Chest X- Ray, Computed Tomography(CT) & MRI

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1- Chest X- Ray(CXR)

Outlines:-

1. Definition of Chest X- Ray.
2. Indications of Chest X- Ray.
3. Contraindications.
4- Inferior factors.
5- Common views.
6-Procedure.
7- Nursing Responsibilities of Chest X-Ray.
8-Normal Results & Abnormal Results.

Definition of Chest X- Ray:

- A chest X-ray (CXR) is a widely used diagnostic imaging technique that produces images of the chest, including the lungs, heart, airways, blood vessels, and surrounding bones.
- It is non-invasive, quick, and provides valuable information for diagnosing and monitoring a variety of medical conditions.

Indications of Chest X-Ray:

- **Diagnostic Purposes:**
  - Suspected lung infections (e.g., pneumonia, tuberculosis).
  - Chronic respiratory conditions (e.g., Chronic Obstructive Pulmonary Disease(COPD), asthma).
  - Suspicion of pulmonary embolism.

- Detection of heart enlargement or heart failure.

➢ **Trauma Assessment:**

- Evaluation of rib fractures, pneumothorax, or hemothorax.

➢ **Preoperative Assessment:**

- To assess lung and heart health before surgery.

➢ **Monitoring:**

- Response to treatment in respiratory diseases.
- Follow-up for known conditions (e.g., cancer, pleural effusion).

Contraindications:

- **Pregnancy:** Avoided unless absolutely necessary due to potential harm to the fetus.
- **Severe Obesity:** May interfere with image clarity.
- **Inability to Stay Still:** Patients unable to hold their breath or remain still might affect image quality.

☒ **Limitations of Chest X Ray(CXR):**

- **Radiation Exposure:** Though minimal, repeated exposure may pose risks.
- **Limited Soft Tissue Visualization:** Cannot provide detailed images of soft tissues or small lesions.
- **Overlapping Structures:** Superimposed organs can obscure findings.
- **Dependent on Technician Expertise:** Poor positioning may result in inaccurate interpretation.

❖ **Common Views:**

- **Posteroanterior (PA) View:** Standard view with the patient standing and chest against the film.
- **Anteroposterior (AP) View:** Used in bed-bound or critically ill patients.
- **Lateral View:** Provides side images for better depth perception.
- **Decubitus View:** For detecting pleural effusions or air trapping.
- **Lordotic View:** Focuses on the upper lobes and apices of the lungs.

☒ **Procedure:**

➢ **Patient preparation:**

- Remove jewelry, clothing, or items that may obstruct the image.
- Explain the process and ensure patient comfort.

➢ **Positioning:**

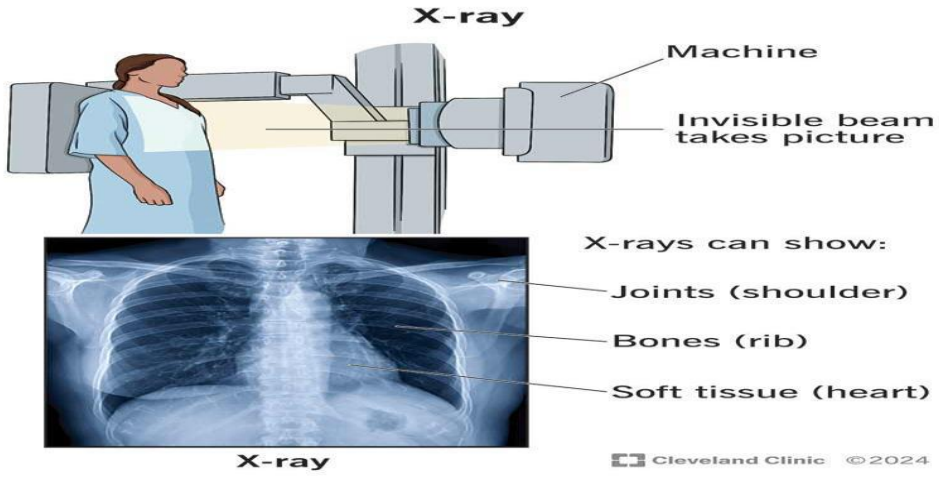
- Depending on the view, the patient is positioned upright, supine, or in a lateral decubitus position.
- Ensure proper alignment of the chest with the X-ray detector.

➢ **Imaging:**

- Patient instructed to hold their breath to avoid motion artifacts.

➢ **Completion:**

- Images are reviewed for clarity and correctness.



Nursing Responsibilities for Chest X-Ray:

➢ **Pre-procedure:**

✓ Educate the patient about the procedure and obtain consent.

✓ Verify the absence of pregnancy or metallic objects.

✓ Position the patient correctly.

