Original article

Radiation Hazards and Protection: Are Nepalese Radiologists Up to Date?

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Abstract

Introduction: Radiation safety is a major concern in this modern era of diagnostic and therapeutic radiology. Institutions in Nepal still lack the adequate standards to maintain radiation safety. This study was conducted to assess the status of update on radiation hazards and methods of protection among radiologists in Kathmandu.

Methods: A questionnaire survey was performed during continuing medical education program at Tribhuvan University Teaching Hospital, Kathmandu before and after a lecture session on radiation hazards and protection.

Results: A total of 28 participants volunteered to answer the questionnaire. The mean pretest score was 57.8±29.7, which increased to 83.5± 16.8 after the lecture session. Twelve (42.86%) participants scored less than 50%, which increased significantly comparable to the rest (scoring more than 50%) in posttest score. Mean score was least in ionizing radiation questions.

Conclusion: The update on radiation hazards and methods of protection is inadequate among radiologists in Kathmandu. Continuing medical education programs pertinent to the topic must be regularly conducted to keep the radiologists up to date.

Key words: Knowledge, Radiation hazards, Radiation protection, Radiologists.

Introduction

The field of radiology has advanced from the era of X-rays to today's modern imaging techniques, most of which use the ionizing radiation. With the benefits of better diagnosis and treatment, it has caused manifold increase in radiation exposure to the patients and the radiology personnel. Many studies done till date have clearly documented the harmful effects of ionizing radiation from radiation exposure, specifically cancer. This is more important in pediatric population as their tissues are more radiosensitive, and they have more years to live. International Commission on Radiological Protection (ICRP) has recommended two basic principles of radiation protection, justification of the practice and optimization of protection. However, Nepal does not yet have a Radiation Protection Act for implementation of these principles. Though the technological advances have been introduced in the market (multislice CT scanners, for example), the issue of quality control has not been addressed. Radiation protection remains a neglected subject in our country. This study aims to evaluate the knowledge of radiation hazards and protection among radiologist in Kathmandu.

Methods

The study was a questionnaire survey performed during radiology continuing medical education (CME) program conducted in Tribhuvan University Teaching Hospital, Kathmandu on 28th of July 2012. A total of 35 radiology professionals including radiology residents and practicing radiologists in Kathmandu participated in the CME. Only

28 of the participants volunteered and participated in the study. Pretest and posttest survey was conducted before and after a lecture session on radiation hazard and protection using the same questionnaire. The questionnaire included 10 multiple-choice questions covering 5 basic topics of radiation hazard and protection: Radiation protection, Radiation dose limit, Effective dose, Biological effect and Ionizing radiation. Scores were calculated in percentage and comparison between pre and posttest scores was performed using t test. SPSS 17.0 was used for statistical analysis.

Results

Out of 35 participants of the CME, 28 volunteered and participated in our survey with a response rate of 80%. The mean pretest score was 57.8 ± 29.7% which increased to a posttest score of 83.5±16.8%($p<0.001$). The highest score in pretest as well as posttest survey was in subgroup Effective dose (pretest-60.71± 39.60, posttest- 91.67 ±19.51); whereas the lowest score was in the subgroup Ionizing radiation (46.43± 50.78) in pretest and Biological effect (71.43±31.70) in posttest. The scores increased significantly in posttest than in pretest in all subgroups except Biologic effect ($p= 0.16$) (Table 1).

Table 1 Pretest and posttest scores among the participants within five basic topics of radiation hazards and protection (n=28)

S. No.	Particulars	Pretest (n=28)	Posttest (n=28)	p-value
1	Radiation protection			
	Mean Score (%)	57.14± 35.26	83.93±27.39	0.009
	Score (%)			
	0	5(19.7%)	1(3.6%)	
	100	9(32.1%)	20(71.4%)	
2	Radiation Dose Limit			
	Mean Score (%)	58.93± 40.94	85.71±26.72	0.01
	Score (%)			
	0	7(25%)	1(3.6%)	
	100	12(42.9%)	21(75%)	
3	Effective Dose			
	Mean Score (%)	60.71± 39.60	91.67 ±19.51	0.002
	Score (%)			
	0	6(21.4%)	2(7.1%)	
	100	11(39.3%)	23(82.1%)	
4	Biological Effect			
	Mean Score (%)	58.93± 33.48	71.43±31.70	0.165
	Score (%)			
	0	4(14.3%)	2(7.1%)	
	100	9(32.1%)	14(50%)	
5.	Ionizing Radiation			
	Mean Score (%)	46.43± 50.78	85.71±35.63	0.003
	Score (%)			
	0	15(56.3%)	4(14.3%)	
	100	13(46.4%)	24(85.7%)	

Out of 28 participants, 12 (42.86%) scored less than 50% in the pretest survey (Figure1). The mean score in participants scoring less than 50% in pretest was 28.3±13.3, which increased to 88.3±14.03 in the posttest survey (p<0.001). In this group, score in all the subgroup questions increased significantly in posttest survey (Table2).

