Radiologic investigation of Chest and CVS diseases

By

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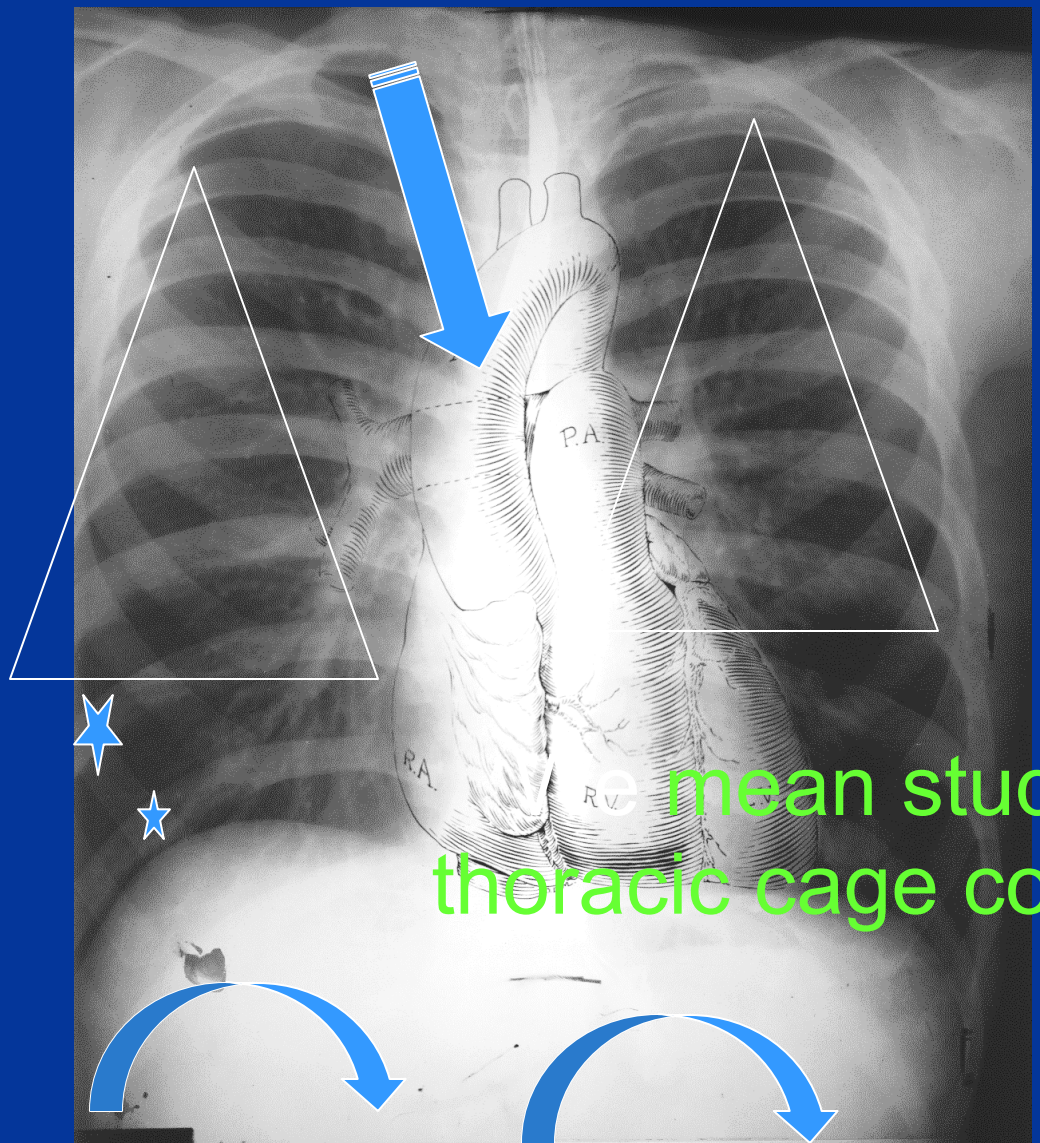
KING SAUD UNIVERSITY

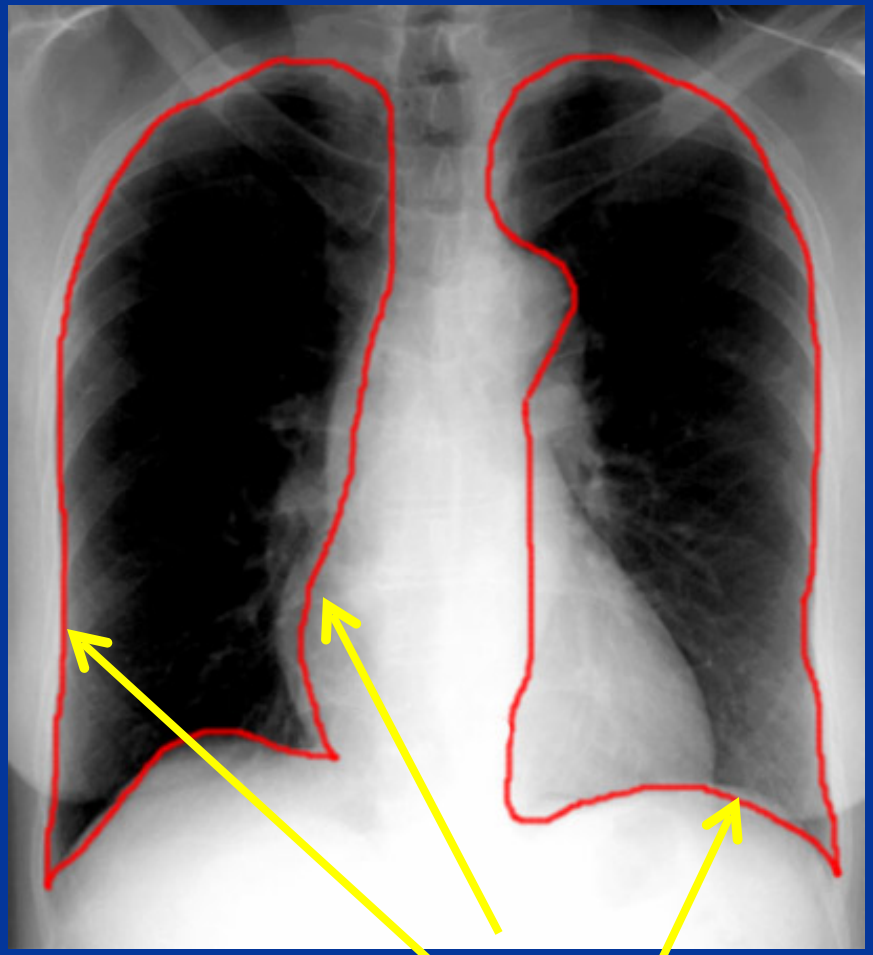
LAST UPDATE
October 2016 5 LECTURES SERIES

