BASICS OF CHEST X RAY

PRESENTED BY

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INTRODUCTION

- The lungs are a pair of respiratory organs situated in the thoracic cavity.
- The lungs are enveloped in a serous cavity-the pleural cavity.There are two layers of pleura- visceral and parietal layers. Visceral layer is inseparable from the lung. The parietal pleura follows the walls of the thoracic cavity.

NORMAL ANATOMY OF LUNGS

- Each lung is conical in shape.
- It has: 1) An apex at the upper end.

  2) A base resting on the diaphragm.

  3) Three borders, i.e. anterior, posterior and inferior.

  4) Two surfaces, i.e. costal and medial.

FISSURES AND LOBES OF LUNG

- Lung fissures are double fold of visceral pleura that either completely or incompletely invaginates lung parenchyma to form the lung lobes.
- Each lung has an oblique fissure separating the upper lobes from the lower lobes and the right lung has a horizontal fissure that separates the right upper lobe from the middle lobe.
- The right lung is divided into 3 lobes (upper, middle and lower)by two fissures, oblique(major) and horizontal (minor).
- The left lung is divided into two lobes by the oblique fissure.

- The oblique fissure extends from the level of the T4/ 5 vertebra postero superiorly to the hemi diaphragm antero inferiorly.

  The horizontal fissure is found in the right lung where it separates the upper and middle lobes . It runs horizontally at the level of the right 4^{th} costal cartilage from the hilum to the anterior and lateral surface of the right lung.

  The tongue-shaped projection of the left lung below the cardiac notch is called the lingula. It corresponds to the middle lobe of the right lung.

Lungs

Features-

- Apex
- Base
- Three borders-ant, post & infer
- Two surfaces- costal & medial

Medial surface – verterbral & mediastinal part

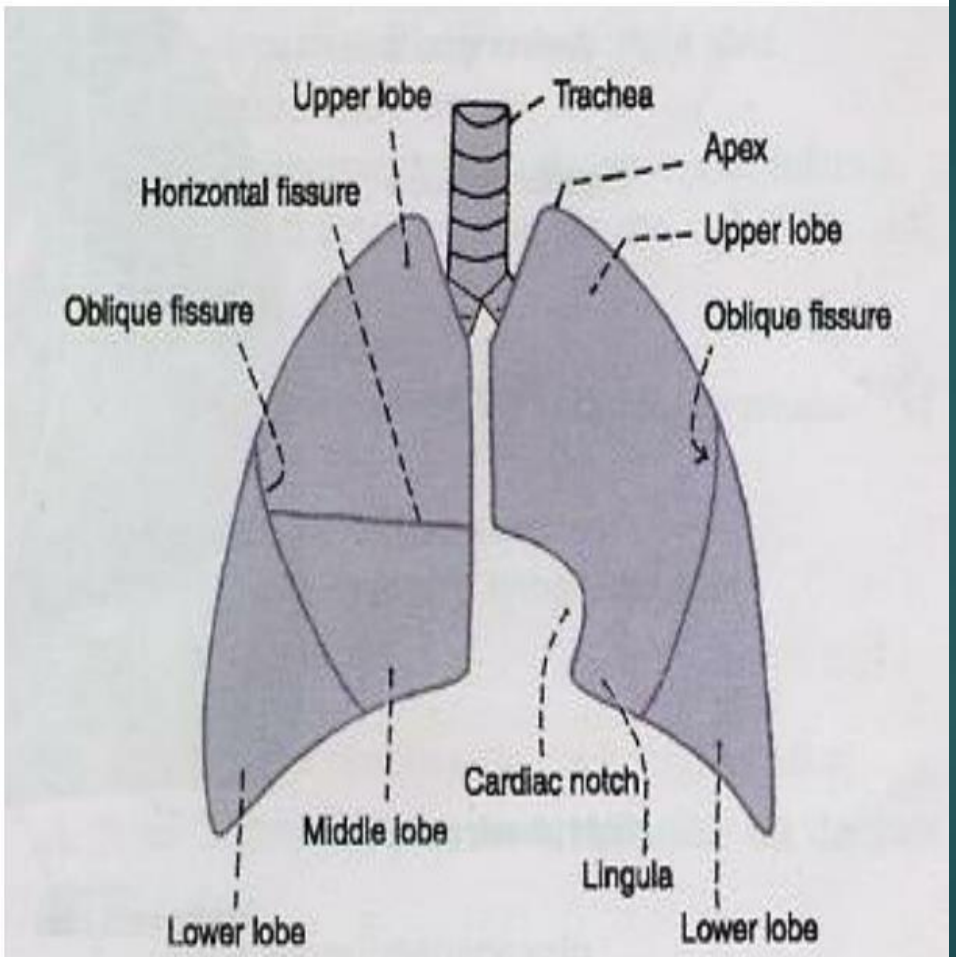
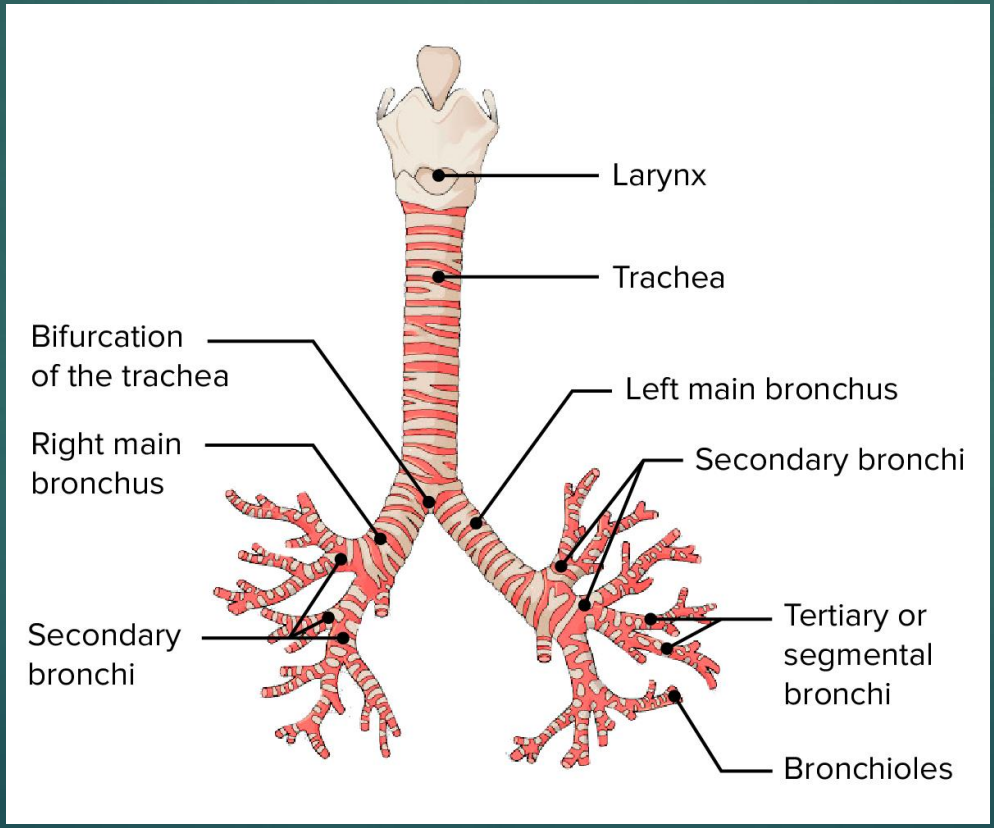


