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Evaluation of Personnel Radiation Monitoring in Radiodiagnostic Centres in South Eastern Nigeria

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Abstract: To assess the level of personnel radiation monitoring in radio-diagnostic centres in South Eastern Nigeria. A cross sectional prospective survey that targeted radiographers working in ten selected government-owned hospitals in South Eastern Nigeria was conducted. The data collection instrument was a sixteen-item semi-structured self-completion questionnaire. Personnel radiation monitoring was available in only 4 out of 10 hospitals (40%) and in two of the hospitals radiation monitoring does not cover all the radiographers on employment. Radiation monitors were found to be read fairly regularly at about every quarter of the year but it takes more than 3 years for fresh supplies of radiation monitoring devices to be made in the hospitals where radiation monitoring is carried out. Radiation protection advisers or supervisors were available in only 4 hospitals (40%). Majority of the radiographers (41.5%; n = 17) believe the hospital management do not make provision for it in their budget. Dosimetric records of staff are not given any consideration during recruitment of new staff. Personnel radiation monitoring in South Eastern Nigeria is abysmally poor. This is a significant precautionary lapse as radiations risks cannot be assessed and corrective measures taken.

Key words: · Personnel radiation monitoring · Radio-diagnostic centres · South Eastern Nigeria

INTRODUCTION

Monitoring of radiation doses received by staff in radio-diagnostic centres is of great importance to the radiographers in their effort to protect themselves, patients and the general public from the untoward effect of excessive radiation. It is clearly sensible for those involved in the use of ionizing radiation in diagnostic radiology to have an appreciation of the possible risks involved. For radiographers measurement of radiation doses received at periodic intervals represents a way of monitoring doses to ensure that they are within safe occupational limits.

Personnel radiation monitoring is essential to ensure that dose limits for staff are not exceeded. The dose limits for staff were published by the International Commission on Radiological Protection (ICRP) in 1977 and subsequently in the ionizing radiation regulations. A downward revision was done in 1991 by re-evaluation of data on risks. The effective annual dose limit was formerly 50mSv and the newly adopted effective annual dose limit is 20mSv averaged over five years [1]. The downward review of annual dose limit was to put stricter control over the use of ionizing radiation in Medicine and minimize possible hazards, especially the stochastic effects.

Film badges, thermoluminiscent dosimeters and pocket ionization dosimeters are the recommended radiation measuring devices for use y radiation workers to monitor received radiation dose [2]. Every worker is expected to wear his personal dosimeter always while working [3]. The dosimeter readings are kept as records

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for every staff for the purpose of evaluating their radiation history and possible risks involved. The records help in improving radiation protection practices in clinical settings. At the Washington State University, employees who have not had a radiation monitoring badge before must apply for and receive one before starting work involving radiation exposure [4]. Also, if the individual has worked with radiation in an institution other than Washington State University, he or she must complete and sign the release statement on radiation exposure history [4]. Dosimetric records are kept and are required to be disclosed when workers change jobs [5]. Personnel dosimetric records and monitoring are integral parts of radiography practice in Malaysia [6].

Our personal observations before embarking on this study are that radiation doses received by radiographers in Nigeria are not monitored in most radio-diagnostic centres and personnel radiation monitoring devices where available are not consistently read and their provisions are irregular. The purpose of this study was to evaluate personnel radiation monitoring in South Eastern Nigeria and ascertain its adequacy.

MATERIALS AND METHODS

The study was a cross sectional prospective survey that targeted radiographers working in ten selected government-owned hospitals in South Eastern Nigeria. The data collection instrument was a sixteen-item semi-structured self-completion questionnaire designed in line with the objectives of the study.

A total of 43 questionnaires were distributed and 41 were duly filled out and returned to the researchers during the period of data collection, giving a response rate of 95.3%. The data collected were analyzed to describe the personnel radiation monitoring practices in the selected hospitals spread across the five states in South Eastern Nigeria.

