Acute mastoiditis in children in the State of Qatar

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ABSTRACT

Background: Acute mastoiditis is a serious complication of otitis media. Its diagnosis and treatment carry a great importance due to its potentially serious consequences. This study was designed to evaluate recent clinical experiences with pediatric acute mastoiditis in the State of Qatar. Our objectives were to highlight the importance of this disease and its possible complications, which emphasize the necessity of early diagnosis and proper treatment. We also assessed the commonality of this condition compared to some other countries as well as explored their experience in this regard.

Materials and Methods: This is a retrospective study of all children ≤ 14 years presenting to the pediatric emergency centers (PEC) in the State of Qatar between January 2005 and December 2008, with a clinical diagnosis of acute mastoiditis supported by CT scan findings.

Results: Twenty-seven patients were diagnosed with acute mastoiditis during the study period, with a mean age of 5.4 years. Only four children were diagnosed with otitis media and started on antibiotics a few days prior to presentation. The following signs and symptoms recorded on presentation were: fever in 77%, ear pain in 51%, ear discharge in 40%, postauricular swelling in 100%. The most frequent pathogen cultured by ear swab was Pseudomonas aeruginosa (in six out of sixteen patients who presented with ear discharge). One patient needed surgical intervention for mastoid abscess. There were two recorded complications of mastoid abscess in one patient that needed drainage and facial palsy in three patients. No mortality was reported during the study period.

Conclusions: Acute mastoiditis in children is not uncommon in the State of Qatar. Full recovery with conservative treatment is noticed in most cases. Pseudomonas aeruginosa is a common pathogen which indicates the need for broader systemic coverage in early diagnosis. Moreover, in order to promote adequate management and prevent inherently severe complications, great care is required from clinicians to reach early diagnosis. Involvement of the otolaryngology physician from the beginning is very significant.

Keywords: Qatar, mastoiditis, pediatric, otitis media, pseudomonas aeruginosa, antibiotics
BACKGROUND
Acute mastoiditis is defined as a suppurative infection of the mastoid air cells and it is considered the most common complication of acute otitis media (AOM). Pathologically, mastoiditis can be divided into the following stages:

- Acute mastoiditis with periostitis: due to the presence of purulent exudates in the mastoid cavities
- Coalescent mastoiditis: defined as destruction of the thin bony septae between air cells
- Abscess cavities: may be followed and ultimately results in the spread of pus into adjacent areas.

Typically, the patient presents with pain, erythema, displacement of the pinna, and swelling of the mastoid process. Rarely, severe complications develop if the infection spreads beyond the periosteum of the temporal bone, causing sub-periosteal abscess, eroding through the mastoid tip to cause a deep neck abscess. Or it can extend posteriorly, causing septic thrombosis of the lateral sinus.

Complications of mastoiditis
Extra-cranial: sub-periosteal abscess, bezold abscess, facial nerve paralysis, osteomyelitis, deafness, and labyrinthitis.
Intracranial: meningitis, temporal lobe or cerebellar abscess, epidural empyema, subdural empyema, and venous sinus thrombosis.

Diagnosis of acute mastoiditis:
1. Fever, otalgia, post auricular swelling and redness
   - Older child: ear up and out
   - Infant: ear down and out
2. Tympanic membrane: acute otitis media
3. Radiograph: mastoid air cells coalescent or clouded
4. Computed tomography, magnetic resonance imaging, or bone scan as needed.

If plain radiographs are obtained, they often show clouding of the mastoid or coalescence of air cells. Clouding of the mastoid is not diagnostic of acute mastoiditis and is observed in at least 50% of patients with uncomplicated AOM.

CT imaging generally is more helpful when there are intracranial complications or in patients suspected of having masked mastoiditis.

In contrast to the usual pathogens that cause acute otitis media (i.e., Streptococcus pneumoniae, Haemophilus influenzae, and Moraxella catarrhalis), the bacterial species most often implicated in acute mastoiditis are S. pneumoniae, S. pyogenes, P. aeruginosa, and S. aureus.

The incidence of acute mastoiditis has declined to only 1.2–2.0 cases per 100,000 person-years (py) in countries with high antibiotic prescribing rates for acute otitis media.

