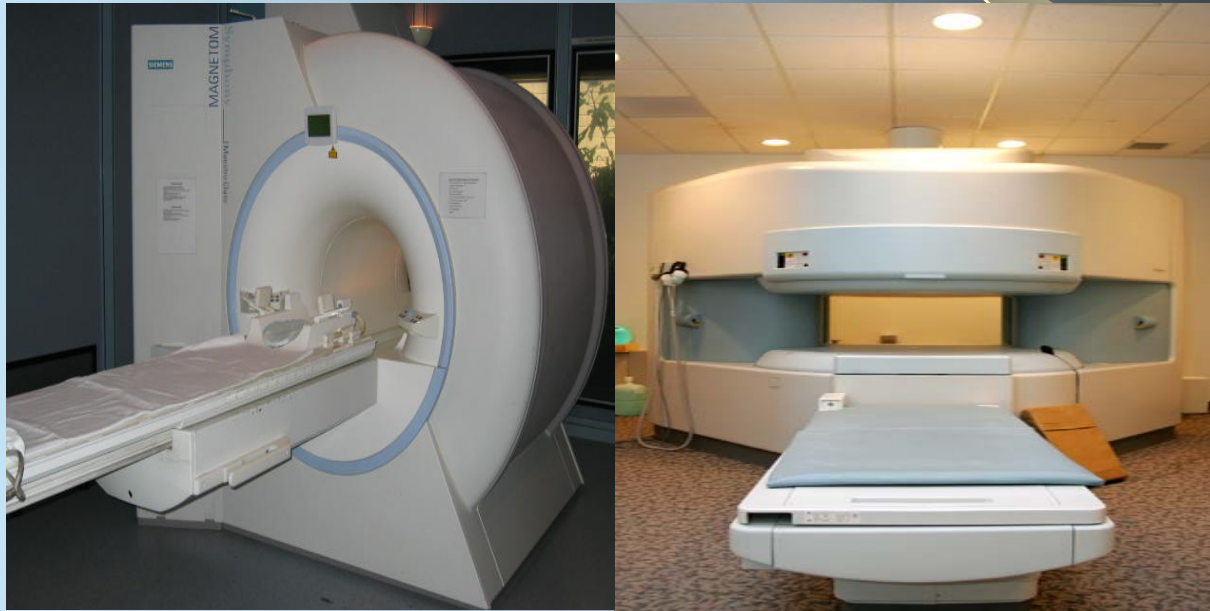


# Magnetic Resonance Imaging (MRI) SAFETY



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# Goal and Objectives

## Goal

This course will enable the learner to provide a safe environment for patients and staff who are in the presence of the MRI scanner.

## Objectives

1. Describe basic knowledge of magnetic fields and their influence on objects near them.
2. Describe the importance of safety when working around the MRI scanner.
3. Identify precautions that should be taken to avoid accidents when working near the MRI scanner.
4. Identify precautions that should be taken when patients have implantable devices or metallic foreign bodies.

# The MRI Magnet

Magnetic resonance imaging (MRI) is a noninvasive, painless medical test that helps physicians diagnose and treat medical conditions by providing views of the inside of the human body.

MR imaging uses a powerful magnetic field, radio waves and a computer to produce detailed three-dimensional pictures of internal body structures.



# The MRI Magnet

Most people have had some experience with natural magnets and their attractive forces (e.g., in science classes, by playing with them or by using a magnet to attach papers to a refrigerator door).

The MRI scanner is a large magnet (10,000 lbs.) with a tremendously strong magnetic pull. The magnet in the MRI scanner creates a force field which can affect objects that are close to it. As you approach the MRI scanner, the attractive force field increases rapidly.

This strong magnetic field can have adverse effects on patients and staff who are within the scanner's magnetic force field.



# Magnetic Field Hazards

All MRI magnets have a magnetic field that extends into the exam room.

Anyone entering the MRI scanner room will be exposed to the magnetic attraction of the scanner. The closer you get to the scanner, the stronger the magnetic pull.

Any ferromagnetic object\* brought into the MRI scanner room will become magnetized and can become a...

