CHEST RADIOLOGY WORKSHOP

AAPA

CHRISTY WILSON PA-C

DISCLOSURES

- *I have no relevant relationships with ineligible companies to disclose within the past 24 months*

OBJECTIVES

- Review chest anatomy and location on chest radiography, including identification of radiographic landmarks on chest X-ray and CT of the chest
- Recognize identifiers of poor quality films and demonstrate proper placement of chest tubes, central venous catheters and endotracheal tubes on CXRs
- Review the types and indications for ordering certain chest radiography such as high resolution CT and CT pulmonary angiogram
- Outline a systemic approach for interpreting CXRs using a step by step approach
- Recognize common ideas states of CXR and CT chest, such as pneumonia, pleural effusions, edema, pulmonary fibrosis, bronchiectasis and pneumothorax and learn to properly describe these findings

GORILLA IN THE ROOM

- 24 radiologists were asked to perform a familiar lung-nodule detection task.
- A gorilla, 48x the size of the average Lung nodule, was inserted in the last case
- 83% of the radiologists did not see the gorilla
- Eye tracking revealed that the majority of those who missed the gorilla looked directly at its location
- Conclusion: “even expert searchers, operating in their domain of expertise, are vulnerable to ***inattentional blindness***.”

CHEST X-RAYS

3 Main Types of CXRs

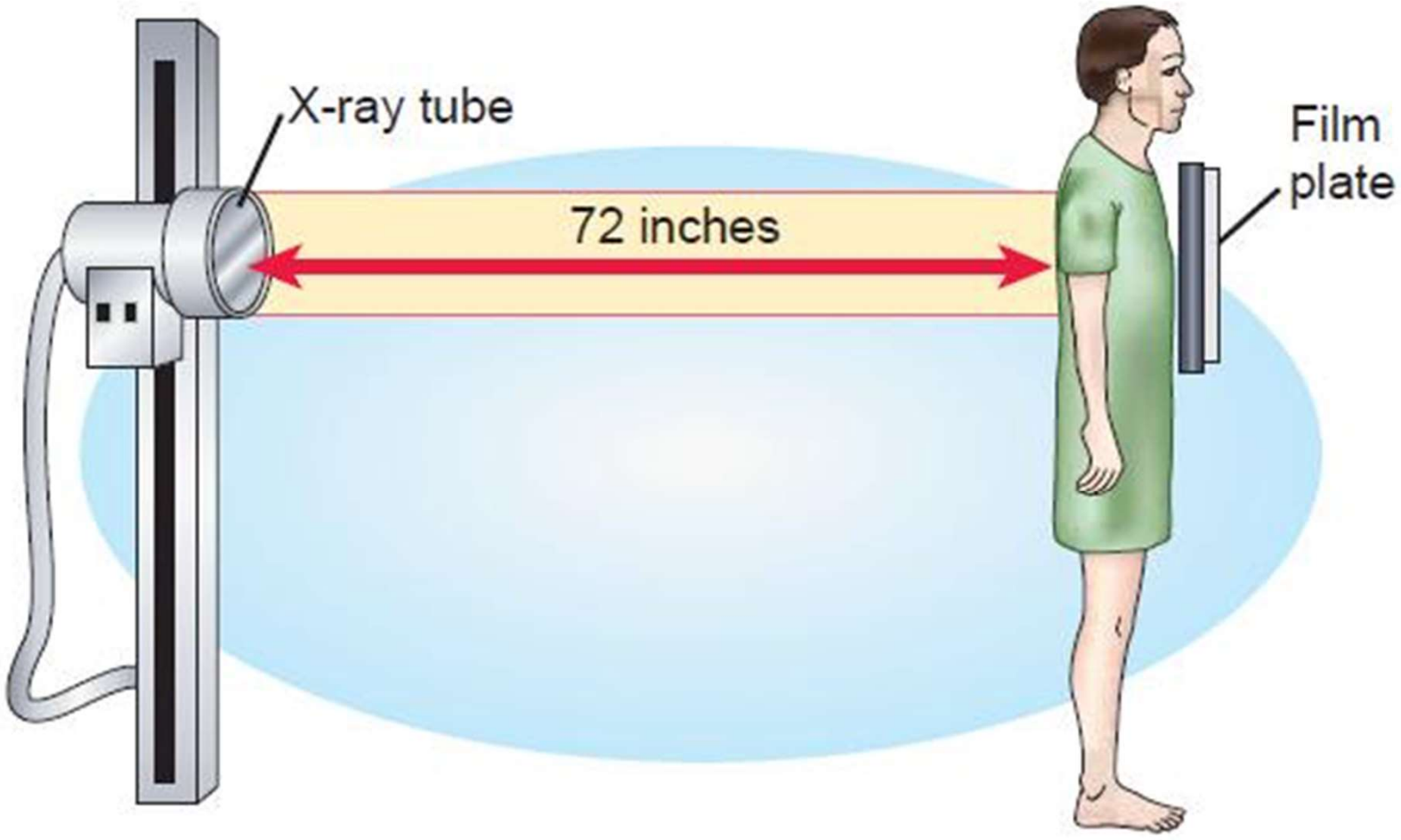
PA / Lateral

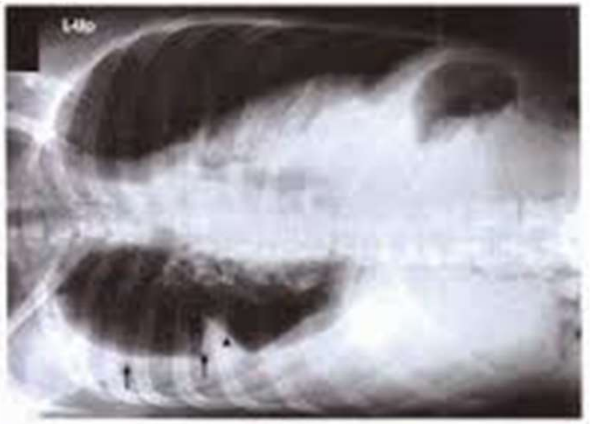
Portable

Decubitus

Common Radiographic Views

Posterior–Anterior (PA)





LATERAL DECUBITUS FILMS

INDICATIONS FOR CHEST X-RAYS

- Infection: exclude pneumonia
- Major trauma: exclude widened mediastinum, pneumothorax and hemothorax
- Acute chest pain: exclude pneumothorax, perforated viscus, aortic dissection
- Asthma/bronchiolitis: when diagnosis unclear and/or not responding to usual therapy
- Acute dyspnea: exclude heart failure, pleural effusion
- Chronic dyspnea: exclude heart failure, effusion and interstitial lung disease
- Hemoptysis
- Suspected mass, metastasis or lymphadenopathy

Guide to thoracic imaging

Volume 44, No.8, August 2015 Pages 558-562

STEPS TO READING A CXR:

Verify the CXR / Imaging is of the correct patient!

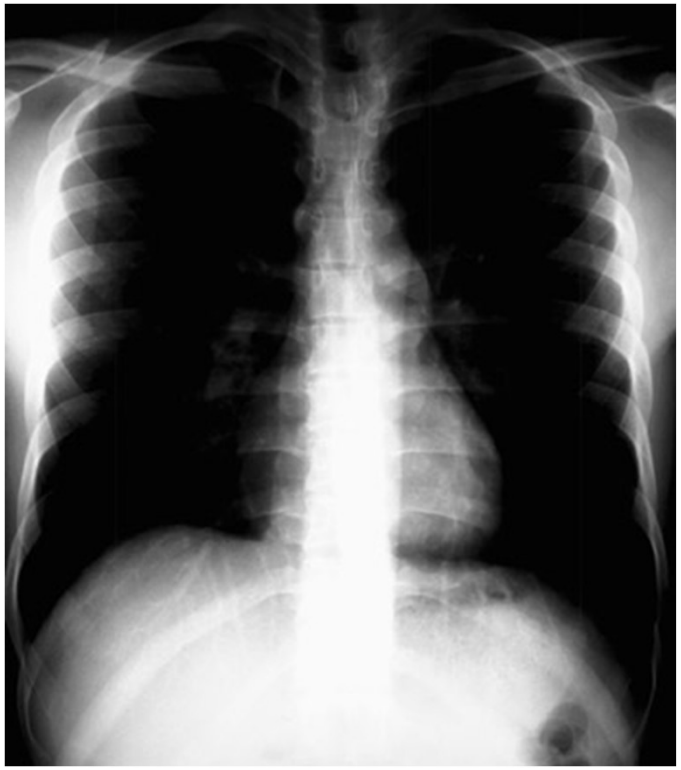
- Name
- Date
- Position markers
- Type of CXR
- Patient History is very important (review first!)
- Compare to previous imaging

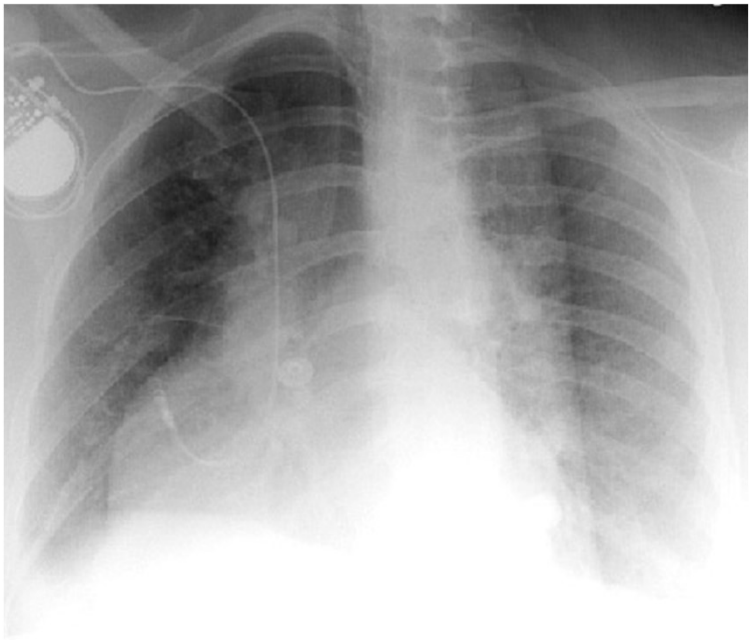
STEPS TO INTERPRETING CXR

- Type of Exam / Image
- Clinical History
- Comparison
- Technique
- Findings
- Impression

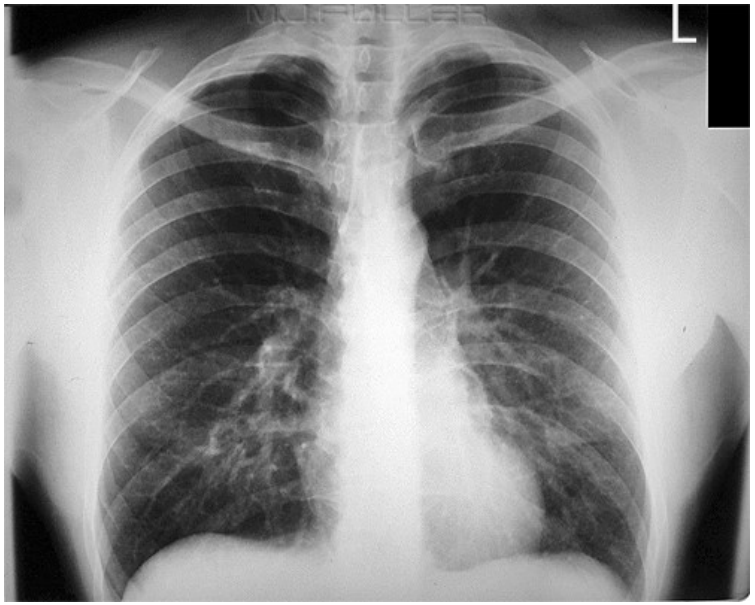
WHAT MAKES A GOOD CXR?

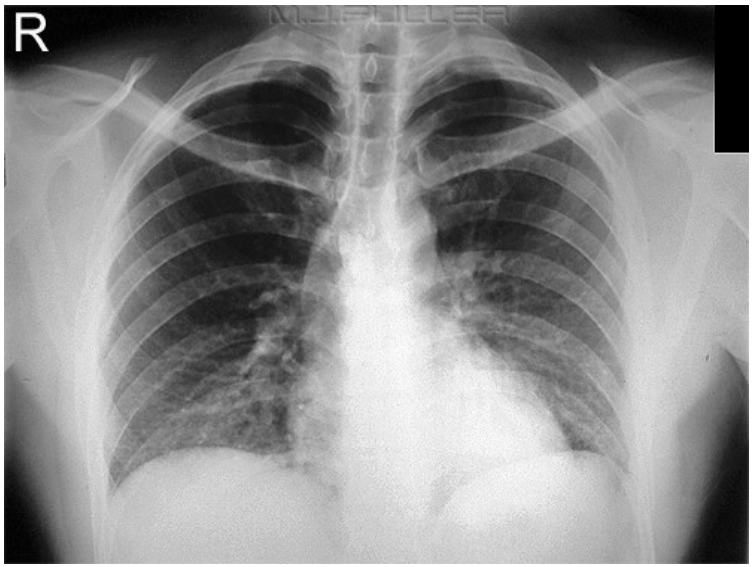
- RIPE
  - Rotation
    - medial clavicle ends equidistant from spinous process
  - Inspiration
    - 8-10 posterior ribs
  - Picture
    - Straight / Full Lung fields
  - Exposure
    - Over or under penetrated



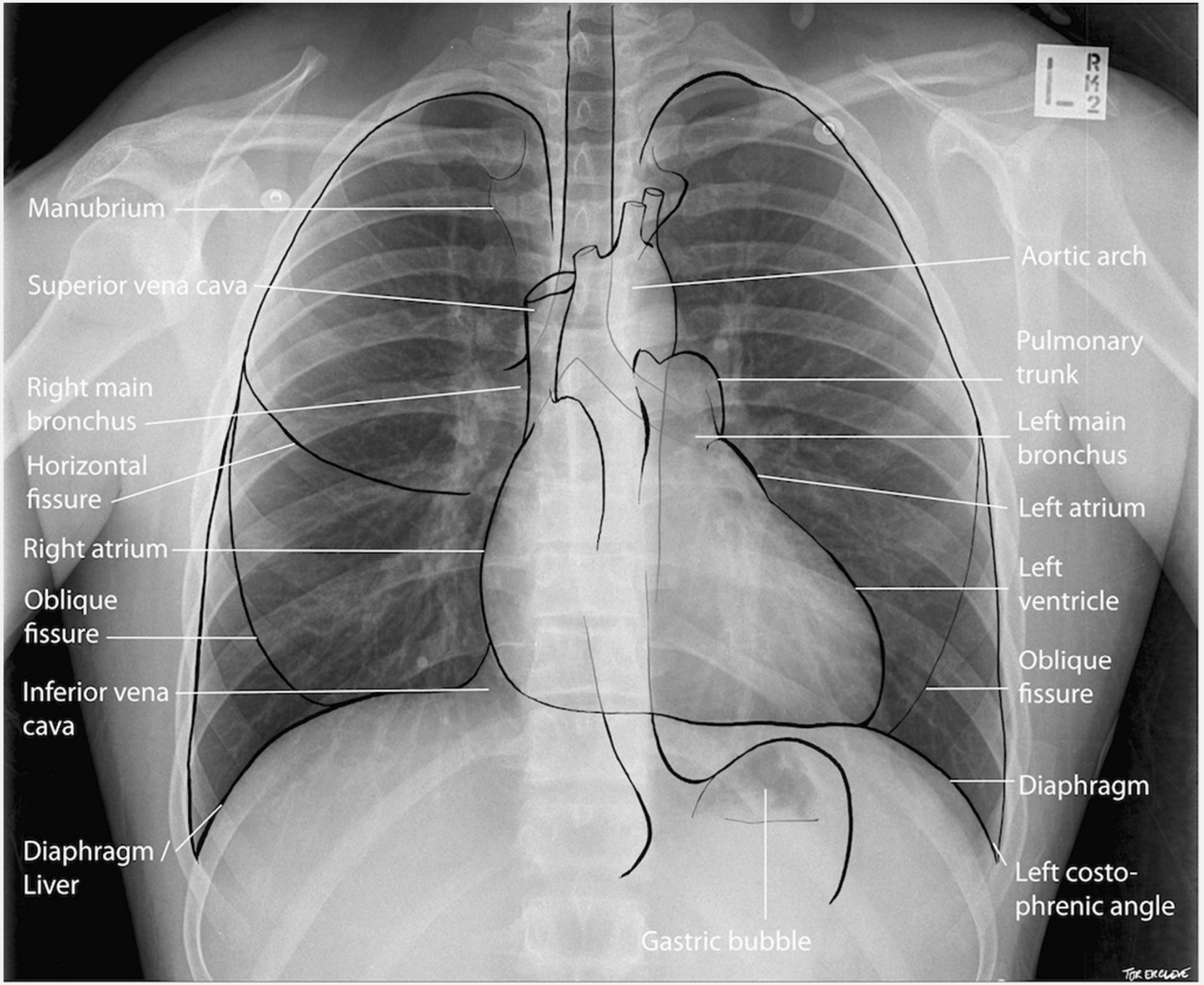


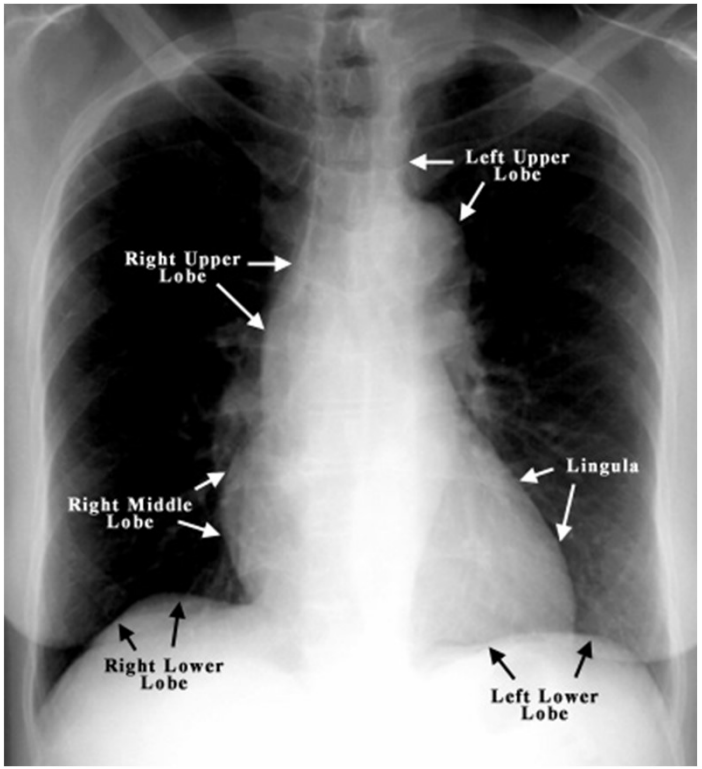
GARBAGE IN GARBAGE OUT

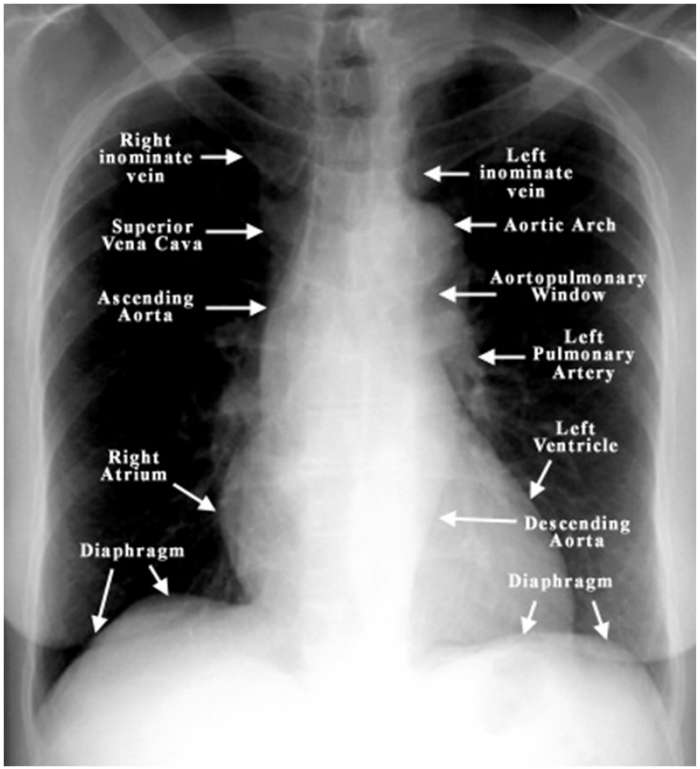




THE VALUE OF GOOD INSPIRATION


Manubrium
Superior vena cava
Right main bronchus
Horizontal fissure
Right atrium
Oblique fissure
Inferior vena cava
Diaphragm / Liver
Aortic arch
Pulmonary trunk
Left main bronchus
Left atrium
Left ventricle
Oblique fissure
Diaphragm
Left costo-phrenic angle
Gastric bubble

