



MRI Scan and Implanted Cardiac Devices

Patient Information Sheet

You are receiving this information sheet because you have an Implanted Cardiac Device and your Doctor has requested for you to have an MRI.

What is an MRI?

Magnetic Resonance Imaging (MRI) is a non-invasive medical imaging test that uses a strong magnetic field, radio waves and a specialized computer to produce detailed images of internal soft tissue structures of the human body. The procedure does not use ionizing radiation and is considered to be safe; however, **metallic implanted devices within the patient's body may be affected by the magnetic field**. When having an MRI, the patient is required to lie on an examination table which then moves him or her into the MRI machine. The machine is open at both ends, and some exams may be performed either head first or feet first. Holding still is important for obtaining the best images since the machine is sensitive to motion. Also, some exams may require an intravenous injection.

What does this mean for you and your device?

There are two main classifications for implanted cardiac devices with regards to MRI scanning; Non-MRI-conditional and MRI-conditional.

Non-MRI-conditional devices are not specifically designed to be scanned. With the use of special programming, close monitoring, and specific MRI settings, these scans can be safe for you and your device.

MRI-conditional devices have been designed and tested to reduce the potential risks associated with MRI with specific MRI settings.

Potential complications include, but are not limited to:

Potential risks associated with MRI scanning in patients with Cardiac Implanted Devices generally arise from 3 sources: the static magnetic field, gradient magnetic fields, and radiofrequency fields.

Static magnetic field

- Mechanical forces of ferromagnetic components (e.g. pacemaker displacement)
- Unpredictable magnetic sensor activation
- Reed-switch closure and sudden loss of pacemaker function
- Changes in electrocardiograms

Gradient magnetic field

- Possible induction of serious arrhythmias (rare)
- Induced voltages on leads causing over- and/or undersensing

Modulated radiofrequency field

- Heating of cardiac tissue adjacent to lead electrodes
- Possible induction of serious arrhythmias (rare)
- Pacemaker reprogramming or power-on-reset
- RF interactions with the device (over- and undersensing)

Combined field effects

- Sudden and unexpected loss of device function
- Alteration of device function because of electromagnetic interference (EMI)
- Mechanical forces (vibration)
- Power-on-reset of the pacemaker or ICD pulse generator
- Damage to pacemaker or ICD pulse generator
- Damage to pacemaker or ICD lead(s)

Imaging-related

- Artifacts that prevent adequate image visualization

The incidence of life-threatening or serious adverse events from MR scanning of Non-MR-Conditional systems is low, at < 1%.

In a study funded by Johns Hopkins University and the National Institutes of Health, the safety of MRI, performed with the use of a prespecified safety protocol in 1509 patients who had Non-MRI-Conditional systems, no long-term clinically significant adverse events were reported. One patient required their generator to be changed. (NEJM 2017; 377:2555-2564)

What to expect on the day of the scan?

- Arrive at the Pacemaker Clinic at your booked appointment time
- The Pacemaker Nurse/Tech will look at the settings of your Cardiac Device
- Once the device has been approved for MRI, the Pacemaker Nurse/Tech will accompany you over to the MRI unit
- You will have a chance to speak with the Radiologist prior to your scan
- The Pacemaker Nurse/Tech will program your device to the required settings for the MRI based on the manufacturer and your specific pacing needs.
- If you have an ICD, this will be deactivated for the scan.
- You will have your scan under supervision of the Pacemaker Nurse/Tech and the MRI Tech.
- After your scan the Pacemaker Nurse/Tech will reprogram your device to the original settings and once the scan is confirmed satisfactory, you will be free to go home.
- You will have your follow up Pacemaker Clinic appointment at your regular interval.

References

Verma et al. Canadian Heart Rhythm Society and Canadian Association of Radiologists Consensus Statement on Magnetic Resonance Imaging with Cardiac Implantable Electronic Devices, Canadian Journal of Cardiology 30 (2014) 1131-1141

Nazarian et al. Safety of Magnetic Resonance Imaging in Patients with cardiac Devices, The New England Journal of Medicine, (2017) 377:2555-2564

Medtronic, SureScan Pacing systems Guidelines for MRI procedures

Boston Scientific, ImageReady MR-Conditional Systems, Programming Manual for MRI Protection Mode
Boston Scientific, ImageReady Programming Manual for MRI Protection Mode

St. Jude Medical, MRI Ready Systems by St. Jude Medical (2017)