

Case Report

Retrofacial Approach for Cochlear Implantation in Chronic Otitis Media: A Case Report*

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Cochlear implantation is anatomically more difficult in postoperative ears than in normal ears due to chronic otitis media. In cochlear implantation after canal wall down mastoidectomy, the electrodes must be protected. We report a case of cochlear implantation with partial mastoid obliteration using a retrofacial approach in an 81-year-old woman. Bilateral tympanoplasty was performed for bilateral chronic otitis media, but no improvement in hearing was observed. Hearing aids were used, but their effect was insufficient and cochlear implantation was needed. Since the patient was an older adult with diabetes, it was necessary to avoid the risk of wound infection associated with fat harvesting from the abdomen, which is necessary for overclosure of the external ear. Therefore, we chose to perform partial mastoid obliteration using a retrofacial approach to ensure the prevention of electrode exposure. One year after surgery, the electrode had not been exposed or infected. The ear canal was preserved, and the eardrum could be observed. Although long-term follow-up is required, this approach may be useful for cochlear implantation in patients with chronic otitis media after canal wall down mastoidectomy.

KEYWORDS: Cochlear implants, otitis media, retrofacial approach, mastoidectomy

INTRODUCTION

Cochlear implantation (CI) after canal wall down mastoidectomy (CWDM) is complicated; it requires more caution than cases without middle ear disease. Electrode exposure may occur, leading to complications. The following techniques are used for CI after CWDM: (1) covering the electrodes with cartilage to maintain the shape of the external auditory canal (partial mastoid obliteration (PMO))¹ and (2) completely closing the ear canal with fat or a muscle flap (overclosure of the external ear (OCEE)).² Overclosure of the external ear is associated with a low risk of electrode exposure,³ but the residual cholesteatoma or granulation formation cannot be visually observed following this technique.⁴ Additionally, the middle and external ears often need to be filled with fat harvested from the abdomen, and invasion of the abdomen is necessary.² In this study, we report a case of CI after CWDM where observation of the middle ear and prevention of electrode exposure were made possible using a retrofacial approach for PMO.

CASE PRESENTATION

The patient was an 81-year-old woman with type 2 diabetes mellitus without any significant family history and she provided written informed consent. She had otitis media since childhood. Left tympanoplasty (canal wall up mastoidectomy) was performed thrice (the last 2 times at our hospital), and right tympanoplasty (CWDM) was performed once at another hospital, with no improvement in hearing acuity. Subsequently, the right ear was considered the good hearing ear (average hearing level at 500, 1000, and 2000 Hz: 71.7 dB [right ear] and 93.3 dB [left ear]). At the age of 80, rapid deterioration of right-sided hearing acuity was observed and promptly treated with steroids; however, it did not improve, and she developed right-sided deafness. Hearing aid use was initiated for the left ear, which became the good hearing ear, but the hearing improvement was insufficient speech performance-intensity function of the left ear with aid: 20% [65 dB sound pressure level (SPL)] and 15% [80dB SPL]).

Since the sensory function of the right ear was better maintained than that of the left ear before deterioration, it was expected to perform well and was therefore chosen for the cochlear implant. Since the patient was an older adult, PMO with a retrofacial approach was performed to reduce surgical invasion.

