MRI: The Problem with July 1st

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Objectives

Describe MRI conditional pacing systems and the check list.

Identify, other than pharmacology, forms of stress reduction that can be utilized in MRI.

Be able to recall the Joint Commissions guidelines for MRI safety

Disclaimer: I have no financial ties to any company and this is my favorite son.





Joint Commission Standard of Environment of Care (EC) EC.02.01.02

MRI handles risks associated with:

-claustrophobia and anxiety

-medical implants, devices,

imbedded foreign object

-ferromagnetic objects

-acoustic noise

-urgent or emergent care

MRI handles risks by doing the following: -restricting access of everyone not trained in MRI -restricted areas are under the direct supervision of MRI staff -posting signage at the entrance of the MRI scanner -having clearly defined 'Zones'

Four Zones

Zone I: Freely accessible to the general public. Outside the MRI environment. Reception Area

- Zone II: Patient waiting room. Between the uncontrolled Zone 1 and strictly controlled Zone III and Zone IV
- Zone III: Control area, access restricted with key locks, passkey systems, etc. Immediately adjacent to the MRI scanner room
- Zone IV: MR scanner room. Area should be clearly marked as a very strong magnetic field. Signage on doors. In direct line of the MR technologists vision who controls and observes access.

All non-MRI personnel should not have independent access to Zone 3 and Zone 4

American College of Radiology's MR Safety Committee, 2009. Core Curriculum for Radiologic and Imaging Nursing 2nd Edition, 2008 12 x 18



Injury, death or property damage may occur. Cell phones, hearing aids, PDA's and other electronic items may be damaged



Joint Commission Standard Human Resources (HR) 01.02.05

The hospital verifies and documents that technologists who perform MRI exams participate in ongoing education that includes:

-Screening criteria

-Proper positioning activities to avoid burns

-Equipment and supplies acceptable to MRI environment

-Safety response procedures

- -Equipment emergency shutdown procedures
- -Hearing protection

-Management of claustrophobia, anxiety, or emotional distress

Screening Forms: Checklist

Implants: Ocular, Pacemaker, Defibrillator, Neuro-stimulator, Dental, Penile

Cardiac Stent/Filter/Coil

Surgical clips, staples, or wires

Medication and nicotine patches

Shunts

Swan-Gantz catheter

History:

- Machinist
- Metal particles in eye
- Tattoos/permanent make-up
- Previous pacemaker with abandoned leads
- Bullets, BBs, Stabbings
- Claustrophobia or emotional distress

Albert Einstein Medical Center MRI /MRA Patient Checklist



MRI/MRA Patient Checklist

Any history of metal particles in eye : N/A or Not Sure Any work experience as machinist : N/A or Not Sure Any history of claustrophobia?: N/A or Not Sure Cardiac Pacemaker/VAD/Defibrillator: No Brain aneurysm clip: Unknown Greenfield filter/Venous umbrella : Unknown Ocular implant (eyes)/artificial eye: Unknown Cardiac Stent/Filter/Coil: Unknown Tattoos/permanent make-up: Unknown Implanted medicine pump/insulin pump: Unknown Swan-Ganz catheter: Unknown Neurostimulator (TENS Unit): Unknown Mechanical heart valve : Unknown Inner ear implant : Unknown Dental implant with magnet : Unknown IUD/diaphragm/pessary ring : Unknown Bone plates, rods, or screws/artificial joints : Unknown Surgical clips, staples, or wires : Unknown Coil in any Blood Vessel: Unknown Medication patches nicotine/nitroglycerine : Unknown Shunt: Unknown Bullets, shrapnel, or pellets : Unknown Prosthesis/penile implant: Unknown

MRI Terms

MRI Safe: No known hazards in all MRI environments

MRI Unsafe: Hazards in ALL MRI environments

MRI Conditional: No known hazards in a specified MRI environment

with specified conditions of use.

Doesn't mean risky.

Means the product has been tested and safe under certain

conditions.

MRI and Pacemakers

Approximately 60 million MRI procedures are performed worldwide eachyear

American Heart Association (AHA) and the American College of Radiology (ACR) have issued guidelines stating that a careful risk/benefit must be established and that cardiac implantable devices remain a relative contraindication to MRI.

