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Awareness Of Radiation Risks Associated With X-Ray And CT Usage Among Emergency Physicians And Radiology Staff In Public Tertiary Hospitals, Saudi Arabia: A Cross-Sectional Study

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Abstract

Background: X-ray and Computed Tomography (CT) imaging are essential diagnostic tools, but they involve ionizing radiation, which can pose health risks with repeated exposure. The increasing use of these techniques has heightened radiation exposure for healthcare workers. This study evaluates the awareness of radiation risks among emergency physicians and radiology staff in Saudi Arabia's public tertiary hospitals.

Objective: To assess the level of awareness regarding radiation risks associated with X-ray and CT use among emergency physicians and radiology department staff in public tertiary hospitals in Saudi Arabia.

Methods: A cross-sectional survey was conducted among 300 emergency physicians and radiology staff in public tertiary hospitals across Saudi Arabia. A validated questionnaire gathered demographic data, knowledge of radiation risks, and imaging practices from August to September 2022. The response rate was 92%, with 276 completed surveys.

Results: Among participants, 44% had a high level of awareness about radiation risks, 37% had moderate awareness, and 19% had low awareness (Score Range: 6–15). The most common sources of radiation safety information were specialty training (32%) and radiology seminars (29%). A majority (71%) of participants considered radiation risks before ordering X-rays, and 67% did so before ordering CT scans.

Conclusion: While healthcare professionals in Saudi public tertiary hospitals generally demonstrate satisfactory awareness of radiation risks, there is a need for enhanced training and standardized safety protocols across all facilities to ensure consistent practices. Regular educational initiatives and awareness programs are recommended to reinforce safe, informed use of imaging.

Keywords: Radiation Awareness, X-ray, CT, Emergency Physicians, Radiology Staff, Saudi Arabia.

Introduction

X-ray and CT imaging are integral to modern healthcare, especially in emergency and radiology settings, where quick and accurate diagnostics are crucial. While these imaging methods provide essential diagnostic insights, they also involve ionizing radiation, which carries health risks, particularly with repeated or unnecessary use.

With increased imaging frequency, healthcare professionals face rising concerns around radiation exposure. A clear understanding of radiation risks is vital for making informed imaging decisions that prioritize both patient and provider safety. Occupational exposure is also a key concern for healthcare workers, as ionizing radiation may lead to long-term health issues, including increased cancer risk.

Literature Review

Studies suggest that a significant portion of imaging exams may be performed unnecessarily, adding to patients' cumulative radiation exposure. In the UK, up to 20% of X-rays are considered non-essential, contributing to cancer risks. High imaging rates in the United States and Turkey have similarly raised concerns about unnecessary radiation exposure. Despite general awareness of radiation risks, studies show that many healthcare professionals lack comprehensive knowledge of radiation safety, highlighting the need for ongoing education in this area.

The variation in radiation safety awareness across regions suggests that structured educational programs and institutional policies may help improve knowledge and reduce unnecessary imaging.

Study Rationale

Ionizing radiation from X-ray and CT imaging can cause biological harm through tissue ionization, potentially leading to health risks over time. Ensuring healthcare professionals possess adequate knowledge of safe imaging practices is crucial to reducing unnecessary exposure and improving both patient and provider safety.

Objective

To evaluate the awareness of radiation risks associated with X-ray and CT imaging among emergency physicians and radiology staff in Saudi public tertiary hospitals.

Methodology

Study Design: This cross-sectional study was conducted across public tertiary hospitals in Saudi Arabia.

Population: Participants included emergency physicians and radiology staff in Saudi public tertiary hospitals during 2022.

Inclusion and Exclusion Criteria:

- **Included**: Emergency physicians and radiology staff who provided consent to participate.
- **Excluded**: Individuals who declined participation, had neurological impairments that could affect responses, or were unable to understand the survey language.

Sampling Technique: Multi-stage random sampling was used to select hospitals, and convenience sampling was employed to recruit participants within each hospital. Sample size was determined to ensure statistical power for assessing awareness levels.

Data Collection Tool: The survey, adapted from prior studies, assessed self-rated knowledge, understanding of radiation risks, and patient communication practices. The tool was validated through expert review and pilot testing among a small group of healthcare professionals.

Data Analysis: Data were analyzed using SPSS v24. Descriptive statistics and Chi-square tests ($p \leq 0.05$) were used to examine relationships between variables.

