

Pediatric Community-Acquired Pneumonia (CAP), Uncomplicated

Scope: suspected or proven CAP managed in outpatient, emergency department, inpatient, or intensive care setting

Inclusion: Infants and children ≥ 3 months -18 years of age that are otherwise healthy

Exclusion: See exclusions (Box 1)

Box 1: Exclusion

NOTE: Pneumonia in an infant less than 3 months of age that is otherwise healthy may warrant additional diagnostic work-up for underlying factors

- Less than 3 months of age in full term infant
- Less than 6 months of age who were born less than 36 weeks of age
- Children with chronic conditions or underlying lung disease such as cystic fibrosis (asthma is not excluded)
- Children with tracheostomy or receiving home mechanical ventilation
- Children with immunodeficiency or immunosuppressive therapy
- Hospital-acquired pneumonia
- Complicated CAP

Signs/Symptoms Suggestive of Pneumonia Clinical diagnosis made following historical and physical examination (See Box 2)

- Tachypnea
- Fever
- Hypoxia
- Dyspnea, retractions and/or nasal flaring
- Apnea
- Focal rales/diffuse crackles (crackles in younger children may be suggestive of bronchiolitis – see pathway)

Positive sepsis screen, concern for sepsis, or toxic appearance?

YES

Sepsis Huddle if not yet done and see Sepsis Pathway

STAT labs: CBC with diff, CRP, CMP, and blood culture

Give IV antibiotic STAT; see Sepsis Order Set

NO

Box 2: Symptom Severity and Definitions

Mild Respiratory Symptoms	<ul style="list-style-type: none"> • Pulmonary parenchymal infection that can be managed in the outpatient setting
Mild Uncomplicated CAP	<ul style="list-style-type: none"> • No moderate/severe retractions, grunting, nasal flaring, or apnea • Pulse oximetry $\geq 90\%$ in room air • Non-toxic appearance

Moderate Respiratory Symptoms	<ul style="list-style-type: none"> • Pulmonary parenchymal infection that failed outpatient management and/or necessitates inpatient non-ICU care
Hospitalized, Uncomplicated CAP	<ul style="list-style-type: none"> • Moderate dyspnea, including: moderate retractions or nasal flaring • Pulse oximetry $< 90\%$ on room air; need for low flow oxygen support (e.g. nasal cannula or vent-mask) and does not meet severe criteria • Follow Escalation of Care Pathway for recognition of clinical deterioration

Severe Respiratory Symptoms	<ul style="list-style-type: none"> • Pulmonary parenchymal infection necessitating ICU level care or escalation from acute, non-ICU setting
Hospitalized, Uncomplicated CAP	<ul style="list-style-type: none"> • Apnea, grunting, severe retractions, hypoxemic, oxygen support beyond low flow nasal or hypercarbic respiratory failure requiring invasive mechanical ventilation or non-invasive mechanical ventilation with requirement attributable to bacterial pneumonia • Systemic signs of inadequate perfusion (change in mental status, hemodynamic instability).

If severe respiratory symptoms develop during hospitalization, see sepsis pathway

Additional Definitions:

Complicated CAP	Pulmonary parenchymal infection complicated by parapneumonic effusions, abscesses or cavities, necrotizing pneumonia, empyema, pneumothorax or bronchopleural fistula; or pneumonia that is a complication of bacteremia disease that includes other sites of infection
Treatment Failure	Treatment failure is defined as > 48 hours of recommended treatment in a patient with no clinical improvement or worsening symptoms

Mild CAP:

- Mild respiratory symptoms
- Laboratory and radiologic testing is not routinely recommended if clinical diagnosis consistent with mild CAP
- During influenza season, add influenza testing to determine need for oseltamivir
- **See Box 3 for Treatment Recommendations** with consideration of vaccination status
- Patients may be discharged if:
 - Able to tolerate oral medications and fluids
 - Adequate observation/ follow-up care established
 - No inpatient supportive measures required
- Patient should return for re-evaluation if symptoms persist or worsen within 48-72 hours after starting treatment
- Encourage routine vaccines as pneumonia prevention

Admission required?

Yes

Mild Needing Inpatient Management:

- Admit to Inpatient
- See Box 3 for antimicrobial treatment recommendations

- Once patient meets discharge criteria, transition to oral antibiotics to complete a 5 day course

Moderate-Severe CAP:

- Obtain chest X-ray
- Obtain CBC with diff, CRP, and CMP
- Blood culture recommended during work-up with severe respiratory symptoms, concern for sepsis, or worsening on antibiotic therapy
- Consider respiratory viral testing (e.g. RSV, SARS CoV-2) if viral etiology thought to be sole cause of disease and detection of virus will change management
- During flu season, add influenza testing to determine need for oseltamivir in addition to antibiotic coverage

Uncomplicated CAP with Moderate Respiratory Symptoms:

- Admit to Inpatient
- See Box 3 for Treatment Recommendations
- Initiate ADT20 order if transport to main campus required
- Administer supplemental low flow oxygen for SpO₂ $< 90\%$ with continuous pulse oximetry

Uncomplicated CAP with Severe Respiratory Symptoms:

- Admit to PICU
- See Box 3 for Treatment Recommendations
- Initiate ADT20 order if transport to main campus required

Treatment Failure or Worsening of Symptoms after 48 hours?

