C.S. MOTT CHILDREN'S HOSPITAL
MICHIGAN MEDICINE

ANTIBIOTIC TREATMENT GUIDELINES FOR COMMUNITY-ACQUIRED PNEUMONIA IN CHILDREN (3 months through 17 years)

This guideline is designed to provide guidance in otherwise healthy children. Management of pneumonia in patients <3 months, or in children who are immunocompromised, receiving home mechanical ventilation, or who have chronic conditions or underlying lung disease (e.g., cystic fibrosis; excluding asthma) is beyond the scope of these guidelines. Other types of pneumonia such as aspiration pneumonia, Lemierre syndrome, atypical pneumonia in infants (pertussis, *C. trachomatis*), and ventilator-associated pneumonia are also beyond the scope of these guidelines.

Setting	Empiric Therapy	Duration/Comments
Outpatient Target pathogen: *S. pneumoniae* Underimmunized[2] Above, plus *H. influenzae* type b	1st line: **Amoxicillin*** 45 mg/kg/DOSE PO BID (max: 2 g/DOSE) PCN allergy (preferred): **Clindamycin** 13 mg/kg/DOSE PO TID (max: 600 mg/DOSE) Alternative if non-severe[1] PCN allergy: **Cefuroxime*** 15 mg/kg/DOSE PO BID (max: 500 mg/DOSE) (See comment) Underimmunized[2]: **Amoxicillin-clavulanate***[3] 30 mg/kg/DOSE PO TID (max: 1 g/DOSE) Underimmunized[2] and PCN allergy: **Levofloxacin***: *<5 years:* 10 mg/kg/DOSE IV/PO BID (max: 375 mg/DOSE) *≥5 years:* 10 mg/kg/DOSE IV/PO daily (max: 750 mg/DOSE)	• Duration: 7 days • For children <5 years, given predominance of viral pneumonia, consider supportive care only • Oral cephalosporins have inferior *in vitro* activity against *S. pneumoniae* compared to high-dose amoxicillin, clindamycin, and levofloxacin • Azithromycin resistance occurs in up to 40% of *S. pneumoniae*
Target pathogens: *M. pneumoniae* *C. pneumoniae*	Children ≥5 years with features of atypical pneumonia[4]: Consider **azithromycin** PO 10 mg/kg once on day 1 (max: 500 mg), followed by 5 mg/kg once daily x4 days (max: 250 mg/day)	• If unable to distinguish atypical from routine bacterial pneumonia, add azithromycin (except to levofloxacin); use azithromycin alone only if clear features of atypical pneumonia[4].

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Setting	Empiric Therapy	Step-Down Therapy	Duration/Comments
Inpatient (uncomplicated or simple effusion only) Target pathogen: *S. pneumoniae* Underimmunized[2] Above, plus *H. influenzae* type b	1st line: **Ampicillin*** 50 mg/kg/DOSE IV q6h (max: 2 g/DOSE) PCN allergy: **Clindamycin** 13 mg/kg/DOSE IV q8h (max: 900 mg/DOSE) Underimmunized[2] OR failed high-dose amoxicillin[5]: **Ceftriaxone** 100 mg/kg once, then 50 mg/kg/DOSE IV q24h (max: 2 g/DOSE) Alternative to ceftriaxone if severe[1] PCN or cephalosporin allergy: **Levofloxacin***: *<5 years:* 10 mg/kg/DOSE IV/PO BID (max: 375 mg/DOSE) *≥5 years:* 10 mg/kg/DOSE IV/PO daily (max: 750 mg/DOSE)	1st line: **Amoxicillin*** 45 mg/kg/DOSE PO BID (max: 2 g/DOSE) PCN allergy: **Clindamycin** 13 mg/kg/DOSE PO TID (max: 600 mg/DOSE) Underimmunized[2]: **Amoxicillin-clavulanate***[3] 30 mg/kg/DOSE PO TID (max: 1 g/DOSE) Failed high-dose amoxicillin[5] OR underimmunized[2] with severe[1] PCN allergy: **Levofloxacin***: *<5 years:* 10 mg/kg/DOSE IV/PO BID (max: 375 mg/DOSE) *≥5 years:* 10 mg/kg/DOSE IV/PO daily (max: 750 mg/DOSE)	• Duration: 7 days (IV + oral) for uncomplicated pneumonia. With effusion, 7 days from afebrile. • Consider ID consult for significant prior antibiotics, no improvement with >48hrs guideline therapy, or anticipated prolonged antibiotics • *Tailor therapy to culture results* • Transition to oral therapy following clinical improvement, as evidenced by improving fever curve, stable respiratory status, and ability to tolerate PO • Ceftriaxone should not be transitioned to oral cephalosporins due to inferior *in vitro* activity against *S. pneumoniae*
Target pathogens: *M. pneumoniae* *C. pneumoniae*	Children ≥5 years with features of atypical pneumonia[4]: Add **azithromycin** PO 10 mg/kg once on day 1 (max: 500 mg), followed by 5 mg/kg once daily x 4 days (max: 250 mg/day)		• Discontinue if RPAN negative for atypical pathogens • No additional atypical coverage needed if using levofloxacin