**Dangerous Projectile!**

\* An object that is attracted by a magnet and which can become magnetized itself.

# Magnetic Field Hazards *(cont.)*

## The Missile Effect

The “**missile effect**” refers to the capability of the MRI magnetic field to attract a ferromagnetic object into the scanner with considerable force.

The “**missile effect**” can pose a significant risk to a patient in the scanner and to anyone who is in the path of the attracted object.

Metal objects can become dangerous projectiles if they are taken into the scan room!



# Magnetic Field Hazards *(cont.)*

## Examples of Ferromagnetic Objects:

Ferromagnetic metal alloys usually contain iron, nickel or cobalt. These elements are found in most metal objects.



# Magnetic Field Hazards *(cont.)*

## Results of The Missile Effect:



- Delayed patient care...It takes 4 days to remove the object and to re-power the scanner!
- Possible injury to patient or staff.
- Possible damage to the MRI scanner.
- Approximate cost due to each “missile effect” incident: **\$250,000.**



## Magnetic Field Hazards *(cont.)*

*The MRI Magnet is Always On*

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## Magnetic Field Hazards *(cont.)*

Which of the following items should you remove from your pockets prior to entering the strong-magnetic-field area of an MRI system?

a. A pen

b. A safe

c. Your

d. All of these

### Multiple Choice

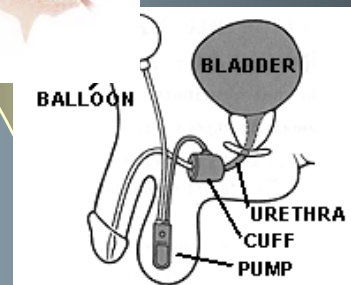
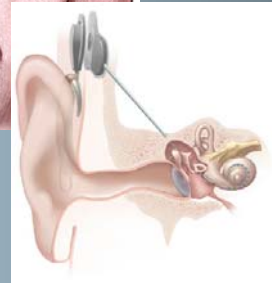
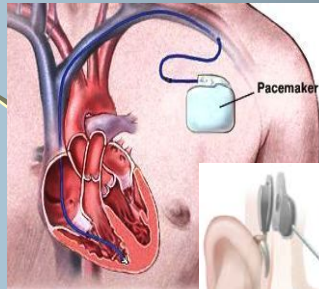
CLOSE X

Select the answer that best fits the question.

# Magnetic Field Hazards *(cont.)*

## Displacement and Heating of Surgical Implants:

- Cardiac pacemakers
- Neurostimulators
- Pain control pumps
- Penile implants
- Cochlear implants

