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FULL PAPER

Evaluation of nurses' awareness of radiation safety principles in portable radiography in Kosar Hospital's ICUs, Semnan, Iran

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With due attention to increasing use of X-ray imaging techniques, raising the level of knowledge of employees in this regard can play an important role in reducing the frequency of genetic abnormalities and carcinogenesis caused by radiation in the community. The purpose of this study was to evaluate the level of awareness of nurses in intensive care units from radiation protection during portable radiography. In a descriptive cross-sectional study, 92 nurses working in intensive care units were evaluated. Data were collected by a two-part questionnaire including 4 questions about demographic information (age, sex, background and education) and 11 questions regarding radiation protection. Data were analyzed by SPSS software version 21 using t-test, ANOVA and Kruskal-Wallis tests. The significance level was less than 0.05 of participants, 38.9% had poor knowledge (score less than 5), 56.9% had moderate knowledge (score of 5 to 7) and 4.2% had good knowledge (score of 8 and more). The difference of mean score in male and female and between nurses with different educational levels was not significant (P=0.470 and 0.683, respectively). The mean score in personnel with different work history and age did not show significant difference (P=0.098 and 0.222, respectively). The level of knowledge from radiation protection was moderate and weak in our study. It seems that the provision of in-person training as well as educational brochures in shorter intervals have a good effect on personnel knowledge from radiation protection.

KEYWORDS

Radiation protection; portable radiography; intensive care units.

Introduction

The application of ionizing radiation to diagnose and treat various diseases has increased in recent decades [1]. Radiography is one of the most accurate diagnostic tools in medicine, but X-rays used in a radiology department can have dangerous side effects on biological systems and cause some incurable complications; thus, the potential risks for the patient and radiologists cannot be ignored [2]. The biological effects of radiation exposure are divided into two main groups: Deterministic effects and stochastic effects. Deterministic effects are subordinate to the radiation dose delivered to the organ or body area. They are caused by any radiation above the threshold dose. Deterministic effects become more severe with higher doses. They are rarely seen on diagnostic radiology. Stochastic effects of radiation may appear as cancer in patients or

as genetic disorders in their offspring. The likelihood of stochastic effects increases by increasing absorbed dose [3]. Nowadays, most radiobiologists' concern about chronic low-dose radiation causes delayed physical (leukemia, cataract) and genetic effects, and the incidence of these effects does not have any threshold dose [4]. The abovementioned conditions of portable radiography exist for staff working in intensive care units. ICU patients are usually attached to various medical devices and many catheters and tubes are attached to them, so it is not possible to transfer the patients to the radiology ward for radiological examinations. As a result, radiological examinations in these wards are usually performed by portable radiography systems [5]. Portable radiography significantly increases nurses' exposure to ionizing radiation [6]. Awareness about hazards of X-ray imaging is essential for all medical staff, especially the staff of the wards with the highest number of portable radiography. Without such knowledge, staff carelessness can lead to unwanted exposure that leaves irreparable harms to themselves and even to future generations; contrarily, excessive fear of radiation, even within the allowed doses, may hinder the proper fulfillment of job duties, so that many hospital staff, including nurses with excessive fear, believe that no dose of ionizing radiation is safe for human and they always have an excessive fear of portable radiography [7]. Several studies denote that nurses' awareness about radiation sources, radiation hazards and protection against them is limited [8-10]. In general, due to the growing use of radiology imaging methods in medical centers, including ICUs, promoting the knowledge of health care workers in this regard can be fruitful in reducing genetic abnormalities and cancers induced by radiation in the community. This can also reduce the poor performance of staff due to fear of radiation, which arises from lack of knowledge. Therefore, in order to prevent possible harms, radiation-exposed staff should be encouraged to learn, practice, and apply protective techniques. The first step in this regard is needs assessment and evaluating the level of staff knowledge. Thus, this study was designed to assess the knowledge level of ICU nurses on radiation safety principles for portable radiography.

