

Community-acquired pneumonia (CAP)

Microbiology

- Respiratory viruses (eg, influenza A and B, adenovirus, rhinovirus, RSV, parainfluenza virus) are twice as common as bacteria
- *S. pneumoniae* is the most common bacterial pathogen
- *H. influenzae* is less common than once thought, it is more likely in those with COPD and structural lung disease.
- Atypical organisms include *Mycoplasma pneumoniae*, *Chlamydia pneumoniae*, and *Legionella*. Only treatment of *Legionella* is shown to be of clinical benefit, the other atypical organisms generally cause self-limited illness.
- *Staphylococcus aureus* is rare in CAP except in the setting of necrotizing pneumonia, pneumonia complicating influenza, or severe pneumonia in those with MRSA colonization or risk factors.

Diagnosis

The diagnosis of pneumonia is based on suggestive clinical features (cough, fever, sputum production, pleuritic chest pain, dyspnea) **AND** a new chest x-ray infiltrate.

Procalcitonin:

- Procalcitonin-guided therapy is effective in reducing unnecessary antibiotic use for non-bacterial pneumonia, with no adverse impact on mortality, length-of-stay, or readmission rates.
- Procalcitonin is a tool to support, not supplant, clinician judgment. Interpretation should be made in light of the clinical picture and severity of illness. Procalcitonin can be used in those on corticosteroids, but has not been validated in patients with higher degrees of immunosuppression.

Procalcitonin Level	Diagnostic Implications	Antimicrobial Guidance
>0.5 µg/L	Bacterial pneumonia very likely	Antibiotics strongly encouraged
0.25-0.5 µg/L	Bacterial pneumonia likely	Antibiotics encouraged
0.1-0.25 µg/L	Bacterial pneumonia unlikely	Antibiotics discouraged
<0.1 µg/L	Bacterial pneumonia very unlikely	Antibiotics strongly discouraged

- Follow-up testing: antibiotic therapy can be discontinued when procalcitonin drops to below 0.25 µg/L **OR** ≥80% decrease.

Investigations:

- Not all patients admitted with CAP require extensive microbiologic workup. Blood and sputum cultures should be reserved for patients with severe presentations, suspected resistant organisms, recent antimicrobial exposure, or failure of therapy.
- During respiratory virus season, consider a nasopharyngeal swab for respiratory virus testing.
 - If positive → consider discontinuation of antibacterial agents
 - If negative → discontinue antiviral agent (if started)
- Rarely, patients admitted with pneumonia may have a negative initial chest x-ray. If clinical features are highly suggestive, it may be reasonable to treat presumptively and repeat imaging after 24-48 hrs. Lack of infiltrate after 48 hrs suggests an alternative diagnosis other than bacterial CAP and may allow early discontinuation of antimicrobials.

Legionella pneumonia:

- *Legionella* is rarely identified as the cause of CAP in FH. Cases typically occur in fall and early winter.
- Classic *Legionella* pneumonia presents with high fever, pneumonia, and gastrointestinal symptoms. However, more commonly, patients present with various non-specific features. Hyponatremia and hepatic dysfunction is seen more with *Legionella* pneumonia than other causes of CAP.
- Urine antigen testing is available and identifies *L. pneumophila* serogroup 1 which causes most—but not all—cases of *Legionella* pneumonia.
- *Legionella* culture and PCR are also available upon discussion with Medical Microbiologist.