An estimated 200,000 patients in the U.S. annually are denied access to an MRI scan because they have a pacemaker

The number of pacemakers currently implanted in the United States is approximately 1.5million

It has been estimated that there is a 50-75% probability that cardiac device patients will be indicated for an MRI over the lifetime of their devices

Within 12 months of device implant, 13% of SureScan pacemaker patients learned that they need an MRI



Magnetic Fields in MRI

	Static	Gradient	RF
Case Heating		•	•
Force and Torque	•		
Vibration		•	•
Device Interactions	•	•	•
Lead Heating			•
Stimulation		•	•

MRI Conditional or "Safe by Design"

Medtronic[®] MRI conditional pacemaker

2008 in Europe, 2011 in USA

Own leads with active/passive

fixation

St. Jude Medical[®] MRI conditional pacemaker 2011 in Europe, waiting approval from the FDA Boston Scientific[®] MRI conditional pacemaker Multicenter, randomized singlearm study is underway Biotronik[®] MRI conditional pacemaker FDA approved trials Sorin Group (Milano, Italy) MRI conditional pacemaker





SureScan[®] Pacemaker



Two CapSure Fit SureScan[®] Leads

Medtronic SureScan[®] Pacing System

Identification of MRI SureScan[®] System

For Medical Questions, Contact Your Physician

This patient has a complete MR Conditional pacing system implanted, consisting of a SureScan pacemaker and two SureScan leads. For important MRI safety information, visit www.medtronic.com/mri or call 1 (800) 551-5544.

If medical questions or emergency, call:

First Name Last Name, MD (000) 000-0000 First Name Last Name, MD (000) 000-0000

My device may trigger metal detection systems.

UC200904855 EN © Meditonic, Inc. 2010. www.meditonic.com/04/2010

For Medical Questions Contact Your Physician

I have a/an Advisa DR MRI SureScan Pacemaker implanted.

This patient has a complete MR Conditional pacing system implanted, consisting of a SureScan pacemaker and two SureScan leads. For important MRI safety information, visit www.medtronic.com/MRI or call 1-800-551-5544



Hedtronic 🗧			*
Doe, John 123 Main St. Any Town, MN	55555		
Implant Date 01/02/2010 01/02/2010 01/02/2010	Serial# PTN600772A LFP005555V LFP005556V	Model# RVDR01 5086MRI52 5086MRI58	
Please contact us with o	changes at 1 (800) 551-554 planted Device le	a. dentification	3.
John Doe 3850 Victoria St Shoreview MN 5	N 5126-2978		
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Please	e contact us with changes	at 1-800-551-5544.	

Medtronic SureScan[®] Pacing System

Verification

Use the patient's records

Perform patient X-ray to identify radiopaque MRI symbols There are no radiopaque markers on the 5076 leads Lead extenders, lead adaptors, or abandoned leads

Use the patient info on the programmer

Call Medtronic at 1-877-MRI-7677

Exam Approval

-Referral for MRI: Attending contacts Radiology

- -Interpreting physician (Radiologist) approves appropriateness of exam
 - "Pacemaker Checklist' form is started
- Make sure patient is not otherwise contraindicated for and MRI
- -If applicable, the patient is not contraindicated for gadolinium contrast
- Patient's Cardiologist approval and order for pacer settings

Cardiology Checklist

PATIENT PRE-SCREENING

Complete SureScan[®] System

Implanted >6weeks

Pulse generator implanted in pectoral area

No lead extenders, lead adaptors, or abandoned leads

Leads are electrically intact

PRE AND POST SCAN PROGRAMMING

Order for pacing support and appropriate pacing rate during SureScan operation

**If the patient needs pacing support placed in asynchronous mode

** If the patient does not require pacing support the pacing mode is set to ODO

Order for pre-scan pacemaker settings to be restored

Day of Scan

-MRI screening questionnaire and consent reviewed with the patient by the MR tech

-Both patient and technologist will sign the questionnaire and consent

-Technologist will discuss scan parameters with the interpreting physician

-MRI compatible pulse oximetry, ECG attached to the patient and accurate base readings are confirmed. Patient will continue to monitored throughout the procedure by a healthcare professional -Pacemaker will be interrogated by qualified healthcare professional. Tachyarrhythmia function will be disabled and pacemakers will be switched to Medtronic's SureScan safe mode.

-Pacing mode will be set according to cardiology order.

-Report printed

-Patient escorted to MR table.

