

# Surgical Complications of Cochlear Implantation

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## Abstract

Cochlear implantation is a method used for the treatment of patients with profound hearing loss. This procedure may be accompanied by some major or minor complications. We evaluated the surgical complications of cochlear implantation in Fars province (south of Iran). A total of 150 patients with cochlear implantation were enrolled in the present study. Most of the patients were pre-lingual children and most of our devices were nucleus prosthesis. We had three device failures and four major complications, including one misplaced electrode, one case of meningitis, one case of foreign body reaction to suture and one case with extensive hematoma. These complications were managed successfully by surgical intervention or re-implantation. Facial nerve damage or wound breakdown was not seen. Minor complications including small hematoma, edema, stitch infection and dizziness were found in 15 cases, which were managed medically. In our center, the rate of minor complications was comparable to other centers in the world. But the rate of major surgical complications was lower than other centers.

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**Keywords** • Cochlear implantation • surgical procedure • complication

## Introduction

**C**ochlear implants are devices that deliver electrical stimulation through an array of electrodes to a bundle of cochlear nerve fibers and established as an effective and safe method of rehabilitation for profoundly deaf patients.<sup>1,2</sup> Despite the procedure difficulty, single and multichannel cochlear implants have been used successfully in malformed inner ears.<sup>3-6</sup>

Cochlear implantation is a surgical procedure with inevitable inherent complications. Kim and colleagues classified the complications of cochlear implantation into adverse reactions and surgical complications, which in turn are subdivided into major and minor complications. The other complications are device-related problems.<sup>2</sup> Although most adverse effects of such surgeries occur transiently and disappear with time, there are some complications that are permanent.<sup>7</sup>

Cochlear implantation increases the incidence of otogenic meningitis, but this risky complication will not preclude the procedure because preventive measures such as modern vaccines against meningitis exist.<sup>8-11</sup>

In the present study, we report our experience on 150 cochlear implant surgeries during 4 years. We used the classification of minor and major complications.

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## Patients and Methods

From January 2004 to January 2008, the patients undergoing cochlear implantation surgery in Khalili Hospital in Shiraz (south of Iran) were included in the study. The medical and surgical records were reviewed retrospectively and analyzed. Patients were divided to per-lingual and post lingual groups.

Selection criteria for the study population were the age of 12 months old or higher, bilateral severe-to-profound hearing loss, the pure tone average of 70 db or more, minimal benefit from hearing aids which is defined as less than 20-30% on single-syllable word test, or for younger children, a bilateral profound sensorineural hearing loss measured by behavioral and objective audiometry, no measurable benefit from hearing aids over a time period of 6 months or higher, no medical or psychological contraindications, and realistic expectations by the patients and their parents. No evidence for central auditory lesions or lack of an auditory nerve and no contraindication for surgery in general or cochlear implantation in particular existed.

Surgical contraindications included cochlear aplasia (Michel disease), ossified and malformed cochlea in imaging studies, hearing in contralateral ear, persistent chronic ear infection with otorrhea, and obviously pathologies that affect the auditory nerve, such as bilateral acoustic neuroma or neurofibromatosis type II.

Small type incision and classic surgical approach were used for cochlear implantation in all patients (bony seat was drilled into the skull bone to place and immobilize the receiver/stimulator, followed by mastoidectomy, facial recess opening, cochleostomy and device fixation with Nylon and Dacron sutures).

The complications that required additional surgery and/or hospital admission for treatment were categorized as the major group, while those cured by a minor procedure at office setting or recovered spontaneously or with medical therapy were categorized as the minor group. Data were analyzed using SPSS software version 14.

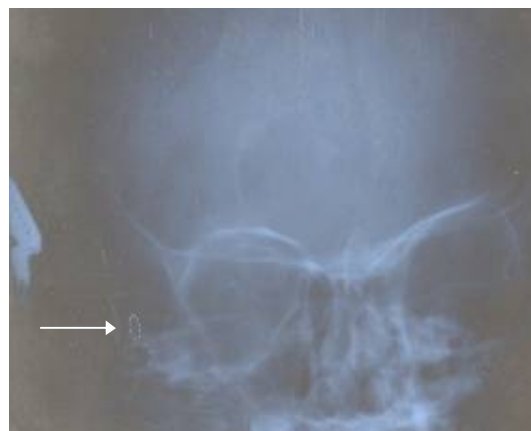
## Results

Total of 150 patients in the age range of 17 months to 54 years (mean age:  $6.67 \pm 9.53$  year) underwent cochlear implantation surgery in our hospital. One hundred thirty two patients were pre-lingual children with mean age of 3.6 years (range 17 months to 10 years,  $SD=1.19$  years) and 18 patients were post-lingual with

mean age 26.55 years (range 8 to 54 years,  $SD=14.95$  years). MED-EL C40+ device (MED-EL, Austria) and Nucleus 24 contour device (Cochlear, Australia) were used for implantation. Twenty two patients (14.66%) showed complications. Surgical complications in 19 patients (12.66%) and mechanical device failure in three patients (2%) were seen. During 1-4 years follow-up, major surgical complications occurred in four patients (2.66%) and resulted in hospital admission. Minor postoperative complications occurred in 15 patients (10%). All of the minor complications were treated with medications and disappeared within a few days.

