# MRI Back to the Basics with Live Positioning

**PRESENTED BY**
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ARMRIT 2025

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This course has been approved for one (1) ARRT Category A CE credit(s) by AHRA

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This course meets all CRA renewal credit criteria and has been approved for one (1) continuing education credit in the following CRA domain(s): Operations Management (OM).

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# MRI BACK TO THE BASICS WITH LIVE POSITIONING

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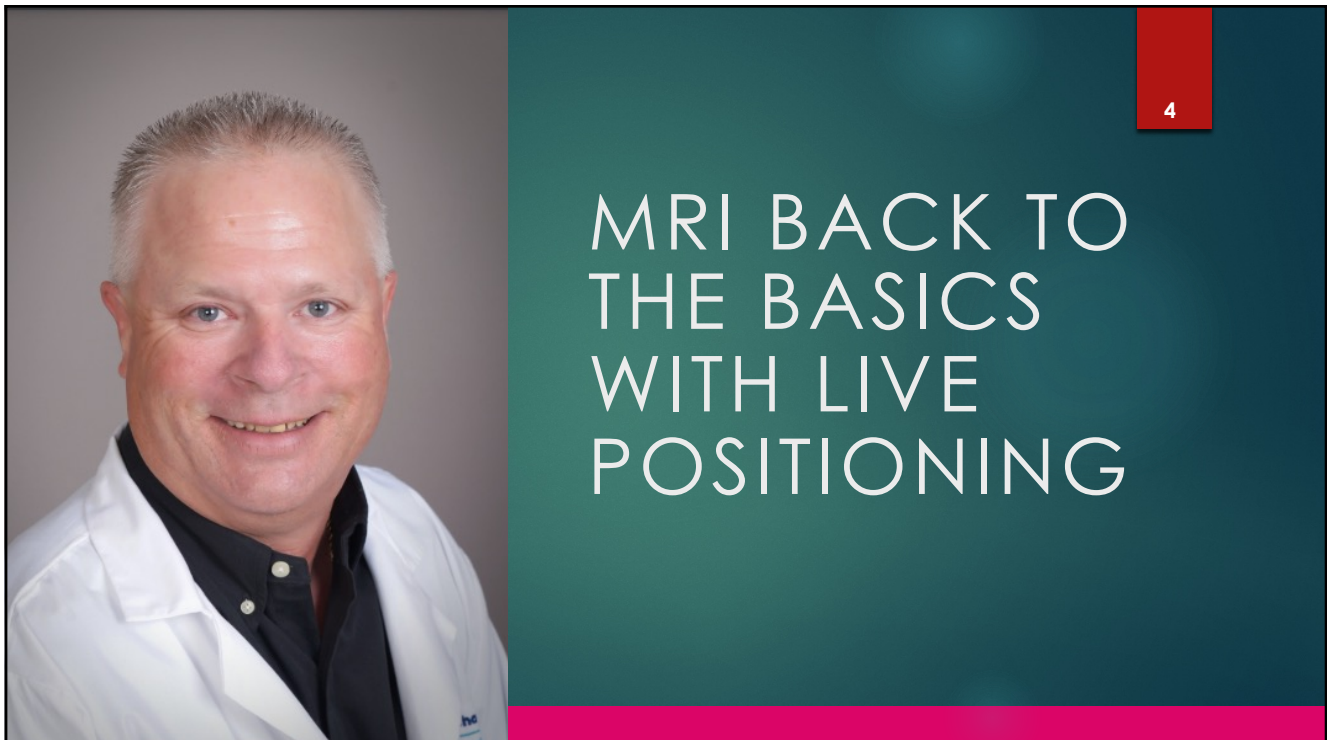
# Agenda

Safety & Clearance

Communication

P.P.E. (Personal Protective Equipment)

Adaptability/Complacency

Time Out Procedure/Safety Protocols/SAR

Professional Growth & Continuous Learning

Risk Mitigation/ Workflow Optimization/ Patient Positioning

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▶The following information reflects my views, opinions, and experience.

▶This presentation content was prepared by Doug Boyd.

