

# **GUIDELINES FOR TREATMENT OF INTRA-ABDOMINAL INFECTIONS IN ADULTS**

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(Infection associated with perforation or spillage of GI pathogens into	(Persistent infection associated with recurring GI perforation and/or		
the peritoneal cavity)	anastomotic leakage after initial treatment for secondary peritonitis)		
Spontaneous Bacterial Peritonitis (SBP) Treatment and Prophylaxis	<u>Pancreatitis</u>		
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Appendicitis				
Empiric Therapy	Duration			
Community Acquired, No Severe Sepsis/Shock	Non-perforated:			
1 <sup>st</sup> line:	Discontinue after appendectomy. If no appendectomy performed a 10-day duration is			
Cefuroxime* 1.5 g IV q8h	recommended <sup>ref1</sup>			
+ Metronidazole 500 mg PO/IV q8h				
High-risk allergy <sup>3</sup> /contraindications <sup>4</sup> to beta-lactams:	Perforated:			
Ciprofloxacin* 400 mg IV q8h	4 full days after source control ref 3			
+ Metronidazole 500 mg PO/IV q8h				
Community Acquired with Covers Sensis (Sheek OP MDD CND Dick	Duration of therapy may be extended with inadequate source control or persistent			
Community Acquired with Severe Sepsis/Shock OR MDR-GINR Risk:	clinical symptoms or signs of infection.			
I IIIIE. Dineracillin-tazohactam*4.5 g IV g6b				
$L_{ow}/medium-risk alleray2 to penicilling:$	Patients with bacteremia:			
Cefenime* 2 g IV g8b	7-14 days			
+ Metronidazole 500 mg PO/IV a8h				
Consider the addition of <b>vancomycin</b> to refenime for Enterococcus	For patients with secondary gram-negative bacteremia, a 7-day duration of IV therapy			
coverage in critically ill patients with risk factors defined in comments	(or oral quinolone at discharge) may be appropriate <sup>rely</sup> in conjunction with ID			
High-risk allerav <sup>3</sup> /contraindication <sup>4</sup> to beta-lactams:	consultation for patients with source control and:			
Vancomvcin*	I ransient bacteremia (single day) and rapid clinical improvement within 72			
+ Aztreonam* 2 g IV g8h	nours			
+ Metronidazole 500 mg PO/IV a8h	Not polymicrobial or bacteremic with <i>Pseudomonas</i>			
	Not neutropenic, HCST/SOT, HIV with CD4 <200			
Step-down oral therapy if tolerating orals and susceptibilities (if available) do not	<ul> <li>Remains hemodynamically stable at day 7</li> </ul>			
demonstrate resistance	<ul> <li>Been afebrile ≥48 hours (at day 7)</li> </ul>			
Amoxicillin-clavulanic acid* 875 mg PO BID				
OR	Comments			
Cefuroxime <sup>*</sup> 500 mg PO BID	Ciprofloxacin use is not preferred unless necessary due to allergy or need for			
+ Metronidazole 500mg PO TID	<i>Pseudomonas</i> coverage due to increasing resistance amongst <i>E. coli</i> . <sup>re14</sup> UMHS susceptibility in 2019 was only 74%.			
High-risk alleray <sup>3</sup> /contraindications <sup>4</sup> to beta-lactams OR MDR-GNR risk:	Enterococcus coverage:			
Ciprofloxacin 750 mg PO BID	<ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal</li> </ul>			
+ Metronidazole 500 mg PO TID	surgery, prosthetic valve, and recent cephalosporin or quinolone use.			
	<ul> <li>Adjust antibiotics based on organism and susceptibilities</li> </ul>			
MDR-GN risk:	<ul> <li>Patients with low/medium-risk allergy<sup>2</sup> to penicillins and cephalosporins other than</li> </ul>			
History of cefuroxime-resistant infection or colonization in prior year	cefepime, ceftriaxone, cefpodoxime, and cefotaxime can receive cefepime			
<ul> <li>History of hospitalization &gt;48 hours in prior 90 days</li> </ul>	, , , , , , , , , , , , , , , , , , ,			
<ul> <li>Current hospitalization &gt; 48 hours</li> </ul>				
<ul> <li>Intravenous antibiotic or quinolone use within prior 90 days</li> </ul>				
Significant immunocompromise				
Presence of an at-risk device <sup>1</sup>				



