ie, frank perforation, abscess, obstruction, fistula)

- Sepsis or SIRS (>1 of temperature >38° or <36° Celsius, heart rate >90 beats per minute, respiration rate >20 respirations per minute, white blood cell count >12,000/mL or <4000/mL, C-reactive protein >15 mg/dL)

- Severe abdominal pain or diffuse peritonitis, and/or failure to reduce abdominal pain in the emergency department to <5 on a VAS

- Microperforation (eg, a few air bubbles outside of the colon without contrast extravasation or phlegmon)

- Age >70 years

- Significant comorbidities (eg, diabetes mellitus with organ involvement [eg, retinopathy, angiopathy, nephropathy], recent cardiogenic event [eg, acute myocardial infarction, angina, heart failure], or recent decompensation of chronic liver disease [≥ Child B] or end-stage kidney disease)

- Immunosuppression (eg, poorly controlled diabetes mellitus, chronic high-dose corticosteroid use, use of other immunosuppressive agents, advanced HIV infection or AIDS, B or T cell leukocyte deficiency, active cancer of hematologic malignancy, or organ transplant)

- Intolerance of oral intake secondary to bowel obstruction or ileus

- Nonadherence with care/unreliability for return visits/lack of support system

- Failure of outpatient treatment

SIRS: systemic inflammatory response syndrome; VAS: visual analog scale.

Graphic 130400 Version 2.0

## Empiric antibiotic regimens for low-risk community-acquired intra-abdominal infections in adults

| | Dose |
|---|---|
| **Single-agent regimen** | |
| Piperacillin-tazobactam* | 3.375 g IV every 6 hours |
| **Combination regimen with metronidazole*** | |
| **One** of the following: | |
| Cefazolin | 1 to 2 g IV every 8 hours |
| or | |
| Cefuroxime | 1.5 g IV every 8 hours |
| or | |
| Ceftriaxone | 2 g IV once daily |
| or | |
| Cefotaxime | 2 g IV every 8 hours |
| or | |
| Ciprofloxacin | 400 mg IV every 12 hours or 500 mg PO every 12 hours |
| or | |
| Levofloxacin | 750 mg IV or PO once daily |
| **Plus**: | |
| Metronidazole¶ | 500 mg IV or PO every 8 hours |

For empiric therapy of low-risk community-acquired intra-abdominal infections, we cover streptococci, Enterobacteriaceae, and anaerobes. Low-risk community-acquired intra-abdominal infections are those that are of mild to moderate severity (including perforated appendix or appendiceal abscess) in the absence of risk factors for antibiotic resistance or treatment failure. Such risk factors include recent travel to areas of the world with high rates of antibiotics-resistant organisms, known colonization with such organisms, advanced age, immunocompromising conditions, or other major medical comorbidities. Refer to other UpToDate content on the antimicrobial treatment of intra-abdominal infections for further discussion of these risk factors.

The antibiotic doses listed are for adult patients with normal renal function. The duration of antibiotic therapy depends on the specific infection and whether the presumptive source of infection has been controlled; refer to other UpToDate content for details.

IV: intravenously; PO: orally.

\* When piperacillin-tazobactam or one of the combination regimens in the table cannot be used, ertapenem (1 g IV once daily) is a reasonable alternative.

¶ For most uncomplicated biliary infections of mild to moderate severity, the addition of metronidazole is not necessary.

---

## Empiric antibiotic regimens for high-risk community-acquired intra-abdominal infections in adults

| | Dose |
| --- | --- |
| **Single-agent regimen** | |
| Imipenem-cilastatin | 500 mg IV every 6 hours |
| Meropenem | 1 g IV every 8 hours |
| Doripenem | 500 mg IV every 8 hours |
| Piperacillin-tazobactam | 4.5 g IV every 6 hours |
| **Combination regimen with metronidazole** | |
| ONE of the following: | |
| Cefepime | 2 g IV every 8 hours |
| OR | |
| Ceftazidime | 2 g IV every 8 hours |
| PLUS: | |
| Metronidazole | 500 mg IV or orally every 8 hours |

High-risk community-acquired intra-abdominal infections are those that are severe or in patients at high risk for adverse outcomes or antimicrobial resistance. These include patients with recent travel to areas of the world with high rates of antibiotics-resistant organisms, known colonization with such organisms, advanced age, immunocompromising conditions, or other major medical comorbidities. Refer to the UpToDate topic on the antimicrobial treatment of intra-abdominal infections for further discussion of these risk factors.

For empiric therapy of high-risk community-acquired intra-abdominal infections, we cover streptococci, Enterobacteriaceae resistant to third-generation cephalosporins, *Pseudomonas aeruginosa*, and anaerobes. Empiric antifungal therapy is usually not warranted but is reasonable for critically ill patients with an upper gastrointestinal source.

Local rates of resistance should inform antibiotic selection (ie, agents for which there is >10% resistance among Enterobacteriaceae should be avoided). If the patient is at risk for infection with an extended-spectrum beta-lactamase (ESBL)-producing organism (eg, known colonization or prior infection with an ESBL-producing organism), a carbapenem should be chosen. When beta-lactams or carbapenems are chosen for patients who are critically ill or are at high risk of infection with drug-resistant pathogens, we favor a prolonged infusion dosing strategy. Refer to other UpToDate content on prolonged infusions of beta-lactam antibiotics.

