



Acute mastoiditis in children with a cochlear implant



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ABSTRACT

Objectives: Cochlear implantation is performed at a young age, when children are prone to acute otitis media. Acute mastoiditis is the most common complication of otitis media, but data on its management in the presence of a cochlear implant are sparse. The objective of this study was to assess the characteristics, treatment, and outcome of acute mastoiditis in children with a cochlear implant.

Methods: The medical files of all children who underwent cochlear implantation at a pediatric tertiary medical center in 2000–2014 were retrospectively reviewed. Those diagnosed with acute mastoiditis after implantation were identified, and data were collected on demographics, history, presentation, method of treatment, complications, association with untreated otitis media with effusion, and long-term middle-ear sequelae.

Results: Of the 370 children (490 ears) who underwent cochlear implantation, 13 (3.5%) were treated for acute mastoiditis (median age at acute mastoiditis, 32 months). Nine had a pre-implantation history of chronic secretory or acute recurrent otitis media, and 5 had been previously treated with ventilation tubes. In all 9 children who had unilateral cochlear implant, the acute mastoiditis episode occurred in the implanted ear. The time from implantation to mastoiditis was 5–61 months. The same treatment protocol as for normal-hearing children was followed, with special attention to the risk of central nervous system complications. Primary treatment consisted of myringotomy with intravenous administration of wide-spectrum antibiotics. Surgical drainage was performed in 8 out of 13 patients, with ($n = 7$) or without ($n = 1$) ventilation-tube insertion, to treat subperiosteal abscess or because of lack of symptomatic improvement. There were no cases of intracranial complications or implant involvement or need for a wider surgical approach. No middle-ear pathology was documented during the average 3.8-year follow-up.

Conclusions: The relatively high rate of acute mastoiditis and subperiosteal abscess in children with a cochlear implant, predominantly involving the implanted ear, supports the suggestion that recent mastoidectomy may be a risk factor for these complications. Despite the frequent need for drainage, more extensive surgery is usually unnecessary, and recovery is complete and rapid. As infections can occur even years after cochlear implantation, children with otitis media should be closely followed, with possible re-introduction of ventilation tubes.

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1. Introduction

Cochlear Implantation is performed at young age, when children are prone to acute otitis media (AOM). The reported

incidence of otitis media in children with cochlear implants is 31–61% prior to surgery and 28% after surgery [1–3]. Although acute mastoiditis is the most frequent complication of AOM, its management in the presence of a cochlear implant has been addressed in the literature by only few authors [1,4–7]. In children with cochlear implants, ear infections can potentially spread through the cochlea to the central nervous system via the electrode array, as well as possible involvement of the device and its subsequent explantation. Therefore, early intervention may be particularly important. Moreover, previous studies have suggested that the risk of acute mastoiditis is higher after cortical mastoidectomy [4], which is routinely performed as part of

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cochlear implantation. Other disease-related factors in this patient population also remain unclear, such as the risk of untreated otitis media with effusion post cochlear implantation on the development of acute mastoiditis, and the long-term outcome of acute mastoiditis.

The aim of the present study was to assess the characteristics, treatment, and outcome of acute mastoiditis in children with a cochlear implant.

2. Methods

The medical files of all children who underwent cochlear implantation at a pediatric tertiary medical center in 2000–2014 were retrospectively reviewed. The children diagnosed with acute mastoiditis were identified, and data were collected as follows: demographics, history, type and side of implant, time to development of acute mastoiditis, treatment, findings on culture, complications, association with untreated otitis media with effusion, and long-term middle-ear sequelae. The study protocol was approved by the local institutional review board.

The diagnosis of acute mastoiditis was based on the presence of otalgia, fever, protrusion of the auricle, signs of acute otitis media, post-auricular erythema, and presence of swelling and local tenderness. In all cases, the focus of inflammatory process was over the mastoid and not over the receiver/stimulator. Our departmental policy stipulates that all children who present with acute mastoiditis undergo primary myringotomy at admission with intravenous administration of wide-spectrum antibiotics; the antibiotic treatment is adjusted when the culture results are received. In patients in whom culture results were negative, specimens were sent for polymerase chain reaction study for pathogens.

In patients with cochlear implant and subperiosteal abscess, our treatment approach is incision and drainage with insertion of a Penrose drain and ventilation tube; precautions are taken such as blunt dissection parallel to the expected path of the electrode. CT scan and a wider surgical approach are considered in cases of treatment failure or suspected intracranial complications. Plain radiographs are not taken routinely prior to drainage procedure, as we do not expect them to be of significant value in assessing the exact electrode path. Audiological assessments and CI mapping are routinely done after episodes of acute mastoiditis.

