

THE AUDITORY BRAINSTEM IMPLANT

1. What is an auditory brainstem implant (ABI)?

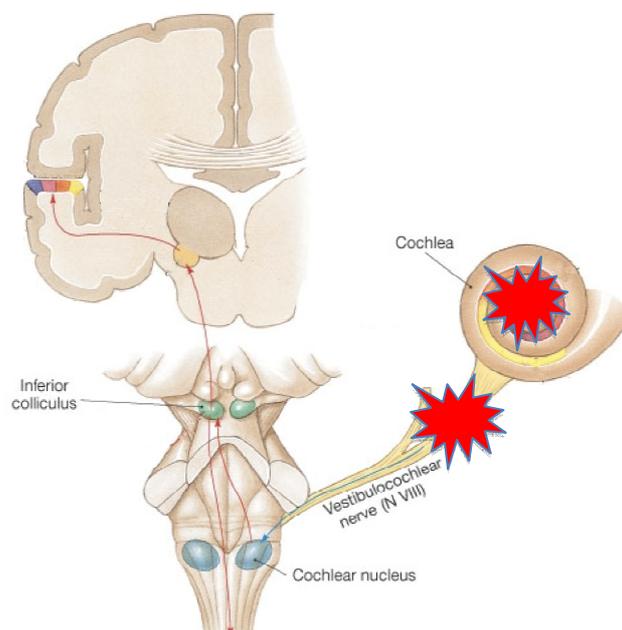
An auditory brainstem implant (ABI) is a device that may allow a person to hear if they have had damage to the cochlear nerves of both ears. Usually these nerves carry an electrical signal to the brain from the cochlea in the inner ear after it has been stimulated by sound. The ABI consists of an external sound processor and an internal part with an electrode. It is identical to a cochlear implant except that the stimulating electrode array is placed on the surface of the brain in an area called the brainstem, where the cochlear nerve usually attaches (called the cochlear nucleus). Its aim is to deliver some access to sound in certain cases of profound or total deafness.

2. Indications for an ABI

The hearing system consists of the hearing organ, the cochlea, the hearing nerve that carries sound as electricity to the brain and the hearing pathways in the brain that allow us to interpret sounds (see figure1). Patients can become profoundly deaf because the cochlea does not work. In this situation the cochlea can be stimulated by a cochlear implant and this restores hearing. If the cochlea or hearing nerve are very badly damaged or absent, however, it is not possible to use a cochlear implant.

Figure 1:

Central hearing pathways



In this situation it is necessary to stimulate the hearing pathways of the brain directly in order to restore hearing. An ABI can be used to do this.

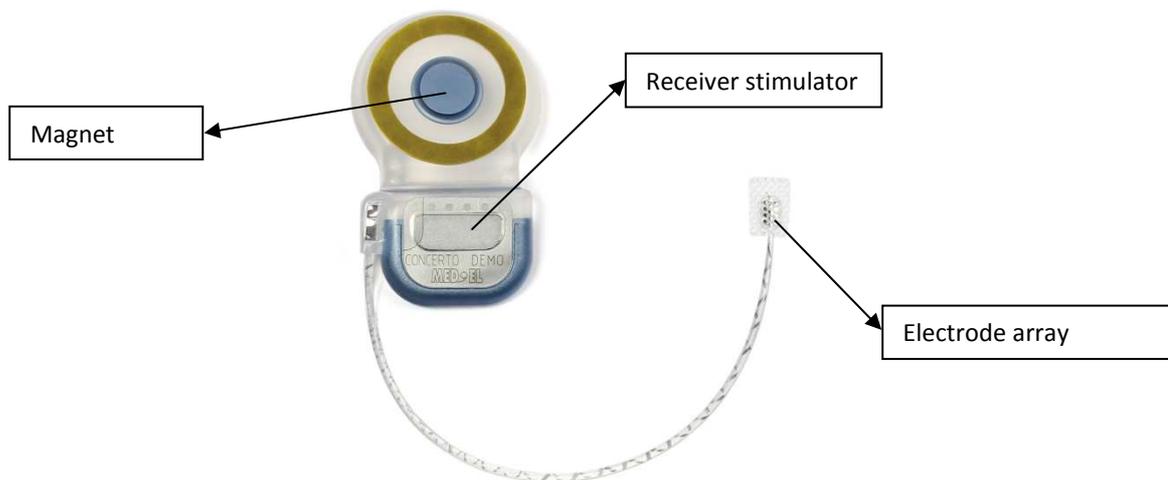
The commonest reason to need an ABI is loss of the hearing nerves following surgery to treat inner ear tumours in neurofibromatosis type 2 (NF2). They are also used to restore hearing in children that are born with no hearing nerves or cochleas.

3. What does the ABI look like?

The ABI has both internal and external parts.

