Original Research Paper

Volume - 15 | Issue - 04 | April - 2025 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Radiology

EXPLORING THE KNOWLEDGE, ATTITUDE, AND PRACTICE OF DIAGNOSTIC RADIOLOGY AMONG THE UNDERGRADUATE MEDICAL STUDENTS

Dr Srinag Gonchikar

Post Graduate Resident, Department of Radiology, KVG Medical College, Sullia – 574327.

ABSTRACT

Introduction: Radiology plays a crucial role in modern medicine, yet medical students often have limited exposure to diagnostic and interventional radiology during their undergraduate studies. This study assesses their knowledge, attitudes, and practices, along with interest in radiology as a career. **Objectives:** To evaluate the radiological knowledge of MBBS students, analyze its development during their studies, and assess their attitudes toward radiology as a potential specialty. **Methodology:** A cross-sectional study was conducted at KVG Medical College, Karnataka, on November 8, 2023, involving 300 MBBS students selected via convenience sampling. Data on knowledge, attitudes, and practices regarding radiology were collected through a structured questionnaire and analyzed for statistical significance. **Results:** Out of 300 students, 54.33% were female, and 75.33% resided in urban areas. Only 2.33% rated their radiology knowledge as excellent, and 82.33% rated their knowledge of radiation doses as poor. Students with prior clinical radiology postings scored significantly higher ($p = 0.0458$), and female students outperformed males ($p = 0.0015$). While 82.33% expressed interest in learning radiology, only 29.66% considered it a potential career, citing concerns about radiation exposure (43.66%) and lack of knowledge (22.33%) as major barriers. **Conclusion:** Medical students' radiology knowledge is limited, with significant gaps in understanding radiation safety and diagnostic techniques. Enhanced undergraduate radiology education and earlier clinical exposure are needed to bridge these gaps and increase interest in radiology as a specialty.

KEYWORDS : Diagnostic Radiology, Indian Medical Students, Knowledge, Awareness

INTRODUCTION

Medical imaging is a critical component of modern healthcare, used extensively for diagnosing, monitoring, and treating various medical conditions. Common imaging modalities such as computed tomography (CT), magnetic resonance imaging (MRI), X-ray radiography, ultrasonography (US), and positron emission tomography (PET) provide invaluable information to clinicians, improving diagnostic accuracy and reducing unnecessary invasive procedures[1]. Diagnostic radiology, the use of imaging for diagnosis, is integral to patient care, while interventional radiology (IR) offers minimally invasive treatment options, further emphasizing the growing importance of imaging in medicine[2].

However, despite the increasing role of radiology in healthcare, awareness among medical students remains limited, especially in the early stages of their education[3]. Medical students must understand the basics of diagnostic and interventional radiology to safely and effectively use these technologies, especially in regard to radiation safety and minimizing exposure risks. Inappropriate use of imaging due to gaps in knowledge can lead to overutilization, increasing radiation risks such as cancer[4,5]. Therefore, it is critical that medical curricula include adequate instruction on imaging safety and indications to optimize patient care[6].

In India, while the use of advanced imaging technologies has risen, medical students often lack sufficient knowledge about imaging safety and the risks of ionizing radiation[7,8]. Studies indicate that medical students in India and abroad are generally unaware of the proper indications for imaging, as well as radiation protection measures[9-11]. Additionally, radiology is often underrepresented in the curriculum[12,13], which may influence medical students' awareness and interest in pursuing it as a career despite its growing importance in modern healthcare. This is particularly concerning as India faces a growing shortage of trained radiologists[14], further exacerbating the need for a well-educated medical workforce in this field.

This study seeks to assess the knowledge, attitudes, and practices of MBBS students regarding diagnostic and interventional radiology. We aim to evaluate whether students possess sufficient radiological knowledge by the time they enter their clinical years, how this knowledge develops during their studies, and the level of interest in pursuing radiology as a career.

