

ORIGINAL ARTICLE

Association of Claustrophobia in Patients Referred for MRI with Premature Termination of Examination and Limited Study Acquisition: A Cross-Sectional Study in Rawalpindi City

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ABSTRACT

Objective: To find the association of claustrophobia with premature termination of examination or limited study acquisition in Magnetic Resonance Imaging examination.

Study Design: A cross-sectional study.

Place and Duration of Study: The study was conducted in the Department of Magnetic Resonance Imaging (MRI) at Pak Emirates Military Hospital (PEMH) Rawalpindi, Pakistan from August 2022 to February 2023.

Methods: Patients were asked to fill out a self-made claustrophobic questionnaire. Data regarding premature termination and limited study acquisition was taken from a magnetic resonance imaging technologist. Data was analyzed by using 26 version of the Statistical Package of Social Sciences (SPSS). Relative frequencies of quantitative variables were calculated. *P* value was calculated by using *Chi-square* analysis.

Results: The frequency of the claustrophobia was 6% (9 out of 150). Around 2.7% of male patients were claustrophobic while 3.33% of female patients were noted to be claustrophobic through the claustrophobic questionnaire. The incidence of premature termination of Magnetic Resonance Imaging examination was noted in 4.67% while 1.33% was included in limited study acquisition.

Conclusion: Conclusively, the termination rate was high in the claustrophobic cases which can cause the loss of resources so a prescreening may be advised to the cases for proper utilization of the Magnetic Resonance Imaging and time of the consultant.

Keywords: Acquisition, Claustrophobia, Incidence, Premature Termination.

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Introduction

Claustrophobia can be defined as a fear of confined and enclosed spaces (claustro: closed, phobia: fear). There are two factors that lead to claustrophobia known as restriction and suffocation factor. In restriction factor, people feel a sense of entrapment

with restriction of movement. In the suffocation factor, claustrophobia induces experimental neurosis. The expression of this fear is in the form of either anger or disgust, danger of harm, or physical symptoms. The suffocation factor is an intense component and is interpreted as a grave threat. The places that trigger claustrophobia include tunnels, revolving doors, tube trains, lifts, and public toilets. Moreover, shop changing rooms, cars with central locking, car washes, hotel rooms with sealed windows, and planes can also induce claustrophobia in certain people.¹

Magnetic Resonance Imaging (MRI) has emerged as one of the most advanced imaging and diagnostic tools which is effective in visualizing soft tissue pathology often in the sub-millimeter range. MRI characterizes the anatomy and pathology of the

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body with excellent contrast for tissues and proposes the least hazard of ionizing radiations. Only in United States of America, about 39 million MRIs are performed each year. There are some disadvantages associated with MRI, one of which is lengthy scan duration due to time-consuming protocols. The patient is required to remain motionless in the bore of magnet for extended period. The major cause of refusal from patients and failed MRI is tunnel like bore of a magnet used in MRI.² There is also some misconception among patients regarding MRI that like other modalities which use ionizing radiation, MRI also causes cancer and other somatic diseases. Moreover, family and friends of claustrophobic patients do not refer them to qualified health professionals regarding their fear instead school them for their behavior.³

The prevalence of claustrophobia differs in different studies and ranges from 1-15%. A study showed the prevalence of claustrophobia to be 1.97% while another showed the refusal rate to be 4.2%. Claustrophobia is a major impediment in the way of a successful MRI examination as even the best and highest quality scanners cannot achieve high-quality results if patient is uncooperative or claustrophobic. MRI imposes spatial restriction with noisy scan acquisition. Claustrophobia in MRI results in premature termination of examination which means patient is not able to perform an exam or limited study acquisition in which only main and important sequences are performed in a limited time. Repetitive acquisitions can affect the revenue and profit of MRI facilities. Different studies have shown that even a minor claustrophobia of 2% can cause a significant loss in profit. Shortness of breath, shivering, shaking, burning sensations or chills, a choking experience, a rapid heartbeat (tachycardia), chest discomfort, headaches, and dizziness, as well as other symptoms like feeling faint, tingling or pins and needles, dry mouth, reverberating in the ears, and a sense of disorientation and loss of control, are all physical manifestations of claustrophobia. Fear of losing control, fear of fainting, dread, and fear of dying are among the psychological symptoms.⁴

