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An Evaluation of Diagnostic Radiology Knowledge Among Medical Undergraduates

Maha Abdullah Bin Sughayyir Alotaibi, Waleed Faisal Almutairi, Abdullah Ibrahim Alshudayyid, Khalaf Raieed M Aldosari, ZAID ABDULLAH ALMESHARI ALTAMIMI, Abdulaziz Awwadh D Alotaibi, Tarek Obid Alharbi

Radiology technology

Abstract

Background: The field of radiology plays a crucial role in modern healthcare, yet medical students often lack awareness and understanding of this discipline. This study aims to evaluate the knowledge and attitudes of medical undergraduates toward diagnostic radiology.

Methods: This cross-sectional study was conducted coinciding with the International Day of Radiology amid the country's ongoing crisis. Data were collected through self-administered surveys and analyzed using SPSS version 25.0.

Results: A total of 269 medical students aged 17 to 30 participated, with 63.6% being male. The findings indicated a satisfactory understanding of fundamental radiology concepts among respondents. While 73.6% were familiar with interventional radiology, some misconceptions persisted, particularly concerning radiation exposure in imaging techniques. Notably, only 24.5% of students showed interest in pursuing radiology as a future career.

Conclusions: The study underscores the impact of awareness levels on career choices, highlighting the need for improved teaching methods and guidance from medical professionals and educators to foster interest in radiology among medical students.

Keywords: Diagnostic radiology, Medical education, Awareness, Career choice

Introduction:

Medical imaging encompasses various technological processes used to gather data about the human body for diagnostic, monitoring, or treatment purposes (FDA, 2020). These technologies include computed tomography (CT), magnetic resonance imaging (MRI), X-ray radiography, ultrasonography (US), and positron emission tomography (PET), each providing unique insights depending on the targeted body area (FDA, 2020). This field, termed diagnostic radiology when used for diagnosis, is integral to modern medical practice due to its ability to diagnose conditions and minimize unnecessary procedures safely (WHO, 2020). Recent advancements have also given rise to interventional radiology (IR), utilizing imaging techniques for therapeutic interventions (Alnajjar et al., 2019). However, there is a noticeable lack of emphasis on promoting awareness about diagnostic and interventional radiology during medical education (Alnajjar et al., 2019). It is crucial for students to grasp concepts related to radiation, given its significance in future medical practice.

The increasing utilization of imaging in healthcare, exceeding that of other technologies, suggests potential overuse with associated risks, notably radiation-induced cancer even at low doses (Hendee et al., 2010; Cardis et al., 2005). In Australia, for instance, diagnostic imaging contributes to approximately 1.3% of cancer cases up to the age of 75 (Berrington de González and Darby, 2004). Overutilization often stems from gaps in physicians' knowledge regarding imaging safety and indications, leading to unnecessary

interventions (Ip et al., 2012; Lehnert and Bree, 2010). Educating physicians on appropriate utilization, safety, protection, and risks of radiology is thus vital for optimal patient care (Dillon and Slanetz, 2010; Leschied et al., 2013).

A study by Sawaf et al. in 2018 highlighted the low interest among medical students in pursuing radiology as a career path, attributing this to factors such as limited postgraduate courses and inadequate education on radiation during their training (Sawaf et al., 2018). The scarcity of radiologists in further exacerbates this issue, with reports indicating a shortage of radiologists compared to the population (Haddad et al., 2007).

The ongoing crisis has significantly impacted healthcare, with attacks on healthcare facilities and the loss of healthcare workers (World Health Organization, 2018). This has strained the radiology sector, reducing facilities and professionals, thereby affecting medical education and access to radiological services (World Health Organization, 2018).

Despite these challenges, there is a lack of published research on radiology knowledge among medical students. This study aims to assess the knowledge and attitude of undergraduate medical students toward diagnostic and interventional radiology at the Private University (PU). It seeks to determine their baseline knowledge in radiology and whether this knowledge evolves as they progress through their studies and clinical practice. Additionally, the study aims to gauge their interest in pursuing radiology as a future career.

