Perception of Radiation Hazards by Medical Interns in Eastern Providence, Saudi Arabia

Mohammed Hazem [1]*, Qusai A Al-Omran [2], Banin Qusay Al Murawhan [3], Abdulhadi A Al Omran [4], Mariam A Alluwaim [5], Ali A Al Saeed [5]

[1] Assistant professor of radiology, college of medicine, King Faisal University, Al-Ahsa, Saudi Arabia.
[2] Intern doctor at king Faisal university, Al- Ahsa, Saudi Arabia.
[3] Medical student at Imam Abdulrahman Bin Faisal University, Qatif, Saudi Arabia.
[4] Intern doctor at alfarabi colleges, Riyadh, Saudi Arabia.
[5] Intern doctor at king Faisal university, Al- Ahsa, Saudi Arabia.

ABSTRACT

Background: Radiographic imaging is extremely valuable as a diagnostic tool in medicine, but ionizing radiation and computed tomography (CT) scans carry well-known potential risks, which can lead to serious health hazards to healthcare workers (HCWs) and the nearby environment if safety measures are not properly applied. **Objective:** To assess the knowledge and awareness among Saudi Medical interns in Eastern Providence regarding radiation protection and radiological examination doses. **Result:** We recruited 387 Saudi medical interns between two universities (KFU: 202; IAU: 185), The proportion of medical interns who attended radiation protection courses, who were having adequate information about radiation risk and radiation protection measures were 11.1%, 43.2%, and 31%, respectively. When comparing KFU and IAU, those who attended radiation protection courses ($p<0.001$), those with having adequate information about radiation risk ($p=0.002$), and those with adequate information about radiation protection measures ($p<0.001$) were statistically significantly higher at KFU. **Conclusion:** The present study found that medical interns in KFU and IAU lack sufficient knowledge concerning radiation, radiation protection, health risks, and doses used for radiological applications.

Key Words: *Radiology, Medical Interns, Saudi Arabia, Occupational medicine*

eIJPPR 2020; 10(6):51-56

HOW TO CITE THIS ARTICLE: Mohammed Hazem, Qusai A Al-Omran, Banin Qusay Al Murawhan, Abdulhadi A Al Omran, Mariam A Alluwaim , Ali A Al Saeed (2020). "Perception of Radiation Hazards by Medical Interns in Eastern Providence, Saudi Arabia", International Journal of Pharmaceutical and Phytopharmacological Research, 10(6), pp.51-56.

INTRODUCTION

Any individual can be exposed to radiation from various sources such as radiation exposure involved occupations, nuclear weapons production, and medical radiological procedures. In the current era, the application of different radiological modalities in clinical practice is considered to be the major artificial source of exposure to ionizing radiation [1-3].

Medical radiological procedures have been utilized in the practice of modern medicine regularly [4, 5]. There are three main aspects by which ionizing radiation is used in the medical field. These encompass diagnostic radiology, radiotherapy, and nuclear medicine [5, 6]. It is worth noting that there are approximately 3.6 billion radiological examinations conducted on a global level annually [1].

Although the purposes of using ionizing radiation are in the interest of the patient, its associated risks are concerning in such growing applications [1, 7]. One of the worrisome risks is radiation-induced malignancy where a linear relationship between the incidence of cancer and exposure to ionizing radiation has been found [6].

A published report in The Lancet 2004 states that there are 430 new cancer cases per year in Australia which are possibly due to diagnostic radiation [8]. Consequently, because of the potential consequences of ionizing radiation, numerous regulations have been established to ensure patients' safety such as the POPUMET regulations

Corresponding author: Mohammed Hazem
Address: Assistant professor of radiology, college of medicine, King Faisal University, Al-Ahsa, Saudi Arabia.
E-mail: Mohamedhazem73 @ yahoo.com
Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
Received: 05 August 2020; **Revised:** 26 November 2020; **Accepted:** 01 December2020

and ALARA (as low as reasonably achievable) principle [9].

Therefore, physicians must justify requested radiological procedures to avoid unnecessary exposure to ionizing radiation in the patients' care process [6]. Given the fact that medical students and interns are the ones who would deal with such applications in the future, great attention should be given to expanding their knowledge about radiation doses, associated risks, and protection measures [10].

