ASSESSMENT OF PATIENTS' KNOWLEDGE, PERCEPTION AND SAFETY REGARDING MRI SCAN.

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ABSTRACT

Introduction: we presume that the knowledge of patients about Magnetic Resonance imaging (MRI) scan is of utmost importance for smooth workflow, patient comfort, patients' safety and to mitigate patients' compliance and save valuable scan time. Therefore, the purpose ofthis study was to determine the awareness of patients undergoing MRI scan regarding Knowledge, Perception and Safety.

Methods: This descriptive cross-sectional study was carried out in Chitwan Medical College Teaching Hospital from April to September, 2018. Total of 310 patients referred to undergo MRI scan were assessed by a questionnaire form covering 4 parts: Part 1- aimed to gather the socio demographic data such as age, sex, occupation and educational status of patients, Part 2- included the knowledge regarding MRI and its safety, Part 3- comprised the patient perception before MRI scan and Part 4 constituted the patient perception after MRI scan.The form was filled by an investigator oneself in a face to face interview with the patients.

Results: Among 310 patients, 35.2% were illiterate and 19.4% graduated from high school. Majority of 85.5% patients answered that MRI uses harmful ionizing radiation like CT scan and radiography. Almost 43 patients who answered MRI functions in disease treatment also answered decreased in pain after MRI scan (Male = 15 and Female = 28) were in age group between 25 years and 50 years. This study also revealed that majority of 26.8% (i.e. n = 83) patients faced problem as claustrophobia along with anxiety during the scan, out of which 13 patients have history of previous MRI scan.

Conclusions: In our study decrease in pain was higher in diagnosis and treatment answer. Majority of the patients faced anxiety along with claustrophobia during the MRI scan. Assessment of patient knowledge, perception and safety regarding MRI scan can be the key to increase patient compliance and save valuable scan time.

Key words: Assessment, knowledge, Magnetic resonance imaging**,** perception, safety

INTRODUCTION

Magnetic Resonance Imaging (MRI) is one of the most advanced imaging modalities currently available in radiology department.MRI suite is an area where safety precautions should be administered all the time due to the ferromagnetic nature of the equipment and the strong magnetic field it uses in its operations.[1]Studies have showed small negligence in following safety protocol have resulted to dreaded accidents.Woefully, it took the tragic loss of a patient's life in a New York hospital to bring the topic of MRI safety, and safety in the MR imaging suite into attention.[2]Hence, American College of Radiology (ACR) has developed safety guideline to be followed before taking patient for MRI scan. They have developed template that is intended to be followed by MR facilities in the progress of MR safety program.[3] In addition to the risks to

patient, it is also important that the patient should be informed about the potential effects (noise exposure, table movement, Peripheral Nerve Stimulation(PNS), heat generated etc.), MR room environment and the approximate duration of MRI scan. It usually takes long duration to complete scan compared to Computed Tomography (CT) which is approximately 30-60 minutes depending on the type of scan.[4] Furthermore, patient needs to remain still and follow breath holding advice depending on the scan type.

In the context of Nepal, MRI safety is even more important as illiteracy rate is high and is a relatively new imaging modality that we are getting used to. That may be the reason why MRI safety issue has received much attention in recent years. CT and X-Rays has been in use for a long time and it is feared that patient may assume these modalities and MRI safety protocol similarly. All the department personnel who operate the machine should be well educated about safety protocol prior to letting them handle the cases independently. In addition to this, patient may take MRI as if for disease treatment rather than diagnosis procedure. Therefore, it has been a great puzzle to be solved whether MRI diagnose or treats diseasefor the patients undergoing MRI scan. Similarly, if patient and health care provider both are not timely alert; variety of foreign material (metal implants, pacemakers, pins, screws etc.) which may be intentionally and unintentionally present in patients' body can be fatal when exposed to MR strong field area. Researches showed magnetic resonance imaging during pregnancy is generally thought to be safe for the fetus, especially in the second or third trimester.[5, 6] Various concerns havebeen expressed about the safety ofMRI exposure in the first trimester, due to the heating of sensitive tissues by radiofrequency fields and exposure to the loud acoustic environment for undergoing MRI during early pregnancy.[7, 8, 9]

