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
What to Evaluate

- Lungs
- Pleural surfaces
- Cardiomedialstinal 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
Maximum x-ray transmission (least dense tissue)

Maximum x-ray absorption (densest tissue)

Blackest
- air
- fat
- soft tissue
- calcium
- bone
- x-ray contrast
- metal

Whitest
All cardiothoracic pathology and normal anatomy is visualized (or not) by 7 different densities. How is this accomplished? Differential x-ray absorption.
Differential X-Ray Absorption

- A structure is rendered visible on a radiograph by the juxtaposition of two different densities
Silhouetted 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
Chest Radiographic Patterns of Disease

- Cardiomedial 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
  - lines
    - interlobular septal thickening
    - fibrosis
  - reticulation
Interstial 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
Subcarinal LAN
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
• 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 $\geq 16$ mm
- Irregular inner lining
Pleural Disease: Basic Patterns

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