

Awareness and attitude of radiographers towards radiation protection

Maryam Mojiri *¹, Abbas Moghimbeigi²

¹Radiology Department, Paramedical school, Hamadan university of medical science, Hamadan, Iran

²Department of Biostatistics and Epidemiology, Research Center for Health Sciences, Hamadan University of Medical Science, Iran

*Corresponding Author: email address: mojiri@umsha.ac.ir (M. Mojiri)

ABSTRACT

Whereas radiology departments have potential to present hazardous effects due of ionizing radiations, awareness and knowledge of application protection guidelines and instruments among radiology technicians has an important role to safe working in these places. Therefore radiographers' knowledge regarding radiation and their healthy behaviors during work time evaluated by a special questionnaire form including different relative questions. The level of participants' awareness about necessity of application film-badge and following the periodical examination were 70% and 63% respectively. Most of them are familiar with radiation adverse effects and they apply the protection devices for themselves and patients by 83.1% and 78.9%. based on the obtained data, the employees have a good awareness about construction protection especially in door shielding and wall. Their knowledge around dose limit was acceptable and there is a significant relationship between their awareness about Maximum permissible dose and their education level ($p < 0.008$). Taking part in different relative courses and continuously educations will affected on radiographers' awareness about important aspects of their activities in workplace and will be ensured working with ionizing radiation.

Key words: awareness; radiographer; ionizing radiation; protection

INTRODUCTION

Ionizing radiation in medical imaging is one of the powerful diagnostic tools in medicine. Radiation which is applied in radiology departments has hazardous effects on biological systems [1,2]. They produce some type of injury that is incurable. Although all medical interventions has potential benefits, but it's potential risks should not be ignored. The cancer risks arise with radiation have been known [2,3]. Ionizing radiation may effects on gastrointestinal system, central nervous system, gonads or even whole body. These effects may appear as a somatic effects or in next generation as a genetic effects [4,5]. So Occupational radiation protection is necessity whenever radiation is used in the practice of medicine. Occupational radiation protection measures are necessary for all individuals who work in the diagnostic imaging departments. This includes not only technologists and nurses, but also individuals who may be in a radiation environment only occasionally.

All of these individuals may be considered radiation workers, depending on their level of exposure and on national regulations. All workers require appropriate monitoring continuously by common personnel dosimeters like film badge and thermo luminescence dosimeter. They must also receive education and training appropriate to their jobs and protect by tools and equipment [6,7]. The amount of

absorbed dose is related to exposure factors such as kV/ potential difference and mA/ intensity of the beam and time. Personnel protection device, working in the safe construction decrease personnel exposure dose. Moreover development and refinement of basic safety standards has a great important role to protect radiology staffs [8,9]. The level of awareness concerning with radiation protection influences in staff behavior. If they have not enough information related to mentioned issue, their action will not be safe and resulted to adverse effects [10,11]. The aim of this study was to assess the knowledge and attitude of radiographers in Hamadan towards radiation protection.

MATERIAL AND METHODS

A cross sectional survey among the radiographers who work in various hospitals in Hamadan city was conducted. The primary aim was to evaluate their awareness regarding radiation safety and their personal practices regarding the use of these protection devices. Collecting the data relation to first part of the subject was performed by designing a special questionnaire. The questionnaire has mainly two parts with various questions around radiation protection and safety related to staff and patients. The first part contained information about demographic data like name, age, sex, work experiences and etc. The second section was about

awareness and attitude of employees around protection acts, protection device and dose limit. The reliability of the questionnaire was assessed by its internal consistency, and by measurement of its test-retest reliability. Internal consistency was measured using Kuder richardson statistic (>0.7). In order to measure test-retest reliability, 20 radiographers chosen at random were asked to complete the questionnaire again on arrival in the department without reference to their previously completed forms. The validity of questions was confirmed by two Radiologist physicians. Also we have signed their professional practices in the designed check list. The collection of data in the check lists prepared us the information about how they concern the protection regulations for themselves and also patients. The questionnaire forms were completed by staff during 4 months and their responses was only base on their subjective data without referring to any books. The designed questionnaire forms were directly distributed to all of 75 radiographers who work in Hamadan hospitals but total 71 radiographers participated and completed the forms. Data analyzed by Chi square and Fisher exact tests to detect relationship between categorical data with statistical package for social sciences (SPSS) version 10.00.

Table2. The percent of employees' awareness about necessity of using film-badge and periodical examination

Employees' awareness	Using film-badge (%)	Periodical examination (%)
Yes	9	88.7
No	1.4	11.3

The majority of responders knew that using of film-badge as a personnel dosimeter in radiation field is necessary. Also they are familiar with this fact that periodical examination in every six months or annual should not be ignored. Their responses show although they believe above facts but there are some radiographers who do not use film-badge and the others who periodical examination was not done by them (5.6% and 22.5% respectively). In addition, 67

Table3. Rate and percent of radiographers' awareness about the existence of personnel protective devices in radiology departments.