What do we mean by chest



mean study of
thoracic cage contents

LUNGS



BASIC CHEST EXAMS

- PLAIN FILM=CHEST X-RAY(CXR)
- CT FOR CHEST AND MEDIASTINUM
- CT FOR LUNG PARENCHYMA *HRCT*
- MRI
- ANGIOGRAMS

BASIC CHEST EXAM FOR THE HEART

- **PLAIN FILM=CHEST X-RAY(CXR)**
- **CT FOR HEART AND MEDIASTINUM**
- **ANGIOGRAMS**
- **MRI**
- **ULTRASOUND (ECHOCARDIOGRAPHY)**
- **ISOTOPIC SCANNING**

Imaging Modalities for chest and CVS examinations

1-Plain films

2-COMPUTED TOMOGRAPHY

CT LUNGS AND MEDIASTINUM

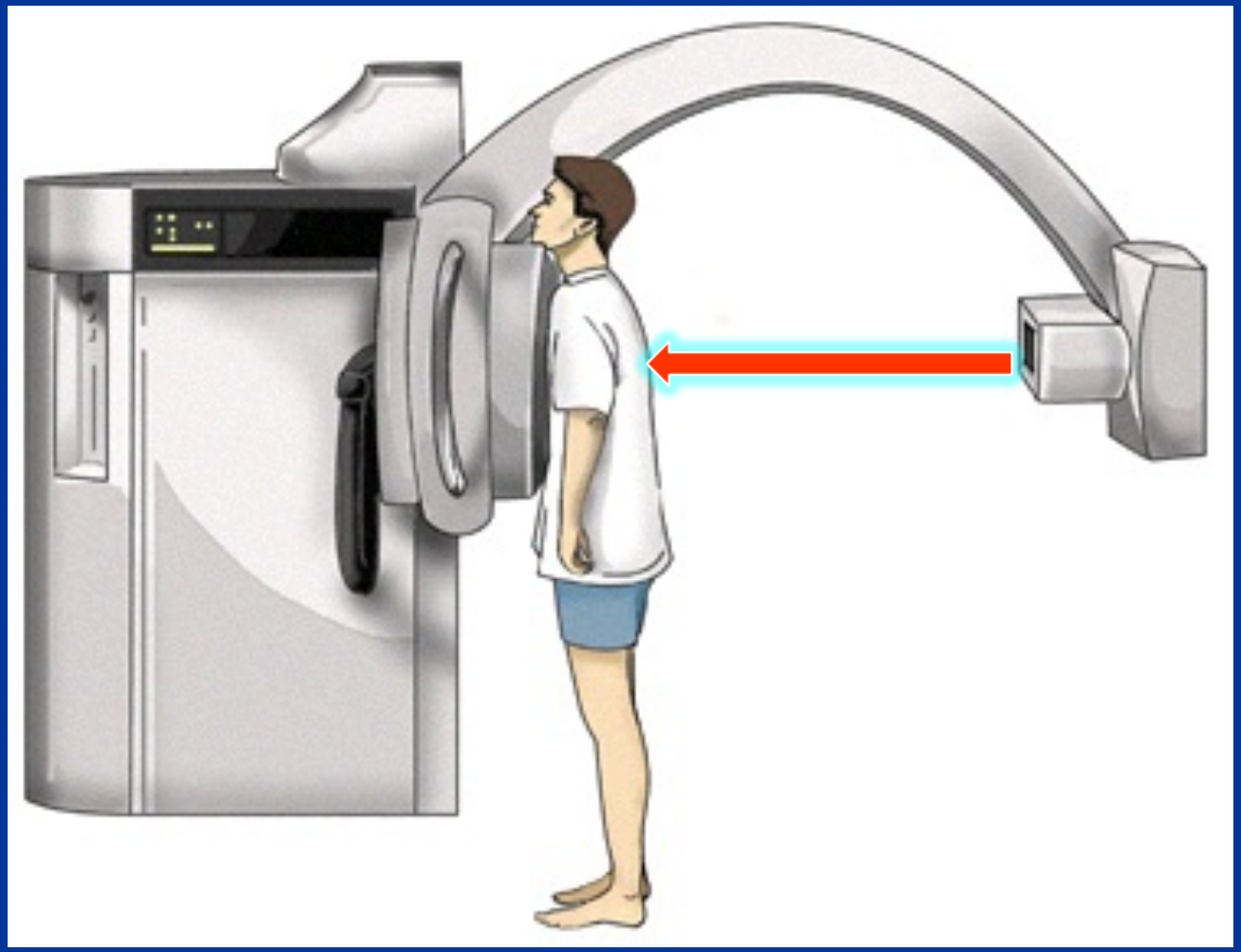
CT- angiography (CTA)

High resolution CT of the chest (HRCT)