Figure 2:

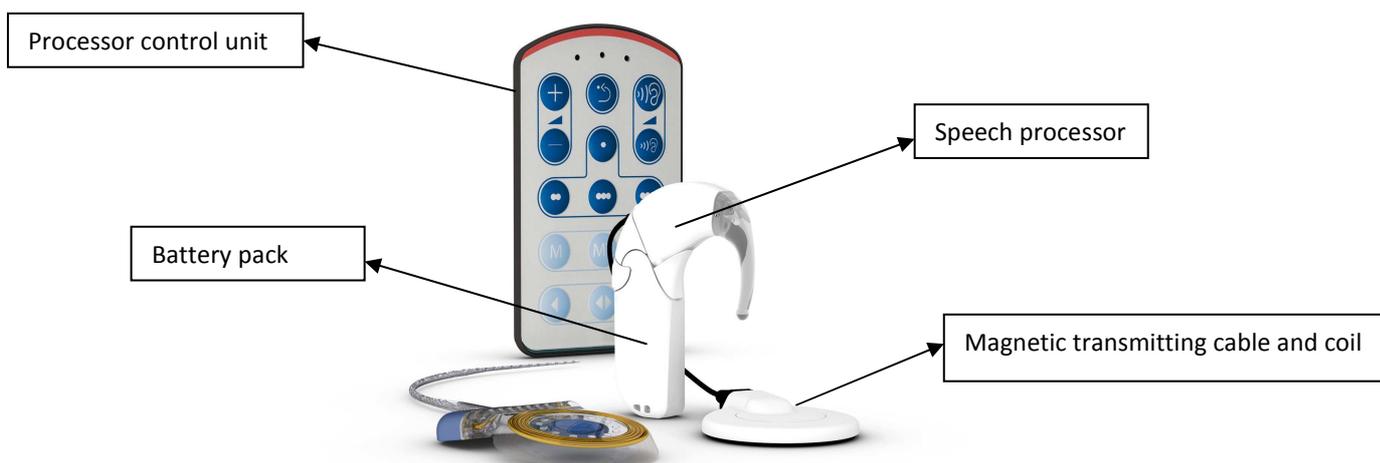
The internal ABI device



The internal components of the ABI consist of a magnetic receiver stimulator that is implanted underneath the skin behind the ear. An electrode array comes off the receiver stimulator and is placed against the central hearing pathways in the brainstem.

Figure 3:

The external ABI device



The external part of the ABI consists of a speech processor and battery pack that looks like a hearing aid. This fits behind the ear. The speech processor is attached via a cable to a magnetic transmitting coil that is positioned on the head over the magnetic, internal receiver stimulator package. The external parts of the implant can be removed at any time, for example when sleeping or swimming and bathing.

4. How does the ABI work?

- Sound is picked up by the microphone on the top of the speech processor.
- The speech processor filters and analyses the sounds and codes them into digital signals.
- The coded signals are sent along the cable to the transmitting coil.
- The transmitting coil sends the coded signals to the implant underneath the skin.
- The implant delivers the signals to the electrodes on the brainstem.
- The electrodes stimulate the hearing pathways in the brainstem, producing a stimulation that can be interpreted as sound.

This whole process happens very quickly so that the ABI user will hear sounds as they occur.

5. What will I be able to hear with an ABI?

About a month after the ABI surgery you will have to come back to the hospital for programming and rehabilitation with the implant. Normally, the process of getting used to listening with the implant may take many weeks or even months. The sound will be very strange at first and possibly not very meaningful. Results from experience to date shows that ABI users may be able to obtain the following benefits:

- Detection of environmental sounds.
- Improvement in the ability to lip-read conversations.
- Ability to follow the rhythm of speech and detect short and long speech sounds.

Some of the limitations of using an ABI have also been described and they are as follows:

- Many noises may sound the same at first and it may be difficult to identify what you hear with the ABI.
- It is normally not possible to understand speech without lip-reading.
- Some patients may not be able to hear anything at all after the ABI.

6. MRI scans and the ABI.

If you have NF2 it is important that you have a head scan at least once every year, and your spine at least every three years.

An MRI scan uses strong magnetic fields in order to take very detailed pictures of your head and spine, and normally we would ask people to remove any metal work before we do the scan. However, if you have a cochlear implant (CI) or an auditory brainstem implant (ABI), this means that the procedure for scans is slightly different, because there is a magnet in the implant inside your head.

We try not to remove the internal magnet when we do these scans, because there is a risk of implant infection when we do this. Also, if we repeatedly remove the magnet from the implant, the housing that covers the implant is more likely to degrade. We are able to perform the MRI scans safely without removing the internal magnet from your implant by using a bandage on your head to support the implant.

Head bandaging

In order to do your MRI scan safely with a magnet in place, we apply some rubber material over the magnet which is kept in place by a pressure bandage. The bandage can feel a little bit tight but should not be too uncomfortable.

Pain relief

Some patients experience some discomfort during scanning. Most patients are able to tolerate this without any need for pain killers. In our experience, some patients have found this more uncomfortable and require injection of local anaesthetic around the implant.

If you have any questions, please ask your NF2 team who will be happy to discuss this with you.

7. How do I get an ABI and how many people have one?

There are two implant centres that provide ABI's in the UK, Manchester and Cambridge. In Manchester the surgery takes place at Salford Royal Hospital and subsequent rehabilitation with the implant takes place at the University of Manchester. In Cambridge the surgery and rehabilitation takes place at Addenbrooke's hospital. Currently there are about 4 people implanted in the UK each year.

8. Website information:

For more information about the ABI please visit the Medel website at:

<http://www.medel.com/maestro-components-abi>

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