

Patient Safety Tip of the Week

November 21, 2023

Another Terrifying MRI Accident

It's only been a few weeks since we did a column about a potentially deadly MRI accident (see our October 24, 2023 Patient Safety Tip of the Week “[Serious MRI Accident at Unregulated MRI Center](#)”). Now an even more terrifying MRI accident has come to attention.

A nurse was crushed when a hospital bed was pulled into an MRI machine ([Jarosz 2023](#)). The nurse was attending to a patient on a bed at a California medical center when the bed was pulled by the MRI's magnetic force, causing the patient to fall out of the bed and pinning the nurse between the bed and the MRI machine. The nurse suffered a severe laceration that required surgery, which included the removal of two embedded screws. She also apparently suffered injuries to her pelvis, leg and abdomen and spent several days in the hospital ([Mibach 2023](#)). The patient who fell from the bed onto the floor at the time was not hurt.

The nurse was in the preparation area with a patient and another nurse. A door between that area and the MRI room should have been closed but was open. Once the patient was prepped, the nurse began to move the bed toward the door to the MRI room. However, the door was open, and as the nurse got closer to the door with the metal bed, she and the bed were suddenly flung toward the machine, pinning her between the machine and bed.

KTVU reported the nurse said “I was getting pushed by the bed” and “Basically, I was running backwards. If I didn't run, the bed would smash me underneath.” An MRI technologist had just finished a call and heard screaming coming from another room. The photo below shows the bed sucked into the MRI machine. It is incredible that someone did not die in this accident.



A report from the California Division of Occupational Safety and Health (Cal/OSHA) notes that the nurse and patient care tech were left unsupervised without MRI personnel. No one, including the patient, was ever screened. The door to the magnetic room was left open. And the safety alarm system never sounded. In addition, some employees had not received required safety training and the hospital had failed to annually test the door alarm as recommended.

This apparently wasn't the only incident at this hospital. A photo provided to KTVU shows a medical equipment cart stuck to the MRI scanner, likely from an incident in March 2015 where no patients or employees were hurt.

The healthcare facility was fined \$18,000 by OSHA over the workplace injury.

Tobias Gilk, arguably the most prominent authority on MRI safety, has reconstructed the accident from the CMS report ([Gilk 2023a](#)) and the OSHA report ([Gilk 2023b](#)). A major contributing factor was the design and layout of the MRI suite. You'll want to watch Gilk's video discussion of that aspect ([Gilk 2023b](#)), in which he demonstrates how the cramped quarters required positioning of personnel and beds that were critical elements in the accident.

To summarize the CMS report:

The MRI Imaging Technician had begun a call to another patient when the bell to Zone III rang. She asked the MRI Technician if she should answer the door or continue with the phone call. She was instructed to finish the call and the MRI Technologist would "get the door". An RN and a PCT (Patient Care Technician) had arrived with an ICU patient in an ICU bed. The MR technologist opened the door to Zone III without first screening the nurse, patient, and PCT in Zone II (Zone II at this hospital was actually just a hallway used for general radiology). The required screening of the patient and two non-MRI personnel was also not performed in Zone III. Intention was that the patient would be transferred from the ICU bed to a detachable non-ferromagnetic MR bed/table. It was not clear why that transfer was to take place in Zone IV rather than Zone III. The MR tech informed the nurse "we are going in head first" and went back to the control room to "open the patient chart". She left the RN, patient, and PCT alone in Zone III. She said she could not begin the procedure without opening the patient chart. The control room is out of sight of Zone III. The nurse pulled the ICU bed into Zone IV (where the scanner is located). The Ferroguard metal detection system (wall-mounted at the entrance to Zone IV) apparently did not alarm as the ICU bed was moved into Zone IV. As the bed approached the MR scanner, the magnetic field powerfully attracted the bed. The patient fell to the floor. The nurse, who was between the bed and the scanner, was pinned against the scanner. The MRI Imaging Technician had just finished her phone call when she

heard screaming. She ran into the scanner room and forcibly pulled the nurse from between the scanner and the bed. The MR technologist did not quench the MR immediately but had the Clinical Technologist notified to ask if she should do that. It is not clear how long before the quench took place.

