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Research Article

Assessment of Awareness and Knowledge among Medical Students Regarding Radiation Exposure from Common Diagnostic Imaging Procedures

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ABSTRACT

***Objective*:** to assess the awareness and knowledge of our medical students regarding dose levels of imaging procedures and radiation safety issues, and to conclude how the curriculum of clinical radiology in the college medical program impacts such knowledge.

Subjects and methods: this is a cross-sectional study conducted among 150 medical students in Alkindy College of Medicine between January 2021 to July 2021, regardless of their age or gender. The study included six grades according to the year 2020-2021. A questionnaire consisting of 12 multiple-choice questions was conducted via an online survey using Google Forms. The questions were divided into two parts (awareness concerning issues of radiation protection, and information about dose levels of frequent radiological investigations).

***Results*:** Regarding their radiology knowledge, about one-third of all participants rated as average. Students who had not established training in radiology chose the inappropriate choice more often than individuals who had received training. Also, students without instruction/ teaching in diagnostic clinical radiology were more likely to connect MRI and ultrasound with an increased cancer possibility compared with those students receiving radiology teaching. About the desired educational method, 32% wanted a tutorial or workshops, 29% wanted a learning module, 25% chose a case study and 14% chose a lecture.

***Conclusion*:** With increasing years in medical school, the student's alertness demonstrates better performance regarding the radiation exposures in imaging diagnosis. The greater part of medical students has inadequate knowledge about different aspects of radiation sources, hazard, and their safety. We think that adding more theoretical and practical programs to the educational radiology curriculum will advance awareness of radiation safety and increase knowledge among medical students regarding the doses of radiological examinations.

Introduction

Currently, medical studies have recognized that increasing utilization of diagnostic imaging tools, principally computed tomography (CT), results in increasing patient radiation exposures (1). Furthermore, the number of referrals for pediatric CT examinations has augmented exponentially, raising considerable

issues concerning the risk of malignancy in this greatly radiosensitive population (2). Not unexpectedly, issues are rising regarding the risk linked with an elevated level of radiation exposure, mainly the probable amplified life span threat of cancerous diseases (3). The European Council Euratom directive of 1997 appreciated this subject and made numeral advice. The incorporation of radiation protection into the curriculum of medical schools was the most important recommendation issued by this directive (4). Hence, health professionals must be alert of the radiation exposures related to radiological diagnostic examinations, especially CT scans. In the last years, health workers from different specialties have been investigated by many studies regarding their familiarity with radiation dose and radiation hazard, and nearly all these studies' results were significantly unsatisfied (5-7). While many studies of medical students' knowledge of radiology have been achieved, the particular area of awareness among medical students regarding relative radiation doses associated with different diagnostic imaging investigations has so far been meticulously investigated (8-10). It is believed that students of medical colleges may not be aware of the radiation dosage and hazards related to frequently used diagnostic imaging procedures. Our work aims to evaluate the awareness and knowledge of our college students regarding radiation exposure, to compare between the stages to evaluate the efficacy and accuracy of the education in the late stage, to know the students' desire for the best way to study radiology, and to illustrate the importance of adding radiation protection education during the initial study years.

Subjects and Methods

We conducted a comparative cross-sectional study, to evaluate the knowledge concerning radiation exposure and its risks among medical students at Al-kindy College of Medicine. This study was conducted under the Declaration of Helsinki and was approved by the local thesis committee of the college (research project number;112/20). The personal information of all participants involved in the study was safeguarded .

A questionnaire with multi-choice was distributed to the participants of our study covered first to sixth-year students (n=150) at the end of the educational year (January 2021 to July 2021) in Al-kindy College of medicine. The questionnaire track a multi-choice arrangement of two main parts. The first part included demographic data of the student and a self-appraisal of awareness of radiology in comparison to other health topics, as well as prior contact to radiological training and teaching. The second part evaluated alertness and general awareness of radiation exposures linked to imaging investigations. Due to the corona pandemic, the questionnaire was in a Google form type.

For ethical considerations, there weren't questions asking about the participants' names, religions, or ID numbers. The questionnaire kept the participants' anonymity i.e. the participant was anonymous.

Statistical analysis

All patients' data were entered using the Statistical Package for Social Sciences software (IBM SPSS Statistics for Windows, version 21.0 Armonk, NY, USA). To evaluate the normal distribution of means, histograms tests of normality were applied. Microsoft Excel 2010 was used to analyze the data. The frequencies were stated first then the Chi-Square test and Fisher's exact test was used to investigate the association. A p-value less than 0.05 was considered significant.

