



NCC Pediatrics Continuity Clinic Curriculum: Otitis Media *Faculty Guide*

Goals & Objectives:

- To identify tympanic membrane features in diagnosing AOM and distinguish from OME.
- To learn etiology and common bacterial pathogens in AOM.
- To appreciate the importance of accurate diagnosis of AOM and consequences of over-diagnosis, using the AAP Clinical Practice Guidelines as a management strategy.

Pre-Meeting Preparation:

- Complete the online module: ePROM: Enhancing Proficiency in Otitis Media
 - You *must* **register** first in order to access the entire course:
http://pedsed.pitt.edu/03_home.asp (activate account via e-mail message)
 - After logging in, **access** module using hyperlink on LEFT side of page, under “Curricula”, or using this link: http://pedsed.pitt.edu/06_browse.asp (scroll down)
 - Complete **Lesson 3** (AOM diagnosis) & **Lesson 7 OR 8** (TM assessment)
- Read [“Acute Otitis Media: Update 2015”](#) (*Contemp Peds, 2015*)— 4 pages

Conference Agenda:

- *Review* Otitis Media Quiz
- Complete Otitis Media Cases
- **Interactive Exercises:**
 - Test your otoscopy skills with **“OtoSim”** stations & annotated images
 - Take turns playing the **“Shoot the Effusion”** game and test your skills. Record the player from your continuity group with highest % accuracy on the whiteboard! **[Works only in Mozilla Firefox]**

Extra-Credit:

- Complete remainder of ePROM modules (*see above for login instructions*)
- [CPG: The Diagnosis and Management of Acute Otitis Media](#) (*Pediatrics 2013*)
 - Summary of CPG at [National Guidelines Clearinghouse](#) (*AHRQ*)
- [Acute Otitis Media](#) (*PIR, 2010*)

Otitis Media Quiz

1. Define the following terms:

- (a) AOM: Inflammation of the middle ear that is of rapid onset and that occurs in association with signs and symptoms of acute infection. TM bulging, opaque, ↓ mobility.
- (b) OME: A collection of liquid in the middle ear space. Signs and symptoms of acute infection are absent. (A.K.A. serous or non-suppurative otitis media)
- (c) MEE: Liquid in the middle ear without reference to the etiology, pathogenesis, or duration. (Can be serous, mucoid, purulent, or a combination of these.)

2. What is the COMPT mnemonic? *Addresses important tympanic membrane findings in AOM*

- C** **Color**: gray, red, amber, white
- O** **Other conditions**: perforation with otorrhea, bullae, fluid level, cobblestoning
- M** **Mobility**: normal, decreased, non-mobile
- P** **Position**: neutral, full, bulging, retracted
- T** **Translucency**: opacified, semi-opaque

3. Use the COMPT mnemonic to describe the following picture:



- C** Color: White
- O** Other conditions: none,
- M** Mobility: Decreased,
- P** Position: Bulging,
- T** Translucency: opaque

4. The new guidelines for diagnosis and management of Acute Otitis Media endorse strict otoscopic diagnostic criteria. What is considered to be the most important characteristic in the diagnosis of AOM? **Moderate to severe bulging of the TM**

5. List at least two risk factors for developing acute or chronic AOM. (Table 1— PIR Article)

- Age < 2 years
- Bottle propping
- Craniofacial abnormalities
- Genetic conditions such as Trisomy 21
- First episode of AOM when less than 6 mo.
- Immunocompromising conditions; ciliary dysfunction

6. AOM occurs most frequently after viral respiratory tract infections, which leads to eustachian tube dysfunction, which causes negative pressure and movement of secretions from the upper respiratory tract which contains causative virus and pathogenic bacteria.