Key conclusions of the CMS report:

- The patient, nurse and PCT were not screened in Zone II prior to entering Zone III
- The required screening of one patient and two non-MRI personnel was not performed in Zone III in accordance with the hospital's policy
- The entrance door to Zone IV was left open
- The hospital did not have a patient interview/clinical screening area that provided privacy for patients and non-MR personnel that would facilitate full and complete patient and personnel disclosure of the medical history. Zone II acts as a buffer between Zone I (general public area) and the more strictly controlled Zones III and IV. The facility's Zone II was located in a hallway used as a pathway by people entering the Radiology Department leading to other Radiology services.
- Neither the MRI Technologist nor the MR Imaging Technician heard the Ferroguard alarm
- The Ferroguard alarm had not been serviced or maintained since purchase and installation in 2014
- The Ferroguard User Manual recommends annual testing by manufacturer-approved technicians, daily qualitative checks, weekly/monthly checks, and what to do if a fault is suspected. The facility did not comply with those recommendations.
- Director of Imaging said "MRI Technologist felt rushed due to a timed procedure set for 08:00"
- The hospital did not provide evidence of MRMS/MRSO annual education or Level II MR safety training.
- The hospital's policy and procedures did not include MRMD and MRSO required MR safety training in their policy

So, what are the lessons learned from this unfortunate but preventable accident? We see issues in at least the following areas:

- Training
- Checking alarms
- Distractions, interruptions, time pressures
- Failure to follow protocols
- Physical layout
- Quenching
- Who's in charge?
- Failure to learn from prior events?
- Complacency, normalization of deviance

Certainly, the case illustrates a problem we all deal with – **orienting all staff to MRI safety**. That means everyone! It includes not only newly hired clinical staff, but anyone

who might enter the MRI suite at some time. That could mean your cleaning or maintenance crews. It also means outsiders like police, firemen, and prison guards who might have need to be at your MRI unit for one reason or another (see that October 24, 2023 Patient Safety Tip of the Week “[Serious MRI Accident at Unregulated MRI Center](#)” and our October 21, 2014 Patient Safety Tip of the Week “[The Fire Department and Your Hospital](#)”). And, importantly, it includes **temporary staff**. Though the RN in this incident was apparently MR II safety trained (meaning for safety of herself and others), she had been a traveller and had only become employed by the hospital within the last couple of months. The reports don’t tell us when she had received that MR safety training. The [ACR Manual on MR Safety](#) definitions of the various levels are listed below.* Was she really trained to that level? And what about your **physicians**? How many of you include MR safety training for your physicians (who might, from time to time, come to the MRI suite). In this case, even the 2 physicians designated as overseeing MR imaging were said to have had their MR safety training “during their residencies and fellowships”. Are they exempt from annual updates? The [ACR Manual on MR Safety](#) says “It is understood that the MRMD will have the necessary education and experience in MR safety to qualify as Level 2 MR Personnel. The MRMD, MRSOs, and MRSEs, as well as all MR Personnel, should undergo MR safety–specific education on an annual basis.”

A second key lesson is that all your **alarm systems need to be checked regularly**. Our February 4, 2014 Patient Safety Tip of the Week “[But What If the Battery Runs Low?](#)” gave lots of examples of alarms that failed because no one checked to make sure their batteries were working. But alarms may fail for other reasons, too. There may be mechanical failures, or someone may have turned off the alarm purposefully and forgot to turn it back on. In this case, no ferromagnetic alarm was audible to the MRI technologist or the MR imaging technician. In this case, the facility was using the Ferroguard wall-mounted metal detection system. That device shows an amber or red color if it detects metal and should sound an alarm to prevent entering Zone IV. The Ferroguard User Manual recommends annual testing by manufacturer-approved technicians, daily qualitative checks, weekly/monthly checks, and what to do if a fault is suspected. The facility apparently did not comply with those recommendations. The Ferroguard alarm had not been serviced or maintained since purchase and installation in 2014. The facility plan of correction notes that Clinical Technology checked the Ferroguard device at the entrance to Zone IV after the accident and confirmed “it was functional”. So, the metal detection capability may have been working but it’s not quite clear whether the alarm was working or whether the audible level was too low.

