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Knowledge and Performance of Radiographers towards Radiation Protection, Taif, Saudi Arabia

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Abstract: *Radiation protection is the science and art of protecting people and the environment from the harmful effects of ionizing radiation. Ionizing radiation in medical imaging is one of the powerful diagnostic tools, and accurate knowledge of radiation protection will affect the radiographers safety behaviors during practice.*

This is a preliminary descriptive study aimed to evaluate radiographers knowledge and performance towards radiation protection during hospital practice in three hospitals in Taif city ,Saudi Arabia.Total of 75 radiographers who work in various hospitals were participated in this study and data was collected through well structured pretested self administered questionnaire by one of this paper authors , during the period from Sep to Nov 2014. Regard to the situation in Taif city, there is no similar study done on this issue so far to the best of our knowledge. In this study there were (69.3%) male and (30.7%) female. Diploma holders were (54.7%), bachelor degree (44%) and PhD holders were only (1.3%). Majority of the participants (98.7%) were know that doors and walls consists from lead and they were periodically used to check their exposed radiation dose from their Thermal Luminance Dosimeters (TLDs), while (72%) using lead apron while taking radiographs.

Keywords: *Knowledge , Performance , Practice , Ionizing , Radiation , Protection.*

I. Introduction

Radiation protection is the science and art of protecting people and the environment from the harmful effects of ionizing radiation. It is also described as all activities directed towards minimizing radiation exposure of patients and personnel during x-ray exposure.[1]

In developing nations , more recent studies show that about 3.6 billion imaging studies per year are carried out world-wide, leading to an increase of 70% in worldwide collective effective dose for medical diagnostic procedures.[2]

More concern has recently been appeared in recent studies that the knowledge of referring doctors about radiation doses incurred during diagnostic radiological procedures is deficient [3]. Such information may be of particular relevance when the expansion of imaging technology is considered.

All radiology field workers require appropriate monitoring, as well as protection tools and equipment. They must also receive education and training appropriate to their jobs [4] . The level of training should be based on the level of risk. The International Commission on Radiological Protection (ICRP) assumes the responsibility of providing guidance in matters of radiation safety. The ICRP has given the recommendations for the system of radiological protection in its ICRP Publication No, 60 (1990) which is based on the following general principles: No practice involving exposures to radiation should be adopted unless it produces a sufficient benefit to the exposed individual or to society and in relation to any particular source within a practice, the magnitude of individual doses, the number of people exposed and the likelihood of incurring exposures where these are not certain to be received should be kept as low as reasonably achievable (ALARA).[5]

The European Commission has addressed the importance of training in radiological protection (RP), publishing a guideline with specific recommendations for accreditation of training programs for interventional procedures. [6] Medical use of radiation may exceed natural background as a source of population exposure. In countries with advanced health care systems, the annual number of radiological diagnostic procedures approaches or exceeds one for every member of the population.[7,8]

All radiation exposures must be kept as low as reasonably achievable (ALARA principle). This is achieved in three ways, using physical methods of minimizing dose (i.e. equipment and film factors), the application of Selection Criteria when choosing whether or not to use a radiographic examination and, finally by Quality Assurance Programmes. In the latter, efforts are made to ensure the consistent production of high quality radiographs, thereby avoiding repeat exposure and maximizing the benefit to the patient.[9]

Ionizing radiation may effects 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.[10]

There is no threshold level of radiation exposure below which it could be said with certainty that cancer or genetic effects will not occur. Doubling the radiation dose doubles the probability that a cancer or genetic effect would occur.[11]

In developed countries a set of personal qualities assessment (PQA) tests have been questions pertaining developed for various professions. These tests measure cognitive ability, personal traits and moral/ ethical reasoning before joining a particular.[12]

The level of awareness concerning with radiation protection influences staff behavior. If they have not enough information related to mentioned issue, their action will not be safe and resulted to adverse effects.[13] A small number of resources are available for use in the context of discussing radiation risk and weighing this up in terms of benefit from the radiological investigation.[14,15]

Radiation dose estimates were defined as correct if they were within 20% (above or below) of the actual dose as reported by the Health Protection Agency.[16]

