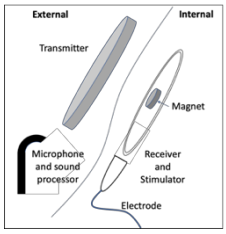
MR Safety Week 2019

Day 3 – Cochlear Implants and Auditory Brainstem Implants

Device Description

Cochlear implants and Auditory brainstem implants (ABIs) convert sounds into electrical impulses which are sent directly to the cochlear or brainstem. The external components consist of a microphone, sound processor and a transmitter. The internal components include a receiver coil, stimulator and a small magnet.



The magnet is used to locate and hold the external transmitter in the correct position.

Interactions with MRI

The two major considerations when scanning patients with cochlear implants and ABIs are the torque force on the internal magnet and RF power deposition.

The torque force on the internal magnet can result in displacement of the magnet (migration outside of the desired surgical site or magnet flipping over to align with the B field of the MR scanner). Older designs of *MR Conditional* cochlear implants and ABIs may require that the magnet is surgically removed. However, newer devices will allow an MRI scan to take place with the internal magnet *in situ*. It may be necessary to brace the magnet using a combination of a splint and bandage to prevent it from moving.

If the magnet is poorly oriented within the field of the scanner then there is a small risk of the magnet de-polarising resulting in the external components not reattaching as strongly or at all. There are some new designs of implant that allow the magnet to freely rotate within a case to align with the direction of the magnetic field, negating the need for splinting and bandaging, and greatly reducing the risk of complications and level of discomfort experienced by the patient.

Common MR Conditions

For some older models of implant, prior approval from the manufacturer is required before a scan can take place

SAR conditions vary with make and model. For some models the Whole Body and Head SAR limits are less than 2 W/Kg and 3.2 W/Kg respectively and so limiting the scanner to its *Normal Mode* of operation may not be sufficient. In this instance it would be necessary to develop and test a low SAR protocol prior to scanning the patient.

A splint and bandage may be required in order to brace the internal magnet. For some models, a proprietary coil cover should be obtained from the manufacturer for this purpose. This bandaging can be done by many different staff groups (radiographers, nurses, clinicians and ENT surgeons undertake this role at different centres in the UK) and manufacturers provide instructions for how this should be done. It is strongly advisable that staff members are properly trained and remain familiar with the process.

Some models require that the patient does not turn or twist their head in the scanner bore. If possible, position the patient on the couch outside room if the couch can be undocked. Limit patient movement close to the bore of the scanner.

Things to be aware of

MR conditions vary by device. Therefore: ***Always positively identify the Make and Model of the device***
Always obtain up-to-date details of MR conditions from the manufacturer

The external components of the device should always be removed. It is important that patient briefing prior to the external components being removed as the patient may no longer be able to hear.

Check whether manufacturer approval or a proprietary coil cover is required

When splinting and bandaging, care should be taken to ensure this is done properly according to the manufacturer protocol.

Finally, if scanning the head, be aware that there will be a large signal drop-out around the device if scanning with the magnet *in situ*, which may reduce significantly the amount of diagnostic information that can be acquired.

Further Reading

BIR MRI Safety Week 2018 information sheets
MR Conditional information obtained direct from the manufacturer

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