ORIGINAL ARTICLE

Acute Otitis Media: Prevalence of Ear Pathogens in Patients at a Public Hospital

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KEYWORDS
Acute otitis media; Bacteriology; Antimicrobial treatment

Abstract
Background and objective: Acute otitis media (AOM) is one of the most common diseases in childhood and is the most common cause of antibiotic prescriptions in children. The gold standard for identifying the pathogens causing AOM is tympanocentesis. This is only possible in the stage of AOM when exudate is retained in the middle ear. The aim of this study was to describe the prevalence of organisms causing AOM in eutrophic patients at a public paediatric hospital.

Material and methods: We included all the patients with AOM diagnosed by otomicroscopy with purulent exudate retained in middle ear and suppurative AOM with inadequate drainage consulting at the Otorhinolaryngology Department in a paediatric tertiary care centre from 2 May 2009 to 31 August 2010.

Results: 324 patients were included in the study, with 180/324 (55.6%) being male. The median age was 8 months (interquartile range: 4–15 months). Bilateral AOM was recorded in 109/324 (33.6%) patients (433 samples for culture were obtained by tympanocentesis in 324 patients). During diagnosis, 37% (120/324) of the children had been receiving antimicrobial treatment. Of the patients who had received antibiotics, 71/120 (59.1%) had bacterial growth in middle ear fluid (MEF) cultures, with 51/71 (71.8%) being susceptible to the antibiotic they received; 20/71 (28.2%) patients were receiving an antibiotic that did not cover the spectrum of organisms isolated.

Conclusion: The pathogens most frequently isolated are Streptococcus pneumoniae (39.5%), Haemophilus influenzae (37.4%), Moraxella catarrhalis (6.1%) and Streptococcus pyogenes (3.0%).

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PALABRAS CLAVE
Otitis media aguda; Bacteriología; Tratamiento antibiótico

Otitis media aguda: prevalencia de otopatógenos en pacientes de un hospital público

Resumen
Introducción y objetivo: La otitis media aguda (OMA) es una de las afecciones más frecuentes en la infancia y es la causa más común de prescripción de antibióticos en pediatría. El método indicado para identificar el germen responsable en OMA es la obtención de material del oído medio para cultivo mediante timpanocentesis. El objetivo de este estudio es describir la prevalencia de gérmenes causantes de OMA en pacientes eutróficos de uno a 120 meses, que consultaron en un hospital público pediátrico.

Método: Se incluyeron pacientes eutróficos con OMA con retención de contenido purulento en oído medio y OMA supurada con drenaje insuficiente de exudado que consultaron en el Servicio de Otorrinolaringología de un hospital pediátrico desde mayo del 2009 hasta agosto del 2010. Resultados: Se incluyeron en el estudio 324 pacientes de los cuales 180 (55,6%) eran varones. Mediana de edad: 8 meses (rango intercuartílico: 4-15 meses). OMA bilateral se registró en 109/324 (33,6%) pacientes (se obtuvieron 433 muestras para cultivo). Al momento del diagnóstico 37% (120/324) de los niños recibían antibioticoterapia. De estos, el 59% (71/120) presentaron desarrollo bacteriano en los cultivos. La antibioticoterapia era adecuada en el 71,8% de los casos; en el 28,2% restante no se cubría el espectro del germen aislado.

Conclusión: Los microorganismos más frecuentemente aislados fueron Streptococcus pneumoniae (39,5%), Haemophilus influenzae (37,4%), Moraxella catarrhalis (6,1%) y Streptococcus pyogenes (3,0%).

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Introduction

Acute otitis media (AOM) is one of the most frequent illnesses in childhood. By the time children are 2 years old, two-thirds of them have had at least 1 episode of AOM. It is the most common cause of prescribing antibiotics in pediatrics. Much has been said about this problem over the years, and the treatments have varied from indiscriminate use of broad spectrum antibiotics to symptomatic treatment without antibiotics under a “wait and see” attitude. The latter option arises in response to constant questioning about generating resistant bacteria.

The method indicated to identify the pathogen responsible in AOM is obtaining material from the middle ear to cultivate by transtympanic puncture (timpanocentesis). This is only possible in the states in which purulent exudate is retained in the cavity.

