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INTRODUCTION

- Radiological anatomy represents the basis of radiological work. It encompasses all systems of human body ranging from head and neck, respiratory system, gastrointestinal tract, musculoskeletal system and other body systems using ionizing radiation, sound waves, contrasts and other imaging techniques and modalities.

OBJECTIVE OF RADIOLOGICAL ANATOMY

- The primary objective of radiological anatomy is to aid the teaching/learning of anatomy using radiological images.

IMPORTANCE OF RADIOLOGICAL ANATOMY

- Development in imaging techniques and increasingly refined treatment methods pose a great challenge to all anatomists, radiologists and clinicians. Thus, the knowledge of radiological anatomy becomes important to be able to study various organ systems of the body.
- It helps to investigate disease conditions
- It guides in making a diagnosis
- It helps in suggesting the treatment options of a particular disease
- It gives a clue about the prognosis of a disease condition
- It also gives a clue about the complication(s) that may follow a disease condition
- It can also be used as a treatment modality.

TYPES OF IMAGING TECHNIQUES

- Plain X-ray (Radiographs)

- Computed Tomography X-rays (CT)
- Magnetic Resonance Imaging (MRI)
- Positron electron tomography (PET)
- Single photon emission computed tomography (SPECT)
- Ultrasound scanning
- Ultrasound guided biopsy or drainage
- Mammogram
- Radio isotope scan
- Barium series- Barium swallow
 - Barium meal
 - Barium meal+ follow through
 - Barium enema
- Urographin series-Intravenous urogram (IVU)
 - Retrograde urethrocystogram (RUCG)
 - Micturatingcystourethrogram (MCUG)

PLAIN FILM X-RAY

- An X-ray film taken without a contrast medium/other special effects.
- It is the practice of producing two-dimensional images using X-ray radiation.
- The X-ray radiation interacts with the human tissues to create diagnostic images.
- Display the shadow of the body part on the films.
- The farther the body part is from the film, the more magnified it will appear but it borders will be less distinct.
- The image produced is a 2-dimensional representation of a 3-dimensional object.
- The views used in plain radiographic images are named for the part of the body that is nearest the film, for example, anterior, right lateral, left anterior oblique. Alternatively, the terms anteroposterior / postero-anterior are used when the X-rays have passed through the object from front to back or from back to front.
- They are still the most common method of viewing osseous structures/the chest.

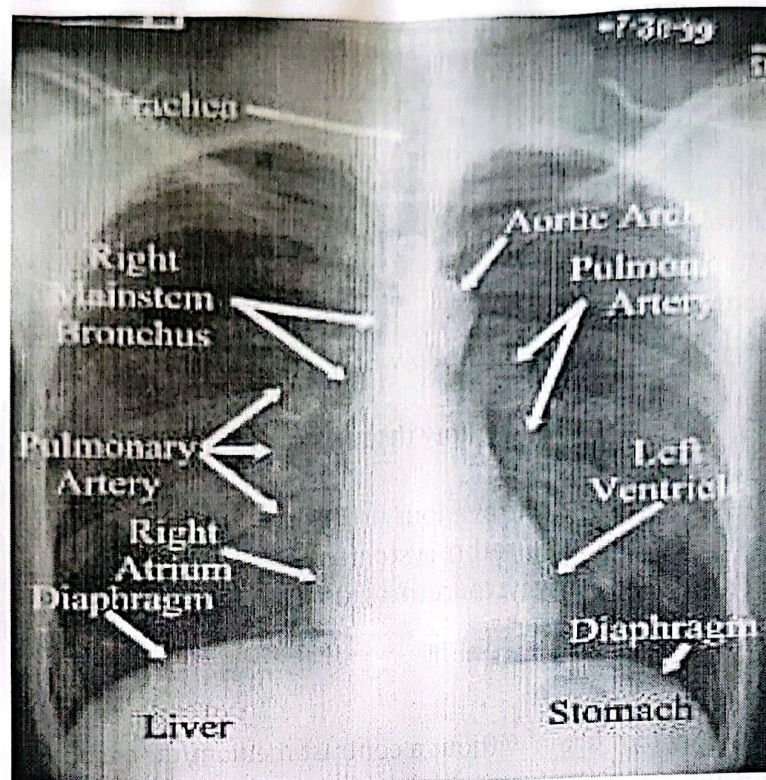


Fig. 15.1 Plain chest X-ray

COMPUTED TOMOGRAPHY (CT) SCAN

- It is a technology that uses computer processed X-ray to produce tomographic images of specific areas of scanned object, allowing the user to see what is inside without cutting it open.
- It produces a volume of data that can be manipulated in order to demonstrate various body structures based on their ability to block X-ray beams.
- The images generated are produced as 3 dimensional images (axial, coronal or sagittal).

