CARILION CLINIC
Antimicrobial Stewardship

Pediatric Community-Acquired Pneumonia Treatment Guideline

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Assessment of Community-Acquired Pneumonia (CAP):

Signs & Symptoms Suggestive of Pneumonia	
Tachypnea (breaths/min) Age 0 – 2 months: > 60 Age 2 – 12 months: > 50 Age 1 – 5 years: > 40 Age > 5 years: > 20	Fever
	Hypoxia (pulse oximetry ≤ 94% on room air [RA])
	Dyspnea (apnea, grunting, nasal flaring, retractions)
	Focal rales/crackles

Assessment of Severity:

Mild CAP (Outpatient)	Moderate CAP (Inpatient or ICU)	Severe CAP (ICU)	Complicated CAP
Non-toxic appearing Pulse oximetry > 90% RA No or mild dyspnea	Moderate dyspnea Pulse oximetry < 90% RA High flow nasal canula (HFNC) or non-invasive mechanical ventilation (NIV) not meeting criteria for severe CAP Infants < 3 – 6 months of age with suspected bacterial pneumonia Presence of virulent pathogen (i.e. MSSA/MRSA)	Acute hypoxic or hypercapnic respiratory failure (AHRF) requiring mechanical ventilation or NIV with high or escalating FiO2 requirements Signs of inadequate perfusion or hemodynamic instability (altered mental status, sustained tachycardia, SpO2 < 92% on inspired oxygen > 0.5, pharmacologic support of perfusion or blood pressure)	Presence of parapneumonic effusions, multilobar disease, abscesses, cavitary lesions, necrotizing pneumonia, empyema, pneumothorax, or bronchopleural fistula Associated bacteremia or additional infection site

Microbiology – Common Pathogens:

Viral* (Most Common)	Mild + Moderate (Uncomplicated) CAP	Moderate (Complicated) + Severe CAP	Atypicals
Respiratory syncytial virus *Rhinovirus* *Metapneumovirus* *Parainfluenza* *Influenza* *COVID-19*	*Streptococcus pneumoniae*	*Streptococcus pneumoniae* *Streptococcus pyogenes* (Group A *Strep*) *Staphylococcus aureus* (including MRSA)	*Mycoplasma pneumoniae* *Chlamydia pneumoniae*

*Viruses are the most common cause of CAP, particularly among preschool age children. Antibiotics in this age group are NOT routinely recommended unless a bacterial superinfection is suspected.

Diagnostics:

Diagnostic Testing for CAP	Considerations
Routinely Recommended	
Pulse Oximetry	Recommended for all patients to assess for hypoxia
Chest Radiograph	Recommended for pediatric patients hospitalized with CAP to characterize infiltrates and identify the presence of complications Repeat imaging may be considered in patients who fail to improve, have progressive symptoms, or have complicated CAP
Complete Blood Cell Count (CBC) with Differential	Consider for pediatric patients hospitalized with CAP Cannot distinguish between bacterial and viral CAP
Acute Phase Reactants (ESR, CRP, Procalcitonin)	Consider for pediatric patients hospitalized with CAP
Viral Testing	Respiratory viruses are the most common pathogen of CAP Obtain appropriate viral testing for children with CAP considering factors such as season, age, and community prevalence: - Influenza, COVID-19, RSV Antibiotics are NOT required for positive viral tests in the absence of findings suggestive of a bacterial coinfection (progressive worsening, lack of clinical improvement, or initial clinical improvement followed by worsening)
Sputum Cultures	Obtain for hospitalized patients who can produce sputum
Blood Cultures	Obtain for children hospitalized for moderate to severe CAP, particularly for complicated CAP Obtain repeat blood cultures for children who fail to improve or worsen after initiation of antimicrobials

Situationally Recommended	
MRSA Nasal Swab	Obtain for patients with complicated or severe CAP where empiric MRSA coverage is indicated
Atypical Bacteria Testing	Consider *M. pneumoniae* testing in patients at risk for and with suspicious signs/symptoms: - School age children (≥ 5 years) - Longer duration of fever (> 2 days) - Bilateral, diffuse interstitial infiltrates on CXR (nonspecific) - Known outbreak or epidemic Diagnostic tests alone cannot differentiate colonization from infection
Tracheal Aspirate	Obtain at the time of endotracheal tube placement for patients hospitalized with CAP who require mechanical ventilation

Management:

Severity	Fully Immunized	Incomplete Immunization History
Mild (outpatient)	**Amoxicillin** 90 mg/kg/day PO in 2 – 3 divided doses (Max: 4000 mg/day) Considerations: - TID dosing optimizes amoxicillin exposure and can be considered for hospitalized children switching to oral therapy or patients with higher body weight - BID dosing is sufficient for most children and provides improved adherence	**Amoxicillin-clavulanate** 90 mg amoxicillin/kg/day PO in 2 – 3 divided doses (Max: 4000 mg amoxicillin/day) Alternatives: Cefpodoxime - 2 months – < 12 years: 5 mg/kg PO q12h (Max: 200 mg/dose) - ≥ 12 years: 200 – 400 mg PO q12h - Use is not routinely recommended in patients < 2 months of age due to limited data Cefdinir 7 mg/kg PO q12h (Max: 300 mg/dose) β-lactam Allergy: Levofloxacin - 6 months – < 5 years: 10 mg/kg IV/PO q12h - ≥ 5 years: 10 mg/kg IV/PO q24h - (Max: 750 mg/day)
Moderate	**Ampicillin** 50 mg/kg IV q6h (Max: 2000 mg/dose) - Consider stepdown to amoxicillin PO when appropriate Alternative: Penicillin G potassium 33,000 units/kg IV q4h (Max: 24 million units/day)	**Ampicillin-sulbactam** 50 mg ampicillin/kg IV q6h (Max: 2000 mg ampicillin/dose) Alternative: Ceftriaxone 75 mg/kg IV q24h (Max: 2000 mg/dose) - Consider for penicillin-resistant strains of *S. pneumoniae* and patients not improving on ampicillin-sulbactam β-lactam Allergy: Levofloxacin - 6 months – < 5 years: 10 mg/kg IV/PO q12h - ≥ 5 years: 10 mg/kg IV/PO q24h - (Max: 750 mg/day)