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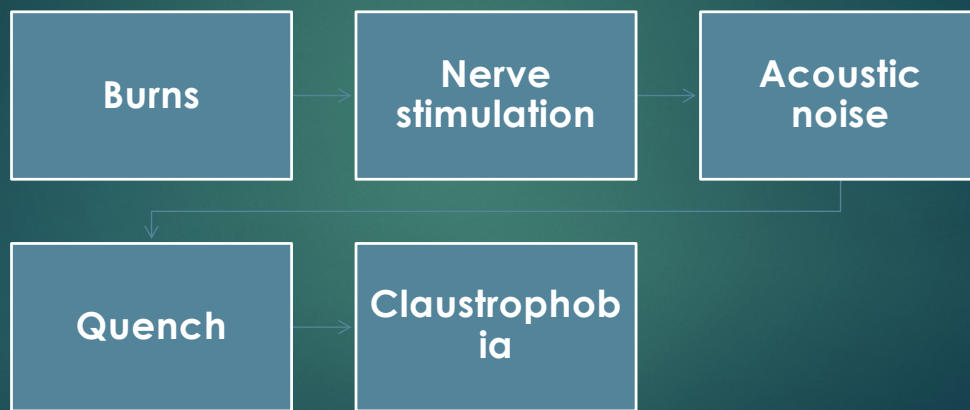
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## Slide 7

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**Safety**

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## Slide 8

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*Restricted access is only as good and as secure as the MRI staff who maintain it.*

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## Safety cont.

Burns → Nerve stimulation → Acoustic noise

Quench → Claustrophobia

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Burns

**MRI Burns – Understanding the Risk**
**What are MRI Burns?**

•**Thermal injuries caused by radiofrequency (RF) energy heating conductive materials.**

•**Most common adverse event in MRI.**

•**Usually occur at the skin surface due to electrical current induction in loops or contact with conductive materials.**

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**Common Causes of MRI Burns**

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**Burns**

•**Skin-to-skin contact** (e.g., thighs, arms folded over chest)

•**Looped ECG leads or wires** touching the patient

•**Conductive clothing** (metallic fibers, silver-threaded athletic wear)

•**Patient contact with bore wall** or RF coil cables

•**Transdermal patches** with metallic backing

•**Improper padding or positioning**

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**Burns**

**Tech Responsibilities**

**Before the Scan**

•**Thorough patient screening**

•**Inspect cables**

•**Remove metallic objects**

•**Use non-metallic blankets or padding**

•**Position patient carefully**

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## Burns

**Key Prevention Tips**

✅ Educate patients about risk and comfort

✅ Use MR-safe padding between contact points

✅ Never let cables or leads form a loop

✅ Don't tuck cables under the patient

✅ Keep patient centered in the bore

✅ Be cautious with larger patients or extremities touching the bore

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## Nerve stimulation

**MRI-Induced Nerve Stimulation**

**What Is It?**

•A **physiological effect** caused by rapidly switching **gradient magnetic fields** during MRI.

•These fields can induce **electric currents** in body tissues, leading to **involuntary muscle twitching**, tingling, or a tapping sensation.

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**How It Happens**

•Caused by **time-varying gradients**, especially your **faster sequences**

•The induced currents **stimulate peripheral nerves**, particularly near the **chest wall, limbs, or spine**.

•Sensations may range from **mild tingling** to **discomfort,** rarely painful but can be startling for patients.

**Nerve stimulation**

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**Reducing Risk of Nerve Stimulation**

✅ **Patient communication** – Inform patients that twitching or tapping sensations can occur and are usually harmless.

✅ **Sequence parameters** – Adjust gradient rise time or amplitude for sensitive patients.

✅ **Body positioning** – Avoid tight or contorted positions that could increase sensation.

✅ **Monitor reactions** – If a patient feels discomfort or pain, **stop the scan immediately** and assess.

✅ **Use earplugs/headphones** – While not for stimulation, loud gradient switching can confuse patients into thinking something is wrong

**Nerve stimulation**

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**Key Takeaways**

•Nerve stimulation is **not a burn** – it's a **transient nerve response** to gradient switching.

•It's **more common at higher field strengths** (3T and up).

•**Always log and report** if patients complains of painful twitching or unusual sensations.

**Nerve stimulation**

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**Acoustic Noise in MRI**

**What Causes It?**

•MRI noise is produced by the **rapid switching of gradient coils** during scanning.