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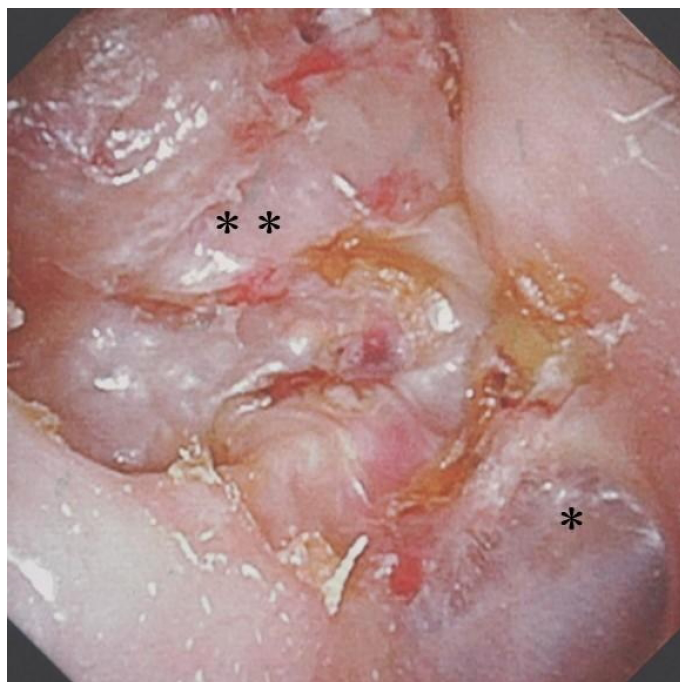


Figure 1. The preoperative findings of the right ear. No inflammation of the ear canal and tympanic cavity is observed. *The eardrum is thickened. **The posterior wall of the ear canal is excised and exposed to the mastoid cavity.

Figure 1 shows the preoperative findings of the right ear. Figure 2 shows the pure-tone audiometry results.

Temporal bone computed tomography revealed an exposed posterior wall of the ear canal and an open mastoid cavity. Bone defects were observed in a part of the lateral semicircular canal ridge (Figure 3A). A 3.5 mm space was observed between the mastoid segment of the facial nerve and the posterior semicircular canal (Figure 3B). No other inner ear or facial nerve abnormalities were found.

An incision was made in the postauricular area. A palva periosteal flap was created. The skin of the mastoid cavity was peeled until the tympanic cavity. Bone defects were noted in a part of the lateral semicircular canal ridge (Figure 4A). The bone defect sites were covered with fascia. A round window fossa covered with thickened mucosa and its superior bony overhang was identified. The mastoid segment of the facial nerve was identified. The

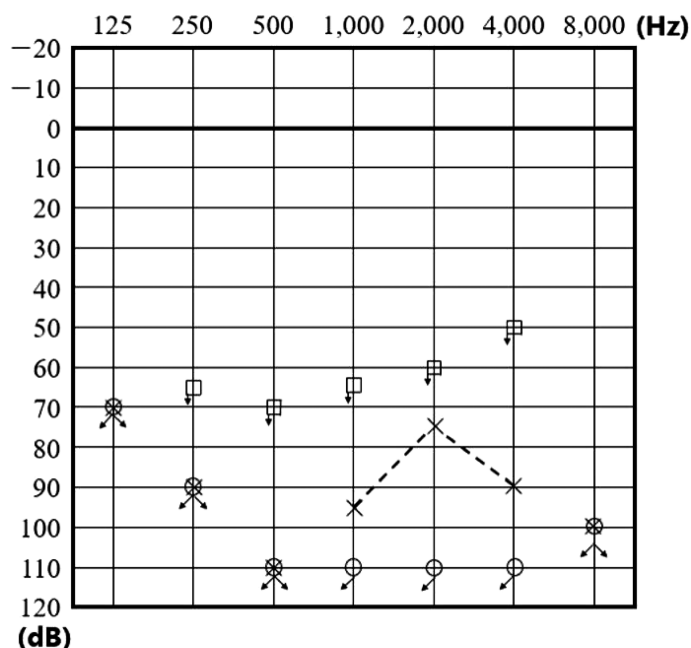


Figure 2. The results of pure tone audiometry performed before cochlear implantation. The average hearing level at 500, 1000, and 2000 Hz: 71.7 dB for the left ear and 93.3 dB for the right ear.

space between the mastoid segment of the facial nerve and the posterior semicircular canal was drilled (retrofacial approach), and the cochlear implantation electrode (CI522: Cochlear Corp., Sydney, Australia) was inserted into the round window through this space (Figure 4B). Fascia temporalis, cymal cartilage, and temporal bone fragments were used to cover the electrode in the mastoid cavity (Figure 4C). The external surface was covered using the palva flap (Figure 4D). Finally, it was covered with ear canal skin. The schema of the electrodes and its coverings is shown in Figure 5.

