Acute mastoiditis: a 10 year retrospective study


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Received 18 December 2001; received in revised form 8 July 2002; accepted 9 July 2002

Abstract

This retrospective study reviews our experience in the management of acute otomastoiditis over 10 years. During the study period we identified 40 cases in children aged 3 months–15 years with a peak incidence in the second year of life. Sixty per cent of them had a history of acute otitis media (AOM). All the children were already receiving oral antibiotic therapy. Otitis, fever, poor feeding and vomiting were the most common symptoms, all the children had evidence of retroauricular inflammation. Computerized tomography (CT) and magnetic resonance imaging (MRI) were used to support the diagnosis and to evaluate possible complications. Streptococcus pneumoniae was the most common isolated bacterium. All the patients received intravenous antibiotics, 65% of children received only medical treatment, 35% also underwent surgical intervention. Mean length of hospital stay was 12.3 days. Cholesteathoma was diagnosed in one child. We conclude from our study that acute otomastoiditis is a disease mainly affecting young children, that develops from AOM resistant to oral antibiotics. Adequate initial management always requires intravenous antibiotics, conservative surgical treatment with myringotomy is appropriate in children not responding within 48 h from beginning of therapy. Mastoidectomy should be performed in all the patients with acute coalescent mastoiditis or in case of evidence of intracranial complications.

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Keywords: Acute mastoiditis; Acute suppurative otitis media; Children

1. Introduction

Acute otomastoiditis is an infrequent complication of acute otitis media (AOM), it has become less common in children since antibiotic treatment of AOM was adopted [1–4]. From 1946 to date, house reported a 50% reduction in admissions for AOM and an 80% reduction in the number of mastoidectomies performed after the introduction of sulfonamides [5].

It is widely accepted that the incidence of acute mastoiditis is decreasing as a result of the availability of antibiotics and proper medical care [4–7]. Today, the estimated incidence is 2–4 out of 100 000 AOM cases in industrialized countries [6–8].
However, complications have not changed in number or severity and they mainly include: subperiosteal abscess, labryntinitis, facial paralysis, meningitis, cerebral abscess, lateral sinus tromboflebitis, and death [8–12].

Otomastoiditis is more frequent in males aged between 1 and 3 years [6,9].

*Streptococcus pneumoniae*, *Haemophilus influenzae* and *Branhamella catarralis* followed by beta *Haemolityc streptococcus* are the most common infectious pathogens [4,8,13,14]. These agents usually cause monobacterial otitis media with inflammation of the mucoperiosteum in the middle ear, swelling and mucosal hyperplasia.

The following pathological stages are successively encountered in the development of acute mastoiditis:

- blocking of the aditus ad antrum;
- trapping of exudate in mastoid cells;
- spreading of pus to the periosteum through the mastoid emissary veins and formation of mastoid subperiosteal abscess (acute mastoiditis with periosteitis);
- demineralization of bone septa and osteonecrosis of thinner mastoid walls;
- creation of large purulent cavities (acute coalescent mastoiditis).

Children with acute mastoiditis present otalgia, fever, protosis of the auricle, erythema, and disappearance of the retroauricular sulcus [6,13,14]. The tympanic membrane is usually inflamed and thickened and may also be perforated with mucopurulent otorrhea. The poster-superior wall may protrude in the external auditory channel [1,3,6].

Children affected by acute mastoiditis with periosteitis are usually hospitalized for parenteral antibiotic and/or surgical treatment [1,4], it is important to distinguish this condition from acute coalescent mastoiditis which requires immediate surgery [4,8,15].

The diagnostic role of X-ray examination is limited, while computerized tomography (CT) is useful to study the morphology of mastoid cells and magnetic resonance imaging is optimal in case of suspected intracranial complications [16,17].

There is universal agreement on the need for surgical drainage of the subperiosteal abscess in order to prevent the spread of suppuration to vital areas. However, new antibiotics therapies and adequate treatment protocols seem to have arrested developing otomastoiditis at the stages, described above, thus, avoiding mastoidectomy in a large number of cases [4,6,10].

This study reports the author’s experience in the treatment of children admitted for acute mastoiditis to the ENT department of G. Gaslini Institute over the last 10 years.

### 2. Materials and methods

We reviewed the clinical records of all the patients admitted for acute mastoiditis to the ENT department of G. Gaslini Institute between January 1991 and December 2000.

Criteria for diagnosis of otomastoiditis were:

- otomicroscopic evidence of purulent AOM;
- postauricular swelling, erythema and tenderness;
- anteroinferior displacement of the auricle.

