



TREATMENT PATHWAY FOR ADULT PATIENTS WITH PNEUMONIA

The purpose of this document is to guide the appropriate treatment of adult patients presenting with pneumonia. Three pathways with different empiric treatment regimens based on risk of infection with multidrug-resistant (MDR) pathogens (including MRSA, Pseudomonas spp., Acinetobacter spp., organisms not susceptible to beta-lactams (ceftriaxone or ampicillin-sulbactam) and/or fluoroquinolones (ciprofloxacin, levofloxacin)) are shown below.

Pathway A: Community-Onset (No Risk Factors listed in Pathway B)

Patients presenting from the community without an risk factors for drug-resistant pathogens (includes patients admitted to the ICU for respiratory failure who do not meet Pathway B criteria)

For dosing, alternative treatment options, duration, and important comments
[Click here for Pathway A Recommendations](#)

Empiric Treatment

**Ampicillin-sulbactam
+
Azithromycin**

*see treatment guidelines for appropriate use of ceftriaxone as an alternative agent

Pathway B: Community-Onset, Risk Factors

Patients presenting with any of the following risk factors for drug-resistant pathogens OR unknown etiology of septic shock:

- History of infection or colonization with Pseudomonas spp., MRSA, or pathogens resistant to standard CAP therapy (ampicillin-sulbactam or ceftriaxone) within previous 12 months
- Severe community-acquired pneumonia (septic shock OR requiring mechanical ventilation OR high clinical concern for needing ICU care^a), AND meeting 1 of the following criteria:
 - Hospitalization for at least 48 hours AND use of any intravenous antibiotic, fluoroquinolone, or linezolid within previous 90 days
- OR
- Immunocompromised, defined as:
 - AIDS (CD4 <200)
 - Neutropenia (ANC <1000)
 - Kidney or liver or heart transplant recipient within previous 1 year
 - Solid organ transplant recipient treated for rejection within previous 6 months
 - Lung transplant recipient
 - Allogeneic stem cell transplant within previous 1 year or those with chronic GVHD
 - Autoimmune disorders on biologic agents (TNF α inhibitors, rituximab, etc.)

For dosing, alternative treatment options, duration, and important comments
[Click here for Pathway B Recommendations](#)

Empiric Treatment

**Piperacillin-tazobactam
(+ tobramycin if admitted to ICU)
+
Vancomycin**

Pathway C: Hospital-Onset

- Hospital-acquired pneumonia (current hospitalization for \geq 72 hours)
- Ventilator-associated pneumonia

For dosing, alternative treatment options, duration, and important comments
[Click here for Pathway C Recommendations](#)

Empiric Treatment

**Piperacillin-tazobactam
(+ tobramycin if admitted to ICU)
+
Vancomycin**

Utilization of procalcitonin (PCT) levels

- Consider diagnosis of a viral respiratory tract infection in patients with a low [#] PCT level (<0.25 mcg/L). Antibiotics are discouraged in these patients and should be discontinued.[^]
- Patients with AKI/CKD, massive trauma, major surgery, post-partum, acute GVHD, and cytokine stimulants may have false elevations in PCT levels.[^]

[#]Repeat 6-12 hours after 1st level if no antibiotics started and clinical suspicion for bacterial pneumonia persists
See [UMHS Procalcitonin Usage Guidelines](#) for more information

