

 <p>JOHNS HOPKINS MEDICINE THE JOHNS HOPKINS HOSPITAL</p>	The Johns Hopkins Hospital <b>Radiology and Radiological Science Policy and Procedure          Manual          MRI</b>	<i>Policy Number</i>	MRI046	
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**Keywords:** cardiac arrest, fire, foreign body, IMRIS, interpreter, labeling, medication patch, MRI, MRI conditional, MRI safe, MRI screening form, MRI unsafe, pregnancy, quench, safety, screening, unconscious patient

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## **I. OBJECTIVES**

This policy is intended to provide a safe environment for patients, visitors, and employees in the magnetic resonance imaging (MRI) suite through education and screening. This includes a detailed process for safe patient scheduling and scanning.



NOTE: **The magnet is ALWAYS ON**, even in the Intraoperative Magnetic Resonance Imaging Suite (IMRIS) garage.

## **II. INDICATION FOR USE**


- A. This policy is to be used by anyone working or visiting in any MRI room/suite on the Johns Hopkins Hospital and Johns Hopkins Medical Imaging campus to include: the Cardiology MRI scanner on Zayed 5, the IMRIS MRI scanner on Zayed 3, the Interventional MRI scanner on Zayed 3 and the Emergency Room MRI scanner on Zayed 1.
- B. Refer to [Pregnancy Verification for Radiologic Studies \(ADO013\)](#) for care of pregnant healthcare workers and patients in the MR/OR environment.

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### III. DEFINITIONS

Ferromagnetic	Characteristic of substances such as iron, nickel, cobalt and various alloys that exhibit extremely high magnetic permeability. When these objects are within the 5 gauss line, they will be drawn to the magnet with great force.
Gadolinium	An intravenous contrast agent used in MRI to produce high quality images when the patient is scanned.
Gadolinium Medication Guide	An approved US Food and Drug Administration (FDA) document that provides updated prescribing information concerning the gadolinium retention safety issues for each gadolinium agent.
IMRIS Garage	The dedicated bay that houses the MRI magnet between ZBOR309 and ZBOR310. The MRI Technologist, Radiology Physics and Engineering, and IMRIS Service Engineers will be the only personnel to have access to the bay. See Appendix A
Intraoperative Magnetic Resonance Imaging Suite (IMRIS)	A MRI scanner that is mounted on an overhead rail located in its own garage between two operation rooms (OR). See Appendix A for details.
Magnetic Resonance Imaging (MRI)	<ul style="list-style-type: none"> <li>A noninvasive imaging tool with a powerful magnetic field, radio waves, and a computer to produce detailed images of the human body.</li> <li>The interaction between individuals or equipment and the MR scanners unique environment may result in serious injury or death.</li> </ul>
MRI Zones	<p>There are four recommended zones defined by the ACR (<b>American College of Radiology</b>) that will assist in limiting MRI related incidents/accidents.</p> <ul style="list-style-type: none"> <li>These zones should be identified in every area where a MRI scanner is located.             <ul style="list-style-type: none"> <li><b>Zone 1-</b> Any area that is freely accessible to the general public.</li> <li><b>Zone 2-</b> The area for unscreened patients, family members/guardians, visitors, and employees.</li> <li><b>Zone 3-</b> This area is strictly controlled and shall allow only screened patients, family members/guardians, and employees.</li> <li><b>Zone 4-</b> The MRI scan room and any room where the 5 gauss line extends into that room. This room may only be accessed by screened patients, family members/guardians, visitors, and employees under the constant supervision of MRI personnel or an identified MRI Safety Officer for that MRI scanner location.</li> </ul> </li> </ul>
MR Safe 	<ul style="list-style-type: none"> <li>Equipment or devices may be used in any area of the MR/OR and will not be affected by the magnetic field or the imaging.</li> <li>Labeled with a green and white sticker and the initials "MR" inside of a square.</li> </ul>
MR Conditional 	<ul style="list-style-type: none"> <li>Equipment may only be used under certain conditions in the MR environment, such as magnetic field strength, gradient magnetic field and distance from magnet.</li> <li>Labeled with a yellow and black sticker with the initials "MR" inside of a triangle.</li> </ul>

