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Assistants' and interns' knowledge and attitudes about radiation in the emergency department: a survey-based study

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Abstract: *Background:* To evaluate assistants' and interns' knowledge and attitudes about radiation associated with diagnostic imaging and to describe their practice with the most preferred imaging techniques in the emergency department. *Material and methods:* The prepared survey consists of 2 sections, namely general information about radiation and information about the preferred imaging techniques in the emergency department. The survey was applied to the academic staff in the emergency department of the university hospital. *Results*: A total of 85 participants, including assistants and interns, participated in the study. Most of the participants (92.9%) agreed with the "People may be exposed to radiation because of radiation sources outside the body or radioactive material accumulated in the body" view. However, the detectors were the most important determinants of radiation dose performance in the Computed Tomography System and very few of the participants (7.1%) agreed with the "As the number of detectors increases in the Computed Tomography scan, the amount of radiation reduces" view. *Conclusion:* In the emergency department, medical imaging techniques support the clinical decision and therefore the rapid techniques are more frequently used. In order to prevent the patient from being exposed to excessive and unnecessary radiation, the use of Magnetic Resonance Imaging and Ultrasonography in emergency departments should be expanded. In addition, it is important to provide radiation trainings and to raise awareness of health personnel about radiation so that they don't expose the patient to unnecessary or excessive radiation.

Keywords: Emergency Department, Imaging techniques, Radiation.

Introduction

Infants, children, or all people can be exposed unexpectedly to ionizing and non-ionizing radiation from their daily life. However, most of the ionizing radiation they are exposed to consists of diagnostic medical procedures. Over the last 2 decades, the use of diagnostic imaging has increased dramatically [1].

There are different imaging techniques using ionizing radiation such as Computed Tomography (CT), Fluoroscopy, and Radiography ("conventional X-ray" including mammography). Ionizing radiation is a type of energy. When radiation spreads to the cell, it can directly or indirectly damage DNA molecules. The molecular structure may be disrupted by direct impact of radiation to DNA molecules. The disrupted molecular structure can lead to cell damage and even cell death [2]. Therefore, ionizing radiation is a form of radiation that can increase a person's lifetime risk of developing cancer, and radiation exposure with medical procedures has a potential carcinogenic effect [3].

The use of imaging techniques especially CT in the Emergency Department (ED) has grown dramatically in recent years and it is a major source of ionizing radiation exposure with medical diagnosis. The potential cancer risks associated with CT imaging are important in the decision making by both emergency physicians and all radiologists [4]. The risk of cancer induction through imaging techniques using ionizing radiation on children has received special attention. Children exposed

to radiation are considered to be at higher risk for developing cancer than adults. The reason is that children are thought to be more radiosensitive because of smaller body and organ sizes [5-6]. The ALARA (As Low as Reasonably Achievable) principle is a rule, and it explains that radiation doses should always be kept as low as possible. Patients undergoing imaging techniques using ionizing radiation should not be exposed to unnecessary radiation or excessive radiation to obtain appropriate image quality [7].

In medicine, individuals are exposed to radiation from diagnostic examinations, interventional procedures or radiation therapies. Studies on radiation protection and recommendations are determined by organizations such as ICRP (International Commission for Radiological Protection), IAEA (International Atomic Energy Agency) and NCRP (National Council for Radiation Protection and Measurement). Studies on radiation are determined by TAEK (Turkish Atomic Energy Authority) in Turkey. There are three basic principles set by the ICRP for radiation protection. These are justification, optimization and dose limit [8-10]. ICRP [10] has defined three distinct categories of physicians according to the use of radiation in medicine:

1. Physicians that have been trained in ionizing radiation in medical specialties (e.g. radiologists, nuclear medicine physicians, radiation oncologists);
2. Physicians that utilize ionizing radiation modalities in their practice (e.g. cardiologists, vascular surgeons, urologists);
3. Physicians that prescribe medical procedures that use ionizing radiation.

According to the definition of ICRP, the differentiation of physicians using radiation in medicine leads to increased demand for diagnostic imaging techniques. Therefore, the physicians who want radiological examination should have the right information about the necessity of the examination they want and should be aware of the radiation exposure. This is particularly important in ED, because many radiological imaging techniques are required every day in EDs [11].

