Postpolypectomy coagulation syndrome

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All topics are updated as new evidence becomes available and our peer review process is complete.

Literature review current through: **Sep 2023.**
This topic last updated: **Aug 16, 2023.**

INTRODUCTION

Colonoscopy is the gold standard for colon cancer screening and surveillance, and the risk of serious complications is low. However, most complications occur in the setting of polypectomy (eg, bleeding, perforation). Postpolypectomy coagulation syndrome (also known as postpolypectomy syndrome, postpolypectomy electrocoagulation syndrome, and transmural burn syndrome) refers to the development of abdominal pain, fever, leukocytosis, and peritoneal inflammation in the absence of bowel perforation after polypectomy with electrocoagulation. Recognizing postpolypectomy coagulation syndrome (PPCS) is important in order to avoid unnecessary exploratory laparotomy because PPCS usually resolves with medical management.

This topic will discuss the clinical manifestations, diagnosis and management of postpolypectomy coagulation syndrome. An overview of colonoscopy including the indications, patient preparation, and potential complications is presented separately. (See "Overview of colonoscopy in adults".)

Endoscopic mucosal resection techniques that are used for removing large colon polyps are discussed separately. (See "Overview of endoscopic resection of gastrointestinal tumors", section on 'Endoscopic mucosal resection techniques'.)

Endoscopic submucosal dissection (ESD) is another method for removing large colorectal lesions that requires endoscopic tools to dissect lesions from the submucosa. Post endoscopic submucosal dissection coagulation syndrome is a potential complication of ESD, and this is

discussed separately. (See "Overview of endoscopic resection of gastrointestinal tumors", section on 'Colon'.)

Management of postpolypectomy bleeding is discussed separately. (See "Management and prevention of bleeding after colonoscopy with polypectomy".)

EPIDEMIOLOGY

Incidence — The reported incidence of postpolypectomy coagulation syndrome varies in cohort studies, ranging from zero to 2 percent of colonoscopies with polypectomy [1-8]. In a large multicenter study including 47,083 patients, postpolypectomy coagulation syndrome occurred in 34 patients (0.07 percent) [6].

Risk factors — Factors associated with an increased risk for developing postpolypectomy coagulation syndrome include:

- **Lesion size** – Large polyp size is associated with increased risk of PPCS [6,9]. In a case-control study including 34 patients with PPCS compared with 68 controls who were matched by age and sex, patients with a large polyp (≥1 cm) were more likely to develop PPCS compared with those with smaller polyps (odds ratio [OR] 2.86, 95% CI 1.03-7.94) [6].

- **Lesion shape** – A nonpolypoid lesion shape is associated with increased risk of PPCS [6]. Classification of adenomas into polypoid and nonpolypoid (eg, flat) lesions based on endoscopic appearance is discussed separately (figure 1). (See "Overview of colon polyps", section on 'Endoscopic features and classification'.)

- **Lesion location** – Lesions in the ascending colon and cecum appear to have higher rates of complications, including postpolypectomy syndrome or bleeding, and this is attributed to the degree of bowel wall thickness (2 to 3 mm when distended with air) [4,10].

- **Patient history of hypertension** – Patients with hypertension may have increased risk of PPCS [6,9]. In a case-control study including 34 patients with PPCS compared with 68 controls who were matched by age and sex, patients with hypertension were more likely to develop PPCS compared with normotensive patients (OR 3.02, 95% CI 1.03-8.83) [6]. Patients with hypertension are more likely to have atherosclerosis, which may be a contributing factor [7]. (See "Overview of hypertension in adults".)

MECHANISM OF INJURY

Postpolypectomy coagulation syndrome develops when an electrical current that is applied during a polypectomy extends past the mucosa into the muscularis propria and serosa, resulting in a transmural burn and peritoneal inflammation but without colonic perforation [11]. Postpolypectomy coagulation syndrome typically occurs after the removal of a large polyp, which usually requires larger amounts of thermal energy applied over a longer duration [12]. (See 'Risk factors' above.)

