

# 432 Radiology Team



## (3): Radiologic investigation of Chest and CVS diseases

\* Many thanks to 431 team for their helpful notes \*



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**COLOR GUIDE:** • Females' Notes • Males' Notes • Important • Additional • 431 team

# Objectives

Not given :(

## Preview of chest contents:

Ribs, lungs, mediastinum (great vessels and heart)

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

## 1) Basic chest exams

- PLAIN FILM=CHEST X-RAY(CXR)\* (It is the **Gold standard** nowadays, It can detect pneumonia, TB and Bronchiectasis)
- CT\*:
  - CT LUNGS AND MEDIASTINUM
  - CT- angiography (CTA) (Example;acute pulmonary embolism)
  - High resolution CT of the chest (HRCT) (Example; finding diffused lung disease in the CXR, we need HRCT)
- ANGIOGRAMS
- MRI

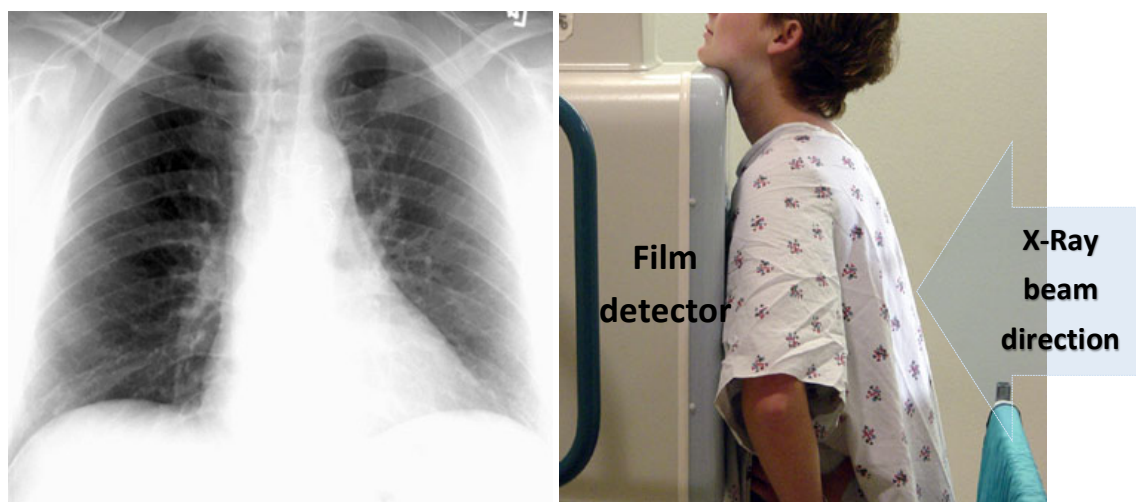
### Note(s):

Chest radiographs are used to diagnose many conditions involving the chest wall, including its bones, and also structures contained within the thoracic cavity including the lungs, heart, and great vessels. Pneumonia and congestive heart failure are very commonly diagnosed by chest radiograph. Chest radiographs are used to screen for job-related lung disease in industries such as mining where workers are exposed to dust.

