Chest X-rays

Notes by Hanin Bashaikh

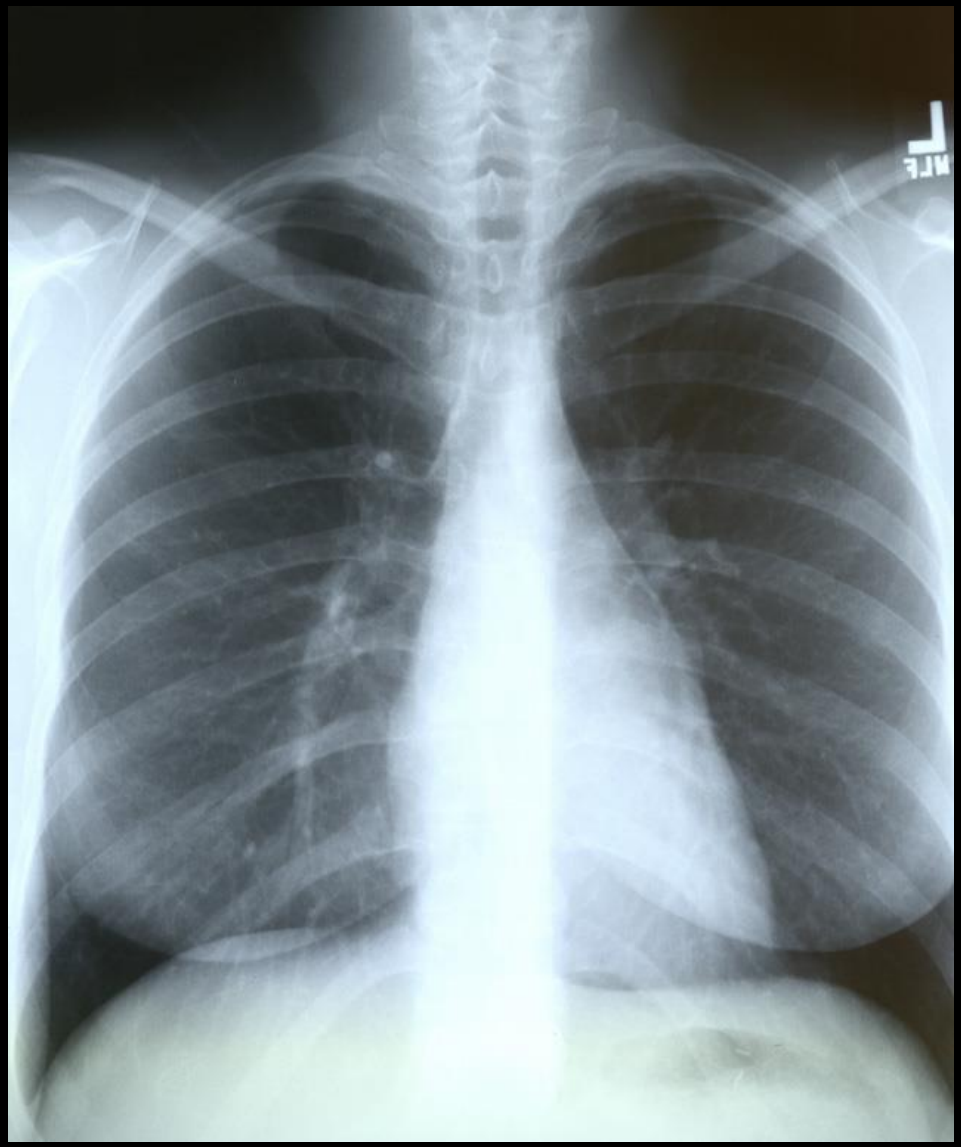
Chest X ray

- Is the most commonly performed diagnostic **x-ray** examination.

Images

- Heart, lungs, airways, blood vessels and the bones of the spine and **chest**.
- Easily and readily available.
- It’s non-invasive.
- Cheap.

Normal Chest X-Ray



The 12-Step Program there are many different systems to read the CXR and this one of the most commonly used

- **1**: Name.
- **2**: Date.
- **3**: Old films.

} **Pre-read**

- **4**: What type of **view(s).**
- **5**: Penetration.
- **6**: Inspiration.
- **7**: Rotation.
- **8**: Angulation.

} **Quality Control**

- **9**: Soft tissues / bony structures.
- **10**: Mediastinum.
- **11**: Diaphragms.
- **12**: Lung Fields.

} **Findings**

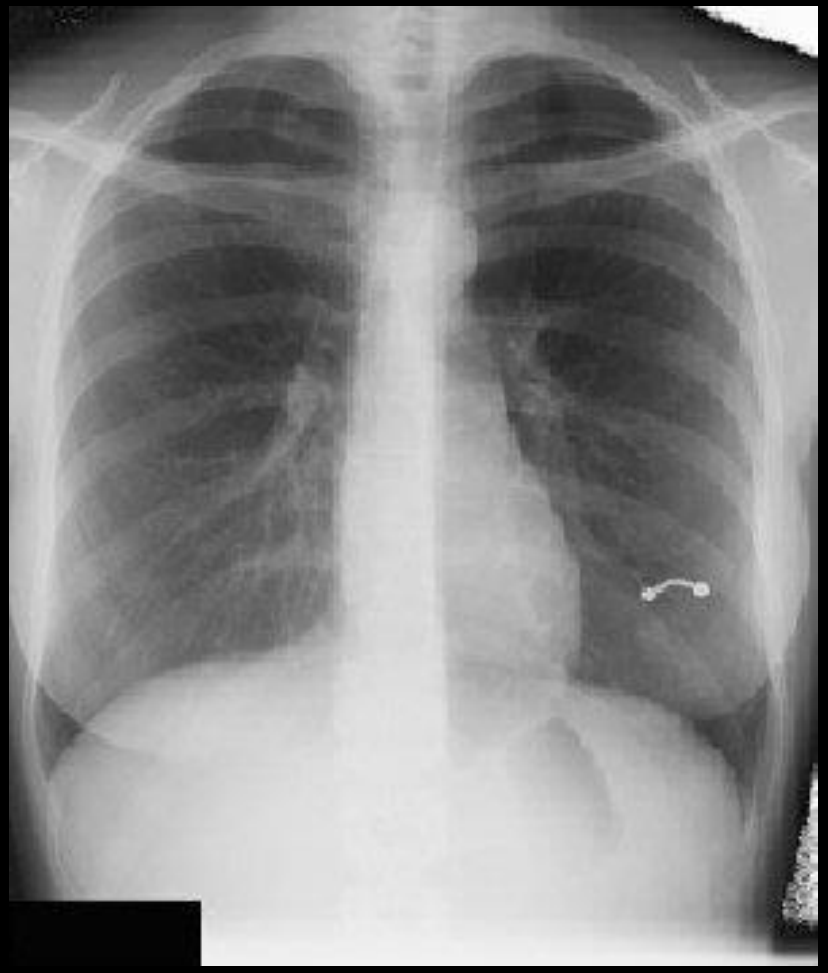
Pre-Reading

- **1**. Check the name
- **2**. Check the date make sure that this is a new x-ray especially if the patient presented acutely.
- **3**. Obtain old films if available to compare

- **4**. Which **view(s)** do you have?
  - PA / AP, lateral, decubitus, AP lordotic

Techniques - Projection

- P-A (relation of x-ray beam to patient) Radiation comes from behind the patient and the x-ray film is anterior to the patient.



Techniques - Projection

(continued)

•Lateral the x-ray machine will be on the patient's side. If you didn't ask the radiology technician to make right lateral imaging, they will automatically do a left lateral.

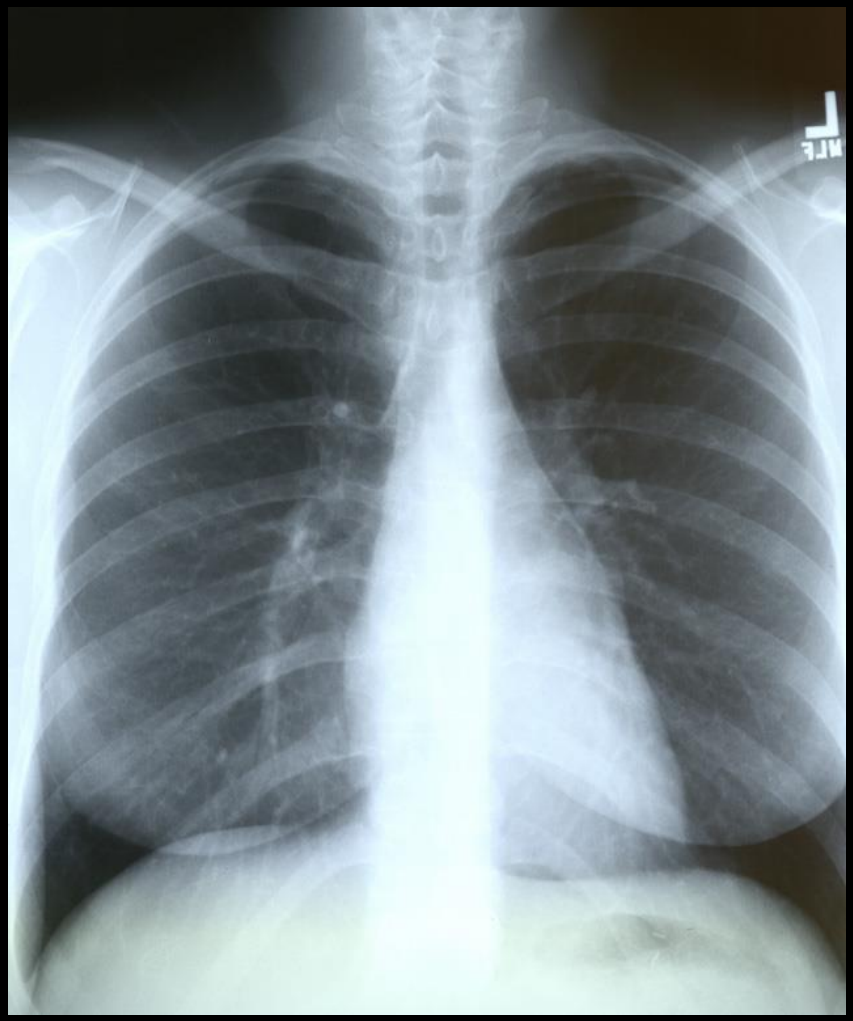
Techniques - Projection

(continued)

•Lateral Decubitus the patient will be laying on the side, and we can use it when we are looking for fluids in the chest and weather it is free fluids or not.

Quality Control

- **5. Penetration**
- In adequate penetration you will:
  - Should see ribs through the heart.
  - Barely see the spine through the heart.
  - Should see pulmonary vessels nearly to the edges of the lungs.

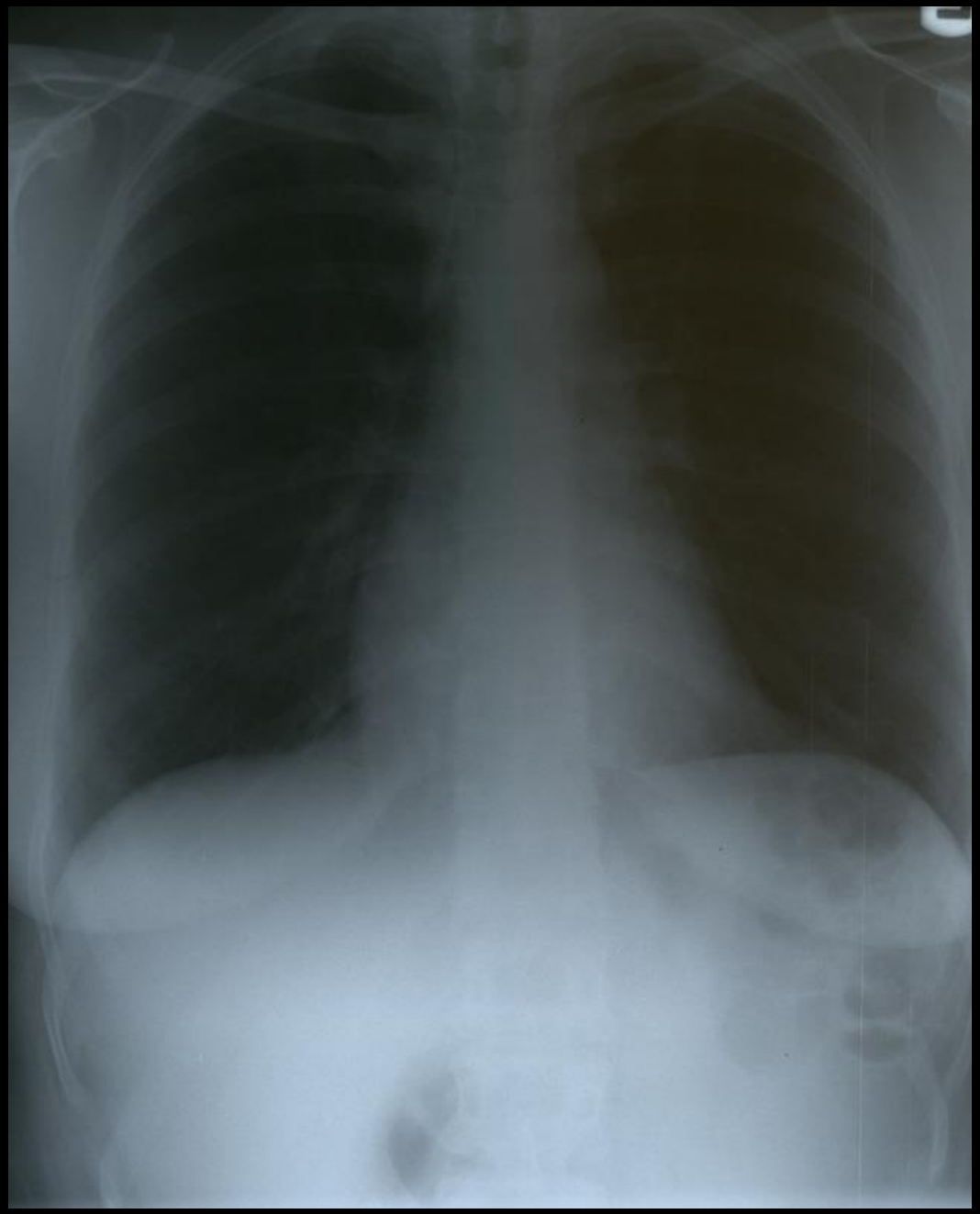


Over penetrated Film:

• Lung fields darker than normal—may obscure subtle pathologies.

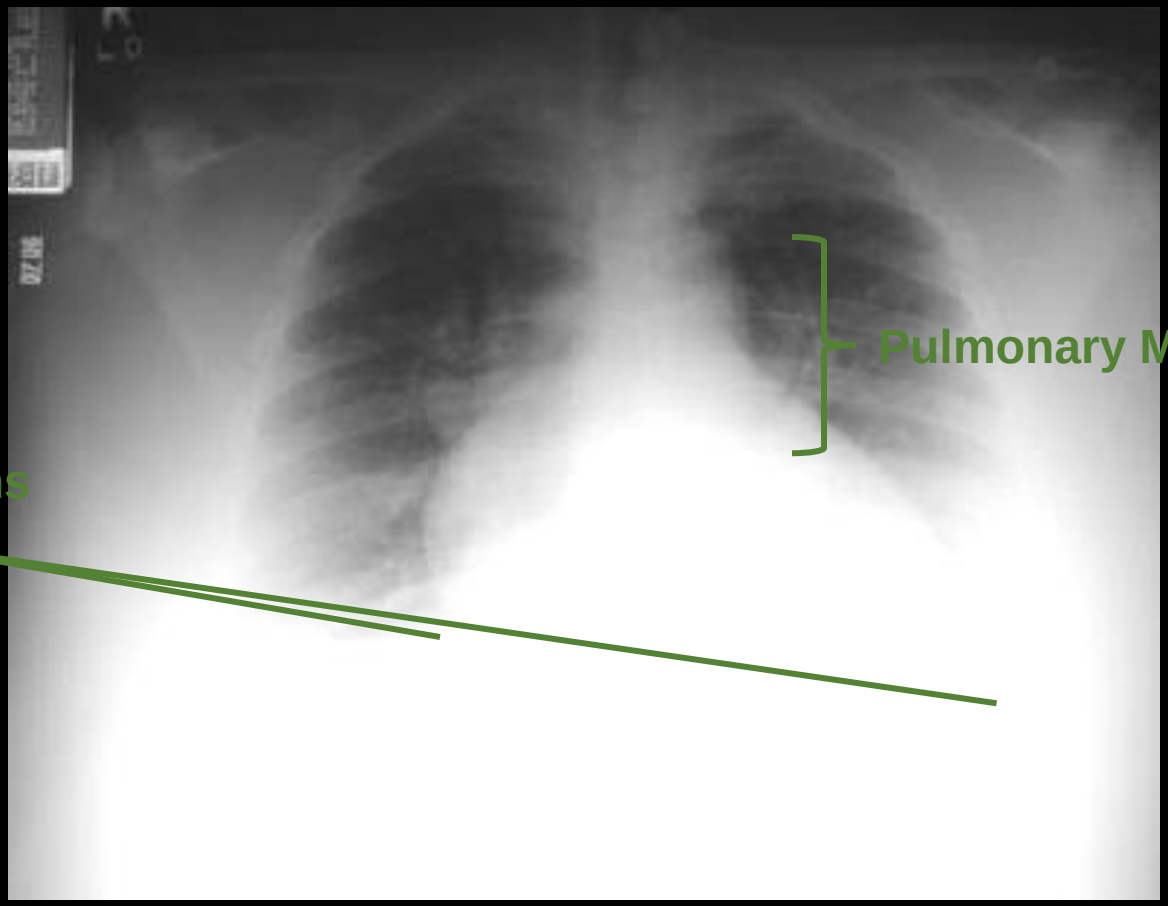
• See spine well beyond the diaphragms.

• Inadequate lung detail.



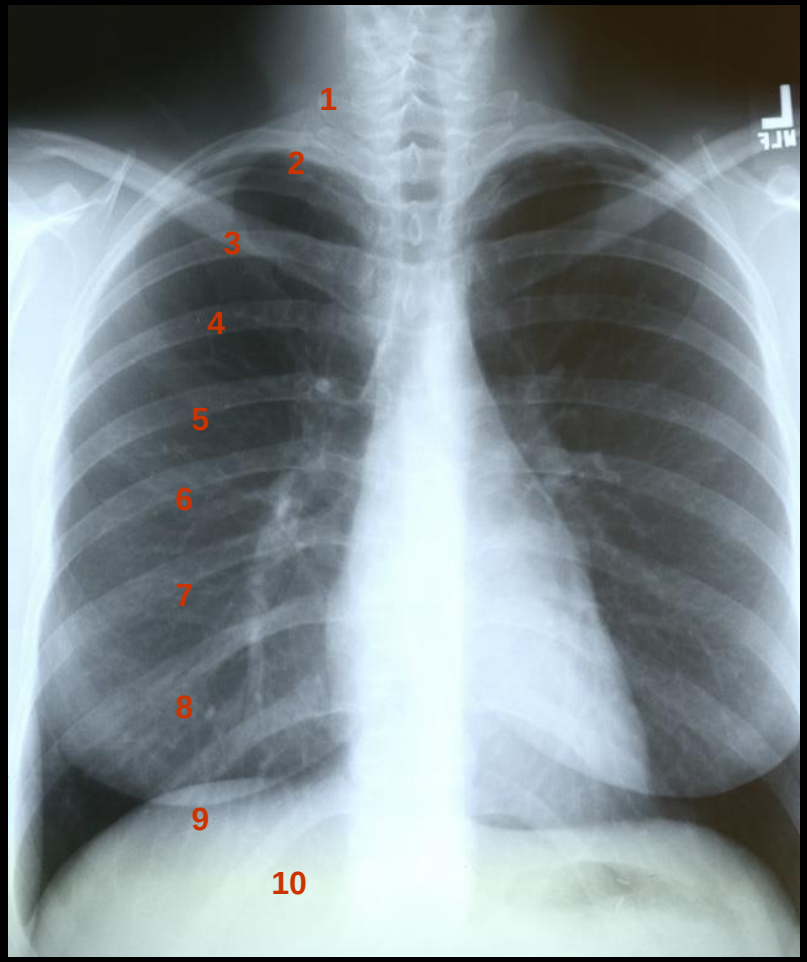
Underpenetrated Film

- Hemidiaphragms are obscured.
- Pulmonary markings more prominent than they actually are.



Quality Control

- **6**. Inspiration
  - Should be able to count 9-10 posterior ribs.
  - Heart shadow should not be hidden by the diaphragm.



About 8 posterior ribs are showing

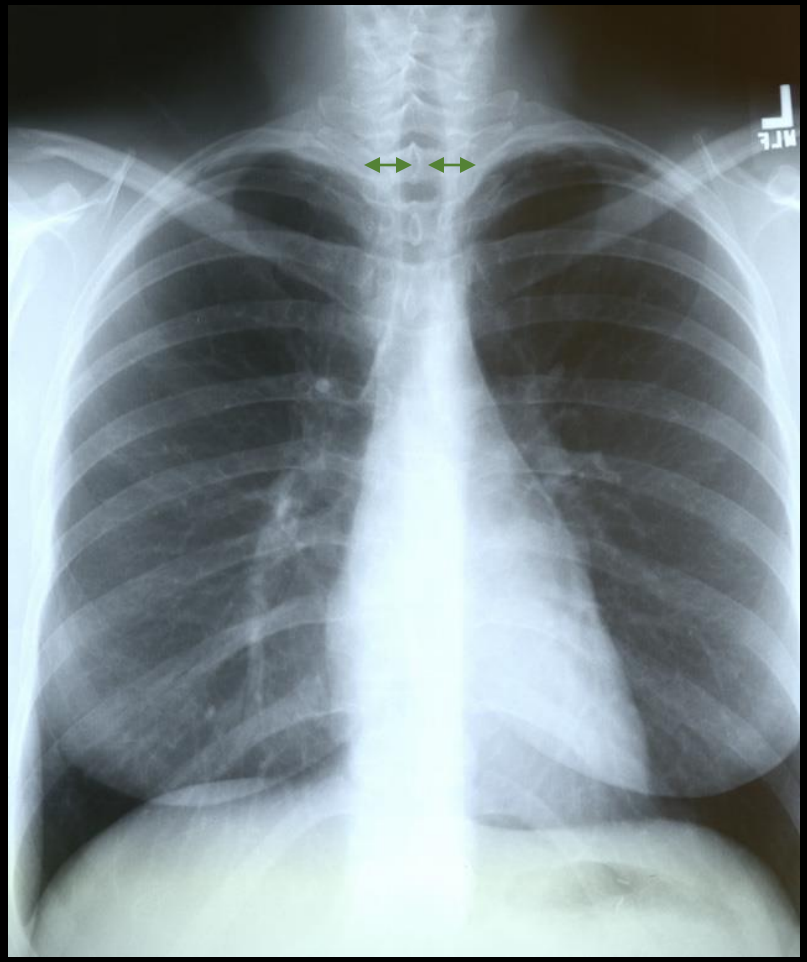
Poor inspiration can crowd lung markings producing pseudo-airspace disease

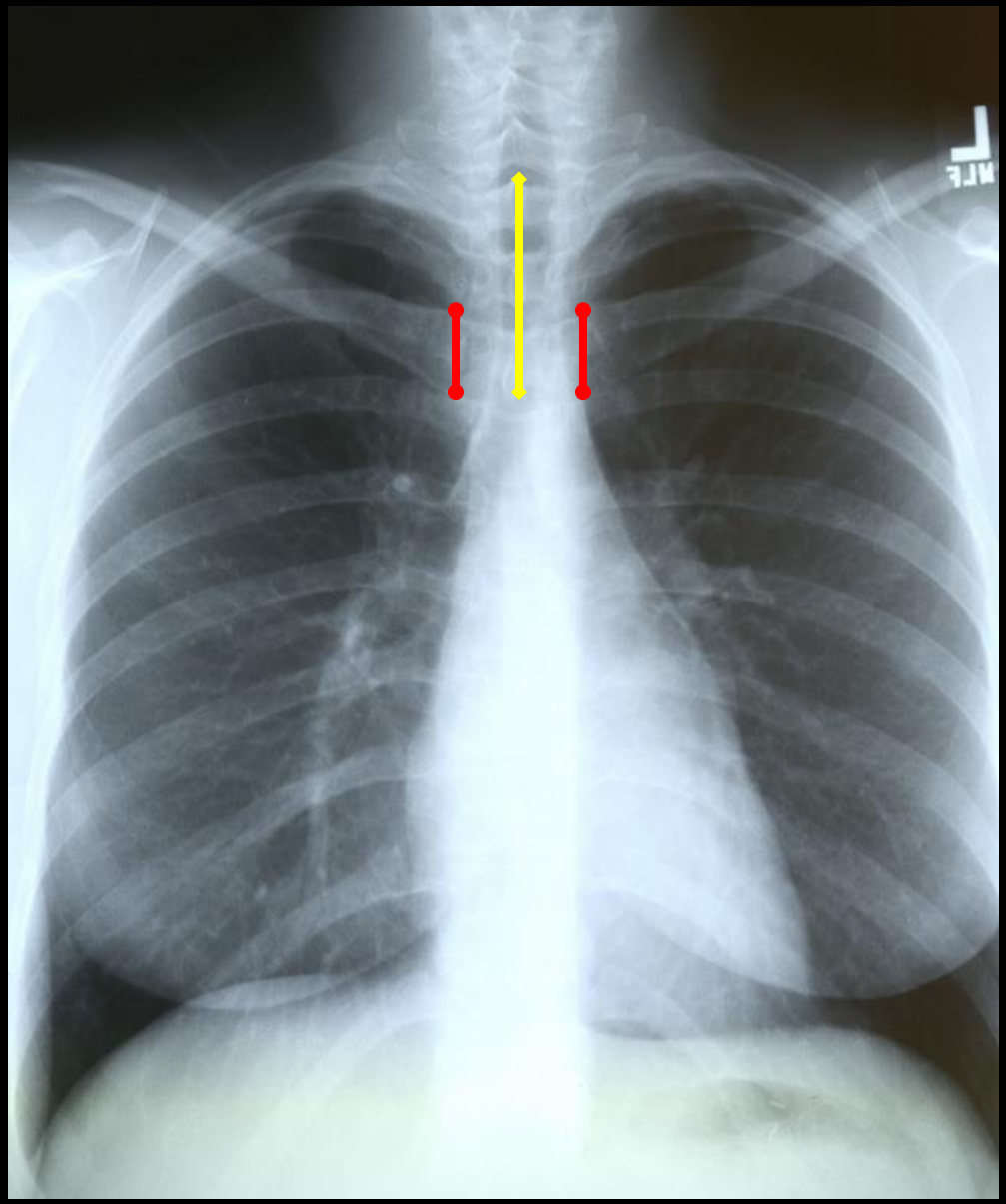
With better inspiration, the "disease process" at the lung bases has cleared

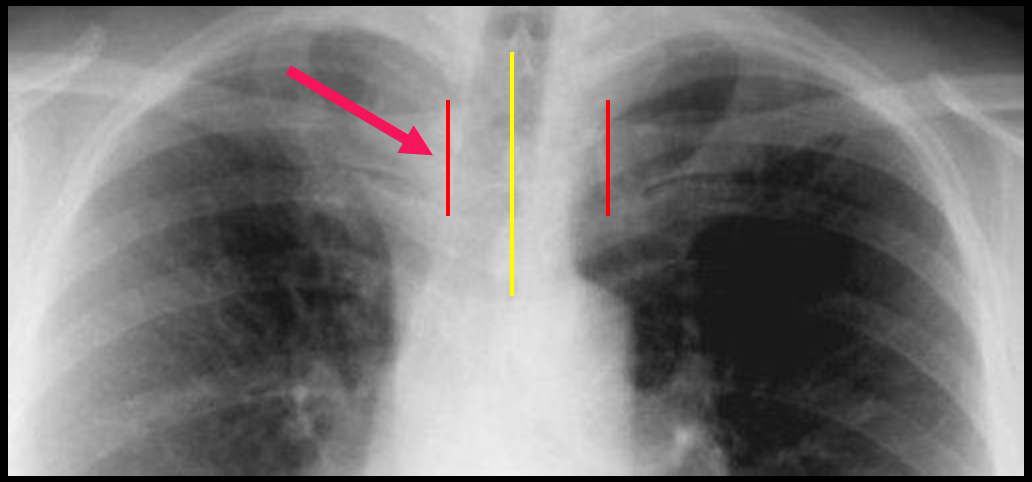
9-10 posterior ribs are showing

Quality Control

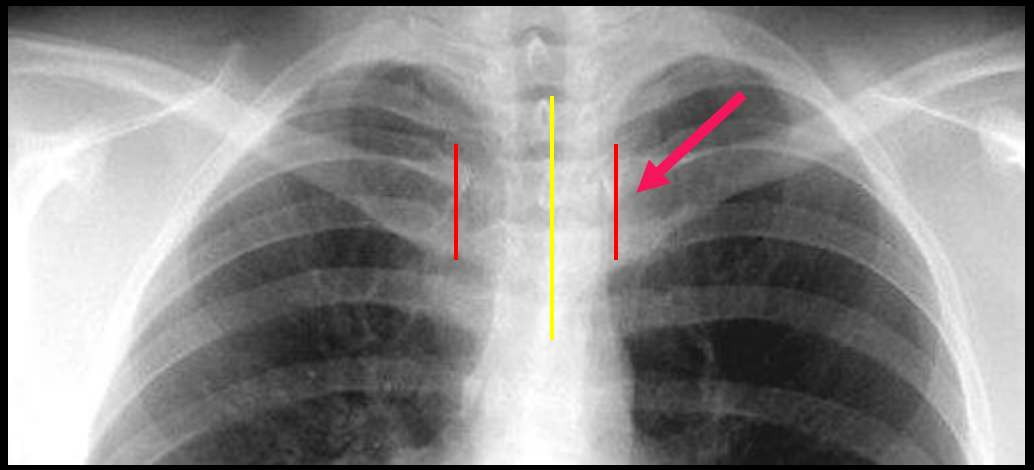
- **7. Rotation**
  - Medial ends of bilateral clavicles are equidistant from the midline or vertebral bodies.
  - The patient should be central, and the spinous processes of the vertebrae are centered.







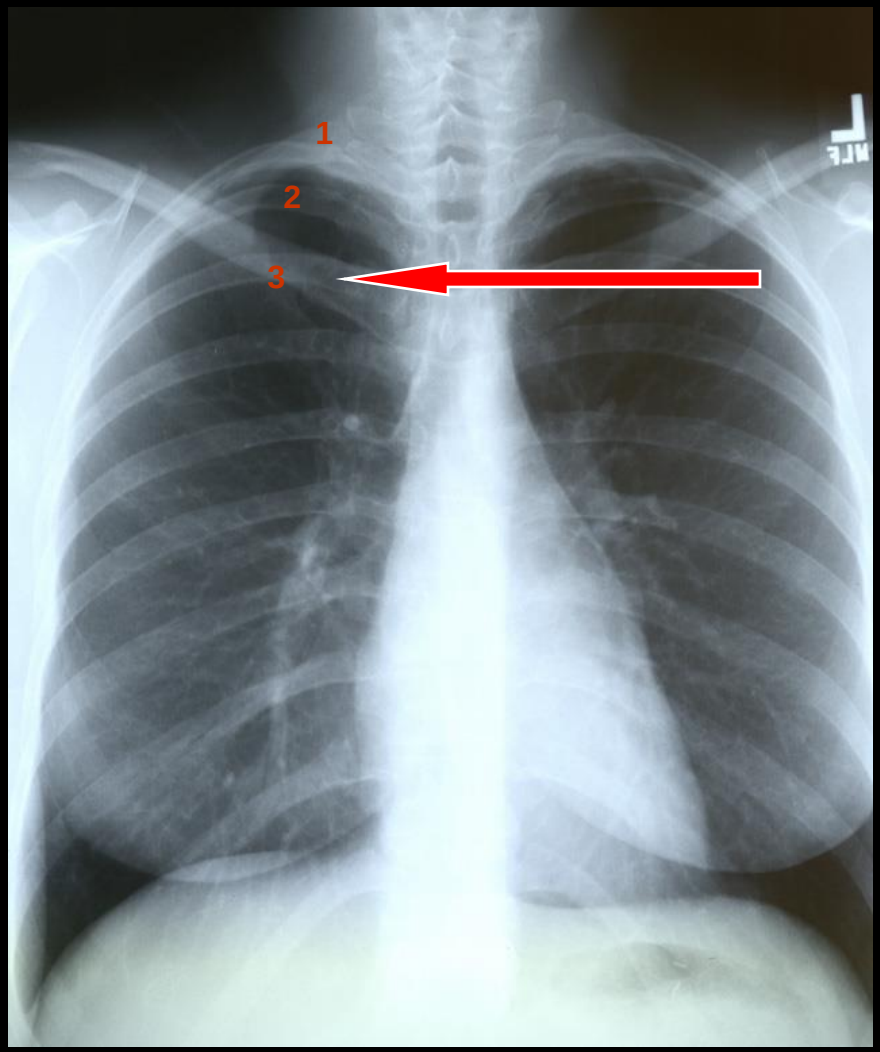
If spinous process appears closer to the right clavicle (red arrow), the patient is rotated toward their own left side



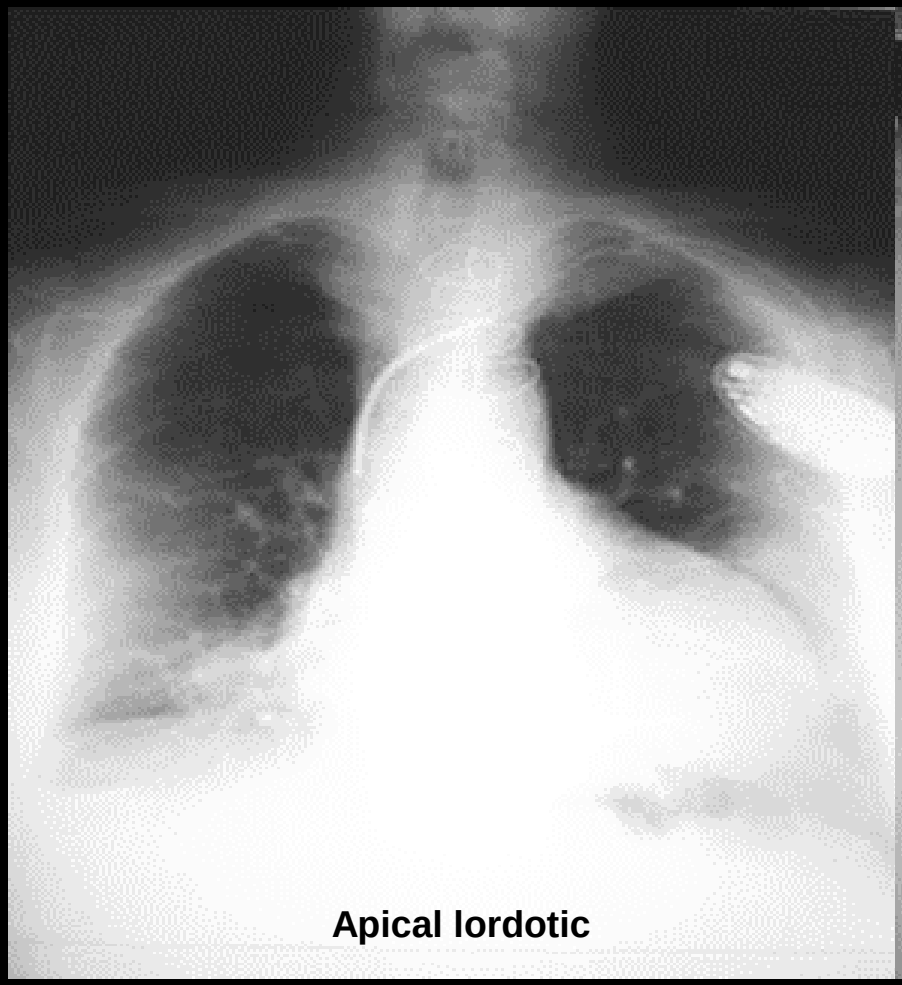
If spinous process appears closer to the left clavicle (red arrow), the patient is rotated toward their own right side

Quality Control

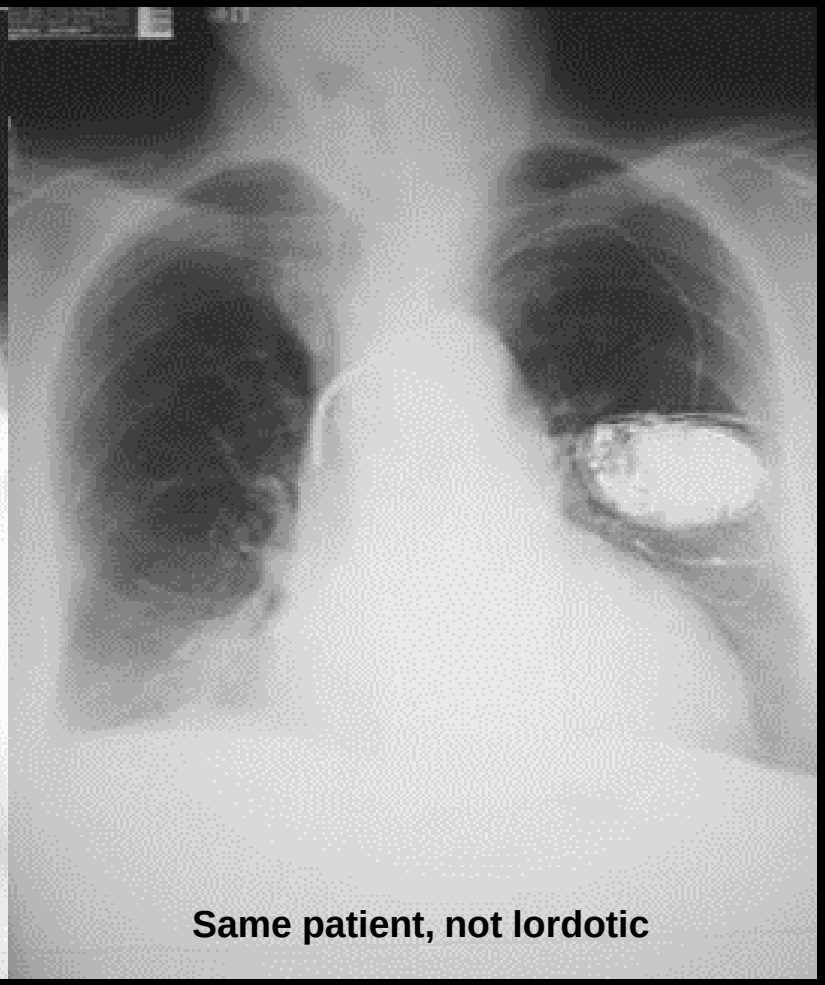
- **8. Angulation**
  - Clavicle should lay over 3rd rib.
  - اللي فهمته ان الروتيشن يمين يسار، الانقيوليشن قدام ورا.