Cholangitis and Cholecystitis			
Empiric Therapy	Duration		
Community Acquired, No Severe Sepsis/Shock	<u>General</u> :		
1 <sup>st</sup> line:	4-7 days <sup>ref 3</sup>		
Cefuroxime* 1.5 g IV q8h			
± Metronidazole 500 mg PO/IV q8h ( <sup>#</sup> see comments)	Cholecystectomy:		
High-risk allergy <sup>3</sup> /contraindications <sup>4</sup> to beta-lactams:	Discontinue within 24 hours unless evidence of infection outside the gallbladder wall		
Ciprofloxacin* 400 mg IV q8h			
± Metronidazole 500 mg PO/IV q8h (#See comments)	Successful ERCP:		
	4 days post-procedure		
Community Acquired with Severe Sepsis/Shock OR MDR-GNR Risk	Duration of therapy may be extended with inadequate source control (such as percutaneous		
	cholecystostomy) or persistent clinical symptoms or signs of infection		
Piperacillin-tazobactam*4.5 g IV q6h	cholecystostomy of persistent clinical symptoms of signs of infection.		
Low/medium-risk allergy <sup>2</sup> to penicillins:	Patients with bacteremia:		
Cetepime* 2 g IV q8h	7-14 days		
+ Metronidazole 500 mg PO/IV q8h	,		
Consider the addition of <b>vancomycin</b> to cetepime for	For patients with secondary gram-negative bacteremia, a 7-day duration of IV therapy (or oral		
Enterococcus coverage in critically ill patients with risk factors	quinolone at discharge) may be appropriate ref5 in conjunction with ID consultation for patients		
defined in comments.	with source control and:		
High-risk allergy <sup>3</sup> /contraindication <sup>4</sup> to beta-lactams:	<ul> <li>Transient bacteremia (single day) and rapid clinical improvement within 72 hours</li> </ul>		
Vancomycin*	<ul> <li>Not polymicrobial or bacteremic with <i>Pseudomonas</i></li> </ul>		
+ Aztreonam* 2 g IV q8h	<ul> <li>Not neutropenic, HCST/SOT, HIV with CD4 &lt;200</li> </ul>		
+ Metronidazole 500 mg PO/IV q8h	Remains hemodynamically stable at day 7		
Step-down oral therapy if tolerating orals and susceptibilities (if available) do not	<ul> <li>Been afebrile ≥48 hours (at day 7)</li> </ul>		
demonstrate resistance	Comments		
Amoxicillin-clavulanic acid* 875 mg PO BID	Ciprofloxacin use is not preferred unless necessary due to allergy or need for Pseudomongs		
OR	coverage due to increasing resistance amongst <i>E. coli.</i> <sup>ref4</sup> UMHS susceptibility in 2019 was only		
Cefuroxime* 500 mg PO BID	74%.		
+ <b>Metronidazole</b> 500mg PO TID ( <sup>#</sup> See comments)	Enterococcus coverage:		
High-risk alleray $^{3}$ /contraindications $^{4}$ to beta-lactams OR MDR-GNR risk:	<ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal surgery.</li> </ul>		
<b>Ciprofloxacin</b> 750 mg PO BID	prosthetic valve, and recent cephalosporin or guinolone use. Empiric antimicrobial		
± <b>Metronidazole</b> 500 mg PO TID ( <sup>#</sup> See comments)	coverage for VRE is not recommended except in critically ill liver transplant recipients.		
	patients with a previous history of VRE intra-abdominal infection, or patients with septic		
MDR-GN risk:	shock who are colonized with VRE.		
<ul> <li>History of cefuroxime-resistant infection or colonization in prior year</li> </ul>	• # Angeropic coverage (metronidazole) is not necessary for patients with community-acquired		
<ul> <li>History of hospitalization &gt;48 hours in prior 90 days</li> </ul>	cholecystitis/cholangitis of mild-moderate severity. unless a biliary-enteric anastomosis or		
<ul> <li>Current hospitalization &gt; 48 hours</li> </ul>	emphysematous cholecystitis is present.		
<ul> <li>Intravenous antibiotic or quinolone use within prior 90 days</li> </ul>	Adjust antimicrobial coverage based on organism identification and antimicrobial susceptibilities		
Significant immunocompromise	<ul> <li>Patients with low/medium-risk allergy<sup>2</sup> to penicillins and cephalosporins other than cefenime.</li> </ul>		
• Presence of an at-risk device <sup>1</sup>	ceftriaxone, cefpodoxime, and cefotaxime can receive cefepime		



Acute Uncomplicated Diverticulitis				
Empiric Therapy	Duration			
Uncomplicated Infection (no abscess, perforation, severe sepsis/shock)	If patient is a candidate for antibiotic therapy:			
$\circ$ If no fever or leukocytosis, immunocompetent, CT findings consistent with acute	5-7 days (including all IV and PO doses)			
uncomplicated diverticulitis, observe without antibiotics				
<ul> <li>Patients not meeting above criteria for observation:</li> </ul>	Comments			
1 <sup>st</sup> line:	• Ciprofloxacin use is not preferred unless necessary due to allergy or need for <i>Pseudomonas</i>			
Cefuroxime* 1.5 g IV q8h	coverage due to increasing resistance amongst <i>E. coli</i> . <sup>ref4</sup> UMHS susceptibility in 2019 was only			
+ Metronidazole 500 mg PO/IV q8h	74%.			
High-risk allergy <sup>3</sup> /contraindications <sup>4</sup> to beta-lactams:	• Antifungal therapy is not necessary for patients with acute uncomplicated diverticulitis.			
Ciprofloxacin* 400 mg IV q8h				
+ <b>Metronidazole</b> 500 mg PO/IV q8h				
Step-down oral therapy       if tolerating orals and susceptibilities (if available) do not demonstrate resistance         Amoxicillin-clavulanic acid* 875 mg PO BID         OR         Cefuroxime* 500 mg PO BID         + Metronidazole 500mg PO TID#         High-risk allergy <sup>3</sup> /contraindications <sup>4</sup> to beta-lactams:         Ciprofloxacin 750 mg PO BID         + Metronidazole 500 mg PO TID				
For Complicated Infection (abscess or perforation), or patients with severe sepsis/shock, see Secondary Peritonitis Recommendations				



