



# 430 Radiology team

## Lecture 3

### **Radiological investigation of chest (Respiratory)**

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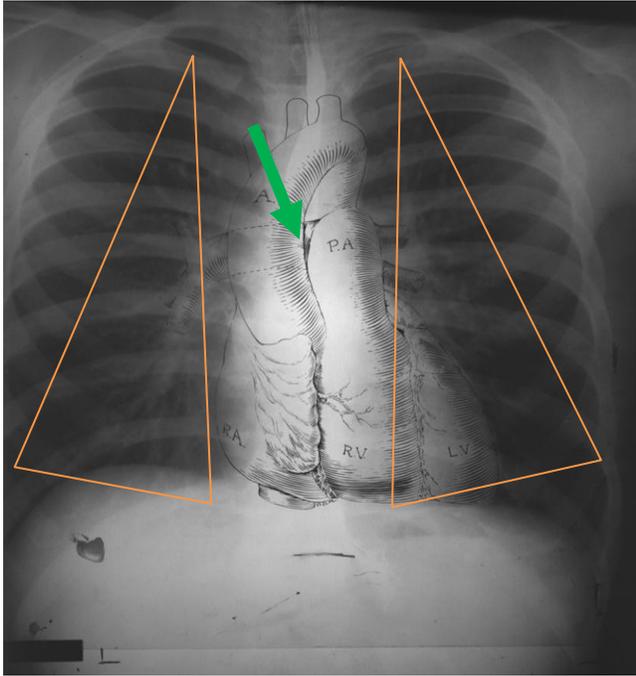
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## ❖ What do we mean by chest?



We mean study of thoracic cage content (including ribs, lungs, Mediastinal structures, great vessels and heart)

- Great vessels (Superior vena cava , inferior vena cava , pulmonary artery and Aorta )
- Lungs

## ❖ Basic Chest Exams:

- Plain film=chest x-ray(CXR) ( it is the Gold standard nowadays ) ( you can detect Pneumonia , TB and Bronchiectasis)
- CT (computed Tomography): ( used it if you want to visualize the mediastinal structures or if you suspect a mass )
  - 1- HRCT (high resolution CT).
  - 2- CT with contrast.
  - 3- CT angiography
- Angiograms
- MRI ( has very limited use)

Q) 18 year boy presented to the ER with cough and fever, what type of radiological investigation you will order?

- CXR

❖ Chest X-Ray :

1- PA view (standing up or erect ):



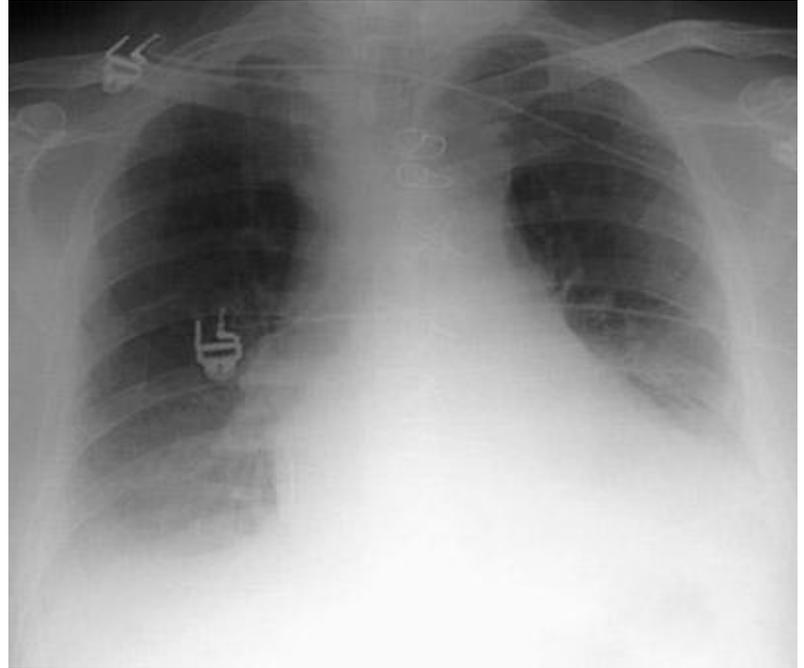
Ideally, the patient should be in an erect position and take a full inspiration and we should take PA view (posterior-anterior) Also known as Frontal view.

2- Lateral view (standing up or erect) with full inspiration :



- It is an optional additional view to the PA view

### 3- AP view ( lying down or Spine) with best inspiration:

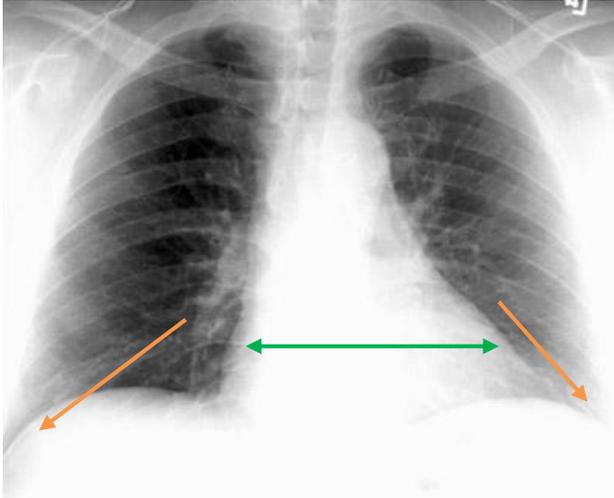


- We use this type of X-ray views if the patient came to the ER and he can't stand up or he is comatose.
- **We don't use it unless necessary because the effect of the gravity is lost here.** The gravity helps the diaphragm to move down, giving us more chest space to be visualized. (If the patient is lying down, the weight of the bowl will not allow the diaphragm to move down).

#### ❖ Remember:

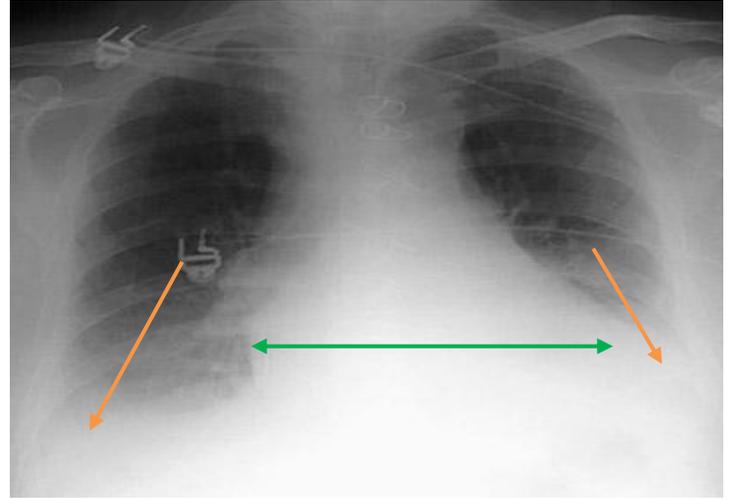
- **PA view not AP view** → because the ribs and clavicles are much clearer, lung borders are visible, **costo-phrenic can be seen only in PA view.** Also, **AP view gives a false enlargement to the heart.**
- **Full inspiration not expiration** → because in expiration, the lungs bases appear hazy and the heart shadow increase giving us a false heart enlargement. Also, **in full inspiration, the diaphragm moves down giving us more chest space.**
- **Patient should be in an erect position** → because in erect position, it is easier to take a full inspiration and **because of the important of gravity effect on the diaphragm.**