Results

A hundred fifty (150) students participated in our study, accounting for a response rate of 61.9% male and 38.1% female. In the first, second, third, fourth, fifth, and sixth study years, the students were distributed (Table 1).

Table 1: Study population distribution

Stage	%
first	11.50
second	19.40
third	30.20
forth	10.10
fifth	15.10
sixth	13.70

About one-third of all students included (36.0%) reported their knowledge of radiology as an average. About 28.1% of the study population had been exposed to theoretical lectures in radiology, 10.8% exposed to tutorials/workshops, 19.4% exposed to a combination of lectures, tutorials, and workshops, Despite this, 41.7% of the study population were not exposed to any lessons or instruction centered on radiation safety. With the number of years completed effectively in medical school, the mean scores were improved (Table 2).

Table 2: Self-estimation of awareness of radiology in comparison to other health topics, and prior exposure to radiological training and education

	first	second	third	forth	fifth	sixth	p-value
Regarding ionizing radiation, have you any education in the form of lectures, tutorials, or training courses?							<0.001
Lectures	6.3%	59.3%	9.5%	14.3%	38.1%	42.1%	
Tutorials/workshops	0.0%	0.0%	16.7%	0.0%	19.0%	21.1%	
A combination of above	18.8%	7.4%	21.4%	7.1%	28.6%	31.6%	
None	75.0%	33.3%	52.4%	78.6%	14.3%	5.3%	
Compared with other medical topics, how does your knowledge of radiology?							<0.001
Excellent	0.0%	0.0%	2.4%	7.1%	19.0%	10.5%	
Good	0.0%	25.9%	16.7%	0.0%	33.3%	26.3%	
Average	18.8%	40.7%	38.1%	28.6%	33.3%	47.4%	
Poor	50.0%	25.9%	40.5%	28.6%	14.3%	5.3%	
No knowledge	31.3%	7.4%	2.4%	35.7%	0.0%	10.5%	

Additionally, the students who established education in clinical imaging and radiation safety achieved responses superior to those without education. Almost 26.6% of the participants thought that the dose of radiation exposure in a chest X-ray was less than one week of natural background radiation and 49% were not familiar with the response. About 23.8% of our study participants overvalued the total radiation of chest radiograph, with 10.1% selecting the choice that

the radiation exposure equal to a dose larger than 1 year of natural background radiation. Only 12.9% of students in our study properly responded that an abdominal X-ray implicated exposure with higher radiation than a chest X-ray, while 33.1% chose the chest x-ray, 9.4 % chose the ultrasound (Table 3).

Table 3: General awareness of radiation exposure related to diagnostic imaging examinations:

	first	second	third	forth	fifth	sixth	pvalue
The maximum patient's radiation exposure occurs in which of the following?							0.002
Abdominal Ultrasound	6.3%	14.8%	16.7%	0.0%	4.8%	0.0%	
Plain film of abdomen	0.0%	0.0%	16.7%	7.1%	33.3%	36.8%	
MRI of spine	18.8%	18.5%	31.0%	21.4%	14.3%	10.5%	
Chest x-ray	25.0%	48.1%	26.2%	35.7%	38.1%	26.3%	
Don't know	50.0%	18.5%	19.0%	35.7%	9.5%	26.3%	
In CXR, dose of radiation is equivalent to natural background radiation received in?							0.001
< One week	0.0%	14.8%	16.7%	14.3%	57.1%	63.2%	
One month	6.3%	3.7%	2.4%	7.1%	9.5%	10.5%	
Six months	6.3%	7.4%	9.5%	7.1%	9.5%	5.3%	
One year	0.0%	7.4%	11.9%	0.0%	4.8%	10.5%	
More than one year	0.0%	3.7%	2.4%	0.0%	9.5%	0.0%	
Don't know	87.5%	63.0%	57.1%	71.4%	9.5%	10.5%	
Which organ is least sensitive to radiation?							0.000
Thyroid	12.5%	3.7%	4.8%	0.0%	0.0%	5.3%	
Breast tissue	6.3%	3.7%	2.4%	0.0%	19.0%	5.3%	
Gonads	18.8%	11.1%	9.5%	7.1%	4.8%	5.3%	
Kidney	6.3%	63.0%	50.0%	28.6%	61.9%	63.2%	
Don't know	56.3%	18.5%	33.3%	64.3%	14.3%	21.1%	

