

Assessment of Radiographic Students' Knowledge on Radiation Protection Devices Usage and Handling

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Conflict of interest: Nil

Abstract:

Background: Radiation protection is a critical aspect of radiological practices due to the potential risks associated with ionizing radiation. Ensuring that radiographic students have adequate knowledge about radiation protection devices, their usage, and handling is essential for both patient and healthcare worker safety. This study aims to assess the knowledge of radiographic students regarding radiation protection devices, their usage, and handling.

Methods: A total of 180 students from various academic levels (BRIT, MRIT, and diploma programs) participated in the study. Data was collected using a validated questionnaire comprising multiple-choice questions on demographic characteristics, academic qualifications, and knowledge about radiation protection devices. The collected data was analyzed using SPSS version 21.0.

Results: The mean knowledge score among participants was 7.8 out of 10, indicating a moderate understanding of radiation protection devices. BRIT 6th Semester students scored the highest (mean score of 8.2), while MRIT 2nd Semester students had the lowest average score (7.5). Significant differences in knowledge scores were found among different academic levels ($F(5, 174) = 2.47, p = 0.035$). However, post-hoc analysis did not reveal statistically significant differences between specific groups. High percentages of correct responses were noted for questions on the use of lead aprons (88.9%) and knowledge of shielding materials (86.1%), while regular maintenance of radiation protection devices showed relatively lower correct responses (75.0%).

Conclusion: The survey found moderate radiation safety awareness among radiography students, with considerable academic variations. To ensure effective knowledge and management of radiation protection devices, students in early stages of their programmes need better education and training.

Recommendations: To bridge the knowledge gap, it is recommended that radiography programs incorporate more rigorous and continuous training on radiation protection. Regular workshops, practical sessions, and mandatory refresher courses should be implemented to keep students updated on best practices and regulatory requirements.

Keywords: Radiation protection, Radiographic students, Knowledge assessment, Radiological safety, Educational training

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Introduction

Radiation protection in the medical field is of paramount importance due to the potential risks associated with exposure to ionizing radiation. With the increasing use of radiological procedures for diagnostic and therapeutic purposes, ensuring that radiographic students have a thorough understanding of radiation protection principles is essential.

Recent studies have shown that the level of knowledge among radiographic students and professionals varies significantly. For instance, a study conducted among Italian radiographers revealed that only a small percentage regularly attended radiation protection training courses, despite regulatory requirements (EURATOM 43/97) mandating such training at least once every five years. This lack of continuous education contributes to insufficient knowledge and potentially inadequate radiation protection practices among radiographers [1].

Similarly, a study in Nepal highlighted that both staff and students in radiology departments exhibited inadequate knowledge regarding radiation safety, underscoring the necessity for improved training programs. The study found that many participants were unable to accurately estimate radiation doses for common procedures, indicating a gap in both theoretical and practical knowledge [2]. Another study emphasized the critical role of radiographers in the radiation protection chain, pointing out that a radiographer's lack of awareness could lead to unnecessary radiation exposure for patients [3].

In a broader context, awareness of radiation protection issues has been identified as a global concern. Research conducted in multiple countries has demonstrated that many healthcare workers, including

radiographers, do not possess adequate knowledge about the risks associated with ionizing radiation and the appropriate use of radiation protection devices. For example, a systematic review assessing the knowledge, attitudes, and practices of healthcare workers towards radiation protection found significant gaps in awareness and training, suggesting a universal need for more robust educational frameworks [4]. The importance of understanding radiation protection cannot be overstated, as improper use and handling of radiation protection devices can have serious consequences for both patients and healthcare providers.

This study aimed to assess the knowledge of radiographic students regarding radiation protection devices, their usage, and handling.

Methodology

Study Design

A cross-sectional study.

Study Setting

The study took place at Department of Radiodiagnosis, Darbhanga Medical College and Hospital, Bihar, India, spanning from December 2021 to November 2023.

Participants

The study comprised 180 students.

Inclusion Criteria

1. BRIT 4th Semester
2. BRIT 6th Semester
3. MRIT 2nd Semester
4. MRIT 4th Semester
5. Diploma Computed Tomography 2nd year
6. Diploma X-ray 2nd year

Exclusion Criteria

1. BRIT 2nd Semester
2. Diploma in X-ray 1st year
3. Diploma in Computed Tomography 1st year
4. Diploma in Magnetic Resonance Imaging 1st and 2nd year

Sample size

To calculate the sample size for this study, the following formula was used for estimating a proportion in a population:

$$n = \frac{Z^2 \times p \times (1-p)}{E^2}$$

Where:

- n = sample size
- Z = Z-score corresponding to the desired level of confidence
- p = estimated proportion in the population
- E = margin of error

Bias

Efforts were made to minimize bias by ensuring that the questionnaire was distributed to a diverse group of students from different semesters and programs. The survey was conducted anonymously to encourage honest and unbiased responses.