•The changing magnetic fields cause **vibrations in the gradient coil**, which are transmitted as **loud knocking, buzzing, or banging sounds**.

**Acoustic noise**

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### Acoustic noise

**How Loud Is It?**

•Noise levels can reach **110–120 dB** — equivalent to a **rock concert** or **chainsaw**.

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### Acoustic noise

**Risks of Acoustic Noise**

⚠️ **Temporary or permanent hearing loss** if unprotected

⚠️ Increased patient **anxiety or discomfort**

⚠️ Communication challenges during scan

⚠️ Can trigger **startle reflex** or claustrophobia

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**Noise Protection – Tech Responsibilities**

✅ **Always provide hearing protection** – foam earplugs, MR-safe headphones, I recommend both

✅ **Explain** to patients what the noise is and that it's normal

✅ Log/document use of hearing protection per facility protocol

**Acoustic noise**

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**Key Reminders**

• **Never scan without verifying hearing protection**

• Use **both passive (earplugs)** and **active (headphones/music)** when possible

• **Warn patients** about what to expect so they're not startled

• Monitor for signs of distress, especially in longer sequences

**Acoustic noise**

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## MRI Quench – What Is It?

**Quench**

**Definition:**

A **quench** is the **sudden loss of superconductivity** in the MRI magnet, causing the **liquid helium** to rapidly boil off and vent out of the system as gas.

## What Happens During a Quench?

**Quench**

•The magnet's superconducting state fails → **cryogens heat up**

•Liquid helium → helium gas (expands ~700x)

•Helium is released through a **quench pipe** to an outside vent

•The **magnetic field collapses** (either partially or fully)

•If the quench pipe fails → **helium can enter the scan room**, displacing oxygen

**Types of Quench Events**

Quench

•**Planned quench** – Performed by service engineers to safely shut down the magnet

•**Unplanned/spontaneous quench** – Emergency situation, rare but dangerous

•**Emergency quench** – Activated by pressing the **Quench Button** in life-threatening scenarios

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**Hazards of a Quench**

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Quench

⚠ **Asphyxiation risk** if helium enters scan room

⚠ **Frostbite or cold burns** from rapid venting

⚠ **Damage to equipment**

⚠ Long **downtime and expensive recovery** ($$$)

⚠ Panic or injury if personnel don't respond properly

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**Tech Response to a Quench**

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Quench

✅ **Evacuate immediately** if you see fog, hear venting, or get oxygen alarms

✅ **Alert engineering/physics team** and safety officer

✅ **Do NOT re-enter** until cleared

✅ **File incident report** and document everything

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**Quench Prevention & Awareness**

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Quench

•Never touch or block the **quench pipe**

•Make sure room is properly ventilated and alarm systems are active

•Educate new staff/students on **emergency response protocols**

•Only press the **Quench Button in emergencies** (e.g., fire or trapped person with ferrous object)

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**Claustrophobia in MRI**

**What Is It?**

•A **fear of enclosed spaces** that can cause **anxiety, panic, or refusal to complete the exam**.

•Affects up to **20% of MRI patients** — more common with **closed-bore scanners** (especially 60 cm or smaller).

Claustrophobia

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**Signs of Claustrophobia**

⚠ Patient appears tense, restless, or tearful

⚠ Refuses to enter scanner or stops mid-scan

⚠ Reports trouble breathing or heart racing

⚠ Requests sedation or "just wants out"

Claustrophobia

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**Preventing Claustrophobia – Before the Scan**

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Claustrophobia

✅ **Educate the patient** – explain the scan, noises, timing, and what they'll feel

✅ Offer to **play music or communicate through the intercom**

✅ Provide **mirror glasses** or prism goggles

✅ **Position feet-first** when possible

✅ Use an **open MRI or wide-bore scanner** if available

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**During the Scan – Comfort Strategies**

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Claustrophobia

✅ Keep **verbal contact** throughout

✅ Give every patient the **communication ball**

✅ **Cover eyes** with washcloth or eye mask

✅ Use **cozy padding and blankets** to create a feeling of security

✅ Break the scan into **shorter segments** if possible

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**When Claustrophobia Persists**

Claustrophobia

•Consider **pre-medication** (ordered by referring provider)