Pitfall Due to Angulation



Apical lordotic

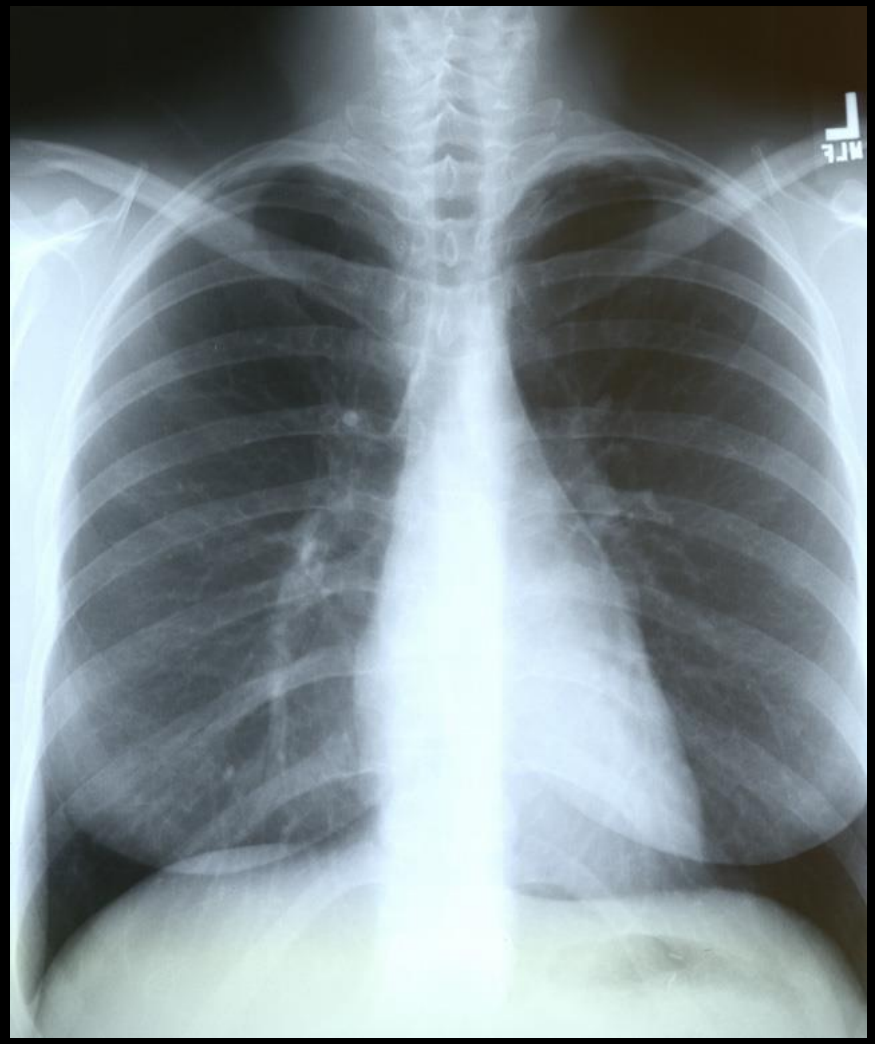


Same patient, not lordotic

- A film which is apical lordotic (beam is angled up toward head) will have an unusually shaped heart and the usually sharp border of the left hemidiaphragm will be absent

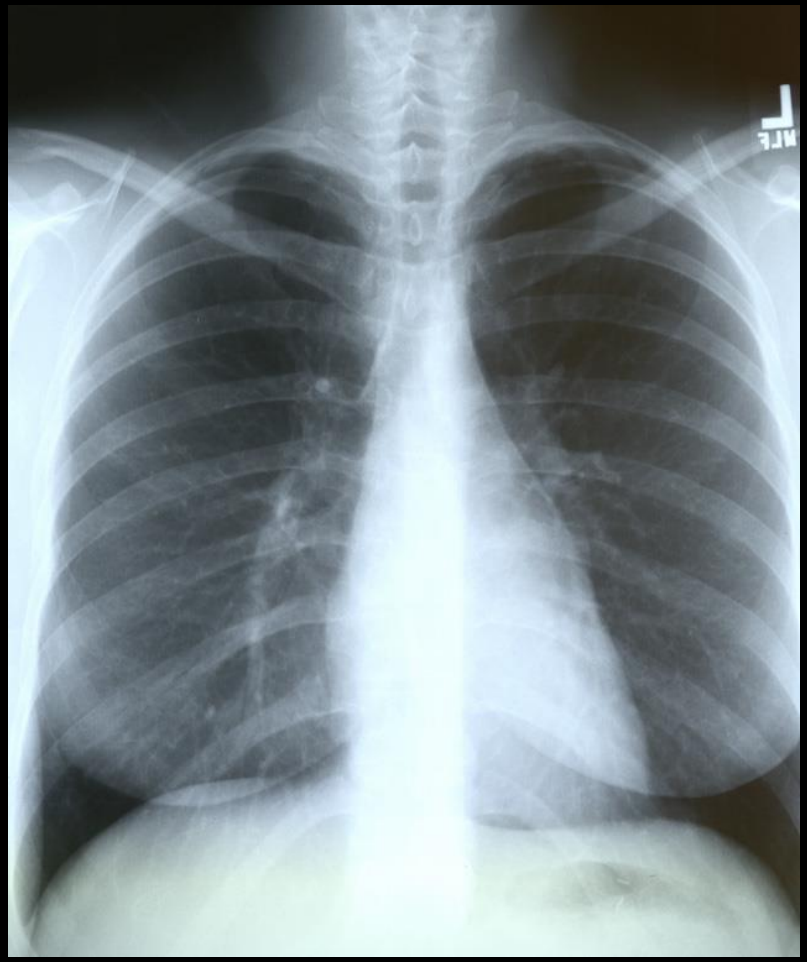
Findings

- **9. Soft tissue and bony structures**
  - Check for
    - Symmetry compare two sides
    - Deformities
    - Fractures
    - Masses
    - Calcifications
    - Lytic lesions



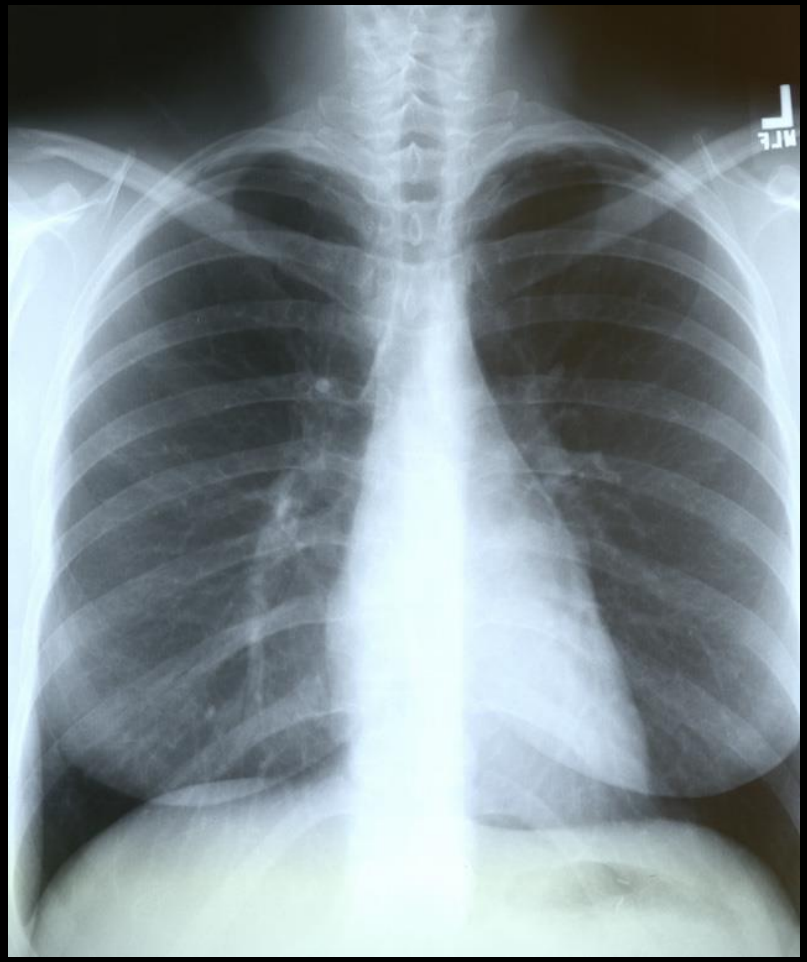
Findings

- **10. Mediastinum**
  - Check for
    - Cardiomegaly
    - Mediastinal and Hilar contours (left hilum is higher than the right hilum) for increase densities or deformities.



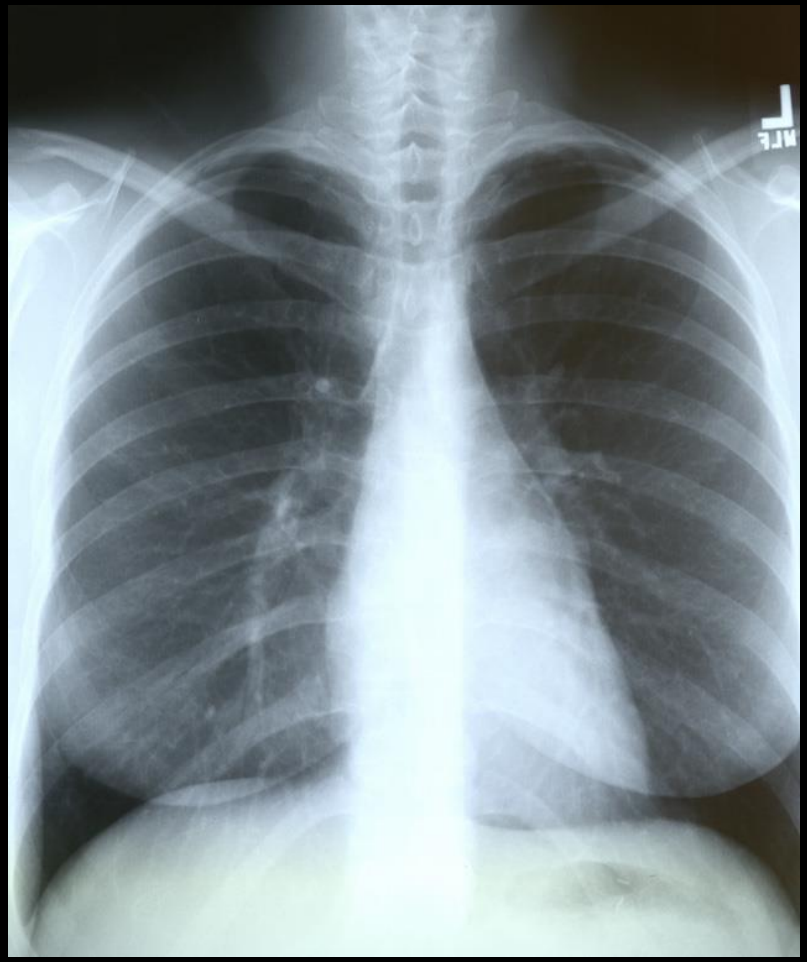
Findings

- **11. Diaphragms**
  - Check sharpness of borders (cardiophrenic and costophrenic borders).
  - Right is normally higher than left.
  - Check for free air, gastric bubble, pleural effusions.



Findings

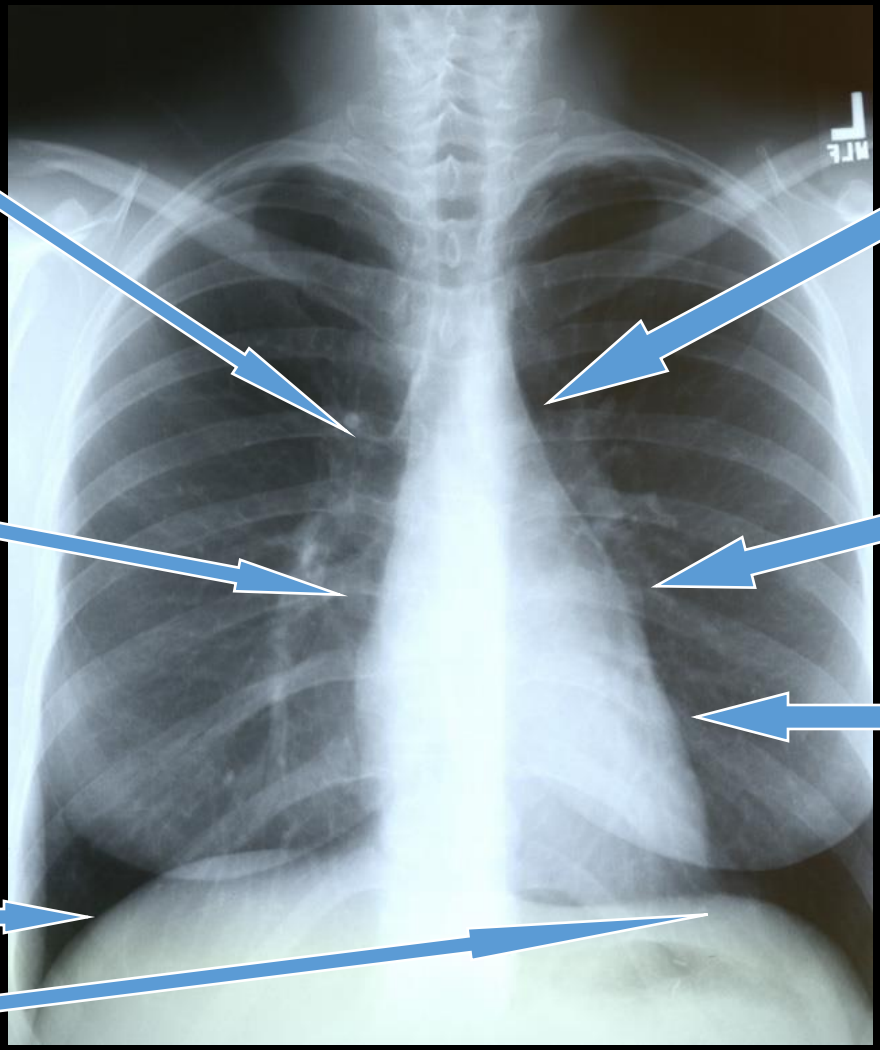
- **12. The Lung Fields!**
  - To help you determine abnormalities and their location…
    - Use silhouettes of other thoracic structures.
    - Use fissures.



Lung Fields: Using Structures / Silhouettes

Silhouette / Structure	Contact with Lung
Upper right heart border/ascending aorta	Anterior segment of RUL
Right heart border	RML (medial)
Upper left heart border	Anterior segment of LUL
Left heart border	Lingula (anterior)
Aortic knob	Apical portion of LUL (posterior)
Anterior hemidiaphragms	Lower lobes (anterior)

Lung Fields: Using Structures / Silhouettes



Upper right heart border / ascending aorta (anterior RUL)

Aortic knob (Apical portion of LUL)

Right heart border (medial RML)

Upper left heart border (anterior LUL)

Left heart border (lingula; anterior)

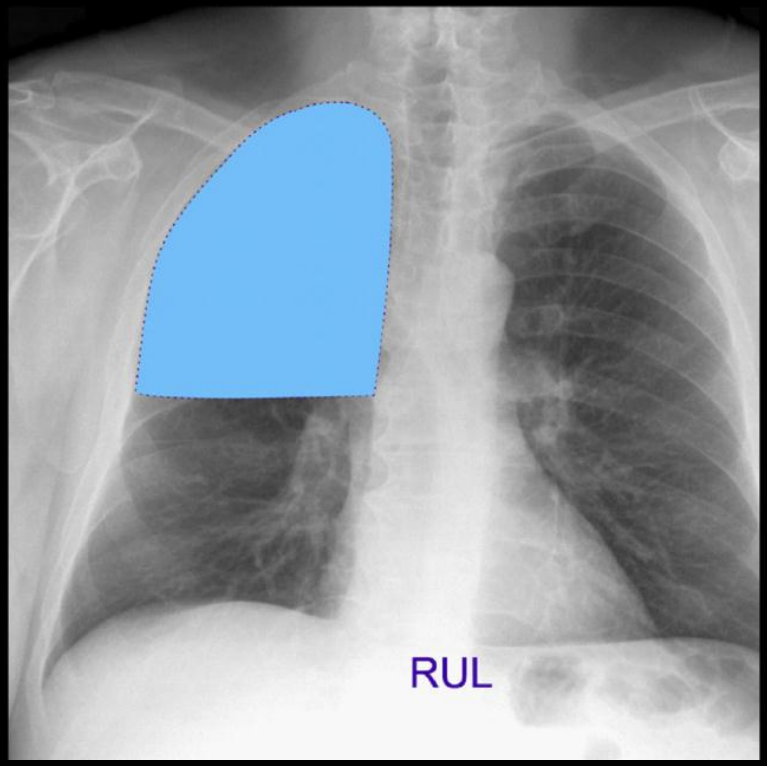
Anterior hemidiaphragms (anterior lower lobes)

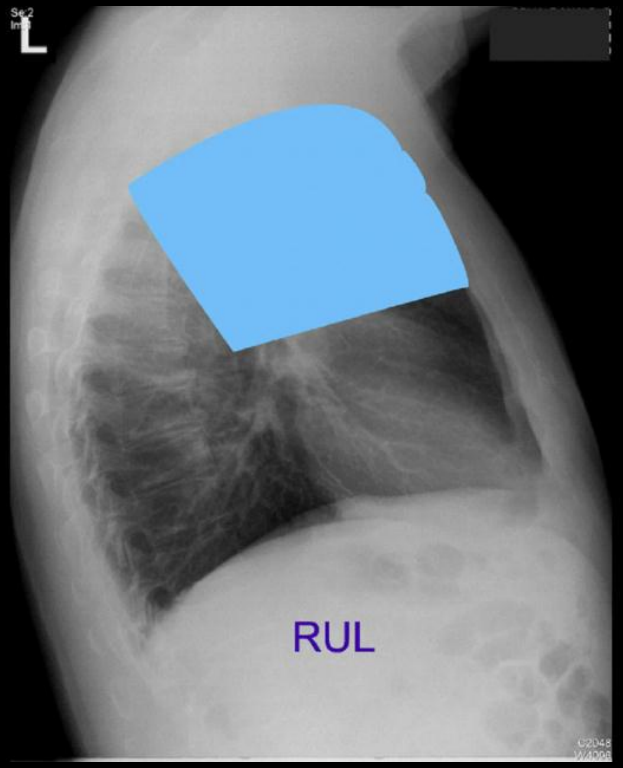
Lung Fields: Fissures

- The fissures can also help you to determine the boundaries of pathology

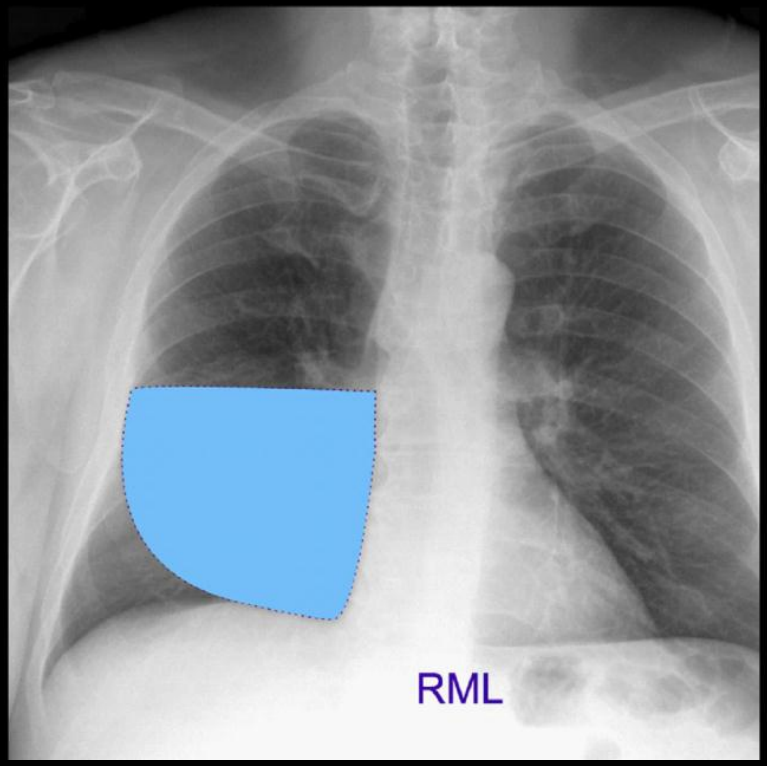
Major Oblique Fissure	Separates the LUL from the LLL
Right Major Fissure	Separates the RUL/RML from the RLL
Right Minor Fissure	Separates the RUL from the RML

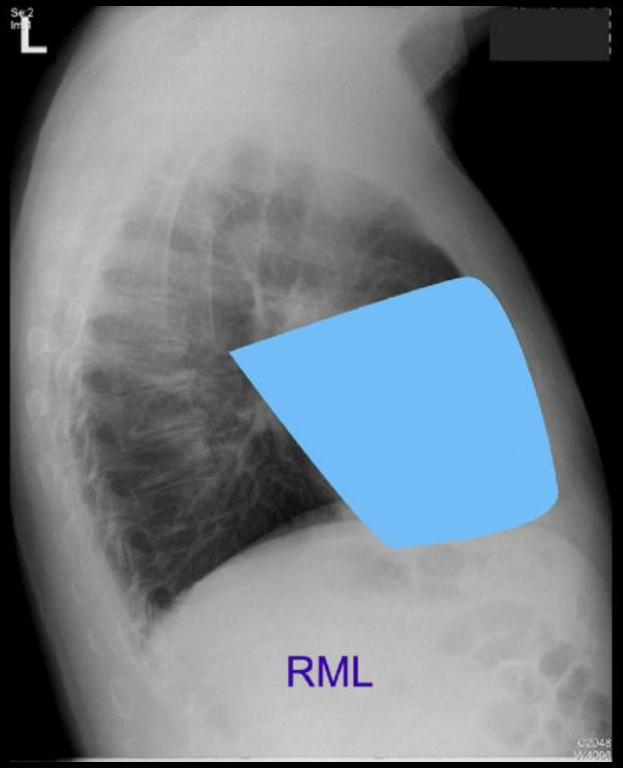
Lobes



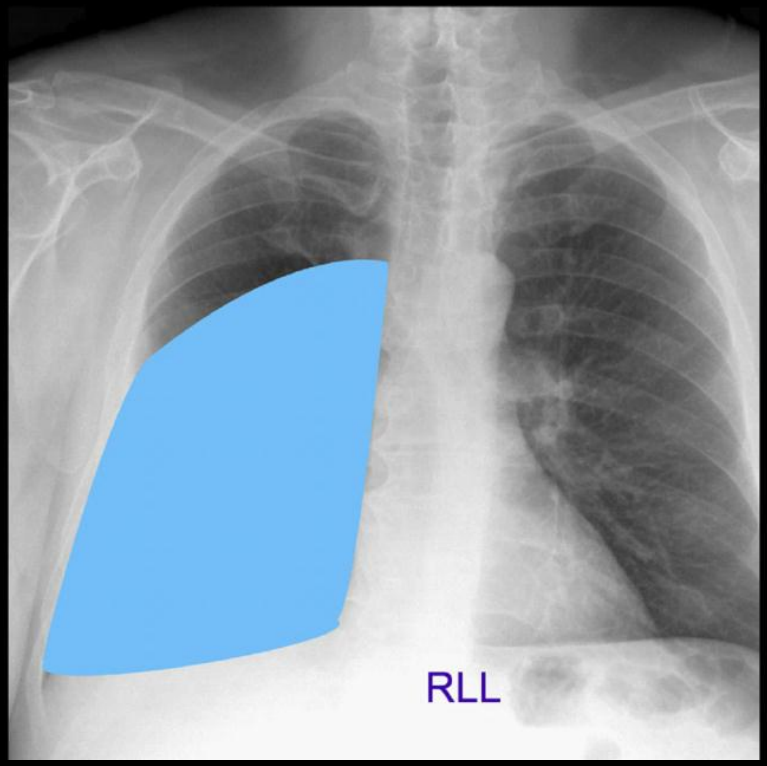


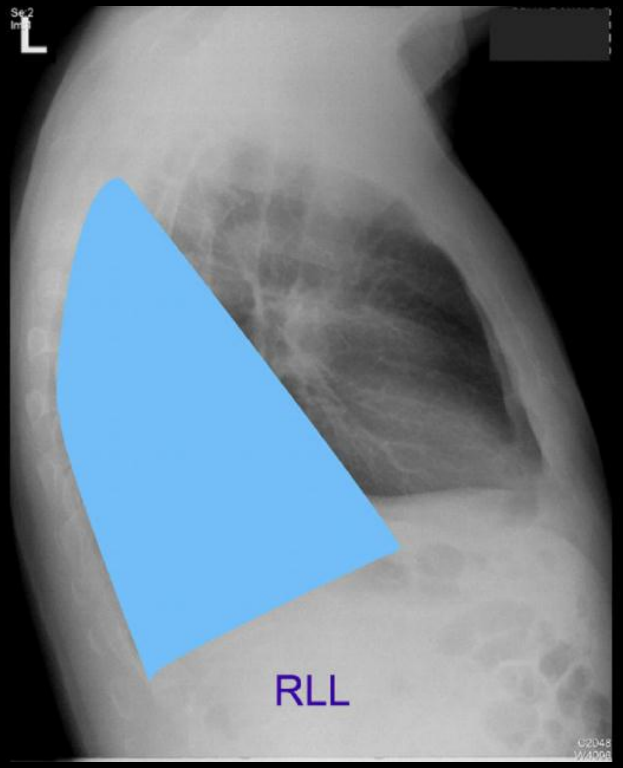
Lobes (continued)



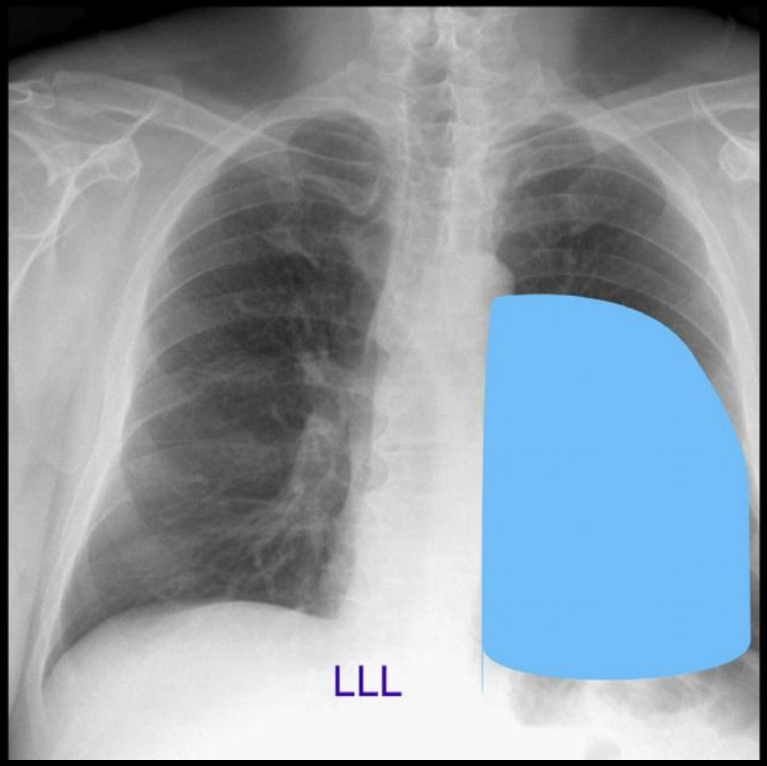


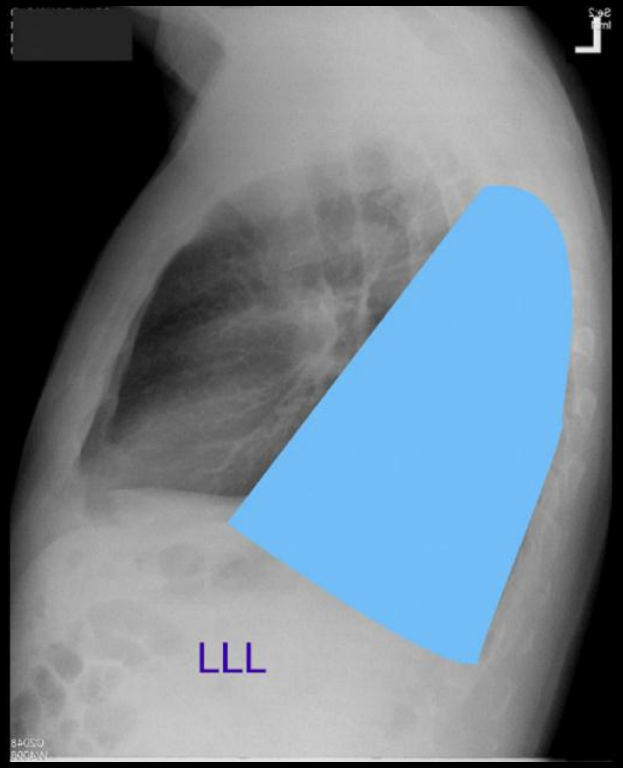
Lobes (continued)



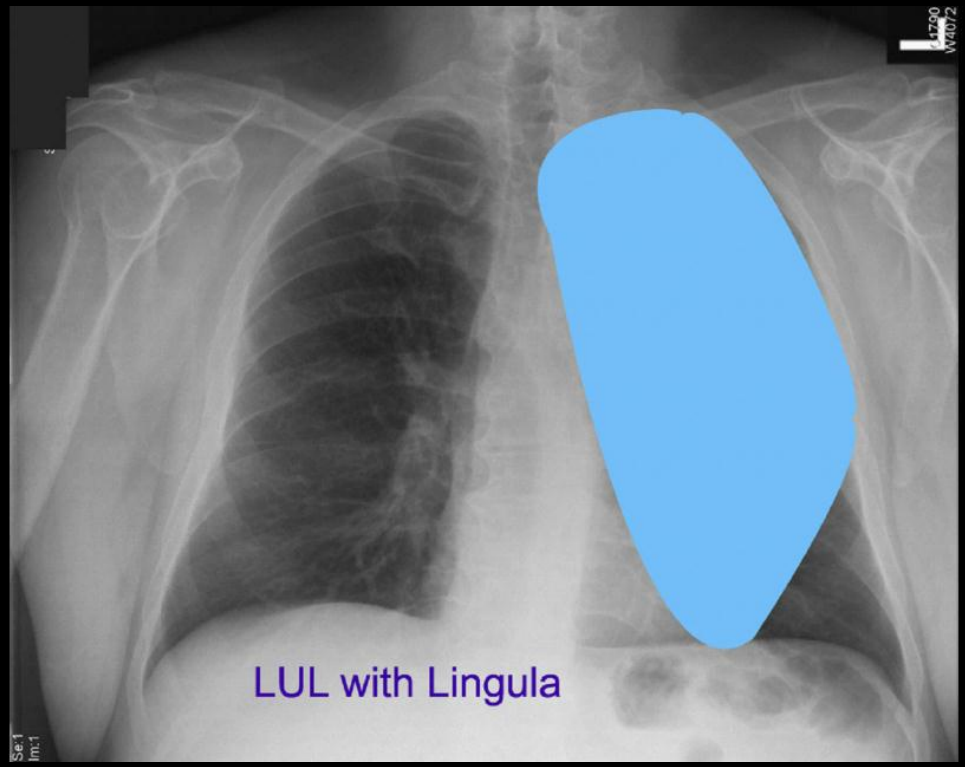


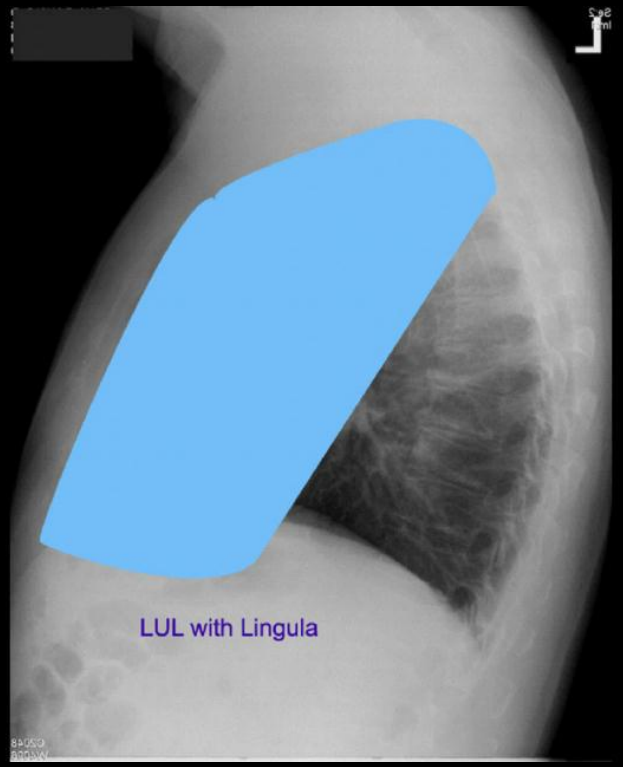
Lobes (continued)



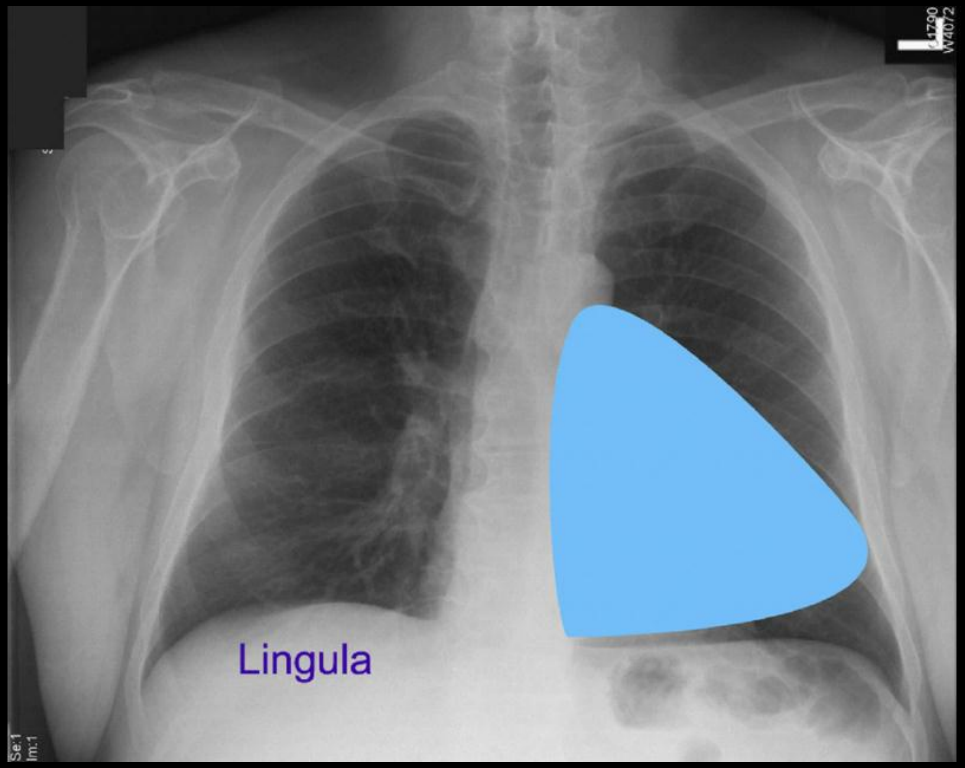


Lobes (continued)





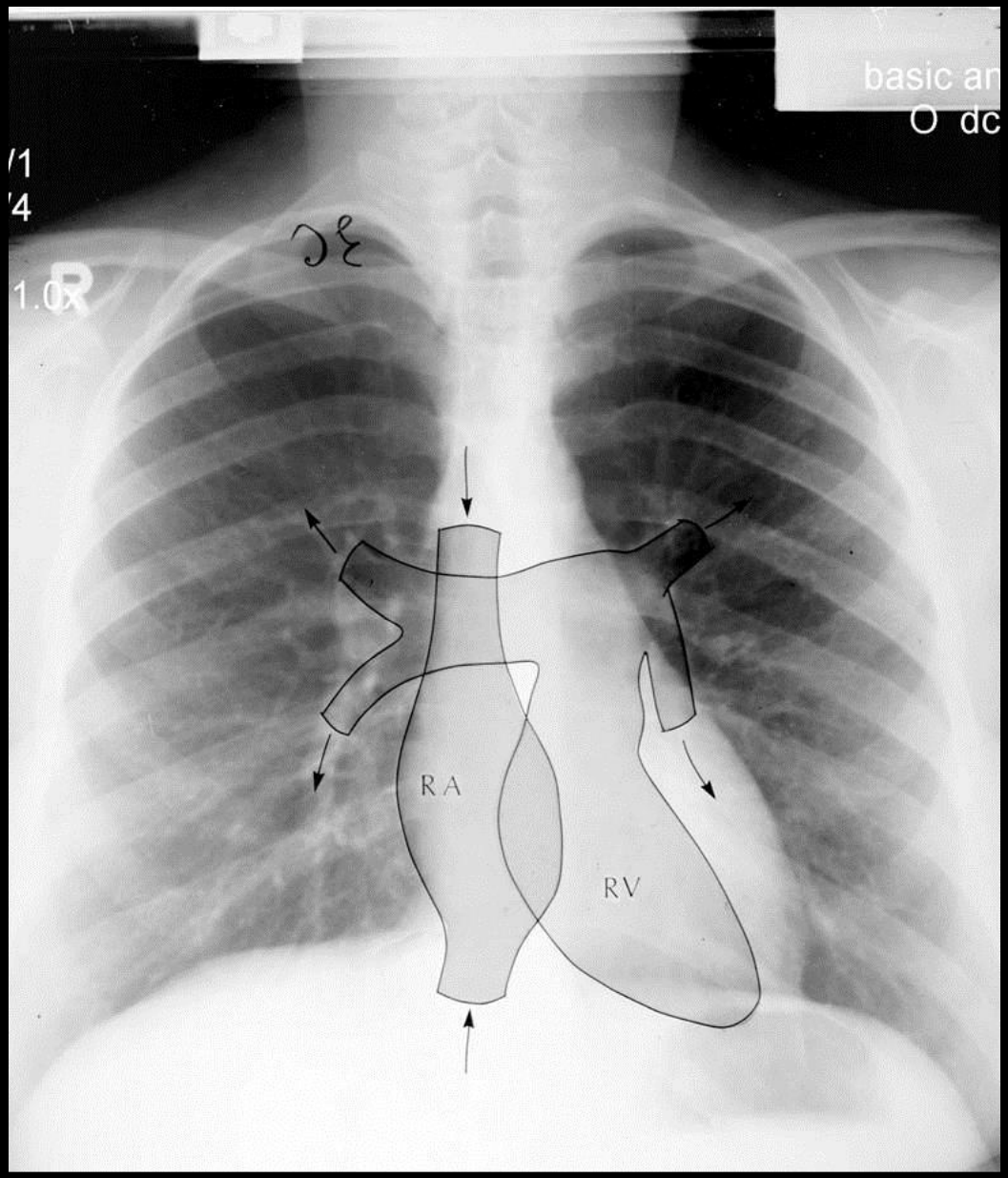
Lobes (continued)



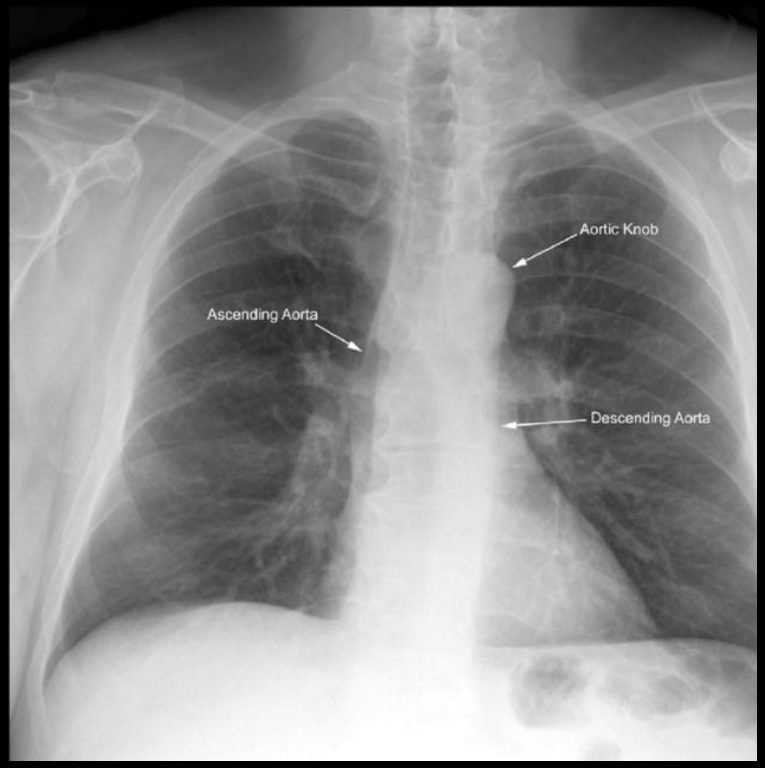
Heart

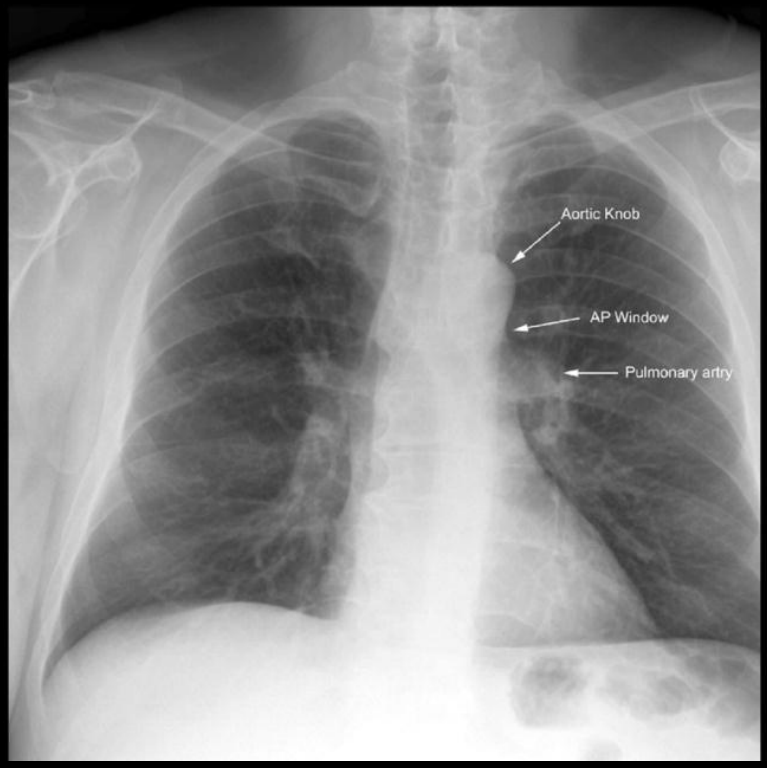
- Right border: Edge of (r) Atrium.
- Left border: (l) Ventricle + Atrium.
- Posterior border: Left Ventricle.
- Anterior border: Right Ventricle.