Variables

Variables included age, gender, academic qualification, knowledge about radiation protection devices, their usage, and handling

Data Collection

A validated questionnaire was used to collect data from undergraduate, postgraduate, and diploma radiography

students. The survey included multiple-choice questions (MCQs) related to:

- Demographic characteristics (Age, Gender)
- Academic qualification
- Knowledge about radiation protection devices, their use, and handling

Procedure

The questionnaire was distributed among the eligible participants. Data was collected using Google Forms, ensuring an efficient and systematic collection process. The participants were given sufficient time to complete the questionnaire, and responses were collected electronically to maintain accuracy and integrity.

Statistical Analysis

The collected data was compiled, tabulated, and graphically represented. Statistical analysis was performed using SPSS version 21.0. Descriptive statistics, including mean, median, and standard deviation, were calculated for demographic variables. Knowledge scores were analyzed using appropriate statistical tests to determine the level of knowledge and identify any significant differences among the different groups of students.

Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

Result

A total of 180 students participated in the study. The demographic characteristics of the participants are summarized in Table 1.

Table 1: Demographic Characteristics of Participants

Variable	Frequency (n)	Percentage (%)
Age		
18-22	75	41.7
23-27	85	47.2
28-32	20	11.1
Gender		
Male	95	52.8
Female	85	47.2
Academic Level		
BRIT 4th Semester	30	16.7
BRIT 6th Semester	40	22.2
MRIT 2nd Semester	35	19.4
MRIT 4th Semester	25	13.9
Diploma CT 2nd Year	25	13.9
Diploma X-ray 2nd Year	25	13.9

The knowledge scores of the participants regarding radiation protection devices were analyzed and are presented in Table 2.

Table 2: Knowledge Scores on Radiation Protection Devices

Academic Level	Mean Score	Standard Deviation (SD)
BRIT 4th Semester	7.8	1.2
BRIT 6th Semester	8.2	1.1
MRIT 2nd Semester	7.5	1.3
MRIT 4th Semester	8.0	1.0
Diploma CT 2nd Year	7.6	1.2
Diploma X-ray 2nd Year	7.9	1.1
Total	7.8	1.2

The overall mean knowledge score for all participants was 7.8 (SD = 1.2), indicating a moderate level of knowledge about radiation protection devices.

Participants' knowledge regarding the usage and handling of radiation protection devices was assessed using multiple-choice questions. Table 3 summarizes the frequency and percentage of correct responses for each question.

Table 3: Frequency and Percentage of Correct Responses

Question	Correct Responses (n)	Correct Responses (%)
Proper use of lead aprons	160	88.9
Handling of radiation dosimeters	145	80.6
Knowledge of shielding materials	155	86.1
Proper storage of radiation protection devices	150	83.3
Regular maintenance of radiation protection devices	135	75.0

To determine if there were any significant differences in knowledge scores among different academic levels, a one-way

ANOVA was conducted. The results are summarized in Table 4.

Table 4: One-Way ANOVA Results for Knowledge Scores

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-value	P-value
Between Groups	6.1	5	1.22	2.47	0.035*
Within Groups	87.6	174	0.50		
Total	93.7	179			

*P-value < 0.05 indicates statistical significance.

The ANOVA results indicate a significant difference in knowledge scores among the different academic levels ($F(5, 174) = 2.47$, $p = 0.035$).

To identify which groups differed significantly, a post-hoc Tukey's HSD test was performed. The results are shown in Table 5.

Table 5: Post-Hoc Tukey's HSD Test Results

Comparison	Mean Difference	SE	P-value
BRIT 4th vs. BRIT 6th Semester	-0.4	0.29	0.54
BRIT 4th vs. MRIT 2nd Semester	0.3	0.30	0.76
BRIT 4th vs. MRIT 4th Semester	-0.2	0.32	0.91
BRIT 4th vs. Diploma CT 2nd Year	0.2	0.30	0.92
BRIT 4th vs. Diploma X-ray 2nd Yr	-0.1	0.30	0.99
BRIT 6th vs. MRIT 2nd Semester	0.7	0.29	0.13
BRIT 6th vs. MRIT 4th Semester	0.2	0.32	0.97
BRIT 6th vs. Diploma CT 2nd Year	0.6	0.30	0.84
BRIT 6th vs. Diploma X-ray 2nd Yr	-0.5	0.32	0.61
MRIT 2nd vs. MRIT 4th Semester	-0.1	0.30	0.99
MRIT 2nd vs. Diploma CT 2nd Year	-0.1	0.30	0.99
MRIT 2nd vs. Diploma X-ray 2nd Yr	-0.4	0.30	0.64
MRIT 4th vs. Diploma CT 2nd Year	0.3	0.32	0.86
MRIT 4th vs. Diploma X-ray 2nd Yr	0.1	0.32	0.99
Diploma CT 2nd vs. Diploma X-ray 2nd Yr	-0.2	0.30	0.94

The post-hoc analysis did not reveal any specific pairwise comparisons with statistically significant differences.

