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Radiodiagnosis

STUDY OF AWARENESS AMONG RADIOGRAPHERS FOR SAFE PERSONNEL RADIATION MONITORING PRACTICES

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ABSTRACT

Background: It is important for staff working in radiology department to be well aware regarding personnel radiation monitoring practices so as to protect themselves, patients and general public from the harmful effects of radiation. It is essential to ensure that the working staff follows the principles of radiation protection, measure radiation dose received by them by monitoring devices & verify the adequacy of facilities of radiation protection in the department.

Aim: To evaluate personnel radiation monitoring awareness among radiographers in a tertiary care centre and their satisfaction with the departmental radiation monitoring services.

Method: A cross-sectional observational survey that targeted radiographers working in a tertiary care hospital was conducted. The data collection instrument was a twenty two-item semi-structured self-completion questionnaire.

Results: The study included 23 radiographers with mean age of 33.96 years. Majority 9 (39.1%) had working experience of 11-20 years and reported duration of 34-40 hours per week exposure to radiation. Male: female ratio was 2.28:1. Thermoluminiscent Dosimetry (TLD) badge was the most commonly used radiation monitoring device which was being monitored regularly at an interval of three months. The radiation exposure level was within safe limits among the radiographers. All radiographers were satisfied with the radiation monitoring practices of the department. All the radiographers were aware of the personal protection devices available in the department and all have been using them adequately & regularly. All radiographers are aware about maximum permissible dose as per AERB guidelines and about ALARA principle. Few 3 (13.1%) radiographers did not know about e Licensing Of Radiation Application (e-LORA). None of the participants reported any shortcomings of the radiation monitoring program and all were found to be satisfied with the radiation monitoring practices of the department.

Conclusion: The results are overall satisfactory, with good level of awareness among the radiographers regarding personnel radiation monitoring and radiation protection and also satisfied about radiation monitoring practices of the department.

KEYWORDS :

INTRODUCTION:

Radiation is a mechanism whereby energy passes through space. The energy takes the form of an electromagnetic wave. The frequency of the electromagnetic wave determines its position in the electromagnetic spectrum. On the one end of spectrum lies low-frequency waves such as radio waves whereas on the other end lies the high-energy, high-frequency X-rays / Gamma rays .Whereas the low frequency waves are non ionising the ones lie on other end are high-frequency, high-energy waves .These high frequency high energy waves are termed as "ionizing radiation" because they contain sufficient energy to displace an electron from the orbit around a nucleus. This displaced electron on human tissue is liable to cause potential damage to the DNA. The damage may be direct or indirect. When the displaced electron hits and breaks a DNA strand, it is called direct damage. In indirect damage the electron reacts with a water molecule, creating a powerful hydroxyl radical which then damages the cell's DNA.

The effects caused by radiation can be either stochastic or non stochastic (deterministic). The stochastic effects are those for which there is no threshold dose and the characteristic curve between dose and effect is linear. The examples of stochastic effects are cancer and hereditary conditions .On the other hand non stochastic (deterministic effects) effects are those in which damage to the body is dependent upon the dose. There is specific threshold for a specific effect e.g. cataract, anaemia and radio-dermatitis.

The biological effects of harmful radiation can be either somatic or hereditary. When the radiation affects only the somatic cells it is called somatic effects and it occurs only in the person exposed to harmful radiation. Hereditary effects are consequence of chromosome modifications of individuals exposed to harmful radiation and it transmits to the next generations.

With the advancements in newer medical diagnostic techniques like CT Scanners, digital x- ray and fluoroscopy machines and their easy availability, the scope of their overuse and disuse has widened. In the absence of regulatory practices in place and lack of sufficient knowledge of radiation hazards in paramedical staff and lay population there are chances of radiation over exposure leading to its acute and chronic detrimental effects. as described above.[1]

In India, Atomic Energy and regulatory Board (AERB) is the regulatory body which regulate and enforces the safe use of ionising radiation. The president of India by exercising his powers conferred by section 27 of Atomic Energy Act 1962 (33 0f 1962) constituted AERB on 15th November 1983. AERB derives its regulatory authority and powers from Atomic Energy Act 1962 and environment (protection) act [1986].The board ensures that the safe use of ionising radiation and nuclear energy in India and that it does not cause undue risk to the health and environment.[2]

Principals of Radiological protection, Newer Approach:

The International Commission of Radiation Protection ICRP in its recent recommendation of 2017 has now formulated a single set of principles that apply to planned emergency and existing exposure situations .In these recommendations the commission also clarifies how the fundamental principles applies to radiation source and to the individuals as well as how the source related principles apply to all controllable situations.

(a) Principle of Justification: It is source related and applies in all exposure situations .It says that any decision that alters the radiation exposure situation should do more good than harm. This means that by introducing a new radiation source, by reducing exposure one should achieve sufficient individual or societal benefit to offset the detriment it causes.

(b) Principle of Optimisation of Protection: The likelihood of incurring exposure, the number of people exposed and magnitude of their individual dose should all be kept As Low As Reasonable Achievable (ALARA). This means that level of protection should be best under the prevailing circumstances, maximising the margin of benefit over harm. In order to avoid severely inequitable outcome of this optimisation procedure there should be restrictions on dose or risk to individuals from a particular source.

(c) The Principle of application of dose limits: The total dose to any individual from regulated source in planned exposure situation other than medical exposure of patient should not exceed the appropriate limits recommended by commission.[3]

ETHICS:

The participants were made to understand that their involvement in the

study was voluntary and could withdraw their participation at any time. In addition, they were assured anonymity and confidentiality of all their personal information. All the participants willingly gave their consent for the study.

