

#### **PedsCases Podcast Scripts**

This is a text version of a podcast from Pedscases.com on "Acute Otitis Media" These podcasts are designed to give medical students an overview of key topics in pediatrics. The audio versions are accessible on iTunes or at www.pedcases.com/podcasts.

### Acute Otitis Media

Developed by Jade Chénard, Dr. Nicole Le Saux, and Dr. Joan Robinson for PedsCases.com. October 17, 2017

### **Introduction**

Hi everybody and welcome to PedsCases. My name is Jade Chénard-Roy and I am a fourth year medical student at Université Laval. Today, we will be discussing acute otitis media, commonly referred to as AOM.

This podcast was developed by PedsCases and the Canadian Paediatric Society, and summarizes the 2016 position statement on the management of acute otitis media in children six months of age and older. This PedsCases podcast was developed with the lead authors of the statement, Dr. Nicole Le Saux, a paediatric infectious diseases physician and associate Professor at the University of Ottawa, and Dr. Joan L Robinson, a paediatric infectious diseases specialist and associate professor at the University of Alberta.

The present position statement is intended to be a guide for sound clinical decision making in management of acute otitis media. The statement does not apply to children under 6 months of age, or to children with craniofacial abnormalities, recurrent AOM, immunocompromising conditions, or tympanostomy tubes.

At the end of this podcast, you should be able to:

- Explain the pathogenesis, etiology and risk factors of acute otitis media;
- Diagnose acute otitis media according to established criteria;
- And to manage uncomplicated acute otitis media depending on the clinical situation and presence of severity criteria.

## **Clinical Case**

Let's start with a clinical case. You are a first year paediatric resident on a community paediatrics rotation working in an after-hours clinic. You meet William, a two-and-a-half year old boy. His parents ask for an antibiotic prescription right away. William's mom is sure that he has an ear infection. According to her, the last time he had these symptoms he was diagnosed with an ear infection.



William's parents tell you that he complains of right ear pain. He has not had any ear discharge. His symptoms started yesterday afternoon, and this morning his rectal temperature was 38.5°C. Last week, William suffered from a mild upper respiratory tract infection (URTI) which he caught from daycare. He has not had any diarrhea, or vomiting. The only relevant point on past history is a previous AOM at the age of one which was treated for ten days with an unknown antibiotic. He has no allergies or craniofacial abnormalities. He is otherwise healthy.

On physical examination, William is awake and playful. He has a runny nose with clear discharge. His vital signs are within normal limits for his age, except for an oral temperature of 38.3°C. His lungs are clear to auscultation, there are no other abnormal finding on examination. There is no lymphadenopathy. On otoscopic examination, you see a bulging and erythematous right tympanic membrane. His left tympanic membrane is normal. William is most likely suffering from acute otitis media!

# Epidemiology

Acute otitis media is extremely common in children. In fact, it is one of the most common diagnosis in children who are seen in outpatient settings, and is one of the most common reasons for antibiotic therapy.

The peak incidence of AOM is between 6 months and 2 years of age. Three out of four children will experience at least one ear infection before starting school. In children under three years old, upper respiratory tract infections evolve into an AOM in about 25% of cases.

# **Pathogenesis**

### Basic anatomy review

Let's start with a quick anatomic review. The ear is made of three distinct parts:

- the external ear
- the middle ear
- and the inner ear.

The external ear is formed by the auricle and the external acoustic meatus. It is separated from the middle ear by the tympanic membrane, or TM. Its function is to funnel sound waves to the tympanic membrane.

The middle ear is a cavity filled with air. It contains three auditory ossicles: the malleus, incus, and stapes. The middle ear acts like a "sound box" which amplifies sound waves so they are detected by neurosensorial afferences. The Eustachian tube is a canal between the middle ear and the nasopharynx. The Eustachian tube acts like a valve that has three main functions: to drain middle ear fluids, to equalize pressures across the tympanic membrane, and to protect middle ear from nasopharynx pathogens and chemical agents.