-Visual and voice communication will be maintained with the patient



Copyright Medtronic SureScan Programming System

Post Scan and Documentation

- -Patient moved from the scan room to the control area
- -Monitor device is removed from the patient
- -SureScan mode will be switched off and pre-scan pacemaker settings will be restored
- -Printed reports from the device programmer will become part of the patient's medical record
- -Exceptions to the routine performance of the MR exam will be documented and added to PAC

Take Homes

-Cardiologist SureScan[®] Programming Order

-Health professional who will monitor patient during MRI exam

-Trained professional who will program the patient's pacemaker in and out of SureScan[®] mode

-Ensure device is programmed in SureScan[®] mode prior to the MRI examination

-Ensure a trained professional programs patient's device back to previous settings after MRI scan completed Scan Guidelines:

- Horizontal cylindrical bore magnet

-MRI system of 1.5 Tesla in normal operating mode

-Proper patient monitoring provided during the scan: visual, verbal, and monitoring such as pulse oximetry or electrocardiography.

-An external defibrillator must be available nearby during the MRI procedure

Guidelines for Sedation

Drugs: Ativan

Haldol

No Versed or Propofol unless airway is protected

Pain medication

Two tries and Anesthesia is consulted

How can we scan claustrophobic patients using less sedation

Albert Einstein Medical Center Conscious Sedation Standards, 2013.

Claustrophobia

-Characterized by the marked, persistent, and excessive fear of enclosed spaces

-Next to pain the main reason for interrupted, incomplete, or poor quality scans

-Many symptoms of a panic attack mimic over-activity of the sympathetic nervous system: nausea, paresthesia, palpitations, chest pain, faintness, dyspnea, choking sensation, sweating, trembling, vertigo, depersonalization, and fear of losing control or dying.

What do we know about MRI and Claustrophobia?

-An average of 5-10.6% of patients screened for MRI have claustrophobia. Another 7% have previously unidentified claustrophobia prior to going into the scanner,

-Effects more females than males

-Pre-existing psychiatric disorders:

- May be at greater risk for distress
- Should be identified prior to the exam
- Patients with depression and any illness complicated by thought dysfunction, such as schizophrenia or manic-depressive disorder may be at increase.
- -Many patients are willing to try an MRI if given techniques they can utilize during the scan

-One techniques is usually not enough



https:www.Zombies.com

It starts with the screening

-The referring team should explain the reason for the MR procedure

- -Start educating about the aspects of the exam that might be challenging or difficult
- The dimensions of the scanner
- Level of acoustic noise will be provided ear protection
- Estimated time duration the technologists will keep you updated

-Studies have documented a decrease in the incidence of premature termination if the patients are provided detailed information about the procedure

-Explain that everything will be done to make them comfortable in the scanner

-Explain they are in control and will have a 'call button' or 'squeeze ball'

Talking the patient off the roof

Adapting the patients' preferred modes of verbal and nonverbal communication by emphasizing the sensory categories of the patient's preferred mode of perception: visual, auditory, kinesthetic

Understanding spaciel boundaries

Correct use of suggestions by avoiding negative words such as 'hurt', 'bad', and 'panic button'

Replace with neutral or positive words such as 'sensation', 'comfort', 'interesting', and 'call button'

Providing perception of control by asking for permission

Use of encouragement as opposed to praise by emphasizing the patient's contribution: "thank you for holding still" instead of "you are a great patient"

Techniques to minimize distress

Prepare and educate the patient

Allow an appropriately screened relative or friend to remain with the patient during the study

Use a blindfold to decrease awareness of surroundings

Use bright lights inside of the MR system

Use vanilla scented oil or aroma therapy

Relaxation strategies: controlled breathing or mental imagery

Systematic desensitization

Maintain verbal, visual, and or physical contact with the patient

Keep the patient updated on the scan

Lang, 2010. Dewey, 2007. Enders, 2011.

Journal of Medical Imaging and Radiation Sciences, 2014. Munn, 2012

Neuro-linquistic Programming: NLP

Recognizes the influence of language both external and internal: allows a person to recognize and enable change in less useful patterns of behavior that were learnt previously but continually repeat

Recognizes that one technique is usually not effective

Process works by identifying precise triggers and replacing them: the 'antidote' is selected by the individual

As the person substitutes the one feeling for another the NLP facilitator touches them on the hand or shoulder 'anchoring' the experience Pacemaker patients receiving MRI may be at risk due to potential hazardous interactions with:

- A. Pacemaker Generator
- B. Leads
- C. The resident
- D. A and B

Lead Heating may have the following effect:

- A. Cardiac stimulation
- B. Pacemaker or lead movement
- C. Pacemaker failure
- D. Thermal cardiac tissue damage

The best way to kill a zombie is:

- A. Shoot them in the head
- B. Shoot them in the heart with an arrow
- C. Burn them to ash
- D. All of the above

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