RADIOLOGY FUNDAMENTALS:
UNDERSTANDING THE CHEST X-RAY

RADIOGRAPHIC DENSITIES

What are the different basic radiographic densities?

Density Characteristics

1. Metal
2. Bone
3. Soft Tissue
4. Fat
5. Air

Hounsfield Units

Bone 1000 HU
Liver 40 - 60 HU
Blood 40 HU
Muscle 10 - 40 HU
Kidney 30 HU
Water 0 HU
Fat -50 - -100 HU
Air -1000 HU
Radiographic Densities

Metal - Radiodense (whiter)
Bone
Soft tissue
Fat
Air - Radiolucent (darker)

QUESTIONS TO ANSWER

• Is the case normal or abnormal?
• WHY?
• What side is the abnormality on?
• WHY?
• What is the abnormality?
  – Give differential diagnosis

MENISCUS SIGN RADIOGRAPHIC FEATURES

MENISCUS SIGN

• Smooth contour
• Wedged shaped, reverse “V”, triangular
• Lies along dependent portion of lung
• Indicates UNCOMPLICATED fluid
LUNG CYST vs ABSCESS CAVITY

**LUNG CYST**

A well circumscribed air filled structure, generally > 1 cm in diameter
Localized within the lung parenchyma
Air-fluid level present
Smooth, thin walls, usually < 2, 3 mm, and often < 1mm thick

**ABSCESS CAVITY**

An air filled cystic structure
Localized within the lung parenchyma
Air-fluid level present
Irregular, thickened walls, often > 4 mm in thickness

**PLEURAL EFFUSION**
PLEURAL EFFUSION

GENERAL
• A small amount of fluid is normally present to lubricate the surfaces of the pleura
• A pleural effusion occurs when an excessive amount of fluid accumulates between the layers of tissue that line the lungs
• At least 200-300 cc of fluid must be present before visible on an upright Chest X-Ray
  – Decubitus views of chest may show smaller amounts of fluid

PLEURAL EFFUSION

SYMPTOMS
Chest pain
  Usually sharp
  Worse with cough or deep breath
Dyspnea
Cough
Hiccups
Tachypnea
Shortness of breath
Sometimes no symptoms

PLEURAL EFFUSION

TRANSDUATE
Exudate

TRANSUDATE
– Caused by fluid leaking into the pleural space
– Caused by systemic factors
– Factors that alter the balance of formation and absorption of pleural fluid such as an increase in capillary hydrostatic pressure or a decrease in colloid oncotic pressure
– Types of transudative pleural effusions
  • CHF
  • Cirrhosis

EXUDATE
– Usually caused by pleural inflammation, infection, injury or lymphatic obstruction
– Caused by alterations in local factors that influence formation and absorption of pleural fluid
– Types of exudative pleural effusions
  • Bacterial pneumonia
  • Cancer
  • Pulmonary embolism
  • Viral infection
  • Trauma
  • Collagen Vascular Disease
  – Rheumatoid Arthritis
  – Systemic Lupus Erythematosus

PLEURAL EFFUSION

DIFFERENT TYPES
• Serous fluid (hydrothorax)
• Blood (hemothorax)
• Chyle (chylothorax)
  Occurs when thoracic duct is disrupted
  Lymphoma, trauma, thoracic surgery most common causes
• Pus (pyothorax or empyema)

PLEURAL EFFUSION

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UNDERSTANDING AND USING THE SILHOUETTE SIGN

DEVELOPING EMPYEMA
LUNG ABSCESS

PNEUMONIA
Can be caused by a variety of agents
Bacterial
Viral
Mycoplasma
Fungi
PNEUMONIA
An important cause of morbidity and mortality in the US
Millions of cases reported yearly
Accounts for over 1 mil hospitalizations
Accounts for over 1 mil ER visits

PNEUMONIA
VIRAL PNEUMONIA
Approx 50% of pneumonias believed to be caused by viruses
Generally less severe than those caused by bacteria
Often seen in very young patients