In many incidents we see **distractions, interruptions, or time pressures** as contributing factors. This case was no different. The MR Imaging Technician was distracted by the phone call and the “MRI Technologist felt rushed due to a timed procedure set for 08:00”.

Failure to follow protocols and procedures. The CMS report showed the following failures:

- The required screening of one patient and two non-MRI personnel was not performed in Zone III in accordance with the hospital's policy.
- The patient and non-MRI personnel were left unsupervised in Zone III.
- The entrance door to Zone IV was left open.
- The RN, who was Level II MR safety trained, continued to move the patient in an ICU bed into Zone IV without stopping for a second screening in Zone III and transferring the patient to a non-ferromagnetic bed/table.
- The daily and other periodic checks of the Ferrogard metal detection system were not carried out.

Deficient physical layout. In addition to the physical layout and design problems noted above by Gilk ([Gilk 2023b](#)), the CMS report notes that Zone II was located in a hallway used as a pathway by people entering the Radiology Department leading to other Radiology services. The hospital did not have a patient interview/clinical screening area that provided privacy for patients and non-MR personnel that would facilitate full and complete patient and personnel disclosure of the medical history. That is where initial screening and review of the risk questionnaire would take place.

Like the accident we described in our October 24, 2023 Patient Safety Tip of the Week “[Serious MRI Accident at Unregulated MRI Center](#)”, there was a **delay in quenching the magnet**. Quenching the magnet is a serious event and can give rise to problems of its own. But both accidents indicate that the staff on-site often feel they do not have the authority to initiate quenching and those delays in “getting approval” to quench could have disastrous consequences. It needs to be made clear that a patient or other person being pinned against the machine is a potentially life-threatening circumstance that merits immediate quenching.

Who's running the show? The CMS interviews with the Chief of Radiology and Imaging Director leave a lot of questions about oversight of the MRI safety and services. The organization chart had some handwritten names for key roles. After first stating that the Chief of Radiology was the MRMD (MR Medical Director), it was later stated that there were 2 MRMD's, one from musculoskeletal and one from neurology. A radiologist was identified as MRSO (MR Safety Officer). But the facility was unable to provide evidence of MR safety training or credentialing for these roles. Tobias Gilk ([Gilk 2023c](#)), in yet another column on this accident, discusses the roles of MRMD and MRSO in some detail. He notes that the level of MR safety training in residency and fellowship programs probably does not rise to the level required for an MRMD. And he notes that the MRSO must be someone who is readily available in the MR suite, noting that radiologists in a reading room are probably not appropriate for the role of MRSO. He recommends that **certification** should be required for both the MRMD and MRSO roles.

Failure to learn from prior events. You'd be surprised how often we see an incident occur despite a facility having experienced a very similar event in the past. We don't have any details in this case, but that photo provided to KTVU showing a medical equipment cart stuck to the MRI scanner, likely from an incident in March 2015, certainly suggests some important lessons went unlearned.

One can only speculate about the roles complacency, normalization of deviance, and lack of leadership might have played as root causes or contributing factors in this accident.

Any facility performing magnetic resonance imaging should be looking at this accident and the one in our October 24, 2023 Patient Safety Tip of the Week “[Serious MRI Accident at Unregulated MRI Center](#)”, and asking themselves “Could that actually happen here?” A thorough review of operations and compliance with policies, protocols, and procedures is in order and many facilities should consider a full FMEA (Failure Mode and Effects Analysis).

