

MRI and Fear of Confined Space: A Cause and Effect Relationship

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A B S T R A C T

Magnetic resonance imaging (MRI) is an imaging modality that produces detailed images of organs and structures within the body to rule out medical diagnosis with the help of a large magnet, radiofrequencies, and a computer. During MRI examination some patients feel anxious or claustrophobic. About 30 percent of patients reported mild distress caused by the need to lie still in a confined space for a long period of time. Certainly, claustrophobia is serious and prevents many patients from seeking out a medically necessary MRI scan. The aim of this article is to highlight the potential effects, diagnosis and management of claustrophobia on the patients undergoing for MRI scan.

Key words: Magnetic Resonance Imaging (MRI), Management, Claustrophobia

INTRODUCTION

In 1946 Purcell and Bloch first describe the properties of Nuclear Magnetic Resonance (NMR), for which they received the Nobel Prize in 1952. Since then Nuclear Magnetic Resonance has become an essential tool in the analysis of chemical composition and structure. In 1973 Lauterbur and Mansfield used the principles of Nuclear Magnetic Resonance to describe a technique for determining the physical structure. Since then Magnetic Resonance Imaging (MRI) has been widely used in various chemical, biomedical and engineering applications. Three dimensional detailed anatomical images of the body can be produced with the help of MRI without using ionizing radiations. It is used for diagnosis, disease detection and treatment monitoring. It is based on the technology that excites and detects the change in the direction of the rotational axis of protons found in the water that makes up living tissues.^{1,2}

The magnetic resonance imaging room is usually a closed room that is completely isolated from the interference of an outside magnetic field and to avoid the effect of the scanners magnetic field effect over the other equipments and settings that are in nearby areas. The typical features of a closed MRI scanner as described earlier, has a great effect on the initiating the fear feeling within the patient. This feeling would be as a result of being alone in a long narrow tunnel inside a closed room for about 30 minutes and the banging noise that would increase their fear or

feeling during the scan, and this feeling would start with some patients even before they have a go with their scans. A significant number of MRI patients can develop sorts of claustrophobia and fear reactions that can reach up to 37% of MRI referrals. In most cases the occurrence of this fear will lead to what so called premature termination of the scan and according to Melendez J. and McCrank E. in 1993 this type of fear is possible between 4-20% of patients' appointments.³

Fatima Mubarak F et al conducted a study to evaluate claustrophobia rate. Claustrophobia rate was acceptable in his set up, however, it contribute to a significant proportion in all canceled exams. Claustrophobia rate was 0.53%, making 14.32% of total cancelled exams. It was more common in middle age group, females, head first exams, morning appointments and neck scans.⁴

Over 80 million Magnetic Resonance procedures are now performed each year worldwide. For an MR scan, patients have to be placed in a long, narrow tube. Thus, claustrophobia during MR imaging is a common problem. Almost 1% and 15% of all patients scheduled for MR imaging cannot be imaged due to claustrophobia or require sedation to complete the scan (mean: 2.3%; 95% confidence interval 2.0% to 2.5%). Approximately 2,000,000 MR procedures are terminated or cannot be performed due to claustrophobia worldwide. At an average cost of € 500 per MR imaging, which is equal to a loss of productivity of € 1 billion, proves to be a big

financial loss for the health care system.⁵⁻⁷

WHAT IS CLAUSTROPHOBIA???

According to the “MedicineNet.com” world web wide site, Claustrophobia can be

Defined as: “An abnormal and persistent fear of closed spaces, or being closed in or being shut in, as in elevators, tunnels, or any other confined space. The fear is excessive (and quite common).” The person who has such feeling is called “claustrophobic”.³ Claustrophobia is an anxiety disorder affecting 15% to 37% of the population across the globe. The word claustrophobia is derived from a Latin word *claustrum* which means ‘a shut in place’ and a Greek word *Phobos* meaning ‘fear’.⁸ Claustrophobia is defined as a ‘fear of enclosed spaces’.¹¹ However, more recent approaches for understanding claustrophobia have suggested that the phobia comprises of two separate fears: a fear of suffocation which refers to the fear of losing oxygen in confined space and a fear of restriction which means the patient has fear of being trapped in a confined space.⁸ Claustrophobia is anxiety in situations with confined freedom of movement. It is common during MR scanning because of the enclosed nature of cylindrical whole-body MR scanners.^{9,10}

Sometimes traumatic event experienced during early childhood can be a major predisposing factor for claustrophobia. For example, adults may develop claustrophobia during MR procedures if, as a child, they have faced following events:

- Being trapped or kept in a confined space.
- Being bullied or abused.
- Parent suffering with claustrophobia.

