Migration of cochlear implant magnets after head trauma in an adult and a child

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Abstract
Cochlear implantation is considered to be a safe and effective treatment for severe to profound sensorineural hearing loss. Device failures are rare. We report the cases of 2 patients—a 44-year-old woman and a 3-year-old boy—with cochlear implants who were referred to our tertiary cochlear implant center for treatment of magnet migration secondary to mild head trauma. The migration had led to device failure in both cases. Surgical reexploration was performed with nonmagnetic instruments, and both magnets were easily returned to their proper place. Postoperatively, implant function was restored to previous levels, and wound healing was uncomplicated. The incidence of magnet migration in cochlear implant patients is unknown. A few cases have been reported in children, but to the best of our knowledge, ours is the first report of magnet migration in an adult.

Introduction
Cochlear implantation is considered to be a safe and effective treatment for severe to profound sensorineural hearing loss. Failure of cochlear implants is rare, but as the size of the implanted population continues to grow, the total number of malfunctions is expected to increase (although the rate of failure is expected to decrease).

In this article, we report 2 cases of an unusual complication of cochlear implantation: magnet migration secondary to minor head trauma. The incidence of magnet migration in cochlear implant patients is unknown. A few cases have been reported in children, but to the best of our knowledge, ours is the first report of magnet migration in an adult. We describe our clinical and radiologic findings and discuss our method of treatment.

Case reports
Patient 1. A 44-year-old woman with a left-sided cochlear implant fell and struck her head. The implant—a Nucleus CI 24R model (Cochlear Ltd.; Lane Cove, N.S.W., Australia)—had been placed to alleviate severe bilateral sensorineural hearing loss. When the patient was 18 years old, she had been diagnosed with a craniopharyngioma, and she had undergone a craniotomy. Ever since, she had experienced epileptic insults. It was during one of these seizures that she fell. In the aftermath of the fall, the implant ceased to function, and the patient was referred to our center. On clinical examination, we found a slight bulge over the processor part of the implant and some local tenderness with a small, firm, palpable but less-well-defined mass. A skull x-ray was taken (figure 1). The patient underwent surgical reexploration 5 days after her fall (see “Treatment of both patients,” below).

Patient 2. A 3-year-old boy with a cochlear implant fell and struck the right side of his head on a chair. Approximately 1 year earlier, he had been diagnosed with a severe bilateral sensorineural hearing loss secondary to pneumococcal meningitis. One month later, he received bilateral Nucleus CI 24R cochlear implants. The procedure was performed without complication, and the child’s hearing was restored.

After the child’s fall, he lost the function of the right-sided implant, and he was referred to our cochlear implant center. A slight bulge of the skin was visible over the implant site, and a small, firm swelling was felt over the processor part of the implant system. The overlying skin was normal, and there was no tenderness. A skull x-ray was taken (figure 2). The patient underwent surgical reexploration 1 day after his fall.

Treatment of both patients. Magnets in various cochlear implant systems are designed to be temporarily removable when, for example, magnetic resonance imaging (MRI) is necessary. Therefore, they are placed in a small round silicone envelope that has a central opening and an overhanging rim; the envelope is situated in the center of the antenna coil. In our 2 patients, the direct external force of their respective falls probably dislodged the magnet from
the envelope, resulting in the migration of the magnet toward the receiver-stimulator part of the device.

In both of our patients, surgical re-exploration was performed via an incision superior to the implant. In both cases, the silicone rim that partly overlaps the magnet was found to be torn; the tear allowed the magnet to slide out of the envelope. Then the magnetic force drew it toward the receiver-stimulator part of the implant, and the magnet attached itself to the metal housing of this part.

Intraoperatively, both magnets were easily put back into place with a nonmagnetic (plastic) forceps. The wound was closed with fibrin glue, and a light-pressure bandage was applied for 1 day. The postoperative course was uneventful in both cases. Two weeks later, the cochlear implants were switched on again. The quality of implant function had not changed in either patient.

Discussion
Failure of a cochlear implant is the most common reason for surgical re-exploration, although failure is fairly rare. Tambyraja et al reviewed the cochlear implant complications reported in the Manufacturer User Facility and Distributor Experience database. They found that device failure was responsible for 267 of 645 complications (41%). It is expected that the incidence of device failures will decrease as their design and manufacture continues to improve.

Head trauma increases the chance that a device will fail. In 2004, Haensel et al reported that 59% of device failures were attributable to head trauma. The next year, Weise et al reported a cumulative reimplantation rate of 5.4% in children and 0.8% in adults; they attributed the difference to the fact that children have a higher incidence of head trauma.

James et al reported that minor magnet site complications occurred in 27% of implanted children, usually a mild skin infection. Complications can be resolved by administering conservative therapy, by lessening magnet strength, and in some cases by temporarily discontinuing implant use.

Traumatic magnet migration appears to be rare. To the best of our knowledge, it has not heretofore been described in an adult. In 2004, Wilkinson et al described the first pediatric case. As mentioned, refinements in the design of cochlear implants have been aimed at facilitating the temporary removal of the magnet to make MRI scanning possible. Nevertheless, MRI safety with the complete implant in situ has been demonstrated by several manufacturers.

Our experience suggests that when magnet migration occurs, recognizing and resolving the problem is a fairly straightforward process. Moreover, in both of our patients, repositioning the magnet did not affect implant function.

References