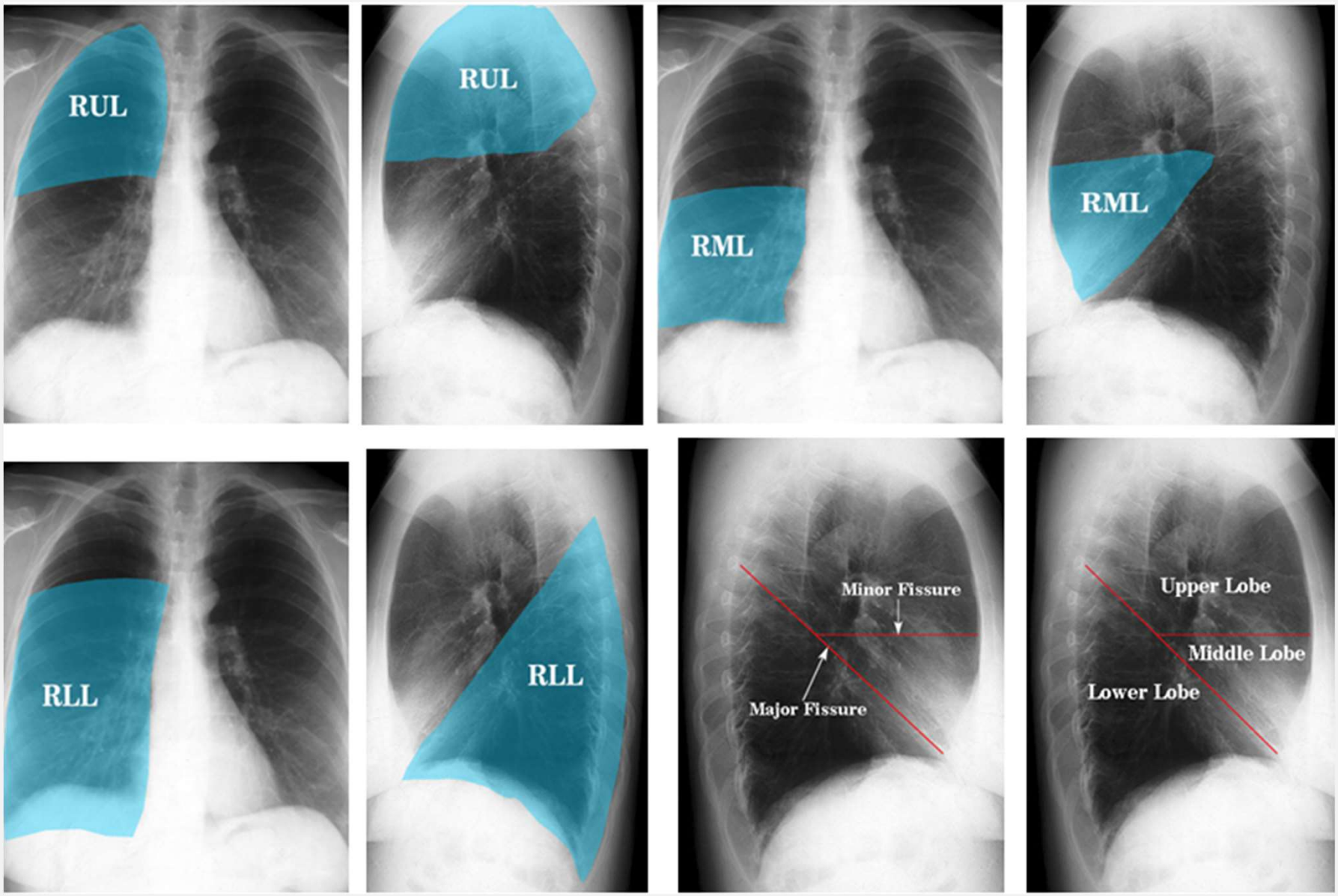




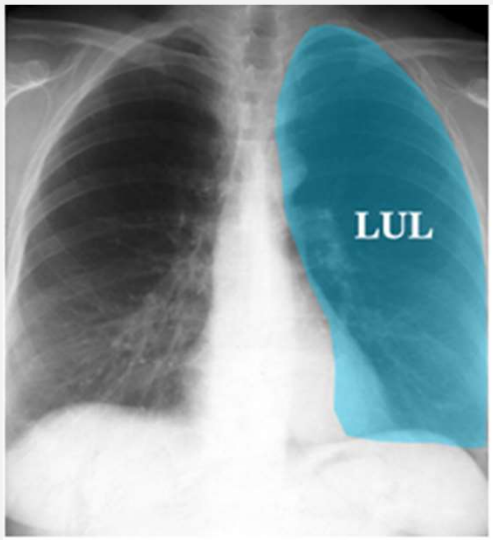
REVIEW ANATOMY

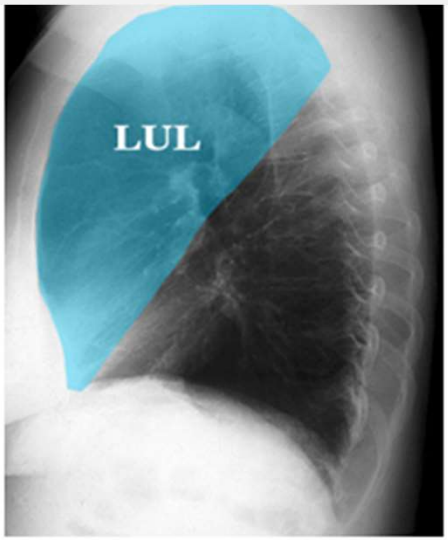
LATERAL VIEW

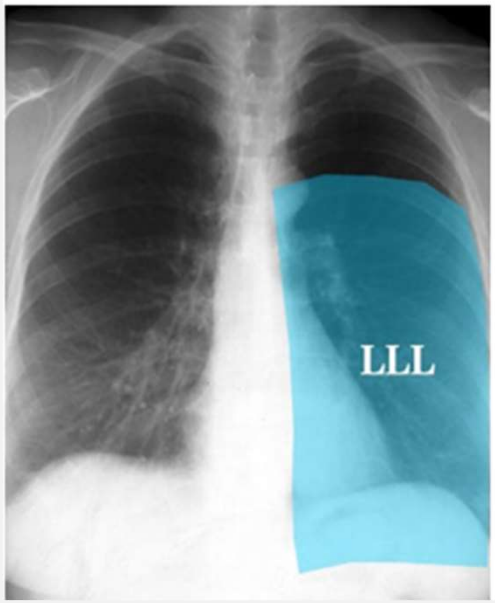
KNOW YOUR FISSURES – RIGHT LUNG

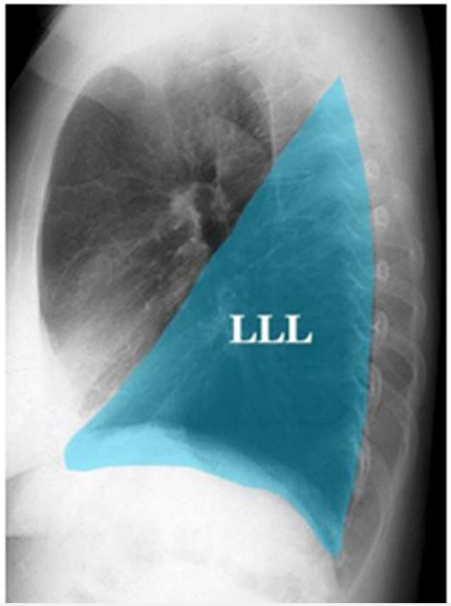


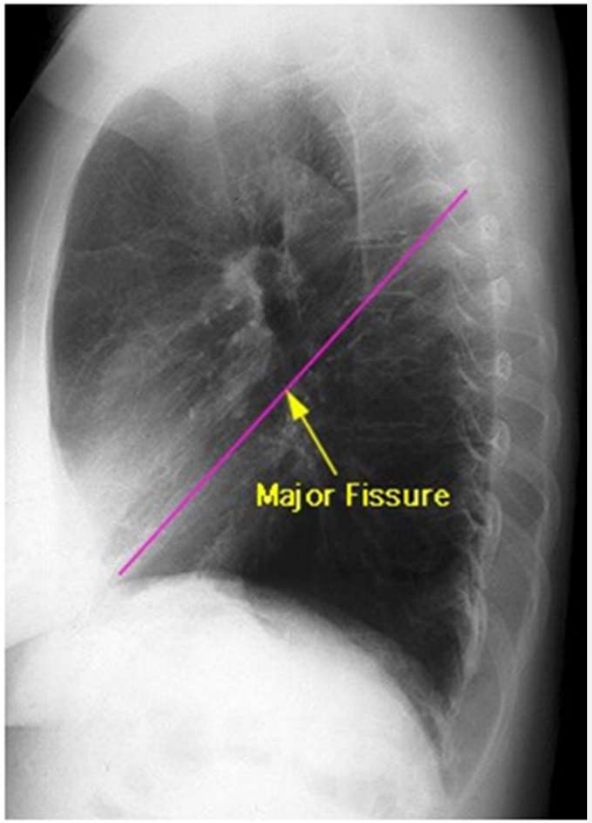
LEFT LUNG





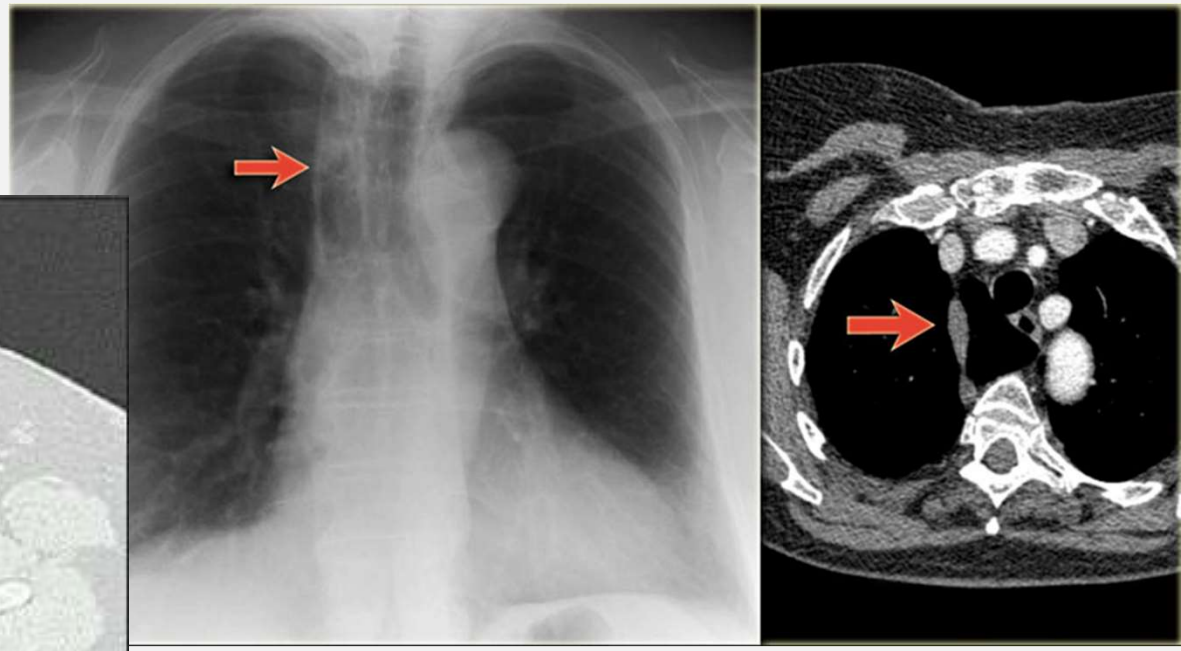


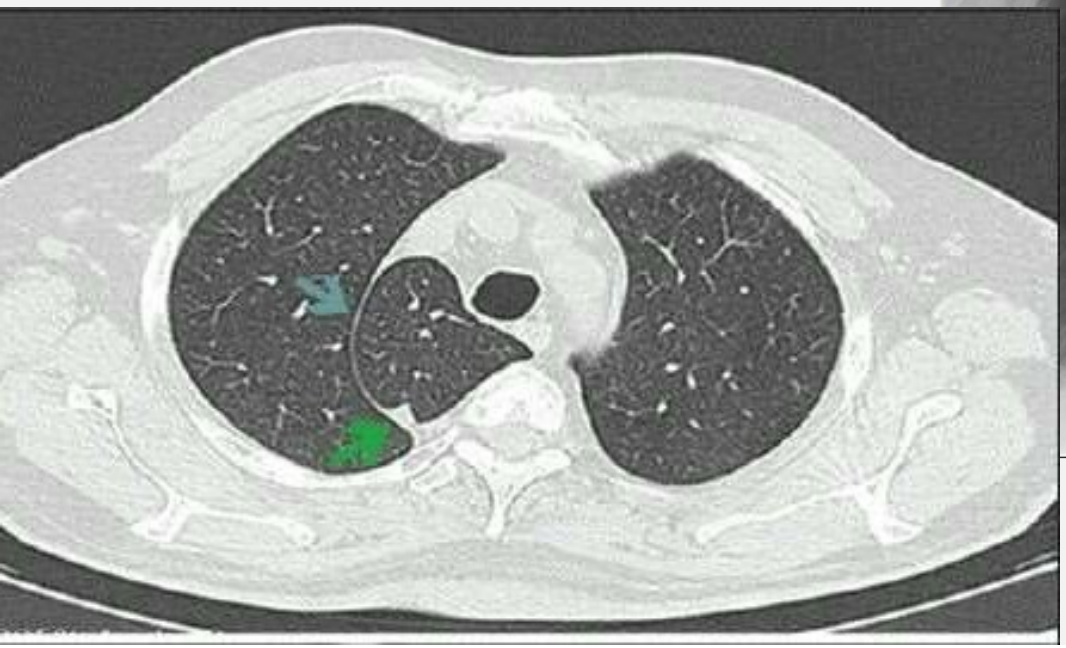




AZYGOS LOBE

- Common normal variant
- Created by a laterally displaced Azygos vein making a deep fissure in the upper lobe
- Approx. 1% of the population





STEPS TO READING A CXR

- Heart
- silhouette sign
- Mediastinum
- Diaphragm
- costophrenic angles / Effusions
- Lungs
- alveolar pattern vs. Interstitial Pattern
- Skeleton / Bones
- check each rib
- check vertebral body height on lateral view

DESCRIBING THE LUNGS

Pulmonary vasculature
- Pulmonary edema

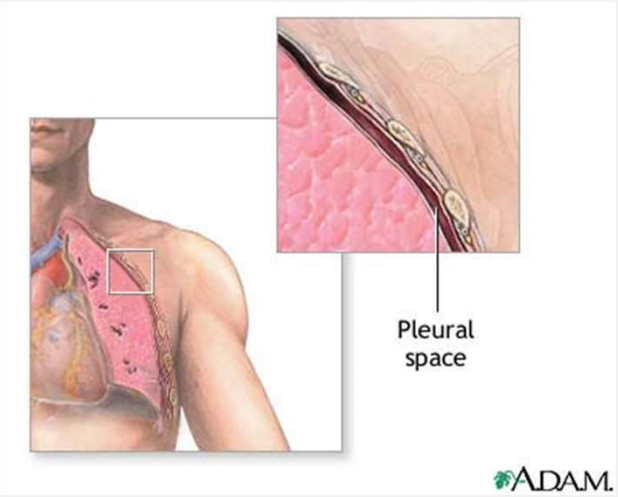
Costophrenic angles
- Pleural effusions

Inflation
- Count the ribs, look at diaphragm
  - Emphysema

Masses/nodules
rule of 3

Consolidation

Parenchyma
- Compare lung fields to each other



LUNGS

Unilateral vs. Bilateral

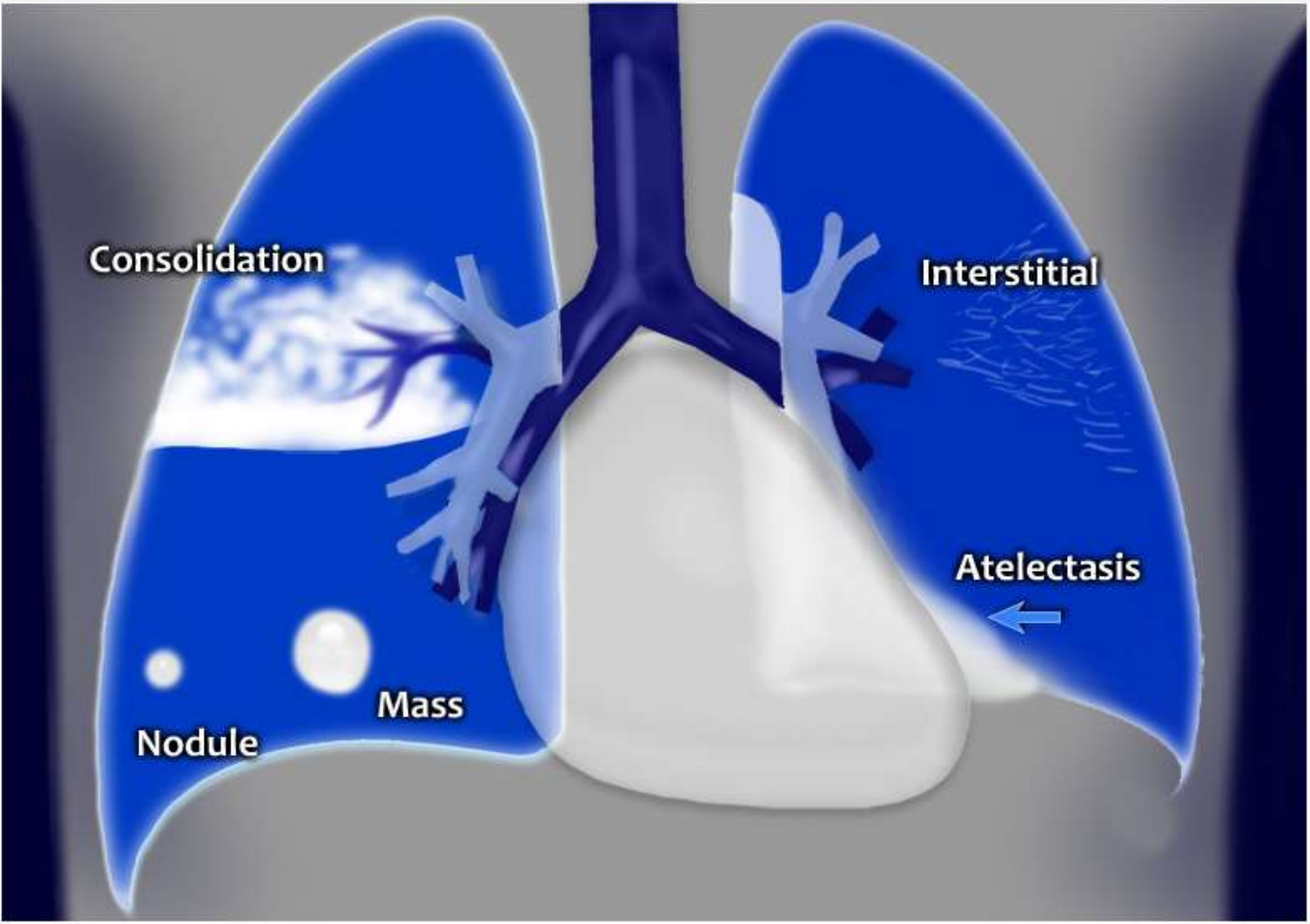
Focal vs. Diffuse

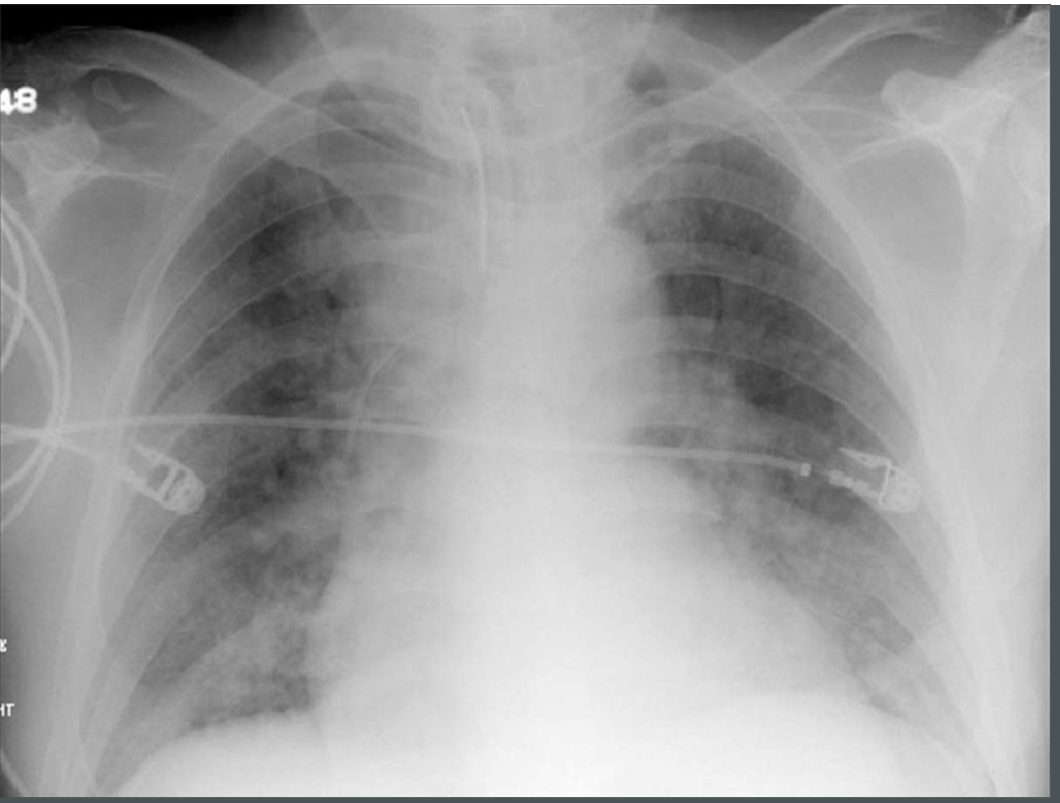
Location

(apex, base, mediastinal, hilar regions)