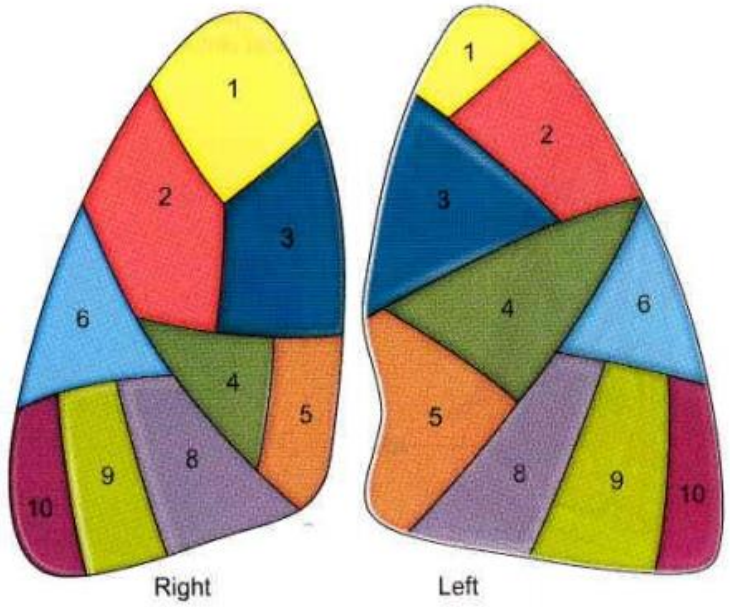
Fig. 16.1: The trachea and lungs as seen from the front.

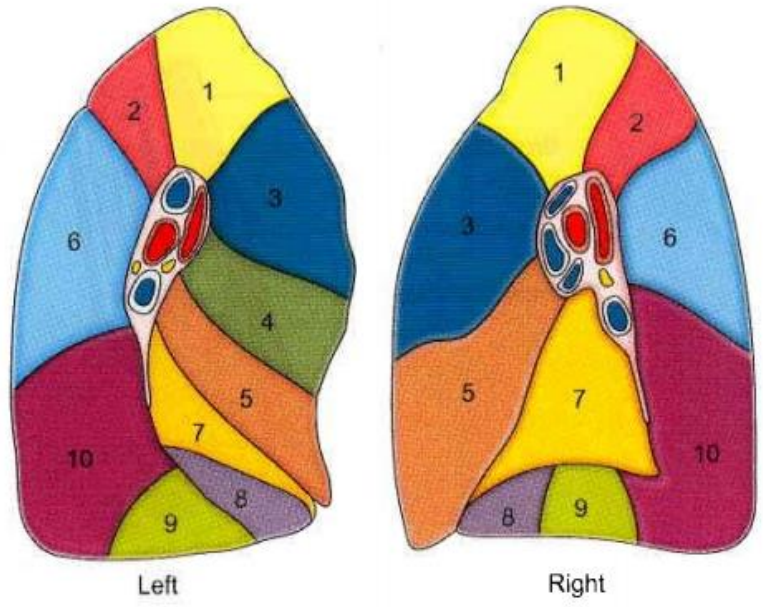
BRONCHIAL TREE

The trachea divides at the level of the lower border of the fourth thoracic vertebra into two primary principal bronchi, one for each lung.



BRONCHOPULMONARY SEGMENTS





Right lung		
Upper lobe	**Middle lobe**	**Lower lobe**
1. Apical	4. Lateral	6. Superior
2. Posterior	5. Medial	7. Medial basal
3. Anterior		8. Anterior basal
		9. Lateral basal
		10. Posterior basal

Left lung	
Upper lobe	**Lower lobe**
1. Apical	6. Superior
2. Posterior	7. Medial basal
3. Anterior	8. Anterior basal
4. Superior lingular	9. Lateral basal
5. Inferior lingular	10. Posterior basal

NORMAL chest x ray

- THE RADIOGRAPHIC IMAGE

Attenuation of the x-ray beam.		
Tissue absorption		**Effect on the radiograph**
LEAST	AIR OR GAS	BLACK IMAGE
	FAT	DARK GREY IMAGE
	SOFT TISSUE	GREY IMAGE
MOST	BONE OR CALCIUM	WHITE

CHEST X RAY

- FRONTAL CHEST X RAY:

1. PA VIEW
2. AP VIEW

- LATERAL CHEST X RAY

THE FRONTAL CHEST X RAY

- This standard CXR is obtained at a fixed distance between the x-ray tube and the cassette of ***180 cm*** (***6 ft***).
- The patient faces the cassette and the x-ray beam passes through in the posterior to anterior direction **- - - - - - - - - -> PA view.**

- If the patient is unable to stand erect then he faces the x-ray tube and an **antero–posterior (AP)** chest radiograph is obtained.(< 180 CM)

- AP CXR are acquired:

- At the bedside or with a seriously ill or frail patient.
- The patient may be lying supine or sitting up.

PA VIEW (STANDARD)	AP VIEW
obtained from 180 cm distance	Obtained from less than 180 cm distance
Rays are parallel with no divergence	Rays are diverging
Cassette faces in front of the patient	Cassette related to back of the patient
Heart is in close relation to cassette	Heart is away from the cassette
No magnification of heart	Magnification of Heart