Heart (continued)



Heart (continued)





Hilum

Made of:

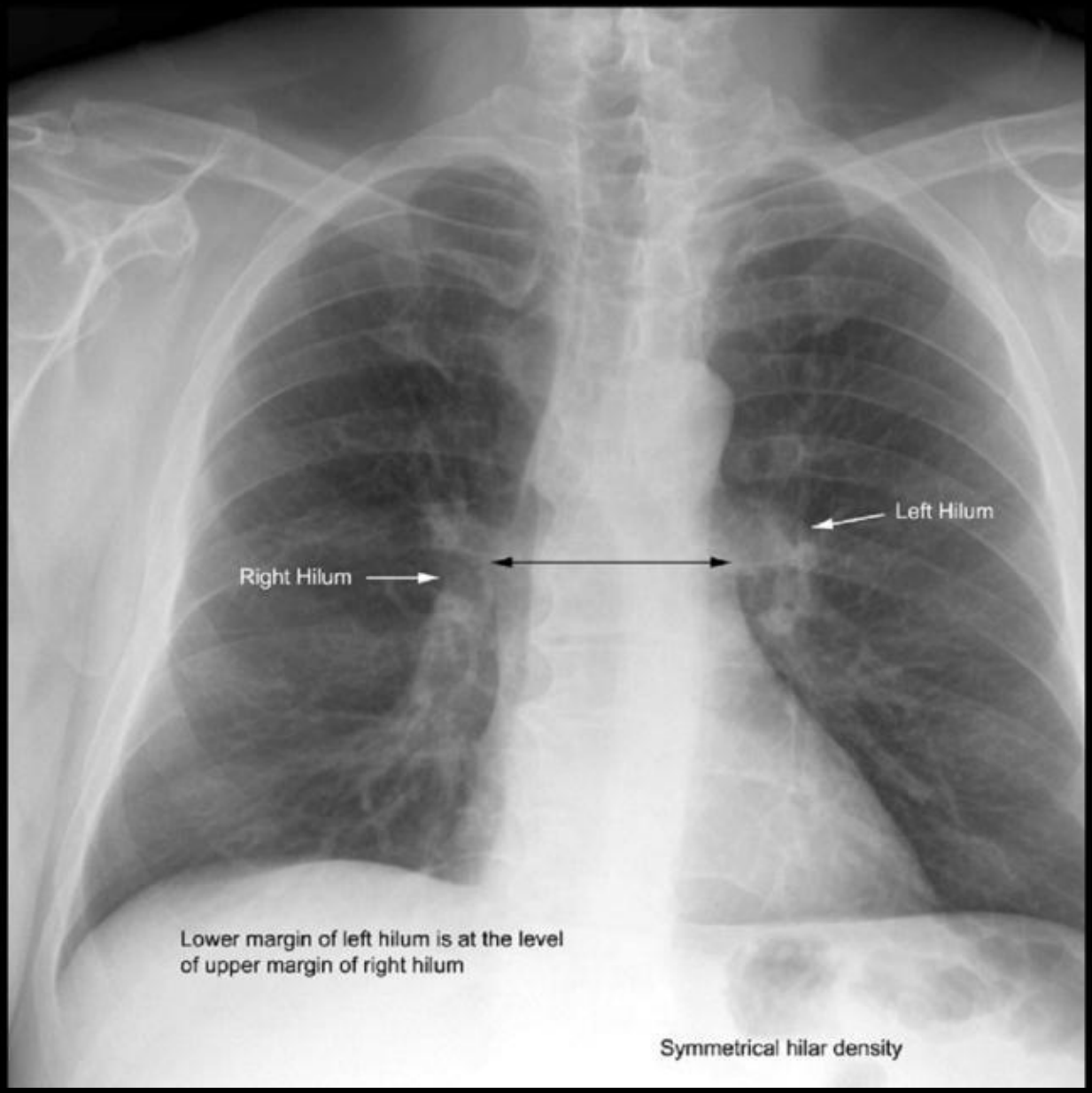
1. Pulmonary Artery + Veins.
2. The Bronchi.

- The left Hilum is higher (max 1-2,5 cm)

Because the heart pushes the left hilum up.

- Identical: size, shape, density.

Hilum


Left Hilum
Right Hilum
Lower margin of left hilum is at the level
of upper margin of right hilum
Symmetrical hilar density

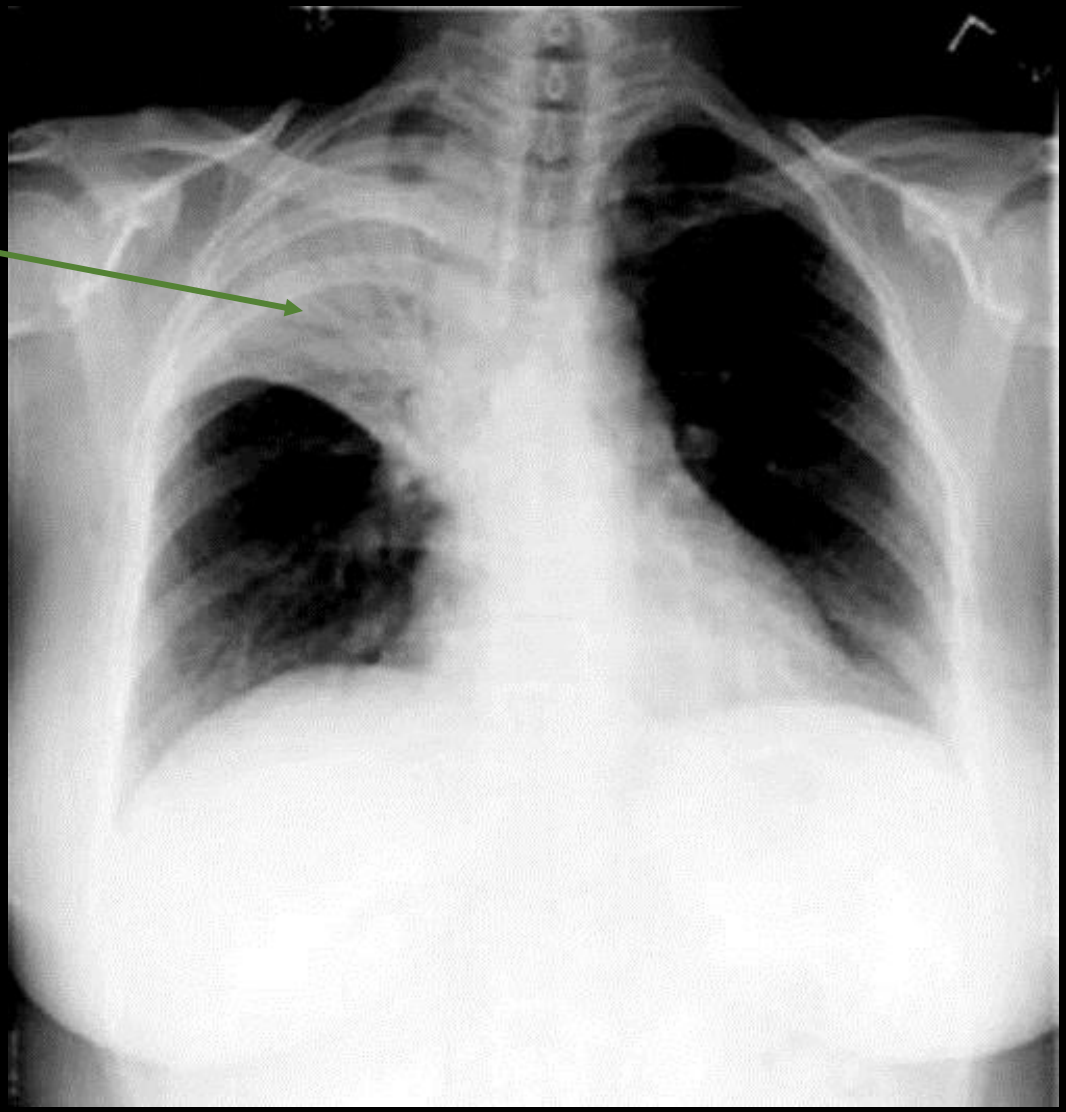
Cases

be systematic

Clinical presentation:

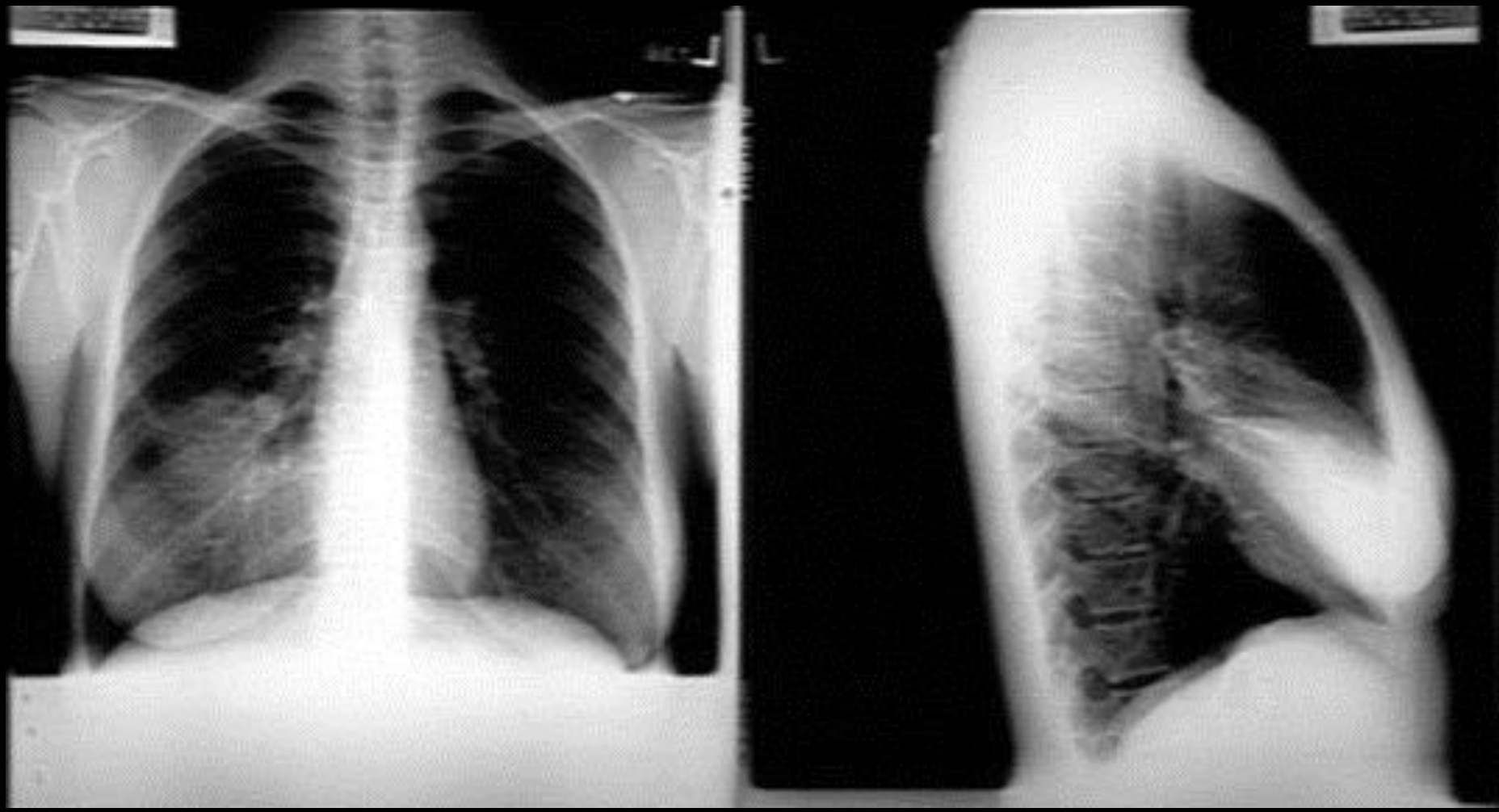
- Fever.
- Cough.
- Breathlessness.
- Hypoxia.
- Spo2 92% ON HFNC 50L/min 70% 02.

Bilateral consolidation, the diagnosis is pneumonia



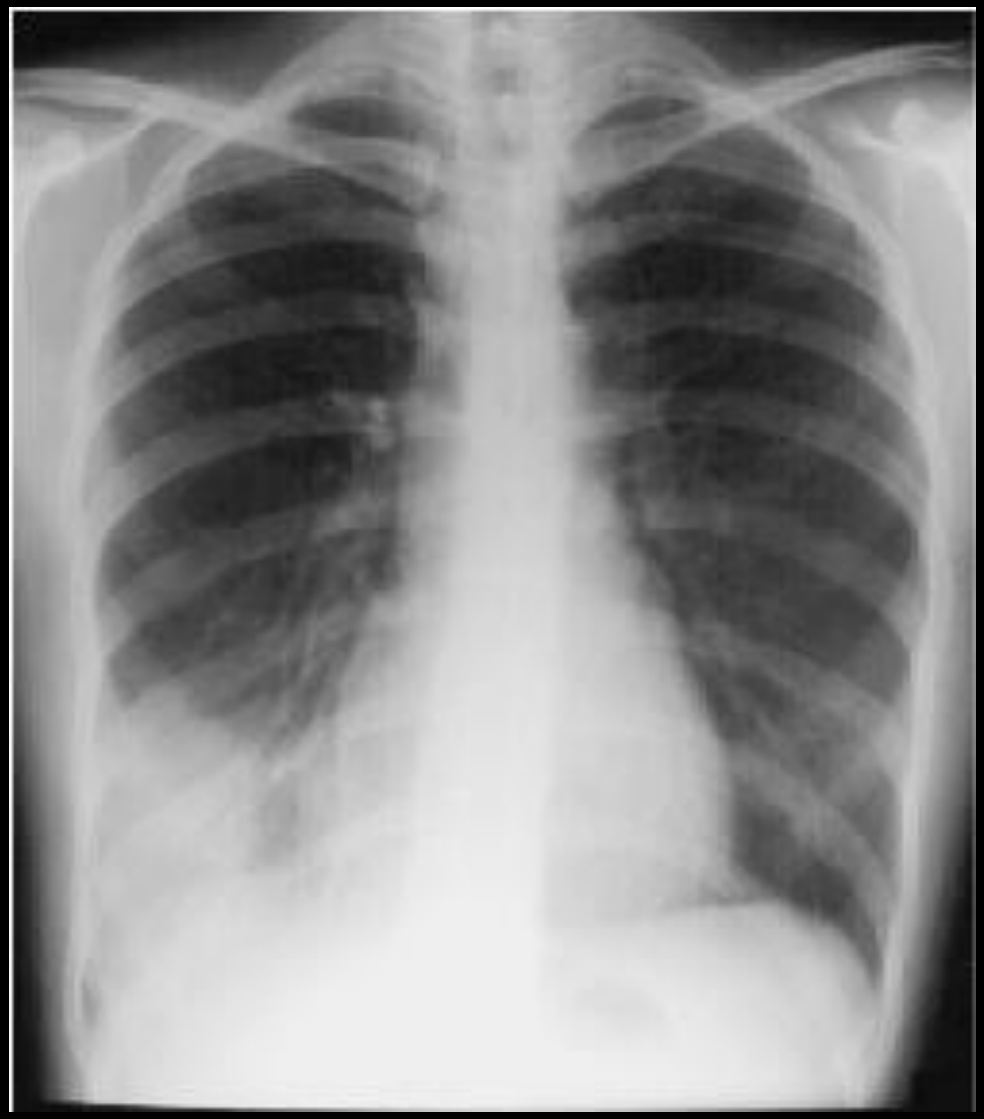
RUL pneumonia

Presents with right pleuritic chest pain



RML pneumonia

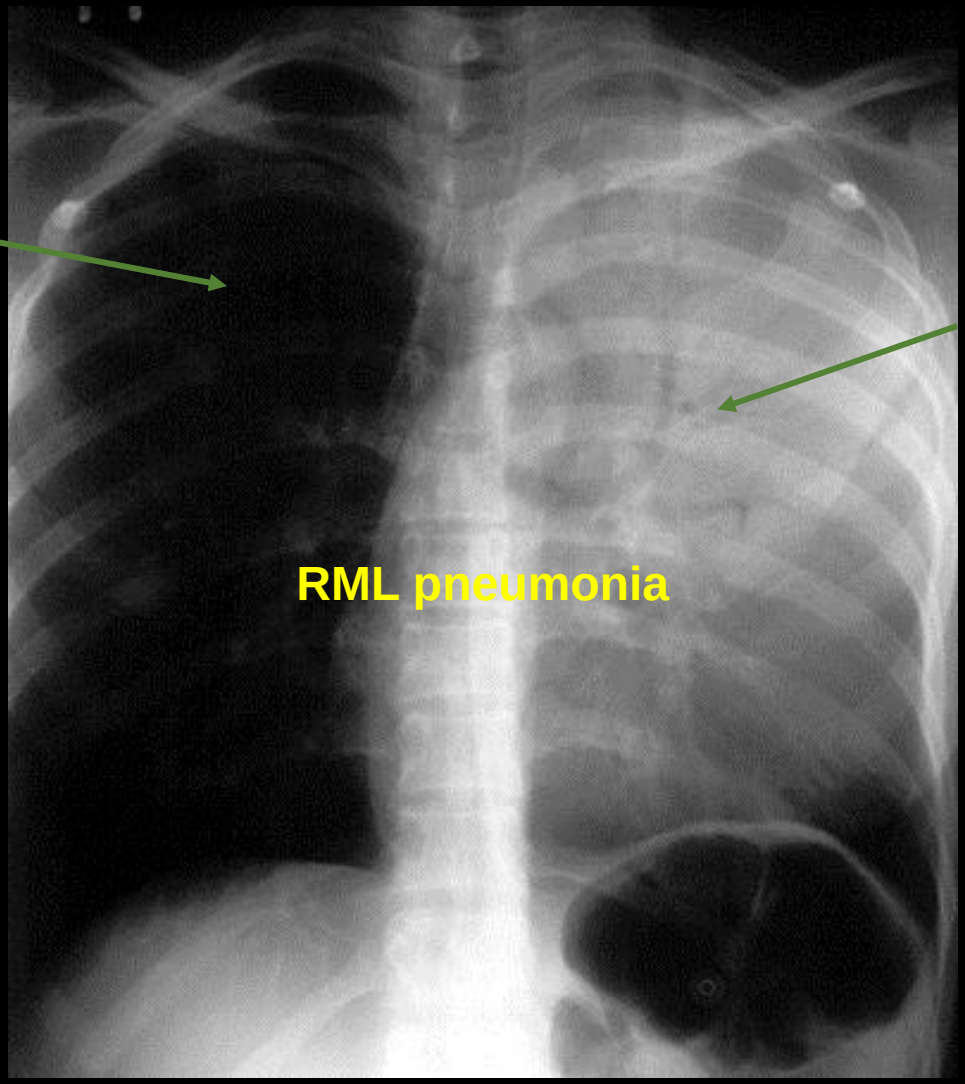
You can’t see the right heart border



RLL pneumonia

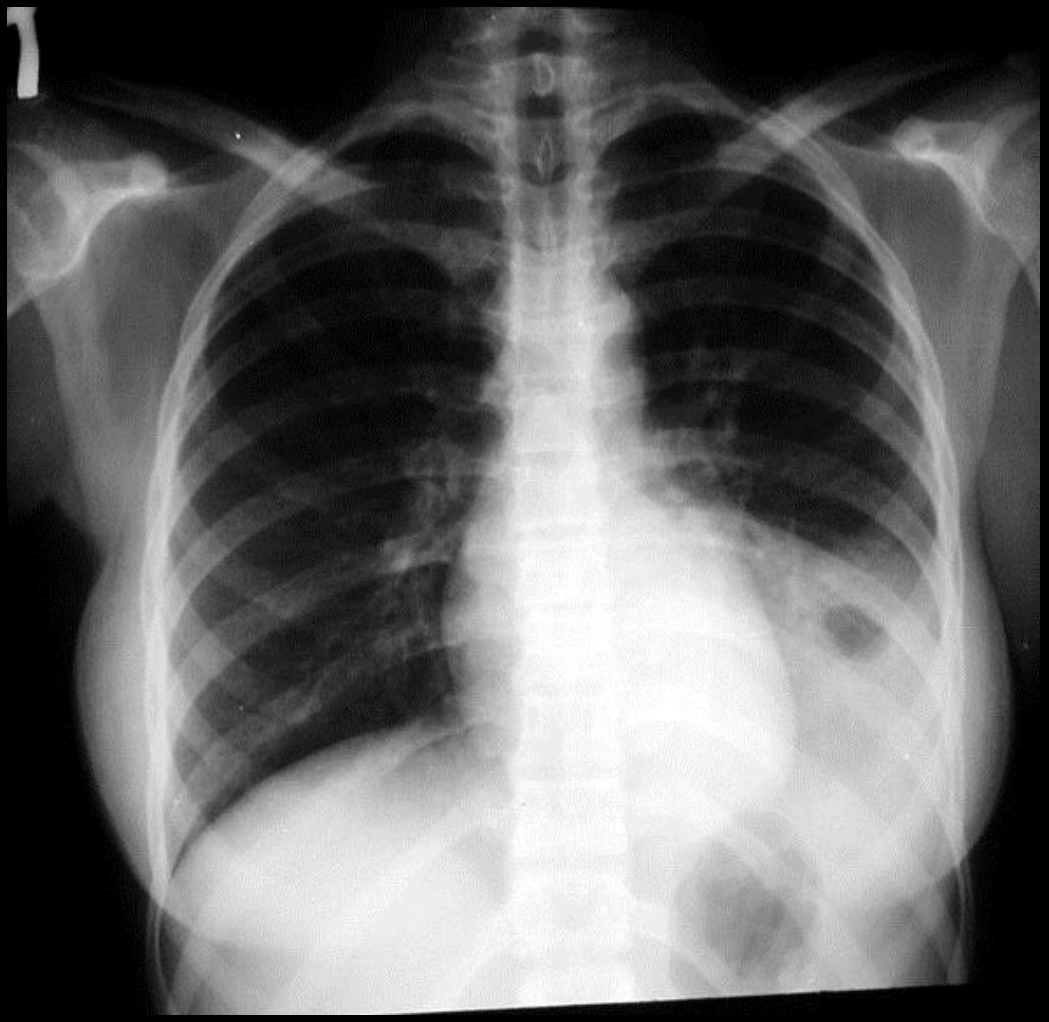
You.can see the right heart border but you can’t see the right hemidiaphragm

Very dark!



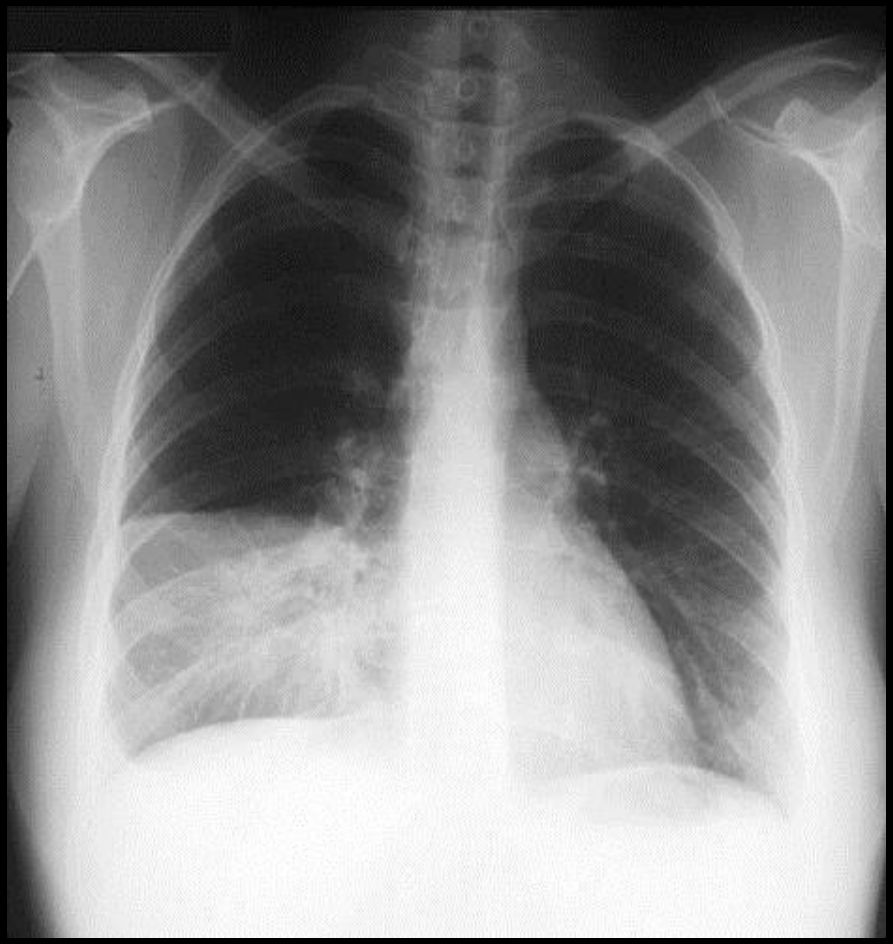
Dark lines: air bronchograms

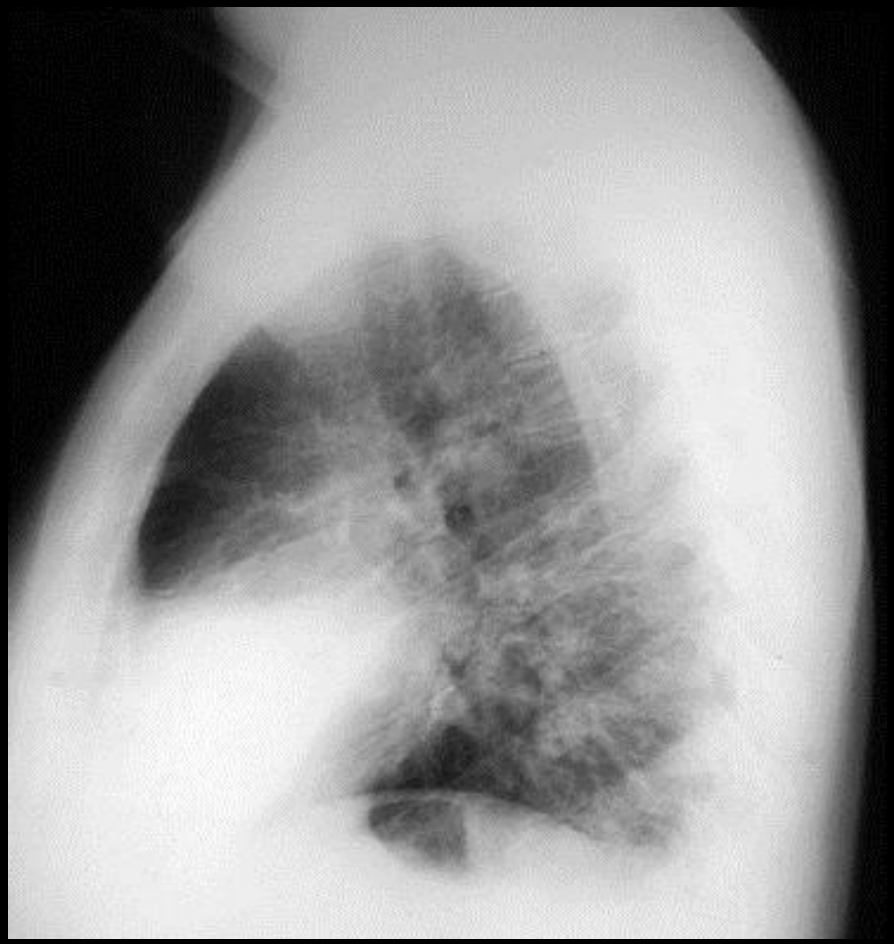
LUL pneumonia



LLL pneumonia

You can’t see left hemi diaphragm

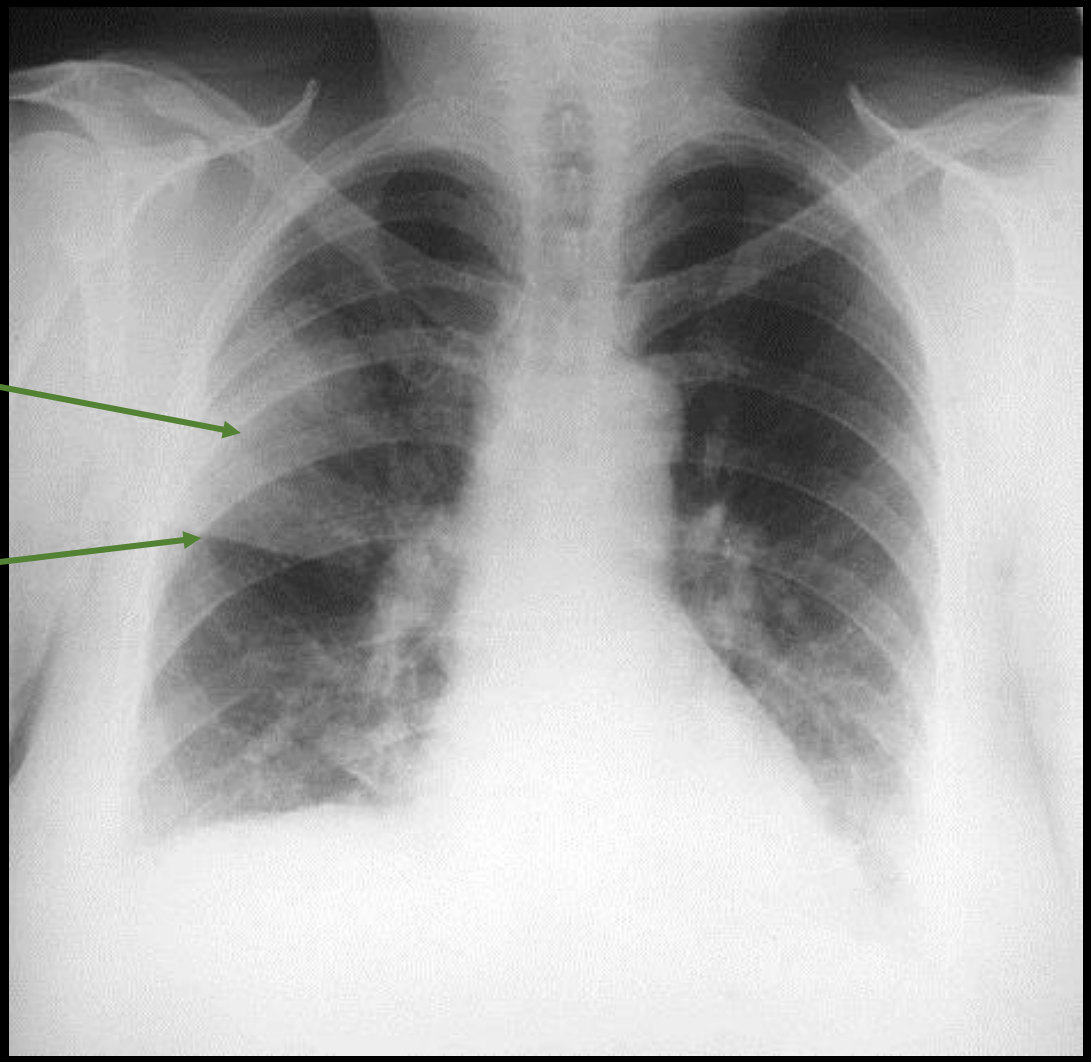




We can see right hemidiaphragm, but we can't see right heart border > **RML pneumonia**

