



MCW MRI Safety Policies and Procedures

Scanning at 7 Tesla

Category: Magnetic Resonance Imaging (MRI) Safety

Policy #: MR.SOP. 015

Applies to: Investigators, study personnel, Medical College of Wisconsin (MCW) staff

(See **MRI Safety Standard Operating Procedures** for general information)

PURPOSE:

The purpose of additional procedures for scanning at 7T is to address associated effects of vertigo, dizziness, metallic taste and nausea reported during movement within the gradient of the strong magnetic field. Personnel may notice these effects especially with rapid physical movement and side to side motion of the head within the field near the bore of the magnet. Subjects have reported magnetophosphenes (flashes of light) while moving through the magnetic field on the scanning table. There are also reports of headaches.

Upon moving from a lying flat position on the scanning table to a sitting and subsequent standing position there are reports of vertigo, dizziness, shakiness, tottering, and nausea.

During scanning there is an increased occurrence of peripheral nerve stimulation (PNS) reported compared to lower magnetic field strength procedures.

All of the effects are dependent on personal sensitivity thresholds.

DEFINITIONS:

Conditions are specifications determined by the manufacturer for the implant or device that allow safe MR scanning which include:

- a. Static Magnetic Field
- b. Spatial Gradient Field
- c. Maximum MR system reported, whole body averaged specific absorption rate (SAR)

Equipment indicates machines that may be used for MRI studies to monitor physiological processes or provide the stimulus or physical task for the study.

Magnetic Environment: The area where the magnetic field is greater than 5 gauss resulting in the potential for objects to become missiles or projectiles as they are attracted into the magnetic field of the scanner. Individuals who may have cardiac pacemakers or other implants and devices may be at risk to enter the magnetic environment. The magnetic field is always present and is three dimensional around the scanner.

(T)Tesla: The unit of measurement for magnetic field strength. 1 Tesla equals 10,000 gauss.

MRI: Magnetic Resonance Imaging which uses a strong static or main magnetic field, radio frequency pulses and time varying magnetic fields or gradients to produce anatomic images, spectroscopy, angiography, and functional data (fMRI).

MRI Safety Training: The required procedure that must be completed prior to working within the magnetic environment.

Materials are pads, cushions or other objects that are not mechanical in nature but are used with or near the research subject during the MRI procedure.

Research MRI scanner operator is an individual who is an employee of the Medical College of Wisconsin, has completed the MRI safety training and is specially trained in the operation of one or more of the MRI scanners. There are two levels of scanner operators:

Individuals who are allowed to operate the scanner for phantom and / or animal studies.

Individuals who are allowed to operate the scanner for human research subjects studies.

Individuals who are allowed to operate the scanner for research participant studies must have current documentation as to valid Red Cross or equivalent basic life support cardiopulmonary resuscitation (CPR) training.

Research Study Personnel are individuals including a student, staff member or laboratory assistant for whom the PI of the study is responsible, and who are at the MR scanner site during the study or may be recruiting subjects for the study.

Research Subject is a human or animal participant who is placed into the bore of the MRI scanner for research purposes.

Safety Screening: The process of inquiring about the safety of individuals, including research subjects prior to entering the magnetic environment. Safety screening also applies to checking equipment for safety prior to being used in the magnet room.

Spatial Gradient Field is the variations (gradients) over distance (space) in the main static magnetic field from isocenter, the center of the magnetic field, within concentric rings.

PROCEDURES:

A. Entering the Magnet Room

1. Individuals must undergo MRI Safety screening for BEFORE entering the scanner magnet room.
2. Personnel including the scanner operators should move very slowly within the magnetic field depending on their personal sensitivity threshold for magnetic field effects.
3. Personnel including the scanner operators will use caution when moving their head within the highest spatial gradient near the bore of the magnet.
4. Personnel including the scanner operators will educate study team members and others present of the potential to experience magnetic field effects within the magnet and the necessity to always move slowly depending on their personal sensitivity threshold.

B. Scanning Research Subjects

1. See **Safe MRI Scanning MR.SOP.011** for general information
2. Imaging Implants and Devices at 7T without documentation
Research participants have been presenting with implants and devices that have no documentation available indicating scanning is safe or conditionally safe at 7T. It is the consensus of the committee that passive implants that have been determined to be safe or conditionally safe at 3T may be allowed for imaging at 7T if the implant will be outside of the area exposed to the radio frequency (RF) pulses during the scanning.
3. Research subjects should change into gown or scrubs if street clothing contains metal.
4. Safety screened Research Subjects should receive information about possible magnetic field effects.
5. The scanner operator and or study team member should slowly walk the subject into the magnet room.
6. The scanner operator and or study team member should assist the subject onto the scanning table and into a lying down position assuring that the subject is comfortable within the magnetic field.
7. The scanner operator and or study team member should keep in constant contact with the subject as the table moves into the bore; keeping in mind that this movement is when magnetic field effects are most noticeable.
8. After it is established that the subject is comfortable within the bore of the magnet the scanner operator and or study team member may leave the magnet room.
9. Scanner operators and study team members will constantly monitor the status of the research subject in the scanner magnet to ensure the subject remains comfortable in the magnetic field.
10. The research subject may withdraw and be brought out of the scanner and or magnet room at any time, especially if they are in discomfort from magnetic field effects.

C. Infection and Allergy Control

1. See **MR.SOP.06** for general information
2. Supplies are available to clean the scanning table and equipment after every subject
3. Linens are changed after every subject.
4. The scanning table and all associated equipment, including the squeeze ball and the head coil used, should be cleaned with the bleach solution prior to the next subject.
5. If a subject becomes nauseous and vomits:
 - a) The study team should attend the subject.
 - b) If there is no visible blood in the emesis, clean with available supplies.
 - c) If there is visible blood in the emesis, call Public Safety and report. They will notify and supervise the housekeeping staff to do the proper clean up.

D. Equipment and Materials

1. Equipment must be approved by the MRI Safety Committee prior to use for a research study, or entry into the magnetic environment. (See **Equipment and Materials MR.SOP.02** for general information)
2. Materials used for stability and comfort of the research subject must be determined to be safe for 7T prior to use.

E. Access Control

1. The door to the scanner magnet room from the control room must be closed and locked when no one is within the control room.
2. The door to the scanner magnet room from the equipment room must be closed and locked when no one is within the equipment room or immediate area.
3. The door to the control room must be closed and locked when no one is within the immediate line of sight.
4. The door to the MRI lobby should be closed and locked when no one is within the immediate line of sight.
5. Failed access points (magnet room door left unlocked and unattended) should be reported to the MRI Safety Committee. MRiresearch@mcw.edu
6. Questions and concerns about safe access to the MRI areas should be directed to the MRI Safety Committee. MRiresearch@mcw.edu

F. MRI Safety Training

1. MRI Safety Training must be completed before an individual is granted badge access to the MRI area or hallway.
2. MRI Safety Training must be completed before an individual is allowed unescorted into the scanner magnet room.
3. Individuals who have not completed MRI Safety Training must be escorted while in the MRI area.

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