MR Safety Week 2019

BIR The British Institute of Radiology

Day 4 – Neuro-Stimulators

Device Description
Neuro-Stimulators are a category of devices that deliver electrical stimulation to nerves in the body. Often the purpose of the device is to provide pain relief by interrupting the pain signal travelling to the brain. Other stimulators can be used to normalise sphincter function (e.g. the gastric sphincter to treat acid reflux). The typical internal components of the device are the neurostimulator (which generates the electrical impulses) and the leads (which deliver the stimulation therapy to the required site). Patients will also commonly have an external patient programmer that can be used to alter the mode of the device.

Interactions with MRI
The major considerations when scanning patients with neurostimulator devices are the field strength, the maximum spatial field gradient and the interaction with the RF field.

Both the power and frequency of the RF are important – scanning at the wrong field strength, and hence the wrong frequency, risks a resonant condition being set-up in the leads of the device. Often the MR conditions will require the device to be outside of the transmit RF coil to minimise exposed to the RF field. Not following stated manufacturer conditions could lead to device failure, unwanted stimulation or dangerous excess heating in the stimulator leads.

Common MR Conditions
Manufacturers often have detailed flowcharts to determine the eligibility of the device for MRI. Both the stimulator **and** the leads should be demonstrated to be eligible; if either are not eligible then the MR conditions have not been met.

Some devices are *MR Conditional* only for head scans using a transmit and receive (TX/RX) head coil. In this case, use of the body transmit coil would be contra-indicated and a scan could only take place if a unit has a TX/RX head coil **and** is competent to use it properly.

The allowed field strengths are often stated explicitly with other field strengths (even lower ones) not allowed.

SAR conditions vary with make and model. For some models the Whole Body and SAR limit is less than 2 W/Kg and so limiting the scanner to its *Normal Mode* of operation may not be sufficient. In this instance it would be necessary to develop and test a low SAR protocol prior to scanning the patient. **Ensure that all scan components meet the MR conditions.**

MR Conditional devices often specify a maximum allowed spatial field gradient. This condition can typically be met by ensuring that the device remains as close as possible to the central axis of the scanner. Refer to the technical documentation for your scanner to determine where in the scanner bore this condition will be met.

The device may need to be placed into a specific MRI mode prior to scanning

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 flowcharts for assessing device eligibility **every time** the patient has a scan. This process may require you to obtain up-to-date information from the patient's clinical team. **Previous MRI scans do not guarantee eligibility for future scans.**

Always determine whether the device is eligible for the required scan. For **any** scan using the body-transmit coil the device needs to be eligible for **whole-body** scanning.

If a device is eligible for a head scan only with a TX/RX head coil then the body transmit coil cannot be used. You should check you have the correct equipment and know how to use it. In this case the MR conditions for head scans using conventional receive-only head coils cannot be met and a scan should not take place.

Further Reading
BIR MRI Safety Week 2018 information sheets
MR Conditional information obtained direct from the manufacturer

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