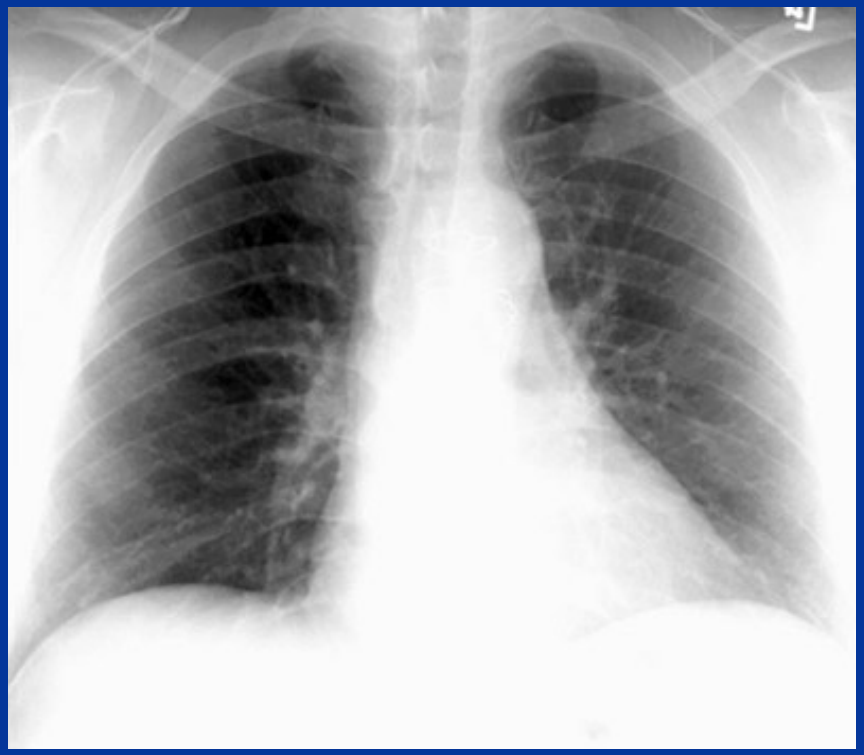
3-Angiography

4- M

Basic Chest X-Ray

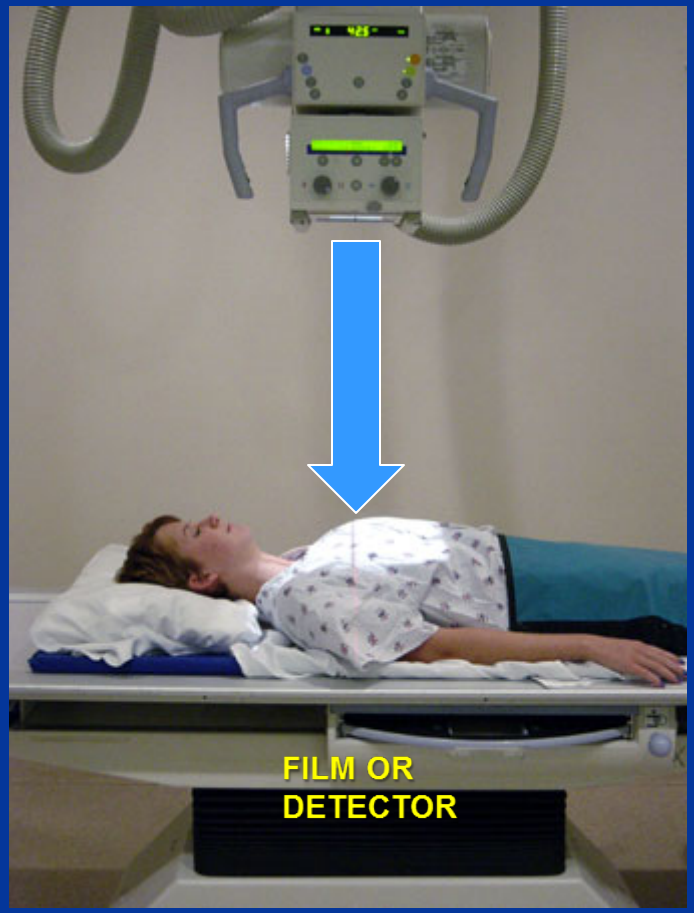


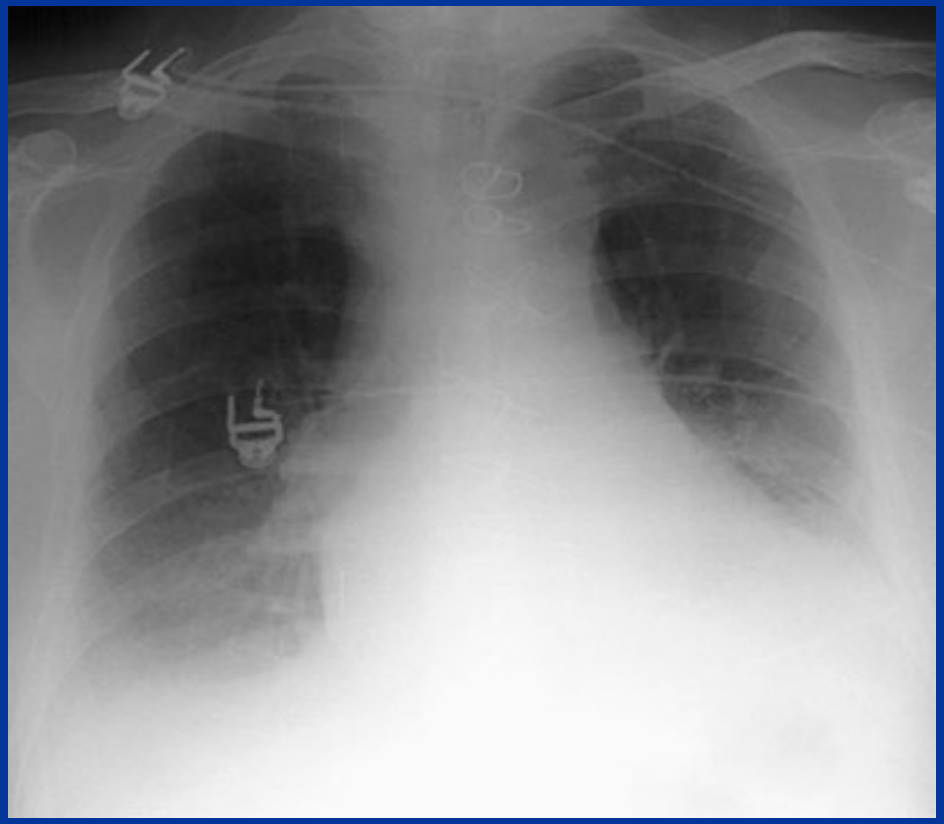
PA VIEW



LATERAL VIEW

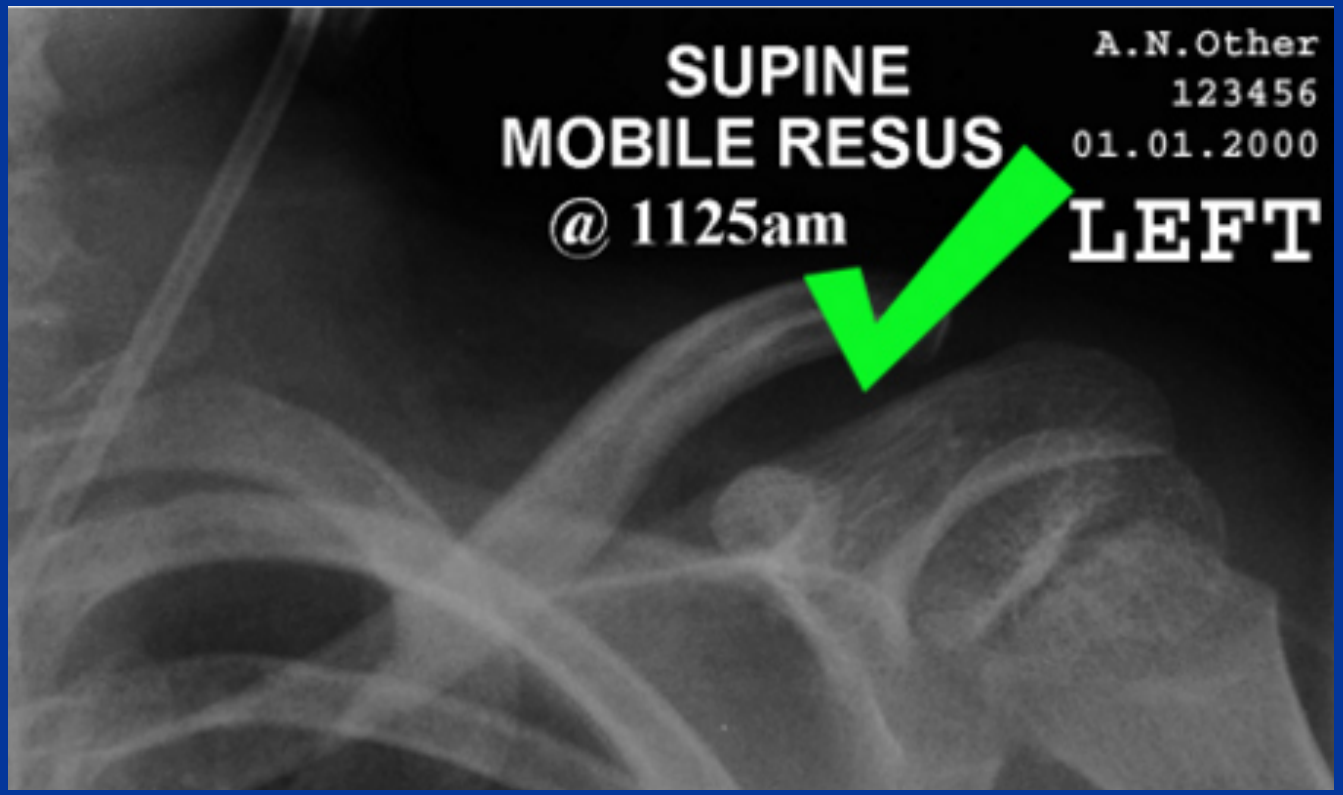