➢ **During the procedure:**

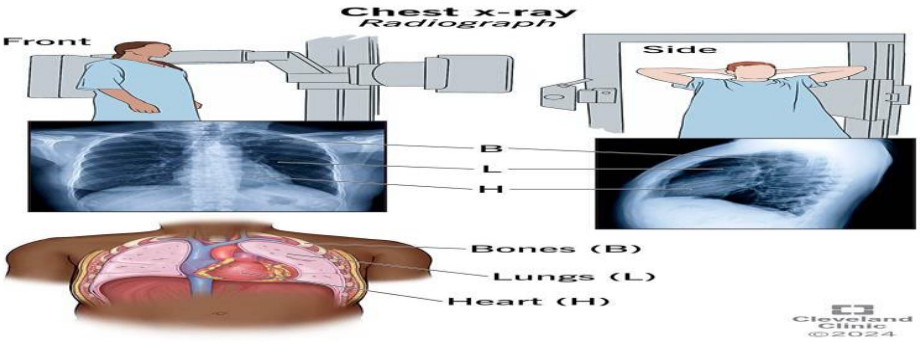
➢ Assist with positioning and ensure patient cooperation.

➢ ·Provide reassurance and support.

➢ **Post-procedure:**

✓ Monitor for discomfort, especially in patients with injuries.

✓ Document the procedure and report findings to the physician.



➢ **Normal Results:**

- **Lungs:** Clear, no signs of fluid, mass, or infection.
- **Heart:** Normal size and shape.
- **Bones:** No fractures or deformities.
- **Diaphragm:** Well-defined with normal contours.

➢ **Abnormal Results:**

- **Lung Abnormalities:**

· Infections (e.g., pneumonia, tuberculosis).

· Tumors or nodules.

· Collapsed lung (pneumothorax).

· Fluid accumulation (pleural effusion).

- **Cardiac Abnormalities:**

· Enlarged heart (cardiomegaly).

· Pulmonary edema.

- **Bone Abnormalities:** Fractures or metastasis.
- **Other Findings:** Foreign bodies.

· Air in abnormal locations (subcutaneous emphysema).

2- Computed Tomography (CT)

Outlines:

- Introduction
- Definition of CT
- Indication Of CT
- Contraindication Of CT
- Definition of MRI
- Principle Of MRI
- Indication Of MRI
- Contraindication Of MRI
- Advantage and disadvantage.

Introduction:

✓ **COMPUTED TOMOGRAPHY (CT)** is a diagnostic imaging procedure that uses x-rays to build cross-sectional images (slices) of the body. Cross-sections are reconstructed from measurements of x-ray beams in the volume of the object studied,

✓ CT is based on the fundamental principle that the density of the tissue passed by the x-ray beam can be measured.

✓ **COMPUTED TOMOGRAPHY):**

Tomo= slice

Graphy= to write

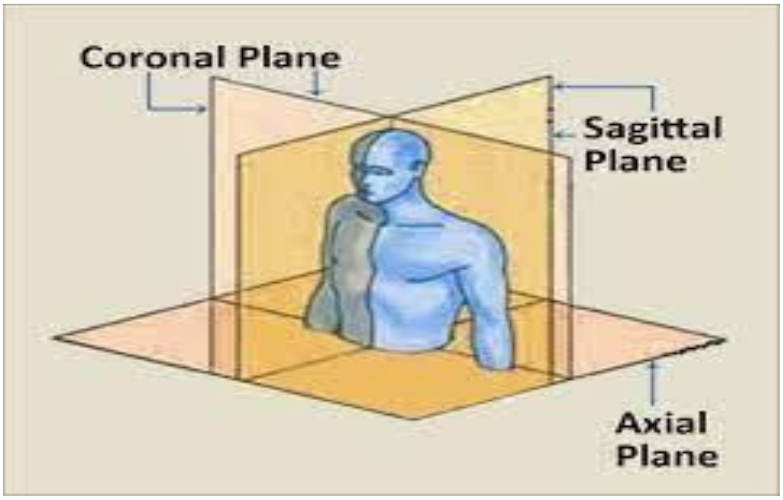
✓ **Tomography**= imaging of an object by analyzing its **slices.**

WHAT IS COMPUTED TOMOGRAPHY?

1- Computed Tomography (CT) is a high-resolution technique using X-ray technology to generate images of any area of the body (in the form of slices).

