

# ASSURE SAFETY IN RADIOLOGICAL PROCEDURES

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## INTRODUCTION

Diagnostic and interventional radiology, are an essential part of present day medical practice. Advances in X-ray imaging technology had a significant impact on the practice of radiology. This includes improvements in image quality, reductions in dose and a broader range of available applications resulting in better patient diagnosis and treatment.

### What is safety:

S-sense the error

A-act to prevent it

F- follow safety guidelines

E- enquire into accidents/ deaths

T- take appropriate remedial measures

Y- your responsibility

**Radiology** is a specialty that uses medical imaging to diagnose and treat diseases seen within the body

A variety of imaging techniques such as

- X-ray radiography, ultrasound, computed tomography (CT), nuclear medicine
- including positron emission tomography (PET), and magnetic resonance imaging (MRI) are used to diagnose and/or treat diseases.
- Interventional radiology is the performance of (usually minimally invasive) medical procedures with the guidance of imaging technologies

Common radiological procedure are;

- CT Scan: Also known as a "C.A.T. scan", the CT scan is a valuable diagnostic tool.

- Mammography: An X-ray technique that's used to create an image of the breast.
- MRI: An extremely precise way to look inside the body without using X-rays.
- PET/CT Scan: PET/CT scans produce pictures of metabolism and anatomy.
- SPECT/CT: Combines the functional imaging of Nuclear Medicine and the anatomical imaging of CT
- Ultrasound: Ultrasound uses sound waves to obtain a medical image or picture of various organs and tissues in the body.
- X-ray: A medical procedure using X-rays that helps identify disease or injury inside the human body.

#### **DIFFERENT TYPES OF RADIOLOGY:**

- **Cardiovascular Radiology**

The subspecialty of radiology devoted to the diagnostic imaging and diagnosis of diseases of the heart and blood vessels (including the arteries and veins, and the lymphatics). This includes x-rays, CT or CAT, ultrasound and MRI.

- **Chest Radiology**

The subspecialty of radiology devoted to diagnostic imaging and diagnosis of diseases of the chest, especially the heart and lungs. This include x-rays, CT or ultrasound, MRI, mammograms and chest procedures, such as lung biopsy and drainage of fluid from the chest.

- **Breast imaging**

The subspecialty of radiology devoted to the diagnostic imaging and diagnosis of breast diseases and conditions. This includes mammography, breast ultrasound, breast MRI, and breast procedures such as breast biopsy

- **Emergency Radiology**

The subspecialty of radiology devoted to the diagnostic imaging and diagnosis of trauma and non-traumatic emergency conditions. This includes x-rays, CT or CAT, ultrasound and MRI.

- **Gastrointestinal (GI) Radiology**

The subspecialty of radiology devoted to the diagnostic imaging and diagnosis of the gastrointestinal (GI), or digestive tract (the stomach and intestines) and abdomen. This includes fluoroscopy, x-rays, CT or CAT, ultrasound, MRI, and GI procedures such as biopsy, fluid and abscess drainage.

- **Genitourinary Radiology**

The subspecialty of radiology devoted to the diagnosis and treatment of the organs of the reproductive and urinary tracts. This includes x-rays, CT or CAT, MRI and procedures such as biopsy, kidney stone removal, and uterine fibroid removal.

- **Head and Neck Radiology**

The subspecialty of radiology devoted to the diagnostic imaging and diagnosis of diseases of the head and neck. This includes x-rays, CT or CAT, ultrasound and MRI.

- **Neuroradiology**

The subspecialty of radiology devoted to the diagnostic imaging and diagnosis of the brain and nerves, head, neck and spine. This includes x-rays, CT or CAT, ultrasound and MRI.

**Pediatric**

The subspecialty of radiology devoted to the diagnostic imaging and diagnosis of diseases of children. This includes x-rays, CT or CAT, ultrasound, MRI and procedures such as fluoroscopy, biopsy and drainage of fluid or abscess collections.

**Radiation Oncology**

The subspecialty of radiology devoted to the treatment of cancer with or through radiation.

The radiation may be delivered from an outside x-ray source or may be injected directly into the body.

A dose of medical radiation is not like a dose of medicine. When it comes to radiation dose, there are different types of and units of measurement. **Absorbed dose** is the concentration of energy deposited in tissue as a result of an exposure to ionizing radiation.

Exposure Sources

- Primary radiation
- Leakage radiation
- Scatter radiation

primary radiation, leakage radiation, and scatter radiation. These terms apply to both diagnostic and therapeutic radiation administration.