Methods

In this cross-sectional study, 92 nurses working in ICUs were investigated for their knowledge about radiation safety principles in portable radiography. The data collection tool was a two-section questionnaire used in previous studies; the first section consisted of 4 questions about the demographic information of nurses (age, gender, work experience and education) and the second section consisted of 11 questions about radiation safety information. Each correct answer was given score 1 and each incorrect answer was given score 0. The total score of the questionnaire was 11 and a score of less than 5 was considered as poor knowledge. After explaining about the study and its objective and obtaining the consent of the participants in person, the questionnaire was given to the nurses and was collected immediately after filling out. The study was conducted after gaining the approval from the Semnan University of Medical Sciences Ethics Committee (code: IR.SEMUMS.REC.1396.132) and obtaining a recommendation letter for the selected hospitals. Identity information has been kept confidential.

Statistical analysis

Data were analyzed with SPSS software version 21. Significance at p value<0.05 was considered as significant. T-test, analysis of variance (ANOVA) and Kruskal-Wallis nonparametric test were used for statistical analysis.

Results

In this study, 95 nurses working in ICUs of Kosar Hospital in Semnan were examined for their knowledge about radiation safety principles in portable radiography. The mean age of the subjects was 31.59±6.6 years (23-53 years). The work experience of the participants was 6.98±5.3 years (1-30 years). 18 subjects (18.9%) were male and 77 subjects (81.1%) were female (Table 1). 82 subjects (86.3%) had a bachelor's degree (Table 2).

TABLE 1 Distribution of gender and age and mean work experience of the participants

		Gender				Total	
		Male		Female			
		Number	Percent	Number	Percent	Number	Percent
Age group	20-29	11	61.1	23	29.9	34	35.8
	30-39	5	27.7	43	55.8	48	50.5
	40-49	1	5.6	9	11.7	10	10.5
	50≥	1	5.6	2	2.6	3	3.2
	Total	18	100	77	100	95	100
Mean age		30.05±8.3		32.59±6.4		31.59±6.6	
Mean work experience (year)		7.33±8.9		6.91±4.4		6.98±5.3	

TABLE 2 Frequency distribution of participants by education level and gender

Education level	Male		Female		Total	
	Number	Number	Number	Number	Number	Number
Associate degree	2	11.1	1	1.3	3	3.2
Bachelor's degree	14	77.8	68	88.3	82	86.3
Master's Degree	2	11.1	8	10.4	10	10.5
Total	18		77	100	95	100

19 subjects (20%) have already had information about radiation safety, while 76 subjects (80%) had no information. 55.8% of the participants believed that holding a training course was appropriate for training on radiation safety. The radiation safety section consisted of 11 questions about radiation protection information, in which a score of 1 was given to each correct answer and a score of 0 to each incorrect answer. The total score of the questionnaire was 11 and a score of less than 5 was considered as low level of knowledge. The mean score obtained in this study was 4.83±1.6 (1-9), which was in the poor knowledge range according to the initial definition. 38.9% had poor knowledge (score<5), 56.9% had moderate experience (score 5-7) and 4.2% had good knowledge (score≥8). There was no significant difference in the mean score of both genders (P=0.470). The mean score was not significantly different among the subjects with different levels of education (P=0.683) (Table 3).

TABLE 3 Mean score in the specific radiation safety test by participants' education level

Education Level	Score		P-Value
	Mean	SD	
Not reported	4.90	1.3	
Associate degree	5.50	2.1	
Bachelor's degree	4.75	1.7	0.683
Master's Degree	5.38	1.1	
Total	4.83	1.6	

Moreover, mean score was not significantly related to age (r=0.197, P=0.098) and work experience (r=0.167, P=0.222). Mean score in participants who had prior knowledge about radiation safety was not significantly different from those who did not have any prior information (P=0.097). There was not a significant difference in the mean score of participants with different training methods for radiation safety (P=0.296).

