ORIGINAL ARTICLE

KNOWLEDGE ABOUT RISK AND PROTECTIVE MEASURES RELATED TO DIAGNOSTIC RADIATION AMONG MEDICAL STAFF IN TEACHING HOSPITALS (WASIT PROVINCE)

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ABSTRACT

The aim: The goal of this research is to find out how much medical staff is acknowledged about radiation protection.

Materials and methods: In Teaching Hospitals, Wasit Province, a questionnaire study in 165 medical personnel was conducted. Part 1 of the questionnaire included socio-demographic information such as age, gender, and employment, whereas part 2 included 16 knowledge-related questions, divided into two sections: health risk (8 questions) and preventative strategies (8 questions). The descriptive analysis was carried out according to the data types: qualitative data were described using frequency and percentages, while quantitative data was described using the mean and standard deviation. The Chi-square test or Fisher's Exact Test were employed to analyze the relationship between the variables. Participants were given a score of 1 for all accurate answers, and a score of 0 for wrong and "don't know" responses. There were 165 participants general, among them 93 males and 72 females; with a mean age of 35.489.570.

Results: Only 27 people (16.36%) had a good knowledge score, while more than half (61.21%) earned an average knowledge score. 30% of radiology technicians had a good level of knowledge, and 26.5 % of those working in radiology units had a good level of expertise as well. Increasing the frequency of radiation exposure showed to have a strong relationship with participant knowledge score, with those with repeated exposure during the day having the greatest proportion (21.4%) of good knowledge.

Conclusions: This study had shown that there is a need to increase awareness about risks of radiation exposures among those who works in this field. Considering the above, the study recommends making training about the risks and methods of radiation protection compulsory, especially for workers in radiography units. In addition, the curricula of medical institutes must be updated and the latest research findings on ways to prevent radiation should be added. Finally, the issue of exposure to radiation is very important and dangerous, therefore, all sectors of society must join for the best awareness of its risks.

KEY WORDS: radiation risks, radiation protection, medical staff knowledge

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INTRODUCTION

Radiation is defined as the propagation of energy in the form of a wave or particles through space or matter [1]. Radiation is classified based on its effect on electrons into ionizing and non-ionizing. Where the former can expel electrons from atoms and change their chemical properties with its high energy, the latter does not possess this amount of energy [2]. Ionizing radiation is divided into four types, including alpha (α) rays, beta (β) rays, neutron rays (n), and photon radiation (gamma [γ] and X-ray) [3]. Both natural a synthetic materials could produce ionizing radiation [2]. Synthetic radiation account for about 18% of total radiation and 15% of these come from nuclear medicine imaging and x-rays [4]. However, this radiation is controllable and preventable compared to natural radiation [3].

Using of ionizing radiation in the medical field is increasing rapidly since the discovery of X-rays by Wilhelm Conrad Roentgen in 1985 [5]. Hence, the exposure to harmful radiation increases, especially among the medical staff. Those in the radiology department of most hospitals expose to one or more of the following radiations which is a part of therapeutic and diagnosis utilities. These radiations could be ionizing or non-ionizing radiation. The ionizing radiation include computer tomography, nuclear medicine, fluoroscopy, and x-ray. Whereas the non-ionizing could be magnetic resonance imaging and also ultrasound [6]. Both of these radiation types have a health hazard, however the ionizing radiation is more dangerous [7]. The way that ionizing radiation make its deleterious effect is altering the human body's chemical features [2]. The change in a chemical feature of cells can kill them or alter them into cancer cells by changing their cellular function [3, 8].

International Commission on radiological protection (ICRP) recommends ways to prevent or reduce radiation exposure including limiting the dose and time of radiation to reduce related health problems such as cancer [9].

