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CLINICAL PEARL

Diagnosis and Treatment of Community-Acquired Pneumonia in Children and Adults

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Community-acquired pneumonia (CAP) is a commonly diagnosed illness, defined as "an acute infection of the pulmonary parenchyma that has been acquired outside the hospital" [1]. The etiology of CAP frequently goes unidentified because it is difficult to obtain a direct sample of the infected tissue for culture. This may pose a challenge in diagnosing and treating CAP. Although adults with CAP typically present with cough, fever, sputum production, and pleuritic chest pain, along with the presence of an acute infiltrate on chest radiograph [2], the wide spectrum of presentation among children can make diagnosing them difficult. While CAP can manifest as an acute febrile illness with clinical decompensation in some children, a small percentage of pediatric patients under 5 years of age may simply have fever and abdominal pain without respiratory distress [3]. This article will review current clinical guidelines for the diagnosis and treatment of community-acquired pneumonia in previously healthy children and adults; aspiration and nonbacterial pneumonia will not be included in the discussion.

Children between 60 days and 18 Years of Age (Who Have Not Been Hospitalized within 7 Days of Presentation)

Diagnosis. History taking and a complete physical exam are critical to diagnose CAP in children. History of the patient should include the age of the child, type of symptoms and date of onset, immunization status (particularly *Streptococcus pneumoniae* and influenza), possibility of aspiration, and recent exposure to tuberculosis. The complete physical exam, including vital signs, can often help determine the severity of pneumonia. Severely ill children should be evaluated for signs of parapneumonic effusion or empyema, including dyspnea, dry cough, pleuritic chest pain, frictional rub on auscultation, or diminished breath sounds. In less acutely ill children, the following combinations of clinical findings are the most predictive of severe CAP [3]:

- In infants less than 12 months of age: nasal flaring and oxygen saturation (SpO2) less than 96 percent on room air and respiratory rate above 50 and intercostal retractions.
- In children 1 to 5 years of age: SpO2 less than 96 percent and respiratory rate above 40.
- In children greater than 5 years of age: SpO2 less than 96 percent and respiratory rate above 30.

Further laboratory tests and imaging studies such as a chest x-ray should be ordered based only on clinical findings and a high index of suspicion [3]. In children,

complete blood count (CBC) should be considered only if this additional information can help determine the use of antibiotics, since the value of CBC for children with signs and symptoms of pneumonia has not been strongly supported by evidence. Typically white blood cell count is 15,000 per mm or more in bacterial infections [3]. In the Texas Children's Hospital 2009 CAP clinical guideline, blood cultures are not generally recommended for an otherwise uncomplicated bacterial pneumonia, especially in the outpatient setting. It can be helpful for children with more severe disease, however, if collected before antibiotics are administered. A tuberculin skin test should be conducted if travel and history suggest possible exposure to tuberculosis, and a pertussis polymerase chain reaction (PCR) can be obtained from nasopharyngeal swab for children with coughs lasting more than 2 weeks.

Treatment. In general, antibiotic therapy should not be delayed while awaiting laboratory test results. Choice of antibiotic therapy should take into consideration the treatment setting (inpatient or outpatient), and the age of the child, both of which can influence the causal organism and its susceptibility to treatment. Most uncomplicated pneumonias in otherwise healthy children can be managed with outpatient therapy. Indications for hospitalization include severe dehydration, inability to tolerate oral rehydration or medication, moderate-to-severe respiratory distress, altered mental status, oxygen requirement, poor compliance or lack of follow-up after discharge, or unsuccessful outpatient management [3].

In the outpatient setting, high-dose amoxicillin (80-100mg per kg per day) has been demonstrated to be a reasonable option for CAP, since *Streptococcus pneumoniae* is a common pathogen (the most common in some age groups) among children. According to the Texas Children's Hospital clinical guideline, outpatient treatment differs by age group:

- Children 3 months to 2 years of age: high-dose amoxicillin for 10 days to provide coverage for *Streptococcus pneumoniae*. Children younger than 2 years who cannot tolerate oral medications should be treated with one intramuscular dose of ceftriaxone at 50 mg per kg.
- Children between 2 and 5 years of age: high-dose amoxicillin for 10 days plus a macrolide for atypical pathogens. Amoxicillin monotherapy can be considered if there is less concern about atypical pathogens, but a second antibiotic should be added if there is no response after 24-48 hours of monotherapy.
- Children older than 5 years: high-dose amoxicillin for 10 days plus a macrolide.

In an inpatient, non-ICU setting, recommended therapy according to age groups is:

- 3 months to 2 years of age: ampicillin or cefotaxime to provide coverage for *Streptococcus pneumoniae*.
- Between 2 and 5 years of age: ampicillin or cefotaxime with a macrolide if needed to cover for *Streptococcus pneumoniae* and atypical pathogens.
- Older than 5 years: ampicillin or cefotaxime with a macrolide if needed to cover for *Streptococcus pneumoniae* and atypical pathogens.

