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Prevalence of Infectious Complications after Cochlear Implantation Surgery among Iranian Children; Report from a Tertiary Hospital

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Abstract

Introduction: Cochlear implantation (CI) surgery is a choice treatment of bilateral profound hearing loss. The most common infectious complications are meningitis, otitis media, surgical site infection and mastoiditis. The aim of current study is to show the prevalence of infectious complications after CI surgery.

Methods: In this cross-sectional study, all of the profoundly deaf patients who underwent CI surgery during two years from March 2015 to July 2017 entered to the study and were followed up for 6 months after surgery. All of the complications and documents were recorded in a pre-designed checklist.

Results: Finally, 364 Patients were enrolled to the study. The mean(± SD) duration of surgery was 2.3±1.5 hours. The complications after surgery occurred in 30 (8.2%) cases. The most common complication after CI surgery was otitis media followed by surgical site infection, meningitis, and mastoiditis.

Conclusion: We found that otitis media is the most prevalent infectious complication after CI surgery. This study showed a significant increase in incidence of otitis media in 4 to 5 year-old children in comparison with other age groups.

Keywords:
Otitis Media;
Cochlear Implantation;
Infection;
Epidemiology

Introduction

Hearing loss either prelingual or postlingual is one of the most common causes of sensory defect. The incidence rate of hearing loss is 1 to 3 cases in 1000, and the age range of children with hearing loss is between 1 month to 3 years [1]. The mean age of hearing loss is 2.5 years in the United States, but many children are not diagnosed for 6 years. Profound hearing loss is the highest degree of hearing loss (more than 90 dB) [4-2]. Cochlear implantation (CI) surgery is a cost-benefit treatment of bilateral profound hearing loss [5 ,4]. The age limitation of surgery is various in different studies, but the treatment should be as soon as possible because of perception and intelligence of speech development forming in the infancy [6]. Previous studies showed that there is a significant reverse association between age and acquired communication skills [8 ,7].

Nowadays, the indications of CI surgery are extended due to improvement of the surgical

techniques and the high success rate of surgeries. The most common indication of elective surgery is when unaided children pure tone audiogram threshold is more than 90 dB. The uncommon indications are cochlear nerve malformation, acquired dysmorphic inner ear, when associated with some types of disabilities and mode of communication [5]. Pure tone audiometry is a behavioral test that measures hearing sensitivity and involves peripheral and central auditory systems.

Many complications of CI surgery occur during operation such as injury to facial or chorda tympani nerve and the others are postoperative such as hematoma, device failure, and infections. Complications after surgery are major and minor and there is no significant difference between adults and children. Majors are related to surgical techniques. Major complications are necrosis, electrode changes, and facial nerve problems and minor complications include dehiscence of incisions, infections, dizziness, and device failure. Infectious complications include meningitis, otitis media, infections due to wounds and mastoiditis [9 ,3].

Infectious complications after cochlear implantation surgery are very important and common. There are few studies demonstrating the infectious complications rate in children with various age and sex groups. The related studies have shown that major complication rate is lower in younger individuals but many studies with complete failure or re-implantation were unrelated with age [10].

The aim of current study is to show the prevalence of infectious complications after surgery and to evaluate complications in different age and sex ranges.

Patients and methods

In this cross-sectional study, all of the profoundly deaf patients who underwent CI surgery during two years from March 2015 to July 2017 at the Baqiyatallah cochlear implantation center, Tehran, Iran entered the study. The patients were followed up for 6 months after surgery. All of the complications after surgery were recorded in a pre-designed checklist. The study was performed in accordance with ethical principles of the Helsinki Declaration and approved by the ethics committee of Baqiyatallah University of Medical Sciences [6]. Indications of CI surgery were bilateral severe to profound hearing loss with pure tone testing (PTA) of more than 90 dB in better ear and subjects in whom hearing aid did not improve hearing (recognition with parent survey in children younger than 5). Demographic information of patients was collected from the data center of Baqiyatallah cochlear implantation center. Many patients were recalled to complete the missing information. Patients with insufficient information and hospitalization for concurrent disorders at the time of surgery and also children older than 5 years old were excluded from the study. Patients were followed up by an otolaryngologist after surgery. Infections such as wound infection, otitis media, mastoiditis and meningitis were recorded during follow-up. Wound infection was diagnosed by clinical signs and symptoms such as erythema, edema, heat, purulent exudate and pain. Diagnosis of Otitis media was also made clinically using an otoscopy examination. Meningitis was diagnosed by spinal tap and pressure of CSF.

Data were analyzed using IBM SPSS Statistics for Windows (version 21, IBM Corp, Armonk, NY) and reported using mean (SD), number, percent and analyzed using chi-square test (two-tailed). The p-value < 0.05 was considered statistically significant. Normal distribution of variables was analyzed using the one-sample Kolmogorov-Simonov test.