3. Results

Of the 370 children (490 ears) who underwent cochlear implantation at our center during the study period, 13 were treated for acute mastoiditis (3.5% of children, 2.6% of implants). Table 1 shows the patient- and disease-related data. Two children had two episodes of acute mastoiditis each. In these cases, only the first episode was included in the analysis for reasons of simplicity. Four children had a Nucleus implant, 4 an Advanced Bionics implant, and 5, a MedEl implant. Nine children had a unilateral implant and four bilateral implants. In all children with a unilateral implant, the acute mastoiditis episode occurred in the implanted ear.

Median patient age was 13 months at the time of implantation and 32 months at occurrence of mastoiditis. Median time from cochlear implantation to diagnosis of acute mastoiditis was 9 months (range, 5–61 months). None of the episodes of mastoiditis occurred in the immediate postoperative period.

Nine children (69%) had a preimplantation history of chronic secretory otitis media ($n = 8$) or recurrent otitis media ($n = 1$). Five children had been previously treated with ventilation tubes; in one, introduction of the tubes was associated with a persistent discharge, delaying cochlear implantation. None of the children

Table 1
Clinical data for 13 children with acute mastoiditis after cochlear implantation.

Pt. no.	Age at CI (mos.)	Etiology of hearing loss	Side of implant	Time from CI to AM (mos.)	Pre-CI history		Findings at CI surgery	Treatment for AM ^a		Culture isolates	Post-AM follow-up		
					AOM/OME	VT placement ^b		I & D	VT		Rec AOM	Duration (years)	
1	13	Auditory neuropathy	Unilateral (AB)	6	NA	No	Edema, granulation, thick fluids	Yes	Yes	3 days	Strep. pneumoniae	No	8
2 ^c	27	Auditory neuropathy	Unilateral (AB)	9	Yes	Yes	Normal	Yes	Yes	2 days	No growth	Yes	5
3	27	Auditory neuropathy	Unilateral 1 (AB)	61	Yes	Yes	Normal	Yes	Yes	Presentation	No growth	Yes	5
4	11	Connexin 26 mutation	Unilateral (MedE1)	5	No	No	Normal	No	No	2 days	NA	No	0.8
5	48	Inner ear malformation	Unilateral (MedE1)	20	Yes	Yes	Normal	Yes	Yes	2 days	Staph. aureus coag ^b	No	6
6	12	Connexin 26 mutation	Bilateral (MedE1)	42	Yes	No	Glue	No	Yes	Presentation	Strep pyogenes A	No	2.5
7	26	Unknown	Unilateral (Nucleus)	6	No	No	Normal	Yes	Yes	Presentation	Strep pyogenes A	NA	12.5
8 ^c	16	Unknown	Unilateral (AB)	61	No	No	Normal	Yes	No	Presentation	No growth	No	4.5
9	13	Unknown	Bilateral (Nucleus)	23	Yes	Yes	Edema, granulation	No	No	Presentation	Strep. pneumoniae	No	2
10	13	Unknown	Bilateral (Nucleus)	31	Yes	Yes	Edema, granulation	Yes	Yes	Presentation	No growth	No	1
11	12	Connexin 26 mutation	Unilateral (AB)	6	Yes	Yes	Normal	Yes	Yes	4 days	Strep. pneumoniae (PCR)	No	1
12	12	Unknown	Unilateral (Nucleus)	12	Yes	No	Normal	No	No	Presentation	Strep. pneumoniae	No	4
13	32	Unknown	Bilateral (Nucleus)	5	Yes	No	Granulation, thick fluids	Yes	Yes	Presentation	Strep. pneumoniae	Yes	0.5
12	32	Unknown	Bilateral (MedE1)	16	Yes	Yes	Edema, granulation	Yes	Yes	Presentation	Haemophilus influenzae	No	0.5
13	10	Connexin 26 mutation	Unilateral (MedE1)	8	Yes	No	Normal	No	No	Presentation	Haemophilus sp.	Yes	5

CI-cochlear implantation, AM-acute mastoiditis, AOM-acute otitis media, OME-otitis media with effusion, VT-ventilator-tube, Rec-recurrent, I & D-incision and drainage, AB-advanced bionics, PCR, polymerase chain reaction
^a All children were treated with IV antibiotics and myringotomy at admission.
^b None of the children had a VT during an episode of AM (VT extruded).
^c Patient with 2 episodes of AM. For simplicity, only the first episode was included in the analysis.

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