FLUOROSCOPY CREDENTIALLING

NuHealth
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Formerly Nassau Health Care Corporation

1) **Study the following material.**
2) **Print and take the test.**
3) **Send the completed test to:**

Medical Staff Office

B-Bldg, 4th floor, room 426, Box 42

What Is Ionizing Radiation?

- Radiation with sufficiently energy to remove electrons from the atoms or molecules of the substances it passes through.
- Can damage the chemical structure of tissue
- Electromagnetic radiation at 3 eV (UV) and above can ionize tissue and disrupt molecular bonds
- Medical radiation you may be exposed to have energies of 15,000 eV to 150,000 eV

Radiation Risks

- **Deterministic Effects (Radiation Burns):**
  - A threshold exists – If the threshold is exceeded, there is a certainty of effect
  - Severity of the effect is a function of dose
  - High dose risks include hair loss, skin damage, cataracts, and congenital abnormalities

- **Stochastic (Probabilistic) Effects:**
  - Assumed Zero Threshold
  - Probability of contracting disease is related to the dose
  - Severity of the disease is independent of dose
  - Risks include cancer and genetic damage

How to Quantify Radiation

- **Radiation Exposure - (Directly related to measurement):**
  - **1 Roentgen (R) = 2.58 ☞ 10^{-4} C/kg**
- **Radiation Absorbed Dose - (Measure of the energy deposited in a sample of tissue) :**
  - **1 rad = 10 mGray (Gy)**
- **Equivalent or Effective Dose - (Measure of biological effect):**
  - **1 rem = 10 mSievert (Sv)**

How to Quantify Radiation

- **Equivalent Dose - (Measure of the deterministic risk - i.e. radiation burns)：**
  - **1 rem = 10 mSievert (Sv)**

- **Effective Dose - (Measure of the stochastic risk - i.e. cancer risk)：**
  - **1 rem = 10 mSievert (Sv)**

- **Note: Although both the Equivalent and Effective Doses use the same units, their values may differ by an order of magnitude or more for the same radiation field in some circumstances.**

Average U.S. Levels of Radiation Background

Radiation Source	rem/year
cosmic rays	0.03
Terrestrial Radioactivity	0.03
Ingested Radioactivity	0.04
Inhaled (Radon)	0.2
TOTAL	0.3

Typical Skin Doses from Diagnostic X-ray Examinations

• **Chest:**	**anterior-posterior**	**0.012**	**rem**
	lateral	**0.03**	**rem**
	ovaries	**0.0003**	**rem**
• **Dental Intra-Oral (film):**	**periapical**	**0.25**	**rem**
• **Skull:**	**lateral**	**0.15**	**rem**
• **Lumbar spine:**	**anterior-posterior**	**0.65**	**rem**
• **Fluoroscopy:**	**abdomen**	**2.5**	**rem/min**
• **CT (absorbed dose):**	**chest**	**2**	**rem**
• **99mTc Myocardial perfusion**	**Effective Dose**	**0.5**	**rem**

Nuclear Regulatory Commission (NRC) Regulatory Requirements for Radiation Workers (Stochastic Risk):

Maximum Permissible Dose Equivalent Annual Limits (MPD)

Occupational Limits	**MPD (rems)**
Total Body	5
Extremity or single organ (except lens of eye)	50
Lens of Eye	15
Embryo/Fetus of an occupationally exposed mother:	0.05 / month; 0.5 / 9 months

Deterministic Radiation Effects on the Skin (Equivalent Dose)

Effective Dose	Skin Reaction
100 rem	No visible effect
200 - 600 rem	Erythema, possible temporary hair loss if > 300 rad
600 - 1000 rem	More serious erythema caused by damage of basal cells, healing delayed
1500 rem	Severe erythema, followed by dry desquamation and delayed/incomplete healing
2000 - 5000 rem	Intense erythema, acute radiation dermatitis with moist desquamation, edema, dermal hypoplasia, vascular damage, and permanent hair loss, permanent tanning, descrution of sweat glands. If >5000 rem followed by ulceration/necrosis

Note: Effects may be delayed

Personal Radiation Monitors (Radiation Badges)

- Wear your radiation badge when working with radiation
- The radiation badge is not a protective device
  - It cannot shield you from radiation
- Return your radiation badge on time
- Wear your badge clipped to your collar or near your sternum.
- Wear your radiation badge **outside** of the lead apron.
- Ring badges should be oriented such that the detecting element faces **towards** the source of radiation.

Personal Radiation Monitors (Radiation Badges)

- Wear only the radiation badge assigned to you
- Report lost radiation badges
  - a replacement will be issued
- Do not wear radiation badges while having personal medical or dental x-rays
- Do not store radiation badges near sources of radiation when not being worn
- Do not let dog chew on badge
- Do not deliberately expose badges. Doing this can create severe difficulties with regulatory agencies.

