AUDIT OF PERSONNEL RADIATION PROTECTION PRACTICES IN MEDICAL RADIOGRAPHY IN NORTH EASTERN NIGERIA

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ABSTRACT

OBJECTIVE: To assess the standard of personnel radiation monitoring practice in North Eastern Nigeria and determine the role played by the hospital management in assisting radiation workers to conform to standards.

METHOD: The study was a cross-sectional survey. Medical Radiation workers in tertiary hospitals in North Eastern Nigeria completed a questionnaire purposely designed to assess personnel radiation monitoring practice. A sample of n=50 participants were recruited over a three month data collection period, and data was analyzed using SPSS version 16.0 (IBM, New York, USA).

RESULT: Forty one questionnaires were returned filled, representing a return rate of 82%. Ninety five percent of the respondents worked without being monitored, majority (70.72%) spent 7.5-9 hours in the workplace. Sponsorship for training in radiation protection was extended to only 15% of the respondents by the hospital management. 63%t and 68% of the respondents had no quality assurance tests and room survey conducted in their departments respectively.

CONCLUSION: The audit revealed poor standards of application of best personnel radiation monitoring practices. Establishment of more training centers, organization of periodic seminars, and inspection of radiological centers in the study locality were identified as being crucial for improvement of the practice.

KEY WORDS: Audit, personnel monitoring, ionizing radiation and radiation protection

INTRODUCTION

Scientists have been fully aware of the beneficial and destructive potentials of ionizing radiation since the early 20th century. By using the knowledge of radiation hazards that has been gained over the years and employing effective methods to eliminate those hazards, greater control can be exercised over the use of ionizing radiation. An example of ionizing radiation that can easily be controlled is radiation produced from an X-ray tube[1]. Professionals educated in the safe operation of imaging equipment can follow practices, use protective devices and select technical factors that significantly reduce radiation dose to patients, personnel and members of the public[2].

To ensure safety of persons undergoing examinations involving the use of ionizing radiation, different international organizations have proposed guidelines that should be adopted to help minimize these destructive potentials while optimizing the useful aspect[1]. An example of such organization is International Commission on Radiological Protection (ICRP), which remains the leading International authority responsible for providing clear and consistent radiation protection guidelines through its recommendations on occupational and public dose limits but does not function as an enforcement agency. Therefore, each nation is required to develop and enforce its specific regulations[1]. The Nigerian Nuclear Regulatory Authority (NNRA) established by the Nuclear Safety and Radiation Protection Act 1995 of the Federal Government of Nigeria is charged with the responsibility of registering, licensing, inspecting and enforcing nuclear safety and radiological protection in all practices in Nigeria[3].

Radiation protection in medical radiography is essential if medical exposure to ionizing radiation is to be maintained at a level of minimal acceptable risk. It is essential that risks to patients, staff and environment are reduced through justification, optimization and limitation of radiation exposures[1].

The key players to ensure this are the medical radiation workers, using recommended best practices guidelines so as not to predispose the patients, people, environment and even themselves to the hazards of ionizing radiation. In this regard, a study by Jacobs et al[4] recommended that an elaborate educational programme be made a prerequisite to achieve improvement in the implementation of standards of quality care for radiography, and radiation protection among radiation workers in dental radiography. A similar study by Mutyabule & Whaites[5] revealed lack of knowledge regarding dental radiography and radiation protection in addition the condition of most equipment in Uganda as major concerns. Another study by Amirzade & Tabatabaie[6] in Shiraz hospital in Iran reported high level of awareness and knowledge of radiation protection.

Radiation protection practice is very vital in radiography since ionizing radiations are hazardous agents in the work place, and produces some type of injuries. Awareness of the application of protection guidelines, practical application of the guidelines and knowledge of the principles of radiation protection play an important role in the health of patients, personnel, and members of the public. Based on the knowledge of the researchers and available literature, no study has been published on the standard of personnel radiation protection practice in the study locality. Therefore, this present study is aimed at assessing the standard of personnel radiation protection practice in the region.

SUBJECTS AND METHODS

A prospective cross-sectional approval was adopted for this study. The present prospective cross-sectional survey was performed on 50 participants. Fifty medical radiation workers, comprising radiographers, resident doctors in radiology/radiologists, and technicians in tertiary health institutions in North-Eastern Nigeria were enlisted into the study.

The questionnaire was designed using reports from previous surveys carried out to assess standard of radiation protection practices by ISRRT[7]. The questionnaire was a 28-item structured one, designed to assess knowledge of radiation protection and the personnel radiation protection practices operational in the institution. The first part of the questionnaire included the participant's demographic details, and the second part included questions to assess the practice.

The questionnaires were sent with a cover letter stating the objectives of the study and that participation was voluntary. Participants were made to consent to participation and all questionnaires were anonymous.

