MR Safety Survey

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Introduction

Special care must be taken to ensure patient and operator safety in the increasingly complex MR environment. Standardized practice guidance from the ACR Committee on MR Safety was initially published in 2002, with multiple updates most recently in 2019, with important editorial insights from Jordan and Gulani.[1-3] Specifically, the 2019 update refined Zone IV access, introducing the "full-stop and final check" which has been shown to be effective in reducing projectile events, a serious type of Zone IV infraction. We review zones of the MR environment and report the results of an MR Safety survey recently offered to the membership of the Michigan Radiological Society which will inform future MR safety education and improved surveys.

To aid in the standardization of safety protocols, the regions surrounding an MRI machine are divided into four zones within which special precautions must be taken to prevent harm. Failure to adhere to the appropriate precautions of each zone constitutes an "infraction." Unintentional introduction of ferromagnetic objects into the MR environment poses significant safety risks including projectile injury, burns, implanted device malfunction, and injury related to implant motion. Mitigating this risk requires constant vigilance and a just-culture safety environment. Reporting of safety events should be supported with process improvement as the central focus. This ensures balanced accountability for both individuals and the organization responsible for designing and improving workplace systems. The MR environment can benefit from such an approach to analyze and mitigate risk. We conducted a survey with the goal of understanding the current state of MR safety practice in radiology departments across the State of Michigan to inform future educational efforts.

A review of the ACR defined MR Safety Zones[4] may be helpful:
Zone I: All areas that are freely accessible to the general public.
Zone II: The area between Zone 1 (Public Access) and the strictly controlled Zone 3 (Control Room) and Zone 4 (Magnet). This is the area just outside of the restricted area Zone 3.
Zone III: The MR Control Room. All access to Zone 3 is to be restricted with access to regions within it controlled by and entirely under the supervision of MR personnel.
Zone IV: The Magnet Room. This zone has restricted access for both personnel and equipment. No individual has access to the magnet room without supervision by trained MR personnel. This zone is by definition located within Zone III. Only MR compatible objects, devices, and equipment are allowed within Zone IV.[4] Zone IV infractions refer to the unintentional introduction of a ferromagnetic metallic object, device, or equipment into MR Zone 4. The time-out memory tool "**SAVE**" acronym has been proposed by Loudill and colleagues for use prior to Zone IV entry[5]:
S-Screening: Has the patient been screened by an MR Technologist and approved for the scan?
A-Ancillary Staff: Have all ancillary staff potentially entering Zone 4 been screened and all ferromagnetic objects removed from their person?
V- Visual Inspection with ferromagnetic detection: Have all non-MR personnel, including the patient been visually inspected and passed metal detection?
E-Equipment: Has all medical equipment entering Zone 4 been confirmed MR Safe or conditional?

Survey Methods:
A voluntary response survey evaluating MRI screening protocols, MRI safety, and documentation requirements was sent by email to members of the Michigan Radiological Society. All survey responses were kept confidential and aggregate results are reported. Respondent site identification was optional. The results were compiled and evaluated for trends. Statistical validity of the response data was very limited by a low number of responses, and summary conclusions regarding MRI safety protocols in Michigan were formulated. The survey included an area for free text to allow for clarification of responses as deemed necessary by the respondent.

Results:
The survey was sent to the 1800 members, and the survey was clicked on at 750 unique IP addresses. Thirty-seven responses were completed for evaluation. The ability to reconcile duplicate and conflicting data was limited without mandatory site information.

Surveys were completed by a relatively even mix of private practice, academic, and hybrid groups, with 31%, 31%, and 39% belonging to each group respectively. One respondent did not indicate site type. Most respondents had a hospital-based practice (35/37, 95%), with 13/37 (35%) also having outpatient practices. One respondent was an outpatient-only site. A majority of respondents utilized an MR Safety Officer (23/37, 62%) with 16 of these also having a physician MR Medical Director. Most respondents (87%) utilized technologists for pre-MR screening with 17/37 (46%) indicating sole usage of technologists for the task. However, pre-screening at the time of scheduling for the MR exam, either in the department (25/37) or at a centralized scheduling center (18/37) was reported. Screening at the time of patient arrival (62%) and prior to entry into the Zone IV scan room (70%) provided multiple disclosure opportunities and safety redundancies. Metal detectors were also used by 8/37, 22% of respondents.

All respondents that knew their site policies for healthcare personnel accompanying patients (33/37) reported screening. Twenty-two of 33 (67%) respondents utilized at least two of four screening mechanisms for healthcare personnel accompanying the patient into Zone IV. For respondents that were aware of their site policies for family or friends accompanying patients, 24/30 reported screening and the other 6 sites do not allow family or friends to accompany patients. Of those that do allow accompaniment, 18/24 (75%) use multiple mechanisms for screening and the other 6 used only screening prior to entry into the scan room Zone IV.

Of the respondents aware of their policies for MR Safety training prior to entry to Zone IV (26/37), 25 require such training for ancillary medical personnel, 6 respondents require it for family and friends, and 5 state that they require it for patients.
Twenty-five of 37 respondents knew their documentation policies for Zone IV infractions. Of these, 12 tracked MRI Zone IV infractions by number, type, and whether there was patient harm. At least 27/37 (73%) groups tracked thermal incidents, 2 respondents stated they did not track thermal incidents, and 8/37 did not know.

Utilization of time-outs prior to transferring patients into Zone IV was reported for 35% of respondents, with 22% reporting they do not. Thirteen sites use the “S.A.V.E.” acronym for time-outs, including 6 respondents who stated they either did not do time-outs or did not know if they did time-outs. This inconsistency may be attributed to ambiguity in the survey.

Discussion:
A key take-away point from this safety survey is the common utilization of multiple safety redundancies. Patients frequently note and occasionally complain that they are repeatedly asked the same questions. While this survey did not address the efficacy of these redundant practices, practical experience supports their utility in preventing patient harm, as repetition often stimulates a more robust memory. Future studies could address the relative effectiveness of the various methods and combination of methods to avoid patient harm. Significant knowledge gaps regarding MR safety protocols were identified by this survey that will inform future educational efforts.

The limitations of this survey highlight the importance of an appropriately targeted representative sample. Response bias severely limits the validity of conclusions drawn from our data. While the membership of the MRS is very broad, many are clustered from the same institutions. The responses were anonymous and the few who offered their affiliation made it likely that there were multiple respondents from the same institutions. Future opportunities include a more selective survey of lead technologists or MR managers on the front lines of implementing policy. This, and removal of anonymity, would likely help reduce duplicate site reporting and inconsistent policy reporting. It was hoped that an anonymous survey would improve participation, but response rates were nevertheless low and duplicate site responses could not be resolved. This current state assessment provided some insight into the variability in radiologists' understanding and implementation of ACR recommendations. We did not quantify Zone IV violations, and the authors plan to characterize these in the future.

The State of Michigan MDHSS website lists 88 hospital-based MR facilities, 43 freestanding facilities, and 213 mobile host sites.[(6)] Many of these sites are operated by common entities or hospital systems thus reducing the complexity of standardization. That being said, standardization within even a single large hospital system can be challenging. Increasingly common mergers and consolidation of practices and hospital systems may afford streamlined opportunities for dissemination of best practices and standardization. Continued education and reinforcement is needed for broader adoption of ACR Guidance Document on MR Safe Practices.

Reference:

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