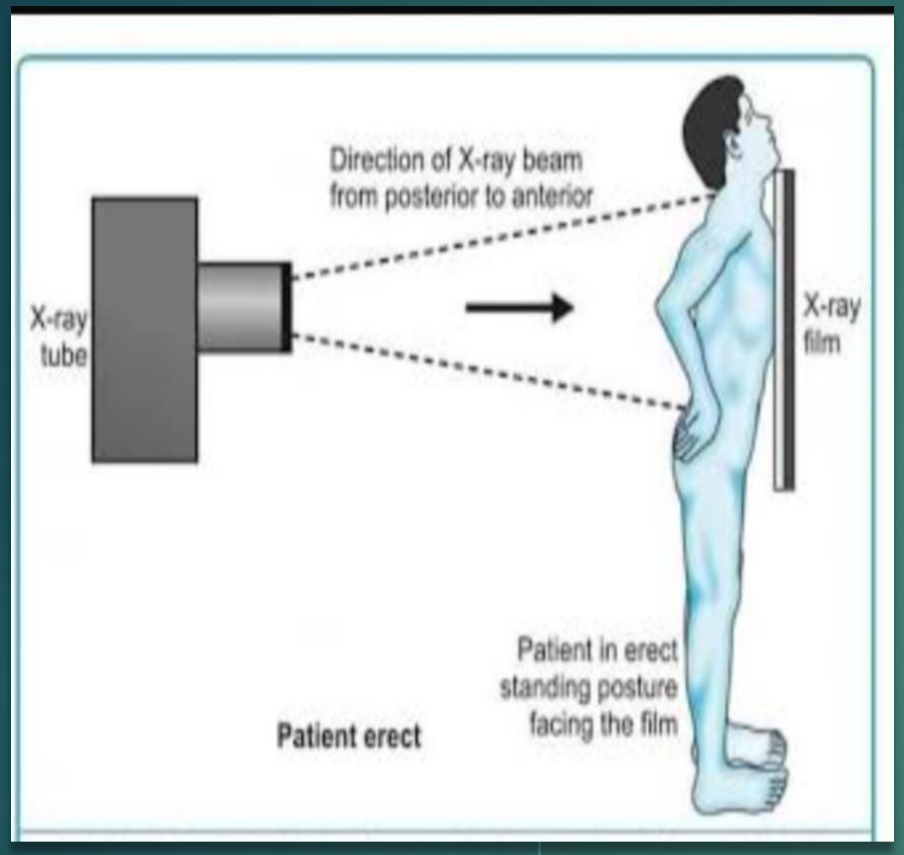
MAGNIFICATION ON AN AP CXR:

- MAGNIFICATION OCCURS BECAUSE OF 2 FACTORS:

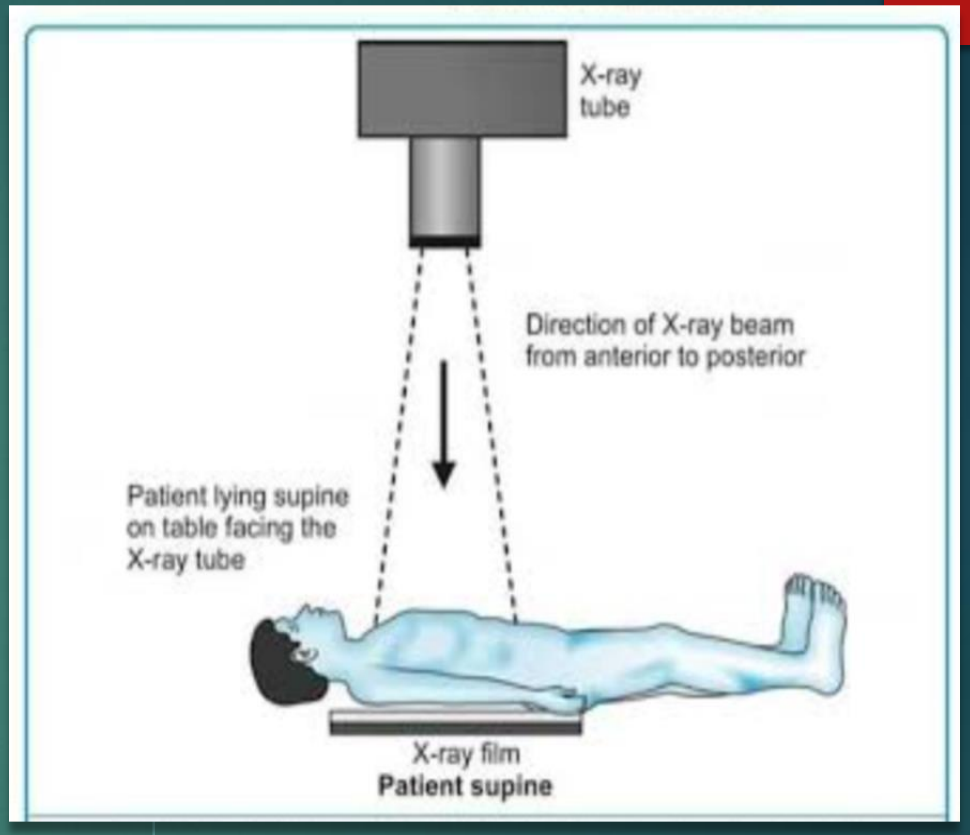
- A shortened distance between the x-ray tube and the cassette (< 180 CM) This results in a diverging x-ray beam at the margins of the heart.
- The heart and mediastinum are situated further from the cassette than is the case with a PA CXR.

DRAWBACK

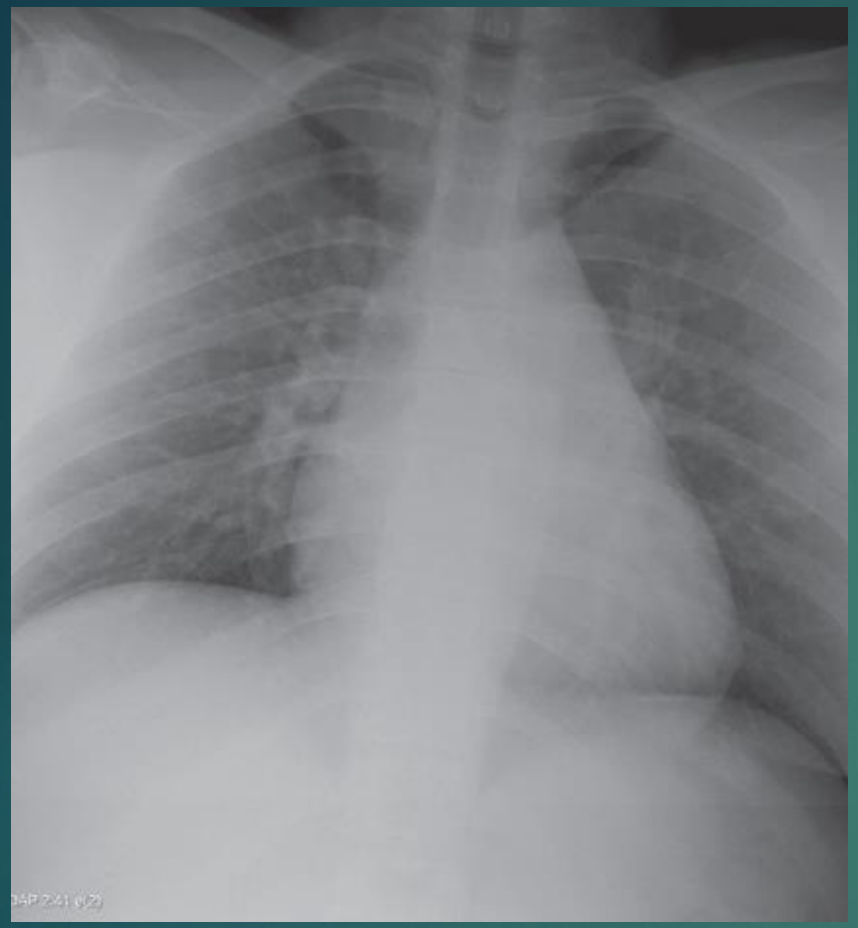
It gives a false impression of cardiac, mediastinal and / or aortic enlargement.