Results

Finally, 364 Patients with mean (± SD) age of 1.02±3.25 years entered the study. %49.2)179) patients were male and 185 %50.8)) female. Table 1 summarizes the distribution of surgical complications between two genders. Also Table 2 and figure 2 show the frequency of complications in different age groups.

The mean± SD duration of surgery was 1.5±2.3 hours and ranged between 1 and 4. The complications after surgery occurred in %8.2) 30) cases. The most common complication after CI surgery was otitis media followed by surgical site infection, meningitis, and mastoiditis (figure 1).

Other complications were temporary facial nerve weakness which occurred in %5.7) 21) cases and device failure in 1 %0.27)) case. The other complications such as nausea, bradycardia, cardiac arrest, Wound dehiscence, hypothermia, surgical site cellulitis, cholesteatoma, scalp hematoma, and atlantoaxial subluxation, were not observed.

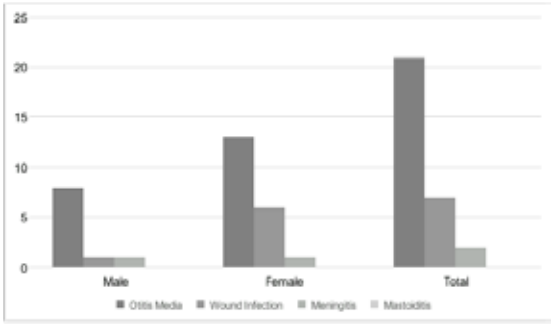

Figure 1: Infectious complications after surgery in two genders.

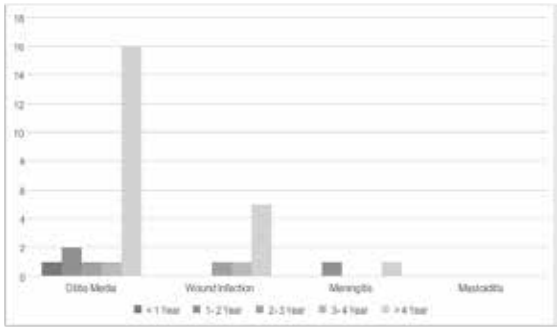

Figure 2: Infectious complications after surgery in different age groups.

Discussion

Due to new indications of CI surgery, nowadays, more patients are using such devices [11]. Therefore, understanding the rate of complications after surgery is of more important than previous. In this study, the prevalence of infectious complications after surgery was %8.2 which was higher than the reported rate in Kempf et al. study [12]. They only have investigated the prevalence of otitis media, not the other infections. In another study, the prevalence of all types of infections after surgery were assessed and the rate of complications was also lower than our study (%2.79 vs. (%8.2 13]]. According to this study, such as our study, otitis media was more prevalent than the other infectious complications. It was not in line with Cunningham, et al. study. [14] Also, we found that otitis media is the only infection that increases significantly with age. Hence, prophylaxis against otitis media is very important, especially in older children. We found that the prevalence of otitis media is not different in male and female patients; however, there was an association between gender and wound infection. On the other side, there was a significant difference between age groups and prevalence otitis media. But, there was no significant association between age and other infections. This study showed a significant increase in otitis media incidence complication in 4 to 5 year-old children.

Another common complication after surgery was wound infection which occurred significantly fewer than Cunningham, et al. study. This may be due to higher techniques in designing of wound flap in recent years which have significantly decreased the rate of wound infections than previous studies [16 ,15].

There was no report of mastoiditis among patients. However, in Javia, Luv, et al. study, they reported mastoiditis in %1.7 of patients after surgery. As we

Gender	Male	Female	Total	P value*
	179	185	364	
Otitis Media	8 (4.46%)	13 (7.02%)	21 (5.76%)	0.295
Wound Infection	1 (0.55%)	6 (3.24%)	7 (1.92%)	0.049
Meningitis	1 (0.55%)	1 (0.54%)	2 (0.54%)	_**
Mastoiditis	0 (0%)	0 (0%)	0 (0%)	_**

Table 1: Distribution of Complications in Genders

* The P value shows the relationship between gender and type of infections.

** Not analyzed the relationship between gender and mention infections because of low incidence in patients

Age Groups	<1 year	2-1 years	3-2 years	4-3 years	>4 years	Total	*P value
Subject Numbers	**17**	**62**	**66**	**68**	**151**	**364**	
Otitis Media	1 (5%)	2 (3.2%)	1 (1.6%)	1 (1.5%)	16 (10.5%)	21 (5.8%)	0.021
Wound Infection	0 (0%)	0(0%)	1 (1.6%)	1 (1.5%)	5 (3.3%)	7 (1.9%)	0.521
Meningitis	0 (0%)	1 (1.6%)	0 (0%)	0 (0%)	1 (0.7%)	2 (0. 5%)	0.708
Mastoiditis	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	_**
Total	1 (5%)	3 (4.8%)	2 (3.2%)	2 (3%)	22 (14.4%)	30 (8.2%)	_

Table 2: Age Groups and Complications

*The P value shows relationship between age groups and type of infections.