MATERIALS AND METHODS

We conducted a cross-sectional study using a convenience sampling method at the KVG Medical College, Sullia, Karnataka, India, during the International Day of Radiology, held on November 8, 2023. The study targeted undergraduate medical students enrolled at the institution. Participation in the study was voluntary, and students were informed that their anonymity would be maintained throughout the process. Ethical approval for the study was obtained from the Institutional Ethics Committee of KVG Medical College.

A structured, self-administered English questionnaire, based on previously published studies, was used for data collection[15-17]. Students were made aware that they could withdraw from the study at any point, without any impact on their academic standing. The questionnaire consisted of 39 questions, which were divided into seven sections. The first section collected basic information, including age, gender, current year of study and their residential status prior to joining the college. The remaining sections focused on students' background and experience (8 questions), their basic knowledge of radiology (9 questions), radiology as a screening tool (4 questions), levels of radiation exposure (5 questions), and the students' attitudes toward radiology as a career (6 questions).

Each correct answer in the radiology knowledge sections was awarded one point. Knowledge scores for individual students were calculated as the percentage of correct answers out of the maximum possible score, with 100% indicating the highest possible score. The mean knowledge score for the group was calculated as the average of individual scores.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 21.0 (SPSS Inc., Chicago, IL, USA). Categorical data were presented as frequencies and percentages, while continuous data were reported as means and standard deviations (SD). Differences in knowledge scores between categorical variables were assessed using the unpaired Student's t-test or the Mann-Whitney U test, as appropriate. The association between categorical variables was tested using the Pearson Chi-square test. A p-value of <0.05 was considered statistically significant.

RESULTS

Demographic Characteristics

Out of 300 medical students, 137 (45.66%) were male and 163 (54.33%) were female. The age of the respondents ranged from 17 to 25 years. A minority of participants were first year MBBS students (n = 41, 13.66%), while the largest group were final year students (n = 94, 31.3%).

S. No.	Basic Characteristics	No. Of Students No. (%)
	AGE GROUP	
1	Under 20 Years	197 (65.66%)
2	20 – 23 Years	92 (30.66%)
3	> 23 Years	11 (3.66%)
	GENDER	
1	Male	137 (45.66%)
2	Female	163 (54.33%)
	YEAR OF STUDY	

1	1st MBBS	41 (13.66%)
2	2nd MBBS	86 (28.66%)
3	3rd MBBS	79 (26.33%)
4	4th MBBS	94 (31.33%)
	RESIDENCE	
1	Rural	74 (24.66%)
2	Urban	226 (75.33%)

Background And Experience In Radiology

Of the 300 participants, 112 (37.33%) had undergone a radiograph at some point, and 77 (25.66%) were aware that one of their relatives had undergone a radiograph at some point in time. Most students (n = 247, 82.33%) expressed interest in learning more about radiology. Only 51 students (17 %) had completed a clinical posting in radiology, while 96 (32%) had never heard of interventional radiology (IR). When students rated their knowledge of radiology, 70 (23.33%) considered it poor, 114 (38%) considered it adequate, 109 (36.33%) considered it good, and 7 (2.33%) rated it as excellent. As for their knowledge of radiation doses, 247 students (82.33%) considered it poor, 21 (7%) rated it as adequate, 32 (10.66%) considered it good, and 0 (0%) considered it excellent.

Impact Of Radiology On Diagnosis

The majority of students (n = 209, 69.66%) believed that radiology is as important as physical examination, while 53 students (17.66%) thought that radiology often changes patient care. Conversely, 27 students (9 %) believed radiology is more important than physical examination.

Knowledge About Radiology

The mean radiology knowledge score of the participants was 44.45 ± 13.08, with the highest score being 76.50% and the lowest being 9.31%. Students who had completed a clinical rotation in radiology scored higher (mean score 46.32 ± 14.32) compared to those who had not (mean score 42.28 ± 12.85).

