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MRI in Claustrophobic Patients: Challenges and Strategies for Improving Patient Compliance

Karan Gupta[1]; Dr. Namrata Singh[2]

[1]Scientific Officer 'B', Department of Radiodiagnosis Homi Bhabha Cancer Hospital & Mahamana Pandit Madan Mohan Malaviya Cancer Centre, Varanasi
[2]Associate Professor, Department of Radiodiagnosis Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly

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Abstract: Magnetic resonance imaging (MRI) is a vital non-ionizing imaging technology at the forefront of neurological, musculoskeletal, abdominal, cardiovascular, and oncological care. The MRI setting may present unique challenges to claustrophobic patients: the restricted space, the unfamiliar sound, the need to lie still, the procedure length, and the test uncertainty can cause distress. Such stress can result in patient movement, acquisition cancellation, and patient cancellation with adverse effects on costs and diagnostic delays. Improving tolerance to the MRI environment is a patient-centric concern. This article describes factors contributing to claustrophobia and methods to optimize the patient's co-operation during MRI. Particular attention is paid to pre-MRI screening, education and communication, relaxation techniques, music and video, scanner options, and medication. The MRI technologist has an ideal position to reduce distress by building a therapeutic alliance and encouraging patient participation. Other approaches, which include virtual reality, silent MRI, AI-based image protocol optimization, and patient-focused MRI settings, represent new frontiers in the prevention of claustrophobia.

Keywords: *Magnetic Resonance Imaging; MRI Safety; Claustrophobia; Anxiety; Patient Compliance; Wide-Bore Magnetic Resonance Imaging; Open MRI; Patient-Centered Care.*

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I. INTRODUCTION

Magnetic resonance imaging (MRI) is one of the procedures that occupy a stable place in today's diagnostic practice. Being characterized by the lack of radiation and good soft tissue contrast, it is highly suitable for assessment of brain, spinal cord, joints, abdomen, pelvis, cardiovascular system, and tumors. However, the MRI procedure can also be quite difficult to perform on patients because of different reasons. The most common one among the patient-related issues faced during MRI is claustrophobia. By definition, it is a term used to describe a state of fear or discomfort caused by being in closed or confined spaces. During MRI procedure, it can occur because of being in scanner tube, lack of visibility of surrounding environment, strange sounds, inability to move for a long period of time, or fears regarding the possibility of leaving the room (1,2). It means that anxiety can occur in a person who was not claustrophobic before but now for the first time he/she needs to undergo MRI scan (1,3). This condition can cause unnecessary patient movements during the imaging, requests to stop the process of examination or refusal of the procedure. It can result in poor quality images that often requires re-examination, which in turn causes extra expenses and increased examination time. Compliance needs to transcend the idea of following instructions. It is influenced by the physical surroundings, the interpersonal interactions within the MRI facility, the feelings of safety and control, the length of the procedure, past experiences, and access to necessary assistance. Patient-centric compliance considering all of these aspects will not only benefit the patients but also increase the efficiency of the MRI process (3).

➢ *Claustrophobia and the MRI Environment*

MRI claustrophobia is an example of a gradient disorder where the level of fear differs from person to person. In some cases, the level of claustrophobia is mild and can be cured by counseling while in other cases the level of anxiety is so high that the patient is unable to remain inside the scanner. The MRI machine is a cylindrical tube in which the patient needs to lie still. Several features of the MRI examination may contribute to anxiety: (1,4).

- The restricted space inside the scanner bore;
- Limited ability to see the surrounding environment;
- Loud and unfamiliar gradient sounds;
- The need to remain still for multiple sequences;
- Communication with staff primarily through an intercom;
- Fear of becoming trapped or being unable to leave quickly;

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- Concern about the examination or its possible findings;
- Previous unpleasant experiences with MRI or other medical procedures; and
- Uncertainty about the duration and sequence of the examination.

Tolerance is not necessarily consistent across examinations. A patient who completed one MRI without difficulty may experience anxiety during another examination because of differences in body region, patient positioning, scan duration, or scanner design. (4).