An extensive hemorrhage and scalp hematoma were detected in a 4.5-year-old girl who needed blood transfusion postoperatively. She was discharged after drainage of hematoma and no flap complication (necrosis or dehiscence) was occurred.

The electrode of one of the MED-EL devices was malpositioned into the vestibule in a 3-year-old boy. Postoperative transorbital view showed this malpositioned electrode (Figure 1) and the patient suffered from vertigo during device use. He underwent a second surgery and the same electrode was repositioned into the cochlea. The patient had good hearing without any vertigo after the second operation.



**Figure 1:** Postoperative transorbital view; the arrow shows malpositioned electrode.

Revision surgery was performed two years after cochlear implantation in a 2.5-year-old boy because of severe foreign body reaction to Nylon sutures used for device fixation. Wire used in the revision surgery and all of the inflammatory signs were subsided postoperatively.

A 3.5-year-old boy who underwent cochlear implantation, developed meningitis one year

after operation. He was admitted to hospital and responded to intravenous antibiotic therapy and no surgical intervention was needed. During the next two years of follow-up, no recurrence of meningitis occurred.

Cochlear implantation was done for a 2-year-old girl who had auditory neuropathy (abnormal auditory brain stem response in the present of normal oto-acoustic emission) with normal cochlea in high resolution computed tomography. She tolerated the device normally with good language development.

Table 1 shows major surgical complications. All major complications and device failure have been detected in pre-lingual patients.

## Discussion

Major complications of cochlear implantations, which require surgery are about 8%, while minor complications are about 4%, as reported by Hoffman and colleagues.<sup>5</sup> Another study showed that revision surgery was performed in 13% of total patients with cochlear implantation, and hardware failure occurred in 4%.<sup>7</sup> Liu and co-workers reported serious major complications (3.9%), and relatively few minor complications (2.9%).<sup>13</sup> In the present study, the rate of major surgical complications was 2.66% and the rate of device failure was 2%, therefore the unwanted outcomes requiring surgery were 4.66%. Cochlear anomaly was not included in our study and this may be the reason of reduced major complications. Minor complications in our study were 10%. According to the criteria for definition of minor complications, our results may be different from other studies.<sup>5,7,13</sup> According to previous reports, postoperative dizziness was a rare and basically negligible problem.<sup>7</sup> However, a recent study showed that a large number of patients suffer from postoperative dizziness or unsteadiness (12.4%).<sup>7</sup> Postoperative dizziness in our study was seen in 12 patients (8%).

Liu and others have reported that both total and major complication rates were lower in children than in adults.<sup>13</sup>

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We did not find major complications and

revision surgery in post-lingual patients (adults). However, our sample size was too small to evaluate these differences.

Device failure rate in our study was 2% and all patients with device failure were pre-lingual children. Fayad, Haensel and their colleagues reported 0.8-15.8% failure rate depending on the type of devices, and Parisier and co-workers reported an overall 11% device failure rate based on survey rate of 1175 adult patients who received multichannel implants.<sup>12,14</sup> A higher device failure rate in children has been reported by Fayad and co-workers.<sup>14</sup> Jeyakumar and Clary reported 3.0% device failure rate in pediatric cochlear implant after one year follow-up.<sup>15</sup>

In a study by Waldman and Niparko, the overall rate of post auricular flap complications was 4.5%.<sup>16</sup> In our study, no flap complication was seen. Even in one patient with extensive hematoma, the flap had normal blood supply and healing. In the present study, misplaced electrode occurred in one patient (0.6%). This result is similar to a study by Kubo and co-workers, with misplaced electrode rate of 1.0%.<sup>7</sup>

Infections were categorized as being a wound infection, complicated otitis media, or meningitis. In one study by Potsic and his co-workers the overall incidence of infection in the pediatric patients (5.9%) was higher than the adult patients (3.0%).<sup>17</sup>

Cunningham and co-workers reported one case of meningitis (0.2%) in a study of 430 cochlear implantations.<sup>18</sup> In the present study, one patient (0.6%) developed meningitis one year after cochlear implantation.

Severe foreign body reaction to Nylon sutures was detected in a 4.5-year-old boy in our study. The inflammatory reaction was severe and showed no response to medical therapy. This complication has not yet been reported in the literature. After removing the sutures and replacing them with wire, inflammatory reaction disappeared.

## Conclusion

Cochlear implantation is a feasible procedure with minimal severe complications that leads to

**Table 1:** Major complications needed hospital admission and /or surgery (n=7)

Sex/age(months)	Major complication	Treatment	Outcome
F/17	Extensive hematoma	Drainage and transfusion	Cured
M/40	Meningitis	Intravenous antibiotics	Cured
M/31	Incorrect electrode position	Reposition electrode	Cured
M/34	Foreign body reaction to suture	Device fixation with wire	Cured
M/34	Device failure	Reimplantation	Cured
M/40	Device failure	Reimplantation	Cured
F/56	Device failure	Reimplantation	Cured

an enhanced quality of life demonstrated by long-term follow-up. In our hospital, minor complications rate was comparable to other centers in the world. Major surgical complications rate in our patients was lower than other centers.

**Conflict of Interest:** None declared

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