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MR Unsafe 	<ul style="list-style-type: none"> <li>Equipment that poses DANGER to the patient, staff, and the MR scanner itself if it enters the MR environment.</li> <li>Labeled with a red sticker with a line across the initials "MR" inside of a circle.</li> </ul>
MRI Procedure Screening Form	A comprehensive list of screening questions that must be answered by patients, family members/guardians, or visitors to determine if it would be safe to enter Zone 4. See Appendix F
MRI Employee Screening Form	A comprehensive list of screening questions that must be answered by employees to determine if the employee would be safe to enter the Zone 4. See Appendix F
MRI Scheduling Questionnaire	A list of screening questions that must be answered by outpatients, the ordering physician, or the medical clinic at the point of scheduling to determine if it would be safe for the patient to enter Zone 4 on the day of their appointment. See Appendix F
MRI Training	<ul style="list-style-type: none"> <li>Level I MR safety training is designed to be taken annually by all medical personnel who work in the MRI environment. The training would provide information about potential catastrophic events associated with the MR scanner, MRI screening, and safe practices that prevent harm.</li> <li>Level II MR safety training is designed for MRI Technologist, MRI Radiologist and Radiology Physics and Engineering staff.             <ul style="list-style-type: none"> <li>The training provides extensive knowledge about the MRI environment including the potential hazards of the magnetic field, cryogenics, equipment and agents used within the MRI environment.</li> </ul> </li> </ul>
Quench	An abnormal termination of the magnet field causing the release of helium gas. See Appendix H.
Ferromagnetic Wand	A hand held metal detector used to check over and around the body of an employee, patient, family member/guardian, and/or vendor for the presence of ferromagnetic material before entering Zone 4.
Ferromagnetic Metal Detection System	Ferromagnetic metal detection systems (FMDS) are stationary devices installed in the frame of the door leading into Zone 4. It is used for the detection of any ferromagnetic material that could potentially enter Zone 4
5 Gauss Line	<p>This line specifies the perimeter around a MR scanner within which the static magnetic fields are higher than five gauss.</p> <ul style="list-style-type: none"> <li>If there is no visible indication of the 5 gauss line around any MRI scanner on the Johns Hopkins Hospital and Johns Hopkins Medical Imaging campuses, the boundary therefore extends to each wall of the scan room up to the MRI scan door.</li> </ul>
MRSO	<p>Magnetic Resonance Safety Officer</p> <ul style="list-style-type: none"> <li>to Assist the MRMD when needed</li> </ul>
MRMD	Magnetic Resonance Medical Director
MRI Order Question	List of questions that must be answered by the ordering physician at the time of order placement

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Coil	Pieces of metal inside of the MRI scanner that functions as a receiver, and sometimes also the transmitters, of radiofrequency (RF) signals to produce MRI imaging
Ferromagnetic	Characteristics of substances such as iron, nickle, cobalt and various alloys that exhibit extremely high magnetic permeability
Ferromagnetic Object	Any Object that when it gets too close to the magnet will be drawn towards the magnet with great force

#### **IV. RESPONSIBILITIES**

- A. MRI Division requires specially trained staff /personnel (MR Level II) who are knowledgeable about the MRI environment to accompany patients, visitors, vendors and other hospital employees into the MRI suite (Zone 4).
- B. MRI Technologists and P&E staff are authorized to prohibit any personnel or equipment into the scanner suite that have the potential to cause injury to the patients, visitors, hospital employees or damage to the MRI scanner itself.
- C. Magnetic Resonance Medical Director/Magnetic Resonance Physician (MRMD)
  1. Is responsible for safety in the MRI environment to include establishing and/or be responsible for the establishment of the MR safety policies and guidelines of the organization/site and will oversee all decisions regarding MR site access and site access restriction decisions.
- D. The MRI Safety Officer (MRSO)
  1. The MRSO will advise the MRMD if/as needed, and is charged with executing the MR safety practices as defined/ ordered for the site by the MRMD/MR Physician to include ancillary staff education, annual MRI technologist safety competency assessments and the development of MRI safety Level I and Level II training.
  2. Enforce all policies and procedure related to MRI Safety and MRI Safety Training.
- E. Radiology Physics and Engineering (P&E) Employees:
  1. Physics and Engineering staff are required to complete the MRI Safety Training Level II annually, monitored by the division manager.
  2. Inspects, maintains (including quality control activities), and repairs the MRI scanning equipment.
  3. At least annually, conducts and documents a performance evaluation of all MRI imaging equipment.
- F. MRI Technologists:
  1. Are required to complete the MRI Safety Training Level II annually.
    - a. Are ultimately responsible for maintaining the safety of all individuals entering the MRI suite.
  2. Are authorized to prohibit any personnel or equipment into the scanner suite that have potential to cause injury to patients, visitors, hospital employees, or damage the MRI scanner.
  3. Obtain MRI Employee Screening Form from all non-MRI staff who do not routinely work in the MRI suite for initial entry into Zone 4:
    - a. Fax MRI Employee Screening Form to Occupational Health JHH (5-1617) or JHU (6-0452) with the employee's name, date of birth, unit manager and best contact number. (see [MRI Employee Screening Form](#))
    - b. Verbally confirm with non MRI staff of no change in their medical history each entry thereafter into Zone 4
  4. Distribute FDA approved medication guide to all outpatients for the type of gadolinium to be given.
    - a. The technologist is responsible for documenting in the "begin exam" navigator in Epic that the medication guide was distributed to the patient.
  5. Review the patients complete and accurate medical history to ensure patient safety for MRI imaging, as documented on the MRI screening form