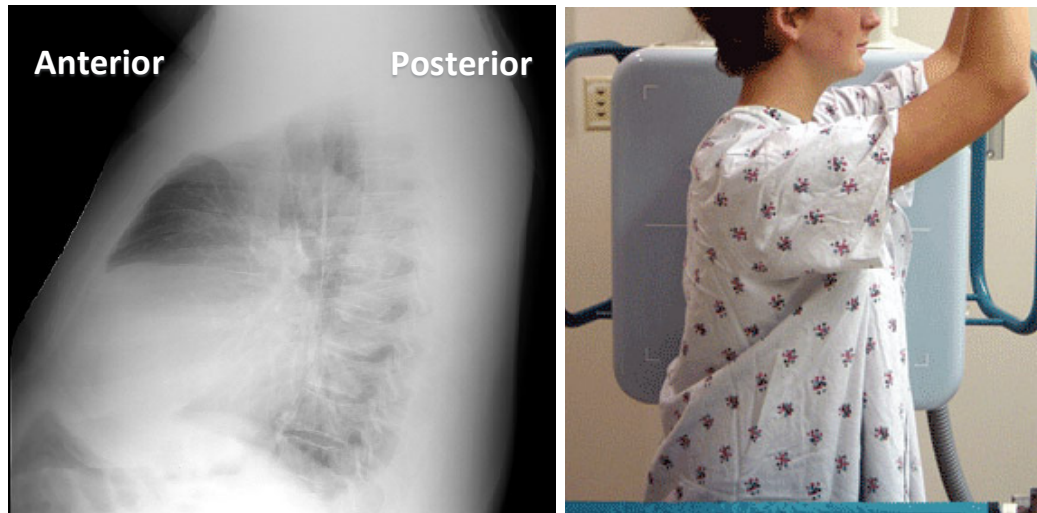
**\* We will go through them only**

## Different views of Chest X-ray (CXR):

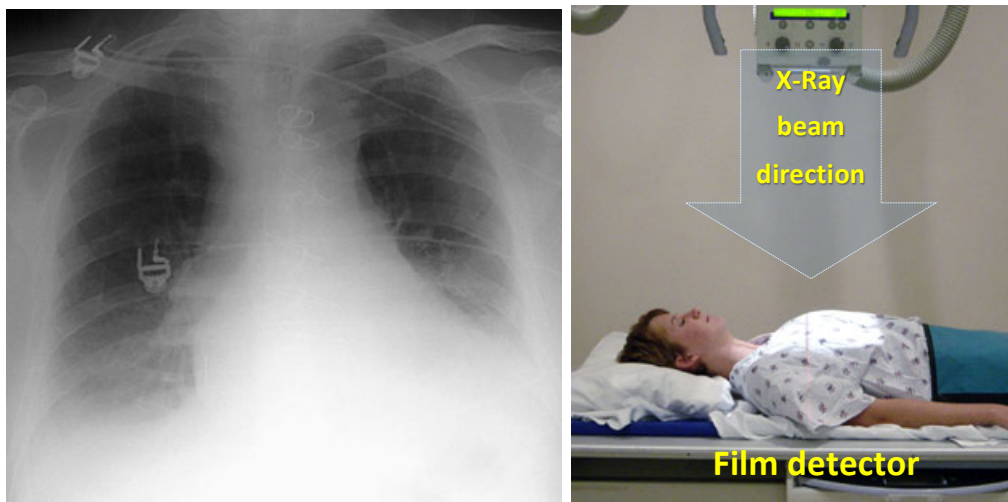
- 1) **Postero-anterior (PA)**: in an erect position. It's the **standard** (Q: why not taken when patient is laying? A: when laying part of the bowl comes up → decreasing chest area + patient will not be able to take full inspiration) \*the patient standing and facing the detectors. The x-ray will be coming from the back > hence posterior anterior\*



- 2) **Lateral view:** in an erect position also. It is important to cover another direction (i.e. to see if the tumor is anterior: closer to sternum, or posterior: closer to vertebral column. it is not routine but in case of having a mass) (The patient stands with both arms raised and the left side of the chest pressed against a flat surface.) (It is important for localizing the lesion and giving more characteristic to it)



- 3) **Antro-posterior (AP)** (only taken when patient is laying – supine position. has lower quality (raised diaphragm \*<sup>1</sup> + false sign of cardiomegaly \*<sup>2</sup>) → used for children, bedridden – comatosed or paralyzed – or severely ill patients) we don't use it unless necessary because the effect of the gravity is lost here. \*<sup>1</sup> 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).



Why is PA done more than AP? Because the ribs and clavicles are much clearer, lung borders are visible, costo-phrenic can be seen only in PA view. \*<sup>2</sup> (The structure that we want to see should be closer to the film. Since the heart is

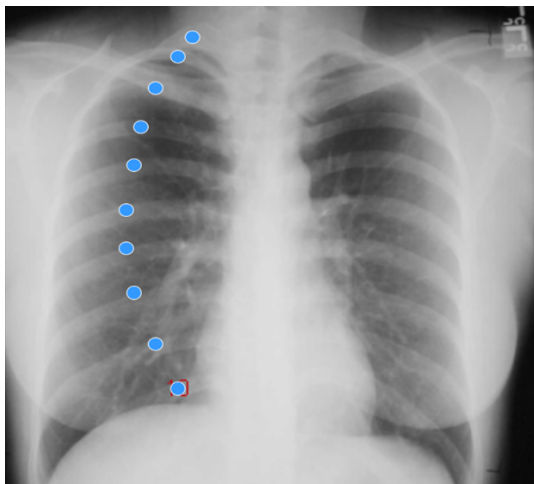


anterior, it will not be magnified or blurred in PA, if the heart is magnified like in an AP view, it covers most of the lung field and will also give a false impression that the heart is enlarged – cardiomegaly)

## 2) Technical factors

### 1) Inspiration

We ask the patient to take full inspiration (confirmed by counting the ribs, 10 ribs = full inspiration) because visualization of pathology depends on contrast provided by the air in the lungs. It also helps us to see as large as we can. Patient is asked to have full inspiration because: in expiration, the lungs bases appear hazy and the heart shadow increase.

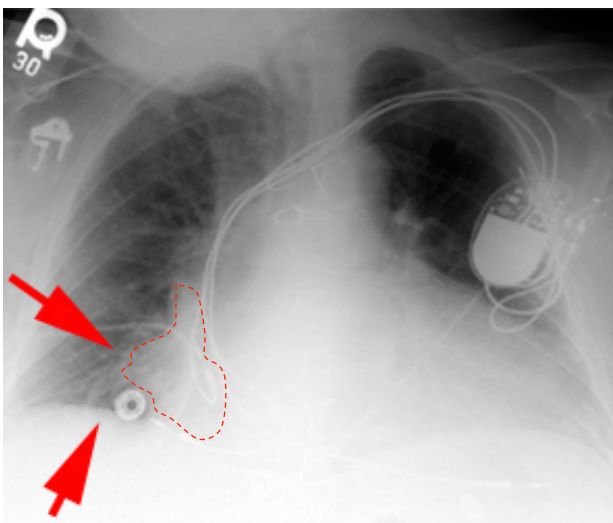


The ribs you are counting are posterior (attached to the spine) anterior part is very flat and thin and most anterior part is cartilage (you can barely see it)

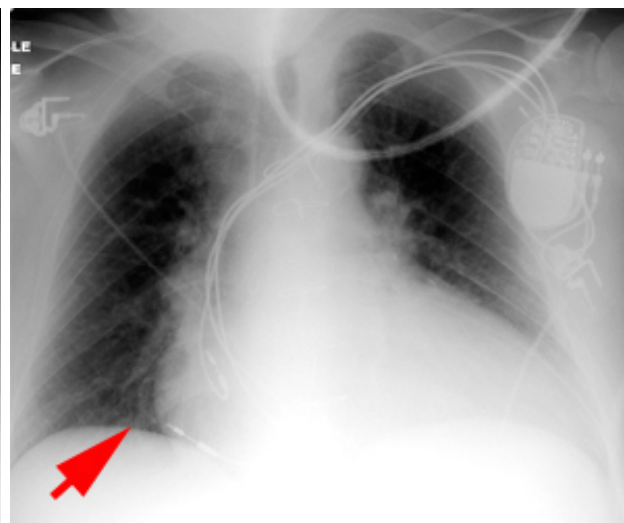
#### Note(s):

Always compare between the two lungs. It helps to find abnormalities.