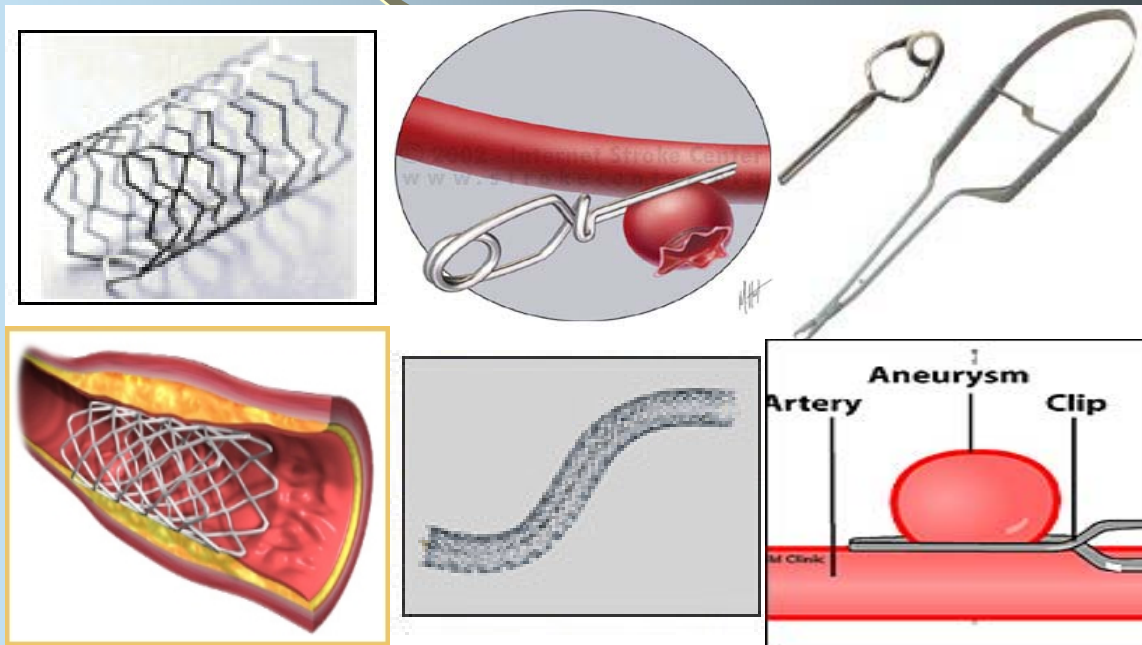


Displacement and heating of these implants may cause a life-threatening situation!

# Magnetic Field Hazards *(cont.)*

## Stents and Aneurysm Clips:

Displacement of these implants may cause a life-threatening situation!



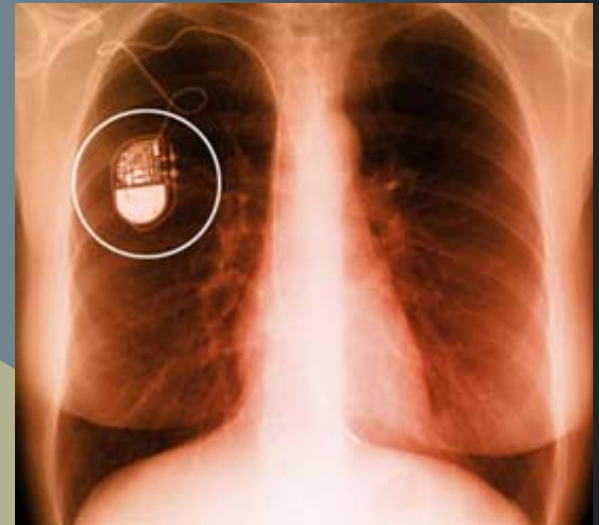
# Magnetic Field Hazards *(cont.)*

## Electromagnetic Interference with **Electronic Devices:**

Mechanically or electrically activated implants may stop or malfunction in the presence of the MRI magnetic field.

Patients with pacemakers have died during or shortly after MRI exams due to disruption of pacemaker function by the MRI system.

Hospital staff with pacemakers or other implanted electronic devices could also be affected, if they come within the strong magnetic field of the MRI.



# Magnetic Field Hazards *(cont.)*

## Body Piercing Jewelry:

### Risks for these patients include:

- Discomfort or painful sensations due to possible displacement (movement) of the jewelry.
- Patient burns due to heat generated from the interaction between the jewelry and the electromagnetic fields.



**All patients with body piercing jewelry must be screened for jewelry removal before they have their MRI scan!**

# Magnetic Field Hazards *(cont.)*

## Transdermal Patches:

Some patients are now wearing transdermal patches for medication delivery.

Many of these patches contain aluminum foil or other metallic components which can cause excessive heating, leading to burns in patients undergoing a MRI scan.