AP VIEW



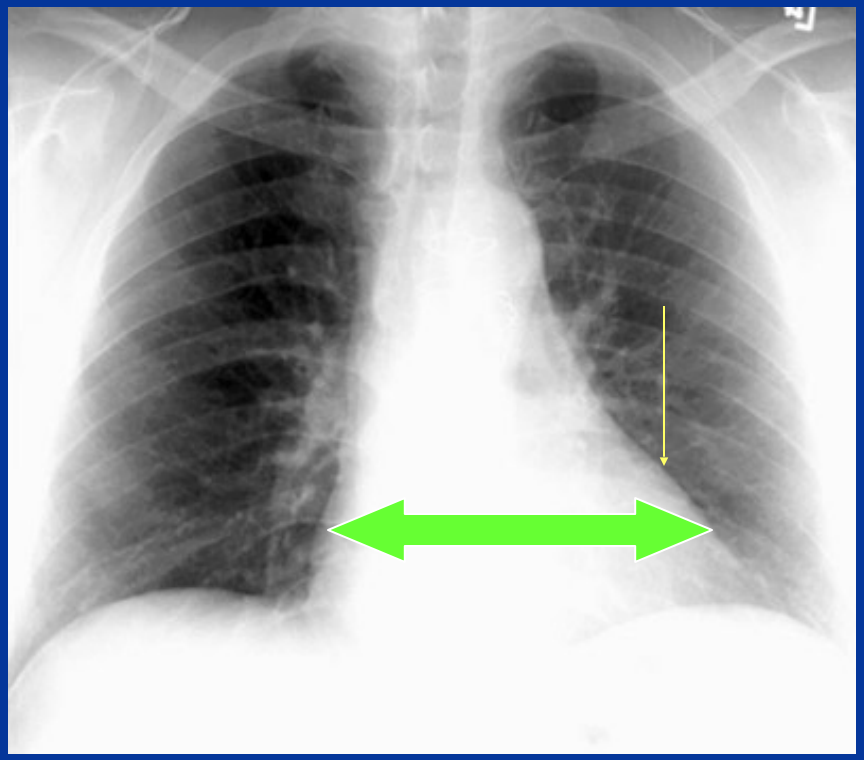


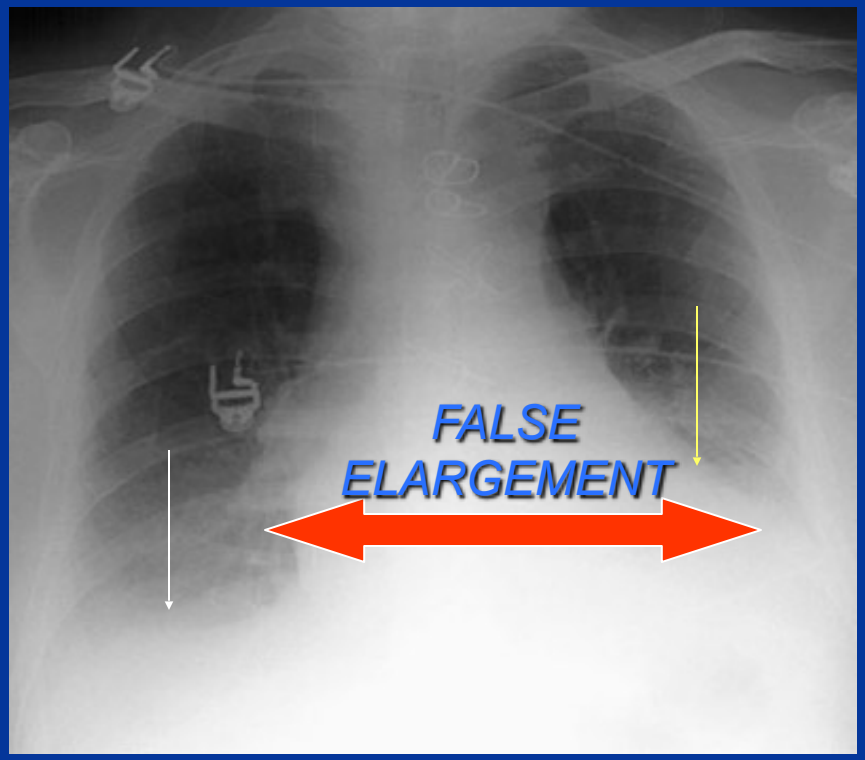
OPTIMAL EXAMINATION

Patient data



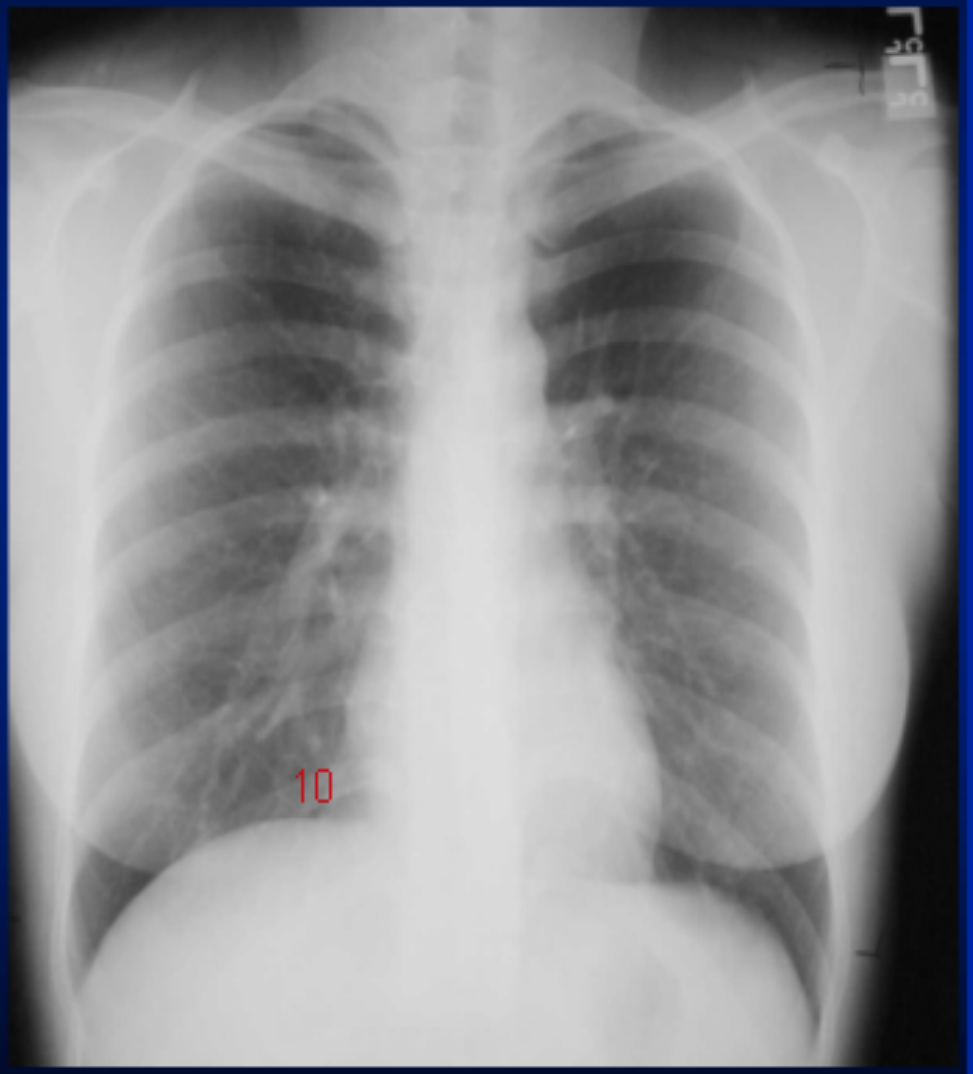
PA vs. AP



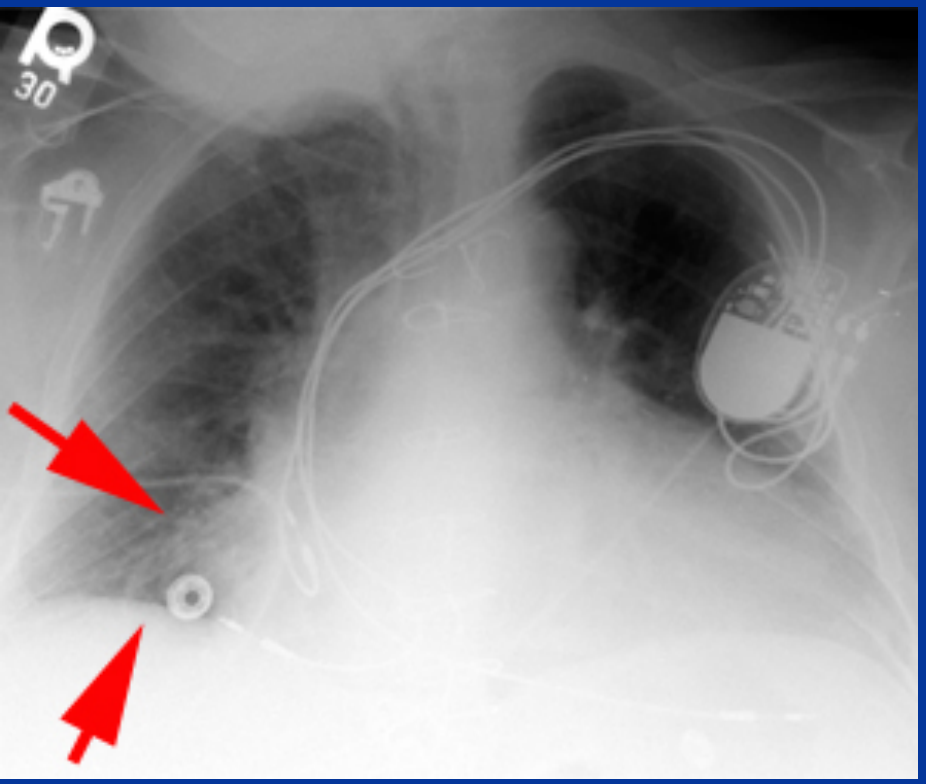