Unpleasant experiences can also trigger claustrophobia, such as turbulence while flying or being stuck in a tube tunnel between stations.

A child growing up watching parents suffering from claustrophobia may also develop it, by associating confined spaces with their parent's anxiety and feeling helpless to comfort them.¹²

A study was conducted in a tertiary care center by Mubarak F et al. enrolling a total of 98,966 consecutive patients referred for MRI over eight years.

In all 98,966 consecutive patients, claustrophobia was determined to be present by one physician and he concluded that claustrophobia reactions in consecutive groups of patients scheduled to undergo MRI and found that a relative high rate of claustrophobia is present and better screening and patient counseling can reduce the incidence of claustrophobia.¹³

FACTORS THAT CONTRIBUTE TO ANXIETY DURING MRI

There are many factors that contribute to distress experienced by certain patients undergoing MR procedures.

The most common concern is regarding the physical environment of the MR system. The anxiety associated with the underlying medical problem necessitating the MR examination is also well documented. Individuals, such as those suffering with psychiatric illnesses are predisposed to such distress to a greater extend.

PHYSICAL ENVIRONMENT OF THE IMAGING SYSTEM

The physical environment of the MR system is an important source of distress. Sensations of apprehension, anxiety, fear, tension, worry, claustrophobia, and panic attacks have been directly attributed to the confining dimensions of the MR system. (Figure: 1) The other distressing sensations that attributes to the MR environment includes the prolonged duration of the examination, the acoustic noise, humidity and temperature and the stress related to restriction of movement within the MR system. Additionally, the patients can a feeling of sensory deprivation being inside the scanner, which is also known to be a precursor of anxiety states.

MEDICAL ISSUES

Patients suffering with pre-existing psychiatric disorders may be at a higher risk for experiencing distress in the MR environment. Thus the patients with pre-existing conditions should be identified prior to MR examinations and proper anxiety-minimizing efforts should be taken. Patients with other psychiatric illnesses such as depression and any illness complicated by thought dysfunction, such as manic-depressive disorder or schizophrenia, may also be at a potential risk for distress in the MR environment

Under normal conditions even a psychiatric patients can tolerate the MR environment without any problem but fear of medical illness or underlying medical issues can exacerbate their psychiatric symptoms to such an extent that they may face problem in complying with MR procedures.



Figure-1: MRI machines open type

PSYCHOLOGICAL REACTIONS

In some cases the examination may be perceived by the patient as a “dramatic” medical test with an uncertainty of outcome, such that the fear of presence of disease or other condition. This can often lead to adverse psychological reactions which are sometimes associated with MR procedures.¹⁴

FACTORS TRIGGERING OF CLAUSTROPHOBIA

The following situations can trigger claustrophobia:

- Lifts.
- Tunnels.
- Tube trains.
- Revolving doors.
- Public toilets.
- Cars with central locking.
- Car washes.
- Shop changing rooms.
- Hotel rooms with sealed windows.
- Planes.

If the patient has felt anxious during the last six months about being in a confined space or crowded place, or avoided these situations for this reason, then there is probability of the patient being claustrophobic.¹²

SYMPTOMS OF CLAUSTROPHOBIA

The first symptom of a patient being claustrophobic is ‘panic attacks’ along with the other two key symptoms:

1. Fear of suffocation.
2. Fear of restriction.

If an individual have a fear of losing oxygen in the confined space then it is known as fear of suffocation and if suffers from the phobia of being trapped in a confined space then it is known as fear of restriction. Anxiety levels are aggravated by panic attacks and in turn triggers many symptoms such as:

- Sweating.
- Trembling.
- Hot flushes or chills.
- Breathlessness.
- A choking sensation.
- Tachycardia.
- Chest pain.
- Tightness in the chest.
- A sensation of butterflies fluttering in the stomach.
- Nausea.
- Headaches.
- Dizziness.
- Numbness.
- Dry mouth.
- A need to go to the toilet.

- Ringing in your ears.
- Feeling confused or disorientated.

If the person has severe claustrophobia, they may also experience psychological symptoms such as:

- Fear of losing control.
- Fear of fainting.
- Feelings of dread.
- Fear of dying.¹²

DIAGNOSIS OF CLAUSTROPHOBIA

If the person experiences some symptoms like panic attacks or fear of being trapped inside a particular place, then they should consult their general physician regarding this. The doctor may ask the person to describe the symptoms, which he or she experienced and also will analyze whether they are suffering from any other type of anxiety disorder.

