



## Clinical presentation of acute mastoiditis in children

Cheun-Bin Jiang<sup>1</sup>, Nan-Chang Chiu<sup>1</sup>, Chyong-Hsin Hsu<sup>1</sup>, Kuo-Sheng Lee<sup>2</sup>,  
Min-Tsan Shu<sup>2</sup>, Fu-Yuan Huang<sup>1</sup>

<sup>1</sup>Departments of Pediatrics and <sup>2</sup>Otolaryngopharyngology, Mackay Memorial Hospital, Taipei, Taiwan, ROC

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Nineteen children with 21 episodes of acute mastoiditis were treated in our hospital from 1989 to 1998. The diagnosis was based on physical, radiologic, and surgical findings. The affected children were aged from 1 year old to 17 years old, with the peak incidence at 4 years old (23.8%). Postauricular pain (90.5%) and fever (81%) were the most common harbingers of incipient acute mastoiditis. *Streptococcus pneumoniae* (38.1%) was the most common organism isolated followed by *Pseudomonas aeruginosa* (23.8%). Underlying diseases such as leukemia and myeloid metaplasia were found in 38.6% of patients. All of the patients were initially treated with intravenous antibiotics during hospitalization. Six patients were managed with an adjunctive drainage procedure such as myringotomy or mastoidectomy. The most common complication of acute mastoiditis was hearing loss (31.6%); the second was meningitis (21.1%). Subperiosteal abscess was found in two patients and brain abscess in one. Although acute mastoiditis is an uncommon condition, early diagnosis and management are necessary to prevent more serious complications.

**Key words:** Acute mastoiditis, myringotomy, mastoidectomy

Acute mastoiditis is uncommon today but remains a potentially serious condition [1]. The incidence of acute mastoiditis has declined since the advent of antimicrobial agents. This marked decline is underscored by the fact that even a large public hospital in the United States treated only two or three such cases of acute mastoiditis a year in a 25-year span from 1955 to 1979 [2]. However, serious and life-threatening complications including periauricular subperiosteal abscess and brain abscess continue to be seen in the post-antibiotic era [3]. This study sought to determine the clinical presentation of children with acute mastoiditis.

### Materials and Methods

We examined the medical records of all patients less than 18 years of age who were hospitalized due to acute mastoiditis from 1989 to 1998. Charts were reviewed to confirm the diagnosis of acute mastoiditis according based on the following criteria: 1. Physical examination revealed postauricular swelling with varying degrees of erythema, tenderness, and protrusion of the auricle, and/or had evidence of acute or subacute otitis media. 2. Radiographs revealed clouding of ipsilateral mastoid

air cells [3]. Patients with a diagnosis of chronic otitis media, acute otitis media without evidence of acute mastoiditis, retroauricular adenitis or trauma were excluded. Data entry forms were used to collect historical, clinical and laboratory data, preadmission history, clinical findings on examination, results of radiological and audiological studies, bacteriologic findings, in-hospital treatment, surgical management, length of hospitalization and/or the presence of complications secondary to acute mastoiditis.

### Results

A total of 21 episodes of acute mastoiditis in 19 children that met entry criteria were treated at our hospital from 1989 to 1998. Of these children, 11 (57.7%) were between 4 and 8 years of age. The peak incidence was at age 4 (Fig. 1). Twelve patients (63.2%) were male and nine (47.4%) were female. The mean age of all patients was  $8.3 \pm 5.1$  years old.

All children presenting with acute mastoiditis had prodromal symptoms lasting from 1 to 21 days (mean  $4.5 \pm 4.2$  days). The preadmission history showed that 13 patients (61.9%) had a clinically significant antecedent otitis media. Postauricular pain was the most common clinical symptom (90.5%) followed by persistent fever (mean oral temperature was  $39.8^\circ\text{C}$ ) (81.0%). Other common clinical symptoms/signs included bulging tympanic membrane, otorrhea,

Corresponding author: Dr. Cheun-Bin Jiang, Department of Pediatrics, Mackay Memorial Hospital, NO. 92, Section 2, Chung Shan North Road, Taipei, Taiwan, ROC.