Esophageal Perforation			
Empiric Therapy	Duration		
Infectious Diseases Consult strongly recommended	Recommend ID consult		
1 <sup>st</sup> line: <b>Piperacillin-tazobactam</b> *4.5 g IV q6h + <b>Fluconazole</b> * 800 mg x1, then 400 mg q24h	Duration of therapy dependent on adequate source control, presence of persistent clinical symptoms or signs of infection. Comments		
Low/medium-risk allergy <sup>2</sup> to penicillins: Cefepime* 2 g IV q8h + Metronidazole 500 mg PO/IV q8h + Fluconazole* 800 mg x1, then 400 mg q24h High-risk allergy <sup>3</sup> /contraindication <sup>4</sup> to beta-lactams: Vancomycin* + Aztreonam* 2 g IV q8h + Metronidazole 500 mg PO/IV q8h + Fluconazole* 800 mg x1, then 400 mg q24h	<ul> <li>Adjust antimicrobial coverage based on organism identification and antimicrobial susceptibilities. Ampicillin-sulbactam empiric step-down may be appropriate in select patients, given reliable coverage of odontogenic microbial flora.</li> <li><i>Candida</i> coverage:         <ul> <li>Limited data suggests that empiric <i>Candida</i> coverage should be considered in patients with esophageal perforation. Antifungal therapy can be considered empirically but should be discontinued if <i>Candida</i> is not identified on culture.</li> </ul> </li> <li>Patients with low/medium-risk allergy<sup>2</sup> to penicillins and cephalosporins other than cefepime, ceftriaxone, cefpodoxime, and cefotaxime can receive cefepime</li> </ul>		
In patients with candidemia or who are in shock, fluconazole should be substituted with <b>Micafungin</b> 100 mg IV q24h			



Secondary Peritonitis (infection associated with perforation or spillage of GI pathogens into the peritoneal cavity)			
Empiric Therapy	Duration		
Community Acquired, No Severe Sepsis/Shock	<u>General</u> :		
1 <sup>st</sup> line:	4 days after adequate <sup>5</sup> source control (see below for exceptions) <sup>ref 3</sup>		
Cefuroxime* 1.5 g IV q8h	Duration of therapy may be outended with incident at course control or persistent clinical		
+ Metronidazole 500 mg PO/IV q8h	Sumation of therapy may be extended with madequate source control of persistent clinical		
	symptoms or signs of infection.		
High-risk allergy <sup>2</sup> /contrainalcations <sup>4</sup> to beta-lactams:	Acute stomach and proximal small bowel perforation:		
<b>Ciprotioxacin</b> * 400 mg iV q8n	Discontinue in 24 hours when source control is achieved & patients are not on acid reducing		
+ Metronidazole 500 mg PO/TV q8n	therapy or have a malignancy		
Community Acquired with Severe Sepsis/Shock OR MDR-GNR Risk	Bowel injuries from penetrating blunt, or jatrogenic trauma, or intraoperative contamination that		
1 <sup>st</sup> line:	are renaired within 12 hrs, and any other intra-operative contamination of the operative field by		
Piperacillin-tazobactam*4.5 g IV q6h	enteric contents:		
Low/medium-risk allergy <sup>2</sup> to penicillins:	Discontinue within 24 hours		
Cefepime* 2 g IV q8h	Discontinue within 24 hours		
+ Metronidazole 500 mg PO/IV q8h	Patients with bacteremia:		
Consider the addition of vancomycin to cefepime for Enterococcus	7-14 days		
coverage in <i>critically ill</i> patients with risk factors defined in comments.	For natients with secondary gram-negative bacteremia, a 7-day duration of IV therapy (or		
High-risk allergy <sup>3</sup> /contraindication <sup>4</sup> to beta-lactams:	oral quinolone at discharge) may be appropriate <sup>ref5</sup> in conjunction with ID consultation for		
Vancomycin*	natients with source control and:		
+ Aztreonam* 2 g IV q8h	<ul> <li>Transient bacteremia (single day) and rapid clinical improvement within 72 hours</li> </ul>		
+ Metronidazole 500 mg PO/IV q8h	<ul> <li>Not polymicrohial or bacteremic with <i>Pseudomongs</i></li> </ul>		
Step-down oral therapy if tolerating orals and susceptibilities (if available) do not	<ul> <li>Not performing HCST/SOT HIV with CD4 &lt;200</li> </ul>		
demonstrate resistance	<ul> <li>Remains hemodynamically stable at day 7</li> </ul>		
Amoxicillin-clavulanic acid* 875 mg PO BID	<ul> <li>Been afebrile &gt;48 hours (at day 7)</li> </ul>		
OR	Comments		
Cefuroxime* 500 mg PO BID	Continents     Continents     Continents     Continents		
+ Metronidazole 500mg PO TID	due to increasing resistance amongst <i>E. coli</i> .		
Lich viel, allow 3/contraindications <sup>4</sup> to hate lastence OD MDD CND viely	<ul> <li>Adjust antimicrobial coverage based on organism identification and antimicrobial susceptibilities</li> </ul>		
High-risk allergy"/contraindications" to beta-lactams OR MDR-GNR risk:	Enterococcus coverage:		
+ Metropidazele 500 mg PO BID	<ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal surgery,</li> </ul>		
	prosthetic valve, and recent cephalosporin or quinolone use. Empiric antimicrobial coverage		
MDR-GN risk:	for VRE is not recommended except in critically ill liver transplant recipients, patients with a		
History of cefuroxime-resistant infection or colonization in prior year	colonized with VRE.		
<ul> <li>History of hospitalization &gt;48 hours in prior 90 days</li> </ul>	Empiric coverage for <i>Candida</i> is not recommended		
Current hospitalization > 48 hours	For diverticular abscess, consult surgery or interventional radiology for aspiration and drainage		
<ul> <li>Intravenous antibiotic or quinolone use within prior 90 days</li> </ul>	• Patients with low/medium-risk allergy <sup>2</sup> to penicillins and cephalosporins other than cefepime,		
Significant immunocompromise	ceftriaxone, cefpodoxime, and cefotaxime can receive cefepime		
Presence of an at-risk device <sup>1</sup>			