Peripheral vs. Central

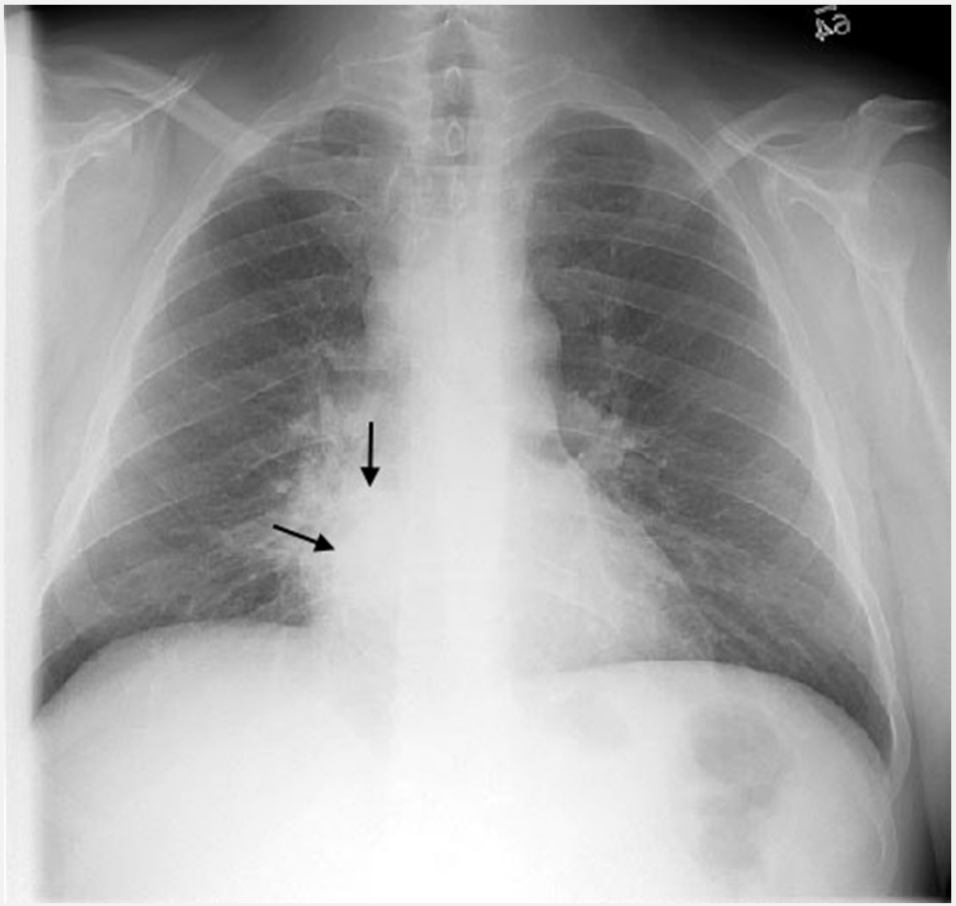
Interstitial vs. Alveolar


Consolidation
Interstitial
Atelectasis
Mass
Nodule

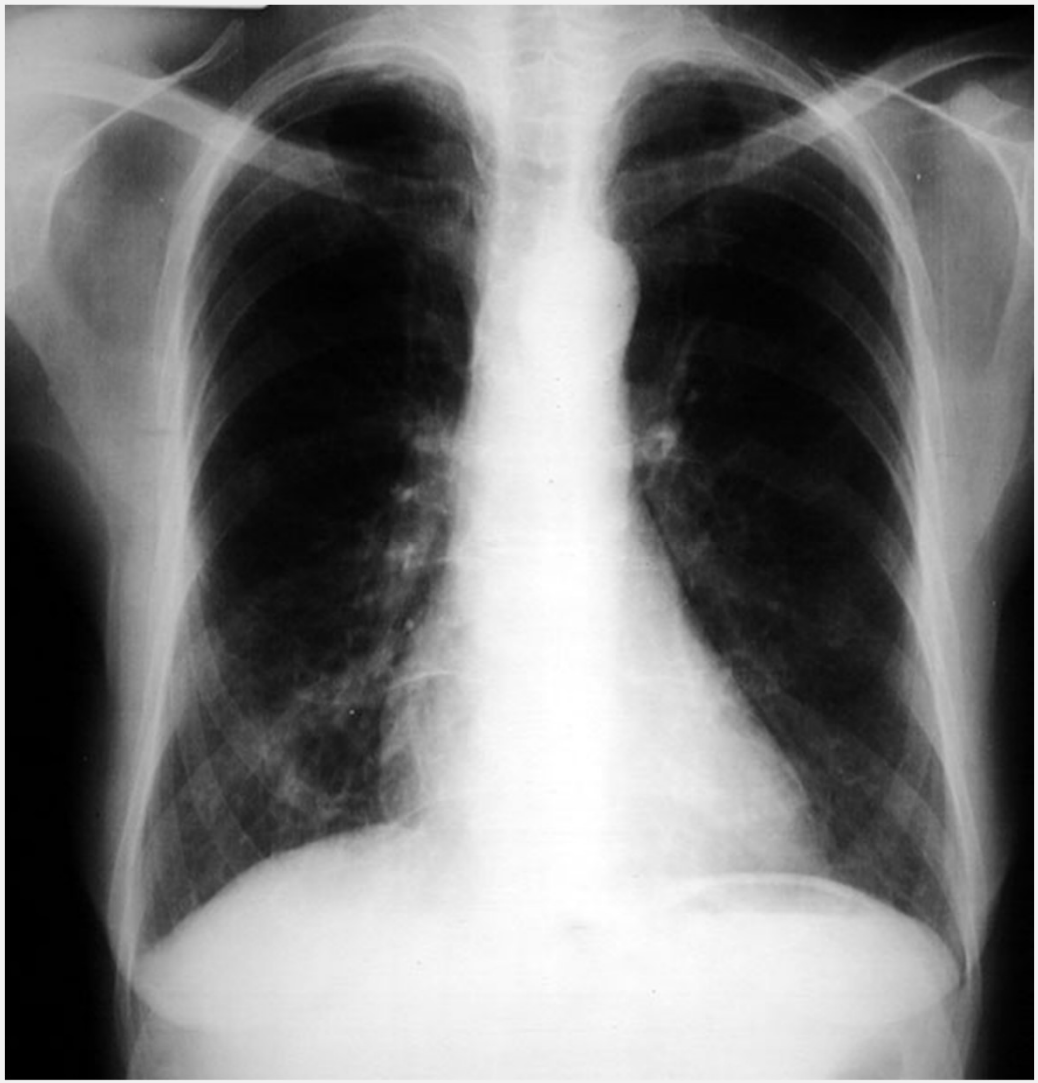


FOCAL VS. DIFFUSE

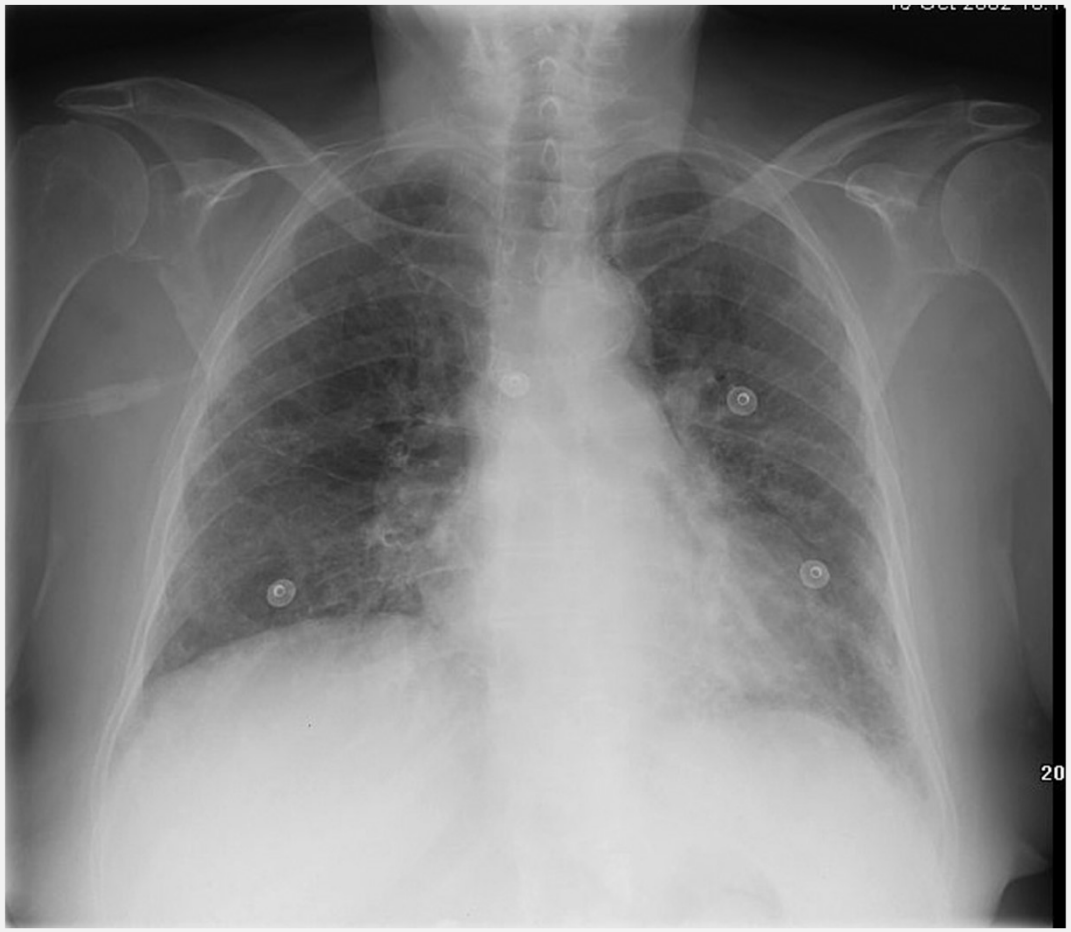
WHY THE LATERAL MATTERS

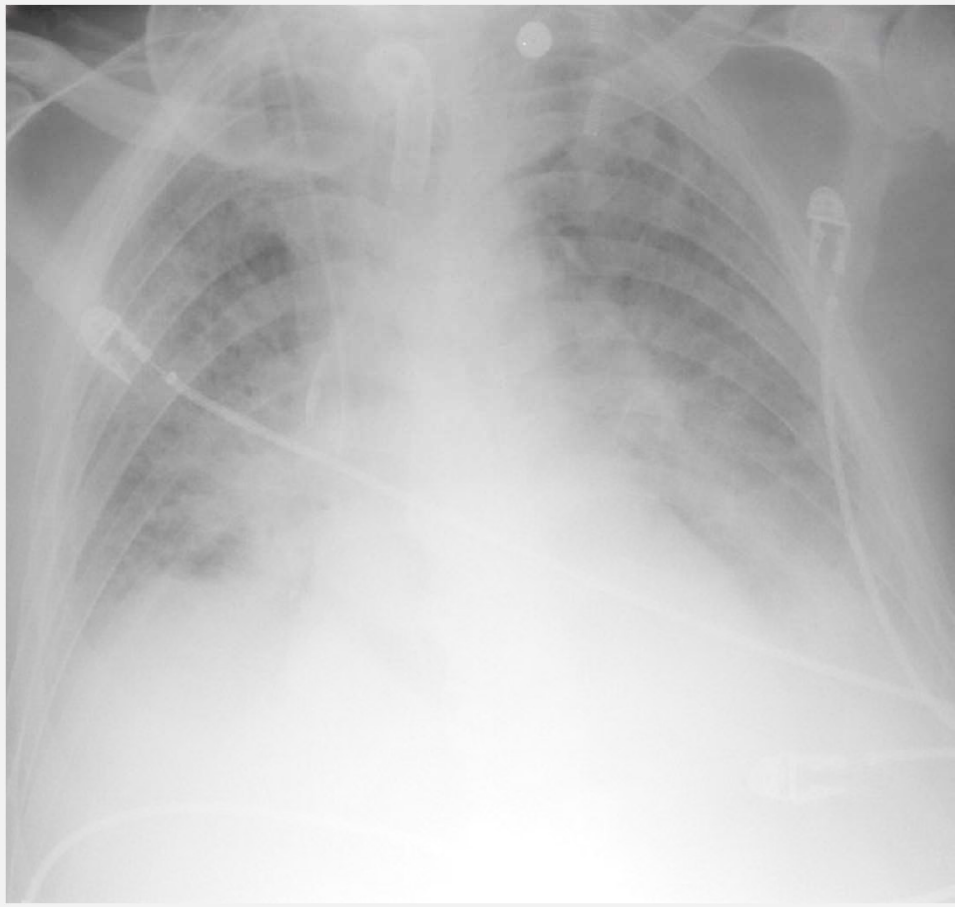


ATELECTASIS VS. PNA

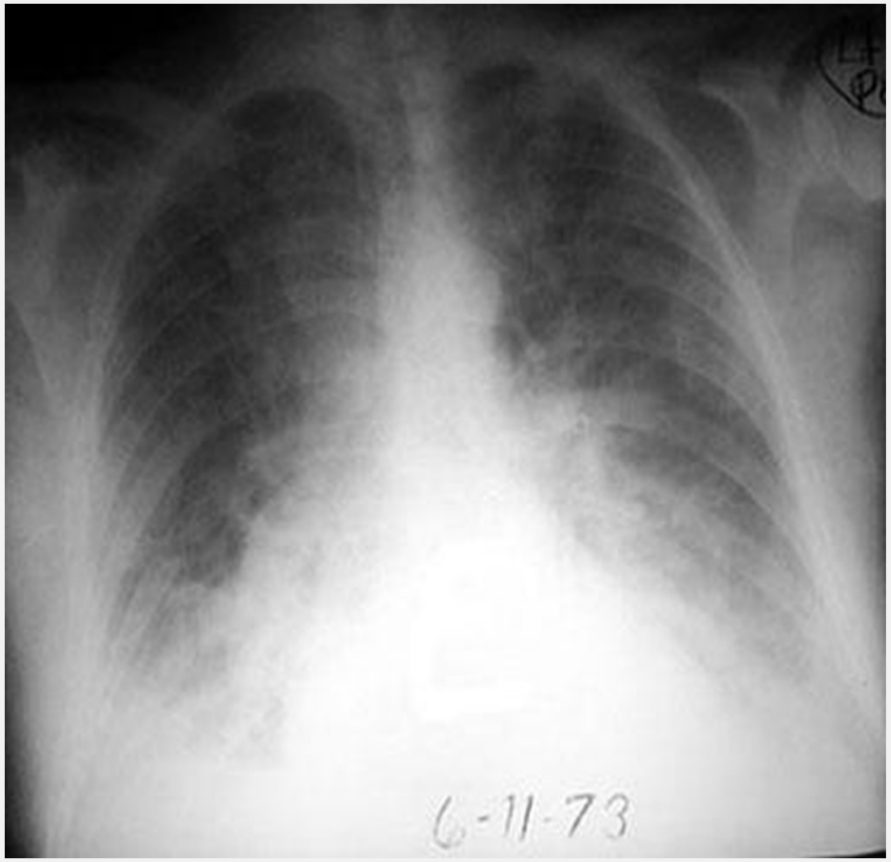


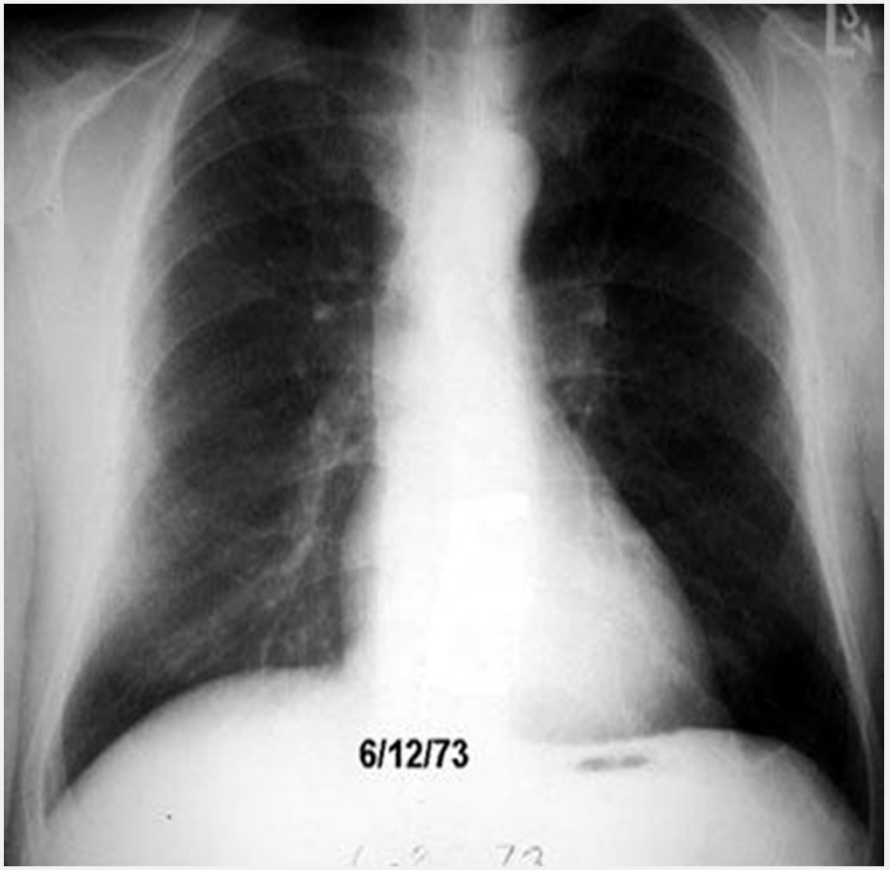
INTERSTITIAL VS. ALVEOLAR



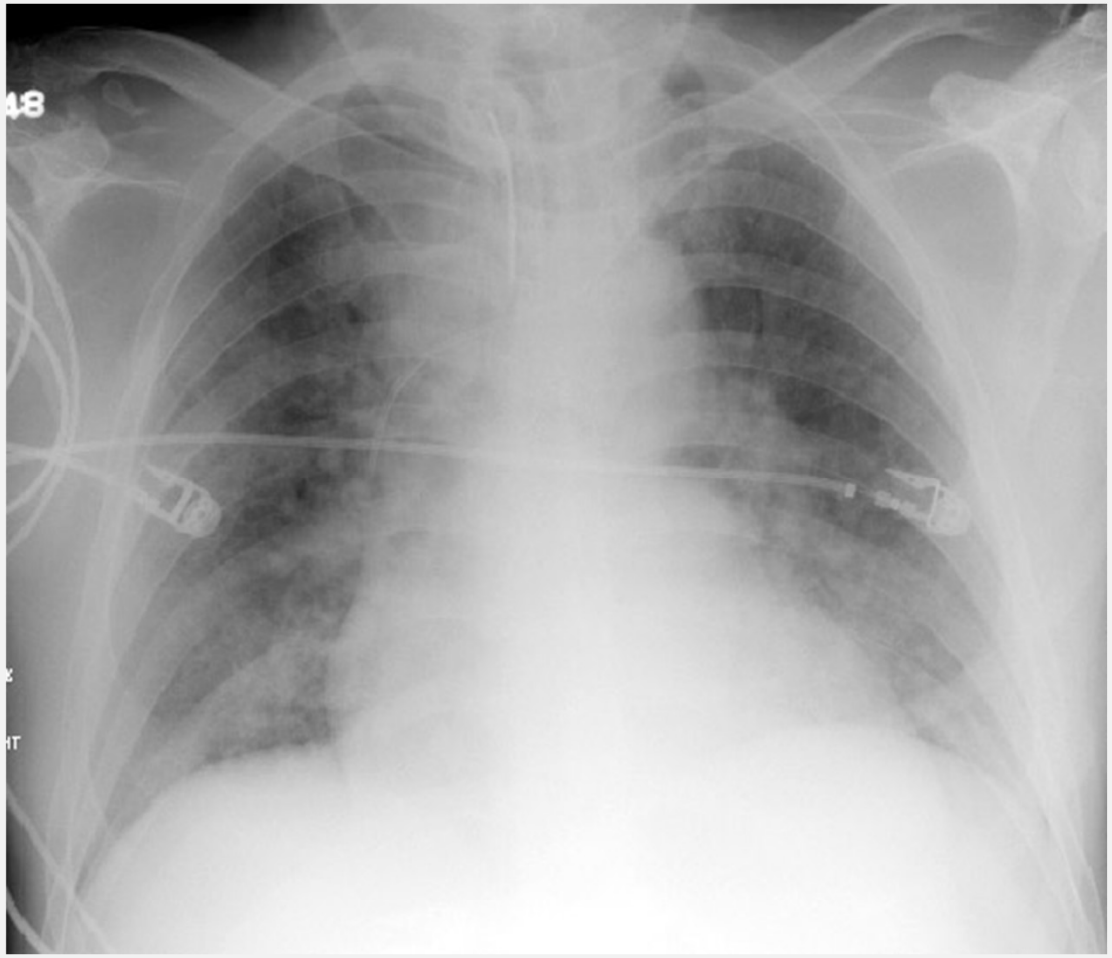


PULMONARY EDEMA





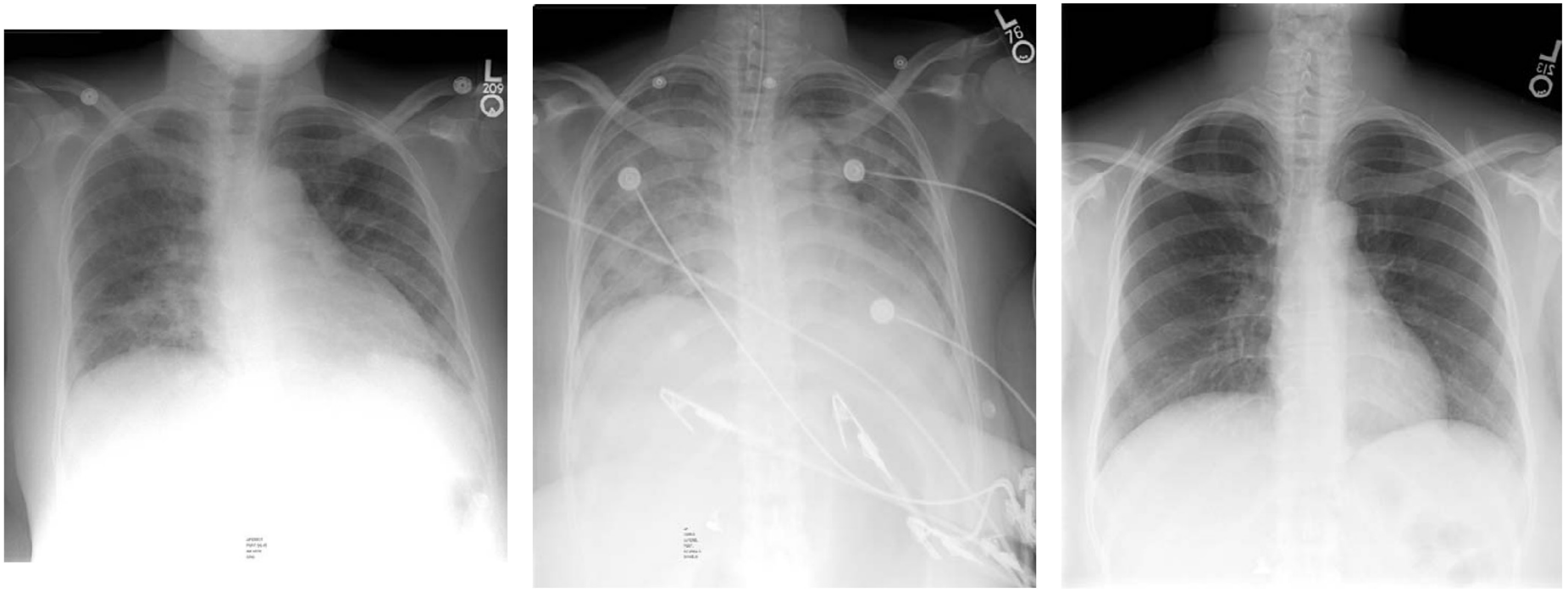
CHF PATTERN ON CXR



Cardiomegaly

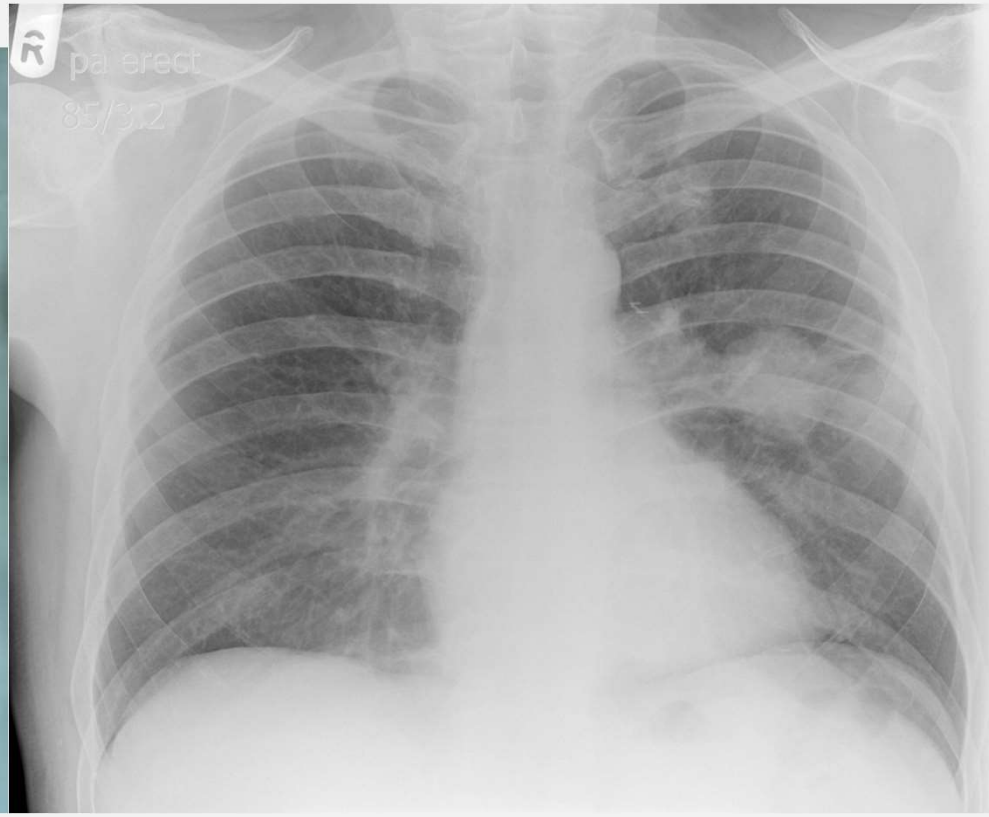
Alveolar infiltrates

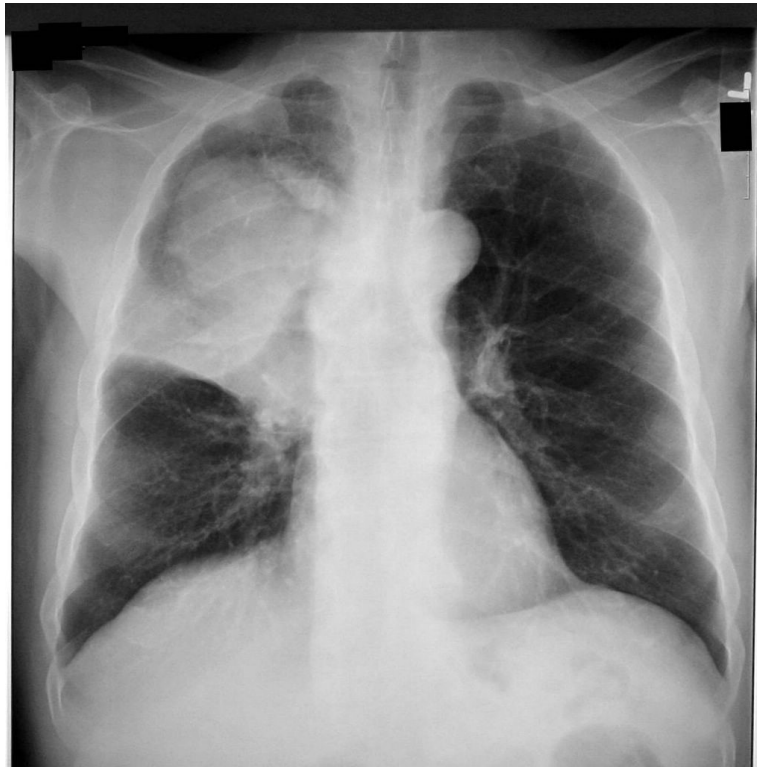
+/- pleural effusions



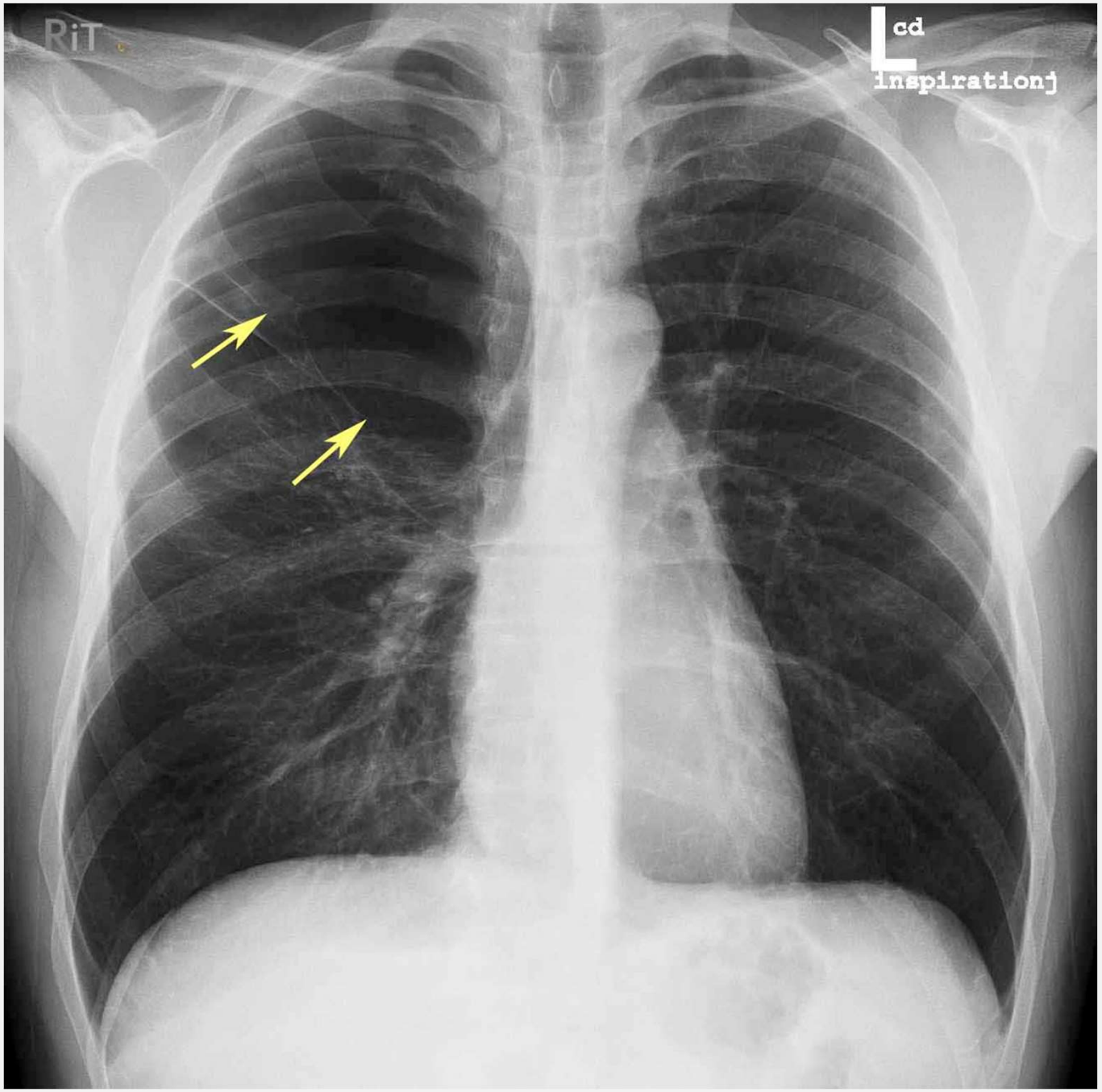
