

CASE REPORT

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Successful cochlear implantation in a patient with preexisting bilateral deep brain stimulation: A case report with two-year follow-up

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ABSTRACT

Introduction: Cochlear implantation (CI) in patients with preexisting bilateral deep brain stimulation (DBS) systems is rarely performed because of concerns regarding electromagnetic interference, device malfunction, telemetry disruption, and intraoperative safety. We report the successful cochlear implantation of a patient with bilateral ventral intermediate nucleus (VIM) DBS, with two years of clinical and audiologic follow-up demonstrating sustained outcomes without DBS-related complications.

Case Report: A 79-year-old man with progressive bilateral sensorineural hearing loss and medically refractory essential tremor treated with staged bilateral VIM DBS underwent right cochlear implantation after obtaining limited benefit from hearing aids. Preoperatively, right hearing-aid testing demonstrated consonant-nucleus-consonant (CNC) word recognition of 16% and an AzBio score of 33%. Right cochlear implantation was performed using a Cochlear Americas CI632 electrode array. Full electrode insertion was achieved, with normal intraoperative neural response

telemetry and no surgical complications. Postoperatively, speech perception improved substantially, with CNC word recognition increasing to 74% at five months and 70% at nine months. Bimodal AzBio sentence scores were 84% at five months and 72% at nine months. During two years of follow-up, there were no episodes of DBS malfunction, telemetry interference, programming difficulty, or cochlear implant device failure.

Conclusion: Cochlear implantation can be safely performed in patients with preexisting bilateral DBS systems with careful perioperative planning and device management. This case adds to the limited literature by demonstrating successful cochlear implantation in a patient with established bilateral VIM DBS, including successful intraoperative device testing, substantial postoperative improvement in speech perception, and sustained compatibility between the cochlear implant and DBS systems over two years of follow-up.

Keywords: Cochlear implant, Deep brain stimulation, Essential tremor, Sensorineural hearing loss

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INTRODUCTION

Cochlear implantation (CI) in patients with preexisting deep brain stimulation (DBS) systems presents a unique clinical challenge because both devices contain implanted electronic components that may raise concerns regarding electromagnetic interference, device malfunction, telemetry disruption, and perioperative safety. Although CI and DBS are each well-established therapies, there are few reports describing CI implantation in patients with established DBS systems. Most published reports focus on patients who underwent DBS implantation in the setting of a preexisting CI, with particular attention to imaging limitations, surgical planning, device positioning, and postoperative programming [1–3].

St. Martin and Hirsch described successful cochlear implantation in a patient with bilateral DBS, providing early evidence that CI can be performed in the presence of bilateral neuromodulation hardware [1]. Subsequent reports have further addressed the interaction between CI and DBS systems and the practical considerations involved in managing both devices. Kons et al. described two patients with preexisting CIs who later underwent DBS implantation and emphasized multidisciplinary planning, careful assessment of hardware location, and postoperative monitoring for potential device interactions [3, 4]. Other reports have similarly discussed the technical considerations involved when these two systems are implanted sequentially [2, 5].

Our case describes cochlear implantation in a patient with established bilateral VIM DBS. Although CI implantation in the setting of bilateral DBS has been previously reported, detailed longitudinal audiologic outcomes and extended follow-up have been less commonly described. In addition to perioperative and surgical considerations, we report postoperative speech-perception outcomes, including CNC word-recognition and AzBio sentence testing, and two years of clinical follow-up evaluating the compatibility and function of both implanted systems.

CASE REPORT

A 79-year-old man presented with a greater than 20-year history of progressive bilateral sensorineural hearing loss. He had used bilateral hearing aids for more than 10

years; however, his speech discrimination continued to decline despite amplification. His medical history was notable for medically refractory essential tremor treated with staged bilateral DBS implantation in 2023. The DBS targets were the bilateral ventral intermediate nuclei (VIM). The system consisted of a Boston Scientific Vercise Genus R16 implantable pulse generator with bilateral Cartesia directional leads and provided substantial tremor control. The DBS system was documented as not being MRI-compatible.

Preoperative cochlear implant evaluation demonstrated limited benefit from amplification in the right ear. With bilateral hearing aids, the patient's AzBio score in quiet was 74%. With the right hearing aid alone, the AzBio score was 33%, consonant-nucleus-consonant (CNC) whole-word recognition was 16%, and CNC phoneme recognition was 31%. With the left hearing aid alone, the AzBio score was 80% (Table 1). Given the poor right-sided speech discrimination despite appropriate amplification and progressive hearing loss, the patient was considered an appropriate candidate for right cochlear implantation.

