INU

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Assignment => Radiological protection.

Submitted To =>

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Radiology.

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Q No: 1

Role of Radiation Protection officer in Radiology Department

=> A radiation protection officer (RPO) is a Specialist in radiation Safety and Compliance matters and is an appointed position within Radiology department and Safety Services.

→ The Role of Radiation protection officer (RPO) is to Support the department's work with ionizing radiations by ensuring arrangement are in place to manage radiation risk

→ . So that the work is carried out safely and in compliance with regulation.

→ The department employes and the public are protected from harmful effect of radiation.

⇒ Responsibilities of Radiation Protection officer (PRO):-

→ The PRO has broad range of duties some When are given below-

⇒ ALARA:- enforcing the as low as reasonably achievable dotime.

⇒ Involvement in developing Shield protocols.

⇒ Auditing ALARA and RPP progiams on regular Shedule.

⇒ Reviewing occupational and patient dose.

⇒ Routine reporting requirements.

=> Reporting incident to proper authorities.

=> Monitoring fitness and regulation of instrumentation.

=> Eastiblishing Spills response and contimination protocols.

=> Personal instruction on radiation Safety.

=> Performing measurments to check radiation doses, dose rates and activity.

=> Posting regularity notices, bulletins, labelling and Emergency Procedure.

=> Advising on training indication Safety.

⇒ Managing and inventory of equipment capable of emiting x-ray.

⇒ Arranging for disposal of radioactive waste to authorized contractors.

⇒ Contrding and contributing to the production of local rules and local radiation safety policies.

⇒ Managing system for the provision of personal dosimetry and associated record keeping.

⇒ Assessing that BPM is being applied.

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Q No: 2

Radiation Protection.

⇒ Measure in Radiology Department:-

⇒ Radiation Protection:-

Radiation protection is the science and practice of protecting people and the environment from the harmful effect of ionizing radiation.

⇒ Radiation Protection Measure

→ Following are the radiation protection measure in Radiology Department.

⇒ There is a Safety Plan that indicate the periodic inspection, maintance and calibration of all equipment.

⇒ The Safety plan involve posting of Safety warnings on the doors.

⇒ The Safty plan also involve the prevision and regular aprons and thyroid and Gonad shield for staff and Patient.

⇒ Record are available indicating the radiation dosimetry Tools and staff radiation exposure for the past twelve month.

⇒ Radiation Exposure:

(*) → The risk of exposure should balance of medical benefits

(*) → Optimize radiation dose by exposing the patient to enough radiation to get the clear image.

⇒ Remember to minimize exposure at all possible time

⇒ Measure the Occupational Dose equivalent from

(*) x-rays
(*) Gamma rays
(*) High energy beta emitters.

⇒ Allow practice ALARA.
(As low as Resonably Achievable)

⇒ Minimize the time by minimize dose.

⇒ Minimize time and you will minimize the time.

⇒ To minimize exposure time to procedure.

⇒ Doubling the distance source can reduce your exposure intensity by 25%.

⇒ Position shielding b/w yourself and the source of radiation at all permissible time.

⇒ Take advantage of permanent shielding i.e equipment or existing structures.

⇒ Select appropriate shielding material during the planning

Stage of procedure.

⇒ Radiation protection in x-ray lead aprons attenuates scattered radiation by 95%.

⇒ The radiology department ensure the following test are conducted at least annually.

(*) Automatic exposure control (AEC) Test.

(*) KVp reproductibility and repeatability.

(*) Half value layer test.

(*) Mean glandular dose test (for Mamography)

⇒ So These are the Radiation protection measure in Radiology department.

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Q No: 3 :-

Radiation Hazard

Hazard :-

→ A hazard is a natural or man made event which may cause physical damage, economic losses or threaten human life and well being if it occurs in an area of human.

Note :-

⇒ Ionizing radiation is generally considered to be more hazardous to human health.

than non ionizing radiation because it can remove electron from atoms.

=) This means it can damage living tissue and DNA.

- Like alpha radiation, beta is caused by particles.

Examples of Radiation

→ Sunlight
→ Radio waves
→ x-ray.
→ Heat
→ Alpha.
→ beta
→ Gamma ionizing Radiations.

Radiation Hazard may divided according to.

(*) → External Radiation exposure.

→ Hazard is related to high penetrating radiation source outside the body.

Examples :-

→ Electromagnetic Radiation

→ High Energy beta and neutron.

That could penetrate the skin and body to cause harm the body.

(*) Internal Radiation Exposure.

→ Hazard related to radiation source in body.

→ involve radiation with low penetrating power.

=> Types of Radiation Hazard

→ Alpha Radiation
→ Beta Radiation.
→ Gamma rays.
→ x-ray.
→ Neutron particles.

Radiation Hazard

Whole body Radiation
↓
Nuclear Bombs
Nuclear reactive Leaks.

Specific area Radiation
↓
Medical diagnostic (and therapeutic)
Dental x-ray.

Radiation Damage

Indirect

↓

Somatic

Affects individual

No effect on

offspring.

Direct

↓

Genetic.

Do not effect individual

offspring is effected.

Radiation Hazard.

Direct Damage :-

$$RH + \text{Radiation} \longrightarrow R^{+} + H^{+} + e^{-}.$$

R^{+} →

- Dissection. $R^{+} \rightarrow X + Y$.
- cross-linkage. $R^{+} + S \rightarrow RS$.

Radiation

→ DNA / RNA molecule → nuclear acid breakdown.

→ Nuclear acid breakdown.

(*) Somatic cells.

(*) Genetic cells.

