NHS
Royal Cornwall Hospitals
NHS Trust

Having an MRI with a cardiac implantable electronic device

One + all | we care

Who is this leaflet for?

Your doctor has asked us to perform an MRI scan in the knowledge that you have a cardiac implantable electronic device (CIED).

What are cardiac implantable electronic devices (CIEDs)?

These include internal cardiac pacemakers and defibrillators. They usually consist of a generator box (battery and computer) and one or more wires known as leads, which attach to your heart. Pacemakers help to keep your heart beating at a normal rate. Defibrillators send an electrical shock to the heart that essentially 'reboots' it to get it pumping normally again. Some devices work as a pacemaker and a defibrillator.

What's the problem with CIEDs and MRI scans?

Historically MRI (magnetic resonance imaging) was contra-indicated (not allowed) for patients with cardiac implantable electronic devices. This was because of concerns that the powerful magnetic and radiofrequency fields (RF) generated during the scan might cause injury or interfere with the device's function. In recent times manufacturers have been producing MR 'conditional' CIEDs. These devices can be considered acceptable in the MRI environment when the manufacturer's guidelines are met. It is important to realise that 'conditional' does not mean 'safe' – risks are managed by following manufacturer guidance.

For a CIED to be considered 'MRI conditional' ALL components should be 'conditional' and be from the same manufacturer.

If you have an internal pacemaker or defibrillator and have received this leaflet with your MRI appointment, we should have already confirmed that your system is MR conditional. We would usually do this by contacting the local cardiology team looking after your device.

You must let the MRI department know before your appointment if:

1. you think your CIED is NOT a MR conditional type
2. you have had your CIED changed recently
3. your generator box is NOT positioned in the pectoral (breast) area of your chest.

Please read your appointment letter for a list of other implants and issues that you need to make us aware of before attending for your scan.

How could an MRI scanner interfere with a CIED?

- **Strong static magnetic field (always present)** – material which is magnetic will experience a pulling or twisting force when exposed to the static magnetic field. You may notice vibrations or a pulling sensation around the implant area.
- **Time varying (gradient) magnetic field** – during scanning, smaller magnets called 'gradient magnets' turn on and off repeatedly. The magnetic fields they generate can cause electrical currents within conductive materials. In some cases this can result in undesirable cardiac pacing eg arrhythmia (irregular heart beat) or bradycardia (slow heart rate).
- **Radio frequency field** – during scanning, electromagnetic radiation with a wavelength similar to radio waves is used. This energy can cause heating in the body and other materials. Conductive materials can act like antenna, absorbing this energy and then dissipating it as heat. Heating of a lead can damage the surrounding tissue. This thermal tissue damage can be temporary or lasting and can cause deterioration of the lead's pacing and sensing functions.

How are these risks managed?

MR Conditional CIED devices are designed to minimise the potential adverse events that may cause patient harm. To manage the risks we follow advice from centres of excellence and the manufacturers of the devices. In most cases this will mean the following:

- we would usually not perform an MRI scan until 6 weeks after implantation. This gives time for the tissue to heal around the device meaning movement is less likely. Please let the MRI staff know if:
    - it has been less than 6 weeks since implantation
    - your generator box is NOT positioned in the pectoral (breast) area of your chest
- a cardiac physiologist will check your device before the scan and programme it as necessary

- during the scan you are monitored visually and verbally. We will monitor your heart rate with ECG and / or pulse oximetry. You must let staff know if you experience any discomfort, pain or feel unwell during the scan
- we limit the amount of RF energy the scanner uses
- we limit the strength and rate of change of the gradient magnet fields
- we have a resuscitation trolley with an external defibrillator machine
- a cardiac physiologist will check your device is operating correctly after the scan.

What are the possible adverse events?

Arrhythmia (irregular heart beat), bradycardia (slow heart rate), discomfort, syncope (fainting), worsening heart failure, loss of beeper function (some devices give an audible warning if battery is low), death.

Patients with internal cardiac defibrillators (ICDs)

Please be aware that these devices are usually deactivated for the duration of the scan. This means they will be unable to detect dangerous heart rhythms and deliver a therapy shock. The nearest external defibrillator is located within the MRI department but cannot be taken into the magnet room (you would need to be brought out to use it).

What happens when I arrive for my scan?

Please arrive at least 10 minutes before your appointment time. You will need to complete a MRI checklist and change into appropriate clothing. We can provide hospital gowns if needed. You need to remove ALL jewellery and piercings.

The cardiac physiologist / technician will be in attendance to:

- perform pre-MRI checks as recommended by your device manufacturer
- place your device into the correct 'MRI mode' before your scan

When your device has been made ready a radiographer will:

4. Perform the final safety checks with you before taking you into the magnet (scan) room.

5. Set up the ECG and / or pulse oximetry monitoring.
6. Perform the scan within the guidelines recommended.
7. You will be given a call bell. You can use this to alert the radiographer to any problems you have whilst in the scanner. You must let staff know if you experience any discomfort, pain or feel unwell during the scan.
8. After the scan the cardiac physiologist will perform post MRI checks as recommended by your device manufacturer.
9. If the cardiac physiologist is happy and you feel well you will be able to leave the department.

Contact us

For further advice, information or to discuss any concerns you can contact:

- the MRI team: rcht-teammri@nhs.net 01872252290
- your referring doctor
- the cardiologist looking after you and your device.

Further information

Further advice or information is available from:

www.bostonscientific.com/imageready

www.biotronik.com/en-us/products/services/promri

www.global.medtronic.com/xg-en/healthcare-professionals/mri-resources.html

www.cardiovascular.abbott/us/en/hcp/resources/mri-ready-resources.html

If you would like this leaflet in large print, braille, audio version or in another language, please contact the General Office on 01872 252690

RCHT 1850

Printed 12/2024 V1 **Review due 12/2027**