** Not analyzed the relationship between gender and mention infections because of low incidence in patients

No.	Study; year	Sample size	Male (%)	Mean age	Total infection	Otitis Media	Wound infection	Meningitis	Mastoiditis
1	Kempf et la.;12] 1999]	366	-	4.3	22(6.01%)	16(4.37%)	-	-	-
2	Cunningham et al.; 14] 2004]	272	-	-	16(5.88%)	2(0.73%)	14(5.14%)	0	-
3	Venail et al.; 13] 2008]	322	50%	5.7	9(2.79%)	5(1.6%)	2(0.6%)	0	2(0.6%)
4	Javia, Luv, et al.;16]2014]	235	49.4%	4.5	14.9%	1)0.42%)	2(0.85%)	0	4(1.7%)
5	Current study	364	49.2%	3.25	30(8.2%)	21(5.8%)	7(1.9%)	2(0.5%)	0

Table 3: Comparison of Our Study with Previous Studies Regarding Infection Prevalence in Children.

know, there is an association between otitis media and mastoiditis. But, low incidence of presenting otitis media in Javia Luv, et al. study cannot justify the high number of patients who presented with mastoiditis and high rate of otitis media cannot justify any report of mastoiditis in the current study [18 ,17 ,16].

Wound infection was significantly more occurred in female patients. But meningitis occurred equally in both genders.

The limitation of this study was excluding some patients from the study. We excluded 12 patients because they did not attend to the hospital for -6 month follow up. The rate of post-operative infections was higher than in the same studies. The study shows the requirement of better management against infections.

Conclusion

Eventually, owing to low rates of complications after surgery, our study suggests that cochlear implantation is a

low risk surgery in children. However, we recommend performing examinations and preventions before surgery to reduce the rate of infections, especially in higher age ranges and female patients.

Reference

1. Cohen NL, Hoffman RA, Stroschein M. Medical or surgical complications related to the Nucleus multichannel cochlear implant. The Annals of otology, rhinology & laryngology Supplement. 13-135:8;1987.
2. Cohen NL, Hoffman RA. Complications of cochlear implant surgery in adults and children. Annals of Otology, Rhinology & Laryngology. 11-708:(9)100;1991.
3. Hampton S, Toner J. Belfast Cochlear Implant Centre; the surgical results of the first 100 implants. Revue de laryngologie-otologie-rhinologie. 9:(1)121;2000.
4. Gibbin K, O'Donoghue G, Nikolopoulos T. Medical and surgical aspects of pediatric cochlear implantation. Cochlear Implants for Young Children London: Whurr. 4-2003:13.
5. Arnold W, Brockmeier SJ. Medical, surgical, and technical complications with the COMBI40-. The American journal of otology. 6)18;1997 Suppl):S8-67.
6. Nikolopoulos TP, O›Donoghue GM, Archbold S. Age at implantation: its importance in pediatric cochlear implantation. The Laryngoscope. 9-595:(4)109;1999.
7. Robbins AM, Koch DB, Osberger MJ, Zimmerman-Phillips S, Kishon-Rabin L. EFFECT OF AGE AT IMPLANTATION ON AUDITORY-SKILL DEVELOPMENT IN INFANTS AND TODDLERS.
8. Govaerts PJ, De Beukelaer C, Daemers K, De Ceulaer G, Yperman M, Somers T, et al. Outcome of cochlear implantation at different ages from 0 to 6 years. Otology & Neurotology. 90-885:(6)23;2002.
9. Lalani T, Sexton DJ, Tucci DL, Calderwood SB, Kaplan SL, Thorner AR. Cochlear implant infections. Up to date Waltham, MA: UptoDate. 2007.
10. Manrique M, Cervera-Paz FJ, Huarte A, Molina M. Advantages of cochlear implantation in prelingual deaf children before 2 years of age when compared with later implantation. The Laryngoscope. 9-1462:(8)114;2004.
11. Sampaio AL, Araújo MF, Oliveira CA. New criteria of indication and selection of patients to cochlear implant. International journal of otolaryngology. 2011;2011.
12. Kempf H-G, Johann K, Lenarz T. Complications in pediatric cochlear implant surgery. European archives of oto-rhino-laryngology. 32-128:(3)256;1999.
13. Venail F, Sicard M, Piron JP, Levi A, Artieres F, Uziel A, et al. Reliability and complications of 500 consecutive cochlear implantations. Archives of Otolaryngology–Head & Neck Surgery. 81-1276:(12)134;2008.
14. Kabelka, Zdenek, et al. «Bacterial infection complications in children with cochlear implants in the Czech Republic.» International journal of pediatric otorhinolaryngology :(2010) 74.5 502-499.
15. Javia, Luv, et al. «Infectious complications and ventilation tubes in pediatric cochlear implant recipients.» The Laryngoscope :(2016) 126.7 1676-1671.
16. Minovi, Amir, and Stefan Dazert. «Diseases of the middle ear in childhood.» GMS current topics in otorhinolaryngology, head and neck surgery 13 2014)).