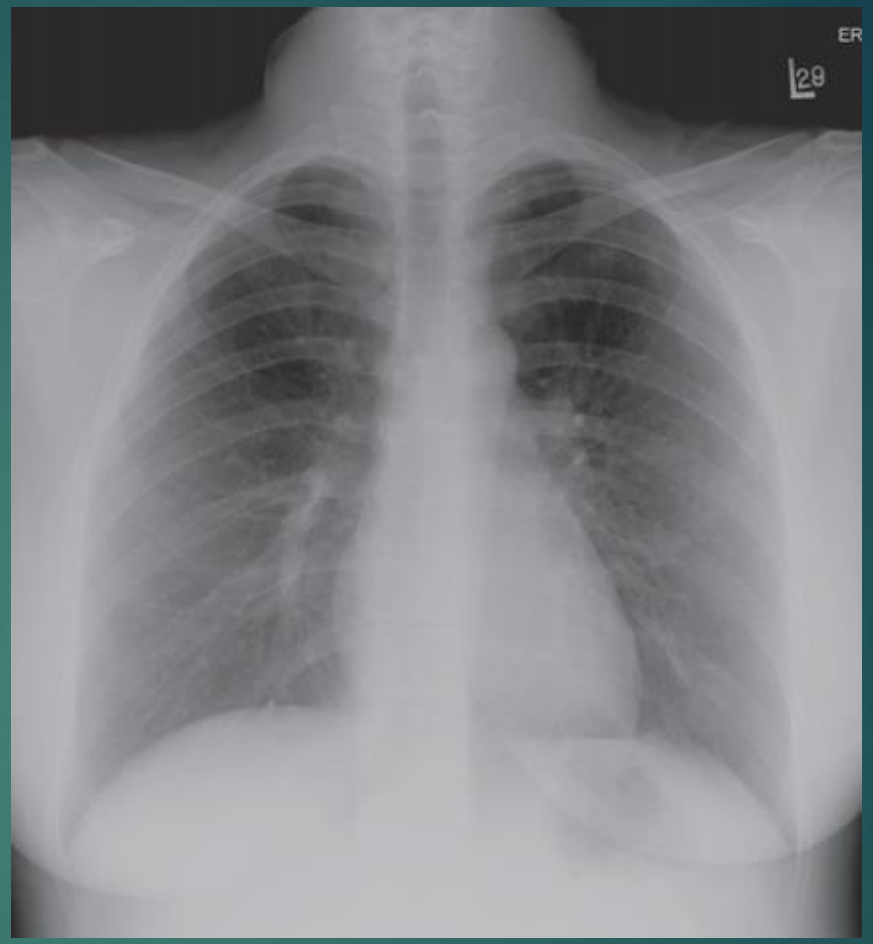
PA VIEW



AP VIEW



AP VIEW



PA VIEW

THE BEDSIDE (PORTABLE) AP CXR HAS DISADVANTAGES

- The mediastinum is magnified.
- When lying supine a patient is often unable to take a full inspiration.

DEPTH OF INSPIRATION:

- If the anterior aspects of at least six ribs do not lie above the left dome of the diaphragm, then suspect a **shallow inspiration.**

common in the elderly, patients with in pain, unconscious patients

Two problems occur when an inspiration is shallow:

- The transverse cardiac diameter may appear spuriously enlarged.
- The failure to distend the lungs fully can cause crowding of vessels at the lung bases. ------simulating basal lung infection or areas of sub segmental collapse.

ROTATION

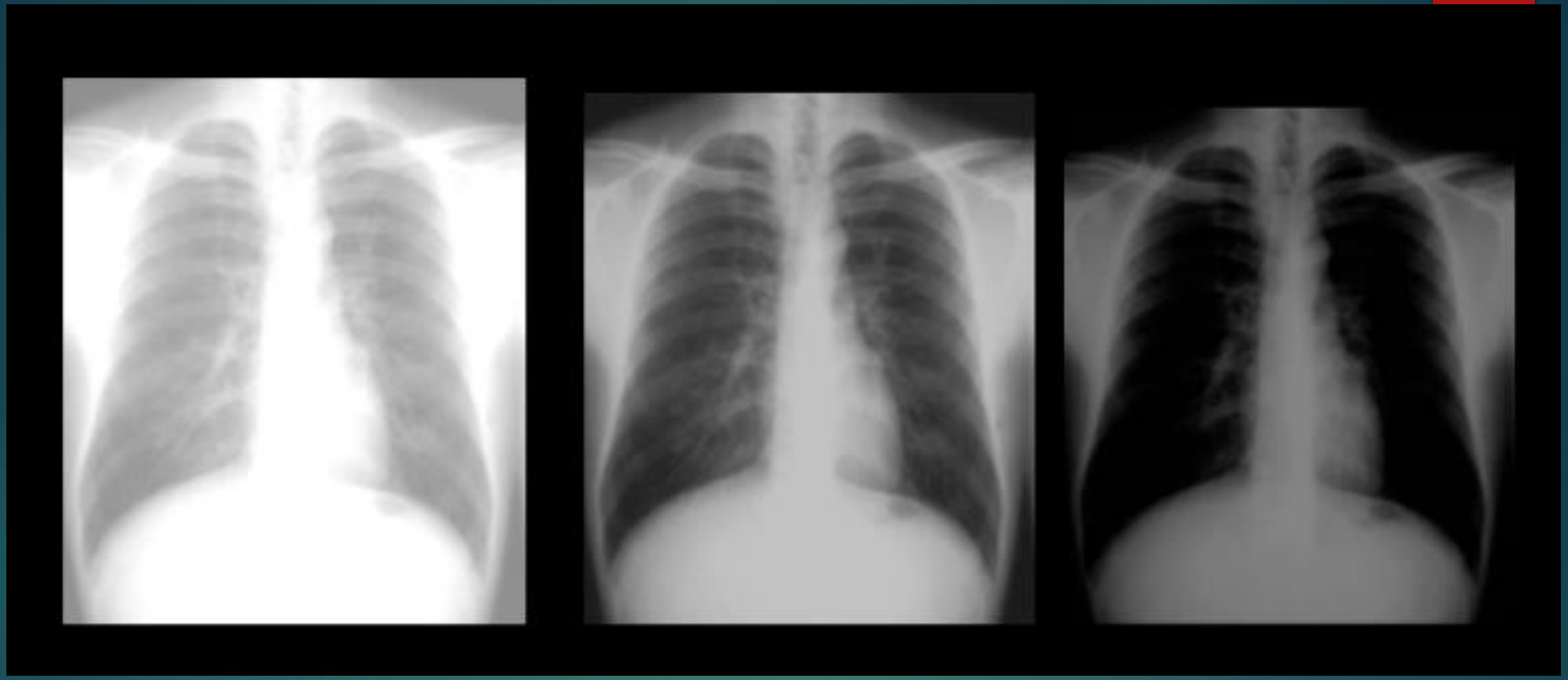
- The patient is not rotated if a vertical line drawn through the center of the vertebral bodies (T1–T5) is equidistant from the medial end of each clavicle.