A year and a half after the surgery, there was no electrode exposure or infection, the ear canal was preserved, and the eardrum could be observed. The hearing thresholds with CI were 30, 25, 25, 30, and 20 for 250, 500, 1000, 2000, and 4000 Hz, respectively. Mild inflammation remained in the material covering the electrodes, and a small amount of scabbing was observed, but it can be controlled by treatment once every 3 months (Figure 6).

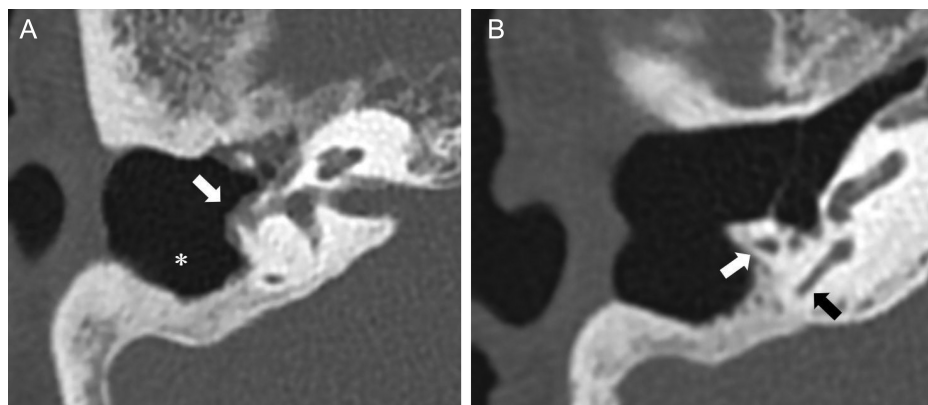


Figure 3. A, B. (A) Temporal bone computed tomography. ⇨ Bone defect in a part of the lateral semicircular canal ridge. *The posterior wall of the ear canal has been excised, and the mastoid cavity is open. (B) Temporal bone computed tomography. ⇨ Mastoid segment of the facial nerve. ⇨ Posterior semicircular canal.