### **Tertiary Peritonitis**

Empiric Therapy	Duration
1 <sup>st</sup> line:	General:
Piperacillin-tazobactam*4.5 g IV q6h	4 days after adequate source control (see below for exceptions) in 3
Low / mandium viale allows 2 to manifolding.	Duration of therapy may be extended with inadequate source control or persistent clinical
Low/meaium-risk allergy <sup>2</sup> to penicillins:	symptoms or signs of infection.
<b>Cefepime</b> <sup>*</sup> 2 g IV q8h	
+ Metronidazole 500 mg PO/IV q8h	Patients with bacteremia:
	7-14 days
Consider the addition of vancomycin to cefepime for enterococcus	
coverage in critically ill patients with risk factors defined in comments.	For patients with secondary gram-negative bacteremia, a 7-day duration of iv therapy (or oral
	quinolone at discharge) may be appropriate ters in conjunction with ID consultation for patients
High-risk allergy <sup>3</sup> /contraindication <sup>4</sup> to beta-lactams:	with source control and:
Vancomycin*	I ransient bacteremia (single day) and rapid clinical improvement within 72 hours
+ Aztreonam <sup>*</sup> 2 g IV q8h	• Not polymicrobial or bacteremic with <i>Pseudomonas</i>
+ Metronidazole 500 mg PO/IV q8h	<ul> <li>Not neutropenic, HCST/SOT, HIV with CD4 &lt;200</li> </ul>
	Remains hemodynamically stable at day 7
Notes:	• Been afebrile ≥48 hours (at day 7)
<ul> <li>Empiric therapy should consider prior cultures and severity of presentation</li> </ul>	Comments
(especially presence of severe sensis/shock). Both factors may dictate	Ciprofloxacin use is not preferred unless necessary due to allergy or need for <i>Pseudomonas</i>
alternative empiric therapies from the above	coverage due to increasing resistance amongst <i>E. coli</i> .
<ul> <li>Bro existing drains are often colonized and should not be cultured</li> </ul>	Adjust antimicrobial coverage based on organism and susceptibilities
	MRSA coverage:
Ston down and therapy if talenating ends and succeptibilities (if available) do not	<ul> <li>Empiric MRSA coverage should only be provided to patients with post-operative</li> </ul>
Step-down oral therapy if tolerating orals and susceptibilities (if available) do not	
	peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not
demonstrate resistance	peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not recovered in culture
demonstrate resistance Amoxicillin-clavulanic acid* 875 mg PO BID	<ul> <li>peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not recovered in culture</li> <li>Enterococcus coverage:</li> </ul>
demonstrate resistance Amoxicillin-clavulanic acid* 875 mg PO BID OR	<ul> <li>peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not recovered in culture</li> <li>Enterococcus coverage:         <ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal surgery,</li> </ul> </li> </ul>
demonstrate resistance Amoxicillin-clavulanic acid* 875 mg PO BID OR Cefuroxime* 500 mg PO BID	<ul> <li>Peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not recovered in culture</li> <li>Enterococcus coverage:         <ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal surgery, prosthetic valve, and recent cephalosporin or quinolone use. Empiric antimicrobial</li> </ul> </li> </ul>
demonstrate resistance Amoxicillin-clavulanic acid* 875 mg PO BID OR Cefuroxime* 500 mg PO BID + Metronidazole 500mg PO TID	<ul> <li>Peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not recovered in culture</li> <li>Enterococcus coverage:         <ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal surgery, prosthetic valve, and recent cephalosporin or quinolone use. Empiric antimicrobial coverage for vancomycin resistant Enterococcus (VRE) is not recommended except in</li> </ul> </li> </ul>
demonstrate resistance Amoxicillin-clavulanic acid* 875 mg PO BID OR Cefuroxime* 500 mg PO BID + Metronidazole 500mg PO TID	<ul> <li>Peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not recovered in culture</li> <li>Enterococcus coverage:         <ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal surgery, prosthetic valve, and recent cephalosporin or quinolone use. Empiric antimicrobial coverage for vancomycin resistant Enterococcus (VRE) is not recommended except in critically ill liver transplant recipients, patients with a previous history of VRE intra-</li> </ul> </li> </ul>
demonstrate resistance Amoxicillin-clavulanic acid* 875 mg PO BID OR Cefuroxime* 500 mg PO BID + Metronidazole 500mg PO TID High-risk allergy <sup>3</sup> /contraindications <sup>4</sup> to beta-lactams OR MDR-GNR risk:	<ul> <li>Enterococcus coverage:         <ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal surgery, prosthetic valve, and recent cephalosporin or quinolone use. Empiric antimicrobial coverage for vancomycin resistant Enterococcus (VRE) is not recommended except in critically ill liver transplant recipients, patients with a previous history of VRE intraabdominal infection, or patients with septic shock who are colonized with VRE.</li> </ul> </li> </ul>