The study group students had a piece of fair information regarding radiation dose associated with CT. Almost 21.6% of all study population mentioned that CT scan of the abdomen was equal to 300-1000 chest X-ray, while about 57.6% chose "I do not know". Students who established radiological education chose the right answer superior to those who were not educated. About 28.8% of the study population answered appropriately that CT is responsible for the greater part of the medical radiation exposure received by the population. The review of students' information regarding MRI and ultrasound principles give up the unsatisfactory outcome. Generally, students did not show good awareness regarding the method of MRI image production, with 33% of our study participants thoughts that MRI is responsible for about 15% of the population's receiving radiation dose. No students in the fifth and sixth stages thought that ultrasound was responsible for about 15% of the population's received radiation dose. In comparison to students not receiving radiological teaching, students who had received education/instruction in diagnostic radiology were unlikely to relate MRI or ultrasound with increased risk of cancerous diseases. About 28% of the medical students indicated that CT is associated with the most received radiation amongst the diagnostic imaging tools. (Table 4).

Table 4: General awareness of the study participants regarding the radiation exposure associated with diagnostic imaging examinations:

	first	second	third	fourth	fifth	sixth	P value
The radiation dose in abdominal CT is about equal to how many CXR?							**<0.001**
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
20-50	6.3%	3.7%	0.0%	7.1%	0.0%	10.5%	
80-150	0.0%	22.2%	19.0%	0.0%	23.8%	10.5%	
300-1000	0.0%	3.7%	11.9%	14.3%	57.1%	52.6%	
10,000-20,000	0.0%	0.0%	2.4%	7.1%	0.0%	5.3%	
Don't know	93.8%	70.4%	66.7%	71.4%	19.0%	21.1%	
Clinical imaging accounts for about 15% of the population's received radiation dose. Which one of the following investigations is accountable for this dose?							**<0.001**
Ultrasound	0.0%	22.2%	11.9%	14.3%	0.0%	0.0%	
Chest x-ray	18.8%	37.0%	21.4%	21.4%	14.3%	15.8%	
CT	6.3%	7.4%	21.4%	21.4%	66.7%	57.9%	
MRI	25.0%	7.4%	11.9%	0.0%	4.8%	5.3%	
Lumbar spine x-ray	0.0%	3.7%	0.0%	7.1%	0.0%	0.0%	
Don't know	50.0%	22.2%	33.3%	35.7%	14.3%	21.1%	
How much radiation in mili Sieverts, mSv, is an individual exposed to, on average, each year, from natural background radiation?							**0.003**
0.24 msv	0.0%	14.8%	9.5%	7.1%	4.8%	5.3%	
2.4 msv	12.5%	22.2%	23.8%	21.4%	66.7%	36.8%	
24 msv	0.0%	7.4%	2.4%	0.0%	4.8%	10.5%	
30 msv	6.3%	0.0%	7.1%	0.0%	0.0%	0.0%	
Do not know	81.3%	55.6%	57.1%	71.4%	23.8%	47.4%	
In chest X-ray, what is the approximate radiation dose in mSv,?							**0.001**
0.02 msv	0.0%	0.0%	7.1%	7.1%	9.5%	15.8%	
0.2 msv	0.0%	14.8%	21.4%	7.1%	47.6%	47.4%	
2 msv	18.8%	18.5%	9.5%	7.1%	19.0%	0.0%	
20 msv	6.3%	3.7%	7.1%	7.1%	4.8%	0.0%	
Don't know	75.0%	63.0%	54.8%	71.4%	19.0%	36.8%	

When we asked which group is most sensitive to radiation, the majority of participants (48%), choose the right option which is children while 19% don't know the answer (Figure 1).

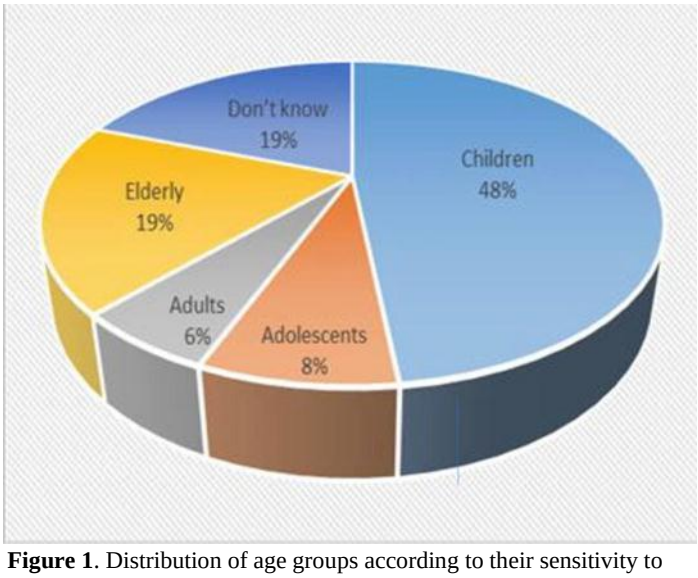

Figure 1. Distribution of age groups according to their sensitivity to radiation

Regarding the desired method of education, (32%) wanted a tutorial or workshops, (29%) learning module, (25%) case study, and only (14%) chose lecture (Figure 2).