Royal College of General Practitioners (RCGP) curriculum in the United Kingdom expects general practice specialty trainees (GPSTs) to demonstrate an understanding of the concept of risk and to be able to communicate risk effectively to the patient and his or her family [17,18]. Thus knowledge of risks of common radiological procedures and how to express these risks to patients are competencies required by General Practitioners (GPs) and those in training. Previous research on knowledge of radiological risk has been centered on secondary care. [17,18]

Gonad shields should have a minimum lead equivalence of 0.5 mm (at150 kVp) but in addition, they should also meet other design specifications outlined in the Australian Standard. Lead aprons, thyroid shields and other personal protective devices should meet minimum design criteria as outlined in the Australian Standard. [19] Although lead aprons should be of at least 0.25 mm lead equivalence at 150 kVp , in practice, their thickness should be selected with due consideration given to the type of workload being undertaken. Operators and other staff should use thyroid shields in all cardiology and interventional radiology suites. Further, the Responsible Person should provide all relevant staff with protective gloves for use during all radiological procedures in which the hands and forearms may be in the primary beam.[19]

Various studies had documented deficiencies in knowledge among medical students, doctors, paramedics and dentists about their understanding of ionizing radiation or the use of equipment involved in the process.[20,21] Other studies have demonstrated a beneficial effect from radiation training, reporting increased awareness and knowledge of radiation dose.[20,22] . So the study aimed to : Evaluate radiographers knowledge and performance towards radiation protection during hospital practice in Taif hospitals.

II. Material And Methods

This is preliminary descriptive cross sectional study among 75 radiographers who work in various hospitals (King Abdul-Aziz Specialist Hospital (KAASH) , King Faisal and Pediatrics Hospitals) in Taif city , during the period from Sep to Nov 2014.

Tool of data collection: The study was conducted through a well structured self-administered questionnaire consists from three parts:

The First Part: Socio- Demographic data (age, sex , level of education (e. g : Diploma , BSc and PhD) and work experiences.

The Second Part: Knowledge regard protection (5 question).

The Third Part: Performance towards radiation safety (8question).

Method of the study:

Oral explaining about the objectives of the study and the benefit of its findings to radiographers was provided to each study participant by one of the study authors before submitting the questionnaire.

The questionnaire forms were completed by radiology departments staff of three hospitals in Taif city during 3 weeks and their responses was only base on their subjective data and recent attitudes without referring to any books. Then questionnaire forms were directly distributed to all radiographers who work in KAASH , King Faisal and Pediatrics hospitals and only 75 radiographers participated and completed the forms.

Knowledge was assessed based on study participants understanding of radiation risks associated with diagnostic use of ionizing radiation to protect themselves from risks. Radiation protection performance was assessed by use of radiation signs during exposures times , using of protective equipments during work such as lead shield, gonad shields, thyroid cola , lead gloves and light beam diaphragm (LBD).

Knowledge shall be assumed to be poor in this study if respondents' average score on five knowledge questions used to assess knowledge is less than three true questions , table (2).

Ethical considerations: All participants were consented orally to fill the questionnaires and join the study and no names or any personal data were be available to publish.

Data Analysis: Data was analyzed using statistical package for social sciences program (SPSS) version 16.00.Then results achieved in tables and graphs.

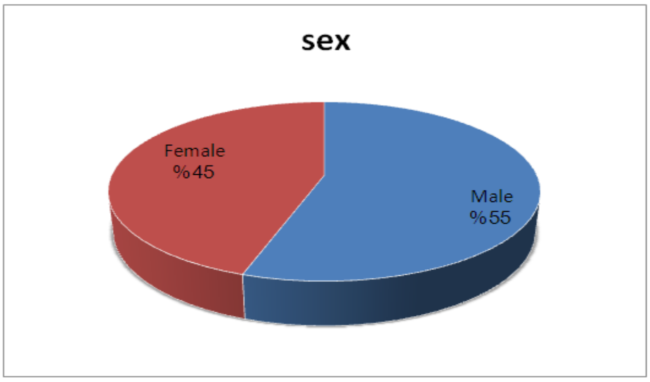
III. Results

Table 1 : Demographic characteristics among participants N=75

Variable	Number & percentage
Age (y) 18-25 y 26-35 y 36-45 y 46-60 y	13(17.3%) 51(68%) 7(9.3%) 4(5.3)
Qualification Diploma Bachelors PhD	41(54.7) 33(44.0) 1(1.3)
Work experience (y) 1-5 6-10 11-16 17 or more	42(56%) 21(28%) 3(4%) 9(12%)

Table (1): Demonstrate that most of participants were from age group (26-35y),Diploma holders were (54.7%) and work experience group 1 to 5 years were (56%).