Lack of knowledge of radiation hazards and non-clinically significant radiological procedures requests, which account for 30% of the cases, may increase the overall exposure of medical staff to harming radiation [10]. Staff

in private clinics is more likely to have a higher dose of radiation compared to those in governmental hospitals due to patient requesting radiological procedures even without physician recommendation [11]. Unnecessary imaging could be reduced by awareness of medical staff and using protective measures as a routine procedure [12]. Many researches from around the world showed the lack of knowledge among medical staff about the health hazard of radiation exposure [13-16].

As the global medical organizations, such as the National Council for Radiation Protection and Measurement (NCRP), recommend to perform radiation exposure periodic surveys [17]. The current study aims to provide evidence of the level of knowledge and awareness among medical staff about the health hazard of diagnostic radiation and the protective measures in Teaching Hospitals, Wasit Province. The importance of such an assessment is to solidify the global database and supply data to health clients to increase the level of awareness about the health hazard of radiation exposure.

THE AIM

The main objective of the current study is to find out the level of awareness about risks related to radiation exposure among medical personnel in general and workers in radiation units especially.

MATERIALS AND METHODS

Study design: This is an analytic cross-sectional study.

Study setting: The study was conducted in two of the biggest teaching hospitals in Wasit province (AL-Zahraa and AL-Karamaa Teaching Hospitals).

Study duration and time: Data were collected during the period from 1st -28th February. All article parts took around four months to be completed.

Study population and sampling: The population involved in this study were all health workers who work in teaching hospitals. The study sample was taken randomly from two biggest hospitals in AL-Kut city, Wasit province. All medical staff in the selected hospitals was included after they were accepted to voluntarily participate in the study.

Data collection tools: The required data for this study was collected by a special questionnaire prepared by two experts using some modified questions from another study [18]. The questionnaire consisted of 2 parts, the first part contains the socio-demographic data like age, gender, and occupation, while part 2 consisted of 16 knowledge-related questions, divided into two sections related to health risk (8 questions) and preventive measures (8 questions). This questionnaire was translated to Arabic and then pretested for 10 health workers who lastly been excluded from the final analysis.

Ethical considerations: All participants were verbally consented to participate in the study after an explanation of the study aims and objectives. Besides, they were informed about keeping their data confidential and using it only for research purposes.

Statistical analysis: All collected data were entered to and analyzed by using SPSS program version 26. The descriptive analysis was performed according to data types; frequency and percentages were used for qualitative data while quantitative data were described by the mean and standard deviation. Chi-square test or Fisher's Exact Test were used for assessment of association considering p-value equal to or less than 0.05 as significant.

Scoring of knowledge: All correct answers mentioned by participants were given a score of 1 while incorrect and "don't know" answers were given a score of zero. A total of 16 questions were calculated by summation of all correct answers and then categorized into three categories according to their score. Those who had 5 and less are in the poor knowledge category, those between (6-11) are with average, and those equal or more than 12 considered with a good knowledge score.

RESULTS

During the period of data collection, all questionnaires were distributed to all medical staff available in the two defined hospitals. The limited number of personnel working in hospitals during the coronavirus-19 pandemic greatly affected the number of filled questionnaires, so only 165 filled questionnaires were received from both hospitals.

The mean age and standard deviation of the respondent staff were 35.48±9.570, other sociodemographic features are presented in table I. It shows that males were slightly more than half (56.4 %) of the participants. There were 56 (33.9%) nursing staff followed by 55(33.3%) assistants and other auxiliary workers, and a near quarter (24.2%) were radiology technicians. Those working in radiology units were represented by 29.7% of all participants and more than half were working at AL-Zahraa Teaching Hospital.

Fig. 1 shows that the majority of medical staff who participated 120 (72.7%) in the study never received any type of radiation protection training during their job at hospitals.

There were seventy-four (44.85%) of the respondents, who have never been exposed to radiation during their daily job, and only 28 (16.97%) mentioned their daily exposure (including several times per day) in diagnostical radiation in patients as is apparent in figure 2.

