# MR Safety Week 2019

## Day 2 – Cardiac Pacemakers

**Device Description**
A cardiac pacemaker is a device that is used to control abnormal heart rhythms. The device consists of a generator unit, which generates the electrical impulses, and leads, which deliver the stimulation to the heart.

**Interactions with MRI**
The presence of a pacemaker has historically been a complete contraindication to MRI scanning. The main safety concerns result from interactions with the static, gradient and RF fields of the scanner. These interactions in older devices could lead to inadvertent re-programming of the device, inappropriate triggering or heating of leads. There are many newer devices which are labelled as *MR Conditional* and are suitable for MRI scanning

**Common MR Conditions**
There are often separate conditions for the establishing the integrity of the device, the exposure to static, gradient and RF fields in the scanner, and for the training of staff members who need to be present during the scan.

Typically, patients should not have implanted lead extenders, lead adaptors or abandoned leads.

Leads should not be broken or have intermittent electrical connection. This condition can often be established by the device itself by measurement of the lead impedance.

There will typically be a 'safe' or 'MRI' mode for MRI scanning that the device should be switched to prior to scanning.

Once the device is in its MRI mode, the typical scanning conditions are not generally restrictive. There are models that can be scanned at both 1.5T and 3T and scans can often be performed in the *Normal Mode* of operation without additional adjustments.

It is normally a condition that an external defibrillator be available, and that staff are appropriately trained to use it.

It is also typically a condition that a cardiac physiologist, or other suitably trained health professional, attend the MRI scan. This can often be the limiting condition for some MRI units.

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

Always follow the manufacturer instructions for assessing device eligibility **every time** the patient has a scan. This process may require establishing up-to-date information on the integrity of the device. **Previous MRI scans do not guarantee eligibility for future scans.**

Although a device's make and model may be eligible for MRI scanning, if a device cannot be put into its MRI mode for any reason then the scan should not proceed.

Typically, there is a 6-week period after implantation of an *MR Conditional* pacemaker during which scans should not take place. This is to allow the implanted leads to become secured in the tissue.

Patients should have monitoring of their heart rate during the scan.

***A Note on Non-MR Conditional pacemakers***
*There is growing evidence for the safe MR scanning of patients with pacemakers that are* ***not*** MR Conditional *following strict procedures similar to those required for* MR Conditional *devices. Importantly, with any device where it is not possible to get assurance from the manufacturer regarding MR safety, a local clinical decision to scan/not scan is encouraged based on a clinical need versus risk comparison. Both MHRA and SCoR-BAMRR guidelines offer advice on such a process.*

**Further Reading**
BIR MRI Safety Week 2018 information sheets
*MR Conditional* information obtained direct from the manufacturer
Magnetic resonance imaging safety in nonconditional pacemaker and defibrillator recipients: A meta-analysis and systematic review.
Shah AD *et al. Heart Rhythm*. 2018 Jul;15(7):1001-1008.



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