



## Acute mastoiditis in children: A retrospective study of 188 patients

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### ABSTRACT

**Objective:** The aim of this study is to define the clinical and bacteriological characteristics of acute mastoiditis (AM) in children in order to optimize diagnostic work-up and treatment.

**Methods:** In this retrospective study, 188 children between 3 months and 15 years of age ( $15 \pm 24$  months; median  $\pm$  SD) were referred to our pediatric ENT emergency center for AM during a 7-year period (December 2001–January 2008).

**Results:** Fifty seven percent were male and 43% were female. Clinical follow-up duration was  $3.9 \pm 0.7$  months (mean  $\pm$  SEM). The incidence of AM remained stable during the whole study period. Microbiological samples ( $n = 236$ ) were negative in 33% of cases. The most frequently isolated germs were *Streptococcus pneumoniae* (51%), *Streptococcus pyogenes* (11.5%), *Anaerobes* (6.5%), and coagulase-negative *Staphylococcus* (6.5%). Paracentesis, puncture of retro auricular abscess under local anesthesia, and peroperative samples all contributed to isolate the involved germ(s). All the patients were hospitalized and received intravenous antibiotics, and 36.2% ( $n = 68$ ) underwent surgery. Several surgical procedures were necessary in 4 cases (2.1%). AM recurrences requiring a second hospitalization were observed in 8 patients (4.3%). The only observed complication was lateral sinus thrombosis ( $n = 6$ ; 3.2%). Surgical failures, requiring more than one surgical procedure, were more frequent in case of: (i) presence of *Anaerobes* ( $p \leq 0.001$ ) or Gram-negative bacteria ( $p \leq 0.05$ ) in microbiological samples; (ii) surgical drainage without mastoidectomy ( $p \leq 0.001$ ). Recurrences were more frequent in AM due to *Streptococcus pneumoniae*.

**Conclusions:** Based on our findings and on literature data, a protocol was established in order to standardize the management of pediatric AM in our center. The main points are: no systematic surgery; if surgery is indicated, it must encompass a mastoidectomy; broad-spectrum intravenous antibiotic treatment covering the most commonly involved germs (3rd generation cephalosporin) and secondarily adapted to the results of microbiological samples. If the infection is not controlled after 48 h of intravenous antibiotherapy, a mastoidectomy had to be performed.

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## 1. Introduction

Acute mastoiditis (AM) is still a common complication of acute otitis media (AOM). In a study reviewing 66 international studies, the percentage of AOM complicated with AM was 0.24% [1]. This rate is higher in developing countries (0.19–0.74%) [2]. Recent incidence increases have been described in some communities [3–7] because of the increase in the percentage of resistant germs to antibiotics and maybe also because of the decrease of antibiotics use in AOM. As a matter of fact, AM incidence ranges from 3.5 to 4.2/100,000 people/year in countries where few antibiotics are prescribed versus 1.2–2/100,000 people/year in countries where antibiotics are more readily prescribed [8].

Our center is responsible for the management of pediatric ENT emergencies in the “ile de France” district, an area which encompasses about 2.3 millions children. Residents and fellows who take duties in this center come from various hospitals, which is a source of great heterogeneity in diagnostic and therapeutic strategies.

The aim of this present study was to try to standardize and to optimize the treatment of pediatric AM by proposing a management protocol based on the analysis of a retrospective series of 188 AM cases, and by reviewing literature data.

## 2. Material and methods

This retrospective study analyzed a series of 188 pediatric cases of AM diagnosed and treated between December 2001 and January 2008 at the pediatric ENT emergency center in Necker-Enfants Malades Hospital, Paris, France. AM was diagnosed in case of AOM associated with at least one of the following anomalies: swelling,

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erythema, tenderness of the retro auricular area, or anteroinferior displacement of the auricle.

Retrieving patients clinical charts, the following data were collected: age, sex, medical history, antibiotic therapy before hospitalization, clinical presentation at admission, CT imaging, microbiological findings, treatment, outcome, and follow-up duration. Four types of clinical evolution were distinguished to define patients outcome: treatment success, surgical failures requiring additional surgery during the same hospitalization, AM recurrences requiring a second hospitalization, and clinical complication. We tested the correlation between the clinical outcome and the following parameters: patients age and symptoms, antibiotic treatment prior to hospitalization, medical and surgical treatment received during hospitalization, and isolated germs.

Student's *t*-test (unpaired, equal variance) and Chi<sup>2</sup> test were used to detect correlations between clinical or paraclinical parameters and the clinical outcome. *p* values of  $\leq 0.05$  were considered to be statistically significant.

### 3. Results

#### 3.1. Overall clinical characteristics

The annual number of AM remained stable during the whole study period (Table 1). The median age of our patients was 15 months (range: 3 weeks to 15 years). Fifty seven percent were male ( $n = 108$ ) and 43% were female ( $n = 80$ ). One point one percent of AM ( $n = 2$ ) were bilateral and 0.5% ( $n = 1$ ) were associated with a cholesteatoma discovered during mastoidectomy. Symptoms at admission were not reported in the clinical charts in two cases. Among the other 186 patients, 59% ( $n = 110$ ) had typical AOM symptoms and signs, and 41% ( $n = 76$ ) had an isolated fever or upper respiratory tract infection before presenting AM symptoms. Treatment received before hospitalization was mentioned for 179 patients (95.2%). Among them, 62.5% had taken antibiotics ( $n = 112$ ).

