



MRI SAFETY PRACTICES AMONG RADIOGRAPHERS IN SOUTH-SOUTH NIGERIA

BLESSING S. IBE, AKPAMA E. EGWU, AKWA E. ERIM, NNEOYI O. EGBE

Email: blessingibe828@gmail.com

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ABSTRACT

Background: Published data on MRI safety practice and policies in Nigeria are lacking. This study aims to evaluate MRI safety practices among radiographers in south-south Nigeria.

Methods: This study is a cross-sectional descriptive survey, carried out in radiology department of healthcare facilities in the south-south geopolitical zone of Nigeria. The targeted population was practicing and intern Radiographers working in the radiology department. 99 radiographers were drawn from MRI suite of these hospitals in the six states of south-south geopolitical zone of Nigeria. A self-developed and well-structured questionnaire was used for this study. A modified checklist designed by Gillies was attached to the pilot phase for respondents to make suggestions. In addition, a structured interview was also conducted with a member of the hospital management. Results were presented using descriptive statistics in the form of frequency tables and percentage.

Results: The results show that majority (90.9%) of the respondents affirmed that MRI magnet is always on. Additionally, 96% of the respondents were of the view that ferrous items become potential flying projectile and magnetic stripes are erased when brought into the MRI suite and 89% of respondents disagree with magnetic object being allowed into the MRI room.

Conclusion: The study highlights limited knowledge of the working and functionalities of MRI equipment, significant understanding regarding potential MRI-related risks and adverse events. However, there was lack of an effective and efficient policy and guidelines in the hospital in general and the radiography department in particular.

KEYWORDS: MRI, Suite, South-South, Safety, Knowledge, Risks

INTRODUCTION

Magnetic resonance imaging (MRI) unit in a radiology department, is one area that requires where strict adherence to safety precaution, owing to the strong magnetic field used in its operation (Joseph, 2006). Evidence suggests that adequate policies and procedures should be developed and adhered to in order to ensure safe operation condition of MRI (Phin, 2001). It has been observed that the factors that affect safety in the MRI unit are management style and attitude of staff (Henner and Servomaa, 2010).

One important way to ensure safety before the MRI procedure, is to ensure all patients and any family member who may accompany a patient and ancillary staff are screened by the MRI radiographer before entering the MRI suite. Various reports found in the literature have indicated that MRI accidents are mainly caused by human errors rather than scanner malfunction. These has led to several calls for regulations and policies to guide the operation of MRI (Kanal, Barkovich, and Bell, et al., 2013). It is a necessity in practice as the risk in the MRI environment does not only affect the patients but also

Blessing S. Ibe, Department of Radiography and Radiological Science, College of Medical Sciences, University of Calabar, Calabar, Nigeria

Akpama E. Egwu, Department of Radiography and Radiological Science, College of Medical Sciences, University of Calabar, Calabar, Nigeria

Akwa E. Erim, Department of Radiography and Radiological Science, College of Medical Sciences, University of Calabar, Calabar, Nigeria

Nneoyi O. Egbe, Department of Radiography and Radiological Science, College of Medical Sciences, University of Calabar, Calabar, Nigeria

the healthcare professionals, and those who find themselves around the magnetic field (Landrigan, 2001). The issue of MRI safety had not gained much attention until the 2001 incident in which a six-year-old boy died while undergoing an MRI investigation. He suffered from irreparable brain damage when a metallic oxygen tank brought into the room by a nurse, became a projectile (Lum and Tsiouris, 2020). In 2010, a wheel chair was pulled into the gantry of an MRI scanner by the missile effect when a patient was lifted off the wheelchair onto the MRI table in Korle-Bu Teaching Hospital in Ghana. It is not clear what the experience is for MRI practice in Nigeria, and the level of adoption of safety practice in MRI investigation, to the best of our knowledge, has not been reported. This study aims to evaluate MRI safety practices among radiographers in south-south Nigeria.

MATERIALS AND METHOD

Study design and Population

This was a cross-sectional descriptive survey, carried out in radiology department of healthcare facilities in the south-south geopolitical zone of Nigeria. The targeted population was practicing and intern Radiographers working in the radiology department. A convenient sample size of 99 radiographers were drawn from MRI suite of these hospitals in the six states of south-south geopolitical zone of Nigeria.

