

Abdominal Infections

Biliary Tract Infections

TREATMENT

Community-acquired infections in patients without previous biliary procedures AND who are not severely ill

- Ceftriaxone 1 g IV q24h **PLUS** metronidazole 500 mg IV q8h
OR
- Ertapenem 1 g IV q24h
OR
- PCN allergy: ciprofloxacin 400 mg IV q12h **PLUS** metronidazole 500 mg IV q8h
OR
- PO Regimen: amoxicillin/clavulanate 875 mg PO BID
OR
- PO Regimen (PCN allergy): ciprofloxacin 500 mg PO BID **PLUS** metronidazole 500 mg PO q8h

Hospital-acquired infections OR patients with prior biliary procedure OR patients who are severely ill

- Piperacillin/tazobactam 3.375 g IV q6h
OR
- PCN allergy: ciprofloxacin 400 mg IV q12h **PLUS** metronidazole 500 mg IV q8h

In severely ill patients with cholangitis or complicated cholelithiasis, **adequate biliary drainage** is crucial as antibiotics will not enter bile in the presence of obstruction.

Duration

- Uncomplicated cholecystitis: treat only until obstruction is relieved. No post-procedure antibiotics are necessary if the obstruction is successfully relieved.
- Complicated cholecystitis: 5-10 days. Trend is now favoring shorter regimens.
- Biliary sepsis: 5-14 days. Shorter course favored if source controlled. Average duration is 7 days.

TREATMENT NOTES

Microbiology

- Gram-negative rods - *E. coli*, *Klebsiella spp.*, *Proteus spp.*, *Pseudomonas* (mainly in patients already on broad-spectrum antibiotics or those who have undergone prior procedures).
- Anaerobes - *Bacteroides spp.*, generally in more serious infections, or in patients with a history of biliary manipulations.
- *Enterococcus spp.* - treatment not always indicated; use clinical judgment.
- Yeast - Rare, mainly in immunocompromised patients or those with extensive antibiotic history.

Other considerations

CT scan is important in assessing need for drainage in severe disease. Some patients will present with diffuse peritonitis.

REFERENCES:

IDSA Guidelines for Intra-Abdominal Infections: Clin Infect Dis 2003;37:997.

Pancreatitis

TREATMENT

- Mild to moderate pancreatitis - no antibiotics
- Severe acute pancreatitis (SAP)* - no prophylactic antibiotics
 - No necrosis - no antibiotics
 - Sterile pancreatic necrosis - no antibiotics
 - Infected pancreatitis necrosis* - empiric therapy:
 - Meropenem 1 g IV q8h
 - OR**
 - PCN allergy: ciprofloxacin 400 mg IV q12h **PLUS** metronidazole 500 mg IV q8h

*Definitions

- **Severe acute pancreatitis (SAP)** is defined as pancreatitis associated with one or more of the following:
 - >30% pancreatic necrosis
 - APACHE II \geq 9
 - More than 3 Ranson's criteria

Ranson's criteria to predict severity of acute pancreatitis

Zero Hours	
Age	>55
WBC	> 16,000/mm ³
Blood glucose	> 200 mg/dL
Lactate dehydrogenase	> 350 U/L
Aspartate aminotransferase (AST)	> 250 U/L

48 Hours	
Hematocrit	Fall by \geq 10%
Blood urea nitrogen (BUN)	Increase by \geq 5 mg/dL despite fluids
Serum calcium	< 8 mg/dL
pO ₂	< 60 mmHg
Base deficit	> 4 MEq/L
Fluid sequestration	> 6000 mL

- **Infected pancreatic necrosis is defined as one or both of the following:**
 - CT scan with gas
 - Percutaneous aspirate or surgical specimen with organisms evident on Gram stain or culture

Duration

For infected pancreatic necrosis, continue antibiotics for 14 days after source control is obtained. Continuation of antibiotics beyond this time places the patient at risk for colonization or infection with resistant organisms and drug toxicity. Antibiotics do not need to be continued until radiographic abnormalities have resolved.

TREATMENT NOTES

- Penicillins and cephalosporins penetrate poorly into the pancreas
- Infection develops in 30-50% of patients with necrosis documented by CT scan or at the time of surgery.
- Peak incidence of infection occurs in the 3rd week of disease.
- Prophylactic antibiotics have been associated with a change in the spectrum of pancreatic isolates from enteric Gram-negatives to Gram-positive organisms and fungi.
- There is insufficient evidence to recommend selective gut decontamination in management of pancreatitis.

REFERENCES

Lack of utility of prophylactic antibiotics: Ann Surg 2007;245:674.
Guidelines for management of SAP: Crit Care Med 2004;32:2524.
Ranson's criteria: Surg Gyneecol Obstet 1974;139:69.

Peritonitis

DEFINITIONS

Primary peritonitis is spontaneous infection of the peritoneal cavity, usually associated with liver disease and ascites [spontaneous bacterial peritonitis (SBP)].

Secondary peritonitis is infection of the peritoneal cavity due to spillage of organisms into the peritoneum, usually associated with GI or genitourinary tract (e.g., due to perforation, trauma, pelvic inflammatory disease).

Tertiary peritonitis is a recurrent infection of the peritoneal cavity following an episode of secondary peritonitis.

Primary Peritonitis/Spontaneous Bacterial Peritonitis (SBP)

TREATMENT

- Ceftriaxone 1 g IV q24h is preferred.
- Amoxicillin/clavulanic acid 875 mg PO BID is the preferred oral regimen.
- Ciprofloxacin 400 mg IV/500 mg PO q12h can be used in PCN-allergic patients who have NOT been taking fluoroquinolones for SBP prophylaxis.