❖ PA view versus AP view :



**PA view**

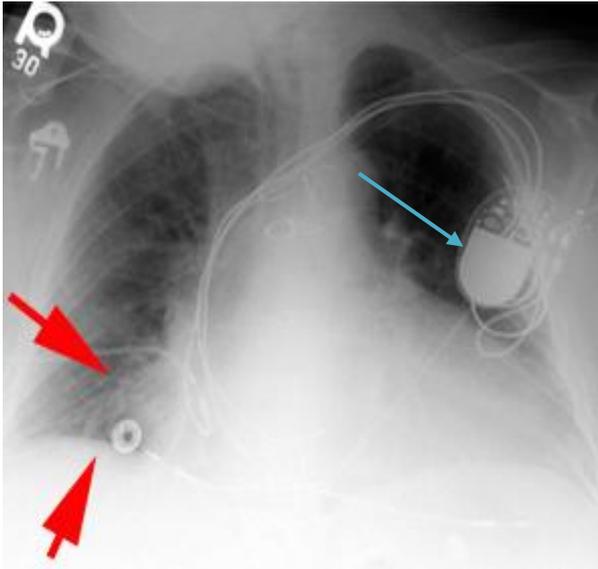
- Heart outline is well defined and normal sized
- Costo-phrenic angle is visible and clear.
- Ribs and clavicle are much clearer.



**AP view**

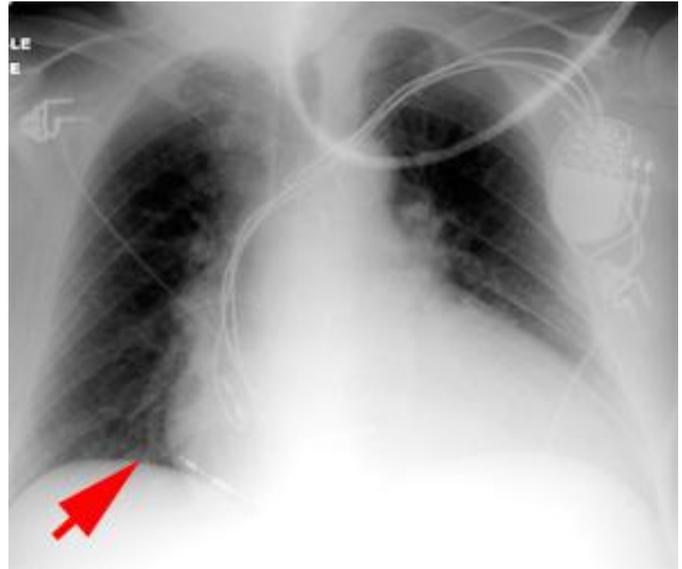
- False enlargement of the heart.
- Costo-phrenic angle is not clear.
- Ribs and clavicles are not as clear as PA

## ❖ Hypo-inspiration versus inspiration



### Hypo-inspiration (or expiration)

- The heart appears larger and the lung bases are hazy. ( the right border of the heart is ill-defined → giving us a false pneumonia diagnosis )
- Pacemaker
- Costo-phrenic angle is not clear



### Full inspiration:

- Normal size of the heart
- Costo-phrenic angle is clear.
- Pacemaker.
- Normal chest X-ray.

## ❖ Technical factors:

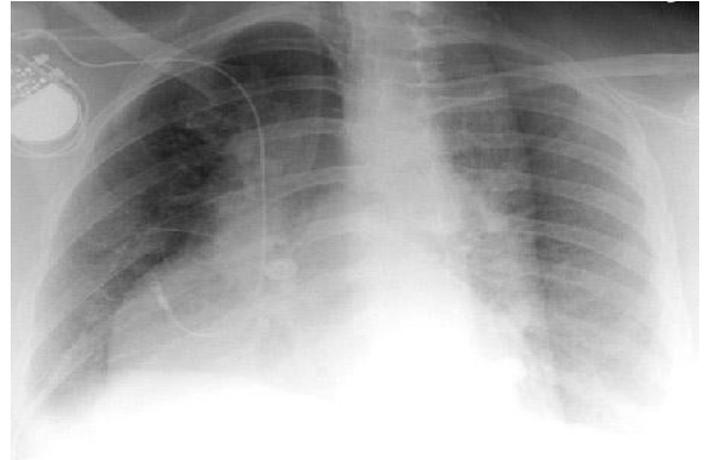
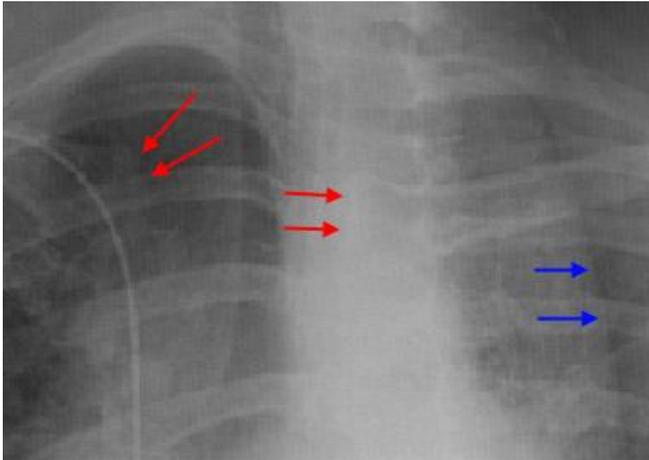
- Depth of inspiration
- Visualization of pathology depends on contrast provided by air in the lungs.
- Count ribs. (With full inspiration, usually you can count till the 10<sup>th</sup> rib.)

## ❖ Inspiration:

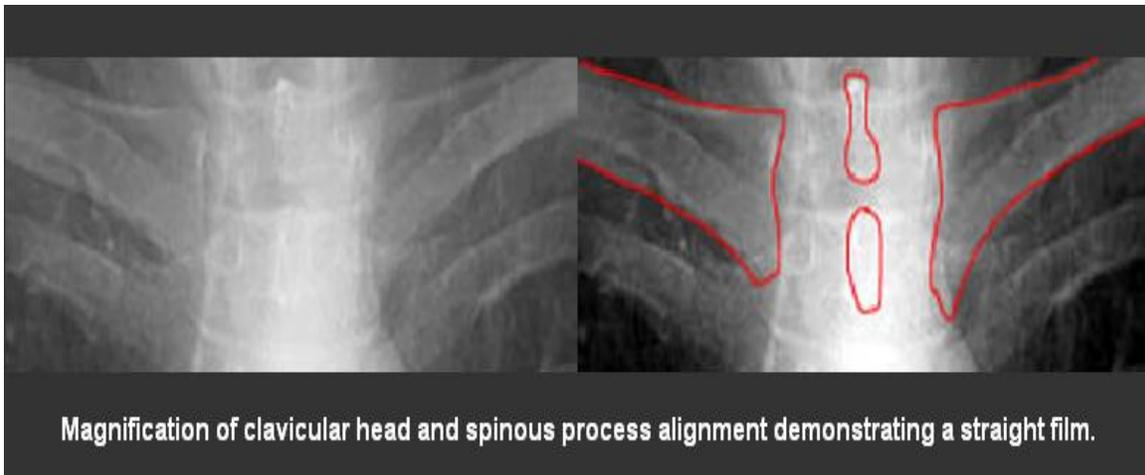
- This greatly helps the radiologist to determine if there are intrapulmonary abnormalities.
- The diaphragm should be found at about the level of the 8th - 10th posterior rib or 5th - 6th anterior rib on good inspiration.