Awareness	Lead Apron		Thyroid Shield		Gonad Shield		Lead Glove		Lead Goggles		Wall Shield		Radiation Sign	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Number	70	1	48	23	56	15	25	46	20	51	47	24	57	14
Percent	98.6	1.4	67.6	32.4	78.9	21.1	35.2	64.8	28.2	71.8	66.2	33.8	80.3	19.7

As it displays in the above table, the maximum percentages of employees' awareness about personnel and environmental protection devices specified to lead apron, radiation signs and gonad shield (98.6, 80.3 and 78.9 respectively). The minimum rate is related to their awareness about lead goggles by 28.2%. One of the radiation protection aspects, relates to construction and

RESULTS

The demographic characteristics of respondents who completed questionnaires are given in table1.

Table 1. Demographic characteristics of respondents

characteristic		N (%)
Years of professional experience	1-4 years	9 (12.7%)
	5-9 years	22 (31.0%)
	10-14 years	14 (19.7%)
	15-19 years	10 (14.1%)
	More than 20 years	16 (22.5%)
Level of Education	Diploma or less than Associate degree	12 (16.9%)
	Bachelor and higher	30 (42.3%)
		29 (40.8%)
Sex	Male	41 (57.7%)
	Female	30 (42.3%)
Age	20-29 years	20 (28.2%)
	30-39 years	32 (45.1%)
	40-49 years	12 (16.9%)
	50 and more	7 (9.9%)

About 16.9% of the radiographers had diploma degree or less than, about 42.3% had associate degree and 40.8% bachelor degree and higher education. Employees' awareness around necessity of using film-badge and periodical examination has presented in table 2.

employees out of 71 (94.4%) claimed that they knew radiation hazardous effects. Their awareness about short-time effects of ionizing radiation and long-time effects was relative information and acceptable. The radiographers' responds to the question relation with personnel protection devices and signs. Their awareness about existence of such equipments in radiology center has summarized in table 3.

condition of radiology departments which it is better to be considered by staff and employees.

The radiographers' awareness about door, wall, floor, ceiling and window relates to their notice to existing safe department against the emission of radiation. In all cases responders' knowledge around construction protection was more than 50%. The highest and lowest level rate was related to door and ceiling 84.5% and

54.9% respectively which is given in table 4 with details.

Table 4. Rate and percent of radiographers' awareness of construction protection of radiology departments

Radiographers' awareness	Door		Wall		Ceiling		Floor		Window	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Number	60	11	59	12	40	31	39	32	54	17
percent	84.5	15.5	83.1	16.9	56.3	43.7	54.9	45.1	76.1	23.9

International organizations have published recommendations on the quantities and units that should be used in occupational dosimetry and indicates annual occupational dose limit. Dose limits to workers are expressed in terms of equivalent dose in an organ or tissue for exposure of part of the body and effective dose (E) for whole body exposure. The relative committee (ICRP) that determines dose limit, explain that dose limit may be change in future. The possible changes will relate to new adverse effects of radiation in human that had not been detected yet. Therefore in different time duration, personnel should be aware of dose limit and protect themselves in determined limit. The radiological technician who participated in this study, responded to the question about amount of annual dose limit and data analysis show that the majority of workers had correct answer (81.7%) (58 out of 71).

According to analysis of obtained data there is a relation between awareness of radiation effects and work experience (years) present a significant relationship in level of $p < 0.05$ ($p = 0.03$). The radiographers with low level of work experiences had less knowledge about adverse effects due of radiation. Besides that there is a statistical relationship between awareness of dose limit and radiographers' education level ($p = 0.008$). Moreover it did not find any relation between level of education of participants and work expertise with their knowledge around necessity performance of periodical examination and also application of organ shield for patients and themselves. In addition application of personal dosimeter have not affected by age, level of education and also work experience of participants.

DISCUSSION

The implementation of radiation protection for radiographer is inevitable. The obtained results show most of radiographers who participated in this study notice to radiation protection guidelines. The majority of them use film-badge in order to detect their occupational absorb dose. They also follow periodical examination as a healthy behavior