Nowadays, MRI is used in routine daily radiological procedures.There are numerous systemic or focal disorders requiring MRI in the diagnostics. MRI has a very wide usage spectrum from head to toe, such as cranial, cervical, spinal, extremities, abdomen MRI, with newer developing pulse sequences.[10]The narrow bore,high pitch loud noise and the long scan duration will cause patient to have a wide range of emotions relating to scan.In utmost cases, scans may need to be terminated or patients may refuse to have the scan and sedation may need to be used. This situation hinders departmental workflow, reduces patient compliance and wastes valuable scan time.[11]Furthermore,the way patients experience health management is largely reliant on the attitudesand actions of the health care professionals they encounter. In addition to this, patient being scanned rely on radiographers[12] to provide reinforce,care and communication required to make it through the scan. Thus, by being abrupt, terse, or inattentive, radiographers can negatively impact the experience of the patient. Specifically, entering the bore of an MRI scanner can be associated with several reactions, with patients reporting feelings of abandonment or disorientation. This emotional discomfort can increase the likelihood that patient may move during the scan period, resulting in motion artifacts which may blur image interpretation or even lead to retakes or aborted exams.Thus,motion artifacts havebecome the cause of repeated sequences.[13] The repeated sequences can also create a cascade effect, resulting in increasing delays throughout the day and decreased patient throughput.

In addition to this, when patients enter into the scan room then it becomes the responsibility of technologist or other health care providers to make positive impact on scan experience of the

patient once scan is completed. Patients who have been scanned in MRI previously may have good, bad or worse experience while undergoing scan for the second time i.e. some of their problems may triggered because of previous scan experience while some of them may also feel nothing changeable. That is why, adopting a holistic approach like asking patient perception before and after scan, patient-technologist intercommunication, etc. towards making their scan experience better, may be the key to mitigate patient distress and its potential consequences.

METHODS

This descriptive cross-sectional studywas carried out in Chitwan medical college teaching hospital (CMCTH). The study was conducted from April 1st to September 25th, 2018 in Chitwan medical college teaching hospital, Nepal. All the Patients undergoing MRI scan were included and emergency and ward patients were excluded, since they were unstable. Random sampling technique was adopted to select the patients undergoing MRI scan. Self-administered questionnaire form was designed after reviewing a number of literatures related to this study. The questionnaire had four parts including 14 questions. Questions of part 1 aimed to gather the socio demographic data such as age, sex, occupation and educational status of patients. Questions in part 2 included the knowledge regarding MRI and its safety. Questions in part 3 comprised the patient perception before MRI scan. Questions in part 4 append the patient perception after MRI scan.The questionnaire form was filled by the researcher herself in a face to face interview with the patients.

RESULTS

The findings of the study are presented into five parts. They are Socio demographic characteristics of the patient, knowledge regarding MRI and its safety, patients' perception of MRI scan, association between knowledge regarding MRI and its safety and socio demographic characteristics of patient and association between knowledge regarding MRI and its safety and patient's perception of scan.

In this study, there were 310 outpatients (149 male and 161 female) with mean age 40.09 ± 13.22 years, maximum 65 and minimum 17.There were 54(17.4%) patients in ≤25year age group, 181 in(25-50) years followed by 75 in 50-75 year age group.The maximum number of the patients were in the category of domestic occupation 124, followed by labor 32,business 65,employee 48 and student 41 respectively.Most of thepatients were illiterate and graduated from high school (+12) i.e. 109 and 60. Whereas, master's, graduated from primary school, graduated from secondary school and graduated from university were5, 56, 58 and 22 respectively.Among 161 female patients, majority(n=110) were in the domestic occupation. Meanwhile, maximum numbers of male patients were in the occupation of employee, labor, business and student which follow the order as (n=30), (n=20), (n=58) and (n=27) respectively.