The inner ear contains two distinct structures: the cochlea and the semicircular canals. The semi-circular canals are the sensory organs of balance while the cochlea is a sensory organ that converts sound waves into electrical impulses.



In AOM, the middle ear fills with purulent fluid which is the hallmark of acute otitis media, while otitis externa is inflammation of the external acoustic meatus.

#### Pathogenesis

Eustachian tube dysfunction is part of AOM's pathogenesis. Acute otitis media is often preceded by upper respiratory tract infection that results in mucosal inflammation of the nasopharynx and Eustachian tube. Inflammation than leads to obstruction of the Eustachian tube's lumen. Lack of fluid drainage through the Eustachian tube leads to fluid building up in the middle ear. Bacterial and viral pathogens then colonize the fluid, leading to accumulation of pus.

Two factors explain children's natural predisposition to AOM:

- first: the high prevalence of viral infections,
- and second: the Eustachian tube position.

In children, Eustachian tube's are shorter and more horizontal, which makes it easier for pathogens to transfer from the nasopharynx to the middle ear. Children's Eustachian tubes are also more prone to get obstructed due to their small size.

#### **Risk factors**

There are several risk factors for AOM which can be divided in modifiable and non-modifiable risk factors.

The non-modifiable risk factors are

- young age,
- first nation or Inuit ethnicity,
- lower levels of secretory IgA,
- family history of acute otitis media,
- and orofacial abnormalities, such as cleft palate.

The modifiable risk factors are those in relation with the child's environment, including:

- household crowding,
- exposure to cigarette smoke,
- shorter duration of breastfeeding,
- prolonged bottle feeding while lying down,
- pacifier use,
- and viral infections including influenza.

Modifying environmental factors is an important part of prevention. Promoting breastfeeding, a smoke-free home and vaccines are recommendations for parents to prevent AOM.

#### **Pathogens**

The child typically has a viral upper respiratory tract infection. They then develop AOM from the same virus or more commonly a bacteria that has been replicating in the middle ear. Usually, there is a single bacterium responsible, but co-infection can occur.

The most common bacteria causing AOM are:

- Streptococcus pneumoniae (or pneumococcus),
- Haemophilus influenzae,
- Moraxella catarrhalis,



• Group A streptococcus (or GAS).

Streptococcus are more virulent pathogens and are thus less likely to resolve spontaneously. A perforated tympanic membrane is often associated with GAS.

### **Diagnosis**

Importance of accurate diagnosis of AOM

Accurate diagnosis is the cornerstone of management. On one side, over-diagnosis may lead to unnecessary treatment of spontaneously resolving conditions such as:

- viral otitis media,
- otitis caused by less virulent bacteria,
- or middle ear effusion without AOM.

Using antimicrobials in these situations may cause unnecessary side effects and contribute to bacterial resistance.

Most of the time, analgesics will work as quickly as antibiotics would be decreasing pain. However, about 1 in 5 children will get better more quickly with antibiotics.

Therefore, it is essential to identify which children require antibiotic therapy using clear and objective diagnostic criteria.

#### History and symptoms

Children with AOM may present with systemic symptoms such as difficulty sleeping, irritability and fever. Ask about these symptoms but keep in mind that they are non-specific and may be due to a simple URTI. If there is a fever, clarify how high, how it was recorded and how it has evolved over time.

Characterize the general appearance of the child: is he mildly, moderately or severely ill? Otalgiaor ear pain is the most common complaint and has the best predictive value of otitis, but most children with AOM are preverbal. Pain may be manifested as irritability or difficulty sleeping. Otorrhea or fluid draining from the ear, and hearing loss might also be present but are rare. Hearing loss can also be a sign of otitis media with effusion (OME) which is not an infectious process but rather residual fluid in the middle ear.

On history, ask about gait disturbances, neurological symptoms and mastoid pain, which may be signs of AOM complications such as mastoiditis and meningitis. The presence of these symptoms often requires imaging. Discussion of AOM complications are beyond the objectives of this podcast.

