NJ Global Tuberculosis Institute

Basics of Chest Radiography

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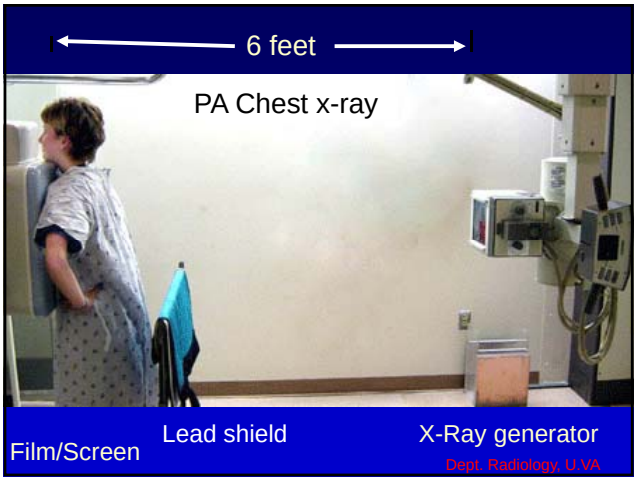
Conflict of Interest

Unfortunately, none

Today's Objectives

- Learn the PIER mnemonic for evaluating the film
- Learn the ABCDE method of reading the CXR
- Learn the major landmarks of the CXR
- Learn to distinguish infiltrates, cavities and pleural effusions on the CXR



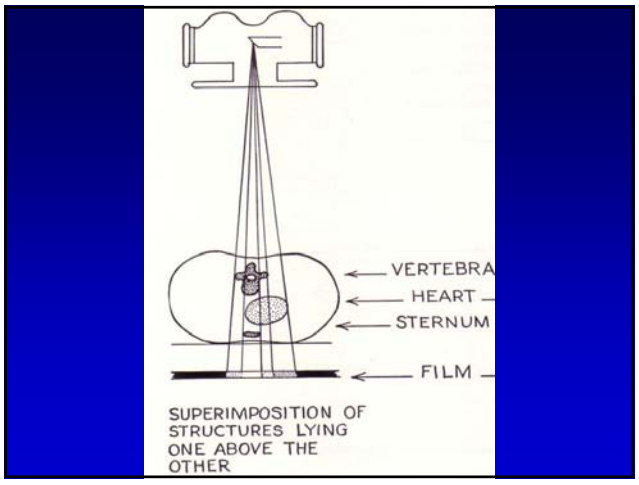


TABLE 1-1

The Five Main Radiodensities on a Standard Radiograph

Material	Effective Atomic Number	Density (g/cm³)	Color on Film
Air	7.6	RADIOLUCENT 0.001	
Fat	5.9	0.9	
Water (Organ tissue, muscle skin, blood	7.4	1	
Bone	14.0	2	
Metal	82.0	RADIODENSE 11	

Fauber TL. Radiographic Imaging and Exposure,2004

PA & AP Chest X-rays

PA View **AP View**

Moillusions.com

The CXR is only a picture

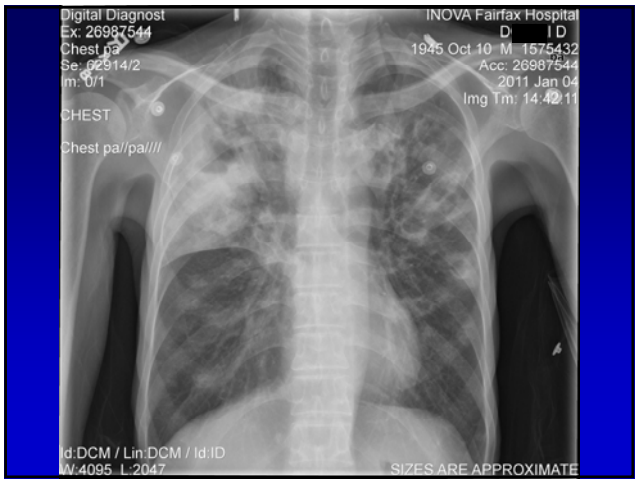
- The x-ray may be normal when the patient has active pulmonary TB. This is especially true if the patient has HIV or otherwise immunocompromised
- The x-ray does not tell you if the process is new and active or old and inactive, only the sputum AFB culture does that

Identify the Film

- Name and Date of Birth: be sure it is the same as your paperwork
- Date of the film: Make sure you are looking at the most recent image and if multiple images are available please compare them