- Rotation is present when one of the clavicles is further away from this vertical line.

Importance of rotation :

- Rotation to the right on a PA CXR…the manubrium and / or superior vena cava and / or vessels arising from the arch of the aorta may become unusually prominent on the right. This can simulate a mediastinal mass.

- Rotation to the left on an AP CXR…the aortic arch may appear enlarged.



Underexposed

Normal exposure

Over exposed

LUNG ZONES:

- **Apical zone** : above the clavicle
- **Upper zone** : below the clavicle and above the cardiac silhouette
- **Mid zone** : the level of the hilar structure
- **Lower zone** : the lung base.

HILA :

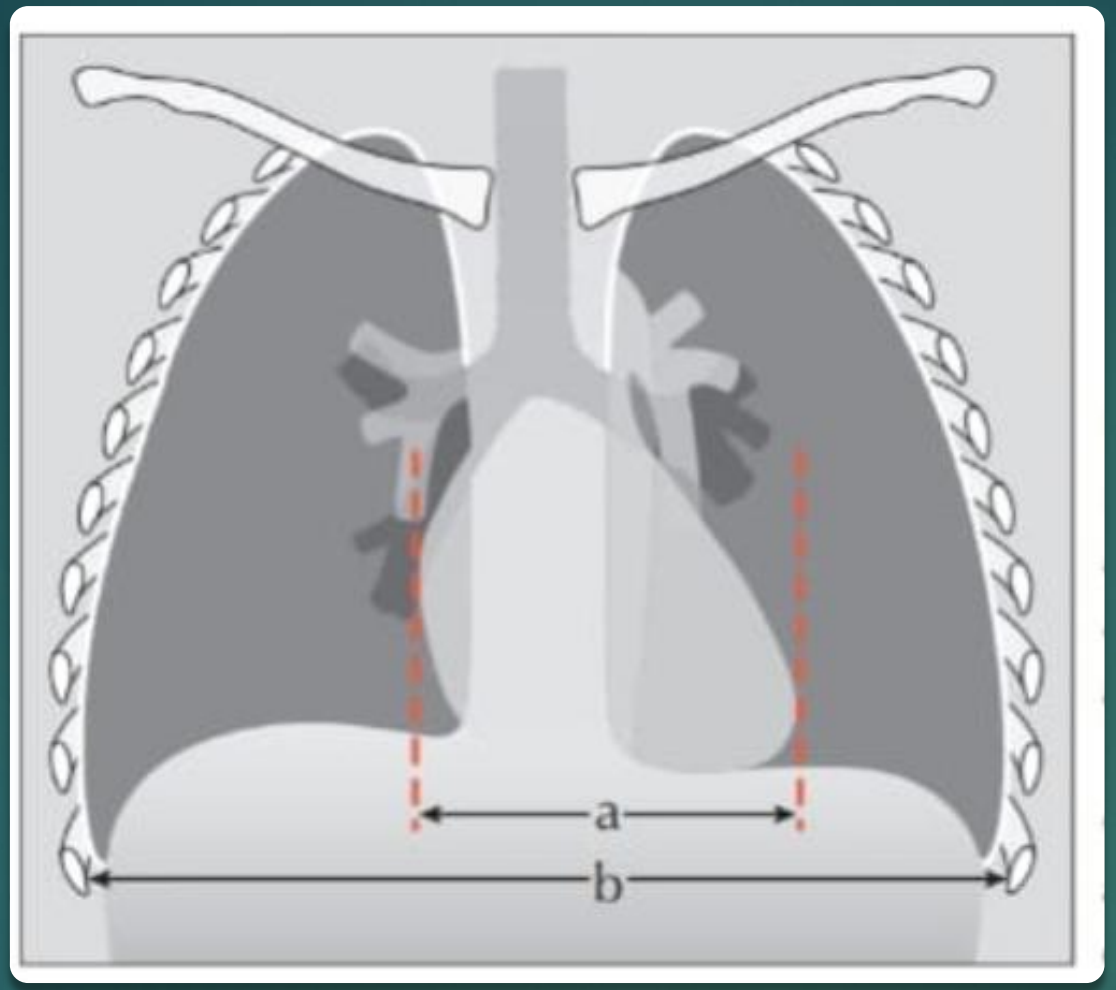
- soft tissue density at each hilum, 95% is due solely to pulmonary artery and pulmonary veins.
- The main pulmonary artery on the right side passes anterior to the right main bronchus, whereas the main pulmonary artery on the left side passes posteriorly and hooks over the left main bronchus.
- The superior margin of the left hilum is normally higher than the right. This is because the left main pulmonary artery passes over the left main bronchus whereas the right main pulmonary artery passes in front of the right main bronchus.
- **The left hilum should never be lower than the right**.

The hilar shadows are due to pulmonary artery and pulmonary veins
X marks the main pulmonary trunk.
Blue = pulmonary trunk and pulmonary arteries; brown = pulmonary veins

HEART:

HEART SIZE :

- Most normal adult hearts have a cardiothoracic ratio (CTR) that does not exceed 50% when assessed on a PA CXR obtained in full inspiration.
- In young children the normal CTR can be slightly larger than 50%.



Measuring the CTR On a PA chest radiograph obtained in full inspiration, if a / b > 50% the heart is likely to be enlarged.

