# Cochlear™ Nucleus® Implants Magnetic Resonance Imaging (MRI) Guidelines

United States of America

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# About this guide

This guide applies to Cochlear™ Nucleus® implants. It is intended for:

- Specialised health care professionals who prepare and perform MRI scans
- Physicians who refer a Cochlear Nucleus implant recipient for an MRI scan
- Cochlear Nucleus implant recipients and/or their carers

This guide provides information about the safe application of an MRI scan on Cochlear Nucleus implant recipients.

MRI scans performed under different conditions than those presented in this guide may result in severe patient injury or device malfunction.

Due to the risks associated with using MRI with an implanted medical device, it is important to read, understand, and comply with these instructions to prevent potential harm to the patient and/or device malfunction.

This guide should be read in conjunction with the relevant documents that accompany a Cochlear Nucleus implant, such as the Physician's Guide and Patient Information, or the Surgeon's Guide, Physician's Package Insert and Important Information Booklet. For more information, visit www.cochlear.us/mri or contact your regional Cochlear office. Contact numbers are available on the back cover of these guidelines.

## Symbols used in this guide

### Note

Important information or advice.

### Caution (no harm)

Special care to be taken to ensure safety and effectiveness.

Could cause damage to equipment.

### Warning (harmful)

Potential safety hazards and serious adverse reactions.

Could cause harm to person.

# Contents

# Preparation prior to an MRI examination

These guidelines are specific to Cochlear Nucleus implants and supplement other MRI examination considerations specified by the MRI machine manufacturer or protocols at the MRI facility.


Non-clinical testing has demonstrated that Cochlear Nucleus implants are MR Conditional. A patient with a Cochlear Nucleus implant may be safely scanned under the conditions described in section *Performing MRI safely* on page 21. Failure to follow these conditions may result in injury to the patient.

## Cooperation between specialists

Preparing for and conducting an MRI examination for implant recipients requires cooperation between a specialist for the device and/or Cochlear Nucleus implant physician, referring physician and radiologist or MR technologist.

- **Cochlear Nucleus implant device specialist** – Knows the implant type and where to find the correct MR parameters for the implant.
- **Referring physician** – Knows the location of the MRI scan and diagnostic information required, and makes a decision on whether the implant magnet needs to be removed for the MRI examination.
- **Cochlear Nucleus implant physician** – If requested by the referring physician, surgically removes the implant magnet and replaces with a non-magnetic plug or non-magnetic cassette. After the MRI scan, the implant physician replaces it with a new sterile replacement magnet or replacement magnet cassette.
- **Radiologist or MR technologist** – Sets up the MRI scan using the correct MR parameters and counsels the implant recipient during the MRI examination.

## Determine eligibility for MRI

If you are a physician referring a Cochlear Nucleus implant recipient for an MRI scan, it is essential that you consider the following:

- Understand and inform the patient of the risks associated with MRI. See ***Risks associated with MRI and Cochlear Nucleus implants*** on page 8.

  Also consider:

  – Timing of the implant surgery and MRI exposure.

  – Age and general health of the implant recipient and time to recover from the implant magnet surgery or potential trauma.

  – Existing or potential for tissue scarring in the location of the implant magnet.

- Understand the conditions for an MRI scan and ensure that there is a clear indication for the MRI examination. See ***Performing MRI safely*** on page 21.
- The Cochlear Nucleus implant will create shadowing on the MR image in the vicinity of the implant, resulting in a loss of diagnostic information. Refer to the relevant artefact dimension tables in the ***Image interference and artefacts*** section.
- Identify if the patient has any other medical device implants, active or abandoned. If another implanted device is present, verify MRI compatibility before conducting an MRI examination.