**All patients with transdermal patches must be screened for patch removal before they have their MRI scan.**

# Magnetic Field Hazards *(cont.)*

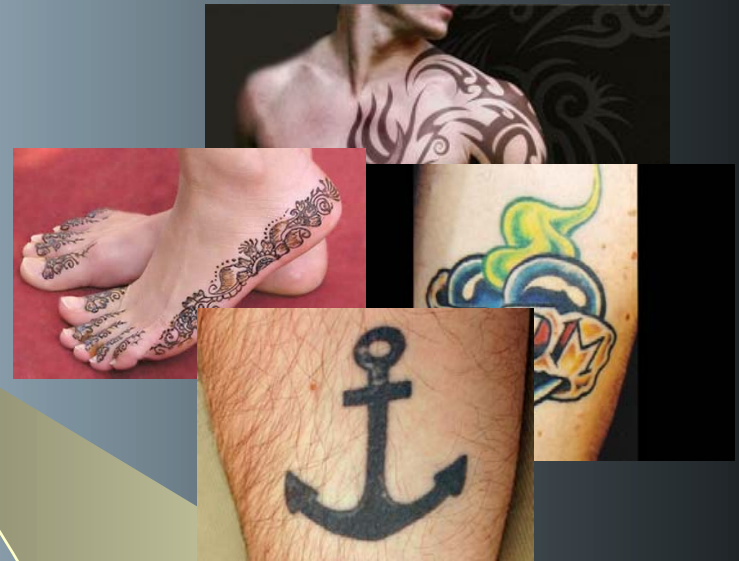
## Tattoos:

Many patients scheduled for an MRI scan will present with tattoos.

These tattoos will be either cosmetic or decorative and can be located anywhere on the body.

Some of these tattoos will contain ferromagnetic material which can cause heating, swelling, or burning at the tattoo site.

**All patients with tattoos must be screened before they have their MRI scan.**





# Magnetic Field Hazards *(cont.)*

*The MRI Magnet is ...*

*Always*

*Always*

*Always*

*On!*

# Magnetic Field Hazards *(cont.)*

## Pregnancy:

MR imaging is recognized as a beneficial diagnostic tool to assess a wide range of diseases and conditions that affect pregnant women and their fetuses.

MR imaging in pregnant women should only be performed in cases where the referring physician and radiologist agree that the findings of the MRI has the potential to change or alter the care of the mother or fetus and that the benefit outweighs the risk.



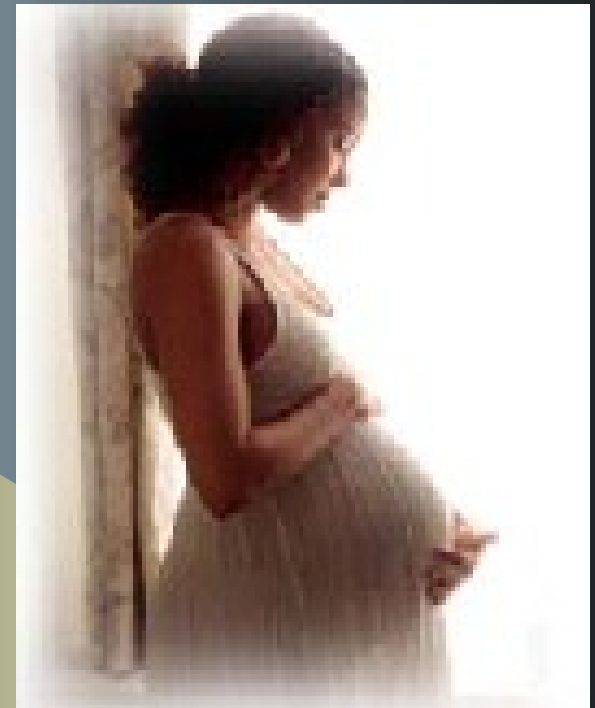
# Magnetic Field Hazards *(cont.)*

## Pregnancy: *(cont.)*

*The Policies, Guidelines, and Recommendations for MRI Imaging, Safety and Patient Management* issued by the Safety Committee of the Society for MRI imaging states:

*“MRI may be used for pregnant women if other non-ionizing diagnostic imaging is inadequate or if the MRI provides important information that would otherwise require exposure to ionizing radiation (CT, fluoroscopy, etc.)”*

**All pregnant patients must be screened before they have their MRI scan.**



# Summary of MRI Hazards

| <b>Hazard</b>            | <b>Possible Danger</b> |
|--------------------------|------------------------|
| Body-piercing jewelry    | Displacement, Heat     |
| Transdermal skin patches | Burning                |
| Tattoos                  | Burning                |
| Aneurysm clips           | Displacement           |
| Stents                   | Displacement           |
| Cochlear implants        | Displacement           |
| Penile implants          | Displacement           |

# Screening of Patients

All **patients** and any **family members** entering the MRI Scanner must be screened by the MRI technologist.