In addition, inadvertent capture of a piece of normal adjacent mucosa within the snare loop during snare placement can result in PPCS if electrocautery transects both portions of tissue (mucosa and polyp) (figure 2) [13].

PREVENTION

Endoscopic techniques that may reduce the risk of bowel wall injury from electrocoagulation include [14,15] (see "Overview of colon polyps", section on 'Polypectomy'):

- Hot polypectomy technique – During hot snare polypectomy, we tent the polyp toward the center of the lumen immediately before application of electrocautery so that the submucosa is stretched away from the muscularis propria and serosa as the current is applied [14]. In addition, we use a hot snare and do not use hot biopsy forceps because of increased risk of thermal injury to the submucosa with hot biopsy technique [16,17].

- Submucosal fluid injections for large polyps – Elevating a large polyp by injecting saline (or an alternative solution) into the submucosa prior to polyp transection may reduce the incidence of PPCS, but there are no large studies to substantiate this hypothesis [9,10,18]. A submucosal fluid injection prior to polypectomy should theoretically decrease the occurrence of a transmural burn by increasing the thickness of the submucosal layer [7]. Submucosal injection technique is discussed separately. (See "Endoscopic removal of large colon polyps", section on 'Submucosal injection'.)

- Alternative polypectomy techniques – Cold snare polypectomy is not associated with PPCS, and the available data suggest that cold snare technique may be a safe and effective option for lesions that are ≥1 cm, located in the right colon, or have a non-polypoid shape [19-21].

CLINICAL MANIFESTATIONS

Clinical presentation and examination — Patients with postpolypectomy coagulation syndrome typically present within 12 hours following colonoscopy, but symptoms may occur up to seven days after the procedure [11]. Most patients complain of abdominal pain that may be generalized or may be located in the region of the polypectomy site. Fever or tachycardia may also be present. The abdominal examination may reveal localized abdominal tenderness, while some patients may have guarding and rigidity that closely resembles the examination of a patient with a large bowel perforation. (See "Overview of gastrointestinal tract perforation", section on 'Presentations'.)

Laboratory and imaging studies — Laboratory studies may show leukocytosis with a leftward shift. Cross-sectional imaging (computed tomography scan of the abdomen and pelvis) demonstrates no radiographic evidence of bowel perforation (no intraperitoneal or retroperitoneal free air) [9]. However, imaging may reveal focal thickening of the colonic wall with surrounding fat stranding.

DIAGNOSIS

PPCS should be suspected in patients who present with abdominal pain and tenderness following polypectomy with electrocautery, particularly after removal of large polyp(s) (ie, ≥1 cm). Abdominal pain may be accompanied by fever, tachycardia, or leukocytosis. Urgent computed tomography scan of the abdomen and pelvis (with water-soluble oral contrast and intravenous contrast) is generally obtained to exclude colonic perforation by demonstrating the absence of extraluminal air. Patients with PPCS may have focal thickening of the colonic wall and/or periluminal fat stranding on imaging, but these findings are not required to confirm the diagnosis [22,23]. For selected patients (eg, those with mild localized abdominal pain, no fever, and no tachycardia), it may be reasonable to make the diagnosis based on clinical presentation and without cross-sectional imaging.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis of PPCS includes procedure-related complications and conditions that are not procedure-related. Listed below are other specific causes of abdominal pain and tenderness following colonoscopy with polypectomy:

Colonic perforation — Patients with colonic perforation may present with sudden, severe abdominal pain that may be accompanied by fever, nausea, vomiting, chest pain, scapular pain, or neck pain. Physical examination may be notable for diffuse or localized abdominal

tenderness with peritoneal signs. The diagnosis of colonic perforation is confirmed with abdominopelvic computed tomography (CT) scan, and this is discussed separately. (See "Overview of colonoscopy in adults", section on 'Perforation' and "Overview of gastrointestinal tract perforation".)

