

## CPS Guideline Podcast – Uncomplicated Pneumonia

The following was adapted in conjunction with the Canadian Paediatric Society's Position statement on uncomplicated pneumonia in healthy Canadian children. Please visit [www.cps.ca](http://www.cps.ca) for the full statement from the Canadian Paediatric Society.

Hi everyone, my name is Dr. Mara Tietzen, a first year paediatrics resident at BC Children's Hospital at the University of British Columbia in Vancouver. This podcast was produced by PedsCases and the Canadian Pediatric Society, and aims to summarize the recently published 2015 Canadian Pediatric Society (CPS) statement on the management of uncomplicated pneumonia in healthy Canadian children and youth. This podcast was developed with Dr. Peter Gill, a pediatric resident at the University of Toronto and Dr. Nicole Le Saux, a pediatric infectious diseases physician and Associate Professor at the University of Ottawa. Dr. Le Saux is the lead author of the CPS statement we are going to review. For further information, and to see the full length CPS statement, at [www.cps.ca](http://www.cps.ca). A written summary of these recommendations can also be found on [pedscases.com](http://pedscases.com).

Let us first start the podcast with a clinical case. Picture this:

You are working in a community clinic. Your next patient is a 5-year-old girl with a 2-day history of worsening cough, difficulty breathing and fever. She is previously healthy and fully immunized. As you walk into the patient room you guide your history and physical exam to work through a differential diagnosis of acute cough, considering infection, asthma, or aspiration, along with must rule-out diagnoses of foreign body aspiration and pneumothorax. You wonder if your top diagnosis is pneumonia. If so, what are the main causes, how can it be diagnosed, and how will you manage this patient's illness?

The objectives of this PedsCases podcast are:

1. To outline the diagnostic criteria for community acquired pneumonia
2. To discuss indications for referral to and admission to hospital for children with CAP
3. To outline initial empirical antibiotic therapy for children and youth with CAP
4. To review important complications of CAP, and
5. To describe appropriate follow-up and planning of care for children and youth with CAP

To start off, let's briefly discuss key definitions for this topic. First, **pneumonia** is defined as acute inflammation of the parenchyma of the lower respiratory tract as triggered by a microbial pathogen. **Uncomplicated pneumonia** refers to signs and symptoms of acute inflammation with possible small parenchymal effusion, but without other complications. A **complicated pneumonia**, on the other hand, refers to pneumonia with associated empyema, lung abscess or parenchymal necrosis. These definitions will later become important as we discuss how to approach treatment and management.

An important caveat is that this podcast only focuses on children who are: 1) previously healthy; 2) fully immunized; 3) do not have underlying pulmonary pathology; and 4) present with a clinical history consistent with an **uncomplicated, acute, community acquired pneumonia**. Therefore, first determine if your patient fits these criteria before deciding if these guidelines are applicable.

### CAUSATIVE ORGANISMS

Understanding which microbial pathogens cause CAP in children and youth is key to guiding management. So, let's talk about the important bugs.

Most CAP is caused by either viruses or bacteria. Infants and pre-school aged children that present with CAP most commonly have a viral etiology. The key pathogenic viruses include respiratory syncytial virus (or RSV), influenza, parainfluenza and human metapneumovirus. When considering viral versus bacterial pathogens, it is important to remember that a viral infection can precede a secondary bacterial pneumonia.

School-aged children more commonly have pneumonia due to a bacterial cause, and the most important bacterial cause is *Streptococcus pneumoniae*. A second important bacterial pathogen is Group A strep or *Streptococcus pyogenes*. Also, *Staphylococcus aureus* is less common but is important to consider, especially in populations at risk of infection from methicillin resistant Staph aureus or MRSA. Thanks to the success of immunization, *Haemophilus influenzae* type B is drastically less common but should be considered in non-immunized children. Influenza is the main pathogen for viral pneumonia in school aged children and adolescents.

In older children, infection from atypical bacteria *Mycoplasma pneumoniae* and *Chlamydia pneumoniae* are more common and need to be considered.