Exclusion criteria were:

- AOM without evidence of otomastoiditis;
- AOM with retroauricular adenitis;
- external otitis with retroauricular involvement;
- presence of cholesteatoma.

Criteria for including children in the medical therapy program were:

- absence of toxic appearance or signs of intracranial involvement;
- absence of postauricular fluctuation;
- absence of CT signs of mastoid bone cell destruction.

Criteria for selection of surgery were:

- intracranial complications;
- evidence of postauricular fluctuation;
- diagnosis of acute coalescent mastoiditis;
- failure of medical therapy program.
During the study period we identified 40 cases of acute mastoiditis.

All the patients were hospitalized and treated at Gaslini Institute by a team including an otolaryngologist, a pediatrician and a infections disease specialist.

All the patients received intravenous antibiotic therapy associating ceftazidime (50–100 mg per kg per die) and netilmicine (6–7.5 mg kg per die).

Surgery was performed in cases not responding to therapy within 48 h, or in case of complications.

3. Results

This study included 40 children (22 males and 18 females) aged from 6 months to 12 years with a mean age of 4.5 years (Fig. 1). Sixty percent of patients had a history of AOM, with a peak incidence in the second year of life.

All the children presenting acute otomastoiditis were already receiving oral antibiotics such as amoxicillin, cephalosporin or macrolides.

Otalgia, often manifested as irritability, was the most frequent symptom (80%), followed by fever (50%), poor feeding (40%) and vomiting (15%).

Upper respiratory tract infection was present in 60% of cases.

All the children studied had evidence of retroauricular inflammation. In 75% of them we observed postauricular swelling (with erytema, disappearance of the retroauricular sulcus and proptosis of the auricle), the remaining 25% also had postauricular fluctuation. The tympanic membrane was described as abnormal in all the children: dull in 60%, perforated with otorrhea in 15% (Table 1).

Cultures were obtained in 28 cases, 12 (42.8%) of which were negative. In 8 (28.6%) of the 16 (57.2%) positive cultures, S. pneumoniae was the most common isolated bacterium. We also isolated three cases of Staphylococcus aureus (10.7%), two cases of Pseudomonas aeruginosa (7.1%), one case of Haemophilus, one of Proteus mirabilis, and one of Escherichia coli (3.6%).

In the 16 positive cases, the previously administered antibiotic was:

Table 1

<table>
<thead>
<tr>
<th>Symptoms and signs of otomastoiditis in children</th>
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<td>Symptom</td>
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<td>Signs</td>
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<td>Dull tympanic membrane</td>
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<td>Otorrhea</td>
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<td>Postauricular swelling</td>
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<td>Postauricular fluctuation</td>
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Fig. 1. Age distribution of otomastoiditis.
- not adequate in four cases (25%): *P. aeruginosa* [2], *P. mirabilis* [1], *E. coli* [1];
- adequate but administered at inadequate dosage in two cases (12.5%): *S. pneumoniae* [1], *S. aureus* [1];
- adequate, but ineffective due to resistant microorganism in ten cases (62.5%): *S. pneumoniae* [7], *S. aureus* [2], *H. influenzae* [1].

Plain mastoid radiography was performed in 38 children, while 30 cases underwent computed tomography, and five with suspected intracranial complications also underwent magnetic resonance. All the cases were reported as abnormal.

All the patients received intravenous antibiotics for mean 10 days. Additional oral antibiotic therapy (cefamandole 50–70 mg per kg per die) was administered after discharge in 80% of our patients (mean duration 9.7 days).

About 26 (65%) children received only medical treatment. In these cases, no further treatment was required and no relapse was observed. About 14 (35%) patients also underwent surgery, namely myringotomy eight cases (20%), and mastoidectomy six (15%), five of these latter patients (12.5%) underwent antroatticotomy and one (2.5%) had a radical modified mastoidectomy [18] (Fig. 2).

The mean length of hospital stay was 12.3 days (range 7–22 days).

4. Discussion

Although several literature reports show that the incidence of acute mastoiditis was decreased over the last few years, there is evidence that it has recently been rising again [6,19,20].

This phenomenon could be due to the increasing antibiotic resistance (62.5% of our positive cultures) of microorganisms like *Streptococcus* to *Penicillin*, in particular the penicillinase-producing *S. pneumoniae* and the β-lactamase producing strains of *Moraxella* and *Haemophilus* [6,10,20].

In addition, the initial treatment can be insufficient (duration, dose) or not proper, leading to an increase in complications such as acute mastoiditis in the majority of cases [6]. In fact, 60% of our patients, in the 30 days before admission to our department, showed evidence of acute or recurrent suppurative otitis media, which can be interpreted as a risk factor of mastoiditis.
Before antibiotics were introduced, acute mastoiditis was a disorder of older children. Recent papers have documented an increased incidence in infants aged under 2 years [21,22]. Our study reports the same trend and suggests that today this disease mainly affects young children.

