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Awareness Assessment of Nurses in the OR, ICU, CCU, and PICU About Radiation Protection Principles of Portable Radiography in Hospitals of Bandar Abbas, Iran

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A B S T R A C T

Utilization of ionizing radiation as portable radiography sometimes is necessary in surgery operations, intensive care units, coronary care units, and pediatric intensive care units that may cause radiation exposure to personnel. The aim of this study was the evaluation of nurses' awareness level about radiation protection principles of the portable radiography in emergency care units. The study was performed on nurses working at two hospitals in Bandar Abbas. For data collection, a researcher-made questionnaire including two sections was used. The first section was related to demographic information of the nurses. The second section included questions related to the nurses' awareness in three fields, including radiation physics, radiation protection, and radiation hazards. Finally, the data were analyzed using the SPSS, version 11.5 software (SPSS Inc., Chicago, IL). The result showed that there was no significant difference between the level of awareness in male and female nurses ($p = .565$). Also, there was not a significant difference between the nurses' awareness about radiation protection principles with work experience and workplace ($p = .393$ and .337, respectively). However, there was a significant difference between the nurses' awareness about radiation protection and education level ($p = .016$). According to the results of this study, nurses' awareness about radiation protection principles is not good, especially among nurses with an associate degree. It seems that their educational level and awareness of potential hazards associated with the use of radiographic examinations need to be increased. To achieve this goal, implementation of periodic training courses for these personnel could be an effective method.

Introduction

Every day human beings are exposed to ionizing radiation from natural resources, like cosmic rays, and artificial radioactive sources, which are man made (Hu et al., 2016). People in the United States are subjected to approximately 1 mRem/day radiation doses from natural and artificial sources existing on the earth; about 15% comes from the artificial sources (Rahman, Dhakam, Shafqut, Qadir, & Tipoo, 2008).

Medical imaging using ionizing radiation is one of the most important diagnostic tools in hospitals and clinics, which led to more accurate diagnosis of diseases and treatment (Mojiri & Moghimbeigi, 2011). Although the use of ionizing radiation such as X-ray has potential advantages, its potential hazards should not be ignored. In the United Kingdom, about 100 to 250 cancer deaths happen every year that are directly related to medical exposure to radiation (Shiralkar et al., 2003). Recently, many studies have represented the adverse effects of radiographic examination (Arslanoglu et al., 2007; Goldberg, Schwietert, Lehnert, Stern, & Nami, 2004; Hamarsheh & Ahmead, 2012). Ionizing radiation may have an effect on the hematopoietic system, digestive system, central nervous system, cell death, whole body, and even subsequent generations. Also, it can cause complications such as origin of various cancers, cataract, shortening of life, and hair loss

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(Hamarsheh & Ahmead, 2012; Mojiri & Moghimbeigi, 2011; Shafi, Amani, Bijani, & Kamali Ahanghar, 2016). Applying occupational radiation protection is necessary for daily practice.

The number of diagnostic examinations is rising every year. Studies show that more than 10 million radiographic tests are done daily in the world (Dellie, Admassie, & Ewnetu, 2014; Shafi et al., 2016). Among them, portable radiographs are the main methods to monitor the patient in operating rooms, intensive care units (ICUs), coronary care units (CCUs), and pediatric intensive care units (PICUs). For example, chest radiography is responsible for around 30% to 40% of all X-ray examinations performed regardless of the level of health care delivery (International Commission on Radiological Protection Publication 93, 2005).

For performing radiation protection principles and decreasing X-ray effects, having knowledge and awareness about radiation physics and radiation hazards for all medical staff, especially in wards that are more often sites for exposure to radiation, is needed. Unexpected and irreversible damages can occur to the person and other personnel because of lack of knowledge of the principles of radiation protection (Shafi et al., 2016).

Investigations representing nurses' awareness and knowledge about radiation sources, radiation hazards, and radiation protection are in limited supply (Bessho & Kusama, 1996). So, to avoid probable radiation damages and poor performance of nurses and the other staff because of fear from radiation caused by lack of awareness about the risks of radiation, it is essential to upgrade the knowledge of personnel who are exposed to radiation and encourage them to learn, practice, and carry out radiation protection methods. The first step to do this is evaluation of the knowledge of the staff.

