

Consensus Guidelines for Inpatient Management of Community Acquired Pneumonia in Infants & Children > 3 Months:

UCSF Northern California Pediatric Hospital Medicine Consortium

Executive summary

Objectives

- Standardize and improve the quality of care of pediatric patients with uncomplicated community acquired pneumonia (CAP) in the outpatient and inpatient settings; specifically:
 - Decrease unnecessary laboratory testing and imaging
 - Standardize admission / discharge criteria to decrease unnecessary hospital days
 - Decrease use of broad-spectrum antibiotics and use best available evidence to guide selection of appropriate antibiotic therapy

Recommendations

- Do NOT routinely obtain laboratory testing or imaging in children with CAP who can be treated in the outpatient setting
- Consider obtaining blood culture in children with moderate to severe CAP requiring hospitalization
- Obtain PA and lateral chest x-ray in children requiring hospital admission for CAP
- Obtain rapid influenza and other respiratory viral testing in the evaluation of children with CAP
- Use Amoxicillin / Ampicillin for first-line treatment of uncomplicated, typical CAP in most children
- Discontinue use of continuous pulse oximetry monitoring in hospitalized patients who are clinically stable and not requiring supplemental oxygen

Methods

This guideline was developed through local consensus based on published evidence and expert opinion as part of the UCSF Northern California Pediatric Hospital Medicine Consortium. In order to maximize the utility of these guidelines for our local patient population, the recommendations do in some places differ from the “weak” Infectious Disease Society of America (IDSA) or other nationally published guidelines based on local practice

Metrics Plan

To be determined.

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Consensus Clinical Guidelines for Inpatient Management of Community Acquired Pneumonia in Infants & Children > 3 Months:

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Consensus Clinical Guidelines

Criteria for Use of Inpatient Community-Acquired Pneumonia (CAP) Guidelines

- Age >3 months and <20 years old
- Absence of chronic lung disease, immunodeficiency, or other congenital anomalies / chronic medical condition predisposing to unusual or recurrent infection
- Community acquired infection (*excludes* hospital acquired, aspiration, other etiologies)
- Uncomplicated pneumonia (*excludes* >moderate to large and/or loculated pleural effusion)
 - *NOTE:* This guideline does not detail recommended antimicrobial therapy and other management for complicated PNA. However, it was created with the understanding that children with who are ultimately found to have complicated pneumonia may be admitted first to community hospitals, and therefore recommendations for initial antibiotic management and transfer decisions are provided in order to maximize its utility.

Site of Care Management Decisions

- Indications for admission to inpatient setting:
 - “moderate to severe” disease
 - respiratory distress / increased work of breathing
 - hypoxia (<90% on RA)
 - “toxic” appearance
 - dehydration / poor PO intake
 - inability to tolerate PO therapy
 - clinically failed appropriate PO antibiotic therapy (at least 48 hours)
 - <6 mo old infants with suspected BACTERIAL CAP likely to benefit from admission

Diagnostic Testing

- Chest X-ray:
 - NOT routinely indicated in outpatient setting
 - PA & Lateral CXR indicated in ALL children upon admission to inpatient setting (for new diagnosis or worsening clinical symptoms / failed outpatient treatment)
 - Repeat CXR should be obtained in children who fail to demonstrate improving fever curve or clinical improvement and in those who have progressive symptoms or clinical deterioration within 48-72 hours after initiation of antibiotic therapy
- Microbiologic Testing:
 - Blood Culture (BCx):
 - NOT indicated in outpatient setting
 - Indications for BCx on admission to inpatient setting:
 - “Moderate to severe” CAP:
 - hypoxia

UCSF Northern California Pediatric Hospital Medicine Consortium. Originated 12/2013. Revised 9/2014, 1/2016, 5/2017, 10/2017.