Splenic injury — Splenic injury during colonoscopy is rare, and patients may present with left upper quadrant abdominal pain, hypotension, circulatory collapse, and decreased hemoglobin due to blood loss [24,25]. The diagnosis is established with CT scan showing splenic injury with blood that may be confined to the left upper quadrant or may extend to the perihepatic region or pelvic areas [26].

Diverticulitis — Patients with acute diverticulitis typically present with left lower quadrant abdominal pain and tenderness, and the diagnosis can be differentiated from PPCS by imaging with abdominopelvic CT scan. (See "Clinical manifestations and diagnosis of acute colonic diverticulitis in adults", section on 'Diagnostic approach'.)

Colonic ischemia — Patients with colonic ischemia usually present with mild cramping, abdominal pain, and tenderness over the affected bowel, most often involving the left side. Rectal bleeding usually develops within 24 hours of the onset of abdominal pain. The diagnosis can be confirmed by performing lower endoscopy that shows edematous, erythematous mucosa, and interspersed pale areas. The diagnosis and management of colonic ischemic is discussed separately. (See "Colonic ischemia".)

Appendicitis — Patients with appendicitis typically present with right lower quadrant pain, anorexia, nausea, and vomiting. Several imaging modalities have been used to confirm the diagnosis of appendicitis (ultrasound, CT scan, magnetic resonance imaging), and these are discussed separately. (See "Acute appendicitis in adults: Clinical manifestations and differential diagnosis" and "Acute appendicitis in adults: Diagnostic evaluation".)

INPATIENT VERSUS OUTPATIENT MANAGEMENT

Hospitalization may be required for patients with PPCS; however, selected patients may be managed in an ambulatory setting if all of the following conditions are met [18,27]:

- Abdominal pain is mild and there are no signs of generalized peritonitis (ie, no guarding or rigidity)
- Patient is hemodynamically stable and afebrile
- Abdominopelvic computed tomography scan shows no sign of perforation or other serious complications (eg, intra-abdominal hemorrhage)

- Outpatient follow-up is feasible (eg, adequate social supports and transportation)

INPATIENT MANAGEMENT

Initial care — Initial inpatient management of postpolypectomy coagulation syndrome typically begins with intravenous antibiotics and intravenous fluids. Patients can be made nil per os (NPO) to allow for complete bowel rest or be offered a clear liquid diet depending upon the severity of their symptoms. Resolution of abdominal pain and tenderness usually occurs within two to three days, at which point the diet can be advanced. Patients who continue to improve are discharged to complete a course of oral antibiotics. Failure to improve should prompt surgical consultation and repeat imaging. (See 'Patients who do not respond' below.)

Intravenous antibiotics — Patients requiring hospitalization should receive intravenous antibiotics with antimicrobial activity against gram-negative rods and anaerobic organisms. The choice of agents depends upon the severity of the illness (table 1 and table 2). Choice of antibiotic therapy for intra-abdominal infections is discussed in more detail separately. (See "Antimicrobial approach to intra-abdominal infections in adults", section on 'Regimens'.)

Intravenous antibiotics should be continued until abdominal pain and tenderness have resolved. This process typically takes two to three days. The patient is then transitioned to oral antibiotics (eg, ciprofloxacin plus metronidazole or monotherapy with amoxicillin-clavulanate) to complete a seven-day course (inclusive of intravenous and oral antibiotic therapy).

This approach is largely based upon observational studies and clinical experience rather than high-quality evidence [6,7,25].

Antibiotics are given because the transmural burn may result in a breach in the intrinsic mucosal defense barrier that allows normal bowel flora to inoculate the abdominal cavity. The microbiology of intra-abdominal infections is discussed in more detail separately. (See "Antimicrobial approach to intra-abdominal infections in adults", section on 'Microbiology'.)

Intravenous fluid — Patients who are admitted for inpatient treatment of PPCS should be given intravenous fluid (eg, normal saline) to correct volume deficits. Intravenous fluid is typically continued until patients are tolerating clear liquids.