S No.	GROUPS	Mean Score	T Value	P Value
GENDER				
1	Male	41.56 ± 17.41	3.2105	0.0015*
2	Female	47.34 ± 13.76		
COMPLETION OF RADIOLOGY POSTING				
1	Completed (51)	46.32 ± 14.32	2.0052	0.0458*
2	Not Completed (249)	42.28 ± 12.85		

Knowledge In Radiology Basics

Most participants (n = 184, 61.33%) knew that children are the most sensitive age group to radiation, and 99 students (33%) knew that ultrasound (US) is the safest radiological investigation. 31 students (10.33%) knew that there is no specific limit to the number of radiographs that can be requested per year. A misconception was noted about the imaging technique most harmful to the fetus: 186 students (62%) thought it was X-ray, while only 73 (24.33%) correctly identified CT imaging as the most harmful. Regarding radiation-sensitive organs, 126 students (42%) correctly identified the testis and ovaries, while fewer named other organs, such as lungs (n = 37, 12.33%) and breasts (n = 7, 2.33%). For CT contraindications, 171 students (57%) named allergy to radio-contrast agents, and 190 (63.33%) identified pregnancy as a contraindication. MRI contraindications were correctly identified by 101 students (33.66%) as metal foreign bodies, 78 (26%) as pacemakers, and 32 (10.66%) as claustrophobia.

Radiation Exposure

When asked about ionizing radiation exposure, only 23 students (7.66%) correctly recognized that a chest CT is equivalent to 100–500 chest X-rays. A common misconception was that MRI uses ionizing radiation, with 201 students (67%) answering incorrectly. On the other hand, 178 students (59.33%) correctly knew that ultrasound does not involve ionizing radiation. Regarding the risk of developing cancer after a CT study, the majority of students estimated the risk as 1/600 (n = 73, 24.33%) or 1/6000 (n = 88, 29.33%), while a smaller group estimated it at 1/60,000 (n = 67, 22.33%) or 1/60 (n = 51, 17%).

Radiology As A Screening Test

Students demonstrated good knowledge of radiology as a screening tool. They correctly identified mammography for breast cancer (n = 256, 85.33%), US for abdominal aortic aneurysm (n = 109, 36.33%), CT for lung cancer (n = 232, 77.33%), and DEXA for osteoporosis (n = 129, 43%).

Sources of Radiology Information

The majority of students (n = 73, 24.33%) reported using the internet as their primary source of information about radiology, followed by social media (n = 129, 43%) and lectures (n = 98, 32.66%). Only 82 students (27.33 %) felt that they learned about radiology during clinical rotations.

Radiology As A Future Career

More than half of the students (n = 151, 50.33%) found radiology interesting only when related to other fields,93 students (31%) believed it was dull but important, and 56 students (18.66%) considered it interesting on its own. Regarding the radiologist's lifestyle and income, 56 students (18.66%) thought radiologists earned the same as other specialists, and 146 (48.66%) believed their lifestyle was slightly easier. Only 89 students (29.66%) considered radiology as a potential future career. The most common reasons for not choosing radiology included concerns about radiation exposure (n = 131, 43.66%), lack of interest (n = 55, 18.33%), and lack of knowledge (n = 67, 22.33%).

Statistical Significance

There was a significant difference in knowledge scores between male and female students where females fared better than male students. A slightly significant difference was observed between students who had completed a clinical rotation in radiology and those who had not. A clear difference in awareness was also found between clinical and preclinical students, with clinical students, showing greater knowledge.

DISCUSSION

Our study assessed the knowledge of 300 medical students in radiology and their attitude toward this specialty as a future career. Our results showed that females were found to be more knowledgeable than male students. However, the significant gender-based differences, with female students demonstrating superior knowledge levels, warrant further exploration. The higher knowledge scores among female students may stem from a combination of factors, including differential learning styles, engagement with the curriculum, and possible variation in interest levels in radiology.

The students demonstrated a moderate level of knowledge in the basics of radiology and radiation exposure. While their understanding was not inadequate, it fell short of being robust or comprehensive. This moderate level of knowledge indicates that, although students have a foundational grasp of the subject, there is significant room for improvement in their conceptual clarity and practical application. However, the majority (61.33%) rated their knowledge as poor/adequate, while only 38.66% considered their knowledge to be good/excellent. These results were similar to those of Leong et al[18], who found that 66% of final-year medical students in a European country rated their knowledge of interventional radiology as poor or having no knowledge, with only 33.4% rating it as adequate or good.

