

Evaluation of awareness of radiation protection among medical professionals in Khartoum

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Abstract

Background: There is an increase use of medical radiation in diagnosis and surgical procedures. Hence, health professionals should be aware about hazards and effects of ionizing radiation to protect themselves as well as the patients. The aim of this study is to evaluate the awareness of radiation protection issues and the knowledge of dose levels of imaging procedures among medical staff in some hospitals in Khartoum, Sudan. A total of 227 medical staff (including 54 physician, 56 nurse, 62 medical technician and 55 resident physician) were provided a questionnaire consisting of 22 multiple-choice questions divided into three parts (i.e., demographic data, awareness about radiation protection issues, and knowledge about radiation dose levels of common radiological examinations). Results showed that, physicians and medical technicians revealed the highest level of knowledge regarding radiation protection principles and dose levels. Medical staff working in radiology departments claimed to have the best knowledge of radiation protection issues more frequently compared to participants in other departments. This study suggests that there is acceptable level of awareness but a relative inadequacy of knowledge about radiation protection principles and dose levels among nursing staff. Thus, continuing medical education on radiation hazards and protection must be mandated.

Keywords: awareness, radiation protection, dose levels, medical professionals, Khartoum

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INTRODUCTION

The introduction of X-rays made by Wilhelm C. Roentgen in 1895 raised many expectations for application of this technique not only in medicine, but also in other fields of everyday life, such as, agriculture, trade, and industry.¹ In addition, the recent expanded use of ionising radiation-based diagnostic techniques such as multidetector computed tomography (CT) has led to a multiplication of

the number of examinations and hence of the overall radiation exposure to the population, with CT currently accounting for nearly 50% of the overall radiation burden for medical purposes.^{2,3} Today, many healthcare staff, who are working in hospitals, oral and dental health hospitals, and veterinary field, are exposed to radiation in some medical procedures. It is approximated that there are 2.3 million healthcare personnel in the world who are working with radiation related practices, and half of them are exposed to human-made artificial radiation and ionized radiation.⁴ Previous investigations reported that exposure to radiation enhance the risk of bone marrow suppression, infertility, cataract, birth deformities, and several types of cancer, especially thyroid carcinoma.⁵⁻⁷ Furthermore, several papers have recently reported a small, but significant increment of cancer risk in children and young patients with past exposure to CT scans,⁸⁻¹⁰ accompanied by a measurable increase in radiation-induced DNA damage following several radiologic examinations that correlates with radiation dose.^{11,12} Subsequently, there is

global interest in establishing recommendations and guidance on radiation protection and some were set out by various organization such as the International Commission on Radiological Protection and National Council on Radiation Protection and Measurements. A general principle of radiation protection, which has been recommended by the International Commission on Radiological Protection (ICRP), states that radiation protection is based on three principles: justification, optimization (as low as reasonably achievable (ALARA)), and dose limitation.¹³ This is the foundation of radiation protection approach. Furthermore, all radiological examinations using ionizing radiation should be performed only when needed to answer a medical question as well as to guide a procedure.¹⁴ The proper radiological examinations should be justified by the advantages that can produce. Such medical procedure should be carried out with precautions in order to minimize any possible effects of ionizing radiation. There are many published investigations concerning physicians and staff radiologists as well as technologists revealed a serious lack of radiation protection awareness among them. Specifically, a considerable number of professionals reported to be underestimating the overall radiation doses associated with different imaging techniques. Furthermore, in a few cases, they were even incapable to accurately discriminate between ionising and non-ionising radiation-based imaging modalities.¹⁵⁻¹⁷ Therefore, the primary objective of this study is to examine knowledge and awareness about radiation hazards and knowledge about radiation protection among medical professionals of selected hospitals within Khartoum, Sudan. This study will be useful for the Medical Council (SMC) in Sudan and for the other local educational colleges to revise and increase their education activities to protect patients from unnecessary harmful radiations.

MATERIALS AND METHODS

A cross sectional survey among the medical professionals who work in selected hospitals in Khartoum city was conducted. The survey of our study was adapted from the previous similar study of Faggioni M and was designed to assess the awareness of radiation protection and the knowledge of dose exposure levels.¹⁸ A total of 54 physician, 56 nurse, 62 technician and 55 resident physicians joined the survey. This survey was divided into three Parts, of which:

Part 1 (Demographics and perceived radiation protection skills) includes the demographic data of each survey participant, as well as including their degree of training and perceived radiation protection knowledge.

