



431

Radiology Team

◆ Leader: Lama AlShwairikh

◆ Sub-leader: Abdulaziz Almutair

Lecture 3: Radiologic Investigation of Chest and CVS diseases



Done By: Bayan Altassan

Revised By: Lama AlShwairikh & Abdulaziz Almutair

◆ Important ◆ Doctor's notes ◆ Team's notes

We thank 430 Team for their helpful notes

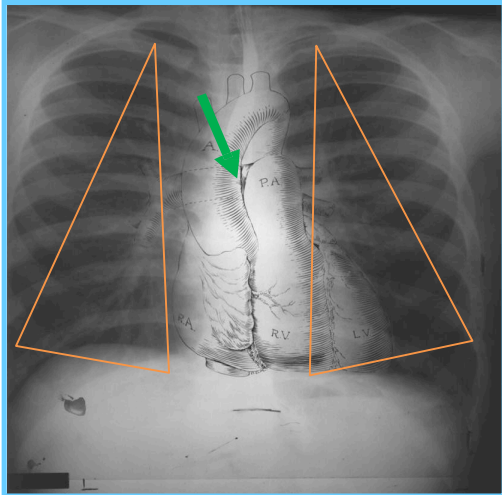
From
Slides

Extra
Images

Best of luck!



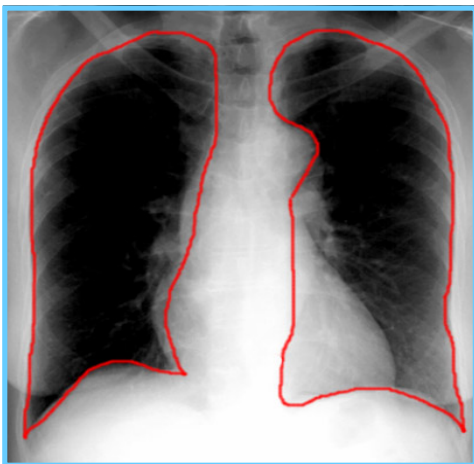
❖ What do we mean by Chest?



The study of thoracic cage contents:
(including ribs, lungs, Mediastinal
structures, great vessels and heart)

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

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.



The red lines are the outlines of the lungs,
also the pleural surface of the lung, we
usually don't see the pleura but we assume
the location of it, which is the wrapping part
of the lungs.

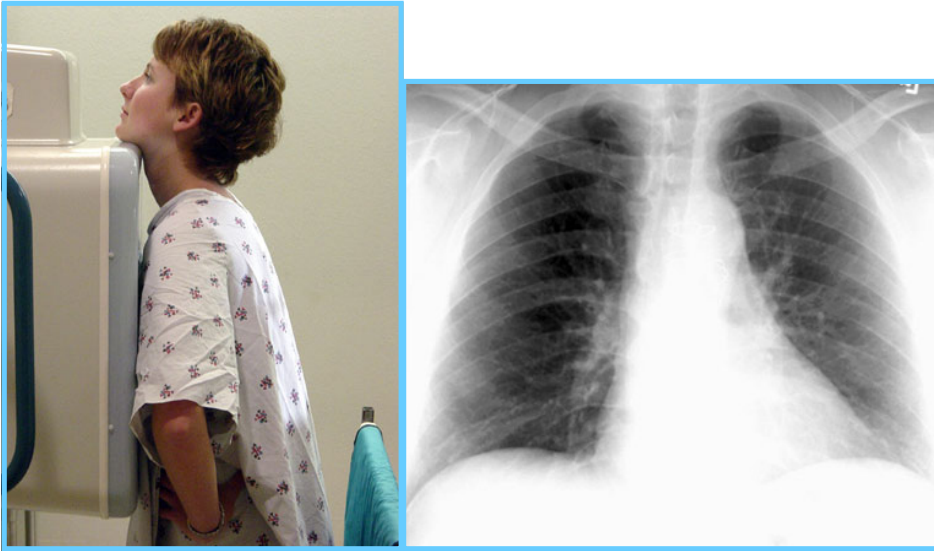
❖ Basic Chest Exams:

- Plain Film (Chest X-Ray=CXR): (It is the Gold standard nowadays) (It can detect pneumonia, TB and Bronchiectasis)
- Computed Tomography (CT)
 1. CT Lungs and Mediastinum
 2. CT-Angiography (CTA) (Example; acute pulmonary embolism)
 3. High Resolution CT of the Chest (HRCT). (Example; finding diffused lung disease in the CXR, we need HRCT)
- Angiography (Obsolete) (Nowadays we don't do Angiography except in very narrow indications)
- MRI.

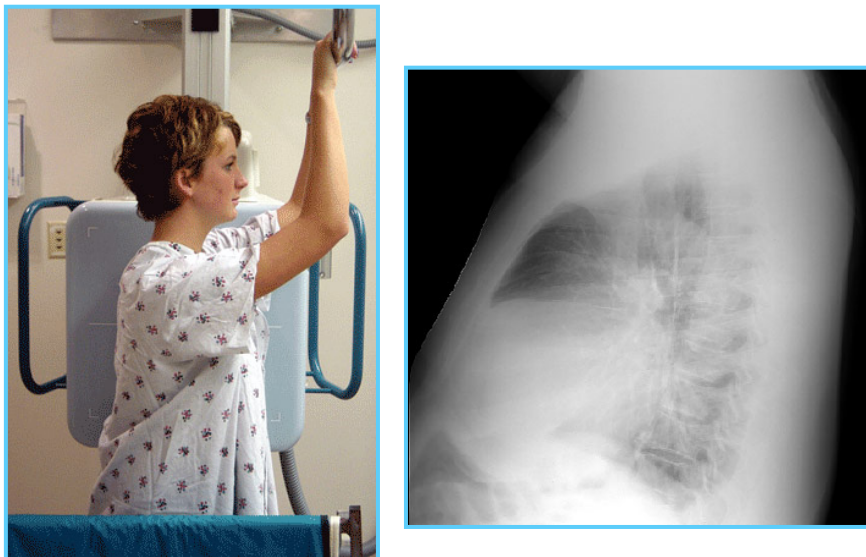
❖ Chest X-Ray:

1- PA View: Postero-anterior view in an erect position.

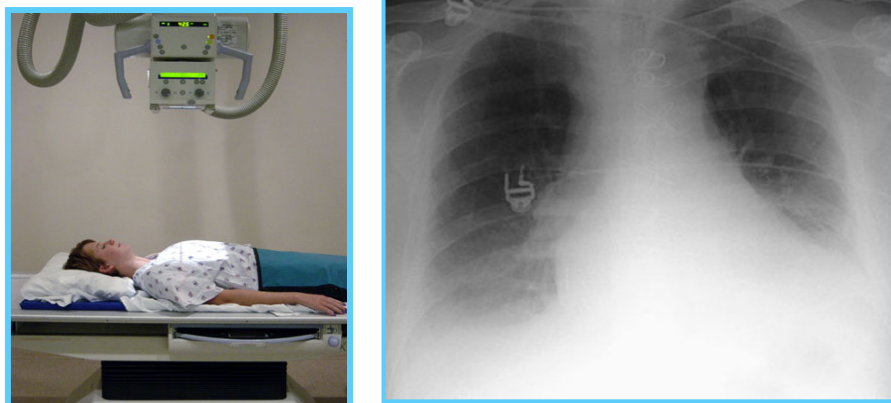
The patient standing and facing the detectors. The x-ray will be coming from the back > hence posterior anterior



2- Lateral View: The lateral view is also done in an erect position (The patient stands with both arms raised and the left side of the chest pressed against a flat surface.)