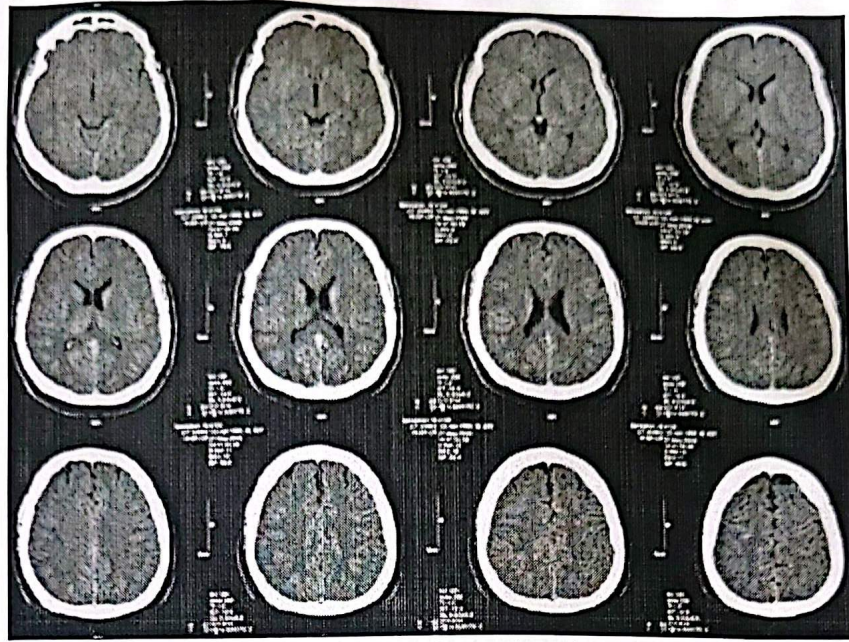


Fig. 15.2 CT Scan of the brain (axial slices)

ULTRASOUND

- It uses mechanical waves of frequencies beyond the audible range,
- It uses sound waves to create images of organs and structures inside the body,
- It does not use radiation,
- It works by travelling freely through fluid and soft tissues and is reflected back when it hits a more solid (dense) surface,
- The test performed by the ultrasound machine is ultrasound scan

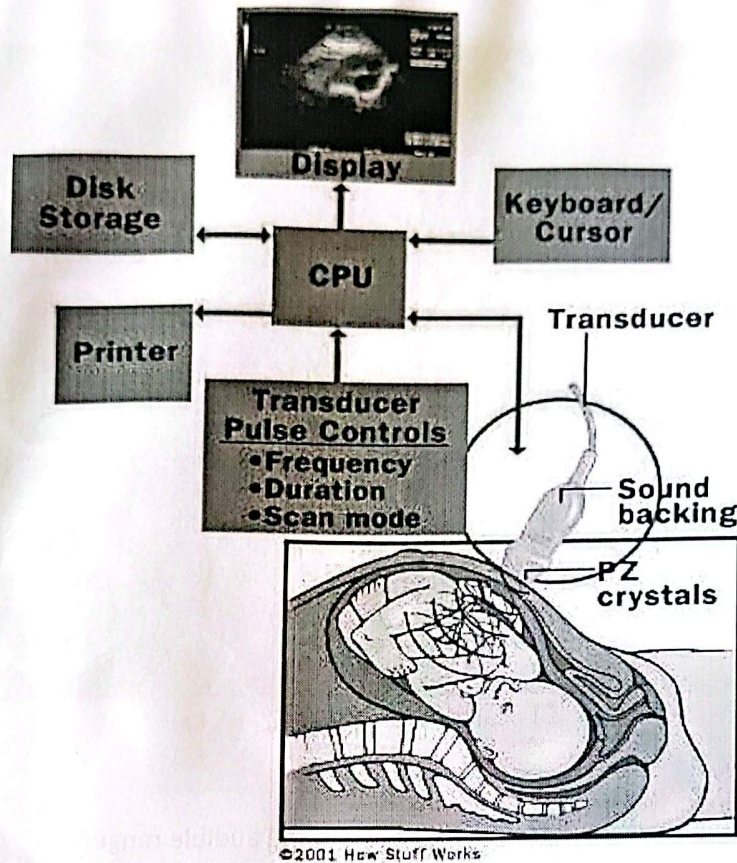


Fig. 15.3 Ultrasonography set-up

MAGNETIC RESONANCE IMAGING (MRI)

- It is another method of creation of cross-sectional images.
- It does not use ionizing radiation.
- The fundamental principle is that polarized molecules in the body (the most ubiquitous being water) will align themselves when placed in a strong magnetic field.
- The ability of the water molecules to move within the magnet varies with the chemical environment of the molecules. Therefore, each tissue will have its own characteristics as will each type of pathology.