  If MRI safety information for the implanted devices is not followed, the potential risks include:

  – Movement or damage to the device

  – Weakening of the implant magnet

  – Uncomfortable sensation for the patient

  – Skin or tissue trauma for the patient

- Cochlear has evaluated the interaction of implants described in this guide with other nearby implanted devices during MRI scanning, and there is no increased heating risk to the Cochlear implant.
- For MRI scans at 1.5 T or 3 T, identify if the implant magnet needs to be removed. See *Implant magnet conditions for MRI* on page 21.
- If the implant magnet needs to be removed, refer the patient to an appropriate physician to arrange for the magnet to be removed before the MRI scan.
- If the implant magnet is retained for an MRI scan at 1.5 T, an MRI Kit must be obtained beforehand for use during the MRI scan, except for CI600 Series implants. Contact the nearest Cochlear office or official distributor to order an MRI Kit.

# Risks associated with MRI and Cochlear Nucleus implants

Clinicians and recipients should weigh the benefits and risks of completing an MRI scan at 1.5 T and choose one course of action:

1. Keep the magnet in place and use an MRI Kit.
2. Remove the implant magnet and replace it via surgical procedures.
3. Do not perform the MRI scan.

See *Table 6: Implant magnet conditions for MRI* on page 21 for full details on performing an MRI examination safely.

The potential risks of performing MRI examinations on patients with Cochlear Nucleus implants include:

- Device movement

  Scanning outside of the parameters contained in these guidelines may lead to the implant magnet or device moving out of position during an MRI examination causing skin or tissue trauma.

- Damage to the device

  MRI exposure beyond the values contained in these guidelines may cause damage to the device.

- Uncomfortable sensation

  MRI exposure beyond the values contained in these guidelines may result in the patient perceiving sound or noise and/or pain.

- Implant heating

  Use the recommended SAR values contained in these guidelines to ensure the implant does not heat beyond safe levels.

- Image artefact

  – The Cochlear Nucleus implant will create shadowing on the MR image in the vicinity of the implant, resulting in a loss of diagnostic information.

  – If inspecting near the implant, removal of the implant magnet should be considered as MR image quality may be compromised with it in place.

## Considerations for implant magnet removal

If the implant magnet needs to be removed prior to an MRI examination, close coordination is required between the specialists to perform the implant magnet removal, MRI scan, and subsequent implant magnet replacement.

### CI600 Series implants

For CI600 Series implant recipients, if single or multiple MRI examinations on the head are needed with the magnet cassette removed, the magnet cassette must be replaced (in a sterile surgical environment) with a non-magnetic cassette.

**Warning**

To prevent infection, do not leave the magnet pocket empty (for CI600 Series implants). When removing the magnet cassette, replace the magnet cassette with a non-magnetic cassette.

### CI500, CI24RE, CI24R, CI24M and CI22M Series implants

For recipients (other than CI600 Series implant recipients) requiring multiple MRI examinations over a period of time, the implant magnet is removed and replaced with a sterile non-magnetic plug. If only a single MRI is required the magnet recess can remain empty. See *Implant magnet conditions for MRI* on page 21.

In the magnet's absence, the non-magnetic plug prevents fibrous tissue growing into the implant recess. Such growth would make implant magnet replacement difficult.

With the non-magnetic cassette or non-magnetic plug in place, MRI scans can be done at both 1.5 T and 3 T without the need for bandaging or use of the MRI Kit.

**Note**

While the magnet is removed, the recipient may wear a Cochlear Disk Retainer to hold their sound processor coil in place. Disk retainers are available from Cochlear.

When there is no further need for MRI examinations, the non-magnetic cassette or non-magnetic plug is removed and replaced by a new replacement magnet cassette or sterile replacement magnet.

The non-magnetic cassette, non-magnetic plug, replacement magnet cassette and sterile replacement magnet are supplied separately in sterile packs. All are single-use items.

### Caution

Non-magnetic plugs for CI500 Series implants are a different size to non-magnetic plugs for CI24RE Series implants. Ensure the correct plug is used.

## Considerations for implant magnet in place

The information below is being provided to ensure an appropriate treatment decision can be made.

### Weakening of implant magnet

Scanning at static magnetic field strengths at values other than those contained in these guidelines may lead to a weakening of the implant magnet.

Incorrect patient positioning prior to the MRI scan or head movement during the scan may result in implant magnet demagnetisation.