The recognised indications for timpanocentesis are:

1. AOM in severely ill patients or those with toxic signs and symptoms.
2. Unsatisfactory response to antibiotic treatment (ABT).
3. AOM in patients who are already receiving ABT.
5. AOM in newborns, very small children or immunocompromised patients.

The objective of this project was to describe the prevalence of pathogens that cause AOM in eutrophic patients from 1 to 120 months old, which were brought for consultation to a public paediatric hospital.

Population and methods

This was a prospective, descriptive, transversal and observational study carried out in the Ear, Nose and Throat Service of a public paediatric hospital between May 2009 and August 2010. This study formed part of a wider project called CAREPNEUMO (Combating Antibiotic-Resistant Pneumococci by Novel Strategies Based on in Vivo and in Vitro Host-Pathogen Interactions), which is coordinated by the Helmholtz Centre for Infection Research (Germany) and financed by the European Union. This protocol was assessed and approved by the hospital Teaching and Research and the Ethics Committee.

We considered all the symptomatic patients (fever, otalgia, irritability) with AOM with retention of purulent matter in the middle ear and serous AOM with insufficient exudate drainage who were brought for consultation in the period indicated.

We excluded patients with primary and secondary immunodeficiencies (oncological, transplanted, and acquired immunodeficiency syndrome) and patients with other comorbidities (fissured, craniofacial syndromes, and fibrocrystic illness).

When the patients presented purulent matter, we performed timpanocenteses and took samples for bacteriological study. This consisted of direct microscopic observation (GRAM) and seeding in blood-agar plates with thioglycollate broth incubated at 37 °C in air for 72 h and 7 days, respectively, in agar-chocolate plates incubated in a 5% CO₂ atmosphere for 72 h and laked blood agar with vitamin K and anaerobic broth in anaerobic conditions for 7 days.
We had previously requested signed informed consent from the parents or tutors for participation in this study. The tympanocentesis procedure consisted of:

1. Cleaning the external auditory canal (EAC) with 70% alcohol saturated with boric acid (to prevent bacterial contamination).
2. Puncturing the tympanic membrane with a needle in its most prominent region or the anterior inferior quadrant.
3. Aspiring the purulent matter with syringe with 1 cm³ of sterile physiological solution.
4. Placing the purulent matter in a sterile transport bottle for aerobic and anaerobic pathogen culture.
5. Sending the matter to the bacteriology laboratory for study.

For the statistical analysis, we used frequency distributions and measures of central tendency and dispersion. The software used was Microsoft® Windows SPSS® version 15.1.

Results

A total of 438 patients with AOM with retention of exudate diagnosed through otoscopy were seen. We excluded 114 children because they presented immunodeficiencies (primary or secondary) or other comorbidities. A total of 324 patients who complied with the criteria indicated were included in the study.

Of these, 55.6% (180/324) were male and 44.4% (144/324) were female.

The median for age was 8 months (interquartile range: 4-15 months).

In all, there were 14/324 (4.32%) patients with complications: 3/14 (21.4%) with mastoiditis; 3/14 (21.4%) with labyrinthitis; 3/14 (21.4%) with peripheral facial paralysis; 3/14 (21.4%) with bacteraemia; 1/14 (7.14%) meningitis and 1/14 (7.14%) with labyrinthitis and otomastoiditis.

Bilateral AOM was registered in 109/324 (33.6%) patients (433 samples for culture were obtained through tympanocentesis).

At the time of diagnosis, 37% (120/324) of the children were receiving ABT (Table 1). The median of antimicrobial treatment time before tympanocentesis was 4 days (interquartile range: 2-7 days). Of the patients that were receiving antibiotics, 40.8% (49/120) had a negative culture.

Of the patients that received some type of antibiotic, 59.2% (71/120) presented bacterial development in the middle ear exudate cultures. In addition, 71.8% (51/71) of the bacterial isolates in the patients with medication were sensitive to the antibiotics that were received.

At the time of consultation, 62.65% (203/324) of the patients were not taking prior antibiotic therapy. This information could not be recorded for 1 of the 324 patients.

A total of 433 samples for culture were obtained from 324 patients. Bilateral AOM was registered in 109/324 (33.6%) patients.