To deal with claustrophobia, sedation or relaxation therapy is used which has its own drawback as it can impede the normal workflow as well as wastes

valuable time in monitoring and evaluation. In general, 2.3% of patients require sedation to complete their MRI exam. In some of the patients, MRI exam results in premature termination⁴. Evolving technology can be a solution for claustrophobia as short bore magnets impose more claustrophobia than large bore magnets. The proposition of open MRI facility is also a solution of claustrophobia. Cognitive Behavioral Therapy (CBT) can also prove effective in phobias. Educating patients about their scan procedure, machine and duration is so far the most effective technique to avoid claustrophobia.⁵ Self-hypnosis reduces chance of claustrophobia by 50% in high-risk claustrophobic patients.⁶ Pre-scan communication not only increases the scan completion rate but also positively affects the patient experience. Claustrophobic Questionnaire is an excellent tool for identification of claustrophobic patients even before the procedure.⁷

This study will help to know the number of patients with claustrophobia consequently helping the radiographers, staff and facility to adopt the methods to avoid unpleasant events due to claustrophobia. It will help reducing the repetitive acquisition and need of sedation adding to the profit of institute. It will save the time and energy of radiographer to educate and relax the patient in the middle of the scan. It will help decrease scanning and waiting time. It will also increase patient's outflow. Implementation of a claustrophobic questionnaire will help in recognition of claustrophobic patients beforehand and suggest them to open MRI or relaxation therapy accordingly.

Methods

The study was conducted in the Department of Magnetic Resonance Imaging (MRI) at Pak Emirates Military Hospital (PEMH) Rawalpindi, Pakistan from August 2022 to February 2023. Cross-sectional descriptive research methodology with a sample size of 150 consecutive patients was used in the study. Non-probability consecutive sampling technique was used for the study. Both male and female patients in age group 10 to 80 years with MRI advised were included. Analyses based on patients were conducted; i.e., patients coming for follow-up were excluded to avoid overestimation of claustrophobia.

Pediatric population and semi-conscious patients, patients with incomplete request forms, clinical data or unclear data, and known claustrophobic patients advised for open MRI were excluded.

Data was collected after approval of the synopsis from the Ethics Review Committee of the hospital vide IERB approval certificate no: 11 held on dated: February 15th, 2022. Performa was designed to obtain all demographic variables (age, gender, and admission numbers. Informed consent was taken from the patients. After that the Detailed claustrophobic questionnaire (CLQ) based on 04 different anxiety levels was filled out by the patients and study status was noted which was either complete study or premature termination and limited study acquisition. Premature termination of examination means the patient was not able to perform an exam and in limited study acquisition, only main and important sequences were performed in limited time. After the collection of data comprising 150 patients, the data was entered into SPSS for analysis. My scale adhered to the international standards of reliability. For the sake of collecting normative data, participants (n=14) who reported being extremely concerned or afraid of enclosed places were categorized as claustrophobic. The data was entered in IBM SPSS 26 for statistical inference. The descriptive data for numerical variables were presented as mean and standard deviation (SD), while categorical variables (Gender, age, and claustrophobia) were expressed in frequencies and percentages. A 95% confidence interval was used, with a *P*-value of ≤ 0.05 considered significant.