•Reschedule with **sedation protocol** if needed

•Always **document the issue** and notify the referring physician if scan incomplete

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**Tech Tips for Claustrophobic Patients**

Claustrophobia

💬 Speak calmly and confidently

🧍 Let them see the room before scanning

⏱ Give realistic time estimates

🎧 Use MR-safe headphones with patient's favorite music

📋 Always **log patient response** for future imaging visits

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# Clearance

## Types of Clearence

### DEVICES

- If an implant is marked "yes" confirm patient is on correct scanner
- Confirm the strength of magnet
- Confirm the SAR setting
- Confirm if prior and or post x-rays are needed
- Confirm implant is compatible with coil selected
- Specialist clearance, example cardiac devices, stimulators

### VERBAL

- Go over the screening form to its entirety: each question making they are marked and not all of them marked with one line (always perform the two-clearance method)
- Screen again before entering room, ask for key questions that may prompt a reminder such as; surgeries to eyes, ears or heart, shrapnel, medication patches
  - Example:" Do you have anything in your body that you were not born with?"

### VISUAL

- Change every patient out into an MRI safe gown and booties.
- Removal of all prosthetics, medication patches, hearing aids, jewelry, walkers, wheelchairs, canes etc.
- Look for scars, question your patient if stated no surgeries
  - Example: scars around the chest or head

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Per the American College of Radiology (ACR) guidelines, we need to verbally and visually be able to always see patients.

Clearly communicating to patients what is expected of them during the exam. This is very important especially if patient is claustrophobic.

Patients understanding expectations, such as holding still during an exam, creates diagnostic imaging.

# COMMUNICATION

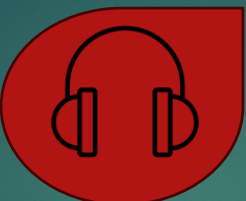The way to get started is to quit talking and begin doing.

Walt Disney

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# Types of COMMUNICATION

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Questions? Comments? Concerns?

**Consent**

Inform your patient of coil set up. Test and give your patient the call ball. Explain the power injector, if you are giving GAD/Contrast and total exam time that your patient will be in scanner.

**Confirm**

Confirm patient that they understand the MRI procedure before placing ear protection and sending them into machine/bore.

**Coaching**

Talk to the patient, let them know what to expect, inform how long the next scan is going to be, make sure they are doing ok

**Encouragement**

Positive words, like "great job" "we are halfway done" "just a few more images" makes patients not feel alone and gives them a time reference. This helps with claustrophobic patients.

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MRI is about being creative, no two patients are the same.

Often, we need to be creative to be able to achieve diagnostic imaging while also providing our patients with comfort and empathy. (Think outside the box/voxel)

That being said not everything is cut and dried there is more than one way and being able to adapt will help provide diagnostic imaging in a timely manner.

# ADAPTABILITY

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# Types of Adaptability

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### CREATIVITY

Be creative and adjust by working with your patient's (THINK OUTSIDE THE BOX/VOXEL) you may need to use the body array coil with the posterior head coil to do a brain.

### POSITIONING

Adjusting with pads, pillows, sandbags to work with patient's physical needs.

### FLEXIBILITY

Make sure to adjust to new positioning and scanning ideas. Sometimes the new way is more beneficial and in favor of the patient's comfort.

### LEARNING

Having an open mind and willingness to learn, MRI is always changing, be adaptable.

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## COMPLACENCY

Extremely important to always be on your A game, never make assumptions, This brings us back to Safety. We need to be diligent to avoid mistakes. In my opinion, this is why we continuously have accidents in the MRI industry.

It is your responsibility to give the patient accurate care and not to be "neglectful" in your duties.

Treat MRI as if it is a Medical Procedure, ie: Colonoscopy etc.

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# Back to the Basics

## Screening

➢ Even if a patient is a frequent flyer, they still need to be re-screened and given a new form for every appointment.

➢ This includes colleagues who are scheduled for exams.

➢ Everyone entering the room need to be screened, no exception.

## Safety

➢ Implant Safety, always refer to the MR Radiologist/MRMD for questions or concerns.

➢ Confirm all MR equipment is safe, example new batch of MR safe oxygen tanks arrived, do not assume, confirm they are MRI safe with magnet.