ARDS PROGRESSION ON CXR

NODULE VS. MASS

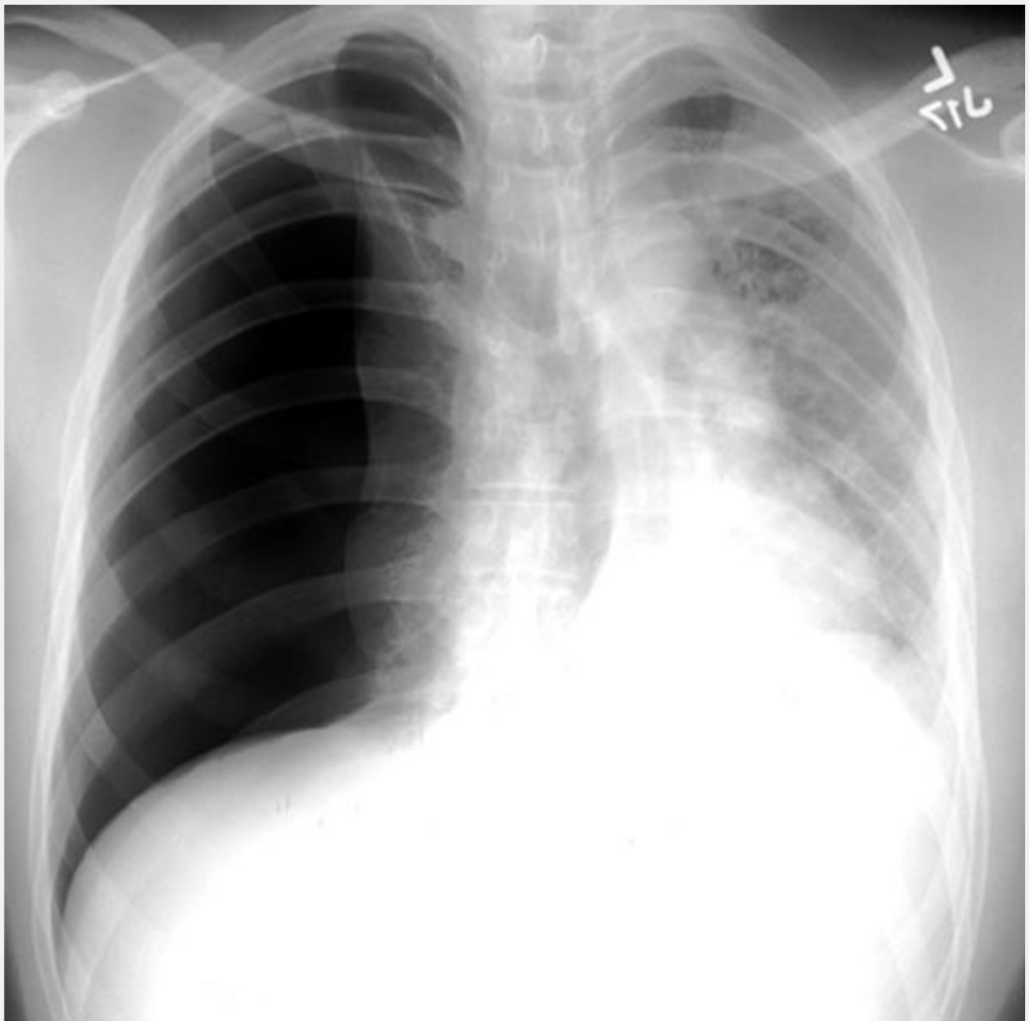


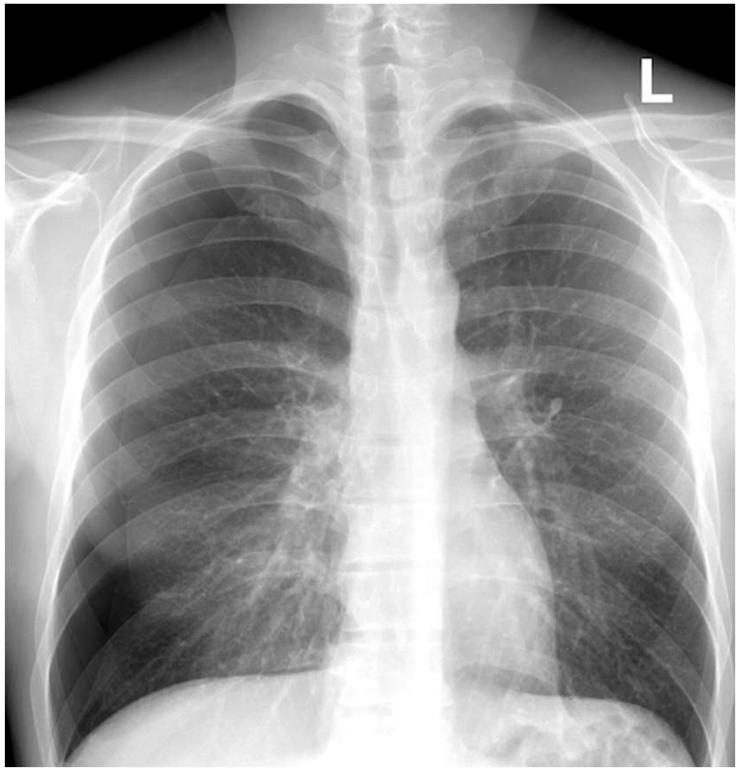


RUL MASS


RiT
cd
inspirationj

PNEUMOTHORAX – HOW TO FIND IT?
THE OBVIOUS





. . . AND THE NOT SO OBVIOUS

1 on right small left apical pna
-Christy Wilson
, 3/8/2016

LOOK FOR THE LACK OF LUNG MARKINGS

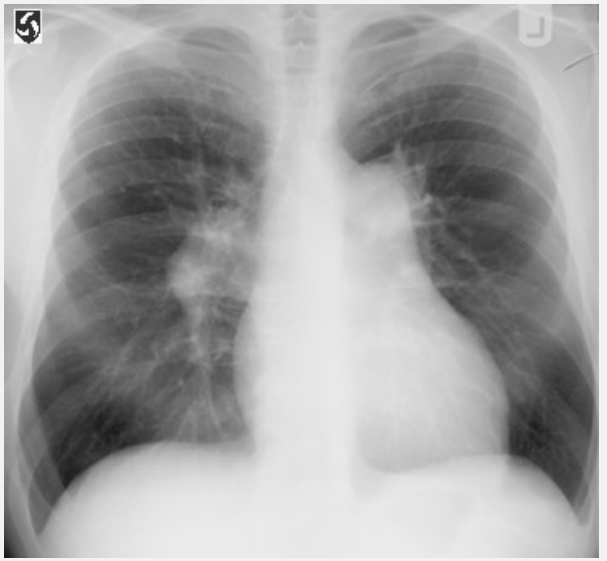
MEDIASTINAL/ HILAR REGION

Differential Diagnosis:

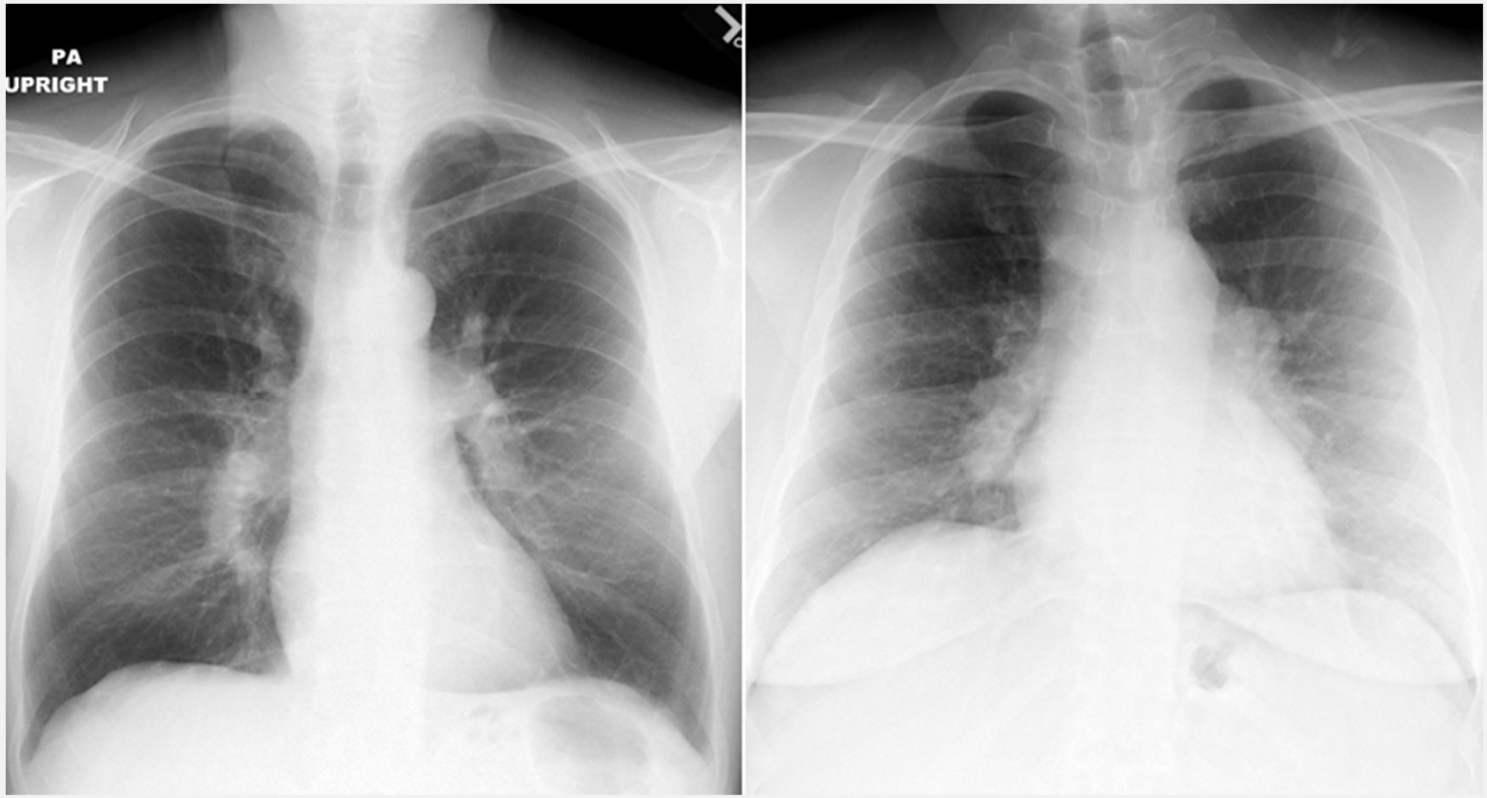
Pulmonary vessel enlargement

- *more "smooth" appearance*

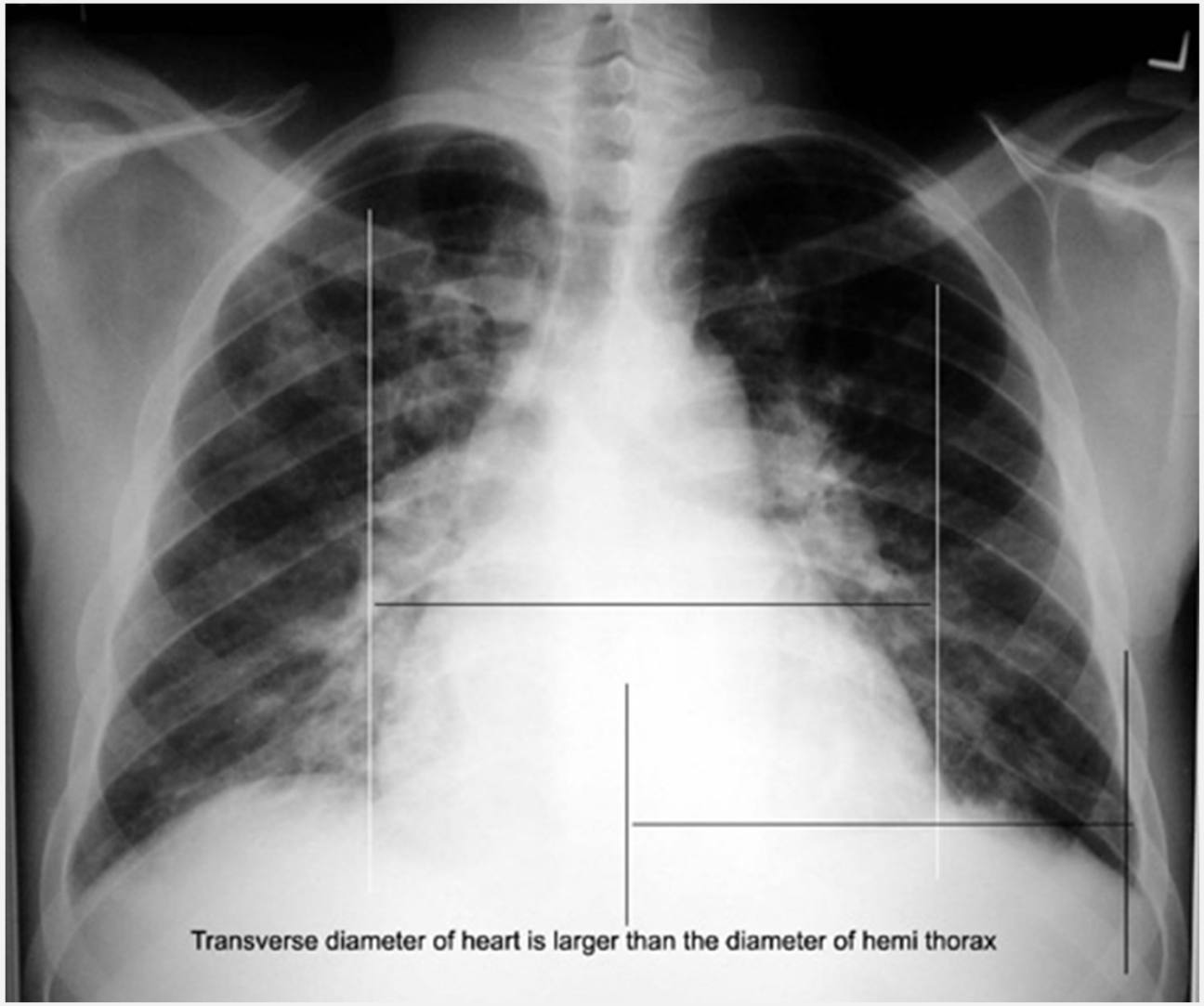
- **Hilar Adenopathy**
  - *more "bumpy" appearance*
- **Inflammation (sarcoidosis, silicosis)**
- **Neoplasm (lymphoma, metz, broncogenic CA**
- **Infection (TB, histoplasmosis, mono)**