Table 1: Socio – demographic characteristics

Age group of patients	Frequency	Percent
<25	54	17.4
25-50	181	58.4
50-75	75	24.2
Total	310	100.0

Occupation	Frequency	Percent
Employee	48	15.5
Labor	32	10.3
Business	65	21.0
Domestic	124	40.0
Student	41	13.2
Total	310	100.0

Gender	Frequency	Percent
Male	149	48
Female	161	52
Total	310	100

Educational status	Frequency	Percent
Illiterate(upto1 class)	109	35.2
Graduated from primary school(upto7 class)	56	18.1
Graduated from secondary school(SLC)	58	18.7
Graduated from high school(+12)	60	19.4
Graduated from university(bachelor)	22	7.1
Master's	5	1.6
Total	310	100.0

Knowledge regarding MRI and its safety

Radiography and CT scan uses harmful ionizing radiation while MRI uses non-ionizing radiation and therefore is not harmful. It was resulted that out of 310 patients, majority of patientswho answered MRI uses harmful ionizing radiationwere 85.5% (n=265) while, 8.4% (n=26) reported that MRI do not uses ionizing radiation and therefore safe. Remaining, 6.1% (n=19) of the patients were unknown about whether MRI uses harmful ionizing radiation like in CT scan and Radiography.Additionally, patient may take MRI as if for disease treatment rather than diagnosis procedure. It was identified that 55.2% (n=171) answered MRI function in diagnosis of the disease process while, 13.9% (n=43) answered MRI functions in treatment of the disease. Meanwhile, 29.7% (n=92) answered MRI function in both diagnosis and treatment of disease process. Remaining, 1.3% (n=4) were unknown about whether MRI functions in diagnosis or treatment of disease. This depicted that they lack knowledge of MRI as for diagnostic tool only. Similarly, MRI uses radio waves and is considerably safe for pregnant women when clinical requirement outweigh the potential risk of MR scanning or if other nonionizing forms of diagnostic imaging are inadequate. Out of 310 patients (n=310), it was found that only 7.7% (n=24) patients had answered 'yes' as MRI scan during pregnancy is safe while 88.1% (n=273) patients answered 'no' and therefore response that pregnant patient can't undergo MRI scan. Remaining, 4.2% (n=13) answered 'do not know' about MR scan during pregnancy.

Table 2: knowledge regarding MRI and its safety

Does MRI use harmful ionizing radiation like in radiography and CT scan?	Frequency	Percent
Yes	265	85.5
No	26	8.4
Do not know	19	6.1
Total	310	100.0

Will MRI diagnose or treat your disease?	Frequency	Percent
Diagnosis	171	55.2
Treatment	43	13.9
Diagnosis +treatment	92	29.7
Do not know	4	1.3
Total	310	100.0

Does pregnant patient can undergo MRI scan at any time?	Frequency	Percent
Yes	24	7.7
No	273	88.1
Do not know	13	4.2
Total	310	100.0

Patients' Perception of MRI scan

It was accounted that with the distribution of patients (n=310) on the basis of problem that they faced during scan, maximum patients faced anxiety along with claustrophobia which was 26.8%, only 0.3% patient faced anxiety along with claustrophobia, isolation and headache. Again, 11.6%

had good perception about MRI scan as they feel relax during the scan period. Similarly, 15.16% faced anxiety, 5.8% faced claustrophobia along with isolation and headache, 8.1% faced isolation and headache respectively.Also the patients distribution according to their pain change status in a chart shows that out of 310 patients, 64% answered no change in their pain status after scan while 14% answered increase in their pain status after MRI scan. Meanwhile, 22% answered decrease in their pain status after MRI scan.

Similarly, the patients (n=310) agecategory on the basis of pain change statusin a bar chart revealed that the maximum number of patient .i.e. 113, 25 and 43 who answered no change, increase and decrease in pain were between age group of 25 years and 50 years while minimum of 3 patients who answered decrease in pain status were in age group less than 25 years. Meanwhile, 22 patients who answered decrease in pain status were in the age group between 50 years and 75 years.