Diet — Patients requiring hospitalization are given either clear liquids or are treated with complete bowel rest and intravenous hydration depending upon the severity of symptoms. Abdominal pain typically resolves within two to three days, at which point the diet is further advanced to a regular diet.

Subsequent care — Patients are assessed daily and abdominal pain and tenderness typically resolve after two to three days of supportive measures (eg, antibiotics, intravenous fluid) [28]. Patients who show continued improvement can be discharged.

The patient must meet all criteria listed below before he/she can be discharged:

- Normalization of vital signs (ie, resolution of fever, tachycardia, or hypotension)
- Resolution of severe abdominal pain
- Tolerance of oral diet

Patients are discharged with oral antibiotics to complete a seven-day course (inclusive of both intravenous and oral antibiotics).

Patients who do not respond — If the patient's condition does not improve or deteriorates (eg, increased abdominal pain or leukocytosis, or development of diffuse peritonitis), urgent surgical consultation is obtained along with repeat imaging (abdominopelvic computed tomography scan). If colonic perforation is suspected based on clinical examination (eg, abdominal guarding, rigidity) and/or imaging showing extraluminal air, management is directed toward the perforation, and this is discussed separately. (See "Overview of gastrointestinal tract perforation".)

Patients with PPCS and a full thickness, transmural burn of the bowel wall may develop necrosis and perforation, although this is uncommon [29].

OUTPATIENT MANAGEMENT

Outpatient management of PPCS typically consists of oral antibiotics for seven days and a clear liquid diet. Patients are reassessed clinically in two to three days after the initiation of antibiotic therapy. If symptoms improve (eg, no abdominal pain or fever), the diet can be liberalized [30]. If the patient's condition does not improve or worsens, inpatient management is necessary. (See 'Initial care' above.)

- **Oral antibiotics** – Patients are typically treated with a course of oral antibiotics for seven days, although treatment duration can be longer (eg, 10 days) if symptoms are not resolved after seven days of therapy. Antibiotics that are used to treat PPCS should cover the usual gastrointestinal flora of gram-negative rods and anaerobes, and options for outpatient antibiotic regimens are listed separately. (See "Acute colonic diverticulitis: Medical management", section on 'No oral antibiotics' and 'Intravenous antibiotics' above.)

- **Diet** – Our approach is to limit patients to a clear liquid diet until they can be reassessed in two to three days. The diet can then be liberalized to a regular diet if they improve clinically (no abdominal pain or tenderness).

Repeat imaging studies are not indicated unless the patient's symptoms persist or worsen. (See 'Patients who do not respond' above.)

PROGNOSIS

The prognosis for patients who recover from postpolypectomy coagulation syndrome is generally excellent with no long-term sequelae. In a multicenter study including 34 patients with PPCS, all patients recovered completely and no deaths were reported [6].

SUMMARY AND RECOMMENDATIONS

- **Background** – Postpolypectomy coagulation syndrome refers to the development of abdominal pain, fever, leukocytosis, and peritoneal inflammation in the absence of bowel perforation after polypectomy with electrocoagulation. Recognizing PPCS is important in order to avoid unnecessary exploratory laparotomy because PPCS usually resolves with medical management. (See 'Introduction' above.)

  Factors associated with an increased risk for developing postpolypectomy coagulation syndrome include large polyp size, nonpolypoid shape of lesion, cecum or ascending colon location, and patient history of hypertension. (See 'Risk factors' above and "Overview of colon polyps".)

- **Mechanism of injury** – Postpolypectomy coagulation syndrome develops when electrical current applied during polypectomy extends beyond the mucosa into the muscularis propria and serosa, resulting in a transmural burn and peritoneal inflammation without colonic perforation. (See 'Mechanism of injury' above.)

- **Diagnosis** – The diagnosis of postpolypectomy coagulation syndrome should be suspected in patients who present with abdominal pain and tenderness following polypectomy with electrocautery. Abdominal pain may be accompanied by fever, tachycardia, or leukocytosis. Urgent imaging (computed tomography scan [CT] of the abdomen and pelvis) is generally obtained to exclude colonic perforation. For selected patients (eg, those with mild localized abdominal pain, no fever, and no tachycardia), it

may be reasonable to make the diagnosis based on clinical presentation and without cross-sectional imaging. (See 'Diagnosis' above.)

