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Case Report

Hearing Improvement After Pain Related to Cochlear Implant Explantation: A Case Report

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This study aims to report a cochlear-implanted case who was explanted due to recalcitrant pain at the site of the device, despite various management trials. After explantation, this patient had an unexpected subjective and objective improvements in hearing. The patient reported improved hearing after explantation and was satisfied with using hearing aids. The audiological evaluation of the patient showed not only preserved hearing but also an unexpected hearing improvement. The medical records of the patient were reviewed to retrieve all the relevant data. This case illustrates how pain after cochlear implantation can be severe enough to discourage the patient from undergoing re-implantation. It also shows an unexpected hearing improvement after explantation. Although a human error in audiological evaluation can be the first and most simple possible explanation for this finding, the objective improvement of the patient is highly suggestive of a real hearing improvement. It can be hypothesized that the mechanical or electrical stimulation by the cochlear implant could have led to this hearing improvement.

KEYWORDS: Cochlear implant, hearing preservation, hearing improvement, pain, explantation

INTRODUCTION

Over the last few decades, cochlear implantation (CI) has remained the mainstay of treatment for severe to profound sensorineural hearing loss that does not improve with hearing aids. Electroacoustic stimulation (EAS) types of CI have had superior functional outcomes in patients with aid-able low-frequency hearing.[1] Cochlear implantation is a safe procedure with low major complication rates.[2,3] Among its rare major complications is intractable pain at the implantation site.[4-6]

Pain with no identifiable precipitating cause, such as infection or inflammation, often occurring without deterioration of hearing performance, has been recently described in the literature. Multiple conservative and invasive management options have been suggested and attempted with varying success rates. An effective last resort approach is device explantation. Most patients who need explantation will undergo reimplantation.[7]

In this study, we report a rare case of a patient who presented with pain after EAS device implantation. The pain persisted despite conservative measures. Thus, the physicians faced the dilemma of requiring explantation, which posed a significant risk of residual hearing loss.

CASE REPORT

A 41-year-old man with no medical comorbidities presented to our clinic in October 2010. The patient presented with progressive bilateral hearing loss since he was 14 years old. He had no prior ear infections, head trauma, noise exposure, or medication use. He did not experience other aural symptoms, such as tinnitus, vertigo, facial weakness, or otorrhea. The patient had no significant family history of hearing loss, except for his mother who had reduced hearing due to old age. Physical examination revealed bilateral intact tympanic membranes. Fork examination revealed a centralized Weber's test and bilaterally positive Renie's test. Audiometric testing showed bilateral moderate sloping to profound sensorineural hearing loss with a poor speech reception threshold and speech discrimination score (Figure 1). Computed tomography (CT) of the temporal bones revealed bilateral abnormalities.

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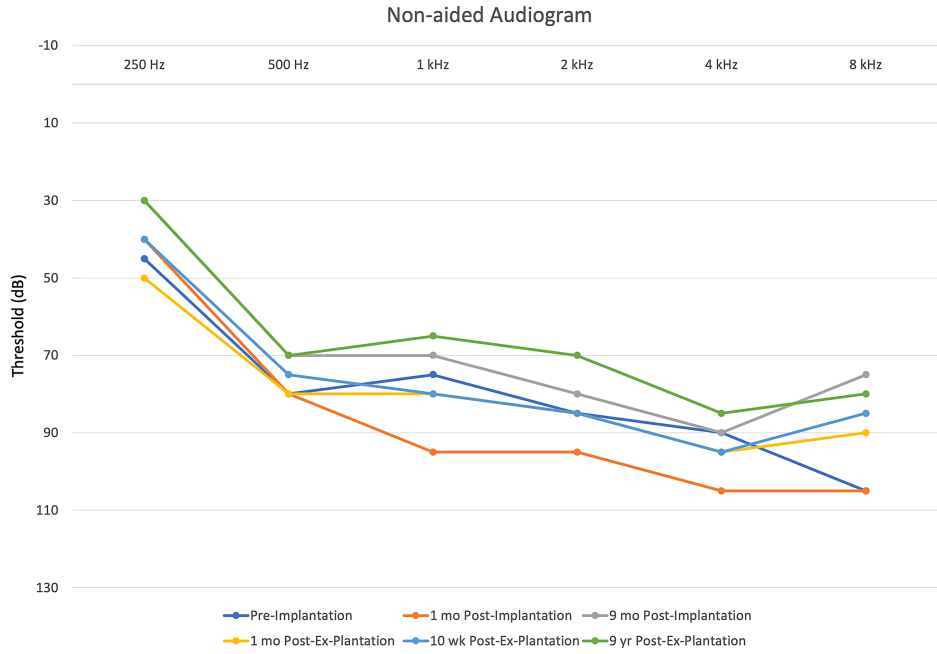

Figure 1. The hearing level of the patient.

The patient's case was discussed at the cochlear implant committee meeting in November 2010, and he became a good candidate for left CI.

In January 2011, the patient underwent left CI with Cochlear Nucleus Hybrid L24. Using the round window approach, the electrode was fully inserted. The internal receiver-stimulator was placed in the bed without suture fixation, and the ground electrode was inserted under the temporalis muscle. Three doses of 8 mg dexamethasone intravenous injection were given in an 8-hour interval on the day of implantation. The first dose was given upon anesthesia induction. He was discharged on the day of surgery. The stapedial reflex was intact in all tested frequencies, and compound action potential was elicited in all channels. The electrode was then sealed with the temporalis fascia. The patient tolerated the procedure and was discharged on the same day. He was prescribed oral antibiotics and paracetamol for pain control.