PA view: RML consolidation and loss of right heart silhouette

Lateral View: RML wedge shaped consolidation

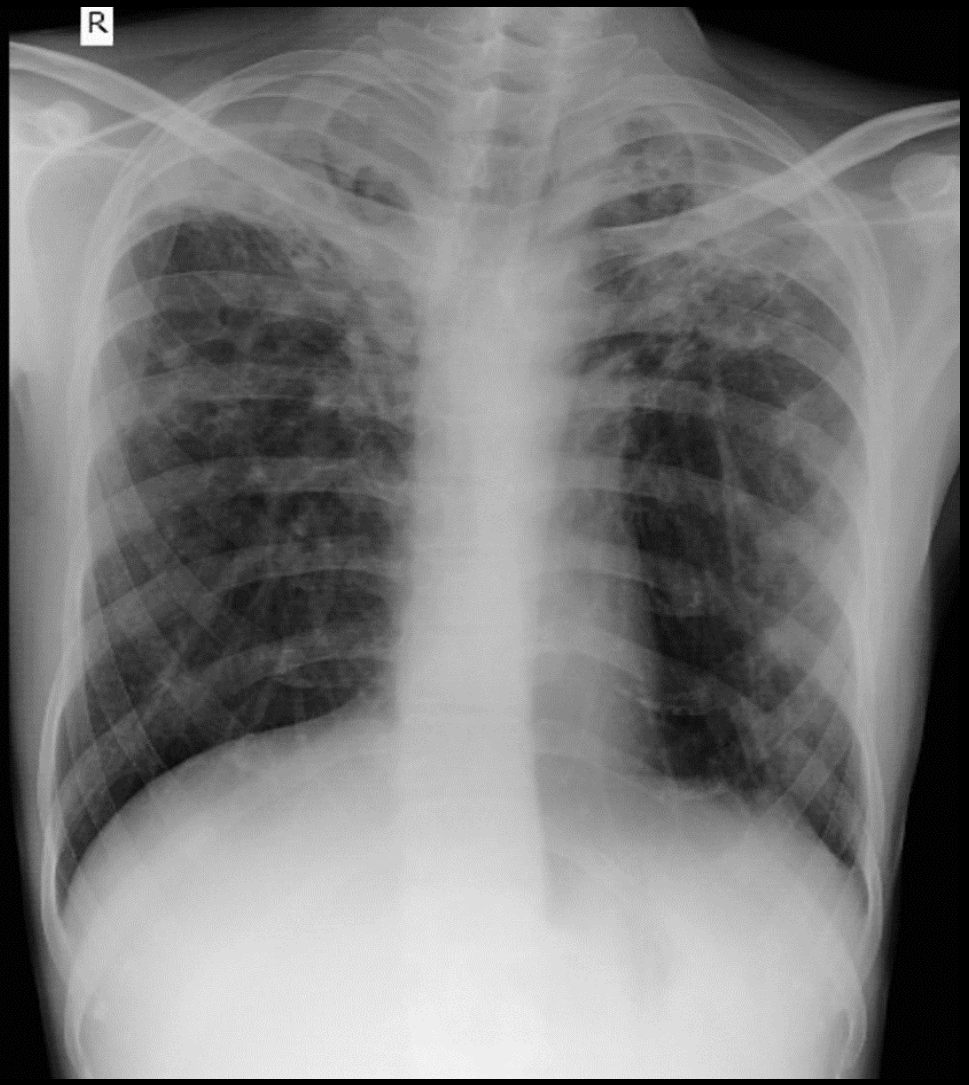


RUL and LLL pneumonia

RUL infiltrate / consolidation, bordered by minor fissure inferiorly

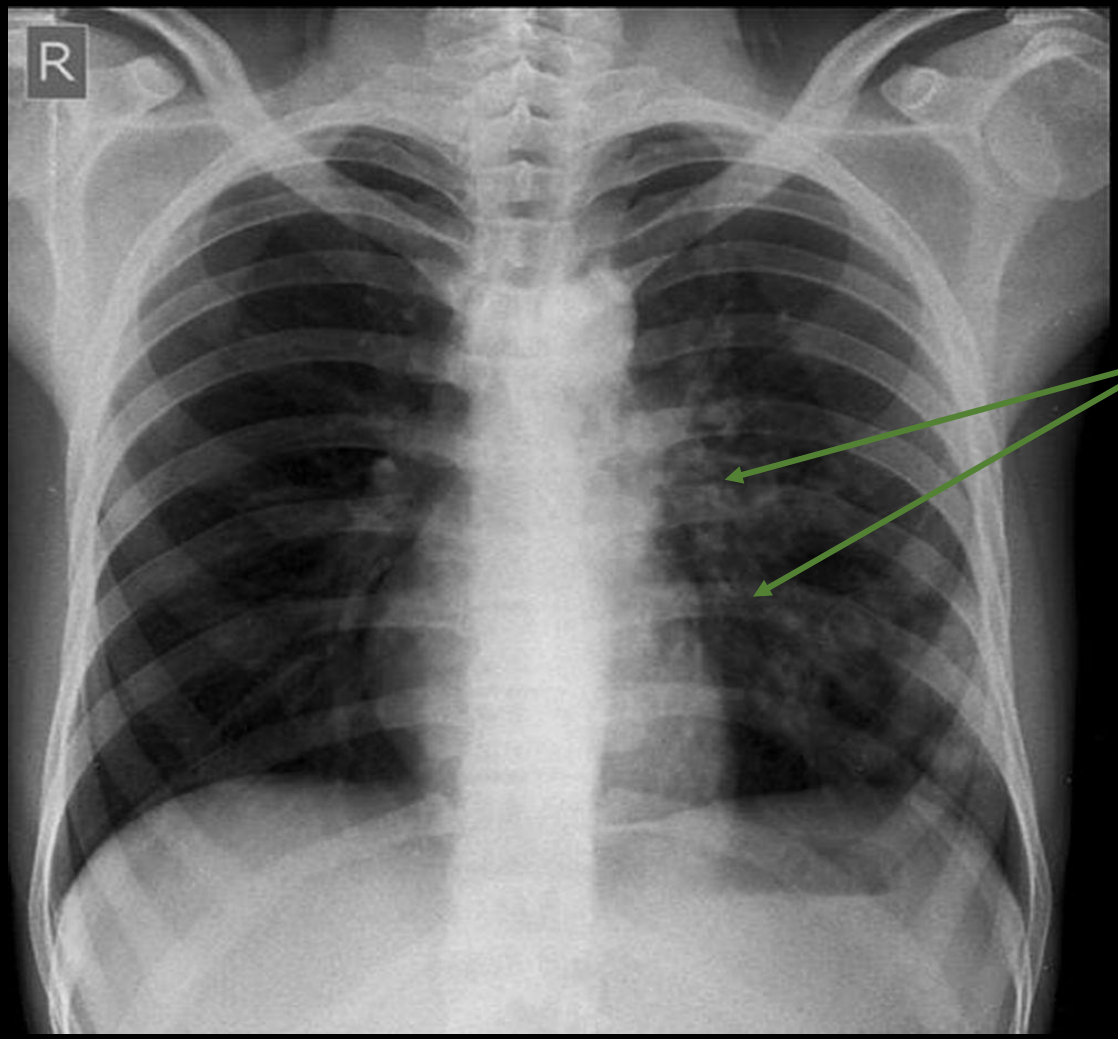
Patchy LLL infiltrate that obscures the left hemidiaphragm; right and left heart borders obscured

Tuberculosis Next 4 slides



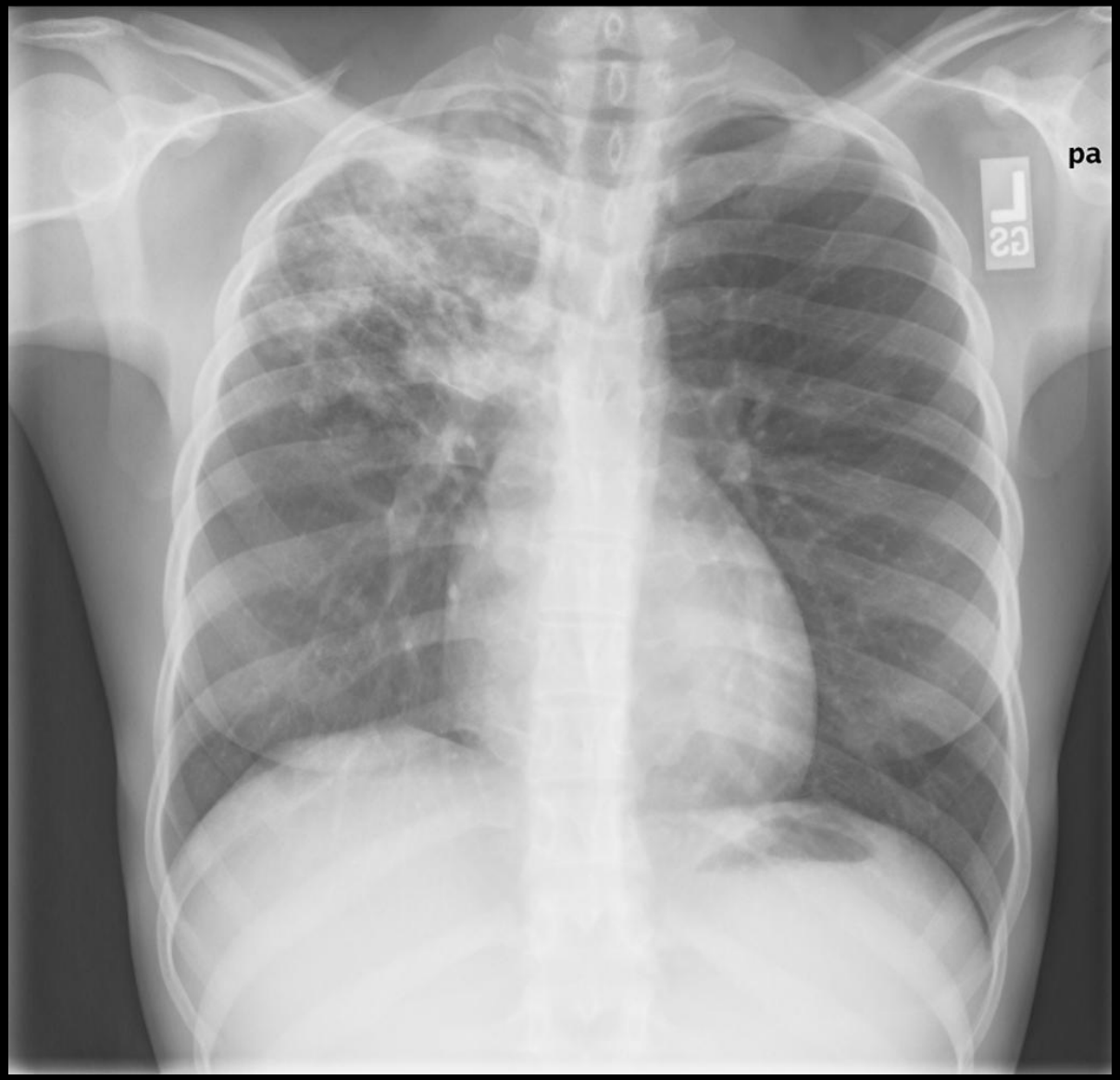
There is fibrosis in the upper area (consolidation with loss of lung volume). Hilum is not clear; they are pulled upwards because loss of volume. This is a patient with **TB (chronic).**

DDx: ILD that affects upper lobes: silicosis.

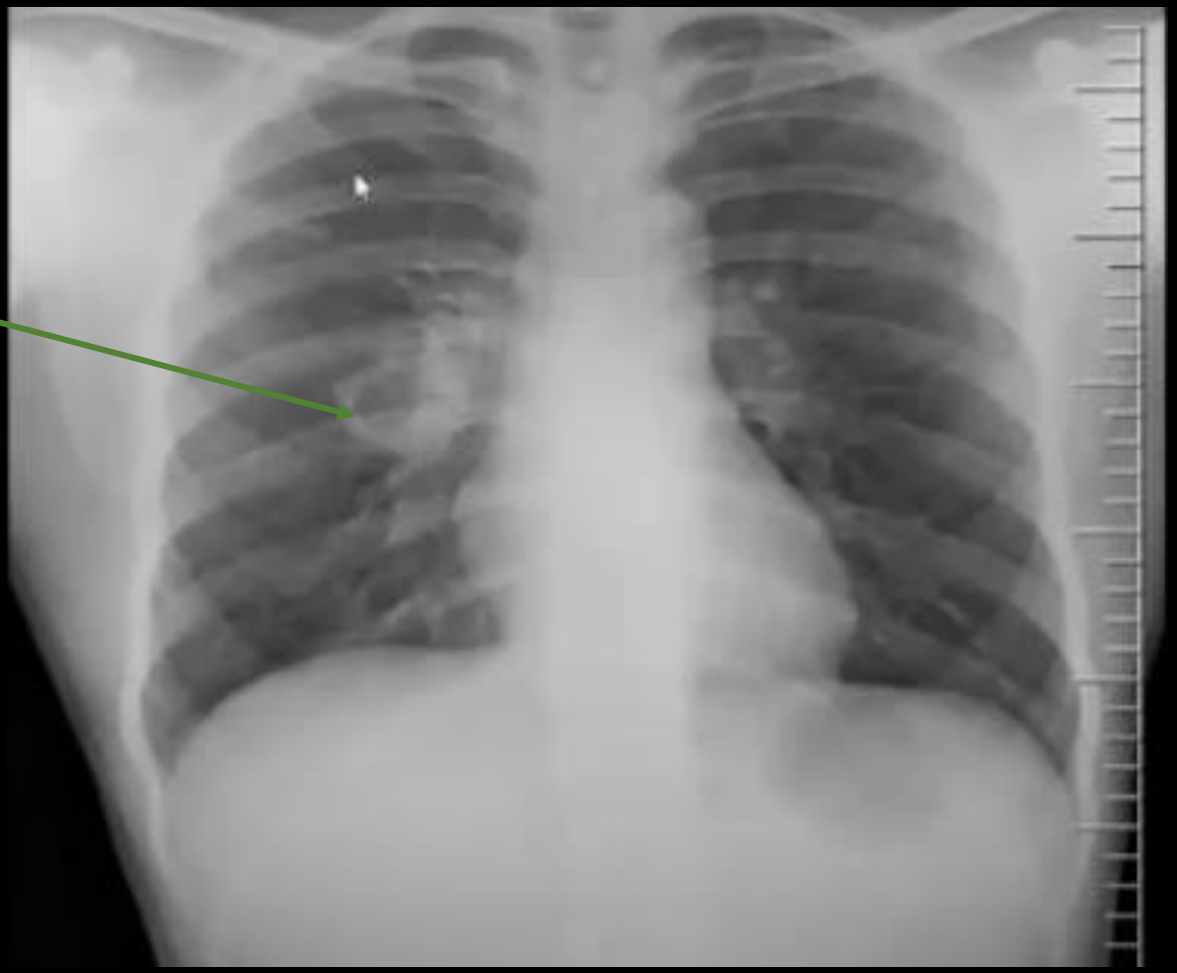


Patchy consolidations **- Depending on the history**:
a) Acute symptoms: Lung infection.
b) Chronic symptoms: TB.

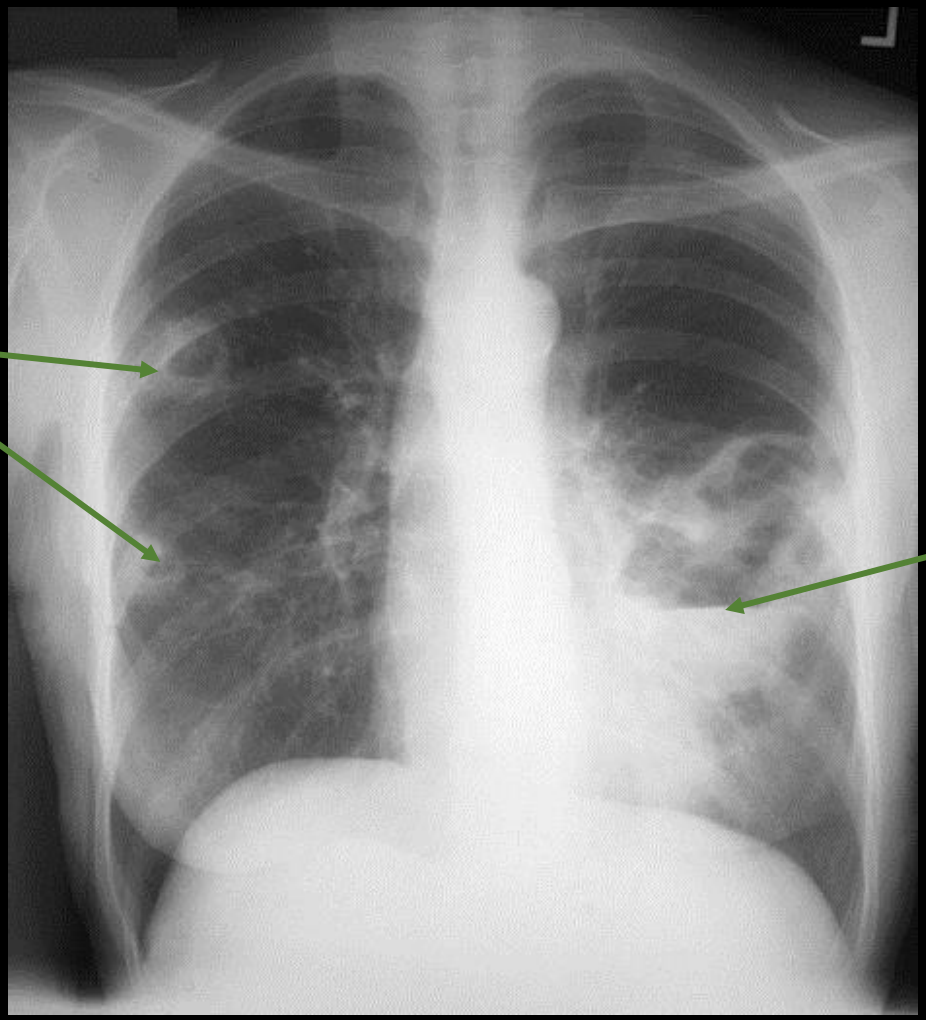
This patient was admitted with cough, weight loss, and fever.



TB



TB

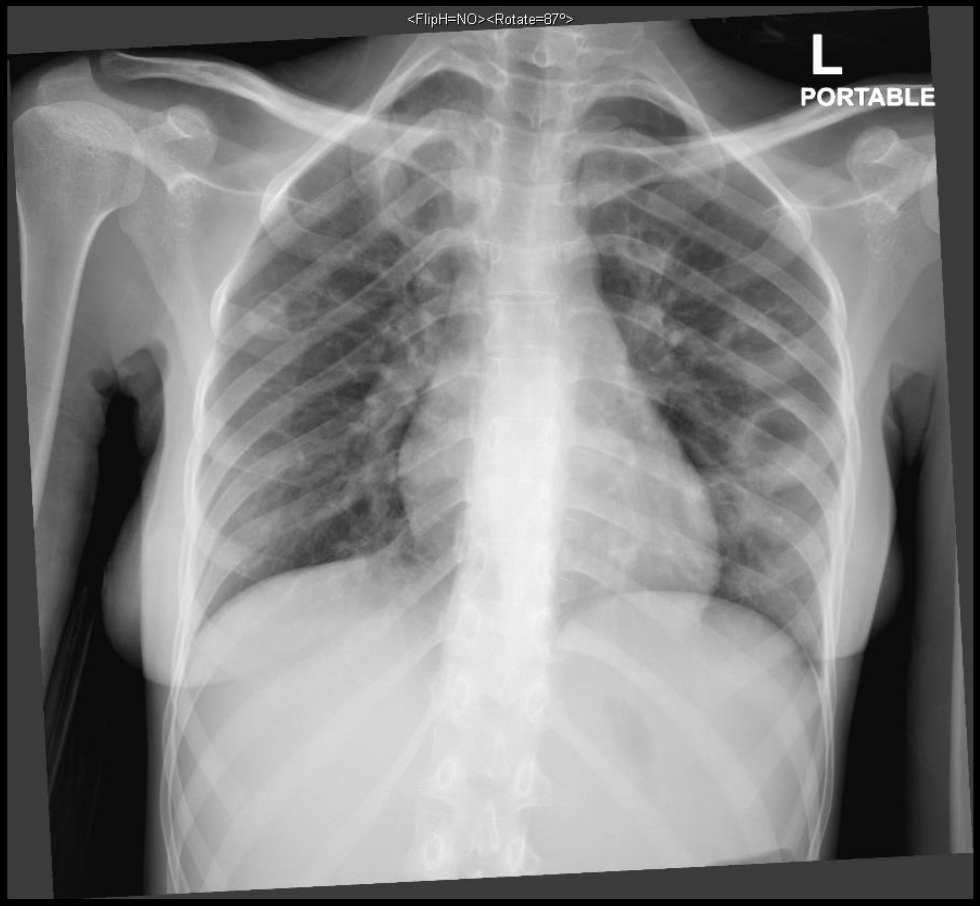


Tuberculosis

Multiple bilateral cavitary lesions with air-fluid levels c/w pulmonary abscesses

DDx: Infections (bacterial/fungal) – Malignancies – Vasculitis– Trauma (Infarction/contusion).

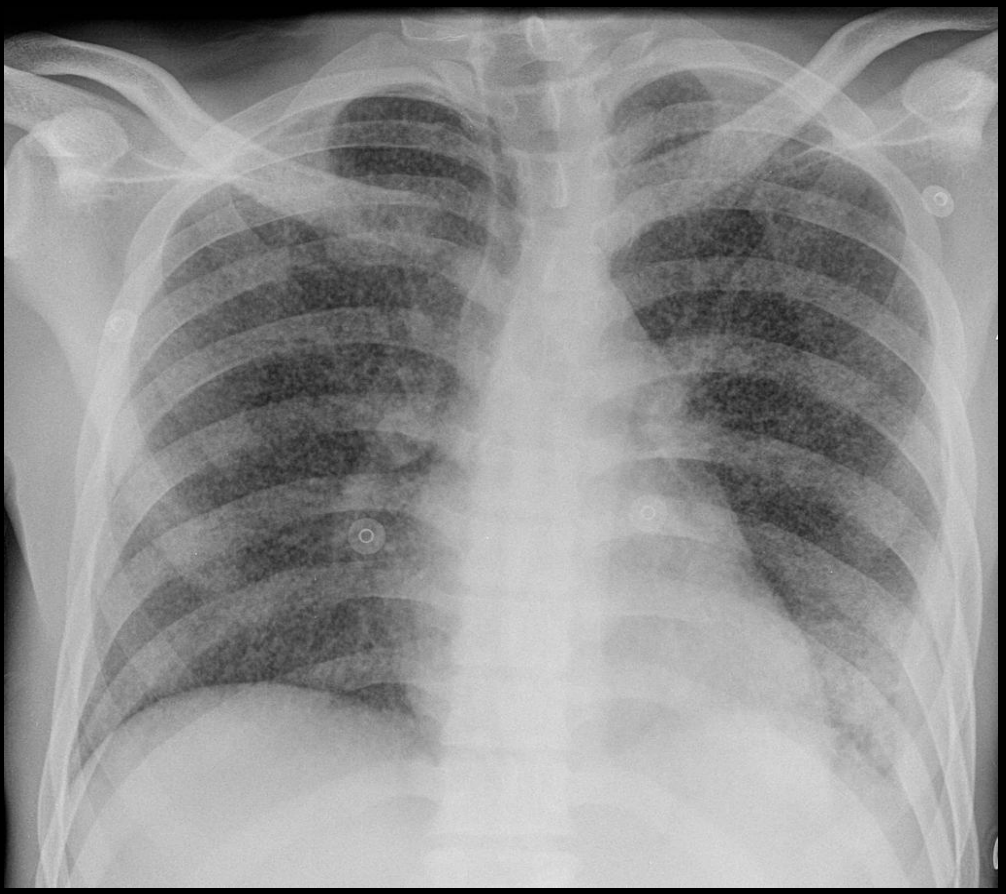
Multiple cavitating lesions



Multiple lung cavitation.

ANCA+ Wegener granulomatosis.

Miliary mottling / Miliary TB



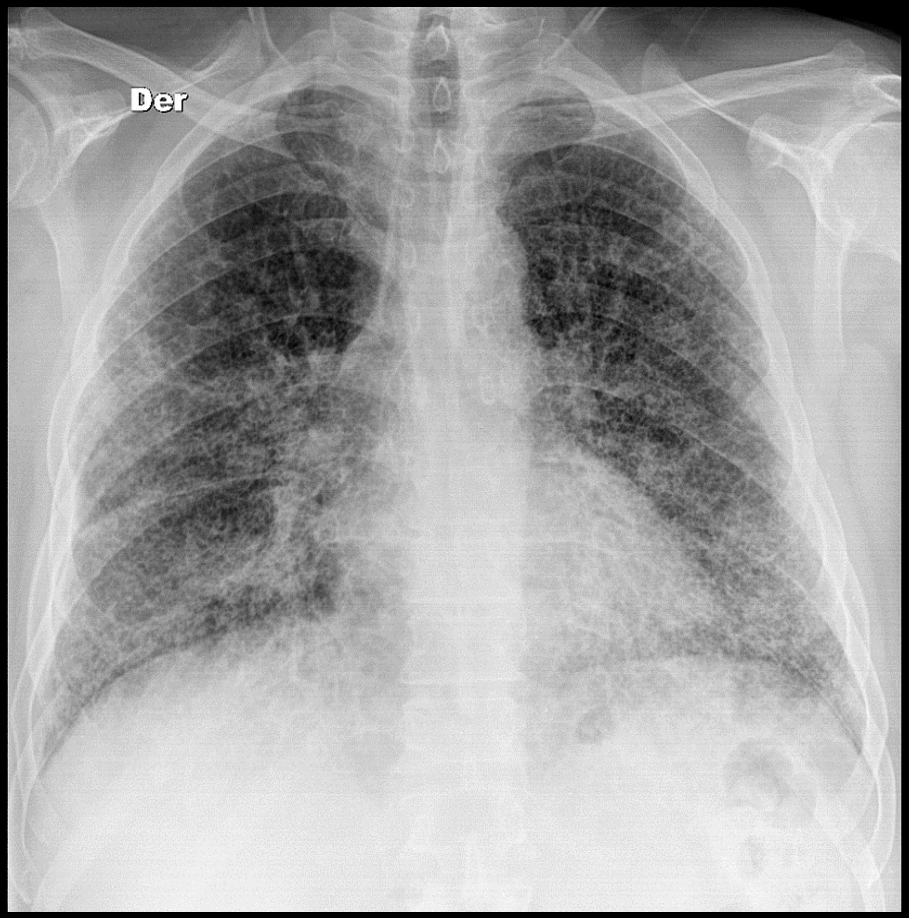
Miliary TB (Many small dots).

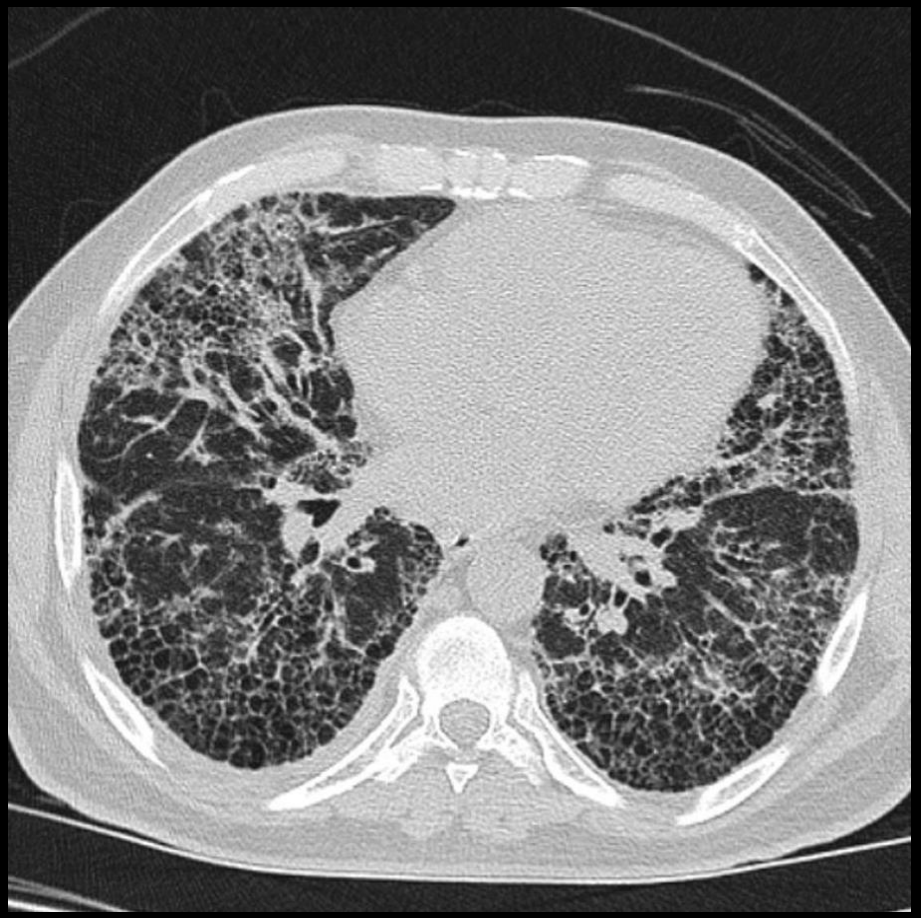
الدخن

ILD

- The following 2 slides Reticulonodular changes.

This patient has become breathless gradually among the two past years, the lung looks smaller, and there are multiple lines that cross each other (reticular changes in both lungs), so this is what you see in **pulmonary fibrosis.**

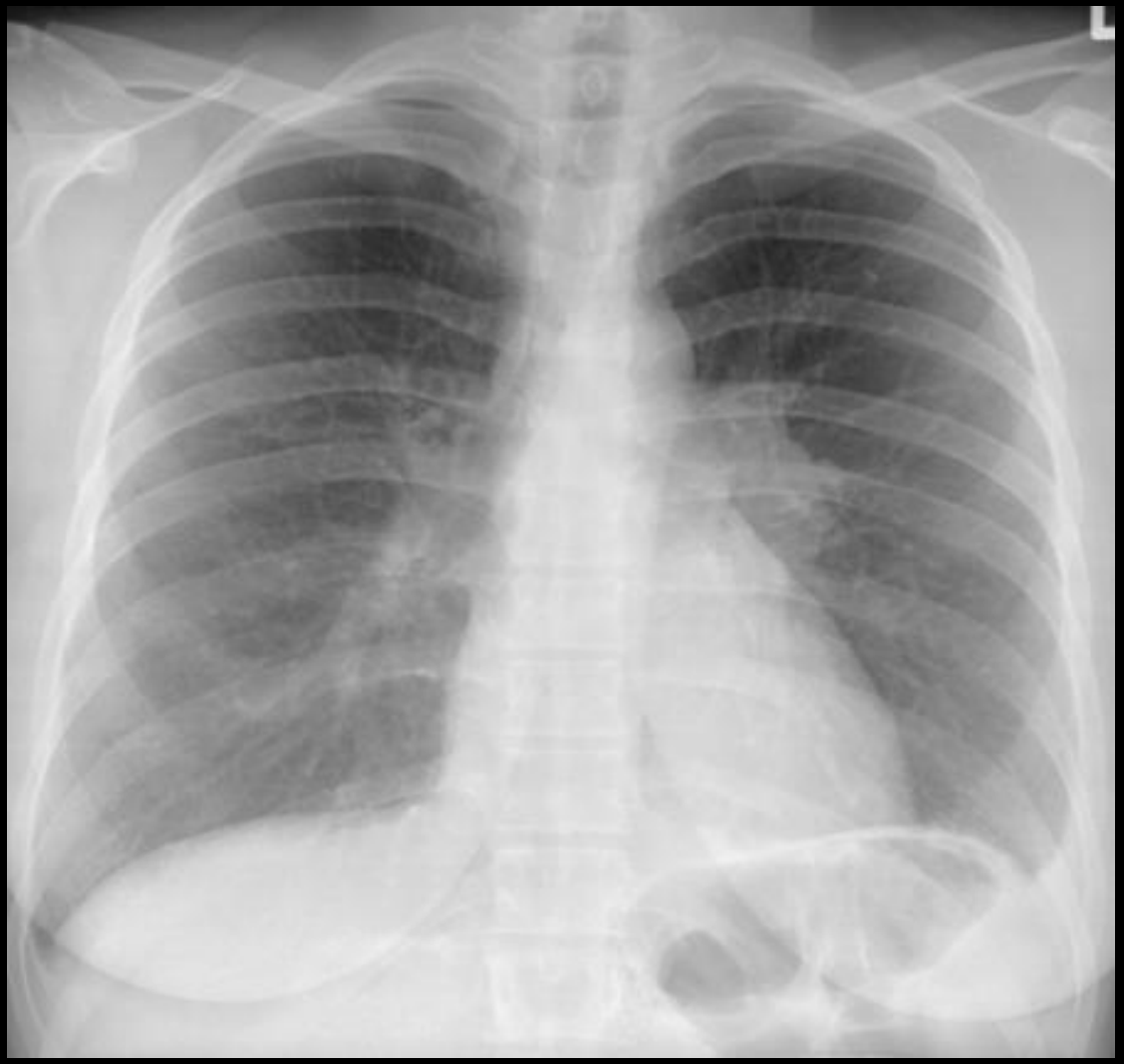




Lines and dots (reticulonodular).

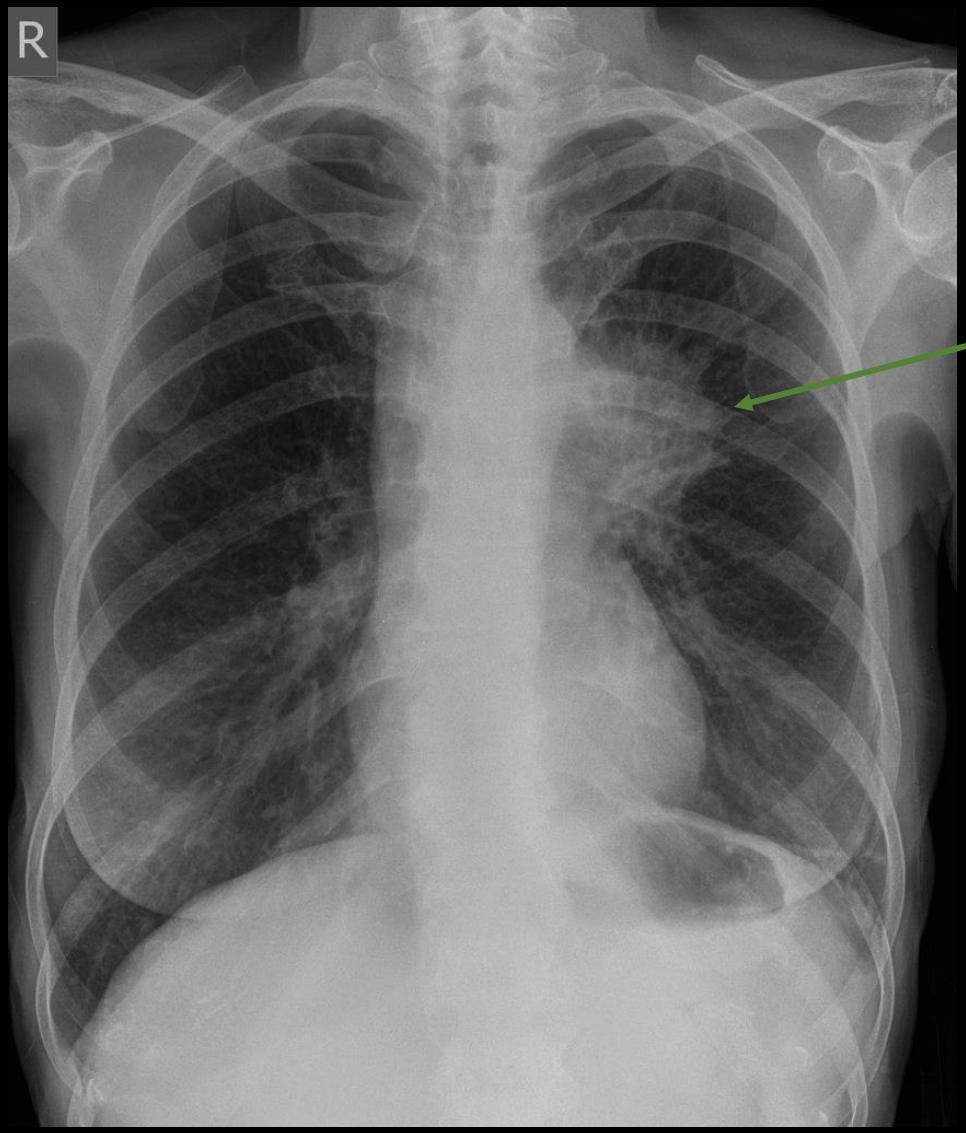
Bilateral dense prominent hilum,

DDX: Sarcoidosis, TB, Histoplasmosis, lymphoma.

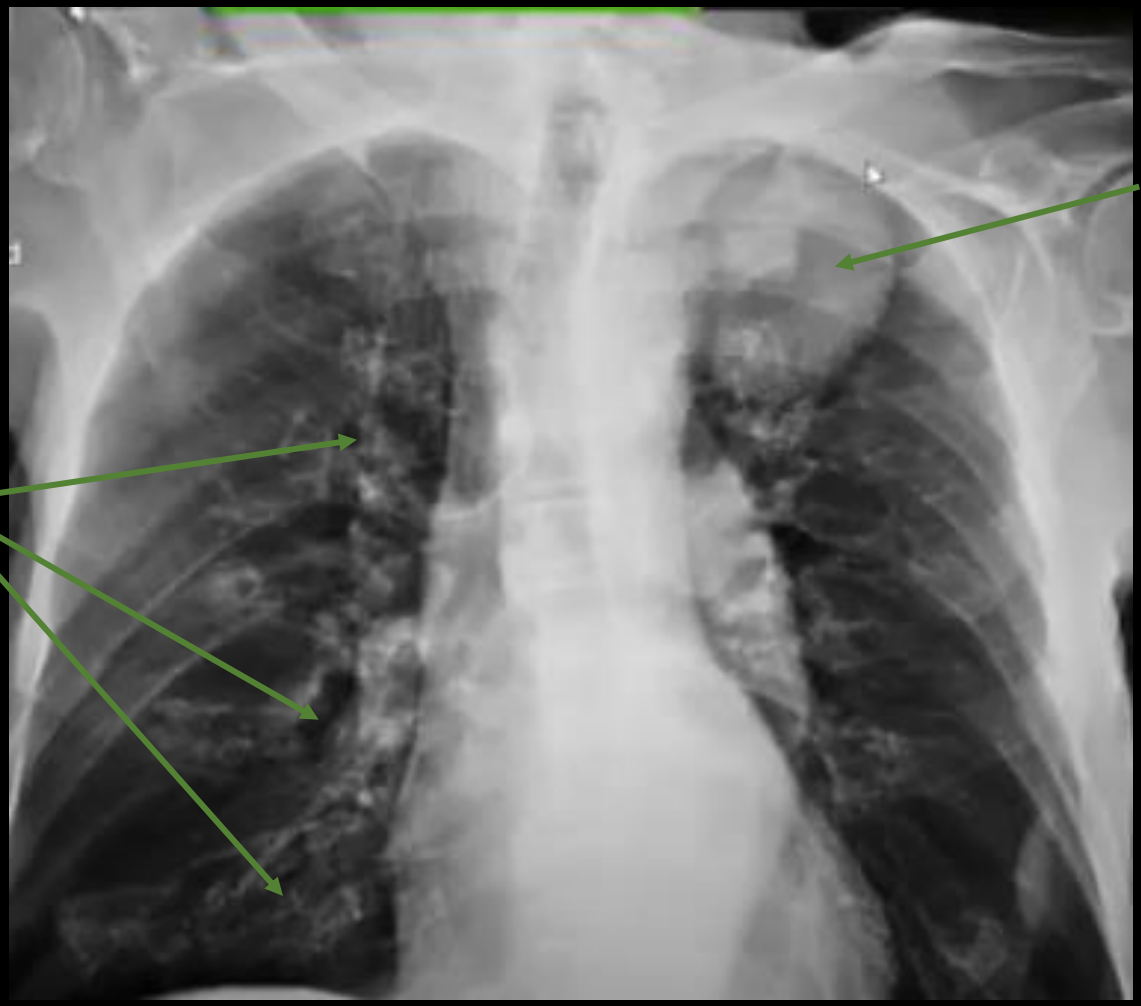


Hilar Lymphadenopathy - BL

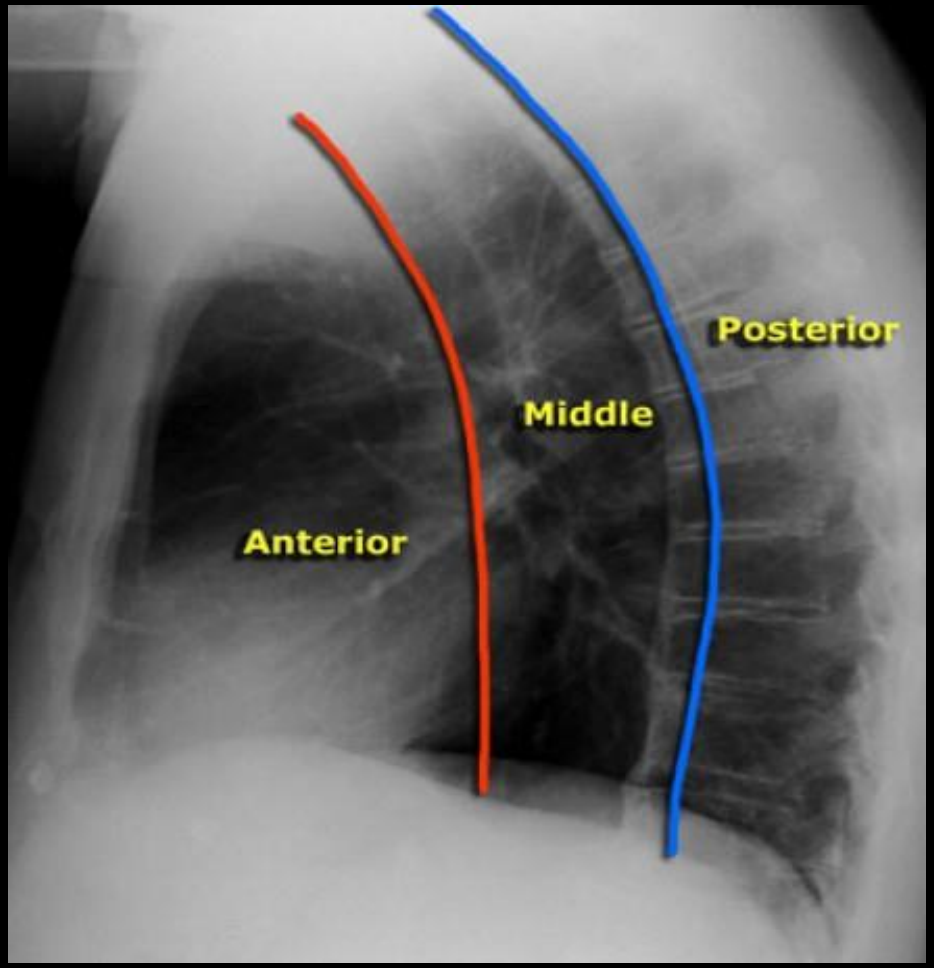
Bilateral Hilar Adenopathy but look at the changes in the lungs= sarcoidosis. Reticular pattern.