The incidence rate in the Netherlands with a low antibiotic prescription rate for AOM was 3.8/100,000 py. In Norway and Denmark, with high prescription rates, the incidence rate was comparable at 3.5/100,000 py and 4.2/100,000 py, respectively. In all other countries with very high prescription rates, incidence rates were considerably lower, ranging from 1.2 to 2.0/100,000 py.

The incidence rate in the Netherlands was about twice that in the United States (rate ratio = 0.5) according to a comparative study of patients aged 14 years and younger during the period 1991–1998.

Widespread use of antibiotics in Qatar and Middle East countries has led to an increase in antibiotic resistance of many organisms.

One of the greatest sources of antibiotic resistance continues to be the widespread and sometimes inappropriate use of antibiotics.
Pseudomonas aeruginosa is a common organism causing acute mastoiditis. Sometimes it can be the most frequent pathogen in acute mastoiditis. Most children recover with medical therapy alone, without surgical intervention.

SUBJECTS AND METHODS
This descriptive retrospective chart review study was conducted for all children ≤14 years who presented to the pediatric emergency centers (PEC) in the State of Qatar between January 2005 and December 2008 and had a clinical diagnosis of acute mastoiditis. Immunocompromised children and patients with previous history of mastoiditis were excluded from the study.
Prior to commencing the study, it was approved by the Hamad Medical Corporation Research Committee in the State of Qatar.

All data of this study were obtained from the PEC database and patient charts. Patients admitted through one of the pediatric emergency centers were identified by the PEC database ICD 10 code (H70.0, H70.1, H70.8, and H70.9).

Acute mastoiditis, abscess of mastoid (H70.0), chronic mastoiditis (H70.1), other mastoiditis and related conditions (H70.8), and mastoiditis unspecified (H70.9) were identified over the study period.

Once identified, medical records of patients were retrieved from the Department of Medical Records. Patients who met the criteria of the study were included and the following data were extracted:
- demographics
- age at presentation
- history of ear infection
- history of antibiotic use prior to presentation
- previous history of same illness
- presenting signs and symptoms
- laboratory physical findings
- CT scan of the mastoid bone if done
- treatment
- length of stay in hospital
- surgical intervention if required
- complications
- morbidity
- mortality if any
- treatment on discharge
- follow up

Results of blood work, cultures, follow-up, and radiological image reported from the electronic laboratory data system of the hospital (THERP).

Results

Twenty-seven children received a diagnosis of acute mastoiditis during the study period. Of those were 12 boys and 15 girls, with a mean age of 5.4 years.

The following signs/symptoms were recorded on presentation: fever in 77% \((n = 21)\), ear pain in 51% \((n = 14)\), ear discharge in 40% \((n = 11)\), post auricular swelling in 100% \((n = 27)\).

Only four children were diagnosed with otitis media and started on antibiotics a few days prior to presentation. Laboratory investigations of these patients revealed the following: a median WBC count of 14.4, ranging 6.20–24.20; a median ESR of 49, ranging from 11.00 to 104.27. Patients had blood culture done on presentation; all were reported with no growth (Table 3).

Ear swabs were done for sixteen patients (60%) with ear discharge, the results of which were positive for nine patients (33%), six patients grew *Pseudomonas aeruginosa* (22%), two of them grew *Staphylococcus aureus* (7%), one patient grew *Streptococcus pneumonia* (3%), and seven patients (25%) had no growth. CT scan of the mastoid was performed for 25 of the study patients and showed: unilateral mastoiditis in 55% \((n = 15)\), bilateral mastoiditis in 14% \((n = 4)\), mastoiditis with sinusitis in 7% \((n = 2)\), mastoiditis with abscess in 7% \((n = 2)\), mastoiditis with cholesteatoma in 3% \((n = 1)\), and one patient with a normal CT scan.

(Detailed information about CT-scan findings can be seen in Table 2.)

Surgical drainage was needed for one case with mastoid abscess (Figure 2).

Intravenous antibiotics were given in the emergency department for all patients, the most common antibiotics used were ceftriaxone and cloxacillin, in 80% of cases (Figure 2).
The mean length of stay in the hospital was 8.5 days, ranging from 2 to 15 days. All patients were covered by oral antibiotics after discharge, with a mean duration of 10 days, ranging between 5 and 21 days (Table 1).

