Chapter 10
Clinical Application of the Chest Radiograph

Overview

- Physics related to radiographs
- Standard and special views
- Techniques for interpreting the chest film
- Common pathologic abnormalities seen on chest x-ray films

Production of the Radiograph

- X-rays: _______ _______ that radiate from a tube that an electric current has passed through
- Tube made of a cathode attached to low-voltage electron source (transformer)
- End of cathode wire is inside the vacuum-sealed tube
- As electrons flow through the wire they strike the anode
Indications for CXR Examination

- Detecting alterations of the lung caused by
- Determining the appropriate________
- Evaluating the________of treatment
- Determining the position of tubes and catheters
- Observing the progression of________

Radiographic Views

- Standard views
  - __________
  - __________
- Special views
  - __________
  - __________
  - __________
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Anteroposterior View

- Film cassette placed __________
- X-ray beam moves from __________ (anterior to posterior) 4 feet from beam’s origin
  - More magnification artifact than PA chest x-ray

Anteroposterior View (cont’d)

- Indications for AP portable films
  - ________________
  - ________________
  - ________________
  - ________________

Postprocedural CXR Evaluation

- ________________
  - Thin radiopaque strip along entire length of ETT
  - Inferior tip of ETT ____ ____ cm above the carina
  - Accidental placement in right mainstem or esophagus must be recognized
    - ________________
    - ________________
    - ________________
Postprocedural CXR Evaluation (cont’d)

- Placed in R or L subclavian vein or jugular vein
- Tip just above confluence of SVC and RA
- Accidental lung puncture must be recognized
  - AP chest film required before initiating fluid therapy
Postprocedural CXR Evaluation (cont’d)

- Tip at the right midlung near the hilum
- Catheter is sutured into place if chest film demonstrates proper position of catheter tip
- Accidental rupture of inflatatable balloon may rupture pulmonary artery
  - Area of pulmonary infarction on CXR

Postprocedural CXR Evaluation (cont’d)

- Ensure tip placed at the
- Chest films to recognize misplacement
  - 
  - 
  - 

Postprocedural CXR Evaluation (cont’d)

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Postprocedural CXR Evaluation (cont’d)

- To drain excess ___________ or ___________ from the pleural cavity
- Tip of the tube should be posterior and near the apex of lung so drainage can occur
- Periodic portable CXRs to ensure tube’s ___________ 

Procedures Requiring Evaluation with an AP Portable Film

- ___________
- ___________
- ___________
  - After transtracheal biopsy or needle aspiration
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Computed Tomography

- Mathematical modeling of tissues
  - Beams pass through tissue
  - Slice of body equivalent to a slice of bread
- __________________________

Computed Tomography (cont’d)

- Lung tumors
  - Differentiate __________________________
  - As small as 2 to 3 mm
- __________________________

- Superior to conventional CXR
- AIDS
  - Early detection of pneumonias, abscesses, and cavities

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Computed Tomography (cont’d)

- **Lung disease**
  - Parenchymal and pleural changes
  - Pleural plaques in asbestosis
- **Cost has restricted its use for pneumonias**
- **Remarkable clarity and detail**

Magnetic Resonance Imaging

- Superior to CT scan in:
  - Evaluating ________ and ________ masses
  - Differentiating lymph node enlargement from enlarged blood vessels
  - Evaluating ____________________

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Radionuclide Lung Scanning

- Radiation emitted from the chest after radiopharmaceuticals injected into the bloodstream and inhaled into the lung
- Evaluation of suspected abnormalities
  - Normal ventilation and abnormal perfusion
- Pneumonia and atelectasis

Positron Emission Tomography

- Also called PET scan
- Determines metabolic activity of tissues
- Tumors and areas of infection have high metabolic activity = _____
- Evaluation of ________
Pulmonary Angiography

- To evaluate ______________________
- Performed after V/Q lung scanning is ______________________
- Injection of contrast medium into ______________________
- CT angiography has reduced frequency of conventional angiography
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Evaluation of the Chest Radiograph

- Recognition of __________
- Review clinical findings before viewing CXR
- Placing the chest film
  - Patient facing clinician
  - __________ more prominent on the left side

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Determine Quality of the Film

- Visualize vertebral bodies through cardiac shadow
  - If easily seen:
- Spinous processes to medial ends of clavicles
- Degree of patient’s __________ effort
  - 10 posterior ribs on PA film

Interpretation

- X-ray penetration inversely proportional to density of structure
- Normal lung tissue has low density
  - 
- Consolidation increases density
  - 
- Greatest density in the chest: __________
- Systematic review of all structures
  - A through Z
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Silhouette Sign and Air Bronchogram

- Infiltrate that obliterates heart border or diaphragm must be located in anterior segments of the lung
- Visible bronchi when surrounded by consolidated alveoli
- Confirms

Limitations of the Chest Radiograph

- Small lesions may not be seen
- Often normal in patients with significant respiratory symptoms
Clinical and Radiographic Findings in Lung Diseases

- A
- H
- I
- C
- P
- C

Atelectasis

- Compressive atelectasis
  - If severe: ________________
- Obstructive atelectasis
- Postoperative atelectasis
  - CXR: lung volume loss, mediastinal shift

Clinical and Radiographic Findings in Lung Diseases

- A
- H
- I
- C
- P
- C
Pneumothorax

- Often causes atelectasis
- Tension pneumothorax
  - M
  - T
  - P
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Hyperinflation

- Obstructive lung disease
  - L
  - F
- CXR neither sensitive nor specific for COPD
  - Provides

Interstitial Lung Disease

- Substance activates patient’s immune system = ______ or _______________
  - Months to years
- Large hilar and paratracheal lymph nodes
- Calcified ___________ or ______________
  _____________________
Interstitial Lung Disease (cont’d)

- End-stage pulmonary fibrosis
  - H
- Bronchiectasis
  - Large
Congestive Heart Failure

- Redistribution of pulmonary vasculature
  - Engorgement of __________________________
- Fluid collection in ____________ portions of the lungs
- Increased cardiothoracic (C/T) ratio (>0.5)
Congestive Heart Failure (cont’d)

- Kerley’s B lines
  - Right base, <1 mm thick, 1 to 2 cm long, horizontal
- Miscellaneous signs
  - Increased ________________________ and/or ____________________________

Pleural Effusion

- Usually >_____ ml of fluid
- Small volume effusion:
  - Blunting of the __________________________
  - Small meniscus sign
  - Partially ______________________________
- Large volume effusion
  - Complete obscuring of the ________________ with ______________________
Consolidation

- M
- L
- H
- A

See Figures 10-17 and 10-18
Summary

- Dense body tissue appears white on CXR (_______); air-filled body tissue appears black (________)
- Increasing ventilator pressures may indicate a _______ and should prompt an order for a CXR
- CT scans show _______________ information using x-rays, but provide more detail and more specific information about

Summary (cont’d)

- MRI uses a strong _______ _________ rather than x-rays to provide images of the body
- V/Q lung scans helpful only if normal or highly suggestive for ____________
- PET scan uses radioactively tagged sugar water injection to demonstrate _______ active tissue

Summary (cont’d)

- CXR interpretation requires evaluation of:
  - Proper
  - Proper
  - Proper
  - Systematic review of
Summary (cont’d)

• __________ allows one to know whether a pulmonary opacity is touching the heart or diaphragm rather than residing in lung tissue anterior or posterior to those tissues.

• __________ suggest fluid in the lung tissue surrounding patent airways.