



Electrode array misplacement into the superior semicircular canal: As a rare complication of cochlear implantation



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ABSTRACT

Objective: To report electrode array misplacement into the superior semicircular canal occurring as a rare complication of cochlear implantation through round window insertion, and to explore the causative association between electrode array misplacement and cochlear implantation surgical techniques.

Methods: A chart review of the electrode array misplacement into the superior semicircular canal and their management in 695 patients undergoing cochlear implantation was undertaken from January 2003 and January 2014 in Anhui Provincial Hospital.

Results: There were two children of electrode array misplacement into the superior semicircular canal complication, and the rate was 0.28%.

Conclusions: Electrode array misplacement into the superior semicircular canal associated with cochlear implantation is rare. Surgeons should be aware of that the smaller round window maybe the reason of electrode array misplacement through round window insertion. Intra-operative neural response telemetry and X-ray can alert the surgeon the problem with the array's misplacement, which can be identified by postoperative CT.

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1. Introduction

Cochlear implantation (CI) has become a common surgery for the treatment of profound hearing-impaired patients throughout the world. Surgery for CI bears the risks of complications associated with implanting a foreign body into the peripheral auditory system, in addition to the risks associated with all major surgery. A surgical complication is an unexpected medical event related to the procedure itself and causing additional morbidity or a need for additional surgery [1]. One of the earliest reports on complications of cochlear implants came from a survey of US surgeons [2]. With the development of surgical techniques and new devices in recent years, CI is now considered to be a very safe surgery in experienced hands. However, despite of decreased complication rates, the complications are still a challenge for both surgeons and manufacturers.

Surgical complications are divided into major and minor complications. Major complications are defined as events that

necessitated major surgical intervention or permanent disability, including incorrect electrode position, facial nerve paralysis, meningitis, wound breakdown, foreign body reaction, cholesteatoma, electrode extrusion and perilymphatic fistula [1,3,4]. Minor complications are defined as those managed by medical measures or by a minor surgical procedure, such as facial edema, hematoma, balance disturbances, tinnitus, taste disturbances, seroma, wound infection, eardrum defect and infection of the middle ear and mastoid [1,3,4]. The major complications could require revision surgery and even re-implantation, and minor may be treated conservatively with or without minor surgical procedures. Considering the total number of implantations, the overall rate of complications reported in most of the available studies ranges from 6 to 20%: the major ones occur in 1–12% of patients, whereas the minor ones occur in 2–20% of patients [4–6]. As a major complication, electrode array misplacement has already been described as an infrequent complication in cochlear implant surgery [3,7]. Various examples of electrode malpositioning were given by Jain and Muknerisi [8]. This paper presents two cases report of electrode array misplacement into the superior semicircular canal (SSC) occurring as a rare complication of cochlear implantation through round window insertion.

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2. Patients and methods

Between January 2003 and January 2014, a total of 695 patients received cochlear implants in Anhui Provincial Hospital. The age of the patients at cochlear implantation ranged from 8 months to 78 years with a mean of 4.9 years. A total of 419 patients (60.3%) were male, and 276 were female (39.7%). Five hundred fifty cochlear implants were performed on the right ear and 145 on the left.

Intraoperative neural response telemetry (NRT) was used to evaluate appropriate electrode placement. X-ray was performed to verify the electrode array position at second day after surgery.

3. Results

3.1. Case 1

An 8-year-old male patient was implanted because of congenital profound-sensorineural deafness. The child was born term. Preoperative computed tomography (CT) and magnetic resonance imaging (MRI) showed that there was no malformations in inner ear. The patient underwent right cochlear implantation. Surgery was performed via posterior tympanotomy. After the round window niche was visualized, diamond burr (0.5 mm) was used to remove the round window niche overhang, maximally exposing the round window membrane. We found the round window membrane was smaller than usual. After placed the receiver stimulator the bony seat, the round window membrane was then carefully incised using a fine-curved pick, and a Med-El Combi 40+ electrode array (Medical Electronics Innsbruck, Austria) was carefully inserted through the round window membrane, resistance was not encountered while introducing the electrodes. The round window membrane was then closed with small pieces of temporalis fascia. Intra-operative neural response telemetry was not performed because of product C40+. X-ray in Stenver's view was performed second day after surgery. The result of X-ray showed doubtful abnormal placement of the cochlear implant electrode array (Fig. 1A).