Table 1. Medications after discharge.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency (patients)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmentin syr.</td>
<td>16</td>
<td>59.3</td>
</tr>
<tr>
<td>Ciprofloxacin syr.</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>Clindamycin syr.</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>Suprax syr.</td>
<td>2</td>
<td>7.4</td>
</tr>
<tr>
<td>Cefuroxime syr.</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>Cloxacillin syr.</td>
<td>2</td>
<td>7.4</td>
</tr>
<tr>
<td>Cefzil syr.</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>Clarithromycin syr.</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>Prednisolone</td>
<td>2</td>
<td>7.4</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100</td>
</tr>
</tbody>
</table>

COMPLICATIONS

The complications reported in the study were mastoid abscess in one patient that required surgical drainage, and facial palsy in three patients, two of whom showed resolution within six months follow-up. One patient had persistent symptoms of facial nerve weakness. No mortality was reported during the study period (Figure 3).

![Figure 3. The flow chart illustrates the steps applied in the management of acute mastoiditis, including diagnosis, treatment, and prognosis.](image-url)
**Discussion**

Acute mastoiditis can be presented with fever, ear pain, ear discharge, postauricular swelling and sometimes with other complications.

In this retrospective study of children ≤14 years (between Jan 2005–Dec 2008), the numbers of cases with acute mastoiditis was found to be relatively high in comparison with other studies.10–12

In the State of Qatar, with a one million-plus population, 27 children presented with acute mastoiditis during the four-year study period, with a mean age of 5.4 years. The female to male ratio was 1.25:1. While De et al. (the Alder Hey experience),10 reported 21 cases during a six year period (1995–2000) in Liverpool with a median age of 5 years, male to female ratio was 2:1. Palma et al.11 examined 55 cases in 11 years (1994–2005), 27 males and 28 females with a mean age 4.18 years. Benito and Gorricho,12 investigated 215 cases in ten years (1996–2005), in which 149 patients were male and 66 were female with a mean of 3.21 years.

Symptoms such as fever were observed in 78% of patients in our study, and ranged from 50–70% in previous studies.10,11 Ear pain was presented in 52% of our cases while in the studies by De et al., Palma et al., and Benito and Gorricho, it was not mentioned.10–12

Ear discharge was presented in 60% of cases in our study and 66.6% in cases reported in the study by Abdel-Aziz and El-Hoshy.13

Postauricular swelling was present in 100% of cases in our study, and was also reported as 100% in the study by Tarantino et al.14

Laboratory investigation revealed a raised white cell count (WBC), the mean being 14,900/mm³. Other studies such as that conducted by Al-Harbi et al.15 found that WBCs varied from 8,900 to 21,000/mm³. Blood culture results were negative in all cases, while in the study by De et al.,10 the blood culture was collected in only two cases, one of them detecting *Fusobacterium necrophorum*.

Ear swabs were done for 16 patients who presented with ear discharge, 9 patients (33%) were positive. The results are demonstrated in Figure 4.

In the study by Al-Harbi et al., they detected 28% presentation of *Streptococcus pneumoniae* and a significantly high rate of *Staphylococcus aureus* (16%; 53% of cases presented negative cultures.12

In another study, the most frequent pathogens were: *Pseudomonas aeruginosa* (25%), *Streptococcus pneumoniae* (20%), Group A streptococcus in (15%).16

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**Table 2. CT scan findings.**

| 1) | Bilateral otomastoiditis |
| 2) | Mastoiditis |
| 3) | Features suggestive of right external otitis media with right mastoiditis |
| 4) | Mastoiditis on the left side with associated otitis media + similar changes in the contralateral side, showing lesser involvement |
| 5) | Mastoiditis on the left side with enlarged mastoid antrum with sclerotic changes in mastoid process |
| 6) | Bilateral otomastoiditis, enhancing vascular structure noted in the left frontal subcortical region |
| 7) | R-chronic Mastoiditis with otitis media |
| 8) | R-Mastoiditis + total pacification of mastoid cells with boney erosion |
| 9) | Mastoiditis |
| 10) | Mastoiditis |
| 11) | Bilateral mastoiditis + pan sinusitis |
| 12) | Left sided mastoiditis + bone cholesteatoma |
| 13) | Right mastoid collection + bilateral maxillary and ethmoid sinusitis, pacification of right external auditory canal |
| 14) | Right sided mastoiditis, right OM |
| 15) | Bilateral pacification of mastoid cells |
| 16) | Right mastoid abscess |
| 17) | Right sided mastoiditis |
| 18) | Mild otomastoiditis |
| 19) | High suspicion of osteomyelitis of the right mastoid |
| 20) | Left mastoiditis complicated by soft tissue postauricular abscess formation |
| 21) | Chronic sclerosing mastoiditis, right sided otitis externa and otitis media |
| 22) | Right sided mastoiditis with soft tissue swelling over the mastoid area |
| 23) | Right chronic mastoiditis with otitis media |
| 24) | Right otitis media with associated inflammatory changes in the mastoid |
| 25) | Done, no result |
| 26) | Not done |
| 27) | Normal |
A CT scan was performed in 25 patients (92%), 24 (88%) revealed mastoiditis, 2 patients (7.4%) presented mastoiditis with sub-periosteal abscess. Other studies, such as S. Palma et al., involved CT scans in 42 cases. In the study by Bahadori et al., 41 cases revealed mastoiditis and sub-periosteal abscess was reported in 18% of their cases.