The following methods are used to diagnose claustrophobia:

Claustrophobia Questionnaire: A hypothesis was given which stated that claustrophobia is comprised of two distinct but related fears--the fear of suffocation and the fear of restriction. An earlier version of the CLQ was developed to test this hypothesis. The scale helped to assess patients undergoing the magnetic resonance imaging (MRI) procedure and in participants with panic disorder.

It was developed in 1993 and was modified in 2001. It included 12 items assessing three mood dimensions such as valence: good mood, bad mood; alertness: awake, tired; calmness, nervous). It determines whether the patient's anxiety is driven by a fear of suffocation or restriction.

Claustrophobia Scale: It was developed in 1979 and consists of 20 questions that help in assessing the anxiety levels. It tends to be an effective method of diagnosing claustrophobia.⁸

MANAGEMENT OF CLAUSTROPHOBIA

There are following techniques that can be used to reduce the claustrophobia in cases of MRI scan:

1. Cognitive behavior therapy.
2. Relaxation therapy.
3. Open MRI machines.
4. Herbal preparations.
5. Pharmacological therapy.

1. Cognitive Behavior Therapy:

This approach involves learning to control the thoughts that occur when confronted with the fear-inducing situation in such a way that it changes patient's reaction towards MR procedure. In this therapy the patient is exposed to the anxiety inducing situation at a gentle pace.¹⁵

2. Relaxation Techniques:

Relaxation and stress relief techniques are frequently used in conjunction with other therapeutic approaches. But this technique is often enough to relieve the stress of claustrophobia by themselves. A good relaxation technique can simply be the way which guides the patient to control their breathing. When the time comes during the MRI procedure that the patient start to feel a little stressed, guide them to breathe in through nose and out through your mouth.. Try to breathe in while counting in head until reach 10. Then do the same thing while breathing out making all the way to ten. If the person has accomplished that, then work on counting slower and slower each time, slowing down the breathing as much as you can.¹⁵ Another well known relaxation technique is hypnosis.

As recognized by the Brazilian Federal Council of Medicine hypnosis is a valuable clinical practice for diagnosis or treatment. Although hypnosis, being a state of deep relaxation can be induced even in patients who are moderately susceptible to this technique, with the physiological alterations resembling natural sleep.

During MRI examination the application of hypnosis in anxious or claustrophobic patients provides a marked reduction in the risks inherent to anesthetic procedures, besides saving in the costs of drug and materials required for such procedures.

Velloso L.G.C. evaluated the efficacy of hypnosis for management of claustrophobia in patients submitted to magnetic resonance imaging and he concluded that hypnosis is an alternative to anesthetic sedation for claustrophobia patients who must undergo magnetic resonance imaging.

3. Open MRI Machines

The three type of open MRI machine available are as followed:

A. Semi open high field MRI scanners: These types of scanners have an ultra short bore (tunnel) and widely flared ends. For example during hip examination in this type of MRI systems, patients lie with the head in the space outside the bore.

B. Open low field MRI machines: These MRI machines provide a wide open design, for example an open C-arm scanner has a shape like two large discs separated by a large pillar. It provides a wider range of positions as patients have an open sided feeling and more space around them.

C. Advanced open MRI scanners: These MRI machines are equipped with high field strength, latest gradient technology and wide open design. It is possible to take scan of patients even in weight-bearing or upright postures, other positions including sitting or even standing with nothing in front of them.¹⁴

4. Herbal Preparations

Since a long time natural herbal medicines have been recommended as a way to treat to reduce claustrophobic anxiety. Two in particular are passionflower and kava. North American Natives used passionflower effectively as a sedative. Passionflower and kawa can be consumed in the form of tablets, capsules, teas or tinctures.¹⁴

5. Pharmacological Therapy

The drugs prescribed in the pharmacological therapy to relief claustrophobia or anxiety simply suppress the symptoms for a period long enough to get through the MR procedure. The ideal sedative drug that alleviates severe anxiety and/or claustrophobia in MRI has not to been identified yet. A potent and highly selective- 2 adrenergic receptor agonist, Dexmedetomidine (Precedex® Hospira, Illinois, USA) has efficient sedative and analgesic properties with a distribution half -life of about 6 minutes and a terminal half-life of about 2 hours.