demonstrate resistance Amoxicillin-clavulanic acid* 875 mg PO BID OR Cefuroxime* 500 mg PO BID + Metronidazole 500mg PO TID High-risk allergy <sup>3</sup> /contraindications <sup>4</sup> to beta-lactams OR MDR-GNR risk: Ciprofloxacin 750 mg PO BID	<ul> <li>peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not recovered in culture</li> <li>Enterococcus coverage:         <ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal surgery, prosthetic valve, and recent cephalosporin or quinolone use. Empiric antimicrobial coverage for vancomycin resistant Enterococcus (VRE) is not recommended except in critically ill liver transplant recipients, patients with a previous history of VRE intraabdominal infection, or patients with septic shock who are colonized with VRE.</li> </ul> </li> <li>Candida coverage:</li> </ul>
demonstrate resistance Amoxicillin-clavulanic acid* 875 mg PO BID OR Cefuroxime* 500 mg PO BID + Metronidazole 500mg PO TID High-risk allergy <sup>3</sup> /contraindications <sup>4</sup> to beta-lactams OR MDR-GNR risk: Ciprofloxacin 750 mg PO BID + Metronidazole 500 mg PO TID	<ul> <li>Peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not recovered in culture</li> <li>Enterococcus coverage:         <ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal surgery, prosthetic valve, and recent cephalosporin or quinolone use. Empiric antimicrobial coverage for vancomycin resistant Enterococcus (VRE) is not recommended except in critically ill liver transplant recipients, patients with a previous history of VRE intraabdominal infection, or patients with septic shock who are colonized with VRE.</li> </ul> </li> <li>Candida coverage:         <ul> <li>Empiric coverage should be considered in patients with recurrent gastrointestinal</li> </ul> </li> </ul>
demonstrate resistance Amoxicillin-clavulanic acid* 875 mg PO BID OR Cefuroxime* 500 mg PO BID + Metronidazole 500mg PO TID High-risk allergy <sup>3</sup> /contraindications <sup>4</sup> to beta-lactams OR MDR-GNR risk: Ciprofloxacin 750 mg PO BID + Metronidazole 500 mg PO TID	<ul> <li>Peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not recovered in culture</li> <li>Enterococcus coverage:         <ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal surgery, prosthetic valve, and recent cephalosporin or quinolone use. Empiric antimicrobial coverage for vancomycin resistant Enterococcus (VRE) is not recommended except in critically ill liver transplant recipients, patients with a previous history of VRE intraabdominal infection, or patients with septic shock who are colonized with VRE.</li> </ul> </li> <li>Candida coverage:         <ul> <li>Empiric coverage should be considered in patients with recurrent gastrointestinal perforations (i.e., tertiary peritonitis). Fluconazole* 800 mg X 1, then 400 mg IV/PO q24h</li> </ul> </li> </ul>
demonstrate resistance Amoxicillin-clavulanic acid* 875 mg PO BID OR Cefuroxime* 500 mg PO BID + Metronidazole 500mg PO TID High-risk allergy <sup>3</sup> /contraindications <sup>4</sup> to beta-lactams OR MDR-GNR risk: Ciprofloxacin 750 mg PO BID + Metronidazole 500 mg PO TID	<ul> <li>Peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not recovered in culture</li> <li>Enterococcus coverage:         <ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal surgery, prosthetic valve, and recent cephalosporin or quinolone use. Empiric antimicrobial coverage for vancomycin resistant Enterococcus (VRE) is not recommended except in critically ill liver transplant recipients, patients with a previous history of VRE intraabdominal infection, or patients with septic shock who are colonized with VRE.</li> </ul> </li> <li>Candida coverage:         <ul> <li>Empiric coverage should be considered in patients with recurrent gastrointestinal perforations (i.e., tertiary peritonitis). Fluconazole* 800 mg X 1, then 400 mg IV/PO q24h (or Micafungin 100 mg IV q24h if candidemic or in shock) can be considered empirically</li> </ul> </li> </ul>