Table II shows the frequency distribution of correct answers related to the eight questions regarding some issues of health risk from medical radiation and the other eight questions related to knowledge about the protective measures used against radiation. The highest percentage of correct answers was (68.7%) for considering the continuous exposure to X-ray as a risk factor for cancer followed by (81.8%) knowing that the dangerous risk of radiation is increasing with the increased time of exposure. Only 10 (6.1%) knew that not any exposure to radiation during pregnancy can harm the fetus.

The total knowledge score for each participant was calculated for all 16 knowledge questions and divided into 3 categories shown in figure 3 which shows that only

Table I. Sociodemographic features of participant medical staff.

Variables	Sub-categories	Frequency	Percentage
Gender	Male	93	56.4
	Female	72	43.6
Age category	Equal or below 35 years	95	57.6
	Above 35 years	70	42.4
Job	Nursing staff	56	33.9
	Doctor	14	8.5
	Radiology technician	40	24.2
	Assistant and Auxiliary staff	55	33.3
Department	Emergency and/ or wards	46	27.9
	Operation theater room	10	6.1
	Radiology units	49	29.7
	Endoscopy units	10	6.1
	other departments	50	30.3
Hospital name	AL-Zahraa Teaching Hospital	76	46.1
	AL-Karama Teaching Hospitals	89	53.9

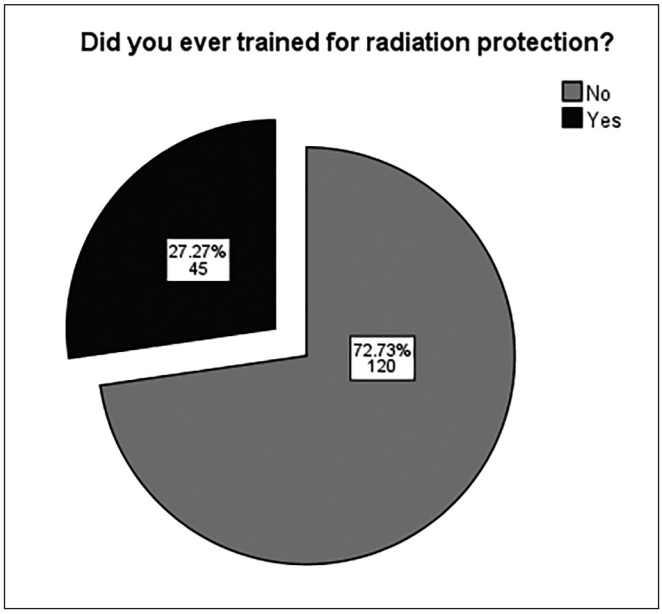

Fig. 1. Pie chart of the participant receiving training for radiation protection.

27(16.36%) had a good knowledge score, while more than half (61.21%) were with average knowledge score.

Table III shows a significant association between the knowledge score of the respondent medical staff with their age, job, department to which they belong, and the frequency of exposure to radiation in the hospital. Thirty percentages of radiology technicians had a good level of knowledge and 26.5% of those working in radiology units also had a good knowledge score. Increasing the frequency of radiation exposure was appeared to have a significant association with participant knowledge score, so the highest percentage (21.4%) of good knowledge was shown among those with repeated exposure during a day.

DISCUSSION

It is important to be aware of the dangers of exposure to ionizing radiation, and most importantly to raise awareness of the pathological effects, such as having cancer as a result of exposure to such radiation. [19]. Exposure to low doses and its side effects are still under discussion, but there are some researches that had proven that exposure to such doses, especially in children who underwent a CT scan, had led to subsequent cases of cancer, and despite the few cases, it is statistically significant. [20, 21].