PIER mnemonic

- Is the film worth PIERing into?
- Position: PA film or AP film?
- Inspiration: Count the posterior ribs, should be able to see the 10th or 11th rib
- Exposure: If a good exposure, you should be able to see behind the heart, the blood vessels and the intervertebral spaces.
- Rotation: The clavicles should appear symmetric, equal in length and be equidistant from the spine. If there is rotation, the side farthest from the film will be narrower and whiter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Ex: 26987544
Chest pa
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CHEST
Chest pa//pa////
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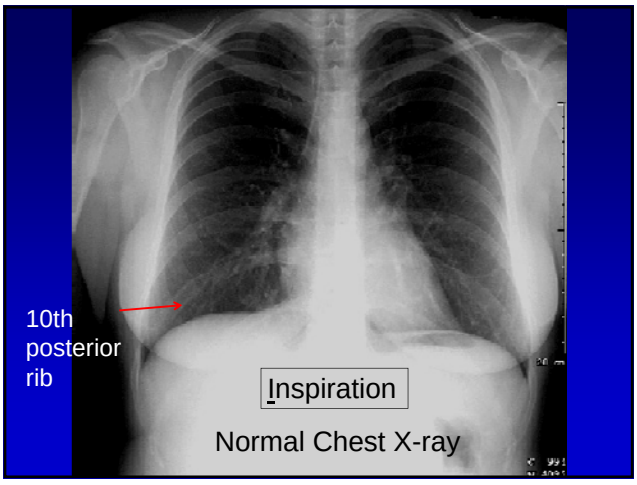
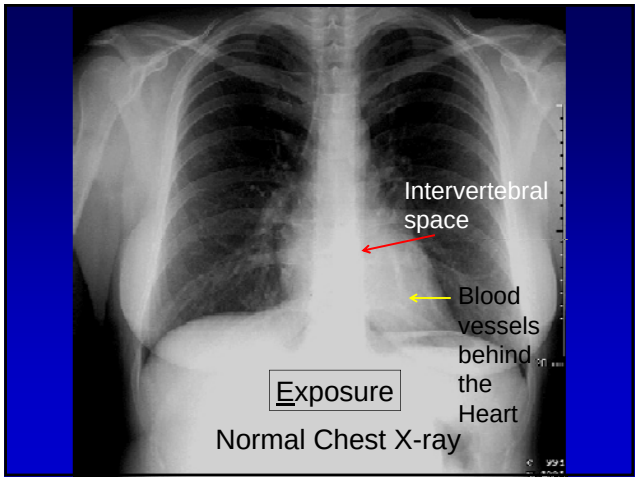
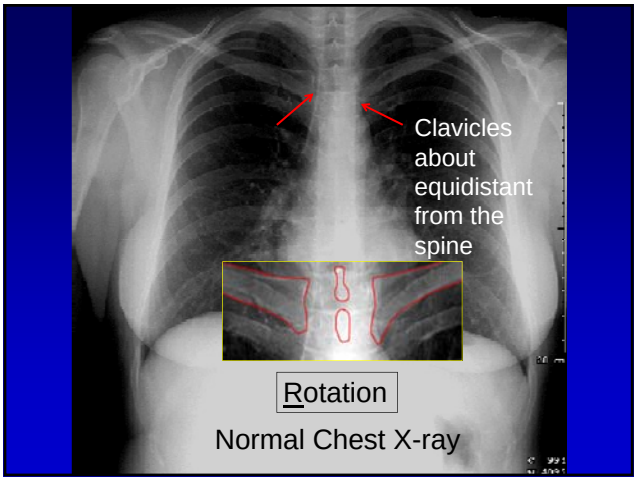
SIZES ARE APPROXIMATE


10th posterior rib
Inspiration
Normal Chest X-ray


Intervertebral space
Blood vessels behind the Heart
Exposure
Normal Chest X-ray


Clavicles about equidistant from the spine
Rotation
Normal Chest X-ray

“Reading” the Chest X-ray

Air: Central airways and lung parenchyma

Bones: Ribs, clavicles, spine, shoulders, scapulae

Cardiac: Heart, blood vessels and mediastinum

Diaphragm and pleura

Everything else: soft tissues of the neck, chest wall

BluePrints Radiology, 2006

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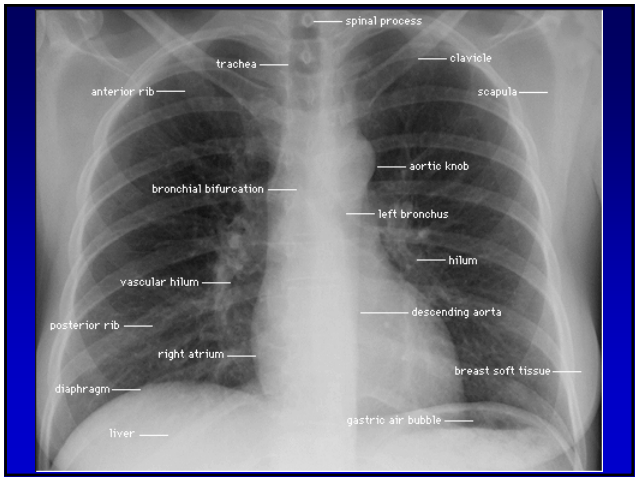
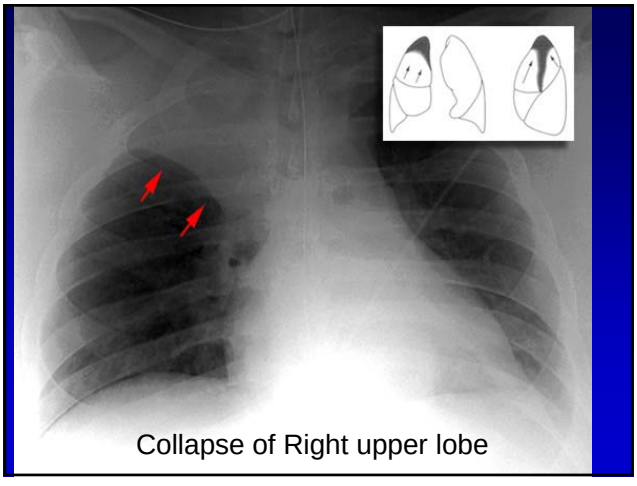
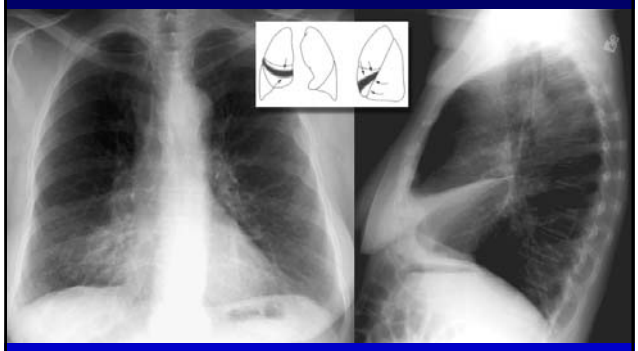