### Usability of Cochlear Nucleus MRI Kit

Cochlear conducted usability testing on the Cochlear Nucleus MRI Kit with chinstrap, including associated accompanying documentation. Test results showed that the MRI Kit and accompanying documentation protect users from committing potentially harmful use errors that could lead to patient harm or suboptimal therapy.

**Warning**

To minimise possible pain and discomfort, apply the items contained in the MRI Kit immediately prior to entering the MRI room.

Ensure the recipient has left the MRI room, and the MRI procedure is complete, before removing the bandage, splints, and chinstrap.

If a splint becomes loose inside the MRI room, this could lead to MRI equipment damage, and/or could cause injury to the MRI staff or recipient.

**Warning**

Do not conduct the MRI scan if the splint does not stay in place.

Misalignment between the splint and implant magnet may result in the dislodgment of the implant magnet and could cause pain or result in explantation.

# Preparation for conducting the MRI examination


All external components of the Cochlear implant system (e.g. sound processors, remote assistants and related accessories) are MR Unsafe. The patient must remove all external components of their Cochlear implant system before entering a room where an MRI scanner is located.

Confirm the following prior to scanning:

- The implant model has been identified. See *Identifying features* on page 16.
  - For additional information for bilateral recipients, see *Bilateral recipients* on page 13.
- For MRI scans on a body location away from the implant site, MRI safety information for the recipient's implant model must be followed. See *Performing an MRI Scan on other body locations* on page 13.
- If the referring physician has prescribed that the MRI scan be performed without the implant magnet, the implant magnet has been surgically removed.
- If the implant magnet is retained for an MRI scan at 1.5 T, an MRI Kit must be obtained beforehand for use during the MRI scan, except for CI600 Series implants. Contact the nearest Cochlear office or official distributor to order an MRI Kit.
- See *Table 6: Implant magnet conditions for MRI* on page 21 for full details on performing an MRI examination safely. For all implants other than CI600 cochlear implants, please also refer to the section *Using the MRI Kit* of the *Cochlear Nucleus MRI Kit User Guide* provided with the MRI Kit.

- Remove the sound processor before entering the MRI room. The sound processor is MR Unsafe.

  **Note**

  Once the sound processor has been removed, the patient may no longer be able to hear.

- Position the patient to minimise discomfort. See ***Patient positioning*** on page 14.
- Discuss the sensations the recipient may experience during the MRI Scan. See ***Patient comfort*** on page 14.
- Comply with the ***Scan conditions and SAR limits*** on page 22.

## Bilateral recipients

**Caution**

If one or more of the implants is a CI22M cochlear implant without a removable magnet, MRI is contraindicated.

If a bilateral recipient has implant models (other than the CI22M cochlear implant without a removable magnet), read the MRI safety information for each implant model relevant to the recipient. Use the MRI safety information of the recipient's implant model with the most restrictive MRI exposure requirements.

## Performing an MRI Scan on other body locations

When an implant recipient requires an MRI scan on a location of their body away from the implant site, you must still follow the MRI safety information for the recipient's implant model. See ***Identifying the Cochlear Nucleus implant*** on page 15 and ***Performing MRI safely*** on page 21.

## Patient positioning

For safety, the patient should be in a supine position (lying flat on back, face upward) prior to entering the MRI bore.

Align the patient's head with the bore axis of the MRI machine. Advise the patient to lie as still as possible and to not move their head during the MRI scan.

### ⚠ Caution

- When scanning with the implant magnet in place, ensure that the patient does not move more than 15 degrees (15°) from the centreline (Z-axis) of the bore during the MRI scan.
- Failure to position the patient correctly prior to the MRI scan may result in increased torque on the implant and cause pain.

## Patient comfort

For patients where an implant magnet is in place, explain that they might feel the implant magnet moving slightly and might sense resistance to movement as pressure on the skin.

For devices which require an MRI Kit, the MRI Kit will reduce the likelihood of the implant magnet moving. The sensation will be similar to pressing down firmly on the skin with the thumb.