(88.7%). Most of them are familiar with radiation effects and it is possibly due of continuing study around radiation course. The radiographers' information about personnel protection devices was proper especially for lead apron, thyroid shield, gonad shield, wall shield and radiation signs. But their knowledge around lead glove and lead goggles is not proper and it may due of the fluoroscopic procedures are not done in the departments where they work and there is not any radioactive materials for injection to patients (such as procedures which are carried out in nuclear medicine departments) so they have not any information around the existence of such tools. In addition their awareness about workplace protection is acceptable for shield of door, Shield of wall and window. But it seems less than half of them are unaware of ceiling and floor conditions. It can be discussed by condition of the surveyed departments as they designed in the lowest floor of the building, whereas space below not occupied so the workers do not pay attention to protection condition of mentioned part. But there were occupied above space and it needs to cover ceiling with lead and they should be aware about it. The existence of statistically significant relationship between work experiences and awareness of radiation effects show that a few radiographers with low experiences have less information about mentioned subject. This result is surprising and alarming. Though they have educated recently, but there is inadequate information around radiation effects. It should be strongly recommended them to improve their knowledge around biological effects and update them through growing their expertise. In comparison with the other study performed in Kerman(Iran) [12], percentage of application shield for patients and themselves among the participants of this study is significantly higher (78.9% and 83.1% respectively against 0.01% and 15.7%). There is no valid reason for this difference, although heavy workload was indicated as the main reason for do not apply of shielding for patients in the other survey. The responses related to question about radiation protection course, show less than half of the technicians have participated in a radiation protection course (43.7%) and this a little less than

similar result from Kerman survey (50%). The comparison of doing periodical laboratory tests and application of film-badge between current study and

result of Kerman survey will be followed below in table5.

Table5. comparison of application film-badge and doing lab.test between our study and Kerman survey

	Periodical Lab.Test	Film-badge
Current study	77.5%	94.4%
Kerman study	60%	88%

In the other study, which has been performed in Shiraz (Iran) [4], 51.2% of radiation employees have relative information about dose limit and the result of our study show higher amount of such index (58%). In conclusion, the radiological protection principles in practical field, the optimization of protection and the individual dose limitation should be continuously performed. Dose limitation for occupationally exposed individuals is necessary to reduce the level of risk and ensures safety for radiographers. Knowledge and education have strong direct effects in technical protection against health hazards associated with radiation exposures. The hope is

that a new generation of experts in radiology technology will promote awareness in academic, institutional of professional field of radiation protection.

ACKNOWLEDGMENTS

The authors would like to thank Hamadan University of Medical Science for financial support and all radiology personnel to complete questionnaire forms and giving access to their radiology departments.

REFERENCES

- 1- Persson L, Shrader-Frechette K. An evaluation of the ethical principles of the ICRP's radiation protection standards for workers. *Health physics* 2001, 80, 3 : 225-234
- 2- Karen E, Thomas June E, Parnell-Parmley, Haidar S, Moineddin R et al. Assessment of radiation dose awareness among pediatricians. *Pediatr Radiol* 2006, 36: 823-832
- 3- Kaushal V, Joshi CP, Passi K, Maria Das J, Aggarwal L, Kheruka S, Kaushal J. Occupational exposure to staff of a major radiological center-trend in radiation safety. *Journal of Medical physics* 1990, 15(2): 141-143.
- 4- Amirzadeh F, Tabatabaee SHR. Evaluation of healthy behavior in radiation employees in hospitals of Shiraz. The fourth international cyberspace conference on ergonomics. International ergonomics association press 2005.
- 5- Michael M, Vilenchik, Alfred G, Knudson. Radiation dose-rate effects, endogenous DNA damage, and signaling resonance. *Proceeding of the National academy of science of the united states of America* 2006 oct. available from: <http://www.pnas.org/content/103/47/17874.full>
- 6- Gray GE. Radiation awareness and exposure reduction with audible monitors. *AJR* 1979 Dec, 133: 1200-1201
- 7- Rahman N, Dhakam S, Shafqut A, Qadir S, Ali tipoo F. Knowledge and practice of radiation safety among invasive cardiologists. *JPMA* 2008, 58:119-122
- 8- Warren-Forward H, Mathisen B, Best S, Boxsell P, Finlay J et al. Australian speech-language pathologists' knowledge and practice of radiation protection while performing videofluoroscopic swallowing studies. *Dysphagia*, springer new york 2008 Dec, 23(4): 371-377.
- 9- Quinn AD, Taylor CG, Sabharwal T, Sikdar T. Radiation protection awareness in non-radiologists. *BJR* 1997 Jan, 70: 102-106
- 10- Jascobs R, Vanderstappen M, Bogaerts R, Gijbels F. Attitude of the Belgian dentist population towards radiation protection. *Entomaxillofacial Radiology* 2004, 33: 334-339
- 11- Svenson B, Grondahl HG, Soderfeldt B. A logistic regression model for analyzing the relation between dentists' attitudes, behavior and knowledge in oral radiology. *Acta Odontologica Scandinavica* 1998, 56(4): 215-219
- 12- Noohi J. Evaluation of personnel protection among radiographers in diagnostics radiology centers in Kerman(Iran). *Environmental Health conference* 2009 Iran. Available form: <http://www.cong.sbm.ac.ir/behdasht%20mohit%2012/521-B.pdf>