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- a. An MRI Screening Form shall be reviewed twice for each patient by the technologist, thus providing two separate opportunities for patients to answer questions about any devices they may have, including: metal objects, implanted devices, drug delivery patches, tattoos, piercings and any electrically, magnetically, or mechanically activated devices (see appendix F).
6. Are responsible to test and label any equipment entering Zone 4-(see appendix for MRI labeling).
7. The MRI technologist are responsible along with - any employee involved in preparing patients for an MRI exam in the scan room to:
  - a. Remove the patient from the MRI scan room immediately in the event of fire, magnet quench, cardiac/respiratory arrest. *(Due to the nature of the MRI environment, emergency equipment is ferrous and could potentially harm a patient or employees. (See Appendix C)*
  - b. Take precautions to prevent patient burns during scanning ie: by placing pads between the patient and the scanner bore and anywhere there is skin to skin contact.
- G. Non-MRI staff whose job duties require routine work in the MRI suite (Zone 4), including, but not limited to: operating/procedure room nurses/ support staff, anesthesia staff, physicians, Lifeline Transport, and cardiology staff shall:
  1. Maintain with the over site of the employee's unit manager, completion of the Level I MRI safety training and the MRI Employee Screening form annually.(see appendix F).
- H. Non-MRI Staff with infrequent contact with MRI suite (inpatient RN, facilities, respiratory therapy, anesthesia staff).
  1. Will be trained on basic MRI safety upon orientation and annually through assignment of **JHH myLearning Course** "Required Annual Topics for Clinicians".
  2. Will be initially screened using the MRI employee screening form for initial entry into Zone 4, and verbally screened by the technologist each entry thereafter.
- I. Respiratory/Lifeline Transport
  1. Operate and maintain the MRI conditional ventilator stored and used in the MRI area
- J. JH Interpreter Services (see [\(PAS002\) Interpretation Services and Other Communication Needs](#) )
  1. The MRI technologist should use one of the 3 forms of interpretation in the presence of a non-English speaking patient: qualified in-person interpreter (IP): video remote (VRI), and over the phone (OPI) to translate registration, instructions, screening form, consents, and any concerns for/from the patient.
  2. A JH Interpreter must be present the entire MRI exam process except for:
    - a. A patient that can speak and understand English.
    - b. A patient who is receiving General Anesthesia
    - c. There is not an interpreter available for the patient's dialect. (see next step)
  3. If unable to stay for the entire MRI exam or if there is no interpretation services available for the patient's dialect:
    - a. The technologist will consult with the Radiologist to determine the necessity of the exam to be performed in the absence of an interpreter.
    - b. If the exam is approved by the Radiologist, the technologist will solicit the help of an English-speaking family member who is screened to safely go into the scan room with the patient to communicate any distress that the patient may experience during the exam.
      - i. The technologist will document in Epic "study notes" which doctor approved for the MRI exam in the absence of an interpreter.
      - ii. The technologist must submit a HERO to document the absence of an interpreter for the non-English speaking patient including the interpreter ID used if applicable.

