Knowledge Levels Of The Students Of Medical Imaging Techniques Program About The Radiation In The Practice Settings

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ABSTRACT
For now, it is unlikely to think that developed industrial economies and high living standards can be maintained without using certain radiation sources which do not exist in nature. That is why human kind has needed to produce certain radiation sources in artificial ways as a necessity of technological development. In thepresent study, the aim is to determine the knowledge levels of students about the radiation dose being exposed to during some frequently-used radiological imaging techniques. The study group consisted of 90 students studying in Medical Imaging Techniques Program (TGTP) of Karadeniz Technical University VocationalSchool of Health Science in 2015-2016 spring and fall semesters. In this descriptive and cross-sectionalstudy, data were collected from the students practising in various hospitals between October 2015 and May 2016 via surveys. At the end of the study, it was revealed that there were knowledge deficiencies about the physical, chemical and biological changes caused by ionized radiation in human organism as well as protection from radiation.

INTRODUCTION
We call the rays named alpha, beta and gamma as 'ionizing radiations' that have high energy and that are self-emanating from the atomic nucleus of some natural ingredients as uranium, radium without any external factor and we also call the materials radiating them as "radioactive substances". We call radiation also as "radiance "or "ray "conditionally. In fact, radiation is nothing short of very fast flow of energy(Preston, 2008, p.428).
Many people afraid of the implementation of radiation (irradiation) to his/her body or lying under the instruments and being irradiated as a result of the idea that radiation is something mysterious and very dangerous. Definitely, the radiation applications have a risk as all other things.
Radiation causes adverse biological effects on living organisms.These harmful biological effects are associated with thedose of radiation and exposure time (Bolus, 2001, Brenner et al., 2003). Some of the imaging methods that are used in medical diagnosis and treatment of many diseases today include ionizing radiation. The ionizing radiation exposed in diagnostic radiology creates stochastic effects. This affect can occur even at lower doses as cancer risk although it is extremely rare. However, it is difficult to prove it. Also, the high doses of ionizing radiation used in treatment shows deterministic effect. The effects from the formation of blood and chromosomal damage for certain levels of the dose until the death in human can be executed clearly (Bolus, 2001, p. 67). However, the threshold dose of radiation that can create cancer and genetic damage in human is not known. Thus, the consciously use of investigations which include ionizing radiation in medical applications is important. The dose of threshold was tried to be predicted in some experimental and epidemiological studies (Sont et al., 2001).There was expressed in the studies done that hundreds of unnecessary tests are performed every year(Shiralkar et al., 2003, Güzel et al., 2010, Jacob et al., 2004).
In this study, there was aimed to research the knowledge level of the students of medical imaging techniques program and radiology staff about the dose of radiation which the patients and employees are exposed during some radiological imaging methods that are commonly used.

THE STUDY
The study was done by asking the questions of questionnaire to students who are performing an application in Karadeniz technical university medical faculty hospital and radiology staff working in various hospitals and getting their answers under observation. The study is a descriptive and cross-sectional study and data were acquired with survey method between the dates of October 2015 and May 2016.
The questionnaire form; includes questions about age, gender, education level, occupation,worked department, working years in the profession and which radiological tests include how much radiation and the effects of them on living organisms.
The answers were evaluated according to the report of (United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, 2000). According to this, the numbers of equivalent chest radiography according

to chest radiography are 95 for abdominal CT, 26 for barium stomach radiography, 4 forabdominal radiograph and2for mammography. All data obtained from the study were recorded to SPSS 17 program on personal computer and analyzed accordingly. The numeric variables were summarized as average± SD;categorical variables were summarized as number and percentage.

FINDINGS

There was negotiated with total participants consisted of 90 students and 40 personel during the study period.The gender, age group, education level, occupation,working years in the profession of the group and percentage distributions of the students as 1st grade and 2nd grade were given in Table 1.

Table 1. The distribution of participants according to defining features

		n	%
Sex	Male	50	61.5
	Female	80	53.8
Age	18-30 Years old	95	73.1
	31-40 Years old	15	11.5
	41-55 Years old	20	15.4
Educational status	University	97	74.6
	High school	20	15.4
	Primary education	13	10.0
Occupational group	Student	90	69.2
	Personel	40	30.8
Working years (for employees)			
	<10 Years	9	6.9
	>10 Years	31	23.8
Student class	1. Grade	40	30.8
	2. Grade	50	38.5

In the study, the rate of the people who think magnetic resonance (MR) and ultrasound imaging (USG) among the radiological examinations for all participants include radiation were determined as %50 (n=65) and %27 (n=35) respectively. The answers of other radiological examinations about the radiation content are given in Table 2.