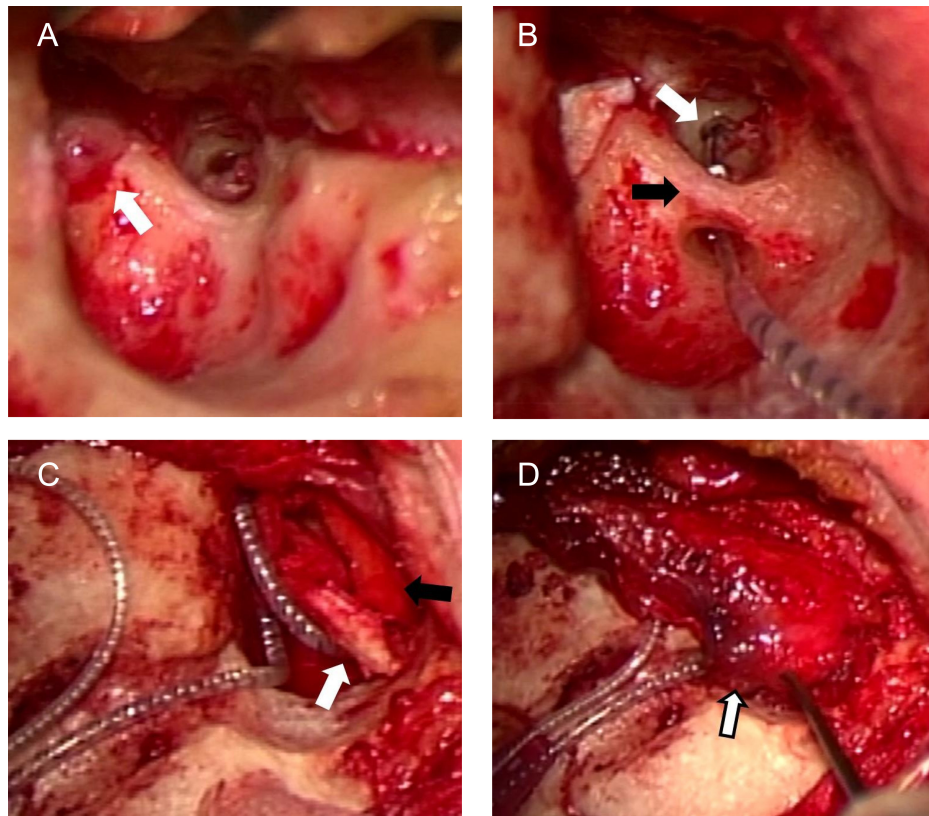


Figure 4. A-D. (A) The post-mastoidectomy findings of the right ear. ⇨ Bone defect in a part of the lateral semicircular canal ridge. (B) Retrofacial approach. ⇨ Round window. ➡ Mastoid segment of the facial nerve. (C) The material covering the electrode. ➡ Cartilage. ⇨ Bone fragments. (D) The material covering the external surface of cartilage and bone fragments.

DISCUSSION

Partial mastoid obliteration and overclosure of the external ear are frequently used for post-CWDM CI. Balk et al¹ observed no electrode exposure in 8 cases of PMO and 4 cases of OCEE. A systematic review of 399 cases reported fewer postoperative complications for OCEE

than for PMO³; OCEE was superior to PMO in preventing electrode exposure (ratio of electrode exposure: 7/358 [1.9%] for OCEE and 5/41 [12%] for PMO). However, OCEE has the following disadvantages: difficulty in observing the middle ear cavity, postoperative

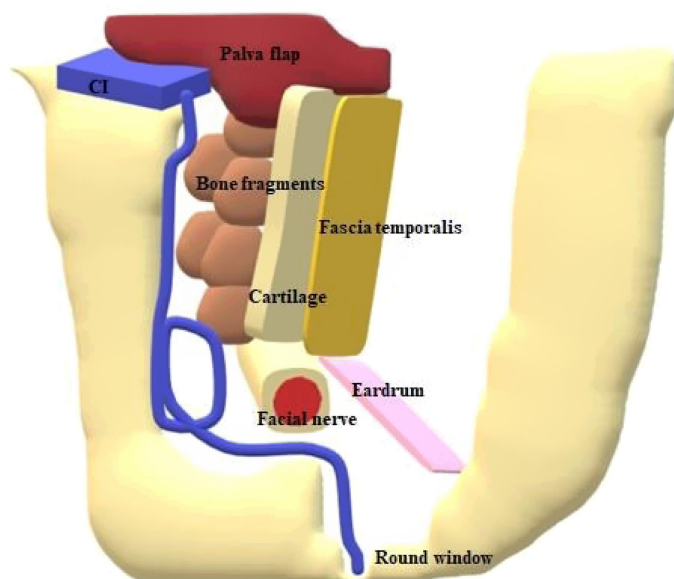


Figure 5. A schema of the electrodes and its coverings. CI, cochlear implantation.

