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Research Article

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Assessing the Level of Knowledge About Radiation Dose in Common Radiological Examinations Among Physicians in Riyadh

Hamad Mohammed AlDossari[1*], Abdullah AlDosary[2], Abdulmohsen AlRashed[3], Sultan Alamro[1], Fahad Alqahtani[1], Abdullah Alanazi[1], Nasser Almoammar[1]

[1]Medical intern, College of Medicine, King Saud University, P.O. Box 7805 (92), Riyadh 11472, Saudi Arabia
[2]Consultant Radiologist, Radiology Department, King Fahad Medical City, Riyadh, Saudi Arabia
[3]Consultant Radiologist, Radiology Department, King Khalid University Hospital, Riyadh, Saudi Arabia

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ABSTRACT

Objective: The study aimed to assess the level of knowledge about radiation doses in common radiological examinations among residents and interns, compare the level of knowledge about radiation doses in common radiological examinations between residents in different specialties, and compare the level of knowledge about radiation doses in common radiological examinations between residents and interns. Methods: A cross-sectional study was conducted on a sample of 157 Physicians in King Khalid University Hospital and King Fahad Medical City. Using the simple random technique with the help of a questionnaire, the data were processed using SPSS (version 22). Results: Overall, 58.6% of the participants underestimated the radiation dose of common radiologic examinations whereas 28.1% correctly recognized them. Conclusion: The knowledge of radiation doses of common radiological examinations is suboptimal among interns and residents, including those of radiology specialty. They mostly underestimate the radiation dose which may put patients at risk of exposure to unnecessary radiation. Educational courses on radiation protection including radiation dose received by patients and radiation safety are recommended to be held for interns and residents.

Keywords: *Radiation dose, Physicians, Radiology, Radiation safety, Saudi Arabia*

INTRODUCTION

Radiological examinations have an essential role in the diagnosis of many medical problems and have significantly increased during the last years on worldwide, [1] and Saudi Arabia is not an exception.

Radiation abuse is known to be related to higher rated of cancer rates. The estimated risk of cancer due to misuse of diagnostic x-rays in the USA and the UK are 5700 and 500 cases per year, respectively [2]. Among children, the situation is more dramatic as they have longer life spans and their tissues are more radiosensitive.[3] Therefore, proper use of diagnostic x-rays among physicians should be stressed through obtaining sufficient knowledge regarding radiation doses.

As the majority of radiological examinations are requested by non-radiologists, they should have basic idea regarding the radiation dose of these examinations before requesting them [4]. Therefore; the present study was carried out to assess the level of knowledge about radiation doses in common radiological examinations among residents and interns working in selected two big institutions in Riyadh city, Saudi Arabia.

METHOD

This quantitative observational cross-sectional study was conducted from September 2017 to December 2017 in King Khalid University Hospital and King Fahad Medical City, Riyadh, Saudi Arabia. Ethical approval for the study was obtained from the Institutional Review Board, College of Medicine, King Saud University. The target population included male and female interns and residents in Radiology, Internal medicine, Pediatrics, Emergency Medicine, Surgery, and Gynecology. Medical students, Fellows, and Consultants were excluded from the study sample. The necessary sample size was estimated to be 147 Physicians, according to the formula $N= (Z^2 P (1-P))/e^2$.
A questionnaire was developed to assess the level of knowledge about radiation dose in common radiological examinations. It consists of questions about different imaging modalities and the dose of radiation equivalent to chest X-ray (AP view only). The validity and reliability were tested, the questionnaire was approved by radiology consultants and the correct answers based on literature [5]. We used a paper-based survey form and an online survey, both included the same content. A pilot study was conducted with 20 physicians to evaluate the questionnaire efficacy before collecting the actual data.
Data were analyzed using the Statistical Package for Social Sciences (SPSS) software, version 22. Frequency and percentage were utilized to describe categorical variables. Chi-square test was applied to test for the association between compared variables and level of statistical significance was chosen at $p<0.05$.

RESULTS

The study included 157 subjects. Their baseline characteristics are summarized in table 1. More than half of them (56.1%) were males and recruited from King Khalid University hospital (57.3%). Majority of the participants (86%) were residents whereas the remaining 14% were interns. Regarding specialty of residents, there were almost equally distributed between internal medicine, pediatrics, emergency medicine, surgery, radiology and obstetrics and gynecology. About one-third of them were either recruited from R1 level (31.9%) or R2 level (32.5%) whereas only 5.2% were recruited from R5 level.
As demonstrated in table 2, there was statistically significant difference between various residents' specialties and interns regarding their knowledge of the radiation doses in common radiological examinations. Correct answered questions were reported by 37.5% of radiology residents whereas they were reported by 22% of interns and 23.5% of pediatric residents. Overestimation was the highest reported by emergency medicine residents (22.1%) and the lowest reported by pediatric residents (4.5%). Underestimation was the highest reported by pediatric residents (72%) and the lowest reported by emergency medicine residents (50%).
Overall, 58.6% of the participants underestimated the radiation dose of common radiologic examinations whereas 28.1% correctly recognized them.
As in table 3, comparison between the answers regarding the modality of the radiological examinations, correct answers were most commonly reported regarding abdominal ultrasound (94.9%), followed by Spine MRI (75.8.8%) and whole body PET/CT scan (^{18}F-FDG) (33.8%). The lowest correct answers were observed with Abdominal X-ray (AP view) (7.6%), barium enema (8 .3%) and Pelvis x-rays (AP view) (10.8%). These differences were statistically significant, $p<0.001$.