EMPIRIC TREATMENT

CRB-65 Score	<i>One point for each of:</i> Confusion (new disorientation in person, place, or time) Respiratory rate ≥ 30 breaths/minute Blood pressure (systolic <90 mmHg or diastolic ≤ 60 mmHg) Age ≥ 65 years Note: CRB-65 is a tool to support, not supplant, clinician judgment.		
Risk Stratification		Duration (days)	
Low Severity CRB-65 = 0 <i>Consider outpatient treatment</i>	amoxicillin 1000 mg PO BID <i>If severe beta-lactam allergy: moxifloxacin 400 mg PO daily</i> If unable to take oral antibiotics: ceftriaxone 1000 mg IV q24h <i>If severe beta-lactam allergy: moxifloxacin 400 mg IV daily</i> Notes <ul style="list-style-type: none"> Oral therapy is still appropriate in patients admitted for comorbidities or social reasons Addition of atypical coverage is not routinely recommended for non-severe CAP 	5	
Moderate Severity CRB-65 = 1-2 <i>Consider medical ward admission</i>	amoxicillin-clavulanate 875-125 mg one tab PO BID OR ceftriaxone 1000 mg IV q24h <i>If Legionella suspected: ADD azithromycin 500 mg PO/IV q24h¹</i> <i>If severe beta-lactam allergy: moxifloxacin 400 mg PO daily</i>	5	
High Severity CRB-65 ≥ 3 OR respiratory failure OR requiring ICU admission	<i>Pseudomonas unlikely</i>	ceftriaxone 1000 mg IV q24h PLUS azithromycin 500 mg PO/IV q24h ¹ <i>If severe beta-lactam allergy:</i> moxifloxacin 400 mg PO/IV daily	7
	<i>Potential Pseudomonas</i> <ul style="list-style-type: none"> COPD with $FEV_1 < 50\%$ Structural lung disease Recent broad-spectrum antibiotics From nursing home or recent hospitalization 	piperacillin-tazobactam 4500 mg IV q6h PLUS azithromycin 500 mg PO/IV q24h ¹ <i>If severe beta-lactam allergy:</i> meropenem 500 mg IV q6h PLUS azithromycin 500 mg PO/IV q24h ¹ OR levofloxacin 750 mg PO/IV q24h	7
	<i>Potential MRSA</i> <ul style="list-style-type: none"> Necrotizing pneumonia Recent influenza Injection drug use Known MRSA colonization 	ADD vancomycin ²	7

Doses may require adjustment for renal insufficiency

¹. Azithromycin duration is 500 mg for 3 days, or 500 mg once followed by 250 mg for 4 days. Longer durations only indicated in Legionella infection.

². For vancomycin dosing, refer to "Vancomycin Dosing and Therapeutic Monitoring" in the ASP Handbook

Oral Step-Down

Patients on IV therapy can be switched safely to oral therapy once:

1. Hemodynamically stable
2. Improving clinically
3. Afebrile for 24 hours
4. Can ingest medications and have a functioning GI tract

Guided by microbiology results (See “Pathogen-Directed Therapy for Pneumonia”)

In the absence of positive microbiology, recommended oral step-down if on initial intravenous therapy:

Intravenous	Oral Step-Down Option
azithromycin	Same
ceftriaxone	amoxicillin 500 mg PO TID or 1000 mg PO BID <i>If penicillin allergy: cefuroxime 500 mg PO BID</i>
moxifloxacin	same
piperacillin-tazobactam	amoxicillin-clavulanate 875-125 mg one tab PO BID

Vancomycin: Empiric vancomycin can be discontinued if nasal MRSA swab is negative, and no MRSA identified in blood or sputum cultures. Nasal MRSA swabs have a high negative predictive value in CAP.

Duration

- Patients with CAP should be treated a minimum of 5 days and can have antibiotics discontinued when:
 1. T ≤ 37.8°C for 48 hours **AND**
 2. Have no more than 1 CAP-associated sign of clinical instability:

sBP < 90 mmHg	HR > 100/min
RR > 24/min	Sat <90% or PaO2 <60 mmHg in room air
- Cough and chest x-ray abnormalities may take several weeks to resolve. If the patient is otherwise improving and afebrile, extension of antibiotic course is NOT necessary.
 - Repeated chest x-rays to document resolution of opacities should not be performed sooner than 6 weeks, unless patient’s condition is worsening.
 - Repeat chest x-rays are warranted if concerned about underlying malignancy (higher risk in smokers and those over 50 years old)
- Azithromycin dosing (due to long tissue half-life):
 - azithromycin 500 mg daily x 3 days
OR azithromycin 500 mg once, then 250 mg daily x 4 days
 - Treatment of CAP due to *Legionella* is the only indication for prolonged azithromycin
- Uncomplicated CAP with *S. pneumoniae* bacteremia includes patients who become afebrile within 72 hours, and have no evidence of necrotizing pneumonia, lung abscess, empyema, or extra-pulmonary disease. The presence of bacteremia alone does NOT require a prolonged course of parenteral antibiotics. Treat as per usual CAP duration above.
- Pneumonia due to *S. aureus* or *Legionella* may require a prolonged course of antibiotics. Respirology and/or Infectious Diseases consultation recommended.
- Necrotizing pneumonia, lung abscess, or empyema will require prolonged therapy. Respirology and/or Infectious Diseases consultation recommended.