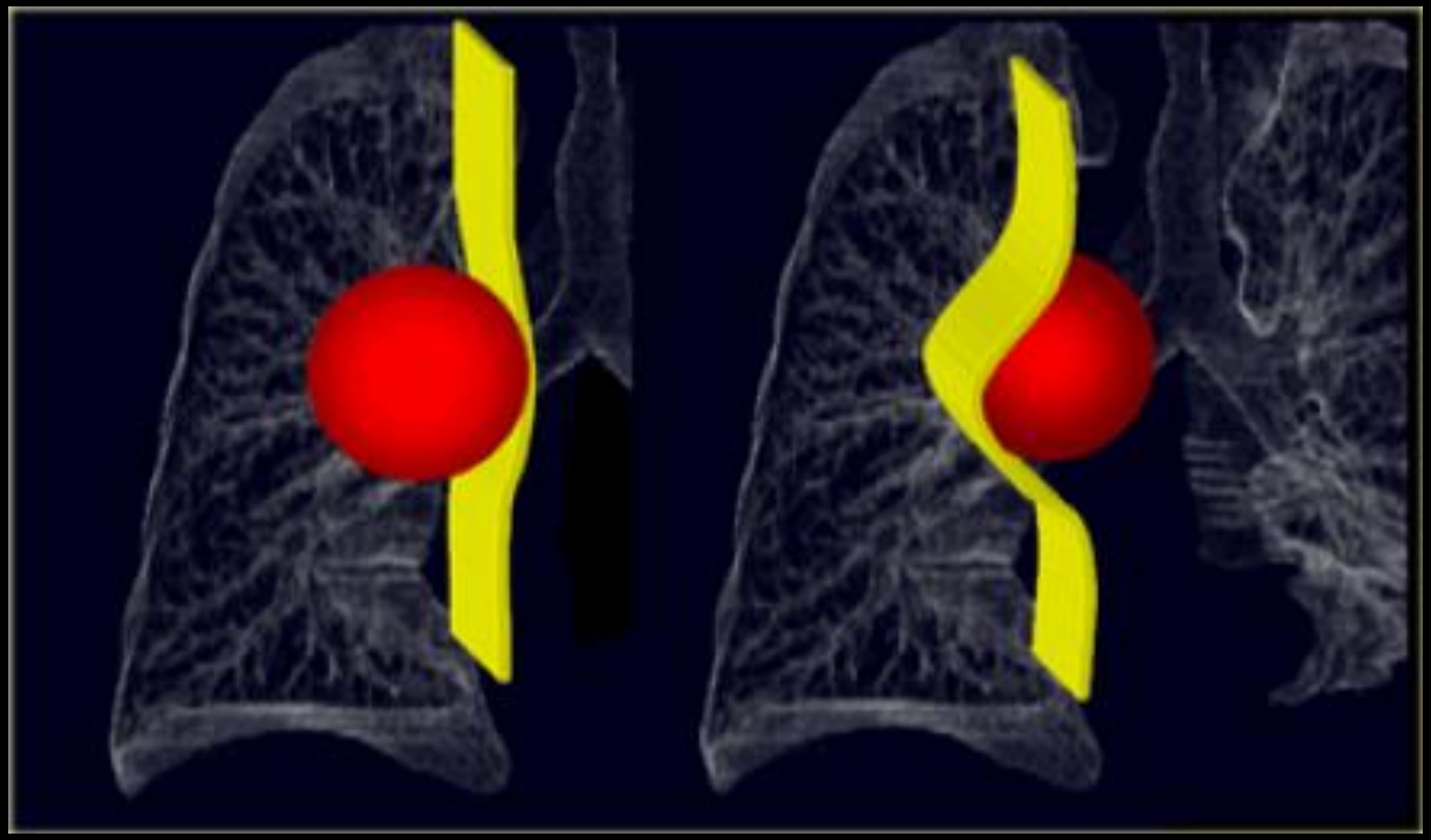
Lung mass, look at the edges its irregular speculated


Mass with a smooth edge.
Calcificated costal cartilages

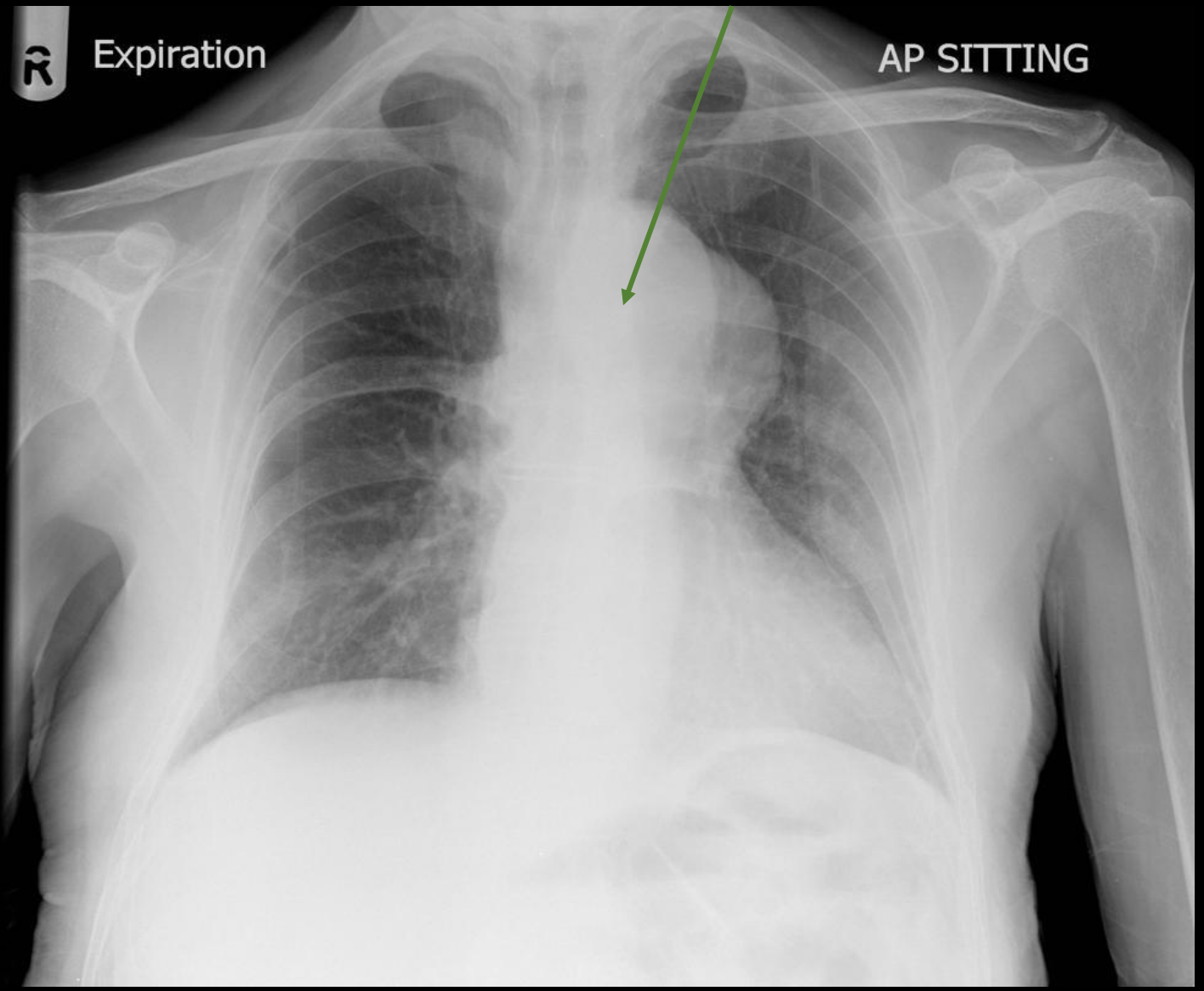
Mediastinum

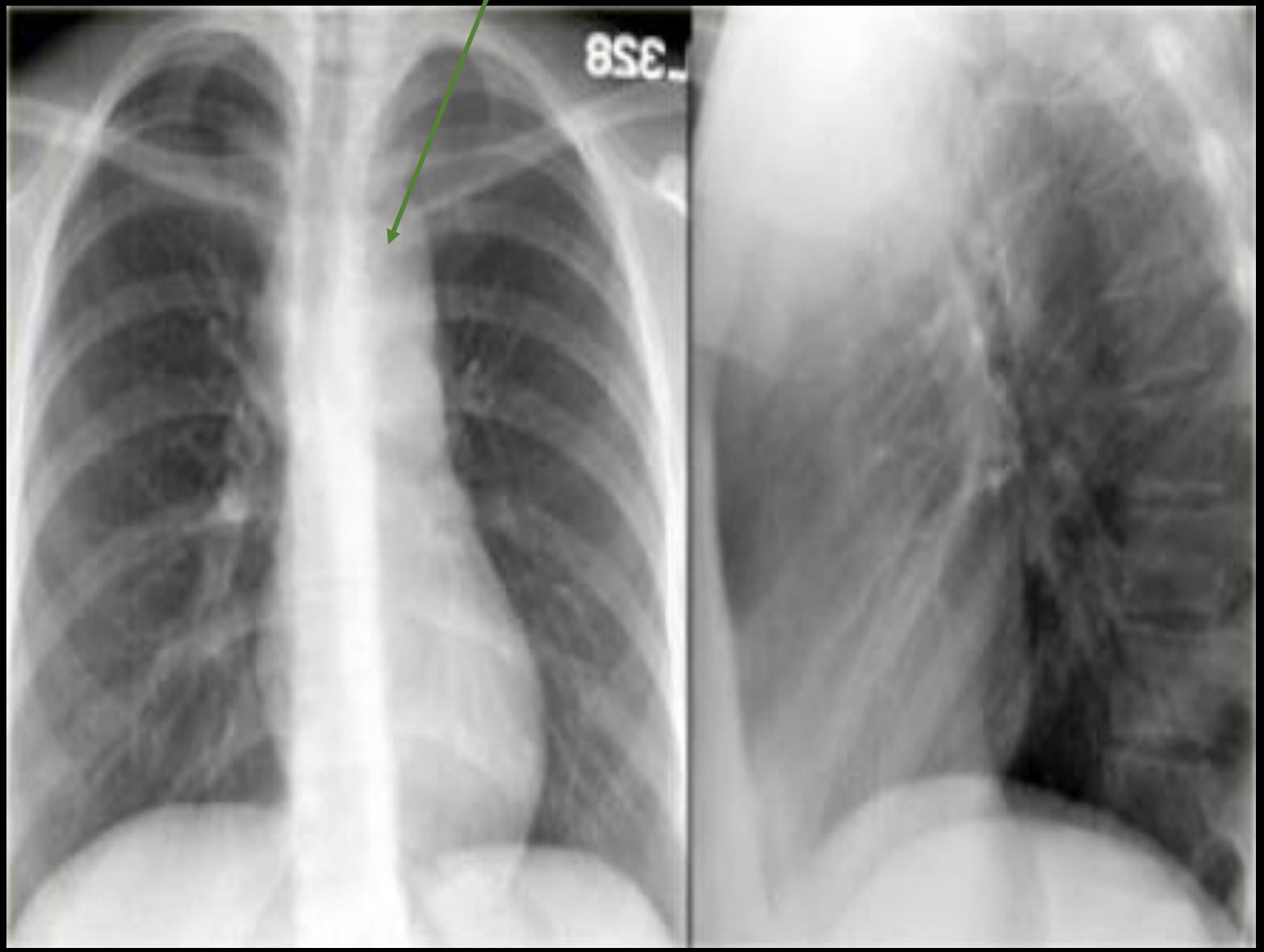


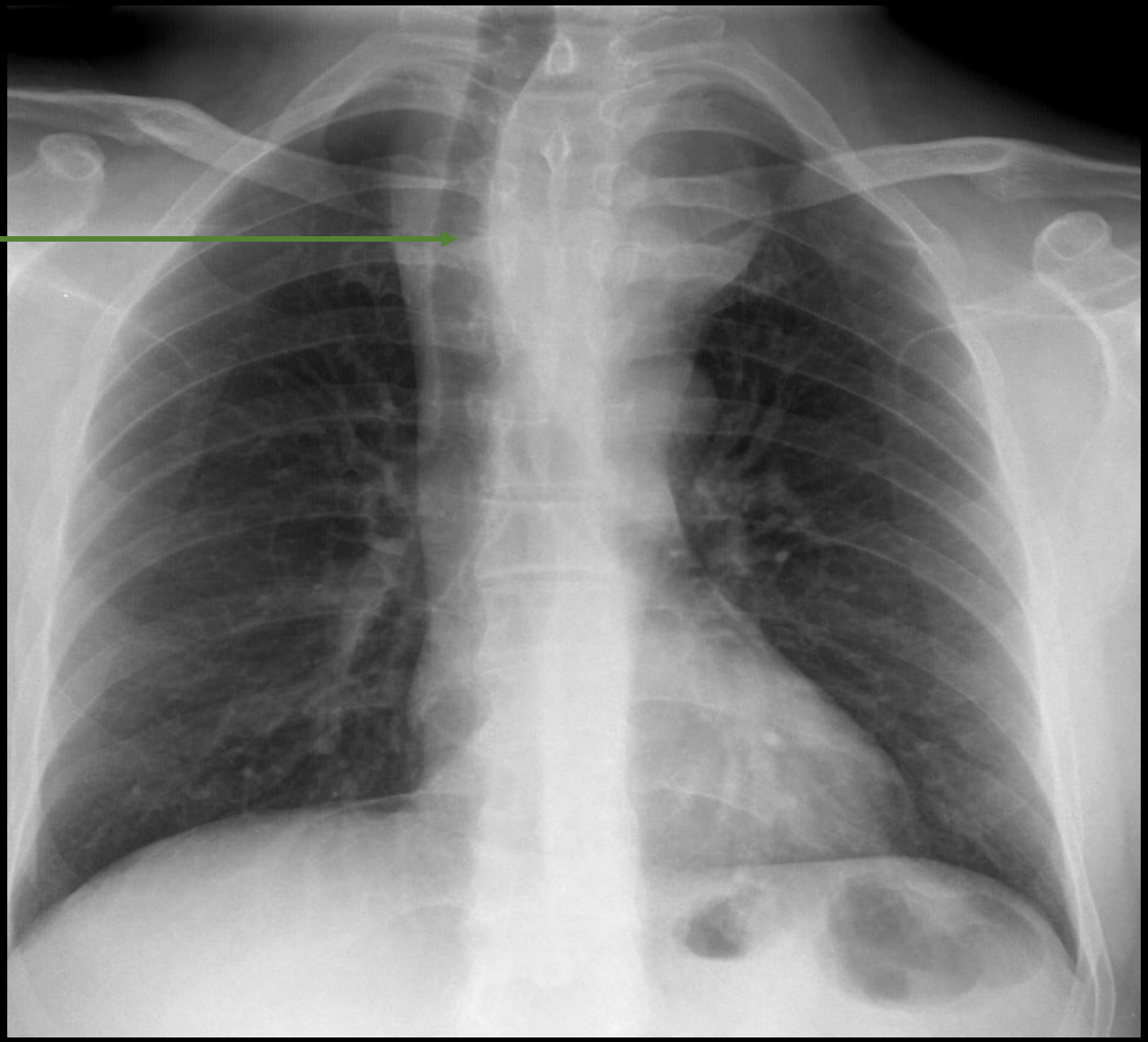
Mediastinal vs lung mass

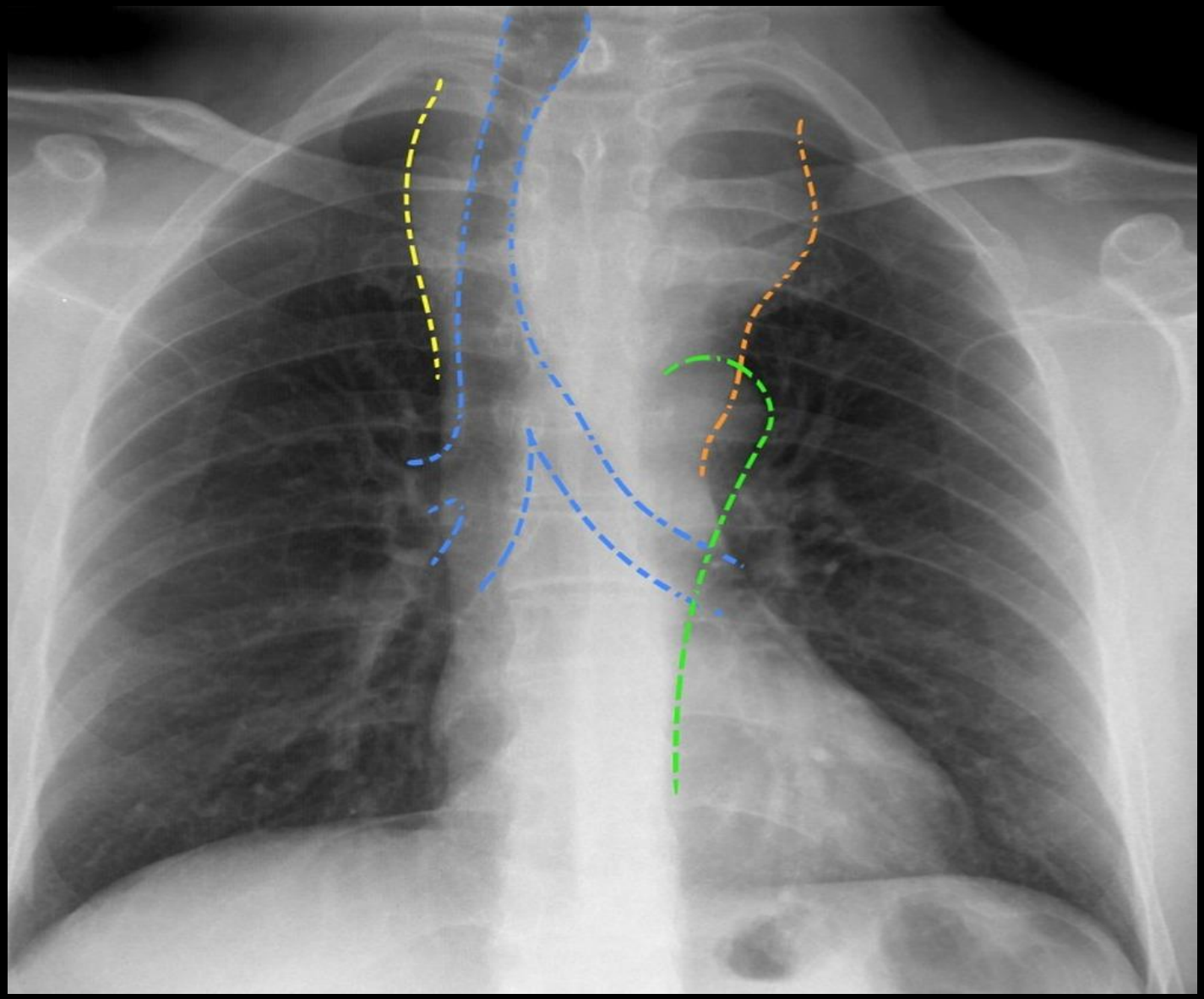


If the lesion is in the mediastinum, it will be pushed against the lung


R
Expiration
AP SITTING

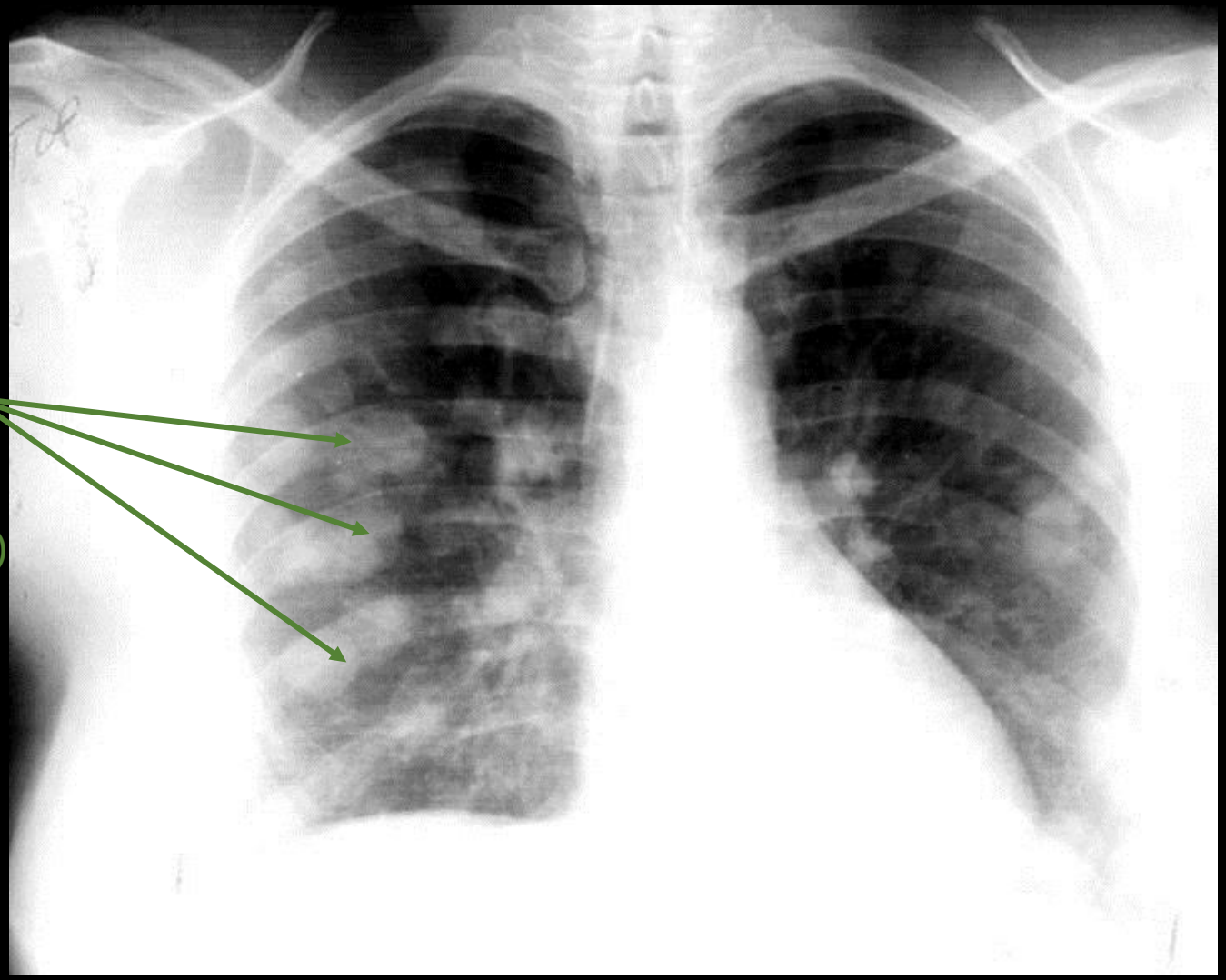

Lesion


Deviated trachea (Pushed to the right)

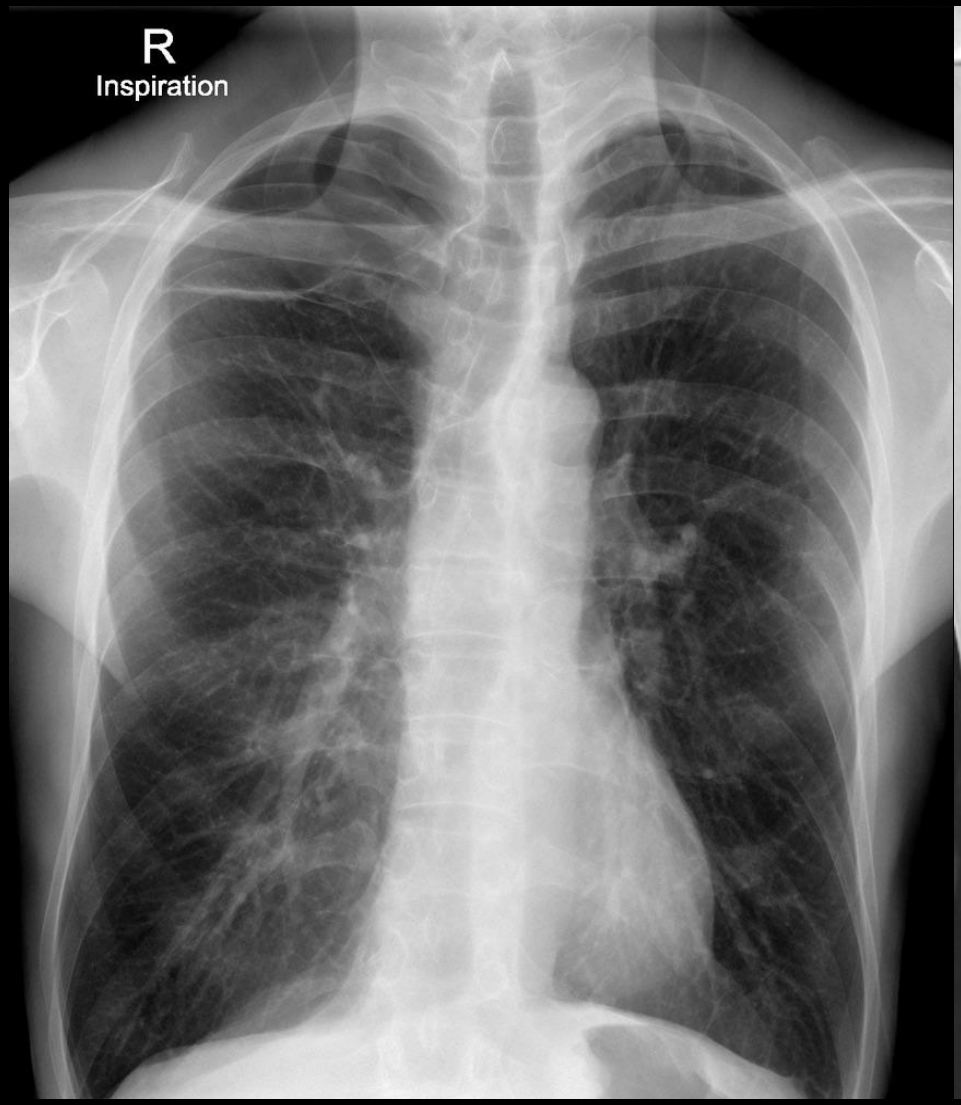


Retrosternal Goiter

Multiple opacities (Cotton ball malignancies) metastasis from the kidney-liver-breasts-thyroid.



Multiple Masses



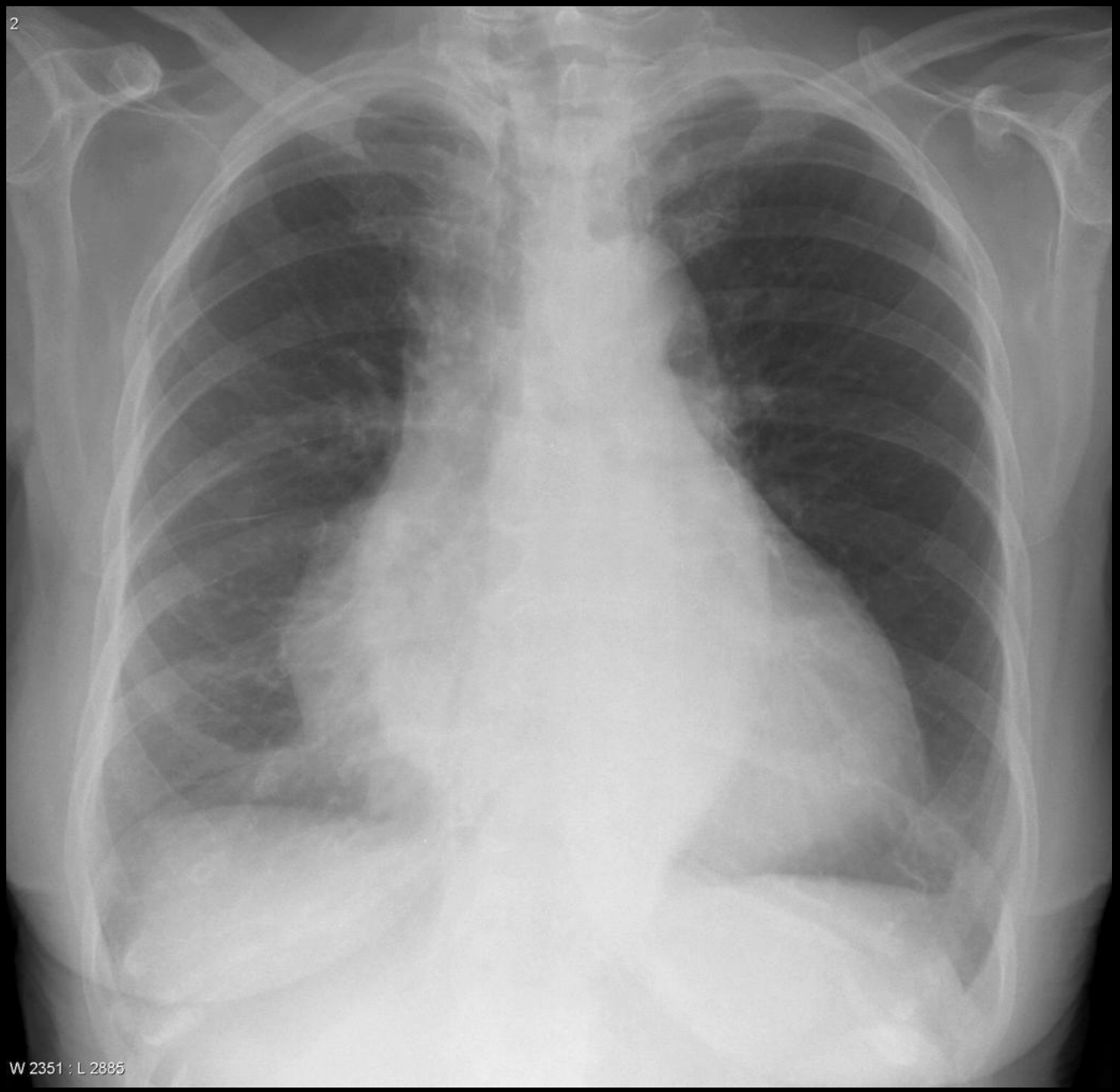
Hyperinflated lungs (more than 10 posterior ribs) **emphysema**

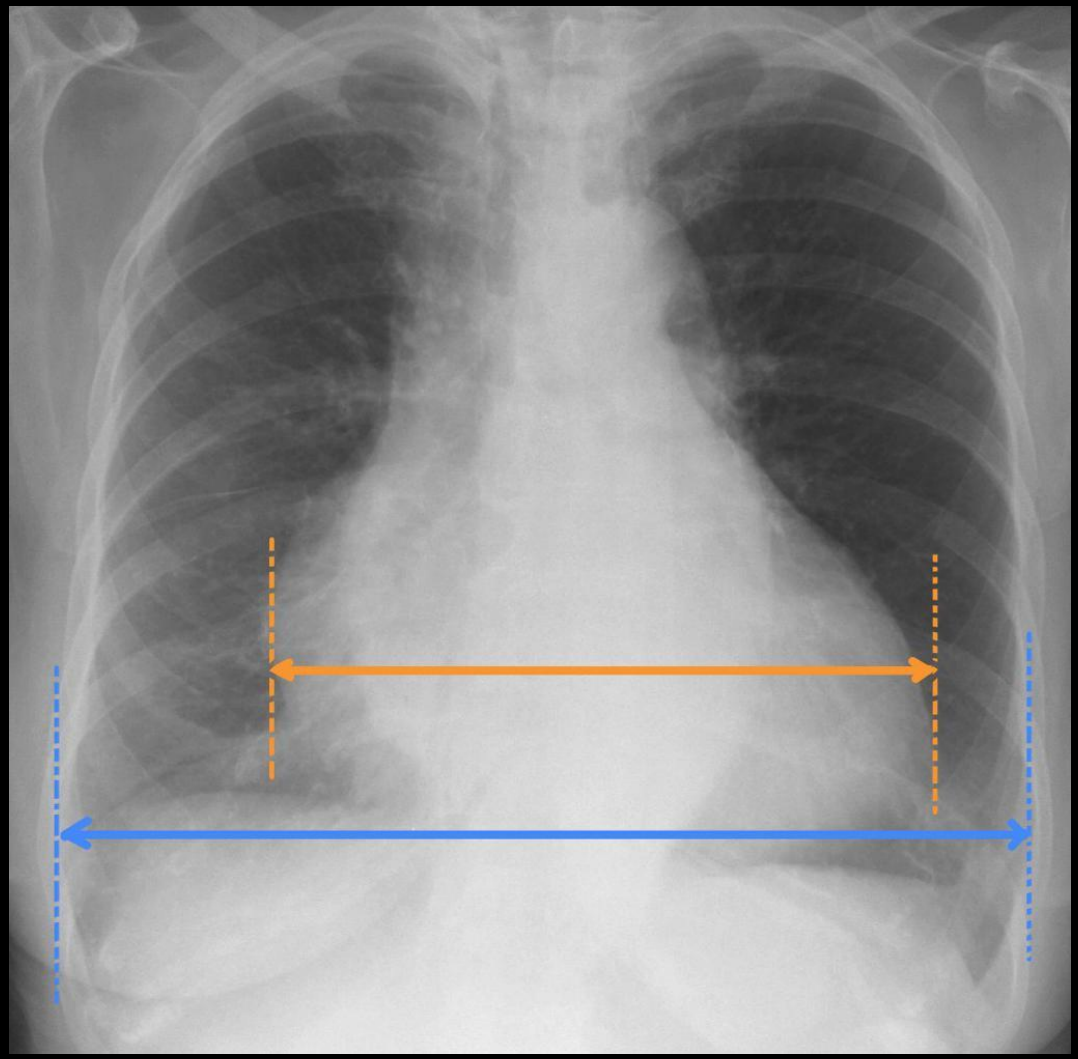
Final diagnosis is reached by spirometry
If the damage is in the lower lobes= alpha antitrypsin

Bullae full of air, not enough lung matrix

Alpha-1 antitrypsin deficiency

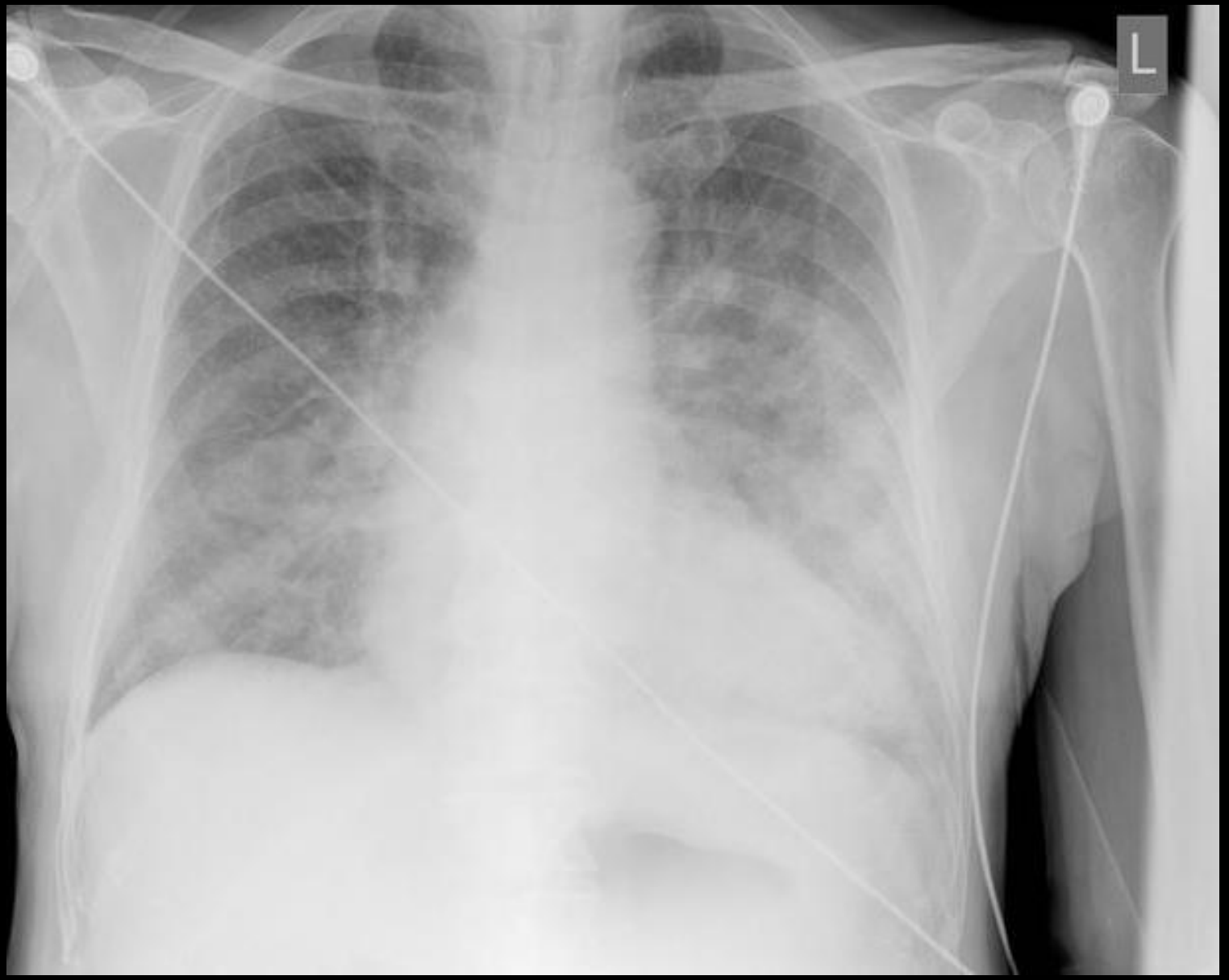
- The next 2 slide cardiomegaly


2
W 2351 : L 2885



Cardiothoracic ratio is more than 50%

- The next slide is Heart failure/Pulmonary oedema

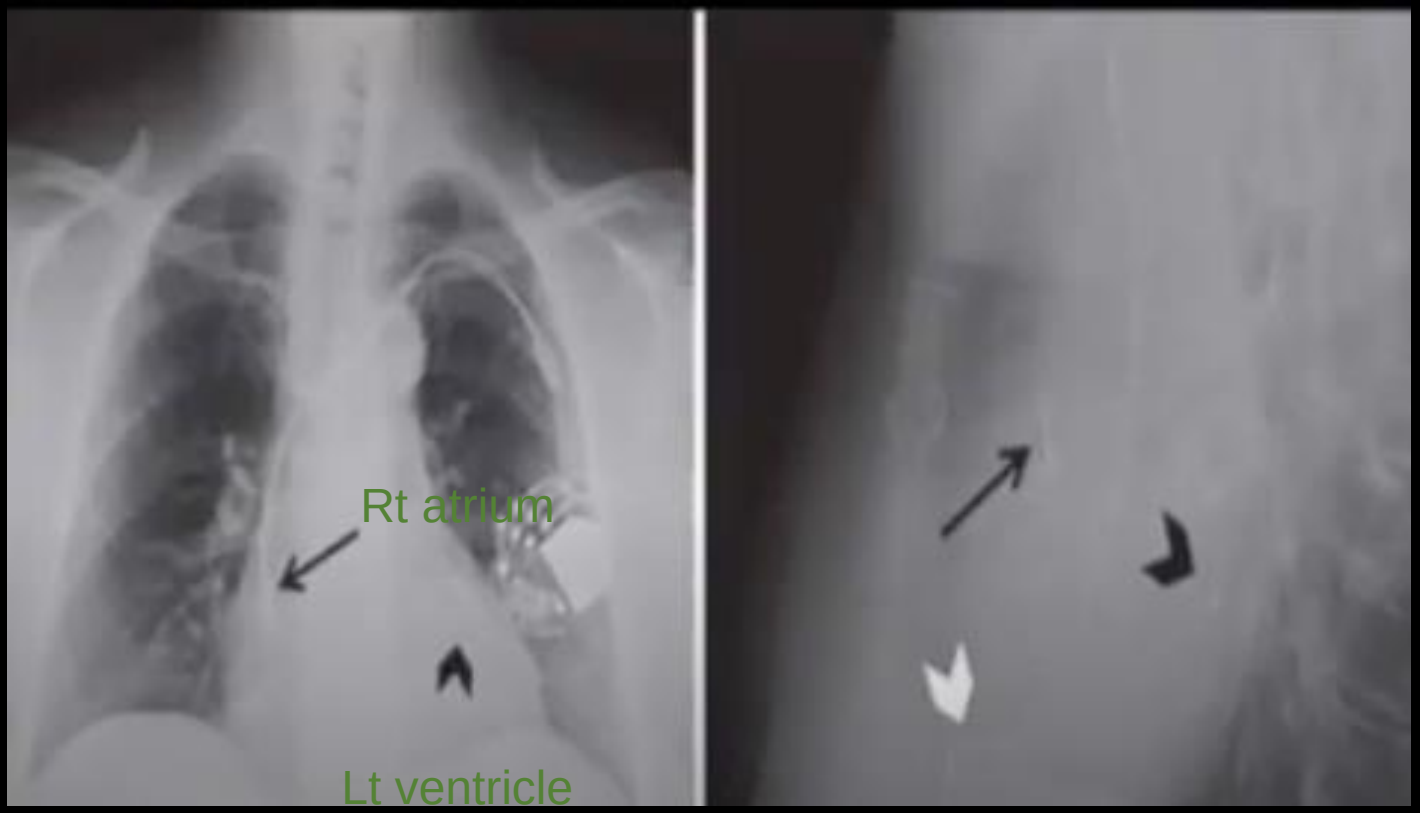

L

Causes of Pulmonary Oedema

- Cardiogenic.
- Non-Cardiogenic: neurogenic.