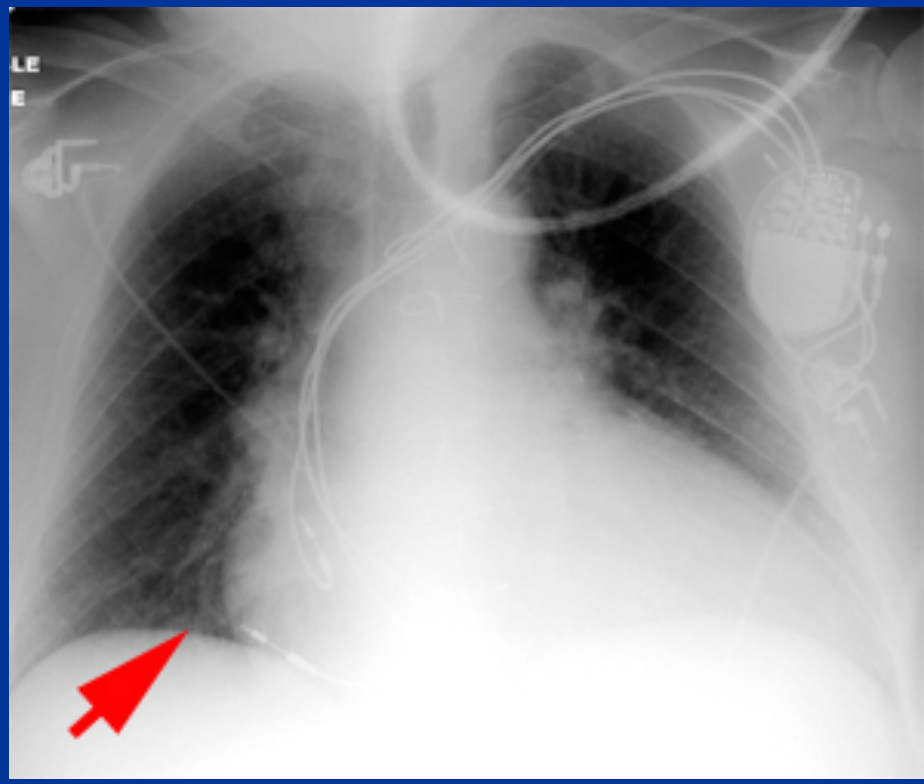
Technical Factors

- Depth of inspiration
- Visualization of pathology depends on contrast provided by air in the lungs
- Count ribs!
- PATIENT NOT ROTATED



