

Knowledge of magnetic resonance safety measures among nursing and housekeeping staff in a tertiary care hospital.

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Abstract

With the increase of use of MRI in the recent times due to its advantages, there has been an increase in the disastrous effects of MRI due to its magnetic field present in vicinity. The accidents due to magnetic field have been on the rise and are generally due to lack of knowledge of the staffs, mainly the housekeeping staffs shifting the patients for MRI and the nursing staffs preparing the patient having implants. This work is done to evaluate the knowledge of ward nursing staffs and the housekeeping staffs regarding the MRI safety measures, so that these accidents can be avoided at the root level. A total of 100 ward nurses and 45 housekeeping staffs in the radiology zone were evaluated using a self-administered closed-ended polar questionnaire, validated by 3 subject experts. The frequency of answers to each question was calculated using SPSS software and the whole population was also evaluated, based on correct answers, and categorized according to scores. The overall population of both housekeeping and nursing staffs showed average results, but focused on the response to individual questions, lack of knowledge regarding the safety measures of MRI were found. The study concluded that there found a strong need for educating the housekeeping staffs and the nursing staff regarding MR safety, so that these incidents can be avoided at the root level.

Keywords: Knowledge, MRI, Safety

1. Introduction

Magnetic resonance imaging (MRI) is an established diagnostic and research tool in the field of diagnostic imaging mainly because of its excellent soft tissue delineation(1). MRI having excellent anatomic imaging along with evaluation of tissue function at different levels have surpassed all the other imaging modalities. Although MRI has various advantages over the other radiology modalities as it is radiation free and painless but there is potential risk for the patients as well as the health care

professionals in the MR environment. These risks are mainly due the presence of a strong static magnetic field which is approximately >100000 times the earth s magnetic pull (2). The magnetic field can impose a threat on the ferromagnetic objects outside as well as inside the body of the patient. When ferromagnetic objects are brought in the vicinity of the magnetic field of the magnet, they experience attractive forces and are accelerated towards the magnet. Apart from the risk due to ferrous object outside the body of the patient, the implants and devices containing ferrous material may also experience rotational (torsion) and linear (translational) forces by the static magnetic field (3). Among the common MRI accidents, the most common are the projectile injuries which are caused due to ferromagnetic objects like oxygen cylinder, wheelchairs, crib, trolley etc., being pulled by the magnet inside the imaging room at a very high speed. There has been a documented increase in MRI accidents of over 523% from year 2000 to 2017. All these cases draw the attention towards the fact most of the accidents in MRI are due to human errors rather than any other technical malfunction.

Considering the literature and the mishaps that have occurred previously indicated that most of these accidents are due to the ward boy's negligence or due to improper preparation of the patient by the nurses. The use of MRI has become a life-threatening activity due to this negligence. The factors that mainly affect the safety practices in the MR suite is the attitude of the staffs and the management. As most of the accidents related to MRI are due to lack of proper knowledge or proper working of the staffs, there is a need for proper guidelines and procedures for the staffs and there is a growing need of awareness among the staffs to avoid this mishap. These growing incidences all over the world are alarming and so it is important for the people in the medical field to be aware of the safety measures and proper training should be given from the root level. Hospital staff bear a strong responsibility to effectively provide the patient with appropriate care and to take care of patient's safety. Therefore, this work aims to assess the awareness and knowledge about the safety practices followed by the nursing and the housekeeping staff.

2.Methods

2.1 Ethical Considerations

The study protocol followed was reviewed and approved by the Research Committee, and ethical clearance was also obtained. All the subjects provided written informed consent to participate after a detailed explanation about the study was given by the principal investigator.

2.2 Participants

A cross-sectional study was carried out with a sample size of 100 for nursing staffs and 45 for housekeeping staffs. The nurses from the wards and the house keepings staffs in the radiology zone were included in the study. A self- administered closed ended polar questionnaire was developed and validated by 3 subject experts. The questionnaire for nurses contained 22 questions and the questionnaire for the house keeping staffs had 18 questions with close ended pattern. Questions were made in local language and English. The housekeeping staffs coming with the patients from the wards were asked to fill the questionnaire to their fullest knowledge. The questionnaire was distributed to the nurses in different wards. The nursing staff filled the questionnaire in their wards.

3.Results

For the result analysis the frequency of correct and incorrect answers was determined for each question. Also, the overall population was categorized under 3 categories i.e., high, medium, and low knowledge based on the overall score of all the patients. As the nursing questionnaire consist of 22

questions, score more than 17 i.e., 75% was regarded as HIGH knowledge category. Score ranging between 11-16 was considered as AVERAGE while score less than 11 i.e., less than 40% was considered as LOW or POOR knowledge. While for the housekeeping staff the questionnaire consisted of 18 questions, score more than 13 i.e., 75% was regarded as HIGH knowledge category. Score ranging between 13-9 was considered as AVERAGE while score less than 8 i.e., less than 40% was considered as LOW or POOR knowledge. The frequency of answers to each question was calculated using SPSS software and the whole population was also evaluated, based on correct answers and categorized according to scores.