Graph1: Distrbuation of sex among participant N=75



Graph 1: Most of participants were male (55%).

Table 2 : Knowledge of participants regard protection during practice N=75

Variable	Number & percentage
Doors and walls consist of isolated materials such as lead for more protection.	
Yes	74(98.7%)
Doing periodical radiation dose check from TLD.	
Yes	74(98.7%)
Knowing annual limitation dose for individuals.	
Yes	56(74.7)
You know Dosimeter.	
Yes	57(76.0)
Knowing radiation doses associated with commonly requested investigations.	
Yes	33(44.0)

Table (2) : Most of study sample knowing that walls and doors consists from lead and (74.7%) knowing annual limitation dose for individuals.

Figure 1: Demonstrate level of knowledge among participants N=75

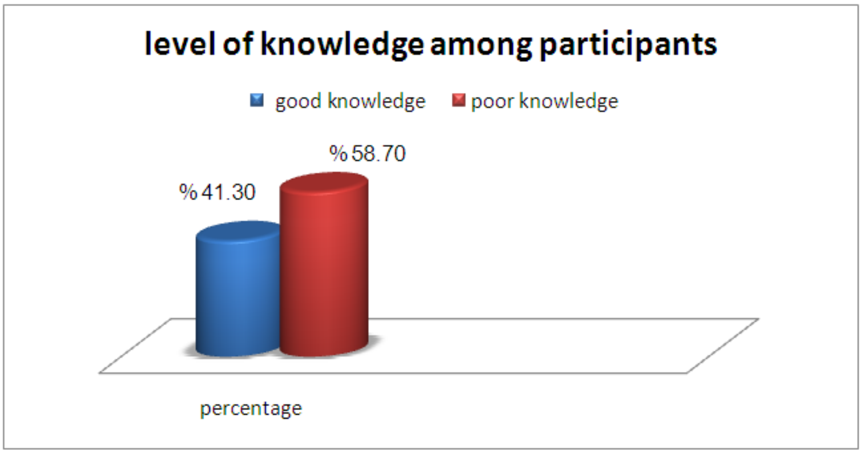


Fig (1) : From the study sample only (41.3) Have good knowledge regarding radiation protection , and this can be justified by most of them were from Diplomas holders .

Table 3 : Performance of participants toward protection during practices **N=75**

Variable	**Number & percentage**
Wearing TLD daily during work	
Yes	51(68%)
Wearing lead apron during working hours	
Yes	54(72%)
Using light beam diaphragm ,cone and grid	
Yes	59(78.7%)
Using lead gloves during work	
Yes	17(22.7%)
Using wall shield during work	
Yes	46(61.3%)
Using Radiation signs during working hours	
Yes	43(57.3%)
Wearing thyroid cola during work	
Yes	27(36%)
Wearing Gonad Shield during work	
Yes	19(25.3%)

IV. Discussion

In this preliminary descriptive study awareness was assessed by measures knowledge of radiographers towards radiation safety during practice in KAASH , King Faisal and Pediatrics Hospitals, Taif city, Saudi Arabia. This study is first of its kind in Taif city to the best of our knowledge and very few similar studies were available for comparison worldwide. A total of 75 radiographers responded to this study, from them there were (69.3%) male and (30.7%) female, graph(1), their ages ranged between 20 year and 60 years, table (1). Diploma holders were (54.7%), bachelor degree (44%) and higher degree holders were (1.3%).One study by Maryam Mojiri stated a statistical relationship between awareness of dose limit and radiographers' education level (P=0.008). Moreover the study 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.[23]

The average working experience of the participants in this study ranged between one year and 40 years, table (1). According to data analysis , there was no significant relation between awareness of radiation safety , performance and work experience. Regarding knowledge in this study (98.7%) of the respondents knew that doors and walls consist of isolated materials such as lead , and this is better than what was reported by Mutyabule T K[24] , in his study that there is similar study in England (United Kingdom),which found knowledge of radiation protection issues among radiographers in that country to be poor.

