Monitoring the Lens of the Eye and Extremity of Radiation Workers in Bangladesh

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1. Background and Aim of the present work

The use of ionizing radiation in nuclear medicine and cardiology departments are being increased in Bangladesh. Nuclear medicine workers are getting higher radiation dose comparing to other medical procedures because nuclear medicine workers used to handle unsealed radioactive substances. Extremities (fingers of the hands) of radiation workers in nuclear medicine is exposed to higher radiation comparing to other parts of the body because it is unshielded and close to the radioactive substances. In 2011 ICRP recommendations, dose limit for lens of the eye of radiation workers has been significantly reduced from 150 mSv/yr to 20 mSv/yr, averaged on five consecutive years, with provision that any single year maximum dose 50 mSv. No study was performed for lens of the eye dose monitoring of radiation worker in Bangladesh ago. Cardiologists are also getting high dose in lens of the eye because they need to stand close to the patient and patient is the main source of the scattered radiation.

This paper gives an overview of extremity doses for radiation workers of five large nuclear medicine departments in Bangladesh during two years and lens of the eye equivalent doses for radiation workers of three large cardiology departments in Dhaka city.

2. Materials and Methods

2.1. Extremity and eye dosimeters

Extremity (fingers of hands) of 45 radiation workers working in five large nuclear medicine departments of Bangladesh were monitored using ring TL dosimeters for consecutive two years. Each worker was worn two ring TL dosimeters at left- hand finger (LHF) and right-hand finger (RHF) and monitoring period was varied from 1 month to 3 months. Lens of the eye equivalent doses of 14 radiation workers working in 3 interventional cardiology departments in large hospitals of Dhaka city were monitored using headbands for one year.

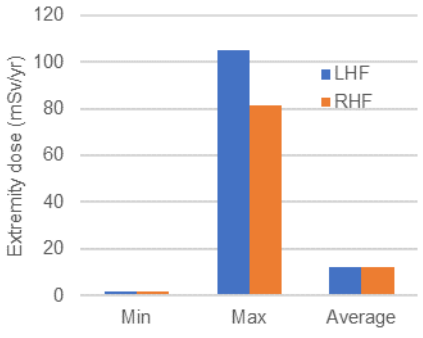
2.2. Dose calculation procedures

- Instructions were provided to radiation worker for proper use of the TL dosimeters.
- TL chips were calibrated at Secondary Standard Dosimetry Laboratory under Bangladesh Atomic Energy Commission. The performance of the calibration laboratory has been maintained at IAEA/WHO network.
- TL chips were readout using Harshaw manual TLD reader. The software installed in the Harshaw TLD reader for dose evaluation was WinREMS.
- Dose of radiation worker was calculated after subtracting the background radiation dose in each laboratory.

3. Results and Discussion

3.1. Extremity dose of radiation worker

The calculated left- hand finger (LHF) and right-hand finger (RHF) doses were varied from 1.609-105.071 mSv/yr (average 11.917 mSv/yr) and 1.587-81.176 mSv/yr (average 12.215 mSv/yr) respectively. It is observed that radiation workers working in the isotope dispensing rooms, gamma camera rooms, and thyroid laboratories were exposed more radiation than those working in other laboratories.



Minimum, maximum & average extremity dose of 45 radiation workers working in the five large hospitals of Bangladesh for 2 consecutive years

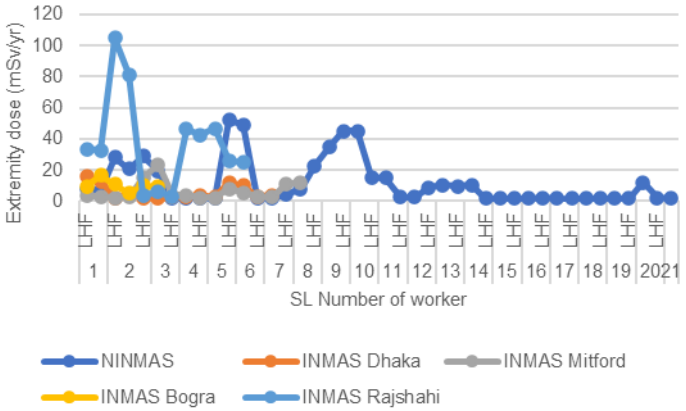
3.2. Eye dose of radiation worker

This is the first study for lens of the eye equivalent dose monitoring of radiation worker in Bangladesh. The equivalent dose for lens of the eye of 14 radiation workers working in the three cardiology departments of large hospitals in Dhaka city were ranged from 0.938-85.714 mSv/yr (average 16.024 mSv/yr). Cardiologists were received higher equivalent dose comparing to radiographers and nurses.

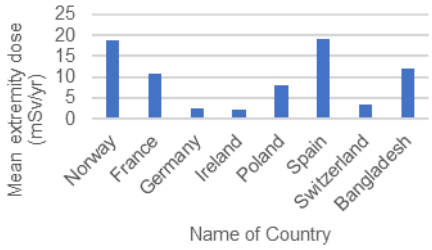
3.3. Average extremity dose of each radiation worker

Average extremity dose of LHF and RHF for 45 radiation workers working in the five nuclear medicine institutes of large hospitals in Bangladesh were depicted in Fig. below.

One radiation worker who working at the Institute of Nuclear Medicine and Allied Sciences in Rajshahi Medical College & Hospital (INMAS Rajshahi) was received the highest extremity dose (105.071 mSv/yr). Extremity dose of radiation workers in Bangladesh were below the national dose limit and international recommendations (ICRP).



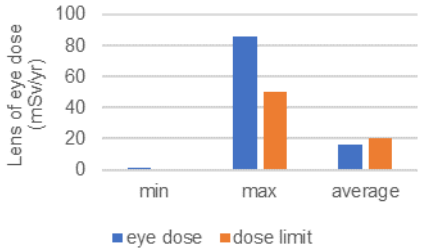
Left-hand finger (LHF) and Right-hand finger (RHF) dose of radiation worker working in five large hospitals: National Institute of Nuclear Medicine and Allied Sciences (NINMAS); Institute of Nuclear Medicine and Allied Sciences (INMAS)



Extremity dose of radiation worker in Bangladesh compared to other countries

3.4. Average eye dose of radiation worker

Lens of the eye equivalent dose of 14 radiation workers who working in the three cardiology departments of large hospitals in Dhaka city. The maximum lens of the eye equivalent dose of radiation workers in Bangladesh was higher than the dose limit recommended by international Commission on Radiological Protection (ICRP). However, average lens of the eye equivalent dose of radiation worker in Bangladesh was below the dose limit recommended by ICRP.



Minimum, maximum and average lens of the eye equivalent dose of 14 radiation workers working in three cardiology departments of large hospitals in Dhaka city

4. Conclusions and Acknowledgements

- Radiation workers of the nuclear medicine and cardiology departments should be more conscious on radiation protection as per national regulations as well as international recommendations (IAEA, ICRP) for minimizing radiation exposures. Periodic training on radiation awareness to be arranged in order to implement the ALARA principle. Authors are grateful to concerned personnel for giving permission and cooperation during the study.