Otitis Media and Antibiotics – Yes, No, or Maybe?

Authors:
Kristin McClung, PharmD, BCPS
Kayla Stover, PharmD, BCPS
Debbie Minor, PharmD
The University of Mississippi Medical Center
Departments of Pharmacy, Pharmacy Practice, and Medicine
Jackson, MS

Goal:
The goal of this review is to describe and discuss the presentation, diagnosis, treatment, and management of acute otitis media in children.

Objectives
1. Describe the presentation and diagnosis of otitis media in children.
2. Review current recommendations for treatment and management of acute otitis media.
3. Discuss antibiotic options and appropriate selection for children with acute otitis media.

This article may appear in other state pharmacy association publications as it was previously published by Mississippi Pharmacists Association.

INTRODUCTION

Middle ear infection, or otitis media, is one of the most common types of infection among children in the United States and the primary reason for which antibacterial agents are prescribed. Fluid accumulation and inflammation in the middle ear occurs more often in children compared to adults because their Eustachian tubes are shorter and more horizontal, facilitating virus and bacteria entry.1-3 Otitis media is differentiated as otitis media with effusion (OME) and acute otitis media (AOM). OME may be caused by allergies, exposure to irritants (e.g., cigarette smoke), and viral infections. With OME, there are usually no signs or symptoms of acute infection, though there may be discomfort or problems with hearing. OME is more common than AOM. The build up of middle ear fluid usually resolves on its own, but OME may be a prelude to or a sequela of AOM.1,4

AOM is described as a painful ear infection that results from viral and bacterial causes. By the age of three, more than 67% of children have had at least one episode of AOM and approximately 33% have had at least three episodes.1,2 Viruses including adenovirus, coronavirus, enterovirus, parainfluenza virus, respiratory syncytial virus, and rhinovirus account for approximately 25% of cases.1,2,4 The most common bacteria causing AOM are Streptococcus pneumoniae, Haemophilus influenzae, and Moraxella catarrhalis. In the 1990s, S. pneumoniae was the most common organism to cause AOM, followed by H. influenzae and M. catarrhalis (25-50%, 15-30%, and 3-20%, respectively). By the early 2000s, rates of AOM caused by H. influenzae and S. pneumoniae were similar.4 The reduction in the incidence of S. pneumoniae is thought to be due to the heptavalent conjugate pneumococcal

ACPE UPN: 0120-9999-13-208-H01-P
1.5 Contact Hours (0.15 CEU’s)
This is a knowledge-based activity.
See end of article for CE details.

Target Audience: Pharmacists
Faculty Disclosure: The faculty have no conflicts of interest to disclose.
TREATMENT AND MANAGEMENT OF AOM

The latest guidelines for the management of AOM in children, published in 2004, outline specific diagnosis and symptom severity criteria to determine treatment (i.e., observation with/without an analgesic or immediate antibiotic). These recommendations focus on the management of uncomplicated AOM in otherwise healthy children without underlying medical conditions (e.g., anatomic abnormalities, cochlear implants, genetic conditions, immunodeficiencies).

The diagnosis and severity categorization of AOM are based on several factors. For diagnosis, the following are required: (1) rapid onset of signs and symptoms (e.g., fever, pulling on ears, crying excessively, and/or disturbance in daily activities or sleep patterns); (2) middle ear effusion (i.e., bulging tympanic membrane, limited or absent tympanic membrane mobility, air-fluid level behind the tympanic membrane, or ear drainage); and (3) middle ear inflammation (i.e., tympanic membrane redness or ear pain). Other symptoms may include vertigo, nystagmus, tinnitus, and hearing loss.

At diagnosis, the severity of the child’s symptoms should be specified as non-severe, defined as mild ear pain and fever < 102.2°F, or severe, defined as moderate to severe ear pain or fever ≥ 102.2°F. The severity of symptoms is then considered when selecting the most appropriate treatment.

Ear pain is a common symptom of AOM and is an essential component in the initial management of AOM. Relief of ear pain is especially important during the first 24 hours of AOM onset. Analgesics (e.g., acetaminophen, ibuprofen) are the mainstay for treatment. For children < 12 years old, the appropriate oral dose of acetaminophen is 10 to 15 mg/kg/dose every 4 to 6 hours as needed (maximum 2.6 g or 5 doses in 24 hours) and for ibuprofen, 4 to 10 mg/kg/dose every 6 to 8 hours as needed (maximum 4 doses in 24 hours). Topical

Recently, the Centers for Disease Control and Prevention and other groups have attempted to focus the attention of the medical community and general public on the need for appropriate otitis media management. The goal of this review is to describe and discuss the presentation, diagnosis, treatment, and management of acute otitis media in children.
agents, such as those containing benzocaine, may offer additional though brief benefit over analgesics and may be considered in children > 5 years. There are no controlled studies that evaluate the effectiveness of home remedies, including ear drops containing oil and external application of heat or cold. 4