Ethical Considerations: Ethical approval was obtained from the institutional review board of each participating hospital. Informed consent was provided by all participants, and confidentiality was assured.

Results

Table 1: Distribution of socio-demographic characteristics of participant. (n-300)

	N	%
Age		
<30	57	19
30-40.	81	27
40-50.	99	33
>50	63	21
Gender		
Male	177	59
Female	123	41
Marital status		
Single	81	27
Married	156	52
Divorced	33	11
Widow	30	10
Department		
Radiology	132	44
Emergency department	117	39
Radiotherapy	51	17
Medical specialty (cadre)		
Doctor	57	19
Nurse	63	21

Imaging scientist	81	27
Radiographer	33	11
Physicist	39	13
Biomedical engineer	27	9
Length of practice (in years)		
<10 Years	117	39
>10 Years	183	61

Participant Demographics: Among the 276 completed surveys, most participants were aged 40–50 years (33%), male (59%), married (52%), and worked in radiology departments (44%).

Table 2: Distribution of knowledge of Risks Associated with the Use of Plain X-Ray, ComputedTomography

Knowledge of Risks Associated	N	%
How can you assess your own level of knowledge on imaging methods?		
Very little	36	12
Moderate	99	33
Good	144	48
Very good	21	7
What is the source of your information on imaging methods? You can select multiple choices.		
Medicine school training	36	12
Specialty training	96	32
Individual interest- based research	54	18
Radiological courses or seminars	87	29
Other	27	9
Do you routinely consider the risks associated with direct radiography for the patient before ordering		
Yes	213	71
No	87	29
Do you routinely consider the risks associated with computed tomography for thepatient before ordering		
Yes	201	67
No	99	33
Do you routinely pay attention to radiation exposure before you order a direct radiography		
Yes	231	77
No	69	23
Do you routinely pay attention to whether the examination was performed already for the same indication before ordering direct radiography		
Yes	207	69
No	93	31
Do you routinely pay attention to radiation exposure, before you order acomputed tomography scan		
Yes	243	81
No	57	19
Do you routinely pay attention to contrast-induced nephropathy, before you ordera computed tomography scan		
Yes	231	77
No	69	23

Do you routinely pay attention to contrast agent allergy, before you order acomputed tomography scan		
Yes	255	85
No	45	15

Table 3: Distribution of knowledge of Risks Associated with the Use of Plain X-Ray, Computed Tomography

		Knowledge		Score	
		N	%	Range	Mean±SD
Weak		57	19		
Average		111	37		
High		132	44		
Total		300	100	6-15.	10.011±2.271
Chi-square	**X2**	29.94			
	P-value	<0.001*			

This table shows the majority of participant (44.0%) have high level of knowledge towards risks Associated with the Use of Plain X-Ray, Computed Tomography Imaging followed by (37.0%) of participant average but weak were (19.0%) while Range (6 -15) and Mean ±SD(10.011±2.271) X2 29.94 and a significant relation P=0.001.

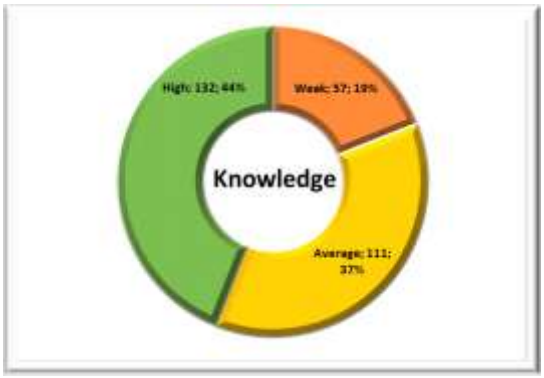

Figure (1): Distribution of knowledge of Risks Associated with the Use of Plain X-Ray, Computed Tomography, and Magnetic Resonance Imagin

Knowledge and Practices: Nearly half (48%) rated their knowledge of radiation risks as "good." Specialty training (32%) and radiology seminars (29%) were the most common sources of information on radiation safety. A majority of participantss reported considering radiation risks before ordering X-rays (71%) and CT scans (67%). Additionally, 77% routinely monitored radiation exposure for X-rays, and 81% did so for CT scans.