(98.7%) of the staff have periodical radiation dose check from their TLDs (wearing TLDs during their work hours),also Eze et al.,[25] reported a better attitude to wearing radiation dosimeters among a sample of industrial radiographers in Port-Harcourt, Nigeria. In this study and responded to the question about amount of annual dose limit for individuals and data analysis show that the majority of workers had correct answer (more than 75%). Results from study by Jafar Fatahi et al.,[26] indicated that only (74.3%) of personnel were using these badges, highlighting the need for further supervision and emphasis.

Knew radiation doses associated with commonly requested investigations (44%) answered with yes , while high proportion of respondents did not know about it (56%),table (2) , and this can be justified by presence of exposures charts in the radiology departments of the participants.

Knowledge shall be assumed to be poor in this study if respondents' average score on five questions used to assess knowledge is less than three true questions, and according to the result (41.3%) had good knowledge regarding protection, fig (1).

(72%) of the participants in this study wearing lead apron during work, while (28%) were not, table (3) , and they justified their performance by various reasons such as non availability of enough numbers of lead apron in their departments or increased weight of apron and some of them preferred to follow position-distance rule rather than wearing lead apron, also Fatahi J et al., [26] study revealed that there exist a shortage of lead apron (29%) and a low level of its use even when available; the gonad and thyroid shield and lead partition for mobile radiology were not used at all.

Using of light beam diaphragm and other protective devices (cone & grid) have percentage of (78.7%) , while (61.3%) were using wall shield during exposures, radiation signs during working hours with (57.3%),table (3).Further, only (22.7%) use lead gloves and this behavior will protect the radiographers themselves, table (3).Study by Margaret A et al.[27], reported that the size of the radiation field must be selected no larger than the size of the organ being photographed.[28]

Limiting the size of the radiation field to the area of the organ being radiographed minimizes the patient's absorbed dose. [29] The results study by Fatahi- Asl J.et al , revealed that using of radiation field limitation was observed in only 43.7% of the cases.[26]

Thyroid protective shield used by (36%) in this study, table (3) ,while multiple authorities have investigated and clearly demonstrated the efficacy of protection equipment and the importance of shielding radiation-sensitive organs in reducing the absorbed dose.[30,31]

It is mandatory, according to International Commission on Radiation Protection (ICRP) radiation safety standards,[32] for gonads shields to be used for the protection of the gonads when the pelvis is not part of the anatomical area being examined. In spite of excellent knowledge found among radiographers in this study, only (25.3%) using gonad shields during work. In comparison with the other study performed in Kerman(Iran),[33] percentage of application shield for patients and themselves among the participants was significantly higher (78.9% and 83.1% respectively against 0.01% and 15.7%).

Atomic Energy Organization of Iran, the gonad area must be shielded whenever in a primary radiation field or very close to a primary radiation field. [34] Shielding the gonad can significantly reduce the radiation dose, and, as absorption by the gonad typically constitutes (20%) of the overall absorption dose of the body, these organs appear to be extremely sensitive to radiation, and prevention of the hereditary effects of ionizing radiation is not possible without protecting them. Therefore, gonad shielding must be routinely used in radiology labs. [35] Fatahi study revealed that gonad and thyroid shielding was never used for patients.[26]

V. Conclusion

Considering the results of this study it is important for all radiology departments to continuing professional development **;** by holding more workshops, short-term training courses, preparation and distribution of posters on the protection and safety against ionizing radiation in order to raise radiology departments staff knowledge and performance j to include the most recent trends in radiation protection.

Similar studies with larger sample size at regular intervals should be carried out in Taif city for strict adherence of standard radiation protection regulation protocol.

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