The decision to initiate antibacterial treatment immediately or undergo a 48 to 72-hour observation prior to starting treatment is based on the diagnostic certainty, age of the child, illness severity, and assurance of follow-up. 4 Discriminating between AOM and OME is often a challenge, and uncertainty will remain in some cases. Observation may be considered for children 6 to 24 months of age with suspected AOM and non-severe symptoms or those ≥ 2 years of age with either confirmed AOM and non-severe symptoms or suspected AOM. The caregivers of children who meet these criteria must ensure adequate follow-up if improvement is not seen after the observational period. Follow-up may include contacting or having the child re-evaluated by their healthcare provider and/or obtaining an antibiotic. During the observational period, symptomatic treatment may be provided, including analgesics (e.g., acetaminophen, ibuprofen) for pain management. 4

While observation is appropriate for some children, others with suspected or confirmed AOM may require immediate antibiotic treatment. Children < 6 months of age with suspected or confirmed AOM, 6 to 24 months with confirmed AOM or suspected AOM and severe symptoms, or ≥ 2 years with confirmed AOM and severe illness should be treated with an antibiotic. 4 A 2006 meta-analysis suggests that children < 2 years of age with AOM regardless of symptoms and children with bilateral AOM or ear drainage benefit from antibiotic therapy. 6

Antibiotics used for the treatment of AOM include oral amoxicillin, amoxicillin-clavulanate, azithromycin, cefdinir, cefpodoxime, cefuroxime, clarithromycin, clindamycin, erythromycin-sulfisoxazole, and sulfamethoxazole-trimethoprim or parenteral ceftriaxone (IM or IV). 4 Selection of an appropriate antibiotic is based on the child’s severity of symptoms, risk of antibiotic resistance, and history of medication allergies and tolerances, as well as prior treatment of AOM. The duration of treatment depends on the selected antibiotic, age of the child, and severity of symptoms. Antibiotic characteristics that increase patient compliance (e.g., dosing interval, taste, formulation) should also be considered. Recommendations for dosing and duration of therapy are provided in Tables 1 and 2.

**Antibiotic Selection – Without Penicillin Allergy**

For children without a history of penicillin allergy, the preferred treatment of AOM is amoxicillin or amoxicillin-clavulanate. Amoxicillin is the drug of choice for non-severe symptoms and is preferred due to its narrow spectrum of activity, clinical success (S. pneumoniae - susceptible, intermediate, some resistant strains), favorable safety profile, acceptable taste, and low cost. Amoxicillin-clavulanate is preferred as the initial treatment for children with severe symptoms, as amoxicillin is not effective for high-level resistant strains of S. pneumoniae. 4 The mechanism of resistance to beta-lactam antibiotics include alterations of the penicillin-binding proteins for S. pneumoniae resistance and the production of beta-lactamases for H. influenzae and M. catarrhalis. 3 Risk factors for amoxicillin-resistance include age < 2 years, daycare attendance, and antibiotic use within the last 30 days. 4 If signs and symptoms do not improve after 48 to 72 hours of treatment with amoxicillin, the treatment should be changed to amoxicillin-clavulanate (preferred), cefdinir, cefuroxime, or ceftriaxone. 2 In children who
experience treatment failure with amoxicillin-clavulanate, ceftriaxone is preferred because of its superior efficacy against *S. pneumoniae*.  

**Antibiotic Selection – With Allergy to Penicillins (not Type I Hypersensitivity)**

For children with an allergy to penicillins other than a history of a type I hypersensitivity reaction (i.e., reactions other than anaphylaxis, bronchospasm, or hives), the treatment of AOM may include cefdinir, cefpodoxime, cefuroxime, or ceftriaxone. The oral cephalosporins (i.e., cefdinir, cefpodoxime, cefuroxime) are the preferred choices for non-severe symptoms. Of these, cefdinir is usually chosen due to its favorable taste. Ceftriaxone (IM, IV) is the drug of choice for children with severe symptoms or for those whose symptoms do not improve after 48 to 72 hours of oral treatment. A three-day course of ceftriaxone was shown to be more effective than a one-time dose in treating children who failed to improve with their first antibiotic regimen. In children who are vomiting or cannot tolerate oral antibiotics, ceftriaxone given as a single dose or in three consecutive doses also may be used for treatment.