Duration

- Treat for 5 days.

PROPHYLAXIS

Cirrhotic patients with gastrointestinal hemorrhage

- Norfloxacin 400 mg PO BID for 7 days
- Ceftriaxone 1 g IV q24h can be used only if patient is NPO, then switch to norfloxacin 400 mg PO BID once bleeding is controlled.

Non-bleeding cirrhotic patients with ascites

- Norfloxacin 400 mg PO daily

OR

- TMP/SMX 1 DS PO daily

TREATMENT NOTES

Microbiology

- Gram-negative rods (Enterobacteriaceae, esp *E. coli* and *K. pneumoniae*), *S. pneumoniae*, enterococci, and other streptococci.
- Polymicrobial infections should raise concern for GI perforation.

Diagnostic criteria

- 250 PMN per mm³ of ascitic fluid.
- Positive culture with < 250 PMN should prompt repeat tap. If PMN < 250 OR culture remains positive, patient should be treated.

Follow-up

- Consider repeat paracentesis after 48 hours of therapy.
- Consider changing antibiotics if ascites fluid PMN has not dropped by 25% after 48 hours and/or patient is not clinically responding.

Notes on prophylaxis against SBP

- All patients with cirrhosis and upper GI bleeding should receive prophylaxis for 7 days (50% develop SBP after bleed).
- Patients who get SBP should get lifelong prophylaxis to prevent future episodes (40-70% risk of recurrence in 1 year).
- Prophylaxis should be considered for those with low protein concentrations in ascites (< 10 g/L) or immunosuppression but must be carefully weighed against the risk of resistance.

REFERENCES

Diagnosis, treatment, and prophylaxis of SBP: J Hepatol 2000;32:142.

Management of variceal hemorrhage in cirrhosis: Hepatology 2007;46:922-38.

Secondary Peritonitis/GI Perforation

TREATMENT

Perforation of esophagus, stomach, small bowel, colon, or appendix

Patient mild to moderately ill

- Ceftriaxone 1 g IV q24h **PLUS** metronidazole 500 mg IV q8h
OR
- Ertapenem 1 g IV q24h
OR
- PCN allergy: ciprofloxacin 400 mg IV q12h **PLUS** metronidazole 500 mg IV q8h

Patient severely ill or immunosuppressed

- Piperacillin/tazobactam 3.375 g IV q6h
OR
- PCN allergy: ciprofloxacin 400 mg IV q12h **PLUS** metronidazole 500 mg IV q8h

Antifungal Therapy

Empiric antifungal therapy is generally **NOT** indicated for GI perforation unless patient has one of the following risk factors:

- Esophageal perforation, immunosuppression, prolonged antacid therapy, prolonged antibiotic therapy, prolonged hospitalization, persistent GI leak.

For patients who are clinically stable and have not received prior long-term azole therapy:

- Fluconazole 400-800 mg IV/PO q24h

For patients who are NOT clinically stable or have received prior long-term azole therapy:

- Caspofungin 75 mg IV x 1, then 50 mg IV q24h

Duration of therapy for secondary peritonitis/GI perforation

	Stomach	Small Bowel	Colon	Appendix
Uncomplicated				
Definition	Operated on within 24 hours	Operated on within 12 hours	Operated on within 12 hours	Non-necrotic or gangrenous appendix
Duration	24-48 hours	24-48 hours	24-48 hours	24 hours
Complicated				
Definition	Late operation or no operation	Late operation or no operation	Late operation or no operation	Necrotic/gangrenous appendix
Duration	5-7 days, may require longer course	5-7 days, may require longer course	5-7 days, may require longer course	5-7 days, may require longer course

TREATMENT NOTES

Microbiology

- Causative agents for small bowel, colon, appendix: anaerobes (esp *B. fragilis*), Enterobacteriaceae (esp *E. coli*, *K. pneumoniae*, *Enterobacter* spp, *Proteus* spp); infections are usually polymicrobial.
- Pathogens causing tertiary peritonitis are variable and are often resistant to or not covered by the initial antimicrobial regimen; thus, a change in antimicrobials is advised.

Diagnosis

- Prompt abdominal and pelvic CT scan is optimal for identification of source and definition of treatment; possible surgical options.

Treatment

- A change in antimicrobial therapy should be considered in patients with hospital-acquired infections who are already on antimicrobials.
- Treatment of enterococci remains controversial but may be of benefit in critically ill patients.
- Treatment of *Candida* spp is generally indicated only when they are recovered from blood or are the primary organism in the peritoneal culture.
- Postoperative antibiotics for appendicitis are unnecessary unless there is clinical evidence of peritonitis, abscess, or gangrene.
- Duration of therapy must be customized to the individual patient. Surgery and Infectious Diseases consultation should be considered.

Surgery

- Antibiotics are adjunctive to source control, which is an absolute necessity. This may be accomplished with surgical debridement or percutaneous catheter drainage, depending on the clinical circumstances. Surgery consultation is strongly encouraged.
- The goal of source control is to evacuate devitalized or avascular infected material, define microbiology, and assist with determining the duration of antimicrobial therapy.
- Lack of source control is defined as ongoing contamination and/or an undrained collection of infection.
- Uncomplicated diverticulitis can usually be managed with antibiotics alone, although up to one-third of patients will have another episode.
- Surgery is generally advised after a first attack of complicated diverticulitis or after 2 or more attacks of uncomplicated diverticulitis.
- Non-operative management of perforated phlegmonous appendicitis when there is no abscess cavity to drain may be an option; Surgery input is critical.