demonstrate resistance Amoxicillin-clavulanic acid* 875 mg PO BID OR Cefuroxime* 500 mg PO BID + Metronidazole 500mg PO TID High-risk allergy <sup>3</sup> /contraindications <sup>4</sup> to beta-lactams OR MDR-GNR risk: Ciprofloxacin 750 mg PO BID + Metronidazole 500 mg PO TID	<ul> <li>Peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not recovered in culture</li> <li>Enterococcus coverage:         <ul> <li>Risk factors in ICU patients include septic shock, recent complex abdominal surgery, prosthetic valve, and recent cephalosporin or quinolone use. Empiric antimicrobial coverage for vancomycin resistant Enterococcus (VRE) is not recommended except in critically ill liver transplant recipients, patients with a previous history of VRE intraabdominal infection, or patients with septic shock who are colonized with VRE.</li> </ul> </li> <li>Candida coverage:         <ul> <li>Empiric coverage should be considered in patients with recurrent gastrointestinal perforations (i.e., tertiary peritonitis). Fluconazole* 800 mg X 1, then 400 mg IV/PO q24h (or Micafungin 100 mg IV q24h if candidemic or in shock) can be considered empirically but should be discontinued if Candida is not identified on culture.</li> </ul></li></ul>
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Spontaneous Bacterial Peritonitis			
<b>Clinical Setting</b>	Empiric Therapy	Duration	Comments
<u>Spontaneous</u> <u>Bacterial</u> <u>Peritonitis</u> ( <u>SBP)</u>	1st line:         Ceftriaxone 2 g IV q24h         Alternative in patients with high-risk allergy <sup>3</sup> /contraindication <sup>4</sup> to beta-lactams receiving fluoroquinolone prophylaxis:         Aztreonam* 2 g IV q8h + Vancomycin*         Alternative in patients with high-risk allergy <sup>3</sup> /contraindication <sup>4</sup> to beta-lactams NOT receiving fluoroquinolone prophylaxis:         Ciprofloxacin* 400 mg IV q8h         See comments for oral step-down options	5-7 Days	<ul> <li>Oral step-down is appropriate for the following populations:         <ul> <li>Culture positive and clinically improving after 48-72 hours of intravenous therapy with oral antibiotic options feasible per culture and susceptibility results</li> <li>Patients with culture-negative SBP who are hemodynamically stable and responding (exam, lab parameters, and repeat paracentesis if performed) after 48 hours of empiric therapy</li> </ul> </li> <li>Oral step-down therapy options for patients with culture-negative SBP (as per above criteria):         <ul> <li>1<sup>st</sup> line:</li> <li>Amoxicillin-clavulanate 875 mg PO q12h*</li> <li>Alternative in patients with low/medium-risk allergy<sup>2</sup> to penicillins:</li> <li>Cefuroxime 500 mg PO BID*</li> <li>OR</li> <li>Cefpodoxime 200-400 mg PO q12h*</li> <li>Alternative in patients with high-risk allergy<sup>3</sup>/contraindication<sup>4</sup> to beta-lactams:</li> <li>Ciprofloxacin 750 mg PO q12h*</li> </ul> </li> <li>More aggressive empiric dosing should be considered for critically ill patients.</li> </ul>
Prophylaxis in Patients with Cirrhosis and GI Bleeds	1 <sup>st</sup> line:         Ceftriaxone 1 g IV q24h         Alternative in patients with high-risk allergy <sup>3</sup> /contraindication <sup>4</sup> to beta-lactams receiving fluoroquinolone prophylaxis:         Aztreonam* 1 g IV q8h + Vancomycin*         Alternative in patients with high-risk allergy <sup>3</sup> /contraindication <sup>4</sup> to beta-lactams NOT receiving fluoroquinolone prophylaxis:         Ciprofloxacin* 400 mg IV q12h         See comments for oral step-down options	5 days (total duration, including IV and PO- see commen ts)	<ul> <li>Oral step-down is appropriate for the following population:         <ul> <li>Patients who are hemodynamically stable and whose bleeding is controlled (no further procedures or transfusions needed in past 24 hours) after 48 hours of prophylaxis</li> </ul> </li> <li>Oral step-down therapy:         <ul> <li><u>1<sup>st</sup> line:</u></li> <li><u>Amoxicillin-clavulanate</u> 500 mg PO q12h*</li> <li><u>Alternative in patients with low/medium-risk allergy<sup>2</sup> to penicillins:</u></li> <li><u>Cefuroxime</u> 250 mg PO BID*</li> <li>Or</li> <li><u>Cefpodoxime</u> 200 mg PO q24h*</li> <li><u>Alternative in patients with high-risk allergy<sup>3</sup>/contraindication<sup>4</sup> to beta-lactams:</u></li> <li><u>Ciprofloxacin</u> 500 mg PO q24h*</li> </ul> </li> </ul>
<u>Prophylaxis in</u> <u>Patients at</u> <u>High Risk for</u> <u>Spontaneous</u> <u>Bacterial</u> <u>Peritonitis</u>	Ciprofloxacin 500 mg PO q24h* OR IF SCr <1 mg/dL TMP-SMX 1 DS PO three times weekly OR 1 SS PO daily	Chronic	<ul> <li>SBP Prophylaxis is warranted in patients with prior SBP (secondary prophylaxis).</li> <li>SBP Prophylaxis may be warranted in the following situations:         <ul> <li>Ascitic protein levels &lt;1.5 g/dL, diuretic- refractory ascites (requires paracentesis), or Child-Pugh C</li> </ul> </li> <li>Choice of agent should be reviewed and adjusted based on previous ascitic culture results in patients with breakthrough or previous SBP. Options besides those listed may be considered in such scenarios.</li> </ul>



