

IMPLEMENTATION OF RADIATION PROTECTION PROGRAM (RPP) IN ACCORDANCE WITH REGULATORY REQUIREMENTS IN A HIGH VOLUME RADIOLOGY DEPARTMENT OF A PUBLIC SECTOR HOSPITAL IN PESHAWAR, KHYBER PAKHTUNKHAWA (KPK), PAKISTAN

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ABSTRACT

OBJECTIVE: Main purpose of this progress report is to highlight the radiation safety measures and steps taken in a public sector hospital towards the implementation of radiation protection program in order to ensure safe radiation culture both for staff, patients and attendants and to comply with regulatory requirements lacking before in a high volume radiology department of Lady Reading hospital, Peshawar, (KPK), Pakistan. **MATERIALS & METHOD:** Qualitative, exploratory and descriptive analysis was carried out in the largest and oldest public sector hospital of Khyber Pakhtunkhawa (KPK) to highlight the radiation safety measures taken in order to implement the radiation protection program in developing safe culture toward radiation practice within radiology department of the hospital. The first step taken started with the induction of medical physicists hired one year back (Sept, 2016). Several radiation safety standards lacking were identified by the physicists, matters were discussed with higher authorities, immediate actions and measures were recommended and taken by hospital administration and achieved considerable success towards the implementations of safe radiation culture in accordance with regulatory requirements to ensure safe radiation practice within the department. **RESULTS:** After a period of one year with intensive planning, all the weak zones were identified and safety measures were taken and addressed accordingly. Radiation safety culture is emerging in its true sense according to regulatory standards and radiation protection program has been implemented in the radiology department of Lady Reading hospital. To ensure the enforcement of radiation protection programme in its true spirit, daily safety rounds are being conducted by medical physicists observing various operational aspects of radiation protection program within the radiology department and technical training of radiation workers is being conducted to develop their skills regarding safe culture of radiation practice. **CONCLUSION:** Radiation protection program has been implemented through team effort of all stakeholders as per regulatory guidelines, safety standards are being followed regarding safety of radiation workers, doctors, patients and public in general.

Historical background of the hospital and present status of radiology department:

Lady Reading hospital is one of the oldest and largest teaching institutes of the country and was established in 1927 by Lady Reading wife of the then viceroy Lord Reading.

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Today the radiology department is equipped with state of the art equipment which are as follows;

- . X-ray machines (06 in main radiology department)
- . Dedicated X-ray machine for chest medicine and thoracic surgical clinics
- . CT scan (160 slice Toshiba) for elective body scans including angiography.

- . CT scan multislice for elective head and neck imaging.
- . Fluoroscopy
- . Mammography.
- . 1.5 Tesla Siemens MRI
- . Multislice CT scan in A&E Department
- . X-ray machine in A&E Department

In addition to the above an interventional angiography suite is in the pipeline.

Wide range of 10 ultrasound machines are available including Doppler's and portable machines.

RADIATION PROTECTION PROGRAMM IN THE DEPARTMENT:

As ionizing radiation has eased the modern era of medical sciences with greater degree of diagnosis and treatment with the use of highly sophisticated equipment but at the same it has increased the risks of certain biological effects that can be caused by the unnecessary & un-judicious use of ionizing radiations. So, to ensure safe culture of radiation practice and to minimize the detrimental effects of ionizing radiations to staff, patients and general public in the department, implementation of Radiation Protection Program within the department was considered both a requirement for the safety of workers and a basic regulatory aspect keeping in view the dismal scenario of demise of seven of its radiation workers due to cancer since inception of the department with one worker currently undergoing chemotherapy.

For successful Implementation and enforcement of Radiation Protection Program, the entire process was set into three (03) integral parts which were:

1. Identification of weak zones regarding radiation protection by Medical Physicists and from Pakistan Nuclear Regulatory Authority inspection reports.
2. Compliance of weak zones as per national and international radiation safety standards.
3. Enforcements of Radiation Protection Program as per Regulatory requirements.

RADIATION SAFETY MEASURES TAKEN FOR THE IMPLEMENTATION OF RPP WITHIN THE DEPARTMENT:

To identify the main radiation safety standards to ensure safe radiation practice within the department,

Pakistan Nuclear Regulatory Authority inspections reports were studied as the observations regarding certain radiation safety measures and necessary directives have been given to address those shortcomings regarding radiation safety. After identification of the weak zones requiring the implementation of Radiation Protection Program from inspection reports and physical verification by physicists, issues were addressed as per regulatory guidelines and compliance was made as per international standards keeping coordination with Radiation Protection Committee and hospital authorities. The safety measurements taken for the implementation of Radiation Protection Program are as follows.

