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Research Article

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Evaluation of Awareness of Radiation Protection Among Medical Professionals in Faridpur, Bangladesh

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ABSTRACT

Background: Several challenges with radiation protection and safety culture in radiology departments needs to be addressed as few studies done in this aspect in our country. Especially with regard to the awareness about radiation protection, hazards, dosimetry usage and measurement.
Aim of the study: The aim of this study was to evaluate the awareness of radiation protection issues and the knowledge of dose levels of imaging procedures among medical staff in Department of Radiology and imaging, Bangabandhu Sheikh Mujib Medical College (BSMMC), Faridpur, Bangladesh.
Methods: It was a cross-sectional survey among the medical professionals who work in Department of Radiology and imaging, Bangabandhu Sheikh Mujib Medical College (BSMMC), Faridpur, Bangladesh was conducted from June 2021 to July 2022.
Result: A total of 113 medical staff (including 27 physician, 28 nurse, 31 medical technician and 27 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.
Conclusion: The level of knowledge among the individuals who participate in the operation of ionizing radiation equipment throughout the country is low. The benefit of training in the use of the C-arm image intensifier is highlighted by the revelation that the individuals who had formal training in the use of these machines performed better than those individuals without training. Annual recertification courses should be implemented such that individuals are kept abreast with current changes and reminded of commonly neglected safety practices.

Key Words: *Awareness, Radiation Protection, Dose Levels, and Medical Professionals*

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INTRODUCTION

Ever since the discovery of X-rays by Wilhelm Conrad Roentgen in 1985, the use of ionizing radiation in medicine has been rapidly increasing, which is attributable to recent advancements in imaging technology, which are promising in solving a wide array of clinical problems [1,2]. While the use of ionizing radiation has revolutionized the medical field, it is a double-edged sword since it is a potential source of health hazards [3]. Radiation accidents have enabled the study of the effects of the high radiation level. Alinear-no-threshold (LNT) model for radiation risk assessment has been established, according to which radiation dose above zero poses risk to a certain extent [4]. Although some consider that concept of LNT-based risk estimation is wrong attributing it to unnecessary fear among people and increased expenditure on safety measures, it is still the basis for radiation regulation [5,6]. Moreover, recent studies have shown the carcinogenic potential of low-dose ionizing radiation from medical imaging [7,8]. Thus, sensible and optimized use of radiation is of utmost importance [9]. Optimization of radiation in medical imaging is achieved through the collective effort of the referring physician, radiologist, radiologic technologist/radiographer, and other staff who are directly or indirectly involved in the imaging technique and the patient himself [10]. The referring physician should always ensure that the use of ionizing radiation is justified i.e.

benefits of radiation should outweigh the risk [11]. Radiologists and radiographers also must check whether the examination is obligatory [12]. Since they are formally educated, they are supposed to have a thorough knowledge of safety measures and optimization techniques [10]. It is their responsibility to spread awareness regarding the wise use of radiation not only among other staff in the radiology department but also among the patients and the public [10]. Therefore, radiation awareness is a must to ensure the rational use of ionizing radiation in medicine [13]. The history of medical use of radiation in Bangladesh dates back to when the first X-ray machine was installed. New setups are being established and radiation workers are constantly being produced through various academic programs. While the field of radiology in terms of academics is growing strong, there is still no radiation act in Bangladesh. According to IAEA, each nation needs to have radiation and nuclear safety authority to prevent repercussions arising from radiation safety issues from one country to other countries [14]. In the absence of a radiation protection authority, Bangladesh is facing a huge challenge in terms of radiation protection. Radiation awareness among radiation workers and the public playsan even stronger role in conditions where there is no regulatory body. However, many studies done worldwide have shown that radiation protection knowledge in radiation workers does not meet the standard [15–18]. Very few studies have been done to assess radiation awareness among radiation workers in Bangladesh. These studies have shown that the level of knowledge is not adequate to ensure radiation safety, and the radiation protection issue is still not taken into serious consideration [19, 20]. The aim of this study was to evaluate the awareness of radiation protection issues and the knowledge of dose levels of imaging procedures among medical staff in Department of Radiology and imaging, Bangabandhu Sheikh Mujib Medical College (BSMMC), Faridpur, Bangladesh.

METHODOLOGY & MATERIALS

It was a cross-sectional survey among the medical professionals who work in Department of Radiology and imaging, Bangabandhu Sheikh Mujib Medical College (BSMMC), Faridpur, Bangladesh was conducted from June 2021 to July 2022. 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]Atotalof113 patients in which 27 patients were physicians, 28 patients werenurses,31 patients were technicians and 27 patients were resident physicians joined the survey.

This survey was divided into three Parts of which:

Part-1: Demographics and perceived radiation

Part-2: Radiation protection awareness

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
7. Recognition of dose optimization

Part-3: Knowledge about radiation dose levels

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 scanand
10. Brain MRI

All questions in parts 2 and 3 were prepared in a multiple-choice format with four to six options and only one correct answer. All data were presented in a suitable table or graph according to their affinity. A description of each table and graph was given to understand them clearly. All statistical analysis was performed using the statistical package for social

science (SPSS) program, and Windows. Continuous parameters were expressed as mean ±SD and categorical parameters as frequency and percentage. Categorical parameters compared by Chi-Square test. The significance of the results as determined by a 95.0% confidence interval and a value of $P<0.05$ was considered to be statistically significant.