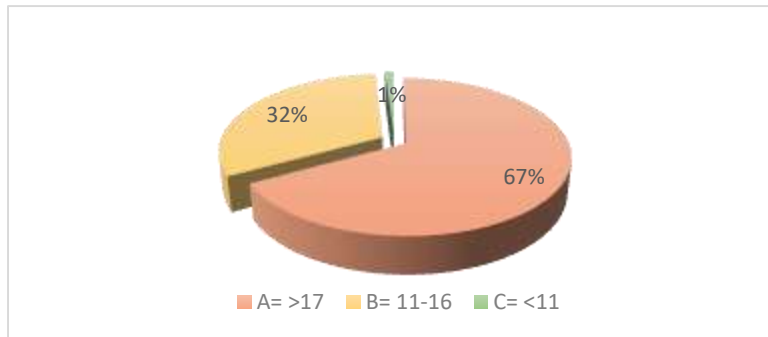


Figure 1: response by the nursing staff population

3.1 Overall response of the nursing population

The response from the participants was categorized based on the score received by each participant into 3 ranges. The overall population of the nurses had high knowledge about the safety aspects in MRI. Around 67% of the population got scores in the HIGH category, scoring between 17-22. Around 32% were falling into the AVERAGE category, scoring between 11-16. While only 1% of the population had LOW knowledge, i.e., scored less than 11 as depicted in Figure I.

Although the overall response of the study suggested that more than 60% of the population had high knowledge about the MR safety practices but the proportion of answer to individual question drew the attention towards lack of knowledge in particular areas.

Questions about various objects that can be taken inside the MR room depicts that many of them were unsure about objects like IV stand, stethoscope or spectacles can be taken inside the scanner room. Only 33% participants said that crash cart can be taken inside the MR room. 19% of the participants answered that oxygen cylinder can be taken inside the scanner room. Questions related to contraindications suggested that the nurses were not clear about the various conditions that were serious contraindications. 8% answered that they can send a patient having pacemaker, aneurysm clips and coronary stents for MRI scan. While 33% suggested that it is safe to send a patient with neurostimulator for MRI scan, which is also an absolute contraindication. 16% answered that if a patient has some severe kidney disease, MRI contrast study can be done. Around 34% of the nurses believed that a pregnant woman cannot be sent for MRI scan as it may harm the fetus.

3.2 Overall response of the housekeeping population

The response depicted that around 49% of the respondents had HIGH knowledge, 49% had AVERAGE knowledge and 2% of the housekeeping staff had LOW knowledge regarding the MR safety practice, as seen in Figure II.

The results showed us that the participants were lacking in various fields of safety aspects as they were not aware of various facts about MR safety. 31% of the housekeeping staffs didn't know that the MRI machine is always ON while 24% replied that they can enter the scan room while the scan is going on.

Various questions regarding the items to be carried in the MRI room, depicted that the participants were not having appropriate knowledge as 13.3 % of them answered that they can take the normal wheelchair from the wards into the scan room for shifting the patients and around 26.7% of the staff were not aware that there is any separate trolley/ wheelchair present near MRI to shift the patient inside the scanner room. 31 % of the housekeeping staffs said that they can take the oxygen cylinder also inside along with the patient. 22% of them said that crash cart can also be taken inside the scanner room. 35.6% said that in case of fire emergency, they can use the normal fire extinguisher inside the MRI room. Around 44.4% said that it is not necessary to remove all the metallic objects from the patient's body. 13.3% believed that they can carry mobile phones along, while entering the MR scanner room while almost 38% answered that ATM cards can be taken inside the MR room.

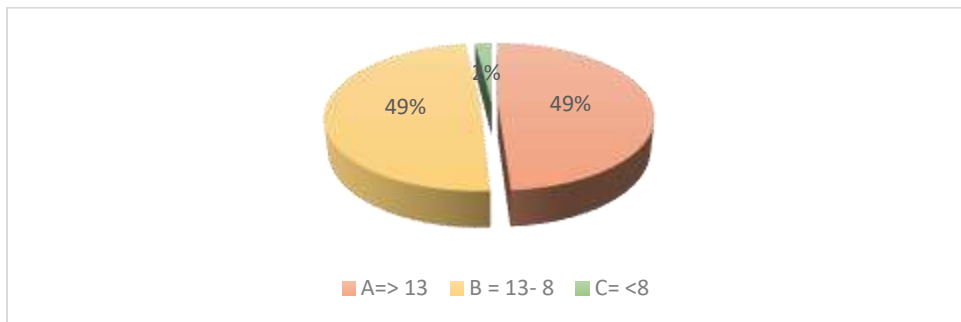


Figure 2: Response by housekeeping staff population

4. Discussion

This study aims at evaluating the knowledge of the nursing and the housekeeping staffs, to access the level of their knowledge and to prevent the incidents due to the negligence of the nursing and the housekeeping staffs that can caused outrageous results.