7. List the 3 most common bacterial pathogens in AOM.

(1) *Streptococcus pneumoniae*:

A recent report with data collected 6-8 years following introduction of PCV7 in the US showed that PCV7 strains of *S. pneumoniae* have virtually disappeared from middle ear fluid cultures of children with AOM who had been vaccinated. The frequency of *S. pneumoniae* serotypes not included in the vaccine has increased in the middle ear fluid cultures and nasopharyngeal cultures of vaccinated children. Serotype 19A is one of the serotypes causing “replacement disease”, treatment failure, and recurrent AOM; a multidrug resistant strain has been reported.

(2) non-typeable *Haemophilus influenzae*:

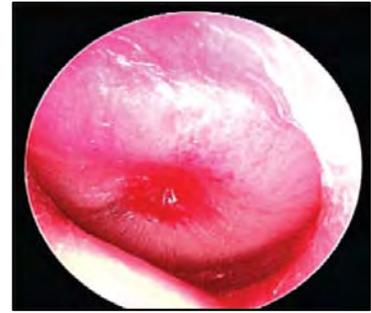
Some *H. influenzae* isolates produce beta-lactamase enzyme. AOM associated with conjunctivitis is more likely caused by non-typeable *Haemophilus influenzae*.

(3) *Moraxella catarrhalis*:

M. catarrhalis may cause up to 20% of bacterial AOM with 100% of isolates producing beta-lactamase. There is a high rate of spontaneous clinical resolution in children with AOM due to *M. Catarrhalis*, but the organism remains susceptible to Amoxicillin-Clavulanate.

Otitis Media Mega-Case

Part 1: Diego is a healthy 7 month-old male who presents to clinic with a one day history of apparent ear pain and fever to 102.5°F. His mother, Mrs. Lopez, also reports that the patient has a five day history of nasal congestion and sporadic cough. Diego has been feeding slightly less than usual, but he is voiding and stooling normally. Physical exam is remarkable for a left tympanic membrane as shown in picture (*right*).



What else would you like to know?

- Past Medical History
- History of previous episodes of AOM
- Daycare attendance
- Secondhand smoke exposure
- Immunization status
- Breastfeeding or bottle feeding

Based on Diego's clinical presentation and exam findings, what is your diagnosis?

Severe unilateral AOM

How would you manage this patient?

Emphasis is made in the new guidelines on maximizing diagnostic accuracy for AOM. Previous guidelines (2004) included the category of "uncertain diagnosis," which is now eliminated.

- (1) **Pain management:** Acetaminophen or Ibuprofen. Otalgia associated with AOM can be significant and may persist for several days in young children. Topical agents (e.g. Benzocaine, Procaine, Lidocaine) may offer additional but brief benefit.
 - (2) **Antibiotic management:** According to recent AOM Guidelines, patients with AOM who should receive antibiotic treatment include:
 - Children older than 6 mo with SEVERE bilateral OR unilateral AOM.
 - Children less than 24 mo with MILD bilateral AOM.
- * **First line antibiotics:** High-dose Amoxicillin (80-90 mg/kg/day div BID)
- (3) **Instructions to return for evaluation** if no improvement noted in 48-72 hrs.

Following the new AOM guidelines, would you offer observation for Diego?

No. Observation may be offered in this age group (6 mo-23 mo) in patients with MILD unilateral AOM, after joint decision making with the parent/caregiver. A mechanism to ensure follow up must be discussed in case of no improvement or worsening of symptoms within 48-72 hrs. Providers may also offer observation in patients >24 mo with mild AOM (U/L or B/L).

Three days after initiation of high-dose Amoxicillin, Diego continues to be fussy and febrile to 102°F. His appetite remains decreased, but he is still tolerating oral intake. Physical exam reveals neither dehydration nor signs of AOM complications.

What should be the antibiotic treatment after failure of 48-72 hours of initial antibiotic?

Amoxicillin-Clavulanate (90 mg/kg/day of Amoxicillin with 6.4 mg/kg/day of clavulanate divided BID) x 10 days OR Ceftriaxone (50 mg /kg) IM or IV X 3 d.