(a = maximum transverse diameter of the heart;

b = maximum internal diameter of the thorax)

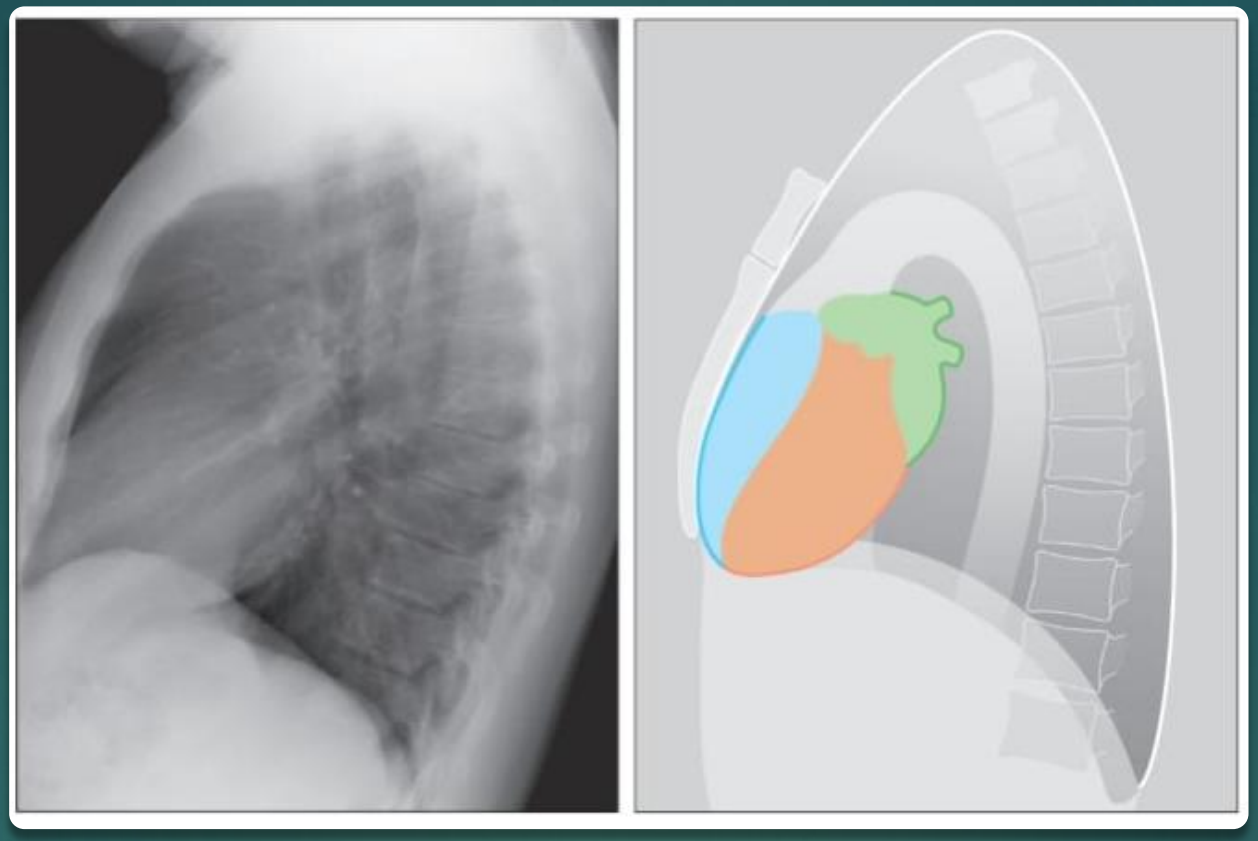
HEART :

CHAMBERS AND BORDERS:

- The margins of the cardiac silhouette are formed by the chambers of the heart.

Normal cardiac Silhouette

border forming chambers
Pink : right atrium
blue = right ventricle;
brown = left ventricle

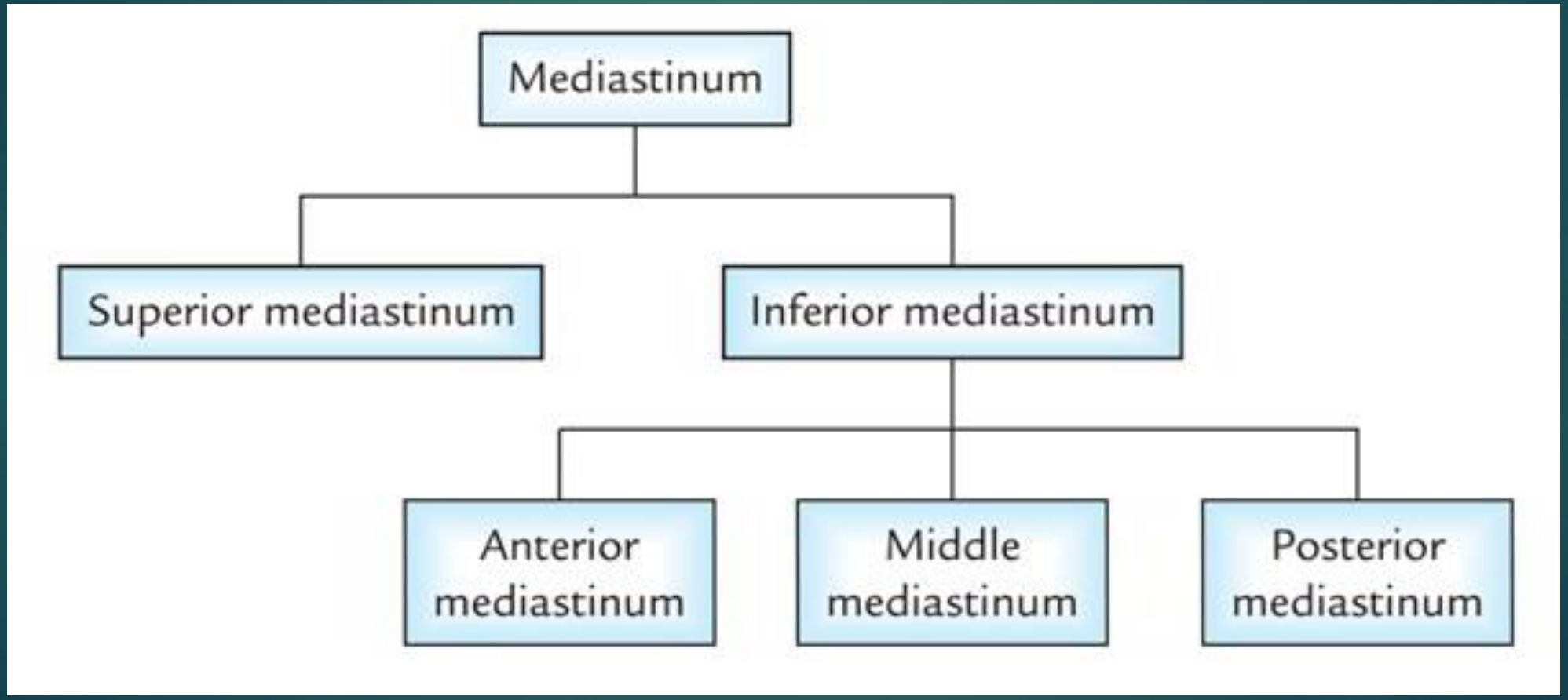


Normal cardiac Silhouette

The border-forming chambers:
green = left atrium;
blue = right ventricle;
brown = left ventricle.