Even though the current study depicted that the overall population had a good knowledge about the various safety practices, the proportion of answers to individual question drew the attention towards lack of knowledge in particular areas like the basic knowledge regarding MRI machine, various projectiles are not allowed and the contraindications of MRI. This is also the common findings reported by other studies (2).

In this study, almost half of the participants of both the groups (nursing and housekeeping) were not aware of the fact that MRI is radiation free modality. Also, most of them didn't know that the magnet in the MR scanner room is always ON. These results corresponded with the similar study done in Ghana where it was seen that the basic knowledge about MRI was lacking among the population (2).

The housekeeping staff showed a lack of knowledge regarding various projectiles that could be taken inside the scanner room. The main reason for most of the MR related accidents is due to the projectile effects in the vicinity of the main magnetic field(4). Majority of the housekeeping staff answered that

various ferromagnetic projectile like the ward wheelchair, crash cart, oxygen cylinder, trolley etc. could be taken inside the scanner room.

The lack of knowledge among housekeeping staffs about wheelchair and trolley use within the MRI scanning room is an alarming issue that has to be addressed at top priority in every healthcare setup using MR imaging. CME and workshops for housekeeping and nursing staff members have to be organized on regular intervals (5).

The housekeeping staffs answers regarding Projectiles which can result in brutal accidents like the crash cart oxygen cylinder and the trolley was very alarming. A look on all the major accidents in the near past depicts that more than half of these accidents are due to the negligence and unawareness of the housekeeping staffs. Similarly, majority of them answered that a normal fire extinguisher could be taken inside during fire emergencies. This showed the training defects and lack of importance given to this serious issue.

The nurses from the wards were asked the questions regarding various contraindications as they are responsible for the sending the patient for MR scans. From the results it was evident that around 8% nurses were not clear regarding the absolute contraindications for MR as they answered that it is normal to send the patients with pacemaker aneurysm clips and coronary stents for MRI.

But alarmingly 33% believed that neurostimulator is not a contraindication despite it being a serious contraindication (6). Also 16% said that MR gadolinium scan can be done for a patient having kidney problems. Studies have shown and proved that gadolinium is considered toxic for the patients with kidney failures or renal impairments (7). All these results draw attention towards the pitfalls in the knowledge regarding the contraindication of MRI that must be kept in mind before sending the patient for scan.

Around 50% of the nurses reported that pregnancy is a contraindication. It has been evident from previous studies that MRI can be done for a pregnant patients and also fetal MRI is also done in case of fetal congenital anomalies. There is no risk of MRI during pregnancy and there has been no reports of any harm to the fetus (8).

It can be inferred from the results of this study that there are various areas where the participants are lacking their knowledge regarding the various safety practices and there is a need to upgrade their knowledge so that 100% MRI accidents can be prevented in the hospital.

5. Conclusion

The study highlights the MR safety practices followed by the nursing and the housekeeping staffs. By the Results of the study, it was found that there were several pitfalls in the knowledge of both the participants regarding various aspects of safety in MRI

There is need for educating the housekeeping staffs and even the nursing staff regarding MR safety, so that these incidents can be avoided at the root level.

Abbreviations: Not applicable

'Declarations'

- **Ethics approval and consent to participate** - The study protocol followed was reviewed and approved by the Research Committee of Manipal College of Health Profession and Manipal Academy of Higher Education, and ethical clearance was also obtained by Kasturba Medical College and Hospital, MAHE, Manipal. A detailed explanation about the study was given by the

principal investigator after which they provided consent for publication. All the participants included in this research gave written informed consent to publish the data contained within this study.

- **Availability of data and material-** The data has been uploaded as supplementary files in the upload section.
- **Competing interests-** The authors declare that they have no competing interests in this study.
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- **Authors' contributions-** DRK conceptualized the study. DRK, SY and NP have given inputs in study design. DRK collected the data. DRK and NP analysed the data and wrote the first draft of manuscript and all co- authors contributed to critical review of data analysis and manuscript writing. DRK will act as guarantor for this paper. All authors have read and approved the manuscript.
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