Results

The bar graph is plotted between the count of patients and study status. Study status was divided into three values. Out of 150 patients, 141 patients were able to successfully complete their examination without showing the signs of claustrophobia. On the other hand, 1.33% patients were unable to complete examination and the study had to be aborted with some basic and essential protocols. This limited study acquisition included 2 out of 9 claustrophobic patients. Contrarily, 7 patients out of 150 were unable to continue examination and the study was abruptly ended by

default. This premature termination of Magnetic Resonance Imaging (ptMRI) executed about 4.67%. (Figure.1)

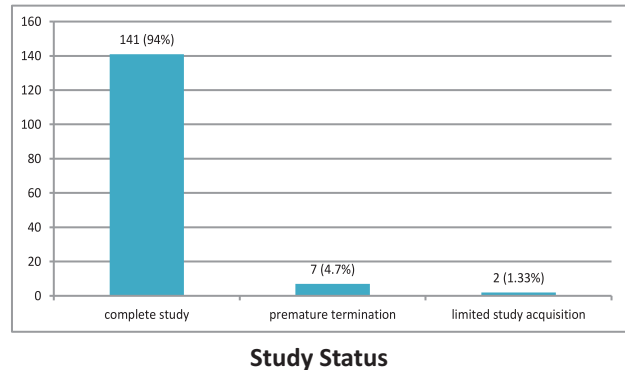


Fig.1: Bar Graph showing the association of claustrophobia with study status

A Pearson *Chi*-square test was conducted to assess the relationship between Study Status and Claustrophobia/normal. The result was statistically significant, $\chi^2 (2, n = 150) = 63.75, P < .001$, suggesting a strong association between the variables. However, 50% of the cells had expected counts less than 5, with the minimum being 0.12, which violates the assumptions of the test. Therefore, these results should be interpreted with caution. A Likelihood Ratio test also showed significance, $\chi^2 (2, n = 150) = 27.91, P < .001$. Additionally, the Linear-by-Linear Association test indicated a significant linear trend, $\chi^2 (1, n = 150) = 49.88, P < .001$. (Table-1).

The bar graph showing the percentages of claustrophobia in male and female patients depicts that female have slightly more claustrophobia than male patients. 3.33% (5 out of 9) of female patients showed claustrophobic symptoms while only 2.67% (4 out of 9) male patients visiting MRI facility were considered claustrophobic. 69 male and 72 female came out to be normal. (Figure.2)

The bar graph shows that the maximum percentage of claustrophobia was shown among the patients were of age group 10-20, exhibiting 2.67% (4 out of 9). Age group 20-30 showed the claustrophobia of 2% (3 out of 09). While age group 60-70% showed the claustrophobia of 1.33% (2 out of 9). Contrarily, the study depicted no claustrophobic patients in age groups 30-40, 40-50, 50-60 and 70-80. Normal patient frequency of these age groups was 16, 40, 25, 10, 28, 11, and 11 respectively. (Figure.3).

Table-1: Chi-square value for association of the claustrophobia with the study status

	χ^2	df	P-value
Pearson Chi-square	63.746 ^a	2	.001
Likelihood Ratio	27.905	2	.001
Linear-by-Linear Association	49.878	1	.001
n of Valid Cases	150		

3 cells (50.0%) have expected count less than 5. The minimum expected count is .12

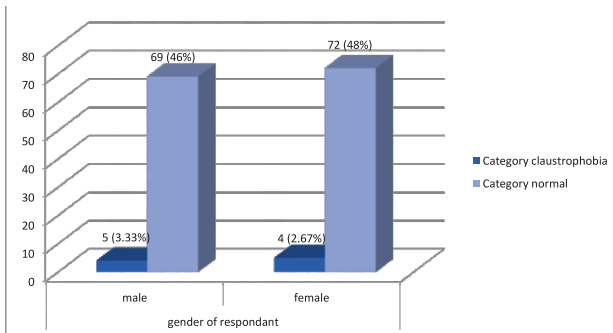


Fig.2: Bar graph showing the association of claustrophobia with the gender of the respondents