Indication	Common Pathogens	Empiric Therapy	Duration of Therapy	Comments
Pathway A (Part I, non-ICU)				
<p>Inpatient community-acquired pneumonia, no risk factors (Non-ICU patient)</p>	<p><i>Streptococcus pneumoniae</i> <i>Haemophilus influenzae</i> <i>Moraxella catarrhalis</i> <i>Mycoplasma pneumoniae</i></p>	<p><u>Preferred:</u> Ampicillin-sulbactam* 3 g IV q6h + Azithromycin 500 mg IV/PO x1 day, then 250 mg q24h x4 days</p> <p><u>Low/medium risk PCN allergy:</u> Ceftriaxone 2 g IV q24h + Azithromycin 500 mg IV/PO x1 day, then 250mg q24h x4 days</p> <p>Consider the addition of anaerobic coverage with metronidazole 500 mg PO q8h <u>if</u> empyema or lung abscess present</p> <p><u>High risk PCN and cephalosporin allergy:</u> Levofloxacin* 750 mg IV/PO q24h</p> <p>Consider the addition of anaerobic coverage with metronidazole 500 mg PO q8h <u>if</u> empyema or lung abscess present</p>	<p><u>Uncomplicated/Aspiration Pneumonia:</u></p> <ul style="list-style-type: none"> • 5 days for patients who defervesce within 72 hours and have <i>no more than 1</i> sign of CAP instability at the time of antibiotic discontinuation[†] • Patients with delayed response should discontinue therapy 48-72 hours after defervesce and have no more than 1 sign of CAP instability[†] at time antibiotic discontinuation. <p><u>Complicated Pneumonia:</u></p> <ul style="list-style-type: none"> • Patients with empyema, infected pleural effusions, and bacteremia secondary to pneumonia may require longer durations of therapy. Bacteremic pneumococcal pneumonia should be treated for a minimum of 7-14 days. ID consult is recommended for patients with bacteremia. <p><u>Pathogen-Specific Considerations:</u></p> <ul style="list-style-type: none"> • Uncomplicated pneumonia with non-fermenting GNRs (e.g., <i>Pseudomonas</i>, <i>Achromobacter</i>, <i>Acinetobacter</i>, <i>Stenotrophomonas</i>) or <i>Staphylococcus aureus</i> should receive 7 days of therapy if defervescence within 72 hours and have <i>no more than 1</i> sign of CAP instability at the time of antibiotic discontinuation[†]. Delayed response will likely require longer durations. <p>†CAP clinical signs of instability (if different than patient baseline status)</p> <ul style="list-style-type: none"> • HR ≥ 100 bpm • RR ≥ 24 breaths/min • SBP ≤ 90 mmHg • Arterial O₂ sat ≤ 90% or pO₂ ≤ 60 mmHg on room air • Altered mental status 	<p>5 days of therapy for Uncomplicated CAP patients</p> <ul style="list-style-type: none"> • Appropriately tailor therapy based on respiratory culture results. • Anaerobic coverage is not necessary for patients with pneumonia following an aspiration event. Only those with empyema or lung abscess should receive empiric anaerobic coverage. • For culture negative pneumonia, transition to oral therapy when patient is afebrile with clinical improvement and hemodynamically stable for 48 hours: <ul style="list-style-type: none"> • <u>1st line:</u> Amoxicillin-clavulanate* 875 mg BID + Azithromycin (complete 5-day course of azithromycin) • <u>Low/medium risk PCN allergy:</u> Cefuroxime* 500 mg BID plus azithromycin (complete 5-day course of azithromycin) • <u>High risk PCN or cephalosporin allergy:</u> Levofloxacin* 750 mg PO q24h • Adjust levofloxacin and ampicillin-sulbactam for renal dysfunction. Always give levofloxacin loading dose of 750 mg x1 dose • Use azithromycin 500 mg q24 h <i>if documented or high clinical suspicion for Legionella</i> (can pursue further diagnostic testing → respiratory legionella PCR) • In setting of macrolide allergy can use doxycycline for atypical coverage in absence of <i>Legionella</i> concern. • In patients with documented <i>Mycoplasma</i>, use of doxycycline should be preferred for treatment due to concern for macrolide resistance. • Antibiotic coverage of atypical organisms can be discontinued if the respiratory panel (RPAN) and urine antigens are negative. • See front page for tips on utilization of procalcitonin (PCT) levels
<p>HMS-Preferred empiric treatment for CAP includes:</p> <ul style="list-style-type: none"> - Ampicillin-Sulbactam PLUS Azithromycin, Clarithromycin, or Doxycycline - Ceftriaxone or Cefotaxime PLUS Azithromycin, Clarithromycin, or Doxycycline 		<p><u>Addition of vancomycin</u></p> <p>Consider if high clinical suspicion for CA-MRSA (prior isolation of MRSA from respiratory culture in past 12 months or post-influenza pneumonia)</p>	<p>Signs of clinical instability impacting determination for therapy duration</p>	
<p>Alternative by HMS Non-Preferred treatment for patients with cephalosporin allergy, allergy to both macrolides and doxycycline/tetracycline, or severe penicillin allergy</p>				