Pancreatitis				
Clinical Setting	Empiric Therapy	Duration	Comments	
<u>Acute Pancreatitis</u> without Necrosis or <u>Abscess</u>	Antibiotics not recommended	N/A		
Acute Necrotizing Pancreatitis with Sterile Necrosis	Prophylaxis for sterile necrosis is not indicated	N/A	<ul> <li>Confirmation of infected pancreatic necrosis chould be courted whenever passible by fine pagelo</li> </ul>	
Acute Necrotizing Pancreatitis in patients with hemodynamic instability	Empiric Regimen: Piperacillin-tazobactam*4.5 g IV q6h Low/medium-risk allergy <sup>2</sup> to penicillins: Cefepime* 2 g IV q8h + Metronidazole 500 mg PO/IV q8h	Short term antibiotic treatment is recommended while investigation for possible sepsis or secondary infection of pancreatic necrosis is underway	<ul> <li>should be sought whenever possible by fine-need aspiration or drainage procedure</li> <li>is on for ection as the presence of gas in the fluid collection on contrast-enhanced CT, fevers, leukocytosis, persistent sepsis, or progressive clinical</li> </ul>	
Persistent/worsening SIRS criteria after 7-10 days off antibiotic therapy	Consider the addition of <b>vancomycin</b> for Enterococcus coverage in <i>critically ill</i> patients with non-life- threatening PCN allergy <u>High-risk allergy<sup>3</sup>/contraindication<sup>4</sup> to beta-lactams:</u> <b>Vancomycin</b> * + <b>Aztreonam</b> * 2 g IV q8h + <b>Metronidazole</b> 500 mg PO/IV q8h	Obtain culture if persistent SIRS and tailor antibiotic therapy accordingly. Duration of therapy will depend on results of culture and resolution of symptoms and fluid collections.	<ul> <li>deterioration should raise concern for infected pancreatic necrosis.</li> <li>After debridement, consider addition of empiric fluconazole for <i>Candida</i> coverage. Fluconazole should be discontinued if <i>Candida spp</i> is not isolated from fluid, tissue or blood cultures.</li> </ul>	
<u>Acute Necrotizing</u> <u>Pancreatitis with Proven</u> <u>Infection</u>	Empiric Regimen Piperacillin-tazobactam*4.5 g IV q6h Low/medium-risk allergy <sup>2</sup> to penicillins Cefepime* 2 g IV q8h + Metronidazole 500 mg PO/IV q8h Consider the addition of vancomycin for enterococcus coverage in <i>critically ill</i> patients with non-life- threatening PCN allergy High-risk allergy <sup>3</sup> /contraindication <sup>4</sup> to beta-lactams Vancomycin* + Aztreonam* 2 g IV q8h + Metronidazole 500 mg PO/IV q8h	Duration of treatment depends on timing of operative debridement, percutaneous drainage, radiographic resolution of infected fluid collection or necrosis, and improvement in clinical signs and symptoms of infection	<ul> <li>Adjust antimicrobial coverage based on organism identification and antimicrobial susceptibilities.</li> <li>Patients with low/medium-risk allergy<sup>2</sup> to penicillins and cephalosporins other than cefepime, ceftriaxone, cefpodoxime, and cefotaxime can receive cefepime</li> </ul>	



