REVIEW ARTICLE

Acute Otitis Media

Joe Kingery, DO,[1] Wanda Taylor, DO,[2] & Denielle Braun, DO[3]

[1]Associate Professor, East Kentucky Family Medicine Residency, University of Kentucky
[2]Assistant Professor, East Kentucky Family Medicine Residency, University of Kentucky
[3]PGY-2, East Kentucky Family Medicine Residency, University of Kentucky

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Acute otitis media (AOM) is one of the most common diagnoses made by physicians treating children. Approximately 80% of children will have at least one episode of AOM by one year of age, and up to 90% will have AOM by two to three years of age. AOM has been the most common condition for which antibiotics have been prescribed for children in the US. Numerous studies have looked at the diagnosis of AOM, how to differentiate it from Otitis Media with Effusion (OME), and its etiologies. New guidelines from the American Academy of Pediatrics requires otoscopic findings to diagnose AOM. Bacteria have been isolated in 50 to 90% of cases depending on diagnostic criteria used to diagnose AOM or OME. The most common bacteria isolated are Streptococcus pneumoniae, nontypeable Haemophilus influenza, and Moxarella catarrhalis. Thus, antibiotic therapy should be directed at those organisms. Currently, high-dose amoxicillin is recommended as a first-line antibiotic. However; new guidelines have significantly changed treatment with antibiotics in children. Those guidelines are reviewed in this article.

INTRODUCTION

Acute otitis media (AOM) is one of the most common diagnoses made by physicians treating children. Approximately 80% of children will have at least one episode of AOM by one year of age, and up to 90% will have AOM by two to three years of age.[1,2] AOM has also represented the most common condition for which antibiotics have been prescribed for children in the US. The etiology and appropriate treatment has been a long debate in medicine. One reason for this is likely the concern for complications if it were not treated with antibiotics. Also contributing to this is the wide variation in diagnosis and treatment that exists amongst different physicians.[3] In 2013, the American Academy of Pediatrics issued a significantly updated clinical practice guideline on the diagnosis and management of AOM. Among those recommendations were changes in treatment with antibiotics for children, clearer diagnostic criteria, and reiteration that complications are rare.

ETIOLOGY

AOM is usually caused by a cascade of events beginning with a viral upper respiratory illness (URI). The URI causes Eustachian tube (ET) dysfunction by causing inflammation and swelling of the ET and entrapment of fluid. That fluid then serves as a medium for growth of viruses or bacteria. Bacteria can be found in 50% to 90% of cases of AOM and OME.[2] In the case of bacterial infection, the most common bacteria isolated are Streptococcus pneumoniae, nontypeable Haemophilus influenza, and Moxarella catarrhalis.[3]

CORRESPONDENCE:
Joe Kingery, DO | joe.kingery@uky.edu

EPIDEMIOLOGY

Acute otitis media has a higher incidence rate in infancy and declines with age. Children less than 2 years of age have more visits with medical providers for AOM than those greater than 2 years old.[4] A peak occurrence has been observed between the ages of 6 to 12 months.[1] Several risk factors for acute otitis media in children have been identified. These include male gender, having parents who smoke, being cared for outside of the home, history of acute otitis media in other siblings and lack of breast feeding.[1,5] A decrease in the rate of visits to health care providers for AOM has been seen from 2004-2011.[4]

CLINICAL PRESENTATION

Younger children may present with a history of tugging or pulling at their ears, excessive crying, and fever. However; these symptoms are nonspecific and seen in many cases when AOM is not present.[6] Older children usually present with acute onset of fever and ear pain. Often times the onset in all age ranges are preceded by a viral upper respiratory illness. There has been different symptom scoring systems proposed to help diagnose AOM. Although history alone does not allow for diagnosis of AOM, the most validated scoring system is a 7-item parent-reported symptom score, the Acute Otitis Media Severity of Symptom Scale (AOM-SOS).[7] The AOM-SOS is presented in Table 1. The usefulness of the AOM-SOS is found with its day-to-day change with regards to AOM symptoms following diagnosis.