Collapse of Right upper lobe



Silhouette sign- Right Middle Lobe Atelectasis

Infiltrates

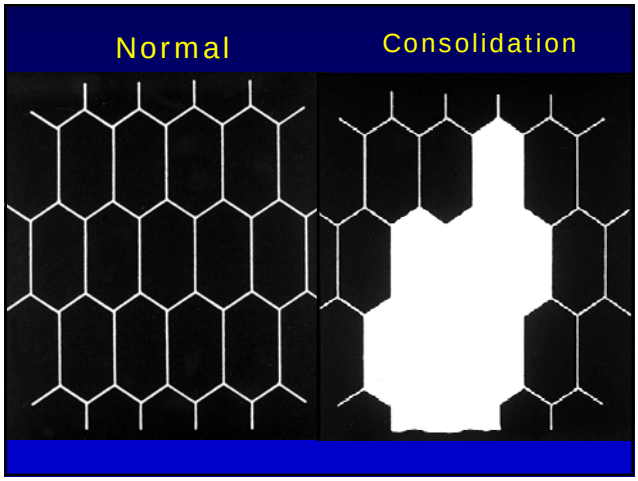
- Also known as air space disease (ASD), alveolar filling disease, or acinar disease

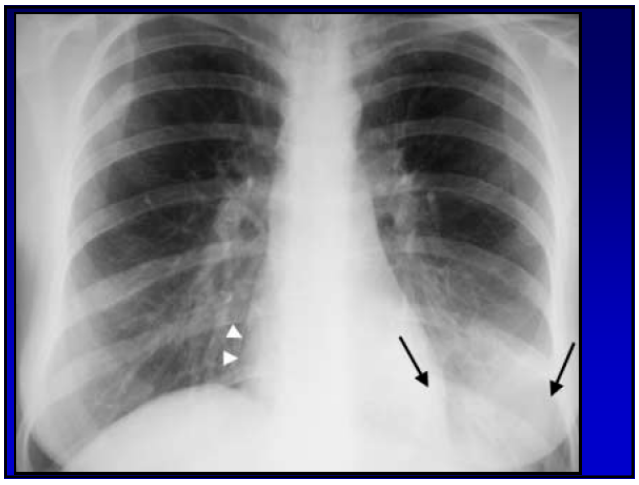
Appearance and findings:

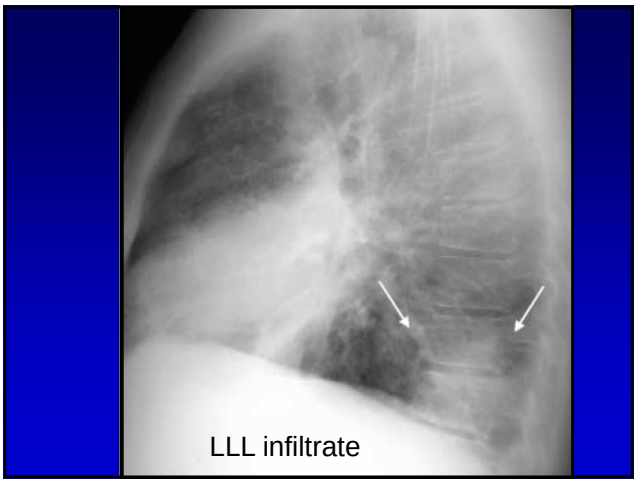
Increased opacity

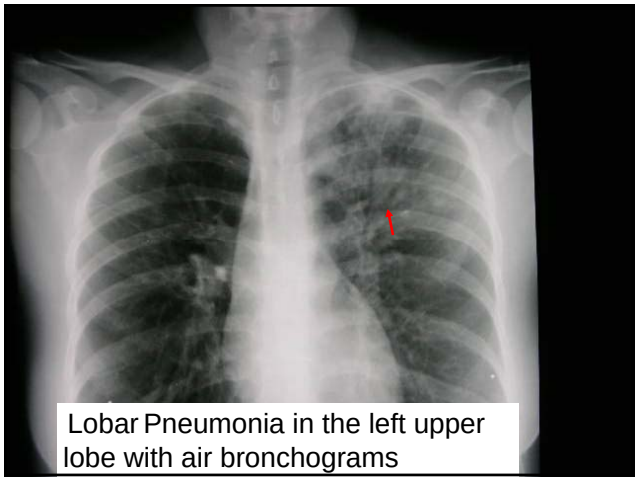
- Ill defined, hazy, patchy, fluffy, or cloud-like
- Silhouette sign
- Air bronchograms