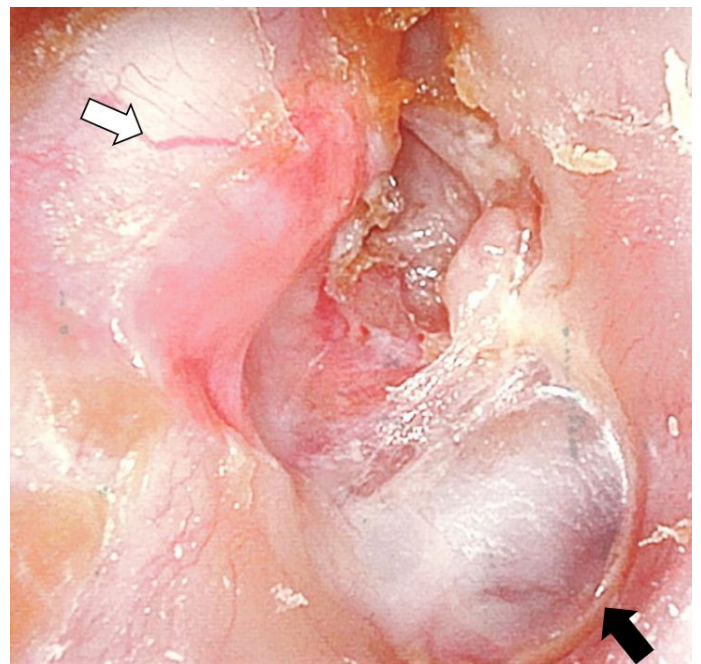


Figure 6. The postoperative findings of the right ear. ⇨ Material covering the electrode. ➡ Eardrum.

middle ear infection, meningitis due to cholesteatoma recurrence in the mastoid cavity, filled fat necrosis and granulation, and hematoma formation due to abdominal fat harvesting. Since PMO allows for visual observation of the middle ear after surgery, it is considered to be more useful than OCEE.

Here, we selected a surgical technique based on 3 criteria: (1) minimally invasive, (2) allows for visual observation of the condition of the middle ear, and (3) prevents exposure to electrodes as much as possible. Due to (1), OCEE, which uses harvested abdominal fat to fill the middle ear and ear canal, was not used. PMO satisfies (2) but is not as good as OCEE for (3). Therefore, we tried to prevent electrode exposure by using the retrofacial approach, which involves drilling between the mastoid segment of the facial nerve and the posterior semicircular canal, for PMO. This technique has been used for directly approaching cholesteatomas in the tympanic sinus which cannot be removed using posterior tympanotomy.⁵

Pickett et al⁶ reported that this approach can be safely performed when the line connecting the medial facial nerve and posterior semicircular canal (FP line) is ≥ 3 mm, and the FP line and rearmost part of the tympanic sinus are within 2.3 mm. Here, the FP line was 3.5 mm, and its distance from the rearmost part of the tympanic sinus was 1.9 mm, which met the aforementioned criteria. Additionally, we drilled between the mastoid segment of the facial nerve and posterior semicircular canal and performed the round window approach without any problem. Moreover, since fat filling was not performed, invasion of the abdomen was avoided.

The retrofacial approach has been used for CI in patients with malformed ears in whom round windows were inaccessible through the standard facial recess.⁷ We believe that only Levent et al⁸ have used the retrofacial approach for CI after CWDM for chronic otitis media; however, it is unclear whether they performed PMO or OCEE.

The bond between the material covering the electrodes and the eardrum is fragile; therefore, the electrode may be exposed here.

By performing the retrofacial approach, the facial nerve canal will be present between the material covering the electrodes and the eardrum. Therefore, the above vulnerabilities can be compensated for, and electrode exposure is further prevented.

CONCLUSION

In a super-aging society such as Japan, there are many older adults with hearing loss after CWDM with chronic otitis media who are potential candidates for CI. For them, the use of the retrofacial approach for PMO, which has relatively minimal invasiveness, should be considered.

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

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Author Contributions: Concept – H.S., S.F.; Design – S.F.; Supervision – T.K.; Materials – S.F., H.S.; Data Collection and/or Processing – S.F.; Analysis and/or Interpretation – S.F.; Literature Review – S.F.; Writin Manuscript – S.F.; Critical Review – S.F.

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