Hazards of Radiation Exposures for Nursing Staff and Measures to Control it

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Due to rapid technical advances in the last two decades, a variety of imaging modalities have become available for diagnostic evaluation of a patient. The newer diagnostic imaging techniques have increased exposure to ionising radiation. The concern for radiation exposure holds good for department personnel as well as for the nursing staff. In the Radio-diagnostic department, especially in interventional procedures, where nursing staff has to work closely with the patient in an ambience of radiation field. Consequently, they are likely to receive over a period of time, relatively high amount of radiation

In risk assessment for radiation exposure, populations can be considered under any of the categories : those occupationally exposed to radiation, those exposed in or near the areas where radiation is used, and the population at large. Nursing staff in the department of Radio-diagnosis could, according to the duration of posting and place of posting, come under any of the above.

A properly protected radiation department of Radio-diagnosis should present no problem to the nursing staff. In the protected setting the amount of radiation likely to affect the nurse staff is quite negligible and well below the hazard range.

Of late, the number of interventional procedures using radiation has increased significantly. Many procedures can deliver high radiation doses to patients and staff, with the potential to cause immediate and delayed radiation effects. The newer Multi-detector Spiral Computed Tomography (MDCT) is regarded as a moderate to high radiation diagnostic technique. While technical advances have improved radiation efficiency, there has been simultaneous pressure to obtain higher-resolution imaging and use more complex scan techniques, both of which require higher doses of radiation. It is important to note that both ultrasound and magnetic resonance imaging produce no ionising radiation.

Potential Hazards of Radiation Exposure

An acute dose, delivered in a short time is more harmful than a chronic dose, delivered over a period of time. The occupational limit of radiation exposure currently has been estimated at 20 mSv per year averaged over five consecutive years

Deterministic effect

The harmful effects of radiation may be classified as deterministic and stochastic effects. The stochastic effects are further classified into somatic and genetic effects.

A deterministic effect is one "which increases in severity with increasing absorbed dose in affected individuals". These effects appear at high dose (>0.5 Gy) and generally result from cell death. Deterministic effects include skin erythema, organ atrophy, fibrosis, cataract induction, blood changes, reduction in sperm count etc.

The cataract formation is dependent on the total dose and on the time over which this dose is delivered. Cataracts may be induced at acute doses as low as 2 Gy and as soon as 6 months after exposure. Radiation-induced cataract occurs in the posterior part of the lens. Sperm count can be decreased with 0.15 to 0.3 Gy, but sterility requires 3 to 4 Gy in women and 5 to 6 Gy in men. Lymphocytes are the most radiosensitive cells in the blood and decreased cell counts have been observed after doses of <1 Gy. When an individual is exposed to 1 – 2 Gy of acute radiation, acute radiation syndrome begins with symptoms of anorexia, nausea, vomiting and diarrhoea.

Stochastic effect

A stochastic effect is one in which "the probability of occurrence increases with increasing absorbed dose rather than its severity. Stochastic effects are very important at low doses (<0.5 Gy). Stochastic means random

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and the severity of stochastic effect is independent of the radiation dose. As the radiation dose increases, the chance of the effect occurring increases. It has no threshold dose, may occur at low doses and the effect may be seen only at later period (10-30 years). Examples are carcinogenesis and genetic effects. Stochastic risks are dependent on sex and age at exposure.

Radiation Risk

Risk is a probability that a given individual will incur deleterious effects as a result of dose of radiation. When an individual is exposed to radiation, the expected risk includes somatic (cancer induction), genetic risk and foetal risk. The radiation effects, produced in an exposed individual during his lifetime are called somatic effects. The cancer induction is the highest risk of radiation exposure encountered in radiology. Bone marrow, gastrointestinal tract mucosa, breast tissue, gonads and lymphatic tissue are most susceptible to radiation-induced malignancy. Radiation may induce both benign and malignant tumours with latent period.

Radiation effects produced in the successive generation of the exposed individual are called genetic effects. The genetic effects are the result of radiation exposure to the gonads. The foetal risk depends on the gestation period of the pregnant women. A high radiation exposure during the first 10 days post-conception may result in early intrauterine death. The foetus is most vulnerable to radiation-induced congenital abnormalities during the first trimester (20-40 days after conception). Radiation-induced microcephaly is the likely abnormality occurring at 50 to 70 days post-conception. Growth and mental retardation may occur at 70 to 150 days post-conception. After 150 days, post-conception is a period of increased risk for childhood malignancies.

The risk of congenital abnormalities is negligible when the exposure is below 10 mGy. At doses above 0.1 Gy, the risk of congenital malformation increases. To avoid radiation-induced congenital anomalies, an abortion may be advised only when doses exceed 0.1 Gy. In the second or third trimester the risk of childhood leukemia may be increased to 40 percent for a dose of 10 mGy.