Several studies were conducted to evaluate the knowledge of medical students and interns about ionizing radiation and its hazards. Kada (2017) concludes that final year medical students in Norway showed a lack of knowledge of radiation dose and its associated risks [10]. Unfortunately, many other studies reported parallel results [11-13].

On a local level, Albusair et al. (2020) demonstrated disappointing total knowledge mean score and low-level confidence regarding ionizing radiation dose among medical students throughout Saudi Arabia [14]. Similarly, Alreshidi et al. (2020) stated overall poor knowledge among medical students at the University of Hail. However, attending radiation protection courses and the progress through clinical years were observed to be related to better knowledge regarding radiation, its risks, and relevant safety measures [15]. Hence, the majority of previous studies were unanimous on the fact that medical students and interns need further education about such subjects globally and locally.

Thus, assessment of medical students' and interns' knowledge of radiation and its adverse effects is a key in the training of keen future physicians who would apply the principle of “do more good than harm” when managing patients. Regrettably, there are no studies conducted on the subject of radiation knowledge among medical interns in the eastern province in Saudi Arabia. Therefore, this study aims to evaluate the awareness of radiation, its hazards, and protection measures among medical interns in the eastern province of Saudi Arabia.

METHODOLOGY

Study sitting

This is a descriptive cross-sectional study was conducted in the eastern province in Saudi Arabia. Data was obtained by using a pre-tested, structured, and web-based questionnaire, which was distributed between interns between June 2020 and October 2020.

Study Tool

The knowledge about imaging modalities, hazards, and protection measures was assessed with a questionnaire that consisted of 31 multiple-choice and true or false questions that had been divided into three sections. The first section composed of 10 questions, tested the respondent’s knowledge about the various imaging modalities and the differences between them, with additional questions regarding effective radiation doses. The second section comprised 13 questions, tested the knowledge about radiation risks and the contraindications of some imaging modalities. The third section consisted of 8 questions, tested the knowledge about radiation safety measures. The validity of the questionnaire was confirmed by a radiologist and a medical physicist [16]. The total score of knowledge has been calculated by adding all questions (31 items) for a total possible score of 31 points. Each section was consecutively calculated following the number of questions compromising 10 points, 13 points, and 8 points for the first section, second and third sections, respectively.

Statistical Analysis

The data were shown as frequency, percentage mean, and standard deviation, whenever appropriate. The categorical data were compared between subgroups using the chi-square test. The mean scores were compared between the medical interns’ demographic profiles and the self-rated knowledge about radiation risk and protection measures using the Mann Whitney U test (non-parametric). All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) software, for Windows (version 21; IBM, Armonk, New York). P values <0.05 were considered statistically significant.

Ethical Approval

Ethical approval was obtained from King Fahd Hufof's hospital-academic affairs and research administration. Besides, informed consent was obtained from each intern before the administration of the questionnaire. Anonymity and confidentiality of the responses of collected data were maintained.

RESULTS

Table 1: Demographic profiles and self-rated knowledge about radiation risk and protection measures of medical interns in accordance with university

Study data	Overall N (%) (n=387)	KFU N (%) (n=202)	IAU N (%) (n=185)	P-value §
Gender				

• Male	215 (55.6%)	112 (55.4%)	103 (55.7%)	0.964
• Female	172 (44.4%)	90 (44.6%)	82 (44.3%)	
Marital Status				
• Single	286 (73.9%)	149 (73.8%)	137 (74.1%)	0.948
• Married	101 (26.1%)	53 (26.2%)	48 (25.9%)	
Attended radiation protection course				
• Yes	43 (11.1%)	35 (17.3%)	08 (04.3%)	**<0.001 ****
• No	344 (88.9%)	167 (82.7%)	177 (95.7%)	
Having adequate information about radiation risk				
• Yes	167 (43.2%)	102 (50.5%)	65 (35.1%)	**0.002 ****
• No	220 (56.8%)	100 (49.5%)	120 (64.9%)	
Having adequate information about radiation protection measures				
• Yes	120 (31.0%)	81 (40.1%)	39 (21.1%)	**<0.001 ****
• No	267 (69.0%)	121 (59.9%)	146 (78.9%)	

KFU – King Faisal University; IAU – Imam Abdulrahman bin Faisal University.