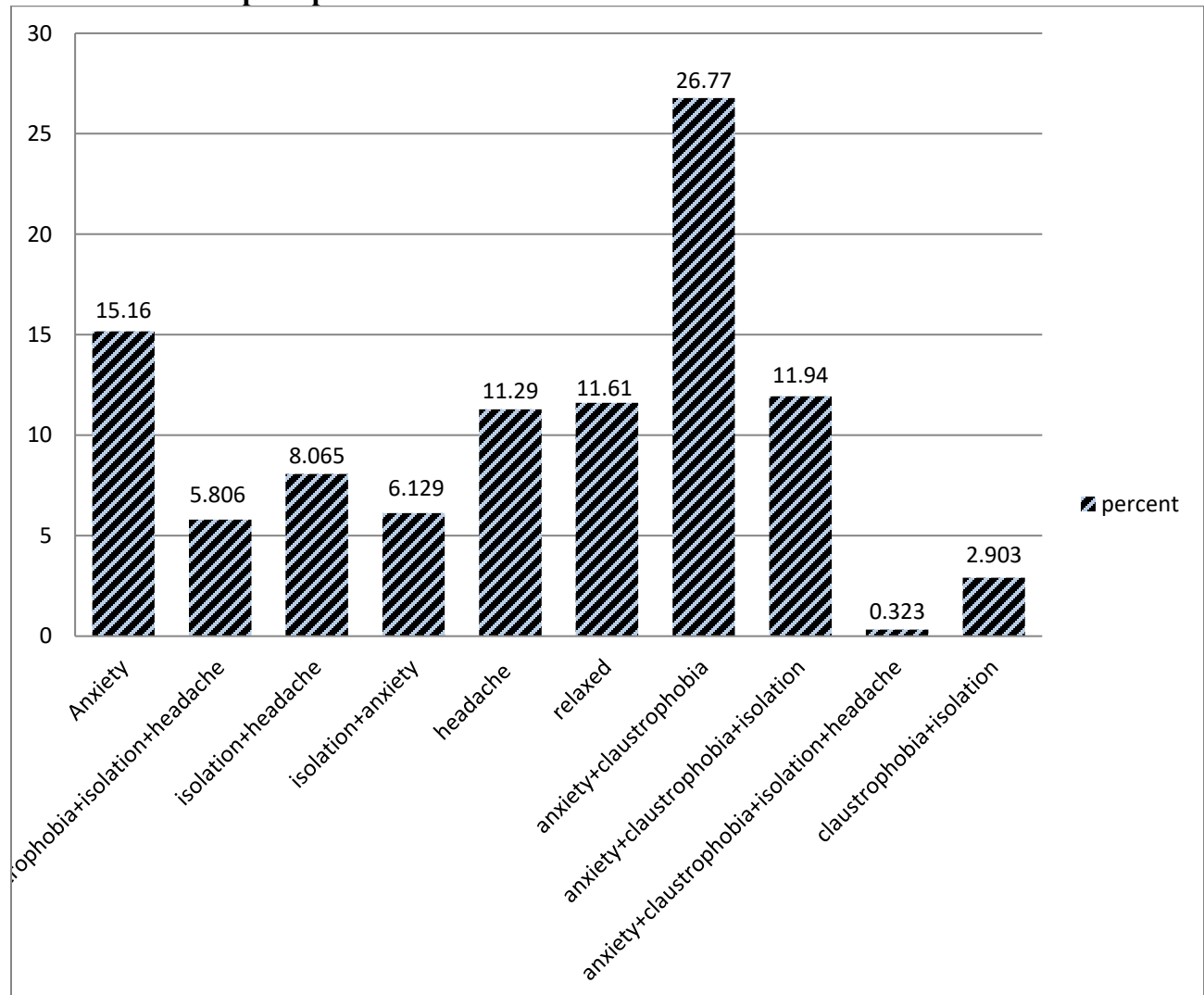**Table 3: Patients' perception of MRI scan**