→ Radiation induced Milagnancy.

(*) Radiation induced

(*) Congenital abnormality.

⇒ Radiation Hazard (indirect Damage)

Water Hydrolysis

Radiation

→ H_2O → $H^+ + OH^-$

$H^+ + H^+ \longrightarrow H_2O$

$OH^- + OH^- \longrightarrow H_2O_2$

$\Rightarrow$ $H_2O_2 + DNA$
$H_2O_2 + proteins$ $\Big] \rightarrow$ Molecular Breakdown.

$\Rightarrow$ Molecular Breakdown $\rightarrow$ cell damage.

Radiation Damage.

↓

Somatic

- Direct
  DNA/RNA hit
  Radiation induced malignancy.
- Indirect
  H_2O_2 formation
  Toxic
  Breakdown of large molecule (proteins/DNA).

Radiation Damage.

↓

Genetics

→ Direct
DNA/RNA hit.
Radiation induced
Malignancy.

→ Indirect
H_2O_2
formation.
Toxic.

Breakdown of
large molecules

⇒ The $LD_{50/60}$ is the dose of radiation to whole body that cause 50% of irradiated subject to die within 60 days.

⇒

Effect of Radiation on organism / Tissue level.

(a) → 1) deterministic effect and

(b) → Stachostatic effect.
- ↳ carcinogensis
- ↳ Genetic effect.

(a) → 1) deterministic effect

→ Are caused by the cell death.

→ If dose of radiation exposure is less then the threshold dose.

Examples:- → death of individual
- → cataracts
- → Demage of skin
- → Demage of bone marrow.

Stochastic effects

→ Are caused by mutant cell.

→ It may cause the effect of radiation if dose of radiation increases.

→ The probability of effect also increases.

→ Stachastic effect means that even low level of radiation exposure do guaranted Safely.

Examples:
→ Carcinogenesis.
→ Genetic influence.

So these are the Radiation hazard and Therefore everyone should be beware of it :-

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Q NO:4

Ans:-

Radiologic Technologist Protection from Radiation Dose and Annual occupational Dose:-

=> Occupational Radiations

Dose Mangement by Radiological technologists:-

The radiation dose is measured in Gyt while exposure dose measured in Gya (Rontgens). But the exposure

is to radiologic. due to longer beam on time for procedure

⇒ Extremity exposures often significant.

⇒ collimate as much as possible. and avoiding bending projection during procedure.

⇒ Mamography :-

→ low personnal exposure

→ Normal walls and barriers adequate.

→ Dosimetry probably not required and the dose getting low of portable machine.

(3) Occupational dose is the dose of radiation to which the radiological staff expose during working in department.

To Minimize occupational Dose the cardinal principle of radiation protection are.

(1) (*) → Time
(2) (*) Distance.
(3) (*) Shielding.

(1) Time :-

→ The amount of exposure an individual recieve is directly proportional to time of exposure.

→ The technologist should minimize the amount of time spent with radiation source.

Example:- time of fluoroscopy procedure should kept to a minimum.

2 (*) → Distance:-

→ The distance has inverse relation.

→ Doubling the distance from source will decrease the exposure by four.

→ x-ray, CT staff should outside the room behind the shielding when machine

behind machine is on.

→ Perform fluoro from as far as practiable.

→ Variety of restoring devices can be used for patient immobilization.

3) ★→ Shielding :-

→ Any object b/w technologist and source of radiation must provide with some shielding.

→ The more dense an object or material the better will be the shielding.

The technologist must wear
(★) protective apron
(★) Gloves.
(★) Gonad shielding.

⇒ Radiation Safety by Modality :-

⇒ Fluoroscopy :-

→ Personnel exposure directly related to beam on plus time.

→ The technologist must be use ALARA principle for to reduce dose.

→ protective apparel must be wear during fluoroscopy.

⇒ Interventional Radiography

→ Exposure is higher technologist and radiologist

⇒ Computer tomography

→ personnel exposure low.

→ Collimated beam result in low scatter x-ray.

→ technologist should remain in room if necessary with lead aprons.

⇒ Mobile Radiography

→ usually low personnel doses.

→ exposure cord should be long enough for technologist to be out of scatter area.

→ Be aware of location of IR.

→ Mobile x-ray unit should have protective apron assigned to it.

→ The exposure cord on a portable x-ray unit be at least 2m long.

→ The useful beam should never be directed toward console.

⟹ Occupational Radiation Monitoring :-

→ Require of worker exposed to exceed 10% of annual limit (500 mrem)

→ All machine user technologist require to wear dosimeter.

⇒ Dosimeter :-

Calculate the exposure radiation.

→ Wear out side the apron.

→ Dosimeter offers no protection just record the radiation exposure.

⇒ Female technologist

→ If the female technologist become pregnancy the worker should limit exposure.

→ Concern about exposure.

→ Trainy should provided to pregnant worker to inform her potential risk.

⇒ Patient Holding

→ Mechanical devices should be used.

→ If mechanical devices impractical than relative or friend should Holding the patient.

→ check protective barriers. appeal etc each year for leak and check the

dosimeter performance.

⇒ Radiation worker

Risks :-

→ Leukemia.
→ Bone cancer
→ Lung cancer
→ Infertility
→ Hair loss.
→ Skin cancer.
→ Kidney Cancer
→ Bronchotitis.

⇒ Annual occupational Dose :-

→ The recommended annual occupational dose is 0.5 Sv/yr 5000 mrem/yr.

→ But Average radiologic personel dose per year is 0.7 mSv/yr for whole body exposure.

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The End

Thank You