We could explain this phenomenon by the fact that young children are sent early to day care centers, where they are exposed to the risk of developing recurrent AOM [23,24].

Acute mastoiditis arises when the most resistant strains are involved and develops through blocking of the aditus ad antrum with trapping of secretions in mastoid cells. Of infectioning spread to the periosteum can cause periosteitis, while acute coalescent mastoiditis occurs when the infection extends beyond the mucoperiosteum and destroys bone walls. This series of events may be arrested at any stages if early recognized and adequately treated [4].

Acute mastoiditis is essentially a clinical manifestation and should be suspected on the basis of anamnesis and clinical examination, showing recent evidence of AOM [4,6]. The tympanic membrane is usually thickened and inflamed but may also be perforated with Mucopurulent otitis media. Other signs include retroauricular swelling, erythema, tenderness, and displacement of the pinna [1,3,6,13,14].

Moreover, mastoiditis can remain undetected as the pathologic secretions may drain through the tube and middle ear findings may result normal: this condition is known as masked mastoiditis. Diagnosis is radiological, showing suppurative in mastoid cells in the absence of the classic signs of otitis media [7,15,21]. MR imaging is used to support the diagnosis and to evaluate complications.

Plain radiographs are not helpful in the diagnosis of acute mastoiditis and they proved to be misleading in 16 of our cases (40%). Actually, the specificity of plain films is too low to justify their use in the diagnosis of acute mastoiditis in children.

CT scans of both temporal bone and central nervous system should be performed to identify not only acute mastoiditis but also intratemporal or intracranial complications such as sigmoid sinus thrombosis or cerebral abscess [12,22–24]. In these cases, MR is also required to better evaluate the stage of intracranial complications.

CT scans have contributed to a better definition of the pathogenesis of this disease [4,6,16,17]. The swollen mucosal lining favors filling of the mastoid cells with mucopurulent secretions. In acute mastoiditis, inflammation of the periosteum causes abnormal new bone formation: the trabeculae appear intact and no postauricular abscess can be demonstrated. In cases of acute coalescent mastoiditis, CT confirms coalescence of the mastoid cells and subperiosteal abscess [4,16,17].

All our patients received intravenous antibiotics with rapid regression of symptoms and full recovery in 65% of them.

A conservative surgical approach such as a myringotomy was adopted in 20% of patients not responding within 48 h from beginning of antibiotic therapy (no regression of fever, pain, vomiting, and poor feeding). After myringotomy, middle ear secretion was aspirated and sent for microbiological studies.

Surgical intervention (antroatticotomy) was performed in all the cases (five patients, 12.5%) with evidence of acute coalescent mastoiditis in order to drain the abscess and prevent further intratemporal and intracranial complications. One patient (2.5%), aged 10 years, presented a cholesteatoma and, therefore, underwent radical modified mastoidectomy. Cholesteatoma should be suspected when mastoiditis occurs in children, above 8 years of age.

Similarly to other reported series, surgical treatment was necessary in 15% of our patients (Vera-Cruz (17.7%), Rosen (32%) or Papournas (23.2%) [3,6,19].

5. Conclusions

On the basis of our retrospective study, we can draw the following conclusions:

- Acute mastoiditis is a disease mainly affecting children [6,9].
- AOM resistant to oral antibiotics is the first risk factor [6,10,20].
— The most common symptoms are: persistent ear pain, fever and poor feeding [1,3,6,20].
— Retroauricular erythema, proptosis of the auricle and inflammation of the tympanic membrane are the main clinical signs of acute mastoiditis [1,3,6].
— Radiological imaging can only support the clinical diagnosis, however, CT scan should be performed to identify intratemporal or intracranial complications, while magnetic resonance imaging (MRI) is useful to better evaluate intracranial complications. Conversely, plain radiographs are not helpful [12,16,17,22–24].
— Adequate initial management always requires intravenous antibiotics [5–7], in our series, we obtained good results with ceftazidime in association with netilmicine.
— Conservative surgical treatment with myringotomy is appropriate in children not responding within 48 h from beginning of therapy [4,6,10].
— Mastoidectomy should be performed in all cases of acute coalescent mastoiditis, when there is evidence of intracranial complications and when conservative treatment is unsuccessful [4,6,18].
— Close follow-up after discharge is mandatory, even when the patient responds readily to therapy [3,6,19].

References