All **ancillary staff** entering the MRI Scanner must verbally be screened by the MRI technologist.

# Screening of Patients *(cont.)*

## MRI Screening Protocols:

All patients must complete the Magnetic Resonance Imaging Information Form before they have an MRI scan. You can access the form on the next page.



# Screening of Patients *(cont.)*

## Instructions:

To zoom in and out, click and drag on the sliding scale bar.



To navigate the document, use the scroll bar.

To view additional pages, use the arrows.



To print the entire document, click the print button.



macromedia FLASHPAPER

MUNSON HEALTHCARE **Magnetic Resonance Imaging Information Form** J-FORM 4541 (7/07)

TESTING SITE  Munson MRI - 217 S. Madison, Traverse City, MI 49684  
 Munson Main Campus, 1105 Sixth Street, Traverse City, MI 49684  
 Munson Community Health Center (MCHC) 550 Munson Ave, Traverse City, MI 49686  
Enter through the South Entrance.

**Please fill out and bring with you. Do NOT mail. Please Print.**

DATE: \_\_\_\_\_ ARRIVE: \_\_\_\_\_ MRI SCAN: \_\_\_\_\_  
**If you cannot make this appointment date and time, please phone us at least 24 hours in advance.**

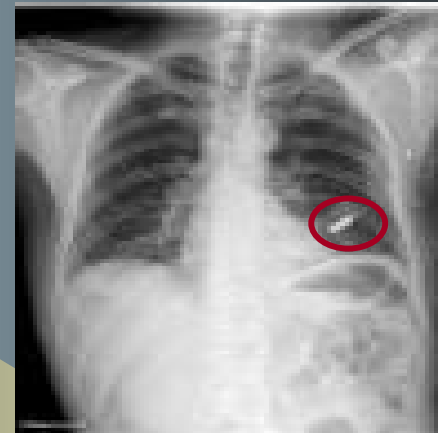
Mon. thru Fri. 8:00 a.m. to 5:00 p.m. (231) 935-7200 or (800) 468-6766  
Sat. and Sun. 7:30 a.m. to 7:00 p.m. for tests schedule at MRI and Munson Main campus  
call (231) 935-7492 - for test scheduled at MCHC campus call (231) 935-8751.

Name: \_\_\_\_\_ Weight: \_\_\_\_\_ Age: \_\_\_\_\_  
Briefly describe your current symptoms and how long they have been present:

# Screening of Patients *(cont.)*

## Patients with Metallic Foreign Bodies:

- All patients with a history of injury by a metallic foreign body must be screened and evaluated before being placed in the magnetic field of an MRI scanner.
- Examples of metallic foreign bodies:
  - ✓ BBs
  - ✓ Bullets
  - ✓ Pellets
  - ✓ Shrapnel
  - ✓ Buckshot
  - ✓ Eye or body metal fragments

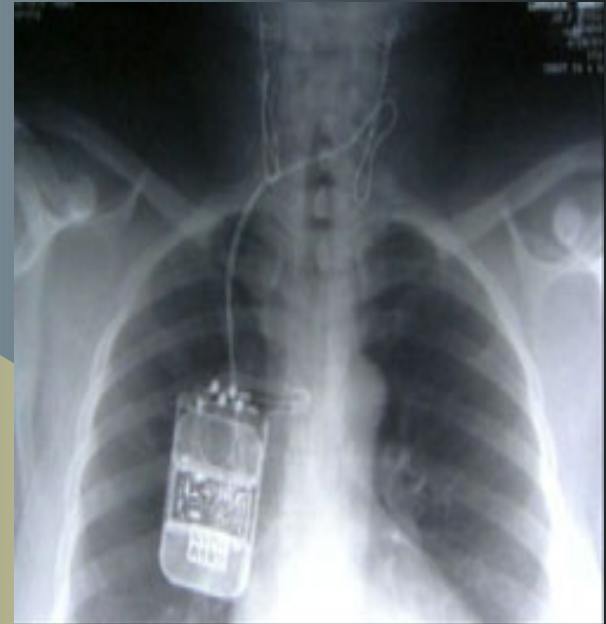




# Screening of Patients *(cont.)*

## Patients with Implants:

- Information that must be supplied by the patient, a family member, or by hospital staff for a patient with an implant includes:
  - ✓ Make and model of implant
  - ✓ Manufacturer of implant
  - ✓ Date of implant insertion
- Medical Alert Cards: Most people who get an implant receive a medical alert card stating whether or not the implant is MRI compatible. These cards should be checked by the MRI technologist.