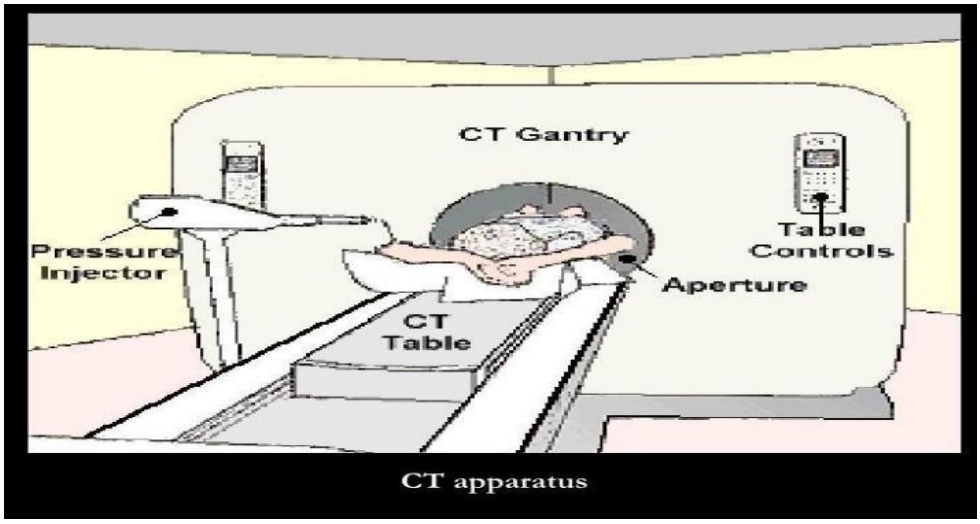
2- Images can be viewed in any anatomical plain.

a) Axial
b) Coronal
c) *Sagittal*
d) reconstructed into three dimensional images (3d)**.**



3- All body structures can be visualized and this can be enhanced with the use of intravenous iodinated contrast medium, to differentiated pathological lesions according to their enhancement pattern

4- It's important to do renal function test before doing CT with contrast.



Indications for computed tomography:

(I) Emergencies including:

1. Head trauma

a. Ct is best modality to detect.

b. Acute bleeding.

c. Skull fracture.

2. Stroke:

a. Differentiate between ischemic from hemorrhagic stroke.

3. Polytrauma Solid organ injury & acute hemorrhage.

4. Bone fracture.

5. Intra-abdominal conditions as:

1- Solid organ focal lesion (Hepatic, renal & spleen).

2- Different abdominal masses.

3- Intestinal obstruction.

4- Biliary obstruction.

5- Inflammatory conditions.

6- Acute vascular conditions as aneurysm.

- **Chest CT:**

1. Standard imaging modality COVID-19.
2. Pneumonia.
3. Chest trauma.
4. Lung masses.
5. Mediastinal & Lung masses.
6. Pleural diseases (Pneumothorax or hemothorax).

Contraindications of Plain CT:

•Early pregnancy.

•Children, since they are more radio-sensitive except if highly indicated.

Contraindication of CTwith contrast:

1. Allergy to contrast.
2. History of diabetes, kidney disease, solitary kidney, or prior kidney or other transplant.
3. Current use of any metformin-containing medications (oral hypoglycemic).
4. Hyperthyroidism or goiter may be a contraindication to the use of IVCM, as it can induce thyrotoxic crisis in these patients.
5. Pregnant women.

IMAGE RECONSTRUCTION

We can obtain 3D image (or colored images) from CT as in:

- ✓ CT angiography.
- ✓ CT endoscopy.
- ✓ CT in polytrauma.
- ✓ CTmyocardial perfusion.

Preparation for*CT with Contrast*:

Before CT with Contrast:

- Ask about Previous reactions to iodinated contrast media.
- Ask about allergies and reactions (medication and food).
- History of diabetes, kidney disease, solitary kidney, or prior kidney or other transplant.
- History of hypertension requiring medication.
- For women of child-bearing age, if they are or may be pregnant or if they are breast-feeding.
- Patient's Consent is signed.
- Prepare creatinine level result.
- Ensure that the patient is fasting 4-6 hours before procedure.
- Remove any metals or gold.
- Insert a wide cannula.
- Explain procedure to the patient.

During CT with Contrast:

1. Explain procedure to patient.
2. Check orders for contrast administration.
3. Verify the five rights (right patient, right medication, right dose, right route, right time).
4. Before beginning injection, explains that Transient minor reactions such as warm flushing and altered sense may occur and reassures the patient.
5. Check IV catheter patency flushing with 0.9% N.S. If there is resistance, pain, or the catheter does not flush, do not proceed.

After **CT with Contrast**:

●After of the injection and completing procedure the catheter is flushed with 10cc 0.9% normal saline, and the IV site is inspected for any swelling or indication of extravasations.

- The patient is observed for any indications of contrast reaction throughout the administrative process.

  - ✓ **Side effects of contrast dye**: Headache, sneezing, nausea, vomiting, and swelling.