No

Yes

Treatment Failure or Worsening Symptoms

- Perform sepsis huddle and obtain blood culture
- If on floor, see Escalation of Care Pathway; initiate watcher status if applicable
- Consider infectious diseases and/or pulmonary consult
- Broaden antibiotic therapy; see antibiotic recommendations (Pneumonia PEDS or Sepsis Order Set)
- If complicated CAP confirmed, remove from pathway. Patient may require longer duration of antibiotics

If patient develops complicated CAP, remove from algorithm and consider ID and/or pulmonary consult

Box 3: Antibiotics for Treatment of Uncomplicated Community-Acquired Pneumonia

Mild Oral Treatment or Transition to Oral Treatment to Complete 5 Day Duration	
Presumed bacterial CAP, first line:	Amoxicillin PO 90 mg/kg/day divided BID (max 2000 mg/dose) x 5 total days of treatment
Presumed bacterial CAP, second line:	Amoxicillin-clavulanate PO 90 mg/kg/day divided BID (max 2000 mg/dose of amoxicillin component) x 5 days (use 600 mg/5 mL concentration)
Presumed bacterial CAP in unimmunized patient	
Non-type 1 or Type 1 B-lactam allergy, first line:	Clindamycin PO 40 mg/kg/day divided TID (max 600 mg/dose) x 5 days
Non-type 1 B-lactam allergy, second line or no improvement in 48 hours	Clindamycin PO 40 mg/kg/day divided TID (max 600 mg/dose) x 5 days PLUS Cefpodoxime PO 10 mg/kg/day divided BID (max 200 mg/dose) x 5 days OR cefixime PO 8 mg/kg/day divided BID (max 200mg/dose) <i>Adding cefpodoxime or cefixime provides Gram-negative coverage</i>
Type 1 B-lactam allergy, second line:	Levofloxacin PO 6 months- < 5 years old: 20 mg/kg/day divided BID (max 375 mg/dose) x 5 days ≥5 years old: 10 mg/kg once a day (max 750 mg/dose) x 5 days
<i>Consider referral to allergist for allergy testing if antibiotic allergy diagnosis uncertain or initial allergy diagnosis was greater than 10 years ago</i>	

Initial Intravenous Treatment for Hospitalized Patients (transition to oral therapy to complete a total of 5 day treatment duration when appropriate)	
Presumed bacterial CAP, fully immunized	Ampicillin 50mg/kg/dose IV q6h (max 2000 mg/dose) If Influenza positive add oseltamivir*
Presumed bacterial CAP, not fully immunized or moderate respiratory symptoms	Ceftriaxone 50mg/kg/dose IV q24h (max 2000mg/dose) If Influenza positive, add oseltamivir*
Non-type 1 B-lactam allergy, first line:	Ceftriaxone 50mg/kg/dose IV q24h (max 2000mg/dose)
Type 1 B-lactam allergy, first line and moderate respiratory symptoms	Levofloxacin IV 6 months- < 5 years old: 10 mg/kg/dose IV twice daily (max 375 mg/dose) ≥5 years old: 10 mg/kg/dose IV once a day (max 750 mg/dose)
Presumed bacterial CAP, severe symptoms, toxic appearance, or signs/symptoms of sepsis	Ceftriaxone 50mg/kg/dose IV q24h (max 2000mg/dose) PLUS Vancomycin IV – pharmacy to dose PLUS If Influenza positive add oseltamivir* PO and clindamycin IV; 13.3mg/kg/dose IV q8h (max 600mg/dose)
Non-type 1 B-lactam allergy Presumed bacterial CAP, severe symptoms, toxic appearance, or signs/symptoms of sepsis	Meropenem 20mg/kg/dose IV q8h (max 2000mg/dose) PLUS Vancomycin IV – pharmacy to dose PLUS If Influenza positive add oseltamivir* PO and clindamycin IV; 13.3mg/kg/dose IV q8h (max 600mg/dose)
Type 1 B-lactam allergy Presumed bacterial CAP, severe symptoms, toxic appearance, or signs/symptoms of sepsis	Aztreonam 40mg/kg/dose IV q8h (max 2000 mg/dose) PLUS Vancomycin IV – pharmacy to dose PLUS If Influenza positive add oseltamivir* PO and clindamycin IV; 13.3mg/kg/dose IV q8h (max 600mg/dose)

Concern for Atypical Pneumonia - any PO/IV regimen above	
<i>Symptoms suggestive of atypical etiology include malaise, sore throat, and low- grade fever, cough, which usually develop slowly over 3-7 days; may find diffuse crackles or wheezes on lung exam. Can consider monotherapy with azithromycin if clear signs and symptoms of atypical pneumonia as above. Given the growing S. pneumoniae resistance to azithromycin, azithromycin should be used in conjunction with the first or second line antibiotics recommended above when diagnosis of atypical vs. community- acquired pneumonia is not clear</i>	In school aged children, consider adding azithromycin to any above regimen if not already on levofloxacin Azithromycin 10 mg/kg day 1 (max 500 mg/dose) PO/IV followed by 5 mg/kg PO/IV days 2-5 (max 250 mg/dose)

*Oseltamivir Dosing	
Influenza Positive: <i>Influenza antiviral therapy should be administered as soon as possible to children with CAP consistent with influenza virus infection during widespread local circulation of influenza viruses, particularly for those with moderate to severe CAP; clinically worsening disease documented at the time of an outpatient visit; or high risk for influenza complications. This includes children with asthma, metabolic conditions, neurologic disorders, neurodevelopmental conditions, and children younger than 5 years old.</i> <i>Treatment most effective if started within 48-72 hours of onset of symptoms.</i>	Oseltamivir PO x 5 days For children ≥12 months ≤15 kg: 30 mg twice daily >15 to 23 kg: 45 mg twice daily >23 to 40 kg: 60 mg twice daily >40 kg: 75 mg twice daily For children < 12 months 1-8 months: 3 mg/kg/dose twice daily 9-11 months: 3.5mg/kg/dose twice daily