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STUDY OF KNOWLEDGE & AWARENESS OF RADIOLOGY, ASSOCIATED HAZARDS AMONG THE MEDICAL STUDENTS IN A TERTIARY CARE TEACHING HOSPITAL, SOUTH INDIA

Dr. Vinod Joseph [1], Dr. Jency Maria Koshy [2], Dr. Grace Mary John [3], Dr. George Chandy Matteethra [4], Dr. Joise P[5]

[1]Associate Professor, Head of the department, Radiology, Believers Church Medical College Hospital
[2]Department of Internal Medicine, Believers Church Medical College Hospital
[3]Department of Clinical Pharmacy, In Charge, Believers Church Medical College Hospital
[4]Professor, Head of the Department Gastroenterology, Believers Church Medical College Hospital
[5]Clinical Pharmacist, Believers Church Medical College Hospital

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***Corresponding author:**
Dr. Vinod Joseph

ABSTRACT

Objectives: The use of radiological examination is increasing worldwide. Since radiation exposure can result in many health hazards, medical professionals, as well as medical students, should possess adequate knowledge regarding radiation and its related hazards to protect themselves and the patients. Many studies have assessed medical students' knowledge on this topic, but never in Kerala. In this study, we aimed to examine medical students' awareness and knowledge regarding radiological examination modalities and their risks on themselves and their patients. To examine the level of knowledge about the radiation exposure to various radiological modalities among the medical students and to suggest how education could be improved. **Material and Methods:** This was an observational, cross-sectional, population-based study, conducted among all medical students and interns from Believers Church Medical College Hospital in Kerala. Participants were asked to complete a questionnaire consisting of their actual knowledge on ionizing radiation and various radiation safety issues. A total knowledge score that ranged from 0 to 20 was calculated for each participant, with higher scores indicating better knowledge regarding radiation doses and the related hazards. All questions were in multiple choice formats ranging from 4 to 5choices. The obtained data were analyzed using statistical software. **Results:** Four hundred and forty seven students participated in our study, with a response rate of 71%. The average knowledge score of the participants was 10.97 ± 1.31 out of a maximum of 20 points. More than half of the students were aware of radiation shielding and the contraindication to radiological modalities. Approximately 78.9% of respondents underestimated or do not know the American College of Radiology (ACR) Appropriateness Criteria. **Conclusion:** This study has clearly shown that awareness of ionizing radiation from diagnostic imaging is lacking among senior medical students and interns. The results highlight the need for improved education to minimize unnecessary exposure of patients.

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INTRODUCTION

Lately, medical imaging procedures involving the use of ionizing radiation are used widely in hospitals and clinics, making possible more accurate diagnosis of diseases and injuries.

However, the use of ionizing radiation such as X-rays is also associated with potentially harmful biological effects specifically; high radiation doses tend to kill cells, while low doses tend to damage or alter the DNA of irradiated cells (World Health Organization, 2020; Smith-Bindman, 2008). Many studies indicate that primary care providers are unaware of the hazards associated with the use of radiation.

Physicians who are responsible for requesting radiological examinations tend to underestimate the actual doses involved, have poor knowledge about the possible risks to the health of populations, and do not discuss the potential risks of CT scans with their patients. Previous studies have shown concerning results indicating that both healthcare professionals and trainees are not sufficiently familiar with radiological dosage and relevant hazards (Mettler, 2008; Zhou *et al.,* 2010). More attention has been directed to physicians' knowledge regarding radiology, which has been frequently rating as inadequate (Harbron, 2016). These findings have prompted increased attention to improving healthcare professionals' knowledge regarding radiological hazards. Physicians' knowledge, in particular, should be appropriately evaluated and defects should be traced back to their education at medical schools.

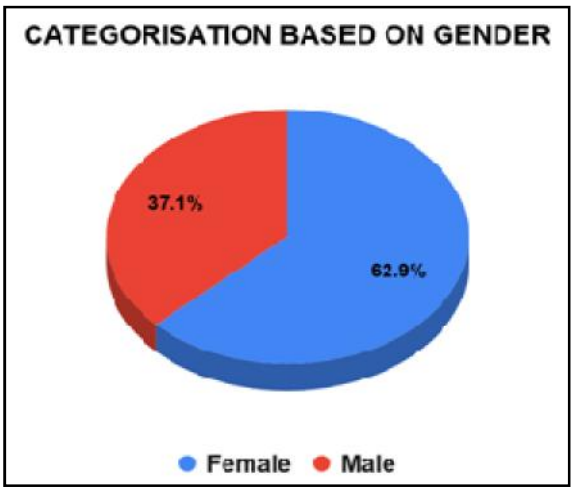
METHODOLOGY

We conducted an observational study, cross-sectional, to assess the awareness regarding radiation exposure and its risks among medical students of Believers Church Medical College Hospital, between March 2021 and April 2021. Participants were enrolled in this study based on the defined inclusion and exclusion criteria. Our target population in this study was undergraduate medical students at BCMCH. We reached out to 447 students to enroll in this study. The participants were selected using the convenience sampling technique. In order to be included in the study, the subject had to be a registered student at BCMCH. Both genders were eligible to participate in the study. Participants whose questionnaires were incompletely filled were excluded from the study if the missing data were significant. Those who did not consent to participate in the study were also excluded.

