Community-Acquired Pneumonia (CAP)

MICROBIOLOGY

- Respiratory viruses (eg, influenza A and B, coronavirus, adenovirus, rhinovirus, RSV, parainfluenza virus) are twice as common as bacteria
- *S. pneumoniae* is the most common bacterial pathogen
- *H. influenza* is less common than once thought, it is more likely in those with COPD and structural lung disease.
- Atypical organisms include *Mycoplasma pneumoniae*, *Chlamydophila 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 can help support early discontinuation of antibiotics. Due to testing turnaround time, procalcitonin cannot be relied on to assist the initial diagnosis and empiric treatment of CAP.
- Procalcitonin less than 0.25 µg/L at the time of initial diagnosis suggests the absence of bacterial pneumonia and supports early discontinuation of antibiotics.
- Serial procalcitonin testing is **not routinely recommended** as it has limited utility above validated clinical stability criteria. If ordered, antibiotic therapy can be discontinued when procalcitonin drops to below 0.25 µg/L **OR** ≥80% decrease from peak.

INVESTIGATIONS

Clinical Scenario	Blood Cultures	Sputum Cultures
Nonsevere CAP	NO	NO
Severe CAP	YES	YES
Empiric *Pseudomonas* coverage (e.g., piperacillin-tazobactam or meropenem)	YES	YES
Empiric MRSA coverage (e.g., vancomycin)	YES	YES
Consider respiratory virus testing (influenza, SARS-CoV-2) depending on local epidemiology		

- 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. pneumophilia* serogroup 1 which causes most—but not all—cases of *Legionella* pneumonia.
- *Legionella* culture and PCR are also available. If concerned, consider reviewing case with Infectious Diseases, Respirology, or Medical Microbiology.

EMPIRIC TREATMENT

CRB-65 Score	*One point for each of:* **C**onfusion (new disorientation in person, place, or time) **R**espiratory rate ≥ 30 breaths/minute **B**lood 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)**
Outpatient CAP	amoxicillin 500 mg PO TID[1] *If severe penicillin allergy:* cefuroxime 500 mg PO BID **OR** doxycycline 100 mg PO BID		**3**
Hospitalized CAP, Nonsevere CRB-65 = 0-1	amoxicillin-clavulanate 500-125 mg PO TID[2] **OR** ceftriaxone 1000 mg IV q24h *If Legionella suspected:* **ADD** azithromycin 500 mg PO/IV q24h[3] *If severe ceftriaxone allergy:* moxifloxacin 400 mg PO daily (addition of azithromycin not necessary)		**3-5**
Hospitalized CAP, Severe CRB-65 ≥ 2 ***OR*** respiratory failure ***OR*** requiring ICU admission	Standard Regimen	ceftriaxone 1000 mg IV q24h **PLUS** azithromycin 500 mg PO/IV q24h[3] *If severe ceftriaxone allergy:* moxifloxacin 400 mg PO/IV daily	**3-7**
	Potential *Pseudomonas* • 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[3] *If severe penicillin allergy:* meropenem 500 mg IV q6h **PLUS** azithromycin 500 mg PO/IV q24h[3] **OR** levofloxacin 750 mg PO/IV q24h	
	Potential MRSA • Necrotizing pneumonia • Recent influenza • Injection drug use • Known MRSA colonization	**ADD** vancomycin[4]	

Doses may require adjustment for renal insufficiency

1. *Amoxicillin 1000 mg PO TID may be considered in patients with recent antibiotic exposure.*
2. *Amoxicillin-clavulanate 875-125 mg PO BID is an acceptable alternative dosing.*
3. *Azithromycin dosing is 500 mg daily for 3 days, or 500 mg once followed by 250 mg daily for 4 days.*
4. *For vancomycin dosing, refer to "Vancomycin Dosing and Therapeutic Monitoring" in the ASP Handbook*

DEESCALATION

- Patients on anti-Pseudomonal therapy (piperacillin-tazobactam or meropenem) who are clinically improving at 48 hours, and whose cultures do not reveal a drug-resistant pathogen, should be deescalated to standard CAP therapy.
- 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.
- Patients with confirmed viral pneumonia (e.g., Influenza, SARS-CoV-2) can have antibacterial therapy discontinued unless there is a high suspicion for concurrent bacterial pneumonia.

ORAL TRANSITION

Patients on IV therapy can be transitioned 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

If positive microbiology, see "Pathogen-Directed Therapy for Pneumonia".

In the absence of positive microbiology, recommended oral transition if on initial intravenous therapy:

Intravenous	Oral Transition Option
azithromycin	Same
ceftriaxone	amoxicillin-clavulanate 875 mg PO BID *If penicillin allergy:* cefuroxime 500 mg PO BID
moxifloxacin	Same

DURATION

- **Validated clinical stability criteria:** Patients with CAP should be treated a minimum of 3 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 (or baseline home oxygen)
- 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.
- 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
- 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 *P. aeruginosa* should be treated for 7 days.
- Necrotizing pneumonia, lung abscess, or empyema will require prolonged therapy. Respirology and/or Infectious Diseases consultation recommended.