We recruited 387 Saudi medical interns between two universities (KFU: 202; IAU: 185). As seen in Table 1, more than half were males (55.6%) and nearly three quarters were single (73.9%). The proportion of medical interns who attended radiation protection courses, who were having adequate information about radiation risk and radiation protection measures were 11.1%, 43.2%, and 31%, respectively. When comparing KFU and IAU, those who attended radiation protection courses ($p<0.001$), those with having adequate information about radiation risk ($p=0.002$), and those with adequate information about radiation protection measures ($p<0.001$) were statistically significantly higher at KFU.

Table 2: Descriptive statistics of the knowledge about imaging modalities, radiation risks, safety, and principles (n=387)

Variables	No. of items	Mean ± SD	Range
Knowledge about imaging modalities	10	6.26 ± 1.52	1 – 10
Knowledge about radiation risks	13	4.13 ± 1.66	0 – 08
Knowledge about radiation safety principles	08	0.99 ± 1.18	0 – 06
Overall knowledge	31	11.4 ± 3.21	1 – 22

Table 2 presented the descriptive statistics of the knowledge about imaging modalities, radiation risks safety, and principles. Following the results, it was found that the overall mean knowledge score was 11.4 (SD 3.21) out of 31 points while the mean score of knowledge about imaging modalities, radiation risks, and radiation safety principles were 6.26, 4.13, and 0.99, respectively.

Table 3: Correlation (Pearson-r) between the knowledge about imaging modalities, radiation risks, and safety principles

SN	Knowledge	I	II	III	IV
I	Imaging modalities	1			
II	Radiation risks	0.385 **	1		
III	Radiation safety principles	0.257 **	0.249 **	1	
IV	Overall knowledge	0.768 **	0.792 **	0.617 **	1

** Correlation was statistically significant at $p<0.01$ level (2-tailed).

Table 4: Relationship between the attendance of a radiation protection course among the knowledge about imaging modalities, radiation risks, and safety principles (n=387)

Knowledge factor	Radiation protection course attendance		T-test	P-value §
	No	Yes		
Imaging modalities	6.23 ± 1.53	6.49 ± 1.45	-1.038	0.157

Radiation risks	4.13 ± 1.64	4.09 ± 1.84	0.140	0.572
Radiation safety principles	0.94 ± 1.16	1.37 ± 1.25	-2.269	**0.017** **
Overall knowledge	11.3 ± 3.20	11.9 ± 3.31	-1.248	0.135

§ P-value has been calculated using the Mann Whitney U test.
** Significant at p<0.05 level

In table 3, we found that the correlation between knowledge about imaging modalities, radiation risks, radiation safety principles and overall knowledge scores were positively highly statistically significant (All p<0.01).

Table 5: Statistical Association between the overall knowledge score among demographic profiles, self-rated knowledge about radiation risks and protection measures of medical interns (n=387)

Factor	Knowledge Total Score (31) Mean ± SD	T-test	P-value §
Gender			
• Male	10.7 ± 3.29	-4.641	**<0.001** **
• Female	12.2 ± 2.93		
Name of the university			
• KFU	11.8 ± 3.09	2.967	**0.004** **
• IAU	10.9 ± 3.28		
Marital Status			
• Single	11.1 ± 3.38	-3.053	**<0.001** **
• Married	12.2 ± 2.51		
Self-rated knowledge about radiation risk			
• Yes	10.9 ± 3.05	-3.331	**0.002** **
• No	11.9 ± 3.33		
Self-rated about radiation protection measures			
• Yes	11.0 ± 3.09	-3.173	**0.004** **
• No	12.1 ± 3.37		

KFU – King Faisal University; IAU – Imam Abdulrahman bin Faisal University.
§ P-value has been calculated using the Mann Whitney U test.
** Significant at p<0.05 level.