➢ *Factors Associated with MRI-Related Anxiety*

The degree of tolerance for MRI procedures is based on three different types of factors: patient-specific factors, procedure-specific factors, and environmental factors. Considering the patient-specific factors, a history of anxiety disorders or even panic disorder becomes a critical risk factor associated with increased probability of discomfort caused by an MRI examination. In terms of factors related to MRI procedures themselves, there are several issues that contribute to increased discomfort experienced by a patient. First of all, longer scanning periods lead to increased risk of experiencing discomfort. In addition, enclosure of the patient's head and upper body in the scanner bore adds to this feeling. For anxious patients, continuous repetition of instructions and performance of certain actions becomes another difficult issue to cope with. Finally, as far as sensory factors are concerned, the presence of gradient coils leads to the production of noise sequence that is very unpleasant and unusual for the patient. In addition, the very design of MRI equipment prevents a patient from receiving much information through visual channels. Although protection against noise is usually provided, some patients might react negatively to the sounds regardless of these measures. Communications play a key role in managing anxiety. Patients who understand what is going to happen, how long will the examination take, and how to communicate with staff members; feel like the situation is predictable and manageable (4,5).

➢ *Impact of Claustrophobia on MRI Examinations*

One of the most prominent results of severe claustrophobia is an inadequate performance of the examination itself. A patient can deny entering the MRI scanner, ask to stop the procedure, or become anxious upon its beginning (1). Patient movements are yet another significant problem associated with claustrophobia. Since MRI demands a certain degree of stillness, it is very likely that the patients will experience both intentional and unintentional movements, thus causing motion artifacts, poor image quality and causing repetition of certain sequences or even the entire procedure (6). Moreover, claustrophobia can prolong the time of scanner usage since it might be extended due to reassurance, positioning, pauses, and additional sequences. Sometimes, it might happen that patients cannot perform the examination at all, which causes re-scheduling, sometimes, even sedation or replacement of the investigation itself. Therefore, the treatment of claustrophobia is essential both for the sake of patient well-being and efficient health care delivery.

➢ *Pre-Examination Screening and Identification of High-Risk Patients*

Pre-examination screening is important to in identifying patients who may experience claustrophobia during MRI examinations. Early identification of patients helps healthcare professionals take necessary precautions and plan appropriate measures before starting the procedure. Though there is no screening tool mandated within radiology pathways brief screening questions at the time of booking or check-in can help identify individuals who may have difficulty undergoing the examination. Patients can be asked about their experiences of MRI intolerance, self-reported claustrophobia, anxiety in confined spaces and any difficulties encountered during earlier examinations. In addition assessment tools such as the Claustrophobia Questionnaire (CLQ) can be used to assess fear and predict distress related to MRI examinations (7). General anxiety assessment tools, such as the Generalized Anxiety Disorder 7-item scale (GAD-7) may also be helpful in identifying patients experiencing levels of anxiety (8). However there is currently no widely adopted screening tool specifically designed to assess claustrophobia in adult MRI patients indicating a need for further research in this area (9). Furthermore information about MRI intolerance and scan-related anxiety helps radiographers and other healthcare professionals determine whether patients require additional preparation, proper counselling, alternative scanner allocation or pharmacological support. Explaining the examination procedure and addressing patients concerns before scanning may also help improve their confidence and cooperation. Therefore systematic pre-examination screening and early identification of high-risk patients are essential, for planning interventions reducing examination-related anxiety and improving the successful completion of MRI procedures.

➢ *Patient Education and Communication*

One of the easiest non-pharmacological ways to improve patients' MRI tolerance is clear and calm communication. The technologist needs to give clear explanations before the procedure, such as how long the exam will take, patient positioning, noise produced by scanner, importance of staying still, and communication process during the exam, if required. (4,5). The patient needs to know that the MRI staff can hear or communicate with him/her and also there is a way to signal the MRI staff about his/her discomfort or the need for help. Such information makes the patient feel more empowered. It is better to give practical explanations instead of technical ones. Describing the procedure step by step can help the patient prepare mentally for the procedure: lying on the table, positioning, moving inside the scanner, sounds, and the whole process of the exam. The patient should be given the chance to ask his/her questions before the procedure starts. It is important to recognize the fear of the patient during the interaction and not ignore it. Even though the procedure may seem common for the staff, it may be new and scary for the patient.