Operative Course

In October 2024, the patient underwent right cochlear implantation with mastoidectomy under general anesthesia using an operating microscope. The DBS system was turned off prior to incision to minimize the risk of unintended stimulation or device interference. Normal mastoid anatomy was identified, and several venous perforators were controlled with electrocautery. The facial nerve was identified but not exposed. An extended round-window approach was used for full insertion of a Cochlear Americas CI632 electrode array. Intraoperative neural response telemetry demonstrated normal impedances and robust responses across all electrodes. Intraoperative imaging confirmed appropriate intracochlear electrode positioning without tip rollover. There were no intraoperative complications (Table 2).

Postoperative Course

Three days postoperatively, the patient turned on the DBS system without complication, device interference, or adverse neurologic symptoms. No changes to the preexisting DBS programming parameters were required. Formal postoperative DBS interrogation was

Table 1: Preoperative audiologic results

Test	Bilateral HA	Right HA only	Left HA only
AzBio in quiet	74%	33%	80%
CNC whole words	—	16%	—
CNC phonemes	—	31%	—

Abbreviations: HA: hearing aid; CNC: consonant-nucleus-consonant.

Table 2: Preoperative and postoperative audiologic outcomes

Time point	Right ear/Right CI	Bimodal (right CI + contralateral HA)
Preoperative	CNC 16% words/31% phonemes; AzBio 33% with right HA	AzBio 74%
Five months after activation	CNC 74% words/86% phonemes	AzBio 84%
Nine months after activation	CNC 70% words/87% phonemes	AzBio 72%

Abbreviations: CI: cochlear implant; HA: hearing aid; CNC: consonant-nucleus-consonant.

not performed because there was no clinical indication for reprogramming or device-related intervention. The patient continued routine follow-up with his neurologist and neurosurgeon, with no subsequent complications or interventions involving either implanted device.

The cochlear implant was activated postoperatively. Compared with preoperative right hearing-aid performance (CNC 16%, AzBio 33%), speech perception improved following cochlear implantation. At five months after activation, CNC word recognition with the right CI was 74%, with 86% phoneme recognition, and bimodal AzBio performance with the contralateral hearing aid was 84%. At nine months, CNC word recognition was 70%, with 87% phoneme recognition, and bimodal AzBio performance was 72%.

During two years of follow-up, there were no reported episodes of DBS malfunction, telemetry interference, programming difficulty, or cochlear implant device failure. The patient continued to benefit from the cochlear implant without reported adverse interactions between the CI and DBS systems.

DISCUSSION

Cochlear implantation in a patient with an established DBS system presents a unique perioperative challenge because of concerns regarding potential electrical or electromagnetic interaction between the two implanted devices. Previous reports describe successful sequential implantation of CI and DBS, although most have involved DBS implantation in patients with a preexisting CI [1–5].

St. Martin and Hirsch previously described successful cochlear implantation in a patient with preexisting bilateral DBS, demonstrating that CI surgery can be safely performed in the presence of bilateral DBS hardware [1]. Our case similarly shows successful CI implantation following bilateral DBS, while providing additional objective audiologic outcomes and detailed longitudinal follow-up. In particular, our report documents postoperative speech-perception outcomes with serial CNC and AzBio testing, as well as sustained cochlear implant and DBS function over two years without device malfunction, telemetry interference, or the need for DBS programming adjustments.

Other reports have described DBS implantation in patients with preexisting cochlear implants. Buell et al.

discussed DBS implantation in the setting of preexisting CIs, including potential interactions between the systems [2]. Kons et al. reviewed the considerations involved when both devices are present, including device location, surgical planning, and potential device interactions [3]. Additional literature has addressed electromagnetic interference involving DBS systems [4, 5].

The sequence of implantation is relevant to surgical planning. When DBS is performed in a patient with a preexisting CI, the cochlear implant may affect magnetic resonance imaging (MRI) access and stereotactic planning, and the DBS extension wires must be positioned to avoid the existing CI hardware [2, 3]. In contrast, during CI surgery in a patient with established DBS, the otologist must identify and avoid the DBS extension wires during the retroauricular approach and mastoidectomy.

Kons et al. discussed the potential for DBS extension wires to course near the mastoid and stressed the importance of knowing their location before CI surgery [3]. In our case, the DBS system was turned off before surgery, and care was taken to avoid the existing DBS hardware during the retroauricular approach and mastoidectomy. Intraoperative CI testing showed normal device function. There were no postoperative device interactions during follow-up.

The DBS system was turned off before surgery to reduce the risk of unintended stimulation and electrical interference [4]. Electrocautery was used to control venous perforators during mastoidectomy without an intraoperative complication. The patient resumed DBS use three days after surgery without adverse neurologic symptoms or apparent device interference. No changes to his DBS programming were required. Formal postoperative DBS interrogation was not performed because there was no clinical indication for reprogramming or device-related intervention.

