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Investigation of awareness levels about the radiation safety of personnel working in the imaging units of the hospitals in Agri, Turkey

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ABSTRACT

Radiation treatments, which are frequent and hidden hazards in imaging centers in hospitals, seriously affect employee health. In general, people think that there will be nothing to them because they do not know the damage of the radiation. It is not possible to stay away from radiation in some professions. For example, the radiology officials, their job is to identify the disease in people with radiographic method has no chance of dealing with radiation. That's why we need to do our job by getting enough information about radiation and its hazards, and by protecting ourselves and our environment from the dangers of radiation. Therefore, our study aimed to determine the level of information about employee safety of the health personnel working in public and private hospitals in Agri city centrum. Data was collected through a questionnaire by answering the questions of the personnel under observation in the imaging centers of hospitals. All official permits required for our work have been obtained from the necessary authorities. Results showed the inadequacy of knowledge related to ionizing radiation of the personnel, and the necessity of the implementation of radiological examinations by planning training for the safe use.

1. Introduction

Radiation is the energy emission or transmission in the form of waves or particles which can penetrate substance and human being. Radiation is divided into two groups as Ionizing Radiation and Non-Ionizing Radiation according to its effects on the substance (Türkkan & Pala, 2009).

Non-ionizing radiation consists of electromagnetic waves having low frequency and hence lower energy that cannot generate ions so its effects on the body remain at the molecular level. This type of electromagnetic waves covering a wide frequency range are propagated from transformers, high voltage lines, mobile phones and base stations, microwave ovens (Atakan, 2014).

Ionizing radiations cause ionization by breaking apart an electron from an atom or molecule. They are divided into two groups as the particulate radiation with mass and the electromagnetic radiation in the character of photon energy wave. Alpha (α) and beta (β) particles, electrons, protons and neutrons create the particulate ionizing radiation types. On the other hand, X and γ-rays are the electromagnetic radiations composed of high-energy photons with ionizing capability. They are substantially similar to each other in terms of their features, but their form of occurrence is different. X-rays are electron beams which occur outside the nucleus, while γ rays are formed as a consequence of the ejection of over energy from the nucleus by splitting during the stabilization of a radioactive core (Algüneş, 2002).

High energy ionizing electromagnetic waves can cause molecular changes which can lead to damage in biological tissue containing DNA and genetic material. In order to be able to this effect, the tissue must interact with high-energy photons such as X-rays and gamma rays. Ionizing radiation is known to cause mutation and cancer by affecting the DNA of cells (Yakıncı, 2016). Even under the limits of safety, radiation can have different negative effects on different people. For example, it is suggested that there is a relationship between low dose X-rays and goitre, breast and lung cancer, cataract and leukemia (Chodick, Bekiroglu & Hauptmann

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et al., 2008; Linet, Slovis, Miller, 2012; Singer, 2005; Vano et al., 2010). It has also been accepted by the International Agency for Research on Cancer (IARC) and the World Health Organization (WHO) that X and gamma rays carry a risk of cancer for people (Cancer Council Western Australia, 2017). As a result, radiation areas are exposed as risky areas in terms of occupational health and safety. When examined the definition of occupational health done by the World Health Organization (WHO), the physical, mental and social well-being of employees must be kept at the highest level. As in all work environments, risk prevention strategies should be adopted in these areas. From this point of view, in order to minimize the risks, protection methods should be applied and protection methods should be determined according to the risks.

Radiation protection rules can be grouped under three headings: distance, exposure duration and shielding. As you approach the source of radiation, the dose rate (intensity) of the radiation increases inversely proportional to the square of the distance. Similarly, as the source is farther away, the dose rate decreases by the square of the distance between them. Secondly, the duration of exposure is also important. Radiation exposure is directly proportional to time. The shorter the exposure to radiation, the lower the negative effect on the employee's health. The last one in protection rules is shielding. A shielding material must be placed between the source. Depending on the energy of the radiation, the thickness of the lead material to be used in the shielding must be calculated. Ideal shielding should be 1 μSv/h in the working environment. Instant dose rate is valued at > 10 μSv/h in radiation fields where the shielding absolutely must be done (Demir, 2015).