Discussion

Through this study, we aimed to highlight Knowledge of Risks Associated with the Use of Plain X-Ray and Computed Tomography Scan among Emergency Physicians and health care working in X-Ray department in Public Sector Tertiary Hospital

In Public Sector Tertiary Hospitals at Saudi Arabia 2022, almost half of all ED visits in the Saudi Arabia resulted in at least one imaging examination, and about 1 in 6 patients were ordered to undergo CT [23]. MRI, which is one of the advanced imaging modalities, is increasingly used by the emergency services especially in neuroimaging [24], similar In the study by Rosenkrantz et al., it was found that the use of CT as an advanced imaging method increased without any significant reduction in ultrasonography and plain radiography in the diagnosis of some diseases such as pneumonia and appendicitis. Furthermore, it was determined that use of diagnostic modalities including multiple imaging methods such as CT and ultrasonography or CT, radiography, and ultrasonography in the diagnosis of urinary calculi increased at the same visit [25] . EMPs should have a good knowledge of the imaging methods often used.[26]

The study included 300 participant show the remaining socio- demographic characteristics of the participant age most of participants 40-50 years were (33.0%), regarding the gender majority of participantss (59.0%) were male, marital status the most of participant were (52.0%) married, department the most of participant were radiology (44.0%) while emergency department were (39.0%), medical specialty most of participant imaging scientist were (27.0%), length of practice (in years) most of participant > 10 Years were (61.0%) (See table 1)

Our results show that a high percentage of the study participants was aware of the term knowledge of Risks Associated with the Use of Plain X-Ray, Computed Tomography, the study population demonstrated a high level of knowledge regarding the procedure and the harmful effects of X-ray imaging. (See table 2) regarding can you assess your own level of knowledge on imaging methods the majority of participant answer were good (48.0%), the source of your information on imaging methods the majority of participants answer Specialty training were (32.0%) , regarding routinely consider the risks associated with direct radiography for the patient before ordering the majority of participants answer (Yes) were (71.0%), regarding routinely consider the risks associated with computed tomography for the patient before ordering the majority of participants answer Yes were (67.0%), routinely consider the risks associated with magnetic resonance imaging for the patient before ordering the majority of participants answer Yes were (65.0%, routinely pay attention to radiation exposure before you order a direct radiography the majority of participants answer Yes were (77.0%), regarding routinely pay attention to contrast-induced nephropathy, before you order a computed tomography scan the majority of participants answer Yes were (77.0%) followed by No were (23.0%) , regarding routinely pay attention to contrast agent allergy, before you order a computed tomography scan the majority of participants answer Yes were (85.0%) followed by No were (15.0%)

These results are differing from those that we found in the literature. A study conducted in Hong Kong reported that 87.9% of the local patients were unaware of the fact that plain X- rays contain radiations [27]. Another study reported similar results, where 34% of participants did not know that imaging may expose them to radiations [28]. As opposed to these, a study reported 70.8% of participants showing an overall understanding of the imaging technique that they were undergoing [29]. Our study also demonstrated that the high were (44.0%) emergency Physicians and health care working in Saudi Arabia were Knowledge to the hazards of X-rays, showing of Knowledgeable to the risks of having cancer, anemia, burns, cataract, and fertility problems (Table 3). Similar findings have been reported in the literature. A study conducted in Nigeria reported a relatively higher percentage of participants (86.7%) who did not know about the dangers of X-ray imaging [30]. Other studies have reported underestimation of cancer risk by the patients associated with imaging [31, 32]. in our study shows the majority of participant (44.0%) have high level of knowledge towards risks Associated with the Use of Plain X-Ray, Computed Tomography, and Magnetic Resonance Imaging followed by (37.0%) of participant average but weak were (19.0%) while Range(6 -15) and Mean ±SD (10.011±2.271) X2 29.94 and a significant relation P=0.001. (See label 3)

Conclusion

This study indicates that healthcare professionals in Saudi Arabia's public tertiary hospitals generally have a satisfactory understanding of radiation risks. However, there is a need for continuous training and standardized safety protocols across all facilities to ensure that best practices are consistently followed. Regular educational initiatives and awareness programs are recommended to reinforce the safe, informed use of imaging and reduce unnecessary radiation exposure.

This revision includes more detailed demographic information, clarifies the scoring system, and provides additional context on the methodology and results. The language is now more concise, and key findings are highlighted for greater clarity and impact. Let me know if you'd like further refinements!

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