- 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.



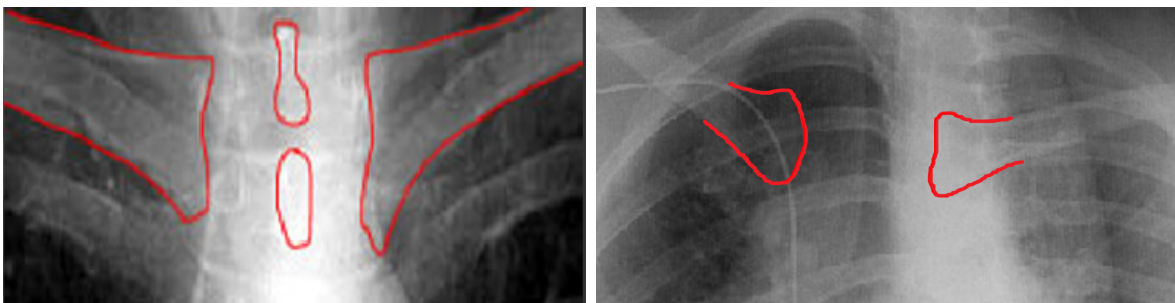
Not full insp.: might be considered as a mass



Full Insp.: More parts to see and more clear tissues

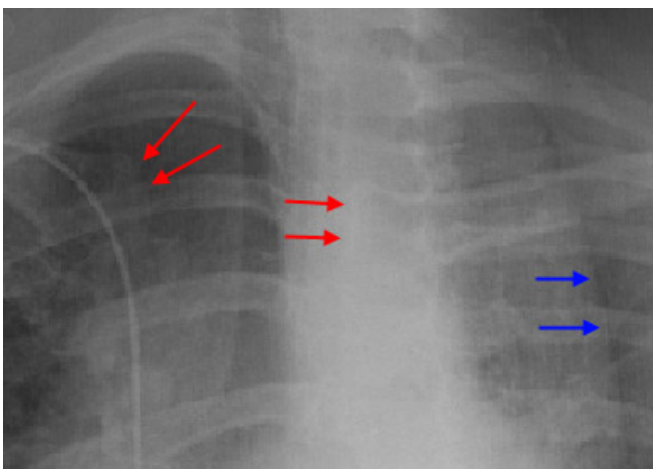
## 2) Rotation

- 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.**



Not rotated

Rotated

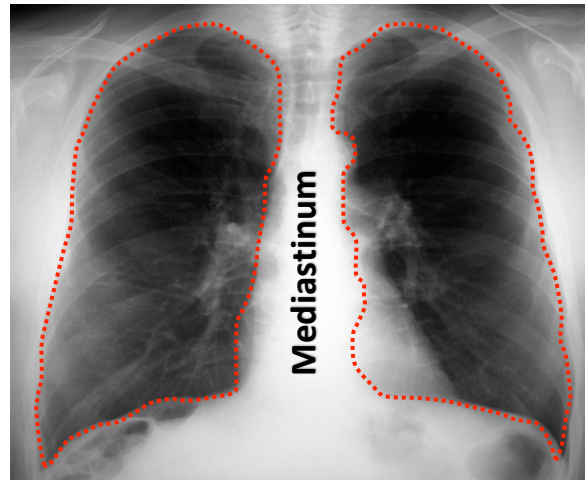


- In this rotated film, **skin folds** can be mistaken for a tension pneumothorax.
- Notice the skewed positioning of the **heads of the clavicles** and the spinous processes.

### 3) Anatomy of normal CXT

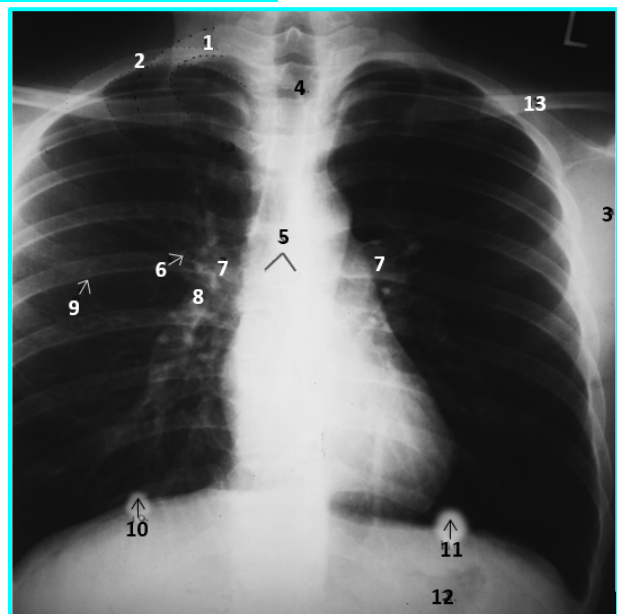
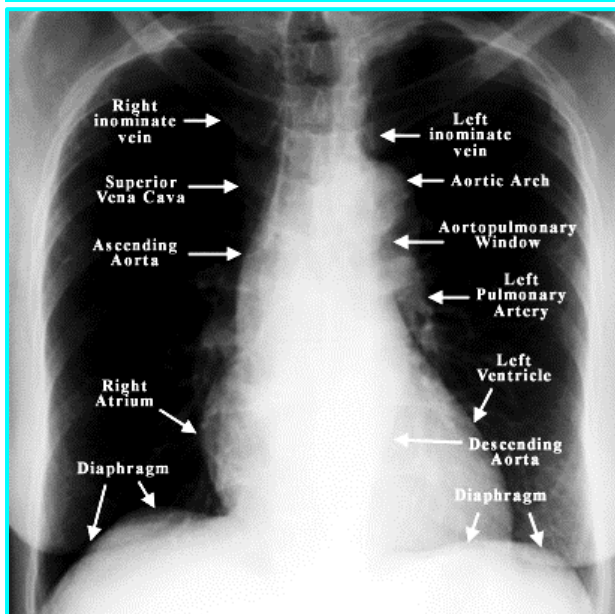


Heart borders and chambers of on PA and lateral views.