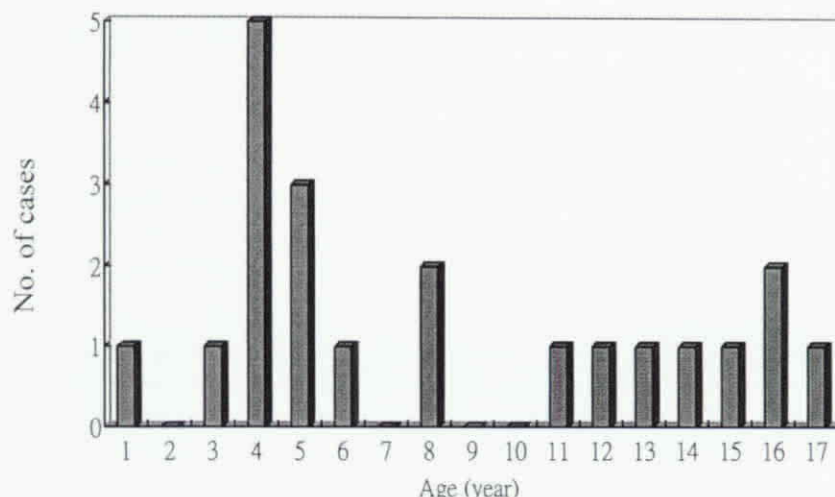


Fig.1. The age distribution of 21 episodes of acute mastoiditis.

prominent pinna, and coryza (Table 1).

Seven children (36.8%) had underlying diseases. Two children had received previous chemotherapy for the treatment of acute lymphoblastic leukemia. One patient with cerebral palsy and seizure disorder had two episodes of acute mastoiditis. Other underlying conditions included myeloid metaplasia ( $n = 1$ ), common variable immune deficiency ( $n = 1$ ), diabetic ketoacidosis ( $n = 1$ ), and ear canal atresia ( $n = 1$ ).

Two children had leukopenia (WBC counts  $< 5,000/\text{mm}^3$ ). Ten children had elevated WBC counts from  $10,000/\text{mm}^3$  to  $20,000/\text{mm}^3$ , and five children had WBC counts greater than  $20,000/\text{mm}^3$ .

Six children underwent lumbar puncture for suspected meningitis. Among them, three patients had positive culture from the cerebrospinal fluid. Two were *Streptococcus pneumoniae* and one was *Pseudomonas aeruginosa*.

Cultures were performed from ear discharge, myringotomy, mastoidectomy specimens, or cerebrospinal fluid. No growth was reported in four of

the cultures. *S. pneumoniae* (38.1%) was the most commonly isolated organism, followed by *P. aeruginosa*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, and other bacteria (Table 2).

All patients underwent radiography. A plain mastoid film was taken for every patient. In addition, computed tomography (CT) scan was done in seven cases, and magnetic resonance (MR) imaging was done in one. Opacity or clouding of the mastoid cells was noted in all the radiological films, and evidence of bony destruction was found in three cases (14.3%).

All of the children were initially treated with intravenous antibiotics. Fifteen patients (71.4%) received only medical treatment while six (28.6%) were treated with medication plus surgical intervention such

Table 1. Clinical symptoms and signs in 21 episodes of acute mastoiditis

Symptom/sign	No. of cases (%)
Ear and/or postauricular pain	19 (90.5)
Fever	17 (81.0)
Bulging tympanic membrane	16 (76.2)
Otorrhea	7 (33.3)
Prominent pinna	7 (33.3)
Coryza	6 (28.6)
Vomiting	4 (19.0)
Poor appetite	4 (19.0)
Perforated tympanic membrane	2 (9.5)

Table 2. Organisms isolated from 21 episodes of acute mastoiditis

Microorganism	Isolated from	
	Pus <sup>c</sup>	CSF
<i>S. pneumoniae</i> <sup>a</sup> (n=8)	6	2
<i>P. aeruginosa</i> (n=5)	5	0
<i>S. aureus</i> (n=2)	2	0
<i>K. pneumoniae</i> (n=2)	2	0
<i>Enterococcus</i> (n=1)	1	0
<i>Micrococcus</i> (n=1)	1	0
Gram-positive bacilli (n=1)	1	0
Mixed infection <sup>b</sup> (n=2)	2	0
No growth (n=4)	1	3

Abbreviation: CSF = cerebrospinal fluid

<sup>a</sup>Three strains were penicillin-resistant *S. pneumoniae*.