Table 2. The answers of participants about the radiation content of examinations

	STUDENT 1st Grade (n=40)		STUDENT 2nd Grade (n=50)		PERSONNEL (n=40)	
	R Exists (%)	R Does not exist (%)	R Exists (%)	R Does not exist (%)	R Exists (%)	R Does not (%)
USG	32.7	67.3	18.3	81.7	33.1	66.9
MR	56.8	43.2	37.4	62.6	57.9	42.1
BT	93.8	6.2	92.5	7.5	85.7	14.3
Sintigrafi	56.2	43.8	50.1	49.9	50.6	49.4
Skopi	17.1	82.9	13.2	86.8	52.8	47.2
Anjiyografi	45.4	54.6	33.6	66.4	56.8	43.2
Mamografi	6.6	13.4	93.8	6.2	54.3	45.7
Röntgen	97.1	2.9	93.8	6.2	85.8	14.2
PET BT	93.0	7.0	76.4	23.6	71.4	28.6
DEXA	52.3	47.7	26.5	73.5	51.2	48.8

BT: I DEXA: Dual Enerji X Işın Absorbsiyometri, MR: Manyetik Rezonans, PET BT: Pozitron Emisyon Tomografi,
BT[CT]:computed tomography DEXA: Dual Nenergy absorptiometry MR:Magnetic resonance PET BT:POSITRON Emission Tomography
R:Radiation USG: ULTRASOUND IMAGING

In the study, there was seen that the question that asks which of the determined radiological examinations

contained most of the radiation was answered as; PET BT by %47.3 of 1st grade students, BT by %51.8 of 2nd grade students and BT and PET BT at an equal rate by %25.8 of the personnel. The answers of participants for various questions about radiation knowledge are summarized in Table 3.

Table 3. The answers of participants for various questions about radiation knowledge

Question (number of answerers)		Yes n (%)	No n (%)	I do not have an idea n (%)
Is radiation harmful for living creatures?	(n=130)	127 (97.7)	1 (0.8)	2 (1.5)
Does the amount change the extent of damage?	(n=128)	122 (95.3)	3 (2.3)	3 (2.3)
Does the damage depend on the duration of exposure?	(n=126)	118 (93.6)	7 (5.5)	1 (0.8)
Do the entrances and exits to the radiation field require attention?	(n=130)	71 (54.6)	33 (25.4)	26 (20.0)
Are the patients informed before imaging?	(n=130)	42 (32.3)	63 (48.5)	25 (19.2)
Are the measures taken in order to prevent exposure?	(n=125)	70 (56.0)	46 (36.8)	9 (7.2)
Is there any side effect of radiation ?	(n=127)	106 (83.5)	6 (4.7)	15 (11.8)
Does the nature of the target tissue change the degree of damage ?	(n=125)	74 (59.2)	32 (25.6)	19 (15.2)
Is the general or local application of radiation important?	(n=127)	109 (85.8)	6 (4.7)	12 (9.4)
Is it known how much radiation enters to our body and exists from it in a day?	(n=110)	5 (4.5)	95 (86.4)	10 (9.1)
Can human be regarded as a low radioactivity radiation source?	(n=114)	10 (8.8)	55 (48.2)	49 (43.0)
Does the kind of ionizing radiation affect the risk of creating damage to the body ?	(n=112)	80 (71.4)	20 (17.9)	12 (10.7)
Is the age of living creature irradiated effective on radiation risk?	(n=115)	65 (56.5)	35 (30.4)	15 (13.1)
Are the corporal damages seen only in people get radiation dose?	(n=110)	41 (37.3)	27 (24.5)	42 (38.2)
Is the effective dose limit known for the people working with radiation?	(n=110)	44 (40.0)	36 (32.7)	30 (27.3)
Is it known how the radiation affect our body?	(n=110)	18(16.4)	77 (70.0)	15 (13.6)