Severe	**Ceftriaxone** 75 mg/kg IV q24h (Max: 2000 mg/dose) Consider MRSA coverage in high risk* patients: **Vancomycin** 20 mg/kg IV q6 – 8h Alternative MRSA agents: Linezolid - < 12 years: 10 mg/kg IV/PO q8h (Max: 600 mg/dose) - ≥ 12 years: 600 mg IV/PO q12h Clindamycin 10 mg/kg IV/PO q6h (Max: 900 mg/dose) - Only use if confirmed susceptibilities due to high local resistance
Complicated	**Ceftriaxone** 75 mg/kg IV q24h (Max: 2000 mg/dose) **AND** **Vancomycin** 20 mg/kg IV q6 – 8h Consider addition of anaerobic coverage when indicated†: **Metronidazole** 10 mg/kg IV/PO q8h (Max: 500 mg/dose) Alternative MRSA agents: Linezolid - < 12 years: 10 mg/kg IV/PO q8h (Max: 600 mg/dose) - ≥ 12 years: 600 mg IV/PO q12h Clindamycin 10 mg/kg IV/PO q6h (Max: 900 mg/dose) - Only use if confirmed susceptibilities due to high local resistance
Atypical Pneumonia	**Azithromycin** 10 mg/kg IV/PO q24h for 3 days (Max: 500 mg/dose) Alternatives: Levofloxacin - 6 months – 5 years: 10 mg/kg IV/PO q12h - ≥ 5 years: 10 mg/kg IV/PO q24h - (Max: 750 mg/day) Doxycycline - > 7 years: 2.2 mg/kg/dose IV/PO q12 h (Max: 100 mg/dose) - ≤ 7 years: Increasing evidence that use is safe and may be considered
Influenza	**Oseltamivir** - 2 weeks – 8 months: 3 mg/kg PO BID - 9 – 11 months: 3.5 mg/kg PO BID - 1 – 12 years: ≤ 15 kg: 30 mg PO BID > 15 – 23 kg: 45 mg PO BID > 23 – 40 kg: 60 mg PO BID > 40 kg: 75 mg PO BID

*Risk factors for MRSA CAP can include prior MRSA infection/colonization or recent hospitalization with IV antibiotic administration within the last 90 days

†Indications of anaerobic coverage include abscesses or cavities, necrotizing pneumonia, empyema

Reminder: Because fluoroquinolones have been associated with serious adverse reactions including disabling and potentially irreversible tendinitis, tendon rupture, peripheral neuropathy, and CNS effects, reserve use for patients who have no alternative treatment options. Special caution should be used in pediatric patients as they may be at higher risk for adverse reactions.

Pediatric Community-Acquired Pneumonia Treatment Guideline

Pathogen Directed Treatment:

Pathogen	Intravenous Antibiotics	Oral Antibiotics	β-lactam Allergy
Streptococcus pneumoniae	**Ampicillin** Alternatives: Penicillin, ceftriaxone	**Amoxicillin** Alternatives: Amoxicillin-clavulanate, cefpodoxime, cefdinir	**Linezolid, levofloxacin** Alternative: Clindamycin
Group A *Streptococcus*	**Penicillin, ampicillin**	**Amoxicillin** Alternatives: Cephalexin, penicillin VK	**Linezolid** Alternative: Clindamycin
Methicillin-susceptible *Staphylococcus aureus* (MSSA)	**Cefazolin, nafcillin**	**Cephalexin** Alternatives: Linezolid, clindamycin	**Linezolid** Alternative: Clindamycin
Methicillin-resistant *Staphylococcus aureus* (MRSA)	**Vancomycin** Alternatives: Linezolid, ceftaroline, doxycycline, clindamycin	**Linezolid** Alternatives: Doxycycline, clindamycin	**Linezolid** Alternatives: Doxycycline, clindamycin
Haemophilus influenzae	**Ampicillin-sulbactam** (empiric or β-lactamase positive), **ampicillin** (β-lactamase negative) Alternative: Ceftriaxone	**Amoxicillin-clavulanate** (empiric or β-lactamase positive), **amoxicillin** (β-lactamase negative) Alternative: Cefdinir	**Levofloxacin**
Mycoplasma pneumoniae, Chlamydia trachomatis, Chlamydia pneumoniae	**Azithromycin** Alternatives: Doxycycline, levofloxacin		

Clindamycin is not recommended for empiric *Staphylococcus aureus* (MSSA and MRSA) coverage due to high local resistance rates

Treatment Duration:

Severity	Duration
Mild	5 days
Moderate	5 days
Severe	7 days
Complicated	7 days from source control and clinical response 2 – 4 weeks from source control may be required for some complicating factors: abscesses, necrotizing pneumonia, empyema Consider ID consult
Influenza	5 days May consider longer duration (up to 10 days) in severe illness or immunocompromised states

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