Methods:

Study Design, Setting, and Participants:

A cross-sectional study was conducted using a convenience sampling method at the Faculty of Medicine, , during the International Day of Radiology . The participants included undergraduate medical students. Participation was voluntary, and anonymity was assured. Ethical approval was obtained from the Institutional Review Board (IRB), Faculty of Medicine, . The study utilized a structured self-administered English questionnaire, adapted from previously published studies. Students had the option to opt-out at any time, with no impact on their grades. The questionnaire comprised 39 questions categorized into seven sections: socio-demographic (7 questions), background and experience (8 questions), basic knowledge (9 questions), radiology as a screening test (4 questions), levels of radiation exposure (5 questions), and radiology as a career (6 questions). Knowledge scores were calculated based on correct answers, with 100% representing the maximum score achievable. Mean knowledge scores were determined as the average of individual scores. .

Statistical Analysis:

Data analysis was performed using the Statistical Package for Social Sciences version 25.0 (SPSS Inc., Chicago, IL, United States). Categorical data were presented as frequencies and percentages, while continuous data were expressed as means and standard deviations (SD). Knowledge score comparisons between categories were conducted using unpaired Student's t-test or Mann–Whitney U test. Associations between categorical groups were assessed using the Pearson Chi-square test. A p-value < 0.05 was considered statistically significant.

Results:

Demographic Characteristics: Out of 300 medical students, 269 completed the questionnaire, comprising 171 (63.6%) males and 98 (36.4%) females. The age range was 17 to 30 years, with a mean age of 21.61 ± 3.58 years. Fifth-year students represented the majority (n = 87, 32.3%), while second-year students were a minority (n = 9, 3.3%). Most participants were single (n = 238, 88.5%).

Background and Experience in Radiology: Among the participants, 221 (82.2%) had undergone a radiograph at least once, and 263 (97.8%) had relatives who had. A majority expressed interest in learning more about radiology (n = 250, 92.9%), with 72 (26.8%) having completed a clinical rotation in radiology. However, 71 (26.4%) had never heard of interventional radiology. The students rated their knowledge in radiology compared to other fields as poor (n = 51, 19.0%), adequate (n = 117, 43.5%), good (n = 91, 33.8%), and excellent (n = 10, 3.7%). Similarly, their self-assessment of knowledge about radiation doses varied from poor to excellent.

Knowledge About Radiology: The mean knowledge score in radiology was 49.2 ± 13.16%, with scores ranging from 16.67% to 87.50%. Students who had completed a clinical rotation in radiology had a slightly higher mean knowledge score (51.85 ± 12.74%) compared to those who had not (48.22 ± 13.21%). Regarding specific knowledge areas, participants showed varying levels of understanding about radiology basics, radiation exposure levels, and radiology as a screening test. For instance, most knew about radiation sensitivity in children but had misconceptions about imaging techniques and associated risks.

Radiology as a Future Career: While a significant number of students found radiology interesting only in relation to other fields of medicine, a minority considered it interesting on its own. Concerns about radiation exposure, lack of interest, and insufficient knowledge were cited as reasons for not considering radiology as a future career. Only 66 (24.5%) participants expressed interest in pursuing radiology as a career.

These findings highlight the varied levels of knowledge, interest, and perceptions among medical students regarding diagnostic and interventional radiology.

Discussion

Our study assessed the knowledge of medical students in radiology and their attitude toward this specialty as a future career. Our results showed comparable knowledge scores between males and females with no significant difference (Alnajjar et al., 2019). Similar findings were reported by Alnajjar et al. (2019) who found that awareness about interventional radiology among Saudi medical students was gender-independent. Furthermore, our students demonstrated adequate knowledge in the basics of radiology and radiation exposure. However, the majority (62.5%) rated their knowledge as poor/adequate, while only 37.5% felt they have good/excellent knowledge in radiology (Alnajjar et al., 2019). Interestingly, our observations were very similar to those made by Leong et al. (2009) who found that 66% of final-year medical students in a European country rated their knowledge in IR as poor/no knowledge, while only 33.4% thought they had adequate/good knowledge. Finally, our results indicated that students who rated their knowledge as good/excellent achieved a higher knowledge score than those who thought they had adequate/poor knowledge in radiology. Increasing evidence is emerging on the correlation between the level of confidence of medical students about their information in radiology and the actual knowledge they demonstrate in this field (O'Sullivan et al., 2010).