MATERIALS & METHODS:

The survey was conducted targeting radiographers working in department of Radiodiagnosis in PGIMER and Dr. RML Hospital, New Delhi. The data collecting tool was a twenty-two item semi-structured self completion questionnaire to be filled by radiographers. All 23 radiographers participated in the study by filling the questionnaire completely, duly returning it to the researchers. The study covered a period of one year. The data was analysed to describe the personnel radiation monitoring practices in the department.

RESULTS:

(I)DEMOGRAPHICS

The maximum radiographers (n=23) participated in study were in the age group 31 to 40 years (11, 47.8%).

The mean age was 33.96 years. The minimum age was 24 years and maximum age was 50 years.

Table 01: Distribution of participating radiographers according to age (N=23)

Age group (years)	No.	Percentage (%)
21-30	5	21.7
31-40	11	47.8
41-50	7	30.5

There were 16 (69.5%) males and 7 (30.5%) females with male: female ratio of 2.28:1

Table 02: Distribution of participating radiographers according to gender (N=23)

Gender	No.	Percentage (%)
Males	16	69.5
Females	7	30.5

The demographics showed that the majority 9 (39.1%) had worked for 11-20 years, while 7 (30.4%) had worked for less than 10 years, 6 (26.2%) had worked for 21-30 years and only one (4.3%) had worked for more than 30 years in department.

Table 03: Distribution of participating radiographers as per number of years of practice

Number of years of practice	No.	Percentage (%)
<10	7	30.4
11-20	9	39.1
21-30	6	26.2
>30	1	4.3

The radiographers reported duration of 34-40 hours per week exposure to radiation.

(II) DOSIMETER & RADIATION MONITORING

All radiographers reported that their dosimetric records were thoroughly evaluated during recruitment.

TLD badges were used for personnel radiation monitoring device in department. All the participating radiographers were found to be aware of the same and were using TLD badges regularly and sending for monitoring the exposure level after three months of use at regular interval .

All the participating radiographers reported their radiation exposure level was within safe limits for previous year.

All the radiographers were found to be aware of agency involved in the personnel radiation monitoring services carried out in the hospital in which all of them were enrolled.

None of the participant radiographer reported any shortcomings of the radiation monitoring program & all were found to be satisfied with the radiation monitoring practices of the department.

III. AWARENESS REGARDING RADIATION PROTECTION REGULATIONS

All the participant radiographers were aware of the personal protection devices available in the department and all have been using them adequately and regularly.

The personal protection devices in the department are lead aprons, thyroid shields and gonadal shields. However, non-availability of lead glasses was brought to the notice.

All the radiographers were aware about safe limits of radiation protection as per Atomic Energy Regulatory Board (AERB). All were aware about harmful effects of radiation and principle of As Low As Reasonably Achievable (ALARA). Majority 20 (86.9%) were aware of e licensing of Radiation Application(eLORA), with only 3 (13.1%) reporting their unawareness about the same.

(IV) **Role of employer and Radiation Safety Officer**: Imparting adequate training to use safe radiation practices and their implementation, use of TLD badges and general awareness among radiographers have helped in minimizing the radiation in radiation workers. Since it is a statutory requirement to follow AERB regulations it has also helped in enhancing the general awareness among the radiation workers.

(V) **Penalty provision for loss of personnel dosimeter** : The employer has kept an additional panel provision for loss of TLD badge which has proved useful in its proper upkeep and radiation monitoring of radiation workers. All the radiation workers have to timely deposit and receive their radiation badges from employer.

DISCUSSION

Personnel radiation monitoring is essential in the practice of radiography. Although it does not in itself provide protection against ionizing radiations however, it measures radiation dose received by the radiation workers, adequacy of radiation protection facilities and hence an acceptable radiation protection techniques.[4]

This study had 23 participating radiographers with mean age of 33.96 years and comprising 16 (69.5%) males and 7 (30.5%) females. Majority participating radiographers were in the age group 31 to 40 years (11, 47.8%).

Most 9 (39.1%) radiographers hold working experience of 11-20 years in the field of radiation , while 7 (30.4%) had worked for ≤10 years. Six (26.2%) had worked for 21-30 years and only one (4.3%) worked for more than 30 years in the department.

The radiographers reported exposure duration of 34-40 hours per week to radiation.

TLD badge is the most commonly used personnel radiation monitoring device in the department. All the personnel monitoring devices(TLD Badges) were found to be monitored regularly at an interval of three months. All the radiographers reported their radiation exposure level within safe limits for last one year. All the radiographers were found to be aware of the personnel radiation monitoring service carried out in the hospital in which all of them were enrolled. All radiographers reported that their dosimetric records were thoroughly evaluated during recruitment. None of the participants reported any shortcomings of the radiation monitoring program and were found to be satisfied with the radiation monitoring practices of the department.

Hence, the personnel radiation dosimetry and radiation monitoring practices in the department were found satisfactory, this is due to the well qualified staff that is recruited in the department having a good working experience of over a decade and the regular departmental training exercises received by the radiographers in this tertiary care hospital.

All the radiographers were aware of the personal protection devices available in the department and all have been using them adequately and regularly. All the radiographers were aware of the basic principles of radiation protection. They are aware about the harmful effects ionising radiation. They know about maximum permissible dose as per AERB and about ALARA. Few 3 (13.1%) radiographers did not know about e LORA. This good level of awareness can be attributed to the qualified staff that is employed alongwith the good working experience. All the radiographers were satisfied with the personnel radiation monitoring program in the department.

CONCLUSION:

The results of our study are overall satisfactory, with good awareness

among the radiographers **regarding personnel radiation monitoring and radiation protection.**

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