Chest X-Ray Interpretation

**1. Decide if the CXR quality is suitable for interpretation:**
- **ID, Date**: Make sure you have the right CXR. Know when the X-ray was taken, to compare sequential CXRs for the pt.
- **Imaging technique: AP or PA?**
  - Assume PA unless told otherwise.
  - PA: clavicles usually moreymore V-shaped.
  - AP: clavicles usually more horizontal.
  - In babies, AP view is common.
  - Only assess heart size on PA view (AP projection artificially magnifies heart).
- **Rotation/Centering**
  - CXR is centered when spinous processes are midway between clavicular ends.
  - If not centered, normal anatomy can be misinterpreted (i.e. tracheal shifts).
- **Adequate inspiration? Count Ribs!**
  - Good = 8-10 posterior ribs visible above diaphragm (Remember: ribs 1+2 overlap)
  - Inadequate inspiration can be misinterpreted (i.e. as interstitial lung disease)
- **Adequate exposure?**
  - Exposure adequate when intervertebral discs can be just barely seen through the cardiac shadow (can adjust digitally).
  - Under-exposure creates abnormal whiteness on CXR; over-exposure (x-ray darkening) may hide pathologies.

**2. Analyze Frontal (PA/AP) CXR:**
- **Symmetry**: are findings similar on both left and right sides?
- **Bones (inspect while counting ribs)**: Inspect for fractures, lesions (lucencies or densities in the bone), or rib notching (small grooves along the edges of the ribs, suggestive of aortic coarctation).
- **Pleura**: Assess for any pleural lines (suggestive of pneumothorax), masses, thickening, or calcification.
- **Trachea**: Find air column, check for tracheal deviation (Tension pneumothorax or pleural effusion).
- **Hilum**: Contains 1) pulmonary arteries/veins, 2) main-stem bronchi, 3) lymph nodes.
- **Heart**: Size (normal cardiothoracic ratio <0.5 on PA film), shape, and location within mediastinum.

**Lung fields - Assess:**
- Degree of whiteness
- Equivalency between right and left sides
- Opacifications/Infiltrates
- Presence of Kerley A/B lines
- Lung apices (above clavicles).
- Vasculature (size, position, and whether vascular markings run to the lung periphery)

**If infiltrates present, note pattern:**
- Lobar, cloud-like densities with air-bronchograms: alveolar/air-space disease (aka consolidation); suggests pus (i.e. pneumonia), blood, water, cells, or protein within alveoli.

**Costo-phrenic angles**
- Blunted = pleural effusion >200-400mL.
- Wide = flat diaphragm; suggests air trapping due to obstructive lung diseases.

**Hemi-Diaphragms (Right and Left)**
- If flat: COPD, asthma exacerbation, foreign body
- Air under R hemidiaphragm: perforated viscous

**Cardiac Shadows (Right and Left):**
- R cardiac shadow = R atrium.
- L cardiac shadow (top to bottom) = aortic arch, L pulmonary artery, L ventricle.
- Assess contour, shape, size, and location.
- White blurring of any cardiac border suggests airspace disease of upper or middle lung lobes.

**Cardio-phrenic angles**
- Blunted = tumor masses (lymphoma, other mediastinal tumors), pericardial fat, pericardial cysts, cardiophrenic space varices, diaphragmatic hernia.

**Key References:**
3. Analyze lateral CXR projection:

- The retro-cardiac space is blocked from view in the frontal projection. Lateral projections can visualize this hidden anatomy, and is also a better reflection of total lung volume.

Retrosternal Clear Space:
- If opacified, consider “4 Ts” (in order of commonality in adults):
  1) Thymoma, 2) Terrible lymphoma, 3) Teratoma, 4) Thyroid tumor

Mediastinum:
- Note posterior para-tracheal tissue line between the anterior trachea & the posterior esophagus (between white arrowheads): if <3mm, can rule out lymphadenopathy.

Hilum:
- Look for changes (enlargement, shifts, asymmetries) in pulmonary vessels, main-stem bronchi, and lymph nodes.
- Extra opacification around pulmonary vessels and bronchi = hilar lymphadenopathy

Spinal column:
- Assess vertebral bodies for densities and abnormal shapes or compressions.
- Assess intervertebral disc spaces: if not well-defined, may indicate discitis.
- Assess neural foramina (holes between vertebral processes). If enlarged: likely tumor or cyst. If narrowed: likely bony enlargement impinging on spinal nerves.

Clear space posterior to heart:
- If opacified: consolidation, atelectasis, enlarged vessels, masses, or hiatus hernias.

Diaphragm:
- Flat if height above anterior-posterior costophrenic angle “line” is <2.7cm
- Flat diaphragm = lung hyperinflation due to airway obstruction (asthma, COPD).

Costo-phrenic angles
- Small pleural effusions best picked up with lateral projection (most commonly due to congestive heart failure).

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4. Important notes to keep in mind:

- Findings that require immediate attention:
  - Tracheal Shift: may indicate tension pneumothorax on the side opposite to the tracheal shift. If suspected on Hx/exam, don’t do CXR; immediately decompress.
  - Free air under R hemi-diaphragm: bowel perforation, urgent surgery consult needed. (Note that air under L hemi-diaphragm is usually the gastric bubble)
  - Massive cavitations & infiltrates, especially in upper lobes, in the context of cough & fever: suspect active tuberculosis, isolate patient and work up to establish diagnosis.
  - Complete white-out of lung fields: severe pulmonary edema, stabilize and transport for definitive ER/ICU care.

- Most common CXR false-negatives (real findings that were not detected):
  - Airspace disease (i.e. consolidation)
  - Apical and retro-cardiac densities
  - Solitary pulmonary nodules
  - Mediastinal widening
  - Cardiomegaly, changes in heart contour

- Ask for previous CXRs to track CXR changes, especially to monitor solitary pulmonary nodules for any changes.

- Lower lung lobes can normally appear to be opacified by both breast and fatty tissue.

Other CXR types/views:
- An AP frontal CXR is done for pts who can’t stand (i.e. quite ill, babies), and when a portable CXR is needed. Note that the AP view 1) magnifies the heart and 2) may shrink apparent lung volume.

- Expiratory View is done to accentuate:
  - Air trapping: localize area of obstruction
  - Pneumothorax
  - Do not confuse expiratory views for pulmonary vasculature congestion, restrictive lung disease, or pneumonia.

- Right: Normal PA CXR
- Far Right: same patient, expiratory CXR


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