In our study, surgical intervention was performed on one patient (3%), while it was performed on five cases (23%) in another study and 13 patients (23%) in another. Complications were observed in three of our patients (11%) in the form of facial nerve palsy, two of whom recovered within 6 months of follow up. In the study by Benito and Gorricho, 215 cases of mastoiditis were studied, and they reported complications—one or more—in 21 patients (10%); 15 patients had sub-periosteal abscess, 1 had facial nerve palsy, and 9 had some sort of intracranial complication.

The average length of stay in hospital was a mean 8.5 days, compared to an average of 5 days in another study (Figure 3).

Intravenous antibiotics were given to all patients, with (96%) improvements observed on antibiotics alone. One patient (3%) needed surgical intervention. In another study, Harley et al. reported that 17 cases were treated with IV antibiotics alone, with a 100% cure rate. In another study, 16 patients (76%) responded to IV antibiotics without any surgical intervention.

By comparison, clinical presentation was almost consistent across populations with only a slight difference—while postauricular swelling was the most common feature among all the studies reviewed, a positive ear discharge was not always found. Male to female ratio was almost the same.

A short average length of stay in hospital might be a sign of good management, such that no more complication could be expected. The mean length of stay is useful from the point of view of costs as seen in a previous study.

At present, our practice in Hamad Medical Corporation regarding the management of acute mastoiditis includes admission of the patient to the hospital; close observation; laboratory and radiological investigations; IV injection of dual antibiotics, and involvement of the otolaryngology physician from the beginning.

Ear swabbing remains a significant laboratory test in order to choose a suitable antibiotic according to culture and sensitivity to a certain microorganism. CT scan is considered as a good support for the diagnosis and can play an important role, particularly when there are complications.

Most of the cases can be improved within 48–72 hours from the start of IV antibiotic. If the patient does not respond to the conservative treatment, myringotomy with ventilation tube insertion is performed. In case of severe complications, further surgical intervention will be needed by otolaryngology and or neurosurgery physicians.
Conclusion

In conclusion, our study demonstrated that the incidence of acute mastoiditis in the State of Qatar is not uncommon because of the relatively high number of patients in just four years in comparison to other studies (taking into consideration the small population in the State of Qatar).

The study showed that *pseudomonas aeruginosa* is a common causative microorganism in acute mastoiditis in our pediatric age group, which warrants the need for early treatment with specific related antibiotics.

Good management of this disease will shorten the time of stay at the hospital and help prevent serious complications. Proper treatment of AOM is quite important because of its crucial role in the etiology of acute mastoiditis.

Regarding the current standard of care, we suggest the following:

1. Currently recommended antibiotics need to be re-evaluated since the more frequently encountered microorganism is *pseudomonas aeruginosa*—i.e., anti pseudomonas antibiotics needs to be considered as a first choice of treatment.

2. Treatment can be started empirically with the current regimen of IV. Antibiotics: IV. Ceftriaxone + IV. Cloxacillin or IV. Ceftriaxone + IV Clindamycin, while waiting for the result of the ear swab culture (if it is available).

Any failure in the treatment could raise the possible presence of *pseudomonas aeruginosa* as a causative microorganism, which is usually resistant to the above antibiotics.

3. Further efforts should be spent to identify the changing trends in microorganisms through more studies.

REFERENCES


