"A STUDY OF AWARENESS OF RADIATION PROTECTION AND RADIATION DOSE LEVEL OF RADIOLOGY PROCEDURES AMONG RADIATION PERSONNEL IN AN ACADEMIC INSTITUTE"

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ABSTRACT

Introduction: The study was conducted on the awareness of radiation protection and radiation dose level of radiology procedures among radiation personnel in academic institutes among radiology students and radiographers.

Aim and objective:

- The aim of studying the knowledge and awareness of basic radiation protection, types, and effects among different categories of radiation personnel.
- The objective of the study was to compare the level and knowledge among different categories of Radiology personnel.

Methods and Methodology:

Methods of the online questionnaire were administered covering areas of general information, basic awareness of radiation hazards, and knowledge about radiation hazards and protection among the radiology postgraduate students, radiographers, and students of radiography from Western UP.

Result: A total of 257 participants took part in this study. Based on the awareness of the radiation protection questionnaire 87.9% answered radiation is hazardous, 10.9% answered not much hazardous and 1.2% answered radiation is non-hazardous to the body. Based on the knowledge about radiation hazard and protection 52.9% were aware of the dose limits according to ICRP and 47.1% were unaware of the ICRP dose limits.

Conclusion: In conclusion, this study found that among the students and the radiographers, there is a deficiency in knowledge on Ionizing radiation and dose level and its potential risks leading to wrong attitudes and poor practices. Also, the participation of the candidate in the radiation protection training is less than 50% which misleads the radiographers and students about radiation hazards and safety.

KEYWORD: Ionizing Radiation, ICRP, AERB, Radionuclides, Radiographers

I.INTRODUCTION

World Health Organization (WHO) launched the Global Initiative on Radiation Safety in the Health Care Setting in December 2008 its aim was to mobilize the health sector on the safe use of radiation in medicine by formulating a common set of global referral guidelines for appropriate use of medical imaging. The different biological effects of IR can be classified as deterministic versus stochastic, acute versus delayed, high dose versus low dose, and somatic versus hereditary and also in-utero effects. It has been shown that some of the underlying reasons for excessive usage of medical imaging include:

- Availability of medical insurance tends to result in overuse of imaging modalities
- Self-referral is commonly seen in patients who come for annual total body CT (Computed Tomography) scans to check that they have no tumors
- Defensive medicine: Where diagnostic or therapeutic measures are applied principally to safeguard against possible accusations of malpractice rather than to benefit the patient
- Lack of appropriateness criteria and referral guidelines, and wherever available many physicians don't know about them or just ignore them.
- Duplication of imaging studies because the physicians disregard or mistrust the patient's previous imaging studies.

Ionizing radiation is a part of the electromagnetic spectrum with sufficient energy to pass through matter and physically dislodge orbital electrons to form ions. It exists in two forms: as electromagnetic spectrum that is x-rays and gamma rays, and as particles, which include alpha and beta particles, neutrons, and protons. The medical imaging modalities that use IR include conventional, computed and digital radiography, fluoroscopy, mammography, computed tomography (CT) and radionuclide imaging (RNI). To understand the harmful effects of the ionizing radiations the clinicians must be aware of IR dose terminologies and appreciate a few basics of radiation dose units. The common units used in IR are **Grays, Sieverts, Rads, and Linear Energy Transfer (LET)**

- **Absorbed dose:** this is a radiation quantity that refers to the radiation energy deposited in unit mass of matter. It is measured using Grays (Gy). 1Gy =100rads
- **Equivalent dose:** this is the absorbed dose and factors in the different radiation types and energies. The units used are Sieverts (Sv), millisieverts (mSv), and rem (Roentgen equivalent in man)
- **Effective dose:** this is the absorbed dose of different radiation types and energy and takes into consideration the different radio-sensitivities of different tissues in the body (tissue weighting factor). Units used are Sieverts (Sv), and millisieverts (mSv).
- **Linear energy transfer/LET:** this is the energy deposition per unit distance along the ionization path. Units are keV/μm

The International Commission on Radiation Protection (ICRP) was created in 1928, as a Commission linked to the International Congress of Radiology. Today, the ICRP is an advisory body offering its recommendations to regulatory and advisory agencies. While the ICRP has no formal power to impose its proposals on anyone, in fact, legislation in most countries adheres closely to ICRP recommendations.
In India, the Atomic Energy Regulatory Board (AERB) is the competent authority that exercises control over the use of radiation in medicine and industry. The AERB implements the safety provisions envisaged in the Atomic Energy Act, of 1962.

II. AIM AND OBJECTIVE OF THE STUDY

- The aim of studying the knowledge and awareness of basic radiation protection, types, and effects among different categories of radiation personnel.
- The objective of the study was to compare the level and knowledge among different categories of Radiology personnel.

