

# MRI Safety Protocols

## Group :3

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# Objectives

**At the end of this lecture the learner will:**

- Know the basic principles of how MRI works.
- Understand MRI safety precautions and procedures.
- The roles of both Level I and Level II staff.

- **THE MAGNET IS ALWAYS ON!!!!**
- 24 hours a day, 7 days a week, 365 days a year!!
- The magnet NEVER shuts off!

**⚠ DANGER**

**THE MAGNET IS  
ALWAYS ON**

# MRI Terms

## Ferromagnetic

- Having a high susceptibility to magnetization,
- the strength of which depends on that of the applied magnetizing field,
- that may persist after removal of the applied field.
- **Examples:** iron, nickel, cobalt, bullets
- Ferromagnetic items **CANNOT** be brought into the MR environment

# Important signs

- MRI Safe
- Caution
- NOT Safe

# Important signs:

## MRI Safe

- These items can be taken into the scanner if marked properly with an “MRI Safe” sticker
- **Ex:** IV poles, Step stools, and stethoscopes
- Keep these items in MR

**They are very expensive**



# Important signs:

## MRI Conditional

- Some of these items can be taken in the scanner, some cannot
- Some items can only be taken into 1.5 TESLA rooms
- Ask MRI Technologist before taking into scanner
- **Ex:** IV poles, Step stools, and stethoscopes



# Important signs:

## **MRI Unsafe**

- These items **CANNOT** be taken into MRI
- **Ex:** Oxygen tanks, Phones, Pagers, Laryngoscopes



**MR Unsafe**



# Hand Magnet

- A hand magnet is used to **test external** items for MR safety
- This is **NOT a safe** way to test implants in a patient's body
- If there is any doubt, **DO NOT** take items into rooms!

# Specialty equipment for the MRI...

- Wheelchairs
- Stretchers
- Monitors
- Oxygen tanks
- IV pumps

**These items are kept in MRI**

# MRI Personnel

- There are **two types** of MRI Personnel:
  - Level I Personnel
  - Level II Personnel

# Level I Personnel

- Employees that need a basic knowledge of MRI, but do not work in MRI on a full time basis include:
  - Anesthesia Students
  - Physician’s Assistants
  - Floor Nurses
  - ICU Nurses
- These employees DO NOT have access to MRI.  
**They need to be monitored by Level II personnel**

# Level II Personnel

- Employees that work full time in MRI and have a vast knowledge of MRI and the safety risks involved
- These employees are in charge of making sure the MRI area is a safe environment **AT ALL TIMES**
- **Examples:**
  - MRI Technologists
  - MRI Nurses
  - Radiologists
- Absolutely **NO** other staff can have access to MRI

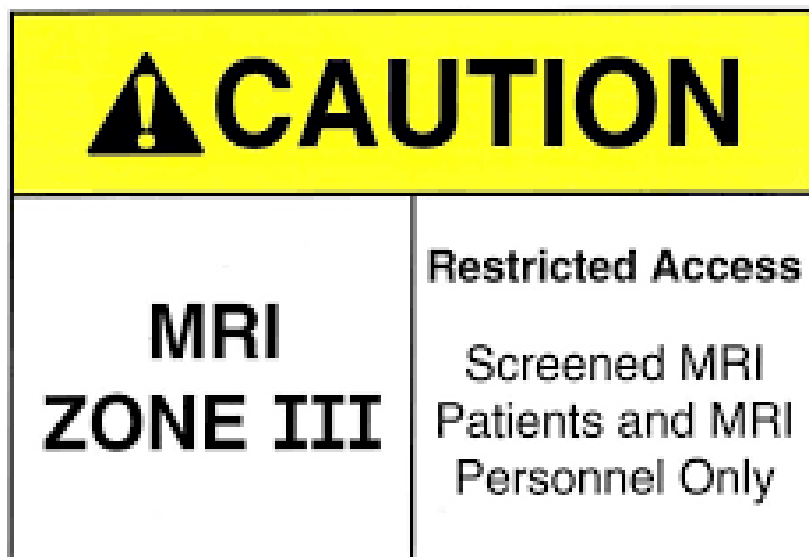
# Patient/Employee Screening

- All patients, family members, and staff MUST be screened by Level II personnel before entering the MRI environment
- Level II personnel are the only staff able to metal screen
- Level II personnel must ask questions regarding metal implants before patient is brought into the MRI room
- Patient screening must be entered into radiology assessment before bringing the patient into the room