QUESTIONNAIRE DESIGN AND STATISTICAL ANALYSIS: We distributed a questionnaire electronically via an online survey process among BCMCH medical students. Participation in the survey was voluntary and anonymous. Collection time (time the survey remained open) was 2 months. In order to increase participation in the study, there were two reminders sent to participants. The questionnaire contained multiple-choice questions on radiation doses and associated hazards. The questionnaire items were in two parts: the first part contained items on socio-demographic characteristics (gender, clinical year), second part contained items on radiation knowledge items and supplemented by additional items regarding common radiological modalities and risks in the vulnerable population (Pregnancy). Each question in the second part of the questionnaire has a single correct answer out of four to six options. One mark was given for each correct answer and zero marks for each incorrect or 'I do not know' responses. The overall knowledge score' range was 0–20, with higher scores corresponding to better knowledge on radiation doses and related hazards. Data analysis was done. All variables were expressed as frequencies and percentages. Means and standard deviations were also presented for continuous variables.

RESULTS

DEMOGRAPHIC AND EDUCATIONAL CHARACTERISTICS: Four hundred and forty-seven (447) students participated in our study, accounting for a response rate of 71%. Overall, 62.9% of the participants were females. They were distributed in the first, second, third, fourth, fifth, and sixth study year with a roughly balanced ratio (19.46%, 20.8%, 20.3%, 20.3% & 19%, respectively). About half of all participants (48.1%) rated their radiology knowledge as average.



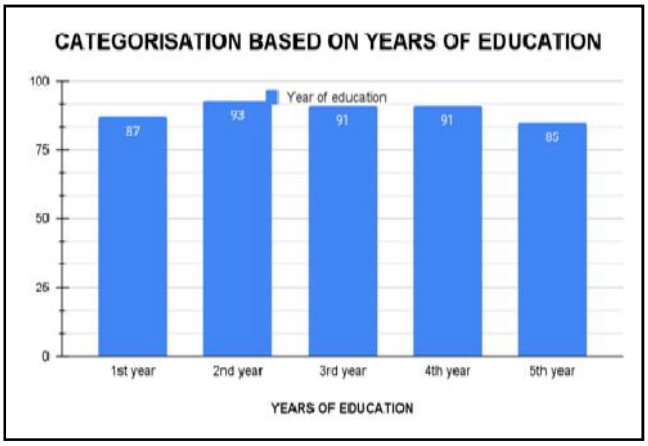


Figure 1 and Figure 2: Demographic and educational characteristics of the participants

KNOWLEDGE REGARDING THE RADIOLOGICAL EXAMINATION AND ASSOCIATED HAZARDS: The average knowledge score of the participants was 10.97 ± 4.31 (out of 20 points maximum). Notably, most participants failed to estimate the annual effective radiation dose limit for occupational exposures.

Only items asking about which radiological modalities used ionising and non ionising radiation and another item asking about the substance used for radiation shielding in CT scan rooms were answered correctly by more than half the participants. When analysing the overall knowledge of safety issues regarding the radiation 50% of the study participants were aware of the contraindications and the methods to reduce the radiation exposure.

SECTION D ATTITUDE TOWARDS RADIOLOGY: Fig no: Number of students and their opinions regarding the role of Radiology in healthcare. Among 387 (86.58%) students agreed that radiology has roles in both diagnostic as well as in therapeutic intervention. However, 52 (11.63) students believed that radiology is only meant for diagnosis while only 7 (1.57) opined of its role mainly in therapeutics.

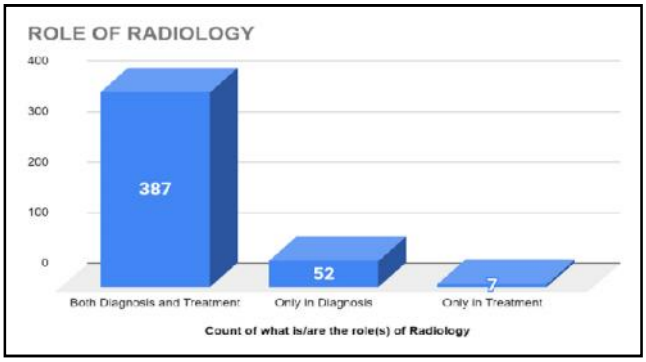


Fig no. Number of students and their opinions regarding the role of Radiology in healthcare

DISCUSSION

In this study, we examined, for the first time in Kerala, knowledge levels regarding radiation exposure and related hazards among medical students. Our findings indicate a serious knowledge gap, as evidenced by medical students' mean radiation knowledge score (10.97 ± 1.31 out of a 20-point maximum).