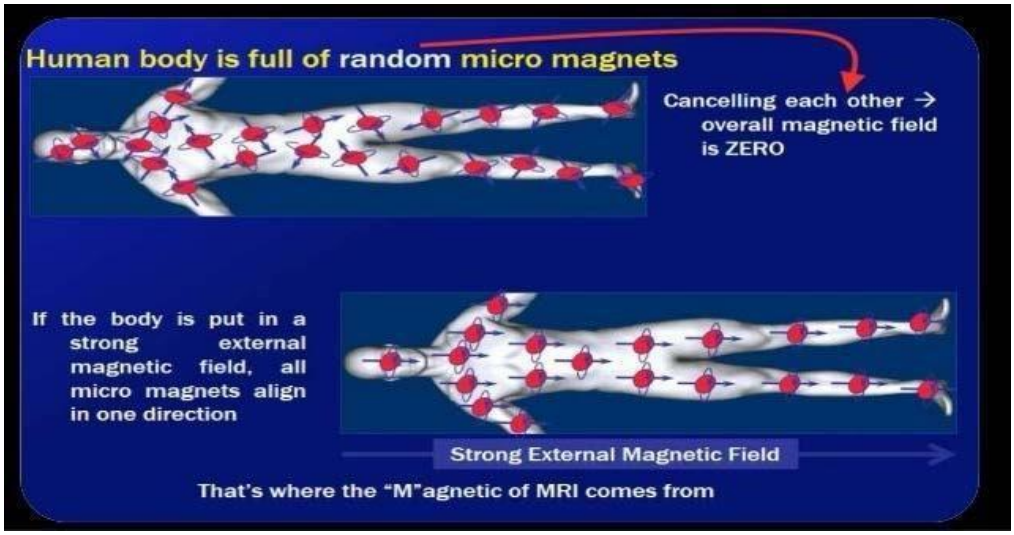
3-Magnetic resonance imaging (MRI)

Introduction:

- MRI explores inherent magnetism in our bodies to create images.
- It is based on a huge magnet with very powerful magnetic field.
- Hydrogen atoms in water and fat are the main source of signal and contrast. MRI is contra-indicated in patients with pacemakers, or old metallic implants.

Principle:

- ✓ MRI is a medical technique used in radiology to form pictures of anatomy & physiological processes of the body.
- ✓ MRI scanner used strong magnetic fields ➔magnetic & radio waves ➔Images
- ✓ MRI is based on magnetizing properties of atomic nuclei using uniform external magnetic field.



Indications:

1- MRI is particularly well suited to image soft tissue of the body.

2- MRI provides information that differs from other imaging modalities.

It can characterize and discriminate tissues using their physical and biochemical properties.

Contraindication Of MRI:

- in patients with Metallic prosthesis.
- Aneurysm clips.
- Cardiac pacemakers .

- Metallic foreign bodies in the orbits.
- New implants are now made from MRI compatible alloys (possess no magnetic properties) & If you know the model and name of the implant you can search if it is MRI compatible or not.

Advantages of MRI:

1. Main advantage over CT or X-ray: No ionizing radiation Could be repeated, and suitable for follow up.
2. Second advantage over CT: Better soft tissue resolution: Can detect pathologies in the soft tissue not seen by CT. (Brain, spinal cord, tendons, muscles, and other organs).

Disadvantages of MRI compared to CT:

1- Less reliable in detection of calcification.
2- Less reliable in acute cerebral hemorrhage.
3- Expensive & time consuming.

❖ Nursing role with MRI:

- Assess the patient for any contraindications such as: Implanted devices (particularly those that contain iron), such as pacemakers, o Internal metal, such as bullets, surgical clips, pins, metal sutures.
- If the patient requires life support such as a mechanical ventilator, call the MRI staff prior to the scan to ensure all necessary equipment is set up outside of the room.
- Confirm that the informed consent has been signed and is placed in the patient's medical record.
- Verify with the MRI staff that the scanner can accommodate the patient's size and weight.
- Note all allergies.
- Patients with claustrophobia may experience anxiety and may not tolerate long scan times inside a closed tube system. o Assist the patient with visualization techniques. Provide sedation as ordered.
- Play music to help calm the patient.
- An open MRI machine does not completely surround the patient; that may be an option.
- Remove metal objects from the patient's body such as hearing aids, dentures, jewelry, body piercings, eyeglasses, and hairpins.

- **Educate the patient and family that:**
- MRIs don’t cause pain.
- X-rays and ionizing radiation aren’t used with MRI.
- Fasting is not required prior to the MRI unless the abdomen or pelvis is being scanned.
- The patient should remain as still as possible during the procedure.
- Warn the patient that the scanner will make loud sounds such as scanner clicking and thumping (up to 120 decibels). Earplugs or music headsets should be provided to reduce the noise.
- Tell the patient that communication with the MRI technician will be always available during the scan and that a button will be provided to alert the technician if they should require immediate attention.
- Scanning may take 30 to 90 minutes.
- MRIs are more expensive than x-rays or CT scanning.