❖ **Rotation:**

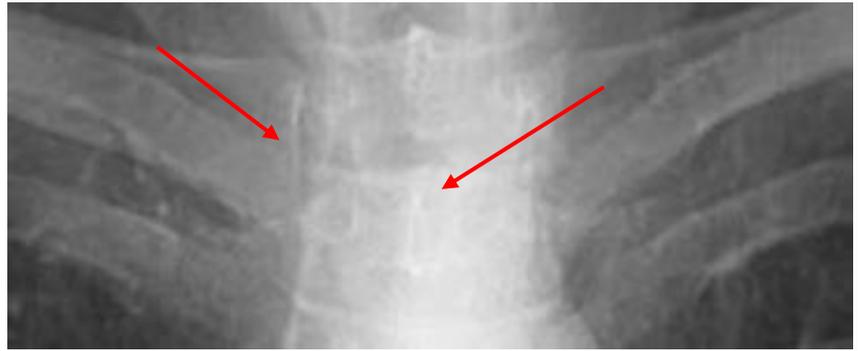
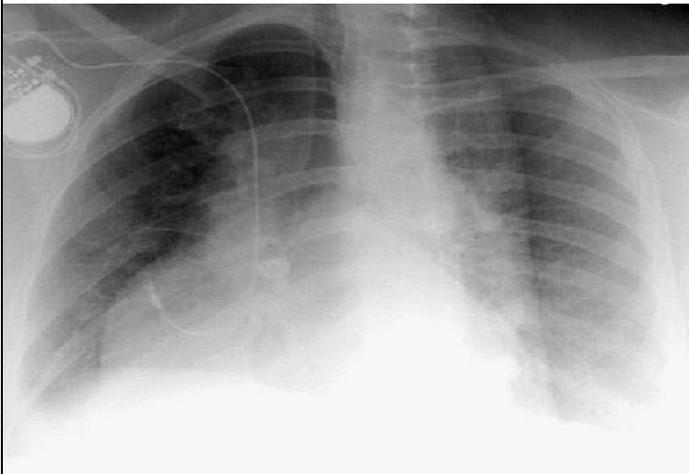
- The technologists are usually very careful to x-ray the patient flat against the cassette. If there is rotation of the patient, the
- Mediastinum may look very unusual.
- One can assess patient rotation by observing the clavicular heads and determining whether they are equal distance from the spinous process of the thoracic vertebral bodies.



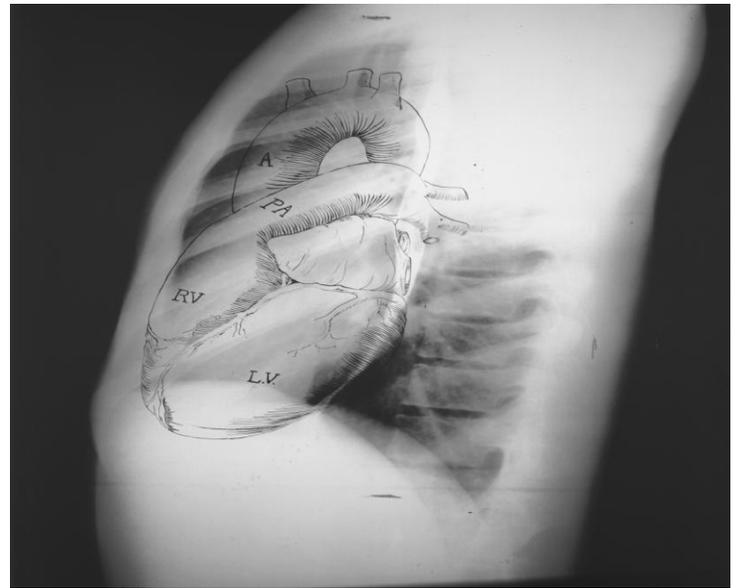
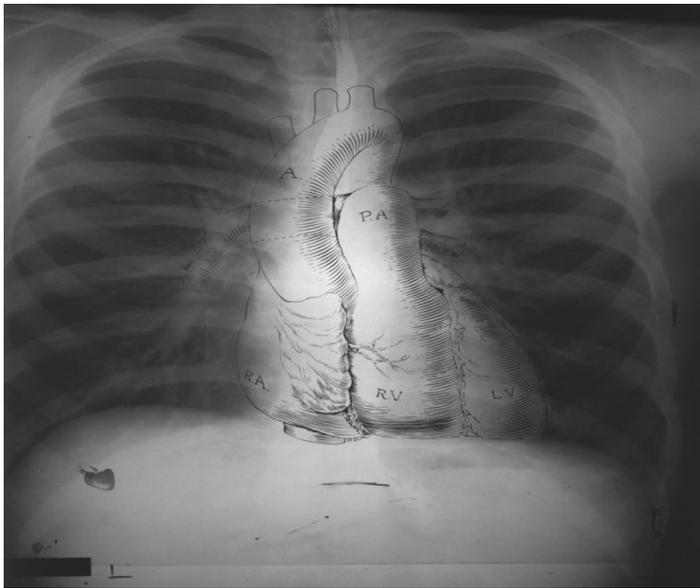
- In this rotated film skin folds can be mistaken for a tension pneumothorax (blue arrows). Notice the skewed positioning of the heads of the clavicles (red arrows) and the spinous processes.



