

Acute Otitis Media: 6 Steps to Improve Diagnostic Accuracy

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ABSTRACT: An efficient and accurate ear examination is dependent on the quality and condition of the equipment, an adequately restrained patient, and the ability to visualize the tympanic membrane (TM). The external auditory canal must be evaluated first. Edema, erythema, or otorrhea may indicate otitis externa or perforation of the TM. To diagnose acute otitis media (AOM) or otitis media with effusion, the middle ear space must be assessed for fluid. The presence of bubbles or an air/fluid level is indicative of middle ear effusion. Use of pneumatic otoscopy to assess TM mobility has been shown to improve the accurate identification of middle ear effusion. A bulging TM with impaired mobility has a 99% predictive value in diagnosing AOM. A retracted TM can be quite painful; however, this is unlikely to be caused by a bacterial infection and treatment with antibiotics would be inappropriate. Abnormal TM color alone is not enough to diagnose AOM.

Acute otitis media (AOM) remains the most common diagnosis for which antibiotics are prescribed for children in the United States. In 2006, ear infections or otitis media in infants and children caused about 9 million office visits and cost roughly \$2.8 billion to manage.¹⁻⁴ Although the 2004 American Academy of Pediatrics (AAP) and American Academy of Family Physicians (AAFP) clinical practice guideline recommended decreased use of antibiotics, the proportion of pediatric AOM cases being managed without antibiotics has not substantially changed.⁵

A major limitation that hinders researchers from providing a better understanding of the management of AOM is the lack of a gold standard for diagnosis.⁶ Several studies have found a high level of inconsistency among practitioners who diagnose AOM.⁷⁻⁹ Overdiagnosis may occur in as many as 50% of cases, and interobserver agreement in diagnosis is low.⁷⁻⁹ Virtually all studies on treatment options for AOM require cautious interpretation and examination of the criteria used for diagnosis.^{10,11}

The 3 components of AOM diagnosis outlined in the 2004 AAP/AAFP clinical practice guideline include:

- Acute onset of signs and symptoms.
- Signs and symptoms of middle ear inflammation.
- Presence of effusion (**Figures 1 and 2**).¹²

Restless sleep, irritability, ear pain, fever, and parental suspicion have not been shown to be reliable diagnostic indicators.^{13,14}

The ear examination, although frequently performed, is rarely easy. This quite procedural process often requires patient restraint and specialized equipment to enter the orifice. In this article, I will review the barriers to a successful ear examination (including a lack of appropriate equipment, uncooperative or inadequately restrained patients, and cerumen obstruction) and how to overcome them. I will also discuss the key otoscopic findings in AOM to help increase clinicians' ability to recognize and rely on them. This, according to a recent systematic re-

view, is “the most important way to improve diagnosis.”⁶

Check Your Equipment

An efficient and accurate ear examination is dependent on the quality and condition of the equipment. Regardless of the type of otoscope used, the examiner should make certain that the instrument contains a fully charged nickel cadmium or lithium battery and a halogen light bulb for optimal illumination of the tympanic membrane (TM). The otoscope head should be free of any cracks or air leaks. The viewfinder should be completely closed to create an airtight system. A bulb insufflator should be attached to the adapter on the side of the otoscope head and tested to ensure that there are no air leaks. Consider investing in new equipment if it is older than 5 years. Enhanced features in the newer otoscopes will improve the view.

Disposable speculums, although convenient, are shorter and their matte finish does not reflect the halogen light as efficiently as the specu-



Figure 1 – A bulging tympanic membrane with impaired mobility is diagnostic of acute otitis media.

lums supplied with diagnostic kits. Nondisposable speculums come in a variety of sizes, which allows for a better view and seal in the ear canal for pneumatic otoscopy. In general, disposable speculums come in only 2 sizes: 2.5 mm and 4.0 mm. Inexperi-

enced clinicians often use a speculum that is too small, which diminishes their view and limits the ability to reliably insufflate. If disposable speculums must be used, choose the 2.5 mm for infants younger than 12 months and the 4.0 mm for children older than a year. However, for many children about 6 years and older, the 4.0-mm speculum may be too small to create a seal in the ear canal, and the nondisposable variety is preferred.



Figure 2 – Middle ear effusion is demonstrated here by the presence of bubbles. An effusion must be present to diagnose acute otitis media or otitis media with effusion.

It's All in the Hold

Because young children in general do not like to be held down, it is always a good idea to ask the family how the child has done with past ear examinations and to have staff available to assist with “the hold.” To complete the examination efficiently, the examiner must assist the holder (parent, caregiver, nurse, or assistant) in quickly placing the child into the most secure position possible. The ideal position for the ear examination is one that allows safe and clear visualization of the

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TM. This varies based on patient age, cooperation of the patient or holder, symptomatology, and need for cerumen removal. With any type of hold, the examiner should be responsible for only securing the head. This way, if the child moves, the otoscope can be removed quickly and safely.

Infants and young children are often held in a bear hug on the parent's lap or on the examination table in a supine or prone position. In these positions, the child's arms are controlled so he or she cannot bat at the otoscope—or the examiner. The caregiver may find that the examination

table provides a more secure hold. This is also the safest place to remove cerumen. For the particularly vigorous child, additional restraint of the pelvis and legs may be required.

