How can we ever forget?? July 2001

Missile Effect....

Have we lost sight of our MR Safety responsibility?
ACR Guidelines History
2002
2007
2013

"Intended to be used as a template"
"Established de facto industry standards"

The Joint Commission
Sentinel Event Alert 38
(2.14.2008)

http://www.jointcommission.org/sentinel_event_alert_issue_38_preventing_accidents_and_injuries_in_the_mri_suite/
Safety Screening and Interview

Non-Patients  Patients

Should they be screened differently?

http://www.mrisafety.com/SCREENING_FORM/PreScrnF.pdf

Zone III regions should be physically restricted from general public access by, for example, key locks, passkey locking systems, or any other reliable, physically restricting method that can differentiate between MR personnel and non-MR personnel.

What are we really dealing with here?
Three Powerful Magnetic Fields

- Static
- Gradient
- RF

Multiple Potential Issues

- Case Heating
- Force & Torque
- Vibration
- Device Interactions
- Lead Heating
- Stimulation

Is this how we test projectiles?

Let’s take a look at our standards....

Gradient Fields (dB/dt)

- Patients
  - Peripheral Nerve Stimulation (PNS)
  - Acoustic Noise

Acoustic Noise....

Don’t forget ear protection
Tiny hint— make sure it works
Acoustic Noise….

Scanners with ‘Silent Techniques’

http://usa.healthcare.siemens.com/magnetic-resonance-imaging/mr-quiet/how-it-works


RF Burns

All too common injury

http://usa.healthcare.siemens.com/magnetic-resonance-imaging/mr-quiet/how-it-works

Always use proper insulating pads

MR-Appropriate Attire

Any individual undergoing an MR procedure must remove all readily removable metallic personal belongings and devices on or in them.

…and clothing items which may contain metallic fasteners, hooks, zippers, loose metallic components or metallic thread.

MR-Appropriate Attire

Event Description
A female patient was undergoing a scan of the left shoulder. During the first sequence (3.5 mins), the patient's blouse caught on fire producing a flame of approximately 20 centimeters. The scan was stopped immediately and the patient was evacuated. The patient suffered 3rd degree burns to the forearm. The customer continued to use the device and scan additional patients before requesting a system check. Initial investigation revealed that the blouse of the patient was apparently electrically conductive. Incident was not caused by system failure.

Invisible Metallic Microfiber in Clothing Presents Unrecognized MRI Risk for Cutaneous Burn

Summary: We report a case of a thermal burn that occurred during MRI imaging likely caused by metallic microfibre particles in the fabric of an anorak. As the prevalence of fabric containing metallic microfibres increases, the risk of having patients come into skin contact with these microfibers during MRI imaging may increase.

Skin-to-Skin Contact

Sports attire
RF Burns

5 days post burn

1.5 T, Head/Neck/Spine coil
Short obese patient with shoulders touching the side of the bore
Study: Brain and Whole Spine
Patient under GA- 2 hour exam

Are we really paying attention?
Do we know what risks we take each time we put a patient on the table?

3rd Degree Burn from Pulse Oximeter

Tattoo

UV “Neon” Tattoos

Labeling of Devices
Labeling

ASTM Standard F2503 Defines Three Terms:

- **MR Safe**: An item that poses no known hazards in all MR environment
- **MR Conditional**: An item that has been demonstrated to pose no known hazards in a specified MR environment with specified conditions of use
- **MR Unsafe**: An item that is known to pose hazards in all MR environments

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MR Safe

An item that poses no known hazards in all MR environment

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MR Unsafe

An item that is known to pose hazards in all MR environments

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MR Conditional

An item that has been demonstrated to pose no known hazards in a specified MR environment with specified conditions of use

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Implants and Devices

What are the issues

- Ferromagnetic Effects
- RF Induced Heating

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Devices

Passive
Devices

Active

- DBS
- Spinal Cord Stimulation

Pacemakers and ICDs

ASTM Testing Method

Decision Tree

What is the implant or device?
What information do I have?
MR Safe......

MRI
What is the implant or device? What information do I have? MR Unsafe….

No MRI…..

What is the implant or device? What information do I have? MR Conditional….

What are the conditions?

Do these conditions match the ones for my MRI scanner?
Decision Tree

Do these conditions match the ones for my MRI scanner?

No…. Do not scan the patient

Yes…. Scan the patient

Guidelines not followed

1.5 T ONLY
T/R Head coil ONLY
Head SAR 0.1 W/kg

For certain lead lengths, less heating at 3-T/128MHz vs. 1.5-T/64MHz due to differences in resonant wavelength.

For elongated or closed loop implant or device implant, heating can differ significantly at different field strengths

Case Report

Undisclosed and Undetected Foreign Bodies During MRI Screening Resulting in a Potentially Serious Outcome

Cynthia A. James, RT(R) (MR)
Alexandra Karacozoff (Pre-Med Student)
Frank G. Shellock, Ph.D.

43 year-old male resident of an inpatient rehabilitation program presented for an MRI examination of his entire spine for back pain

Standard screening performed

Additional screening with hand-held system (Mednovus) focusing on area of pockets
Case Report

Undisclosed and Undetected Foreign Bodies During MRI Screening Resulting in a Potentially Serious Outcome

- Pt placed on table head-first wearing gym shorts, t-shirt and socks
- Pt became noticeably agitated and started to shake and kick as he was advanced to isocenter

Upon removal pt reported he was not anxious but experienced intense painful sensation localized to the area of his genitals in association with being moved into the scanner

Denied piercings but refused examination

After the female technologist left the room, the pt stated that something was inserted into his penis when he and his girlfriend were “fooling around”, and that “it didn’t block anything” so he wasn’t concerned

Radiographs revealed four, spherical, metallic-density objects within the patient’s bladder and a less dense, irregularly-shaped hyper-density item at the base of his penis
Ferrous-Free Environment

What does this statement mean to you?

Do you believe this is possible at your facility?

Safety Event Prevention Tools
- Strong handheld test magnet
- Ferromagnetic detectors
  - screening
  - entry protection

Site Access and Restrictions

Ferro Free Environment Control
Luck or Procedure?

- Highly trained personnel
- Well defined procedure
- Well practiced procedure

Implants and Devices

Resources

- [www.mrisafety.com](http://www.mrisafety.com)
- [www.imrser.org](http://www.imrser.org)
- [www.magresource.com](http://www.magresource.com)

Thank You!!!

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