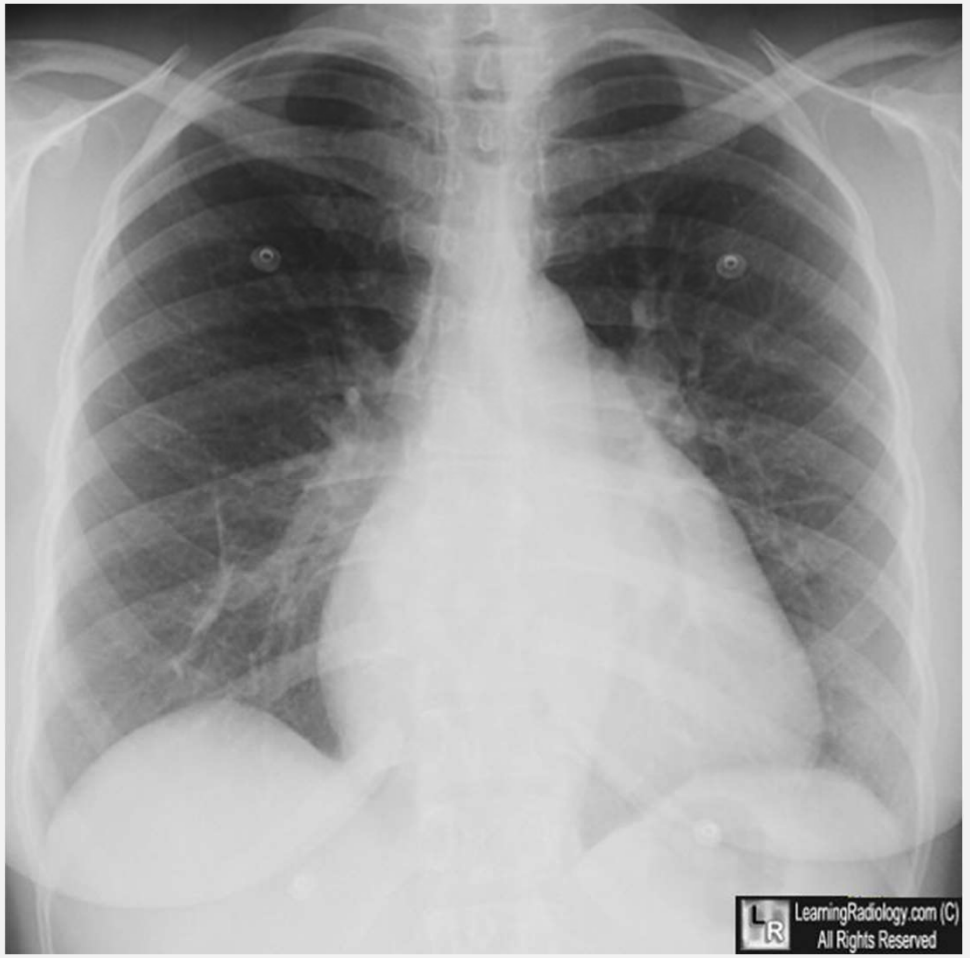
PULMONARY ARTERY ENLARGEMENT VS. LAN



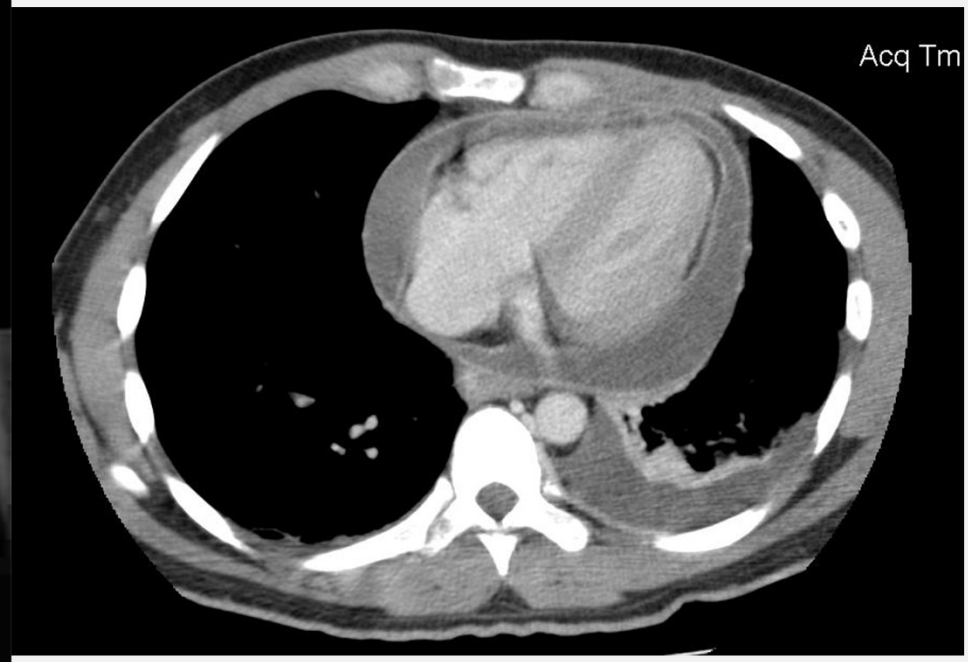
HEART / CARDIAC

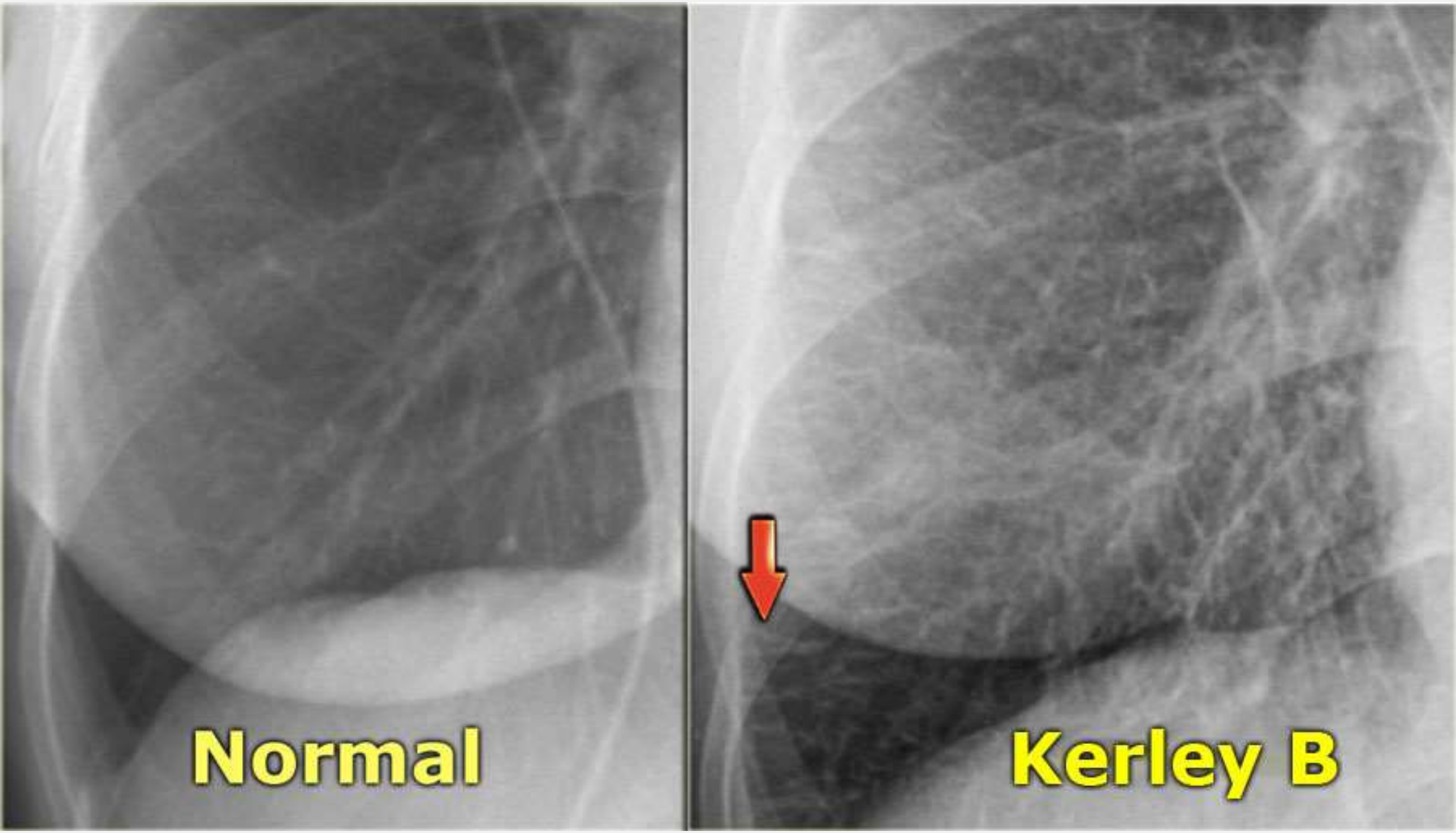


CARDIOMEGALY

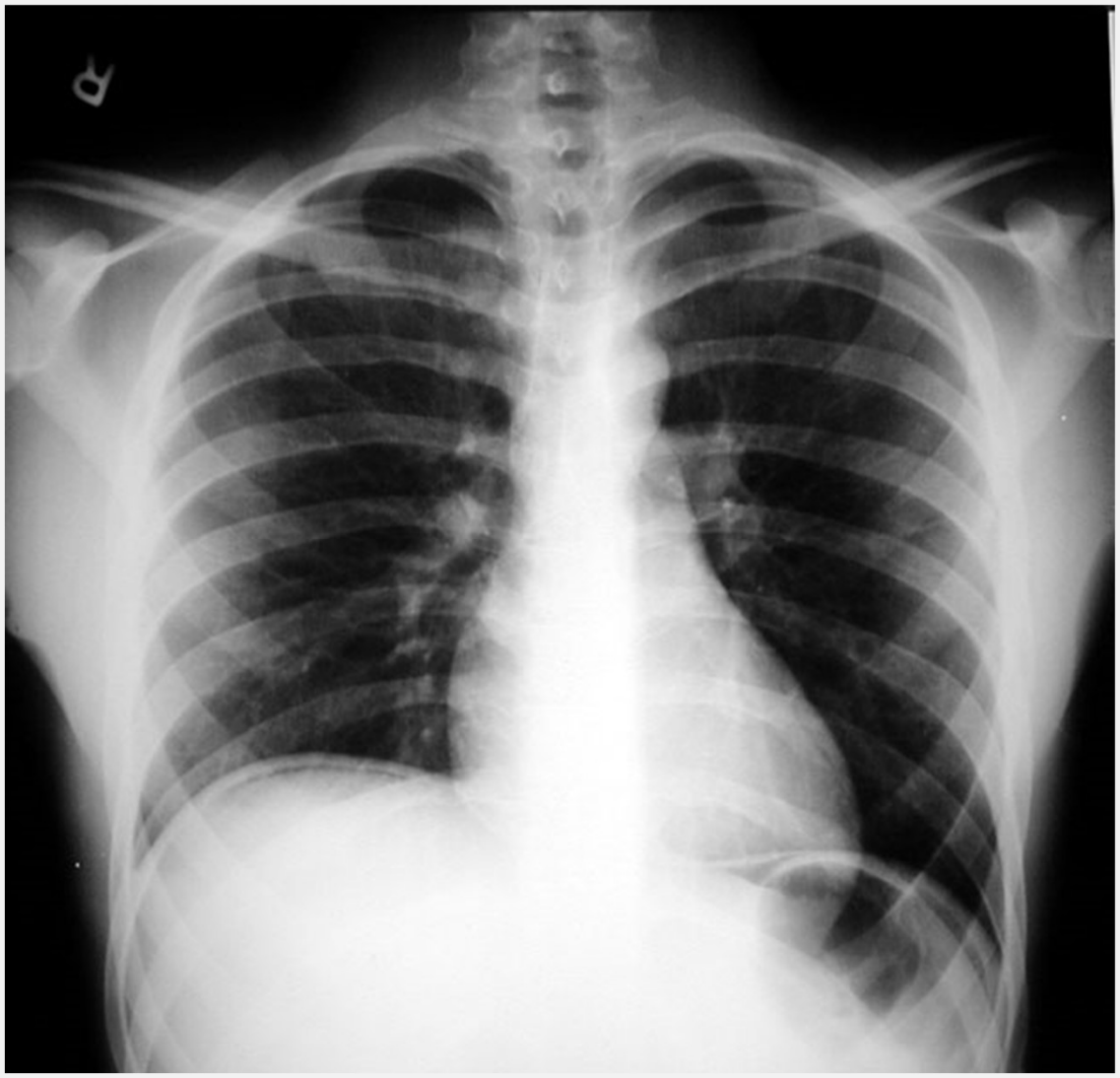


PERICARDIAL EFFUSION

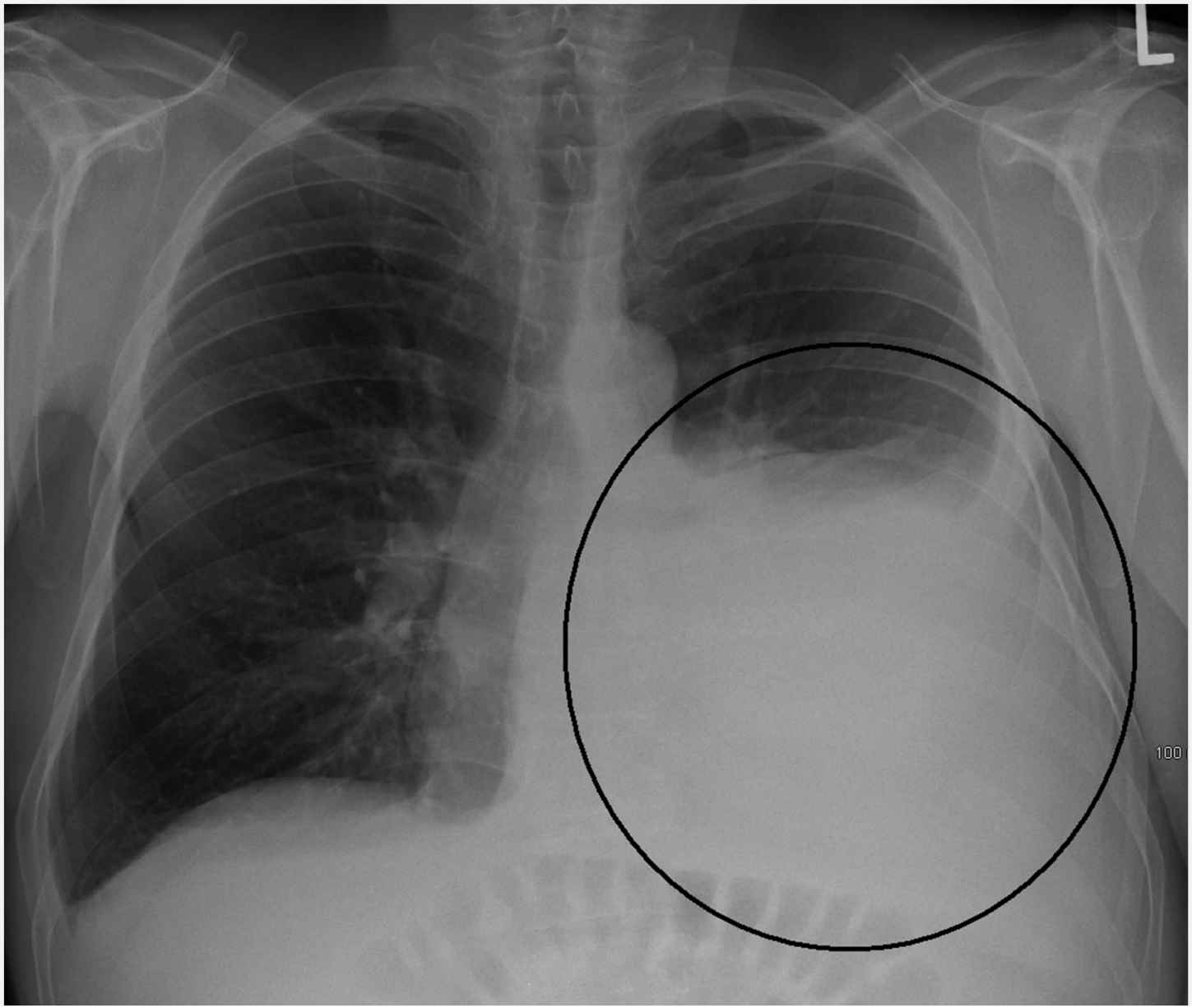



Normal
Kerley B

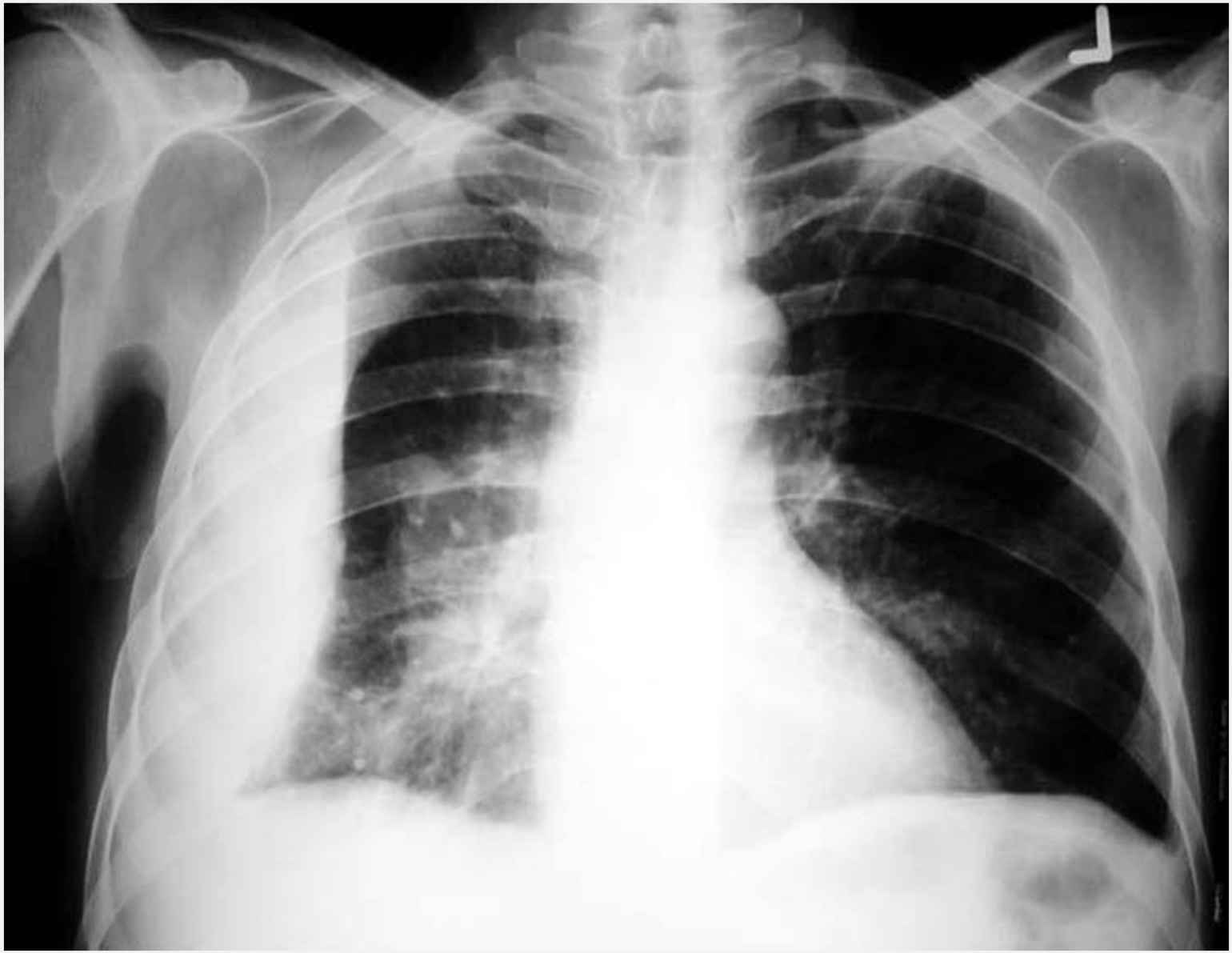
PNEUMOPERITONEUM



PLEURAL EFFUSION



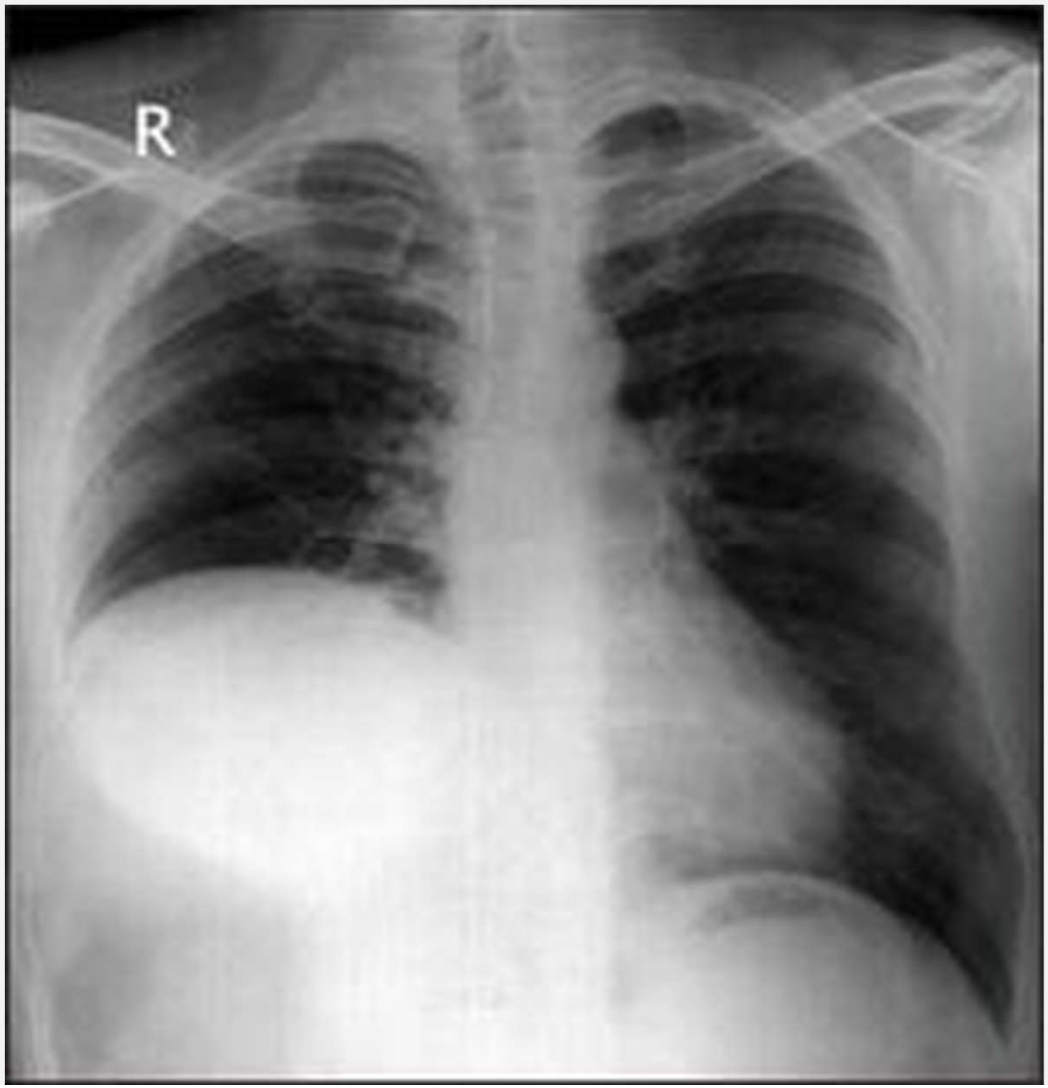
LOCULATED EFFUSION



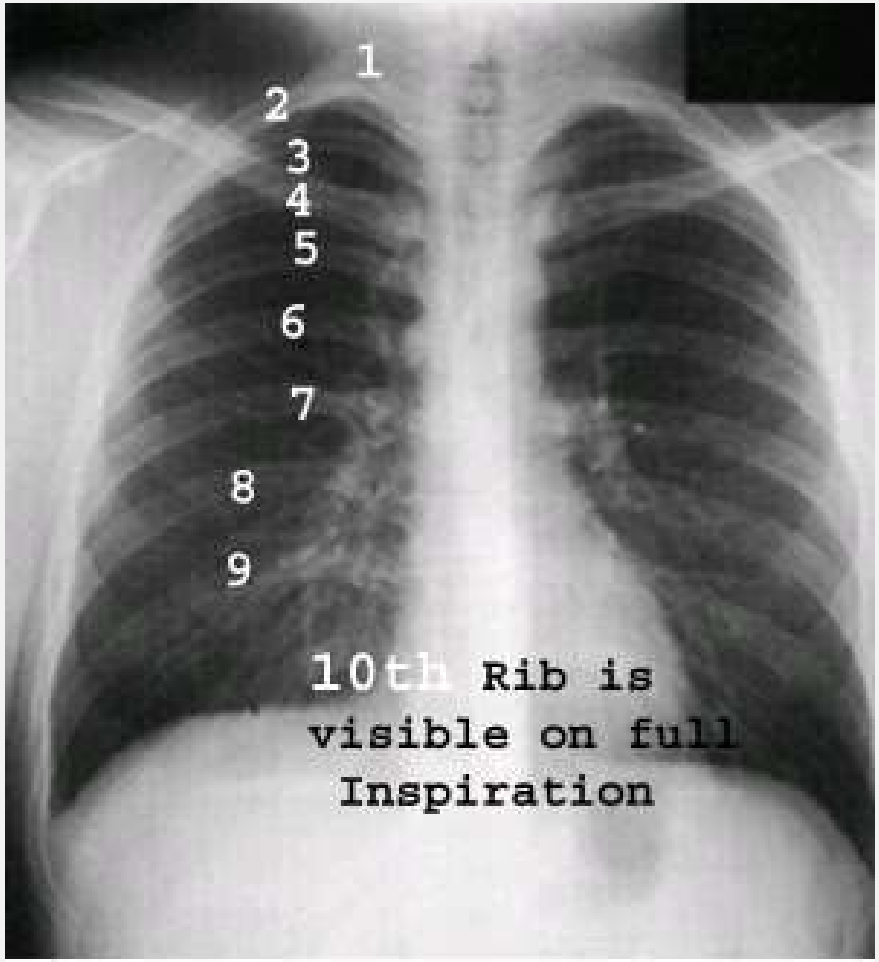
ELEVATED RIGHT HEMIDIAPHRAGM

Sniff Test

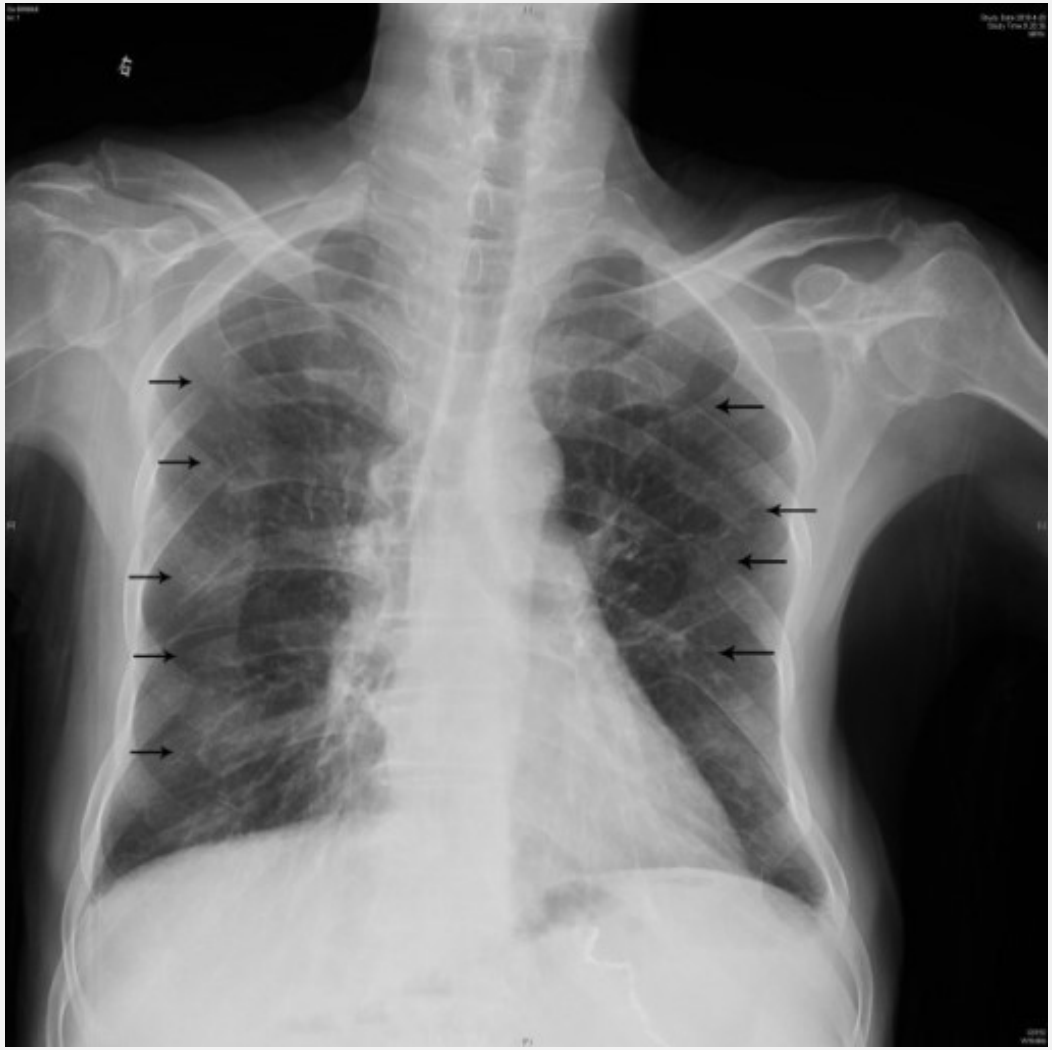
- Is it paralyzed?



COUNTING THE RIBS/ FRACTURES

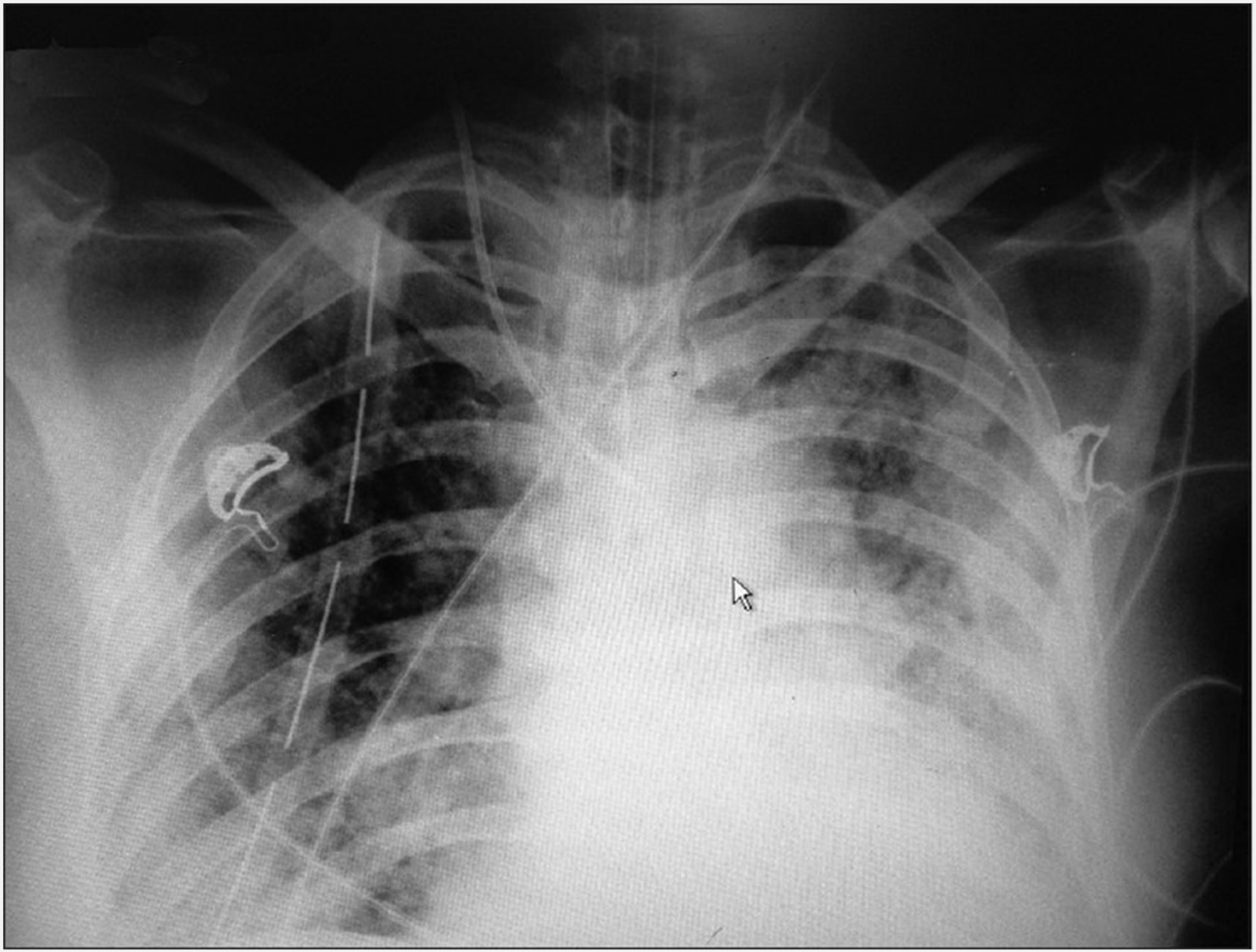


PA view on full inspiration. Image courtesy of Dr. Naveed Ahmad.