Lungs inside thoracic cage are covered by **plura** (we cannot see it normally) but if there is plural disease we will be able to see the findings (i.e. plural effusion: we will see fluid accumulation)

**These tow pictures are included in the slides but the Dr. skipped them**



- ① Right 1<sup>st</sup> rib \_ ② Right 2<sup>nd</sup> rib \_ ③ Scapula \_ ④ Trachea \_ ⑤ Carina \_ ⑥ Bronchus
- 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

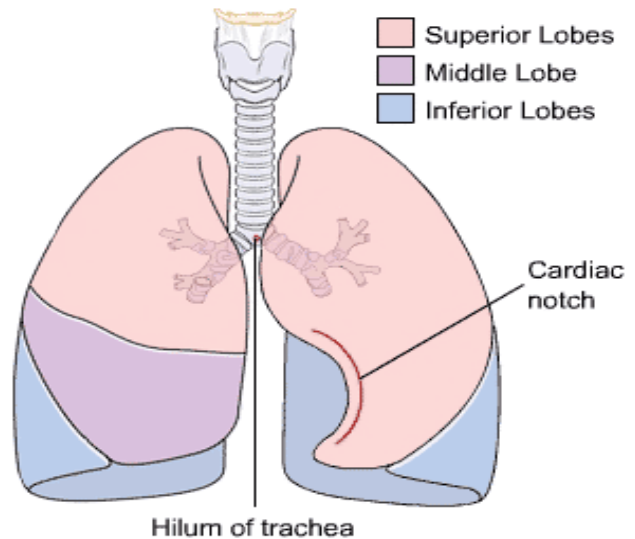
## Fissures:

(Only seen if there is abnormality. It helps in localizing and diagnosing)

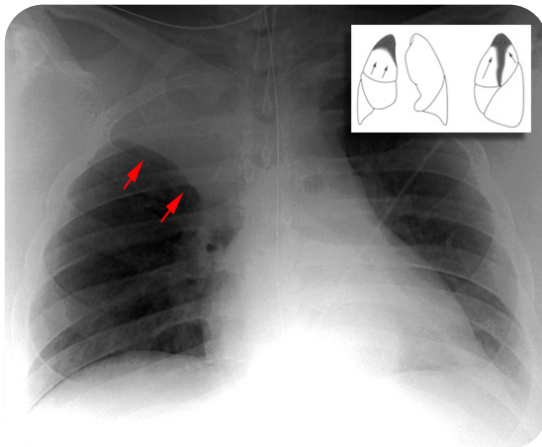
(Also, it helps in identifying the lobe borders)

**Normal:** The right lung has three lobes, upper, middle and lower. The oblique and horizontal fissures separate them. The left lung has two lobes, upper and lower separated by the oblique fissure.

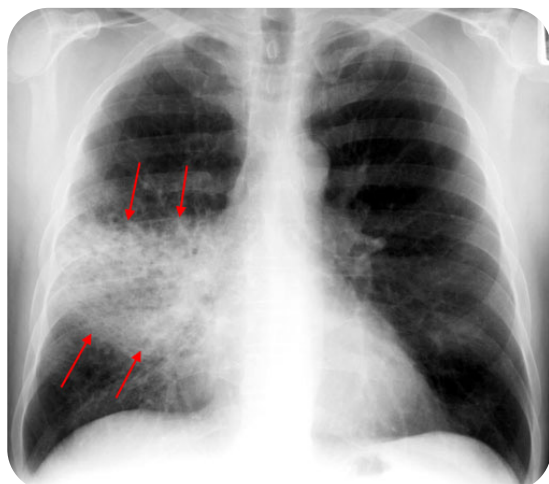
In the exam, you will not be asked to detect fissures in normal patient, but you will be asked about the diseases that you can diagnose by abnormal fissures.



## Abnormalities:



There is **loss of consolidation** in the right upper lobe. Notice that the horizontal fissure had **shifted up**. The only cause for that is **loss of volume**, which indicates **lung collapse**. This will not be seen in the next case: pneumonia.



As you can see here, there is **loss of consolidation** in the right middle lobe **without** shifted fissures. Indicates **pneumonia**.

