MedStar Health

Community Acquired Pneumonia – Pediatric
Ages 3 month to 18 years
Clinical Practice Guideline
MedStar Health
Antibiotic Stewardship

"These guidelines are provided to assist physicians and other clinicians to make decisions regarding the care of their patients. They are not a substitute for individual judgment brought to each clinical situation by the patient's primary care provider in collaboration with the patient. As with all clinical reference resources, they reflect the best understanding of the science of medicine at the time of publication but should be used with the clear understanding that continued research may result in new knowledge and recommendations."

These guidelines are intended to assist clinicians in treating community acquired pneumonia in otherwise healthy infants and children older than 3 months of age. These guidelines do not pertain to infants ≤ 3 months of age, immunocompromised children, children with chronic lung disease (ex: cystic fibrosis), or ventilator dependent children.

I. INITIAL PRESENTATION

- Fever (temperature ≥ 38.0 C or 100.4 F)
- Cough
- Abnormal lung sounds (rhonchi, rales [crackles], wheezing)
- Variable degrees of respiratory distress (tachypnea, dyspnea, retractions, grunting, nasal flaring, apnea, altered mental status)

II. RISK FACTORS

A. General Risk Factors

- Age < 5 years
- Male
- Prematurity
- Malnutrition
- Exposure to tobacco smoke
- Childcare attendance
- Low socioeconomic status

III. SELECTION OF CARE SETTING

A. Conditions that favor **Outpatient management:**

- Absence of respiratory distress
- Sustained SpO2 ≥ 90%

- Adequate outpatient caregiver support and ability to be compliant with outpatient therapy

B. Conditions that favor **Inpatient management**:

- Respiratory distress (tachypnea, dyspnea, retractions, grunting, nasal flaring, apnea, altered mental status)
- Sustained SpO2 < 90%
- < 3 months of age with suspected bacterial pneumonia
- Children who are Immunocompromised or ventilator dependent or with neuromuscular or chronic pulmonary disease (such as cystic fibrosis)
- Suspected pathogen with increased virulence (ex: MRSA)
- Poor outpatient support with concerns about the ability to be compliant with outpatient therapy
- Failed outpatient therapy of presumed bacterial pneumonia (with worsening symptoms or no response in 48-72 hours)
- Toxic appearance
- Complications such as pleural effusion, empyema, or abscess

IV. Age group/Most common Pathogens

A. < 2 years of age – Approximately 80% of CAP is caused by a viral etiology in this age group – usually evidenced by gradual onset, preceding upper respiratory tract symptoms, and lack of toxic appearance

B. > 5 years of age - Viruses are responsible for CAP in children > 5 years of age in only 1/3 of cases.

<u>Viruses</u>

- The incidence of a viral etiology decreases with age
- Common viruses:
  - *Adenovirus*
  - *Coronaviruses including SARS-CoV-2*
  - *Human bocavirus*
  - *Human metapneumovirus*
  - *Influenza A, B*
  - *Parainfluenza viruses 1, 2, and 3*
  - *Respiratory syncytial virus (RSV)* (found in up to 40% of children <2 years of age)
  - *Rhinovirus*

<u>Bacteria</u> (In order of prevalence)

- *Streptococcus pneumoniae* ***(most common cause of bacterial pneumonia in children of all ages)***
- *Staphylococcus aureus, including MRSA*
- *Streptococcal pyogenes (Group A strep)*

- *Haemophilus influenza, non-typable*
- *Moraxella catarrhalis*

<u>Atypical bacteria</u> - Table 1 lists preferred and alternative agents for atypical pathogens.

- *Mycoplasma pneumoniae (causes 'walking pneumonia')*
  - More common in older children and adolescents
  - Course is classically slowly progressive and is associated with malaise, cough and no fever.
- *Chlamydia trachomatis* and *Chlamydia pneumoniae*
  - More often found in infants < 3 months age
  - Transmitted vertically from the mother
  - May be preceded by Chlamydial conjunctivitis in the neonatal period

V. DIAGNOSTIC TESTING ROUTINELY RECOMMEDED

- **Pulse oximetry** should be performed in all children with pneumonia and suspected hypoxemia. The presence of hypoxemia should guide decisions regarding site of care and further diagnostic testing. Pulse oximetry of less than 90% should be transferred to an ED or hospital and 90-93% while awake should warrant consideration of further evaluation.
- **Rapid testing for influenza** is recommended when seasonally appropriate and available. A positive test would guide appropriate antiviral therapy.
- **Rapid testing for RSV**
- **Rapid testing for *SARS-CoV-2***. If rapid COVID test is negative, it is recommended that a confirmatory PCR test follow.