PNEUMONIA
BACTERIAL PNEUMONIA
Pneumococcus most common cause
Commonly called lobar pneumonia, even though infection does not usually involve the entire lobe
Lower lobes and posterior segments of upper lobes most common

PNEUMONIA
MYCOPLASMA PNEUMONIA
Has features of both bacterial and viral pneumonias
Usually causes a mild, wide spread infection
Common cause of community acquired pneumonia

PNEUMONIA
SYMPTOMS
Fever
Cough
Headache
Muscle pain
Weakness
Fatigue
SOB

PNEUMONIA
SYMPTOMS
Chills
Chest pain
Sweats
Tachypnea
Tachycardia
Etc
PNEUMONIA

RADIOGRAPHIC FINDINGS
- Patchy infiltrates
- Mottled infiltrates
- Peribronchial distribution
  - Diffuse
  - Homogeneous

PNEUMONIA

RADIOGRAPHIC FINDINGS
- Focal alveolar infiltrates
- Interstitial densities
- Miliary, nodular, reticular
  - With or w/o adenopathy

PNEUMONIA

COMPLICATIONS
- Pleursy with effusion
- Empyema
- Pulmonary abscess
- Toxic ileus

PNEUMONIA

COMPLICATIONS
- Rare:
  - Broncopleural fistulas
  - Pericarditis with effusion

CONGESTIVE HEART FAILURE
CONGESTIVE HEART FAILURE

- Affects up to 5 million Americans
- 400,000 new cases each year
- 40,000 deaths a year
- Contributing factor in over 200,000 deaths
- Men > Women
- Blacks > Whites

CONGESTIVE HEART FAILURE

Risk Factors

- Smoking
- High Cholesterol
- Hypertension
- Diabetes
- Obesity
- CAD

CONGESTIVE HEART FAILURE

-Radiographic Signs-

- Cardiac Enlargement
- Enlarged Pulmonary Vasculature
- Increased Interstitial Markings
  - Kerley B lines
  - Kerley A lines
- Pulmonary Edema
- Pleural Effusions
  - Blunting of CPA
    - If unilateral usually on right
    - If bilateral usually larger on right
    - If pt supine see homogeneous density over affected lung

KERLEY LINES

- Named after Peter Kerley
- Kerley A lines
- Kerley B lines
- Kerley C lines

KERLEY LINES

- Kerley B lines
  - Short, parallel lines at lung periphery
  - Represent dilatation of the interlobular septa
  - 1-2 cm in length, usually less than 1 cm
  - Parallel to one another
  - At right angles to pleura
  - Located peripherally
  - Most often seen at lung bases
    - at costophrenic angles on PA radiographs
    - in substernal region on lateral radiographs

KERLEY LINES

- Kerley A lines
  - Longer than Kerley B lines
    - at least 2 cm in length or longer
  - Located in inner half of lung
  - Oriented diagonally from lung periphery toward hila
  - Caused by distension of anastomotic channels between peripheral and central lymphatics of lung
  - Less commonly seen than Kerley B lines
KERLEY LINES

- Kerley C lines
  - Less commonly seen than any of the Kerley lines
  - Short, fine lines
  - Reticular in appearance
  - Seen throughout the lungs
  - Caused by
    - Thickening of anastomotic lymphatics or
    - Superimposition of many overlapping Kerley B lines

KERLEY B LINES

RADIOGRAPHIC FINDINGS

- Thin linear lines
- 1-2 cm in length
- At lung bases
- At right angles to pleura
- Represent thickening of the interlobular septa
- Usually an indication of raised venous pressure
- Wall is normally hairline thin
- Often associated with:
  1) Thickening of the fissures
  2) Fluid in subpleural space
  3) Pleural effusions

CAUSES

- Congestive Heart Failure
- Mitral Stenosis
- Lymphangitic carcinomatosis
- Pulmonary fibrosis
- Parasitic infection
- Interstitial deposition of heavy metal particles