Although there is less risk associated with single radiation exposure, an increase in the number of times of exposure may increase the risk of developing cancer later [22]. This is a paramount study that highlights the awareness of radiation protection among Medical Staff in Teaching Hospitals, Wasit Province. In the present study, 72.7 % of medical staff never received any type of radiation protection training, of them 16.36% had a good knowledge score, while more than half (61.21%) possessed an average knowledge score. The later represent high percentage and need to improve their awareness of radiation protection issues. However, 44.85% of population of present study have never been exposed to radiation during their daily job, mainly by not working in the radiation unit. Therefore, emphasis must be placed on holding training courses and workshops organized at the national and institutional levels [23]. Many researchers found a lack of awareness among radiographers and recommended improving their awareness[23-25], especially during their academic studies. [26-28]. The studies also recommended to provide workers in the field of radiation and medical imaging with updated educational documents, scientific protocols, and training instructions on the prevention of radiation risk. [29]. In addition, conferences, workshops, and affiliated courses have an effective role in raising awareness about radiation protection. In the present

Table II. Frequency of correct answers related to risk and protection regarding radiation.

Questions	Correct answer	No.	%
Questions related to health risks of radiation			
Continuous exposure to X-rays can increase the risk of cancer?	Yes	143	86.7
Continuous radiation exposure can affect the skin and cause hair loss?	Yes	129	78.2
Exposure of pregnant women to any type or dose of radiation at any stage of pregnancy, can harm her fetus?	No	10	6.1
Continuous and frequent exposure to radiation has the same effect as little exposure?	No	67	40.6
Which are the organs that can be affected by diagnostic radiation?	All (genitalia, thyroid gland, eyes)	98	59.4
Is there any gender difference between males and females regarding radiation's effect on the body?	Yes	58	35.2
Which of the following diagnostic methods is safer for pregnant women?	Sonographic ultrasound	92	55.8
Which of the following parts of the body is less affected by diagnostic radiation?	Chest	56	33.9
Questions related to protective measures			
Protective dressing and shield against ionizing radiation are made from?	Lead	99	60.0
During computerized tomography picturing or portable radiograph, the bystanders of the patient must be with the patient?	If a patient is agitated with using protective measures	71	43.0
Which of them does not work on x rays?	Magnetic resonance imaging	82	49.7
TLD (Thermoluminescent dosimeter) badge is used for?	Measure exposure to radiation	49	29.7
The standard measure for radiation protection during the examination?	Isolation room	94	57.0
The dangerous risk of radiation is increasing with the increased time of exposure?	Yes	135	81.8
The film badge is safe to be used for one year without replacement?	No	51	30.9
is the magnetic field surrounding the MRI available at any time even if the device is switched off?	Yes	79	47.9

Table III. Association between sociodemographic features with knowledge score.

Variables	Sub-categories	Score of knowledge			P-value
		Poor	Average	Good	
Gender	Male	22(23.7%)	56(60.2%)	15(16.1%)	0.911*
	Female	15(20.8%)	45(62.5%)	12(16.7%)	
Age	35 years and above	15(15.8%)	66(69.5%0	14(14.7%)	0.027*
	More than 35 years	22(31.4%)	35(50%)	13(18.6%)	
Job	Nursing staff	18(32.1%)	32(57.1%)	6(10.7%)	0.001**
	Doctor	1(7.1%)	7(50%)	6(42.9%)	
	Radiology technician	4(10%)	24(60%)	12(30%)	
	Assistant and Auxiliary staff	14(25.5%)	38(69.1%)	3(5.5%)	
Department	Emergency and/ or wards	14(30.4%)	27(58.7%)	5(10.9%)	0.039**
	Operation theater room	3(30%)	7(70%)	0(0%)	
	Radiology units	4(8.2%)	32(65.3%)	13(26.5%)	
	Endoscopy units	2(20%)	8(80%)	0(0%)	
	other departments	14(28%)	27(54%)	18(27%)	
Exposure to radiation	Never exposed	17(23%)	51(68.9%)	6(8.1%)	0.038**
	Several times per a month	10(26.3%)	16(42.1%)	12(31.6%)	
	Several times per a week	6(24%)	16(64%)	3(12%)	
	Several times per a day	4(14.3%)	18(64.3%)	6(21.4%)	
Hospital	AL-Zahraa Teaching Hospital	17(22.4%)	50(65.8%)	9(11.8%)	0.343*
	AL-Karama Teaching Hospital	20(22.5%)	51(57.3%)	18(20.2%)	
Training course	Yes	9(20%)	25(55.6%)	11(24.4%)	0.229*
	No	28(23.3%)	76(63.3%)	16(13.3%)	