Examine From the Outside In

3 Before assessing the TM and middle ear space, first assess the external auditory canal. Edema, erythema, or otorrhea may indicate otitis externa or perforation of the TM (**Figure 3**). Foreign bodies (**Figure 4**) are common in pediatrics and may require removal most commonly with forceps, flushing, or suction. However, the most common finding is cerumen obstructing the view of the TM.

The Cure-ette for Earwax Obstruction

4 After assembling the equipment and placing the child in a secure position, the examination often comes to a halt because of cerumen obstruction. As many as 50% of infants and children require cerumen removal in order for the examiner to properly visualize the landmarks of the TM.¹⁵

The curette, the standard tool for cerumen removal, comes in both metal and disposable varieties. Lighted ear curettes are also available. Some examiners remove cerumen by feeding the curette through the viewfinder of the otoscope. This procedure requires significant additional restraint because the examiner needs to use both hands. Many examiners visualize the cerumen and then remove it incrementally with the curette directly in the ear canal.

At times, the curette is inadequate to remove hard or impacted cerumen. The family may be instructed to use hydrogen peroxide diluted in half with water dropped into the canal on a regular interval.



Figure 3 – Perforation of the tympanic membrane in this child was caused by use of a cotton tip swab.



Figure 4 – The grasshopper in this child's ear canal was found after acute onset of discomfort during a Fourth of July parade. It was removed with forceps under microscopy.

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Photos courtesy of Carlos Armengol, MD



Figure 5 – Bullous myringitis accounts for fewer than 10% of acute otitis media cases and may present with more severe symptoms at the time of diagnosis.²⁰

When the earwax needs to be removed during an office visit, several drops of docusate followed by irrigation with water under directed pressure often works.

Perforation of the eardrum during cerumen removal is exceedingly rare if the child is adequately restrained. It is important to impress upon families that earwax is protective for the ear canal and normal and does not require removal at home.

Effusion or No Effusion?

5 To make the diagnosis of AOM or otitis media with effusion (OME), the middle ear space must be assessed for fluid.¹⁶⁻¹⁹ The presence of bubbles, an air/fluid level (see **Figure 2**), or bullous myringitis²⁰ (**Figure 5**) is indicative of middle ear effusion.

Use of pneumatic otoscopy to assess TM mobility has been shown to improve the accurate identification of middle ear effusion.¹⁹ Some examiners may supplement this with tympanometry or reflectometry. The

pneumatic otoscope is indicated as the optimal instrument in the guidelines of 10 countries, including the United States.²¹ Yet few pediatricians use pneumatic otoscopy, and the skill is not emphasized in many pediatric educational programs.

TM mobility can be assessed using positive and negative pressure delivered from the pneumatic insufflator bulb. When pressure in the middle ear space is equivalent to ambient air pressure, the normal TM moves laterally and medially with a pressure pulse from the bulb as low as 10 to 15 mm H₂O. Reduced TM mobility is caused by fluid, a solid mass in the middle ear space, retraction, atrophy, or sclerosis. Perforation also causes the TM to become immobile (see **Figure 3**), although this may be obscured by otorrhea.

Examiners should initially apply negative pressure followed by positive pressure. This can be accomplished by slightly compressing the bulb just before inserting the speculum in the canal and obtaining a seal. When positive pressure alone is applied to a retracted TM (**Figure 6**), the TM may not move and the examiner may misdiagnose OME.

Maintaining a consistent amount of gentle pressure is important. Clinicians have been shown to use more than 30 times the threshold pressure needed to visually detect mobility.



Figure 6 – A tympanic membrane that is retracted, such as the one shown here, may be painful; however, it is unlikely to be caused by a bacterial infection.

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Even markedly abnormal TMs can move with enough pressure, which diminishes the discriminative value of pneumatic otoscopy.¹⁶⁻¹⁹

Know Your Position

6 The normal TM is in a neutral position and is translucent; this provides a view into the middle ear space (Figure 7). A bulging TM with impaired mobility has been shown to have a 99% predictive value in diagnosing AOM (see Figure 1).²²

A retracted TM can be quite painful because of negative pressure and Eustachian tube dysfunction; however, this is unlikely to be caused by a bacterial infection and treating with antibiotics would be inappropriate. Some examiners refer to a “light reflex” when describing the TM. This is usually present if the otoscope bulb is functioning. When the TM is retracted or bulging, the light may be splayed rather than sharply focused. However, emphasis on identifying the position of the TM will lead to a more accurate diagnosis.

An opaque TM is abnormal; however, this alone does not distinguish between AOM and OME. The color of the TM must be considered in the context of symptoms and mobility. A normal TM is pearly gray or pink. Effusions in OME may be white, amber, or bluish. In AOM, pus in the middle ear space generally appears yellow, and the TM may be erythematous. However, unless the child is not crying, is afebrile, and/or the redness of the TM is unilateral, erythema is not a reliable diagnostic sign of AOM.

Taking a Closer Look

As we await the forthcoming revision of the AAP/AAFP clinical practice guideline for the diagnosis and management of AOM, it is important to hone our diagnostic skills and accurately differentiate between OME and AOM. The microbiology of AOM



Figure 7 – The normal eardrum is in a neutral position and is translucent.

will continue to shift and the guidelines for treatment will change; however, an accurate diagnosis and consistent definition remain essential. ■

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