The combination of vancomycin, aztreonam, and metronidazole is an alternative for those who cannot use other beta-lactams or carbapenems (eg, because of severe reactions).

The antibiotic doses listed are for adult patients with normal renal function. The duration of antibiotic therapy depends on the specific infection and whether the presumptive source of infection has been controlled; refer to other UpToDate content for details.

IV: intravenous.

# Empiric antibiotic regimens for health care-associated intra-abdominal infections in adults

|  | Dose |
|---|---|
| **Single-agent regimen** | |
|    Imipenem-cilastatin | 500 mg IV every 6 hours |
|    Meropenem | 1 g IV every 8 hours |
|    Doripenem | 500 mg IV every 8 hours |
|    Piperacillin-tazobactam | 4.5 g IV every 6 hours |
| **Combination regimen** | |
|    ONE of the following: | |
|      Cefepime | 2 g IV every 8 hours |
|       OR | |
|      Ceftazidime | 2 g IV every 8 hours |
|    PLUS: | |
|      Metronidazole | 500 mg IV or orally every 8 hours |
|    PLUS ONE of the following (in some cases*): | |
|      Ampicillin | 2 g IV every 4 hours |
|       OR | |
|      Vancomycin | 15 to 20 mg/kg IV every 8 to 12 hours |

For empiric therapy of health care-associated intra-abdominal infections, we cover streptococci, enterococci, Enterobacteriaceae that are resistant to third-generation cephalosporins and fluoroquinolones, *Pseudomonas aeruginosa*, and anaerobes. We include coverage against methicillin-resistant *Staphylococcus aureus* (MRSA) with vancomycin in those who are known to be colonized, those with prior treatment failure, and those with significant prior antibiotic exposure. Empiric antifungal coverage is appropriate for patients at risk for infection with *Candida* spp, including those with upper gastrointestinal perforations, recurrent bowel perforations, surgically treated pancreatitis, heavy colonization with *Candida* spp, and/or yeast identified on Gram stain of samples from infected peritoneal fluid or tissue. Refer to other UpToDate content on treatment of invasive candidiasis.

If the patient is at risk for infection with an extended-spectrum beta-lactamase (ESBL)-producing organism (eg, known colonization or prior infection with an ESBL-producing organism), a carbapenem should be chosen. For patients who are known to be colonized with highly resistant gram-negative bacteria, the addition of an aminoglycoside, polymyxin, or novel beta-lactam combination (ceftolozane-tazobactam or ceftazidime-avibactam) to an empiric regimen may be warranted. In such cases, consultation with an expert in infectious diseases is advised.

When beta-lactams or carbapenems are chosen for patients who are critically ill or are at high risk of infection with drug-resistant pathogens, we favor a prolonged infusion dosing strategy. Refer to other UpToDate content on prolonged infusions of beta-lactam antibiotics.

The combination of vancomycin, aztreonam, and metronidazole is an alternative for those who cannot use other beta-lactams or carbapenems (eg, because of severe reactions).

The antibiotic doses listed are for adult patients with normal kidney function. The duration of antibiotic therapy depends on the specific infection and whether the presumptive source of infection has been controlled; refer to other UpToDate content for details.

---

IV: intravenous.

* We add ampicillin or vancomycin to a cephalosporin-based regimen to provide enterococcal coverage, particularly in those with postoperative infection, prior use of antibiotics that select for *Enterococcus*, immunocompromising condition, valvular heart disease, or prosthetic intravascular materials. Coverage against vancomycin-resistant enterococci (VRE) is generally not recommended, although it is reasonable in patients who have a history of VRE colonization or in liver transplant recipients who have an infection of hepatobiliary source.

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## Oral antibiotics for acute colonic diverticulitis in adults

| |
|---|
| Ciprofloxacin (500 mg every 12 hours) **plus** metronidazole (500 mg every 8 hours) |
| Levofloxacin (750 mg once daily) **plus** metronidazole (500 mg every 8 hours) |
| Trimethoprim-sulfamethoxazole (1 double-strength tablet [contains sulfamethoxazole 800 mg and trimethoprim 160 mg] every 12 hours) **plus** metronidazole (500 mg every 8 hours) |
| Amoxicillin-clavulanate (1 tablet [contains 875 mg amoxicillin and 125 mg clavulanic acid] every 8 hours) **or** amoxicillin-clavulanate extended-release (2 tablets [each tablet contains 1 g amoxicillin and 62.5 mg clavulanic acid] every 12 hours) |

- The local antibiogram should be consulted to avoid prescribing a regimen to which bacterial resistance exceeds 10%.
- Doses may need to be adjusted for kidney impairment or other factors; refer to drug monographs included within UpToDate for additional details.
- The total duration of treatment is 10 to 14 days (inclusive of both IV, if any, and oral antibiotics).

Graphic 134487 Version 5.0

## Contributor Disclosures

**Krishnan Raghavendran, MD, FACS** No relevant financial relationship(s) with ineligible companies to disclose. **Martin Weiser, MD** Consultant/Advisory Boards: PrecisCa [Gastrointestinal surgical oncology]. All of the relevant financial relationships listed have been mitigated. **Wenliang Chen, MD, PhD** No relevant financial relationship(s) with ineligible companies to disclose.

Contributor disclosures are reviewed for conflicts of interest by the editorial group. When found, these are addressed by vetting through a multi-level review process, and through requirements for references to be provided to support the content. Appropriately referenced content is required of all authors and must conform to UpToDate standards of evidence.

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