Figure 1: Distribution of patients on the basis of problems that they faced during scan
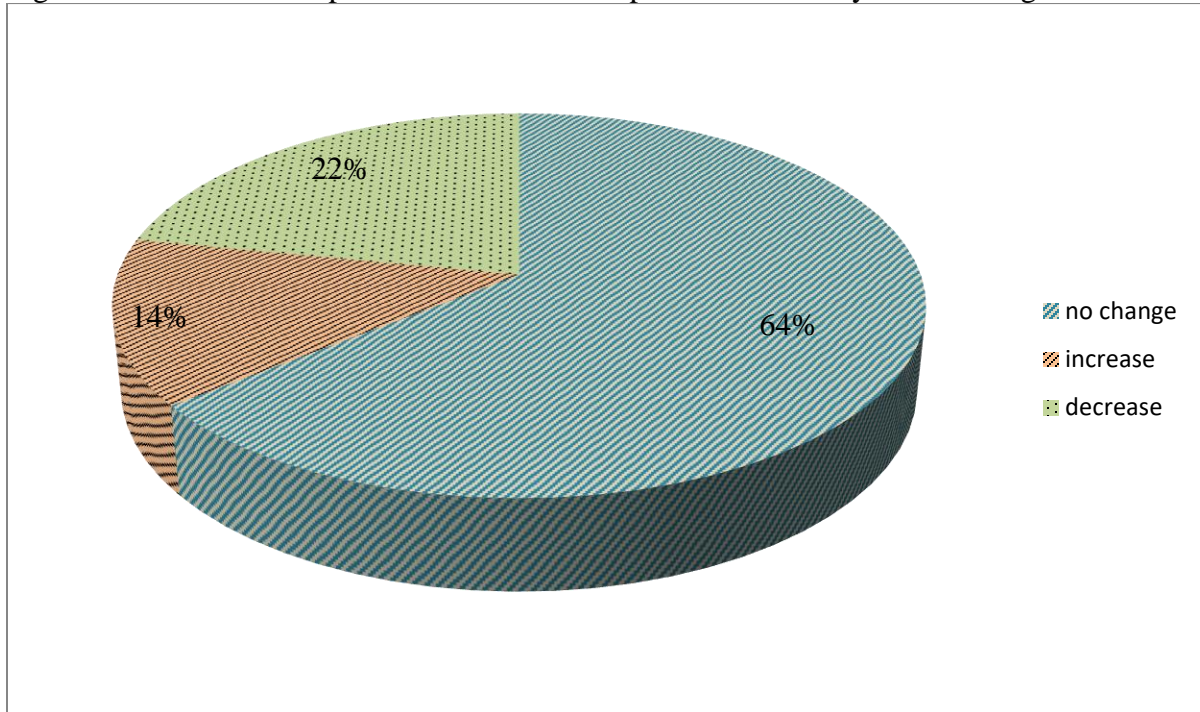