Antibacterial therapy is not necessarily recommended for viral pneumonia in children with a positive viral test, unless there is compelling evidence that there is a bacterial co-infection.

NOT ROUTINELY RECOMMENDED

- **Chest x-ray** is not necessary to confirm CAP in patients in the outpatient setting. Chest x-ray is a consideration for patients with a non-specific exam but persistent clinical symptoms consistent with pneumonia.
- **Blood cultures** are not routinely recommended for non-toxic, fully immunized children.
- **Acute phase reactants (ESR, CRP, procalcitonin)** should not routinely be obtained.
- ***Mycoplasma and Chlamydia* testing for pneumonia** is not routinely recommended.
- **Complete blood cell count** is not routinely recommended**.** However, it may provide useful information in patients with an unclear diagnosis or with concern for increasing systemic infection.

VI. DRUG THERAPY – Table 1 lists preferred antibiotic regimens

Antibacterial therapy is not necessary for viral pneumonia. However, be alert for clinical symptoms consistent with a bacterial super-infection after a viral illness. **Staphylococcal (MRSA) pneumonia is a frequent complication after influenza infection.**

- **Amoxicillin should be used as first-line therapy** for previously healthy, appropriately immunized children (< 5 years of age) with mild to moderate CAP suspected to be of bacterial origin. Amoxicillin provides appropriate coverage for *Streptococcus pneumoniae,* the most prominent invasive bacterial pathogen. High-dose amoxicillin is recommended due to concerns about antibiotic-resistant Streptococcus pneumoniae identified in pediatric community acquired pneumonia.

- **Macrolide antibiotics** should be prescribed for initial treatment of children (primarily school-aged children and adolescents) with findings compatible with **CAP caused by atypical pathogens. (Remember that 40-50% of S. pneumoniae is resistant to macrolide antibiotics.)**

- **In children with moderate to severe CAP consistent with influenza virus infection, antiviral therapy should be administered as soon as possible** during widespread local circulation of influenza viruses. Antiviral treatment provides maximal benefit when started early (< 48-72 hours). Treatment with antiviral therapy should not be delayed if influenza is suspected but influenza testing is not available. Negative influenza diagnostic tests, especially rapid antigen tests, do not conclusively exclude influenza disease.

Table 1.
Empiric Therapy for Outpatient Pediatric Community-Acquired Pneumonia (CAP)

Presumed bacterial pneumonia	**Presume d atypical pneumonia**	**Presumed influenza pneumonia**
Amoxicillin, oral 90 mg/kg/day divided into three doses/day for 10 days (max 4 g/day) * Alternative: amoxicillin-clavulanate Dose amoxicillin component, standard 45 mg/kg/day or high dose (ES with lower clavulanate) 90 mg/kg/day Divide in 2 doses for 10 days. (max 4 g/day)	Azithromycin oral 10 mg/kg (max 500 mg) on day 1, followed by 5 mg/kg/day (max 250 mg) once daily on days 2– 5 Alternatives: oral clarithromycin (15 mg/kg/day in 2 doses for 7-14 days) or oral erythromycin (40 mg/kg/day in 4 doses for 7-14 days)	Oseltamivir ≥24 months old: ~4 mg/kg/day in 2 doses, for a 5-day treatment ≤15 kg: 60 mg/day; >15 to 23 kg: 90 mg/day; >23 to 40 kg: 120 mg/day; >40 kg: 150 mg/day (divided into 2 doses for each group) 9–23 months old: 7 mg/kg/day in 2 doses; 0–8 months old: 6 mg/kg/day in 2 doses; premature infants: 2 mg/kg/day

***Although prospective data supports efficacy of twice daily dosing for treatment of acute otitis media, similar data is not available for documented S. pneumoniae infection so TID dosing is recommended.**

VII. AMOXICILLIN OR PENICILLIN ALLERGY:

For children with a history of non-anaphylactic allergic reactions to amoxicillin, treatment is not well defined and should be individualized.

Options include:
1) a trial of amoxicillin under medical observation
2) 2nd or 3rd generation cephalosporin (such as cefdinir), or
3) clindamycin or a macrolide

Patients with history of anaphylactic or life-threatening reactions to penicillins should be treated with clindamycin rather than a cephalosporin.

