Ministry of Higher Education and Scientific Research
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Type of the Physics of Diagnostic Radiology

Lecture 2

By

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Radiology: is the science that uses medical imaging to diagnose or treat of the diseases. These medical imaging include X-ray, ultrasound, CT, MRI.

Plain films and fluoroscopy

1. Conventional radiography

Principle: X-rays are part of the electromagnetic spectrum, emitted because of bombardment of a tungsten anode by free electrons from a cathode. Hard copy plain films produced by their passage through the patient and exposing a radiographic film.

Five principal densities recognized on plain radiographs, listed in order of increasing density:

- Black, Air/gas: e.g., Lungs, bowel, and stomach
- Dark grey, Fat: e.g. subcutaneous tissue layer, retroperitoneal fat
- Light grey, soft tissues/water: e.g. Solid organs, heart, blood Vessels, muscle and fluid-filled organs such as bladder.
- Off-white Bone:
- Bright white, contrast material/metal:

2. Digital radiography

Principle: in digital radiography, the basic principles are the same, but a digital screen replaces the X-ray film. The tissue absorption characteristics are computer analyzed and the image visualized on a monitor.

Advantages of digital radiography:

- Reduce radiation exposure.
- Digital enhancement of image quality.
- Transfer and rapid retrieval of the images
- Elimination of storage problems associated with conventional films.

3. Fluoroscopy

Principle: Fluoroscopy is the term used when a continuous low power X-ray beam is passed through the patient to produce a dynamic image that can be viewed on a monitor.

Uses:

- 1-Contrast studies of GIT.
- Angiography and interventional radiology.
- Guidance of therapeutic joint injections and arthrograms
- Screening in theatre: operative cholangiography, reduction, and fixation of fractures …

4. Ultrasound

Principle: ultrasound employs high-frequency sound waves, produced by a piezoelectric crystal in a transducer. The waves travel through the body, and reflected variably, depending on the different types of tissue encountered. The same transducer, as well as transmitting ultrasound, receives the reflected sound and converts the signal into an electric current; this is subsequently processed into a grey-scale picture.

Uses:

- Brain: imaging the neonatal brain.
- Thorax: confirms pleural effusions and pleural masses.
- Abdomen: visualizes liver, gallbladder, pancreas, kidneys, etc.
- Pelvis: useful for monitoring pregnancy, uterus and ovaries.
- Peripheral: assesses thyroid, testes and soft - tissue lesions.

5. Doppler ultrasound

Principle: Doppler ultrasound is a technique to examine moving structures in the body. Blood flow velocities measured using the principle of a shift in reflected sound frequency produced from moving structures.

Uses of doppler ultrasound:

- cardiac Assessment
- Arterial flow studies
- Venous flow studies

6. Computed Tomography

Principle: CT is an imaging technique whereby cross-sectional images are obtained with the use of X-rays; the patient is passed through a rotating gantry that has an X-ray tube on one side and a set of detectors on the other. Information from the detectors is analyzed by computer and displayed as a grey-scale image.

Uses :

- Whole body scan.
- Staging primary tumors
- Radiotherapy planning.
- Detail vascular and structural anatomy.

7. Magnetic resonance imaging

Principle: Magnetic resonance scanning produces images of the body by utilizing the magnetic properties of hydrogen. The patient is placed in the scanner tunnel & subjected to a high-intensity magnetic field. This forces the hydrogen atom nuclei to align with the magnetic field. A pulse of radiofrequency applied to these nuclei then displaces them from their position; when the pulse ceases, they return to their original state, releasing energy (in the form of a radio-frequency signal). Computer analysis processes this energy into a digital signal with conversion to a grey-scale image.

Uses:

- Central nervous system imaging.
- Musculoskeletal: accurate imaging of joints, tendons, ligaments, and muscular disease.
- Diagnosis of many cardiac conditions.
- Assessment of mediastinal pathology.
- Abdominal imaging including MRCP.
- Pelvis: staging of prostate, bladder and pelvic neoplasms.

H.W

1. **……are part of the electromagnetic spectrum, emitted because of bombardment of a tungsten anode by free electrons from a cathode.**

a. X.Ray

b. Magnetic resonance scanning

c. CT scan

d. Doppler ultrasound

2. Advantages of digital radiography:

a. Reduce radiation exposure.

b. Digital enhancement of image quality.

c. Transfer and rapid retrieval of the images

d. All of them

Thank you

لا بأس ايها القارئ ستمُر مثلما مَر قبلها العديد ..
تضيق وتحزن وتيأس ولا تعلم أن الله يسمعك ويراك ويدبر أمرك الذي تحزن من أجله !