MR Safety Week 2019

Day 5 – Deep-Brain Stimulators

Device Description
Deep-Brain Stimulators (DBS) are devices that produce electrical stimulation to regulate brain activity. They can be useful for conditions such as Parkinson's disease and can help to reduce symptoms such as tremor in these patients.

Interactions with MRI
The major considerations when scanning patients with DBS devices are the field strength and the interaction with the RF field.

The RF field of the scanner can induce significant heating effects in the leads of the device – this is the most serious risk posed by these devices in an MRI scanner as excess heating could result in severe impairment. Induced voltages on leads due to interactions with the gradient and RF fields can also result in unintended stimulation effects which may be uncomfortable for the patient.

Common MR Conditions
Manufacturers of *MR Conditional* devices 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 system integrity usually needs to be established. This means that the impedance of the leads needs to be measured and recorded so as to establish that there are no open or short circuits. These measurements should be made by a suitable member of the patient's clinical team as close to the scan date as possible. If the impedance values are outside of the manufacturer's quoted safe ranges, then a scan cannot take place.

Usually the stimulator therapy should be switched off for the scan.

SAR conditions vary with make and model but are normally extremely restrictive. The MR condition for RF power is usually expressed as a maximum B1+rms value. If a B1+rms setting is not available for the scanner then usually SAR can be used instead. However, SAR limits are typically more restrictive than B1+rms (often < 0.1 W/Kg for Whole Body and Head SAR), so practically it is better to follow the B1+rms limit. **Ensure that all scan components meet the MR conditions of the device.**

There is sometimes an MR condition for the maximum total scan time allowed within the scanning session.

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 usually requires that you to obtain up-to-date information from the patient's clinical team. **Previous MRI scans do not guarantee eligibility for future scans.**

Importantly, if the MR conditions for a device specify a TX/RX head coil must be used for scanning the head, then a conventional head coil should **not** be used as this will almost definitely be a receive-only coil, using the in-built body coil to transmit. You should check you have the correct equipment and know how to use it.

The MR conditions for RF exposure are exacting for these devices and so modified protocols are usually required. These should be developed and tested for compliance with the MR conditions of the device prior to the scan date

When a patient's therapy is switched off the symptoms of their condition (e.g. tremor) may return. This can sometimes impact on the ability to perform a successful MRI scan.

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

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