Sampling Technique

In order to provide equal chances for the population of the study, correct data with reduced rate errors which helps the research analysis and provides the correct findings was generated and the researcher employed convenience sampling technique. A self-developed and well-structured questionnaire developed from the 2020 edition of ACR guidance document on MR safe practices consisting of 23 test items was used. This was distributed via email and other online platforms to inquire about MR general knowledge, MR safety policy and compliance, patient screening, emergency preparedness, infection control, equipment safety signage and barriers, reports of adverse incident and MR safety training. This self-administered open and closed ended questionnaire was used to obtain data from the participant. Before the main study, a copy of it was sent to the researchers, supervisor and other experts in the field to assess for content validity. Corrections were made to ensure that the item related to the objectives of the study and the pilot test was conducted to assess the validity and reliability of the questionnaires. A modified checklist designed by Gillies (2002) was attached to the pilot phase for

respondents to make suggestions that help to modify the questionnaire as required. Ambiguity was thus removed; clarity of the format and design adopted was also ensured. A structured interview was also conducted with a member of the hospital management. This was to obtain additional data, validate and verify results obtained from the survey. Policy formulation and supervision of implementation is the responsibility of management of the hospital and the department (Beddoe et al., 2004). Thus, interviewing members of the management was considered the best way to obtain detailed and comprehensive information about safety management.

Data Analysis

The data obtained from the questionnaires were rearranged in an ordered manner to enhance its processing using the Statistical Package for Social Sciences (SPSS) version 27.0. Results were presented using descriptive statistics in the form of frequency tables and percentage.

RESULTS

This study investigated MRI safety practices among radiographers in south-south geopolitical zone of Nigeria. A 23-item one hundred (100) questionnaire was distributed to all practicing and intern radiographers, ninety-nine (99) questionnaires were completed and returned. The results show female radiographers as having the highest number of participation (51.5%), while males accounted for 48.5%. In terms of educational qualification, 78 (78%) were B.Sc. Degree holders. Majority of the respondent 60 (60.6%) worked in public hospitals. In Table 2, majority (90.9%) of the respondents affirmed that MRI magnet is always on. Additionally, 96% of the respondents were of the view that ferrous items become potential flying projectile and magnetic stripes are erased when brought into the MRI suite and 89% of respondents disagree with magnetic object being allowed into the MRI room. These results demonstrate that 39.4% of the respondent thinks that MRI is dangerous, while 21.2% thinks that it is very dangerous. Table 4 shows that majority of respondents (86.9%) affirm to the presence of MRI safety and procedure, 9 (9.1%) were not sure and the least 4 (4%) said there were no safety polices. Table 5 shows the highest frequency (65.7%) agreed to the manual for MRI safety management system, 20 (20.2%) respondents disagreed and at the least 13 (13.1%) were not sure of the presence of safety management system. Table 6 shows the highest frequency of respondents (58.6%) have had training programs on MRI safety while 41 (41.4%) respondents have not had such training.

Table 1: Demographic Data of the Respondents

	Gender		Age Range			Educational Qualification		Work Facilities		Years of Experience		
	M	F	18-25	26-35	36-45	B.Sc.	Masters	Public Hospital	Private Hospital	1-5	6-10	11-15
Frequency	48	51	38	49	11	78	21	60	39	61	29	9
Percentage	48.5	51.5	38.4	49.5	11.1	78.8	21.2	60.6	39.4	61.6	29.3	9.1

The results show female as having the highest number of participation (51.5%), while males accounted for 48.5%. In terms of educational qualification, 78 (78%) were B.Sc. Degree holders. Majority of the respondent 60 (60.6%) worked in public hospitals.

Table 2: General Knowledge on MRI and its Associated Risk

Question Code	Question	Responses to MRI		General	Total
		Yes	No		
Q1	The magnet is always on	90 (90.9%)	9 (9.1%)	0	99 (100%)
Q2	Ferrous items become potential flying projectile and magnetic stripes are erased when brought into the MRI suite?	96 (96.0%)	3 (3.0%)	0	99 (100%)
Q3	Magnetic objects are allowed in the MRI room?	10 (10.1%)	89 (89.9%)	0	99 (100%)

In Table 2, majority (90.9%) of the respondents affirmed that MRI magnet is always on. Additionally, 96% of the respondents were of the view that ferrous items become potential flying projectile and magnetic stripes are erased when brought into the MRI suite and 89% of respondents disagree with magnetic object being allowed into the MRI room.

Table 3: Respondents' thoughts about MRI incidence.