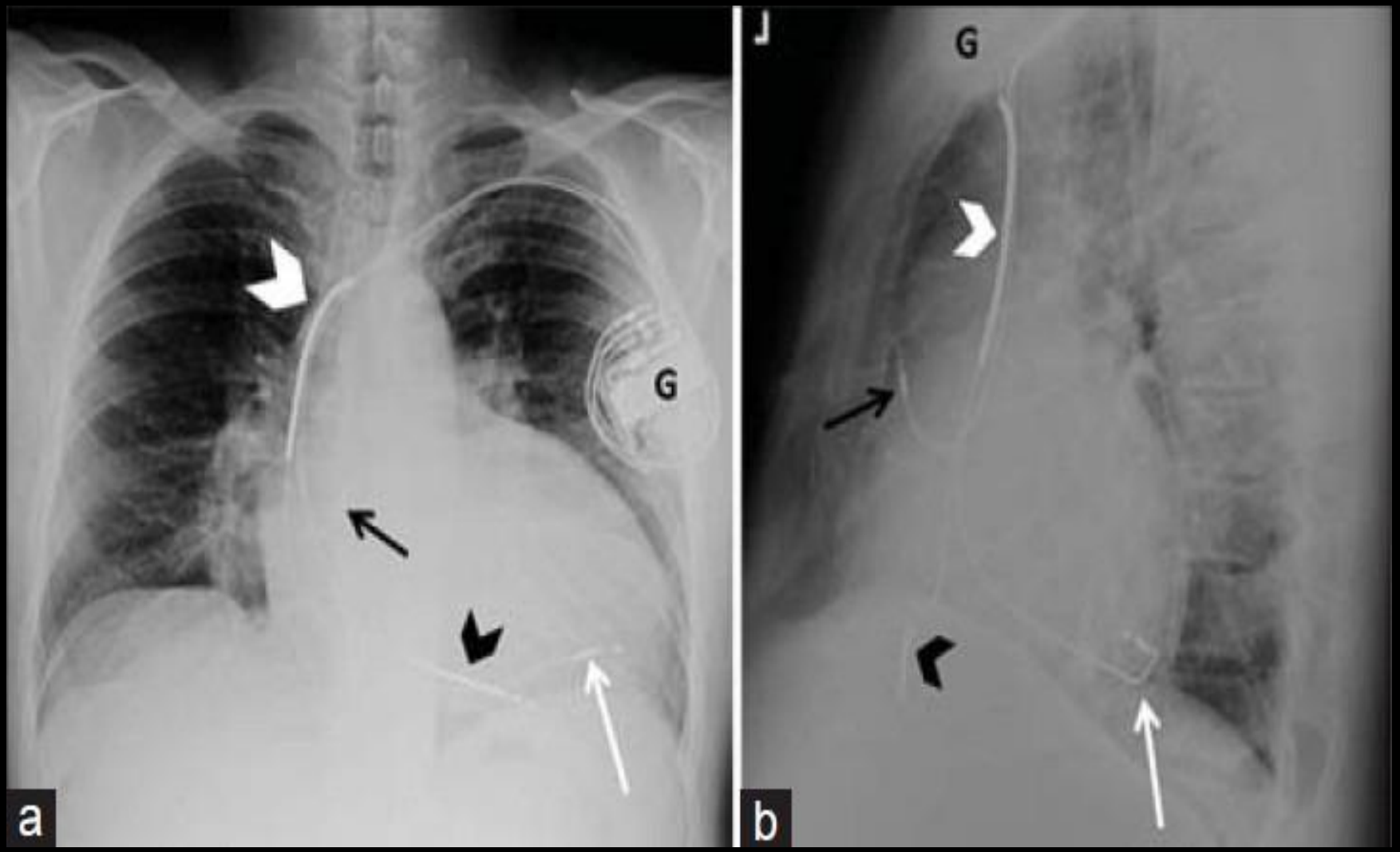
BIV PACEMAKER

Biventricular pacemaker

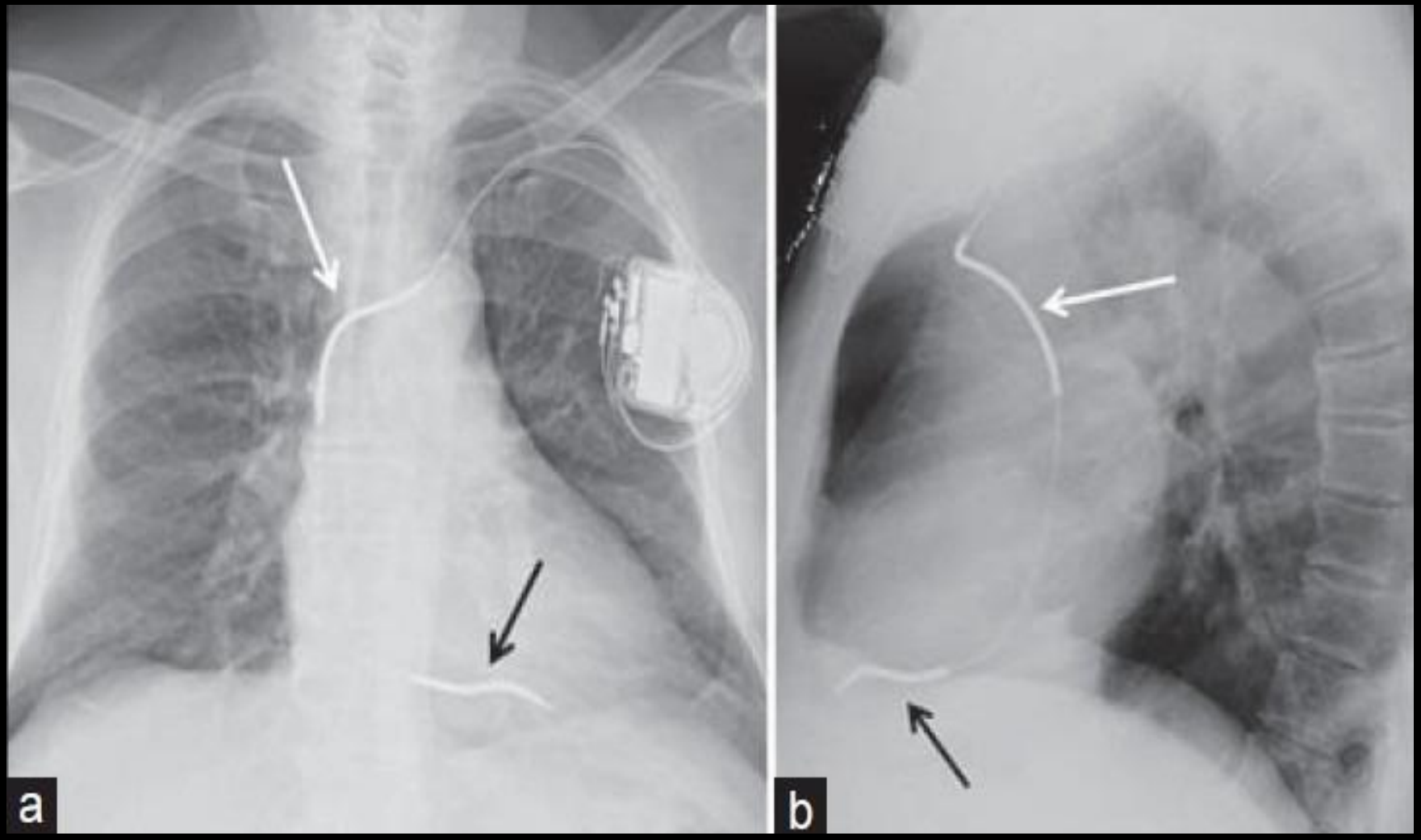


Pacemaker with 2 wires (one in the right ventricle and one in the left ventricle)
This type of pacing is called “Biventricular pacing” and the therapy is “resynchronization therapy”

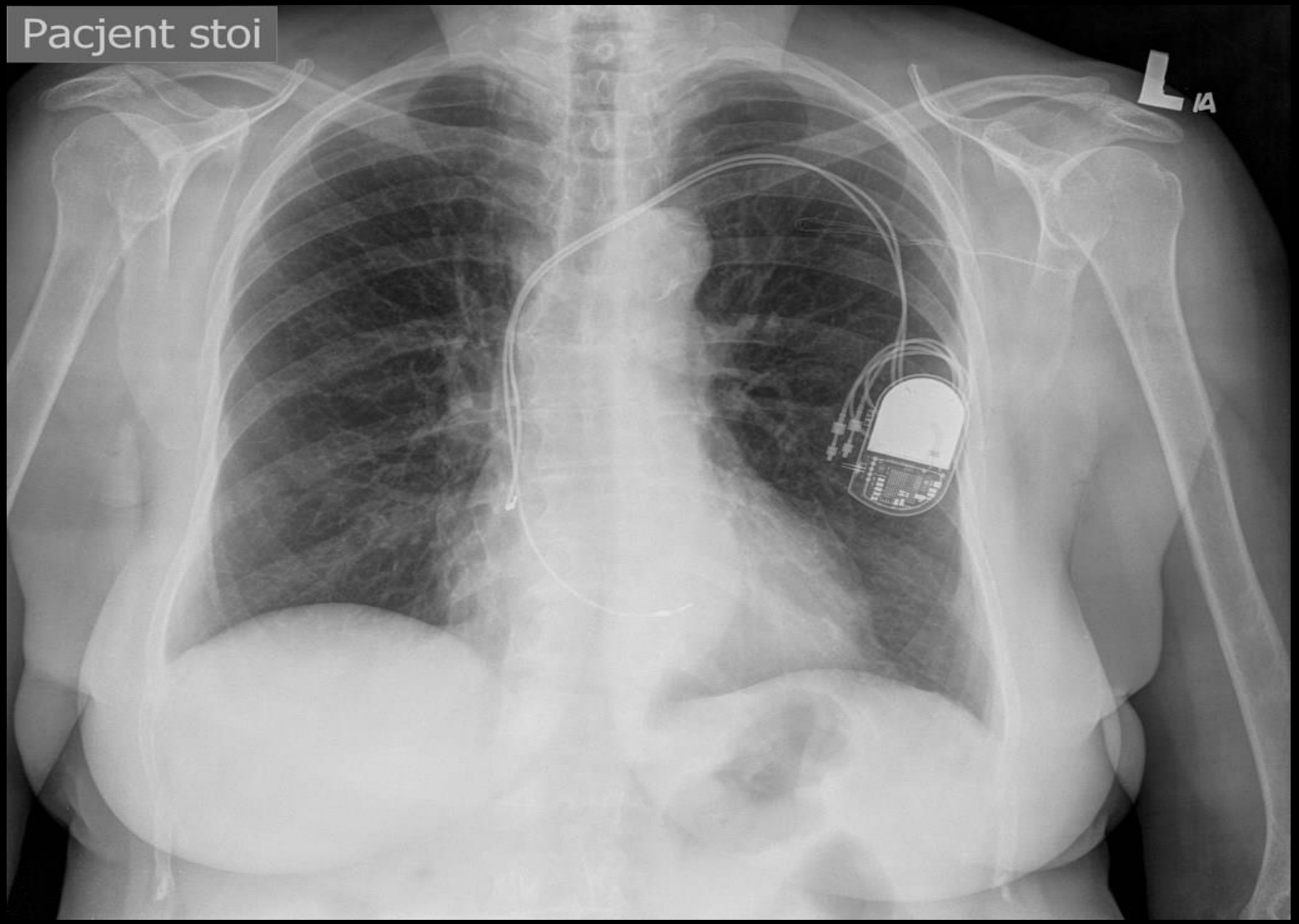
ICD CRT (implantable cardioverter defibrillator/cardiac resynchronization therapy) Thick wire to concentrate the electrical current



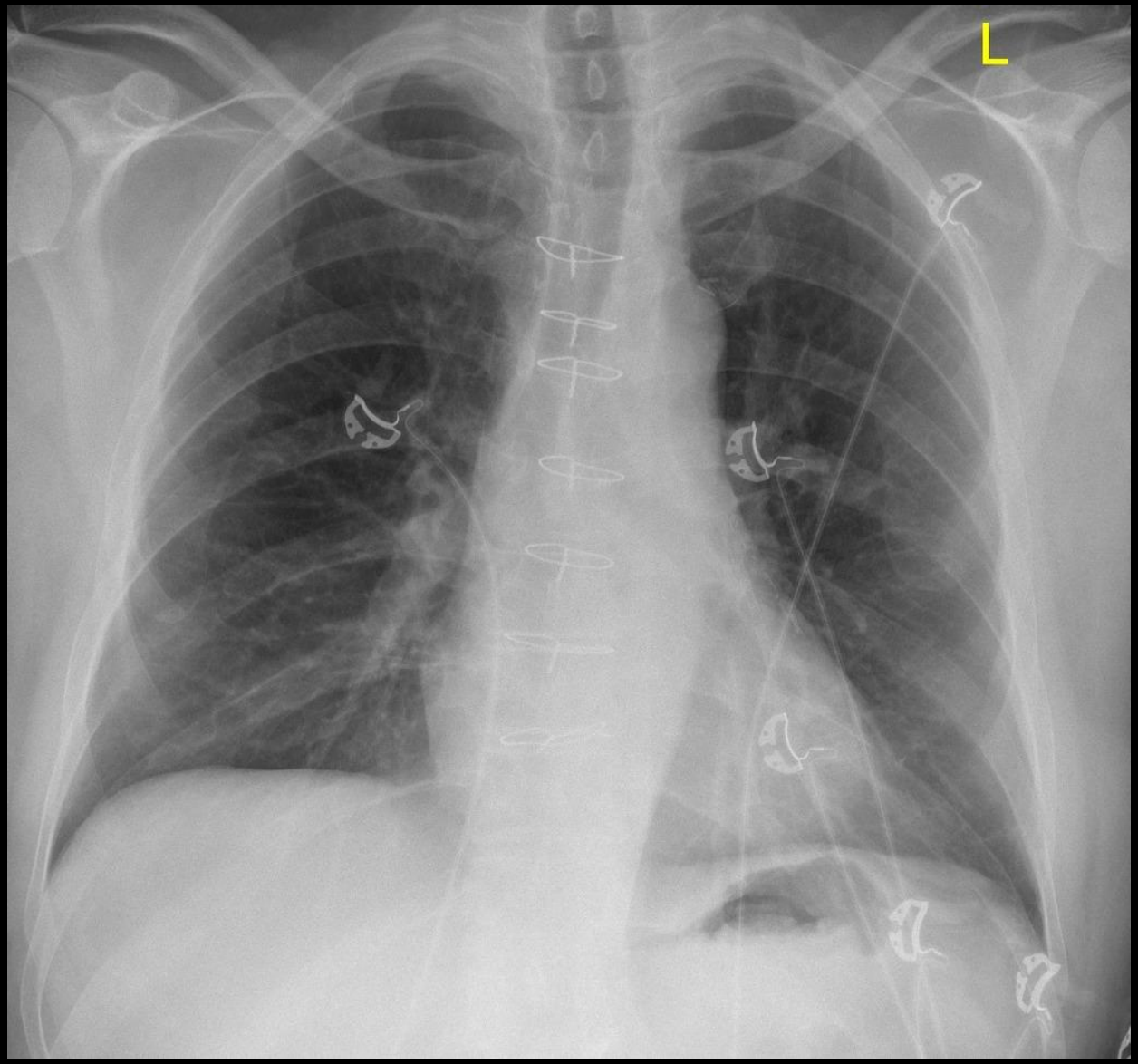
ICD (implantable cardioverter defibrillator)



Dual chamber pacemaker Rt Atrial and Rt Ventricular

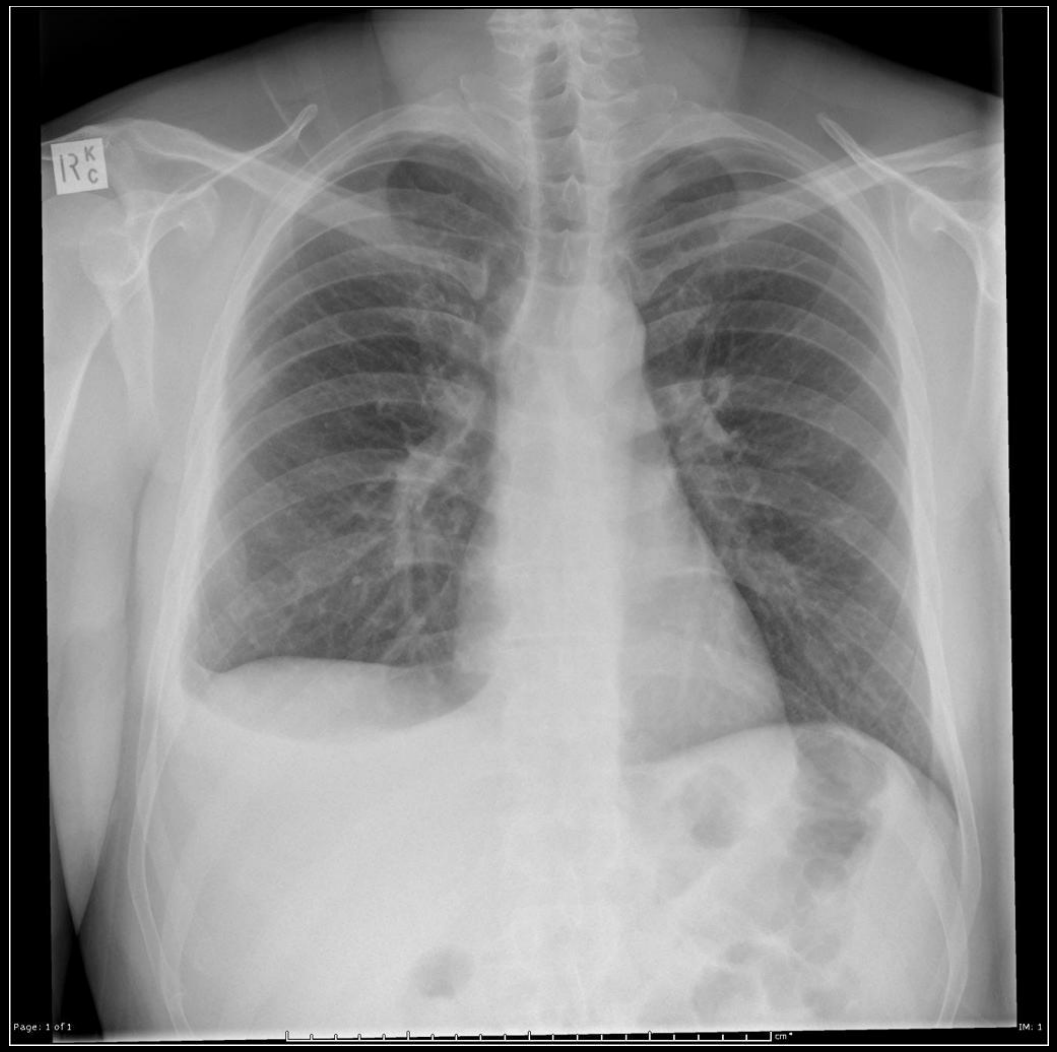


Median Sternotomy if you look carefully you can also see a coronary stent



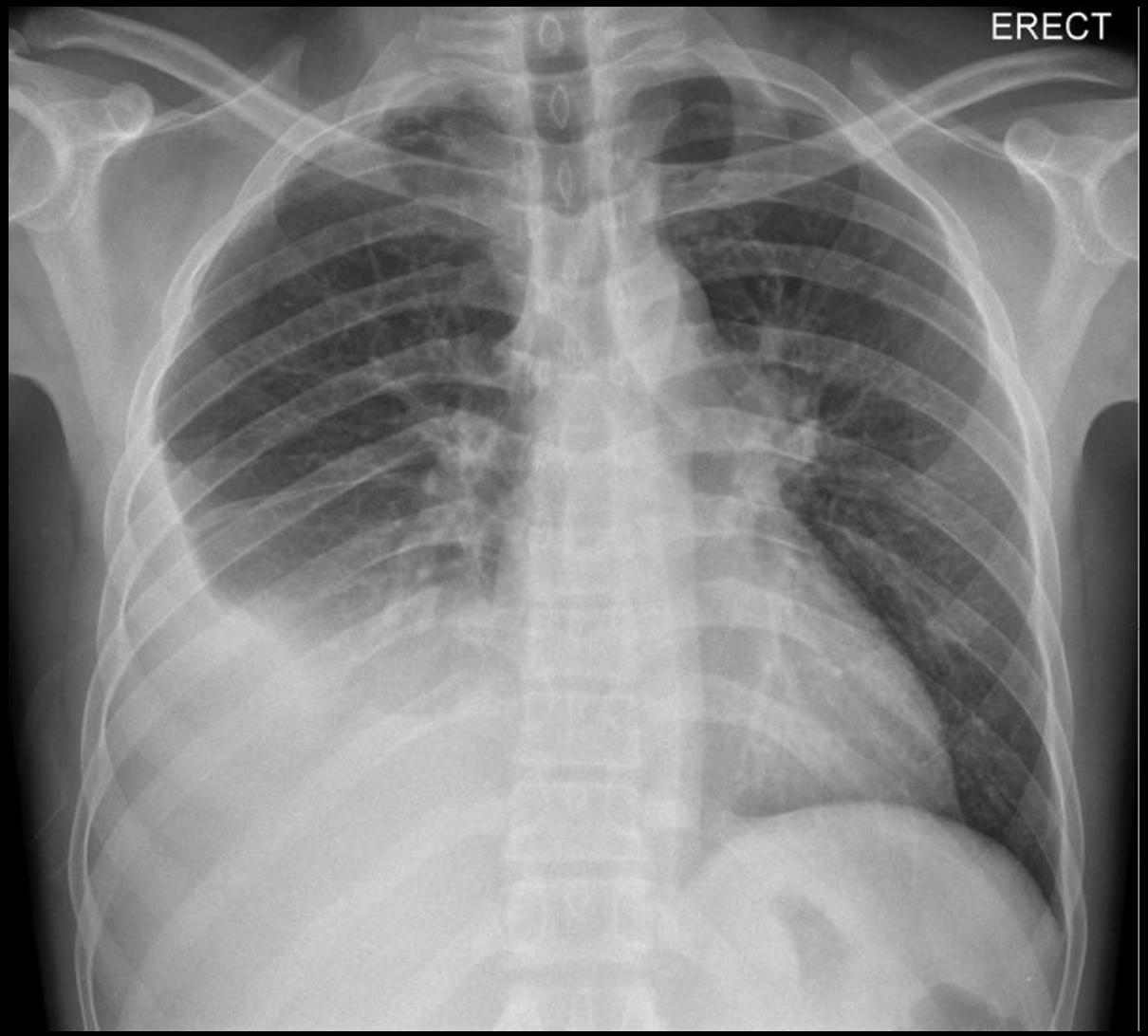
Cardiac resynchronization look carefully you see 3 cardiac wires pacing the rt and lt ventricle

Pleural effusions



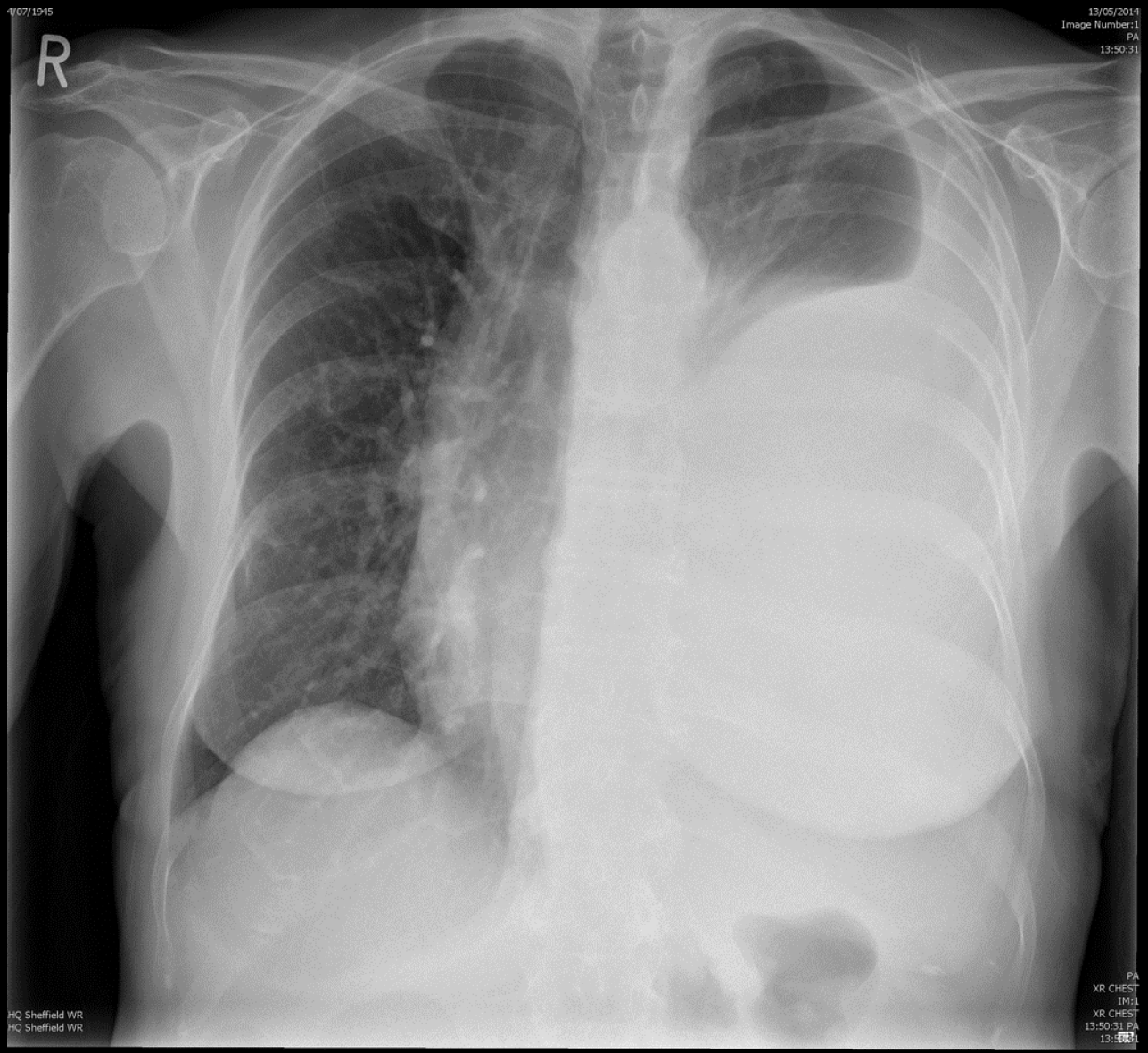
Pleural effusion

Suggestive of infection (Pneumonia with parapneumonic infection)



Unilateral Pleural effusion

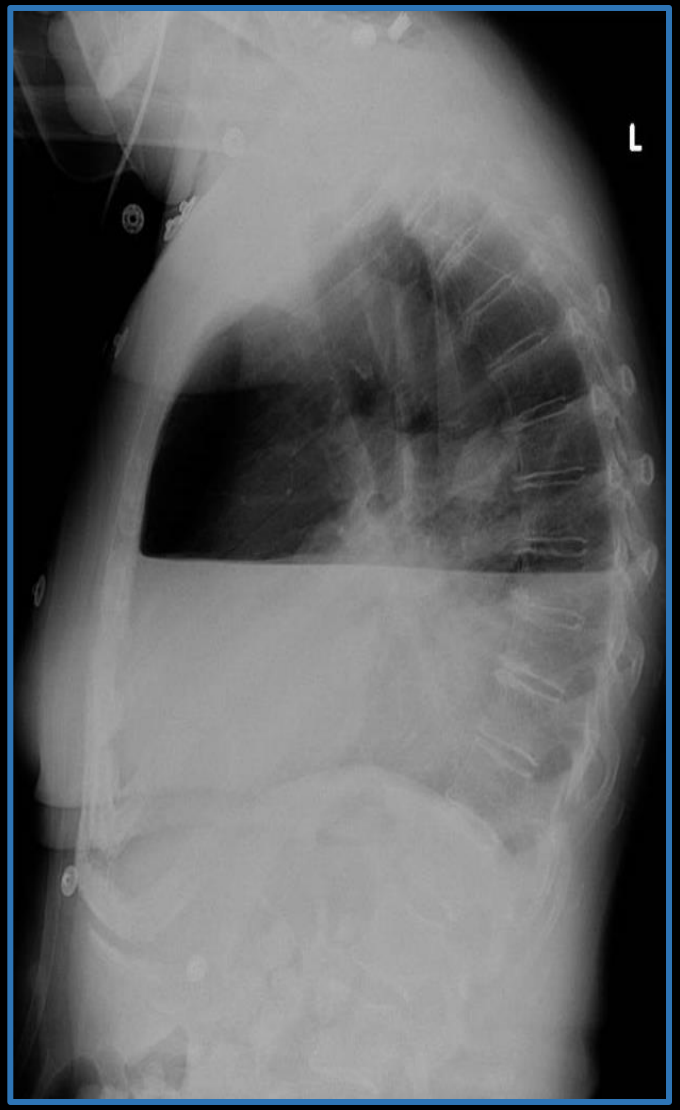
Unilateral: Infection, malignancy. Usually diseases such as liver diseases or nephrotic syndrome tend to drain through the openings of the diaphragm into the right pleural space



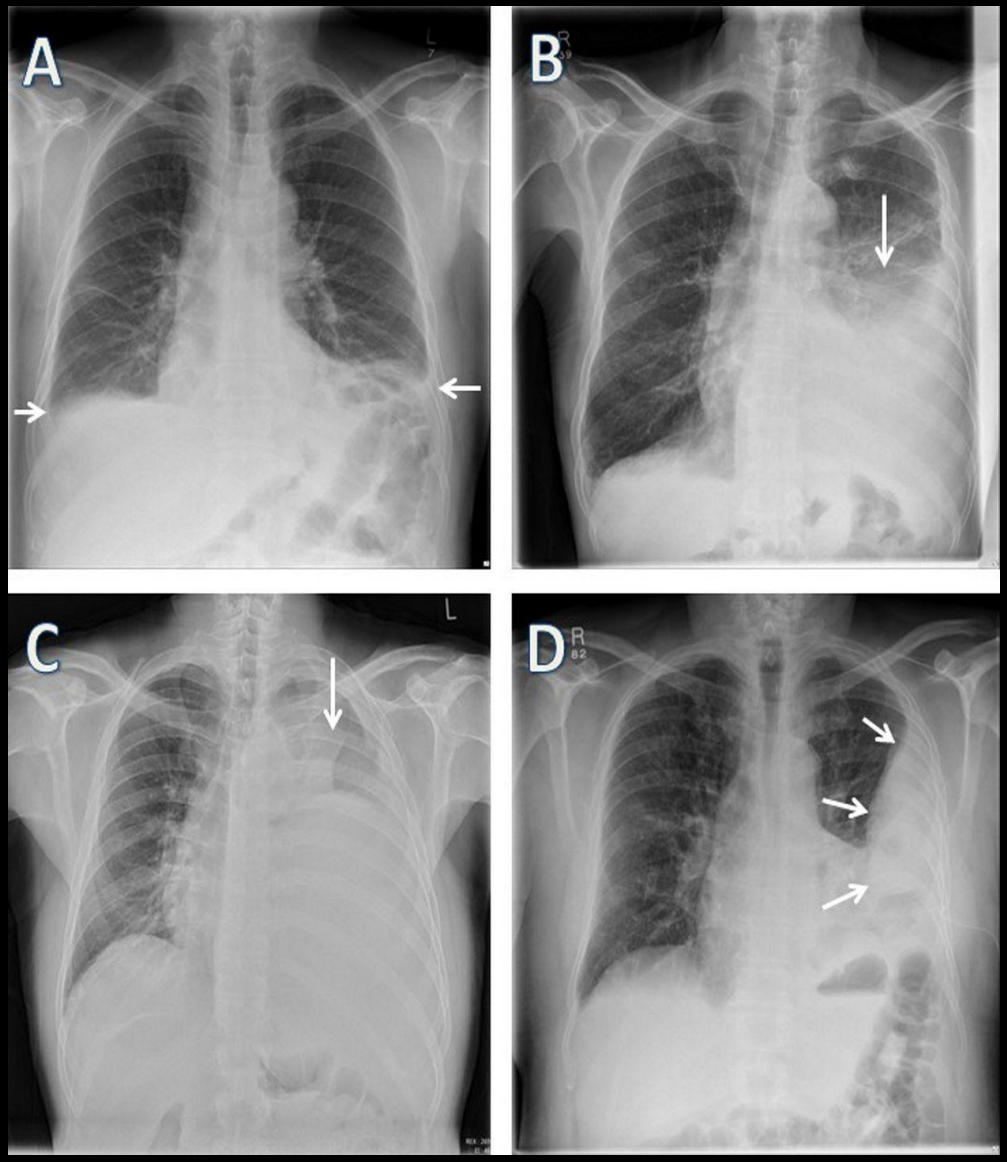
Left Pleural effusion with mediastinal shift (huge effusion)