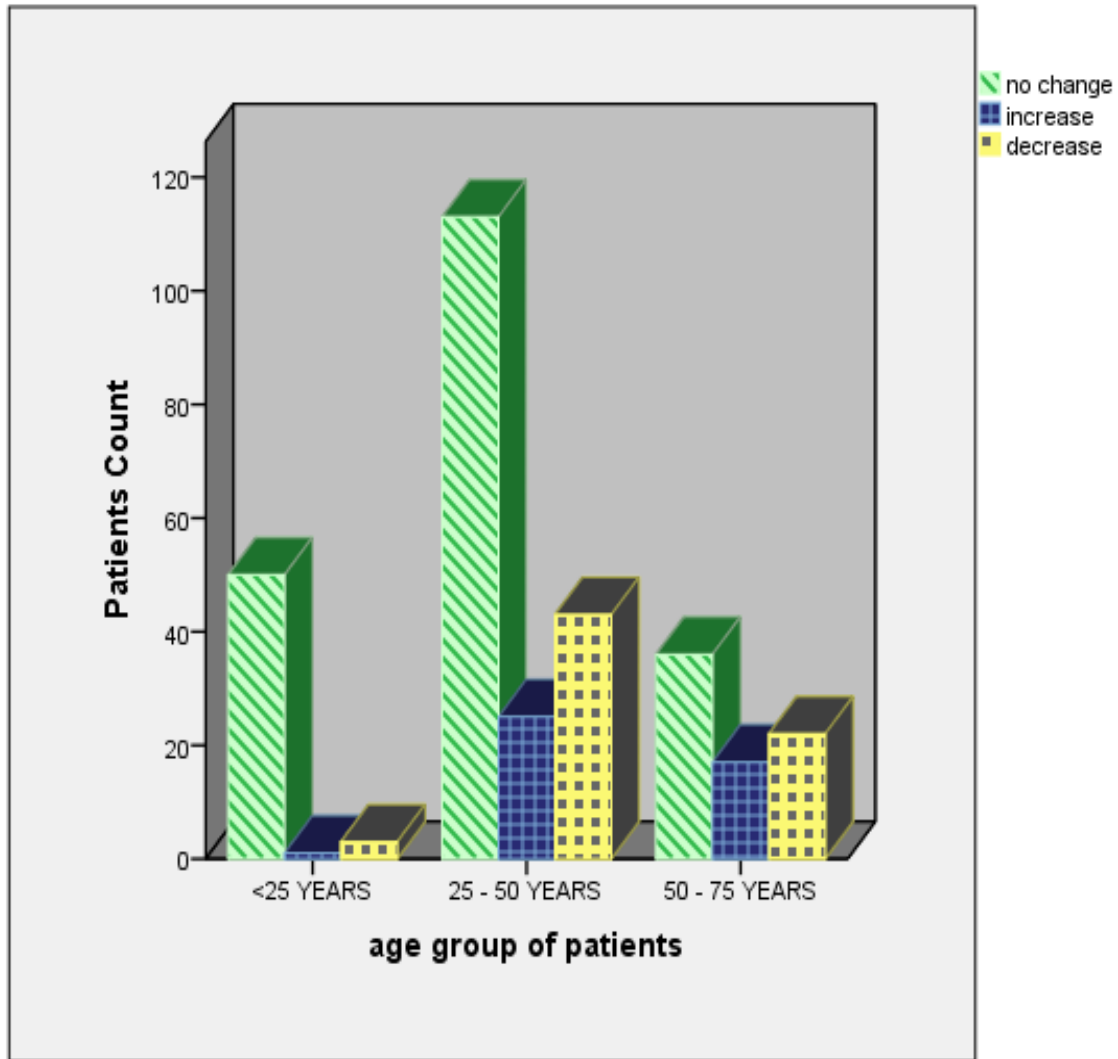Figure 2: Distribution of patients according to their pain change status

Figure 3: Age category on the basis of pain change status

Association between knowledge regarding MRI scan and its safety with socio-demographic characteristics of patients

Association between educational status of patient with their knowledge whether MRI function in diagnosis or disease treatment shows thatthere is a statistical significant association of educational status of patients with their knowledge whether MRI functions in diagnosis or treatment of disease with chi-square p-value of 0.000 (.i.e. $p<0.05$) and df-10. I.e. patients' choice of MRI functions in diagnosis or treatment of disease was influenced by their educational status. Furthermore, the association between educational status of patient with their knowledge whether MRI uses harmful ionizing radiation like in CT scan and radiography shows that there is a statistical significant difference in knowledge whether MRI uses harmful ionizing radiation like in CT scan and radiography based on the educational status with chi-square p-value of 0.000 (i.e. $p<0.05$) and df-10. I.e. Educational status of patient influences their knowledge whether MRI uses harmful ionizing radiation as CT scan and other radiography.

Table 4: Association of educational status of patients with their knowledge whether MRI functions in diagnosis or treatment of disease.