The audiologic outcomes were favorable. Before implantation, CNC word recognition in the right ear was 16%, with an AzBio score of 33% using the right hearing aid. After implantation, CNC word recognition increased to 74% at five months and was 70% at nine months. Bimodal AzBio scores were 84% at five months and 72% at nine months. These results represent a substantial improvement in speech perception compared with preoperative performance with the right hearing aid.

Our patient underwent CI implantation after established bilateral VIM DBS without injury to the

existing DBS hardware or apparent interaction between the two systems. The postoperative speech-perception results also showed substantial benefit from cochlear implantation. This experience supports consideration of CI implantation in patients with established DBS when the location of the DBS hardware and perioperative device management are carefully addressed.

CONCLUSION

Cochlear implantation was successfully performed in this patient with established bilateral VIM DBS. The patient had substantial improvement in speech perception following right cochlear implantation, with no reported DBS malfunction, telemetry interference, programming difficulty, or cochlear implant failure during two years of follow-up. This case suggests that preexisting DBS should not be considered an absolute contraindication to cochlear implantation, although careful perioperative planning and device management are important.

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AI was used to edit the manuscript.

AI tool used: ChatGPT (OpenAI), GPT-5.5. I certify that AI was used only for language and grammar assistance. All facts, data, and records presented in the manuscript are the authors' own intellectual contribution, and no part of the facts, data, and records presented in the manuscript are generated using AI tools.

Author Contributions

Nirmal Thapa – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the

version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Marissa J Rabadi – Design of the work, Acquisition of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Cayce G Jabour – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

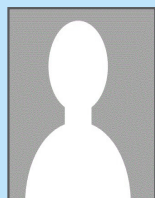
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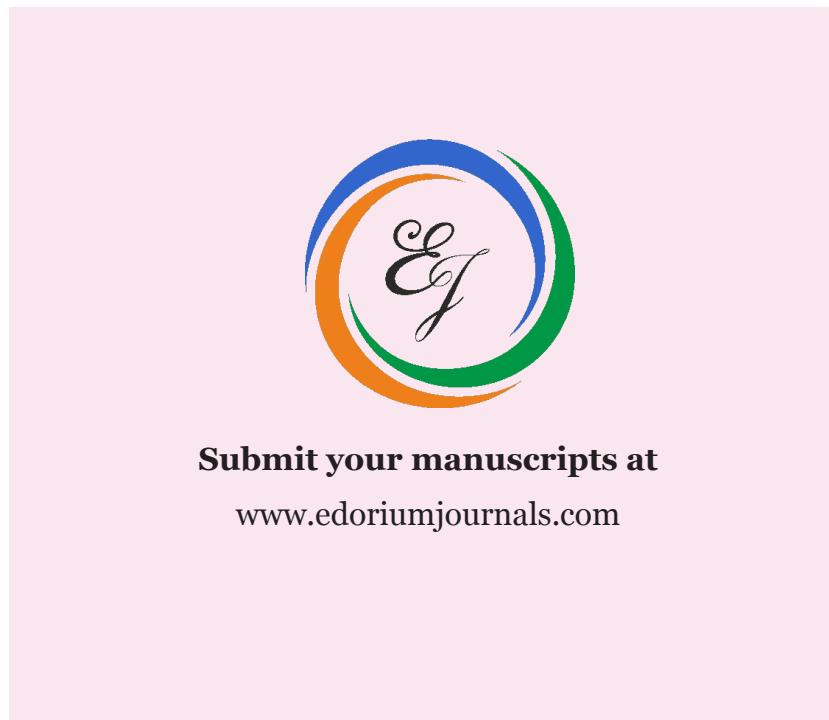
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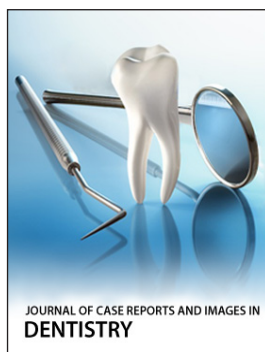
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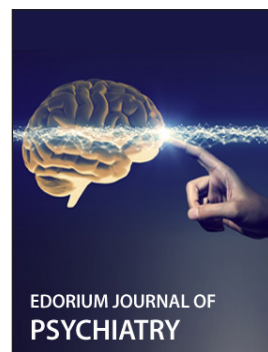
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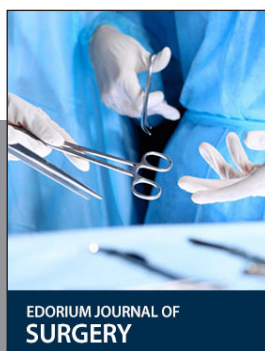
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