DIAGNOSIS

The diagnosis of AOM is more clearly defined in the latest American Academy of Pediatrics (AAP) guidelines that include otoscopic criteria *(See Table 2)*. In particular, AOM should not be diagnosed in

children who do not have middle ear effusion based on pneumatic otoscopy or tympanometry. AOM should be diagnosed in children presenting with moderate to severe bulging of the tympanic membrane or new onset of otorrhea not due to otitis externa. Additionally, AOM can be diagnosed in children who present with mild bulging of the tympanic membrane and recent (<48 hours) onset of ear pain (including holding, tugging, or rubbing of the ear in a nonverbal child).[7] The more strict criteria are aimed at decreasing antibiotic resistance and side effects from unnecessary antibiotic use. The differential diagnosis includes Otitis Media with Effusion, eczema, contact dermatitis, otitis externa, viral upper respiratory infection, and acute sinusitis. Red flag symptoms include fever unresponsive to therapy, meningeal signs including nuchal rigidity, significant tenderness over the mastoids, and significant lethargy or weakness.[8]

TREATMENT

Treatment is partly guided by age as well as symptoms. For all children without severe symptoms (moderate or severe otalgia, otalgia for at least 48 hours, or temperature 102.2 F or higher), no otorrhea and only unilateral AOM, observation can be considered without antibiotics. For those 2 years and older without any severe symptoms, bilateral AOM without otorrhea can also be observed *(see Figure 1, page 24)*. Pain can be quite severe and thus, should be treated appropriately. One of the challenges with stricter antibiotic use is educating patients, and particularly parents, about the evidence based medicine and complications that can occur when antibiotics are over utilized. The Centers for Disease Control and Prevention have published a lot of resources in their campaign "Get Smart". These include educational materials and information for patients and parents. As with most things that change in medicine, the challenge will be education and helping change a culture.[9]

ANALGESICS

Pain associated with AOM can be quite severe and last up to 7 days. Otalgia does not begin to improve for at least 24 hours after starting antibiotics. Therefore, analgesics should be prescribed or recommended during the duration of the ear pain. Common analgesics that show significant benefit are acetaminophen or ibuprofen. These will also help with the fever associated with AOM.

Although commonly prescribed, topical agents including benzocaine/antipyrine show little to no benefit. Any benefit that may exist from it does not last beyond 30 minutes.[10]

ANTIBIOTICS

Antibiotic therapy is aimed at targeting the most common causative organisms. When a decision has been made to treat with antibiotics and the child has not been treated with amoxicillin in the past 30 days, in the absence of an allergy, high-dose amoxicillin is recommended as the initial treatment. Amoxicillin is the first line choice due to multiple factors including efficacy against the most common causative organisms, acceptable taste profile, low cost, and narrow spectrum.[5] In the event the child has received amoxicillin within the last 30 days, has concurrent conjunctivitis, or in cases where coverage for beta lactamase positive organisms is desired, therapy should be high dose amoxicillin-clavulanate. Other alternative initial therapies that can be considered in cases of initial treatment failure or in patients with allergies include cefdinir, cefuroxime, cefpodoxime or ceftriaxone *(See Table 3, page 24)*.[5]

TABLE 1:

Acute Otitis Media Severity of Symptom Scale (AOM-SOS)

Symptoms	No	A Little	A Lot
Ear tugging / rubbing / holding			
Excessive crying			
Irritability			
Difficulty sleeping			
Decreased activity			
Decreased appetite			
Fever			

TABLE 2:

Diagnosis of Acute Otitis Meda

Findings	Quality of Evidence
Moderate to severe bulging of the tympanic membrane	Grade B
New onset of otorrhea not due to otitis extern	Grade B
Mild bulging of the tympanic membrane and recent onset of ear pain (holding, tugging, rubbing of ear if nonverbal)	Grade C

OSTEOPATHIC MANIPULATIVE THERAPY

There is a role for osteopathic manipulative therapy in AOM as well. One study showed that a standardized OMT protocol, which was administered along with standard care for AOM, resulted in faster resolution of middle ear effusion following AOM than standard treatment by itself.[11] One study suggests that there is a potential benefit of OMT as adjuvant therapy in those with recurrent AOM and may prevent or at least decrease surgical intervention and antibiotic use. Another study demonstrated the same findings.[12] OMT techniques that can be utilized include myofascial release, balanced membranous tension, balanced ligamentous tension, facilitated positional release, and counterstrain.[13]

COMPLICATIONS

While the overall incidence of complications from acute otitis media is low, clinicians should be able to recognize these should they occur. Infratemporal and intracranial complications occur in one in 100,000 children and in one in 300,000 adults per year.[14]

FIGURE 1:

Decision of antibiotic therapy

**Severe symptoms: moderate or severe otalgia, otalgia for at least 48 hours, or temperature 102.2° F or higher*

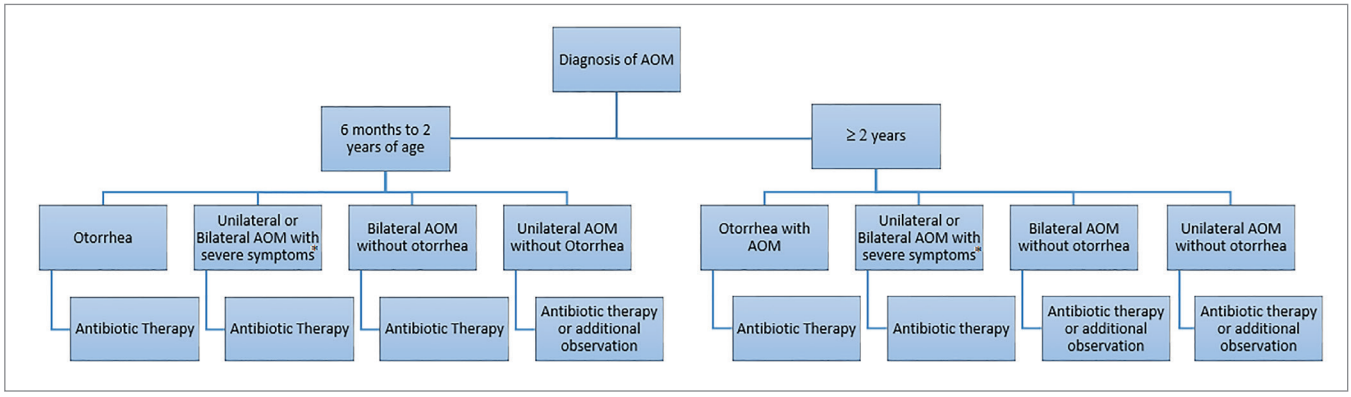

TABLE 3:

Initial immediate or delayed antibiotic treatment		**After 48 - 72 hrs of failure of initial antibiotic (or received amoxicillin w/in 30 days)**	
First-line treatment	Alternative treatment (if penicillin allergy)	First-line treatment	Alternative treatment
Amoxicillin *(80-90mg/kg per day in 2 div doses)*	*Cefdinir* *(14mg/kg per day in 1 or 2 doses)*	*Amoxicillin-clavulanate* *(90mg/kg per day of amox w/6.4 mg/kg per day of clavulanate in 2 div doses)*	*Ceftriaxone, 3 d clindamycin* *(30-40mg/kg per day in 3 div doses)* *+/- 3rd generation cephalosporin*
Amoxicillin-clavulanate *(90mg/kg per day of amox w/ 6.4mg/kg per day of clavulanate in 2 div doses)*	*Cefuroxime* *(30mg/kg per day in 2 div doses)*	*Ceftriaxone* *(50mg/kg IM or IV per day for 1 to 3 days, max 1g per day)*	Failure of 2nd antibiotic: *Clindamycin* *(30-40mg/kg per day in 3 div doses)* *+/- 3rd generation cephalosporin*
	Cefpodoxime *(10mg/kg per day in 2 div doses)*		
	Ceftriaxone *(50mg/kg IM or IV per day for 1 to 3 days, max 1g per day)*		

Chronic middle ear effusion can lead to conductive hearing loss which may be fluctuating or persistent. These children may score lower on tests of speech, language, and cognitive abilities. A perforation in the central portion of the tympanic membrane, may potentially lead to infection in the middle ear as well as the potential for mastoiditis, which could subsequently lead to abscess. In addition, infections of the temporal bone, meningitis, and intracranial infections, are a rare complication of otitis media more commonly seen in developing countries where access to medical care is limited.[14] Children with chronic suppurative otitis media or recurrent instances of acute otitis media are more at risk for mild to moderate conductive hearing loss, and may need referral to a specialist for tympanocentesis/tympanostomy tube placement. Children six months to 12 years of age with bilateral otitis media with effusion for 3 months or longer with documented hearing loss, or those children with recurrent acute otitis media with effusion at the time of assessment are candidates for tube placement.[5]

PREVENTION

There are several ways to help prevent AOM. One of the most common bacteria causing AOM has been significantly decreased by the routine use of the pneumococcal vaccine. A meta-analysis of five studies of AOM showed a 29% reduction in AOM caused by all pneumococcal serotypes among children receiving the vaccine before 24 months of age.[15]

Additionally, lifestyle changes can have significant impacts on rates of AOM. These include tobacco cessation, breast-feeding, avoiding supine bottle feeding, and reducing or eliminating the use of pacifiers after 6 months of age. Breast-feeding has been shown to be beneficial with most benefit seen if breastfeeding for at least 4 to 6 months. The largest impact has been seen in those with exclusive breastfeeding in the first 6 months of life.[16] An increase in OME and recurrent otitis media (ROM) is seen in children exposed to passive tobacco smoke.[17] Eliminating exposure to second-hand smoke is important for children to decrease chances of upper respiratory symptoms and OME as well as ROM. Supine bottle-feeding creates negative pressure in the oral cavity and in the bottle as fluid is removed from the bottle by sucking. To overcome the negative pressure in the bottle, the infant must suck excessively and causes the intraoral negative pressure to be transmitted to the middle ear via the ET which can then lead to OME and AOM.[18] Pacifiers have shown an increase in the incidence of AOM in children when used beyond the first 6 months of life.[19] Encouraging parents to reduce or eliminate the use of a pacifier beyond six months of age may help prevent AOM.

