MRI Safety

Group :2

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What is MRI ?

- Magnetic resonance imaging, or MRI, is a way of obtaining detailed images of organs and tissues throughout the body without the need for x-rays or "ionizing" radiation.
- MRI uses a powerful magnetic field, radio waves, rapidly changing magnetic fields, and a computer to create images that show whether or not there is an injury, disease process, or abnormal condition present.

How does it work?

- The Patient is placed inside of the MR system or scanner—typically a large donut-shaped device that is open on both ends.
- The powerful magnetic field aligns atomic particles called protons that exist in most body tissues. The applied radio waves then interact with these protons to produce signals that are picked up by a receiver within the MR scanner.
- The signals are specially characterized using the rapidly changing magnetic field. With the help of computer processing, images of tissues are created as "slices" that can be viewed in any orientation.
- An MRI examination causes no pain, and the electromagnetic fields produce no known tissue damage of any kind.

How safe is MRI ?

- The powerful magnetic field of the MR system will pull on any iron-containing object in the body such as a medical implant, certain aneurysm clips or certain medication pumps.
- As a patient, it is vital to remove all metallic belongings in advance of an MRI exam, including external hearing aids, watches, jewelry, cell phones, and items of clothing that have metallic threads or fasteners.
- Additionally, makeup, nail polish, or other cosmetics that may contain metallic particles should be removed if applied to the area of the body undergoing the MRI examination.

Items that may create a health hazard or other problem during an MRI include:

- Certain cardiac pacemakers or implantable cardioverter defibrillators (ICDs)
- Ferromagnetic metallic vascular clips placed to prevent bleeding from intracranial aneurysms or blood vessels
- Some external or implanted medication pumps (such as those used to deliver insulin, pain-relieving drugs, or chemotherapy)
- Certain cochlear (i.e., for hearing) implants
- Certain neuro stimulation systems
- Catheters that have metallic components
- A bullet, shrapnel or other type of metallic fragment
- A metallic foreign body located within or near the eye (such an object generally can be seen on an x-ray; metal workers are most likely to have this problem)

Items that need to be removed by patients and individuals before entering the MR system room include:

- Purse, wallet, money clip, credit cards, cards with magnetic strips
- Electronic devices such as beepers, cell phones, smartphones and tablets
- Hearing aids
- Metallic jewelry and watches
- Pens, paper clips, keys, coins
- Hair barrettes, hairpins, hair clips and some hair ointments
- Shoes, belt buckles, safety pins
- Any article of clothing that has metallic fibers or threads, metallic zippers, buttons, snaps, hooks, or underwire

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MRI BURN PREVENTION

Tips for Keeping Patients Safe

Screen patients for implants, devices, and other metallic objects. Assume anything unknown is MR Unsafe.

MR

MR

Screen objects to ensure that anything entering the scan room is MR Conditional or MR Safe. Match conditions on MR Conditional devices with your scanner. All metals, even non-ferromagnetic ones, have the potential to heat up and cause burns.

Have patients change out of street clothes whenever possible.

Position patients to avoid skin-to-skin contact (e.g. no hands on hips, no crossed arms, no crossed legs, etc.).

Always use the manufacturer-provided padding to insulate the patient. Sheets and blankets may be added for patient comfort but are not a substitute for manufacturer-provided padding.

Route cables out of the scanner in a straight line. Don't coil cables or allow them to touch the patient.

Use only Normal Operating Mode and the lowest SAR, whenever possible.

Lowest SAR Possible

Keep your eyes and ears on the patient at all times. Stay in communication with patients to identify warming. Monitor sedated patients using MR Conditional monitoring equipment.

FDA

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Visit the SMRT MR Safety Website for real-time resources & information!
www.ismrm.org/mr-safety-links/

SMRT MRI Safety

Active Implanted Biomedical Devices

Does your patient have an implanted device that is electronic, programmable, or provides active therapy?
Need to obtain the following information:

- **Manufacturer name**
- **Model name and/or number**
- **Serial number**

Does the active implanted device have MRI safety information?