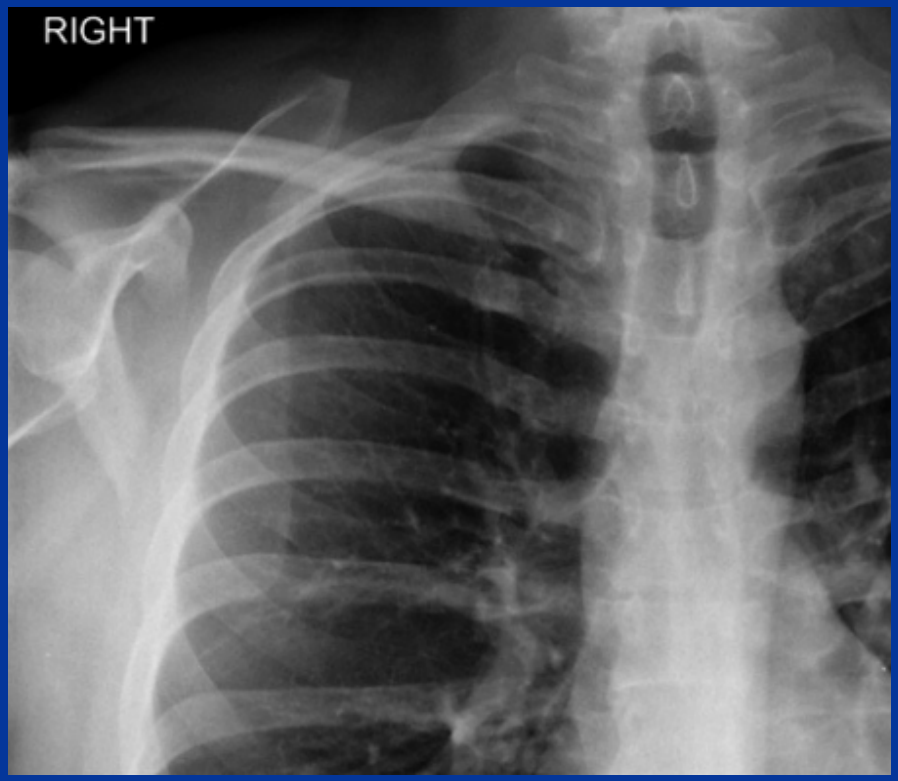
Hypo-inspiratory vs inspiratory

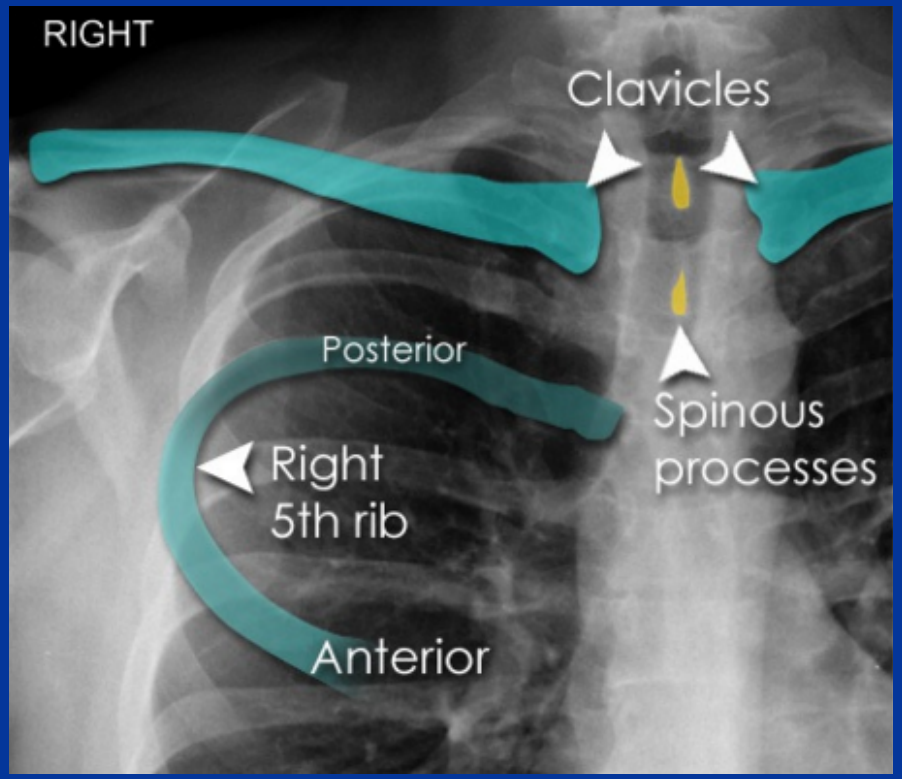




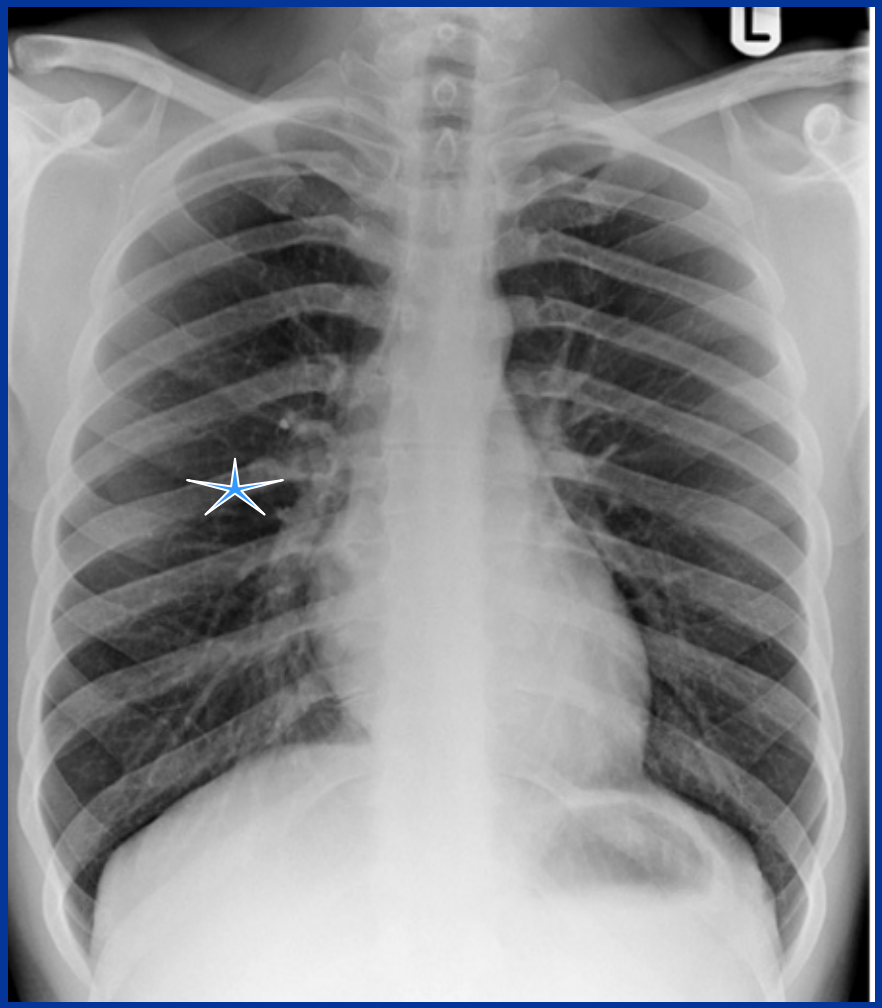
Inspiration

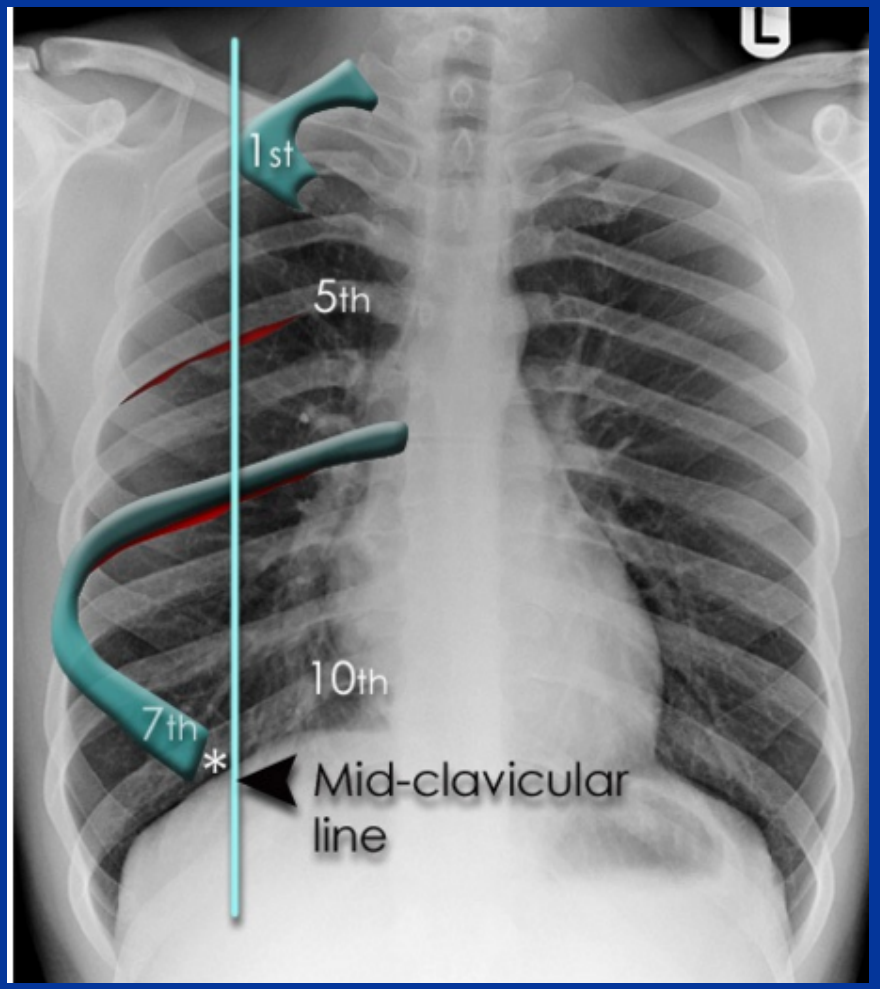
- **This greatly helps the radiologist to determine if there are intrapulmonary abnormalities.**
- **The diaphragm should be found at about the level of the 8th - 10th posterior rib or 5th - 6th anterior rib on good inspiration.**