Table 4. The answers of participants about the quantity of radiation according to examinations

Imaging method		Less than normal n (%)	True n (%)	More than normal n (%)
Abdominal BT	(n=126)	94 (%74.6)	0 (%0)	32 (%25.4)
Barium stomach graphy	(n=110)	91 (%82.7)	0 (%0)	19 (%17.3)
Abdominal graphy	(n=114)	68 (%59.6)	19 (%16.7)	27 (% 23.7)
Mammography	(n=130)	15 (%11.5)	34 (%26.2)	81 (%62.3)

In the study, the question "how many chest radiography does the ionizing dose of radiation included by commonly used imaging examinations correspondsto?" was asked to the participants. There was determined that most of the participants guessed less than normal for abdominal BT (CT) barium stomach graphy and abdominal graphyand more than normal for mammography. The answers of participants for the question about the quantity of examinations and radiation were presented in Table 4. Also, there was determined (n=40) %70 (n=25) abdominal BT(CT) examination, %82,4'ü (n=31) barium stomach graphy and %68,1 (n=24) abdominal graphy of personnel included radiation less than normal.

% 21 (n=130) of the participants explained the question « are the positive effects of Ionizing radiation known?

» as accelerating the growth and development of the body,increase the rate of survival of cells and being more resistant to high doses for the cells as a result of low-dose irradiation of the cells in advance; and % 74 of the participants did not answer the question.

- %88, 5 (n=115) of participants specified the USG applied to pregnant is harmless, %60 (n=78) of participants specified MR is harmless and %80 (n=104) of participants specified that BT is harmful. The question « In which trimester the radiation applied is harmful mostly? »was answered by %90, 8 (n=118) of participants as in first three months of pregnancy (first trimester).
- The question about « Entering of the pregnant women to X-ray room » was answered by %96, 9 (n=126) of participants as the pregnant women cannot get into the x-ray room during the radiography. The rate of the people who think that is also harmful to the pregnant women to get into the room while there is no radiography action was determined as %75,4 (n=98).

CONCLUSIONS

The radiological examinations have great importance in diagnosis and treatment of diseases. The adverse biological effects of radiation on the living organisms are known(Lee et al., 2004, Tack et al., 2004, Hauptmann et al., 2003).It is specified in literature that every year averagely 100-150 people die of cancers due to medical radiation applications(Shiralkar et al., 2003, Güzel et al., 2010, Jacob et al., 2004).

- In the study, 2nd grade students specified that there is radiation in USG and MR methods in the rates of %18, 3and %37, 4 respectively.However, it is determined these rates are higher in other groups.
- It came in sight that almost all of 1st grade students think that radiation exists in BT (CT), Rontgenand PET BT (CT). This situation makes us think that 2nd grade students have more clinical experience and at the same time, they can interpret the data more accurately in comparison with personnel and 1st grade students as a result of the fact that they have new and updated information.
- 1stgrade students bring to mind that they can avoid applying BT (CT), mammography and Rontgenbecause they think these methods include radiation more than the others.
- It can cause the exposure to unnecessary radiation because of the fact that almost %50 of personnel specified that there is no radiation in examinations ofscintigraphy, fluoroscopy, angiography, mammography and DEXA.Further, it came into the openthat nearly & 20 of hospital staff have wrong information about the examinations involving radiation. This situation can cause not to take precautions in the area of radiation while helping the patients and making the students the practices done.
- It was found that 2nd grade students have better level information than the other groups in the questions addressed to participants about general radiation information. This situation makes us think that 2nd grade students have sufficient information about radiation in comparison with 1st grade students as a result of the fact that 2nd grade students are having more intensive training in the theoretical application.
- The situation that the other group has information at a lower level can originate because of the educational status, inter-academic different applications, and postgraduate educational differences. In order to overcome this shortcoming; supporting the students after graduation or supporting them by in-service training programs can be useful in terms of refreshing the information. At the same time, preparing brochures about radiation and its effects in hospital contribute to it.
- There was required from the physician to answer the ionizing dose of radiation in radiological imaging methods in Sievert (mSv) terms in comparison with chest radiography in the studies done in order to measure the awareness about the examinations including Ionizing radiation.
- Also in questionnaire form, the ionizing radiation doses the patients are exposed to radiological imaging methods were asked as “how many chest radiography they correspond to” in terms of answering the questions in an easier way.
- While it is evaluated separately (n=40) in the research, %70 (n=25) of personnel specified about abdominal BT (CT) examination, %82.4 (n=31) of them specified about stomach graphy and %68.1 (n=24) of them specified about abdominal graphy that these examinations have less radiation than normal.
- The fact that almost more than half of personnel think examinations have the dose less than normal also presents a danger in terms of radiation safety.
- Almost all of the participants explained the question “what are the prevention methods from the radiation?” as follows: «Keeping away from the radiation source as far as possible,standing near the source for less time and putting suitable armor materials which will absorb rays and mitigate the impact of them between the source and person».
- The constraints of study can be sorted as;inhomogeneity of distribution of participants, educational status, andevaluations remain limited because the participants leave some questions empty.
- The deficiency of knowledge about ionizing radiation shows that radiology education should be renewed and improved before and after the graduation in terms of safely usage of radiological examinations.
- Long-term and comprehensive scientific studies should be done in various branches because of the fact the impact retains the uncertainty at low radiation doses.It is essential that the patient and radiology staff get the