Diego had adequate clinical improvement within 24 hours of initiation of Augmentin. You also make a note to assess for resolution of MEE at the next well baby visit since up to 25 % of patients may have persistent MEE three months after resolution of acute symptoms.

Part 2: One year later, you are in continuity clinic, and you see Diego on your schedule. He is now 19 mo of age and presents with two days of fever to 101°F and possible otalgia. Physical exam is consistent with a diagnosis of bilateral AOM; otherwise unremarkable. Mrs. Lopez has lost count of the number of ear infections Diego has suffered over the last year, but you find 5 AHLTA encounters in the last 12 mo with a diagnosis of AOM (last encounter was 4 mo ago).

You decide to treat with high dose Amoxicillin for mild bilateral AOM in a patient < 24 mo. You discuss signs of treatment failure and reasons to return to clinic for evaluation.

Does Diego meet criteria for diagnosis of recurrent AOM?

Yes. Recurrent AOM is defined as the occurrence of 3 or more separate episodes of AOM in a 6-month period or 4 or more episodes in a 12-month period with at least 1 episode in the preceding 6 months.

What other recommendations or counseling would you do at this visit?

ENT referral for tympanostomy tubes may be offered due to recurrent AOM, as per recent AOM Guidelines. Counseling on lifestyle changes (e.g. eliminating exposure to passive tobacco smoke; ensuring UTD on immunizations) is also important as it may reduce AOM incidence in infants.

Otitis Media Board Review

1. A-14 year-old girl presents with a 4-year history of recurrent infections. Her parents state that it seems she is on antibiotics almost every other month for the treatment of otitis media, sinusitis, or pneumonia. During a recent hospitalization for lobar pneumonia, the inpatient team measured serum immunoglobulins (Igs), which showed:

- Low IgG of 54 mg/dL (0.54 g/L) (normal range, 700 to 1,500 mg/dL [7 to 15 g/L])
- Absent IgA at <7.5 mg/dL (75 mg/L) (normal range, 15 to 200 mg/dL [150 to 2,000 mg/L])
- Low IgM of 10 mg/dL (100 mg/L) (normal range, 50 to 300 mg/dL [500 to 3,000 mg/L])

Despite the recurrent infections, the girl is otherwise growing and developing appropriately and has no other specific medical concerns.

Of the following, the MOST appropriate next laboratory test is

- A. flow cytometry for B lymphocytes, T lymphocytes, and natural killer cells
- B. genetic analysis for mutations of the Bruton tyrosine kinase (*Btk*) gene
- C. lymphocyte proliferation assay of peripheral blood mononuclear cells to mitogens
- D. measurement of antibody responses to protein and polysaccharide vaccines**
- E. measurement of IgG subclasses (IgG1, IgG2, IgG3, IgG4)

An adolescent or young adult who has recurring infections and hypogammaglobulinemia, such as the girl described in this vignette, should be evaluated for common variable immunodeficiency (CVID). The diagnosis of CVID requires three criteria: a decrease of more than 2 standard deviations of one immunoglobulin below the age-adjusted mean (usually IgG, with decreased IgA or IgM), poor antibody response to protein (eg, diphtheria tetanus toxoid) and polysaccharide vaccines (eg, 23-valent pneumococcal vaccine), and exclusion of other causes of hypogammaglobulinemia (Item C121). Because the girl already meets the first criterion, the next step is to measure baseline antibody titers, vaccinate her, and repeat antibody measurements in 3 to 4 weeks. The recommended appropriate protein vaccine response in adolescents consists of a fourfold increase in titers. An appropriate pneumococcal polysaccharide response in patients 5 years and older is a titer of 1.3 µg/mL or higher in 70% of pneumococcal serotypes. Patients who demonstrate both hypogammaglobulinemia and impaired vaccine response should be referred to an immunologist for additional testing and consideration for either intravenous or subcutaneous immunoglobulin replacement therapy.