Part 2 (Radiation protection awareness) was centred on assessing: (1) radiation standards (2) susceptibility to radiation damage, (3) regulations, (4) knowledge about professionals with a higher exposure risk, (5) tissues showing sensitivity to ionising radiation, (6) type of disorders caused by radiation, and (7) Recognition of dose optimisation.

Part 3 (Knowledge about radiation dose levels) includes specific topics, such as: (1) Plain abdominal radiography; (2) Extremity angiography; (3) Head CT (4) Thoracic CT; (5) Abdominal and pelvis CT; (6) Voiding cystourethrogram; (7) Abdominal Ultrasound scan; (8) abdominal ultrasound (US) dose; (9) Thyroid isotope scan and (9) Brain MRI.

All questions of parts 2 and 3 were prepared in a multiple-choice format with four to six options and one only one correct answer.

Statistical analysis:

The statistical analysis of this study was performed using Origin 8.0 software. Categorical variables are tabulated and expressed as percentages and continuous variables as means.

RESULTS AND DISCUSSION

The protection of patients and staff is a primary issue of every diagnostic or therapeutic practice requiring ionizing radiation. All medical staff in association with ionizing radiation must proceed analogously with the As Low As Reasonable Achievable (ALARA) principles. This incorporate operating the scans with possibly lowest doses of ionizing radiation granting to achieve the desired diagnostic effect.¹⁶ The demographics of the health professionals participated in this study are presented in Table 1. All 227 participants completed the questionnaire. Mean age was 33.1, 28.4, 28.8 and 30.1 years old for physicians, nurses, medical technicians, and resident physicians, respectively. Gender distribution was close over the four groups (48.3% , 51.4%, 57.2% and 47% of males percentage, respectively.

The study group encompassed non-physicians (i.e. nurses and technicians). This was because of the continual contact of these medical professionals with patients before and at the time of procedures requiring ionizing radiation. In addition, the study group should also be differing regarding the place and length of service. As it is shown in Table 1, concerning the perceived knowledge of radiation protection issues, physicians were found to have the highest level of knowledge (9.3% excellent and 41.1% good) among the other categories of survey participants. However, nurses group showed the lowest level of knowledge regarding perceived knowledge of radiation protection (1.8% excellent and 22.6% good).

Table 1: Sample demographics (age, gender, and level of radiation protection awareness and training).

	Physician (N = 54)	Nurse (N = 56)	Technician (N= 62)	Resident (N = 55)
Age (mean)	33.1	28.4	28.8	30.1
Gender (%Male)	48.3	51.4	57.2	47.0
Perceived knowledge (%):				
Excellent	9.3	1.8	7.5	8.6
Good	41.1	22.6	38.9	38.7
Sufficient	44.2	24.4	40.7	42.5
Insufficient	5.4	51.2	12.9	10.2
Training %				
Frequently	58.3	11.7	37.4	51.9
Rarely	30.6	47.7	41.8	29.3
Never	11.1	40.6	20.8	18.8

Figure 1 shows the distribution of the profession in the study group. The most populous group within the study population were medical technicians – 62 (27.3%), followed by nurses – 56 (24.7%), resident physicians – 55 (24.3%) and physicians – 54 (23.8%). The distribution of length of service among the study participants is shown in Figure 2. The most populous groups consisted of responders with 6–10 years (75 responders) and 1–5 years of clinical service (55 responders).