# MRI Zones

- All MRI suites have designated “zones” to ensure safety
- Zones are labeled I-IV, **I being** the furthest from the scanner and **IV being** the scanner itself
- Note: Zones III and IV are restricted to MRI staff ONLY

# MRI ZONE I General Public





# Staff Attire – Zones III and IV

- Anyone entering Zones III and IV of the MRI department **MUST** be changed into the approved **MRI Pocket less Scrubs!**
- This Includes:
  - Technologists
  - Floor Nurses
  - Physicians
  - Respiratory
  - All other staff

# Patient Attire

- A patient requires a FULL CHANGE of attire, including undergarments.
- This also applies to any accompanying parents/guardians.
- Not properly changing a patient can cause burns and heating

# Metal Implants

- If a patient has a metal implant, the implant make and model number will have to be reviewed in the MRI safety handbook by level II personnel.
- If there is no documentation, a radiologist will decide on whether the patient can be scanned or not.
- Documentation of implants and/or consents **MUST** be entered into radiology assessment before patient is brought into MRI
- If a patient has an implant without documentation, they will **NOT** be allowed in the scanner. There are **NO** exceptions

# Items NOT permitted in scanner:

- Purse, wallet, money clip, credit cards, cards with magnetic strips
- Electronic devices such as beepers or cell phones
- Hearing aids
- Metal jewelry, watches
- Pens, paper clips, keys, coins
- hairpins
- Any article of clothing that has a metal zipper, buttons, snaps, hooks, underwire, or metal threads

# Burns

- MRI will generate heat at a very fast rate
- Remove before the scan to reduce the risk of burns:
  - Medication patches
  - EKG electrodes
  - Pulse Ox sensors
  - All metallic clothing
  - Jewelry
- Burns can be caused by any of the above items

# Response to Cardiopulmonary Arrest/Medical Emergencies

- In the event of a crisis in MRI, it is the responsibility of the MRI technologists and nurses to remove the patient from the scanner and take the patient into the hallway behind the MRI scanners.
- The CODE BLUE team will respond to the MRI suite and their entrance will occur via the MRI technologist opening the door to this hallway. The code team will care for the patient in this area.
- The CODE BLUE team is not to enter into the scanner because of safety and therefore will take responsibility for the patient once the patient is in this designated hallway.

- Codes are NEVER to be run in the MRI room!
- If there is reason to call a code, the patient will be removed from the scanner and the code will be run in the back hallway (Zone III)
- NEVER bring the crash cart into the room.

# MRI Accidents

- If a ferromagnetic item is brought into the room (wrench, oxygen tank), it will become a projectile and attract towards the magnet with tremendous force
- This item will fly toward the center of the magnet and take anything in its path with it
- Ex: If a patient comes in with an unsafe wheelchair, the wheelchair will fly to the center of the magnet with the patient in the chair



# Metal Objects Becoming Projectiles



# Metal Objects Becoming Projectiles



# MRI Accidents (cont.)

- There have been many MRI accidents since MRI was introduced in the 1980's
  - Patient having an MRI Unsafe aneurysm clip in the brain, resulting in the death of the patient
  - Six year old boy struck with an oxygen tank, resulting in his death
  - Patient having nail clippers in his pocket. When being sent into the scanner, the clippers flew out of the pocket and struck the patient in the eye. As a result, this patient lost his eye

- RCA
- FMEA

# Operating Safely

- When operating the MR equipment, be attentive to the following abnormal conditions:
  - Louder-than-normal motor noises
  - Sparks
  - Overheating
  - Smoke or odors coming from the electronic equipment or from within the scan room.

# Magnetic Field / Scan Room Emergencies

- If an emergency situation arises, you may need to quickly shut down the operating systems and remove power from the MR system.
- The nature of the emergency will dictate which procedure you follow.
- Each procedure has a distinct and specific purpose.