➢ *Psychological Preparation and Relaxation Techniques*

The relaxation techniques can be adopted for patients suffering from moderate to mild anxiety. Slow, deep, and gentle breathing will enable the patient to handle the stress

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response. Distraction techniques that can aid the patient to get his mind off the scanning room include progressive muscle relaxation, breathing, guided imagery, simple behavioral techniques, and mindfulness. Visual aids can be personalized for each individual. In some instances, a patient feels more at ease if he enters the bore when his eyes are closed since he cannot visualize the narrow space around him. However, other patients prefer keeping their eyes open so as to monitor their movements. Allowing them to choose might yield better cooperation. Practicing the communication cue or breathing rhythm before the scan can also help in building confidence in the patient. It is not about eliminating all symptoms of anxiety in the patient but providing practical tools for coping.

➢ *Music and Audiovisual Distraction*

Music is an example of a straightforward technique that can help some patients refocus their attention during the process of magnetic resonance imaging (MRI). During the scan, with the help of MRI-compatible headphones or earphones, not only provides music but can also be beneficial for hearing protection, depending on the device used (6). An audiovisual distraction technique can become another focus for attention. If there is compatible equipment, patients will have the chance to watch soothing or any other appropriate video during the examination. Patient's individual needs must be considered because not all people react to music, talking, relaxation techniques, or visual distraction in the same way.

➢ *Role of the MRI Technologist*

Technologists who work with MRI units are crucial in providing support to those patients who have claustrophobia. This starts before the process takes place and continues until the whole procedure is over. Calmness, confidence and empathy are factors that help reduce anxiety in patients. Anxiety and apprehension should be recognized, not underestimated. Confidence can be achieved by explaining to patients that they have access to an emergency situation and creating a plan for communication before the scan takes place. Knowing how to seek help gives patients assurance when they are feeling anxious because of leaving the scanning room (4). When it is clinically required, adding short intervals between different sequences helps patients recover their composure. Even though pauses increase the duration of the examination, they are important for obtaining good images in the future.

➢ *Wide-Bore and Open MRI Systems*

Design of the scanner may influence the level of tolerance experienced by patients. The wide-bore MRI scanners have a larger inner diameter compared to the conventional MRI scanners and help reduce the feeling of being confined while maintaining most functions of a regular MRI machine (2). On the other hand, open MRI scanners create an open physical environment and might be useful for some patients who are not able to endure a regular MRI scanner. However, the different machines have varying levels of magnetic field strength, quality of the images produced, and availability of specific scans.

➢ *Shorter and Faster MRI Protocols*

Longer examination periods might raise anxiety levels and make the patients more likely to move. Improvements in MRI scanning have enabled faster MRI procedures in certain settings. Optimization of MRI protocol can be achieved by eliminating unnecessary sequences, using acceleration strategies and ensuring that the procedure is geared towards answering the clinical questions. Shorter examinations will help improve the patients' tolerance and also cut the use of scanners but it should not come at the expense of diagnostic goal. Any accelerated or shortened protocol should be clinically indicated and supported by proven imaging practice.

➢ *Pharmacologic Management*

Medications can be used as a solution in patients who are claustrophobic and if non-medical strategies fail. The sedative or anxiolytic drugs in certain situations can help the patients to complete the MRI scanning, although such an approach is associated with other clinical implications (10,11). The pharmacologic management should be given by appropriate clinician as per the institutional policy. There may be need for increased monitoring and post-examination follow-up depending on the drug given and patient's characteristics. Moreover, the patients will need guidance on post-sedation driving and other related activities. Medications should not be the first line of treatment and non-medication approaches should be tried first whenever possible.

➢ *Virtual Reality and Emerging Technologies*

Virtual reality (VR) is one of the latest modalities that can be used in preparation for MRI among patients. In such a way, VR could help patients adapt to the scanner environment, their position, noise level, and overall process of the investigation before the actual procedure starts. This could prevent anxiety due to unfamiliarity and allows the technical staff to determine which patient need more assistance (4). Moreover, further progress in technology could be used in other ways too. The use of faster data acquisition and protocol optimization could reduce the duration of the procedure in appropriate cases, while quieter gradients and better scanner designs could make the environment less stressful. However, it would be more effective if combined with personalized patient's communication.