➢ Always check the labels and expiration dates on any items being administered to your patient's.

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# Back to the Basics

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## Double Check

- When working with another tech always do a second clearance before entering Zone IV. If you are by yourself always do a second clearance as well and document.

- Confirm dosage to patient's weight before administering GAD/Contrast.

- Check the power injector and make sure it is running without any issues. Run saline through the lines and make sure all the bubbles are gone, and you are good to go.

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# Complacency & Risk Mitigation

Avoid assumptions: 'They've done this before' it is safe

Distractions, shortcuts, and fatigue increase risk

Encourage double-checks, team clearances, speaking up

Create a culture of proactive safety awareness

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## Complacency The Silst Risk

▶ Routine can cause missed screening or skipped steps

▶ Overconfidence and shortcuts are leading causes of incidents



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# Personal Protective Equipment (PPE) & Infection Control

Use PPE with high-risk patients (MRSA, TB, bodily fluids)

Gloves, masks, gowns; disinfect coils and equipment

Protect both the patient and you as the MRI Technologist

Always clean between patients and deep clean if needed

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## Types of Personal Protective Equipment

### ATTIRE

- Designated work shoes.
- Washing scrubs separately to avoid contaminating other clothing.
- Changing before leaving your site, or when first getting home.

### MASK & GLOVES

- Contagions
- Results pending, TB, MRSA etc.
- Hygiene
- Bed bugs/ Lice
- Bodily Fluids
- Always remove gloves when exiting zone IV!

### DISINFECT

- Control Room
- Chair and arm rests
- Desk supplies
- Phone keys and Earpiece
- MRI Machine-Deep clean if needed for patients with bed bugs/lice, bodily fluids.
- Mats and Pads
- Injector & Communication ball
- Headset

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# TIME OUT PROCEDURE

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## "TIME OUT PROCEDURE LIST PRIOR TO SCANNING YOUR PATIENT"

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REMEMBER TO PERFORM A TIMEOUT PROCEDURE FOR "EVERY" PATIENT!

DOUBLE SCREEN PATIENTS (ARRVIAL AND BEOFRE ENTERING INTO ZONE IV).

CHANGE YOUR PATIENTS DOWN INCLUDING UNDERWEAR AND SOCKS.

NO LOOPS FROM THE COILS.

NO SKIN-TO-SKIN CONTACT. NO SKIN TOUCHING THE BORE.

USE CUSHIONS FOR COMFORT AND TO PROTECT THE PATIENT FROM BURNS.

USE HEADPHONES AND EAR PLUGS.

GIVE PATIENT THE COMMUNICATION BALL AND TEST BEFORE YOUR FIRST SEQUENCE.

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## "TIME OUT PROCEDURE PRIOR TO SCANNING YOUR PATIENT"

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Headphones &Emergency ball

Earplugs
Classic

Earplug Placement

Cushion under patients for comfort

Handing the patient the communication ball

Padding/Pads

Set up:

ACR calls this final check or full stop. I like prefer "time out". Make sure to have all your tools prior to positioning your pt, including headphones, ear plugs, and check the communication ball before starting your first scan.

Make sure your pt. is comfortable by adding a cushion under there knees, no loops for the coils and most important to provide padding/pads to protect from burns.

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**"THE DON'T'S OF MRI"**

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MAKE SURE TO HAVE PT.S TAKE SOCKS OFF — PIC #2

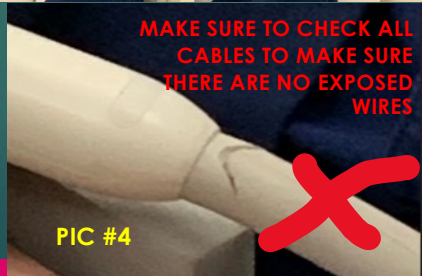INCORRECT WAY DO NOT HAVE PT CROSS THEIR LEGS TO PREVENT KISSING BURNS — PIC #1

MAKE SURE TO HAVE PT.S REMOVE ALL JEWLRY — PIC #3

MAKE SURE TO CHECK ALL CABLES TO MAKE SURE THERE ARE NO EXPOSED WIRES — PIC #4

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**"THE DO'S OF MRI"**

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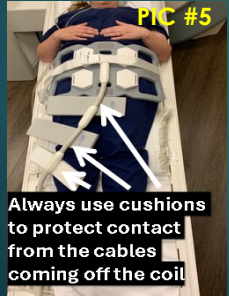CORRECT WAY DO NOT HAVE PT CROSS THEIR LEGS TO PREVENT KISSING BURNS — PIC #1