Studies have highlighted a correlation between medical students' self-reported confidence in their radiology knowledge and their actual performance in the field. For instance, O'Sullivan et al. reported that students who rated their radiology knowledge as excellent or good achieved significantly higher scores than those who perceived their knowledge as inadequate[19]. This emphasizes the importance of fostering both competence and confidence among students to enhance their learning outcomes and future performance.While our study primarily focused on assessing knowledge and attitudes, the findings align with the broader literature that underscores the role of self-confidence in driving academic success. Future research could explore this aspect in greater depth to better understand how confidence influences performance and career preferences in radiology.

In our study, the majority of participants (61.33%) correctly identified children as the age group most affected by radiation, a finding consistent with other studies. O'Sullivan et al[19] reported that 80% of their participants selected children as the most sensitive group to ionizing radiation, and Kada [20], who studied the knowledge of radiation dose and risks among Norwegian final-year medical students, found that 94% identified children as the most susceptible. These results highlight the importance of raising awareness about the risks of radiation in medical education worldwide. Most of our students were aware that radiation affects the fetus. However, there was a notable misconception regarding the most harmful type of imaging to the fetus, with 62% of students indicating that X-ray was the most harmful, while

only 24.33% correctly identified CT as the most harmful. This lack of definitive information, due to the ethical prohibition of experimentation on human fetuses, underscores the need for better education on this topic. The available information is derived solely from observations of patients who survived the Hiroshima bombing in Japan and the Chernobyl nuclear power plant disaster[21,22].

Regarding radiosensitive organs, our students demonstrated a limited understanding, with only 42% correctly identifying the testes and ovaries as the most sensitive organs to radiation. Other studies also reported substantial awareness of radiosensitive organs among medical students. For example, O'Sullivan et al[19] found that 51% of medical students were aware that the kidneys are less sensitive to radiation than the gonads. In our study, 33% of participants correctly identified ultrasound as the safest imaging method, though a significant number incorrectly identified X-ray, CT, or MRI as the safest, revealing a gap in students' understanding of imaging-related hazards.

When it comes to contraindications for imaging techniques, our study found that 57% of participants correctly identified allergy to radio-contrast agents as a contraindication for CT, and 63.33% identified pregnancy as a contraindication. However, only very few provided correct answers. Similarly, for MRI, 33.66% identified metal foreign bodies as a contraindication, 26% identified pacemakers, and 10.66% identified claustrophobia. These gaps in knowledge were also observed in an American study by Prezzia et al[23], where only 26.4% of participants answered all the contraindication questions correctly.

Concerning radiation doses, a considerable proportion of our respondents were unaware of the annual limit for imaging. A similar lack of knowledge about radiation doses was reported in a study by Sundaran Kada, where 89% of Norwegian medical students did not know that there are no limits on MRI doses as long as they are medically justified [20]. The risks of ionizing radiation can be managed by using the lowest possible dose that still provides adequate image quality[24]. However, our study also found misconceptions about the cancer risks associated with CT imaging. A little lesser than a quarter percent of students correctly estimated the risk for a 30-year-old woman developing cancer after undergoing CT of the abdomen as 1 in 600, while Prezzia et al[17] reported that only 8.6% of their sample answered this question correctly. O'Sullivan et al[19] reported that 70% of their participants were aware of the association between CT and an increased cancer risk.

In our study, 59.3% and 33% of students correctly recognized that ultrasound and MRI, respectively, do not involve ionizing radiation. In contrast, O'Sullivan et al[19] reported that only 4.6% and 16.4% of their sample incorrectly associated ultrasound and MRI with ionizing radiation. This misconception extended to radiation doses, as only a small proportion of students knew the radiation equivalent of CT and PET-CT scans, with only 16.7% correctly estimating the radiation dose from chest CT as equivalent to 100-500 chest X-rays. Studies by Zhou et al[15] and Faggioni et al[25] also reported similar misconceptions among medical students regarding radiation doses from CT.