# Magnetic Field / Scan Room Emergencies

Each magnet is equipped with two emergency buttons:

- **Emergency Stop / Shut Off**
  - Turns off all incoming electrical power. The scanner will turn off as well as the operating computer.
  - **The magnetic field however will still be on.**
- **Quench or Emergency Run Down**
  - Causes immediate collapse of the superconductive magnetic field within minutes. The magnetic field will dissipate.

**FAMILIARIZE YOURSELF WITH THESE BUTTONS AND  
KNOW THE DIFFERENCE!**

# Emergency Stop / Shut Off Button

- Shutting power may be required for situations such as:
  - Fire in the computer room
  - Fire, sparks, loud noises emanating from the scan room
  - Flooding or sprinkling system goes off
  - Catastrophic equipment failure
- When this button is pushed, it does **not** initiate a quench, the magnetic field remains on.
- make sure that all ferromagnetic materials remain outside of the scan room, they can still become projectiles.



# Emergency Buttons @ the SCAN center: The E-Stop Button



Located in the operations room



Located in the scanning room

# Quench / Emergency Run Down Button

- MR scanners are super cooled with gases such as helium.
- If these cryogenics boil off either intentionally or unintentionally, a quench has occurred.
- This is **extremely** bad.
- An intentional quench is done in an emergency to run the magnetic field to **zero**. This is done in extreme situations only (**ex- a projectile that is pinning a patient against the magnet, injuring them**).
- If a quench occurs, everyone must be removed from the room immediately.
- The vapors and gases are very cold and can cause frostbite.
- They also often condense the moisture in air, creating a highly visible fog that can replace oxygen in the room.

# Quenching

- A magnet quench will result in several days' downtime and is extremely expensive.
- Do not press the button except in a true emergency.
- The quench button will have a protective covering over the button so it cannot be pressed inadvertently.
- *Do not attempt to test this button!*

# Emergency Buttons @ the SCAN center: The Quench Button



# Summary

- MRI scanners are powerful magnets with the ability to attract ferromagnetic objects.
- Any personnel around the MRI suite must be adequately screened for metallic implants *and* personal items before entering the scan room.
- Patients in the scanner must be carefully monitored for reversible bioeffects caused by the magnet's hardware.
- Become familiarized with Electronic Stop vs. Quench buttons at each scanner.

# SVIMS MRI SAFETY CHECK LIST

PATIENT NAME/UHID:

DATE:

MRI PART TO BE EXAMINED:

TIME:

S.No	QUESTION	YES*	NO*
1	Have you had an MRI before		
2	Did you have any difficulty related to the procedure		
3	Do you have or have you had a pacemaker, ICD or defibrillator		
4	Have you ever worked with grinding metals or had metal fragments in your eyes		
5	Have you ever had a reaction or ill effect from MRI contrast material (gadolinium)		
6	Do you have medicine or food allergies		
7	Do you have kidney problems or a kidney transplant?		
8	Do you have diabetes (high blood sugar)?		
9	Is there a possibility that you might be pregnant?		
10	Are you currently breastfeeding?		
11	Aneurysm clips, coil or graft, Vascular stent, coil, clips or clamps		
12	Heart valve replacement		
13	Implanted infusion pump, catheter or device		
14	Ear surgery/Stapes prosthesis, cochlear implant		
15	Eye prosthesis, lens implant, eyelid spring or wire, retinal tack		
16	Medication patch (nitro-glycerine, nicotine, hormones)		
17	Ingested camera pill for capsule endoscopy		
18	Currently wearing a wig, hairpiece, hair pins, magnetic fingernail polish or a body piercing		
19	Do you have any wound dressings		
<p><b>SPECIAL NOTE:CHECK FOR MRI COMPATIBLE TROLLY OXYGEN CYLINDER WITH PATIENT</b></p>			

\*Tick in the column applicable.

SIGNATURE/LTI OF PATIENT: SO AS CONSENT OBTAINED AND INFORMED ABOUT SAFETY	
SIGNATURE OF MRI TECHNICIAN ON DUTY	

THANK YOU