RESULTS

Table 1. shows the availability and methods of personnel radiation monitoring in the selected hospitals. It shows that personnel radiation monitoring is available in only 4 out of 10 hospitals (40%) and in two of the hospitals radiation monitoring does not cover all the radiographers on employment. Table 2 shows the regularity and consistency of reading and supply of personnel radiation monitoring devices. It shows that radiation monitors are read fairly regularly at about every quarter of the year but it takes more than 3 years for fresh supplies of radiation monitoring devices to be made in the hospitals where radiation monitoring is carried out.

Radiation protection advisers or supervisors are in the employment of only 4 hospitals (40%) out 10 studied as shown in table 3. Table 4 shows the various reasons advanced by the radiographers for not carrying out personnel radiation monitoring. Majority of the radiographers (41.5%; n = 17) think the hospital management do not make provision for it in their recurrent budget. Other miscellaneous reasons were advanced by 29.2% (n = 12) of the radiographers. The results also show that dosimetric records of staff are not given any consideration during recruitment of new staff.

Table 1: Availability and methods of personnel radiation monitoring in the various hospitals

Hospital	1	2	3	4	5	6	7	8	9	10
Number of radiographers	5	2	2	3	10	6	1	3	3	6
Number of radiographers monitored	3 (60%	Nil	Nil	3 (100%)	Nil	Nil	Nil	3 (100%)	1 (33.3%)	Nil
Type of radiation monitor	TLD	Nil	Nil	TLD	Nil	Nil	Nil	TLD	TLD	Nil

Table 2: Regularity and consistency of personnel radiation monitoring

Hospital	1	4	8	9
Time interval before monitors are read (months)	>3 months	3 months	>3 months	>3 months
Last time fresh supply of monitors was made (years)	>2 years	>3 years	>3 years	>3 years

Table 3: Availability of radiation protection adviser or radiation protection supervisor

Hospital	1	2	3	4	5	6	7	8	9	10
Availability of radiation protection adviser or supervisor	YES	NO	NO	YES	YES	NO	YES	NO	NO	NO

Table 4: Reasons for not performing personnel radiation monitoring in the hospitals

Reasons advanced	Number of respondents
No radiation safety officer to provide service	4 (9.8%)
Lack of funds	6 (14.6%)
Radiographers do not request for personnel radiation monitoring	2 (4.9%)
Hospital management do not provide for it in its budget	17 (41.5%)
Others	12 (29.2%)

DISCUSSION

Personnel radiation monitoring is an important safety precaution in the practice of radiography. It does not in itself provide protection against ionizing radiations. Its main purpose is to measure radiation dose received by radiology personnel, which can be used that radiation doses received are within permissible limits, verify that facilities for radiation protection are adequate and show that radiation protection techniques are acceptable [7].

The result of our survey shows that personnel radiation monitoring is available only in a few hospitals and in most cases does not cover all the radiographers on employment. This finding agrees with the result of a previous survey which covered 28 x-ray centres in two states of south eastern Nigeria. The survey result showed that radiation monitoring was almost non-existent in the centres [8]. The finding of our survey is appalling considering the importance of radiation monitoring to radiography practice. Determining radiation dose received by personnel will ensure reduction of untoward biological radiation effects. Radiation exposures in medical practice are usually no accidental and protection is usually geared towards reducing stochastic effects, which likelihood is determined by the magnitude of the absorbed dose [9]. It is therefore important to estimate the risk of low dose radiation to radiography personnel. The most important of the stochastic effects is cancer induction. The risk associated with genetic effects of radiation is smaller than the risk of cancer induction, so it is the latter that is the principal consideration in determining dose limits [10]. To limit the probability of stochastic effects on radiographers, exposure doses have to be constantly monitored using suitable devices.

The radiation monitoring device used in hospitals where radiation monitoring is available are themoluminiscent dosimeter (TLD) badges and these are read fairly regularly. Thermoluminiscent dosimetry is a phenomenon by which solid state detectors can be used to detect and measure exposures to ionizing radiations. When exposed to these radiations, free electrons in the TLD crystals become trapped in lattice imperfections and when heated to about 300°C, the electrons escape the traps and emit light. The amount of light emitted is proportional to the dose of radiation asorbed [7]. The possible mechanism to explain this phenomenon is the band theory of multiatomic crystalline structures [11, 12]. TLD is a convenient method of personnel radiation monitoring as it is portable, lightweight and can always be worn by the radiographer during work sessions. Its most important advantages are that it measures total radiation dose over a period of time, high sensitivity and reusability. Our finding is that TLD badges are available to all the radiographers on employment only in 2 out of 4 hospitals where they used. We therefore note that all radiographers are exposed to radiation risk and therefore should be monitored. Leaving out some in the monitoring process may dampen their morale and affect their output negatively.