Azithromycin is only partly effective for pneumonia. It has limited action against resistant *Strep pneumoniae*, which causes 25% or more cases of pneumonia in children.

VIII. DURATION OF TREATMENT

A. Treatment of 10 days is commonly used for pediatric patients with CAP. In children > or = 4 months of age with suspected bacterial pneumonia, treatment with shorter courses of 7 days has been studied and shown to be equally effective in pediatric patients. For children between 6 and 59 months of age, other studies demonstrate that a 5-day course of amoxicillin (80 mg/kg/day divided TID) is equally effective as a 10-day course. (Azithromycin is prescribed as a 5-day course.)

B. Complicated CAP and infections caused by certain pathogens, notably CA-MRSA, may require longer treatment than those caused by *S. pneumoniae*.

C. Azithromycin is dosed for 5 days due to different tissue-site pharmacokinetics.

IX. MINMIZING ANTIMICROBIAL RESISTANCE

A. Antibiotic exposure selects for antibiotic resistance; therefore, **limiting exposure to any antibiotic**, whenever possible, is preferred.

B. **Limiting the spectrum of activity of antimicrobials** to that specifically required to treat the identified pathogen is preferred.

C. **Using the proper dosage of antimicrobial** to be able to achieve a minimal effective concentration at the site of infection is important to decrease the development of resistance.

D. **Treatment for the shortest effective duration** will minimize exposure of both pathogens and normal microbiota to antimicrobials and minimize antimicrobial resistance.

X. RESPONSE TO TREATMENT

A. Children receiving adequate therapy should demonstrate clinical signs of improvement within 48–72 hours. If repeat laboratory testing is done, ideally there should be improvement from baseline labs. However, initial and repeat lab testing is not necessary and clinical improvement should be the determination of adequate therapy.

B. For children who show no improvement in fever or clinical symptoms within 48–72 hours after diagnosis and initiation of antimicrobial therapy, consideration of further investigation or adjustment of antibiotic coverage should be performed.

C. Clinical deterioration at any timing should receive a higher level of care.

XI. VACCINATIONS

- COVID-19 Vaccination (if eligible).
- *HIB (Haemophilus influenza b)*
- Influenza (seasonal flu)
- Measles (MMR)
- Pertussis (whooping cough; in DTaP or Tdap)
- Pneumococcal Conjugate Vaccine (Prevnar 13 valent)
- Pneumococcal Polysaccharide Vaccine (Pneumovax 23 valent) if eligible.
- Varicella (chicken pox)

See CDC Vaccination website Special Situations with link

XII. PATIENT EDUCATION

Please review the information below with your patients.

A. Pneumonia is an infection of the lungs. Bacterial pneumonia is treated with antibiotics. Influenza may be treated with antiviral drugs such as Oseltamivir, if diagnosed early. Viral pneumonia does not get better with antibiotics.

B. Catching illnesses such as pneumonia, upper respiratory infections (colds), and other respiratory infections can be decreased by following good hygiene practices. Wash your hands regularly and disinfect frequently touched surfaces.

C. If you smoke and/or vape, stop.

D. Avoid exposure to cigarette and/or vape smoke.

E. Make sure the child and all family members are up to date on their vaccines including influenza and COVID-19 vaccinations.

F. Call your physician if your child shows any of the following warning signs that the pneumonia is getting worse:

- Fever lasting more than 3 days after starting antibiotics
- Increasing breathing difficulties
- Signs of dehydration, not drinking, repeated vomiting, and decreased urination.
- Evidence of an infection elsewhere in the body: red swollen joints, bone pain, severe headache, stiff neck, vomiting, or other new signs or symptoms.
- Skin around mouth or fingers looks blue or dusky.

G. Parents should follow these home care guidelines

- Rest
- Increase fluid intake
- No cough suppressants (such as codeine or dextromethorphan [DM]). Coughing is necessary to clear the excessive secretions caused by the infection and open the airways.
- Use over the counter drugs such as acetaminophen or ibuprofen to relieve fever or pain.

Initial Approval Date and Reviews:	***Most Recent Revision and Approval Date:***	***Next Scheduled Review Date:***
Effective 10/1/2015 by Pediatric Ambulatory Workgroup October 2017	***October 2021***	*October 2023 Pediatric Ambulatory Workgroup* Condition: **Community Acquired Pneumonia - Pediatric**

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