CONCLUSIONS

Acute otitis media remains one of the most common diagnosed conditions in children. New guidelines for the diagnosis of AOM have been developed in effort to reduce antibiotic overuse and subsequent resistance. According to new criteria AOM should be diagnosed when a patient presents with moderate to severe tympanic membrane bulging, mild bulging of the tympanic membrane with recent ear pain, or new onset of otorrhea. Analgesics are recommended for the duration of ear pain. Acetaminophen and ibuprofen have shown the most significant benefit in reducing pain. High dose amoxicillin is first line treatment and should be used whenever possible. Preventative measures including administration of the pneumococcal vaccine and lifestyle changes such as tobacco cessation, breast-feeding, inclined feeding, and eliminating pacifier use after 6 months of age have helped to reduce the incidence of AOM.

REFERENCES

1. Teele, D.W., J.O. Klein, and B. Rosner, Epidemiology of otitis media during the first seven years of life in children in greater Boston: a prospective, cohort study. J Infect Dis, 1989. 160(1): p. 83-94.
2. Harmes, K.M., et al., Otitis media: diagnosis and treatment. Am Fam Physician, 2013. 88(7): p. 435-40.
3. Coker, T.R., et al., Diagnosis, microbial epidemiology, and antibiotic treatment of acute otitis media in children: a systematic review. JAMA, 2010. 304(19): p. 2161-9.
4. Marom, T., et al., Trends in otitis media-related health care use in the United States, 2001-2011. JAMA Pediatr, 2014. 168(1): p. 68-75.
5. Uhari, M., K. Mantysaari, and M. Niemela, A meta-analytic review of the risk factors for acute otitis media. Clin Infect Dis, 1996. 22(6): p. 1079-83.
6. Rothman, R., T. Owens, and D.L. Simel, Does this child have acute otitis media? JAMA, 2003. 290(12): p. 1633-40.
7. Lieberthal, A.S., et al., The diagnosis and management of acute otitis media. Pediatrics, 2013. 131(3): p. e964-99.
8. Bethel, J., Otitis Media, in Paediatric Minor Emergencies. 2008. p. 164-165.
9. Prevention, C.f.D.C.a. Get Smart. 2016; Available from: http://www.cdc.gov/getsmart/.
10. Foxlee, R., et al., Topical analgesia for acute otitis media. Cochrane Database Syst Rev, 2006(3): p. CD005657.
11. Steele KM, C.J., Viola JH, Conte JA, Ridpath LC, Effect of Osteopathic Manipulative Treatment on Middle Ear Effusion Following Acute Otitis Media in Young Children: A Pilot Study. The Journal of the American Osteopathic Association, 2014. 114(6): p. 436-447.
12. Degenhardt BF, K.M., Osteopathic Evaluation and Manipulative Treatment in Reducing the Morbidity of Otitis Media: A Pilot Study. The Journal of the American Osteopathic Association, 2006. 106(6): p. 327-334.
13. Mills MV, H.C., Barnes LLB, Carreiro JE, Degenhardt BF, The Use of Osteopathic Manipulative Treatment as Adjuvant Therapy in Children with Recurrent Acute Otitis Media. Arch Pediatr Adolesc Med., 2003. 157(9): p. 861-866.
14. Ramakrishnan, K., R.A. Sparks, and W.E. Berryhill, Diagnosis and treatment of otitis media. Am Fam Physician, 2007. 76(11): p. 1650-8.
15. Pavia, M., et al., Efficacy of pneumococcal vaccination in children younger than 24 months: a meta-analysis. Pediatrics, 2009. 123(6): p. e1103-10.
16. McNiel, M.E., M.H. Labbok, and S.W. Abrahams, What are the risks associated with formula feeding? A re-analysis and review. Breastfeed Rev, 2010. 18(2): p. 25-32.
17. Ilicali, O.C., et al., Relationship of passive cigarette smoking to otitis media. Arch Otolaryngol Head Neck Surg, 1999. 125(7): p. 758-62.
18. Brown, C.E. and B. Magnuson, On the physics of the infant feeding bottle and middle ear sequela: ear disease in infants can be associated with bottle feeding. Int J Pediatr Otorhinolaryngol, 2000. 54(1): p. 13-20.
19. Niemela, M., et al., Pacifier as a risk factor for acute otitis media: A randomized, controlled trial of parental counseling. Pediatrics, 2000. 106(3): p. 483-8.