The results of this study are in concordance with reports from the relevant literature, which indicated a gap in vital radiation knowledge among medical students. These studies stem from the need to prepare medical students for their future duties as physicians who should understand the risks and benefits of different radiological examination tools in order to optimally use them. So far, the results of such studies, including the current study, have been concerning. Our study has shown concerning results indicating that medical students are not sufficiently familiar with radiological dosage and relevant hazards.

However, the statistics for these sections (Section A Average score 4±2, Section B Average score 3±1) where quite significantly better than the section Radiology and Pregnancy (Average score 2±1). In our sample, female students scored higher than male students on radiation knowledge. This finding is just contradictory to a previous study conducted by Awadghanem A, *et al* which found a significant disparity among the sexes on radiation knowledge & concluded that the disparity among the genders was possibly due to an uneven encouragement for male students to pursue radiology education and career paths that their female counterparts and insisted further investigation in this field (6)

Table 2. Frequencies and percentages of participants who answered correctly for each of the knowledge items

	Questions	N (%)
SECTION A KNOWLEDGE TOWARDS RADIOLOGY & RADIATION		
1.	Which of the following DOES NOT involve Ionizing radiation ?	332 (74.2)
2.	Have you heard of American College of Radiology (ACR) Appropriateness Criteria?	85 (19.01)
3.	A medical imaging technology that combines multiple X-ray projections taken from different angles to produce detailed cross-sectional images of areas inside the body	212 (47.43)
4.	The oldest and most commonly used form of medical imaging that uses ionizing radiation to produce images of the internal structure	230 (51.45)
5.	A medical imaging technology that uses a radioactive material (radiopharmaceutical) to produce images of the internal structure	302 (67.56)
6.	Which of the following substances are used to coat the walls of a CT scan room for radiation shielding?	373 (83.45)
7.	How far from the X-ray, should you stand without any protection during the radiological-guided procedure(e.g., C-arm)?	22 (4.92)
8.	What is the annual effective dose limit for occupational exposure?	63 (14.09)
9.	How many times more radiation do you get from an abdominal X-ray, compared to a chest X-ray	173 (38.70)
SECTION B RISKS AND SAFETY ISSUES REGARDING RADIOLOGY		
1.	Regarding the risk of cancer as long-term effect of radiation exposure, which statement of the following is true	97 (21.70)
2.	Any metal device is considered as a contraindication to use in which of the following medical imaging modalities?	272 (60.85)
3.	As a result of eye exposure to radiation the patient might be at risk of which of the following:	112 (25.05)
4.	All the following are methods used to reduce the amount of exposure to ionizing radiation except:	272 (60.85)
5.	Which organ among the following is the least sensitive to radiation?	142 (31.77)
SECTION C RADIATION AND PREGNANCY		
1.	Pregnant women should avoid all types of medical imaging	101 (22.59)
2.	Stage of pregnancy where the fetus is sensitive to pregnancy?	147 (32.89)
3.	The imaging technique(s) of choice for the pregnant patient	129 (28.86)
4.	Prenatal Gender determination in India acceptable or not?	310 (69.35)
5.	Probability of miscarriage during post conception may increase with a radiation dose of > 0.5 Gy(50 rads) (Yes/No)	112 (25.06)
6.	Which is/are the adverse effects of radiation exposure to a fetus?	390 (87.25)

The finding that medical students in more advanced study years achieved higher knowledge scores may point to a positive accumulation of knowledge throughout medical school, but considering thelow average knowledge score regarding radiation, this effect is still insufficient for students to gain the appropriate level of relevant knowledge. Another interesting finding in our study was that students' knowledge on risks and safety of various radiological modalities in pregnancy was underestimated or found overlooked. Deficiencies of studies considering the level of awareness of radiation safety issues among the medical students regarding pregnant people and the exposure of radiation has already been established previously by Scali E, *et al*. (2017). A major limitation of this study was its cross-sectional design, which determined associations but could not address causality. Also, the convenience sampling method may have limited the generalizability of our results. Another limitation was the single-center setting of the study. On the other hand, this was the first study of its kind in Kerala, and it provided important information regarding radiation awareness. Additionally, we used a very cost-efficient data collection method and, at the same time, included a large sample size (N=447), which increased the representation of our target population.

CONCLUSIONS

In conclusion, we found a severe lack of knowledge regarding radiation doses and related risks among medical students in Palestine. Such a low level of knowledge calls for a reconsideration of the current curriculum of medical education regarding radiation knowledge and its relevance. Our results also showed that medical students specifically underestimated radiation and risks in pregnancy and demonstrated little knowledge about radiological doses associated with radiological examination tools. We highly recommend redesigning certain courses and lectures in medical schools' curriculum to include more information on radiation doses, associated risks, and radiation protection strategies. We also recommend using better tools for assessing students' knowledge prior to participating in the medical field to avoid the overuse of ionizing radiation modalities. Finally, we recommend conducting multi-centric studies on a larger scale that assess radiation knowledge in order to explore this problem

Conflict of interest statement: Nil

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