3- AP View: We usually do an AP (Antero-posterior) view in a supine position. *It is mostly used when the patient is bedridden (ICU, Comma) or severely ill*

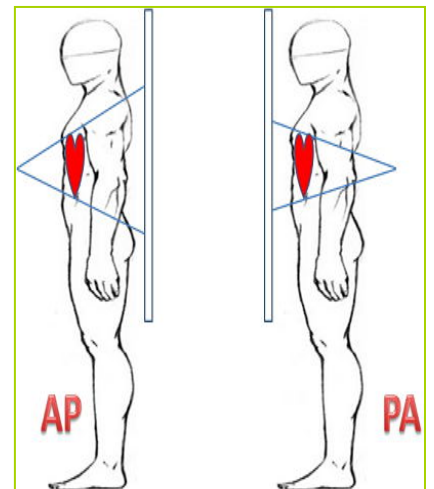
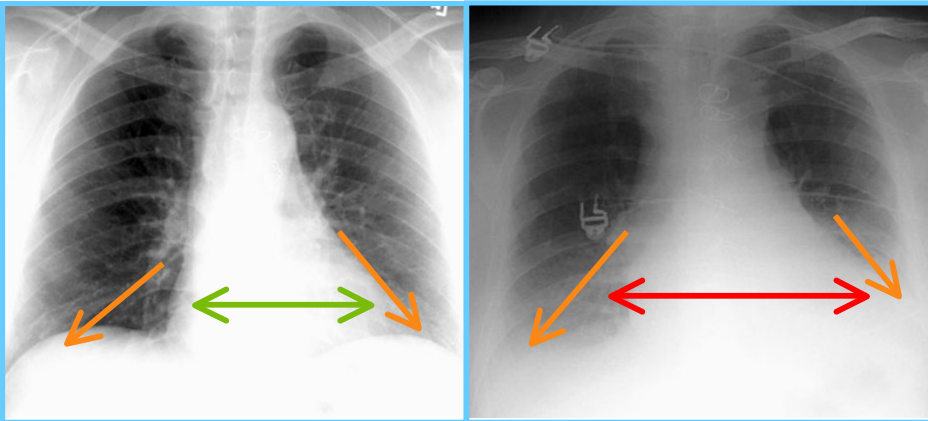


- We use the AP view if the patient came to the ER and he can't stand up or he is comatose.
- We don't use it unless necessary because the effect of the gravity is lost here. The gravity helps the diaphragm to move down, giving us more chest space to be visualized. (If the patient is lying down, the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

REMEMBER

- Why is PA is 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. (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, 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.)
- Why is it erect in both the PA and Lateral views? The bowel loops will go downwards due to gravity and it will pull the diaphragmatic cupola with it, so it will give more chest space to visualize. "The patient will be asked to inhale deeply and hold it"
- Full inspiration not expiration? Because in expiration, the lungs bases appear hazy and the heart shadow increase

❖ PA view VERSUS AP view:



PA View

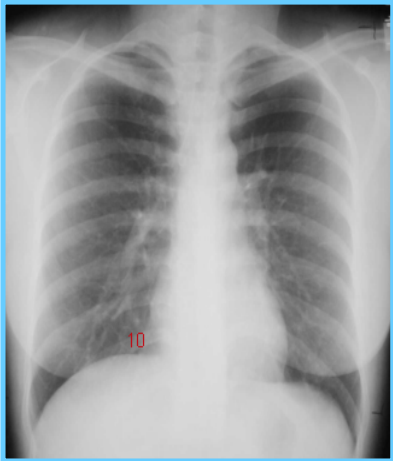
- Heart outline is well defined and normal sized.
- Costo-phrenic angle is visible and clear.
- Ribs and clavicle are clearer.
- Patient can take full inspiration because gravity pull bowel down as the patient standing (allowing us to see more of the lung field)

AP View

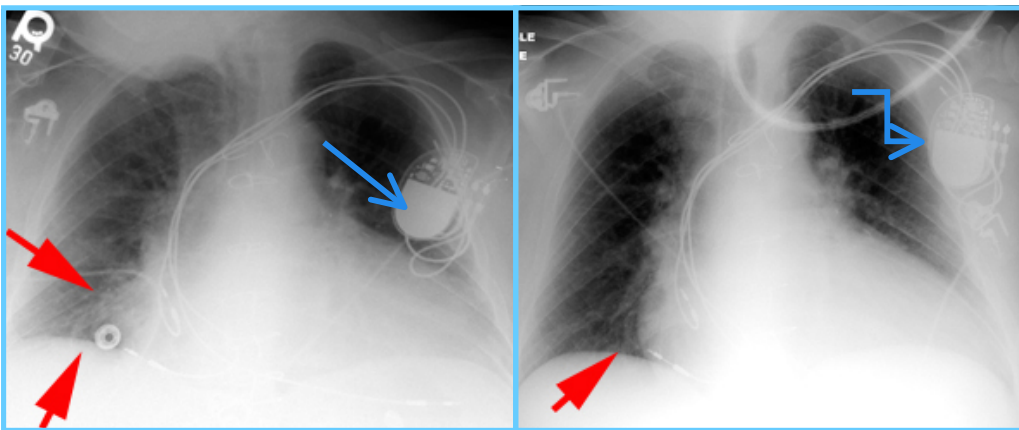
- False enlargement of the heart.
- Costo-phrenic angle is not clear.
- Ribs and clavicles are not as clear as PA
- Patient is usually bed ridden so he can't take full inspiration because bowel can't retract down by the gravity as the supine position (that will shorten the lung field)

❖ Technical Factors:

- Depth of inspiration.
- Visualization of pathology depends on contrast provided by air in the lungs.
- **Count ribs.** (We need to make sure that the diaphragmatic cupola reaches the 10th rib or maybe 9th so we count the ribs until we reach the 10th with the diaphragmatic cupola to determine that it was don't on full inspiration.)



❖ Hypo-inspiratory versus inspiratory:



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:

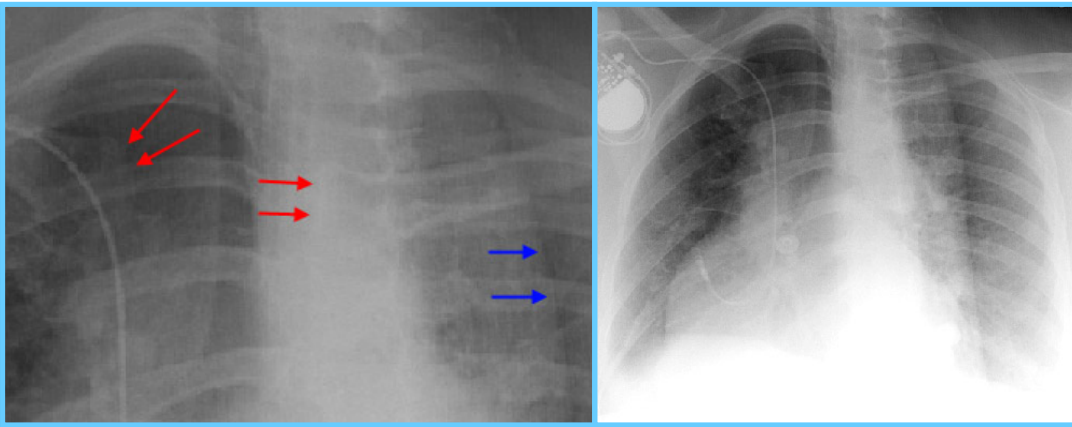
- Normal size of the heart
- Costo-phrenic angle is clear.
- Pacemaker.
- Normal chest X-ray.

❖ Inspiration:

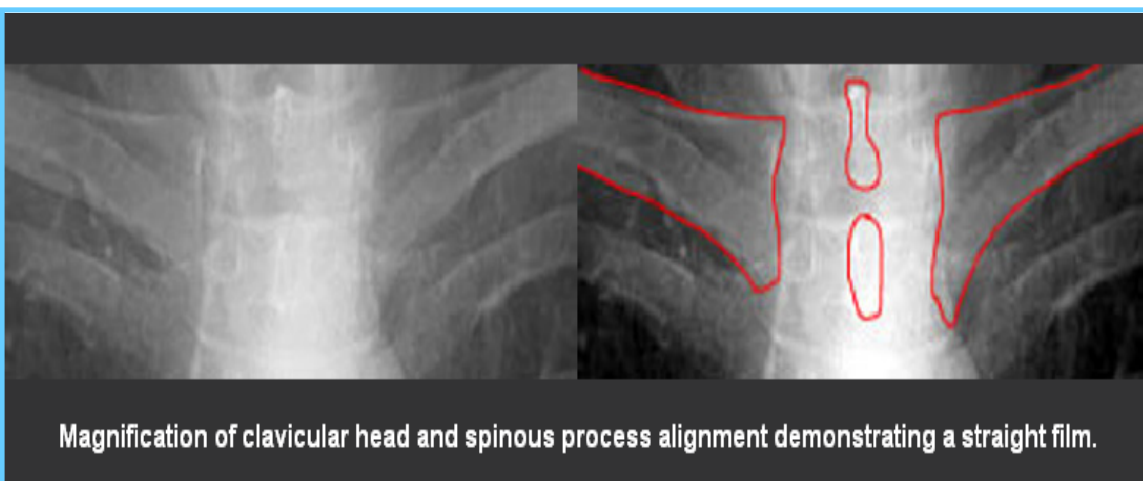
- This greatly helps the radiologist to determine if there are **intrapulmonary abnormalities**.
- The diaphragm should be found at about the level of the **8th - 10th posterior rib** or **5th - 6th anterior rib** on **good inspiration**.