The responses on the questionnaires were extracted, grouped and analyzed using the Statistical Package for Social Sciences (SPSS) 16.0 (IBM, New York, USA), where descriptive statistics such as frequency counts, mean and percentage were generated and the results presented on tables and figures.

RESULTS

Out of a total number of 50 questionnaires that were distributed to various radiation workers working in tertiary hospitals in North-Eastern Nigeria, 41 questionnaires (82%) were returned. The percentage returned consisting of 33 males and 8 females, whose average age ranged from 31-40 years, with mean age of 37 years. The participants included 11 resident doctors in radiology department, 19 radiographers and 11 technicians as shown in Table 1.

Table 1: Demographic Data of Participants

Variables	Frequency	Percentage (%)
Sex		
Male	33	80
Age Range (Years)		
21-30	14	34.14
31-40	16	39.02
41-50	6	14.64
51-60	3	7.32
61-70	2	4.88
Distribution of Radiation Workers		
Resident Doctors in Radiology	11	27
Radiographers	19	46
Technicians	11	27

Table 2: Standard of Radiation Protection Practice

Variables	Frequency	Percentage (%)
Time Duration Spent in the Work Area		
1-3 Hrs	0	0.00
3.5-5 Hrs	2	4.88
5.5-7 Hrs	8	19.52
7.5 - 9Hrs	29	70.72
Above 9 Hrs	2	4.88
Sponsorships for Radiation Protection Training		
Yes	6	15
No	35	85
Personnel Radiation Monitoring		
Monitored	2(TLD)	5
Not Monitored	39	95
Protection Accessories Used		
Lead Apron	41	100
Lead Gloves	14	34
Thyroid Shield	3	7.32
Lead Goggles	3	7.32
Breast Shield	3	7.32
Gonad Shield	23	56.1
Survey of Diagnostic/Darkrooms		
Yes	13	32
No	28	68
Implementation of routine QA Programme		
Yes	15	37
No	26	63
Availability of Warning Signs		
Yes	4	10
No	37	90
Causes of Repeats		
Positioning Error	19	
Patients' Fault	16	
Equipment Failure	20	
Exposure Factors Error	21	

DISCUSSION

This study using questionnaires consisting of both closed and open-ended questions and administered on radiation workers in North-Eastern Nigeria, revealed that Radiographers topped the list of radiation workers in the region with 19, followed by Radiologists/Resident Doctors in radiology and Technicians with 11 respectively. Only 8 of them were females and the remaining 33 males, majority of them fell within the age range of 30-41 with mean age of 37. Standards of personnel radiation monitoring has been found to be very poor in the region owing to the fact that personnel (95%) were not provided with radiation monitoring devices, and were not routinely monitored. Probably this might be due to negligence on the part of the radiation workers as some may have been provided with monitoring devices but failed to utilize them or acquaint the hospital management with the standard practice. However, this does not rule out the fact that some hospitals may not have provided their workers with these devices. A significant number of the respondents spent 7-9 hours in the work place as against the 5 hours recommended by international community. This could be due to the limited number of radiation workers in the region coupled with the high demand for radiologic services, as majority of them had to attend to an average of 25 patients per day.

A very small proportion of respondents, fifteen percent of the required data gained sponsorship for radiation protection training program from hospital management. However the few that gained, had the sponsorship only twice within working for 25-35 years. This is contrary to the recommendation that a radiation worker should get an update of knowledge in radiation protection every 5 years[8]. Absence of post-graduate education provision on radiation in the region could be a reason for this lack of knowledge update. Majority of the respondents (68%) indicated that no radiation survey of diagnostic rooms was carried out in their various centers. In other words, the state of the working environment was not established, and coupled with the fact that most of them were not monitored might predispose them to more radiation hazards than their colleagues in other parts of the country. Another interesting aspect of findings about the working environment was that most of the participants responded positively to the presence of radiation warning signs in the department, in keeping with the findings from international survey of radiation protection practices[7].

Majority of workers responded that quality assurance tests were not done in their various centers. This could be the reason for equipment failure ranking as one of the highest causes of repeat radiographs. However, it was not possible to establish how true the participants' judgment on exposure factor as the highest cause of repeat radiographs, since inconsistency in reproducibility of radiographic results on the part of the equipment could also give an erroneous impression that exposure factor is the cause of repeat. Therefore, a more comprehensive study is required that will survey occupational radiation dose received by radiation workers and assess the standard of quality assurance as well as working environment in various centers in the region.

CONCLUSION

It is concluded that significant proportion of radiation workers were not monitored and were unnecessarily overworked. In addition, only a small percentage gained sponsorship for training in radiation protection program. A greater percentage of the radiation workers reported lack of quality assurance and room survey being carried out. This calls for the establishment of more training centers, organization of periodic seminars and inspection of radiologic centers in the study locality.