➢ *Recommended Patient-Centered Approach*

A management plan should be individualized based on the level of anxiety and clinical needs of the test:

- Assess the patient for claustrophobia and previous challenges during MRI scans.
- Explain the test to the patient before scanning.
- Maintain proper communication with reassurance about help that would be available.
- Use breathing exercises, relaxation, music, or other forms of distraction that work for the patient.
- Use wide-bore or open MRI machines where possible.
- Optimize or shorten the protocol wherever possible and still maintain adequate diagnostic information.

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- Allow breaks when required.
- Use pharmacological help for cases where needed.
- Record patient reactions and strategies that could help in future MRI tests

This can save time from unnecessary use of sedatives while ensuring a consistent approach.

II. DISCUSSION

MRI-related claustrophobia is an issue that is affected by many different things. These things include how a person feels psychologically the environment around them how the procedure is done and the technology used. The way someone feels anxious can be different for each person. This depends on what happened how well they can handle being in small spaces how long the scan takes and what kind of MRI they are having. The small space inside the machine the noises, not being able to see much and having to stay still for a long time can all make people uncomfortable and anxious. These feelings can make it harder for people to follow instructions. May lead to not finishing the scan having movement problems in the pictures needing to do the scan again and delays in getting a diagnosis (3–5).

One important part of dealing with MRI-related claustrophobia is understanding that there is no one way to help people feel better. The results show that teaching patients and talking to them clearly should be part of MRI procedures. Giving them details about the scan explaining how long it will take and letting them know help is available can lower confusion and make them feel more in control. The job of the MRI technician is very important here because how they talk to patients can change how confident and ready patients are to finish the scan (4,5). Also ways like relaxing, breathing exercises, listening to music or watching something on a screen can help by taking the patients mind off the environment. The success of these methods can be different for each person based on what they like and how anxious they are (6).

Another important thing to think about when dealing with claustrophobia's checking patients before the scan. Finding out if someone had problems with MRI before has anxiety or struggles with spaces can help doctors plan the best way to help. Using questionnaires. Having a quick talk about past experiences can help find people who need more help. However there is no tool that is used widely to check for claustrophobia in adults having MRI scans. This shows that more work is needed to create a way to check (7–9).

New technology has also given choices for people who have trouble with regular MRI machines. Machines that are wider or open can help some people feel less trapped.. Choosing the right machine should also take into account the quality of the pictures the strength of the magnet what the doctor needs and what machines are available. Earlier studies comparing types of MRI machines have also shown that how a person feels is important when choosing the right machine (2). Also making the scan process better. Cutting down on extra steps can make the scan shorter as long as the needed medical information is still there.

Using medicine is still an option for people who can't handle MRI scans after trying other ways. Medicine that helps with anxiety and sedation can help some people finish the scan.. These ways need the right checks watching closely and following safety rules (10,11). So medicine should be part of a plan that is made for the person, not the first choice for everyone.New and developing technology may offer ways to make the MRI experience better. Things like reality for preparing, quieter machines faster image making and better machine designs that are easier for patients to use can help lower anxiety from being in a strange place and having a long scan.. More research is needed to see if these work, especially for adults, with different levels of claustrophobia. Future studies should also look at ways to check for claustrophobia better how well different ways work together and if new machines are worth the cost. In the end a plan that puts the patient first finds problems early talks well gives support picks the right machine and uses medicine safely may help patients work better and finish the scan successfully.

III. CONCLUSION

Claustrophobia is an important factor that hinders the success of MRI and may result in refusal to go through the procedure, early termination, patient movement, image degradation, need for repeat scanning, and delayed diagnosis. This problem should be approached using both technical aspects of MRI and the psychological aspects of the patient. A pre-scanning interview, proper communication, patient education, relaxation techniques, auditory or audiovisual distractions, scanner selection, optimization of the protocol, and individualized approach are good starting points for improving patient tolerance for the procedure. Wide-bore and open MRI scanners might be a better choice for some patients, and pharmacological treatment could be used on case basis. MRI technologists have an important role in creating the proper atmosphere, communicating effectively, and helping distressed patients. A systematic and patient-oriented approach might help increase the number of completed examinations and quality images, which might eliminate the need for repeat scanning and sedation. The development of new designs of scanners, faster imaging, virtual reality, and artificial intelligence might help improve the availability of MRI and increase patient tolerability.

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