Further testing that is usually performed by the immunologist includes flow cytometry, consideration of genetic analysis for mutations in the Bruton tyrosine kinase (*Btk*) gene, lymphocyte proliferation assay, and assessment of IgG subclasses. Flow cytometry uses technology that can detect specific cell surface markers of T cells (CD3, CD4, CD8), B cells (CD19), and natural killer (NK) cells (CD16, CD56). Most patients who have CVID have normal B, T, and NK cell numbers, although up to 10% can have low B cell numbers, and many patients have an inverted CD4/CD8 ratio. Although flow cytometry is important, the results are not part of the current laboratory criteria for diagnosing CVID.

Patients who have low-to-absent B-cell concentrations or who are younger than 2 years of age should be evaluated for X-linked recessive (Bruton) agammaglobulinemia. Flow cytometry screening detects most patients who have complete or partial expression of the Btk protein, but up to 30% of patients have abnormal function that can only be detected by *Btk* gene sequencing.

Additional T-cell qualitative analysis can include both anergy testing (eg, delayed hypersensitivity testing to *Candida*, tetanus, mumps, *Trichophyton*) and lymphocyte proliferation assay of peripheral blood mononuclear cells. Mitogen proliferation testing is expensive, typically yields normal results in patients who have CVID, and should be performed under the direction of an immunologist.

Many clinicians assess IgG subclasses (ie, IgG1, IgG2, IgG3, and IgG4), but the clinical significance of a low IgG subclass value is unclear. Although low IgG2 concentrations have been associated with a poor

polysaccharide response and low IgA concentrations in some patients, low values for one or more IgG subclasses is currently not recognized as a specific primary immunodeficiency, and the use of immunoglobulin replacement is controversial.

2. A 4-month-old infant comes to your office for a health supervision visit. When you pass through the waiting room, you observe his young mother prop the infant's bottle while he is in his stroller. **Of the following, the MOST appropriate action is to**

- A. advise the mother to prop only bottles containing water
- B. discuss the advantages of holding her baby during feedings**
- C. explain that the child is too young to have the bottle propped
- D. recommend that the mother obtain a bottle sling
- E. tell the mother that a bottle should not be propped when the infant is falling asleep

Infants should be fed when hungry, warm, and dry, not just when they are fussy in an attempt to quiet them. In addition, the bottle should be held, not propped, regardless of the infant's age. Even the use of a "safe" bottle holder such as a bottle sling should be avoided. Parents should be counseled that holding their baby when feeding enhances physical closeness and a feeling of security for the baby.

Propping a bottle increases the risk of choking and the development of otitis media. Parents also should be advised that their infant should not be put to bed with a bottle of formula or juice, a practice that could lead to dental decay.

A parent should not force a baby to eat. If the child stops feeding, the parent should try to burp the baby. If the infant still does not want to feed after burping, he or she has had enough. If the baby prefers the formula to be warmed, the parent should not use the microwave, which might create hot spots that can burn a baby's mouth.

3. A 2-year-old boy who has trisomy 21 has been plagued by middle ear infections for several months. You last saw him days ago and prescribed high-dose amoxicillin at 80 mg/3kg per day for recurrent otitis media. Today he has a new onset of drainage from the ear and continued fussiness and nocturnal awakening. Although his tympanic membranes are always difficult to see through his tiny canals, today purulent drainage occludes the membrane completely. You decide to discontinue the amoxicillin therapy.

Of the following, the BEST course of action for this patient is to

- A. administer intramuscular ceftriaxone**
- B. administer one dose of intramuscular ampicillin
- C. begin topical fluoroquinolone otic drops
- D. begin trimethoprim-sulfamethoxazole
- E. refer him for urgent placement of tympanostomy tubes

The boy described in the vignette is at higher-than-usual risk for persistent and recurrent otitis media because he has trisomy 21. He continues to have symptoms despite 3 days of antibiotic therapy and now has ear drainage. These findings are an indication that his antibiotic therapy should be changed. Other indications for a change in antibiotic therapy during the treatment of acute otitis media include persistent or recurrent fever after 2 to 3 days of therapy or suppurative complications.