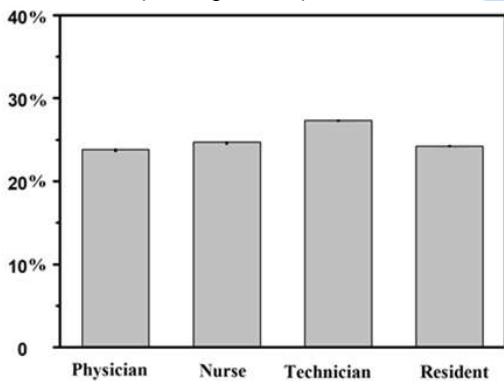


Figure 1: Distribution of the profession in the study group

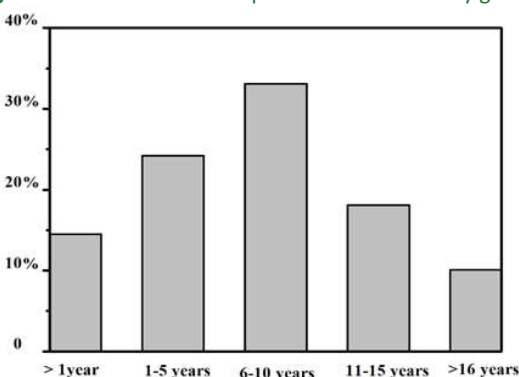


Figure 2: Distribution of the length of service in the study group.

Figure 3 shows the results concerning knowledge of radiation protection principles among participants. Physicians and technicians showed the best level of

knowledge (63.5% and 61.3 % correct answers for physicians and technicians respectively).

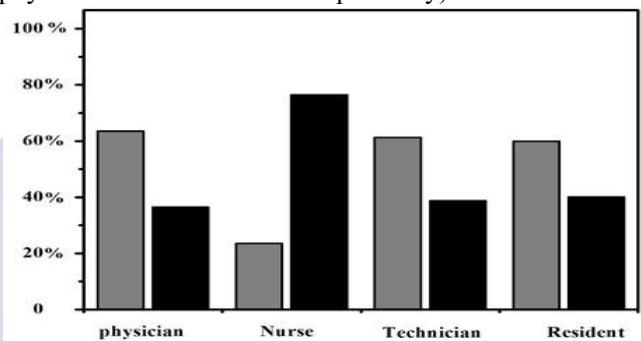


Figure 3: The knowledge of radiological protection principles according to position (correct answers marked in grey, wrong answers in black)

Furthermore, the findings for the knowledge about radiation dose levels according to the position are presented in Figure 4. Physicians and technicians showed the best level of knowledge regarding radiation dose levels (64.4% and 56.3 % correct answers for physicians and technicians respectively). The worst results about radiation protection principles (76.5% wrong answers) as well as radiation dose levels (75.9% wrong answers) were achieved by nursing staff. This low level of knowledge is alarming, and it appears that this might be due to the lack of radiological protection trainings.¹ Compared to other departments, participants working at radiology departments had the best knowledge of radiation protection principles and radiation dose levels (100% correct answers) compared to emergency, urology, and anaesthesiology departments. Remarkably is the reasonably good awareness of radiological protection in radiology departments, nevertheless of position (physician, nurse, technician, resident). This is may be due to the repeated contacts of these professionals with imaging machines, hence better understanding of radiological procedures.¹⁵

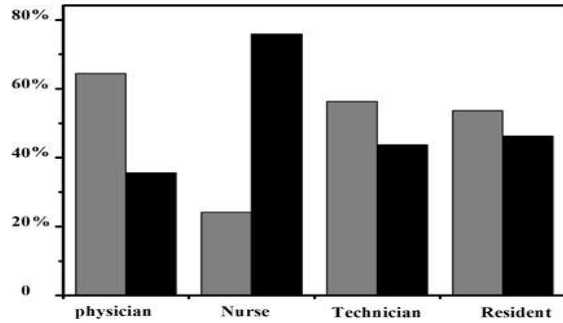


Figure 4: The knowledge about radiation dose levels according to position (correct answers marked in grey, wrong answers in black)

CONCLUSION

Even with the passing of more than 120 years from Roentgen’s discovery, protection against ionizing radiation resume to be an important problem in everyday practice of all medical professionals. Awareness and knowledge about radiation hazards may vary based on the job-related roles and level of training. This study showed that, in general, there is a high level of awareness about radiation hazards among medical staff in radiology departments. The conclusion from this study is that increased awareness must be paid to rigorous education of all healthcare professionals concerning radiological protection. An additional conclusion is the nursing staff and their low level of knowledge of radiographical procedures. It is particularly interested in the context of care they contribute to hospitalized patients as well as their effective assistance in arrangements for scheduled imaging examinations.

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