Padding/Pads — PIC #2

PIC #3 — Make sure not have the pt. cross their arms

Always use cushions to protect skin on skin contact from the cables coming off the coil — PIC #4

PIC #5 — Always use cushions to protect contact from the cables coming off the coil
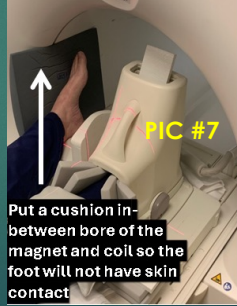
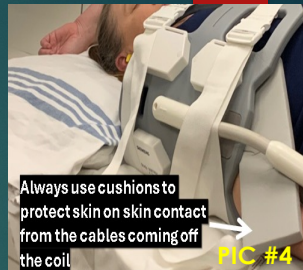PIC #6 — Coban and cushion to help keep the feet internally rotated

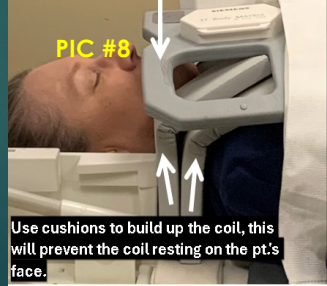Put a cushion in-between bore of the magnet and coil so the foot will not have skin contact — PIC #7

PIC #8 — Use cushions to build up the coil, this will prevent the coil resting on the pt.'s face.

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# MRI Safety Policy

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| Implement systems to support safe MRI practice | → | Periodically review and assess compliance with your organization's MRI policies | → | Procedures and protocols | → | Pt sedation policy |

| Policy for critically ill patient monitoring | → | Policy for monitoring inmates | → | Pregnancy Policy for patients and Technologists | → | Policies must also identify high risk examinations/pro cedures |

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# Examples of an Adverse Event Form

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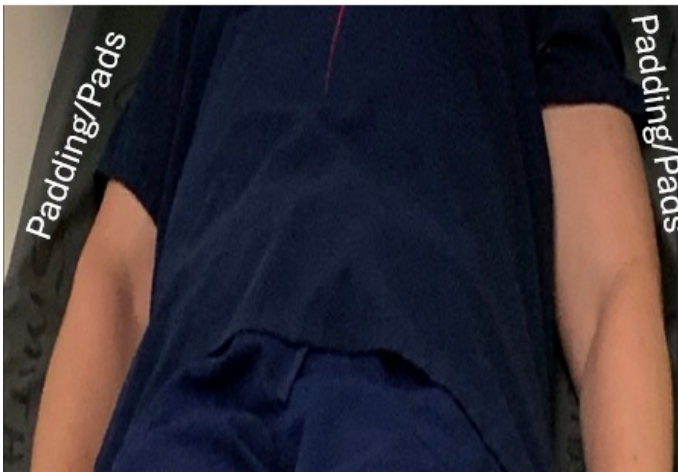| DATE OF EVENT | ADVERSE EVENT | PATIENT TREATMENT/ OUTCOME | ACTION/FOLLOW UP | RECOMMENDATIONS | STATUS |
|---|---|---|---|---|---|
| September 16, 2008 | Contrast Reaction: MultiHance (Gadobenate Dimeglumine Injection, 529 mg/ml) s/s sneezing, n/v, sob, weakness, edema: nose/throat/tongue/eyes and headache | -Notified MRI Radiologist -Benadryl 50 mg IV -Solumedrol 125 mg IV -Transported to ED via stretcher -Educated verbally and written (contrast allergy and discharge antihistamine medications) -Discharged home | -Reported to Drug Company, -Entered CPRS allergy posting | Continue to follow protocol | **CLOSED** |
| February 9, 2009 | Contrast Reaction: MultiHance (Gadobenate Dimeglumine Injection, 529 mg/ml) s/s sneezing and weakness/dizziness, anxiety (mild reaction) | -Notified MRI Radiologist -NS 500 cc IV given -Observed for one hour in MRI holding area -Verbal and Written Education Provided to patient -Discharged Home | -Reported to Drug Company -Entered CPRS allergy posting | Continue to follow protocol | **CLOSED** |