The child felt dizziness and no auditory perception upon the first electrical stimulation of the device. Electronic failure of the device was ruled out after performing various electrical tests that confirmed implant functionality. Postoperative CT indicated that the electrode array had been inserted in the superior semicircular canal (Fig. 1B).

The revision surgery with re-implantation were performed with extended round window insertion. The electrode array was removed and the round window was widened slightly antero-inferiorly. The electrode was inserted through extended round window, advanced within the scala tympani of the basal turn of the cochlea from its inferior segment to its ascending, superior and descending segments. Position of the electrodes was confirmed in the postoperative X-ray. The device was successfully programmed, and there has been considerable improvement in audiological and language performances after 1 year of follow-up.

3.2. Case 2

A 6-year-old female patient was implanted because of congenital profound-sensorineural deafness. The child was born term. Preoperative CT and MRI also showed that there was no malformations in the inner ear. We also found the round window membrane was smaller than usual. An Advanced Bionics Hires90k electrode array (Advanced Bionics, America) was carefully inserted through the round window membrane, resistance was not encountered while introducing the electrodes. Intra-operative neural response telemetry revealed absent responses. An X-ray in Stenver's view showed abnormal placement of the cochlear

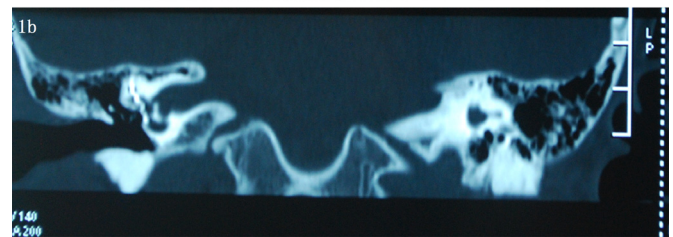


Fig. 1. (A) X-ray in Stenver's view, showing the misplaced electrode entering probably the superior semicircular canal. (B) CT showing the misplaced electrode entering the superior semicircular canal.

implant electrode array (Fig. 2A). Postoperative CT verified that the electrode array had been inserted in the superior semicircular canal (Fig. 2B).

The revision surgery with re-implantation was also performed with extended round window insertion. The electrode array was

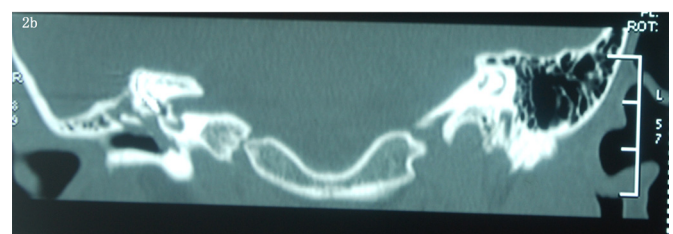
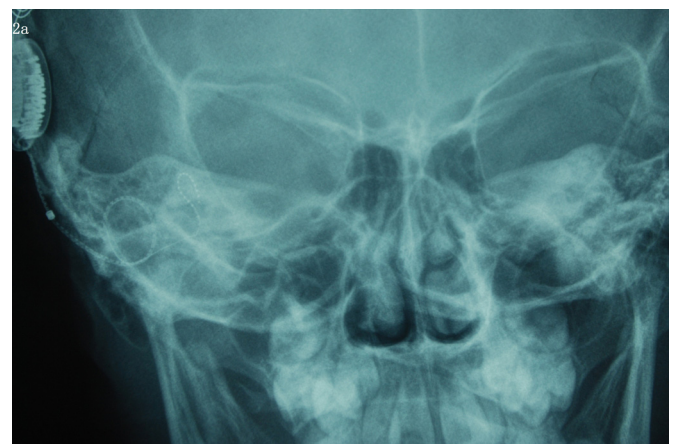


Fig. 2. (A) X-ray in Stenver's view, showing the misplaced electrode entering probably the superior semicircular canal. (B) CT showing the misplaced electrode entering the superior semicircular canal.

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