*Chi-square test
**Fisher's Exact Test

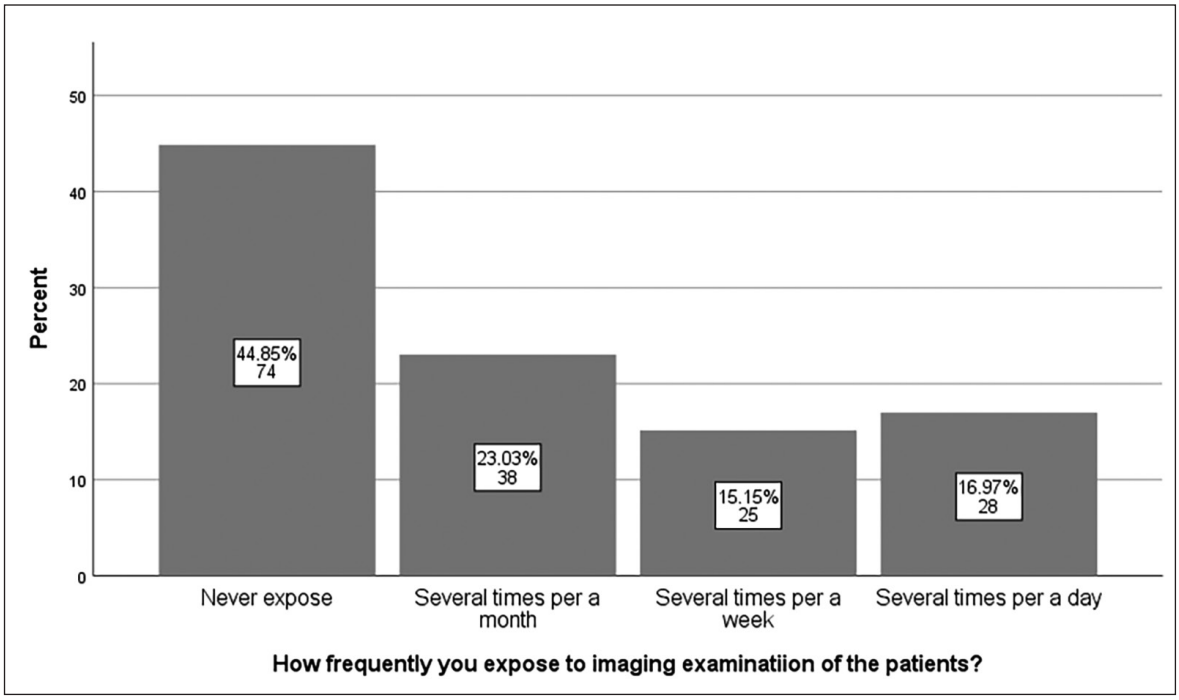

Fig. 2. Distribution of respondents' exposure to imaging radiation with patients.