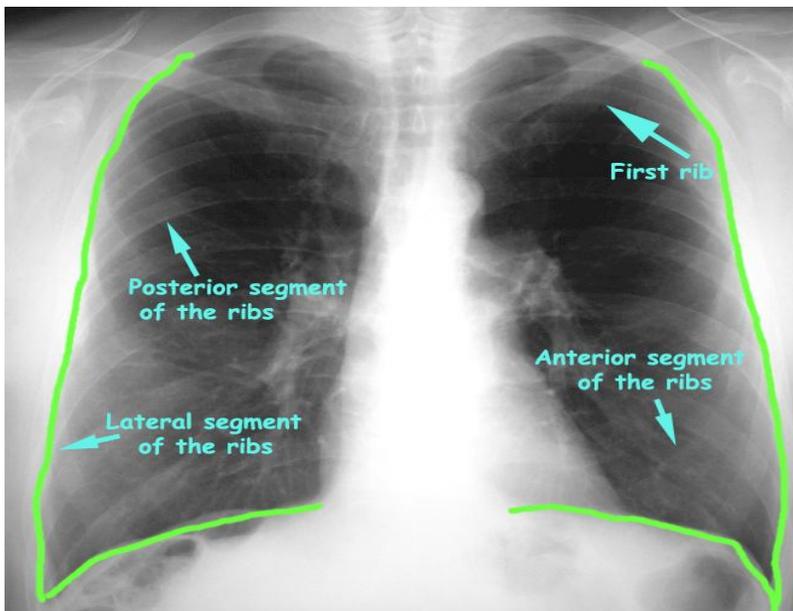
Magnification of clavicular head and spinous process alignment demonstrating a straight film.

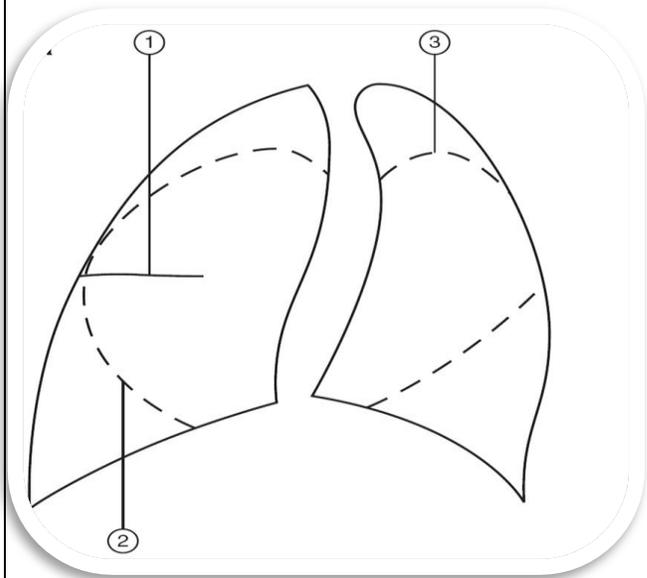


❖ **Anatomy on Normal Chest X-Ray:**

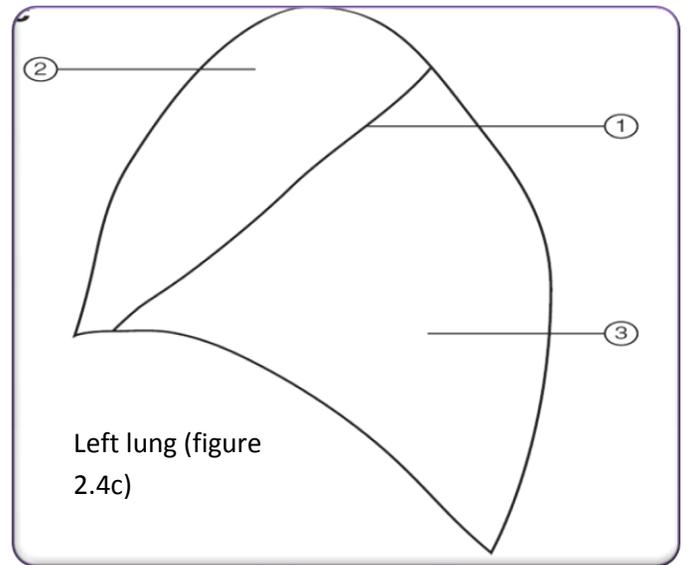
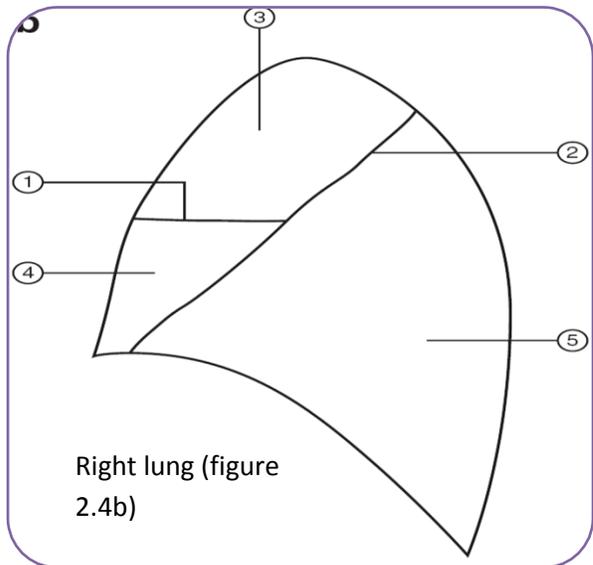


- Heart borders and chambers of the heart on PA and lateral views.



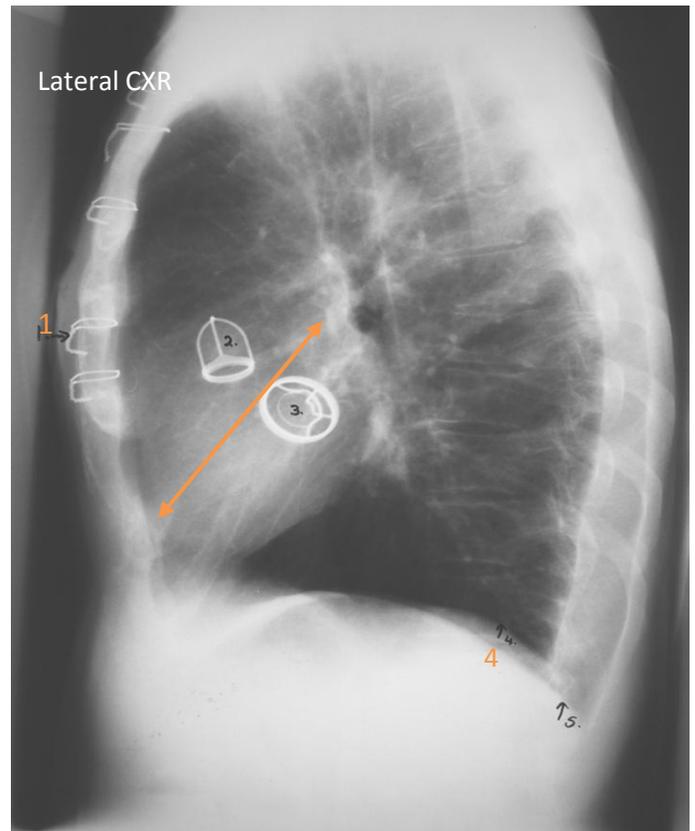
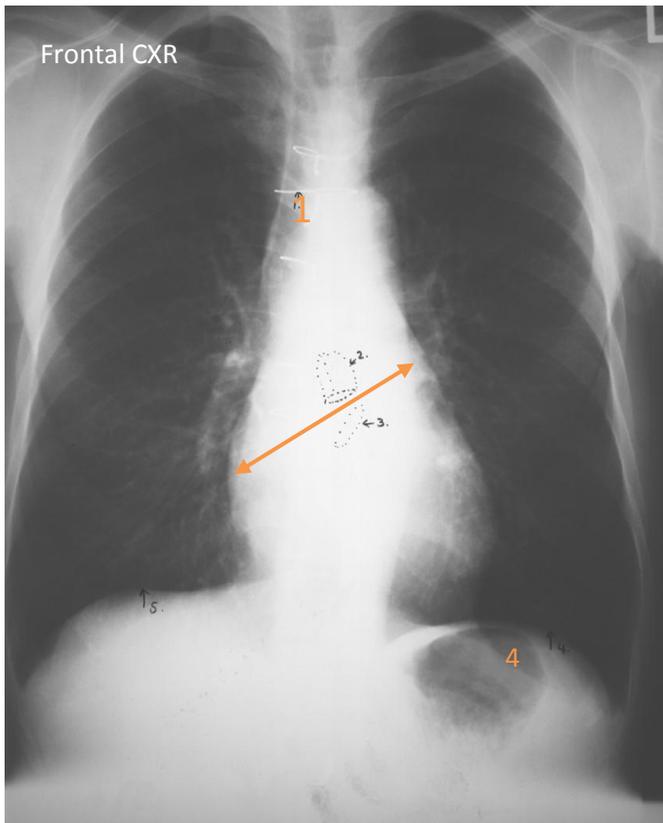