In some cases, the physician may have to intervene in ED without leaving to the patient's opinion and preference. In such cases, the physician must choose the imaging technique that will benefit the patient, taking into account the condition of the patient. They should avoid arbitrary CT examinations, especially in pediatric patients. In the study, we aimed to assess assistants' and interns' knowledge and attitudes about radiation associated with diagnostic imaging and to describe their practice with the most preferred imaging techniques in EDs.

Material and Methods

The study was done after approval of the ethical board of Mustafa Kemal University (27/06/2019-20). The prepared survey consists of 2 sections, and eight and five questions were aimed at the general knowledge about radiation and the preferred imaging techniques in the ED, respectively. The survey was applied to the academic staff in the ED of the university hospital. The study population includes members enrolled in 1 health care system. Demographic characteristics such as age, gender of the participants were not taken into consideration. Analysis of the results was performed using the IBM SPSS Statistics Version 22.0 software.

Results

A total of 85 participants, including assistants and interns, participated in the study. A total of 13 questions were asked about general information about radiation and the most preferred imaging techniques in the ED. When asked about a general definition of radiation, 84.7% of the participants defined it as correctly. The majority of assistants and interns (disagree; 63.5%, undecided; 29.4%) did not know that radiation would be associated with the change of detectors on CT.

While most of the assistants and interns needed to know "The biological damage in the target tissue caused by the radiation dose depends on the tissue volume", only 44.7% of the participants agreed. The desired answer could not be achieved to a large extent. Especially in children and adults, the amount of radiation exposure can lead to different damages depending on the organ/tissue volume. Without knowing the result, pediatric patients should not be exposed to unnecessary radiation. The effects of radiation toxicity in

normal tissues vary depending on tissue type, radiation dose, fractions and irradiated tissue volume. The importance of this should be emphasized in the trainings to be given. The rates of responses of the participants related to radiation are shown in Table 1.

Table-1: General questions about radiation

	Agree (true) %	Disagree (false) %	Undecided %	Std Deviation
Radiation is an energy released by atoms in the form of electromagnetic waves or particles.	84.7	11.8	3.5	0.66
People may be exposed to radiation because of radiation sources outside the body or radioactive material accumulated in the body.	92.9	4.7	2.4	0.44
The ALARA (As Low As Reasonably Achievable) principle is the lowest possible radiation dose.	70.6	4.7	24.7	0.56
ALARA principle is the dose limitation principle.	58.8	2.4	38.8	0.54
Studies on radiation are determined by TAEK in Turkey.	36.5	3.5	60	0.54
As the number of detectors increases in CT scan, the amount of radiation reduces.	7.1	63.5	29.4	0.62
An abdominal CT is equal to about 500 lung X-rays.	68.2	18.8	12.9	0.79
The biological damage in the target tissue caused by the radiation dose depends on the organ/tissue volume.	44.7	42.4	12.9	0.93

The answers to the questions about the most preferred imaging techniques in the ED are shown in Table 2. 96.5% of the participants answered as CT to the question of "Which imaging technique gives the maximum radiation exposure to the patients?". X-rays are the first preferred imaging techniques for the examination of extremities. 71.8% of the participants answered as X ray to the question of "What is your first preferred imaging technique in the case of trauma?". However, it is known that the best result in detecting traumas is obtained by CT. In spinal and musculoskeletal cases, the first preferred imaging technique was also answered differently among the participants. At the point of application, it is seen that there are many differences between the preferred methods. The percentages of the answers given are as shown in Table 2. X-rays were the most preferred imaging techniques for residents and interns (97.1%) in EDs. According to this result, it is seen that X-ray is active and it is one of the most commonly used imaging techniques. Because of the long duration of MRI in the emergency room, rapid shooting such as X-rays cannot be performed. Therefore, MRI may not be used extensively in ED.