Several factors may contribute to these misconceptions, including a lack of information provided during lectures, as only 32.66% of students considered lectures as their primary source of information, and the unavailability of preclinical radiology postings. This gap in knowledge must be addressed within medical education programs in India to prevent unnecessary radiation exposure and minimize associated cancer risks.

The low percentage of students who expressed interest in pursuing radiology as a future career (29.66%) suggests a lack of awareness and interest in this field. This result aligns with global trends, where low interest in radiology is commonly observed [18,26]. The primary reasons for dismissing radiology included fear of radiation exposure (43.66%) and a general lack of interest (18.33%). This fear can be attributed to a lack of knowledge about radiation safety measures. This lack of interest could also stem from insufficient knowledge about the field, as interventional radiology (IR) has seen rapid global growth but is not officially recognized as a specialty. Educational efforts such as introductory lectures on IR have been shown to boost interest in radiology as a career[27,28].

Finally, our study found that the primary sources of information about radiology were the Internet (24.33%), social media (43%), and university lectures (32.66%). Similar findings were reported by Wang et al[29] in China, where the Internet, textbooks, and media outlets were common sources of information. It is essential that students have access to online resources, such as electronic textbooks, medical databases, and multimedia content, to stay informed about radiology advancements.

Limitation

This study was conducted at a single institution in India, which may not fully represent the broader situation across the country, although it offers valuable insights into the topic. Additionally, the sample of medical students included in the study may not accurately reflect the overall state of knowledge among Indian medical students.

CONCLUSION

This study found that medical students at India possess a moderate level of knowledge in radiology, though some misconceptions persist, and their interest in pursuing radiology as a career remains low. The awareness level of medical students regarding radiology can significantly impact their choice of the specialty. Educational interventions, such as recruiting exceptional radiologists as teaching faculty, equipping them with effective teaching skills, and providing ongoing support, are essential to ensure students receive comprehensive radiology training. Further exploration of teaching methods, input from medical boards, curriculum developers, and guidance from practicing radiologists is necessary. These efforts can help attract top students to the field, cultivate doctors who understand the risks and benefits of imaging, apply radiology appropriately, and value the critical role of radiologists in healthcare.