- Diagram of lungs showing lobes. The right lung has three lobes, upper, middle and lower. These are separated by the oblique and horizontal fissures. The left lung has two lobes, upper and lower separated by the oblique fissure.



- (1) Horizontal fissure  
 (2) Right oblique fissure, (3) Left oblique fissure. Figure 2.4b  
 (1) Horizontal fissure (2) Right oblique fissure (3) Right upper lobe  
 (4) Right middle lobe (5) Right lower lobe. Figure 2.4c (1) Left oblique fissure (2) Left upper lobe (3) Left lower lobe.

## ❖ Cardiac Valves:



### • Locations of the valves on the CXR:

#### 1- PA view

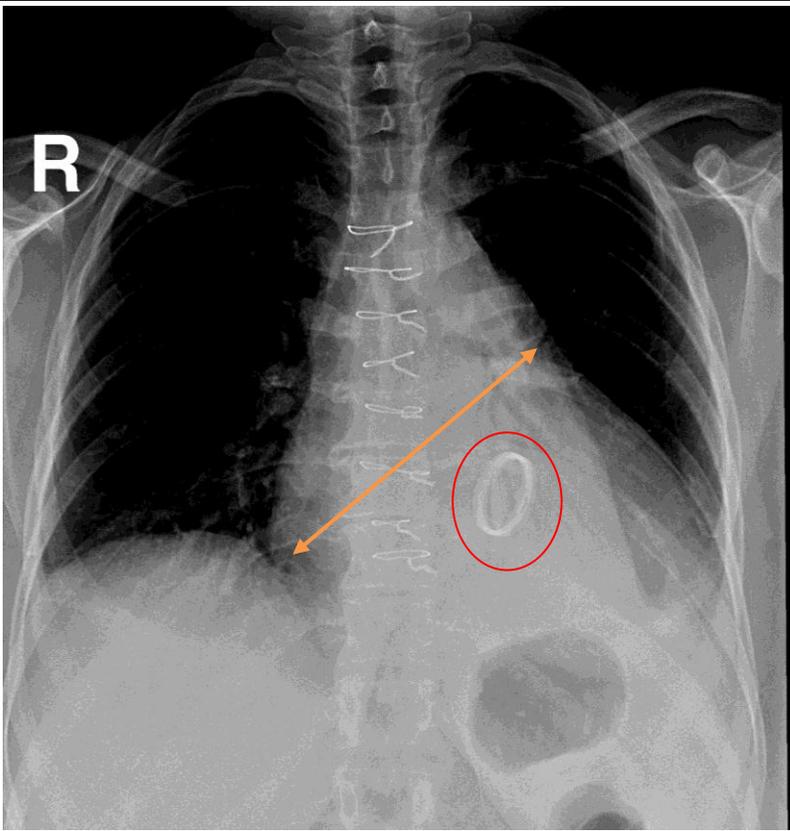
- Draw an **imaginary line from the Right cardiophrenic angle until the left hilum, above** this line is the **aortic valve** and what's **below** this line is the **mitral valve**.

#### 2- Lateral view

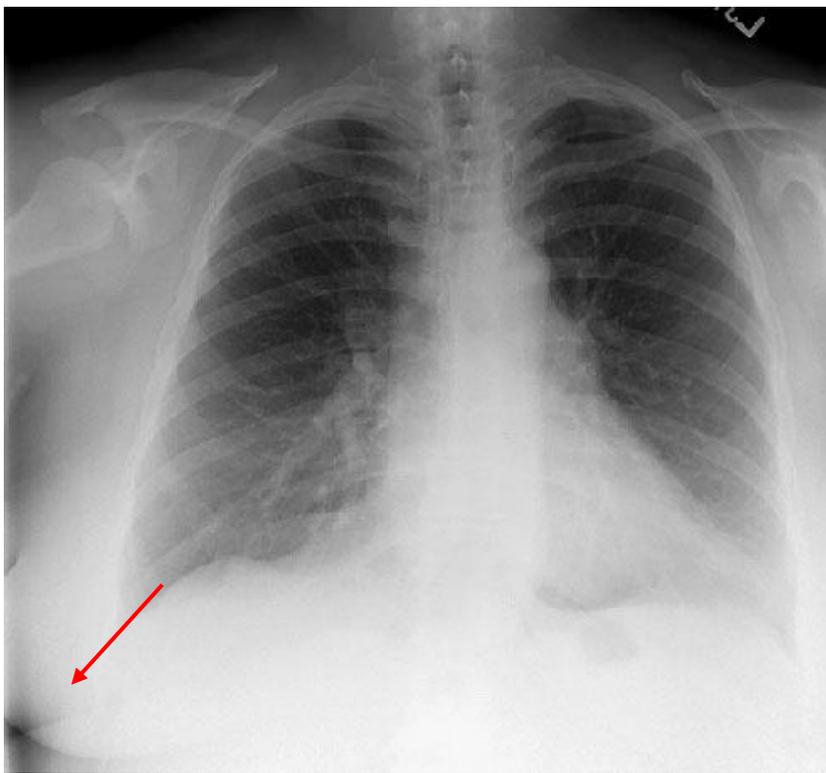
- Draw an **imaginary line from the cardiophrenic angle to the hilum**
  - **Above** → **aorta**
  - **Below** → **mitral**

- 1- Suture material used for repair of vertical incision thru sternum (median sternotomy)
- 2- Aortic valve prosthesis
- 3- Mitral valve prosthesis
- 4- Left hemi diaphragm
- 5- Right hemi diaphragm

- This patient had a malfunctioning mitral valve (between left atrium and left ventricle) and aortic valve (between left ventricle and aorta) and prosthetic valves were inserted (better seen on lateral)