Educational status of the patients	Will MRI diagnose or treat your disease				Total	p-value (df-10)
	Diag nose	Tre at	Diagnose +treatmen t	Do not know		
Illiterate(upto1 class)	5	41	59	4	109	
Graduated from primary school(upto7 class)	34	2	20	0	56	
Graduated from secondary school(SLC)	49	0	9	0	58	.000
Graduated from high school(+12)	56	0	4	0	60	
Graduated from university(bachelor)	22	0	0	0	22	
Master's	5	0	0	0	5	
Total	171	43	92	4	310	

Table 5:Association of patient knowledge whether MRI uses harmful ionizing radiation like in radiography and CT scan with their educational status.

Educational status of the patients	MRI uses harmful ionizing radiation like in radiography and CT scan			Total	p-value df-10
	Yes	No	do not know		
Illiterate(upto1 class)	97	0	12	109	
Graduated from primary school(upto7 class)	50	2	4	56	
Graduated from secondary school(SLC)	55	0	3	58	
Graduated from high school(+12)	50	10	0	60	
Graduated from university(bachelor)	11	11	0	22	.000
Master's	2	3	0	5	
Total	265	26	19	310	

Association between knowledge regarding MRI and its safety with patients' perception of MRI scan.

To our best surprise, the association between MRI function in diagnosis or treatment of disease with their pain change status shows that there is statistical significant association of patients knowledge regarding MRI functions in diagnosis or treatment of disease based on their pain change status with chi-square p-value of 0.000 (i.e. $p<0.05$) and df-6. So, patients who answered MRI functions in diagnosis of disease had answered no change in their pain status after scan while patients who answered MRI function in treatment, and diagnosis along with treatment also had answered decrease in pain status after scan.Similarly, the association between problems faced by the patient undergoing scan for the first time with the patient scanned in MRI previously shows that there is no statistical significant association of problems faced by the patient undergoing scan for the first time based on patient who have been scanned in MRI previously with chi-square p-value of .215 (i.e. $p>0.05$) and df-9. So, patients who have been scanned in MRI previously also faced problems during their present MRI scan.

Table 6: Association of MRI functions in diagnosis or treatment of disease with their pain change status

Will MRI diagnose or treat your disease	pain change status of patient after MRI scan			Total	p-value (df-6)
	no change	increase	Decrease		
Diagnose	139	23	9	171	
Treatment	9	6	28	43	
Diagnose +treatment	49	14	29	92	
Do not know	2	0	2	4	
Total	199	43	68	310	.000

Table 7: Association of problems faced by the patient undergoing scan for the first time with the patient scanned in MRI previously

What kind of problem did you face during the scan period?	Have you been scanned in MRI previously?		Total	p-value (df-9)
	Yes	No		
Anxiety	12	35	47	
Claustrophobia +isolation +headache	2	16	18	
Isolation +headache	1	24	25	
Isolation +anxiety	2	17	19	
Headache	8	27	35	
Relaxed	3	33	36	
Anxiety +claustrophobia	13	70	83	
Anxiety +claustrophobia +isolation	3	34	37	

Anxiety +claustrophobia +isolation +headache	0	1	1	
Claustrophobia +isolation	2	7	9	
Total	46	264	310	.215

DISCUSSION

Previous studies published on patients' perception of going through an MRI scan and MRI knowledge is quite incomplete. They described the experiences related to MRI scan and knowledge regarding MRI only. Our study reflects the assessment of knowledge regarding MRI and its safety, perception regarding MRI scan which have an indispensible role in knowing patient misperception of MRI, its safety related risk and precautions. This study also manifests the association of patients' perception of scan with knowledge regarding MRI and its safety and association between socio-demographic characteristics with knowledge regarding MRI and its safety.

This study includes 310 patients. Among 310 patients majority (52%, 161) were females and minority (48%, 149) were male patients. Similarly, majority (58.4%, 181) were found in age group between 25 years and 50 years followed by 50 years and 75 years (24.2%, 75) and less than 25 years (17.4%, 54). The spectrum of experiences, in this study, ranges from feeling of being relaxed during scan to varying degrees of emotions. Reactions seem to be influenced by earlier scan experiences that are triggered by the narrowness in the scanner.