REFERENCES

1. Hussain S, Mubeen I, Ullah N, Shah SSUD, Khan BA, Zahoor M et al. Modern Diagnostic Imaging Technique Applications and Risk Factors in the Medical Field: A Review. Biomed Res Int. 2022 Jun 6;2022:5164970.
2. Mashoufi R, Mashoufi R. Interventional Radiology for Disease Management: A Narrative Review. Cureus. 2023 Nov 10;15(11):e48603.
3. Elsayed M, Mohamed RH. Awareness of Interventional Radiology Among Medical Students. Cureus. 2024 Sep 22;16(9):e69938.
4. Lin EC. Radiation risk from medical imaging. Mayo Clin Proc. 2010 Dec;85(12):1142-6
5. Cardis E, Vrijheid M, Blettner M, Gilbert E, Hakama M, Hill C et al. Risk of cancer after low doses of ionising radiation: retrospective cohort study in 15 countries. BMJ 2005 Jul 9;331(7508):77.
6. Alchallah M O , Ismail H, Dia T, Shibani M, Alzabibi M A, Mohsen F *et al*. Assessing diagnostic radiology knowledge among Syrian medical undergraduates. *Insights Imaging* 2020;**11**:124.
7. Jindal T. The Knowledge of Radiation and the Attitude Towards Radio-Protection among Urology Residents in India. J Clin Diagn Res. 2015 Dec;9(12):JC08-11.
8. Shah K K. Knowledge regarding risk in radiation exposure among health care professionals at a tertiary care centre. Int J Med Res Prof. 2018 Mar; 4(2):385-8.
9. Rahman FBA, Gurunathan D, Vasantharajan MS. Knowledge, attitude and practice of radiation exposure protection for pediatric patients among undergraduate dental students. Biomed Pharmacol J. 2018;11(2).
10. Maharjan S, Parajuli K, Sah S, Poudel U. Knowledge of radiation protection among radiology professionals and students: A medical college-based study. Eur J Radiol Open. 2020 Nov 22;7:100287
11. Shafiq P, Mehmood Y. Awareness of Radiation Hazards and Knowledge About Radiation Protection Among Medical Students at the Northern Border University, Arar. Cureus. 2024 Mar 4;16(3):e55484.
12. Rohren SA, Kamel S, Khan ZA, Patel P, Ghannam S, Gopal A et al. A call to action; national survey of teaching radiology curriculum to medical students. J Clin Imaging Sci. 2022 Oct 10;12:57.
13. Alnajjar SF, Alshamrani HM, Banasser AM, Alshehri HZ, Wazzan MA, Abduljabbar AH . Awareness of interventional radiology among medical students at a Saudi Medical School: clerkship versus pre-clerkship years. Oman Med J 2019;34(5):420
14. Thakur A. Shortage of radiologists a concern, fostering research in AI can augment capabilities of radiologists: Experts. Indian Express. 2023 Nov 16 [cited 2024 Nov 05]. Available from: https://indianexpress.com/article/cities/bangalore/shortage-radiologists-research-ai-capabilities-experts-8884446/
15. Zhou G, Wong D, Nguyen L, Mendelson R. Student and intern awareness of ionising radiation exposure from common diagnostic imaging procedures. J Med Imaging Radiat Oncol 2010; 54(1):17–23
16. Kada S. Awareness and knowledge of radiation dose and associated risks among final year medical students in Norway. Insights Imaging 2017; 8(6):599–605
17. Prezzia C, Vorona G, Greenspan R . Fourth-year medical student opinions and basic knowledge regarding the field of radiology. Acad Radiol 2013; 20(3):272–283
18. Leong S, Keeling AN, Lee MJ. A survey of interventional radiology awareness among final-year medical students in a European country.Cardiovasc Interv Radiol 2009;32(4):623–629
19. O'Sullivan J, O'Connor OJ, O'Regan K et al. An assessment of medical students' awareness of radiation exposures associated with diagnostic imaging investigations. Insights Imaging 2010; 1(2):86–92
20. Kada S . Awareness and knowledge of radiation dose and associatedrisks among final year medical students in Norway. Insights Imaging 2017; 8(6):599–605
21. Brent RL. Saving lives and changing family histories: appropriate counseling of pregnant women and men and women of reproductive age, concerning the risk of diagnostic radiation exposures during and before pregnancy. Am J Obstet Gynecol. 2009;200(1):4–24.
22. De Santis M, Cesari E, Nobili E, Straface G, Cavaliere AF, Caruso A. Radiation effects on development. Birth Defects Res C Embryo Today. 2007;81(3):177–182.
23. Prezzia C, Vorona G, Greenspan R. Fourth-year medical student opinions and basic knowledge regarding the field of radiology. Acad Radiol. 2013;20(3):272–283.
24. International Commission on Radiological Protection. 1990 recommendations of the International Commission on Radiological Protection. Ann ICRP. 1991;21(1–3):i–203.
25. Faggioni L, Paolicchi F, Bastiani L, Guido D, Caramella D. Awareness of radiation

protection and dose levels of imaging procedures among medical students, radiography students, and radiology residents at an academic hospital: results of a comprehensive survey. Eur J Radiol. 2017;86:135–142.
26. O'Malley L, Athreya S. Awareness and level of knowledge of interventional radiology among medical students at a Canadian institution. Acad Radiol. 2012;19(7):894–901.
27. Ghatan CE, Kuo WT, Hofmann LV, Kothary N. Making the case for early medical student education in interventional radiology: a survey of 2nd-year students in a single US institution. J Vasc Interv Radiol. 2010;21(4):549–553.
28. Branstetter BF IV, Faix LE, Humphrey AL, Schumann JB. Preclinical medical student training in radiology: the effect of early exposure. AJR Am J Roentgenol. 2007;188(1):W9–W14.
29. Wang Z-X, Shan T. Awareness of interventional radiology before professional training and outcome measurement of an interventional radiology curriculum: a survey of third-year undergraduates in a Chinese medical college. Diagn Interv Radiol. 2019;25(5):375.