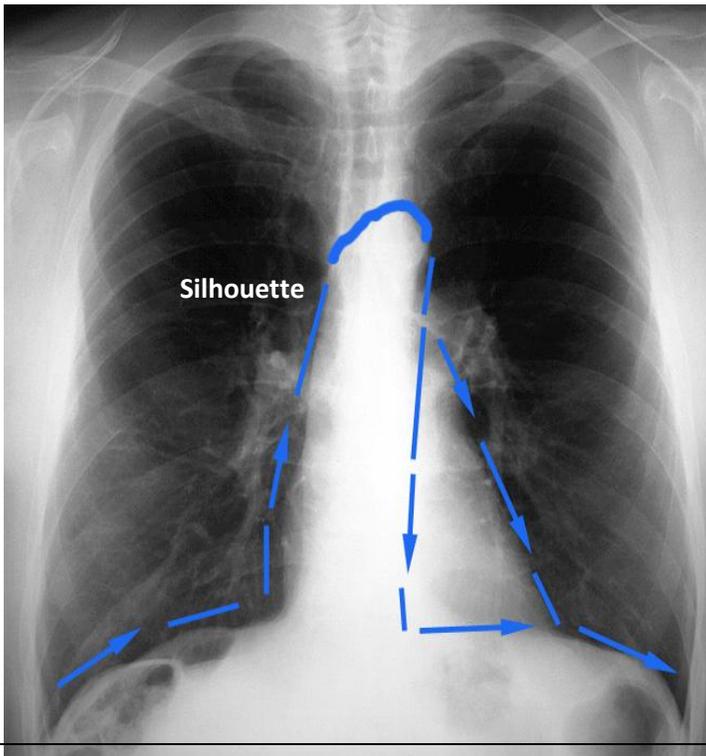
- Mitral valve replacement



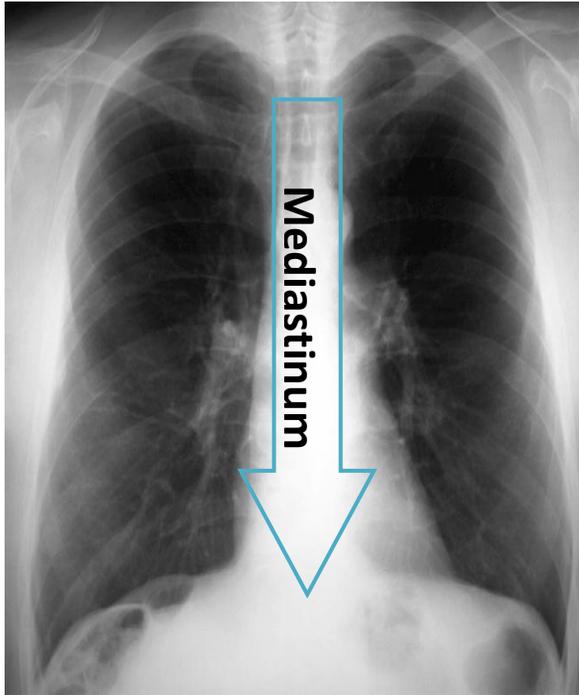
- Breast shadow

❖ **How To Read Frontal Chest X-Ray:**

- When studying the x-ray, divide it into several compartments and compare both sides
- We can see the SILHOUETTE of the heart, the anterior and posterior ends of the ribs, and the diaphragmatic borders.
- The most important things in chest x-ray in PA view are :
  - Lung field
  - Hilum shadow
  - Heart
  - Cardiac silhouette



### ❖ Frontal Chest X-Ray:

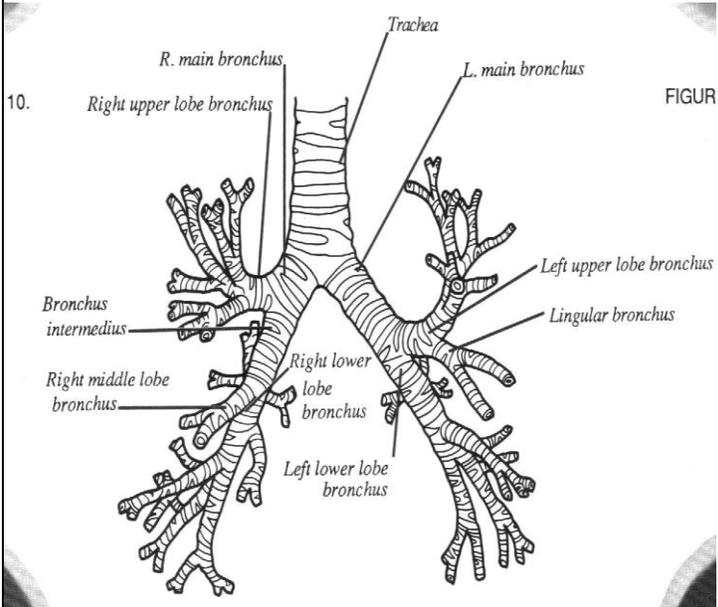


In the Mediastinum, you can see heart, great vessels and spine in the posterior.

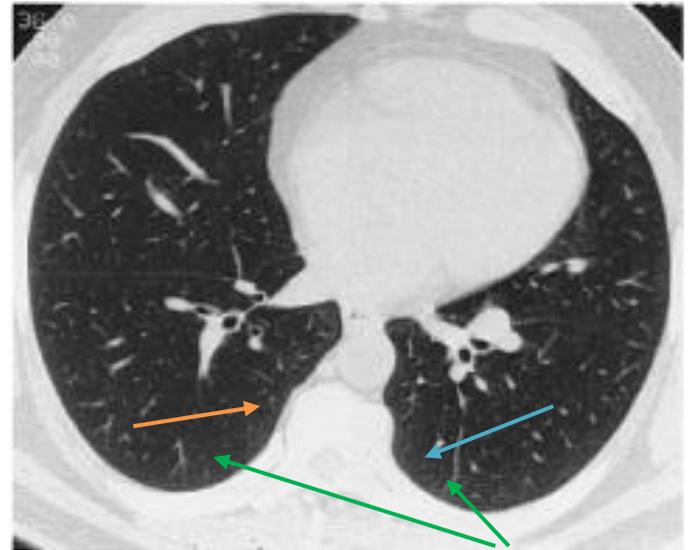
### ❖ High Resolution CT Scan:

- HRCT uses very thin slices (1mm) to achieve better spatial resolution & precision.
- HRCT is indicated after normal CXR in a symptomatic patient - the setting of high clinical suspicion of disease.
- Advantages
  - High sensitivity for adenopathy, infiltrates, and architectural distortion.
  - HRCT can identify areas of reversible vs. irreversible lung damage.