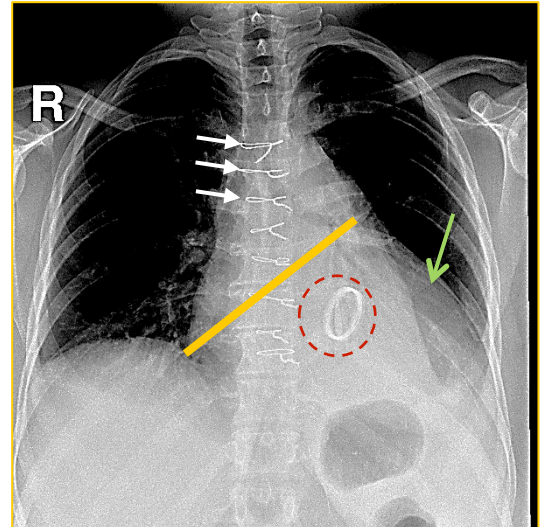
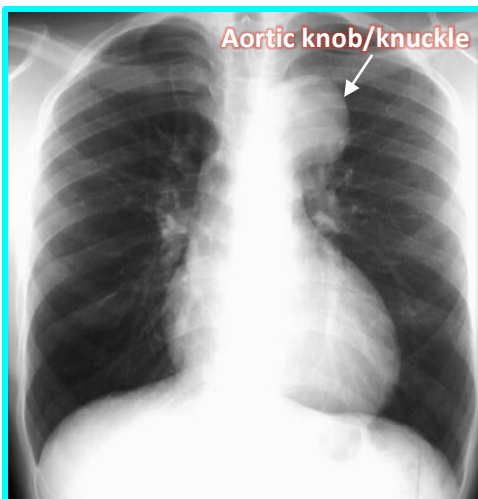


## Cardiac valves:

Not seen normally but sometimes we need to know which valve is **calcified** or **replaced**. There for, we will draw a line between left **hilum** and the **right cardiophrenic angle**. Anything above the line relates to **aortic valve**, below → **mitral valve**. This is for PA view, for lateral view we draw from the hilum (we can see which is left which is right) to the cardiophrenic angle.

**This picture is included in the slides but the Dr. skipped it**

### Example for Aortic aneurysm

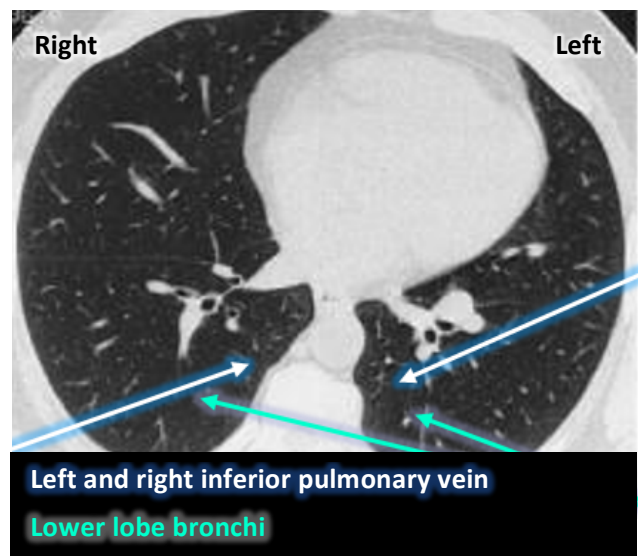


Below the line: mitral valve replacement. **Green arrow:** left lower lobe collapse

(White arrows: Valve replacement operation requires opening of the chest by breaking the sternum and then suture it again. this is a suture of the sternum done for the patient by using a silk; because it is a hard bone)

## 5) High Resolution CT

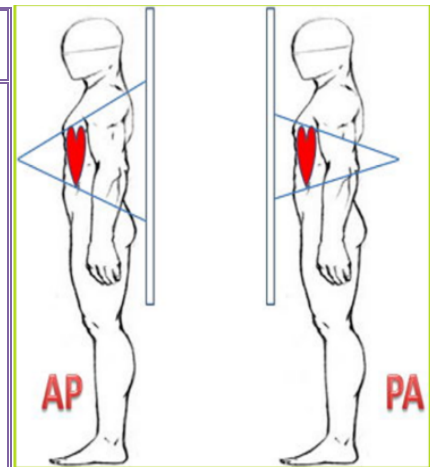
- HRCT uses very thin slices (1mm) to achieve better spatial resolution & precision.
- HRCT is indicated **after normal CXR** in a symptomatic patient - the setting of high clinical suspicion of disease.
- Advantages:
  - High sensitivity for **adenopathy, infiltrates, and architectural distortion**.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



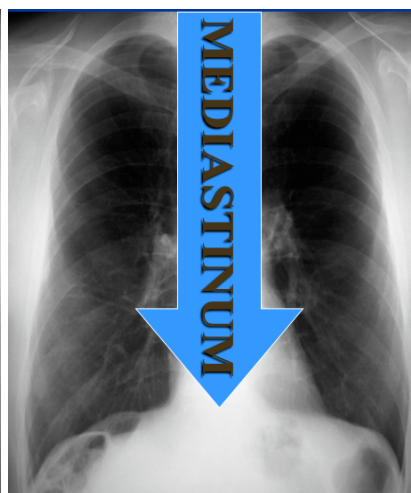
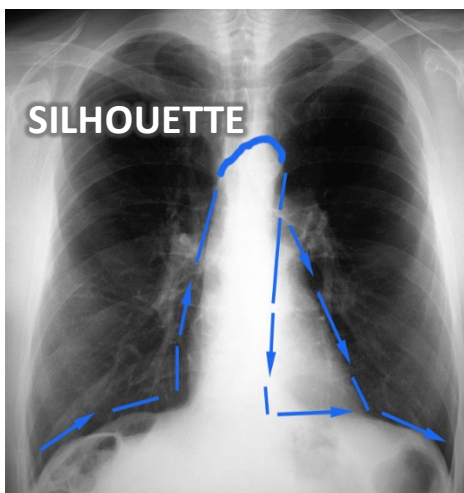