Negative cultures were presented by 74 children (22.8%) and 49 of them (66.2%) were under ABT when diagnosed.

In 71/324 (21.9%) patients, mixed cultures (more than 1 pathogenic middle ear germ per culture in the same patient) were recorded.

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>No. of patients</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
<td>43</td>
<td>35.83</td>
</tr>
<tr>
<td>Amoxicillin-clavulanic acid</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>38</td>
<td>31.67</td>
</tr>
<tr>
<td>Cephalaxin</td>
<td>2</td>
<td>1.67</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>1</td>
<td>0.83</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>2</td>
<td>1.67</td>
</tr>
<tr>
<td>Clarithromycin</td>
<td>2</td>
<td>1.67</td>
</tr>
<tr>
<td>Amoxicillin+amoxicillin-clavulanic acid</td>
<td>5</td>
<td>4.17</td>
</tr>
<tr>
<td>Amoxicillin+ceftriaxone</td>
<td>5</td>
<td>4.17</td>
</tr>
<tr>
<td>Amoxicillin+cephalexin</td>
<td>2</td>
<td>1.67</td>
</tr>
<tr>
<td>Amoxicillin+erythromycin</td>
<td>1</td>
<td>0.83</td>
</tr>
<tr>
<td>Amoxicillin+clarithromycin</td>
<td>1</td>
<td>0.83</td>
</tr>
<tr>
<td>Amoxicillin+cefuroxime+amoxicillin-clavulanic acid</td>
<td>1</td>
<td>0.83</td>
</tr>
<tr>
<td>Amoxicillin-clavulanic acid+cefuroxime</td>
<td>1</td>
<td>0.83</td>
</tr>
<tr>
<td>Trimethoprim-sulfamethoxazole (prophylaxis)</td>
<td>1</td>
<td>0.83</td>
</tr>
<tr>
<td>Furadantin (prophylaxis)</td>
<td>1</td>
<td>0.83</td>
</tr>
<tr>
<td>Unknown</td>
<td>2</td>
<td>1.67</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 1  Antibiotic Therapy Received by the Patients Studied Before the AOM Diagnosis and Culture-Taking.

Bacteriology

In the middle ear exudate of 250 patients, 326 pathogens were isolated (Table 2).

Of the Streptococcus pneumoniae (S. pneumoniae), 69.8% (90/129) were sensitive to penicillin; 37/129 (28.7%) had intermediate sensitivity and only 2/129 (1.5%) were strains resistant to this antibiotic.

Of the 129 pneumococci isolated, 124 strains were typified (Fig. 1).

In our population, only 7.4% of the patients were immunised, given that this vaccine was not found in the official calendar at the time of the study.

Serotypes 6A, 6B, 9V, 14, 19A, 19F and 23F are considered those of greatest bacterial resistance. Only serotypes 6A,
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9V, 14 and 19A presented high resistance to penicillin in our study. The potential coverage of the various vaccines in AOM would be 40.2% with 7-valent pneumococcal conjugate vaccine (PCV7), 46.5% with PCV10, and 71.7% with PCV13 of the strains isolated.

Of the Haemophilus influenzae (H. influenzae) isolated, 29.5% (36/122) were resistant to ampicillin through beta lactamase production.

Of the 14/324 patients who presented complicated AOM (4.32%), the following strains were isolated: Streptococcus pyogenes (S. pyogenes) in 3/14 (21.43%), penicillin-sensitive S. pneumoniae in 2/14 (14.28%), methicillin-resistant Staphylococcus aureus in 1/14 (7.14%), non-beta lactamase producing H. influenzae in 1/14 (7.14%) and 7 were negative (50%).

Discussion

The appearance of antibiotics brought about a decrease in complications and mortality from this problem. However, it also brought the indiscriminate use of these antibiotics. Different therapy regimes and even prophylactic long term antibiotic use appeared. This led to the current concern in the medical community: the emergence of resistant bacteria, that is, when various authors began to propose a «wait and see approach» when confronted with AOM, administering only symptomatic treatment and assessing the patient.

The half-way point in this quandary is found one step before treating the disorder. We can find the way to use antibiotics rationally in the diagnosis, in the first place, and in the patient, in the second.