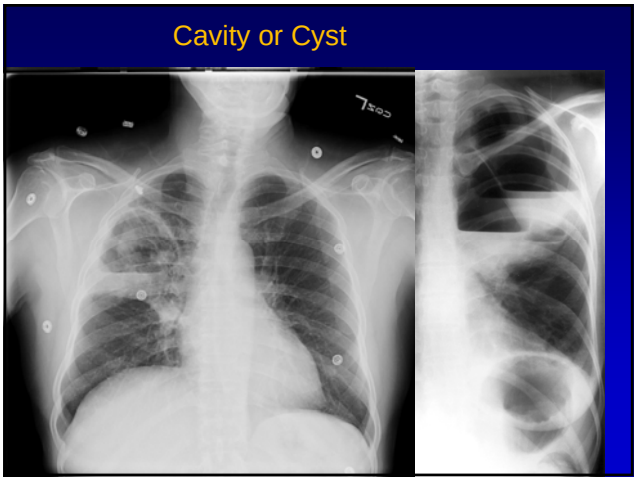
Lobar or segmental distribution





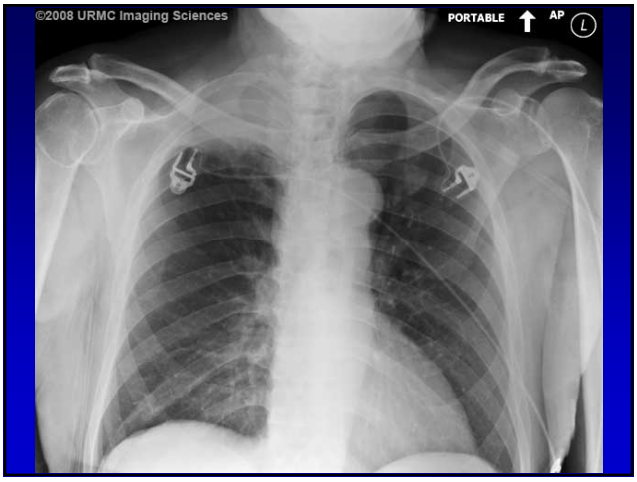

LLL infiltrate

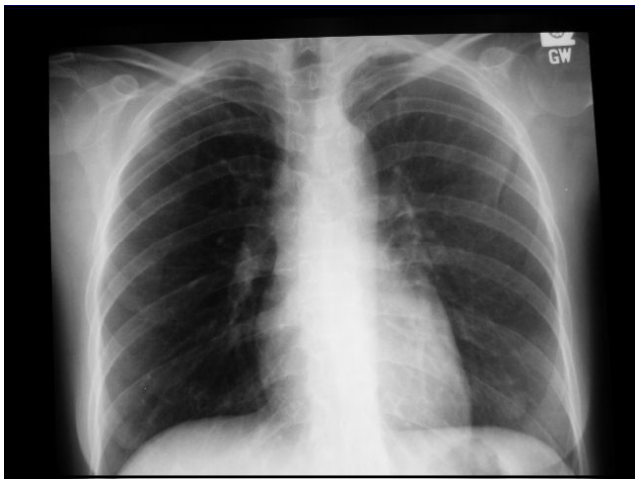

Lobar Pneumonia in the left upper lobe with air bronchograms

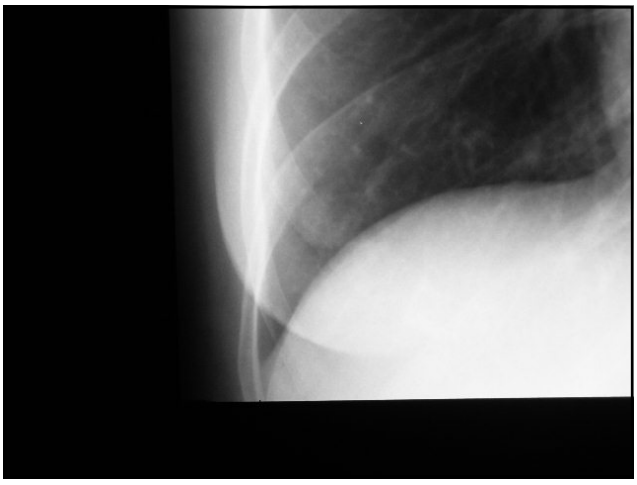

Cavity or Cyst

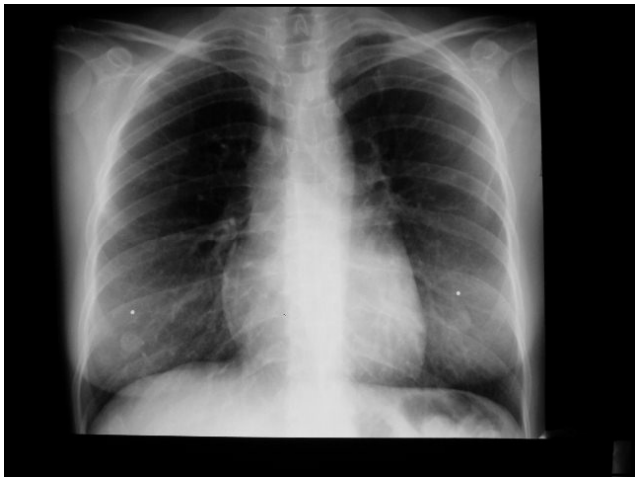
Masses

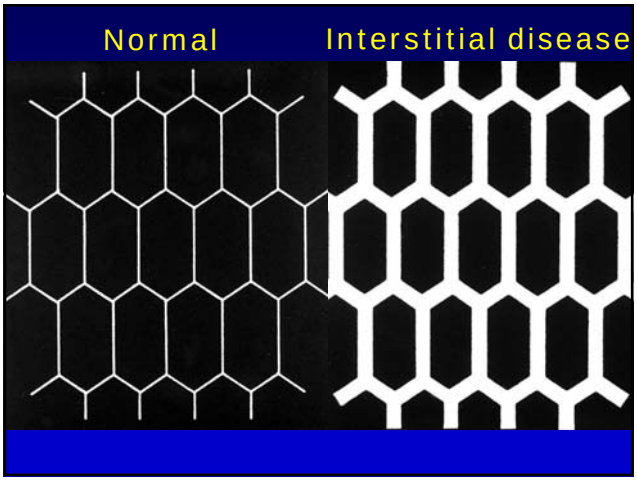
- Nodules and masses are discrete areas of increased lung opacity whose borders do not conform to anatomic divisions (such as a fissure)
- Masses are similar to nodules except that they are larger, measuring greater than 30mm in diameter
- Nodules and masses should be described by noting their size, the sharpness of their borders, their number, their location and the presence or absence of calcification