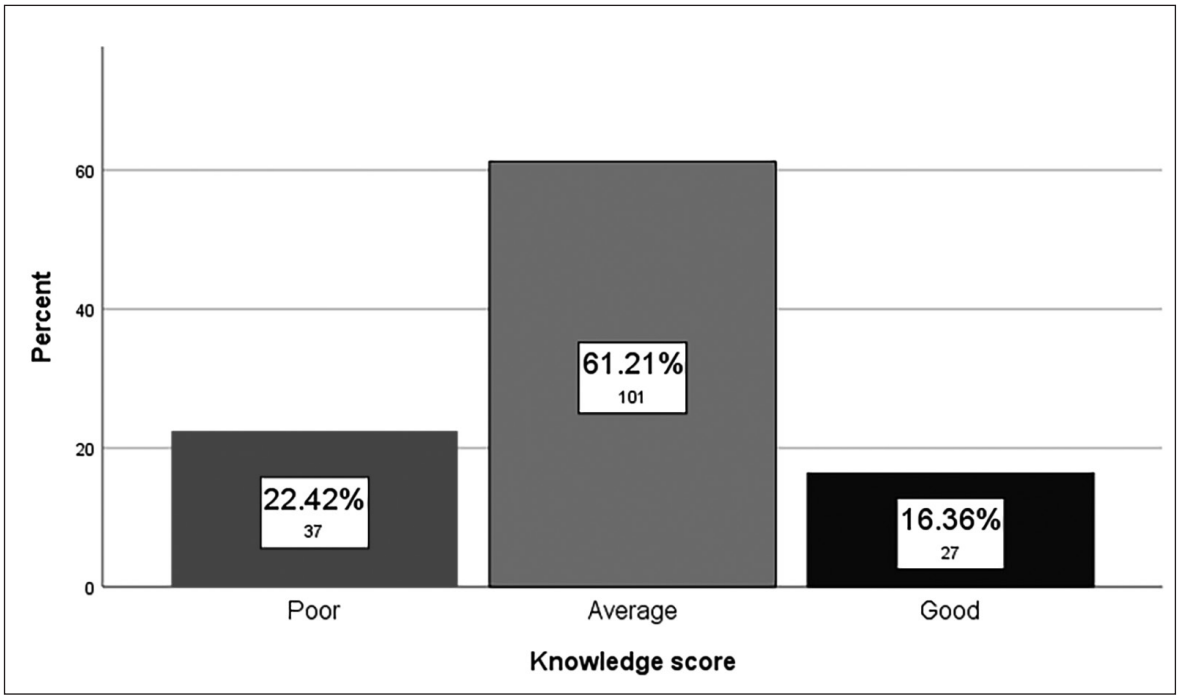

Fig. 3. Distribution of knowledge score among participant medical staff

study, 30% of radiology technicians had a good level of knowledge and 26.5% of those working in radiology units also had a good knowledge score which is a low percentage. One of the most important basics of work in radiation units is knowledge of radiation protection methods. Lack of knowledge may endanger their lives and the lives of patients by exposing them to unjustified doses of radiation [23]. It is worth noting that the risk of exposure to radiation was detected approximately one year after the discovery of the x-ray.

Since then, the interest in safe use and radiation protection methods has increased. Interest is increasing in this field due to the increase in the use of ionizing radiation and the emergence of problems associated with its use. On this basis, bodies concerned with radiation protection were established and presented the basic principles to ensure the safe use of radiation. [30].

Despite the development of protection from the risk of exposure to radiation by developing radiography techniques to ensure a clearer image and a lower level of

exposure for patients and workers, it is still important to increase the awareness of workers in the field of radiation. Full awareness of protection methods for the workers in this area is very important because they are the ones who have complete control to protect themselves and their patients. Although the current study was conducted in one of the developing countries (Iraq), where the deficiencies in detection systems for the level of radiation and modern technologies to protect against it are not hidden, the study proved that there is a good level of awareness among health workers and radiation units. On another hand, workers in this field need to assess for radiation exposure as a routine monitoring system since it is missing in radiology center.

CONCLUSIONS

This study had shown that there is a need to increase awareness about risks of radiation exposures among those who works in this field. Considering the above, the study recommends making training about the risks and methods of radiation protection compulsory, especially for workers in radiography units. In addition, the curricula of medical institutes must be updated and the latest research findings on ways to prevent radiation should be added. Finally, the issue of exposure to radiation is very important and dangerous, therefore, all sectors of society must join for the best awareness of its risks.

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