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ABSTRACT

Nepal has a long history of medical radiology; but we still do not have any radiation protection infrastructure to control the use of ionizing radiations in the various fields. Recently Nepal is one of the 15% countries which has to bear the financial and this will certainly support and speed up the creation of appropriate conditions.

The aim of this study was an assessment of the radiation protection in medical field. In this study, measurements were performed to assess the status of radiation protection barriers and general conditions in the same radiological centers. Questionnaire for radiation workers were used; radiation dose levels were measured and made an inventory of equipment. Another aim of the study was to create awareness in the works on possible radiation health hazard and risk. It was also important to gain an inside of the level of understanding of the personnel in order to initiate steps towards the establishment of code of radiological practice.

Altogether, 33 radiological and radiation therapy facilities at different hospitals/institutions were monitored. The professionals who completed the questionnaire represent more than 65% working in this field in Nepal. Almost all diagnostic radiology working areas are safe. Radiation dose level around radiotherapy centers show that most of modalities are within standard limit and are built according to protection criteria. Around 65% of the radiation workers are not monitored for radiation. There is neither quality control program except radiotherapy nor training program in radiation protection. The basic radiation protection principles of Justification and Optimization should be taken into consideration in this period of rapid increase of investigation following the availability of new equipment.

INTRODUCTION

Recently, a tremendous development has taken place in the field of x-ray diagnostic imaging at Nepal. Newer modalities are being applied in major hospitals and latest radiological equipment is being used. At the same time small x-ray “set-ups” are being established on a day-by-day basis. This quantitative increase may have a positive impact on the health service system of the country, but the lack of control is a serious problem. For the time being there are 4 tele-cobalt machines, 3 linear accelerators, 3 simulators, 3 high dose rate (HDR) brachytherapy, 2 gamma camera (SPECT), 9 MRI, around 30 CT and about 800 x-ray equipment in the country. There are more than 330 qualified professionals including radiologists, radiation oncologists, medical physicists, radiographers, radiation therapists, nuclear medicine physicians and nuclear medicine technologists.

Due to lack of radiation protection knowledge and infrastructures, there is no legislative body or any radiation Act to set standards for radiation protection.

OBJECTIVES

The main objective of the study is to carry out a survey of radiation level:

1. To study about the structural shielding design for radiation in different rooms of radiology and radiotherapy department and to identify the relatively more radiation hazardous locations around the occupancy area.
2. To calculate weekly equivalent dose received by the radiation workers as recommended by ICRP [4,5].
3. To make the radiation workers aware about the possible radiation health hazard and to know their view and knowledge on radiation protection.
4. To make an inventory of availability of equipment of the surveyed hospitals.
5. To initiate steps towards establishment of Nepalese code of radiological practice and to develop radiation safety culture to benefit Nepalese people.

MATERIALS AND METHODS

Three ways were applied to assess the status of radiation protection:

1. Questionnaire for radiation workers
2. Radiation level measurement
3. Inventory of radiation-emitting equipment at surveyed hospitals.

The questionnaire consists on twenty-five questions seeking information regarding professional responsibility, protection training, personnel dose monitoring, institutional and self-motivation towards radiation safety, etc. In addition, the questionnaire gives also some information about the general understanding of radiation protection.

\[ \text{Workload Level} = \sum (\text{mA min}) \times N_i \]

where \( N_i \) is examination number of kind \( i \) and (mA min), used techniques for examination kind \( i \).

For general x-ray unit: 160 mA min/week; for fluoroscopy: 1200 mA min/week; for mammography unit: 2000 mA min/week and for CT unit: 5000 mA min/week. Then in each area is:

\[ W = \sum (\text{mA min}) \times N_i \]

where \( W \) is the equivalent dose rate level readings in air at each point in mSv/week and to measure it the higher voltage (kVp) and intensity \( (I_{kVp}) \) in mA are used and so long time (t) to avoid dead time of the survey meter and \( W \) is units of mA min/week.

This study also shows the different areas of the hospitals regarding the level of radiation protection between the radiation safety officers and non-safety officers.

CONCLUSIONS

- Thirty three different hospitals/institutions were monitored.
- Radiation survey was done in 44 x-ray equipment, 10 CT scans, 2 mammography and 2 catheterization laboratory in diagnostic radiology.
- In radiotherapy, 3 tele-cobalt units, 2 HDR brachytherapy, 3 linear accelerators and 2 simulators were surveyed.
- More than 330 qualified professionals were participated in questionnaire.
- Almost 70% of the radiation workers are aware on radiation safety issue.
- There is a need for rules, regulation and radiation Act in the field of radiation in medical field.
- There is no QA program in diagnostic radiology but there is a maintenance contract with the company at few centers. But there is a QA program in radiation centers.
- There must be regular quality control parallel to maintenance program for the x-ray equipment at regular intervals. The basic radiation protection principles of Justification and Optimization should be taken into consideration in this period of rapid increase of investigation.
- The detailed evaluation of the answers given by the personnel might provide good indication about the strategy to adopt in designing training program, very much needed.
- Through proper education and training and regularly organized seminars, conferences people are becoming more and more aware about radiation, its uses in medicine. In addition, national infrastructures include certain essential services, such as personal dosimetry, calibration and inter-comparison of radiation measuring equipment as well as external audit.

- By establishing basic standard and radiation control authority, rules and regulations can be enforced in the country effectively and efficiently.

REFERENCES


Limitations of the study:

The study area covers only major hospitals, zonal, regional and sub-regional hospitals and its generalization may not be valid for all other hospitals in remote areas of Nepal. It is doubtful about whether the given mA or kV are actual mA or kV used in actual control program.

The workloads that we have taken both in terms of workstations at hospitals in Nepal.