Approved by UCSF Antimicrobial Subcommittee: 11/2017

Approved by UCSF Pharmacy and Therapeutics Committee: 12/13/2017

Approved by UCSF Quality Improvement Executive Committee: 12/19/2017

- increased work of breathing
 - “toxic” or “sick” appearance
- Balancing factors:
 - (-) risk of contaminants
 - (-) low yield
 - (+ / -) potential change in management
 - (+) opportunity to identify organism pre-antibiotic therapy
- Viral testing
 - Outpatient:
 - Influenza testing ROUTINELY recommended in patients with influenza-like illness at high risk of influenza complications: Patients <2 years old, chronic medical conditions, immunocompromised, obese, pregnant, residents of chronic care facilities, Native American/Native Alaskan and those on chronic aspirin therapy
 - Please refer to yearly CDC guidelines for recommendations about treatment with anti-virals
 - RSV testing: consider RSV testing for children < 3 yrs with compatible symptoms, especially if a positive result would lead to avoidance of antibiotic therapy
 - Recommendations for testing upon admission to inpatient setting:
 - Flu testing indicated during influenza season; flu testing may need to be repeated with more sensitive method if initially done in rapid/office setting (POCT office/ED-based test not as sensitive)
 - Empiric antiviral therapy is recommended for influenza if patient admitted during influenza season with compatible signs/symptoms, until influenza is ruled out by adequately sensitive test
 - RSV testing indicated during RSV season in patients <3 years old with consistent symptoms
 - Serum testing for *Mycoplasma pneumoniae* NOT routinely indicated for suspected atypical infections
 - Sputum sampling NOT routinely indicated
- Pulse Oximetry Monitoring:
 - Indications for continuous pulse oximetry monitoring:
 - Initial assessment (for period of 4hrs)
 - Unstable clinical status
 - Supplemental oxygen (for period of at least 24hrs)
 - Indications for spot O2 sat checks with periodic vital signs:
 - Clinically stable patient for >24hrs
 - Patients not requiring supplemental oxygen

Antimicrobial Therapy

- **NOTE:** Children with suspected or confirmed viral PNA should generally NOT be treated with antibiotics
- **NOTE:** Institutional antibiogram susceptibilities may not be applicable for CAP because susceptibility data is drawn from patient population with higher acuity disease / more invasive disease processes
- **NOTE:** Immunization status *may* affect antimicrobial treatment decisions, but **based on herd immunity data and current epidemiology, children who are completely unimmunized should**

not necessarily be treated with broader spectrum therapy especially if their pneumonia is not severe

- Consider consultation with ID if concurrent bacteremia, potentially immunocompromised, or more severe pneumonia

Table 1: EMPIRIC ANTIBACTERIAL THERAPY FOR PEDIATRIC CAP

| Condition | Major Pathogens | First Choice Therapy | Alternative Therapy* |
|--|--|---|---|
| Community-acquired pneumonia, 3 months-5 years old, outpatient therapy | Majority: respiratory viruses <i>Streptococcus pneumoniae</i> , <i>Haemophilus influenzae</i> | Antimicrobial therapy is not routinely indicated unless suspected bacterial etiology If suspected typical bacterial etiology: Amoxicillin 45mg/kg/dose PO BID (max 1000mg/dose*) Note: Atypical pneumonia is rare in this age group | Non-severe penicillin allergy: Cefdinir 7mg/kg/dose PO BID (max 600mg/day) Severe penicillin allergy: Azithromycin 10mg/kg/dose PO x 1 on day 1 then 5mg/kg/dose PO daily on days 2-5 |
| Community-acquired pneumonia, > 5 years old, outpatient therapy | Typical, lobar: <i>Streptococcus pneumoniae</i> Atypical, bilateral interstitial infiltrates: Respiratory viruses <i>Mycoplasma pneumoniae</i> | If typical bacterial etiology suspected: Amoxicillin 45mg/kg/dose PO BID (max 1000 mg/dose*) If atypical bacterial etiology suspected: Azithromycin 10mg/kg/dose PO on day 1 (max 500mg/dose) then 5mg/kg/dose PO daily on days 2-5 (max 250mg/dose) | Non-severe penicillin allergy: Replace Amoxicillin with Cefdinir 7mg/kg/dose PO BID (max 600mg/day) Severe penicillin allergy: Replace Amoxicillin with Azithromycin 10mg/kg/dose PO on day 1 (max 500mg/dose) then 5mg/kg/dose PO daily on days 2-5 (max 250mg/dose) |
| Community-acquired pneumonia, > 3 months old and up, inpatient therapy but not complicated (empyema/necrotizing pneumonia) | Similar to outpatient etiologies | Suspected typical bacterial etiology: Ampicillin 50mg/kg/dose IV q6h (max 2g/dose) Strong suspicion for atypical etiology: Azithromycin 10mg/kg/dose PO on day 1 (max 500mg/dose) then 5mg/kg/dose PO daily on days 2-5 (max 250mg/dose) Note: Atypical pneumonia is rare in children < 5 years old If no distinguishing features for typical vs. atypical bacterial etiology and especially if > 5 years old: Consider combination of Ampicillin + Azithromycin (doses as above) | Non-severe penicillin allergy: Replace Ampicillin with Ceftriaxone 50mg/kg/dose IV q24h (max 2g/dose) Severe beta lactam allergy: Levofloxacin 10mg/kg/dose IV q24h if ≥ 5 years old, q12h if < 5 years old (max 750mg/day) (provides both typical and atypical bacterial activity) OR Azithromycin 10mg/kg/dose PO on day 1 (max 500mg/dose) then 5mg/kg/dose PO daily on days 2-5 (max 250mg/dose) if strong suspicion for atypical etiology with low suspicion for typical bacterial etiology |
| Community-acquired pneumonia, complicated (empyema, necrotizing pneumonia) *Consider transfer to tertiary center. Recommend ID consult if at tertiary center. * Blood cultures are recommended for patient with complicated pneumonia. | <i>Streptococcus pneumoniae</i> <i>Staphylococcus aureus</i> | Ceftriaxone 50mg/kg/dose IV q24h (max 2g/dose) AND One of the following agents with MRSA activity: Clindamycin 10mg/kg/dose IV q8h (max 900mg/dose) for clinically stable patients OR Vancomycin 15mg/kg/dose IV q6-8h (initial max 1g/dose) for critically ill/clinically unstable patients | Severe beta lactam allergy: Replace ceftriaxone with levofloxacin 10mg/kg/dose IV q24h if ≥ 5 years old, q12h if < 5 years old (max 750mg/day) |