- **'MR Conditional'**
- **'MR Unsafe'**
- **Not tested or labeled for MRI**
- **FDA warning**

MR

MR

Risk versus Benefit decision is conducted by the MR Physician

- **Does the device require special programming or monitoring?**
- **Any scanning limitations?**
- **Are there exclusion zones?**
- **Do you have the personnel and necessary equipment to meet the 'MR conditional' labeling requirements of the device?**

Device labeling 'MR conditions' necessary to fulfill can include:

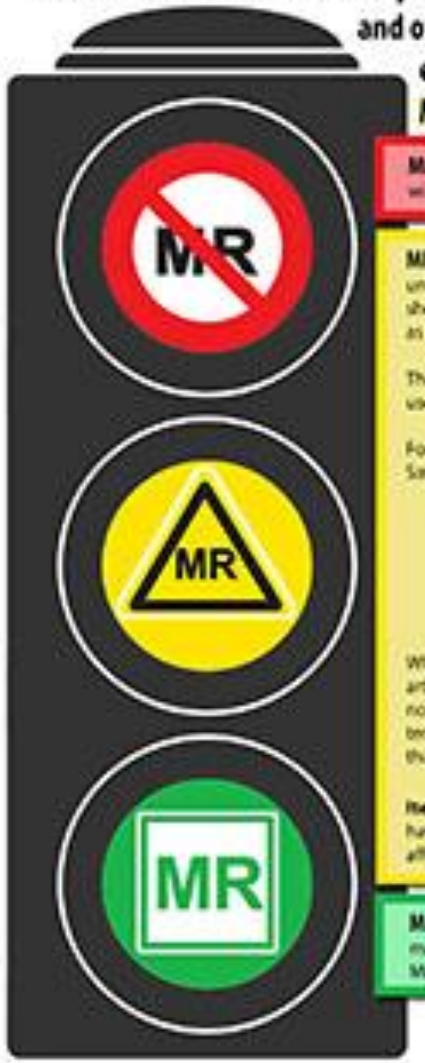
- **Field strength (B_0)**
- **Maximum spatial gradient level (B_0)**
- **RF coil (transmit-receive coil or whole body transmit coil)**
- **SAR and/or B1+rms levels**
- **Time varying gradient magnetic fields (dB/dt or slew rate)**
- **Length of each MRI acquisition/scan**

Is your MRI suite equipped and ready to handle adverse events?

- **Overriding safety warnings can result in injuries and potentially life-threatening events**

Understanding MRI Safety Labeling

The MR environment has unique safety hazards for patients with implants, external devices and accessory medical devices. Implants, medical devices and other equipment used in or near the MR environment should be labeled as MR Unsafe, MR Conditional, or MR Safe.



MR Unsafe items should not enter the MRI scanner room. Patients with MR Unsafe devices should not be scanned.

MR Conditional items may safely enter the MRI scanner room only under the very specific conditions provided in the labeling. Patients should not be scanned unless the device can be positively identified as MR Conditional AND the conditions for safe use are met.

The conditions for safe use will be different based on the intended use of the device.

For **items intended to enter the bore of the MRI system**, the MR Safety labeling should be matched with the MRI system for:

- Static field strength
- Maximum spatial field gradient
- dB/dt limitations (usually only applicable to active implants)
- SAR limits
- Any other conditions needed for safe use of the device, for example restrictions on the types of coils that may be used

When present, information about expected temperature rise and artifact extent may inform the risk/benefit decision of whether or not a patient should undergo an MRI examination. Expected temperature rise and artifact extent information are not conditions that must be met.

Items NOT intended to enter the bore of the MRI system usually have gauss line positioning restrictions or requirements to tether or affix the device to an unmovable part of the room.

MR Safe items pose no safety hazards in the MR environment. They may be placed anywhere in the MR environment. Patients with MR Safe devices have no scanning restrictions.

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WARNING

For Those Entering MR Room

Only MR Safe Devices Allowed

Not Allowed in Imaging Rooms

MRI Safety Program

MRI safety program essentials should include:

- Policies and procedures that are written, enforced and reviewed annually
- Reporting of all MR adverse events, or near miss incidents
- Restricted site access
- Managing MR personnel – including educating and screening personnel
- Device screening and rating of hazardous materials/equipment
- Patient screening guidelines
- Managing cardiac or respiratory arrest
- Managing patient claustrophobia, anxiety, sedation, anaesthesia, violent behaviour
- Contrast agent safety

MRI Safety Program (contd..)

- Monitoring patients in the MR environment
- Emergency preparedness (planning for fire, flood or water damage, power failure, police action and magnet quenching
- Compatibility of passive implants
- Education for all staff who may be operating in one of the MR safety zones, including the facility code teams, hospital security and housekeeping staff
- Ensuring effective communication and understanding of risks to patient of diverse cultures and to those patients who cannot share medical information related to possible contraindications due to disabilities.