Following were the areas prioritized and addressed in order to implement Radiation protection program:

1. Restructuring of Radiation Protection Committee:

Radiation Protection Committee within any hospital is the only body which has the full authority to look into all issues related to ionizing radiation, to formulate policies regarding the operational aspects of radiation protection program within a hospital. It plays vital role to ensure safe radiation practice in accordance with guidelines of regulatory body and enforce those guidelines with the coordination of the hospital authority.

In order to address the issues of radiation protection within the hospital and implementation of Radiation Protection Program, the Radiation Protection Committee was made operational by involving one member from each department associated with the use of ionizing radiations i.e. cardiology, nuclear medicine and orthopedics, bio-medical engineer, representative of hospital administration and Medical physicists, nursing director with the committee chaired by chairperson of Radiology dept. Meetings are held on quarterly basis where all issues related to radiation protection and progress regarding implementation of RPP in particular are discussed along with proposal of future plan.

2. Renewal of license from PNRA:

As per Pakistan Nuclear Regulatory Authority regulation" Regulations for the Licensing of Radiation

Facility(ies) other than Nuclear Installation(s)-PAK/908", every radiation facility has to be registered and licensed from Pakistan Nuclear Regulatory Authority. It is a mandatory requirement before starting any facility for patient service.

Hence, the department was registered with Pakistan Nuclear Regulatory Authority however, all pending issues related to license renewal were addressed on priority to avoid any observation on behalf of regulatory body thus ensuring a mutual understanding and trust.

3. Personnel dosimeter for radiation workers:

Personnel dose monitoring of radiation workers is the foremost regulatory requirement of Pakistan Nuclear Regulatory Authority as per their regulation "PAK/904: Regulation on Radiation protection" and from the directives of Pakistan Nuclear Regulatory Authority inspection report dated(28-10-2015) for arrangements for Personnel dosimetry of radiation workers to ensure safety and assessment of their dose records. However despite a high volume and a large setup of one of the oldest tertiary care public sector hospital of the country there was no concept and system for personal dosimeter of workers.

Personnel radiation monitoring film badges were ordered from Pakistan Institute of Nuclear Science & Technology, Islamabad. A total of sixty five (65) radiation workers have been issued film badges who are working within controlled areas and their doses are assessed on monthly basis. This initiative besides ensuring safety was greatly welcomed by all staff as a milestone achievement in fulfillment of a long standing demand of mandatory requirement of a radiology department.

4. Workplace monitoring:

As per International Atomic Energy Agency safety standards for protecting people and the environment. Radiation Protection and Safety of Radiation Sources Requirement 20: Requirements for monitoring and recording of occupational exposures The regulatory body shall establish and enforce requirements for the monitoring and recording of occupational exposures in planned exposure situations.

To ensure the safety of workers within imaging rooms, a system of workplace monitoring was introduced on priority in order to ensure safety of radiation workers.

Pakistan Nuclear Regulatory Authority was requested to conducted survey to assess exposure levels within the imaging rooms, as well as assessment of radiation leakage. In addition, shielding capacity of x-ray rooms was also assessed and report submitted for necessary amendments and civil works where shielding was compromised.

5. Liaison with PNRA:

PNRA conducts one informed annual general inspection (beside carrying out other special on request and uninformed inspections) of Radiology facilities on annual basis to rule out any non-compliance and deficiency towards safe radiation practice and issues post Inspection Report (PIR) comprising evidence of good practice as well as observations. The report also contains certain directives to be addressed by the licensee for ensuring safe culture towards radiation practice on priority basis. This important aspect was streamlined by the induction of dedicated personnel (Medical Physicist/RPO). Directives have been complied as per regulatory guidelines and full coordination is being extended with PNRA team for safe radiation practice.

6. Planning and designing of new X-ray facilities:

As the per Pakistan Nuclear Regulatory Authority post inspection reports dated (27- 04-2015 and 28-10-2015), considerable amount of radiation exposure were noticed within the consoles of two rooms indicated in the report and clear directions have been given for the replacement of the movable shielding boards by permanent wall consoles with enough thickness to ensure safety of workers.

Installation of X-ray machine within a facility needs special attention from trained personnel who are aware of the risks associated if proper planning and design are not considered at the time of installation. In order to ensure adequate shielding, the decades old movable redundant barriers were replaced by concrete lead lined barriers for shielding of console areas which were planned according to prescribed international standards taking distance as a basic measurable factor of shielding. Now, the exposure levels within the console equals natural background, hence addressed of a serious observation of Pakistan Nuclear Regulatory Authority for the implementation of radiation protection program.