GW






Normal
Interstitial disease

Miliary TB

“Reading” the Chest X-ray

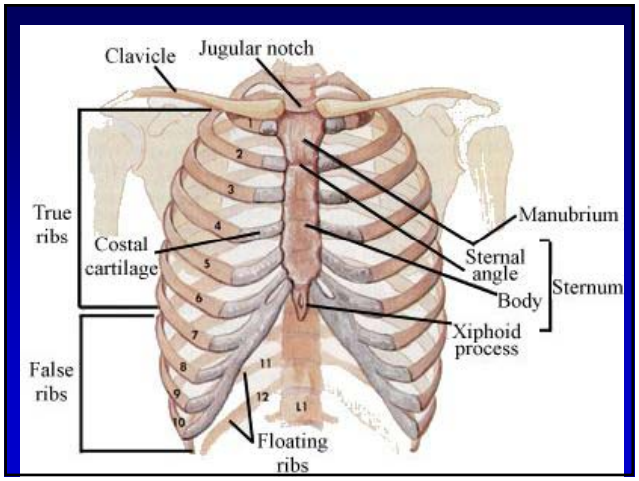
Air: Central airways and lung parenchyma

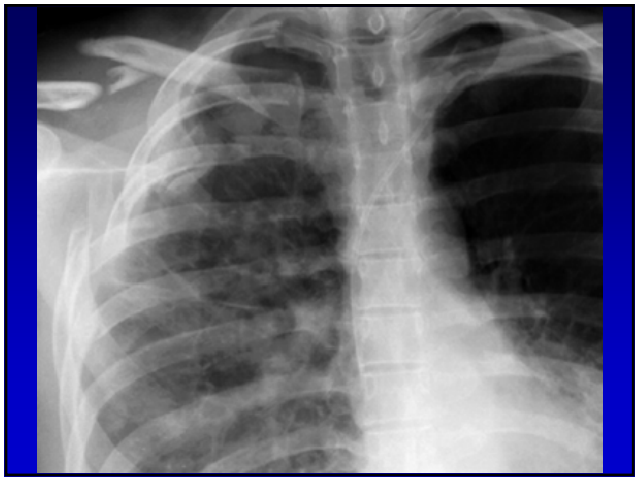
Bones: Ribs, clavicles, spine, shoulders, scapulae

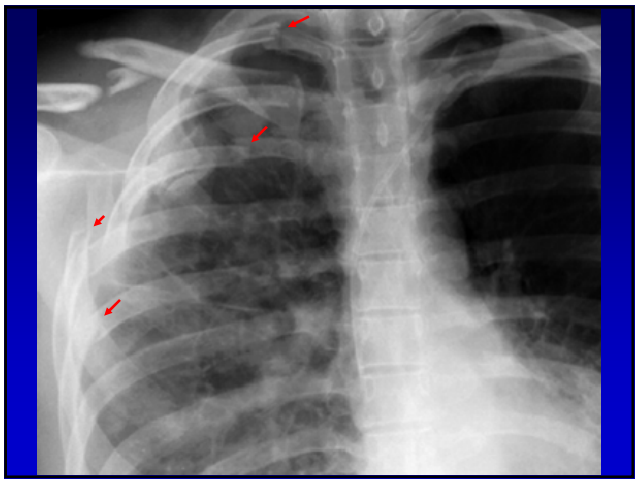
Cardiac: Heart, blood vessels and mediastinum