**A comparison between PA and AP view:**

PA View	AP View
<ul style="list-style-type: none"> <li>§ Heart outline is well defined and normal sized.</li> <li>§ Costo-phrenic angle is visible and clear.</li> <li>§ Ribs and clavicle are clearer.</li> <li>§ Patient can take full inspiration because gravity pull bowel down as the patient standing (allowing us to see more of the lung field)</li> </ul>	<ul style="list-style-type: none"> <li>False enlargement of the heart.</li> <li>§ Costo-phrenic angle is not clear.</li> <li>§ Ribs and clavicles are not as clear as PA</li> <li>§ Patient is usually bed ridden so he can't take full inspiration because bowel can't retract down by the gravity as the supine position (that will shorten the lung field)</li> </ul>



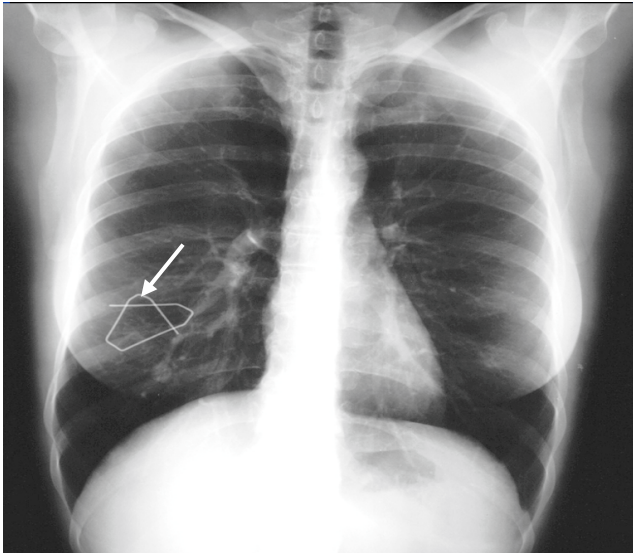
**How to read frontal X-ray**



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: Lung Field - Hilum Shadow - Heart - Cardiac silhouette.

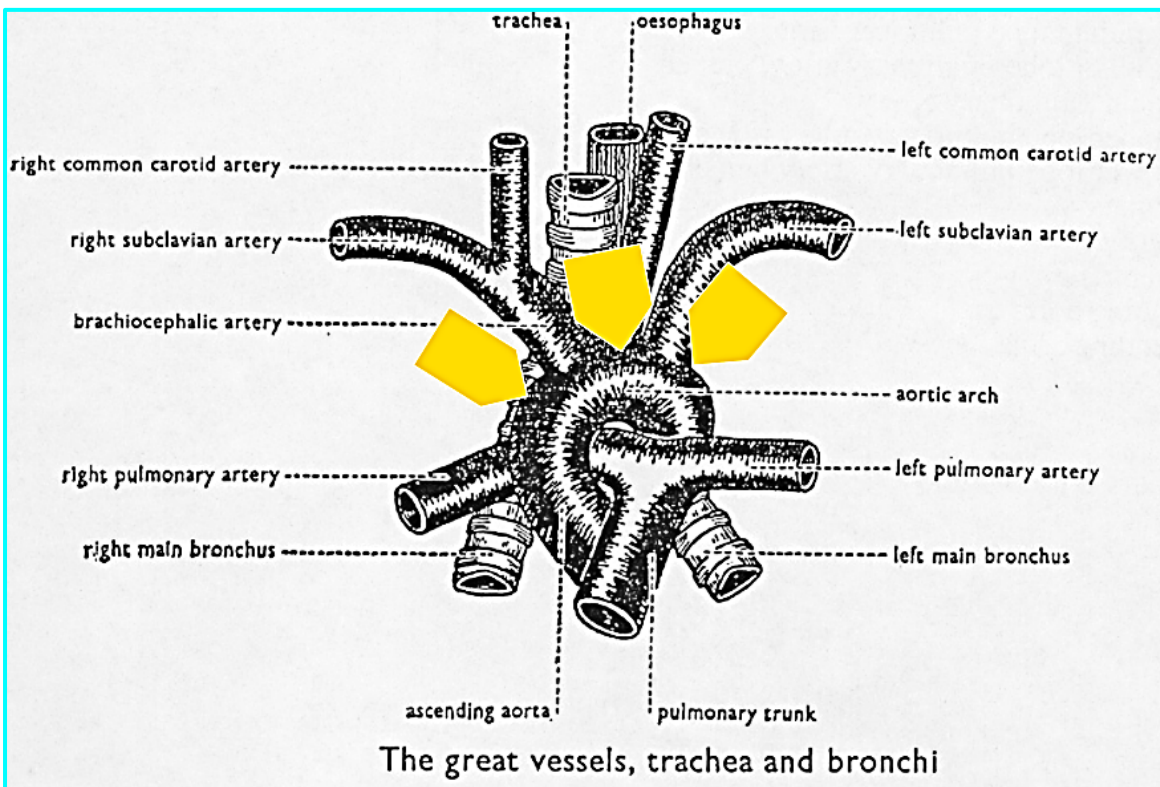
**Extra pictures:**

To avoid mistaken the nipple as nodule (or the opposite) in CXR, radiologist will put a paper clip on the nipple of the patient so it will appear like this