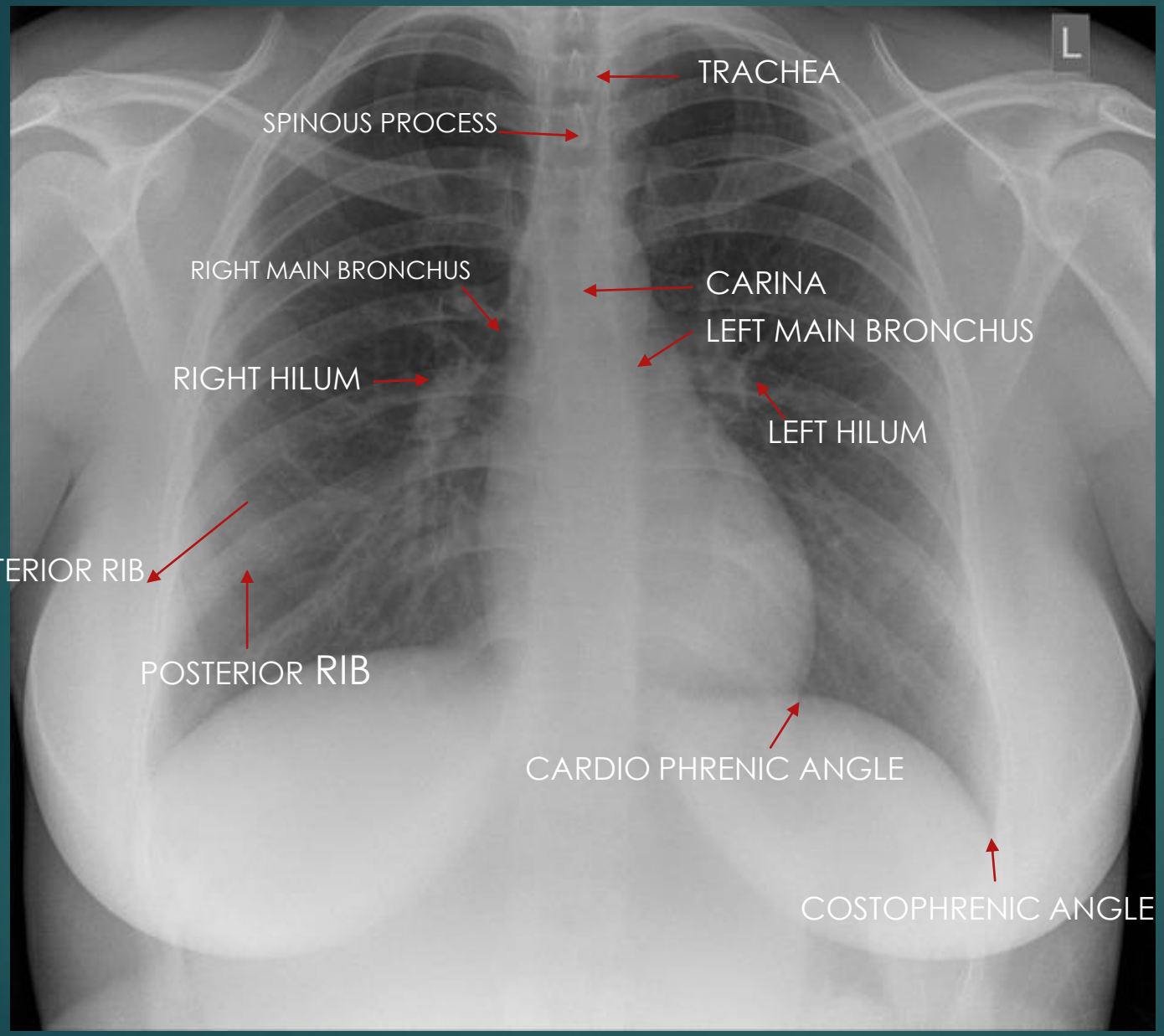
MEDIASTINUM:

- The mediastinum is situated between the pleurae covering the medial aspects of the right and left lungs.



CONTENTS OF MEDIASTINUM

SUPERIOR MEDIASTINUM		INFERIOR MEDIASTINUM	
	ANTERIOR	**MIDDLE**	**POSTERIOR**
Trachea	Thymus (in children)	Heart	Esophagus
Esophagus	Small vessles	Ascending aorta	
Arch of aorta	Lymphatics	Superior vena cava	
Superior vena cava		Pulmonary trunck and branches	


L
TRACHEA
SPINOUS PROCESS
RIGHT MAIN BRONCHUS
CARINA
LEFT MAIN BRONCHUS
RIGHT HILUM
LEFT HILUM
ANTERIOR RIB
POSTERIOR RIB
CARDIO PHRENIC ANGLE
COSTOPHRENIC ANGLE