For treatment of clinical failure 3 days into antibiotic therapy, as described for this boy, the American Academy of Pediatrics recommends high-dose amoxicillin-clavulanate (90 mg/kg per day amoxicillin and 6.4 mg/kg per day clavulanate) or intramuscular ceftriaxone for 1 to 3 days. A 3-day course of ceftriaxone is more effective than a single dose in achieving a bacteriologic cure. If a beta-lactamase-producing organism (such as nontypeable *Haemophilus influenzae* or *Moraxella catarrhalis*) is suspected, other agents may be indicated, including cefpodoxime, cefdinir, or cefuroxime. Although macrolides may be

used as first-line agents in children who are allergic to penicillin, their use is controversial due to high rates of pneumococcal resistance to these agents. Finally, trimethoprim-sulfamethoxazole or sulfasoxazole is not adequate for treating *Streptococcus pneumoniae* infection.

Topical fluoroquinolones have no proven efficacy in acute otitis media in the presence of an intact tympanic membrane. They may be useful in this child, who is presumed to have had a ruptured tympanic membrane, but they should not supplant systemic antibiotic use.

Although otolaryngology evaluation that includes tympanocentesis may be needed for the child who fails to respond to a change in antibiotics, urgent referral to an ear-nose-throat specialist for tympanostomy tube placement is not indicated. Intramuscular ampicillin is unlikely to be effective for the child who has been receiving amoxicillin and would not be as effective as ceftriaxone because it is a short-acting antibiotic.

4. A 4-year-old boy presents with recurrent otitis media (OM) with persistent effusion. He is otherwise healthy. His mother is concerned about possible hearing loss and also wants to know if her son is at risk for any other neurologic complications because of his recurrent OM.

Of the following, the MOST likely neurologic complication for which this boy is at risk is

- A. autistic spectrum disorders
- B. balance difficulties**
- C. nystagmus
- D. speech apraxia
- E. tic disorders

The boy described in the vignette has a persistent middle ear effusion after recurrent bouts of otitis media. In addition to dampened conductance of sound to the inner ear, balance problems may occur, due to differences in pressure in the middle ear. However, "balance problems" in a 4-year-old also can be due to serious diseases affecting the brainstem and cerebellum. Therefore, any toddler who presents with such problems warrants a careful neurologic examination.

Autistic spectrum disorders involve impairments in language and communication. Although chronic conductive hearing loss can affect speech articulation, the other problems in autism with communication, social skills, and need for sameness do not occur. Similarly, speech apraxia, a neurologic problem affecting the child's ability to coordinate production of sounds to produce words, is not related to conductive hearing loss.

Nystagmus (ie, rhythmic oscillations of the eyes) is an important neurologic finding that should be sought in any person who has balance problems or subjective dizziness because it can indicate serious disease. Nystagmus may be peripheral, due to pathology in the inner ear or vestibule-cochlear nerve, or central, due to pathology in the brainstem or cerebellum. Middle ear effusions do not produce nystagmus. Most consultations for "dizziness" do not reveal any nystagmus, and neuroimaging, although often ordered, rarely is needed. Balance problems accompanied by nystagmus require urgent neurologic evaluation in the emergency department, if necessary. The differential diagnosis is very large, but some immediate considerations include toxins/ingestions, acute cerebellar ataxia, acute disseminated encephalomyelitis, opsoclonus-myoclonus ataxia syndrome, cerebellar strokes, and posterior fossa tumors.

Tics are repetitive, nonrhythmic, patterned movements or sounds produced involuntarily or in response to premonitory urges. They are neurologic symptoms and are not produced directly by infections or middle ear effusions. Upper respiratory tract infections may act as a precipitant for tics in susceptible children.