In order to protect from radiation, the Turkish Atomic Energy Authority has introduced ALARA (As Low As Reasonably Achievable) measures regarding radiation safety in Turkey (Güden et al., 2012). These measures suggest that the minimum possible doses should be obtained during studies done with radiation. That is, irrespective of the upper limits, it is necessary to arrange the working environment and working conditions according to the rules of radiation protection and to provide the conditions that the dosage can be minimized.

However, investigations have shown that knowledge of health care workers is insufficient for radiation safety (Yurt, Çavuşoğlu, & Günay, 2014). It is emphasized that radiology workers are negatively affected by radiation because personnel are not educated at a sufficient level (Şaşkın, 2010). The imaging centers in hospitals are among the areas where the risk potential is high as a working condition. The risk of radiation causes health problems such as thyroid, eye diseases and hair loss, especially cancer types. This makes the issue of employee safety for employees at imaging centers more important. By providing a level of employee safety information, it will be easier to minimize the harm for employees who have lack of information in this regard. Thus, it is considered that the necessary measures to protect the health of the employees are taken at the top level in these units so a more effective and efficient service provision can be provided.

2. Materials and methods

The study was based on the screening model of quantitative research methods. The study was carried out in the form of survey questions to be answered by the personnel working at imaging centers in private and public hospitals in the city of Agri under observation. The necessary permits were obtained from the General Secretariat of Agri Public Hospitals Association for our work. 50 staff members working at the imaging centers in the hospitals in Agri province center participated in the study. A questionnaire form was used as a data collection tool in the study. Our survey consists of 20 questions. Seven questions with basic knowledge about radiation consisted of yes/no answer options in the questionnaire. The answers to 13 questions asked in order to measure the level of awareness of employee safety of radiology workers were already prepared as electives. Frequency, percentage and mean calculations were made in the analysis of the collected data, and *t*-test and the one-way variance analysis (ANOVA) were used in the comparison of the averages. At least 0.05 level of significance was taken into consideration in the analyses made.

3. Findings

The data obtained from the "Determination of Radiation Safety Information Level" questionnaire used for collecting research data was analyzed with SPSS 18.0 software package. After the data were entered into the program, the total score was calculated by using the program and it is proceeded to the analysis process. The analysis results are explained in detail below.

3.1. Demographic characteristics of health staff working at the imaging center

Health staff working in the imaging units of the public and private hospitals in the city center of Agri participated in this study. 25 of these health staff are composed of radiology technicians while 25 of them are nurses working in these units. The distribution of demographic characteristics is shown in Table 1.

3.2. Findings related to radiation safety knowledge levels of health personnel at imaging center

The arithmetic mean and standard deviation values of the scores obtained by the healthcare workers in the radiation safety information level test were calculated and given in Table 2. There are 17 questions in the knowledge level test. The evaluation was scored 1 for correct answers and 0 for wrong answers.

As shown in Table 2, the arithmetic mean of the scores of healthcare workers in the radiation safety information level test is 9.42. Considering the points that can be taken from the radiation safety information level test and their level equivalents, it is seen that the average level of knowledge of healthcare workers is not sufficient.

The state of differentiation of radiation safety knowledge levels of healthcare workers were examined according to some demographic characteristics and their results are given below. Table 3 shows the results of *t*-test relating to the state of differentiation of the radiation safety information levels of healthcare workers according to gender variable.

Table 1
Demographic characteristics of the health personnel participating in the study.

		Number(N)	Rate(%)
Gender	Male	24	48.0
	Female	26	52.0
Age	20–30	28	56.0
	30–40	11	22.0
	40–50	11	22.0
Occupational Type	Radiology Technician	25	50.0
	Nurse	25	50.0
Educational Status	High School	13	26.0
	Associate Degree	16	32.0
	Bachelor Degree	21	42.0
Occupational Experience	1year<	2	4.0
	2-5 years	20	40.0
	6-10 years	15	30.0
	11-15 years	6	12.0

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