Table 2 Pretest and posttest score among participants scoring less than 50% (n=12)

S.No	Particulars	Pretest(n=12).	Posttest (n=12).	p-value
1	Radiation Protection			
	Mean (%)	37.5±22.6	83.3±24.6	0.001
2	Radiation Dose Limit			
	Mean (%)	37.5±31.07	91.6±19.4	<0.001
3	Effective Dose			
	Mean (%)	22.2±25.9	100	<0.001
4	Biological Effect			
	Mean (%)	33.3±24.6	79.17±33.4	0.001
5	Ionizing Radiation			
	Mean (%)	0	83.3±38.9	<0.001

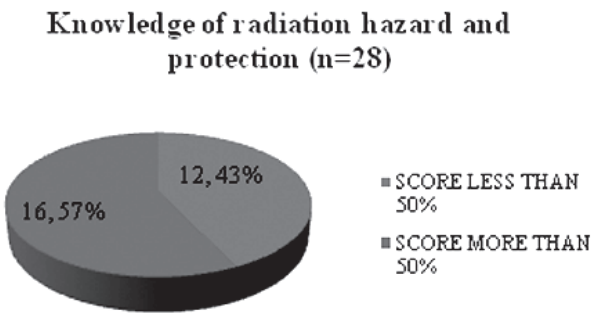

Figure 1 Overall knowledge of radiation hazards and protection (n=28)

Discussion

Diagnostic and therapeutic radiological procedures are integral part of modern medical practice,exposing both patients and medical staff to ionizing radiation. Without proper protective measures, this radiation causes many negative health effects.[1] Hence, proper knowledge and awareness regarding the radiation hazards and radiation protection is mandatory for health professionals, especially the radiology professionals.

Radiology professionals are responsible for the radiation exposures in various radiological procedures. All the radiological procedures should be based on as low as reasonably achievable (ALARA) principles. Though the radiologists are trained on the radiation hazards and the methods of protection in their postgraduate medical study, to keep themselves updated and abreast of the subject matter depends solely on themselves. Without the knowledge and update on the radiation hazards, the basic principle ofALARA will never be followed.

The mean pretest score in our study (57.8%), though less for radiation experts, is higher compared to previous study conducted by Lee et al in Hongkong, which showed an overall accuracy of 40% for radiologists and 16% for non radiologists.[2] Another study by Hamarsheh et al in Palestine showed knowledge of ALARA principles in only 6% of physicians; however the participants were non-radiologists.[1] The knowledge of radiation dose among participants was also higher in our study as compared to other studies performed to evaluate knowledge of radiation dose.[2-4] But the results in our study might be biased as our questionnaire included comparison of radiation dose among various investigations rather than exact estimation of the radiation dose for individual investigation.Most studies reported that physicians as well as radiologists underestimated the risk of radiation; however our study did not include the estimation of radiation dose.[2-5] Our study is comparable to previous study from Nepal, which reports knowledge of radiation dose limits among the participants to be 52.7% and 48.3% for radiation workers and general public, respectively.[6]

The results of biologic effect were low in our study (58.93%). Similar study conducted by Quinn et al reported most participants answering correctly to questions regarding radiation effect in the gonads and urinary bladder; however the effects in the stomach and kidney were underestimated. Though the latter study was conducted among non radiologists, it was surprising to note that the participants were not aware that a patient has an annual dose limit of radiation.[4]

The result of ionizing radiation (mean pretest score of 46.3%) in our study is comparable to study done by Lee et al which showed the overall accuracy of radiologists in estimating the radiation dose to be 40%.[2]

Study done in Kathmandu in 2007 stated that X-ray units, fluoroscopy unit and computer tomography units showed higher radiation than standard and exposure to staffs much beyond occupational exposure limit.[7] However study done in Kathmandu in 2012 reported X-ray and CT working area to be safe but with leakage of radiation in almost all units.[6] In background of such high associated risk with working environment, the level of knowledge of radiologist should be considered inadequate. Radiologists and radiation workers should be encouraged to keep themselves abreast of the recent advances and the methods of minimizing radiation dose to patients and themselves.

The level of knowledge in the posttest survey was significantly higher than the pretest, even in the group scoring less than 50% in pretest survey. This signifies a successful presentation on the topic.

There were some limitations of the study. The study did not include exact estimation of radiation dose for various investigations. Long term follow up for assessment of impact of the CME was not performed. The study did not include non-radiologist. Finally, patients' knowledge and perception of radiation risk as well as level of awareness was not assessed.

Conclusion

Radiation protection remains a neglected topic in our country. The update on radiation hazards and methods of protection is inadequate among radiologists in Kathmandu. Continuing medical education programs pertinent to the topic must be regularly conducted to keep the radiologists up to date.

Conflict of interest: None declared.

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