# Preventing Accidents and Injuries in the MRI Suite


In response to the Sentinel Event Alert issued by the Joint Commission on 2-14-08, the MMC Radiology Department has published the 10 recommendations found below.

## Instructions:

To zoom in and out, click and drag on the sliding scale bar.



To navigate the document, use the scroll bar.

To print the entire document, click the print button. 

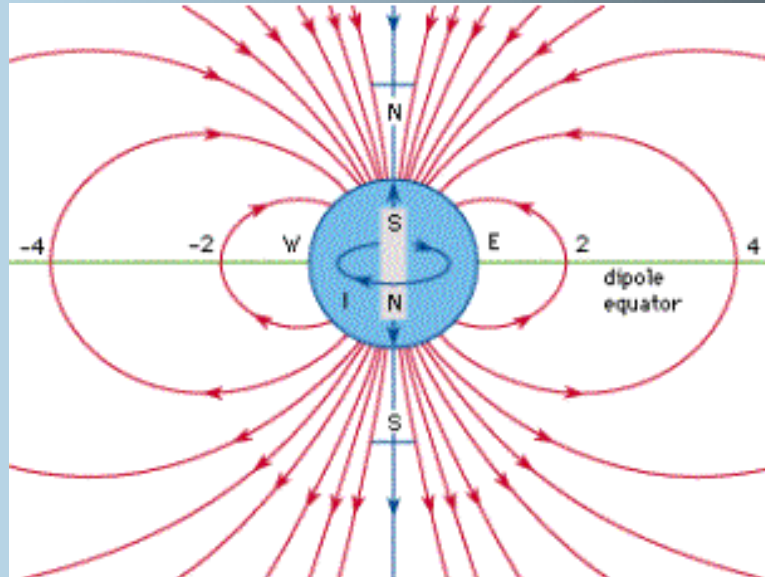
**RESPONSE TO JOINT COMMISSION 10 RECOMMENDATIONS:**  
Sentinel Event Alert  
Preventing Accidents and Injuries in the MRI Suite

1. The department utilizes progressive restrictions for access including:
  - General public – this includes general reception and patient/family waiting areas
  - Unscreened MRI patients – this includes dressing and staging areas
  - Screened MRI patients and personnel – these are secured areas adjacent to the magnet room used for final screening and interview.

# Summary

The MRI Magnet is Always...

*On*



*On*

*On*

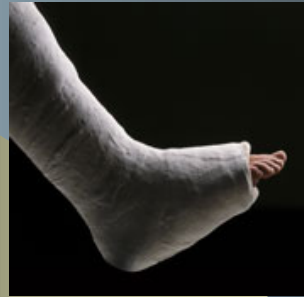
*On*

# Summary

***MRI = Metal Results (in) Injury***



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# Resource Instruction

Joint Commission. (2008). Preventing accidents and Injuries in the MRI suite [Sentinel Event Alert], 38. Retrieved from [http://www.jointcommission.org/SentinelEvents/SentinelEventAlert/sea\\_38.htm](http://www.jointcommission.org/SentinelEvents/SentinelEventAlert/sea_38.htm)

MR Research Facility. (2007). MR Safety. Retrieved March 12, 2008, from <http://www.mrc.wayne.edu/safety.htm>

Gould, Todd. (n.d.). How MRI Works. *How Stuff Works*. Retrieved March 12, 2008, from <http://www.howstuffworks.com/mri.htm>

Further Questions? Call Ed McNamara in Radiology, 56403