#### FOOTNOTES and DEFINITIONS

\*Adjust based on renal function

- <sup>1</sup>At risk implanted or indwelling devices are those deemed by the clinician to have a high risk of colonization or infection with resistant gram-negative organisms, including but not limited to Pseudomonas aeruginosa (e.g., central venous catheter, tracheostomy, nephrostomy/suprapubic catheter, percutaneous biliary catheter)
- <sup>2</sup> Low-risk allergies include: pruritus without rash, remote (>10 years) unknown reaction, patient denies allergy but is on record, mild rash with no other symptoms (mild rash: non-urticarial rash that resolves without medical intervention). Medium-risk allergies include: urticaria/hives with no other symptoms, severe rash with no other symptoms (severe rash: requires medical intervention [corticosteroids, anti-histamines] and/or ER visit or hospitalization).
- <sup>3</sup> High-risk allergies include: respiratory symptoms (chest tightness, bronchospasm, wheezing, cough), angioedema (swelling, throat tightness), cardiovascular symptoms (hypotension, dizzy/lightheadedness, syncope/passing out, arrhythmia), anaphylaxis.
- <sup>4</sup> Previous reactions that are contraindications to further beta-lactam use (except aztreonam, which can be used unless the reaction was to ceftazidime, cefiderocol, or aztreonam) unless approved by Allergy: organ damage (kidney, liver), drug-induced immune-mediated anemia/thrombocytopenia/leukopenia, rash with mucosal lesions (Stevens Johnson Syndrome/Toxic Epidermal Necrosis), rash with pustules (acute generalized exanthematous pustulosis), rash with eosinophils and organ injury (DRESS – drug rash eosinophilia and systemic symptoms), rash with joint pain, fever, and myalgia (Serum Sickness).
- See  $\beta$ -lactam allergy evaluation and empiric guidance for further information
- <sup>5</sup>Adequate Source control: Is defined as any procedure that stops the ongoing contamination of the peritoneal cavity and removes the majority of the contaminated intraperitoneal contents to the extent that no further acute interventions are felt to be necessary.

Severe Sepsis: Sepsis PLUS at least 1 organ dysfunction

- Sepsis: ≥ 2 SIRS criteria (heart rate greater than 90 bpm, respiratory rate greater than 20 breaths per minute, temperature less than 36°C, white blood count less than 4,000 cells/mm<sup>3</sup>, • temperature greater than 38°C, white blood count greater than 12,000 cells/mm<sup>3</sup>)
- Organ dysfunction: CV: SBP <90 mmHg or MAP <70 mmHg or require vasopressor support; Respiratory: PaO2/FiO2 <250 or mechanical ventilation; Renal: decreased urine output <0.5 mg/kg/hr for 1 hour, increased SCr (>50% from baseline); Hematologic: platelet <100,000 or increase aPTT; Metabolic: pH <7.3 increased lactate; Hepatic: liver enzymes >2x upper limit of normal; CNS: altered consciousness

Shock: Sepsis induced hypotension persisting despite adequate fluid resuscitation (Systolic blood pressure (SBP) <90 mmHg; MAP <70 mmHg; SBP decrease >40 mmHg)

References:

- 1. Salminen P. Paaianen H. Rautio T. et al. JAMA 2015:313:2340.
- 2. Morris AM, Regenbogen SE, Hardiman KM, et al. JAMA 2014;311:287.
- 3. Sawyer RG, Claridge JA, Nathens AB, et al. NEJM 2015;372:1996.
- 4. Solomkin JS, Mazuski JE, Bradley JS, et al. Clin Infect Dis 2010;50:133.
- 5. Yahav D, et al. Clin Infect Dis. 2019 Sep 13;69(7):1091-1098.

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10/2020: Updated E. coli resistance rates, updated Cholangitis/cholecystitis comments.

12/2022: Revised duration for cirrhosis with GI bleed.

If obtained from a source other than med.umich.edu/asp, please visit the webpage for the most up-to-date document.

The recommendations in this guide are meant to serve as treatment guidelines for use at Michigan Medicine facilities. If you are an individual experiencing a medical emergency, call 911 immediately. These guidelines should not replace a provider's professional medical advice based on clinical judgment, or be used in lieu of an Infectious Diseases consultation when necessary. As a result of ongoing research, practice guidelines may from time to time change. The authors of these guidelines have made all attempts to ensure the accuracy based on current information, however, due to ongoing research, users of these guidelines are strongly encouraged to confirm the information contained within them through an independent source.