Indication	Common Pathogens	Empiric Therapy	Duration of Therapy	Comments
Pathway A (Part I, non-ICU)				
<p>Inpatient community-acquired pneumonia, no risk factors</p> <p>(Non-ICU patient)</p>	<p><i>Streptococcus pneumoniae</i></p> <p><i>Haemophilus influenzae</i></p> <p><i>Moraxella catarrhalis</i></p> <p><i>Mycoplasma pneumoniae</i></p> <p><i>Chlamydia pneumoniae</i></p> <p><i>Legionella</i> species</p>	<p><u>Preferred:</u></p> <p>Ampicillin-sulbactam* 3 g IV q6h + Azithromycin 500 mg IV/PO x1 day, then 250 mg q24h x4 days</p> <p><u>Low/medium risk PCN allergy:</u></p> <p>Ceftriaxone 2 g IV q24h + Azithromycin 500 mg IV/PO x1 day, then 250mg q24h x4 days</p> <p>Consider the addition of anaerobic coverage with metronidazole 500 mg PO q8h <u>if</u> empyema or lung abscess present</p> <p><u>High risk PCN and cephalosporin allergy:</u></p> <p>Levofloxacin* 750 mg IV/PO q24h</p> <p>Consider the addition of anaerobic coverage with metronidazole 500 mg PO q8h <u>if</u> empyema or lung abscess present</p> <p><u>Addition of vancomycin</u></p> <p>Consider if high clinical suspicion for CA-MRSA (prior isolation of MRSA from respiratory culture in past 12 months or post-influenza pneumonia)</p>	<p><u>Uncomplicated/Aspiration Pneumonia:</u></p> <ul style="list-style-type: none"> • 5 days for patients who defervesce within 72 hours and have <i>no more than 1</i> sign of CAP instability at the time of antibiotic discontinuation[†] • Patients with delayed response should discontinue therapy 48-72 hours after defervesce and have no more than 1 sign of CAP instability[†] at time antibiotic discontinuation. <p><u>Complicated Pneumonia:</u></p> <ul style="list-style-type: none"> • Patients with empyema, infected pleural effusions, and bacteremia secondary to pneumonia may require longer durations of therapy. Bacteremic pneumococcal pneumonia should be treated for a minimum of 7-14 days. ID consult is recommended for patients with bacteremia. <p><u>Pathogen-Specific Considerations:</u></p> <ul style="list-style-type: none"> • Uncomplicated pneumonia with non-fermenting GNRs (e.g., Pseudomonas, Achromobacter, Acinetobacter, Stenotrophomonas) or <i>Staphylococcus aureus</i> should receive 7 days of therapy if defervescence within 72 hours and have <i>no more than 1</i> sign of CAP instability at the time of antibiotic discontinuation[†]. Delayed response will likely require longer durations. <p>†CAP clinical signs of instability (if different than patient baseline status)</p> <ul style="list-style-type: none"> • HR ≥ 100 bpm • RR ≥ 24 breaths/min • SBP ≤ 90 mmHg • Arterial O₂ sat ≤ 90% or pO₂ ≤ 60 mmHg on room air • Altered mental status 	<ul style="list-style-type: none"> • Appropriately tailor therapy based on respiratory culture results. • Anaerobic coverage is not necessary for patients with pneumonia following an aspiration event. Only those with empyema or lung abscess should receive empiric anaerobic coverage. • For culture negative pneumonia, transition to oral therapy when patient is afebrile with clinical improvement and hemodynamically stable for 48 hours: <ul style="list-style-type: none"> • <u>1st line:</u> Amoxicillin-clavulanate* 875 mg BID + Azithromycin (complete 5-day course of azithromycin) • <u>Low/medium risk PCN allergy:</u> Cefuroxime* 500 mg BID plus azithromycin (complete 5-day course of azithromycin) • <u>High risk PCN or cephalosporin allergy:</u> Levofloxacin* 750 mg PO q24h • Adjust levofloxacin and ampicillin-sulbactam for renal dysfunction. Always give levofloxacin loading dose of 750 mg x1 dose • Use azithromycin 500 mg q24 h <i>if documented or high clinical suspicion for Legionella</i> (can pursue further diagnostic testing → respiratory legionella PCR) • In setting of macrolide allergy can use doxycycline for atypical coverage in absence of <i>Legionella</i> concern. • In patients with documented Mycoplasma, use of doxycycline should be preferred for treatment due to concern for macrolide resistance. • Antibiotic coverage of atypical organisms can be discontinued if the respiratory panel (RPAN) and urine antigens are negative. • See front page for tips on utilization of procalcitonin (PCT) levels

Footnotes:

- * Dose may need to be adjusted for renal dysfunction
- ** For ADULTS: Dose per vancomycin nomogram with trough goal 10-15
- α High clinical concern for needing ICU level care can be defined as having at least 3 of the following: RR ≥30 breaths/min, SpO₂ <90% OR O₂ supplementation ≥7 L, multilobar infiltrates, confusion, hypothermia (<36°C), severe sepsis

NOTE: See [Beta-lactam Allergy Evaluation and Empiric Therapy Guidance](#) document for further allergy information. High-risk allergies are defined as: respiratory symptoms (chest tightness, bronchospasm, wheezing, cough), angioedema (swelling, throat tightness), cardiovascular symptoms (hypotension, dizzy/lightheadedness, syncope/passing out, arrhythmia), anaphylaxis. If a patient has a high-risk allergy to penicillins, cephalosporins, or carbapenems, the only beta-lactam antibiotic that can be safely used without Allergy consult is aztreonam (if the allergy is to ceftazidime or aztreonam, aztreonam should be avoided as well).

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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.

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