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# RUN EMERGENCY DRILLS ROUTINELY

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Padding/Pads

Padding/Pads

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## SAR and Thermal Risks

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## Slide 57

$$\text{Power In} - \text{Power Out} = \text{SAR}$$

Specific absorption rate (SAR) is a measure of the rate at which energy is absorbed by the human body when exposed to a radio frequency (RF) electromagnetic field.

# SAR and Thermal Risks

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## Slide 58

# SAR and Thermal Risks

**Do you really read this?**

SIEMENS

SAR Monitor Operating Mode

Current measurement [ Normal ]

○ Normal mode

● First Level mode

Switch Operations Mode                    ? ⊗

⚠ You are about to switch from Normal to FIRST LEVEL OPERATING MODE

Click on help to get important information on SARI
For more information see manual
Click on continue to continue

G.E.

Select the desired Operating Mode:

dB/dT ————————————

Normal dB/dT

First Level dB/dT

Entering First Level for dB/dT.
Operator/Physician confirms awareness of potential risk and accepts the responsibility.

**FIRST LEVEL VS. SECOND LEVEL 2W/KG.**
First level or fast should never be used or selected. Selecting first level or fast can and could cause burns in the MRI environment. All the manufacturers recommend and warn not to use or use with extreme caution. I have never used fast or first level in 30+ years as an MRI Tech. I felt there was never a need for selecting this option, and all the burns and incidents I have researched indicate that patients have been burned or heated up for no reason when the fast and first level was selected. In 30+ years, I have never burned or overheated a patient because Safety is my number one priority!

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- ▶ Define common risks and incidents in the MRI environment
- ▶ Recognize how complacency contributes to safety breakdowns
- ▶ Apply daily safety practices and protocols to prevent harm
- ▶ Understand the importance of documentation and double-checks

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# Back to the Basics Summary

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# Professional Growth & Continuous Learning

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- ▶ Understand the value of continuous professional development
- ▶ Identify certification and advanced credentialing opportunities
- ▶ Recognize career pathways in MRI beyond scanning
- ▶ Embrace mentorship, collaboration, and lifelong learning

## Why Growth Matters in MRI

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MRI is constantly evolving – stay ahead of the curve

Enhances patient safety, image quality, and job satisfaction

Increases value to your employer and healthcare team

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## Continuing Education

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ARMRIT require on going CEUs

Topics: MRI safety, anatomy/pathology, protocols, technology

Resources: ARMRIT CMEs, conferences, online platforms

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## Career Pathways

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Clinical Leadership or Preceptor roles

MRI Educator, Application Specialist, Research Tech

Legal expert or consultant for MRI safety

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## Reflection & Goal Setting

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What skill or certification do you want to pursue this year?

Set one short-term and one long-term professional goal

Find a CE course and share it with a peer

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## What is Risk in MRI?

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▶ Risk = the potential for harm to patients, staff, or equipment

▶ Sources: implants, SAR, human error, distractions, fatigue
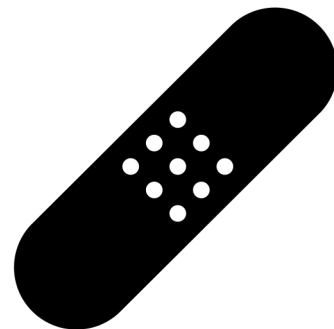
▶ Even low-frequency events can have serious outcomes

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## Real-World MRI Incidents

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▶ Projectile injuries from metal objects

▶ Burns from coil loops, cables, or skin contact

▶ Implants not screened properly

▶ All preventable with consistent protocols

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## Daily Practices for Mitigating Risk

- ▶ Follow clearance protocols every time
- ▶ Use the time-out checklist before scanning
- ▶ Confirm all implants and remove all metal
- ▶ Communicate with your team — double-check each other

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## Safety Culture & Documentation