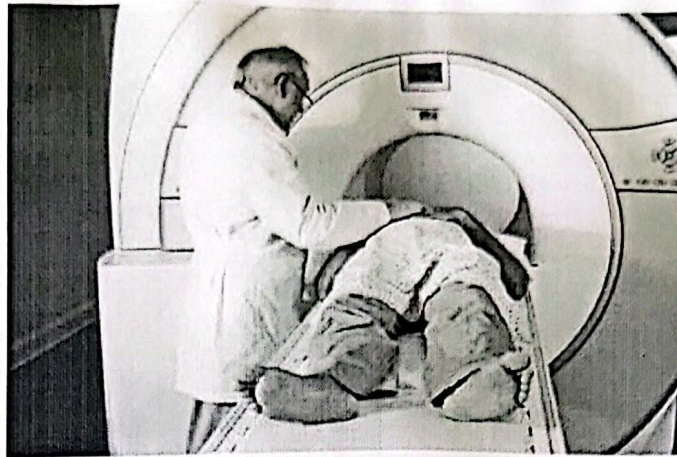


Fig. 15.4 MRI Scanning Machine

POSITRON EMISSION TOMOGRAPHY (PET)

- It is a radiological procedure used for finding particular types of tissues in the body and studying its metabolism.
- It is often combine with a CT scan or MRI.
- It also produces 3 dimensional scan of the organ in question.

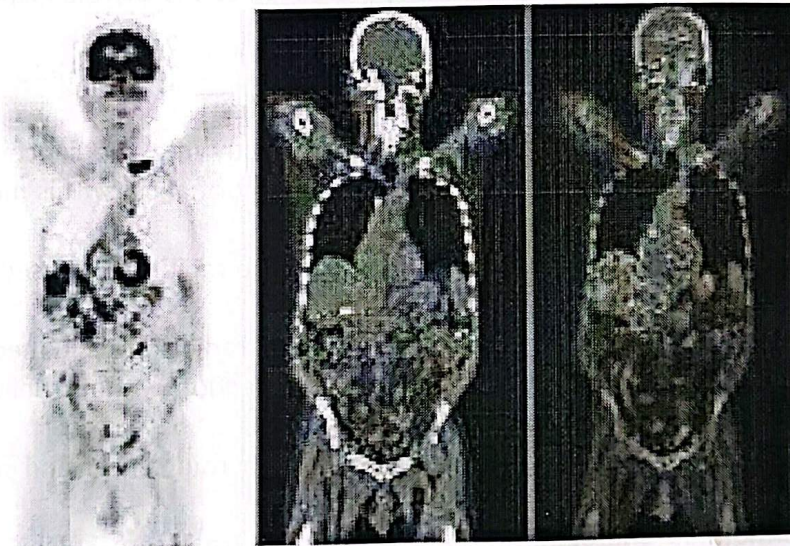


Fig. 15.5 PET images

SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY (SPECT)

- Single photon emission computed tomography (or less commonly called SPECT) analyzes the function of some internal organs.
- It is a special type of imaging test which utilizes a radioactive substances to produce images representing slices through the body in different planes.
- SPECT images are functional in nature rather than being purely anatomical such as ultrasound, computed tomography and magnetic resonance imaging.