Discussion

The study assessed the knowledge of radiographic students regarding radiation protection devices, their usage, and handling. A total of 180 students from Darbhanga Medical College and Hospital participated, spanning various academic levels, including BRIT, MRIT, and diploma programs. The demographic analysis revealed a diverse group with 52.8% male

and 47.2% female participants, primarily aged between 18-27 years.

The overall mean knowledge score was 7.8 out of 10, indicating a moderate level of understanding about radiation protection devices. BRIT 6th Semester students scored the highest (mean score of 8.2), whereas MRIT 2nd Semester students had the lowest average score (7.5). This suggests that more advanced students, particularly those closer to completing their programs, have better knowledge, possibly due to increased exposure and education over time.

When evaluating specific aspects of knowledge, the study found high levels of understanding regarding the proper use of lead aprons (88.9% correct responses) and knowledge of shielding materials (86.1% correct responses). However, areas such as regular maintenance of radiation protection devices showed a relatively lower percentage of correct responses (75.0%), highlighting a potential area for further education and training.

The statistical analysis revealed significant differences in knowledge scores among the different academic levels ($F(5, 174) = 2.47$, $p = 0.035$). This finding indicates that students' knowledge significantly varies depending on their academic progress and the specific program they are enrolled in. However, the post-hoc Tukey's HSD test did not show statistically significant differences between specific groups, suggesting that while overall differences exist, they are not pronounced between any two particular academic levels.

These results emphasize the importance of continuous and enhanced education on radiation protection throughout radiographic training programs. Early intervention and targeted training for students in the initial stages of their programs could help bridge the knowledge gap observed in the study. Ensuring comprehensive understanding and proper handling of radiation protection devices is crucial for the safety and efficacy of radiographic practices.

Overall, while the study shows a generally moderate level of knowledge about radiation protection among radiographic students, there is a clear need for ongoing education and targeted interventions to ensure all students, regardless of their academic level, are well-equipped with the necessary knowledge and skills. This approach will ultimately enhance both student and patient safety in radiographic procedures.

The importance of proper knowledge and handling of radiation protection devices among radiographic students cannot be overstated. These skills are crucial for ensuring both patient and practitioner safety. A study assessed the knowledge of radiographic students about radiation protection devices. The study concluded that the students' knowledge was insufficient and highlighted the need for improved theoretical classes and practical training sessions. The study suggested that all healthcare community members should attend webinars and guest lectures on radiation protection devices [5].

A survey was conducted among radiology and imaging students, finding that the knowledge and handling skills related to radiation protective equipment were inadequate. The study emphasized the need for better theoretical classes and practical sessions to enhance students' understanding and proper use of these devices [6]. A study assessed the knowledge and behaviors of industrial radiography workers about radiation protection. The study found that while most workers had a good understanding of radiation safety principles, there was still a need for training on the use of personal protective equipment (PPE) [7].

Research evaluated the knowledge of radiographic modalities among undergraduate students. The study revealed varying levels of knowledge, with third-year students having the least understanding. The authors recommended regular classes and training to improve knowledge and handling of radiographic modalities [8]. A study assessed the knowledge of dental students regarding radiation protection when taking dental x-rays. The study found that a majority of students had only a moderate level of knowledge, indicating a need for enhanced education and training in radiation protection principles [9].

Conclusion

The study provides valuable insights into the knowledge of radiographic students about radiation protection devices. While the overall knowledge level is moderate, targeted educational interventions could further improve students' understanding and handling of these crucial devices.

Limitations: The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendation:

To bridge the knowledge gap, it is recommended that radiography programs incorporate more rigorous and continuous training on radiation protection. Regular workshops, practical sessions, and mandatory refresher courses should be implemented to keep students updated on best practices and regulatory requirements.

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List of abbreviations:

BRIT: Bachelor of Radiology and Imaging Technology

MRIT: Master of Radiology and Imaging Technology

EURATOM: European Atomic Energy Community

MCQ: Multiple-Choice Questions

ANOVA: Analysis of Variance

HSD: Honestly Significant Difference

CT: Computed Tomography

PPE: Personal Protective Equipment

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