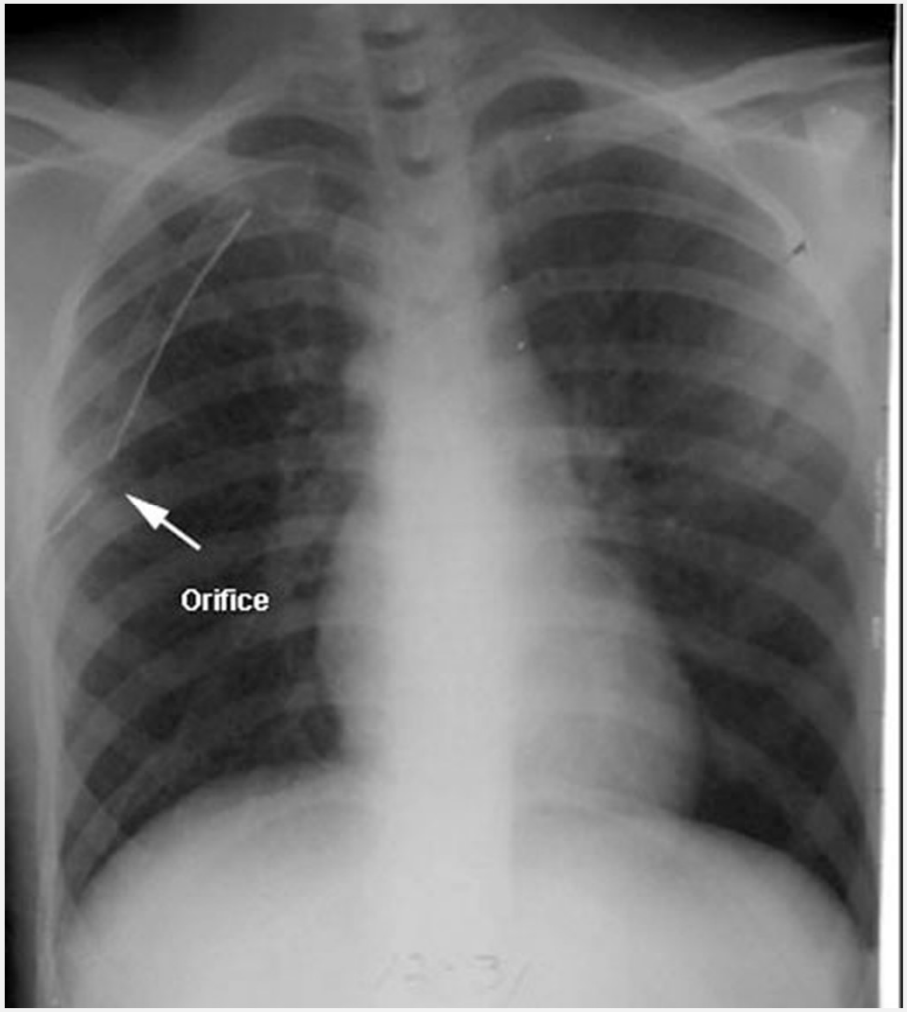


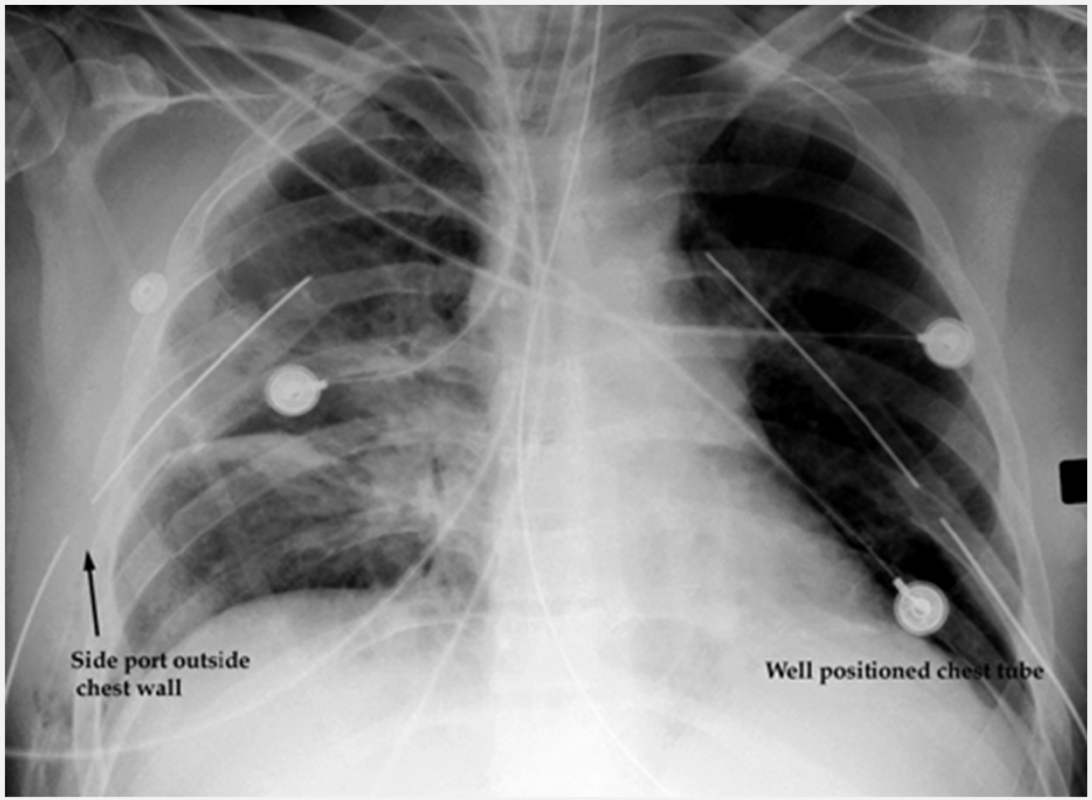
SOFT TISSUE

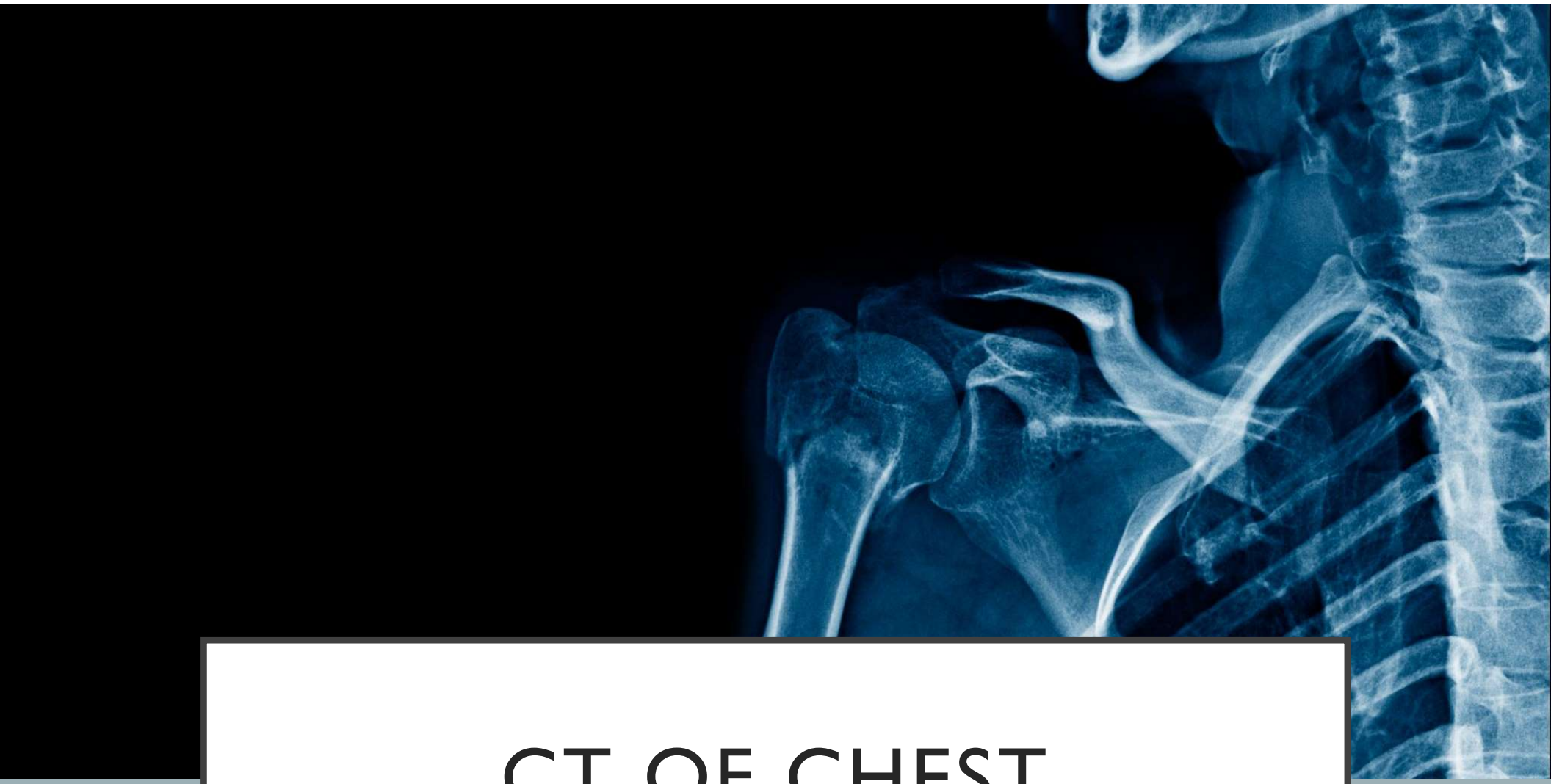
APPLIANCES AND FOREIGN BODIES



CHEST TUBE PLACEMENT







CT OF CHEST

TYPES OF CT CHEST

Standard:

- - 3-10 mm, Full lungs, +/- contrast

High resolution:

- 0.625 – 1.5 mm every 10 mm
- High definition of lung parenchyma, vessels, airspaces, airways, interstitial
- Prone and supine

FleiSchner Guidelines 2017:

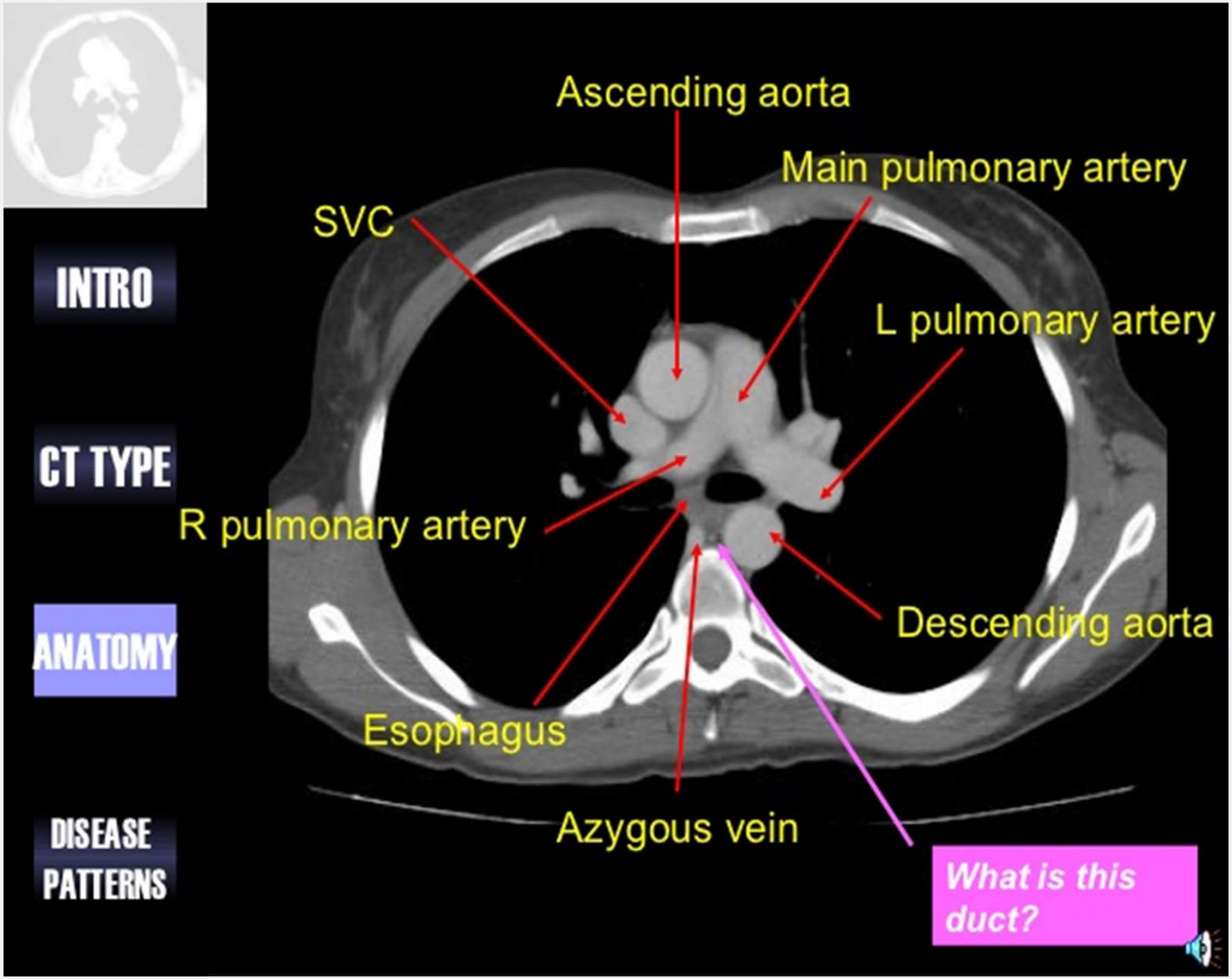
CT pulmonary angiogram:

- Bolus of contrast
- Indications: PE, aortic aneurysm, aortic dissection

LDCT:

- Screening tool

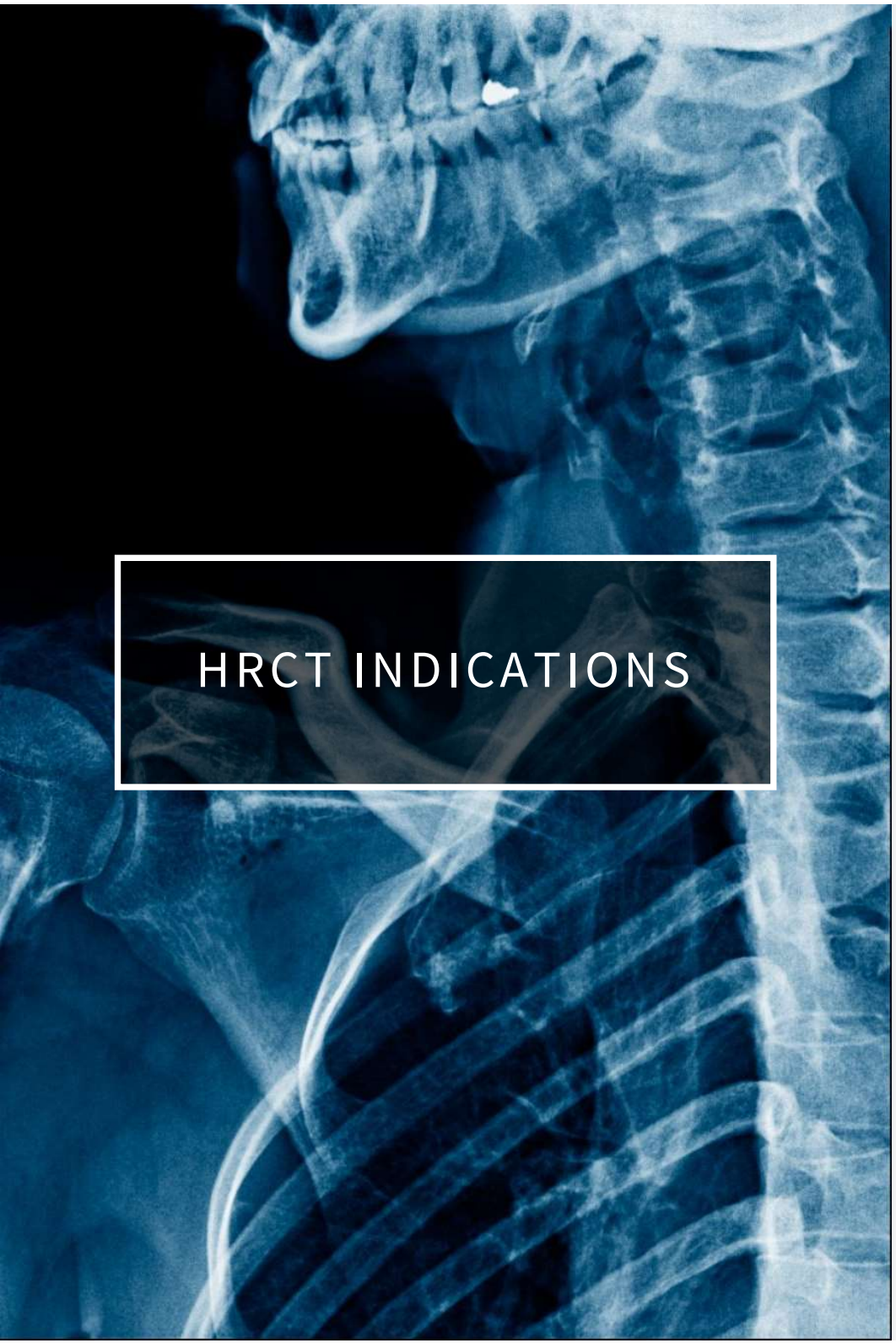
STANDARD CT CHEST



OTHER INDICATIONS FOR CT CHEST

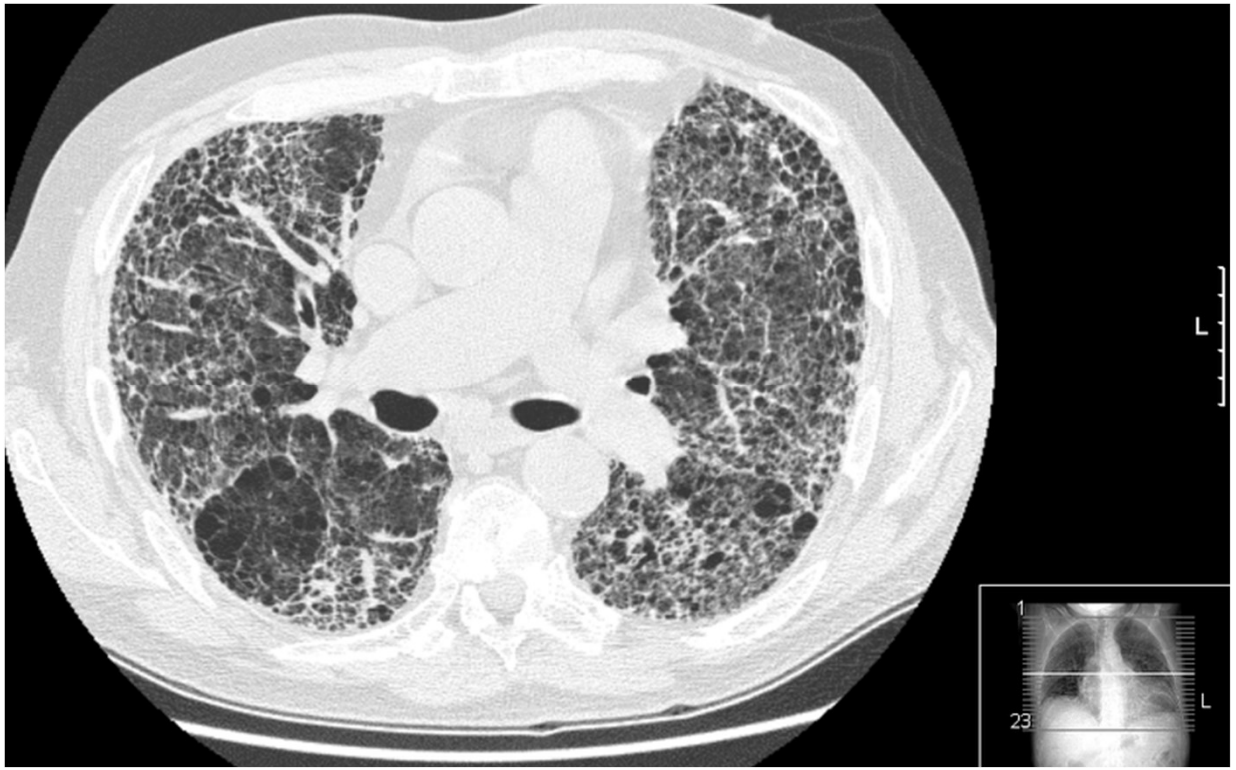
- **Evaluation of an abnormality detected on a chest X-ray**
  - Pulmonary / Mediastinal mass or nodule
- **Evaluation of aortic disease**
  - Aortic aneurysm/dissection
  - Trauma
- **Malignant disease**
  - Staging of primary tumor extent and its relationship to adjacent structures
  - lymphadenopathy and metastatic disease
  - Assess suitability for biopsy
- **Evaluation of pleural disease**
- Suspected pulmonary embolus

Guide to thoracic imaging
Volume 44, No.8, August 2015 Pages 558-562



HRCT INDICATIONS

- **Bronchiectasis**
- **Pulmonary Fibrosis**
- **Abnormal CXR with diffuse changes**
- **Abnormal PFTs with normal CXR**
- **Known diffuse lung disease / Interstitial lung disease**
- **Assessment of Rx response (ex: IPF (idiopathic pulmonary fibrosis)**



HRCT OF IPF

LOW DOSE CT CHEST / SCREENING TOOL

CMS guidelines for ordering LDCT (low dose CT for lung cancer screening) updated 2/2022

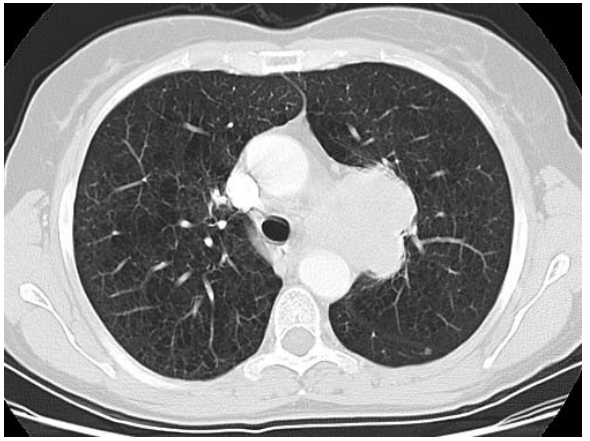
- Age 50-77 years old
- Asymptomatic
- Tobacco abuse of >/= 20 pack history
- Current smoker or quit within the last 15 years

- USPTF – 50-80 yo

- *Medicare coverage as of February 2022*
- *www.cms.gov for specifics*

LUNG WINDOWS on CT Chest

- Emphysematous changes
- Bronchiectasis
- Honeycombing
- Ground glass opacities
- Nodules/masses
- Air bronchograms
- Tree in Bud pattern



EMPHYSEMATOUS CHANGES

- **Permanent enlargement of air spaces distal to bronchioles**
- **Destruction of elastin in the walls of the alveoli**
- **Often see barrel chest/hyperinflation/ flattened diaphragms**

- ***Differential Diagnosis:***
- COPD
- Hx smoking
- Alpha 1 antitrypsin def.

EMPHYSEMA

3 Types:

<u>Centrilobular</u>:

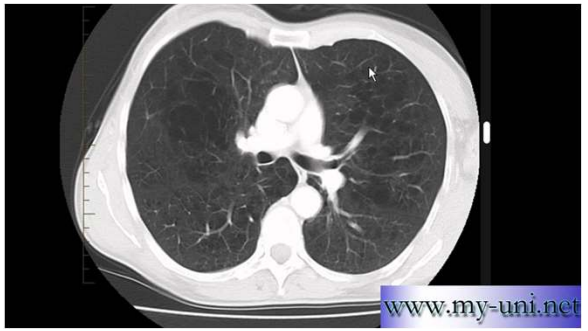
from smoking/upper half of the lungs, most common

<u>Panacinar</u>:

destroys entire alveolus/ lower half of lungs/A1AT def.