Table 1. Baseline characteristics of the participants (n=157)

	Frequency	Percentage
Gender		
Male	88	56.1
Female	69	43.9
Institution		
King Khalid University hospital	90	57.3
King Fahad medical city	67	42.7
Job title		
Resident	135	86.0
Intern	22	14.0
Specialty (n=135)*		
Internal Medicine	22	16.3
Pediatrics	22	16.3
Emergency Medicine	23	17.0
Surgery	22	16.3

Radiology	24	17.8
Gynecology	22	16.3
Residency level (n=135)*		
R1	43	31.9
R2	44	32.5
R3	24	17.8
R4	17	12.6
R5	7	5.2

* For residents only

Table 2. Difference between various residents' specialties and interns regarding their knowledge of the radiation doses in common radiological examinations

Specialty	Underestimation	Correct	Overestimation
Radiology (n=288)*	151 (52.4)	108 (37.5)	29 (10.1)
Internal medicine (n=264)*	152 (57.6)	70 (26.5)	42 (15.9)
Pediatrics (n=264)*	190 (72.0)	62 (23.5)	12 (4.5)
Emergency Medicine (n=276)*	138 (50.0)	77 (27.9)	61 (22.1)
Surgery (n=264)*	139 (52.7)	86 (32.6)	39 (14.7)
Gynecology (n=264)*	168 (63.6)	68 (25.8)	28 (10.6)
Intern (n=264)*	166 (62.9)	58 (22.0)	40 (15.1)
Total (n=1884)	1104 (58.6)	529 (28.1)	251 (13.3)

* Number of answered questions

$p<0.001$

Table 3. Comparison between the answers regarding the modality of the radiological examinations

Investigation	Underestimation N (%)	Correct N (%)	Overestimation N (%)
Abdominal X-ray (AP view)	141 (89.8)	12 (7.6)	4 (2.5)
Pelvis x-rays (AP view)	129 (82.2)	17 (10.8)	11 (7.0)
Abdominal Ultrasound	0 (0.0)	149 (94.9)	8 (5.1)
Bone Scan (^{99m}Tc-MDP)	117 (74.5)	21 (13.4)	19 (12.1)
Whole Body PET/CT scan (^{18}FFDG)	104 (66.2)	53 (33.8)	0 (0.0)
V/Q Scan (^{99m}Tc-MAA&^{99m}Tc-DTPA)	68 (43.3)	32 (20.4)	57 (36.3)
Chest CT (Standard)	104 (66.3)	31 (19.7)	22 (14.0)
Abdomen CT (Standard)	93 (59.3)	33 (21.0)	31 (19.7)
Pelvis CT (Standard)	101 (64.4)	23 (14.6)	33 (21.0)
Barium Enema	139 (88.5)	13 (8.3)	5 (3.2)
Coronary Angiogram (Catheter) (diagnostic)	108 (68.8)	26 (16.6)	23 (14.6)
Spine MRI	0 (0.0)	119 (75.8)	38 (24.2)

$p<0.001$

Discussion

In the present study, we measured the level of knowledge about radiation dose in common radiological examinations among physicians in Riyadh.

Overall, 58.6% of the physicians underestimated the radiation dose of common radiologic examinations.

The radiation dose of abdominal x-ray (AP view) was underestimated by the great majority of the participants.

Among all radiological examinations, the doses of Whole Body PET/CT scan (18F-FDG) as well as all others CT scan examinations are the highest. Although CT only constitutes 4% of examinations, but contribute as much as 40% of the collective dose of radiation [6]. In the present study, most of the participants underestimated the radiation dose of all CT scan examinations. The same has been reported elsewhere [4, 7, 8].

In this study, most of the participants (75.8%) correctly recognized the absence of radiation in spine MRI [4]. reported that two-thirds of non-radiologists realized the absence of radiation in MRI. Also, similar results have been reported by others [8, 9-12].

In the present study, with the exception of abdominal ultrasound and spine MRI, small percentage of residents and interns had enough knowledge about the radiation dose of other common radiological examinations. The same has been reported in a similar study carried out recently in Iran by [7].

In this study, residents from all specialties including radiology as well as interns underestimated the dose delivered in the commonest radiologic examinations. Not surprisingly, radiology residents had higher percentage of correct answers regarding dose of the commonest radiologic examinations than residents of other specialties and interns. The same has been reported by [4] This is of course attributed to their basic training in radiology and physics. However, their knowledge is suboptimal as only 37.5% of them could realize correctly the dose of common radiologic examination whereas more than half of them (52.4%) underestimated these doses.

The main limitation of the study is the possibility of bias in the responses of participants as they were not prohibited from access to an external reference or source of knowledge while answering the questionnaire. Despite this possible bias, the knowledge levels were still suboptimal, even among radiology residents.

CONCLUSION / RECOMMENDATIONS

The knowledge of radiation doses of common radiological examinations is suboptimal among interns and residents, including those of radiology specialty. They mostly underestimate the radiation dose, which may put patients at risk of having unnecessary increased radiological examinations and thus increasing exposure to radiation hazards. Awareness about the hazardous of radiation for interns and residents during radiology examinations should be considered an essential part of medical education; therefore, educational courses on radiation protection including radiation dose received by patients and radiation safety are recommended to be held for interns and residents.

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