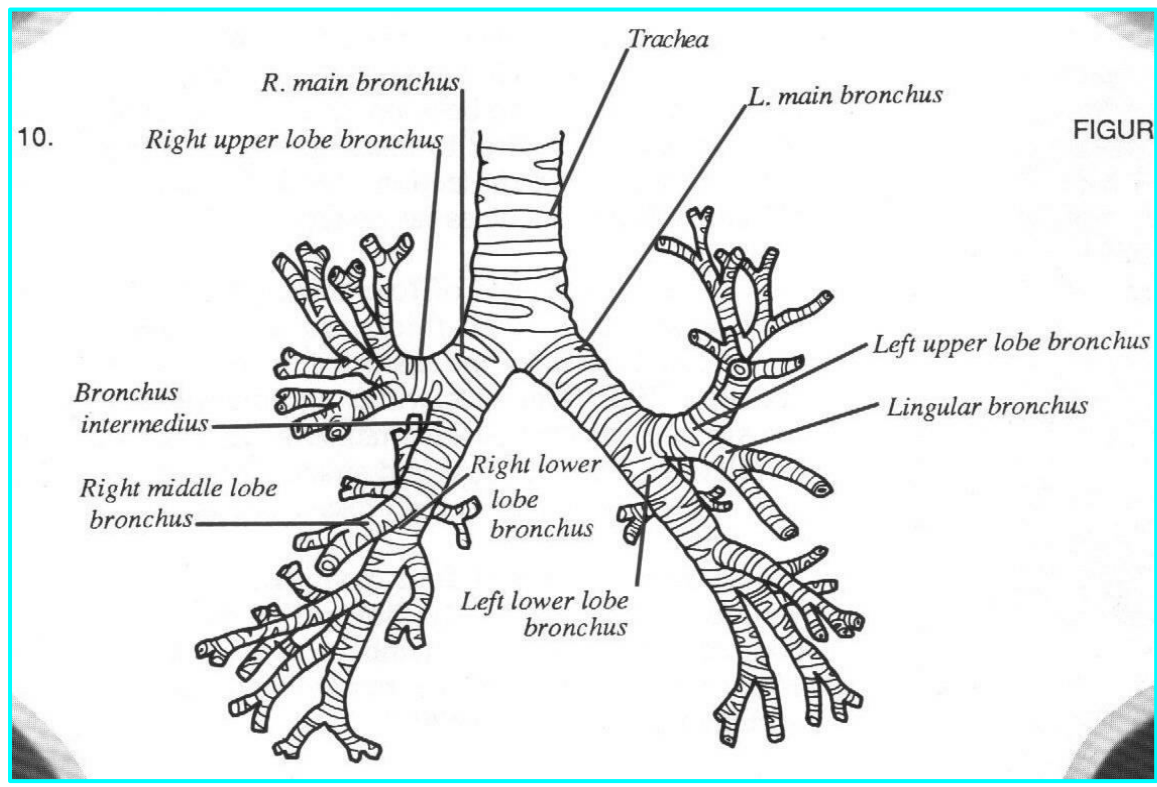


The nipple should appear inside the paper clip (white arrow) but this one is not. Therefore, it is a nodule. (Some might say having one nipple in one side can be an indicator, as long as we cannot see the other one it should be a nodule. This is NOT right because the possibility to see patients CXR with one nipple only = 30-40%)

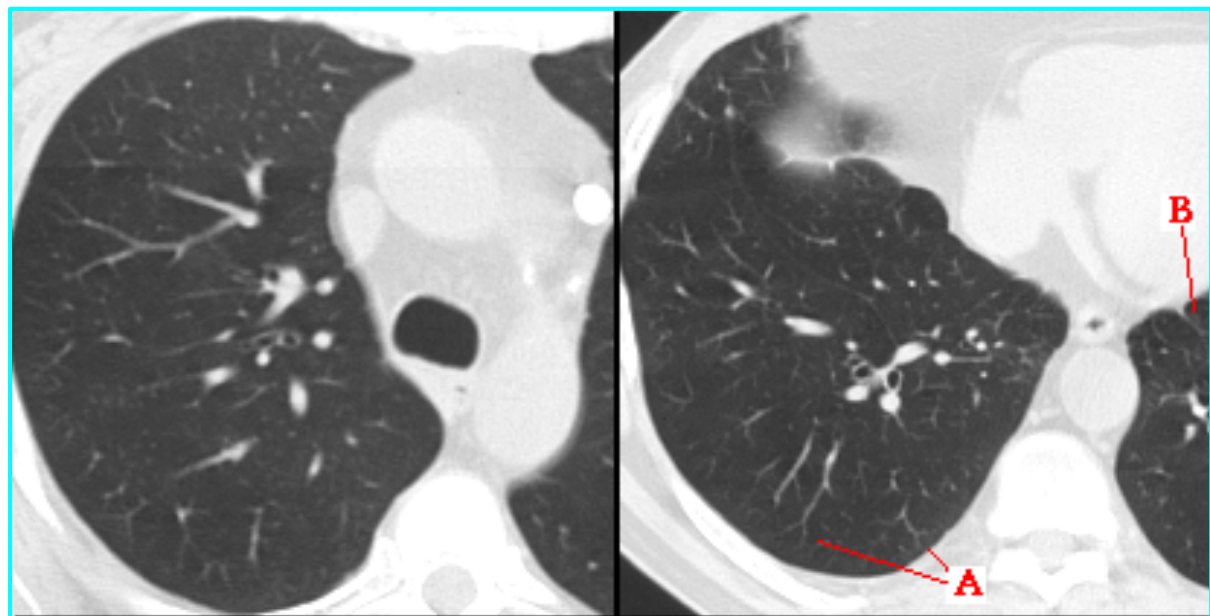
**Anatomy of great vessels (dr. skipped this one)**