Research conducted by Munn Z and et.al[12] revealed that there was no statistical significant difference between anxiety for first time scanners and people who had been scanned in MRI before (P-value = .779) which is similar to our study. This study also showed that there is no significant association of problems faced by the patients undergoing scan for first time with the patient who had prior MRI scan (p-value=.215). 46 patients had been scanned in MRI previously, out of which maximum patients faced anxiety along with claustrophobia and most of the patients (i.e. 264) who had their first time scan, also faced anxiety along with claustrophobia. The problems faced during scan period may depend upon their psychological motivation. Thus patient's reactions may have been triggered due to narrow entrance bore, acoustic noise and the long scan duration.

The finding of the study performed by Mahmut Duymus and et al[14] was comparable to this study in respect to educational status with regard to the answers diagnosis or treatment of disease which showed that knowledge of patients on whether MRI also functions in diagnosis or treatment of disease was not influenced by their educational status which was different to our findings. According to this study, the educational status of patients had shown difference regarding choice of treatment or diagnosis option. Majority of patients who answered the treatment option were female (i.e. 43 out of 161) and half of the female were illiterate or graduated from primary school. This study also revealed that there is a significant association between choice of whether MRI functions in diagnosis or treatment with patient's pain change status after MRI scan i.e. patients who thought that MRI helps in treatment of disease also thought they had a significant decrease in pain after MRI scan i.e. (about 2/3 of the patients).

According to this study result, there is a significant association between educational status and the understanding of whether MRIis harmful like CT scan and radiography. Maximum numbers of patients (about 1/3) were illiterate and answered that MRI also emits harmful ionizing radiation like CTscan and radiography. Meanwhile, most of the patients who have answered MRI do not emit harmful ionizing radiation were graduated from university i.e. 11 out of 26.

Again, patients who were illiterate and graduated from primary school answered 'do not know' whether MRI is as harmful as CT scan and radiography.

We also found that among 310 patients, 26.77% faced anxiety along with claustrophobia during the scan period. These results were similar to the study conducted by Lucinda Watt[15], which revealed Anxiety and claustrophobia to be the examples of patient response to factors regarding MRI scan. The results suggest that most of the patientsundergoing MRI scan have feelings of panic or anxiety in the MRI environment.

This study further shows the outcome of knowledge regarding MR scan during pregnancy. Out of 310, only 24 patients answered MRI scan is safe during pregnancy while 273 answered MRI is harmful during pregnancy period. MRI do not have hazardous effect like CT scan or other radiography but can be a leading cause for MRI potential risk if patients are not aware about MRI scan risk and benefits. Hence, the deficiency in knowledge regarding MRI and its safety among patients revealed their misperception regarding MRI scan.

CONCLUSION

Study carried out among patients on knowledge, perception and safety regarding MRI scan revealed that there is a statistical significant ($p<0.05$) difference in educational status and knowledge of patients about MRI scan. But the difference in problems faced by the patients scanned in MRI previously and problems faced by the patients who had not previously had an MRI is insignificant ($p>0.05$) i.e. patients who have had their scan in MRI previously also faced various problems during the scan period and the problems may have been triggered due to their prior scan experience, narrow entrance bore, acoustic noise and the long scan duration. This study also shows that there is a statistical significant ($p<0.05$) association of whether MRI functions in diagnosis or treatment of disease, with their pain change status. .i.e. patients who answered MRI functions in diagnosis of disease had answered no change in their pain status after scan, whereas patients who answered MRI functions in treatment and diagnosis along with treatment had also answered decrease in pain status after scan.

We found that knowledge of patients is lacking regarding MRI scan, its safety and function. This leads to decreased workflow of the department, decreases the patient compliance and increase valuable scan time. Although patients are aware about MRI safety, this might have been an emerging issue due to patient distress and potential consequences. Therefore, this study emphasizes the need to adopt a holistic approach like, to assess patients' knowledge regarding MRI and its safety, patient perception before and after scan, patient-technologist intercommunication, etc. which may be the key to increase patient compliance and save valuable time.

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