**Antibiotic Selection – With Type I Hypersensitivity Allergy to Penicillins**

For children with a type I hypersensitivity allergy to penicillins (i.e., anaphylaxis, bronchospasm, or hives), the treatment of AOM may include azithromycin, clarithromycin, clindamycin, erythromycin-sulfisoxazole, or trimethoprim-sulfamethoxazole. Azithromycin, clarithromycin, erythromycin-sulfisoxazole, or trimethoprim-sulfamethoxazole are suggested for treatment in children with non-severe symptoms. Of these, azithromycin or clarithromycin are preferred due to the increasing incidence of *S. pneumoniae* resistance to erythromycin-sulfisoxazole and trimethoprim-sulfamethoxazole. Clindamycin is the preferred treatment in children with severe symptoms and those who experience treatment failure due to *S. pneumoniae* resistance.

**Alternative Therapies**

The utilization of alternative therapies (e.g., acupuncture, chiropractic therapy, herbal products, homeopathy, and nutritional supplements) for the treatment of AOM is increasing. The use of these therapies is controversial due to the lack of supporting clinical data. Even though most of these therapies are harmless, others are toxic or could interfere with the effects of analgesics and antibiotics. Health care providers should question and educate caregivers about the use of alternative therapies and be able to discuss the possible risks and benefits of such therapies.

**PREVENTION**

One of the easiest and most effective ways to prevent complications from AOM is prevention. Immunization has shown to dramatically reduce the incidence of pneumococcal-associated AOM. Health care providers should encourage parents to not only immunize their children, but to keep their own immunizations up to date to prevent transmission. Altering the patterns of daycare attendance and avoiding exposure to tobacco smoke and air pollution may reduce the number of respiratory tract infections. Breastfeeding for at least the first 6 months, reducing or eliminating pacifier use in the second 6 months, and bottle feeding in the upright position may also provide some protective effect for infants.

**CONCLUSION**

AOM is a common condition among children with many opportunities for more effective management. As the most accessible health care provider, pharmacists should be well prepared to offer guidance and recommendations for the treatment and management of AOM. Most importantly, determining the appropriate treatment will
maximize the benefits and minimize the associated risks. For selected children, based on diagnostic certainty, age, illness severity, and assurance of follow-up, observation without use of an antibacterial agent is a viable option. This approach could reduce antibiotic prescriptions for ear infections in the United States by up to 3 million annually and would significantly reduce the prevalence of resistant bacteria.

### Table 1 – Antibiotics for AOM

<table>
<thead>
<tr>
<th>Generic</th>
<th>Brand</th>
<th>Age (months)</th>
<th>Daily Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
<td>Moxatag&lt;sup&gt;TM&lt;/sup&gt;</td>
<td>&lt; 3</td>
<td>20-30 mg/kg (divided into 2 doses)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 3</td>
<td>80-90 mg/kg (divided into 2 doses)</td>
</tr>
<tr>
<td>Amoxicillin/clavulanate</td>
<td>Augmentin®</td>
<td>&lt; 3</td>
<td>30 mg/kg of amoxicillin component (divided into 2 doses)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 3</td>
<td>90/6.4 mg/kg (divided into 2 doses)</td>
</tr>
<tr>
<td>Azithromycin</td>
<td>Zithromax®</td>
<td>≥ 6</td>
<td>10 mg/kg x 1 day (max: 500mg/day), followed by 5 mg/kg (max: 250mg/day)</td>
</tr>
<tr>
<td>Cefdinir</td>
<td>Omnicef®</td>
<td>≥ 6</td>
<td>14 mg/kg (divided into 1-2 doses, max: 600 mg/day)</td>
</tr>
<tr>
<td>Cefpodoxime</td>
<td>Vantin®</td>
<td>≥ 2</td>
<td>10 mg/kg (divided into 2 doses, max: 200 mg/dose)</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>Ceftin®</td>
<td>≥ 3</td>
<td>30 mg/kg (divided into 2 doses, max: 1 g/day)</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>Rocephin®</td>
<td>≥ 6</td>
<td>50 mg/kg IM or IV (max: 1 g/day)</td>
</tr>
<tr>
<td>Clarithromycin</td>
<td>Biaxin®</td>
<td>≥ 6</td>
<td>15 mg/kg (divided in 2 doses, max: 1 g/day)</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>Cleocin®</td>
<td></td>
<td>30-40 mg/kg (divided into 3 doses)</td>
</tr>
<tr>
<td>Erythromycin/sulfisoxazole</td>
<td>E.S.P®</td>
<td>≥ 2</td>
<td>50/150 mg/kg (divided into 4 doses, max: 2/6 g/day)</td>
</tr>
<tr>
<td>Sulfamethoxazole / trimethoprim</td>
<td>Bactrim&lt;sup&gt;TM&lt;/sup&gt;, Septra®</td>
<td>≥ 2</td>
<td>6-10 mg/kg of trimethoprim (divided into 2 doses)</td>
</tr>
</tbody>
</table>

Compiled from references 4 and 7.