LATERAL CHEST X RAY

- **IMPORTANCE :**

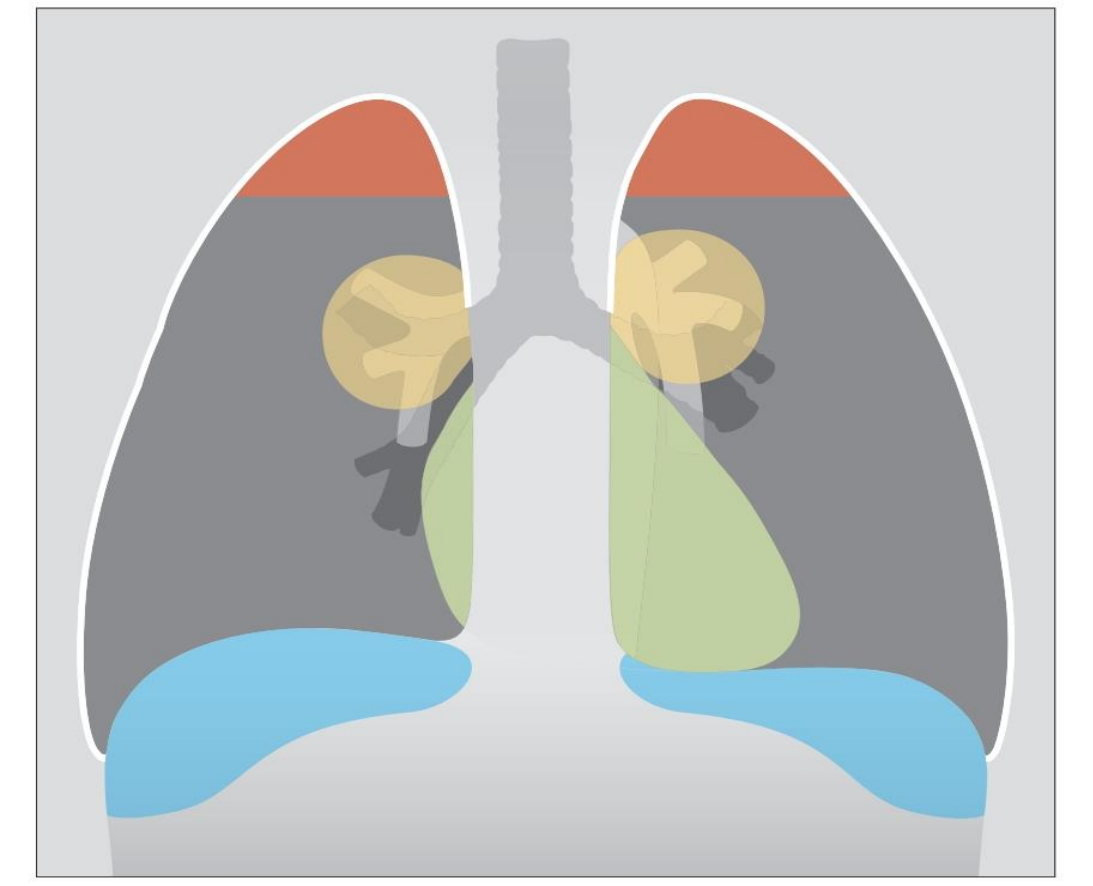
1) To check whether an equivocal frontal CXR shadow is actually present.

2) To position an abnormality shown on the frontal CXR.

3) To check the tricky areas

- behind the heart
- behind and in front of the hila
- behind the domes of the diaphragm

HIDDEN AREAS:

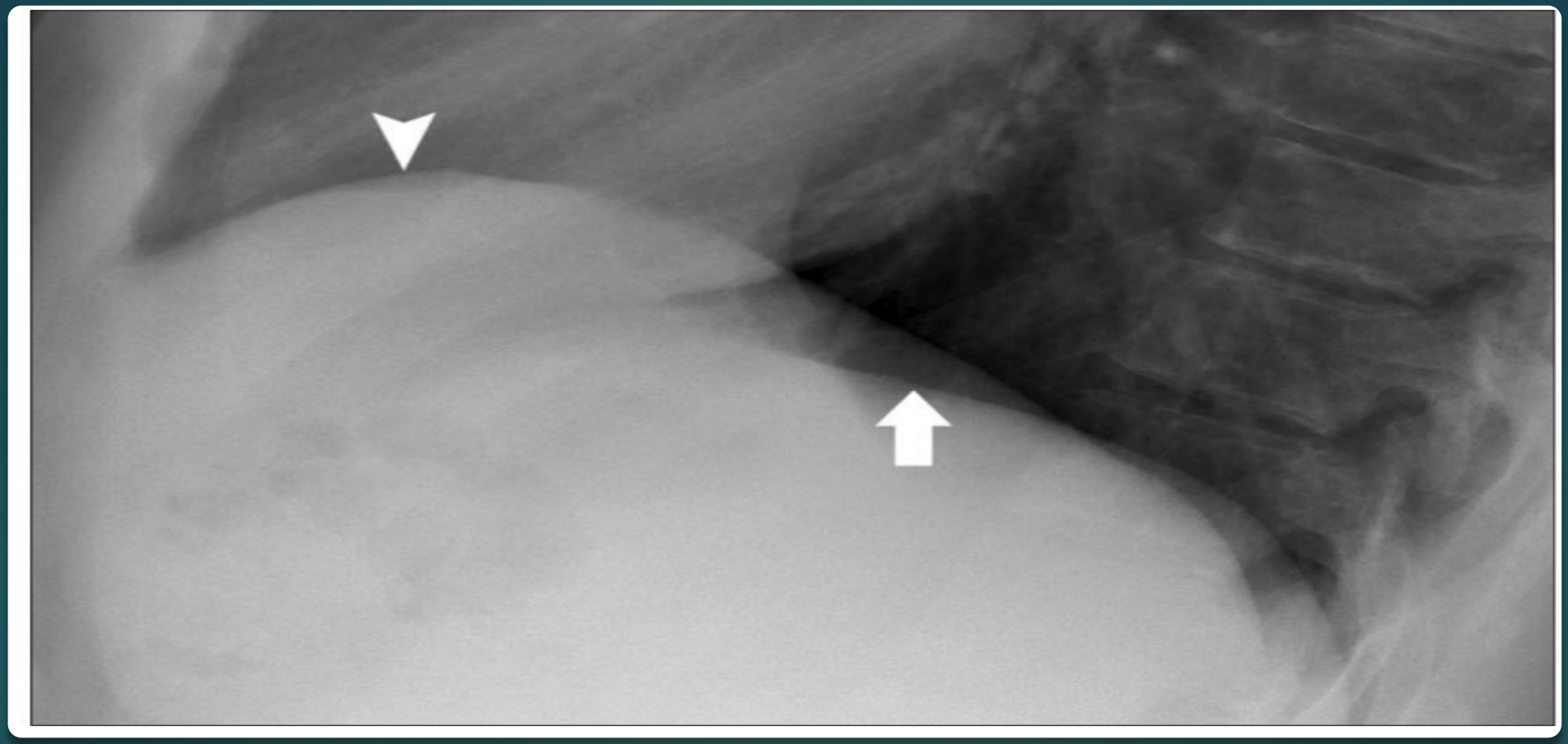


Four tricky hidden areas: apices (brown), superimposed over the heart (green), around each hilum (yellow), and below the domes of the diaphragm (blue).

NORMAL LATERAL CHEST X RAY- special appearance:

DIAPHRAGM:

- The two domes are usually easy to separate from each other.
- The right dome is visualised all the way from front to back.
- The shadow of the left dome only extends from the costophrenic angle posteriorly to the back of the cardiac shadow anteriorly. This is because the heart obliterates the lung /diaphragm interface anteriorly.



Right and left dome of diaphragm

COSTOPHRENIC ANGLES:

- The posterior and inferior part of each lung occupies a well-defined gully created by the pleura reaching the posterior limit of each dome of the diaphragm. These two gullies—one on each side—are the costophrenic angles or sulci.

THANK YOU