- **Management** – Hospitalization is often required for patients with PPCS; however, selected patients may be managed in an ambulatory setting if all of the following conditions are met (see 'Inpatient versus outpatient management' above):

  - Abdominal pain is mild and there are no signs of peritonitis (ie, no guarding or rigidity)
  - Patient is hemodynamically stable and afebrile
  - Abdominopelvic CT scan shows no sign of perforation
  - Close outpatient follow-up is feasible (eg, adequate social support)

  Management of PPCS consists of the following (see 'Inpatient management' above and 'Outpatient management' above):

  - **Antibiotic therapy** – For patients with PPCS, we suggest antibiotic therapy rather than supportive care alone (**Grade 2C**). Antibiotics are given intravenously (IV) initially for patients who require hospitalization; whereas oral antibiotics are appropriate for patients with mild symptoms (outpatients). Acceptable antibiotic regimens are summarized in the tables (table 1 and table 2). The typical duration of therapy is seven days. (See 'Intravenous antibiotics' above.)

  - **Diet** – Patients with severe symptoms should be managed with bowel rest and IV hydration initially until tolerating clear liquids. Patients with milder symptoms are limited to clear liquids initially. Once abdominal pain and tenderness improve (typically within two to three days), the diet can be advanced. (See 'Diet' above.)

  - **Failure to improve** – Failure to improve with medical therapy should prompt surgical consultation and repeat cross-sectional imaging. If the patient is being managed in the outpatient setting, hospitalization is generally necessary. (See 'Patients who do not respond' above.)

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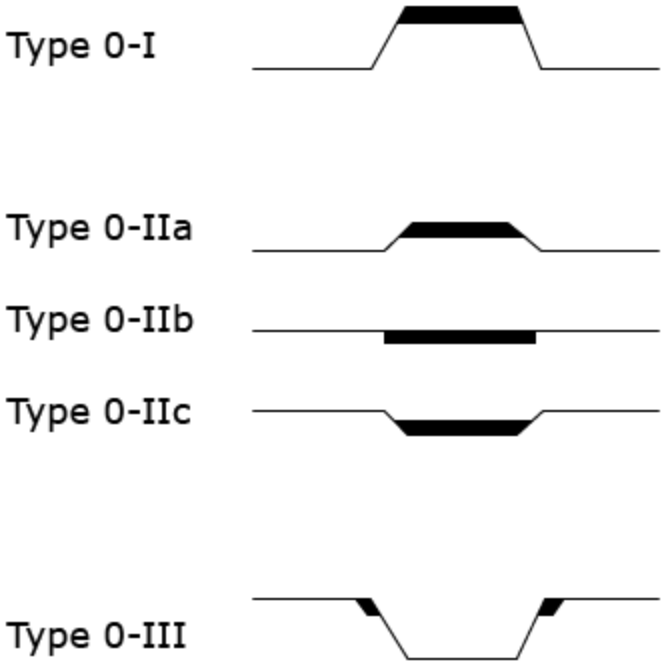
Topic 2669 Version 20.0

GRAPHICS

Paris classification system of superficial neoplastic lesions of the gastrointestinal tract