Radiation protection advisers or supervisors are hardly available in the centres surveyed. They were found only in four centres when ideally they should be in every radiology department. It means that where they are not available, no one oversees radiation monitoring in the department. In an ideal situation a medical physicist is employed to the job or a radiographer trained and assigned the duties.

The poor level of personnel radiation monitoring is obvious. Majority of the radiographers believe it is not provided for in the hospitals' recurrent budgets. This lack of will to do something beneficial to radiation workers leads to job dissatisfaction and discourage young school leavers who may want to make careers as radiographers. The token spent on regular personnel radiation monitoring would be far less than the money that would be spent managing cancers resulting from radiation. The dosimetric records which are not considered during recruitment of new staff is another lapse on the part of the centres. In other parts of the world it is recommended and practiced that persons who have worked with radiation in the past should make their dosimetric records available to their new employers [5, 6]. This is important as it helps to assess the radiation morbidity risk associated with the new employee.

CONCLUSION

Personnel radiation monitoring radio-diagnostic centres in South Eastern Nigeria is abysmally poor. This is a significant precautionary lapse as radiations risks cannot be assessed and corrective measures taken.

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APPENDIX

A questionnaire for a survey on the "Evaluation of Personnel Radiation Montoring in Radio-diagnostic Centres in Southeastern Nigeria.

The information supplied here will be treated with utmost secrecy and used only for the purpose of this study.

Tick [V] for Any Option Chosen:

1. Name of your hospital/clinic: UNTH [ ] Parklane [ ] Orthopaedic [ ] FMC Owerri [ ] FMC Umuahia [ ] AbsuthAba [ ] FMC Abakaliki [ ] NAUTH Nnewi [ ] General Hospital Onitsha [ ] EBSUTH Abakaliki [ ].
2. How long have you worked in your department? Less than 1 year [ ] 1-5 years [ ] 6-10 years [ ] 11-15 years [ ] 15 years and above [ ].
3. How many hours do you work in the diagnostic room per day? Less than 3 hours [ ] 3-4 hours [ ] 4-6 hours [ ] more than 6 hours [ ].
4. Considering the time spent in the diagnostic room per day, do you think you receive occupational radiation exposure higher than necessary? Yes [ ] No [ ].
5. Are you provided with any personnel radiation monitoring device? Yes [ ] No [ ].
6. If Yes, what type? Thermoluminescence dosimeter (TLD) [ ] Film badge [ ] Pocket lonisation dosimeter [ ]Others (specify) ……..
7. How often is this taken for reading? 2 weekly [ ] Every month [ ] Every 2 months [ ] Every 3 months [ ] Above 3 months [ ].
8. If no, were you provided with any personnel monitoring device before? Yes [ ] No [ ].
9. For how long it been stopped to be provided less than 1 year [ ] 1 -2 years [ ] 2-3 years [ ] Above 3 years [ ].
10. What is the reason for non-provision of the device? No radiation safety officer to provide the service [ ] Lack of fund for the exercise [ ] Radiographers do not request for it [ ] Management do not care [ ].

11. Has there been complaint to the hospital management by the radiographers for non-provision of the devices? Yes [ ] No [ ].

    (a). If Yes, what has been the reason?
    Specify……..……

    (b). IF No, what has been the reason?
    Specify……

12. Have you worked in other hospital (s) before you were employed in your present hospital? Yes [ ] No [ ].
13. If Yes, were you monitored in your previous place of work with any of the personnel monitoring devices? Yes [ ] No [ ].
14. Did your present place of work demand for your dosimetric monitoring record before employment? Yes [ ] No [ ].
15. Do you have any Radiation Protection Adviser (RPA) or departmental Radiation Protection Supervisor (RPS) in your department? Yes [ ] No [ ].
16. Suggest a way of improving personnel radiation monitoring in your department.

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