### **CLINICAL PRESENTATION AND EXAMINATION**

The diagnosis of pneumonia, especially in young children, requires a high index of suspicion as the clinical symptoms and signs are often non-specific. Key features on history include fever, lethargy, fast or difficult breathing, vomiting and poor feeding. Look for evidence of respiratory distress including tachypnea, tracheal tug, subcostal or intercostal retractions and in-drawing. World Health Organization (WHO) approved standards for tachypnea are a respiratory rate of more than 60 breaths per minute in infants less than 2 months, more than 50 in ages 2-12 months, more than 40 in ages 1-5, and more than 20 for children older than 5. Occasionally chest pain may be present in older children. Some non-specific signs like headache and malaise may suggest an atypical bacterial cause. Sudden onset of fever and myalgias may point towards influenza, especially during the flu season.

When assessing the patient, get a full set of vitals, including oxygen saturation in patients who appear unwell. Physical exam should be used to identify evidence of consolidation, while maintaining a keen eye for findings that would suggest other etiologies such as bronchiolitis or asthma.

**Remember** that you CAN make a clinical diagnosis of CAP without further investigations if you have a febrile child with acute respiratory symptoms and physical findings of consolidation or effusions. But, it is preferable to get a chest x-ray as other conditions can resemble CAP.

### **MANAGEMENT OVERVIEW**

Now let's start discussing management. The first important decision is disposition: are you comfortable with outpatient management, or should the patient be admitted to hospital?

The **important indications for hospitalization** include: 1) Inadequate oral intake; 2) Inability to take oral antibiotics; 3) Severe illness that may lead to respiratory compromise; 4) Hypoxemia requiring supplemental oxygen; or 5) complicated pneumonia, with evidence of empyema or large pleural effusions. If the patient fits **ANY** of these criteria, they should be admitted to hospital.

If the patient is admitted to hospital, a chest x-ray with PA and lateral views should be completed to confirm the diagnosis and fully assess the extent of disease, including the presence of pleural effusions. While chest x-ray is the most used imaging modality to diagnose pneumonia, there are some scenarios where it is not needed. For example, a child with a clinical picture suggestive of pneumonia but who is clinically stable and DOES NOT fit criteria for hospital admission does not need imaging. Also, consistent with Choosing Wisely recommendations, a patient with bronchiolitis or an asthma exacerbation does not need imaging.

Typical chest x-ray findings in pneumonia include lobar consolidations with air bronchograms; you can also see sub-segmental or nodular opacities. Poorly defined patches of infiltration are more suggestive of viral disease, particularly if bilateral. The presence of bilateral focal or interstitial infiltrates that appear more extensive than predicted by the clinical picture should be suspicious for an atypical bacterial pathogen. Ultrasound has potential to be quite specific and sensitive for detecting pneumonic infiltrates, but this technology still requires further validation before widespread use.

Let's jump back to our clinical case. Your patient was a previously healthy, fully immunized 5-year old girl who presented with a 2-3 day history of fever, cough, rhinorrhea with mild increased work of breathing. Despite having decreased interest in solid foods, she is still drinking good amounts of water and juice with a normal urine output. Her initial vital signs were: HR 110bpm, RR 30/min, SpO2 98% on RA, BP 100/60 and a temperature of 38.3C. On physical examination, she has distinct findings of decreased air entry to her left lower lung field with crackles. You feel comfortable that she can tolerate oral medications as her symptoms are mild. You determine that she is a suitable candidate for outpatient management and does not need a chest x-ray.

### **OUTPATIENT MANAGEMENT**

Ideally, antimicrobial therapy should target the exact pathogen causing the illness. Unfortunately, for respiratory illnesses in young children, a sputum sample is often not possible. Another option is a nasopharyngeal swab or NP swab to test secretions for viruses. An NP swab does not influence treatment in the outpatient setting so should not be completed. The only exception is during influenza season where you may want to test for influenza before considering antiviral therapy.

The most important principle of antimicrobial therapy for CAP is to treat *Streptococcus pneumoniae*, the main causative organism. Therefore, most patients should be treated with amoxicillin 40-90 mg/kg/day divided three times per day for 7-10 days. If a patient is allergic to penicillin, take time to clarify the reaction. If it was non-urticarial or non-life threatening, they can likely still receive amoxicillin. But if it was a true allergy, the patient should instead receive a second or third generation cephalosporin like cefprozil or cefuroxime. If the patient had a severe anaphylactic reaction, or another serious reaction, clarithromycin or azithromycin should be used.

Traditionally, atypical pneumonia or "walking pneumonia" in older children is treated with macrolides. However, most of these children get better on their own, and macrolide resistance is growing. Reserve prescribing azithromycin or clarithromycin for children that are severely ill.