When measuring the association between the attendance of a radiation protection course among the knowledge regarding imaging modalities, radiation risk, and safety principles, it was found that those who attended the radiation protection course showed significantly better radiation safety principles than those who did not attend (T=-2.269; p=0.017) while the difference in the knowledge about imaging modalities, radiation risks and overall knowledge in regards to radiation protection course attendance was not significantly different (All p>0.05) (Table 4).

When determining the association between the overall knowledge score among the demographic profiles, self-rated knowledge about radiation risks and protection measures, it was found that the knowledge score of females (T=-4.641; p<0.001), medical interns at KFU (T=2.937; p=0.004), those married (T=-3.053; p<0.001) were statistically significantly higher while the overall knowledge score of those who believe that their knowledge about radiation risks was adequate (T=-3.331; p=0.002) and those who thought that their knowledge about radiation protection measures was sufficient (T=-3.173; p=0.004) was statistically significantly lower compared to its opposite groups (Table 5).

DISCUSSION

Medical imaging plays an important role in Modern medicine where radiation exposure is inevitable in many of the diagnostic and interventional radiology procedures. Even though there are minimal risks associated with radiation, the overall benefits compensate for these risks. However, there is a rising disquiet over the severe deleterious effects of radiation on the human body. The lifetime risk of malignancy increased proportionally with the radiation dose received from some imaging modality. [14] Numerous previously published researches showed that medical students have inadequate knowledge regarding ionizing radiation and its protective measures. [16-18]

The results of this study revealed that, despite the significance of radiation and its associated risks, only

11.1% of the participants had engaged in radiation protection courses in the eastern province including two universities. And this is consistent with the finding of another study in KSA, done at the University of Hail in which there was only 10.3% of students had been educated about radiation protection. [15] Moreover, in the West of KSA in Al-Madinah Al-Munawarah, a study revealed that only 8% of the members had participated in a course comprehended radiation risks. [9]

Overall, the level of awareness among these interns was poor, with statistically significantly higher at KFU. Furthermore, 43.2% of the interns consider themselves as they have adequate knowledge about the risks of radiation and 31% reported that they have adequate knowledge about radiation protection measures. In comparison to another study in which 31% of their participates considered that they had adequate knowledge about the risks of radiation and 11% reported that they had adequate knowledge about radiation protection measures. [15]

In this study, the lowest score was found in the section of knowledge about safety principles in radiology; the mean score of 0.99 ± 1.18 of 8 assisted items, which signifies that the interns have poor knowledge about radiation protection which might affect them and others during routine radiation procedures, consequently it will disturb a core principle in patient safety. A similar score was measured at the University of Hail with a mean score of 0.79 ± 0.922 of 8. [15]

When we compare interns who attend a course for radiation protection and those who did not attend, there was no significant difference, which means that both of the groups have generally poor knowledge about radiation risk even if they have some form of education on this subject previously. Excepting the part of radiation safety principles in which the group who attend have significantly better mean scores. A study done in Al-Madinah Al-Munawarah reports that students who had to join a course on radiation risk had greater mean ranks than those who did not attend with mean ranks of 181.94 compared to 87.55 respectively. [9] Zewdneh et a., in 2012 stated that those participants who have had educated about ionizing radiation have a better understanding of the risks involved, compare with those who have not been educated. [18]

The difference in the level of knowledge and gender was found to be significant, in which the mean score of females was 12.2 compared to 10.7 in males. This result corresponds with a previous study that confirmed that female students scored 102.78 while male students 87.41 in the mean rank. [9]

The results of this study emphasize the insufficient awareness of ionizing radiation. Education is an essential solution to increase awareness of the potential hazards of ionizing radiation. Therefore, radiation protection, hazards, and doses should be included in the curriculum before and during clinical practice to correct this misconception and prevent further disastrous results.

CONCLUSION

The results of this study emphasize the insufficient awareness of ionizing radiation. Education is an essential solution to increase awareness of the potential hazards of ionizing radiation. Therefore, radiation protection, hazards, and doses should be included in the curriculum before and during clinical practice to correct this misconception and prevent further disastrous results.

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