❖ 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.



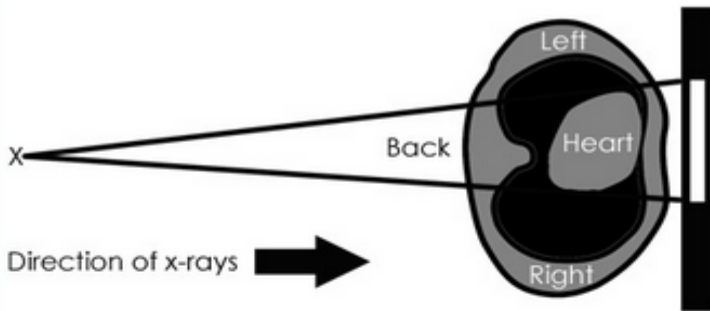
In this rotated film skin folds can be mistaken for a tension pneumothorax (blue arrows). Notice the skewed positioning of the heads of the clavicles (red arrows) and the spinous processes.



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

How to determine that it's not rotated? We use the reference points, which are the medial aspects of the clavicles and measure them with the midline, which is the spinous processes.

Well centred patient

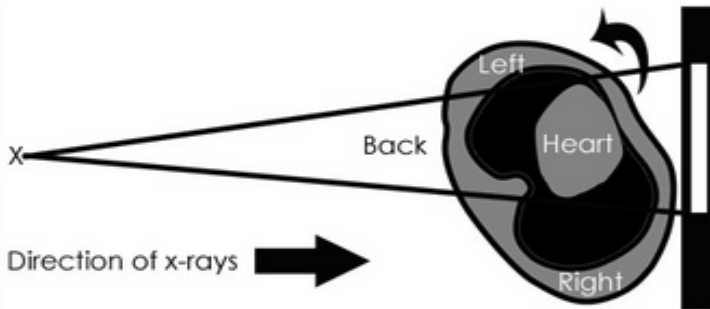


Click image to align with the top of the page

Well centred patient

- An accurate assessment can be made

Rotated patient - Left

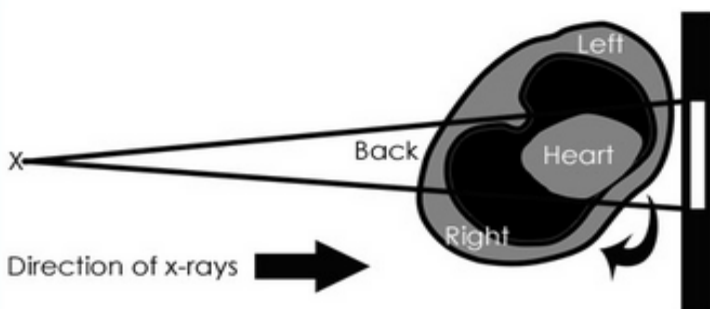


Click image to align with the top of the page

Rotated patient - Left

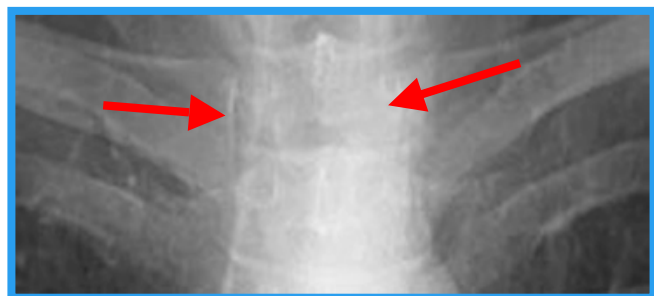
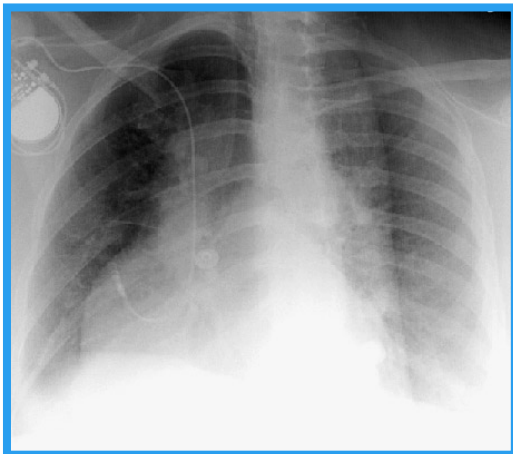
- Heart size is exaggerated

Rotated patient - Right



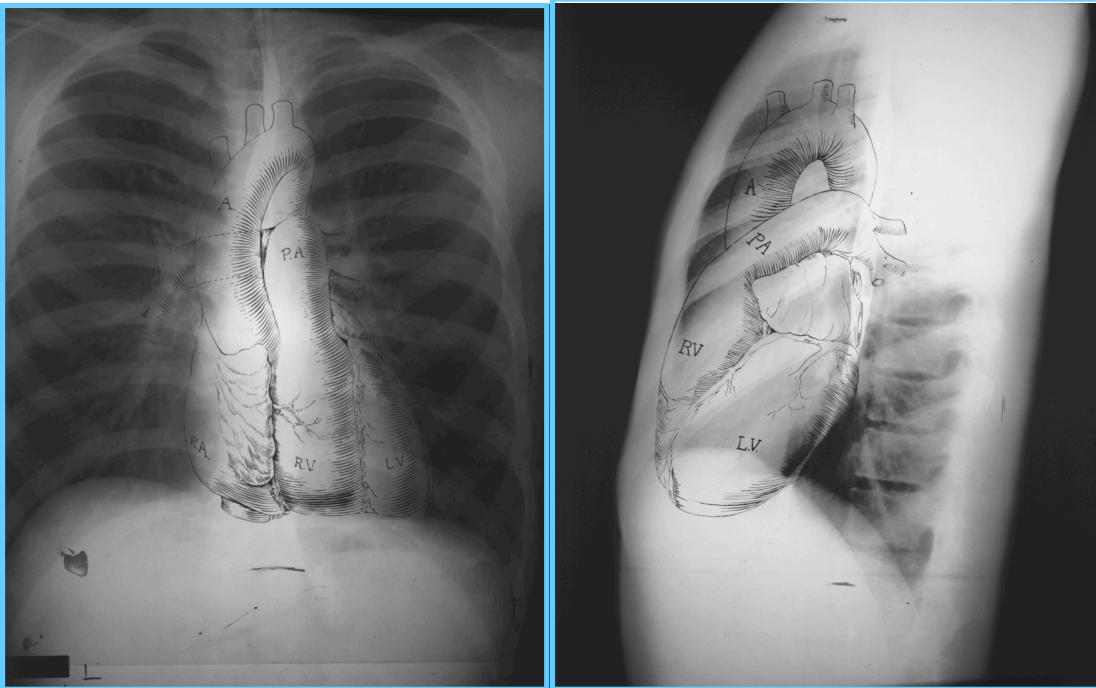
Rotated patient - Right

- The true size of the heart may be underestimated



Rotation

❖ Anatomy on Normal Chest X-Ray:



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

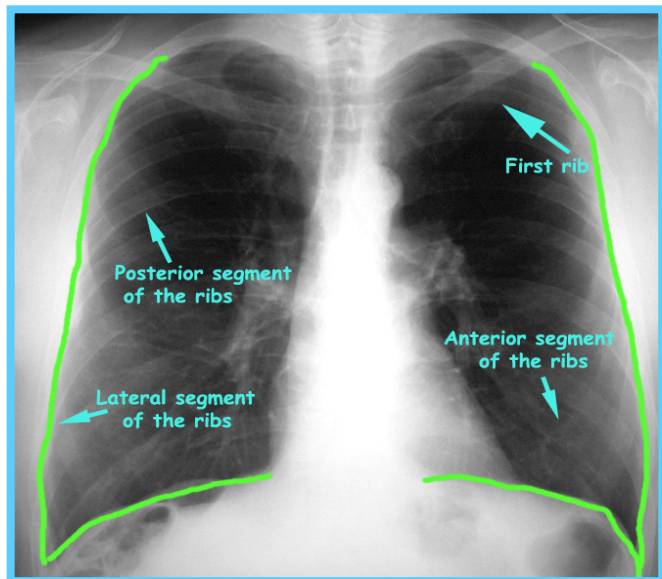
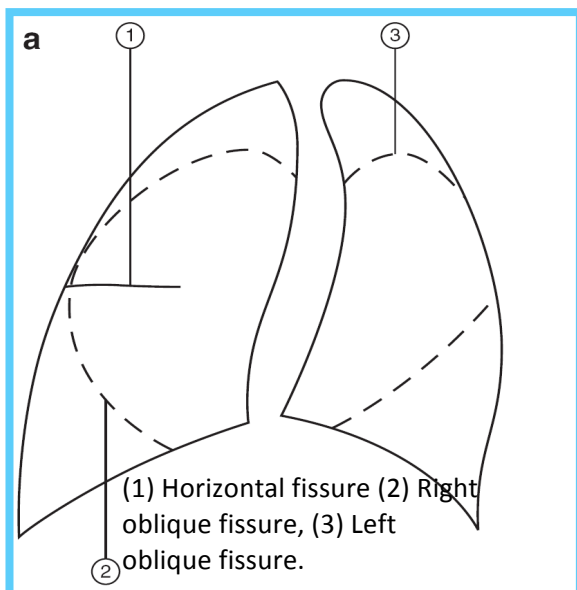
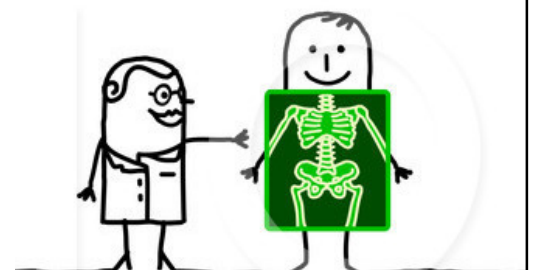
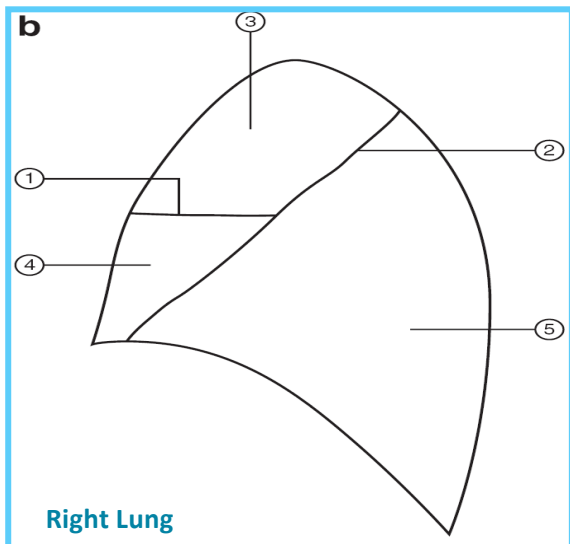
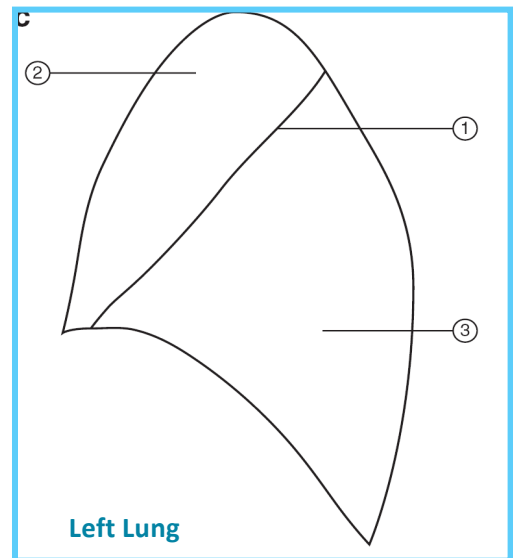


Diagram of lungs showing the lobes. The right lung has three lobes, upper, middle and lower. The oblique and horizontal fissures separate these. The left lung has two lobes, upper and lower separated by the oblique fissure.

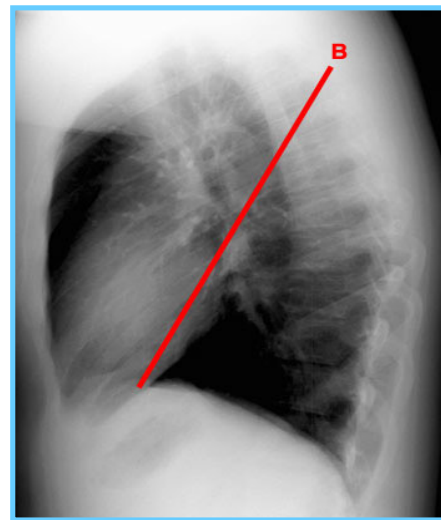
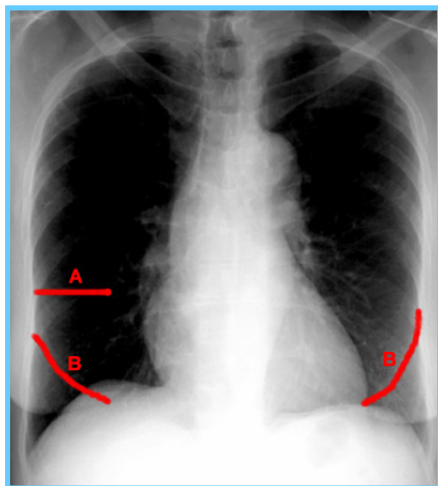




- (1) Horizontal fissure
- (2) Right oblique fissure
- (3) Right upper lobe
- (4) Right middle lobe
- (5) Right lower lobe

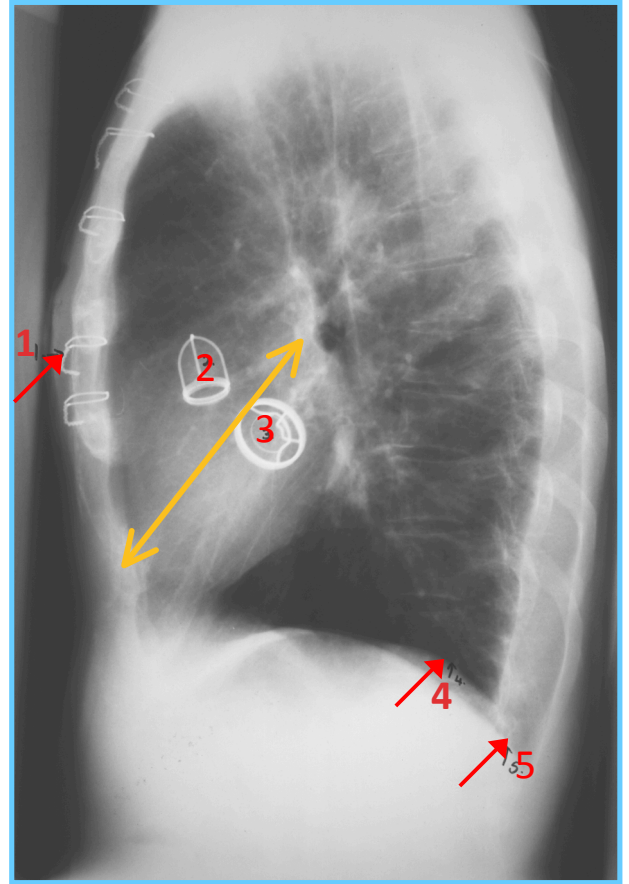
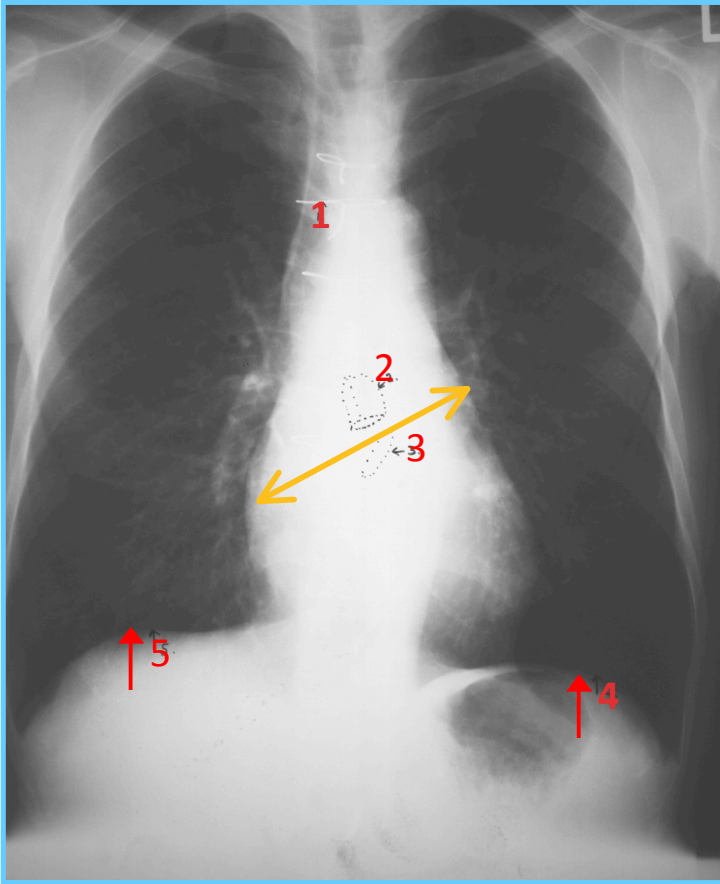