This study aimed to evaluate nurses' awareness in the operating room, ICU, CCU, and PICU about radiation protection principles of portable radiography at hospitals in Bandar Abbas, Iran.

Materials and methods

The present research is a descriptive/analytic study and was conducted as a cross-sectional design on the nurses of two hospitals affiliated with Hormozgan University of Medical Sciences in 2016. This study was conducted with the approval of the Ethics Committees of Hormozgan University of Medical Sciences. The two hospitals were Shahid Mohammadi and Childcare. The total number of nurses in the operating room, ICU, CCU, and PICU was 85, and all of them received the questionnaire.

The data collection instrument was a two-part questionnaire. The first part was related to demographic information of the nurses (i.e., age, gender, education, work experience, place of work, and to pass retraining courses). The second part consisted of 22 questions related to the nurses' awareness in three fields, including radiology physics, radiation protection, and radiation hazards. The subjects that were being asked about them are as follows:

For Radiation Physics

X-ray path in the environment, source of X-ray production during portable radiography, duration of remaining of primary and scatter radiation in the environment after exposure, the energy of X-rays used in diagnostic imaging, the range of X-rays used in diagnostic imaging, and the amount of beam intensity reduction by increasing distance from the source.

For Radiation Protection

The ways of radiation protection, the radiation protection devices, the effective shield for gamma rays, the minimum allowable distance from the patient during portable radiography, personal monitoring devices, and radiation safety during pregnancy.

For Radiation Hazard

The effects of radiation on the fetus, the most radiation-sensitive age, the most radiation-sensitive organ in the body, the chronic and acute diseases caused by ionization radiation, the minimum dose of radiation causing genetic damage and cancer generation, and the most radiation-sensitive period of pregnancy.

All questions in the second section were in a multiple-choice format with four options and only one correct answer. One point was awarded for each correct response and zero point for each wrong or nonresponse, respectively. This gives a minimum score of 0 and a maximum score of 22 points. Participants who scored greater than 15 of 22 points were considered as having good knowledge, whereas those who scored lesser than 15 of 22 points were graded as having poor knowledge. Also, the reliability of scores was measured using Cronbach alpha. Finally, the data were analyzed using the SPSS, version 11.5, software (SPSS Inc., Chicago, IL) using Mann–Whitney *U* test, Kruskal-Wallis test, and *t* test. The significance level was chosen as .05.

Results

From among 85 nurses, 83 subjects participated and completed the questionnaire. Therefore, the participation rate was 98%; 24 subjects (28.2%) were men, and 59 subjects (69.4%) were women. Among them, 68 (80%) were ward nurses, and 17 (20%) were operating room nurses. In this study, the Cronbach alpha is 0.79, which suggests that the results can be considered reliable.

Table 1 demonstrates relationships between nurses' gender and their awareness about radiation protection. Independent *t* test showed that there is no significant difference between nurses' gender and their awareness regarding radiation protection principles ($p = .565$).

Relationships between nurses' workplace and awareness about radiation protection were investigated. The mean score of knowledge regarding radiation protection among Shahid Mohammadi and Childcare nurses are 12.27 (standard deviation [SD], 2.41) and 11.41 (SD, 3.11), respectively. The Mann-Whitney *U* test showed that there is no statistically significant difference between nurses' workplace with awareness about radiation protection ($p = .337$).

Investigators found that 7.1% of the nurses had participated in the training programs related to radiation, and 92.9% of the nurses did not participate. Although a small number of nurses had participated in the training courses, the independent *t* test showed that there is no significant difference between the passing radiation training course and the nurses' knowledge about principles of radiation protection ($p = .783$).

The work experience of nurses ranged from 1 to 30 years. Table 2 shows the relationships between nurses' work experience and their awareness about radiation protection. The Kruskal-Wallis test demonstrated no significant difference between nurses' work

Table 1
The mean and SD of scores related to investigated factors in male and female nurses

Gender	Number of nurses	Percent	Mean scores	SD	Test statistics of *t* test	Degrees of freedom	*p*
Male	24	28.2	11.75	2.77	−0.578	81	.565
Female	59	69.4	12.12	2.59			
Not stated	2	2.4	—	—			

SD = standard deviation.