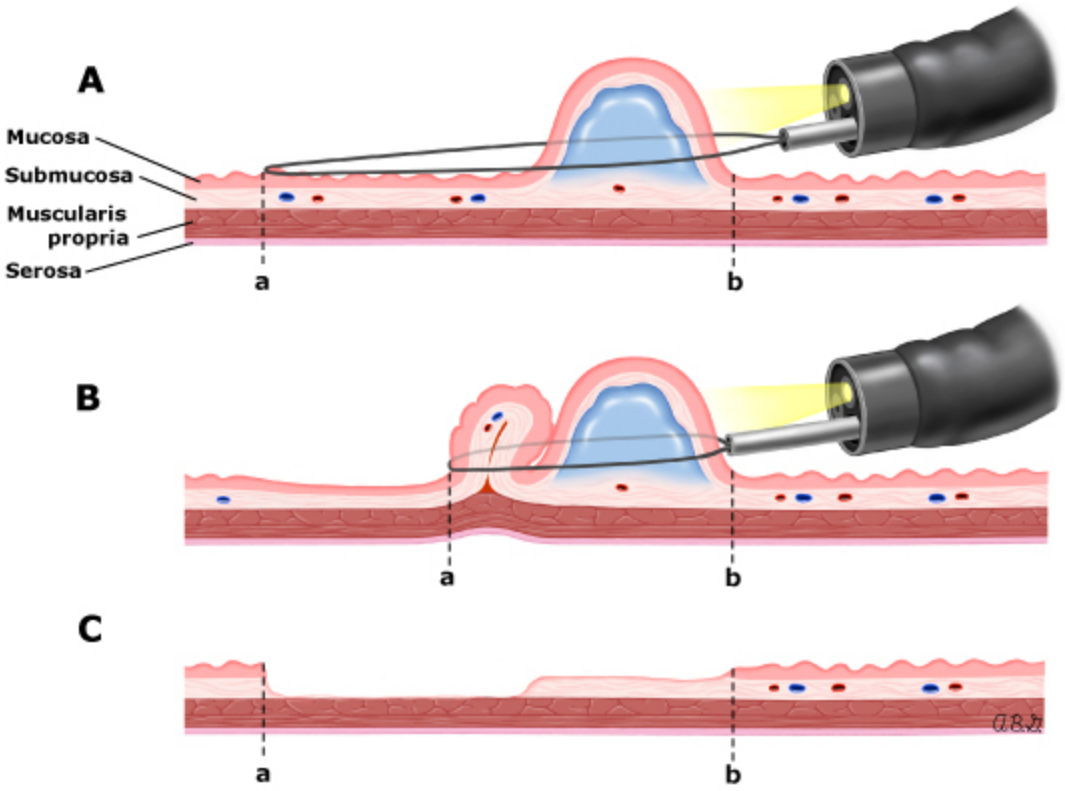


Paris classification system of superficial neoplastic lesions of the esophagus, stomach, and colon. Type 0-I lesions are polypoid (protruded or pedunculated); type 0-II lesions are nonpolypoid and may be slightly elevated (IIa), flat (IIb), or slightly depressed (IIc); type 0-III lesions are excavated.

Based on data from: The Paris endoscopic classification of superficial neoplastic lesions: esophagus, stomach and colon: November 30 to December 1, 2002. Gastrointest Endosc 2003; 58(6 suppl):S3.

Graphic 61277 Version 3.0

Postpolypectomy electrocoagulation syndrome after removal of a large sessile colon polyp



A) Normally, the snare extends beyond the polyp, and the tip contacts mucosa behind the polyp (point a). B) As the snare is closed, the tip may catch on the mucosa behind the polyp (point a) and draw it toward the polyp. The submucosa is bunched up into the snare, but the entrapped mucosa cannot be seen because it is hidden behind the polyp. Cutting through a broad based polyp may also transfer sufficient thermal energy to the deeper layers to result in a transmural burn. C) After polypectomy, there is a large defect, and the wall beneath the area of denuded mucosa is thinner and more liable to conduct electrical energy (heat) to the serosal surface causing deep thermal damage, resulting in the postpolypectomy electrocoagulation syndrome.

Graphic 53817 Version 4.0

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.

Graphic 106948 Version 13.0

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.

Graphic 106949 Version 12.0

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Brooks D Cash, MD, FACG, AGAF, FACP No relevant financial relationship(s) with ineligible companies to disclose. **John R Saltzman, MD, FACP, FACG, FASGE, AGAF** No relevant financial relationship(s) with ineligible companies to disclose. **Kristen M Robson, MD, MBA, FACG** No relevant financial relationship(s) with ineligible companies to disclose.

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