Background

3 Tesla magnetic resonance imaging (MRI) systems have become more accessible and utilized for a wide range of clinical applications. It confers the benefits of shorter scan times and improved image quality due to its stronger field strengths [1]. Cochlear implants (CI) were previously considered incompatible with higher field strengths MRI due to the risk of CI magnet-associated complications [2, 3]. The MED-EL Synchrony CI is currently the only routinely used CI platform that has been approved for use in 3 Tesla MRI scanners. To date, there is no published study in the medical literature on its use in 3 Tesla MRI in children.

We present the first reported case, worldwide, of a 3 Tesla MRI scan performed in a pediatric MED-EL Synchrony CI recipient under GA.

Case Study

A 3-year-old child with right-sided sensorineural hearing loss was assessed for unilateral CI candidacy. He had a concurrent bilateral optic pathway glioma, for which he received chemotherapy with curative intent. Preoperative imaging found normal cochlear anatomy, cochlear nerve caliber and mildly dilated vestibular aqueduct bilaterally.

A MED-EL Synchrony device was selected due to its purported 3 Tesla MRI compatibility and is the only widely adopted device on the market with this property [2, 4, 5]. The child underwent a successful right-sided CI insertion with no postoperative complications.

His first MRI scan conducted at 3 months after CI surgery to monitor the growth of the bilateral optic pathway glioma.

- All external components of the CI, including the audio processor and accessories were removed from the child’s head prior to entering the MR room.
- An elastic compression bandage was applied firmly around the head three times as per manufacturer recommendations [4].
- A 3 Tesla MRI was then performed (3T MAGNETOM Skyra, Siemens AG Healthcare, Erlangen, Germany) with appropriate specific absorption rate and included four sequences.
- Mild, persistent tachycardia was observed (heart rate: 120 bpm) for the duration of the GA, with no spikes in heart rate or diastolic blood pressure to suggest pain or discomfort at the CI site.
- The patient had an uneventful extubation and recovery.

There was no magnetic dislocation or demagnetization, and the speech processor coupled in a predictable manner.

The patient underwent another three uneventful 3 Tesla MRI scans of the same region without complications over a period of 10 months. No further episodes of tachycardia were observed during the subsequent GAs.

Discussion

- CI can interact with the MRI’s strong electromagnetic fields, resulting in induction of voltage, heating of the implant, application of force and torque, and production of artifact on the resulting diagnostic image [6].
- Clinically, these effects can be described in the literature as pain and clicking noises at the CI site.
- Dislocation of the magnet can occur and at 3 Tesla, it is possible to demagnetize the implant magnet [2, 5, 7, 8].
- The MED-EL Synchrony CI has a freely rotating and self-aligning magnetic system, which minimizes torque and demagnetization [4]. This theoretically reduces pain along the CI site and minimizes the potential for magnet dislocation.
- Our experience with this index case of a paediatric MED-EL Synchrony recipient suggests that this device is safe to use with 3 Tesla MRIs in children.

Conclusion

This is the first reported case of 3 Tesla MRI scanning in a child with a unilateral MED-EL Synchrony CI under GA. Provided that manufacturer guidelines are adhered to, 3 Tesla MRI scanning should not be contraindicated in pediatric CI recipients with a compatible Synchrony device.