Now let's change up our clinical case. Assume now that you are in the emergency department. The clinical history is the same, but the patient is much sicker. Her respiratory rate is 40 breaths per minute, and her oxygen saturation is 89% on room air. She needs to be admitted to hospital. You complete PA and lateral chest x-rays which show evidence of a lobar consolidation in the left lower lobe.

## **INPATIENT MANAGEMENT**

The principles for starting antimicrobial therapy are the same but before starting treatment, you should get a complete blood count with differential and a blood culture. In the inpatient setting, a NP swab can be important for infection control procedures, for patient cohorting based on a common pathogen and to confirm or rule out influenza.

Similar to management in the outpatient setting, the main goal of antimicrobial therapy is to cover *S. pneumoniae*. Therefore, for inpatients, start **IV ampicillin**. If the patient presents in respiratory failure or septic shock, aim for broader coverage with a third generation cephalosporin such as ceftriaxone which will cover resistant strains of *S. pneumoniae* and *H. influenzae*. If there are pneumatoceles on chest x-ray or a high suspicion of MRSA, (for example if the patient was previously known to be colonized with MRSA), add vancomycin empirically. Treatment of patients with empyema is the same as those without.

If you are strongly suspicious of influenza, you are seeing the patient during influenza season, and the patient is at least moderately ill, you could consider antiviral therapy with a neuraminidase inhibitor such as oseltamivir or zanamivir as these are effective drugs for influenza.

A few other points about admission orders for patients with pneumonia. Consider making the patient NPO if they are very tachypneic, particularly for younger children who may not have enough reserve to tolerate the exercise of feeding. Place the patient under contact and droplet precautions for 24 hours until viral studies have been reported and they have had 24 hours of antimicrobials. Place the patient on continuous oxygen monitoring and ask for accurate ins and outs to help refine management of hydration status.

## **MONITORING FOR IMPROVEMENT**

So you have admitted the 5-year-old patient to hospital and started her on IV Ampicillin. How will you decide if she is improving, and when will she be appropriate for discharge and continuation of therapy as an outpatient?

You should expect to see improvement in respiratory and illness symptoms within the first 48 hours of therapy. Thus within 48-72 hours many patients can be switched or stepped-down to oral amoxicillin in preparation for outpatient management. If this does not occur OR there is worsening of symptoms, ask yourself three questions:

- 1) Do I have the right diagnosis?
- 2) Have I started appropriate therapy? and
- 3) Has the patient developed a complication of pneumonia?

If you answer yes to the last question, a repeat chest x-ray is indicated to look for an empyema, pleural effusion, or another complication.

In general, patients can be discharged home once they are afebrile, do not require supplemental oxygen, have clinically improved, and are feeding well. Total duration of antibiotic therapy is 7-10 days, but should be extended to 2-4 weeks if pneumonia is complicated by empyema or abscess formation.

An important point to emphasize is that radiographic improvement of uncomplicated pneumonia may not be apparent until 4-6 weeks post diagnosis. Therefore, in children with uncomplicated pneumonia who are otherwise well and getting better, a repeat x-ray sooner than 4-6 weeks is not indicated, and a chest x-ray to confirm resolution is not needed.

## **SUMMARY**

Let us finish with a few key take home points on the management of uncomplicated pneumonia in Canadian children and youth:

1. Pneumonia is common in children, and the most common causative pathogen is *Streptococcus pneumoniae*.
2. Pneumonia should be suspected in children and youth who present with fever, cough, increased work of breathing and tachypnea.
3. In general, the diagnosis of pneumonia should be confirmed with a chest x-ray unless the patient is well enough for outpatient management
4. Initial treatment of choice in the outpatient setting is oral amoxicillin for 7-10 days while initial treatment of choice in the inpatient setting is IV ampicillin with step-down to oral therapy to complete a total of 7-10 days.
5. Routine chest x-rays are not recommended to confirm resolution of illness.
6. Repeat chest x-rays are important if the patient's symptoms are not improving or worsening after 48 hours of treatment.

That concludes our podcast on pneumonia, brought to you by PedsCases and the Canadian Pediatric Society. Please check out the PedsCases podcast on Acute Cough for detailed discussion of an approach to acute cough. Thanks for listening to PedsCases podcasts!