- (1) Left oblique fissure
- (2) Left upper lobe
- (3) Left lower lobe



- 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

❖ Cardiac Valves:

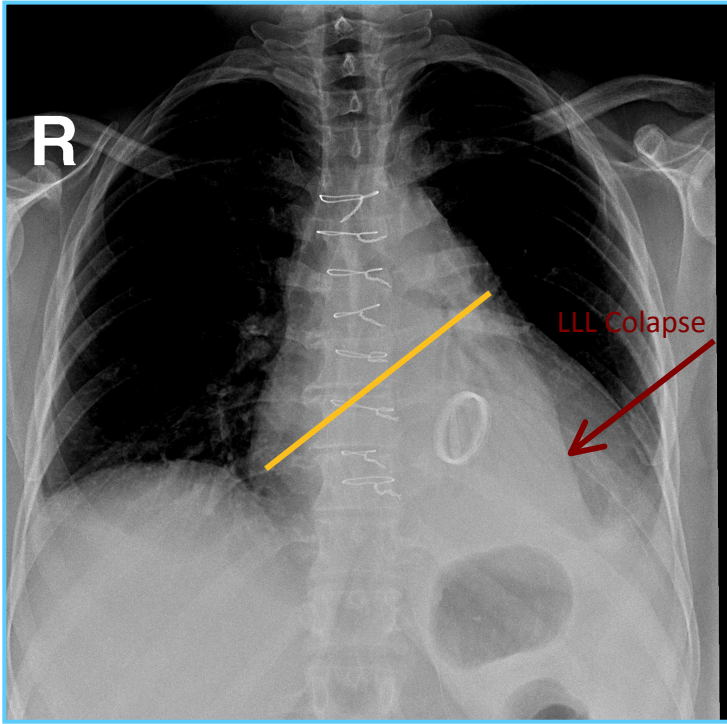


❖ Locations of the valves on the CXR:

- **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.
- **Lateral View:** Draw an imaginary line from the cardiophrenic angle to the hilum, above is the Aortic and below is the Mitral valve.

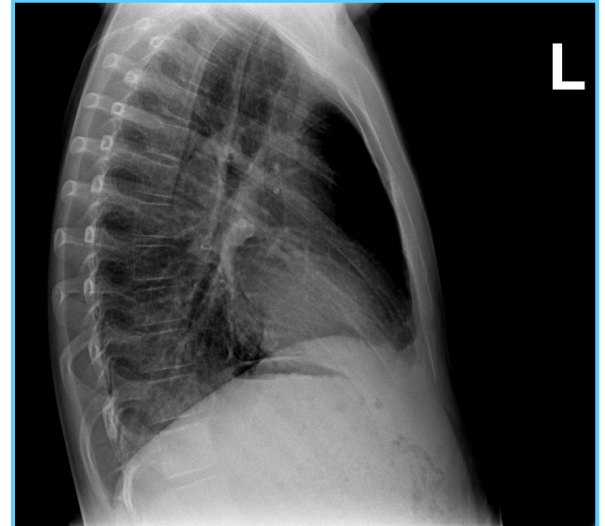
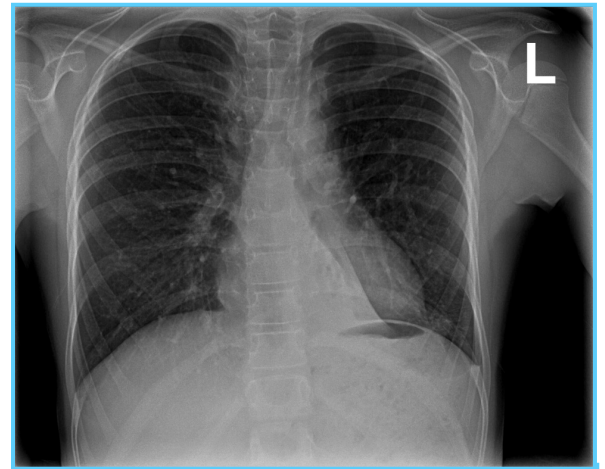
1. Suture material used for repair of vertical incision thru sternum (median sternotomy)
2. Aortic valve prosthesis
3. Mitral valve prosthesis
4. Left hemidiaphragm
5. Right hemidiaphragm

- 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)

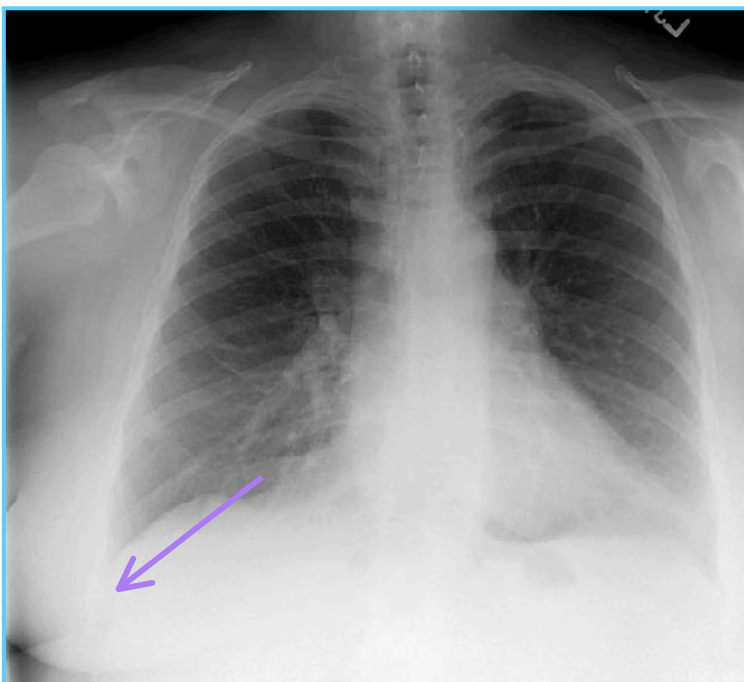


Mitral Valve Replacement

Common



LLL Colapse



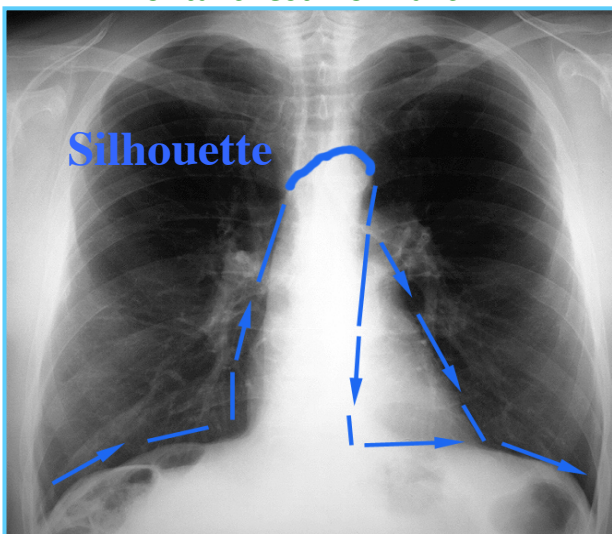
Breast Shadow

(A woman who has undergone mastectomy came to follow up "looking for metastasis")