Table-2: General questions about the most preferred imaging techniques in emergency department

	R %	CT %	MRI %	USG %	Std Deviation
Which imaging technique gives the maximum radiation exposure to the patients?	1.2	96.5	2.4	-	0.18
What is the most common radiological examination you want?	78.8	18.8	1.2	1.2	0.53
What is your first preferred imaging technique in the case of trauma?	71.8	25.9	-	2.4	0.60
What is your first preferred imaging technique in spinal and musculoskeletal problems?	38.8	37.6	23.5	-	0.77
What is the first imaging method you prefer in examining the extremities?	94.1	4.7	1.2	-	0.30

CT is the first imaging technique choice for the determination of mass effect and edema in acute trauma, intracranial hemorrhage, and rapid and accurate results can be obtained with CT. MRI has a higher sensitivity in detecting post-traumatic encephalomalacia and parenchymal lesions in subacute and chronic cases. Since X-ray is used as the energy source in CT, x-ray-dependent artifact may be involved. Therefore, posterior fossa, brain stem and cortical surfaces are better detected by MRI [12].

Discussion

It is stated that in almost all types of medical professionals requesting or performing diagnostic and interventional procedures, radiation protection education and training are insufficient and there are deficiencies for some other professionals involved in medical exposures [13]. Avoiding unnecessary testing, minimizing radiation dose and using alternatives to radiation-based imaging techniques should be realized in order not to expose the patient to excessive radiation [14].

Repplinger*et al.* applied a survey on radiation to the patients in the EDs of two different hospitals. They concluded that the patients did not have any information about the risk of radiation dose in CT imaging in the survey. In addition, it was stated that MRI did not expose them to radiation and therefore it was not known that there was no high risk for cancer [15]. Balsak*et al.* stated that radiology professionals do not have a lack of sufficient knowledge about the maximum allowable dose limits regarding radiation safety in their survey [16].

Krille*et al.* conducted a systematic literature review of all information about physicians' knowledge of the radiation doses and associated health risks. As a result of the systematic review, it has been implied that radiation awareness among physicians can be improved, especially for CT [17]. Günalp*et al.* mentioned that the doctors', interns', and radiographers' knowledge of radiation exposure from radiological investigations and associated risks was poor in ED [18]. Teferi*et al.* conducted a survey for assessing the awareness of pediatric residents and medical interns about pediatric CT dose and possible risks. As a result of the survey, it was found that while the majority of the residents and interns knew that children were more sensitive to radiation than adults, 93.7% did not know that there is currently no annual dose limit set for medical exposure of patients. The majority of the respondents knew the risk of cancer from CT scans, but most of the respondents did not know that many imaging facilities still use adult doses for pediatric patients. Furthermore, 18.8% thought that magnetic resonance imaging involves ionizing radiation [19].

Nur and Atalay surveyed 127 health personnel. They concluded that the awareness of the health personnel should be increased in order to increase the radiation awareness [20]. Keijzers and Britton surveyed 110 doctors working in the ED. They concluded that the emergency doctors in their study had a varied knowledge of risks from radiation exposure [11]. In our study, we found that interns and assistants have varied knowledge about radiation and its risks. Therefore, we also concluded that the distribution of answers to some questions appeared quite different.

Our study has limitations. The questionnaire was applied to only one academic medical center. The study group comprised a large proportion of interns. In the study, we concluded that there is a significant lack of knowledge between the imaging techniques and radiation doses.

Conclusion

Recently, the use of diagnostic medical imaging techniques has been increasing. Especially in EDs, medical imaging techniques support the clinical decision and therefore the rapid techniques are more frequently used. In order to prevent the patient from being exposed to excessive and unnecessary radiation, the use of MRI and ultrasound in EDs should be expanded. In addition, it is important to provide radiation trainings and to raise awareness of health personnel about radiation so that they do not expose the patient to unnecessary or excessive radiation.