If the patient experiences pain, consult the patient's physician to determine if the implant magnet should be removed or if a local anaesthetic may be applied to reduce discomfort.

### ⚠ Caution

If administering local anaesthetic, take care not to perforate the implant silicone.

In addition, explain to the patient that they may perceive sounds during the MRI scan.

# Identifying the Cochlear Nucleus implant

The implant model can be found on the patient's Cochlear patient identification card.

If the patient does not have their patient identification card with them, the implant type and model can be identified without surgical intervention. See ***X-ray information for identification of Cochlear Nucleus implants*** and ***X-ray guidelines*** along with ***Identifying features*** on the following pages.

## X-ray information for identification of Cochlear Nucleus implants

Cochlear Nucleus implants are made of metal and implanted under the skin behind the ear.

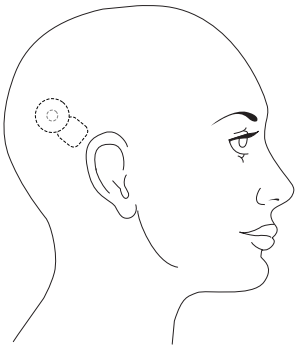


Figure 1: Location behind the ear for Cochlear Nucleus implants

## X-ray guidelines

Lateral X-ray at 70 kV/ 3 mAs provides sufficient contrast to identify the implant.

A modified Stenver's view is not recommended for implant identification as implants may appear oblique.

Imaging should include an unobstructed view of antenna coils and implant bodies.

Bilateral recipients may have different implant models on either side of the head. A lateral skull X-ray with a 15 degree cranial tube angle will offset the implants in the image, enabling identifying features to be distinguished.

## Identifying features

Identifying features on Cochlear Nucleus implant X-ray images are explained in the following pages. Other implant models may have other identifying features.

## Cochlear Nucleus CI600 Series and CI500 Series implants

Cochlear Nucleus CI600 Series implants – CI612, CI622, CI624, CI632 – and CI500 Series implants – CI512, CI522, CI532, ABI541 – do not have radiopaque characters.

Using an X-ray, CI500 Series and CI600 Series implants can be identified by the implant shape and electronic assembly layout. If further implant details are required, contact your Cochlear representative who will provide instructions on how to determine the following:

- Manufacturer
- Model
- Year of manufacture

The electronic assembly layout is identical for Cochlear CI600 and CI500 Series implants. The unique identifier for CI600 Series implants is the magnet shape and the three holes next to the magnet, as illustrated in the table below.

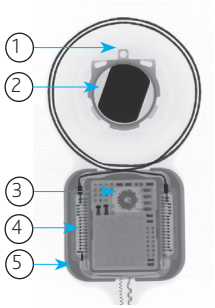
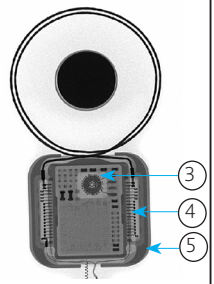
| CI600 Series implant X-ray | CI500 Series implant X-ray | Unique identifier |
|---|---|---|
|  |  | 1. Three holes adjacent to magnet<br>2. Magnet shape<br>3. Round shape at coil exit end of electronic assembly layout<br>4. Series of wire connectors that are visible on both sides of the electronic assembly<br>5. Square implant body shape |

Table 1: CI600 Series and CI500 Series implants identified by their shape and electronic assembly.

## Cochlear Nucleus CI24RE Series, CI24R Series, CI24M Series and CI22M Series implants

Cochlear Nucleus implants that can be identified by the radiopaque characters printed on them are:

- CI24RE Series – CI422, CI24REH (Hybrid L24), CI24RE (CA), CI24RE (CS), CI24RE (ST)
- CI24R Series – CI24R (CA), CI24R (CS), CI24R (ST)
- CI24M Series – CI24M, CI 11+11+2M, ABI24M
- CI22M Series – CI22M

There are three sets of radiopaque characters printed on each implant.