Components of the Fluoroscopic X-Ray System

- Image Intensifier (x-rays are detected here after passing through the patient)
- C-arm may rotate from vertical (pictured) to horizontal about axis (arrow points to axis)
- Collimator (increases or decreases the x-ray field size)
- X-ray tube housing (primary x-rays come from here)

Primary Radiation
(X-ray Only)

- Primary radiation is the radiation emanating from collimator of the x-ray unit
- Primary radiation is used to expose the patient
- Primary radiation is collimated to a narrow beam
- The leakage of the radiation is very low
- Primary radiation is relatively energetic
- Primary radiation has relatively high penetrating power
- Shielding is relatively less effective against primary radiation

Scattered Radiation

- Scattered radiation emanates from the area of the patient illuminated by the primary beam
  - Mainly from the entrance surface
- Scattered radiation radiates in all directions
- Scattered radiation is less energetic than primary radiation
- Scattered radiation has less penetrating power than primary radiation
  - Shielding is more effective against scattered radiation

Protection From Radiation

Goal is for the radiation level to be As Low As Reasonably Achievable (ALARA)

- **Distance From Source - Inverse Square Law**
  - **Moving away from the source of radiation greatly reduces our exposure**
- **Time of Exposure - Linear**
  - **Minimize fluoroscopic exposure time to what is necessary to see motion.**
- **Shielding - Negative Exponential**

Radiation Protection During Fluoroscopic X-Ray

- Use distance whenever possible to minimize your exposure
- Measure distance from the entrance surface of the patient
- Work on the Image Intensifier side of the patient if possible

Radiation Protection During Fluoroscopic X-Ray

- Use Collimation to reduce the x-ray field size to the field clinically necessary.
  - Magnification mode often increases patient skin dose
- Acquire fluoro images only to observe motion
  - Use last image hold or Loop-Replay whenever possible
- Use the lowest dose rate that will produce clinically useful images
  - High resolution images and DSA masks have significantly higher dose rates.
- Staff members should step back from the table during fluoroscopy when it is not necessary for them to remain close to the table.

Radiation Protection During Fluoroscopic X-Ray

- Shielding
  - Use a well tailored apron
  - Use a thyroid collar
  - Wrap-around aprons offer protection in all directions
  - Hang up apron properly when not in use to maintain integrity of shielding
  - Floor, table, and ceiling mounted movable shields should be used whenever possible
  - Lead surgical gloves in the beam often increase hand dose and are not recommended

Radiation Protection During Fluoroscopic X-Ray

- FDA recommends that information should be recorded in the patient's record that permits estimation of absorbed dose to the skin – especially for long, complex, and multiple procedures.
  - an unambiguous identification of those areas of the patient's skin that received an absorbed dose that may approach or exceed the selected threshold.
  - an estimate of the cumulative absorbed dose to each irradiated area of the skin noted in the patient record or sufficient data to permit estimating the absorbed dose to those areas of skin.
- Record fluoroscopic on-time for all procedures.

Protecting the Patient From Radiation

- Minimize Exposure to the Patient

  - Collimate to the smallest field that covers the region of interest.
  - If the primary beam irradiates the gonads, use gonadal shielding if the shields do not obstruct regions of clinical interest.
  - Maintain adequate source-skin distance
    - Patients should be placed against the image intensifier
    - If a table is not used in the procedure, a spacer cone must be used.

Protecting Pregnant Patients From Radiation

- Ask female patients if they are or might be pregnant
- Have a sign posted asking the patients to inform the staff if they are or might be pregnant
- Apply the10 day rule if possible.
- Avoid exposing pregnant patients to routine x-rays if possible
- If possible order a pregnancy test if you have reason to suspect the patient may be pregnant.

Notification Threshold

- All Departments using fluoroscopy should monitor and record fluoroscopic on-time.
- Whenever fluoroscopic exposure to a single field exceeds one hour the patient should be notified that skin erythema may occur and to notify their physician should that occur
- If a fluoroscopic procedure exceeds six hours of on-time the Radiation Safety Officer must be notified. The RSO will then determine if the 1500 rad threshold for a sentinel event has been exceeded

Ordering or Directing Diagnostic X-rays (Including Fluoroscopy):

- Anyone with a valid NYS physician's license.
- A Physician's Assistant (PA) working under the authority of a Physician.
- A Certified Nurse Practitioner working within a practice agreement with a Physician, or under the authority of a Medical Director or Medical Board in a Hospital.

Taking Diagnostic X-rays (Including Fluoroscopy):

- Only a Physician or a Licensed Radiological Technologist (LRT) may:
    - Position the patient (or adjust the c-arm) for an exposure.
    - Adjust the controls on the x-ray unit.
    - Take the exposure.
- Performance of any of these three tasks by anyone other than a Physician or an LRT is a misdemeanor (practicing without a license) and could subject the offender to criminal prosecution.

For Further Information:

Contact the Radiation Safety Officer:

Bruce P. Emmer, DABR, DABMP

Office: D 012

Phone X 2-6457

Pager 1 516 651-1184