**Update in Pediatric Acute Otitis Media: A Review**

Galdino Eliasib Hernández-Vaquero, German A. Soto-Galindo, and José Luis Treviño González*

Department of Otolaryngology and Head and Neck Surgery, University of Nuevo Leon, USA

**Abstract**

Otitis media is a disease characterized by the presence of inflammation of infectious or non-infectious origin facilitated by dysfunction of the Eustachian tube, it occurs mostly in children due to their anatomical characteristics. The most frequent isolated agent is *Streptococcus pneumoniae* being the most common chief complaint in children. The main important risk factors are: absence of breastfeeding, use of the pacifier, assistance to daycare among others. Four clinical stages of the disease can be differentiated, tubotympanitis, hyperemia, exudative stage and suppurative stage. The diagnosis of certainty is based on the presence of acute symptoms of infection, evidence of inflammation and effusion in the middle ear. However, the diagnosis can be suspected with a high degree of certainty in patients with otalgia without an appropriate otoscopy, or with the presence of exudate in the otoscopy without otalgia or otorrhea.

Acute otitis media poorly treated can have serious complications such as facial nerve palsy, acute mastoiditis and acute bacterial meningitis. However, they are currently uncommon due to improvements in treatment regimens. The basis of the initial treatment in acute otitis media is observation during the first 48-72h and in case of therapeutic failure, the administration of high doses of amoxicillin for 5 to 10 days is recommended. In case of previous use of antibiotics or failure in the initial antibiotic therapy scheme a change of antibiotic should be considered, individualizing the condition of the patient based on the therapeutic guidelines.

**INTRODUCTION**

Acute otitis media is a clinical entity characterized by the presence of an inflammatory reaction in the middle ear, triggered by a variety of infectious or non-infectious agents [1]. This pathology occurs mostly after a high respiratory infection. There is inflammation of the mucosa and obstruction that causes negative pressure in the middle ear and effusion. Acute otitis media differs from otitis media with effusion due to the presence of signs and symptoms of inflammation [2].

**EPIDEMIOLOGY**

Acute otitis media is the most frequent chief complaint in infants, accounting 80% of children below 3 years old. This entity generates annual costs of 2.8 billion dollars in the United States [3-5]. It occurs mostly below 20 years old and it is more prevalent in men (57%) than in women (43%). Unilateral affection and positive cultures are present in the 93% of patients. The most common agent reported in the cultures is *Streptococcus pneumoniae* (25-50%), followed by *Haemophilus influenzae* (15-30%), and *Moraxella catarrhalis* (3-20%). Some authors report up to 25% of viral origin acute otitis media [6-8]. Routine immunization against *Streptococcus pneumoniae* has decreased significantly the number of hospital admissions and complications in children below 2 years old [9].

**RISK FACTORS**

Various factors have been stated to influence the development of acute otitis media. The most important risk factors are: breastfeeding absence, pacifier usage, daycare assistance, smoke exposition, craniofacial abnormalities, gastroesophageal reflux, and Down syndrome [10].

 Clinically, 4 stages can be differentiated in the course of otitis media:

**Tubotympanitis**

Nonspecific discomfort occurs, during examination a retracted tympanic membrane with loss of mobility and light reflex can be seen.

**Hyperemia**

Clinically there may be otalgia and fever up to 39 °C, during examination of the ear an opaque tympanic membrane is observed, with decreased mobility.

**Exudative**

Severe otalgia with loss of anatomical references in otoscopy.
Suppurative

There is severe pulsatile otalgia fever up to 40 °C with yellowish areas of necrosis in addition to purulent or bloody otorrhea that on presentation improves the clinical picture [11].

DIAGNOSIS

In clinical practice, the use of 3 criteria has been standardized to establish the diagnosis of acute otitis media with a high level of certainty: 1) Acute symptoms of infection, 2) Evidence of middle ear inflammation, 3) Presence of effusion in the middle ear. However, there are patients who do not meet these 3 criteria. Thus, some considerations have been added that can be taken into account to diagnose probable acute otitis media. These added criteria are as follows: a) otalgia with the impossibility of performing an appropriate otoscopy due to an obstruction in the external auditory canal to confirm the presence of exudate; b) presence of exudate confirmed by otoscopy without otalgia or otorrhea.

These criteria can be taken into account for the diagnosis of acute otitis media when accompanied by an infection of the upper airways [12].