	Frequency	Percentage
Very Dangerous	21	21.2
Dangerous	39	39.4
Not Dangerous	39	39.4
Total	99	100

These results demonstrate that 39.4% of the respondent thinks that MRI is dangerous, 39(39.4%), while 21.2% thinks that it is very dangerous.

Table 4: Presence of MRI safety policies and procedures

	Frequency	Percent
Yes	86	86.9
No	4	4.0
Not sure	9	9.1
Total	99	100

Table shows that majority of respondents (86.9%) affirm to the presence of MRI safety and procedure, 9 (9.1%) were not sure and the least 4 (4%) said there were no safety policies.

Table 5: Existence or availability of an MRI safety management system.

	Frequency	Percentage
Yes	65	65.7
No	20	20.2
Not sure	13	13.1
Total	99	100

Table 5 shows the highest frequency 65 (65.7%) agreed to the manual for MRI safety management system, 20 (20.2%) respondents disagreed and at the least 13 (13.1%) were not sure of the presence of safety management system.

Table 6: Training program on MRI safety issues

	Frequency	Percentage
Yes	58	58.6
No	41	41.4
Total	99	100

Table 6 shows the highest frequency of respondents (58.6%) have had training programs on MRI safety while 41 (41.4%) respondents have not had such training.

DISCUSSION

The study shows that the respondents were more of females. This might be because MRI uses non-ionizing radiation, and is women friendly. In terms of age range, the data shows that the highest frequency was in the 26-35 age range with 49 respondents in this category. This suggests that a large proportion of respondents were relatively young adults (intern radiographers). On the other hand, the lowest count was in the 36-45 age range with only 11 respondents. This indicates that the sample had a relatively smaller representation of middle age individuals. More than three-quarters of the respondents were degree holders, while majority of the respondents works in a public hospital. This shows that the survey captured more radiographers working in the public sector. It is evident that the majority of the respondents have a good understanding of the dangers associated with ferrous items and magnetic objects in the MRI suite. Notably, a greater majority of the respondents acknowledged that the MRI magnet is always on, indicating that they are aware of the possible risks associated with ferromagnetic materials being in the MRI room. The high percentage of respondents that agree with the idea of magnetic objects not being allowed in the MRI suite, demonstrates a good understanding of safety protocols in MRI facilities. This is a crucial piece of knowledge since ferrous materials can cause possible injury to patients, staff, and visitors in the MRI suite as they can become a flying projectile when they come into contact with the magnetic field. Furthermore, a significant majority of the respondents were aware that ferrous items might become potential flying projectiles in the MRI suite.

This level of awareness is impressive and it shows that respondents had an understanding of the dangers of ferrous items and why it is crucial not to bring them into the MRI room since they can cause serious injury. Additionally, 89% of respondents disagreed that magnetic objects should be allowed in the MRI suite except it is MRI compatible. This is a significant finding since some patients may not understand the risks associated with metallic objects in the MRI suite. The high percentage of respondents that disagreed with the idea of magnetic objects being allowed in the MRI suite demonstrates a good understanding of safety protocols in place in MRI facilities. Similar findings were reported which found that 95.2% of respondents were aware of the potential danger of ferromagnetic objects and 88.7% of respondents believed that MRI magnets are always on. In another study, it was reported that 95.5% of healthcare professionals had knowledge about the dangers of magnetic objects in the MRI room (Mohan et al, 2019). These findings suggest that healthcare professionals have a good understanding of the potential hazards associated with MRI. A study conducted also found that the majority of respondents were aware that MRI magnets are always on and that ferromagnetic objects can become dangerous projectile in the MRI environment (Farag, Thompson and Thiessen, 2019). Furthermore, most respondents were aware of the need to remove metallic objects before entering the MRI room; this, the present study is in consonance with. In the present study, a significant proportion of the respondents believe that MRI incidences are dangerous.