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Setting	Empiric Therapy	Step-Down Therapy	Duration/Comments
Complicated and/or Severe (empyema, abscess, necrosis, or pneumonia requiring ICU care, including those with severe sepsis) Target pathogens: *S. pneumoniae* *S. aureus* *S. pyogenes* Anaerobes (abscess, necrosis) Underimmunized[2] Above, plus *H. influenzae* type b	1st line: **Ceftriaxone** 100 mg/kg once, then 50 mg/kg/DOSE IV q12h (max: 2 g/DOSE) + **Vancomycin*** 15 mg/kg/DOSE IV q6h or 20 mg/kg/DOSE IV q8h Severe[1] PCN or cephalosporin allergy: **Levofloxacin***: *<5 years:* 10 mg/kg/DOSE IV/PO BID (max: 375 mg/DOSE) *≥5 years:* 10 mg/kg/DOSE IV/PO daily (max: 750 mg/DOSE) + **Vancomycin*** 15 mg/kg/DOSE IV q6h or 20 mg/kg/DOSE IV q8h Abscess or necrotizing pneumonia: Add **metronidazole*** 10 mg/kg/DOSE IV/PO q8h (max: 500 mg/DOSE) to either regimen	1st line: **Amoxicillin-clavulanate***[3] 30 mg/kg/DOSE PO TID (max: 1 g/DOSE) **+ TMP-SMX***[6] 5 mg TMP/kg/DOSE PO BID (max: 320 mg/DOSE) PCN allergy: **Levofloxacin***: *<5 years:* 10 mg/kg/DOSE IV/PO BID (max: 375 mg/DOSE) *≥5 years:* 10 mg/kg/DOSE IV/PO daily (max: 750 mg/DOSE) **+ TMP-SMX***[6] 5 mg TMP/kg/DOSE PO BID (max: 320 mg/DOSE) PCN allergy with abscess or necrotizing pneumonia: Add **metronidazole*** 10 mg/kg/DOSE IV/PO q8h (max: 500 mg/DOSE)	• Duration: 7 days from afebrile. Longer duration may be required for empyema/abscess. • Please consult ID for patients with complicated pneumonia, or severe illness with extensive work-up • Vancomycin goal AUC: 400-600 mcg*hr/mL • *Tailor therapy to culture results* • Transition to oral therapy following clinical improvement, as evidenced by improving fever curve, stable respiratory status, and ability to tolerate PO • Ceftriaxone should not be transitioned to oral cephalosporins due to inferior *in vitro* activity against *S. pneumoniae*
Target pathogens: *M. pneumoniae* *C. pneumoniae*	Children ≥5 years with features of atypical pneumonia[4]: Add **azithromycin** IV/PO 10 mg/kg once on day 1 (max: 500 mg), followed by 5 mg/kg once daily x 4 days (max: 250 mg/day)		• Consider discontinuing if RPAN is negative for atypical pathogens • No additional atypical coverage needed if using levofloxacin

Setting	Empiric Therapy	Duration/Comments
Emergency Department	Anticipated discharge to home: • Prescribe antibiotics per Outpatient recommendations • If failed high-dose amoxicillin[5] for typical bacterial pneumonia, use levofloxacin Hypoxemic and/or not tolerating PO with negative sepsis screen: • Begin empiric therapy per Inpatient recommendations • Transition to Outpatient empiric therapy if able to discharge Positive sepsis screen and/or pneumonia with empyema, abscess, or necrosis: • Begin empiric therapy per Complicated and/or Severe recommendations • If signs/symptoms of sepsis resolve and patient does not have empyema, abscess or necrosis, transition to Inpatient recommendations	• Duration for outpatient therapy: 7 days (IV + oral)

*Renal adjustment may be necessary. See Pediatric Antimicrobial Dosing Guidelines.

[1]Severe allergy is defined by urticarial, angioedema, or anaphylaxis

[2]Children who are not up-to-date for age with conjugate vaccines for S. pneumoniae or H. influenza type b

[3]Use amoxicillin-clavulanate ES (600 mg/42.9 mg/5 mL) to limit the risk of diarrhea associated with high doses of clavulanate

[4]Atypical pneumonia is characterized by slow progression of symptoms (over 3-5 days); typical signs/symptoms include, but are not limited to: malaise, sore throat, headache, cough, low-grade fever, and non-focal auscultatory and chest x-ray findings

[5]Refers to patients who were compliant with, and tolerated oral high-dose amoxicillin for >48 hours

[6]TMP-SMX: trimethoprim-sulfamethoxazole

Reference:

Bradley JS et al. The Management of Community-Acquired Pneumonia in Infants and Children Older Than 3 Months of Age: Clinical Practice Guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. Clin Infect Dis. 2011 Oct;53(7):617-30.

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