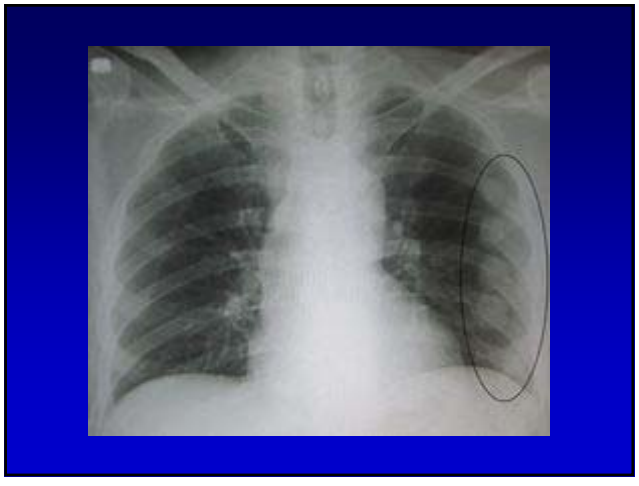
Diaphragm and pleura

Everything else: soft tissues of the neck, chest wall










L

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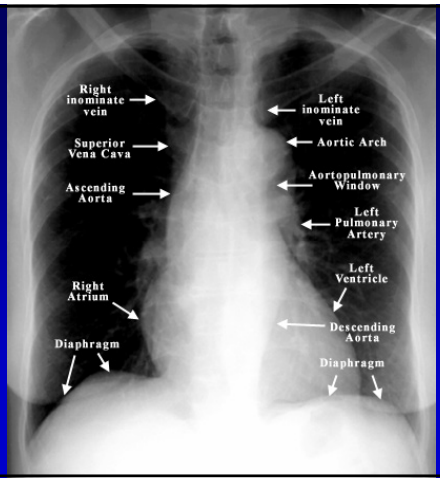
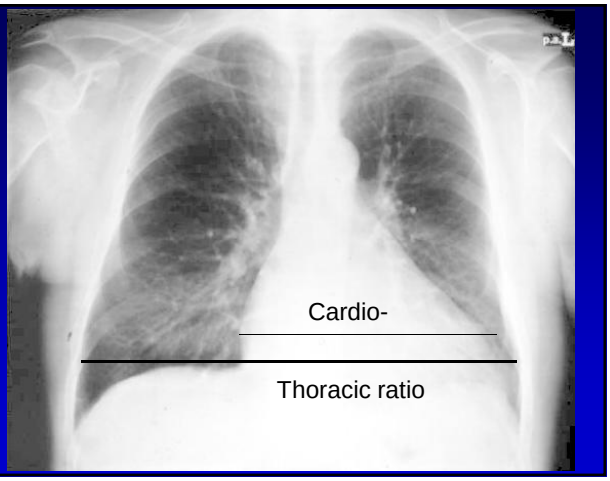
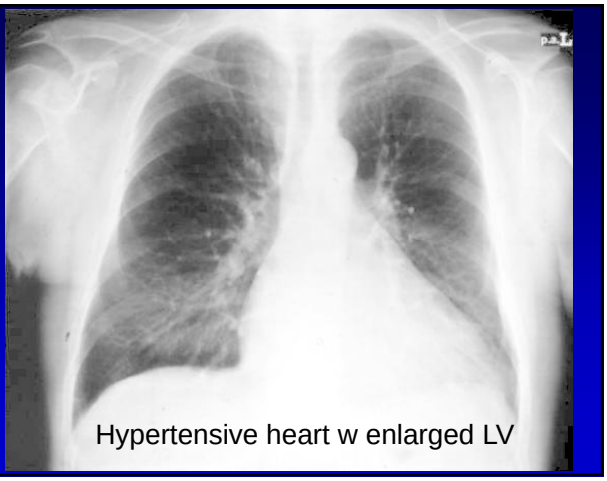
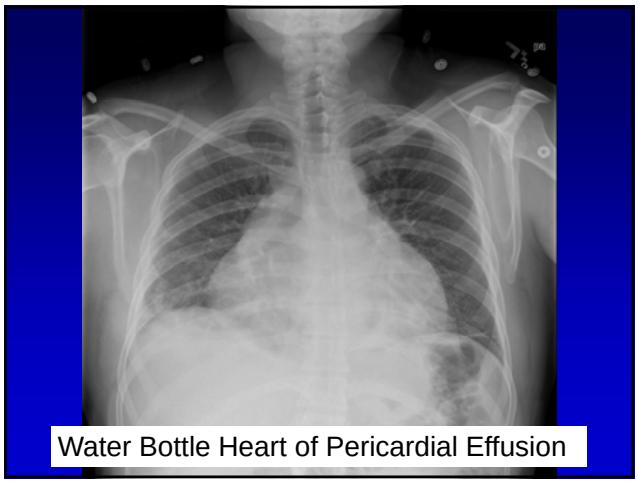




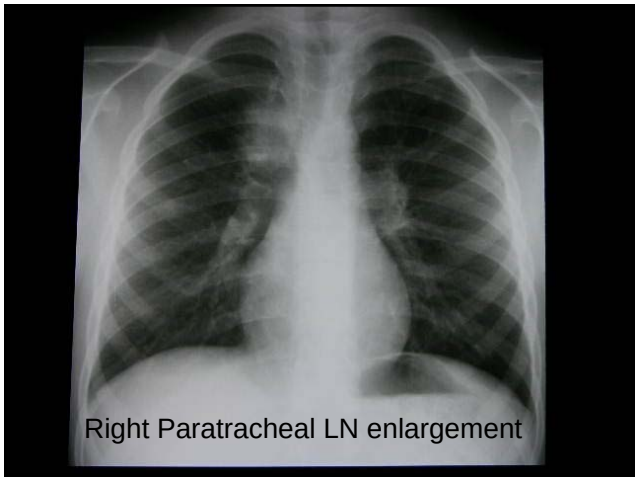




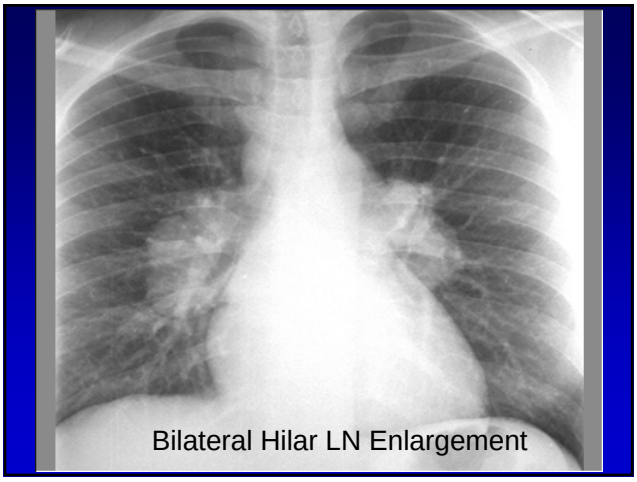
Water Bottle Heart of Pericardial Effusion

Lymphadenopathy

- Enlarged lymph nodes appear on the chest radiograph as soft tissue densities in characteristic locations, including:
  - Right paratracheal area
  - Hila
  - Aorticopulmonary window
  - Subcarinal mediastinum
  - Supraclavicular area
  - Paraspinous region
  - Retrosternal area on the lateral radiograph
- One or more regions may be involved, and in certain conditions, nodes may calcify