***Maximum Dosing for Amoxicillin and Amoxicillin-Clavulanate:**

- although the absolute maximum Amoxicillin dose is 4000mg/day, we recommend the following for usual maximum dosing when targeting a high dose (80-90 mg/kg/day):

--Amoxicillin suspension – usual maximum 2000mg/day = 1000mg/dose

--Amoxicillin tablet – usual maximum 875mg/dose or 1000mg/dose (2 of the 500mg tablets)

--Amoxicillin-clavulanate suspension – usual maximum 2000mg/day

---If patient weight < 40 kg, use Augmentin ES-600 formulation

---If patient weight ≥ 40 kg, use regular Augmentin 400mg/ml formulation

--Amoxicillin-clavulanate tablet

---Usual maximum 875mg/dose BID

---For acute bacterial sinusitis with high-risk features such as systemic illness, fever 39°C, immunocompromised host, use maximum dose of 2000mg amoxicillin/dose BID

*For further information on assessment of true allergies, please see: <http://idmp.ucsf.edu/pediatric-guidelines-assessment-antibiotic-allergies>

Diagnosis of Effusion & Adjunctive Therapy

- Considerations if pneumonia is failing to improve:
 1. Re-consider diagnosis of CAP – is there potentially another infectious or non-infectious source?
Is it viral?
 2. Consider evaluation of less common pulmonary infections e.g. tuberculosis, coccidioidomycosis, etc.
 3. Consider evaluation for suppurative complication e.g. empyema which may develop/progress/not respond even on appropriate microbiologically-directed therapy.
- Diagnosis of effusion:
 - History, exam, + CXR (PA+lateral)
 - If CXR inconclusive or >small effusion → Chest Ultrasound or Chest CT
- Management of effusion:
 - If small / simple (<1cm on lateral decubitus or <1/4 hemithorax): antibiotics only (with uncomplicated pneumonia regimen), with reassessment if failing to improve
 - If moderate (>1/4 but <1/2 hemithorax) and with low degree of respiratory compromise
 - Per IDSA guidelines, it could be reasonable to consider treatment with antibiotics alone (using complicated pneumonia regimen)
 - Also consider chest US and obtaining pleural fluid (thoracentesis or chest tube)
 - These patients require close monitoring as their status may change requiring intervention, strongly consider transfer to tertiary center
 - If large / loculated (= *complicated PNA*):
 - If at a tertiary center, consult with Infectious Disease and Peds Surgery service
 - If at community center, transfer to tertiary center

Discharge Criteria / Discharge Planning

- Choice of PO Antibiotic (usual transition):
 - Typical PNA treated with Ampicillin IV: High-dose Amoxicillin
 - Typical PNA treated with Ceftriaxone IV or Ampicillin-Sulbactam IV: High-dose Amoxicillin-Clavulanate (generally preferred over cefdinir due to poor bioavailability of cefdinir or cefixime)(*See antibiotic table for dosing recommendations)
 - Atypical PNA: Azithromycin
 - Influenza PNA: Oseltamivir
 - Complicated PNA: Should be guided by ID consult
- Total Duration of Therapy (IV+PO)
 - Uncomplicated CAP: 7-10 days
 - Complicated CAP: Duration is individualized, consult with ID recommended
- PMD follow-up: within 2 days of hospital discharge

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References

- 2011 IDSA Guidelines: http://www.idsociety.org/uploadedFiles/IDSA/Guidelines-Patient_Care/PDF_Library/2011%20CAP%20in%20Children.pdf
- BCH-SF Pediatric Antimicrobial Stewardship Program Empiric Therapy Guidelines <http://idmp.ucsf.edu/pediatric-guidelines-respiratory-infections-community-acquired-pneumonia>
- Moreno et al. “Development and Validation of a Clinical Prediction Rule to Distinguish Bacterial from Viral Pneumonia in Children”. *Pediatric Pulmonology*. 41: 331-337 (2006).