1. The first character identifies the manufacturer – 'C' indicates Cochlear Ltd.
2. The second (middle) character identifies the implant model.
3. The third character indicates the year of manufacture. To determine the year of manufacture of your implant, contact your Cochlear representative.

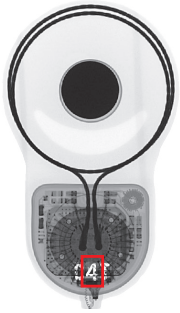
| Implant model | Location of second (middle) radiopaque character set | Radiopaque characters |
|---|---|---|
| CI422 |  | 13 |
| CI24REH (Hybrid L24) | | 6 |
| CI24RE (CA) | | 5 |
| CI24RE (CS) | | 7 |
| CI24RE (ST) | | 4 |

Table 2: CI24RE Series implants identified by radiopaque characters

| Implant model | Location of second (middle) radiopaque character set | Radiopaque characters |
|---|---|---|
| CI24R (CA) |  | 2 |
| CI24R (CS) | | C |
| CI24R (ST) | | H |

Table 3: CI24R Series implants identified by radiopaque characters

| Implant model | Location of second (middle) radiopaque character set | Radiopaque characters |
|---|---|---|
| CI24M |   | T |
| CI 11+11+2M | | P |
| ABI24M | | G |

Table 4: CI24M Series implants identified by radiopaque characters

| Implant model | Location of second (middle) radiopaque character set | Radiopaque characters |
|---|---|---|
| CI22M with removable magnet |   | L or J |
| CI22M without removable magnet | | Z |

Table 5: CI22M Series implants identified by radiopaque characters

# Performing MRI safely

## Implant magnet conditions for MRI

For some implant models and MRI field strengths, bandaging with an MRI Kit is required, or the implant magnet needs to be surgically removed. Refer to the table below for information on each Nucleus implant model.

| Implant type | MRI field strength (T) | Remove implant magnet Yes/No | MRI Kit required Yes/No |
|---|---|---|---|
| CI600 Series implants | | | |
| CI612, CI622, CI624, CI632 | 1.5 | No | No |
| | 3 | | |
| CI500 Series implants | | | |
| CI512, CI522, CI532, ABI541 | 1.5 | No | Yes |
| | 3 | Yes | No |
| CI24RE Series implants | | | |
| CI422, CI24REH (Hybrid L24), CI24RE (CA), CI24RE (ST) | 1.5 | No | Yes |
| | 3 | Yes | No |
| CI24R & CI24M Series implants | | | |
| CI24R (CA), CI24R (CS), CI24R (ST), CI24M, ABI24M | 1.5 | No | Yes |
| | 3 | Yes | No |
| CI 11+11+2M | 1.5 | No | Yes |
| | 3 | MRI is contraindicated | |
| CI22M Series implants | | | |
| CI22M with removable magnet | 1.5 | No | Yes |
| | 3 | MRI is contraindicated | |
| CI22M without removable magnet | 1.5 | MRI is contraindicated | |
| | 3 | | |

Table 6: Implant magnet conditions for MRI

## Scan conditions and SAR limits

The MRI safety information provided in these guidelines only applies to 1.5 T and 3 T MRI horizontal scanners (closed bore or wide bore) with a circularly polarised (CP) RF field for a maximum active scan time of 60 minutes.

### Warning

MRI scans at 3 T must be performed in quadrature mode or CP mode for the radio frequency (RF) transmit coil. Using a multi-channel mode may result in localised heating above safe levels.

A patient with one or two of these devices can be safely scanned in an MR system meeting conditions on the following pages. All scans shall be performed according to the specified SAR limits for the relevant implant.

Consider the following prior to scanning:

- Transmit/receive head coils and whole body coils may be safely used within the recommended SAR limits. Refer to the MRI safety information and recommended SAR limit tables in the following pages.
- Local cylindrical transmit/receive coils may be safely used, without SAR restriction, provided that the distance between the entire implant and the end of the local RF coil is at least equal to the radius of the local RF coil.
- It is safe to use local cylindrical RF receive only coils with cochlear implants during MRI scanning, provided SAR limits for the transmit coil have not been exceeded.