Right Paratracheal LN enlargement



Bilateral Hilar LN Enlargement

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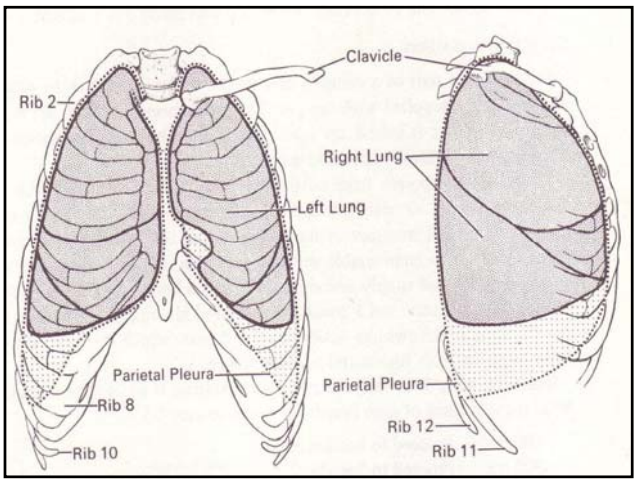
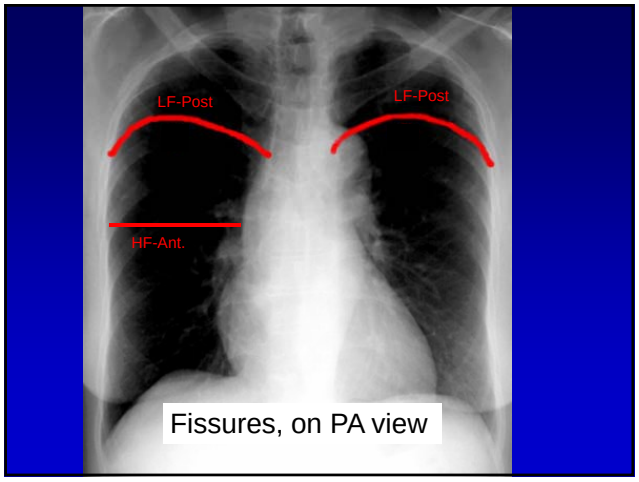
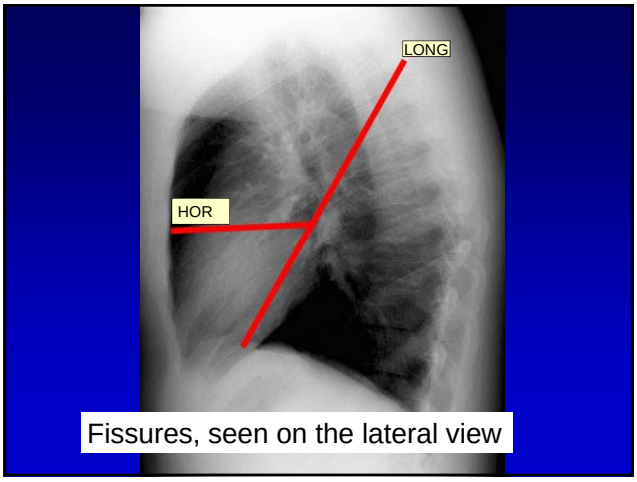
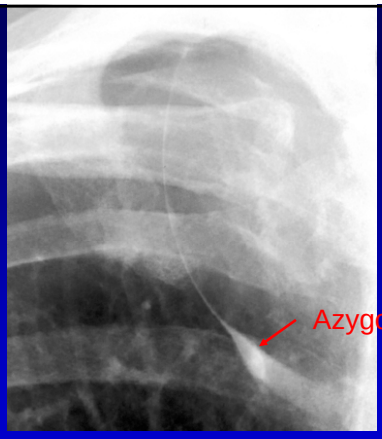