#### 3.2. Microbiological investigations

236 microbiological samples were performed (including recurrences): 155 paracentesis (65.7%), 31 punctures of retro auricular abscess under local anesthesia (13.1%), and 50 peroperative samples (21.2%). No germ was isolated in 28.4% ( $n = 44$ ), 35.5% ( $n = 11$ ) and 46% ( $n = 23$ ) respectively.

For 22 patients of the 31 who had a retro auricular puncture under local anesthesia, another bacteriological sample performed by paracentesis or peroperative allowed to isolate the germ in 36% of cases ( $n = 8/22$ ).

In the 35 patients who had a peroperative sample after paracentesis or puncture under local anesthesia, the peroperative sample allowed to discover another germ in 23% ( $n = 8/35$ ).

Among the 158 positive samples, 171 germs were isolated (Table 2). The most frequently isolated germs were *Streptococcus pneumoniae* (51%,  $n = 87$ ), *Streptococcus pyogenes* (11.5%,  $n = 20$ ), *Anaerobes* (6.5%,  $n = 11$ ), and coagulase-negative *Staphylococcus* (7.6%,  $n = 13$ ).

Despite the mandatory vaccine against *Streptococcus pneumoniae* till 2006, the number of *Streptococcus pneumoniae* positive

**Table 1**  
Number of new cases of AM per year from 2003 to 2007.

Year	2003	2004	2005	2006	2007
Number of cases	26	38	33	33	35

AM, acute mastoiditis.

**Table 2**

171 germs isolated from the 158 positive microbiological samples.

Germs	%	<i>n</i>
<i>Streptococcus pneumoniae</i>	51	87
<i>Streptococcus pyogenes</i> (GAS)	11.5	20
<i>Anaerobes</i> ( <i>Fusobacterium necrophorum</i> )	6.5 (5.8)	11 (10)
Coagulase-negative <i>Staphylococcus</i>	7.6	13
<i>Haemophilus influenzae</i>	4.5	8
<i>Pseudomonas aeruginosa</i>	4.5	8
Gram-negative bacteria	4	7
<i>Staphylococcus aureus</i>	3.5	6
<i>Corynebacteria</i>	2.5	4
<i>Turicella otitidis</i>	2.5	4
Alpha-hemolytic <i>Streptococcus</i>	1.2	2
<i>Streptococcus mitis</i>	0.6	1

*n*, number; %, percentage; GAS, Group A *Streptococcus*.

samples did not vary: 54% before 2007 (68/126 positive samples) and 59% in 2007 (19/32 positive samples) ( $p = 0.58$ , Chi<sup>2</sup> test).

#### 3.3. Treatment and follow-up

During hospitalization all the patients underwent intravenous antibiotic treatment. Information about the chosen antibiotics was missing in two cases. For the other 186 patients, 185 received a bitherapy and one received a monotherapy (amoxicillin/clavulanic acid). Details about the antibiotic treatment are given in Table 3.

After diagnosis of AM, 36.2% of the patients underwent surgery ( $n = 68/188$ ): mastoidectomy was performed in 91.2% ( $n = 62/68$ , 61 were unilateral and one bilateral), simple drainage of retro auricular abscess in 8.8% ( $n = 6/68$ ). A CT scan was performed in all the patients who underwent surgery.

After hospitalization, all the 188 patients had an oral or intramuscularly antibiotic treatment to carry on. Treatment was known for 177 patients. A monotherapy was prescribed in 74.5% ( $n = 132/177$ ) and a bitherapy in 25.5% ( $n = 45/177$ ). For monotherapy treatment, amoxicillin/clavulanic acid was given in 66% ( $n = 87/132$ ), amoxicillin in 14.4% ( $n = 19/132$ ) and ceftriaxone in 14.4% ( $n = 19/132$ ). The most frequent bitherapies were amoxicillin/clavulanic acid–amoxicillin in 42.2% ( $n = 19/45$ ) and amoxicillin/clavulanic acid–ceftriaxone in 24.4% ( $n = 11/45$ ). The antibiotic therapy duration was known for 171 patients and was of 9.2 days  $\pm$  3.88 (mean  $\pm$  SD).

#### 3.4. Evolution

The clinical follow-up was of 3.9  $\pm$  0.7 months (mean  $\pm$  SEM). Ninety percent of patients ( $n = 170/188$ ) had a complete recovery after initial treatment.

Surgical failure was observed in 2.1% of cases ( $n = 4/188$ ): 3% of mastoidectomies ( $n = 2/62$ ) and 33.3% of surgical drainage without mastoidectomy ( $n = 2/6$ ). For these four surgical failure cases,

**Table 3**  
Intravenous antibiotic treatment given during hospitalization in the 186 cases.

Intravenous antibiotic treatment	<i>n</i>	%
Beta lactamase	186	100
Ceftriaxone	159	85.5
Cefotaxim	24	13
Ceftazidim	1	0.5
Amoxicillin/clavulanic acid	2	1
Amino glycosides	119	64
Fosfomycin	50	27
Metronidazole	34	19
Macrolides (clindamycin)	12	6.4
Rifampin	8	4.3
Glycopeptides (vancomycin)	1	0.5

*n*, number of patients; %, percentage.

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