Loss of septations

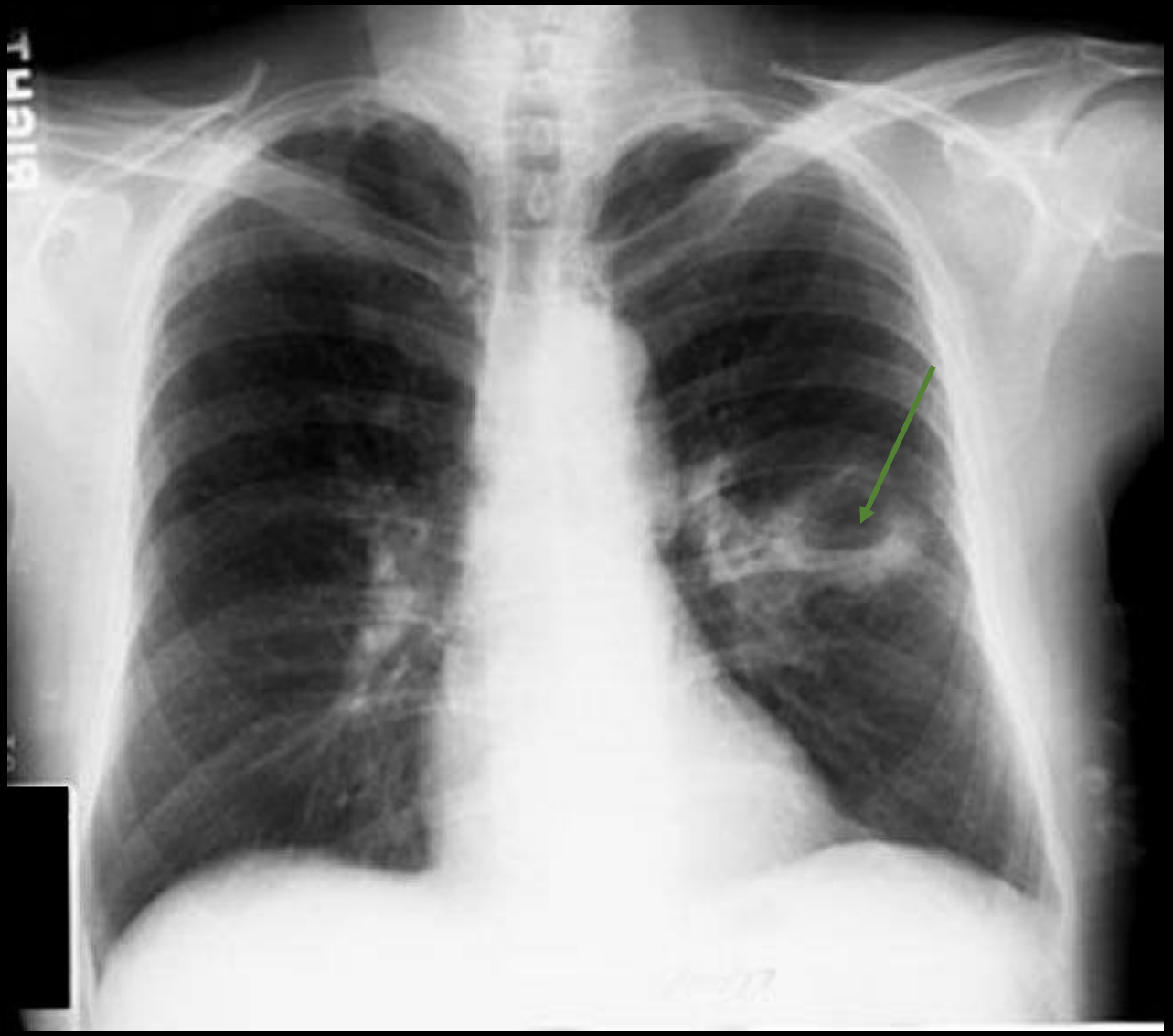
Left empyema



Air-Fluid level (air is introduced into the pleura from inside the lung or outside or even from gas producing bacteria in severe infections)

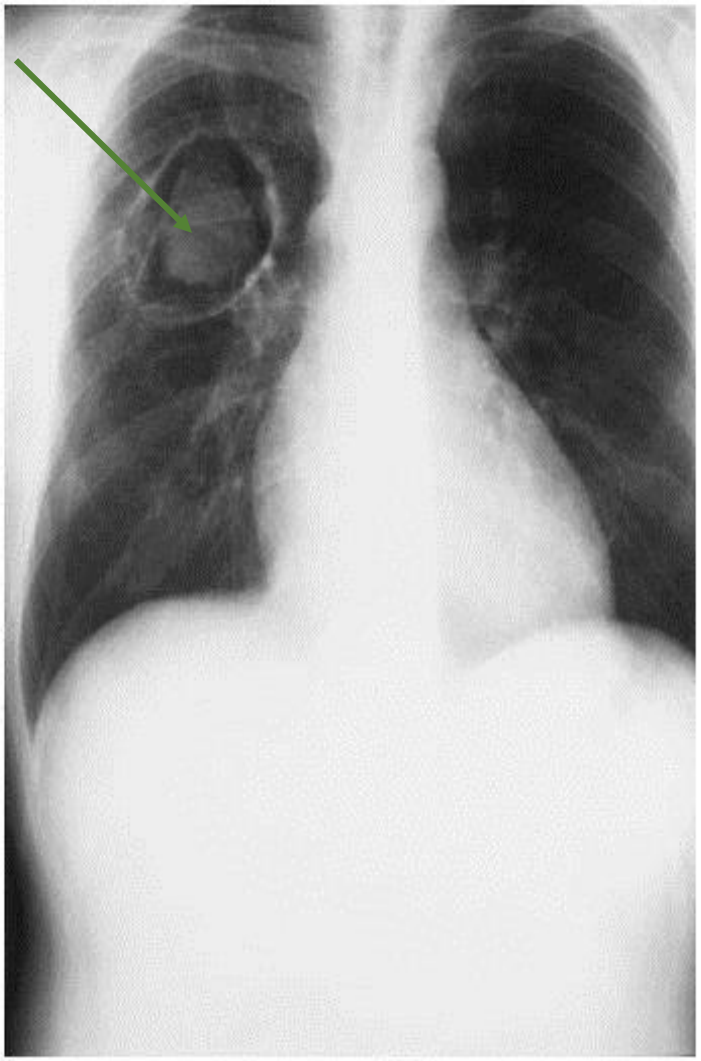


A: Mild bilateral effusion. B: Left border pleural effusion. C: Large left unilateral effusion. D: Localized effusion.

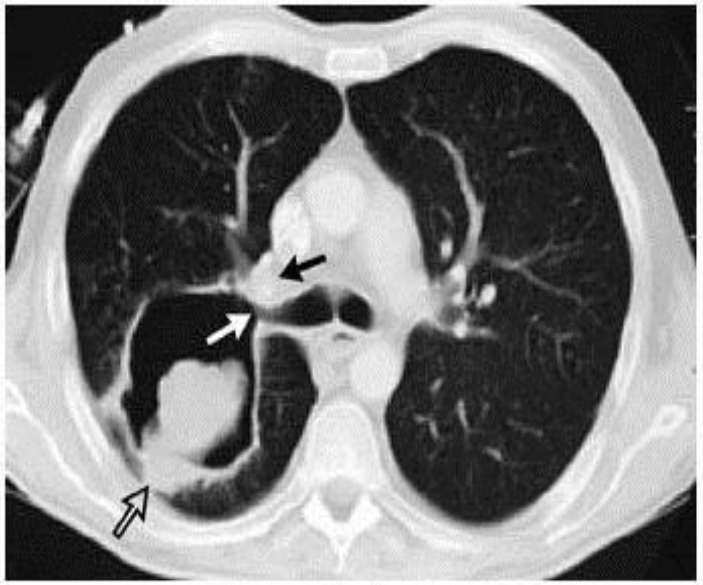


Cavitating lesion

With thick wall (strongly suggestive of malignancy)



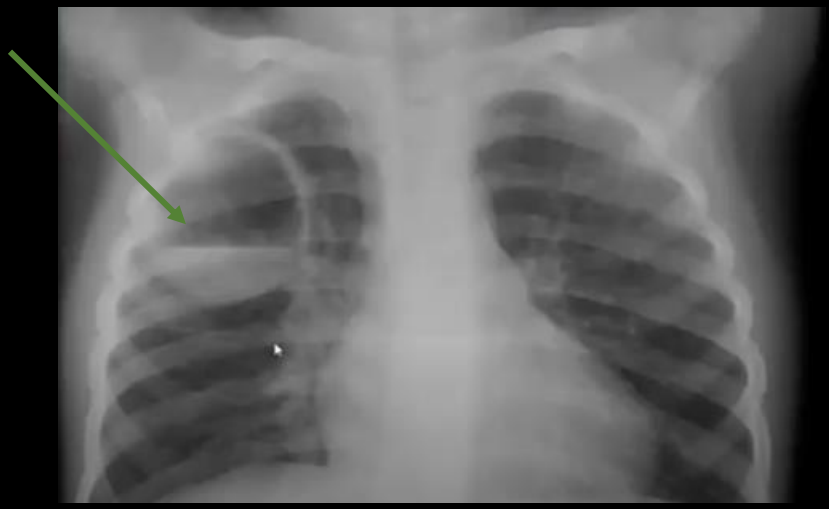
A



B

A: Cavity filled with something (bleeding?/fungi?)

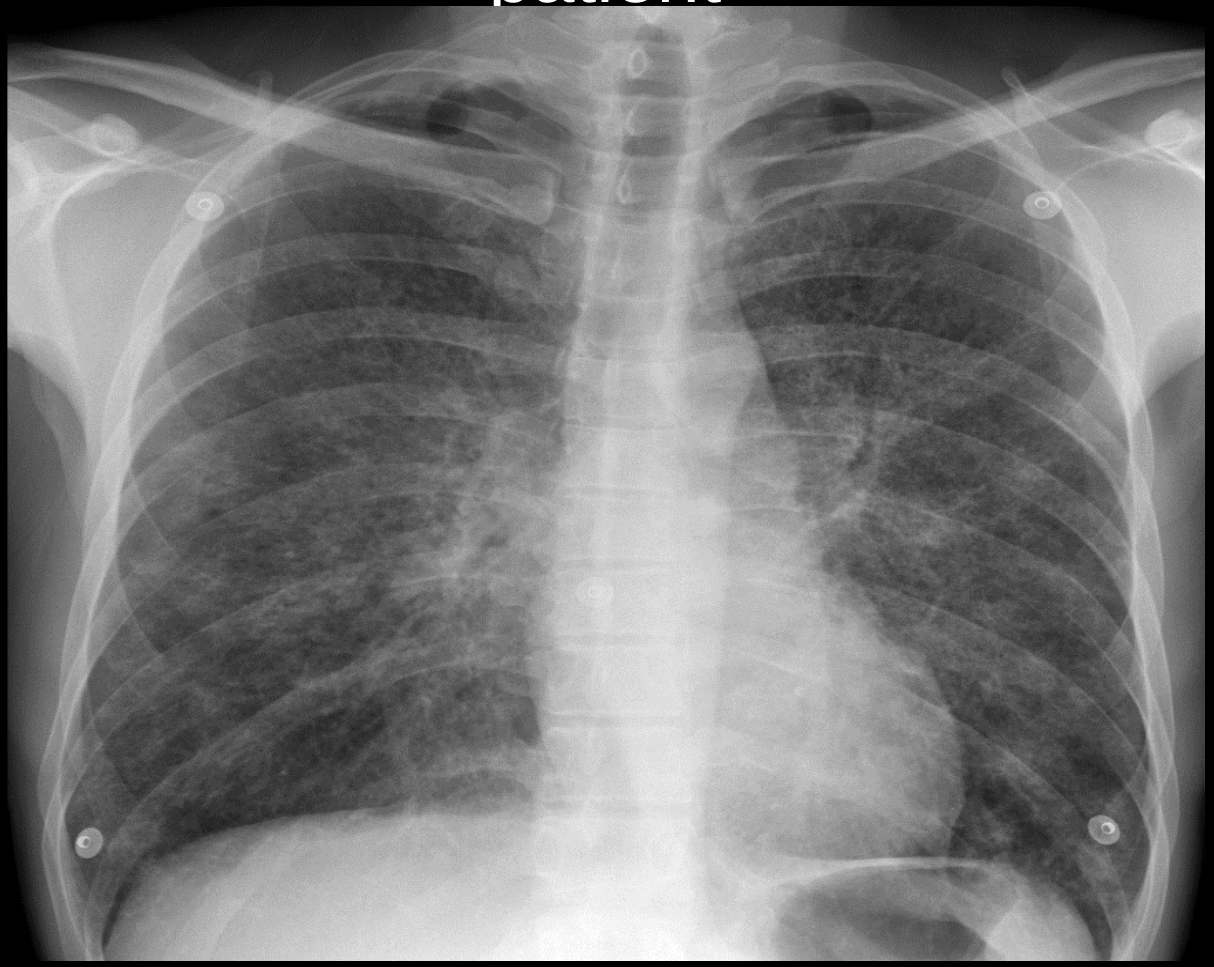
B: Small arrows (black and white) points at small communication between the cavity and airways.



Thick wall cavity in a child who had pneumonia (Post pneumonic cavity)

On CT scan, it appears with a thin wall

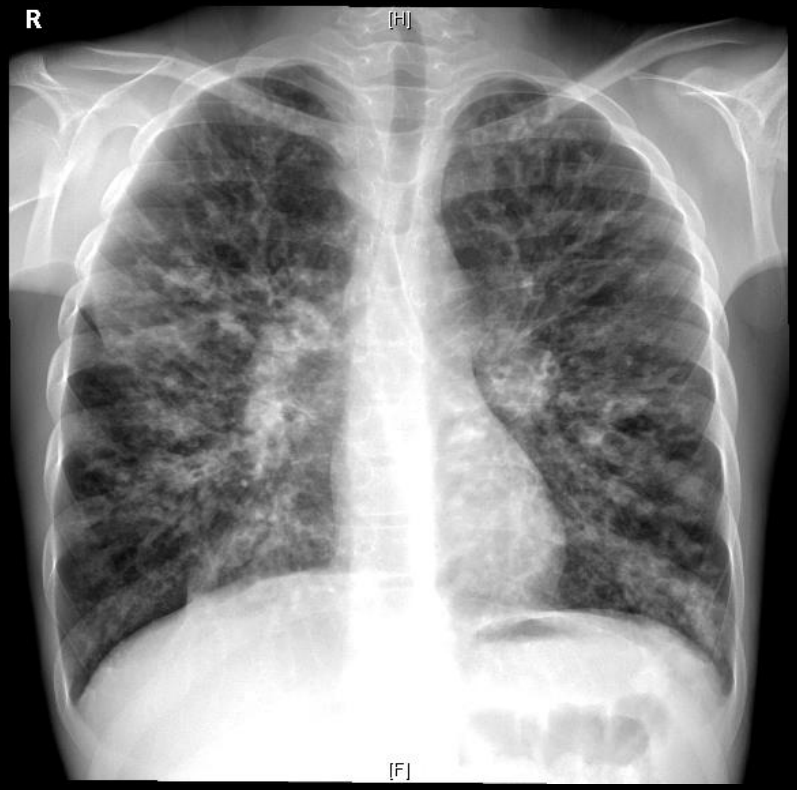
Breathless Immunocompromised patient

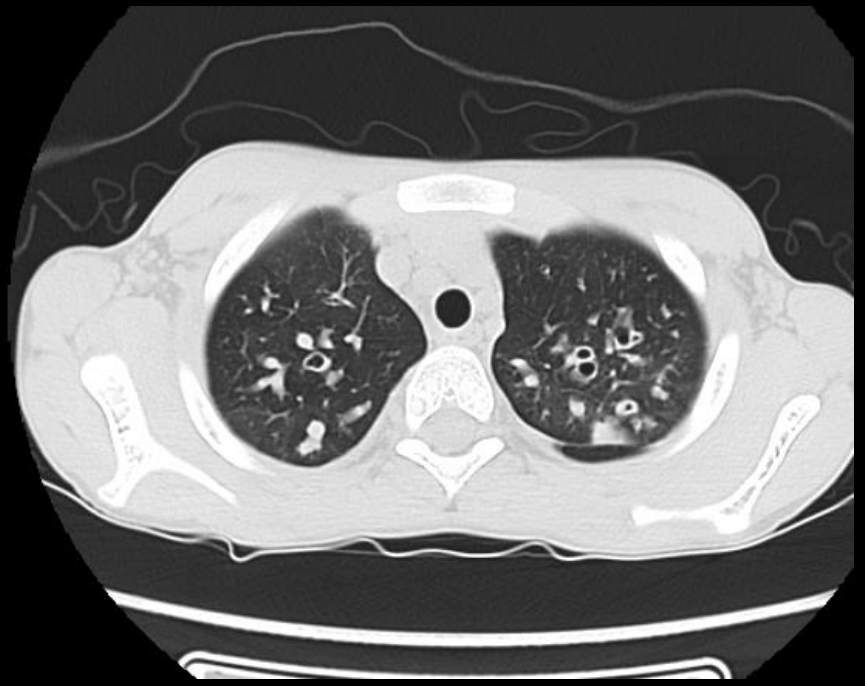


Diagnosis: Pneumonia.

Bilateral changes of the lung (ground glass appearance).

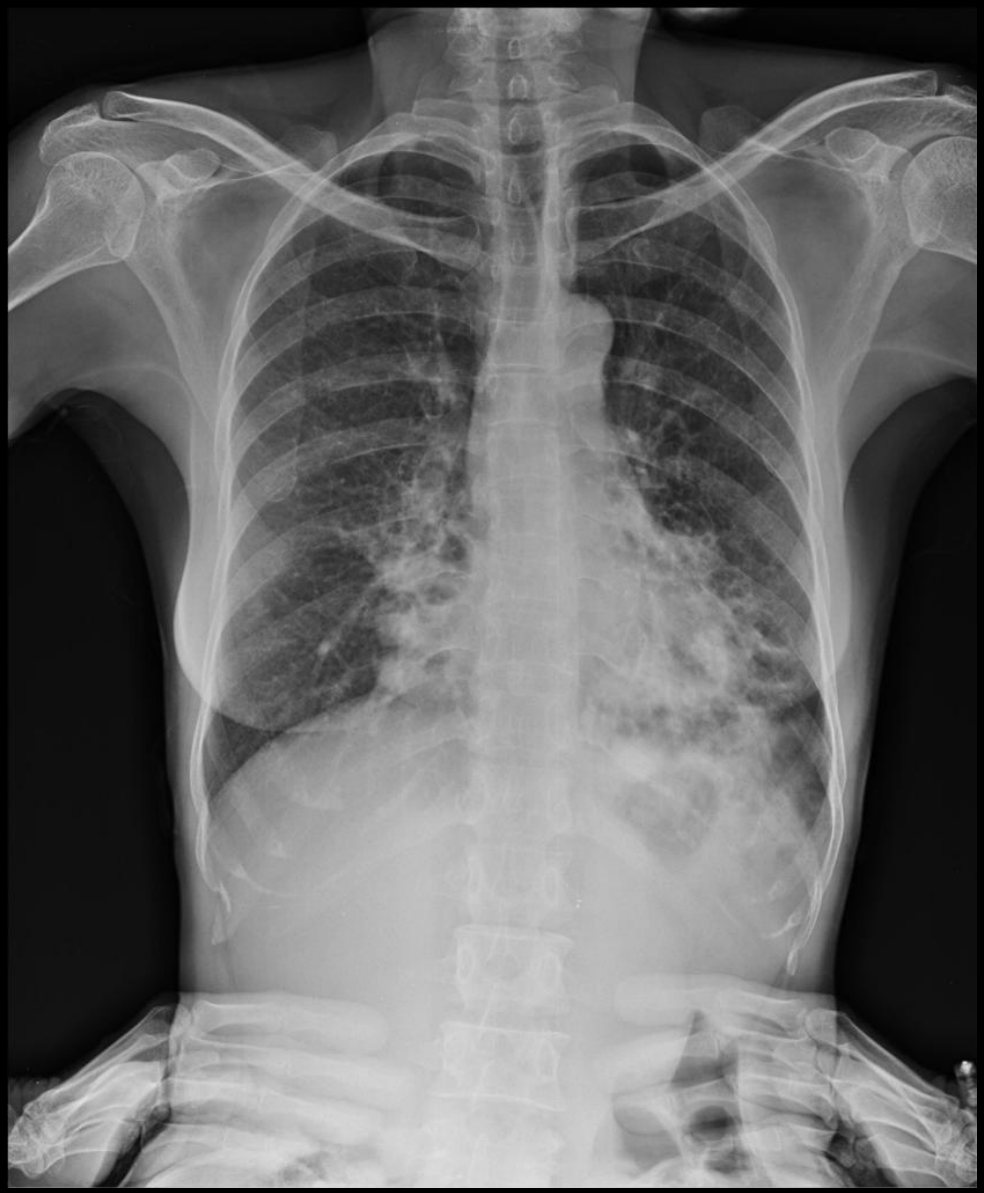
Think of organisms that are common among immunocompromised patients. And remember that they have different reaction to infections.





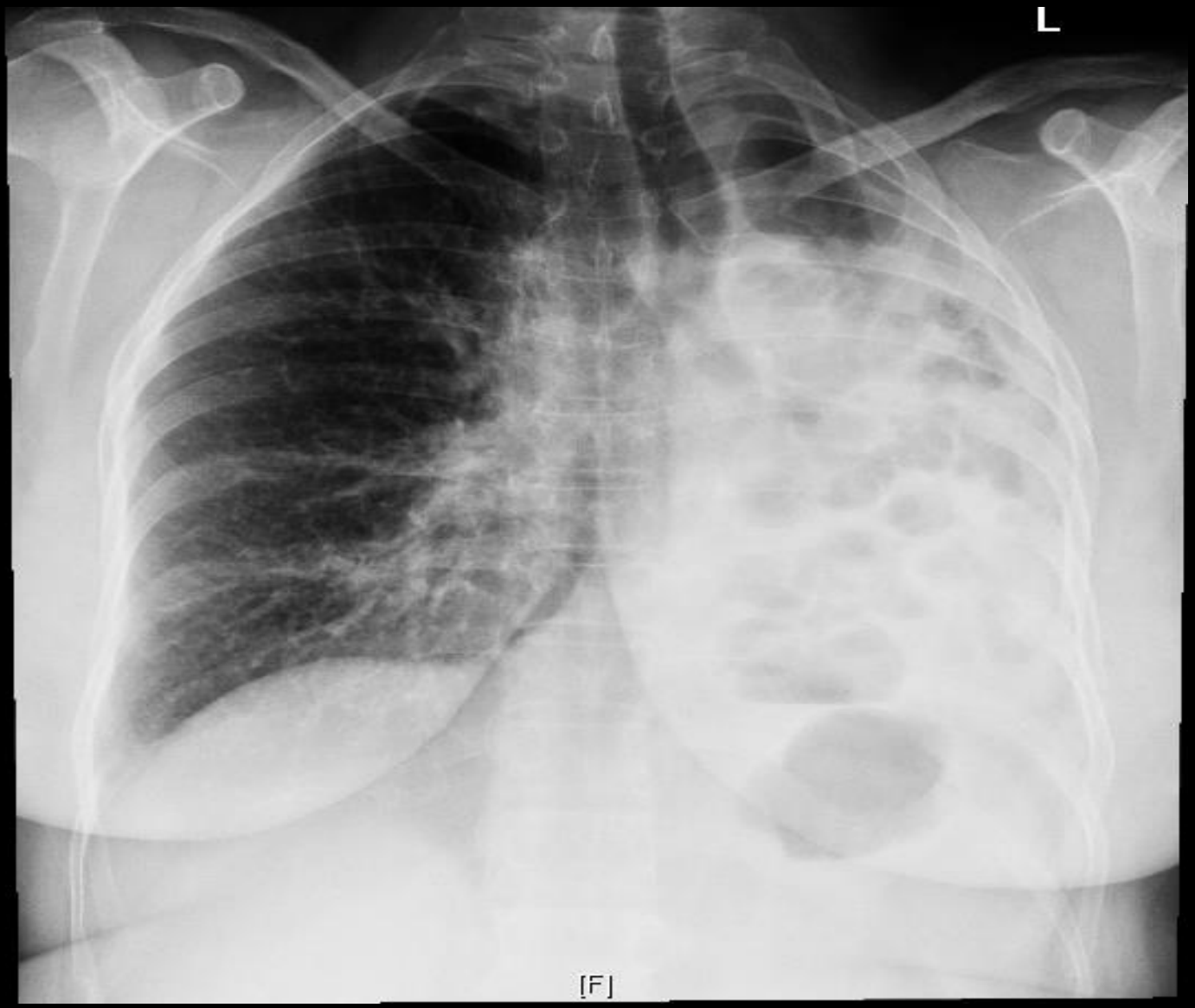
Diagnosis: Bronchiectasis (mucus in the airways).

Another bronchiectasis predominantly on the right lobe



Bilateral bronchiectasis

Bilateral = think more of systemic disease

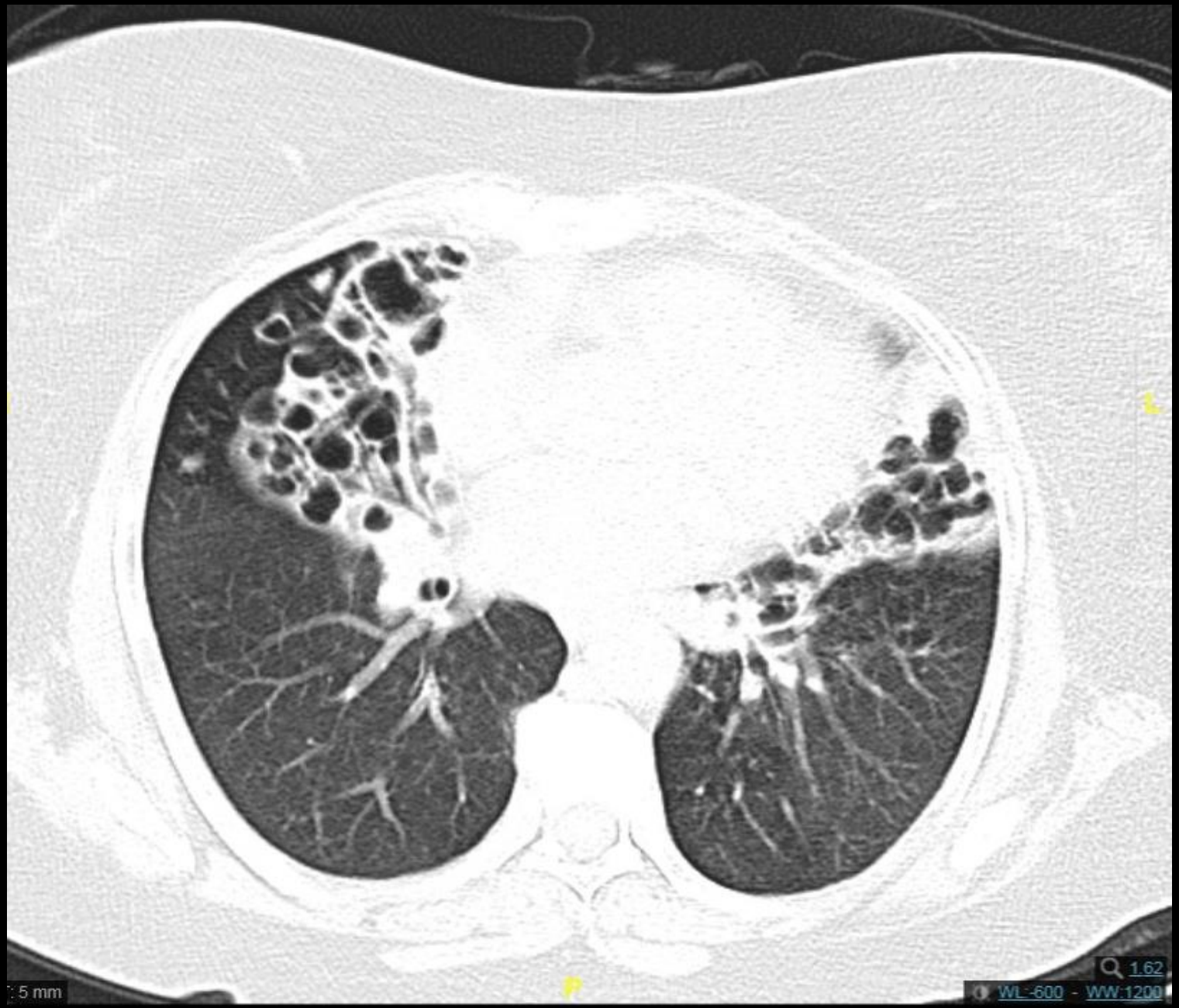


Post TB LT lung destruction with associated bronchiectasis (There is loss of left lung volume)

Bronchiectasis predominantly affecting upper lobes


W CHEST PA
Se: 1
Im: 1/1
L
Lossy 30 : 1


Study Date: 18-Jun-20
Study Time: 14:35:
L
10
cm

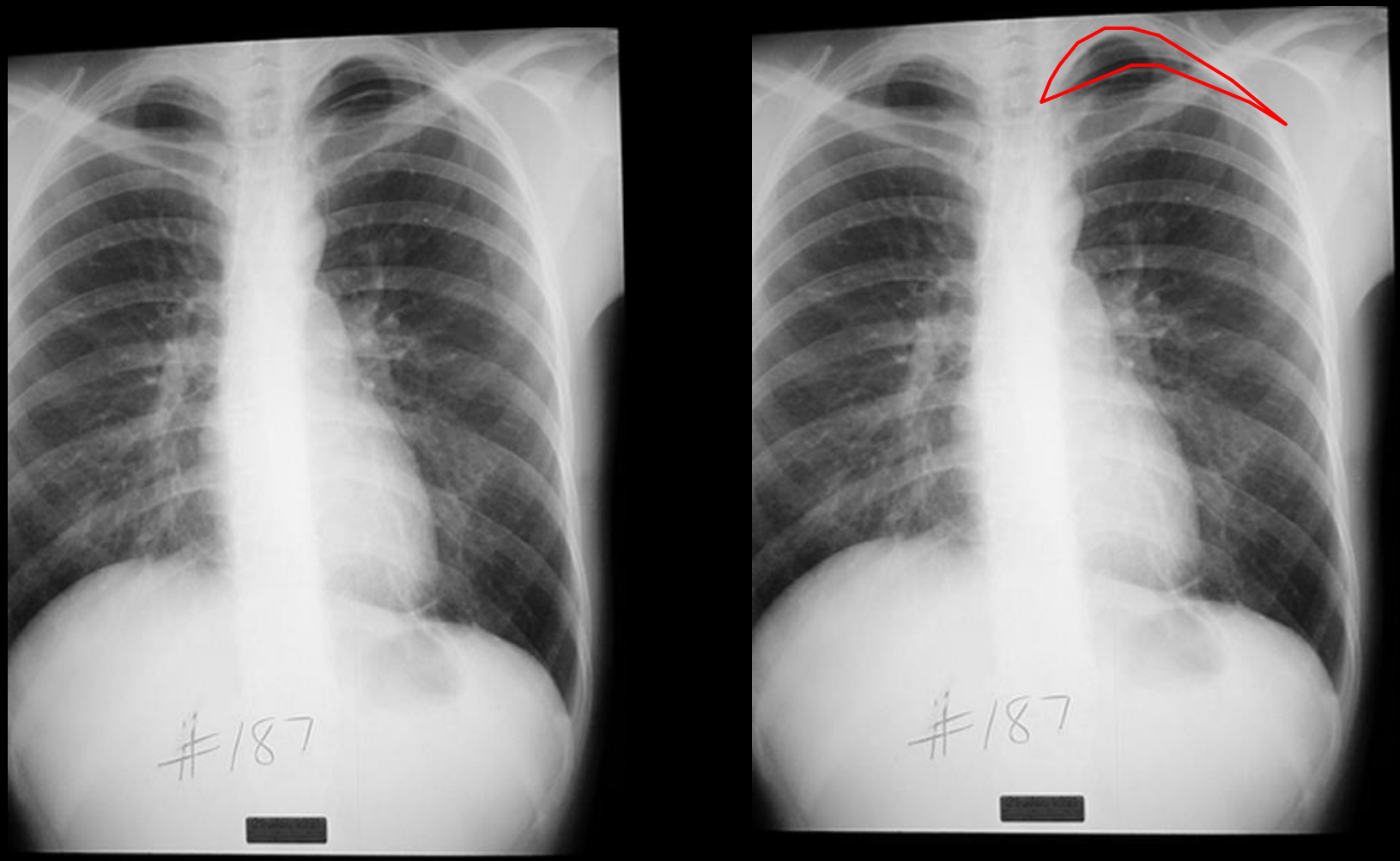

5 mm
1.62
WL: -600 - WW: 1200


a
b

- Chronic Cough.
- Sputum production.

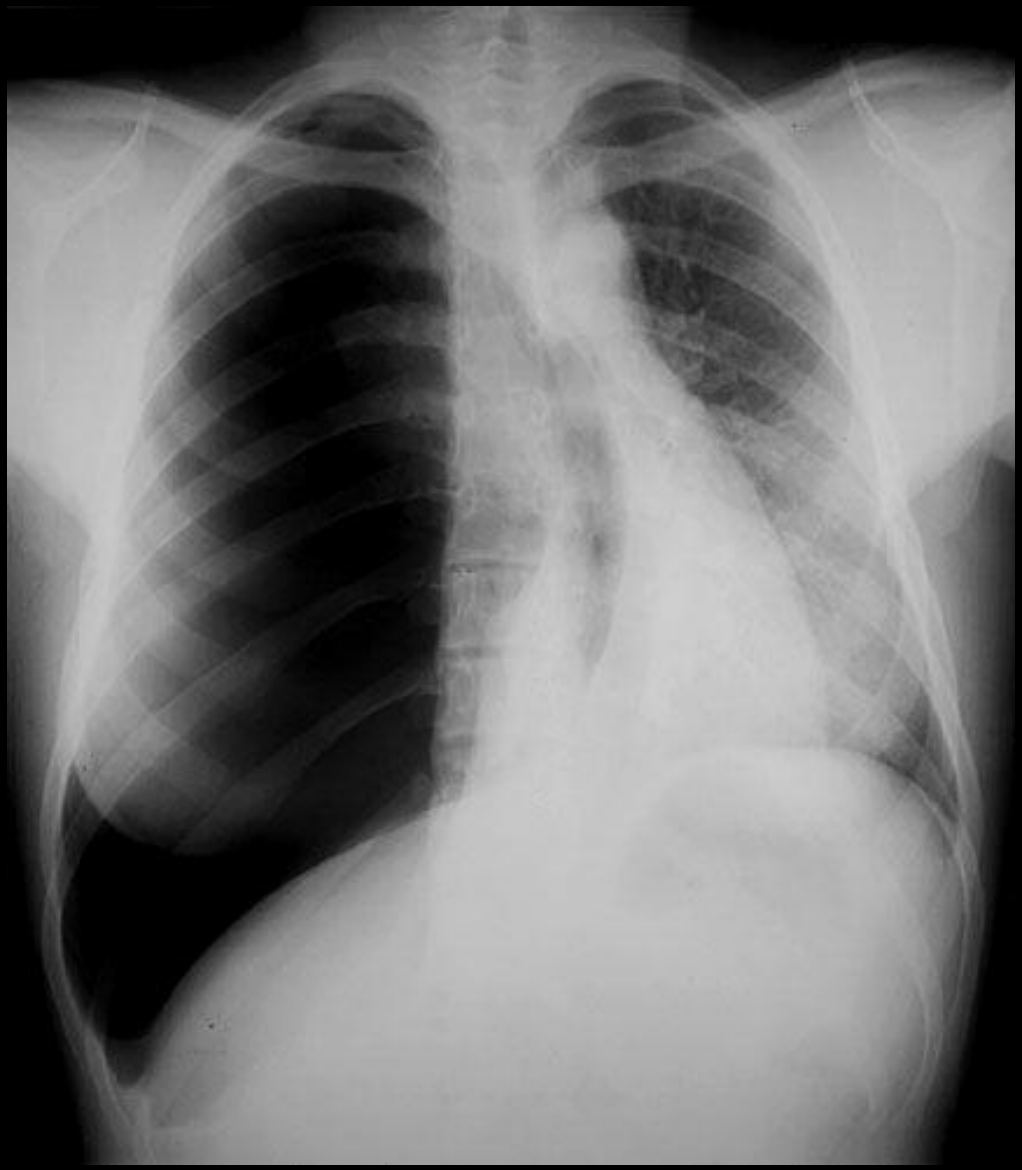
Diagnosis: Bronchiectasis.