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SECTION A: BIODATA

1. Age of Respondent.....

2. Gender: Male [ ] Female [ ]

3. Occupation in radiation field

(a) Radiographer (d) Nurse

(b) Radiologist (e) Others. Please specify.....

(c) Technician

4. Work experience ..... (years)

5. Are you a radiation safety officer: yes [ ] no [ ]

6. Qualification: PhD [ ] MSc [ ] BSc [ ] HND [ ] OND [ ] O'level [ ] FSLC [ ]

Others.....

SECTION B: RADIATION PROTECTION

7. What kind of radiologic equipment do you have in your department? Tick as appropriate

(a) Conventional X-ray Unit [ ] (b) Fluoroscopy [ ] (c) Computed Tomography [ ]

(d) Magnetic Resonance Imaging (MRI) [ ] (e) Nuclear Medicine [ ] (f) Mammography [ ]

(g) Angiography [ ] (h) Others.....

8. Which of the equipment as stated above do you use most frequently in the department? .....

9. Average number of patients you attend to per day.

(a) Below 10 patients (c) 20 – 30 patients

(b) 10 – 20 patients (d) above 30 patients

10. Average duration of time you spend per day in the department

(a) 1 – 3 hours (d) 7 – 9 hours

(b) 3 – 5 hours (e) above 9 hours

(c) 5 – 7 hours

11. In your department, what is the average exposure factor used for the following radiography of an average size adult (60 – 70kg)?

	kVp	mA	x	s	=	mAs
Skull	[ ]	[ ]		[ ]		[ ]
Chest	[ ]	[ ]		[ ]		[ ]
Upper Limbs	[ ]	[ ]		[ ]		[ ]
Lower Limbs	[ ]	[ ]		[ ]		[ ]
Pelvis	[ ]	[ ]		[ ]		[ ]
Abdomen	[ ]	[ ]		[ ]		[ ]

12. What type of screen system do you use in your hospital?

Rare earth [ ] or calcium tungstate [ ] or both [ ]

Please specify the speed (tick one or more) 100 [ ] 200 [ ] 300 [ ] 400 [ ] others……

13. Have you been sponsored by hospital management for training in Radiation Protection? Yes [ ] No [ ]

If yes, mention the number of times since the beginning of practice ……

14. Is there any policy on radiation exposure monitoring of workers in your hospital? Yes [ ] No [ ]

If yes, specify the radiation monitoring devices used. Film badge [ ] TLD [ ] Others……..

15. Does ionizing radiation have effect on human body? Yes [ ] No [ ]

16. If yes, list 2 types of radiation hazards you know

…… and ……..

17. List ways in which you practically apply radiation protection.

a.

b.

c.

18. During radiographic procedure, which of the following or its combination do you use when protecting yourself and patient? Tick one or more depending on what you have in your hospital

	Patients	Yourself	other persons
Lead apron	[ ]	[ ]	[ ]
Lead gloves	[ ]	[ ]	[ ]
Protective lead goggles	[ ]	[ ]	[ ]
Gonad shield	[ ]	[ ]	[ ]

19. What are the major causes for repeat radiographs in your department? Tick as appropriate

Positioning fault [ ] patient fault [ ] equipment fault [ ] exposure factors [ ]

20. What parameter is/are used in monitoring radiation dose to patients in your department?

DAP [ ] ESD [ ] DLP [ ] CTDI [ ]

21. Do you carry out quality assurance/control test in your department?

Yes [ ] No [ ]

22. If yes, how often? Tick as appropriate

Daily [ ] weekly [ ] every 2 weeks [ ] monthly [ ] every 6 months [ ] annually [ ]

23. Is radiation survey of the Diagnostic/Darkrooms performed? Yes [ ] No [ ]

If yes, how often? Tick as appropriate

Daily [ ] weekly [ ] every 2 weeks [ ] monthly [ ]

Every 6 months [ ] annually [ ]

24. Do you know the age of the X-ray equipment used in your department? Yes [ ] No [ ]

If yes, state the age.....

25. Are there radiation warning signs in your department? Yes [ ] No [ ]

26. Do you know the amount of radiation dose given to your patient during chest X-ray?

Yes [ ] No [ ]. If yes, state the amount .....

SECTION C

27. What is your opinion about the practice of radiation protection in your area?

.....

28. As a medical radiation worker, how can you rate your degree of awareness on radiation protection?

Fair [ ] good [ ] very good [ ] excellent [ ]

DECLARATION FORM

I, ... agree to the terms and conditions of this questionnaire on "Audit of Radiation Protection Practices in Medical Radiography in North-East of Nigeria" Hence, my participation in the research.

All information given herein shall be to the best of my knowledge.

Respondent's Signature .....