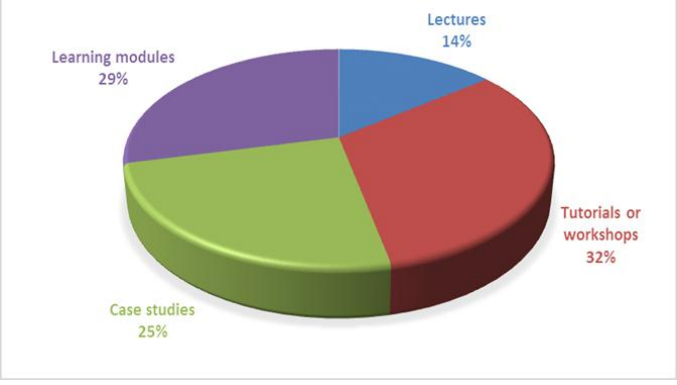

Figure 2. The desired method of education in radiology

Discussion

Everybody living in this world is being exposed to ionizing radiation. The European Council issued the Euratom instruction/directive in 1997 in an attempt to concentrate on radiation safety knowledge (4). This directive/instruction reported that medical radiation exposure must give way a good advantage to the patient and people in general. When clinical decisions are being made, the application of radiological tools using radiation to a lesser degree or if possible avoiding radiation should be considered. According to the directive, the medical students must learn what radiological tools use radiation and the estimated amount of radiation implicated so that they will be able to create suitable knowledgeable medical judgments. Our study revealed much significant deficiency in medical students' knowledge concerning vital points of radiation safety that must be appreciated when rising the medical college curriculum to meet great challenges in the future. Even though all medical students were exposed to a 6-year undergraduate integrated curriculum that included lessons in clinical radiology, their understanding, and knowledge of the fundamental ideas essential to radiation protection left much space for perfection. This may be to some extent clarified by the lack of a dedicated radiation safety module in the curriculum. Despite the lack of a formal radiation protection module, it was noted that students' awareness of radiation protection concerns enhanced year after year. Radiation safety training should be included as an essential part of a university's requirement. Proper knowledge about radiation dose and protective measures from ionizing medical investigations are vital constituents.

Our findings indicate that medical students near the end of their undergraduate careers tend to overestimate their knowledge of radiation protection. This is similar to other studies' findings (8,10,11). The majority of the population study demonstrates that the best way to raise their knowledge is through tutorials or workshops. This agrees with other studies (7,11-13). The study shows that the curriculum does not focus as much as necessary on radiation dose and related risks and protection. This issue is also mentioned in other studies (14-16).

Based on our results, we recommended that medical students (especially stages how do not receive enough education yet) need more teaching on radiation exposure and risk. The curriculum of medical college is the chief source for teaching the students regarding the safety measures of radiation. Hence, the incorporation of more radiation risk and protection education into the medical curriculum is an important concern. In addition, more instructive seminars, tutorials, or workshops may have impaction on the subject of radiation. Further studies are necessary to emphasize the importance of radiation harm and its protection. Awareness of the radiation hazards of radiological examinations can be raised among medical students.

Conclusion

This study concludes that the majority of medical students have insufficient information about radiation doses of common radiological tests, risks, and their protection. Misunderstanding about exposure risk was present among medical students that could potentially influence medical care judgments. Despite the newly increased sensitivity of the health society and radiology dealers towards building a stronger radiation protection background, more efforts are required to guarantee that radiation protection effectively becomes a crucial part of the professional skills of all healthcare contributors implicated. It is hoped that the conclusion and results from our study will aid give impulsion to enhanced referring medical students so that they may appropriately notify the patients and apply caution when requesting diagnostic radiological examinations. It is also anticipated that our study will encourage elevating awareness of the radiation risk among patients provided by the diagnostic radiology department so that they can be informed and play a vital responsibility in building judgments concerning their care.

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Conflict of Interest

No conflict of interest

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