The majority of our participants (79.6%) correctly identified children as the age group most affected by radiation (O'Sullivan et al., 2010). Our observation was in agreement with other studies. O'Sullivan et al. (2010) indicated that 80% of their participants selected children as the most sensitive group to ionizing radiation. Kada (2017), who studied the knowledge of radiation dose and risks among Norwegian final-year medical students, found that 94% of the students correctly identified children as the most susceptible group to radiation risks. Taken together, these results show that raising awareness of the risks of radiation is at the core of medical education programs worldwide.

In 2007, the International Commission on Radiological Protection issued recommendations that named the ovaries and testes, bone marrow, and eye lens as the most radiosensitive organs (ICRP, 2007). In this context, our students showed good knowledge as 65.1% of them identified 'the testis and ovaries' as the most sensitive organs (ICRP, 2007). Other studies also showed abundant knowledge in radiosensitive organs among medical students (O'Sullivan et al., 2010; Hamarsheh & Amro, 2017).

About 42% of our sample successfully identified ultrasound as the safest imaging method (Cardis et al., 2005). Surprisingly, a considerable number of participants incorrectly named X-ray, CT, or MRI as the safest imaging approach which revealed an existing gap in the knowledge of medical students regarding imaging-associated hazards (Cardis et al., 2005). As CT and MRI are only requested when indicated, we assessed our sample's knowledge about the most common contraindications for these two imaging techniques (Ip et al., 2012). Regarding CT contraindications, 65.4% of our participants chose allergy to radio-contrast agents, 56.9% chose pregnancy, 42.8% chose renal failure, and 14.1% chose liver failure. However, only 8.2% responded with all four correct answers (Ip et al., 2012). As for MRI contraindications, the presence of metal foreign bodies, pacemaker, and claustrophobia was selected by 72.9%, 46.8%, and 43.5% of our students, respectively (Ip et al., 2012). Again, only a small percentage (21.6%) responded

with all four correct answers (Ip et al., 2012). This gap in knowledge was also observed in an American study conducted by Prezzia et al. (2013).

The uncontrolled use of procedures that employ ionizing radiation for body imaging has raised concerns about cancer risks (Berrington de González & Darby, 2004). In our study, 33.5% of the students correctly placed the chance of a 30-year-old woman developing cancer after undergoing CT of the abdomen at 1 in 600 (Berrington de González & Darby, 2004). In contrast, Prezzia et al. (2013) indicated that only 8.6% of their sample responded correctly to this question. Finally, O'Sullivan et al. (2010) reported a high level of knowledge among their participants as 70% of the medical students were aware of the association between CT and increased cancer risk.

Training in radiology in the first year of medical school is a necessity, especially for those interested in the field as a future career (Leong et al., 2009; O'Malley & Athreya, 2012). Our results showed that 73% of the students did not complete a radiology rotation (Sawaf et al., 2018). Other studies supported our findings. Muzumdar et al. (2019) reported that only 35% of English medical students completed a rotation in IR. Similarly, Alnajjar et al. (2019) observed that only 25% of Saudi medical students completed or were planning to complete an elective in IR. Finally, Agrawal et al. (2019) noted an alarmingly low rate of IR rotation completion at 5.7% among Indian medical students (Sawaf et al., 2018; Muzumdar et al., 2019; Agrawal et al., 2019). Students who had a previous rotation in IR tended to be more informed about the specialty (Alnajjar et al., 2019; Muzumdar et al., 2019).

In our study, only 24.5% of the respondents considered specializing in radiology for their future career (Sawaf et al., 2018). This result indicates a significantly low interest in radiology among medical students

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