

## MRI Without Magnet Removal in Neurofibromatosis Type 2 Patients With Cochlear and Auditory Brainstem Implants

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**Objective:** To assess the impact on image quality of MRI without magnet removal in cochlear implant (CI) and auditory brainstem implant (ABI) users with neurofibromatosis type 2 (NF2).

**Study Design:** Prospective cohort.

**Setting:** Tertiary center for cochlear and auditory brainstem implantation.

**Patients:** Thirteen patients (10 ABI, 3CI) with NF2 underwent a total of 76 MRI scans.

**Interventions:** MRI without magnet removal.

**Main Outcome measure:** Ability to visualize the ipsilateral and contralateral cerebellopontine angles (CPAs) and internal auditory meati (IAM) with head MRI.

**Results:** Of the 76 scans, 40 were of the head, 28 of the spine and 8 of other regions. Scanning was performed with a tight head bandage and plastic card. There were no cases of altered implant function or demagnetization of the device magnet. A

grading system was used to assess the view of the ipsilateral IAM-CPA. In 85% of head scans, the view was unimpaired (Grade 0). In 13%, there was distortion (Grade 1). In 2% (1 case), the view was entirely obscured by artifact (Grade 2). Views of the contralateral CPA and IAM were unimpaired in all cases. The best 3 sequences for the depiction of the ipsilateral IAM-CPA (percent graded as 0) were as follows: axial 3D inversion recovery prepared fast spoiled gradient echo (100%), 2 mm coronal T1W of the IAM-CPA (88.9%), and 2 mm axial T1W of the IAM-CPA (76.9%).

**Conclusion:** MRI scanning without magnet removal is safe and well tolerated in NF2 patients with auditory implants. With appropriate MRI sequences, the image quality is not significantly impaired. **Key Words:** Auditory brainstem implant—Cochlear implant—Magnetic resonance imaging—Neurofibromatosis type 2—vestibular schwannoma.

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### OBJECTIVE

Neurofibromatosis type 2 (NF2) is a rare genetic disorder characterized by the development of bilateral vestibular schwannomas, spinal tumors, and other benign lesions of the nervous system. A majority of those affected will acquire a profound postlingual sensorineural hearing loss as a result of their disease or its management. Hearing rehabilitation in these patients has been revolutionized by auditory brainstem implants (ABIs) and cochlear implants (CIs). Both CI and ABI directly stim-

ulate the auditory pathway electrically. A CI electrode is placed in the cochlea and may be used when there is a cochlear hearing loss in the presence of an intact functioning cochlear nerve. An ABI electrode is placed on the cochlear nucleus and is required when the cochlear nerve is absent (1,2).

These devices contain an internal magnet within the implanted receiver stimulator package. Currently, all implanted devices (CI and ABI) have been tested by the individual manufacturing companies and meet international EN45502 safety standards for static magnetic fields up to 1.5 Tesla (3–6).

NF2 patients require life-long tumor surveillance and multidisciplinary team management. Current UK guidelines recommend yearly MR imaging of the head after tumor diagnosis and 3 yearly imaging of the spine (7). The regular frequency of imaging can prove problematic

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