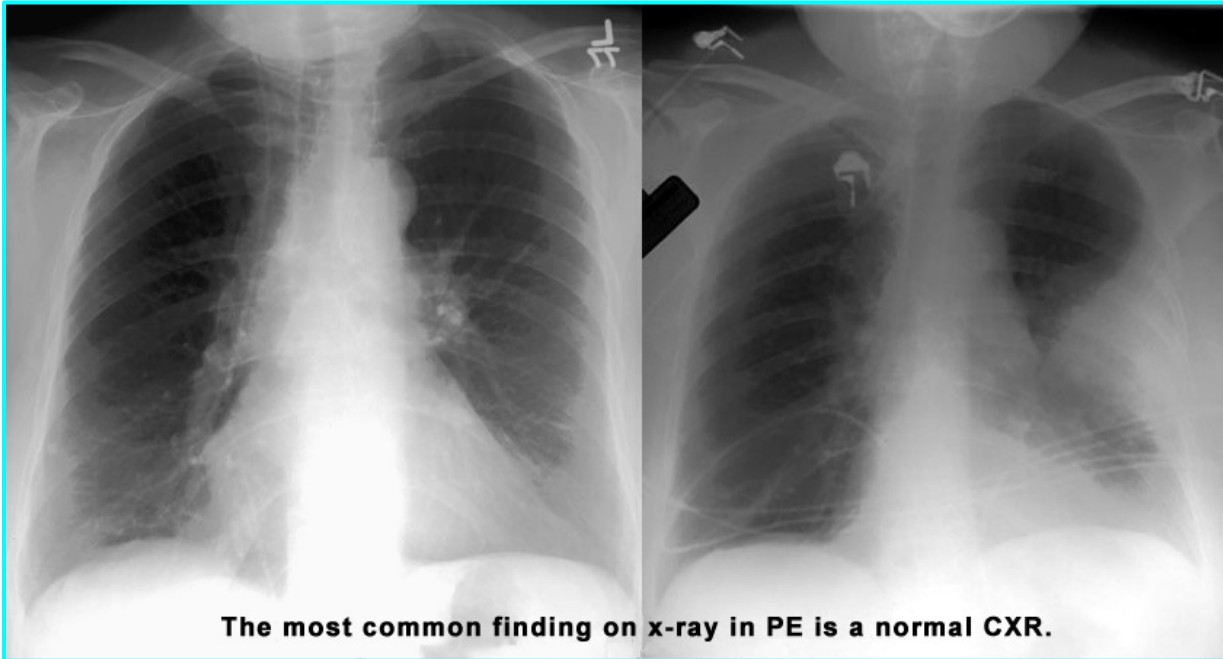
Anatomy of the lungs (dr. skipped this one)



Normal lung CT at the level of inferior pulmonary veins (dr. skipped this one)



**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.**

**Pulmonary embolism (Dr. skipped this pic saying that he's going to cover in next lecture)**

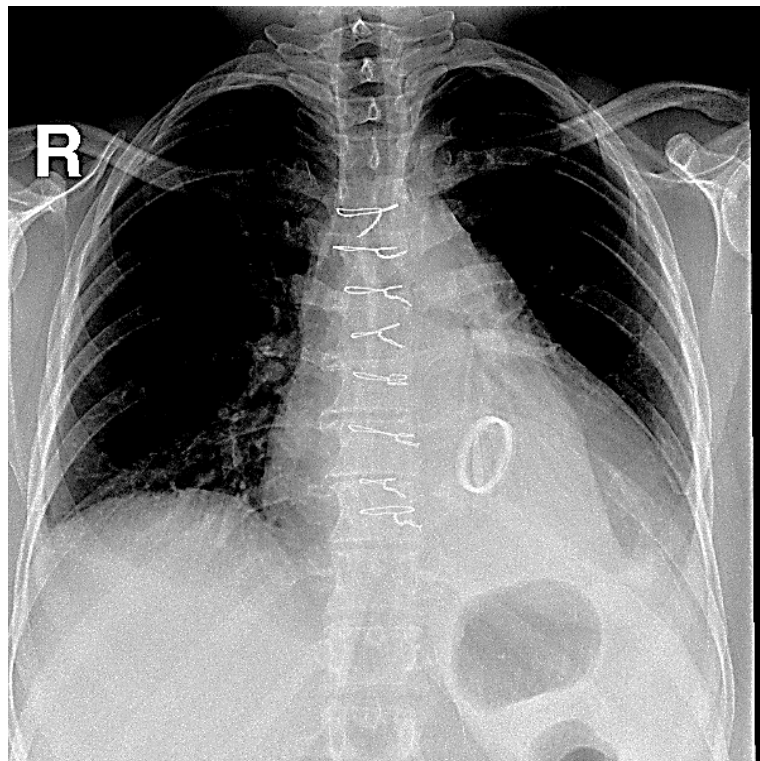
### SUMMARY

1. **Chest X-Ray views:** PA (standard), lateral and AP.
2. **Technical factors to be considered in X-Ray:**
  - Full inspiration by the patient (you may check it by counting the ribs (10 = full inspiration) it helps radiologists to see as large as they can.
  - Rotation: might give false manifestations. Radiologists can tell if patient was rotated or not by checking the distance between clavicular heads and spinous process, (it should be approximately equal).
3. **Abnormalities:**
  - Fissures: loss of consolidation + shifted fissure → collapse / loss of consolidation only for a **complete lobe** → pneumonia.
  - Valves: drawing a line between left hilum and right cardiophrenic angle helps indicating which valve is calcified or replaced (above: aortic / below: mitral)
4. **HRCT:** after normal CXR in case of confirming a disease. High sensitive for adenopathy, infiltrates, and architectural distortion.



## Question

1) This is a chest x-ray of a 23 years old patient showing which ONE of the following:



- a. Mitral valve replacement.
- b. Aortic valve replacement.
- c. Mitral and aortic valve replacement.
- d. Spine operation with correction of scoliosis
- e. Cardiac pacemaker.

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**Answers:**

**1st Questions: A**