### Table 2 - Duration of Therapy for AOM

<table>
<thead>
<tr>
<th>Number of Days</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>Ceftriaxone - severe symptoms</td>
</tr>
<tr>
<td>3</td>
<td>Ceftriaxone - severe symptoms with failure of initial antibiotic</td>
</tr>
<tr>
<td>5-7</td>
<td>Oral therapy - non-severe symptoms and 6-12 years of age</td>
</tr>
<tr>
<td>10</td>
<td>Oral therapy - severe symptoms or children &lt; 5 years of age</td>
</tr>
</tbody>
</table>

Compiled from reference 4.
The Pharmacists Education Foundation (PEF) is accredited by the Accreditation Council for Pharmacy Education (ACPE) as a provider of continuing pharmacy education. To receive continuing pharmacy education (CPE) credit, pharmacists MUST COMPLETE AN ONLINE QUIZ AND EVALUATION FORM. A score of 70% or above is required to receive CPE credit. The link to the quiz can be accessed from the MEMBERS page of the IPA website at www.indianapharmacists.org. This is a free service to IPA members in 2013. Initial release date: 11/25/2013. Expiration Date: 11/25/2016. Questions: Call IPA at (317) 634-4968.

References

INSTRUCTIONS: This page is intended to help participants REVIEW the quiz prior to submitting their answers online. Please take the quiz online using the members section of the website.

Questions
1. The most common bacteria to cause AOM include(s):
   a. Streptococcus pneumoniae.
   b. Haemophilus influenzae.
   c. Moraxella catarrhalis.
   d. all the above.
2. Diagnosis of AOM include(s):
   a. rapid onset.
   b. middle ear effusion.
   c. middle ear inflammation.
   d. all the above.
3. All patients under 2 years old with AOM and severe symptoms should be treated with an antibiotic.
   a. True
   b. False
4. All patients with a confirmed diagnosis of AOM should be treated with an antibiotic.
   a. True
   b. False
5. The duration of treatment with an antibiotic for AOM depends on the:
   a. class of antibiotic.
   b. gender of the child.
   c. severity of symptoms.
   d. history of medication intolerances.
6. The most appropriate treatment for a child with AOM and no allergies if *Streptococcus pneumoniae* resistance is suspected would be:
   a. amoxicillin.
   b. amoxicillin/clavulanate.
   c. erythromycin/sulfisoxazole.
   d. sulfamethoxazole/trimethoprim.
7. Which antibiotic is preferred for children with AOM, severe symptoms, and no allergies who failed amoxicillin/clavulanate?
   a. Amoxicillin
   b. Ceftriaxone
   c. Clindamycin
8. Of the oral cephalosporins, ______ is usually preferred, because of taste?
   a. Cefdinir
   b. Cefpodoxime
   c. Cefuroxime
9. Which antibiotic would not be appropriate for a patient with a type I hypersensitivity allergy to a penicillin?
   a. Azithromycin
   b. Ceftriaxone
   c. Clindamycin
   d. Sulfamethoxazole/trimethoprim
10. Which of the following is not a first-line antibiotic for the treatment of severe AOM?
    a. Amoxicillin/clavulanate
    b. Azithromycin
    c. Ceftriaxone
    d. Clindamycin

11. Did the article help you achieve EACH of the stated objectives? If not, describe in the comment box at the end of this section. Refer to the article for the list of learning objectives.
   a. Yes
   b. No
12. Quality of the written material/content?
   a. Very good quality
   b. Good quality
   c. Neutral
   d. Poor quality
   e. Very Poor Quality

13. Overall evaluation of this article?
   f. Very good quality
   g. Good quality
   h. Neutral
   i. Poor quality
   j. Very Poor Quality

14. How much time was required to complete this article?
   a. 0.5 hrs.
   b. 1.0 hrs.
   c. 1.5 hrs.
   d. 2.0 hrs.
   e. 2.5 hrs

15. The learning activities (e.g. case studies, quiz) were effective?
   a. Strongly agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly disagree

16. The information in this article will help assist and reinforce my practice/treatment habits?
   a. Strongly agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly disagree
17. The author(s) did NOT appear to be promoting a product or company? Please use COMMENT box at end of evaluation to explain or provide comment.

   a. Strongly agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly disagree

18. Author(s) communicated material clearly? Strongly agree

   a. Agree
   b. Neutral
   c. Disagree
   d. Strongly disagree

19. ACPE universal Program Number for PEF reporting purposes to CPE Monitor. Please select ANSWER (A) for this question

   a. 0120-9999-13-208-H01-P
   b. Not a valid answer choice