<u>paraseptal:</u>

distal airways/ apical bullae



BRONCHIECTASIS

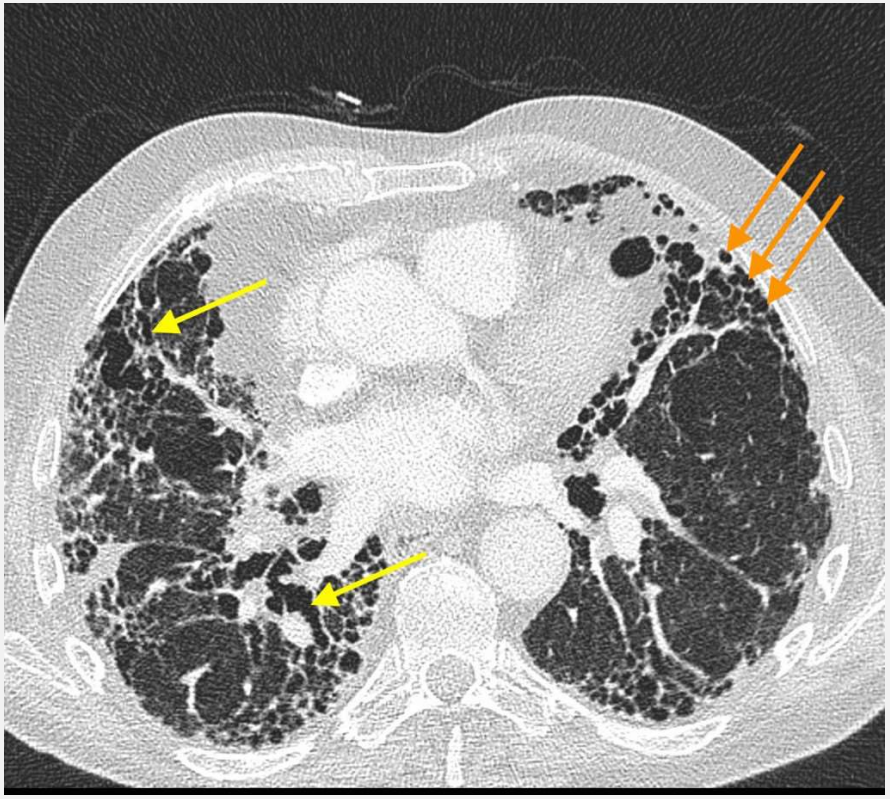
Dilation of the bronchi

- **Causes impairment of clearance of airways -> recurrent infections -> bronchial damage**
- **HRCT is best CT of choice**

Differential Diagnosis:

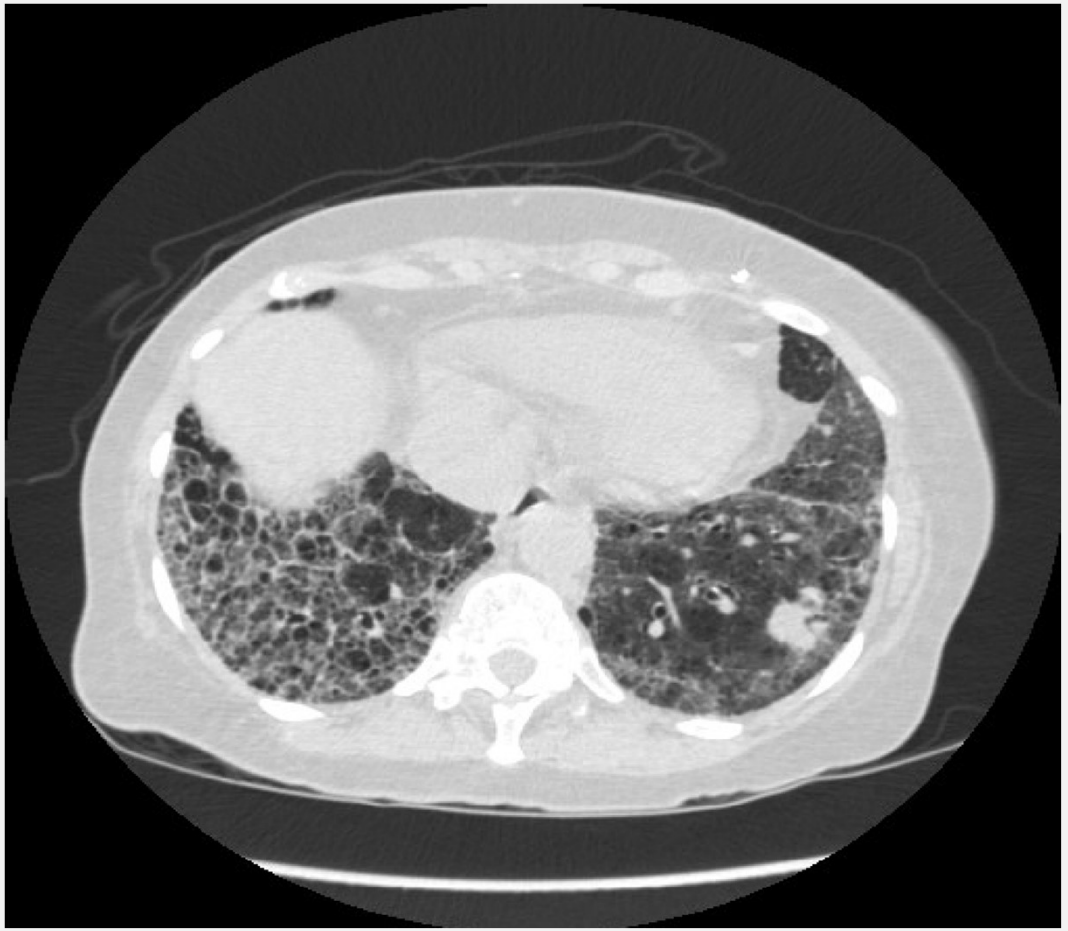
- **Infection**
- **Bronchial**
- **Cystic fibrosis**
- **Immunodeficiency / A1AT def.**
- **Pulmonary fibrosis**

BRONCHIECTASIS

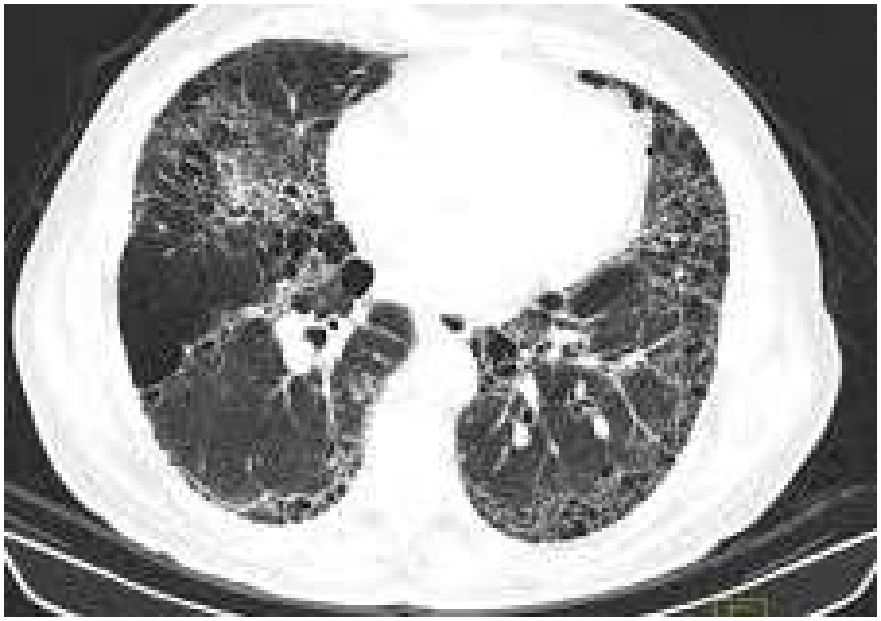


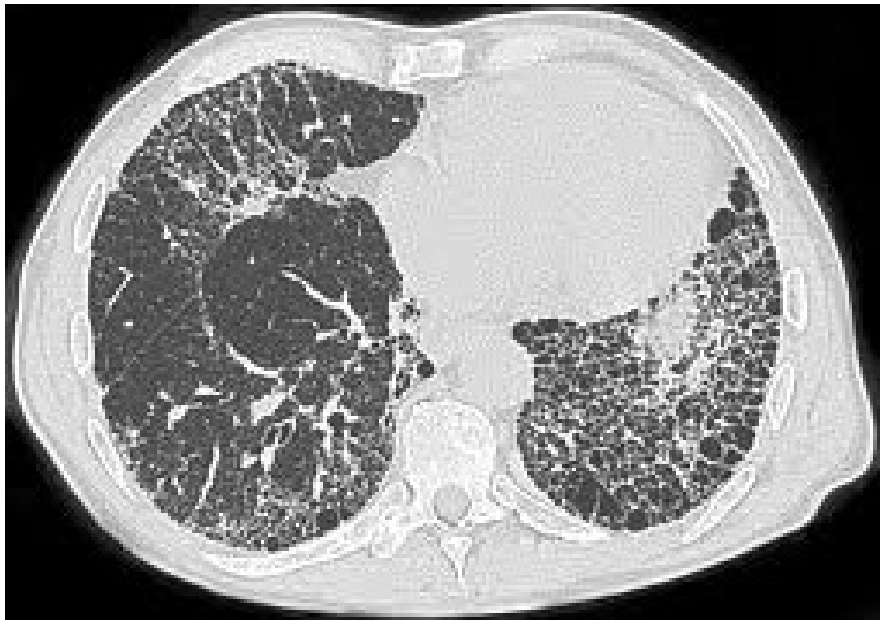
BRONCHIECTASIS / CYSTIC

HONEYCOMBING



HONEYCOMBING





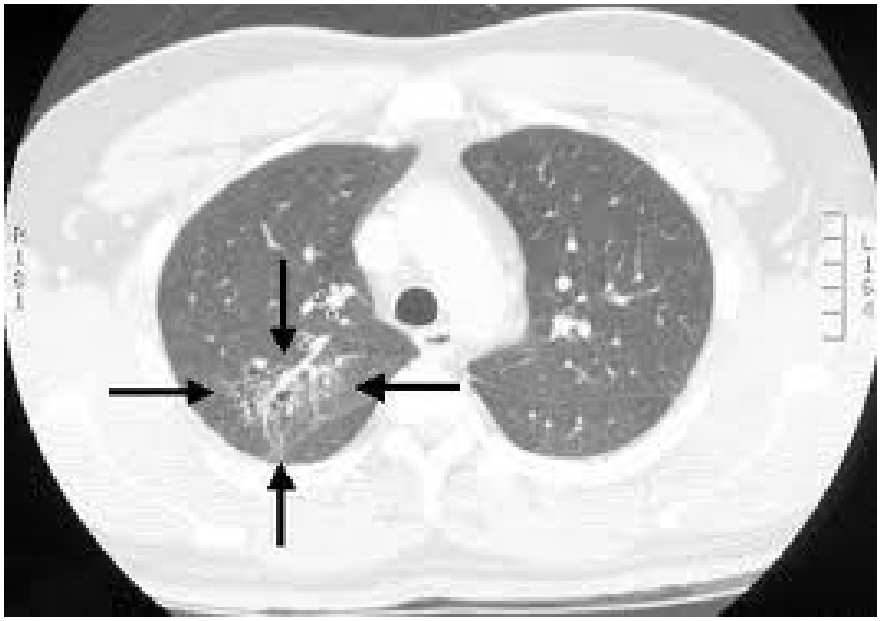
HONEYCOMBING

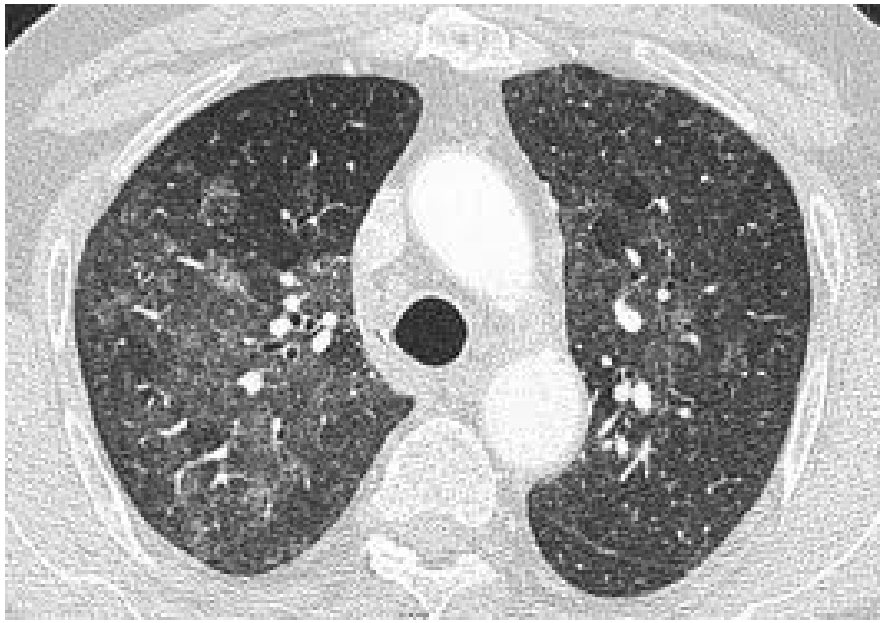
GROUND GLASS OPACITIES

- **Common *non-specific* finding**
- **Decrease air without complete obilteration of alveoli**
- **Lung opacity / infiltrate but doesn't obscure the pulmonary vessels**

Differential diagnosis:

- alveolitis / interstitial pneumonitis (HP/IPF/sarcoidosis)
- Pulmonary edema
- Resolving PNA or hemorrhage
- COVID 19 pneumonia





GROUND GLASS OPACITIES

FLEISCHNER 2017 GUIDELINE FOR PULMONARY NODULES

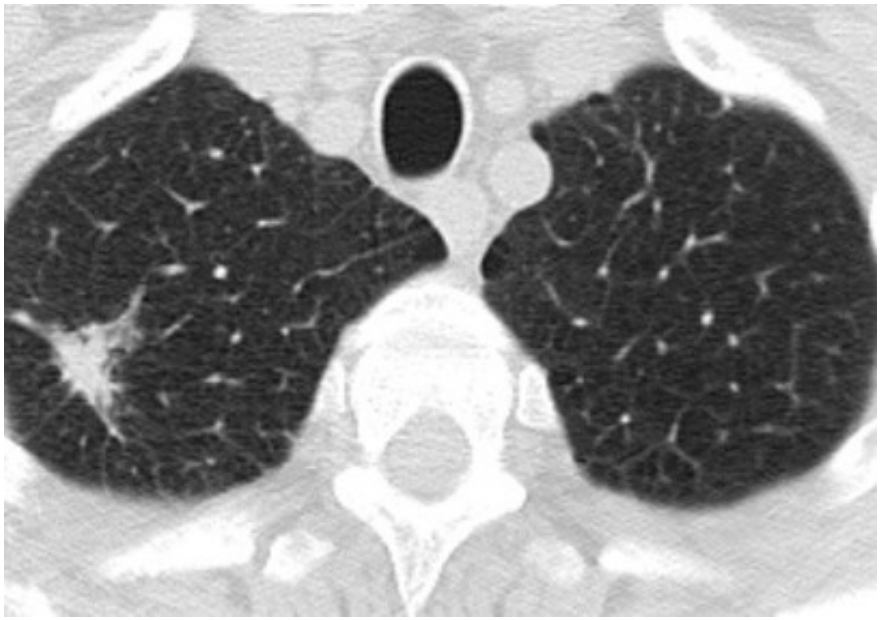
- Updated in 2017 from 2005
- Purpose is to give providers guidelines / management recommendations for follow up
- Pulmonary nodule
  - Solid Lesion
  - Sub-solid lesion
    - Part solid vs. GGO

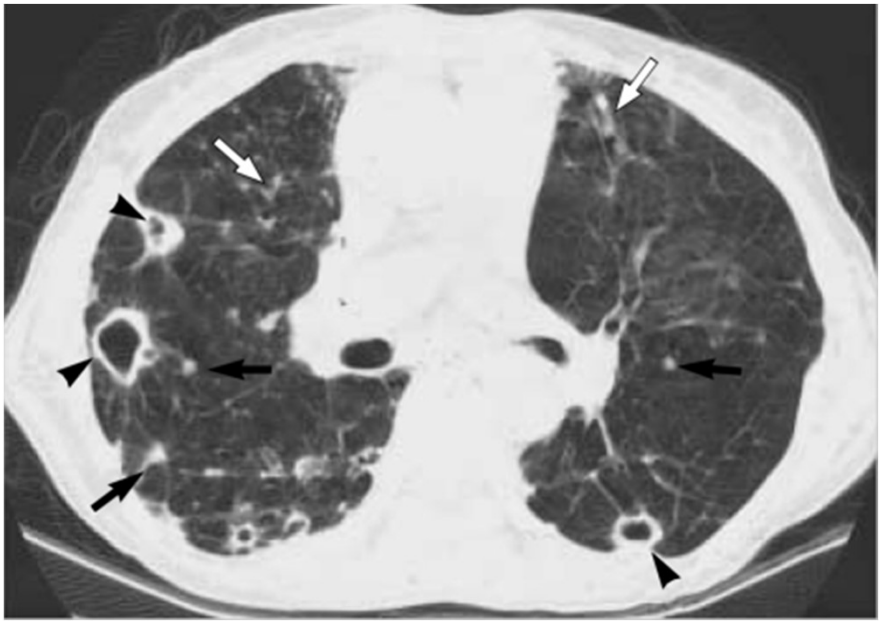
NODULES / MASSES

Types of common lung nodules/masses:

- **granuloma**
- **metastatic disease**
- **lymphoma**
- **cavitary**
- **lung primary cancer**
- **sarcoidosis**

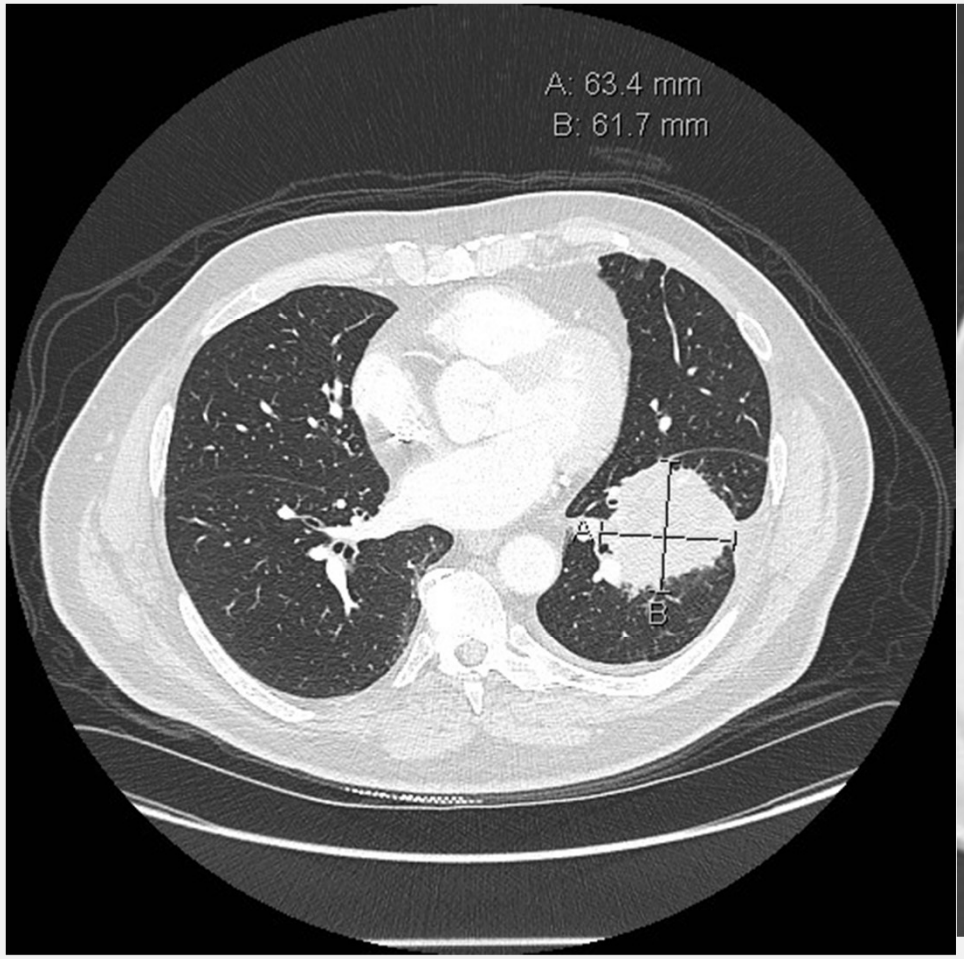
Lung nodules is *less than 3 cm* in size

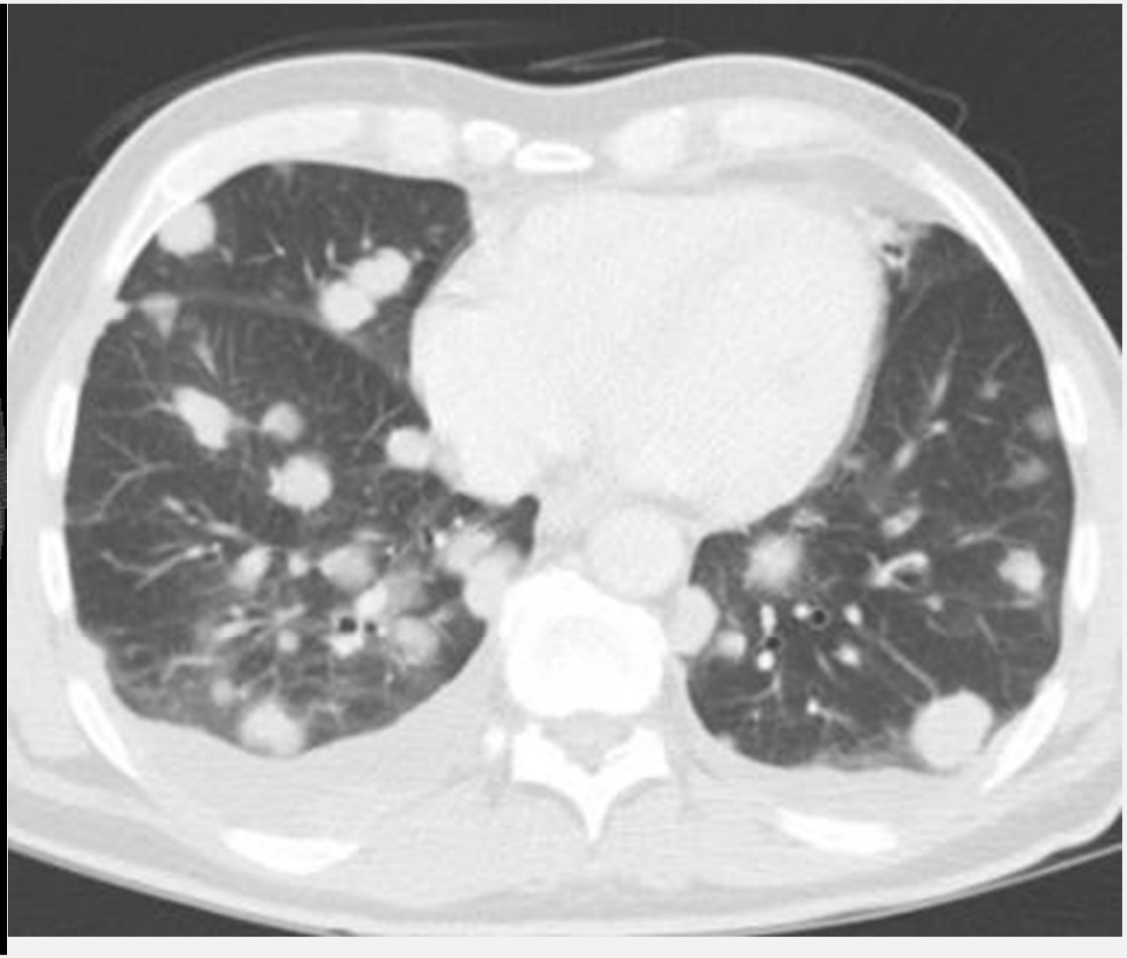




SPICULATED NODULE / CAVITARY

LUNG MASS OR MASSES





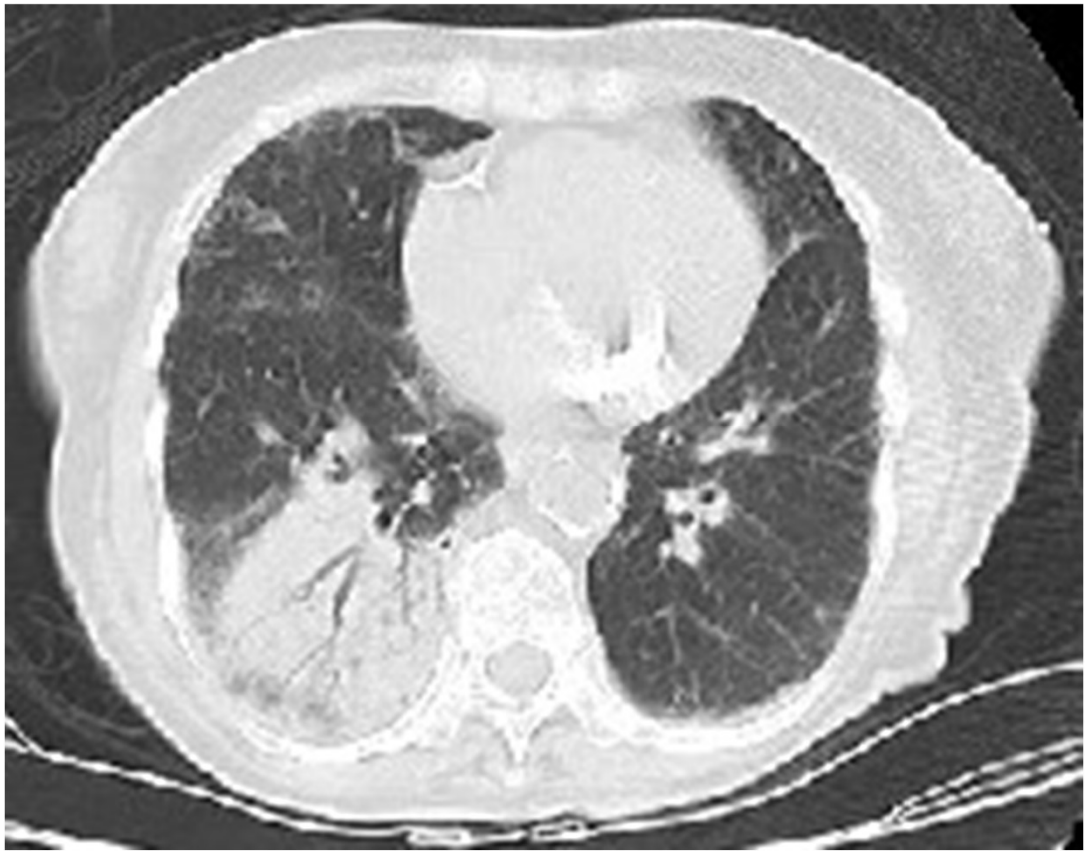
AIR BRONCHOGRAM

Seen when bronchi become visible d/t infiltrates/attenuation of the surrounding lung tissue