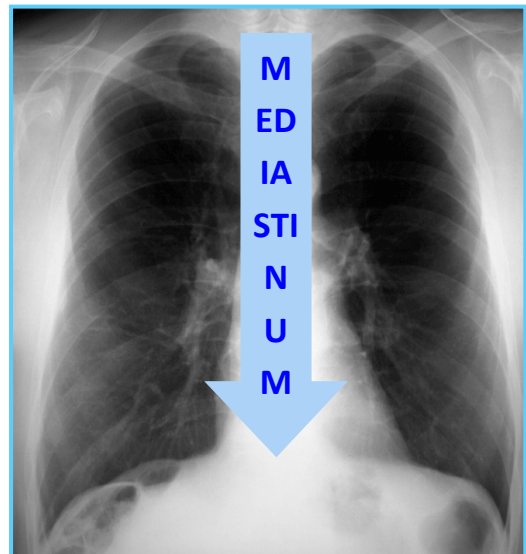
❖ How to Read a Frontal CXR:

- 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

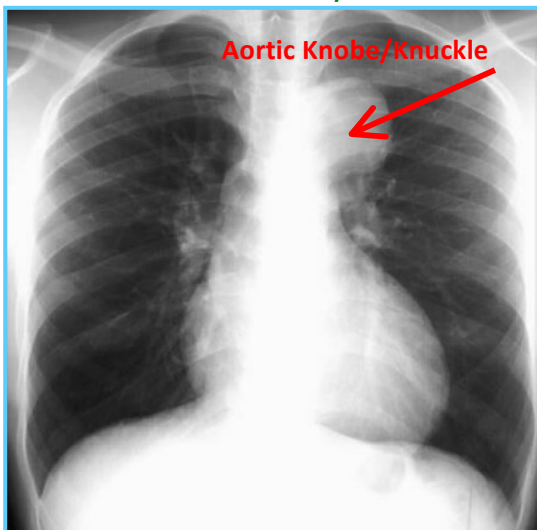
Frontal chest-Normal cxr



Frontal chest-Normal cxr

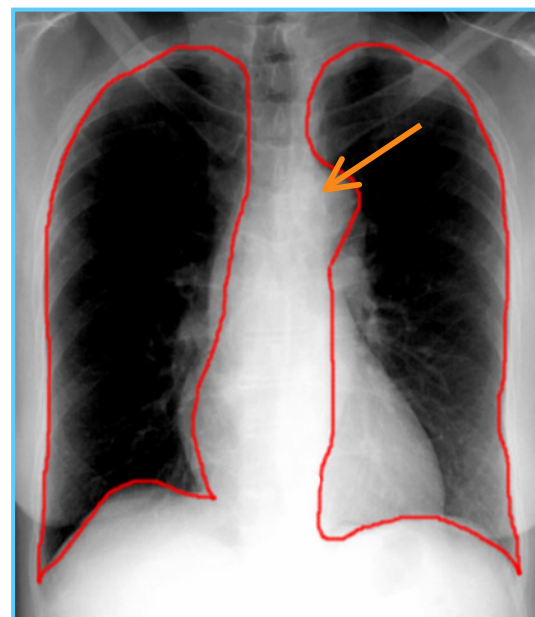


Aortic aneurysm



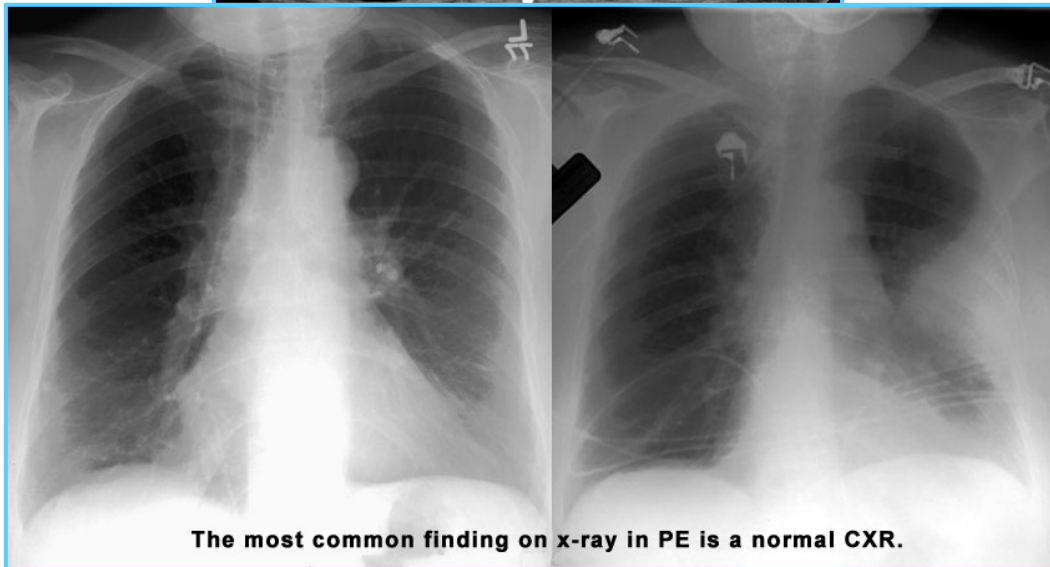
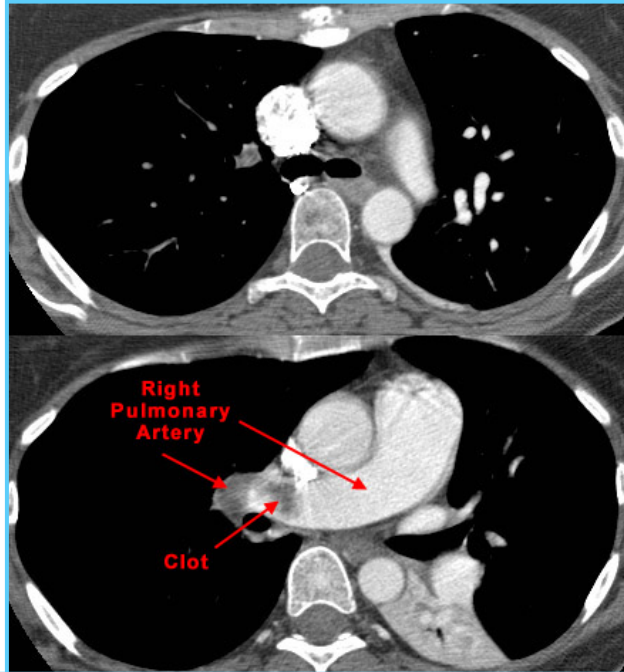
However, in this CXR the aortic knuckle is abnormal, it is bulging (5-fingers) and prominent, most likely an aortic aneurysm.

Normal cxr

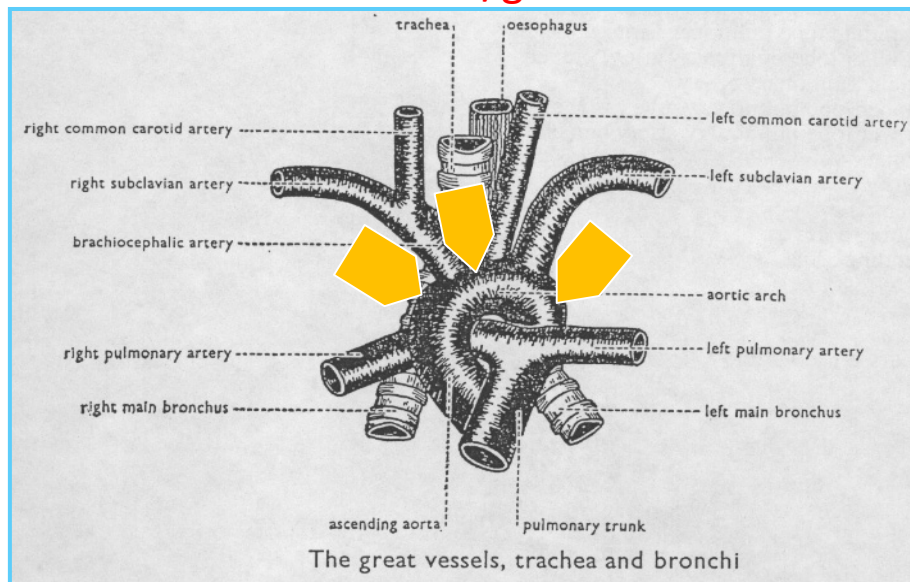


This is a normal CXR, the orange arrow points at the Aortic Arch/Knuckle, it is slightly bulging.