*ACR Manual on MR Safety Personnel Definitions

Non-MR Personnel: Patients, visitors, or facility staff who do not meet the criteria of Level 1 or Level 2 Magnetic Resonance (MR) Personnel will be referred to as Non-MR Personnel.

Level 1 MR Personnel: Individuals who have successfully passed safety educational efforts as defined by the facility’s MR Medical Director (MRMD), sufficient to ensure their own safety and that they do not pose a potential threat to themselves or others as they work within Zone III will be referred to as Level 1 MR Personnel (eg, MR imaging [MRI] department office staff and patient aides.) Note that Level I MR Personnel must regularly and routinely work within Zone III in order for them to maintain their Level 1 status. (For illustration purposes, undergoing a single lecture once a year and virtually never stepping foot in the MRI suite may be insufficient to satisfy the requirements of Level 1 MR Personnel.)

Level 2 MR Personnel: Individuals who have been more extensively trained and educated in the broader aspects of MR safety issues, including, but not limited to, RF safety, dB/dt-related safety of time-varying imaging gradients, cryogen safety, contrast agent safety, etc, will be referred to as Level 2 MR Personnel (eg, MRI technologists, radiologists, radiology department nursing staff).

Some of our prior columns on patient safety issues related to MRI:

- February 19, 2008 “[MRI Safety](#)”
- March 17, 2009 “[More on MRI Safety](#)”
- October 2008 “[Preventing Infection in MRI](#)”
- March 2009 “[Risk of Burns during MRI Scans from Transdermal Drug Patches](#)”
- January 25, 2011 “[Procedural Sedation in Children](#)”
- February 1, 2011 “[MRI Safety Audit](#)”
- October 25, 2011 “[Renewed Focus on MRI Safety](#)”
- August 2012 “[Newest MRI Hazard: Ingested Magnets](#)”
- October 22, 2013 “[How Safe Is Your Radiology Suite?](#)”
- October 21, 2014 “[The Fire Department and Your Hospital](#)”
- August 25, 2015 “[Checklist for Intrahospital Transport](#)”
- August 2016 “[Guideline Update for Pediatric Sedation](#)”

- October 2016 “[MRI Safety: There’s an App for That!](#)”
- January 17, 2017 “[Pediatric MRI Safety](#)”
- August 8, 2017 “[Sedation for Pediatric MRI Rising](#)”
- March 2018 “[MRI Death a Reminder of Dangers](#)”
- March 2018 “[Cardiac Devices Safe During MRI But Spinners!?](#)”
- November 2018 “[OMG! Not My iPhone!](#)”
- April 2, 2019 “[Unexpected Events During MRI](#)”
- September 2019 “[New MRI Hazard: Magnetic Eyelashes](#)”
- October 15, 2019 “[Lots More on MRI Safety](#)”
- November 5, 2019 “[A Near-Fatal MRI Incident](#)”
- November 2019 “[ECRI Institute’s Top 10 Health Technology Hazards for 2020](#)”
- January 7, 2020 “[Even More Concerns About MRI Safety](#)”
- March 2020 “[Airway Emergencies in the MRI Suite](#)”
- October 2020 “[New Warnings on Implants and MRI](#)”
- January 2021 “[New MRI Risk: Face Masks](#)”
- June 1, 2021 “[Stronger Magnets, More MRI Safety Concerns](#)”
- November 2021 “[Yet Another Risk During MRI](#)”
- January 2022 “[MRI Safety Issues](#)”
- July 26, 2022 “[More Risks in the Radiology Suite](#)”
- October 24, 2023 “[Serious MRI Accident at Unregulated MRI Center](#)”

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<https://www.tiktok.com/@tobiasgilk/video/7276500408137190702>

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<https://www.linkedin.com/pulse/who-organizationally-charge-mri-safety-tobias-gilk-mrso-mrse/>

ACR (American College of Radiology). ACR Manual on MR Safety

<https://www.acr.org/-/media/ACR/Files/Radiology-Safety/MR-Safety/Manual-on-MR-Safety.pdf>



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