Fissures, on PA view



Fissures, seen on the lateral view

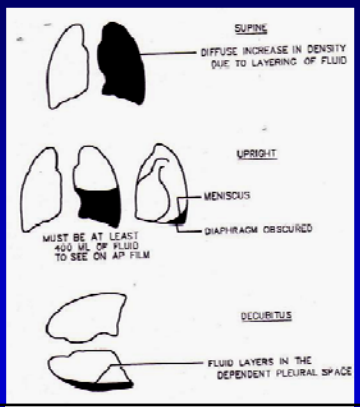


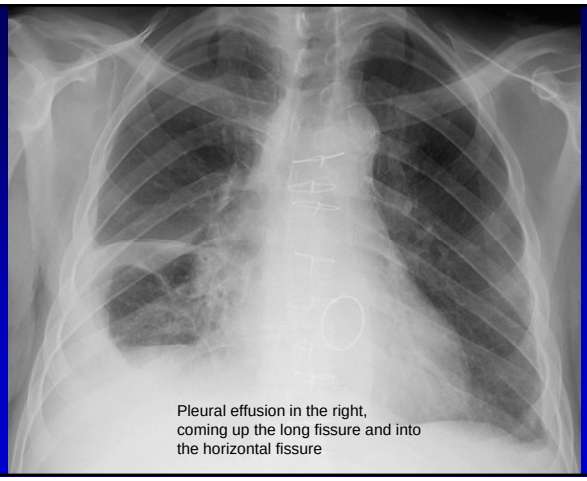
Azygous lobe in right apex

Pleural Disease

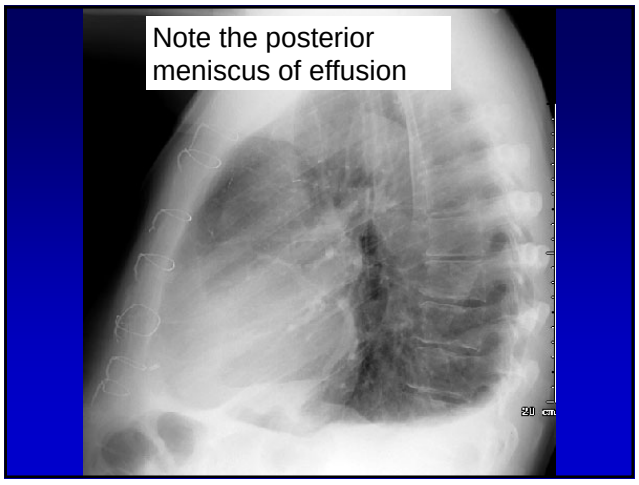
- Because pleural abnormalities are, by definition, outside the lung parenchyma, an air bronchogram cannot be seen
- Pleural abnormalities are usually homogeneous opacities
- In the upright patient, a pleural effusion will form a curvilinear interface with aerated lung that resembles a meniscus. This occurs because the pleural fluid settles dependently within the pleural space
- In the supine patient, a pleural effusion may layer posteriorly in a dependent fashion, creating a hazy opacity over the entire hemithorax

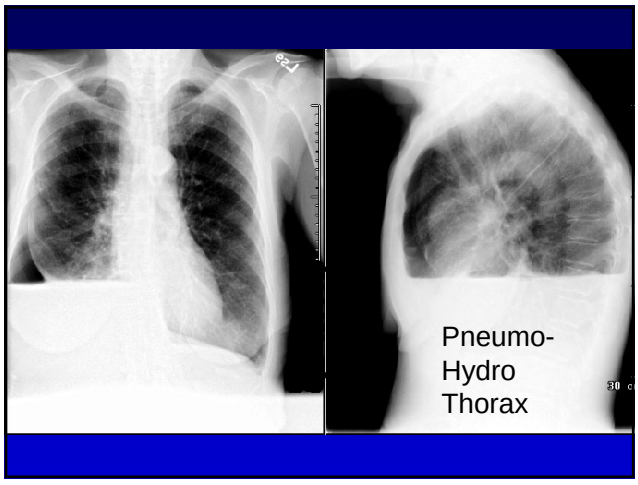
Pleural Effusion





Pleural effusion in the right, coming up the long fissure and into the horizontal fissure





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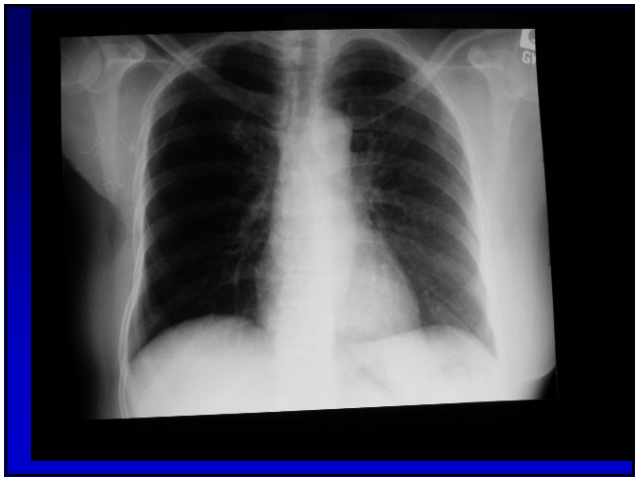

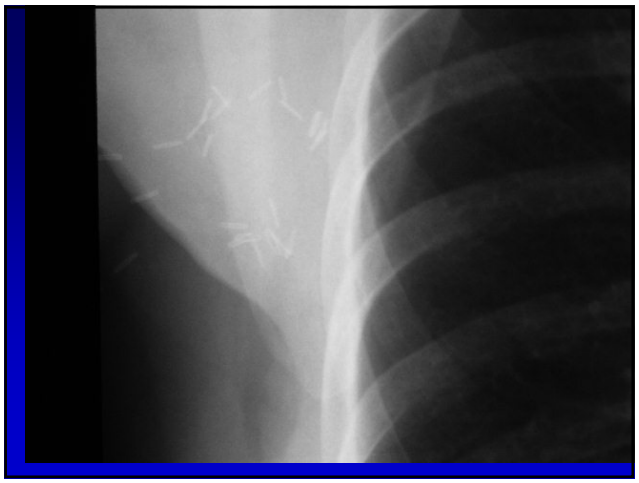

When to order other X-ray studies

- Lateral film
- Apical Lordotic
- Lateral decubitus
- Expiratory film
- CAT scan
- PET scan

What have we accomplished?

- Learned the PIER mnemonic
- Learned the ABCDE method of reading the CXR
- Learned the major landmarks of the CXR
- Learned to distinguish infiltrates, cavities and pleural effusions on the CXR

Acknowledgements

- Reynard J. McDonald, MD, Medical Director, NJMS Global Tuberculosis Institute
- www.med-ed.virginia.edu/courses/rad/cxr/index.html

Selected References

- Atlas Radiologic Anatomy; L. Wicke, 7th Ed, Icon Learning Systems, 2004
- Blueprints Radiology; A. Uzelac and RW Davis, Lippincott Williams and Wilkins, 2006
- Introduction to Diagnostic Imaging; G. Stimac, WB Saunders, 1992
- Getting Started in Clinical Radiology; G Eastman, Wald and Crossin, Thieme, 2006

Web sites

- www.med-ed.virginia.edu/courses/rad/cxr/index.html
- wikiHow.com/Read-a-Chest-X-Ray
- Rad.usuhs.mil/rad/chest_review/index.html