<sup>b</sup>Three organisms were isolated in one episode, and two organisms were isolated in the other episode.

<sup>c</sup>The specimens were taken from the mastoid process.

as mastoidectomy (four patients) or myringotomy (two patients). For those treated medically alone, the mean duration of hospitalization was  $16.0 \pm 10.6$  days. The mean duration of hospitalization for patients who underwent a surgical procedure was  $22.5 \pm 15.2$  days ( $p > 0.05$ ).

Complications occurred in 11 patients (57.9%), and included hearing impairment in six (31.6%), meningitis in four (21.1%), subperiosteal abscess in two, cholesteatoma in two, seizure in two, and brain abscess in one.

## Discussion

In this study, the most common presenting symptoms of acute mastoiditis were pain in the postauricular region, fever, and abnormal tympanic membrane. Several other studies performed in the antibiotic era have also reported these three presentations as the most common signs and symptoms of acute mastoiditis [4-6]. The classic presentation of acute mastoiditis, including a history of antecedent acute otitis media and middle ear infection, was found in only 62% of our patients. Similar observation was made by others as well [1,5]. In a patient with acute otitis media with retroauricular swelling and erythema, acute mastoiditis should be highly suspected and evaluated [7].

Young children are more predisposed to this disorder. Bluestone *et al* reported that the peak incidence of acute mastoiditis was between 6 months and 3 years [8]. However, the peak incidence in our patients was 4 years of age. This might be explained by the fact that fewer young children attend daycare centers in Taiwan. Attendance at daycare centers is a known risk factor for recurrent acute otitis media [9,10]. Most of the children in Taiwan do not attend daycare centers before the age of 4 years old.

Radiographic abnormalities were found in all patients. Radiography is of practical diagnostic value because radiographic evidence of coalescent mastoiditis, signifying the breakdown of the bony trabeculae in the mastoid, is usually apparent after several days of active infection. The use of CT scans in mastoiditis is valuable, especially for detecting intracranial spread of the disease [11].

*S. pneumoniae* was the most common pathogen isolated from our patients as well as in other studies [2, 12]. The proportion of *P. aeruginosa* infection was relatively high in our study. This might have been because nearly one-third of our patients had underlying disease. Khafif *et al* reported *P. aeruginosa* as the most common pathogen isolated in their series [7]. Anaerobic bacteria have been suggested to be far more important

than previously thought and are under-represented because of inappropriate culture techniques [5,12]. This might be the reason why no anaerobic bacteria were found in our study.

Acute mastoiditis is usually treated with intravenous antibiotics and, if necessary, drainage procedures such as myringotomy or mastoidectomy [3,4,13]. Of our patients, 71.4% were cured by intravenous antibiotics alone, while the rest of them needed additional surgical drainage procedures. Our data suggests that conservative management is warranted in the initial treatment of acute mastoiditis in children. This approach was also recommended by Rubin *et al* [4]. In the present study, the mean length of hospital stay for all patients was 17.8 days. Those who needed surgery had longer hospitalization time. The indications for surgery in this study were failure of medical therapy and the presence of suspected or known complications such as subperiosteal abscess [1,5]. Once postauricular inflammation has been controlled, the patients can be discharged with a course of oral antibiotics.

Inadequately treated acute otitis media may result in acute mastoiditis. This may lead to intratemporal complications such as chronic mastoiditis and cholesteatoma, or more serious intracranial complications such as a brain abscess [13]. In this study, meningitis and other neurologic complications were found in one-third of patients. This complication rate is considerably higher than that reported (ranged from 5% to 20%) in the literature [2,14]. The higher complication rate in our series may have been due to a higher proportion of cases associated with underlying disease.

In conclusion, acute mastoiditis is a disease that affects mainly young children and most commonly presents with postauricular pain, fever, and an abnormal appearance of the tympanic membrane. The most common causative organism is *S. pneumoniae*. Conservative treatment with intravenous antibiotics is appropriate for children who do not exhibit any sign of intracranial complications. However, patients with complications may benefit from surgical intervention.

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