The most frequent symptoms are otic and ear rubbing pains that have a sensitivity of 42-60% and specificity of 82-87% respectively [13].

The otoscopy examination is of vital importance to confirm the diagnosis of otitis media. The use of a pneumatic otoscope is recommended whenever it is available. There are different signs that are not necessarily pathognomonic of otitis media; however, their presence allows confirming with a high degree of certainty the diagnosis. The most important signs are: a) erythema of the tympanic membrane, b) yellowish tympanic membrane with presence of purulent material in the middle ear, c) presence of spontaneous tympanic perforation with otorrhea [14].

TREATMENT

Different treatment guidelines (Spanish Pediatric Association, diagnostic-therapeutic Otitis Media Protocols, 2007; American Academy of Pediatrics, Acute Otitis Media Clinical Practice Guidelines, 2004; México, Otitis Media, Clinical Practice Guidelines, 2011; American Academy of Family Physicians, 2013 Otitis Media, Clinical Practice Guidelines.) suggest an individualized treatment according to the patient’s conditions. This treatment is based on the management of the symptoms with analgesia. Antibiotic therapy may be postponed from 48 to 72 hours after the beginning of the symptoms. The initial recommendation is 80-90 mg/kg/day of amoxicillin in patients without previous antibiotic therapy, and amoxicillin – clavulanic acid in the case of previous antibiotic treatment. The recommended initial treatments of several guidelines are summarized in Table (1) according to the patient’s characteristics [15-19].

In patients allergic to penicillin the use of erythromycin or clindamycin plus a sulfonamide is advised [20]. When therapeutic failure is evidenced, it is recommended to follow the scheme presented in Table (2). Evidence has shown that tympanocentesis reduces the failure of antibiotic therapy by 50%. Physicians should beware the adverse effects caused by the drugs used in the treatment of otitis media. Some of these adverse effects may be the cause of treatment withdrawal if they are not informed to the patient. The adverse effects of the most commonly used drugs are shown in Table (3) [21-24].

Antibiotic resistance is an important factor to take into account

### Table 1: Summary of recommended initial treatment by age.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Recommended initial treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 Months</td>
<td>– Hospitalization is recommended.</td>
</tr>
<tr>
<td></td>
<td>– Pain management with analgesia.</td>
</tr>
<tr>
<td></td>
<td>– Tympanocentesis with culture.</td>
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<tr>
<td></td>
<td>– Cefotaxim or amoxicillin-clavulanic acid at standard doses in case of general malaise or fever.</td>
</tr>
<tr>
<td>2 to 6 Months</td>
<td>– Amoxicillin-clavulanic acid at high doses for 10 days.</td>
</tr>
<tr>
<td></td>
<td>– Pain management with analgesia.</td>
</tr>
<tr>
<td>&gt; 6 Months</td>
<td>– First 48 to 72 hours – expectant attitude in the absence of a severe clinical features or history of antibiotic taking.</td>
</tr>
<tr>
<td></td>
<td>– First line treatment - Amoxicillin at high doses for 7 to 10 days.</td>
</tr>
<tr>
<td></td>
<td>– Pain management with analgesia.</td>
</tr>
<tr>
<td></td>
<td>– Amoxicillin-clavulanic acid - in presence of severe clinical features or history of antibiotic taking.</td>
</tr>
</tbody>
</table>

### Table 2: Recommended management after initial treatment failure.

<table>
<thead>
<tr>
<th>Initial treatment with expectant attitude</th>
<th>- Amoxicillin 80-90 mg/kg/day.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Pain management with analgesia.</td>
</tr>
<tr>
<td>Previous use of antibiotics</td>
<td>- Amoxicillin-clavulanate 90mg / kg per day of amoxicillin with 6.4mg / kg per day of clavulanate divided into 2 doses for 5 to 10 days</td>
</tr>
<tr>
<td></td>
<td>- Pain management with analgesia.</td>
</tr>
<tr>
<td>Failure after 48 to 72 hours with pharmacologic treatment</td>
<td>- Ceftriaxona.</td>
</tr>
<tr>
<td></td>
<td>- Tympanocentesis</td>
</tr>
<tr>
<td></td>
<td>- Pain management with analgesia.</td>
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</tbody>
</table>
in the treatment of acute otitis media. Antibiotic resistance varies in each country and depends mainly on the use of vaccines. In countries where pneumococcal is the main agent, an incidence of 26 to 50% of penicillin resistance is observed. Most strains have intermediate or complete resistance to penicillins and are multidrug-resistant. The use of Ceftriaxone and Ofloxacin in cases of resistance to antibiotics has been demonstrated to be effective. To avoid therapeutic failure, microbiological identification and antibiotic resistance determination prior to the initiation of medical treatment is recommended [25,26].