28 y/o female with sudden onset SOB while jogging this morning



Well demarcated paucity of pulmonary vascular markings in right apex

Left spontaneous pneumothorax

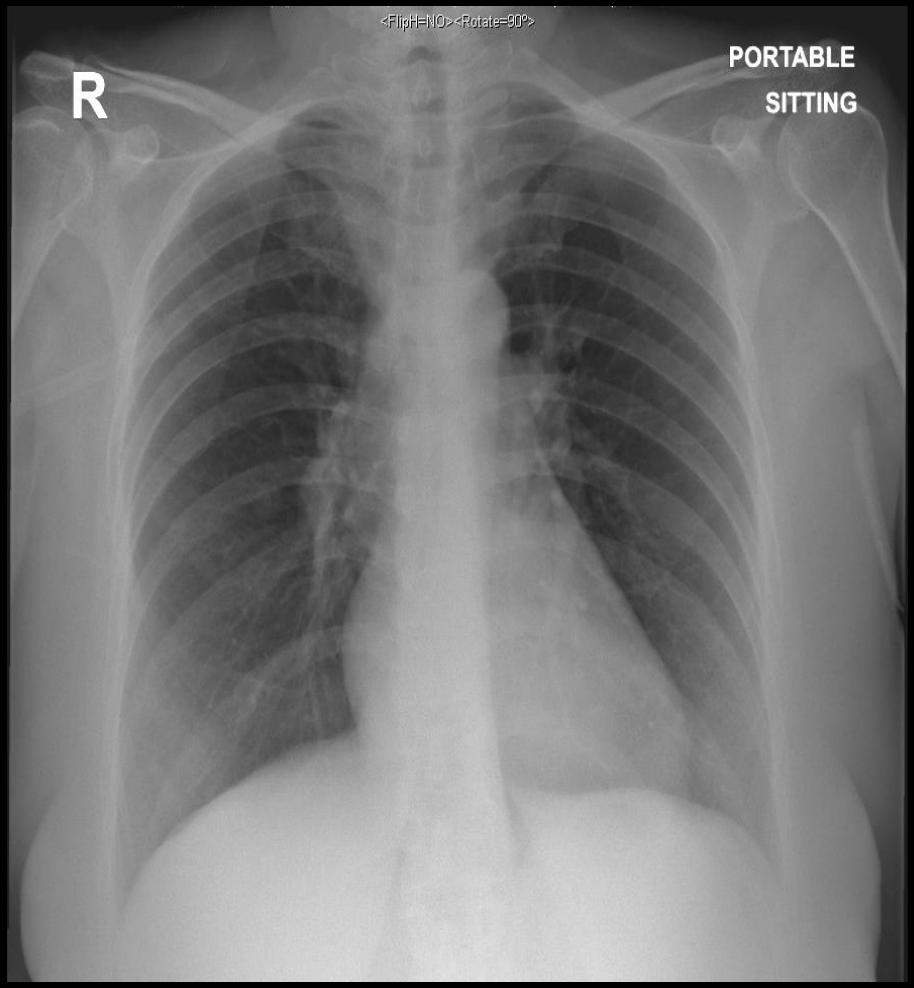


Tension Pneumothorax

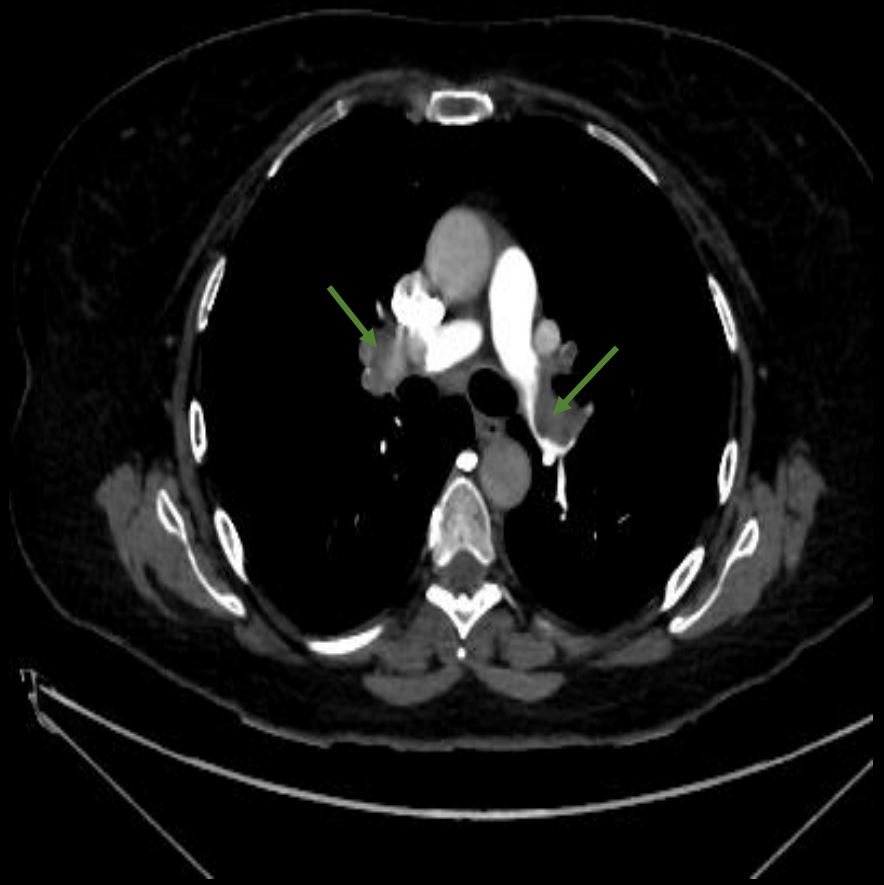
How will you treat: Insert needle in the right lung in the 5th intercostal space

45-year-old with UC

Sudden onset SOB

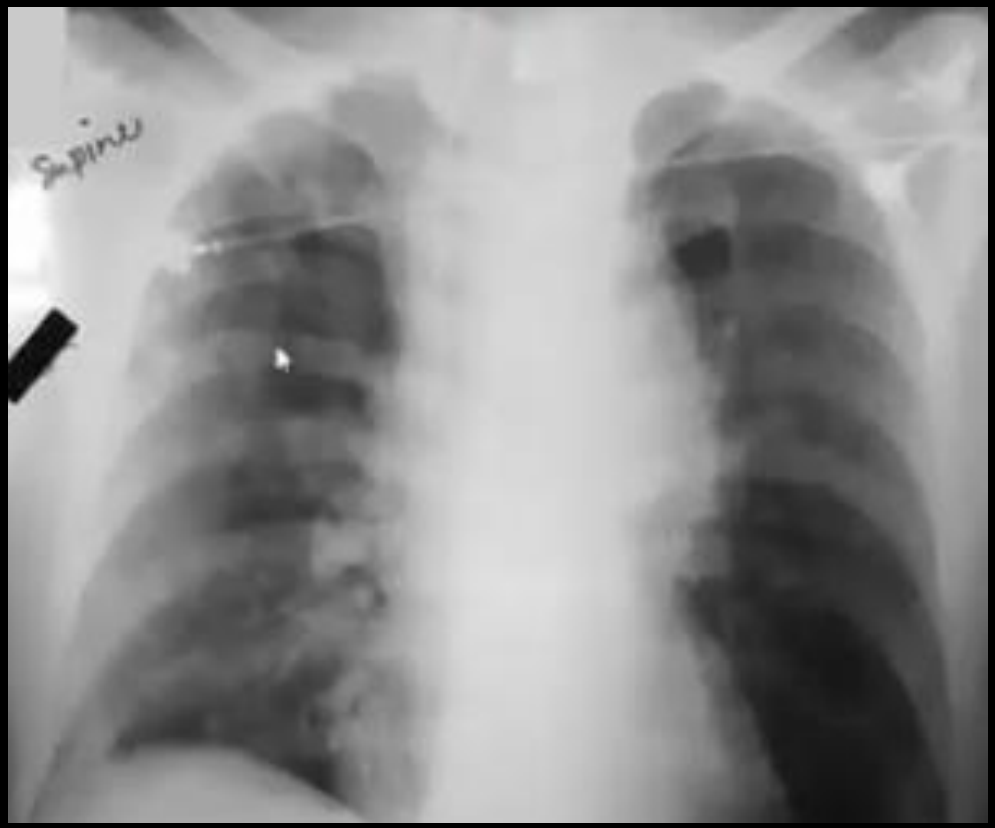


Frpm hx the DDx: PE, pneumothorax.
So we perform CT.



CT pulmonary angiogram
Huge clots in the left and right pulmonary trunks.

Patient brought by the ambulance to the ER s/p airplane crash



Widened mediastinum

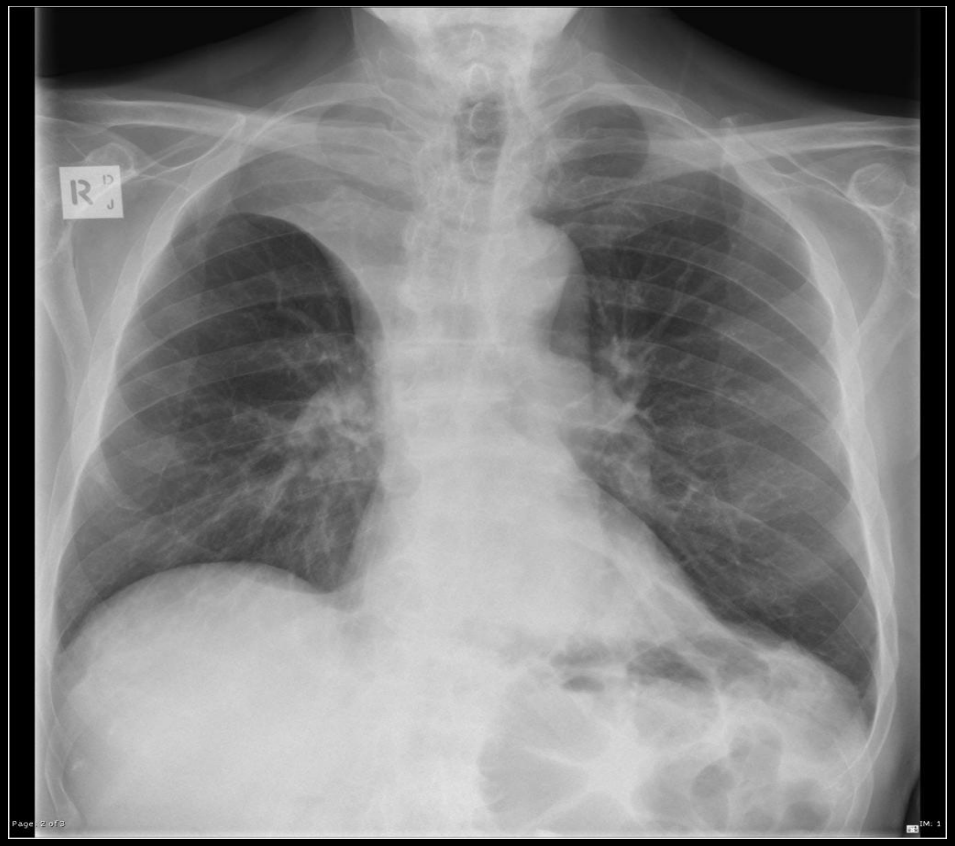
DDx: Aortic dissection**.**

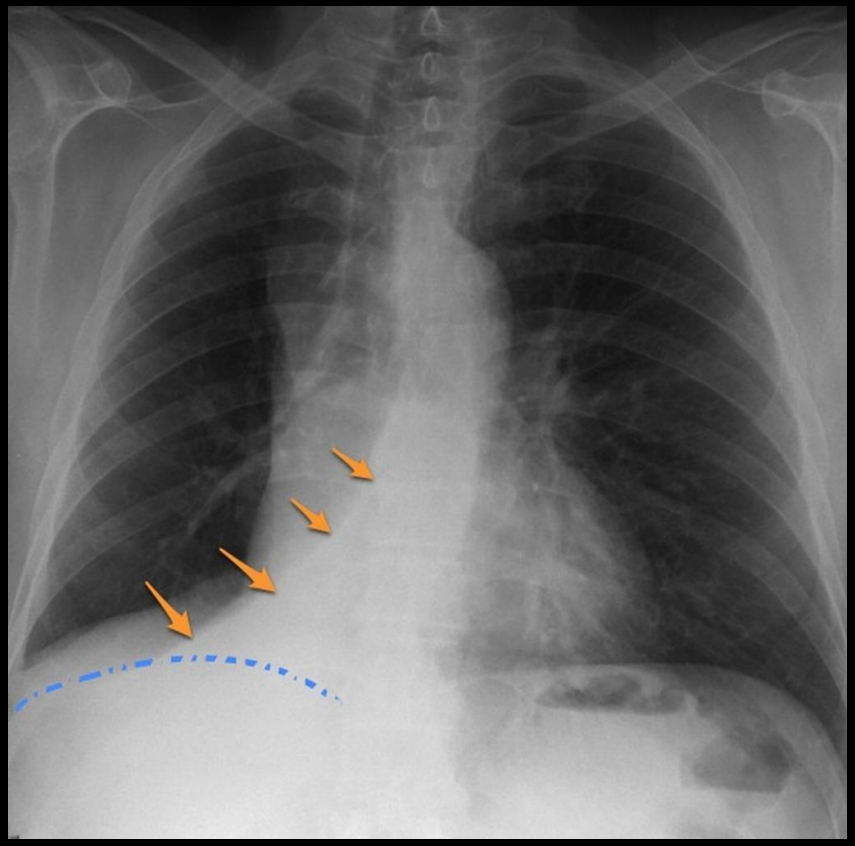
Next step is CT scan

Lung Collapse

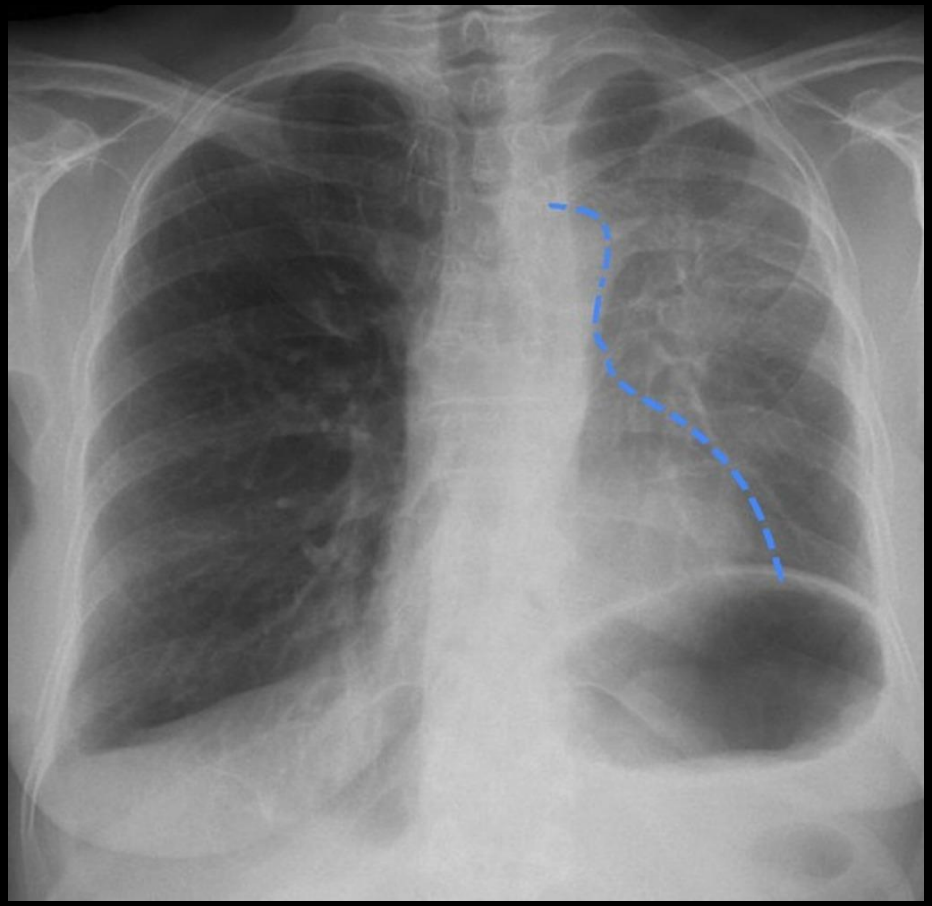
Different lobes

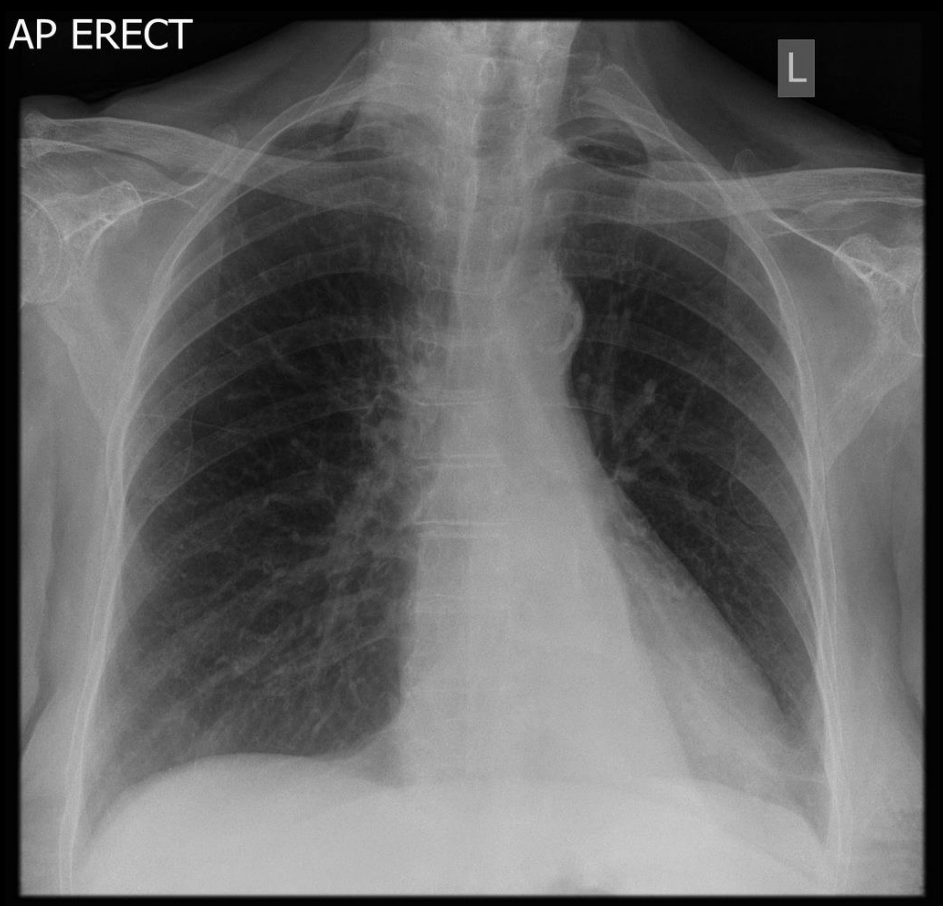
What are the causes?





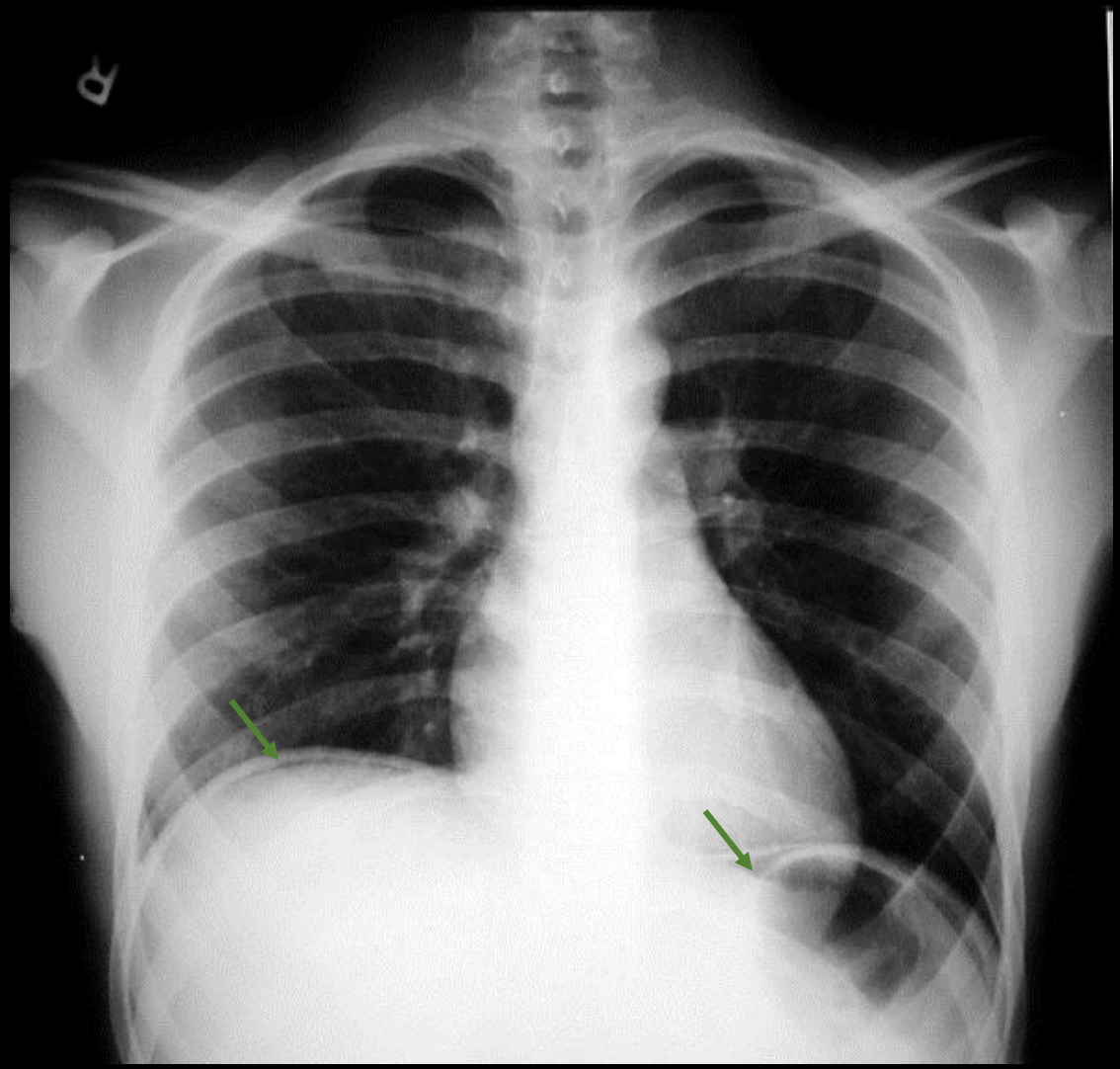
Lung Collapse
Different lobes
What are the causes?





Right upper lobe collapse

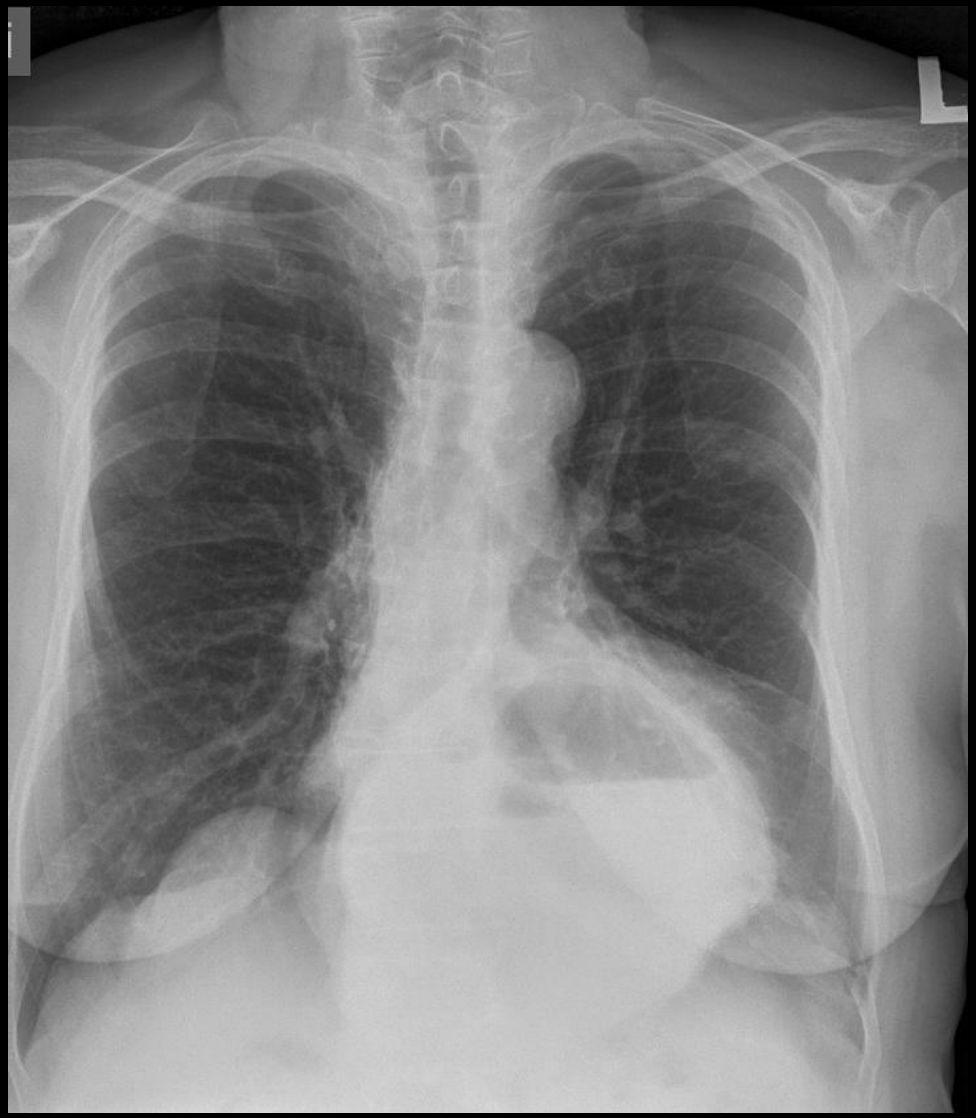
Lung Collapse
Different lobes
What are the causes?



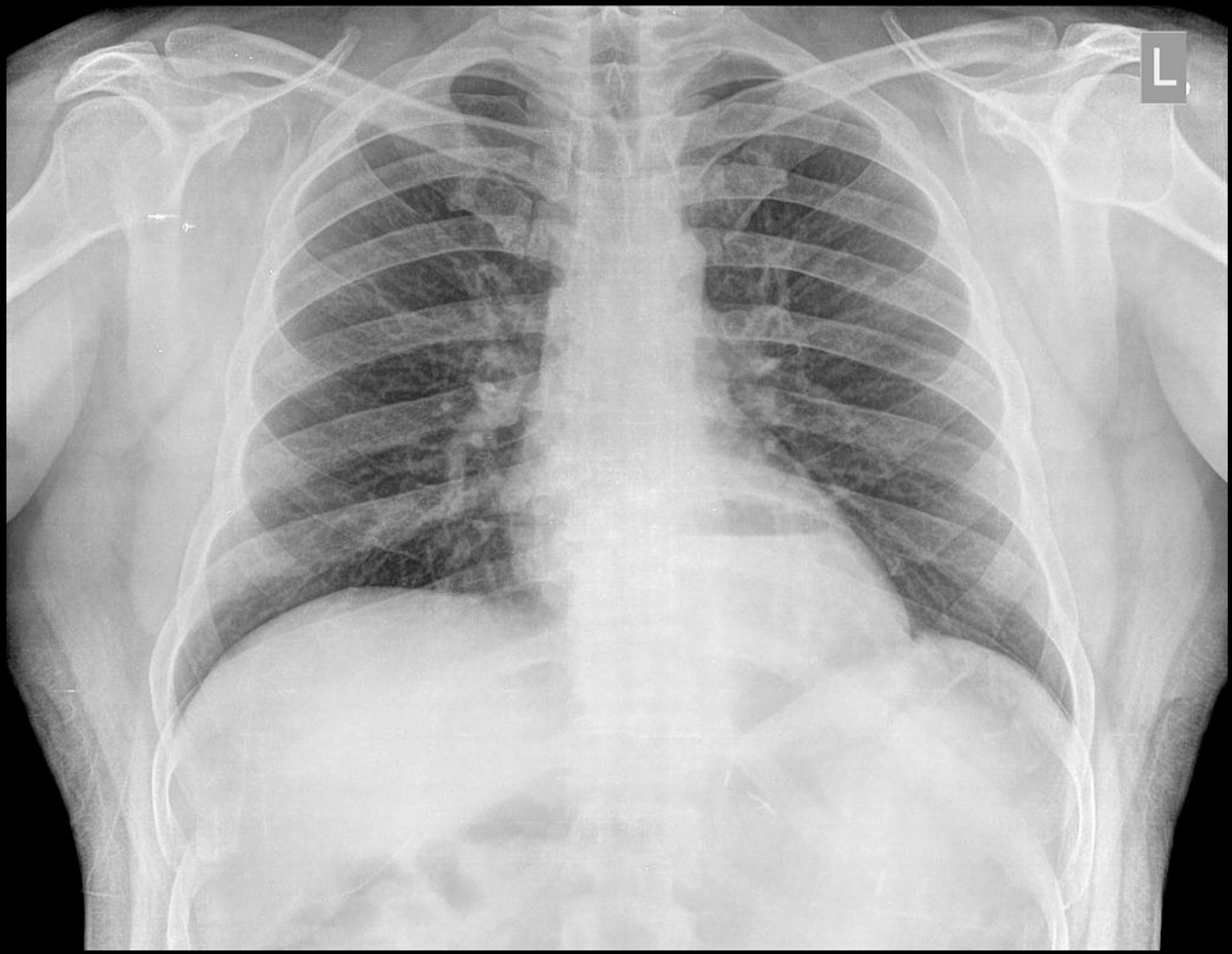
Air under the diaphragm

DDx: Perforated viscus.

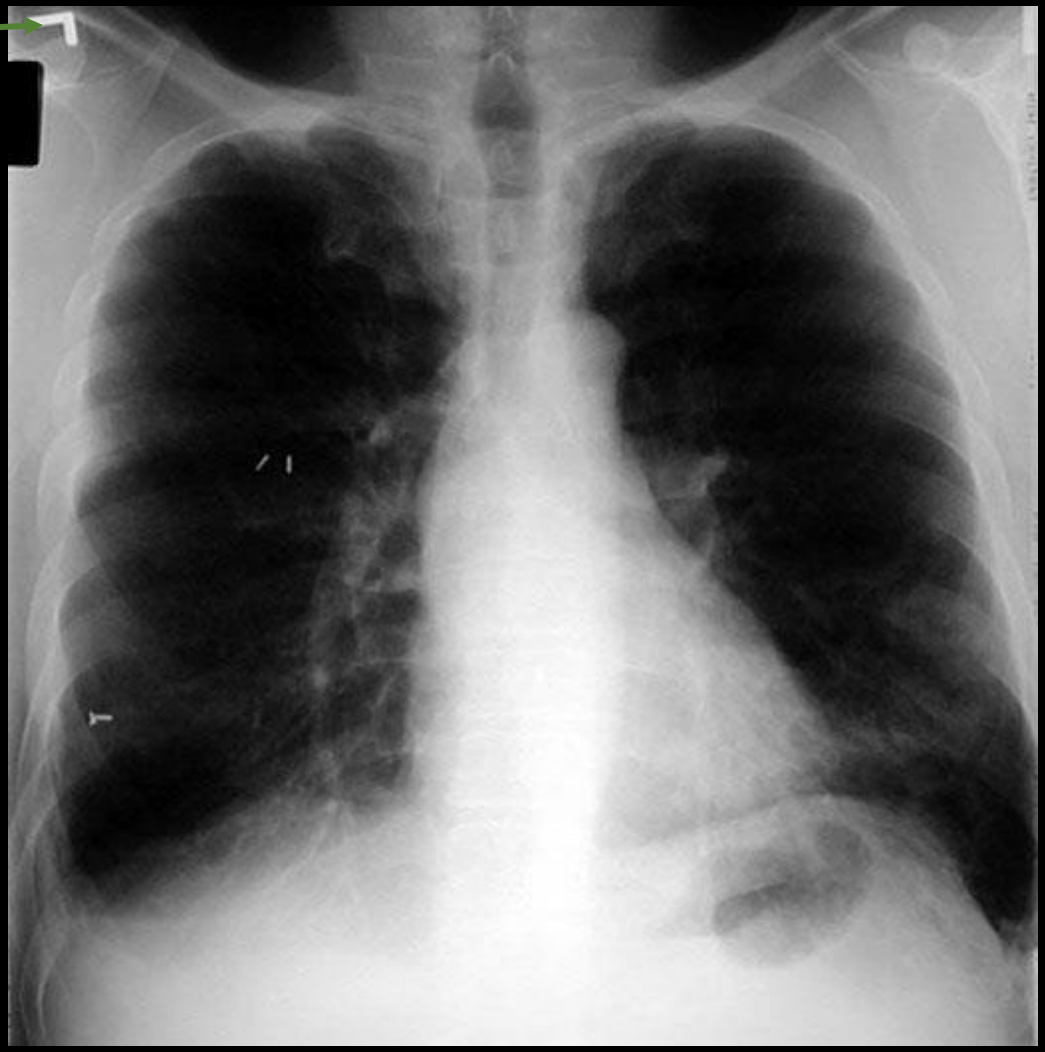
Chronic cough, upper GI symptoms



Air-fluid level behind the heart

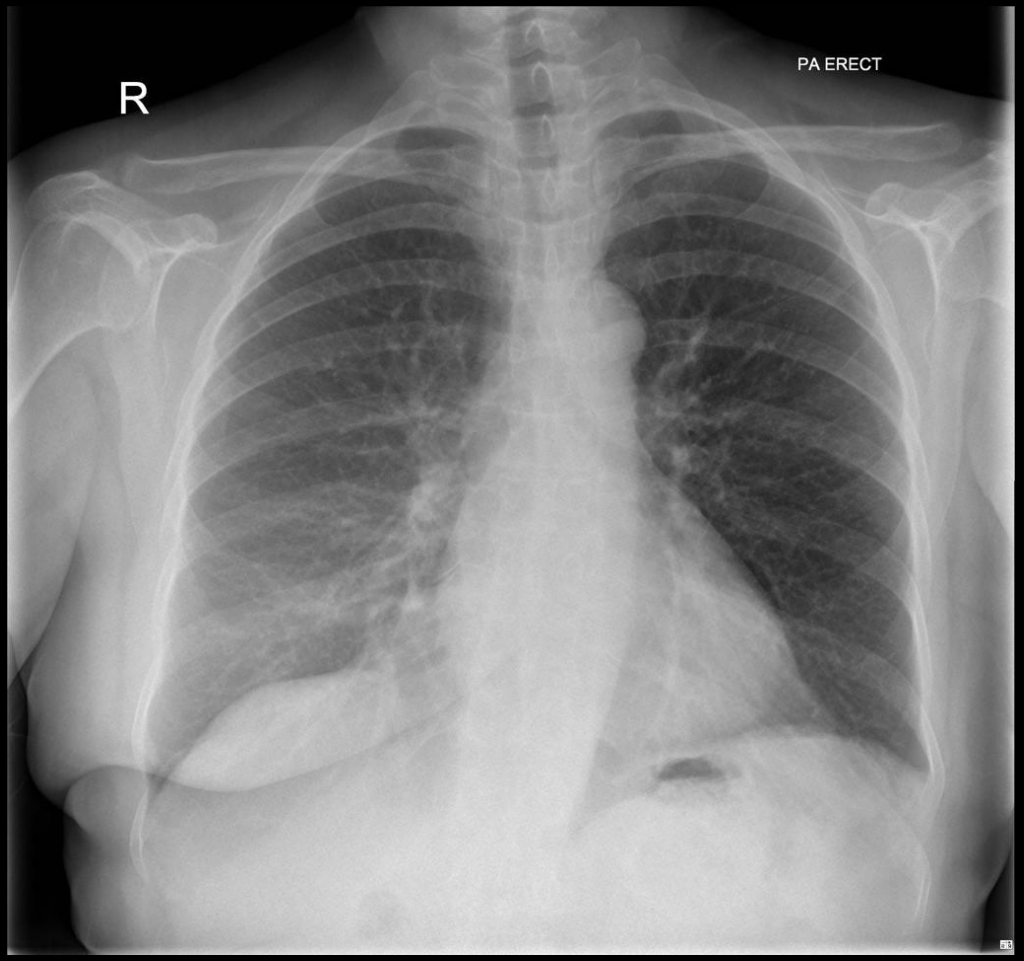

L

Someone flipped the film. Look carefully!

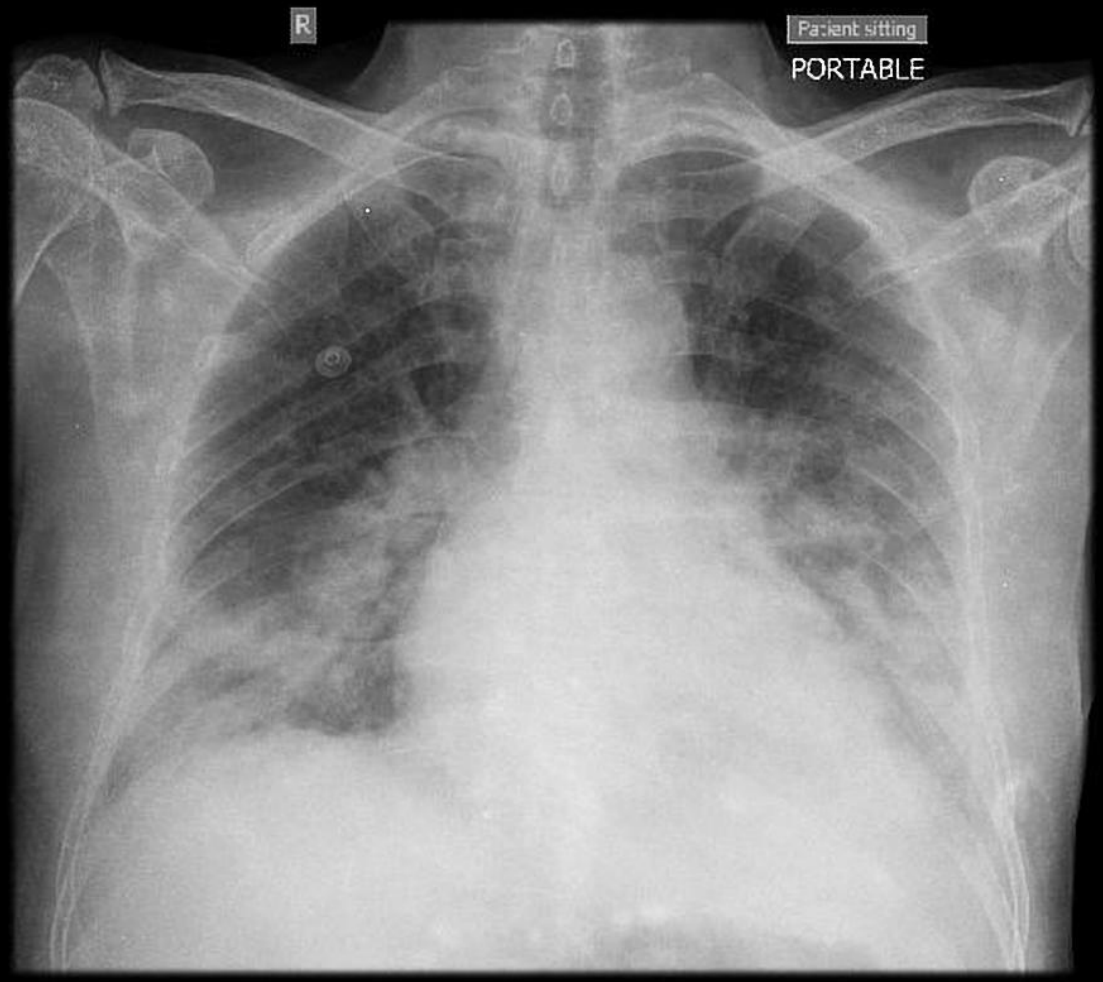


Dextrocardia

Rt Mastectomy



COVID 19 Pneumonia



The 12-Step Program

- **1**: Name
- **2**: Date
- **3**: Old films

} **Pre-read**

- **4**: What type of **view(s)**
- **5**: Penetration
- **6**: Inspiration
- **7**: Rotation
- **8**: Angulation

} **Quality Control**

- **9**: Soft tissues / bony structures
- **10**: Mediastinum
- **11**: Diaphragms
- **12**: Lung Fields

} **Findings**

The End

Questions?