Discussion

In the present study, 95 nurses working in the ICUs of Kosar Hospital in Semnan were evaluated for their knowledge of radiation safety principles in portable radiography. 38.9% had poor knowledge (score<5), 56.9% had moderate knowledge (score 5-7) and 4.2% had good knowledge (score≥8). There was no significant difference in the mean score of both genders (P=0.470). The mean score was not significantly different among the subjects with different levels of education (P=0.683). The mean score was positively related to age (r=0.197, P=0.098) and work experience (r=0.167, P=0.222), but this association was not significant. The mean score in participants who had prior knowledge about radiation safety was not significantly different from those who did not have any prior information (P=0.097). The results of our study were similar to those of Shafei *et al.* (2104) who examined the level of nurses' knowledge about radiation safety principles. Their results signified that 16.7% of nursing staff had poor information and 83.3% had moderate information about radiation safety.56.9% of the participants passed radiation safety training courses; and the knowledge level of nursing staff about radiation safety was not related to the training courses. Besides, the level of nurses' knowledge of radiation safety principles was not very desirable [11]. In our study, about 96% of participants had poor and moderate knowledge and passing prior training course was not related to their knowledge level.

In the study of Tohidnia *et al.* (2017), the general observance of radiation safety principles in ICUs was appropriate (94.7%); however, the observance of safety tips by radiologists was not very desirable for nurses of ICUs and other wards (26.3%) [12]. In the study of Karami *et al.* (2017), the knowledge of radiologists about radiation safety was 20.65%, their attitude was 16.59% and their performance was 11.43%. The mean age of participants was 34.19 years and their work experience was 9.96 years. The results showed that as the age increased and the education level decreased, the knowledge of radiologists decreased; besides, there was a direct relationship between their performance and radiation safety knowledge [13]. In our study, age increase was associated with a relative increase in radiation safety knowledge, but the increasing educational level was not associated with an increase in radiation safety knowledge; these results were inconsistent with the results of Karami *et al.*'s study (2017). In the study of Alipour *et al.*, the knowledge of radiologists about radiation safety was 42.36%, their attitude was 62.4% and their performance was 48.54%. There was a significant relationship between knowledge and education level (P=0.024). There was no association among age, gender, work experience, knowledge, attitude and performance. An increase in education level increased radiation safety knowledge and holding relevant training courses was effective [14]. The results of Alipour *et al.* (2016)'s study were consistent with the results of our study. In our study, none of the parameters of age, work experience, gender and education level had a significant relationship with the knowledge level of radiation safety, and if there was a difference, it was not significant. In the study of Ameryoun *et al.* (2016), the awareness of health staff about nuclear risks at military

hospitals was reported to be moderate or low. In their study, the knowledge levels in GPs, specialists, emergency and nuclear medicine staff, and nurses were 16.1%, 14.7%, 12.7% and 11.9%, respectively [15]. This study, like our study, pointed to the low level of nurses' knowledge. In our study, only 4.2% of nurses were well aware of radiation safety tips. In the study of Mahdipour *et al.* (2017), 78.5% of participants had poor knowledge, 11% had moderate and 10.5% had good knowledge of radiation safety tips, while 73.7% had poor performance score and 26.3% had moderate performance score. In addition, further education was emphasized to promote the level of awareness and performance [16,17]. Our study reached the same conclusion. In our study, moderate knowledge and poor knowledge were 95.8% and good knowledge was 4.2%, which were almost similar to Mahdipour *et al.* (2017)'s study. In the survey of Hoseini *et al.* (2014), awareness of 124 nursing staff and nursing professors in three hospitals was examined. The education level of most of the subjects was bachelor's degree. Awareness of nuclear monitoring devices was 68.3%, awareness of decontamination method was 52.5% and awareness of radiation safety tips was 57% [18]. Their study pointed to the moderate level of awareness and emphasized the holding of training courses on radiation protection. The results were in line with our results. In our study, the level of awareness was moderate and poor, although our study did not show any relationship between prior knowledge and current knowledge of radiation safety tips.

Conclusion

The awareness level of radiation safety tips in the present study was moderate and poor; this awareness was not related to the education level and prior training. It can be concluded that holding training courses and giving educational brochures frequently are beneficial to raise staff's awareness about radiation safety.

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