- ▶ Create a culture were speaking up is encouraged
- ▶ Document incidents and near misses to improve systems
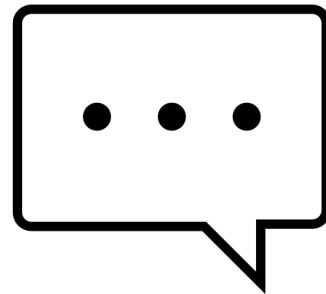- ▶ Learn from mistakes, yours and others'

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## Communication Strategies

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- ▶ Explain each step to the patient before positioning
- ▶ Use positive reinforcement: 'You're doing great!'
- ▶ Maintain calm, confident tone to reduce anxiety
- ▶ Encourage patient feedback: comfort, pain, concerns

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- ▶ Demonstrate effective patient positioning techniques
- ▶ Understand the impact of positioning on image quality and safety
- ▶ Apply workflow strategies to reduce delays and increase throughput
- ▶ Enhance communication for smoother exams and better patient experience
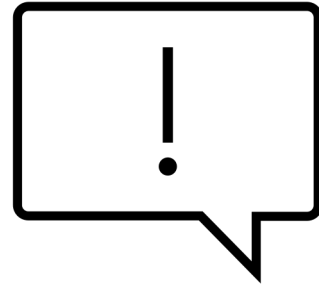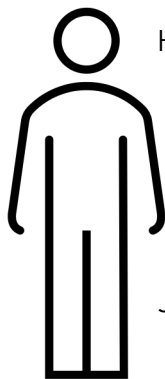
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# Importance of Proper Positioning

- ▶ Ensures diagnostic image quality
- ▶ Reduces need for repeats
- ▶ Minimizes patient discomfort and movement
- ▶ Helps avoid safety risks like RF burns

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# Head-to-Toe Positioning Tips

Head: secure with pads and headphones
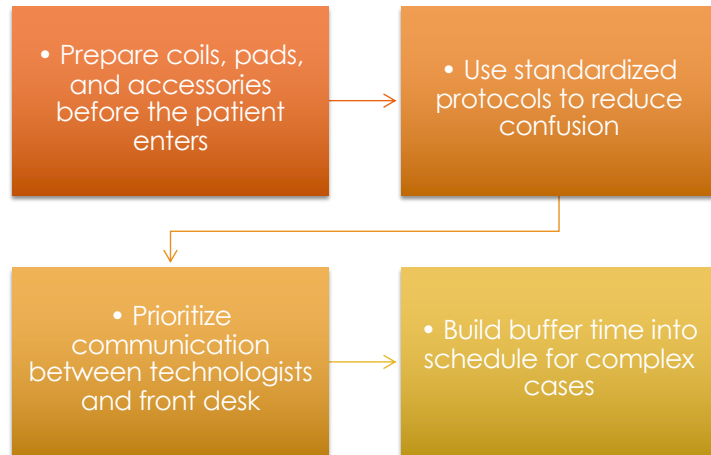
Spine: knees elevated for comfort, arms by side

Abdomen/Pelvis: breath coaching, straps if needed

Joints: immobilize with cushions/sandbags

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## Workflow Optimization

- Prepare coils, pads, and accessories before the patient enters

- Use standardized protocols to reduce confusion

- Prioritize communication between technologists and front desk

- Build buffer time into schedule for complex cases

## Summary and Best Practices

✔ Good positioning supports great imaging

✔ Prepare early, communicate clearly, and adapt when needed

✔ Workflow efficiency reduces patient wait and tech burnout
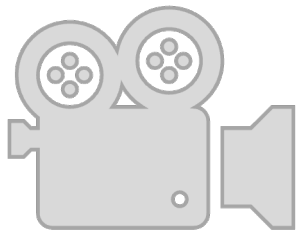
✔ Create a calm, professional scanning environment

# MRI Safety Websites

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WWW.MRISAFETY.COM

WWW.MAGRESOURCE.COM

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"LET'S POSITION OUTSIDE THE VOXEL"

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# Thank you!

## Questions?

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3. On the next page, enter the code for this session in the space provided and click "Unlock." **The code for this session is ==awake.==**
4. Click "Take Course."
5. Click "Start Course" or "Resume Course" to access the session evaluation.
6. Complete the evaluation and click "Submit."
7. Download your certificate.

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