Children in transition to oral antibiotics should receive at least 10 days of antibiotics when clinical improvement is demonstrated with the given therapy.

Antibiotic therapy should be used in accordance with the antibiogram and the susceptibility/resistance pattern of *Streptococcus pneumoniae* observed in each specific hospital. Special considerations and appropriate treatment guidelines apply to children with complicated pneumonia or pleural effusions, those who require intensive care, and those who demonstrate no clinical improvement on the suggested therapy.

Adults Older than 18 Years (Who Have Not Been Hospitalized within 7 Days of Presentation)

Diagnosis. In adults, CAP typically presents as a constellation of suggestive features including cough, fever, sputum production, and pleuritic chest pain, along with the presence of an acute infiltrate on chest radiograph, with or without microbiological data [2]. As in children, the management and prognosis of CAP in adults depend on the initial assessment of severity of illness. Once again, history and physical examination are important parts of the evaluation. If there is infiltrate on the chest x-ray of an otherwise healthy adult, community-acquired pneumonia should be strongly considered.

When evaluating adults with CAP, prognostic models (e.g., PORT Severity Index or CURB-65) can be helpful in determining the severity and therefore treatment setting of illness [4]. According to the Infectious Disease Society of America (IDSA) 2010 clinical practice guideline for CAP, criteria for severe CAP include but are not limited to rapid respiratory rate (more than 30 breaths per minute), hypoxemia, uremia, altered sensorium, leukopenia, hypotension requiring fluids or vasopressors, and multilobar infiltrates. Inpatient admission and discharge criteria should also take into consideration compliance and support on an outpatient basis [2].

With the exception of chest radiograph, most other laboratory tests in adults with strong clinical suggestion of CAP are optional in the outpatient setting. The IDSA guidelines include specific indications of more extensive diagnostic testing such as blood culture, sputum culture, urine legionella and pneumococcal antigen testing, and fungal and tuberculosis studies [4].

Treatment. As in children, antibiotic therapy should not be delayed while awaiting laboratory test results and should take into consideration the treatment setting. For outpatient treatment of adults without comorbidities, a macrolide or doxycycline is an acceptable first-line treatment. In adults with comorbitidies such as diabetes, malignancy, chronic obstructive pulmonary disease, or other chronic medical conditions, either a respiratory fluoroquinolone (such as moxifloxacin, gemifloxacin, or levofloxacin) or an advanced macrolide (azithromycin or clarithromycin) can be used as monotherapy [2, 4]. Beta-lactams (such as high-dose amoxicillin or amoxicillin-clavulanate) with a macrolide can also be used. In regions with a 25 percent or higher infection rate with high-level macrolide-resistant *Streptococcus*

pneumoniae, patients with or without comorbidities should be treated with a respiratory fluoroquinolone or combination therapy of a beta-lactam agent and a macrolide, as stated above [2, 4].

In an inpatient setting, the clinician should consult the antibiogram of the specific hospital for susceptibility and resistance pattern of common CAP pathogens. The first-line treatment of adult CAP in the medical ward should consist of monotherapy with a respiratory fluoroquinolone or, for some patients, a combination of an advanced macrolide with a beta-lactam agent such as cefotaxime, ceftriaxone, ampicillin, or ertapenem. If pseudomonal infection is a specific concern, antipneumococcal-antipseudomonal beta-lactams such as cefepime, imipenem, meropenem, or piperacillin-tazobactam should be given in combination with ciprofloxacin or levofloxacin [2, 4].

As always, special consideration should be applied to patients with complicated pneumonia or evidence of pleural effusion, or patients requiring intensive care.

References

1. Cincinnati Children's Hospital Medical Center. Evidence-based care guideline: community acquired pneumonia in children 60 days to 17 years of age; December 2005. http://www.cincinnatichildrens.org/assets/0/78/1067/2709/2777/2793/9199/1633ae60-cbd1-4fbd-bba4-cb687fbb1d42.pdf. Accessed July 7, 2011.
2. Infectious Diseases Society of America. Guidelines pocketcard: community acquired pneumonia in adults; 2010. http://guidelinecentral.com/viewers/community_acquired_pneumonia.html. Accessed July 14, 2011.
3. Texas Children's Hospital Evidence-Based Outcomes Center. Community-acquired pneumonia (CAP) clinical guideline; February 2009.
4. Mandell LA, Bartlett JG, Dowell SF, File TM Jr, Musher DM, Whitney C; Infectious Diseases Society of America. Update of practice guidelines for the management of community-acquired pneumonia in immunocompetent adults. *Clin Infect Dis*. 2003;37(11):1405-1433.

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