minimum dose in the use of examinations include ionizing radiation on the principle of "least as far as possible".The examinations include radiations which do not have the important contribution for diagnosis pose a risk to patients.

- Giving in-service training about radiation information and safety after graduation can help physicians to be more conscious and careful while requiring examinations include ionizing radiation.
- Today,the softwares of patient information system and radiology information system are used almost in all hospitals in Turkey. If the doctor who requires the radiological examinations sees “how much dose of radiation will the patient get in which examination and how many chest radiography the examination corresponds” on the request screen, he/she can change order of priority for examination and preferences.
- This is an important proposition and the doctor who requires examinations can relinquish the examination that he/she does not believe the necessity of it or he/she can give primacy to the other examination at the same level that does not include radiation accordingly.

REFERENCES.

Bolus, NE. (2001).Basic review of radiationbiologyandterminology, *J NuclMedTechnol*,29(pp. 67-73).

Brenner, DJ., Doll, R., Goodhead, DT. Et al. (2003). Cancerrisksattribute abletolowdoses of ionizingradiation: assessingwhatwereallyknow. *ProcNatlAcadSci USA*,100(pp.13761 -13766).

Güzel, A., Temziöz, O., Aksu, B., Süt, N., Karasalihoğlu, S. (2010). A costanalysis of radiologic imaging in pediatric traumapatients. *Ulus Travma Acil Cerrahi Derg.* 16 (pp.313-318).

Hauptmann , M., Mohan, AK., Doody , MM., Linet, MS., Mabuchi , K. (2003). Mortality from diseases of the circulatory system in radiologic technologists in the United States. *Am J Epidemiol* , 157 (pp. 239 - 248).

Jacob, K., Vivian, G., Steel, JR. (2004). X-ray dose training: are we exposed to enough? *Clin Radiol*, 59 (928 - 934).

Lee, CI., Haims, AH., Monico, EP., Brink, JA., Forman, HP. (2004). Diagnostic CT scans: assessment of patient, physician, and radiologist awareness of radiation dose and possible risks. *Radiology*, 231 (pp. 393 - 398).

Preston, DL. (2008). Solid cancer incidence in Atomic Bomb Survivors Exposed in Utero or as Yaung Children .*JNCI J Natl Cancer Inst*, 100 (pp. 428-436). Oxford Jornals Medicine.

Sont, WN., Zielinski, JM., Ashmore, JP.et al. (2001).First analysis of cancerincidenceandoccupationalradiationexposurebased on theNationalDoseRegistry of Canada. *Am J Epidemiol*,153 (pp. 309- 318).

Shiralkar, S., Rennie, A., Snow, M., Galland, RB., Lewis, MH., Gower-Thomas, K. (2003). Doctorsknowledge of radiationexposure: questionnairestudy. *BMJ*, 327 (pp. 371 -372).

Tack, D., Gevenois, PA. (2004). Radiationdose in computedtomography of thechest. *JBRBTR*, 87 (pp. 281-288).

United Nations Scientific Committee on the Effects of Atomic Radiation. *www.unscear. org/reports/2000_1. Annex D: Medical radiation exposures. Table 15, Parts A and B* (pp.375- 377).