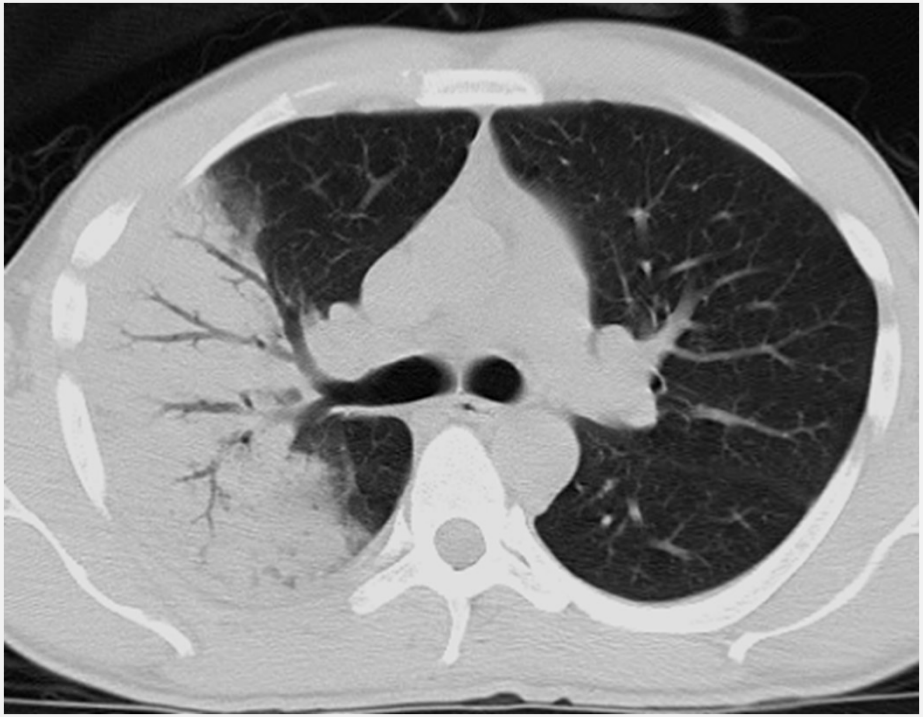
If seen -> exclude pleural or mediastinal lesions

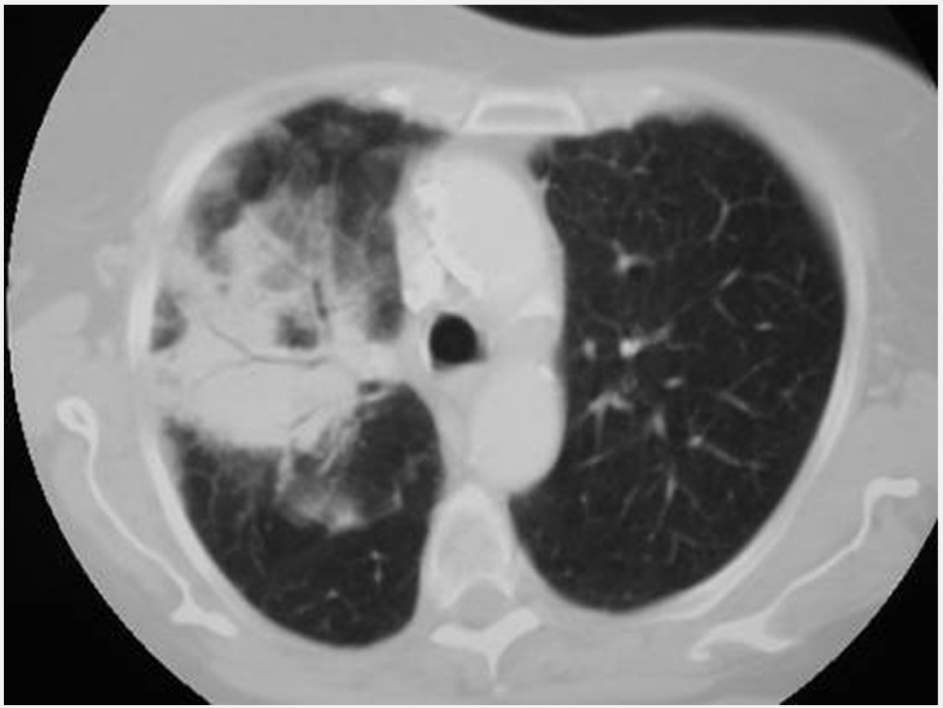
Differential Diagnosis:

- **atelectasis**
- **pneumonia**
- **pulmonary edema**
- **hemorrhage**
- **bronchio-alveolar carcinoma**
- **lymphoma**



AIR BRONCHOGRAMS





TREE IN BUD PATTERN

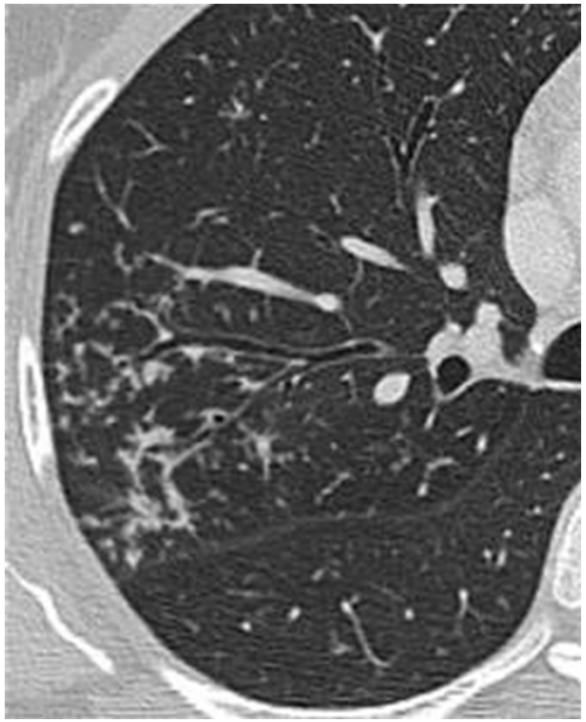
Dilated bronchiols

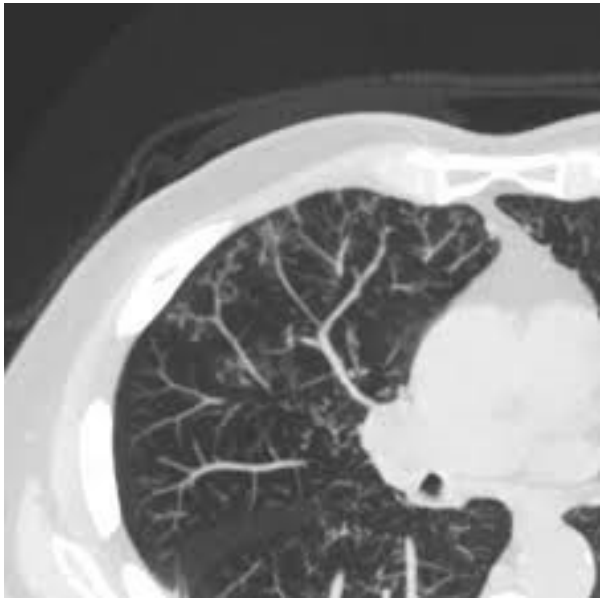
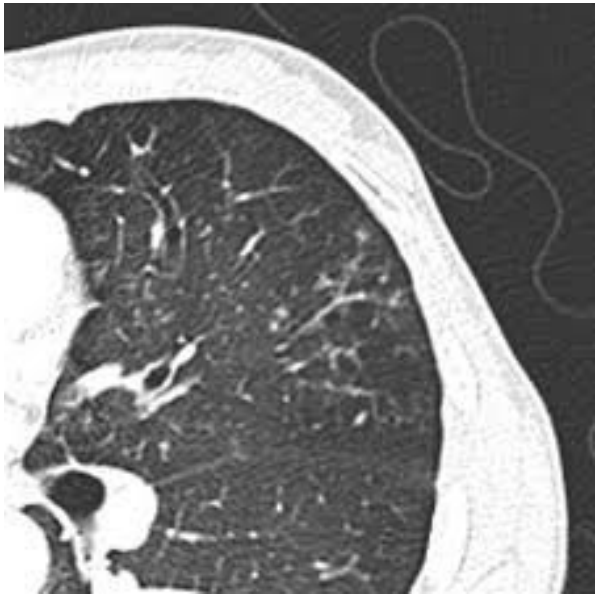
- usually filled with fluid or pus

- often seen with infection / aspiration

<u>Differential Diagnosis:</u>

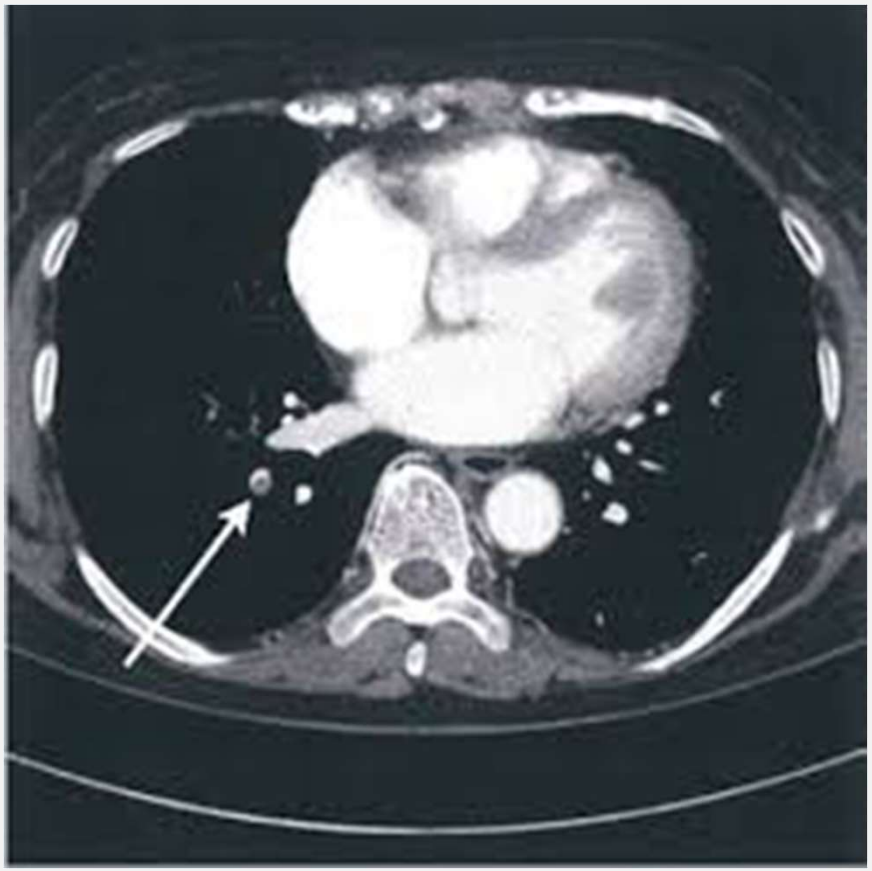
- **pulmonary TB**
- **Aspiration pneumonia**
- **can be associated with COP / BOOP**
- **Seen with bronciectasis**



TREE IN BUD PATTERN

PULMONARY ANGIOGRAM / CTPA

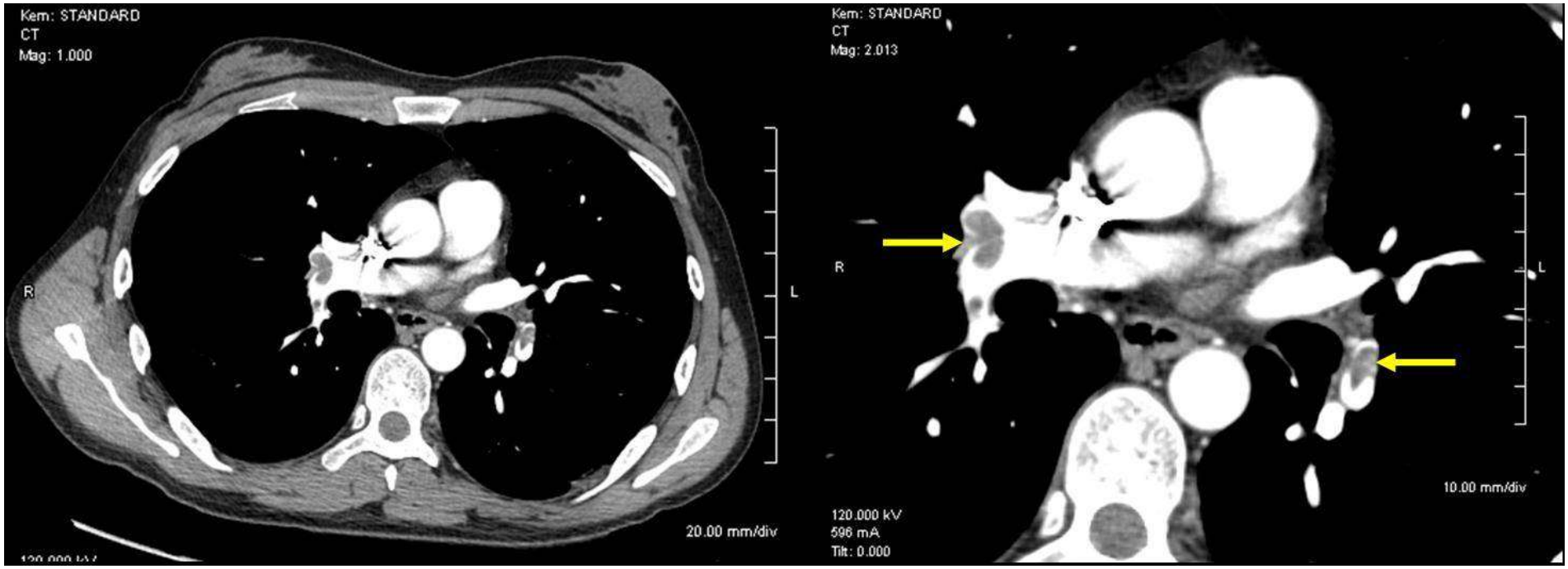


CT PULMONARY ANGIOGRAM

- [ ] **Indicated for diagnosing pulmonary emboli**
- [ ] **Bolus of IV contrast (using injector pump) given to look for clots within the pulmonary arteries**
- [ ] **IV contrast will appear white within the pulmonary arteries, any gray/dark areas indicate filling defects**
- [ ] **Contraindications: AKI / allergy to iodine**

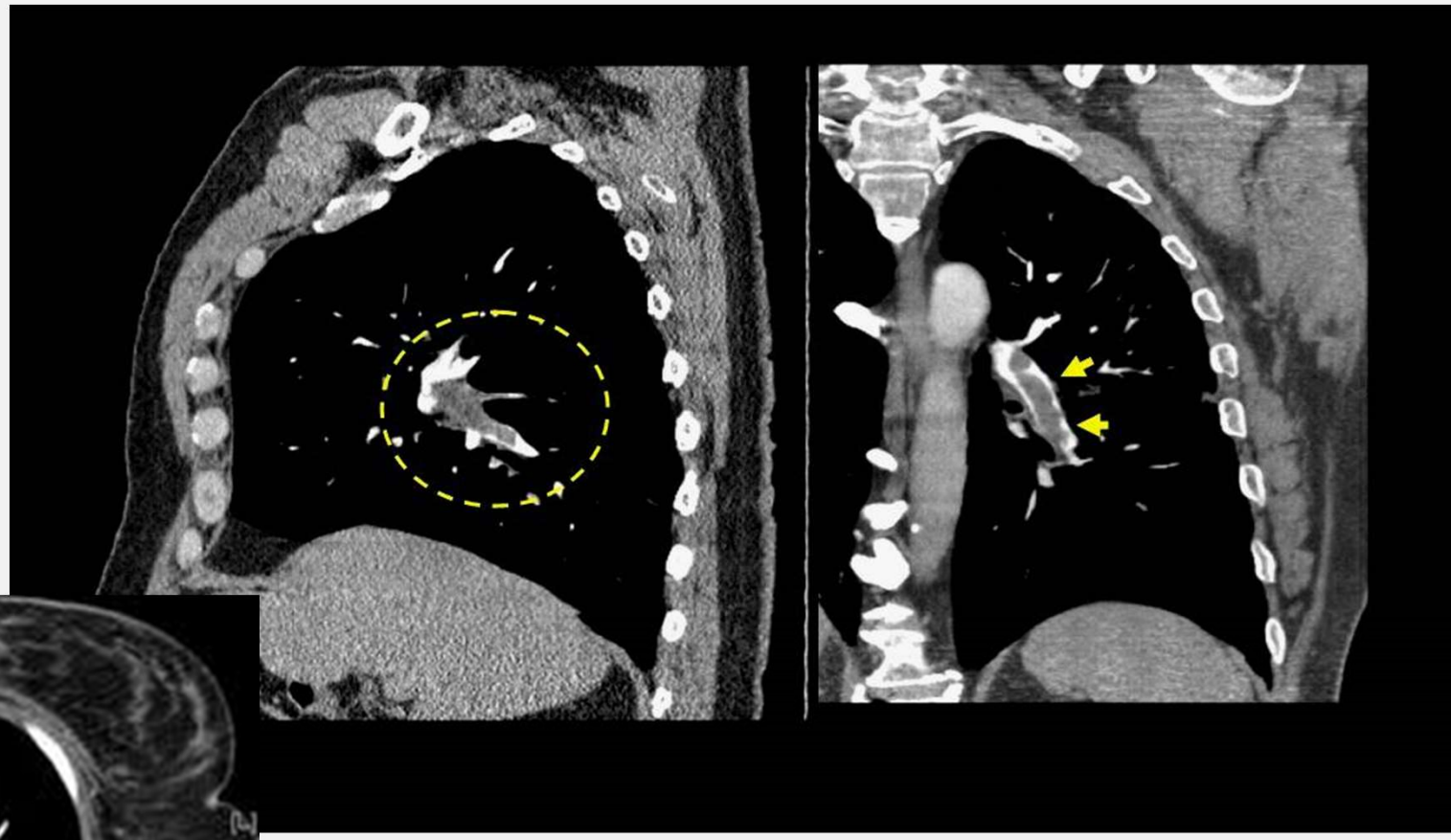
Indications:

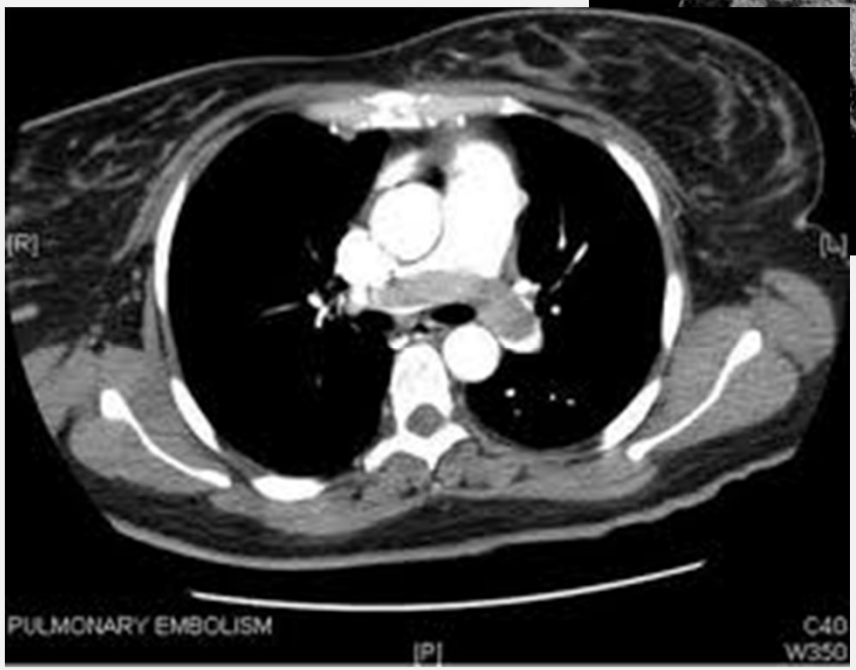
- [ ] Pulmonary emboli
- [ ] Aortic aneurysms
- [ ] Aortic dissection


Kern: STANDARD
CT
Mag: 1.000
R
L
20.00 mm/div
Kern: STANDARD
CT
Mag: 2.013
R
L
10.00 mm/div
120.000 kV
596 mA
Tilt: 0.000

CTPA

AXIAL VS. SAGITTAL VIEW





LESSONS FOR PRACTICE

- Always compare to previous films
- The obvious is not always the most important finding on chest imaging
- If able always obtain a Lateral and PA CXR
- Trust no one / Always ”personally” look at the images

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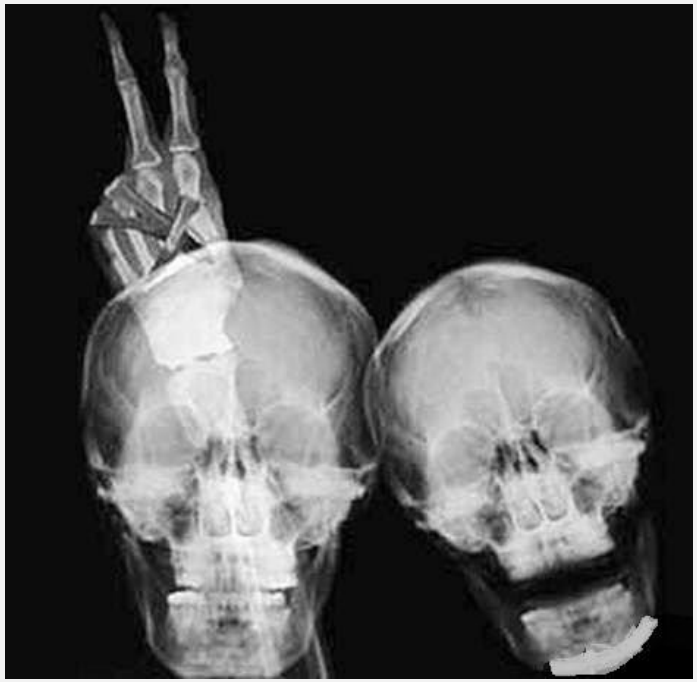

updated 3/2023