As Easy as Black and White – CXR Interpretation

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Chest x-ray basics

Technique

Black & white principles

1. White color indicates lack of exposure and black color indicates intense exposure.
2. Dense substances absorb all the rays and appear white on the film -- radiopaque
3. Soft tissues and air absorb part of the beam and appear gray (tissues) or black (air) – radiolucent

Whitest	Off White/Gray	Blackest
• Bone: Ribs, Sternum, Spine, Clavicle • Barium • Calcium Deposits • Prosthetic valves • Surgical wires, clips	• Fluid • Blood • Heart • Veins/arteries • Aorta • Skin/fat	• Air • Lungs • Trachea • Stomach • Bowel

Systematic Approach

Bone Structures

1. Is the entire thorax visible? 9 – 10 posterior ribs should be visible
2. Shape of the thorax – emphysema, polio, scoliosis?
3. Any rib fractures?

Intercostal Spaces

1. Note width and angle
2. Wide or narrow?

Soft tissues

1. Check neck and axilla for SQ emphysema, hematomas, tumors
2. Large breast tissue may obscure lung field to some extent

Lungs/Trachea/pulmonary vasculature

1. Check expansion of lungs
2. Is the entire thorax visible?
3. Is the trachea deviated?
4. Carina (where trachea divides into right and left bronchus) should be visible with slightly blacker outline over the lung fields themselves.
5. The lungs are radiolucent with traces of gray linear marking which are blood vessels
6. Hilia: pulmonary arteries and veins. Left helium appears smaller and higher than the right

Clinical findings:

Pleural effusion: an upright CXR will ensure that fluid levels will drop to the bottom of the cavity. Fluid levels taken on a patient lying will displace the fluid laterally over the cavity and will therefore not be detected as a distinct line

Pulmonary edema: The white linear markings of the vessels will be enlarged all over the lung fields and will appear as marked prominent vasculature.

Pulmonary embolism, infarction*:* Will appear as a white distinct narrow shaped wedge, fanning out to the periphery of the lung.

Atelectasis: Causes densities (white areas) of the lobes but usually not symmetrical changes in each lung field.

Pleural Surfaces

1. Pleural is only able to be identified if separated from the thoracic lining by fluid or air

Small pneumothorax – veil like line evident below the thoracic cage beyond which there are no lung markings.

Large pneumothorax – Black area over entire lung field with no lung markings evident.

Diaphragm

1. Diaphragm is normally rounded and concave (domeshaped)
2. The right hemidiaphragm is usually higher by 1 – 2 cm than the left due to the liver.
3. Costophrenic angles are very sharp acute angles formed by the water density of the diaphragm and chest wall
4. Normal diaphragm elevations occur with obesity, pregnancy, pain, bowel obstruction
5. Flatten diaphragms are indicative of emphysema
6. Unilateral diaphragm changes are indicative of abdominal organ distention or paralysis

Mediastinum

1. Check for mediastinal shifts
2. Check for increasing shadows from tamponade, aneurysms, tumors

Heart and great vessels

1. Check size. The heart should be < 50% of the Cardiothoricic ratio (CTR)
2. CTR = Horizontal width of the heart/widest thoracic interval
3. Check aortic arch for aneurysm
4. Check for prosthetic valves

Invasive Lines

1. ET tube: Correct placement is usually 4-5 cm above the carina but can be 2 – 8cm above carina
2. Trach tubes: Position
3. Nasogastric tubes: Thin radiopaque line down in the esophagus to the stomach. Tip and side holes should be 10 cm into the stomach
4. Central venous line: Tip should be in right atrium
5. Swan ganz catheter: Tip should be in pulmonary artery and no more than 2 - 4 cm beyond the vertebral midline.
6. Pacemaker: Look for point of origin, location of wires – transvenous, epicardial, or permanent , generator. Atrial lead should be in the right atrium, ventricular lead in the right ventricle.
7. Prosthesis: Valves, bone pinnings,
8. Sutures: Clips, metal rings, wire sutures
9. Chest tubes: Location – inserted high in apex for pneumothorax, low in bases for effusions or hemothorax.
10. Intraaortic Balloon Catheter: Tip should be in the aorta ~ 2 cm below the aortic arch
11. Foreign bodies --- bullets, inhaled objects, swallowed objects, safety pins, hemostats