7. Technical training of radiation workers and radiation awareness sessions:

As per the guidelines on radiation protection education and training of medical professionals in the European Union (2014), publication no. 175, General recommendations in training programs for radiation protection. An essential and integral part of any Radiation Protection Programme is the technical training of staff working within the department. There was no concept of continuous professional development as a result of which there was lack of awareness of radiation protection amongst the staff. A series of dedicated radiation protection awareness sessions have been started for the technicians as per their needs both by the facility and regulatory body as well.

8. Personal protective equipments and their screening:

As provision of Personal protective equipments and their screening is the basic requirement of Pakistan Nuclear Regulatory Authority regulation "PAK/904: Regulation on Radiation protection".

Provision of personal protective equipments (PPE's) to radiation workers is the basic component of radiation protection and a basic radiation protection tool. There were no PPE's (Lead aprons, thyroid shields, Gonadal shields) present in the department and all procedures were being carried out without using PPE's where needed and the screening and inventory of PPE's was not being carried out. PPE's was provided to personnel with both verbal and written instructions regarding their use and safe handling and their screening is being made and record maintained.

9. Radiation awareness literatures, working instruction and warning signs:

Public awareness about the harmful effects of ionizing radiations, radiation awareness literature and warning signs were displayed on the main entrance door of individual imaging facilities. Standard operating procedures for regarding radiation protection for staff, patient and public were also displayed in the console/control areas. This ensures restricted unauthorized access to imaging rooms.

10. Radiation warning light indicators:

As per Pakistan Nuclear Regulatory Authority post inspection reports dated (28-10-2015), radiation

warning indicator (red light) were not installed outside imaging rooms to restrict access inside when procedure is being performed.

To keep the public, patients and other unauthorized personnel at bay from the x-ray imaging room when other patients are undergoing imaging procedure, radiation warning light "Red light indicator" synchronized with the exposure panel were installed visibly at the entrance of individual imaging rooms. The warning lights flash exposure is for the duration of exposure time.

11. Medical surveillance of radiation workers:

Health surveillance (collection of samples) of radiation workers is the foremost regulatory requirements of PNRA as per regulation "PAK/904: Regulation on Radiation protection" to ensure their medical fitness for working in radiation facility. The health surveillance of radiation workers was implemented according to fulfill regulatory requirement and to ensure medical fitness of the radiation worker.

12. Mechanism for automatic closure of entrance of imaging rooms:

As the per Pakistan Nuclear Regulatory Authority post inspection reports dated (28-10-2015), imaging doors remained opened during exposure, a serious violation of radiation protection principle and patient dignity and privacy.

The main entrance door of x-ray rooms should always be closed especially when patient is being imaged in order to maintain patient privacy and to ensure safety of patients and attendants from scattered radiation. It was noticed that the doors remained opened due to which patients were waiting in turn inside the x-ray rooms thus exposing themselves to excessive radiation and creating panic disturbing the entire work pattern which were against radiation protection principles and patient privacy. Hence automatic door closers were installed immediately in order to ensure compliance of rules and doors remain close during patients examination.

13. Temperature control of imaging rooms:

To ensure smooth functioning of equipment's, temperature control is an integral environmental component, this was ensured by installing new air conditioning system in the imaging rooms in order to provide con-

ducive environment for both technical staff and patients alike while ensuring an ambient temperature for the machine for smooth functioning.

14. Mechanism for planning and designing of new Radiology imaging facilities:

A proper mechanism is being followed while installing any new imaging facility within the department or making design assessment in the existing setup. The physicists are responsible for all the design assessment and associated shielding calculations and for correspondence with regulatory body.

15. Preparation of Standard operating procedures for safe Radiation practice:

Standard operating procedures (SOP's) have been prepared regarding safe working in radiation area, female patients, pregnant patient/staff, radiation protection and quality assurance within the department and are being followed accordingly.

16. Daily safety rounds:

To keep a close eye on the implementation of Radiation Protection Programme, daily safety rounds are being conducted by the Physicists who oversee various operational aspects and parameters of Radiation Protection Programme which is documented for quality assurance record. The report is presented to Chairperson Radiation Protection Committee for necessary action on priority basis.

Conclusion

Radiation safety is the shared responsibility of all staff within the Radiology department. Milestone achievements have been attained in the past one year in Radiology department of a high volume public sector hospital which is an example and trendsetter of its kind for all hospitals to follow specially in the government sector. In the next phase we are hopeful to implement and enforce RPP within the entire hospital and make a huge difference toward safe radiation practice.

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