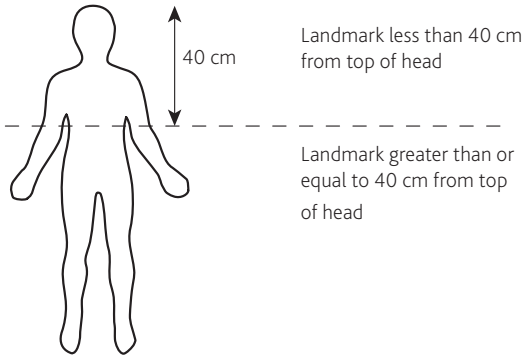



Figure 2: Landmark locations

## CI600 Series implants

CI600 Series implants can be safely scanned at least ten times without any adverse effect on magnet strength.

| Implant type | MRI field strength (T) | Maximum allowable spatial gradient field (T/m) | Head average SAR limit (W/kg) Using transmit /receive head coil | Whole body average SAR limit (W/kg) Landmark location | | Max Temp. Rise °C |
|---|---|---|---|---|---|---|
| | | | | <40 cm from top of head | ≥40 cm from top of head | |
| CI612 | 1.5 | 20 | <2 | <1 | <2 | 4.8 |
| CI622 | | | | | | 5.1 |
| CI624 | | | | | | 5.1 |
| CI632 | | | | | | 5.5 |
| CI612 | 3 | 20 | <1 | <0.5 | <1 | 4.9 |
| CI622 | | | | <0.4 | | 5.2 |
| CI624 | | | | <0.4 | | 5.2 |
| CI632 | | | | <0.4 | | 5.7 |

Table 7: MRI safety information and recommended SAR limits for CI600 Series implants

## CI500 Series implants

| Implant type | MRI field strength (T) | Maximum allowable spatial gradient field (T/m) | Head average SAR limit (W/kg) Using transmit /receive head coil | Whole body average SAR limit (W/kg) Landmark location | | Max Temp. Rise °C |
|---|---|---|---|---|---|---|
| | | | | <40 cm from top of head | ≥40 cm from top of head | |
| CI512 | 1.5 | 20 | <2 | <1 | <2 | 4.8 |
| CI522 | | | | | | 5.1 |
| CI532 | | | | | | 5.5 |
| ABI541 | | | | | | 2.0 |
| CI512 | 3 | 20 | <1 | <0.5 | <1 | 4.9 |
| CI522 | | | | <0.4 | | 5.2 |
| CI532 | | | | <0.4 | | 5.7 |
| ABI541 | | | | <0.5 | | 3.2 |

Table 8: MRI safety information and recommended SAR limits for CI500 Series implants

## CI24RE Series implants

| Implant type | MRI field strength (T) | Maximum allowable spatial gradient field (T/m) | Head average SAR limit (W/kg) Using transmit /receive head coil | Whole body average SAR limit (W/kg) Landmark location | | Max Temp. Rise °C |
|---|---|---|---|---|---|---|
| | | | | <40 cm from top of head | ≥40 cm from top of head | |
| CI422 | 1.5 | 20 | <2 | <1 | <2 | 5.1 |
| CI24REH (Hybrid L24) | | | | | | 4.5 |
| CI24RE (CA) | | | | | | 4.5 |
| CI24RE (ST) | | | | | | 4.5 |
| CI422 | 3 | 20 | <1 | <0.5 | <1 | 2.8 |
| CI24REH (Hybrid L24) | | | | | | 4.3 |
| CI24RE (CA) | | | | | | 4.3 |
| CI24RE (ST) | | | | | | 4.3 |

Table 9: MRI safety information and recommended SAR limits for CI24RE Series implants