#### Diagnostic criteria

Identification and characterization of a middle ear effusion is key for diagnosis. Clinicians must be able to differentiate acute otitis media from middle ear effusion. Otitis media with effusion, or OME, consists of middle ear fluid accumulation without signs of acute infection. Middle ear effusions may persist for months after AOM and generally do not require treatment unless they are persistent, and associated with hearing or speech impairment.

The presence of middle ear effusion can be assessed with different modalities. A pneumatic otoscopy assesses tympanic membrane mobility. Tympanic membrane mobility is a very



sensitive and specific criterion for middle ear effusion. Unfortunately, this technique is not commonly used by clinicians. The most common device used by clinicians is a plain otoscope which allows for assessment of the tympanic membrane color and position, air fluid levels and bony landmarks.

Signs of middle ear inflammation with an acute onset of symptoms strongly suggests a diagnosis of AOM. Multiple studies have shown that a bulging tympanic membrane is the most sensitive and specific otoscopic finding for AOM. On the other hand, air fluid levels or tympanic membrane erythema have poor diagnostic value. To summarize, diagnostic criteria for AOM are as follows:

- 1. Middle ear effusion with inflammation, that can be objectified with
  - a. Decreased tympanic membrane mobility when using pneumatic otoscope
  - b. Or bulging tympanic membrane on otoscopy
- 2. And concurrent presence of acute onset symptoms linked to AOM, such as otalgia.

If a child has AOM, always palpate the mastoid bone. If it is tender or if the pinna is pushed forward, the child probably has mastoiditis.

#### Severity criteria

When otoscopic exam confirms AOM, clinical severity guides medical management and helps determine which patients require antibiotic therapy. Children with severe AOM are those with:

- · Moderate or severe illness with irritability, difficulty sleeping or severe otalgia;
- Fever ≥ 39.0°C or poor response to antipyretics;
- or duration of symptoms over 48 hours.

In children with severe AOM, empirical antibiotic therapy is recommended. Children that are mildly ill and do not fit in these criteria can be safely managed with a 24 to 48 hour period of analgesics and observation. Different approaches are acceptable, including:

- planned reassessment in 1-2 days,
- ensuring appropriate access to timely reassessment,
- or expectant antimicrobial prescription (i.e. providing an antibiotic prescription with instructions to fill the prescription in 1-2 days if the symptoms are not improving).

In all instances, clinicians need to ensure that the caregivers understand the children's clinical illness and have the resources to come back for medical reassessment if needed.

Further, clinicians should provide appropriate advice about antipyretics and analgesia. Irrespective if children meet criteria for mild or severe AOM, appropriate pain management is essential. Clearly write down suggested doses and frequency of administration of acetaminophen and ibuprofen for families to ensure their symptoms are well managed.

## **Treatment**

#### Prevention

Elimination of risk factors is the first step in AOM prevention. Health care practitioners should educate families to reduce or eliminate modifiable risk factors, in particular reducing exposure to second-hand smoke, encouraging breastfeeding, discouraging prolonged bottle feeding while lying down, and pacifier use. The conjugated pneumococcal vaccine is also an important



prevention tool. Routine use of the septavalent pneumococcal vaccine has decreased the incidence of AOM by 13 to 19%.

#### First line antibiotic

Amoxicillin is the first line antibiotic for AOM because it covers the dominant pathogen *Streptococcus pneumoniae*, in addition to Group A strep. Given that most invasive infections are due to streptococcus, amoxicillin is the ideal first line antibiotic.

Resistance to amoxicillin is higher among *M. catarrhalis* and *H. influenzae* populations, the two other main pathogens in AOM. However, these organisms are less common and more likely to resolve spontaneously.

Amoxicillin is also advantageous because it has excellent middle ear penetrance, is inexpensive, has few side effects and has a relatively narrow antimicrobial spectrum.

#### Duration of therapy

Antibiotic therapy duration depends on the patient's age and clinical state. Children over two years old can be treated for 5 days. A 10-day course is recommended in the following clinical situations:

- In children between 6 months and 2 years of age;
- if there is tympanic perforation;
- if there is initial therapy failure;
- or with recurrent AOM.