Authors in the United States4 re-examined patients with a diagnosis of AOM and found a diagnostic error in 50% of the cases. In Chile, Rosenblut et al.6 assessed children older than 3 months referred to the Ear, Nose and Throat Department for AOM study and found that the initial diagnosis of AOM was confirmed in only 222 of 529 (41.9%) cases. With these data, we could say that, by performing a good diagnosis, we would use 50% less antibiotics.

The ear, nose and throat specialist plays an essential role, which is why we stress the importance and the value of otomicroscopy in AOM diagnosis. The EAC in children, especially in newborns, is shorter, narrower and collapsible; consequently, good cleaning and appropriate illumination are essential for making a precise diagnosis and therefore avoiding the first step in indiscriminate use of antibiotics.

Diagnostic error would be the cause of possible bacterial resistance, not the antibiotic itself.

Some authors consider appropriate 1–3 doses of parenteral antibiotic therapy for AOM. In our study, it is noticeable that 36% of the patients with antibiotic therapy before diagnosis had received ceftriaxone parenterally and the AOM had not been cured.

Analysing the same data, the pathogens most frequently isolated in our population were: S. pneumoniae (39.5%), H. influenzae (37.4%), Moraxella catarrhalis (M. catarrhalis) (6.1%) and S. pyogenes (3.0%). Except for beta lactamase producing H. influenzae and M. catarrhalis; the rest of the pathogens (which corresponded to 79.3%) were sensitive to amoxicillin.

We should also consider the characteristics of the population studied. It is noteworthy that the published studies that showed success in symptomatic treatment of AOM come from such countries as Holland, Denmark, Norway, the United States, etc. (where, on the other hand, the prevalence of complications also increased).

The developing countries present a very different reality. The possibility of follow-up is scant and the nutritional and immunological state of the child is generally insufficient. Consequently, early diagnosis and intervention are essential to prevent complications. Spontaneous cure of the disease is lower in children younger than 2 years old. Patients of any age with severe AOM and those with family history of this condition are the ones who benefit most from antibiotic therapy.6

With respect to a study by Sibbald,7 some similarities and other variations appear in relation to our data. We agree that it is common for otitis media with effusion (EOM) to be confused with AOM, and that this error leads to unnecessary ABT. A strategy posed in that study7 is limiting treatment length to 5 days instead of the conventional 10 days in children at low risk. In our hospital setting, we do not generally have low-risk children, so shortening treatment length could lead to increasing bacterial resistance.

The other difference with the study cited is that it considers S. pneumoniae to be the most frequent pathogen, the most aggressive and the one with the least possibilities of spontaneous cure. In our study, S. pneumoniae was coincidentally the most frequent pathogen, but only 1.5% (2/129 patients) presented resistance to penicillin and the largest number of complications occurred with S. pyogenes (Group A beta-haemolytic streptococcus).

Despite appropriate antimicrobial treatments, AOM complications still occur in our environment.

The elevated percent of labyrinthitis observed in our study is noteworthy, in spite of the small size of the sample studied. This could be due to the fact that the clinical picture is transitory and reversible in the cases of serous labyrinthitis from AOM. In small children and breastfeeding infants, it can be underdiagnosed, given that the signs and symptoms can be transitory and not pathognomonic. In cases with fever, labyrinthitis signs and symptoms simulate a meningeal syndrome; in cases without fever, the condition can go unnoticed, above all in patients that are not walking. The prognosis after therapy with antibiotics and after myringotomy is generally favourable, so many cases are probably cured with AOM treatment without a precise diagnosis of the complication being made.
Conclusions

The pathogens most frequently isolated in the sample studied were as follows: *S. pneumoniae* (39.5%), *H. influenzae* (37.4%), *M. catarrhalis* (6.1%) and *S. pyogenes* (3.0%).

Of the isolates, 79.3% were sensitive to amoxicillin. For this reason, the treatment of choice for children with AOM is amoxicillin at 80–100 mg/kg/day. AOM is not only one of the most frequent illnesses in childhood, but it is also one of the most overdiagnosed. Consequently, it is also the most common cause of overprescription of antibiotics.

Funding

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Conflict of Interests

The authors have no conflict of interest to declare.

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