## CI24R and CI24M Series implants

| Implant type | MRI field strength (T) | Maximum allowable spatial gradient field (T/m) | Head average SAR limit (W/kg) Using transmit /receive head coil | Whole body average SAR limit (W/kg) Landmark location | | Max Temp. Rise °C |
|---|---|---|---|---|---|---|
| | | | | <40 cm from top of head | ≥40cm from top of head | |
| CI24R (CA) | 1.5 | 20 | <2 | <1 | <2 | 5.7 |
| CI24R (CS) | | | | | | 5.7 |
| CI24R (ST) | | | | | | 5.7 |
| CI24M | | | | | | 5.1 |
| ABI24M | | | | | | 2.4 |
| CI 11+11+2M | 1.5 | 20 | <1 | <0.5 | <1 | 4.1 |
| CI24R (CA) | 3 | 20 | <1 | <0.5 | <1 | 4.6 |
| CI24R (CS) | | | | | | 4.6 |
| CI24R (ST) | | | | | | 4.6 |
| CI24M | | | | | | 5.7 |
| ABI24M | | | | | | 2.5 |
| CI 11+11+2M | 3 | MRI is contraindicated | | | | |

Table 10: MRI safety information and recommended SAR limits for CI24R and CI24M Series implants

## CI22M Series implants

| Implant type | MRI field strength (T) | Maximum allowable spatial gradient field (T/m) | Head average SAR limit (W/kg) Using transmit /receive head coil | Whole body average SAR limit (W/kg) Landmark location | | Max Temp. Rise °C |
|---|---|---|---|---|---|---|
| | | | | <40 cm from top of head | ≥40cm from top of head | |
| CI22M with removable magnet | 1.5 | 20 | <2 | <1 | <2 | 1.1 |
| | 3 | MRI is contraindicated | | | | |
| CI22M without removable magnet | 1.5 | MRI is contraindicated | | | | |
| | 3 | | | | | |

Table 11: MRI safety information and recommended SAR limits for CI22M Series implants

# Image interference and artefacts

The Cochlear Nucleus implant will create shadowing on the MR image near the implant, resulting in a loss of diagnostic information.

If inspecting near the implant, consider removing the implant magnet as MR image quality may be compromised with it in place.

If the implant magnet needs to be removed, refer the patient to an appropriate physician to arrange for the magnet to be removed before the MRI scan.

The following image artefact results are based on maximum artefact extension from the centre of the implant when scanned at 1.5 T and 3 T using a common Metal Artefact Reduction Sequence (MARS).

The further optimisation of scan parameters can be used to minimise the extent of the artefact.

The image artefact extends from the centre of the implant. The MARS parameters detailed in the table below were used to produce the artefact sizes detailed in the following pages.

| Sequence: | MARS Turbo spin-echo | |
|---|---|---|
| | 1.5 T | 3. T |
| Echo Time (TE) [msec] | 17 | 50 |
| Repetition Time (TR) [msec] | 2375 | 4000 |
| Flip angle [°] | 90 | 90 |
| Bandwidth per Pixel [Hz/pixel] | 319 | 781 |
| Bandwidth [kHz] | 82 | 200 |

Table 12: MARS parameter settings

The following artefact images are representative of the axial results across all implants. Individual artefact sizes per implant model are detailed in the following tables.

For bilateral implant recipients, the image artefacts as shown below are mirrored on the opposite side of the head for each implant. There may be some extension of the artefact between the implants.

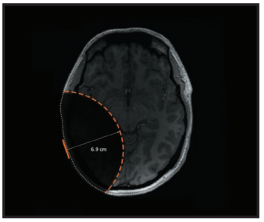
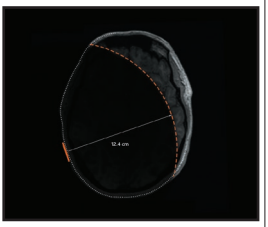
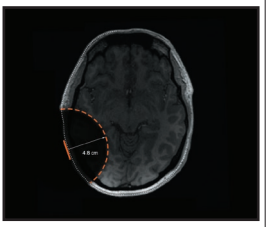
| Implant magnet in place (CI600 Series only) | Implant magnet + magnetic splint | Implant magnet removed |
|---|---|---|
|  |  |  |
| 6.9 cm (2.7 in) | 12.4 cm (4.9 in) | 4.8 cm (1.9 in) |