Pulmonary Embolism



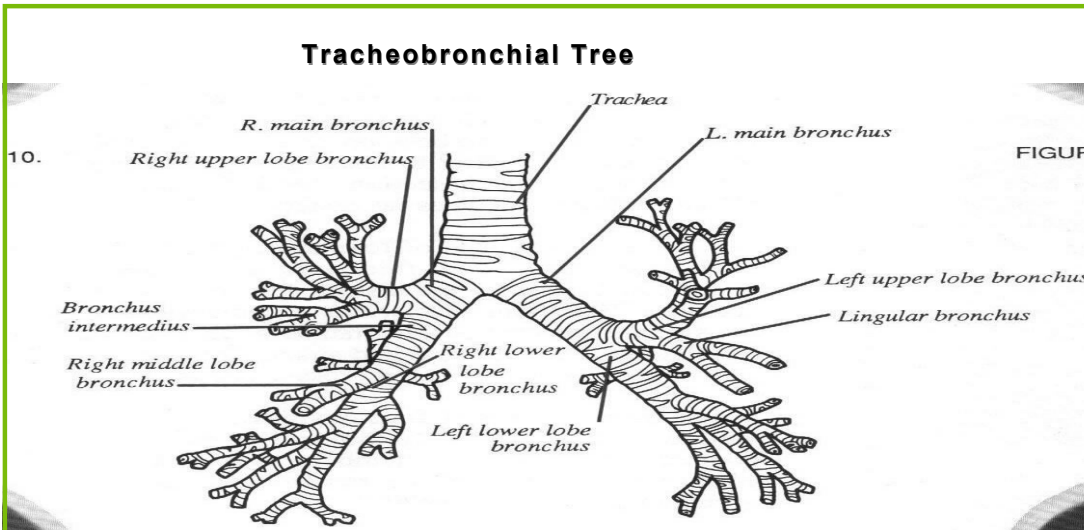
The aortic arch/great vessels



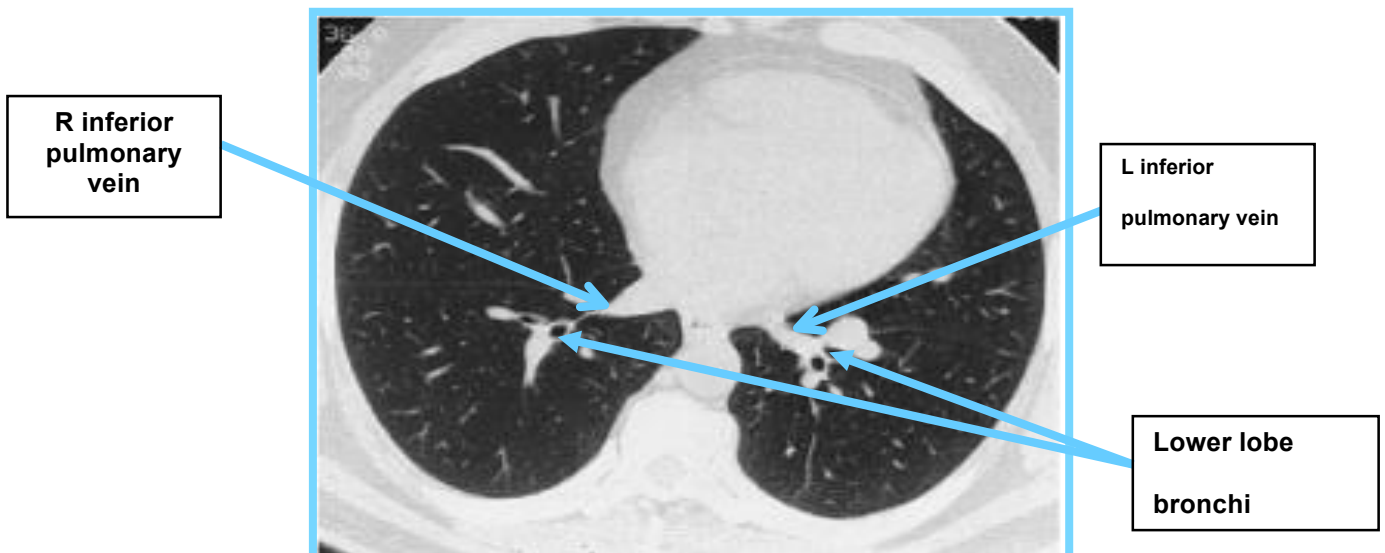
❖ High Resolution CT Scan:

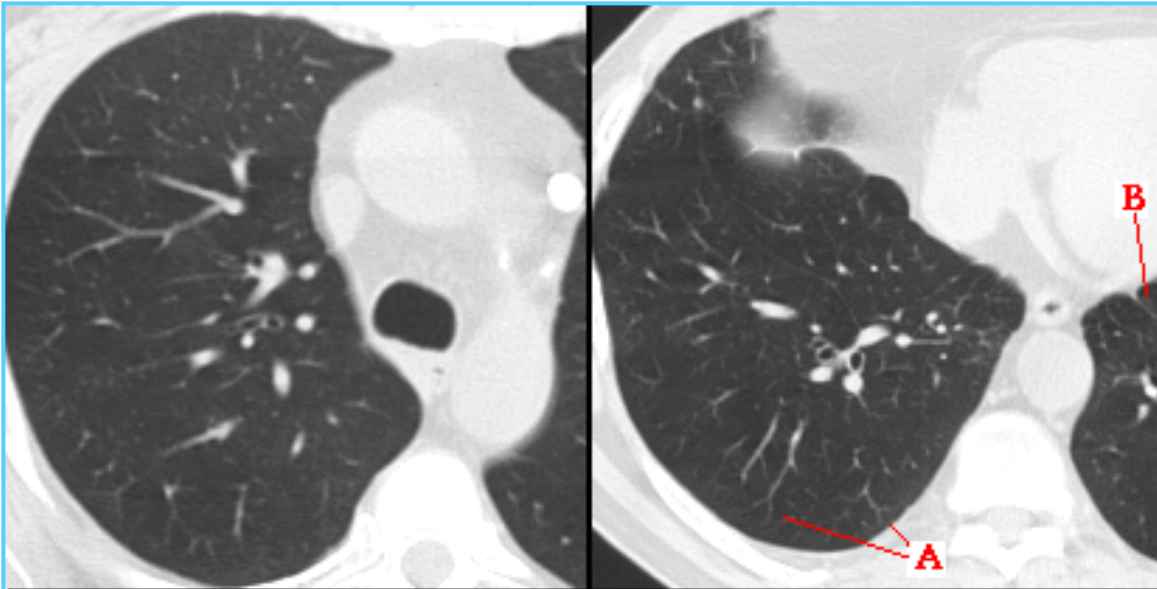
- HRCT uses very thin slices (1mm) to achieve better spatial resolution & precision.
- HRCT is indicated after normal CXR in a symptomatic patient - the setting of high clinical suspicion of disease.
- **Advantages:**
 - High sensitivity for adenopathy, infiltrates, and architectural distortion.
 - HRCT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

❖ Normal Lung Anatomy:

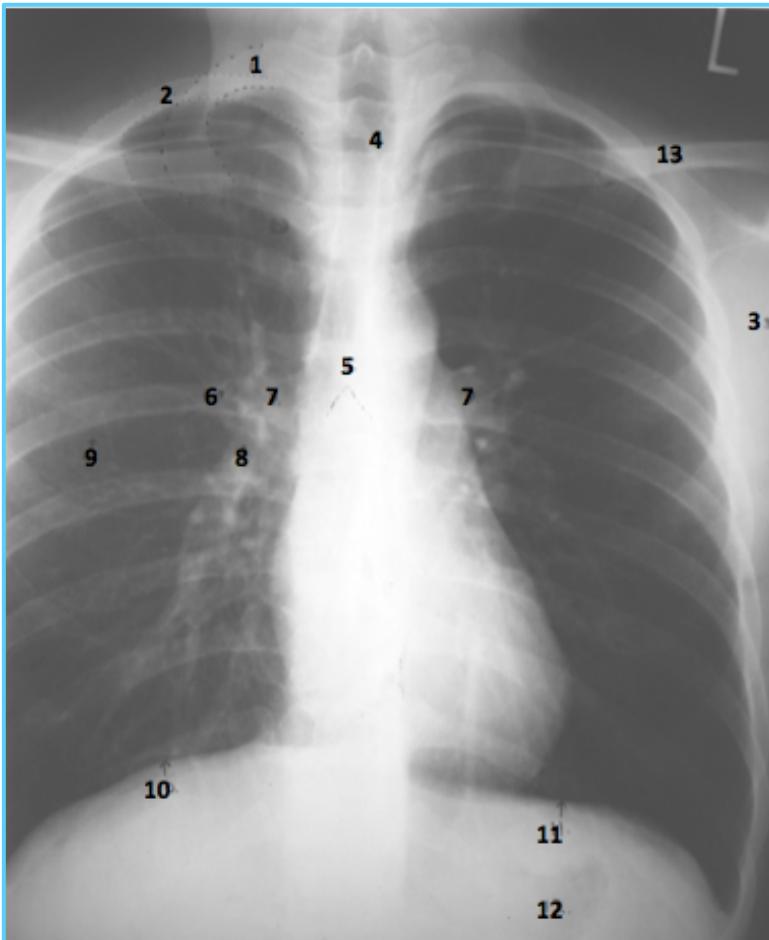


❖ Normal lung at level inferior pulmonary veins





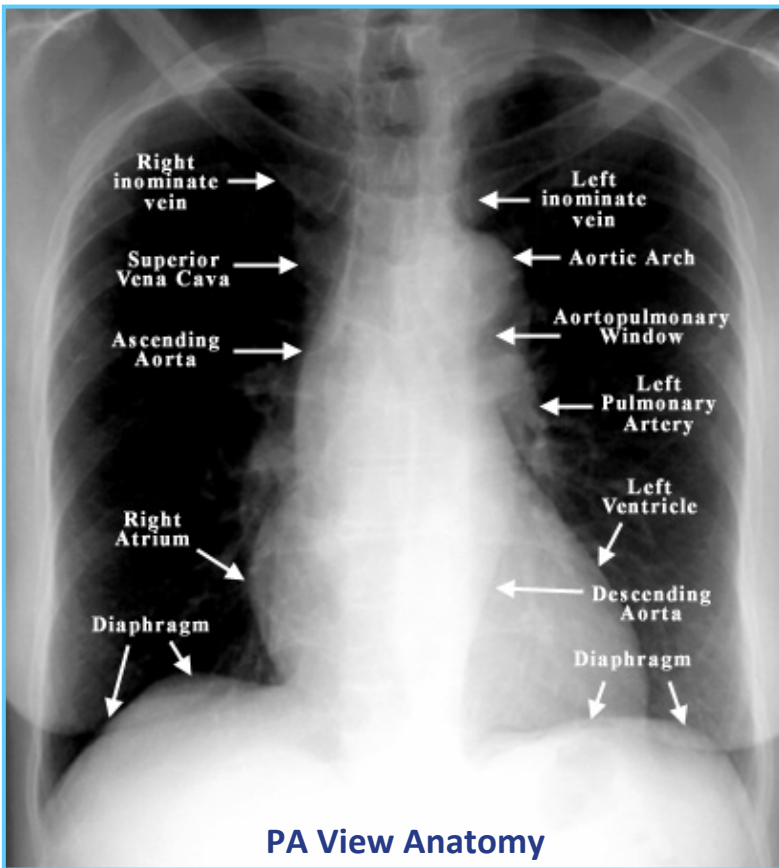
Normal upper (left) and lower (right) HRCT scans obtained in the prone position. The center of a pulmonary lobule is defined by the presence of a distal pulmonary artery (A). The faint outline of a distal interlobular septum is noted in the lower lobes (B). A subpleural clear space is normally present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



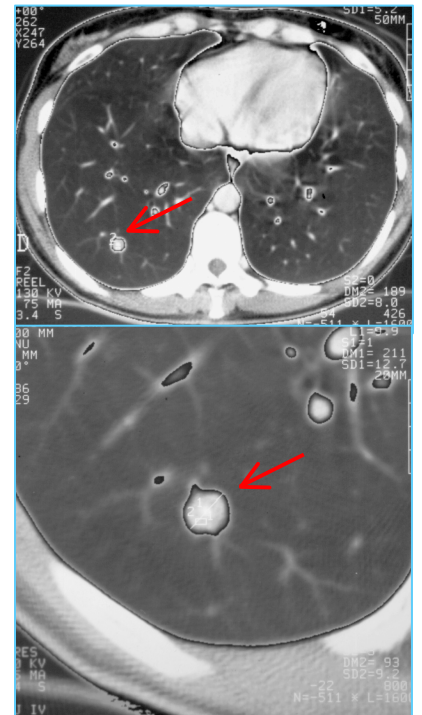
CXR-PA View:-

Key:

1. Right 1st rib
2. Right 2nd 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

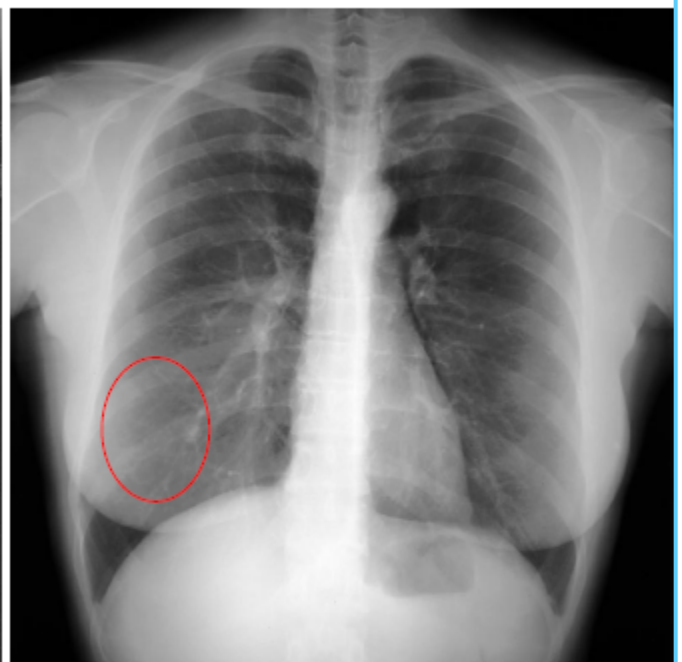
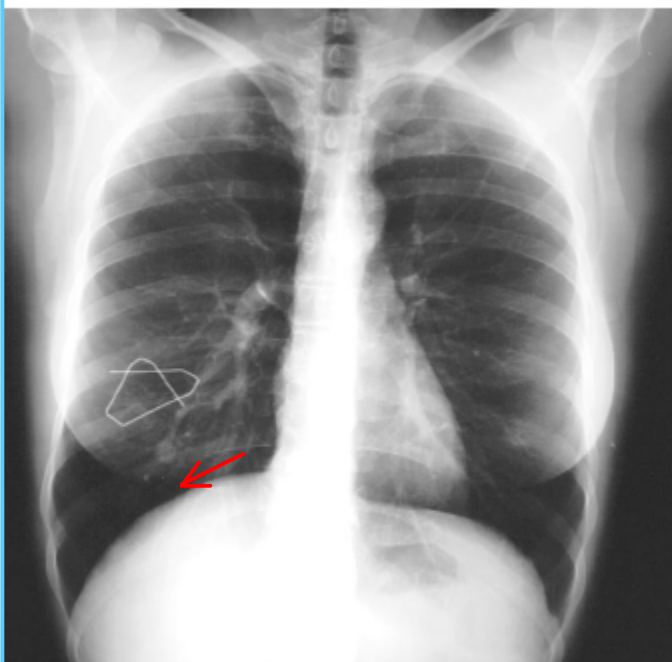


Is this a nodule or the right nipple?



❖ Frontal Chest X-Ray interactive radiology

Is this a nodule or the right nipple?



- 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.. Intra pulmonary nodule: hamatroma

Remember! It's a **chest** x-ray not a **lung** x-ray