- Primary radiation is the beam itself, which goes from the tube to the intensifier.
- Leakage radiation leaks out through the covering on the machine.
- Scatter radiation is the largest source of radiation to staff members. This is radiation that goes through the patient or bounces off of the patient or other things that do not allow penetration by the radiation beam.

**FACTORS INFLUENCING RADIATION HAZARDS**

- The intensity of radiation.
- The rate at which the radiation decreases in intensity or half-life of the substance.
- The penetrating power of radiation.
- The time exposure to radiation.
- The rate at which radioactive material taken into body is excreted from body (Radioactive iodine)
- The general condition or health of the patient or tissue.

## PRINCIPAL OBJECTIVES OF THE SAFETY CODE

- To minimize patient exposure to ionizing radiation while ensuring the necessary diagnostic information is obtained and treatment provided;
- To ensure adequate protection of personnel operating X-ray equipment;
- To ensure adequate protection of other personnel and the general public in the vicinity of areas where X-ray equipment is used.

## THIS SAFETY CODE IS COMPOSED OF THREE SECTIONS

- **Section A: Responsibilities and Protection**

sets out the responsibilities of user, operators and other staff for the safe installation, operation and control of the equipment, and sets out practices to minimize radiation doses to patients, staff and the public.

- **Section B: Facility and Equipment Requirements**

out requirements for the facility design and minimum equipment construction and performance standards.

- **Section C: Quality Assurance Program**

sets out requirements for quality assurance programs including acceptance testing and quality control procedures

### **Pregnant Staff Safety:**

- Follow standard radiation protection techniques
- Declare the pregnancy to the radiation safety officer or through other appropriate facility channels
- Wear radiation monitors at the waist under shielding during times of exposure to radiation

### **Patient Safety**

- The Department of Radiology and Biomedical Imaging is committed to maintaining the highest possible standards of patient care and safety, from the moment a test is requested through to performance and final reporting of an imaging examination. This is true for all the tests we perform, whether it be plain X-rays, CT, MRI, US, nuclear medicine tests, or an interventional radiology procedure.

#### **Procedures for Minimizing Radiation Exposure to Patients**

- The risk to the individual patient from a single radiographic examination is very low. However, the risk to a population is increased by increasing the frequency of radiographic examinations. . For this reason, it is important to reduce the number of radiographs taken, the number of persons examined radiographically, and the doses associated with the examinations.

- patients must only be subjected to necessary radiological examinations and, when a radiological examination is required, patients must be protected from excessive irradiation during the examination.
- to provide guidelines for elimination of unnecessary radiological examinations and for minimizing doses to patients when radiological examinations are necessary.

## PROTECTION OF PATIENTS

### GROUPING OF RADIODIAGNOSTIC PROCEDURES ACCORDING TO HAZARD

- Gonad dose grouping-adults
- Lumbar spine, lumbosacral vertebrae
- Pelvis
- Hip and femur (upper third)
- Urography
- Retrograde pyelography
- Urethrocytography
- Lower gastrointestinal tract
- Abdomen
- Obstetric abdomen
- Pelvimetry



### Shielding Devices

#### Personal protective devices

- Aprons
- Thyroid shields
- Leaded eye protection
- Protective gloves
- Sterile radiation shield drapes
- Protective caps

### The Radiation Safety Committee

- X-ray Equipment Operator
- Medical Physicist/Radiation Safety Officer

- Referring Physician/Practitioner
- Information Systems Specialist
- Repair and Maintenance Personnel
- Quality Control Testing Procedures and Equipment
- Quality control testing must be carried out during routine operation of a radiological facility. This section sets out the required and recommended quality control tests, the associated test equipment and testing frequencies.

Quality control testing of a medical X-ray system includes several major steps.

They are

- The verification of the system mechanical integrity and stability, including safety mechanisms, automatic patient release, power drives, interlocks;
- The verification of the performance of ancillary equipment such as film processors and display units;
- The verification of X-ray performance; and
- The verification of imaging or diagnostic performance, including assessments of dose.

### Basic principles of radiation

#### Radiation protection:

- Justifiable exposure
- ALARA
- Dose limits

#### Radiation Safety Program

SHOULD include

- Processes and requirements for the selection of equipment at the time of purchase
- Requirements for personnel education and competency assessment
- Quality assurance and improvement program
- Frequency of and processes for testing of protective devices
- Requirements for patient education
- Processes for sterilization of radiation seeds when seed sterilization is required

#### Radiation Exposure Education

- Minimizing exposure to radiation (ie, as low as reasonably achievable [ALARA])
- Dosimeter used and monitored

- Care of patients receiving radioactive nuclides
- Handling radioactive nuclides

Controlling and providing security for the material (ie, constant surveillance).

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