Three weeks postoperatively, the patient experienced sharp pain at the implantation site. The history-taking and physical examination were otherwise normal. He had no swelling, tenderness on touch, redness, or discharge. The device functioning was examined which showed within normal impedances and electrically evoked compound action potentials in all electrodes. The external device was checked for any breakage, the wires were evaluated, and the batteries were changed. In an attempt to decrease the pressure over the implanted site, the power of the magnet was decreased to the minimum. However, the pain persisted despite not using an external device. A 1-week trial of oral non-steroidal anti-inflammatory drugs, followed by a 1-week trial of oral antibiotics, failed to alleviate the pain. The patient was referred to a psychiatry clinic to exclude underlying depression or psychosomatic abnormalities. He was also referred to a highly specialized pain clinic, but his symptoms did not improve. He received 3 lidocaine injections at the anterior tip of the mastoid, but this did not improve his pain. He also received a trial of oral steroids for 2 weeks with no benefit. Computed tomography of the temporal bone performed 3 months postoperatively showed no abnormalities or sources of the pain. One year after CI, the patient continued to experience pain. Due to this pain, the patient was not able to wear the device. No programming could be performed; hence, the audiological gain of the device could not be evaluated. No significant decline in residual hearing was noted during this year. Finally, the patient opted for implant removal. He was counseled on the high risk of losing his residual hearing, which would leave him with a hearing status that was worse than his preoperative status. The patient still desired to proceed with the removal. The case was presented at the cochlear implant committee meeting. The patient's wishes to proceed with explantation were respected.

In October 2011, the patient underwent explantation of his left CI with no complications. The electrode array was cut distally in the mastoid cavity to optimize the view of the round window before removal. Using a needle, the soft tissues were removed gently in the mastoid, over the facial recess, and around the electrode at the entrance to the round window. The electrode array was then removed under vision smoothly and in one piece. There was no perilymph gush and the round window was sealed with a small piece of temporalis muscle. Similar to the primary procedure, 3 doses of 8 mg dexamethasone intravenous injection were given in an 8-hour interval on the day of implantation. The first dose was given upon anesthesia induction. He was discharged on the day of surgery. Subsequent follow-up examinations showed complete resolution of pain, and the patient was satisfied with his hearing condition. Pure tone average (PTA) testing showed no change from pre-explantation hearing (paired *t*-test; mean difference = 0.00, $P = 1.00$).

The explanted device was sent to the company for the analysis of its integrity. The visual inspection showed an intact device and electrode array, except for the cut that was consistent with the explantation procedure. Electrical telemetry test confirmed normal communication between the implant and the speech processor. The implant showed to be functioning to specification and manufacturing

records confirmed compliance with quality system procedures and processes.

The patient had 2 long-term follow-ups at 4 and 9 years post explantation. He has not reported pain, and his hearing has maintained the same thresholds as his initial PTA. Upon comparing with the preoperative audiogram, the patient's current hearing was shown to improve (paired *t*-test; mean difference = 13.33, $P < .001$). The patient had a speech reception threshold of 65 dB and a word recognition score of 80% at 100 dB. He was satisfied with his condition and had no desire to attempt implantation again.

Written informed consent was obtained from the participant who participated in this case study.

DISCUSSION

This case demonstrated the challenging complication of intractable pain post-CI in an ear with preserved low-frequency hearing. Oral analgesics and oral antibiotics did not alleviate the pain. These measures have reportedly resolved pain in 22% and 32% of cases, respectively.[7] Other treatment options reported in the literature included local therapy with topical and injected steroids or anesthetics.[4,8,9] Local therapy was reportedly 63% effective.[7] Other management options included magnet replacement, electrode deactivation, and tympanic neurectomy.[7] Explantation harbored the risk of losing the benefits of the CI and preoperative residual hearing. This would have resulted in a hearing capability that was worse than the preoperative state.

The patient decided to undergo explantation without reimplantation. The patient has maintained his residual hearing postoperatively for 9 years. Reports on patients who maintained residual hearing after EAS explantation are few.[5,10-13] By contrast, there are articles that have reported the total loss of residual hearing after CI.[14] The use of a straight electrode array and round window approach are known to improve hearing preservation, and these were used in our case. The auditory outcomes of patients who refuse reimplantation have not been well studied and there is a paucity of evidence on this subject. In a recent systematic review, none of the patients opted out of reimplantation after explantation due to pain.[8] In our case, the patient's preserved residual hearing likely motivated his decision to refuse CI.

Our patient experienced pain with no signs of inflammation, infection, or implant failure. Any infection or inflammation may have contributed to intracochlear fibrosis with loss of residual hearing. Our case further showed that the robustness of the inner ear could be preserved as long as trauma to the inner ear structures is minimized, and proper "soft surgery" techniques are followed.

Hearing fluctuations and improvement in unaided hearing in the implanted ear were observed. This was an unexpected finding, reliably documented via audiometry. Repeated audiologic assessments during the same session gave consistent results. The hearing improvement observed after implantation was discussed in the cochlear implant committee. The first consideration was personal or machine errors. However, it was impossible to repeat the preoperative audiologic assessment to eliminate this possibility. Considering the subjective improvement of the patient and his increased satisfaction with hearing aids after explantation, other reasons were considered. Some hypothesized that the perioperative intravenous steroid injection and oral steroids administered for postoperative pain management improved his hearing. Another hypothesis was the mechanical stimulation of the basilar membrane upon electrode array insertion.

CONCLUSION

Severe post-CI pain with no identifiable etiology can discourage patients from keeping the CI and undergoing reimplantation. Long-term attainment of auditory function after EAS device plantation is possible. The improved residual hearing 9 years postoperatively illustrated the importance of low-frequency hearing preservation surgery to achieve the most favorable outcome in these situations.

Informed Consent: Written informed consent was obtained from the participant who participated in this study.

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