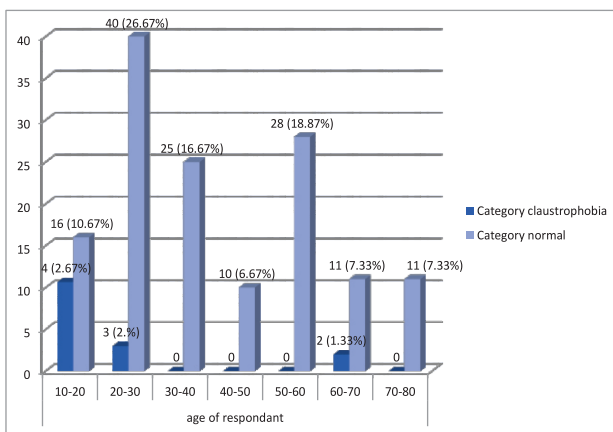


Fig.3: Relation of claustrophobia with age

Discussion

Claustrophobia presents serious problems for patients undergoing Magnetic Resonance Imaging (MRI) exams, affecting scan completion rates and patient comfort. The necessity to comprehend the frequency and treatment of claustrophobia in MRI settings has been underscored by recent studies.

MRI patients encountered a 6% incidence of claustrophobia in our study using MRI machine of 1.5 Toshiba and 3T GE, which is higher than the lower rates observed in other investigations. A systematic review by Madl JEM et al. found that, among different MRI settings, the average premature termination rate for claustrophobia or panic attacks

was 2.1%.⁸ This disparity points to the possibility of variation in patient demographics or procedural parameters impacting claustrophobia incidence. Our findings show that female patients have higher rates of claustrophobia than male patients, which is consistent with previous research. Similar findings were made by Zaidi SAR et al. who observed that claustrophobia was more common during MRI scans, especially in female patients having head and neck exams.⁹ The significance of customized therapies based on patient characteristics is highlighted by this demographic trend.

Similarly, in another study performed in Karachi, 76,254 MRI patients were evaluated over the course of eight years, and 471 (0.53%) of them were found to be claustrophobic, resulting in the cancellation of 14.32% of the scans. Females, middle-aged adults, head-first exams, morning shifts, and head and neck scans were associated with higher rates of claustrophobia. Pediatric groups had a 0.13% claustrophobic rate, whereas adult groups had a 0.58% rate. The incidence was 0.6% for females and 0.5% for males, with head and neck scans having the highest frequency (0.6%). These results emphasize how crucial it is to manage MRI-related claustrophobia by taking procedural and demographic factors into account.¹⁰ It has been demonstrated that MRI equipment innovations, such as bigger bore scanners, reduce claustrophobia incidents. According to Napp AE et al., claustrophobia rates with contemporary scanners are much lower than with traditional machines, highlighting the importance of equipment design for patient comfort and scan completion.¹¹

While the results of our study corroborate earlier research on gender differences and the advantages of Diazepam, the observed 6% incidence of claustrophobia differs from the 9.8% found in a

related study.¹² Variations in study demographics, geographic locations, or therapeutic methods could be the cause of this disparity. Subsequent comparison studies may investigate these characteristics in further detail to clarify their impact on the prevalence of claustrophobia.

Another study concluded that the patients evaluated using the most modern scanner had a considerably lower rate of claustrophobic reactions (93 out of 12,736 patients; 0.7%) than those examined using a traditional MR scanner (911 out of 42,998 patients; 2.1% $P < 0.001$). Claustrophobia rates on the two scanners differed by 1.4% (95% CI, 1.2-1.6%) in absolute terms.¹³

Further studies ought to investigate other variables, such as patient anxiety profiles and differences in MRI protocols that may be influencing claustrophobia rates. Comparative studies between various patient groups and environments will yield important information about how to best manage claustrophobia in clinical settings.

In summary, our research adds to the expanding body of knowledge about MRI-related claustrophobia by shedding light on technology developments, pharmacological therapies, and demographic trends. Healthcare professionals might customize strategies to improve patient comfort and optimize MRI scan outcomes by incorporating our findings with current investigations.

Conclusion

This patient-based analysis of the incidence of claustrophobia associated with MRIs and the subsequent premature termination of examination suggest claustrophobic reactions continue to be an issue and cause significant hindrances in MRI examinations.

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Conflict of Interest: The authors declare no conflict of interest.

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Authors Contribution

AK: Idea conception, study designing, data collection

SK: Idea conception, data analysis, results and interpretation, manuscript writing and proofreading

ND: Study designing

LZ: Data analysis, results and interpretation

BN: Idea conception

ZA: Study designing, data collection