FDA approved new indication for dexmedetomidine, expanding its use for sedation in non-incubated patients in a monitored setting for surgery and other procedures. Rai V. et al conducted a study to determine dexmedetomidine as a sedative agent alleviates claustrophobia. He finally concluded that Dexmedetomidine is a potent sedative that can allow patients with anxiety and/or claustrophobia to undergo MRI scanning successfully in a large proportion of the population suffering with anxiety.¹⁷

ELEVEN STEPS TO ALLEVIATE CLAUSTROPHOBIA DURING MRI

In cases of examination of MRI of lumbar spines, cervical spines, shoulders, brain, abdomen, pelvis or MRI chest require the patient being centered in the middle of the MRI scanner bore. The following eleven steps can be followed to alleviate the claustrophobia during MRI scan:

- 1. MRI Pre-Screen Appointments:** Directly ask questions to the patient about their claustrophobic condition. To set a pre-screen appointment for such patients and make them aware about the entire MRI procedure. The series of events, expectations, answer questions and the results should be discussed with the patient calmly and patiently. Not to rush while talking with the patients.
- 2. Refrain from All Stimulants:** The patient should refrain from coffee, teas and high sugar items at least 24 hours prior to the examination.
- 3. Claustrophobic exercise test:** The patient with appointment within the next few days should be advised to perform a personal test for a claustrophobic exercise while lying in the comfort of their bed at home. Ask them to put a dry washcloth over their eyes, and lie there for a few minutes, imagining they are inside the MRI scanner. "Feel" when they have this experience in their own home comfortably.

4. Listening favorite soothing music: These days most setups have MRI compatible headphones for music, along with CD and music systems. Though some cervical spine MRI hardware and even some brain MRI hardware will not allow room for headphones to be worn during the examination. If headphones are not permitted, reassure the patient that they will be provided with earplugs during the examination.

5. Sedation: The sedation orders should be prescribed by the referring physician so the patient can collect the drug from a pharmacy prior to their exam. The patient should have a driver to drop them home after their examination.

6. Table test run: The patients undergoing MRI for the first time, may experience claustrophobia in their first attempt to go inside the scanner. An experienced technologist will understand this situation and can help the patient to go through this experience.

Once the patient has cleared the MRI screening process and is comfortable and prepared for the MRI exam, make the patient comfortable onto the MRI table, and turn on the internal MRI bore fan and lights. Explain the patient about the “test run” where they are sent into the scanner bore, and then brought out immediately. Later discuss with the patient about their experience in that short “test run”. If the patients express any tension or troubling dialogue, either try the dry run again, or discuss further sedation options with the patient.

If the patient felt uncomfortable with the first dry run, discuss further about their experience. Talk to the patient calmly about others experience that first feeling of anxiety, but just as many absolve it with each time they go through scan. In respect of the dry run a positive response of the patient shows the comfort and trust towards the individual technologist.

Take prior permission of the patient before moving them into the bore. Once they have been placed in the center location, bring them out again immediately.

In case it's necessary, take time to work with the patient, moving them into and out of the MRI gantry bore several times. If the experience gets better with repeated dry runs, next give them a washcloth over their eyes, which psychologically fools the brain, but they are still aware of being inside the scanner. Do this without immobilization or hardware.

At one point of this experience, the technician will understand whether the personal coaching is making a successful difference in getting the patient through their MRI exam or not.

7. Encourage either a friend or family member to accompany the patient. In ideal condition this friend or family member could accompany the patient into the MRI exam room and hold the hand (or the leg) of the patient while they are inside the MRI bore of the magnet.

8. The “Call Button”: Inform them that they are nearby at the operator’s console and immediately available as they press the “call button”. The term “Panic ball” or “panic button” should not be used during discussion with the patient.

9. Talk to the patient in between the sequences, or each series of pictures, and enquire how they are doing between each set of images. Inform them about the time frame for the next set of images, and remind them to hold as still as possible for the best image quality. Only begin the next sequence after being approved by the patient.

10. Remind the patient while giving the call button that they are always in control. Assure them if they press the call button, then they will be immediately removing them from inside the MRI scanner.

11. Respect and trust between the technologist and the patient is an essential parameter for any radiology study and even more important is the doctor’s help to alleviate claustrophobia during the MRI scanner. These factors will not eliminate the ultimate fear experienced by those who are completely claustrophobic, but these are a series of suggested actions which may help minimize the fear of claustrophobia that many patients experience.¹⁸

CONCLUSION

During MRI imaging the patient is lying down in large tube that produces the picture of the body part that is not amicable to radiation. One in 6 patient suffer from claustrophobia in MRI machine n cannot go through MRI scan due to the same. To overcome this problem various management therapies have been developed so that the patient then gets relief of their fears before n during MR procedure.

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