Table 13: Maximum artefact extension at 1.5 T across all implant types

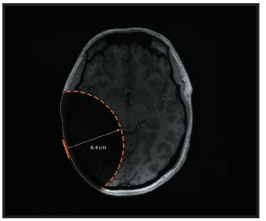
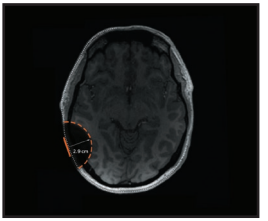
| Implant magnet in place (CI600 Series only) | Implant magnet removed |
|---|---|
|  |  |
| 6.4 cm (2.5 in) | 2.9 cm (1.1 in) |

Table 14: Maximum artefact extension at 3 T across all implant types

| | MRI field strength (T) | Maximum artefact radius (with MARS sequence) [cm/in] | |
|---|---|---|---|
| | | Implant magnet in place | Implant with non-magnetic cassette |
| | | Axial | Axial |
| CI600 Series implants | | | |
| CI612, CI622, CI624, CI632 | 1.5 | 6.9 / 2.7 | 2.9 / 1.1 |
| | 3 | 6.4 / 2.5 | 2.9 / 1.1 |

Table 15: Artefact dimensions for CI600 Series implants

| | MRI field strength (T) | Maximum artefact radius (with MARS sequence) [cm/in] | |
|---|---|---|---|
| | | With implant magnet + magnetic splint | Implant magnet removed |
| | | Axial | Axial |
| CI500 Series implants | | | |
| CI512, CI522, CI532, ABI541 | 1.5 | 12.4 / 4.9 | 2.9 / 1.1 |
| | 3 | N/A* | 2.9 / 1.1 |
| CI24RE Series implants | | | |
| CI422, CI24REH (Hybrid L24) CI24RE (CA), CI24RE (ST) | 1.5 | 11.3 / 4.4 | 2.6 / 1.0 |
| | 3 | N/A* | 2.5 / 1.0 |
| CI24R Series implants | | | |
| CI24R (CA), CI24R (CS), CI24R (ST) | 1.5 | 11.3 / 4.4 | 2.6/ 1.0 |
| | 3 | N/A* | 2.5 / 1.0 |
| CI24M Series implants | | | |
| CI24M, ABI24M | 1.5 | 11.3 / 4.4 | 2.8 / 1.1 |
| | 3 | N/A* | 2.5 / 1.0 |
| CI 11+11+2M | 1.5 | 11.3 / 4.4 | 2.8 / 1.1 |
| | 3 | MRI is contraindicated | |
| CI22M Series implants | | | |
| CI22M with removable magnet | 1.5 | 11.3 / 4.4 | 4.8 / 1.9 |
| | 3 | MRI is contraindicated | |
| CI22M without removable magnet | 1.5 | MRI is contraindicated | |
| | 3 | | |

Table 16: Artefact dimensions for CI500, CI24RE, CI24R, CI24M and CI22M Series implants

* Surgically remove the implant magnet before MRI scans at 3 T.

# Considerations after an MRI examination

## With the implant magnet in place

After the patient leaves the MRI room, remove the MRI Kit contents from the patient's head, as required. Ask the patient to place the sound processor on their head and turn it on.

Confirm:

- Placement of the sound processor is correct.
- There is no discomfort.
- Sound is perceived as normal.

If there is discomfort or a change in sound perception, or problems with the placement of the sound processor, ask the patient to seek assistance from their implant clinician as soon as possible.

See *Considerations for implant magnet in place* on page 11.

## With the implant magnet removed

See *Considerations for implant magnet removal* on page 9.

# Legal statement

The statements made in this guide are believed to be true and correct as of the date of publication. However, specifications are subject to change without notice.



# Trademark legal notice

Cochlear implant systems are protected by one or more international patents.

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# Notes

# Notes

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P1536020-D1536023 V9 2022-12

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