## V. PROCEDURE

### A. General Information

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1. Patient belongings and valuables are stored per [PAS005 Valuables and Property, Safekeeping and Disposition of Patient...](#)
  2. The MRI Screening Form must be completed and reviewed before a patient, family member, or representative can enter the MRI Zone 4. If the patient, family member, or representative is unable to complete the MRI Screening Form refer to the MRI Screening Form Guidelines for next steps (See Appendix F).
  3. The patient will be screened for claustrophobia, anxiety and emotional distress. Any questions or concerns will be addressed by the MRI technologist
  4. The MRI Technologist must use the hand held metal detector to scan every patient prior to the patient entering the MRI scan room to detect the presence of hidden metal objects that may be under the patient's gown, or family members clothing.
  5. Prior to conducting the imaging study, the technologist shall confirm the following: correct patient, correct imaging site, correct patient position, correct laterality
  6. Provide all MRI patients, family members/guardians, visitor, and employees remaining in the room during MRI scanning with hearing protection (i.e...ear plugs and/or headset), and the communication ball.
  7. MRI technology staff will have all patients remove all jewelry, and change into institution provided MRI attire I.G. (gown, pants, robe and socks) before entering the MRI room to eliminate risk of harm for the patient
    - a. Patients who wear head covering (hat/scarf/cap) for religious reasons will be given a hospital cap to cover their hair for the MRI exam.
- B. For Inpatients:
1. MRI Technologist shall contact the patient unit to verify the following:
    - a. Patient level of consciousness.
    - b. Presence of medication patches (see Appendix E).
    - c. Presence of infusion pumps that must remain attached.
    - d. Mode of transportation.
  2. MRI technologist shall dispatch appropriate level of transportation for patient or discuss the need for life Line transport. Follow [PAT007 Transport of Patients, Intra-Facility](#).
    - a. Inpatient units that must have patients transported by life support must complete the transport request form in Epic and fax non-electronic MRI screening form to (443) 287-3416 to be reviewed by the MRI Technologist prior to the patient being transported.
- C. During the MRI Scan, the MRI technologist and support staff will:
1. Communicate with patient regularly to monitor patient for signs of claustrophobia and anxiety.
  2. Ensure that no items (e.g. leads) are formed into a loop since magnetic induction can occur and cause burns.
  3. If the patient's body touches the bore of the MRI scanner or coil, use non-conductive foam padding to insulate the patient's skin and tissues to eliminate contact with the scanner bore, coil or skin to skin contact.
  4. Only use equipment that has been tested and approved for use during MRI scans (fire extinguishers, oxygen tanks, and physiologic monitors).
- D. Troubleshooting
1. The MRI technologist will contact:
    - a. Radiology Physics And Engineering (P&E) for all preventative maintenance, checks, scanner failures
    - b. Facilities for any repairs not related to the MRI scanner.

## **VI. REPORTABLE CONDITIONS**

A HERO shall be submitted by MRI technologist when the patient:

1. Is canceled on the day of the procedure due to an MR contraindication:

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1. The patient has an unidentified implant
2. The patient has an allergy to gadolinium without being premedicated. (see [Contrast Administration; Process and Management of Patient Receiving \(NDG547\)](#))
2. Encounters potential or actual harm due to a ferromagnetic object during the MRI. (e.g.) projectiles, thermal injuries
3. Any untoward injury related to the MRI exam. (e.g.) thermal injuries, hearing loss, allergic reaction to contrast
4. Exam performed or canceled, due to the absence of an in-person interpreter
5. Any potential or actual harm during encounter in MRI (e.g) falls

## VII. DOCUMENTATION

See the following MRI Screening forms on the Johns Hopkins Radiology Intranet:

1. [MRI Patient Screening Form](#)
2. [MRI Employee Screening Form](#)
3. [MRI Outpatient Pre-Screening Form](#)

## VIII. EDUCATION AND COMMUNICATION

1. The policy will be posted in the on the JHH Policy website in the [Radiology and Radiological Science Policy and Procedure Manual](#) .

## IX. SUPPORTIVE INFORMATION

### A. See Also:

- The Johns Hopkins Hospital, Radiology and Radiological Science Policy and Procedure Manual
- B. [MRI1026 MRI Screening Form Policy](#) Appendix F
  - C. [MRI1034 Equipment Labeling in the MRI Environment](#) Appendix E
  - D. The Johns Hopkins Hospital, Interdisciplinary Clinical Practice Manual
  - E. [PAS005 Valuables and Property, Safekeeping and Disposition of Patient...](#)
  - F. [PAT007 Transport of Patients, Intra-Facility](#)
  - G. The Johns Hopkins Hospital, Radiology Intranet
  - H. [MRI Patient Screening Form](#)
  - I. [MRI Employee Screening Form](#)

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## **X. APPROVAL**

### Revision History

4/22/2020: Document updated to reflect change in consent requirement for MRIs of pregnant women. Consent no longer needed at request and approval of MRI prescribers.

Electronic Signature(s)	Date
Ihab Kamel MRI Clinical Director	10/22/2019