#### Dose

For clinical cure, levels of amoxicillin in the middle ear should be sufficient for more than half of the day. To do so, you can either administer amoxicillin from 45 to 60 mg/kg in three daily doses or from 75 to 90 mg/kg in two daily doses.

#### Second line agents

Initial therapy failure occurs when the child does not get better after two days of adequate antibiotic therapy. *H. influenzae* and *M. catarrhalis* are more commonly associated with treatment failure because they are more likely to produce beta-lactamases. A 10-day course of amoxicillin-clavulanate is recommended after initial treatment failure.

It the child still does not improve after two days of amoxicillin-clavulanate, escalation of therapy includes:

- intramuscular ceftriaxone (50 mg/kg x one dose),
- referral to an otolaryngologist for tympanocentesis,
- or referral to an infectious disease specialist for other therapeutic options.

For more details on allergy to penicillin or peculiar cases of AOM management, please refer to the summary on our website.

Let's summarize the key points in AOM management.

- First, risk factor elimination including up-to-date immunization.
- Watchful waiting for 24 to 48 hours is recommended in mild cases, with antibiotic therapy indicated for moderate to severe cases.



- Do not forget to tell families about symptomatic treatment with analgesics and antipyretics, including frequency and doses of acetaminophen and ibuprofen.
- Lastly, do not hesitate to ask for help from ENT or infectious disease specialists for complicated cases!

# Case Conclusion

Let's go back to our clinical case. William does not meet criteria for moderate or severe AOM at present. His fever is under 39°C, he has been symptomatic for less than 48 hours and is only mildly ill appearing. You feel that his parents are reliable as they know how to detect symptoms of worsening from their past experience with AOM. William's parents confirm that he does not have a penicillin allergy. Therefore, you opt to give them an "expectant" antimicrobial prescription of amoxicillin 60 mg/kg/day divided in three doses. William's parents understand that they will only use the antibiotics if he does not get better in the next 1-2 days. You give a 5-day prescription, as William is older than 2 years old and does not need prolonged therapy. You advice the parents to come for medical follow-up if William is worsening, and also provide appropriate advice on analgesics and antipyretics.

# Summary

Let's take a moment to summarize this PedsCases podcast on acute otitis media. Here are the take home messages:

- 1. The most common bacteria causing AOM is *Streptococcus pneumoniae*.
- 2. The diagnostic criteria for AOM are acute onset symptoms, such as otalgia AND the presence of a middle ear effusion with inflammation. A bulging tympanic membrane on otoscopic examination is key for accurate diagnosis.
- 3. Moderate or severe AOM is defined as children who appear moderately or severely ill, have a fever ≥39.0 °C or a poor response to antipyretics, or those with a duration of symptoms over 48 hours.
- 4. Children with mild AOM can be managed with a "watchful waiting" period of 24-48 hours.
- 5. If treatment is indicated, first line antibiotic therapy is amoxicillin for 5 or 10 days. A 10day course is preferred for children under two years old, with a tympanic perforation, or with recurrent AOM.
- 6. Children with AOM may have a persistent middle ear effusion for months. Middle ear effusions can be managed conservatively unless there is evidence of hearing or speech problems.
- 7. Lastly, do not forget to provide appropriate advice to the caregivers about analgesics and antipyretics.

Thank you for listening to this PedsCases podcast! You are now able to put into practice the key points of the 2016 Canadian Paediatric Society Position statement on acute otitis media. We invite you to read the summary on the PedsCases website for a quick reminder of key points, diagnostic criteria and antibiotic dosage. Stay tuned for more PedsCases podcasts!

## **References**

Canadian Paediatric Society, « Management of acute otitis media in children six months of age and older », 2016.



English: <u>http://www.cps.ca/documents/position/acute-otitis-media</u> French: http://www.cps.ca/fr/documents/position/otite-moyenne-aigue

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