RESULT

This is a cross-sectional study; 113 patients were enrolled and analyzed. Table 1 shows the patient's professions where 31(27.43%) patients were technicians, 28(24.78%) patients were nurses, and 27(23.89%) patients were physicians. Almost 35% of patients were in service for 6-10 years, and only 11(9.73%) were in service for more than 16 years (Table 2). In this study, 52(46.01%) patients were male, and 61(53.98%) were female. Table 4 shows the distribution of the study population based on professions. According to professions, most patients were aged 20-30 years. Among the physicians, 12(44.44%) patients had sufficient knowledge, and 11(40.74%) patients had good knowledge of radiation protection. However, half of the nurses do not have minimum knowledge. Both technicians and residents had good or sufficient knowledge, more or less. From another perspective, more than 50% of physicians and residents had frequent training, but nurses differed; most had training rarely or never (Table 5). The knowledge of radiological protection principles according to the position is shown in table 6; among all the patients, physicians were answering correctly, from others and nurses were answering wrong from others. Table 7 shows the knowledge about radiation dose levels; here, nurses answered incorrectly more than others again.

Table 1: Distribution of participants of the study based on profession (N=113)

Medical Professional	Frequency	Percentage
Physician	27	23.89
Nurse	28	24.78
Technician	31	27.43
Resident	27	23.89
Total	113	100.00

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

Length of service (Years)	Frequency	Percentage
>1	16	14.16
1-5	27	23.89
6-10	39	34.51
11-15	20	17.70
>16	11	9.73
Total	113	100.00

Table 3: Male distribution of the study population (N=113).

Medical Professional	Gender	Frequency	Percentage
Physician(27)	Male	18	15.93
	Female	9	7.96
Nurse(28)	Male	5	4.42
	Female	23	20.35
Technician(31)	Male	16	14.16
	Female	15	13.27
Resident(27)	Male	13	11.50
	Female	14	12.39

Table 4: Age distribution of the study population (N=113).

Age range	Physician (N=27)		Nurse (N=28)		Technician (N=31)		Resident (N=27)	
	N	%	N	%	N	%	N	%
20-30	12	10.62	11	9.73	13	11.50	10	8.85
31-40	8	7.08	9	7.96	10	8.85	12	10.62
41-50	5	4.42	5	4.42	5	4.42	4	3.54
>50	2	1.77	3	2.65	3	2.65	1	0.88

Table 5: Sample demographics (level of radiation protection awareness and training)

Variables	Physician (N=27)		Nurse (N=28)		Technician (N=31)		Resident (N=27)	
	N	%	N	%	N	%	N	%
Perceived knowledge								
Excellent	3	11.11	1	3.57	2	6.45	2	7.41

Good	11	40.74	6	21.43	12	38.71	10	37.04
Sufficient	12	44.44	7	25.00	13	41.94	12	44.44
Insufficient	1	3.70	14	50.00	4	12.90	3	11.11
Training								
Frequently	16	59.26	3	10.71	12	38.71	14	51.85
Rarely	8	29.63	13	46.43	13	41.94	8	29.63
Never	3	11.11	12	42.86	6	19.35	5	18.52

Table 6: The knowledge of radiological protection principles according to position (correct answers marked in grey, Wrong answers in black)

Variable	Answer	Frequency	Percentage
Physician	Correct Answer	17	62.50
	Wrong Answer	10	37.50
Nurse	Correct Answer	7	24.00
	Wrong Answer	21	76.00
Technician	Correct Answer	19	60.00
	Wrong Answer	12	40.00
Resident	Correct Answer	16	59.00
	Wrong Answer	11	41.00

Table 7: The knowledge about radiation dose levels according to position (correct answers marked in grey, wrong answers in black)

Variable	Answer	Frequency	Percentage
Physician	Wrong Answer	17	62.00
	Correct Answer	10	38.00
Nurse	Wrong Answer	6	23.00
	Correct Answer	22	77.00
Technician	Wrong Answer	18	58.00
	Correct Answer	13	42.00
Resident	Correct Answer	15	56.00
	Wrong Answer	12	44.00

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 incorporates operating the scans with possibly the lowest doses of ionizing radiation granting to achieve the desired diagnostic effect [21]. The demographics of the health professionals who 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 male's 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, the nurse's group showed the lowest level of knowledge regarding perceived knowledge of radiation protection (1.8% excellent and 22.6% good). 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 training [22]. Compared to other departments, participants working in 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 a reasonably good awareness of radiological protection in radiology departments, nevertheless of position (physician, nurse, technician, resident). This may be due to the repeated contact of these professionals with imaging machines, a hence better understanding of radiological procedures [23].

Limitations of the study: *The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.*

CONCLUSION AND RECOMMENDATIONS

Even with the passing of more than 120 years since Roentgen's discovery, protection against ionizing radiation resume to be an important problem in the 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 the 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. We recommend that radiation protection and safety training should be a part of mandatory training for radiology professionals, especially for diploma graduates. Ample radiation protection modules should be introduced in the curriculum of the diploma level. 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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