FOLLOW-UP

[Follow-up is recommended only when symptoms persist. It is advised to perform tympanometry after 3 months after the acute otitis media episode in search of a type B tympanogram, which is associated with conductive hearing loss. In case this result is obtained it should be advised to perform tonal audiometry. The purpose of this diagnostic test is to detect long-term hearing loss. In absence of symptoms, neither follow-up, nor additional studies are required [27].

COMPLICATIONS

The development of complications in acute otitis media has decreased with the implementation of new antibiotic escheme. The reported prevalence is variable in each country and dependent on factors such as the treatment algorithms used, the causal agent and the use of vaccines. Currently the literature generally recognizes acute mastoiditis as the main complication of acute otitis media. However, some authors report an even greater prevalence of complications such as labyrinthic fistula, post-auricular abscess, and facial paralysis among others [28-33].

ACUTE MASTOIDITIS

Acute mastoiditis is caused mainly by an extension of the inflammation of the middle ear mucosa that extends to the mucosa of the mastoid causing obstruction of aditus ad antrum causing accumulation of purulent secretion in the mastoid. This inflammation can extend to the periosteum of the mastoid and produce periostitis with bone destruction. Currently, there is no consensus for diagnosis; however, the diagnosis is based on the presence of inflammatory data such as pain, redness, retro auricular inflammation or antero-inferior atrial protrusion at the same time as the reassessment of otitis media. The treatment is based on specific antibiotic therapy for the etiologic agent, can be combined with the realization of myringotomy or tympanostomy with ventilation tube. In cases with severe mastoid cells necrosis or resistant to treatment with antibiotic therapy, mastoidectomy is preferred [30-33].

FACIAL NERVE PALSY

This complication can be caused by an increase in the pressure of the middle ear or by the presence of inflammation within the bone channel that is part of the path of the facial nerve. It has an incidence of up to 0.005%. There are different hypotheses about the pathophysiology of facial paralysis among the most accepted are infection by continuity of the middle ear to the facial nerve canal, ascending through the tympanic cord, reactivation of previous viral infections or demyelination caused by bacterial toxins [34].

Treatment consists of adequate antibiotic therapy at the primary site of infection. Myringotomy can be considered if there is a bulging presence in the tympanic membrane. It is advisable to perform an electroneurography 3 to 4 days after the onset of the disease, in patients who have a presence of degeneration greater than 95% is advised the surgical decompression of the facial nerve bone canal [35].

ACUTE BACTERIAL MENINGITIS

It is the most common intracranial complication of acute otitis media. It is caused by insufficient antibacterial treatment leading to infection of the mastoid causing bone destruction and progression to infection of the meninges. The main agent implicated in this complication is Streptococcus pneumoniae. There are three important dissemination mechanisms are: a) dissemination by tissue continuity, b) retrograde dissemination caused by thrombophlebitis, c) or by dissemination routes such as oval window. The most important warning signs are: fever, headache, altered mental status and stiff neck. In children under 2 years of age, high fever, irritability, and sleepiness could also be noted.

The diagnosis is made with the findings found in the cerebrospinal fluid, it is recommended to perform a computed tomography on each patient to detect other complications. The treatment is based on an adequate antibiotic therapy with treatment of the primary origin of the infection [36-38].

DISCUSSION & CONCLUSION

Acute otitis media is one of the most relevant pathologies during childhood due to its high prevalence and possible complications, although infrequent, cause serious damage to the pediatric population. Therefore, doctors should pay special attention to this type of patients to avoid long-term damage that
causes alterations in the future development. The treatment of acute otitis media is based mainly on observation and correct antibiotic therapy regime when indicated. Patients should be monitored to ensure the reintegration of auditory functions and avoid long-term functional losses.

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3. Demant MN, Jensen RG, Jakobsen JC, Ghud C, Homæe P. The effects of ventilation tubes versus no ventilation tubes for recurrent acute otitis media or chronic otitis media with effusion in 9 to 36 month old Greenlandic children, the SIUTIT trial: study protocol for a randomized controlled trial. Trials. 2017; 18: 30.