This suggests that there is a concern about the potential risks associated with MRI, which accounts for the caution of the do(s) and don't(s) given to patients before undergoing MRI to avoid adverse effect of MRI. It is important to note, however, that nearly an equal number of respondents do not believe that MRI incidences are dangerous. This implies lack of proper knowledge of the working and functionalities of MRI equipment among respondents, which could be due to limited knowledge, and information or misinterpretation of the risks. Furthermore, a smaller proportion of the respondents (21.2%) believe that MRI safety incidence is very dangerous. This suggests that some individuals may have a heightened perception of the risks associated with MRI, which may be related to their personal experiences or perceptions of the technology. This is consistent with a study conducted on awareness and knowledge of MRI safety among referring physicians in a tertiary care hospital in the Gulf region, Saudi Arabia which found out that the overall awareness and knowledge of MRI safety among the physicians were inadequate, with only 28.8% of the respondents demonstrating adequate knowledge (Feldman, Rutland and Fields, 2017). Likewise, the study found that there was a significant lack of understanding regarding potential MRI-related risks and adverse events. The authors concluded that there is a need to develop continuous education programs and guidelines aimed at increasing physicians' awareness and knowledge of MRI safety.

According to the table 4, majority of respondents affirmed the presence of MRI safety policies and procedures in their MRI suite. This indicates that the MRI suite where these respondent work have established policies and procedures to ensure the safe use of MRI machine. In addition, a small percentage of respondent were not sure if there were MRI safety policies and procedures indicating a potential lack of clarity or communication around these policies and procedures. The smallest percentage of respondent reported that there were no MRI safety policies and procedures in their MRI suite. This is a concern as the safe use of MRI machine is critical to ensuring the well-being of patients, staff and visitors. These findings are comparable to a study conducted to investigate the presence and effectiveness of MRI safety policies and procedure in healthcare facilities across the United States where 87% of facilities in over 1000 healthcare facilities reported having MRI safety policies and procedures in place (Huang et al., 2023). A similar study conducted, explored the level of awareness and compliance with MRI safety policies and procedures among MRI technologies in China. The study found out that 82.2% of the respondents were aware of the presence of MRI safety policies and procedures in their facilities and 85.5% of the respondents reported compliance with MRI safety policies

and procedure in their facilities (Kim et al., 2018).

Table 5 shows that more than half the number of respondents agreed that their facility have a manual for MRI safety management system. This suggest that the respondents are aware of the importance of having safety management in place to ensure the safe and effective use of MRI equipment. The fact that only a small percentage of the respondent disagreed with the existence of this manual indicates that the facilities surveyed may have established a clear and effective system for managing MRI safety. However, the table also shows a significant proportion of the respondents were not sure about the existence of this manual in their facilities. This highlights the need for improved communication and awareness about the safety management system among the staff in these facilities as having a manual for MRI safety management systems essential for promoting a safe working environment for MRI technologist and other healthcare professionals, as well as for ensuring the safety of patients undergoing the MRI procedures. The manual should outline the procedure for MRI safety such as patient screening and monitoring, equipment maintenance and testing and emergency response protocols. The manual should also provide guidance on the use of personal protective equipment such as hearing protection and magnetic field shielding to minimize the risk of adverse effect associated with prolong exposure to the magnetic field.

A slight majority of the respondents had undergone training program on MRI safety. This is a positive sign as it implies that the staff is aware of the potential risk and hazards involved in MRI procedures and are equipped with knowledge and skills to mitigate those risks. On the other hand, 41% of respondents reported that they have not had any training on MRI safety. This is a cause for concern as untrained staff may not be aware of the risk involved in MRI procedures and may not know how to handle emergencies in case of an accident. Therefore, it is essential to ensure that all staff who work in MRI facilities undergo regular training on MRI safety. The findings from this study are consistent with similar studies, conducted by Kanal et al. (2013), which found that only 67% of MRI technologist had received formal MRI safety training. Similarly, a study revealed that only 53.7% of radiology technologist had received training on MRI safety. These findings highlight the need for continuous training and education on MRI safety among staff working in MRI facilities. The study has a few limitations, which could have reduced the overall credence of this study; the researchers experienced difficulties in getting response from some MRI unit in the south-south zone since some of the emails were not responded to within the time frame of the research and hard copy questionnaires could not be sent across due to distance barriers.

CONCLUSION.

Even though many respondents demonstrated compliance in some areas of MRI safety practice, there are as well, several shortfalls which did not meet the ACR guidance document on MR safe practices. The study highlights limited knowledge of the working and functionalities of MRI equipment, significant understanding regarding potential MRI-related risks and adverse events. However, there is lack of an effective and efficient policy and guidelines in the hospital in general and the radiography department in particular. One important takeaway, is the need for continuous training and education on MRI safety among staff working in MRI facilities to maintain and update Radiographer' knowledge on MRI safety as new technology and practices may arise.

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