III. MATERIALS AND METHODS

This is a questionnaire-based study. The questionnaire covered the following areas:
The questions are divided into three sections-

1. General information.
2. Basic Awareness of radiation hazards.
3. Knowledge about radiation hazards and protection.

The data was collected through a survey containing multiple-choice questions.
Multiple-choice questions are designed in a way that is easy to understand by the Radiology personnel's.
The Data is collected randomly among students of Diploma in x-ray, (1st year and 2nd year),
B.Sc. MIT (1st year, 2nd year, and 3rd year), M.Sc. MIT (1st year and 2nd year) and Radiology Technician in 3 different academic institutes in western U.P.

IV. OBSERVATION AND RESULT

The present study "A study of awareness of radiation protection and radiation dose level of radiology procedures among radiation personnel in the academic institute" deals with the authenticating findings of the awareness about radiation

protection, radiation hazards, and dose limits among the individuals in the radiology department. Based on the questionnaire survey was conducted on radiology students and radiographers and the following data was collected which is summarized in Table 1. In the present study, a total of 32 radiographers participated out of which 81.2% were male and 18.8% were female. The participation of the students was 225 out of which 64.9% were male and 35.1% were females.

TABLE 1. KNOWLEDGE AMONG PARTICIPANTS

S NO.	QUESTIONS	CORRECT RESPONSE (%)	INCORRECT RESPONSE (%)
1	When was the Radiation Protection Act introduced by AERB?	71.4%	28.6%
2	In your Knowledge, how hazardous is radiation to your body?	77.4%	22.6%
3	Have you worn a lead apron when you work with radiation?	30.1%	69.9%
4	Have you worn lead goggles when you work with radiation?	13.6%	86.4%
5	Have you worn a thyroid shield when you work with radiation?	18%	82%
6	Which of the following has no radiation risk?	81.3%	18.7%
7	From the International Commission on Radiological Protection (ICRP), which of the following is the principle of radiation protection?	98.5%	1.5%
8	From the International Commission on Radiological Protection (ICRP) recommendation, how much is the 1-year maximum permissible dose limit for adult radiation workers?	60.4%	39.6%
9	From the International Commission on Radiological Protection (ICRP) recommendation, how much is the 1-month maximum permissible dose limit for pregnancy radiation workers?	48.1%	51.9%
10	In the intervention room, which of the following is the major source of radiation affects to healthcare workers?	56.4%	43.6%
11	To which organ, radiation can be hazardous?	66.2%	33.8%
12	Which of the following are considered the most radio-sensitive organ?	58.8%	41.2%
13	From the International Commission on Radiological Protection (ICRP) recommendation, how much thickness of lead should be inserted in the lead apron?	54.5%	45.5%
14	Which of the following is true about lead goggles?	38.0%	62.0%
15	Which of the following is TRUE about dosimeters?	48.1%	51.9%
16	What is the radiation amount of chest X-ray?	44.4%	55.6%

V. DISCUSSION

In the above study, 257 participants took part and they attempted all questionaries with the best of their knowledge. The 225 were radiography student participants, and 32 were senior and junior radiographers. Based on the study, we observe that there is a lack of knowledge in the new generation as they were found to have less exposure to training for radiation protection by different organizations like AERB. Only 77.4% generation are aware of radiation hazards and 81.3% know about the risk factor due to ionizing radiation which can lead to stochastic and deterministic effects in both radiographers and patients. The International Commission on Radiological Protection recommended the Dose limit for pregnant ladies but during the study, it was found that only 48.1% of workers were aware of this. Because of the unenlightening of the radiographers and the students, the chances of the biological effects of radiation are increasing. While using radiation protection devices is the best way to shield people from ionizing radiation, only 30.1% of lead aprons and 18% of thyroid shielding were used in the study. As a result, the risk of induced thyroid cancer increases significantly with age. However, if the thyroid shield is not worn, the thyroid glands may be extremely exposed to scatter radiation, making protection of the glands crucial.

VI. CONCLUSION

The following conclusions can be drawn from this study:

1. Students and some radiographers lack knowledge on ionizing radiation level of doses
2. There is a significant knowledge gap between senior radiographers and junior radiographers, senior and junior students when it comes to some aspects of ionizing radiation.
3. The radiographers and students with formal training had a very small advantage over those with no formal training as regards ionizing radiation knowledge and dose level.
4. Deficiency in knowledge on IR and dose level and its potential risks leads to wrong attitudes and poor practices.

In order to correctly identify whether an exposure is medico-legal or not, one must examine the reason for the exposure. If the exposure is performed mostly for diagnosis and to guide the cure of the injured person, it is a medically indicated exposure. If it is the case that the exposure is meant to avoid or limit damage for the individual worker himself or for others due to the injury, it is occupational health surveillance as has been discussed already under pre-employment exposures. If the primary objective in taking the exposure is to get compensation etc., then they are considered to be medico-legal.

This study also provides crucial data about the radiation protection practice in the western U.P. It observed that there was a lack of use of essential personal protective equipment and monitoring devices for workers. This study has also revealed a low level of radiation safety training.

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