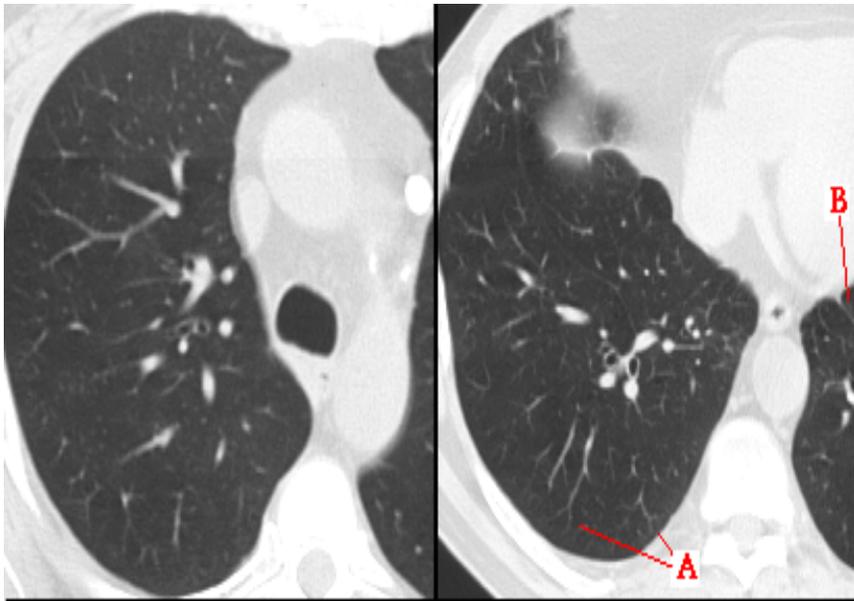
❖ **Normal Lung Anatomy:**



- **Tracheobronchial Tree**



- Right inferior pulmonary vein.
- Left pulmonary vein.
- Lower lobe bronchi.



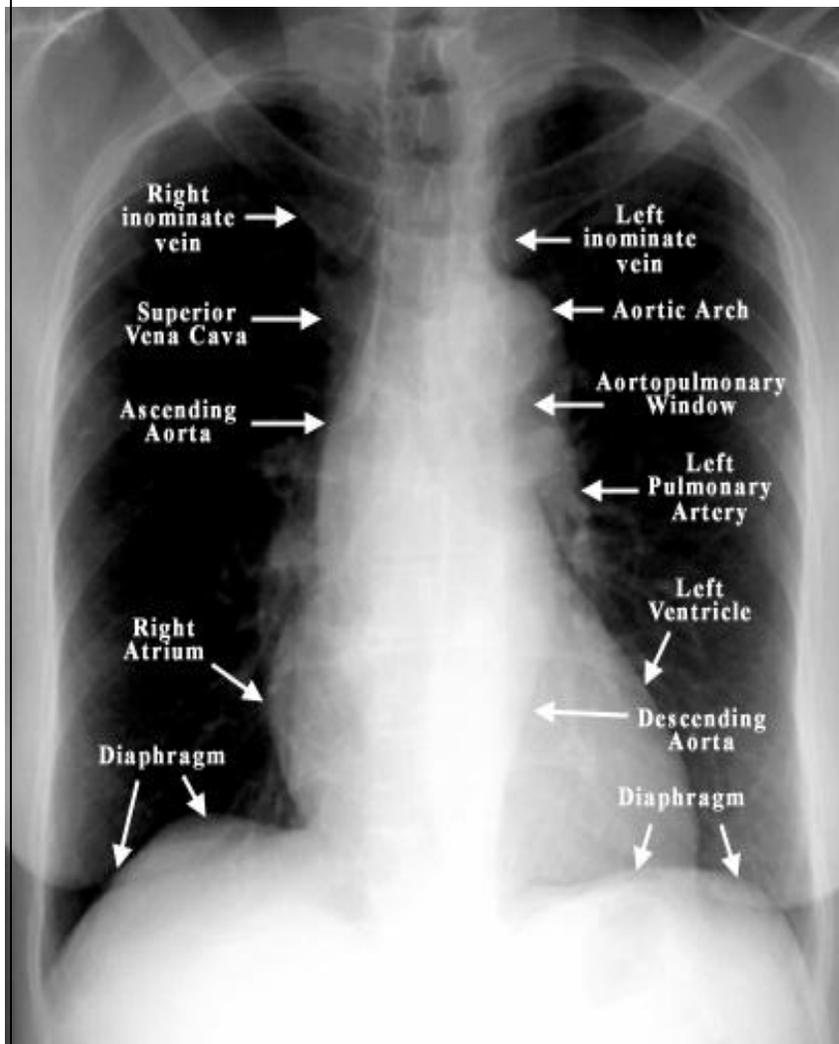
- **Normal HRCT**

**Normal upper (left) and lower (right) HRCT scans obtained in the prone position. The center of a pulmonary lobule is defined by the presence of a distal pulmonary artery (A). The faint outline of a distal interlobular septum is noted in the lower lobes (B). A subpleural clear space is normally present in the nondependent lung.**



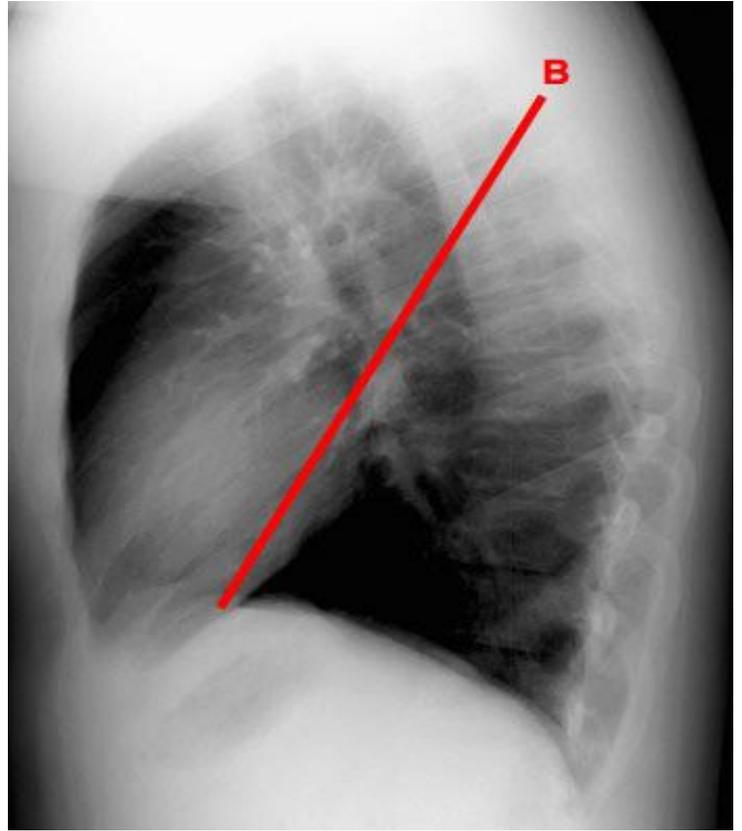
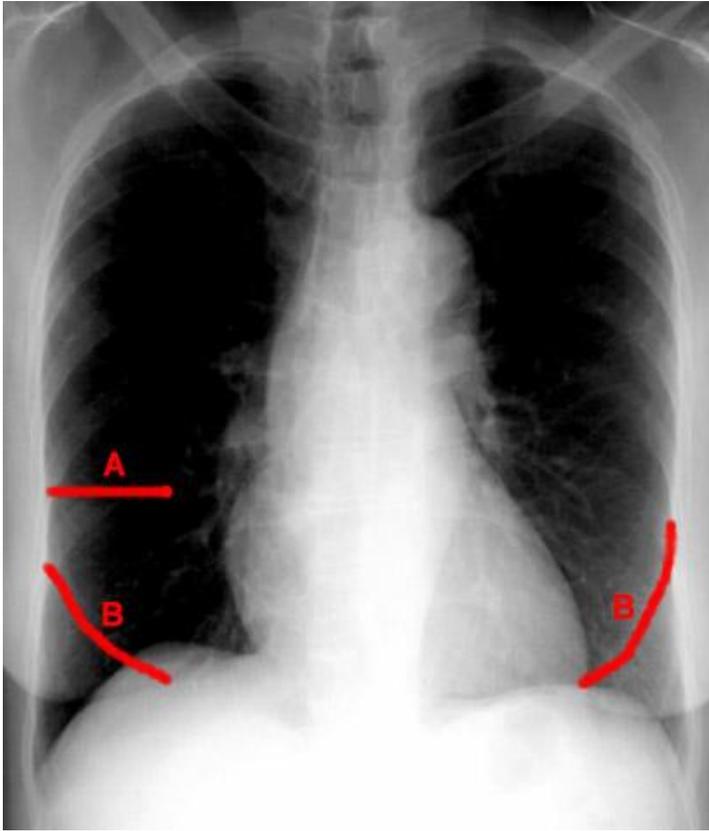
Key:

1. Right 1<sup>st</sup> rib
2. Right 2<sup>nd</sup> rib
3. Scapula
4. Trachea
5. Carina
6. Bronchus seen end on
7. Bilateral hila
8. Branch of right main descending pulmonary artery
9. Right minor (horizontal fissure)
10. Right hemi diaphragm
11. Left hemi diaphragm
12. Gastric air bubble
13. Left clavicle



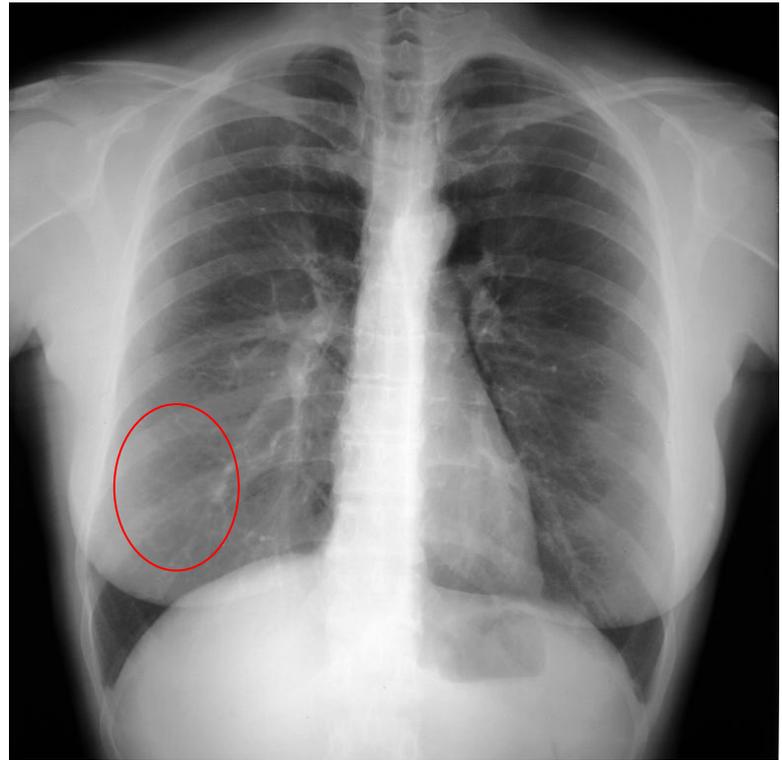
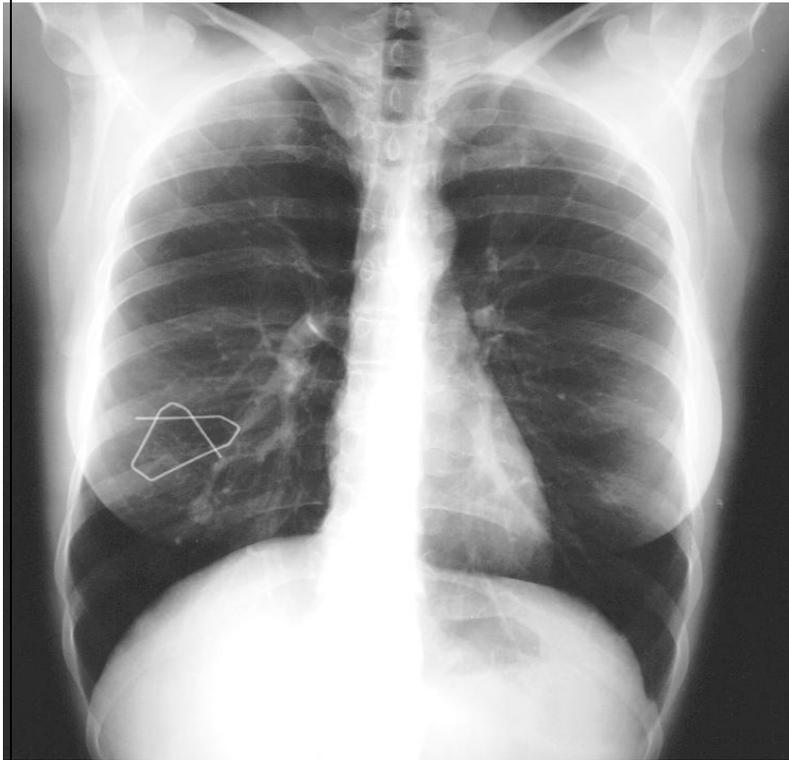
PA VIEW ANATOMY

❖ **Fissures:**



- The fissures are not seen in normal x-rays (only in 30% of Pt)
- Always **COMPARE** both lungs looking for an abnormality.
- Deep inspiration helps radiologists to determine if there are any intrapulmonary abnormalities.
- On the PA chest x-ray, the **Transverse (A)** fissure divides the right middle lobe from the right upper lobe and is sometimes not well seen. There is **no Transverse fissure on the left.**
- The **Oblique fissures (B)** are **usually not well seen on the PA view** because you are looking through them obliquely. If there is fluid in the fissure, it is occasionally manifested as a density at the lower lateral margin

❖ Frontal Chest X-Ray interactive radiology



- Is this shadow Nodule or nipple shadow?
- Put a **metallic material on the nipple** and then **take an X-ray** → if the shadow is **inside the metallic material** → it is a **nipple** → if the shadow is outside the metallic material → it is a **nodule**
- The pt here has a nodule..