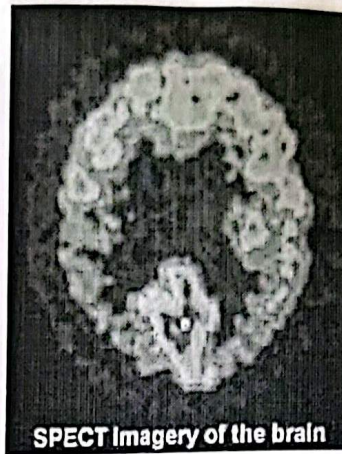


Fig. 15.6 SPECT image of the brain

RADIOISOTOPE SCAN

- This is also known as the nuclear medicine test.
- It is a two-dimensional representation of the gamma rays emitted by a radioisotope showing its concentration in a body sites such as the thyroid gland, brain or kidneys, etc.
- It works by injecting a tiny amount of the radioisotope into a vein (sometimes breathed in, or swallowed, depending on the test).
- Radioisotope therapy delivers radiation directly into the cancer cells. Cancer cells absorb the radioactive substance more than normal cells. This means they receive a higher dose of radiation, causing them to die.
- There are different types of radionuclides. The radionuclide used depends on which part of the body is to be scanned.
- **Technetium-99m** is the most commonly used radioisotope in medicine. It is ideal for imaging organs of the body for disease detection without delivering a significant radiation dose to the patient.
- **Iodine-131** is used to treat certain types of thyroid cancer and some rarer types of cancer.
- **Strontium-89 and samarium -153** is used to treat some types of secondary bone cancers. They can help reduce pain.
- **Radium-223** is a new radioisotope therapy that is used to treat secondary bone cancers

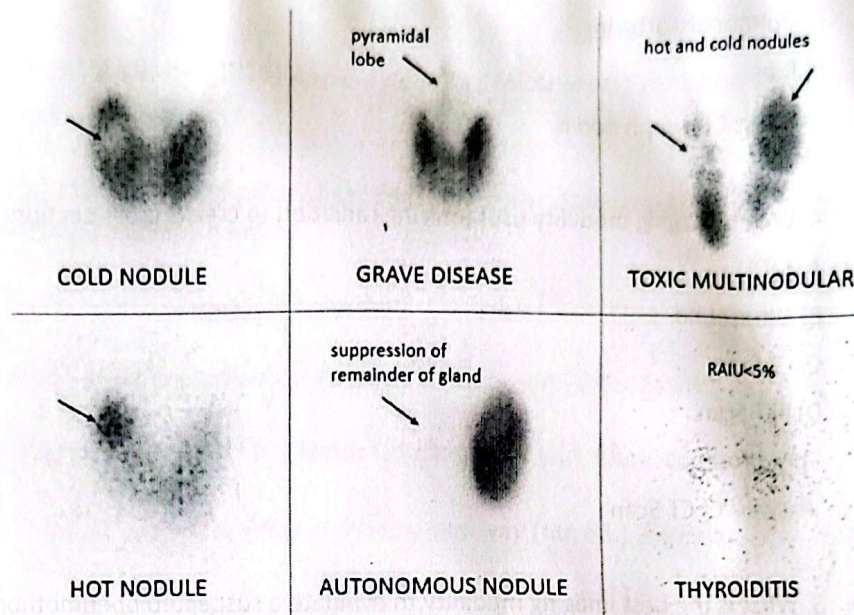


Fig. 15.7 Image of a thyroid scan

MCQ (1 in 5)

1. Which imaging modality is most appropriate for visualizing soft tissue detail in the brain?

- A) X-ray
- B) Ultrasound
- C) MRI
- D) CT Scan
- E) PET Scan

Answer: C) MRI

2. On a lateral X-ray of the cervical spine, what is the most anterior vertebral structure visible?

- A) Spinous process
- B) Lamina
- C) Pedicle
- D) Vertebral body
- E) Transverse process

Answer: D) Vertebral body

3. Which structure is not typically visible on a standard chest X-ray?

- A) Aortic arch
- B) Diaphragm
- C) Lymph nodes

D) Pulmonary arteries

E) Ribs

Answer: C) Lymph nodes

4. Which imaging modality uses ionizing radiation to create cross-sectional images of the body?

A) MRI

B) Ultrasound

C) CT Scan

D) PET Scan

E) Fluoroscopy

Answer: C) CT Scan

5. What is the best imaging modality to evaluate a suspected pneumothorax?

A) MRI

B) Ultrasound

C) Chest X-ray

D) Bone Scan

E) Angiography

Answer: C) Chest X-ray

Short Answer Questions (SAQ)

1. What radiological modality is most sensitive for detecting acute brain hemorrhage?

Answer: CT Scan (Computed Tomography)

2. Name two common indications for performing a chest X-ray.

Answer: Pneumonia, Pleural effusion (other answers could include pneumothorax, heart failure, trauma, etc.)

3. How can you differentiate between the left and right sides of the diaphragm on a chest X-ray?

Answer: The right hemidiaphragm is usually higher than the left due to the liver; the left hemidiaphragm may have a gastric bubble (air under the diaphragm).

4. Which imaging modality is ideal for evaluating ligament injuries in the knee?

Answer: MRI (Magnetic Resonance Imaging)

5. Which part of the gastrointestinal tract is best visualized with a barium enema?

Answer: Colon (large intestine)

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