Minimising Risk of Exposure to Nursing Staff

It is imperative that all nursing staff, working in areas where ionising radiation is a risk, is protected against excessive exposure. Learning about the hazards of radiation is only half the battle. Educating them about the potential dangers and how to reduce their exposure is the next step.

Working environment

It is essential that nursing staff consult the radiologist and the Radiation Protection Officer (RPO) on all aspects of radiation safety. Lectures on radiation protection should be arranged. Appropriate training should include awareness of the potential for radiation injury, doses measurement and recording methods and dose reduction techniques. Nursing staff should be encouraged to clear all their doubts regarding radiation exposure. They should be posted on rotation duty. Only essential staff should be in the radiology suite during radiation exposure. When possible, the nursing staff and all other personnel required in the room should step back from the table and behind portable shields during cine and serial radiography procedures. This action can decrease the exposure of the radiologist and the other nearby nursing personnel by a factor of three or more. Staff radiation exposure levels should be monitored using dosimeters. Worn at waist level and beneath protective equipment, dosimeter records are reviewed by an RPO. In the event of an identified excessive dosage, the member of staff will be notified and their working practice and environment investigated.

Assigned to each working area, the RPO can provide advice on radiation protection matters relating to that individual location. A risk assessment should be undertaken to identify the risks for nurses in each area and the actions taken to reduce these. All staff operating in the imaging department and those involved in the exposure of patients to radiation, must be aware of the Local Rules and how to apply them.

Protective equipment

Appropriate protective equipment must be available for

the nurse to use during normal duties.

Lead aprons reduce the exposure of breast tissues, the wrap-around version should be fitted with a lumbar support belt to reduce strain on back and shoulders. Now-a-days lead jackets and skirts which have been newly introduced will further reduce the back strain. A well-chosen lead apron can reduce the effective dose by 75 to 90 percent. Thyroid shields and lead goggles provide protection for both the thyroid and the eyes. Fully adjustable, these shields and goggles are only required when staff are standing within one metre of the patient.

Pregnant staff

The staff posted should volunteer information regarding pregnancy states, so that adequate measures can be undertaken. A full risk assessment should be undertaken; exposure levels for the unborn child should be no more than 1mSv for the remainder of the pregnancy. A pregnant nurse should ensure that wherever practical, she is isolated from the x-ray tube by remaining behind the protective screen. Nurses operating outside the screen in an x-ray room should wear a lead protective coat that comfortably covers the abdomen. A dosimeter may also be worn to assess exposure levels.

Conclusion

The radiation burden faced by nursing staff in a radiology department depend on many factors. The place and duration of posting of a nurse in the various radiodiagnostic wings influences the exposure rate. It is imperative that regulatory standards must be strictly followed. Guidelines in place for the department must be well known to the nursing staff, to ensure minimum radiation exposure.

References

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Election Results: TNAI Arunachal Pradesh State Branch-2010

The elections of TNAI Arunachal Pradesh State Branch were held at Chief Minister's Banquet Hall, Itanagar on 25 July 2010.

The following Office Bearers were declared elected: 1. **President:** Mrs CS Tada, I/c Nursing Cell, Directorate of Health Services, Naharlagun, Itanagar. 2. **Vice-President:** Ms Kipa Sonu, Staff Nurse, General Hospital, Naharlagun, Itanagar. 3. **Vice- President:** Ms Minorova Mili, Staff Nursing, CHC Likhabali, Dist West Siang. 4. **Secretary:** Ms Pate Yasuk Ngurang, Staff Nurse, CHC Doimukh. 5. **Joint Secretary:** Ms Tadar Yagam, Staff Nurse, General Hospital Naharlagun, Itanagar. 6. **Joint Secretary:** Ms Soma Leepcha, Staff Nurse, CHC Chokham, Lohit Distt. 7. **Treasurer:** Ms Yakang Lomdak, Staff Nurse, General Hospital, Naharlagun, Itanagar. 8. **Joint Treasurer:** Ms Tobom Dubi, Staff Nurse, General Hospital, Naharlagun, Itanagar. 9. **Chairperson Nursing Services:** Ms T Yasung, Nursing Superintendent, General Hospital Naharlagun, Itanagar. 10. **Chairperson, Nursing Education & Research:** Ms Subra Mukharjee, Asst Nursing Superintendent, General Hospital, Naharlagun, Itnagar. 11. **Chairperson, Socio-Economic:** Ms Yape Hokom, Staff Nurse, General Hospital, Naharlagun, Itanagar. 12. **Chairperson, Community Nursing:** Kago Kena, Jr PHN, District Hospital, Ziro. 13. **ANM Representative:** Ms Mide Gamlin, ANM, General Hospital, Naharlagun, Itanagar. 14. **LHV Representative:** 15. **Chairperson, Membership Committee:** Shri Shankar Pator, Staff Nurse, District Hospital, Ziro. 16. **Branch Advisor:** Ms Sushi Prava Cholu, Asstt Nursing Superintendent, General Hospital, Naharlagun, Itanagar. 17. **SNA Advisor**

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