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References

1. Jones JGA, Mills CN, Mogensen MA, Lee CI. Radiation Dose from Medical Imaging: A Primer for Emergency Physicians. *Western Journal of Emergency Medicine,* 2012; 13(2):202-210.
2. Desoukya O, Ding N, Zhou G. Targeted and non-targeted effects of ionizing radiation. *Journal of Radiation Research and Applied Sciences,* 2015; 8(2):247-254.
3. U.S. Food & Drug. Medical X-ray Imaging. Accessed at: *https://www.fda.gov/radiation-emitting-products /medical-imaging/medical-x-ray-imaging*. Accessed on 23.07.2019.
4. Barbic D, Barbic S, Dankoff J. An exploration of Canadian emergency physicians' and residents' knowledge of computed tomography radiation dosing and risk. *CJEM,* 2015; 17(2):131-139.
5. Merzenich H, Krille L, Hammer G, Kaiser M, Yamashita S, Zeeb H. Paediatric CT scan usage and referrals of children to computed tomography in Germany-a crosssectional survey of medical practice and awareness of radiation related health risks among physicians. *BMC Health Services Research,* 2012; 12:47.
6. Linet MS, Kazzi Z, Paulson JA. Pediatric Considerations Before, During, and After Radiological or Nuclear Emergencies. *Pediatrics,* 2018; 12(6):1-18.
7. Bora A, Açikgöz G, Yavuz A, Bulut MD. (2014) Computed tomography: Are we aware of radiation risks in computed tomography?. *Eastern Journal of Medicine,* 2014; 19(4):164-168.
8. Saeed MK, Al-shaari H, Almarzooq MMS, Alsareii SA, Aljerdah SA, Al-ayed MS. (2018) Radiation awareness among physicians about the hazards of radiological examinations on the health of workers and their patients in Saudi Arabia. *Journal of Radiation Research and Applied Sciences,* 2018; 11: 299-304.
9. Do KH. General principles of radiation protection in fields of diagnostic medical exposure. *Journal of Korean Medical Science,* 2016; 31(1):6-9.
10. International Commission on Radiological Protection Radiological protection in medicine. ICRP Publication 105. *Ann ICRP.* 2007; 37:1-63.
11. Keijzers GB, Britton CJ. Doctors' knowledge of patient radiation exposure from diagnostic imaging requested in the emergency department. *MJA,* 2010; 193:450-453.
12. Suma S, Polat P. Traumatic and Non-Traumatic Neurological Emergencies: Radiologic Evaluation. *TurkiyeKlinikleri J Surg Med Sci,* 2007; 3(11):8-19.
13. ICRP. Education and Training in Radiological Protection for Diagnostic and Interventional Procedures. ICRP Publication 113. *Ann. ICRP,* 2009; 39 (5): 11-22.
14. Mills AM, Raja AS, Marin JR. Optimizing Diagnostic Imaging in the Emergency Department. *AcadEmerg Med,* 2015; 22(5):625-631.
15. Repplinger MD, Li AJ, Svenson JE, Ehlenbach WJ, Westergaard RP, Reeder SB, Jacobs EA. (2016) Emergency Department Patients' Perceptions of Radiation from Medical Imaging. *WMJ,* 2016; 115(1):22-28.
16. Balsak H, Güneş G, Ulutaşdemir N. Knowledge, Attitude and Behavior of Radiology Professionals about the Harmful Effects of Radiation Which is Used for Diagnosis. *Electronic International Journal of Education, Arts, and Science,* 2016; 2(1):31-51.
17. Krille L, Hammer GP, Merzenich H, Zeeb H. Systematic review on physician's knowledge about radiation doses and radiation risks of computed tomography. *Eur J Radiol,* 2010; 76(1):36-41.
18. Günalp M, Gülünay B, Polat O, Demirkan A, Gürler S, Akkaş M, Aksu NM. Ionising radiation awareness among resident doctors, interns, and radiographers in a university hospital emergency department. *La radiologiamedica,* 2013; 119(6):440-447.
19. Teferi S, Zewdeneh D, Bekele S. Pediatric Residents' and Medical Interns' Awareness about Pediatric Ionizing Radiation Dose from Computed Tomography and Its Associated Risks at TikurAnbessa Specialized Referral and Teaching Hospital. *Ethiop J Health Sci,* 2018; 28(4):383.
20. Nur S and AtalayE. Evaluation of Ionizing Radiation Awareness of Pre-Hospital Healthcare Staff. Sağlik Bilimlerinde Akademik Çalişmalar-2019/2. *Cetinje-Montenegro;* 1st ed. 2019; 205-209.

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