Chest Radiography Interpretation: Reading Chest Films

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Approach to the CXR: Technical Aspects

- Inspiratory effort
  - 9-10 posterior ribs

- Penetration
  - Thoracic intervertebral disc space just visible

- Positioning/rotation
  - Medial clavicle heads equidistant to spinous process
Low Lung Volumes
Over Exposure

Proper Exposure
What to Evaluate

- Lungs
- Pleural surfaces
- Cardiomedialastinal contours
- Bones and soft tissues
- Abdomen
Where to Look

- Apices
- Retrocardiac areas (left and right)
- Below diaphragm
Apical TB
Normal Anatomy: Frontal CXR

- Heart
- Aorta
- Pulmonary arteries
- Airways
- Diaphragm/costophrenic sulci
- Junction lines
Normal Anatomy: Lateral

- Heart
- Aorta
- Pulmonary arteries
- Airways
- Spine
Chest Radiography: Basic Principles

- **X-ray photon fates:**
  - completely absorbed in patient
  - transmitted through patient; strike film
  - scattered within patient; strike film

- **X-ray absorption depends on:**
  - beam energy (constant)
  - tissue density
Blackest
air
fat
soft tissue
calcium
bone
x-ray contrast
metal
Whitest

Maximum x-ray
Transmission (least dense tissue)

Maximum x-ray Absorption (densest tissue)
Chest Radiography: Basic Principles

- All cardiothoracic pathology and normal anatomy is visualized (or not) by 7 different densities.
- How is this accomplished?
  - Differential x-ray absorption.
A structure is rendered visible on a radiograph by the juxtaposition of two different densities.
Silhouette Sign

- Loss of the expected interface normally created by juxtaposition of two structures of different density
- No boundary can be seen between two structures of similar density
Right Lower Lobe Pneumonia
Differential X-Ray Absorption

- The absence of a normal interface may indicate disease;
- The presence of an unexpected interface may also indicate disease;
- The presence of interfaces can be used to localize abnormalities.
Chest Radiographic Patterns of Disease

- Air space opacity
- Interstitial opacity
- Nodules and masses
- Lymphadenopathy
- Cysts and cavities
- Lung volumes
- Pleural diseases
Bone and soft tissue abnormalities

- Cardiomeediastinal contour abnormalities
- Bone and soft tissue abnormalities
- Below the diaphragm: abdominal and retroperitoneal disease
Air Space Opacity

**Components:**
- Air bronchogram: air-filled bronchus surrounded by airless lung
- Confluent opacity extending to pleural surfaces
- Segmental distribution
Air Space Opacity: DDX

- Blood (hemorrhage)
- Pus (pneumonia)
- Water (edema)
  - hydrostatic or non-cardiogenic
- Cells (tumor)
- Protein/fat: alveolar proteinosis and lipoid pneumonia
LUL Pneumonia
Interstitial Opacity

- **Hallmarks:**
  - Small, well-defined nodules
  - Interlobular septal thickening
  - Fibrosis
  - Reticulation
Interstitial Opacity: Small Nodules
Interstitial Opacity: Lines
Interstitial Opacity: Lines & Reticulation
Interstitial Opacity: DDX

- Idiopathic interstitial pneumonias
- Infections (TB, viruses)
- Edema
  - Hemorrhage
- Non–infectious inflammatory lesions
  - Sarcoidosis
- Tumor
Nodules and Masses

- **Nodule**: any pulmonary lesion represented in a radiograph by a sharply defined, discrete, nearly circular opacity 2-30 mm in diameter.

- **Mass**: larger than 3 cm.
Nodules and Masses

- **Qualifiers:**
  - single or multiple
  - size
  - border definition
  - presence or absence of calcification
  - location
Lymphadenopathy

- **Non-specific presentations:**
  - mediastinal widening
  - hilar prominence
- **Specific patterns:**
  - particular station enlargement
Right Paratracheal Lymphadenopathy
Cysts & Cavities

- Cyst: abnormal pulmonary parenchymal space, not containing lung but filled with air and/or fluid, congenital or acquired, with a wall thickness greater than 1 mm
  - epithelial lining often present
Cysts & Cavities

- **Cavity:** abnormal pulmonary parenchymal space, not containing lung but filled with air and/or fluid, caused by tissue necrosis, with a definitive wall greater than 1 mm in thickness and comprised of inflammatory and/or neoplastic elements.
Cysts & Cavities

- Characterize:
  - wall thickness at thickest portion
  - inner lining
  - presence/absence of air/fluid level
  - number and location
Benign Lung Cyst: *PCP* Pneumatocele

- Uniform wall thickness
- 1 mm
- Smooth inner lining
Benign Cavities:
Cryptococcus

- max wall thickness ≤4 mm
- minimally irregular inner lining
Indeterminate Cavities

- max wall thickness 5-15 mm
- mildly irregular inner lining
Malignant Cavities: Squamous Cell Ca

- max wall thickness ≥16 mm
- Irregular inner lining
Pleural Disease: Basic Patterns

- **Effusion**
  - angle blunting to massive
  - mobility
- **Thickening**
  - distortion, no mobility
- **Mass**
- **Air**
- **Calcification**
Pleural Effusion
Pleural Calcification