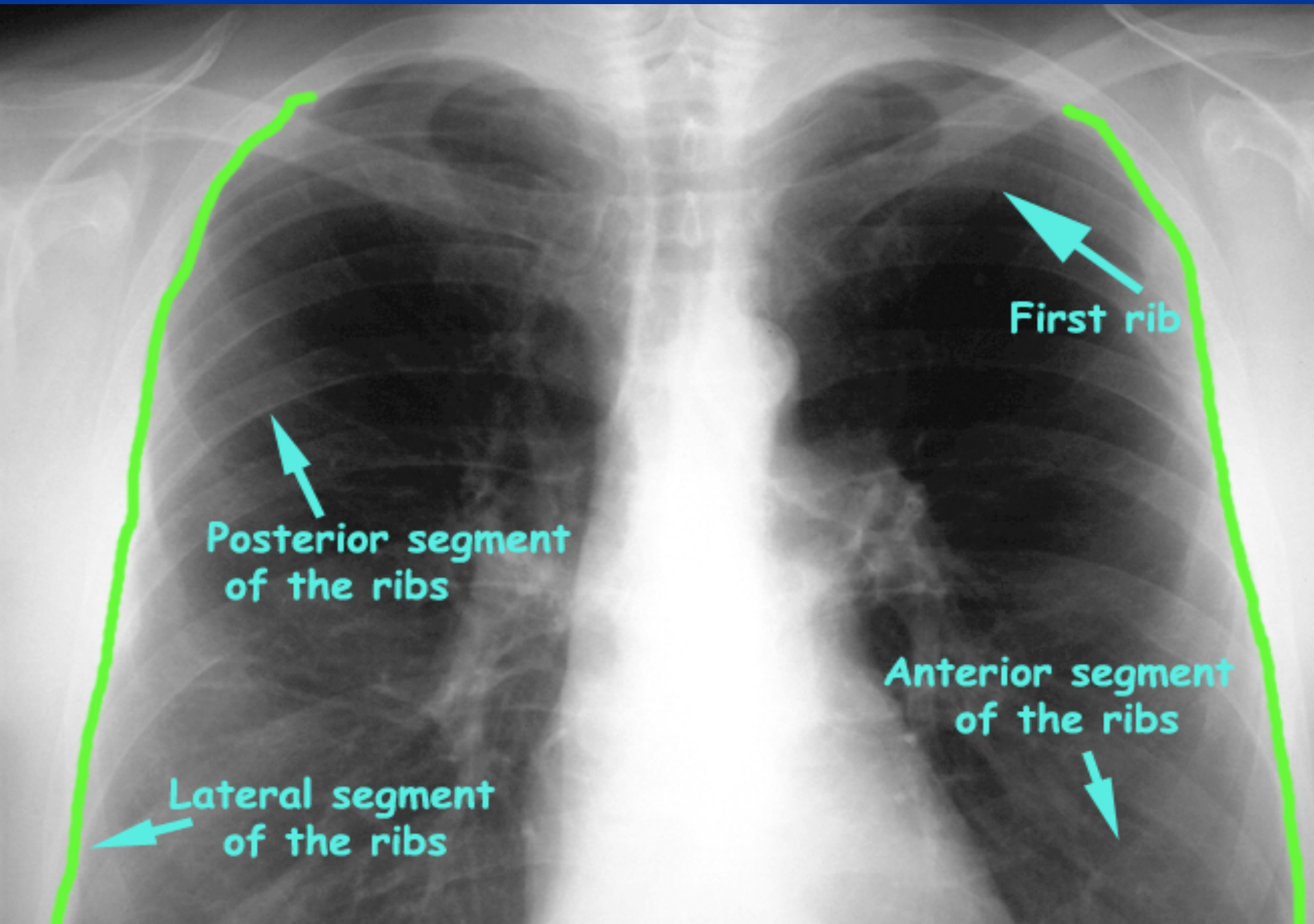

RIGHT


RIGHT
Clavicles
Posterior
Spinous processes
Right 5th rib
Anterior

RIBS





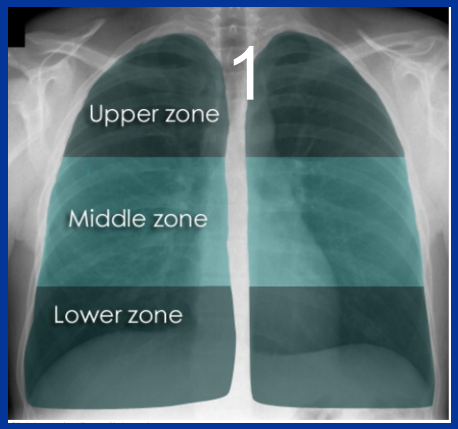

First rib
Posterior segment of the ribs
Anterior segment of the ribs
Lateral segment of the ribs

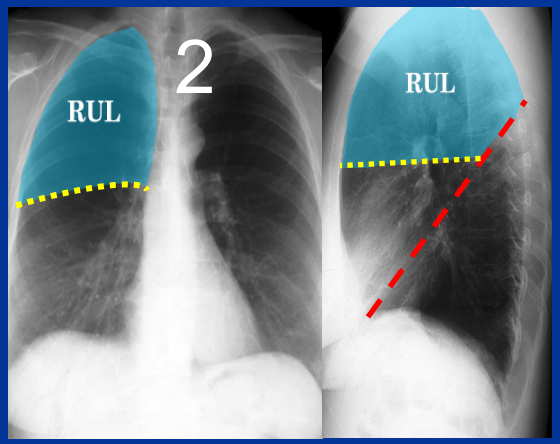
FOR DIAGNOSTIC REASONS

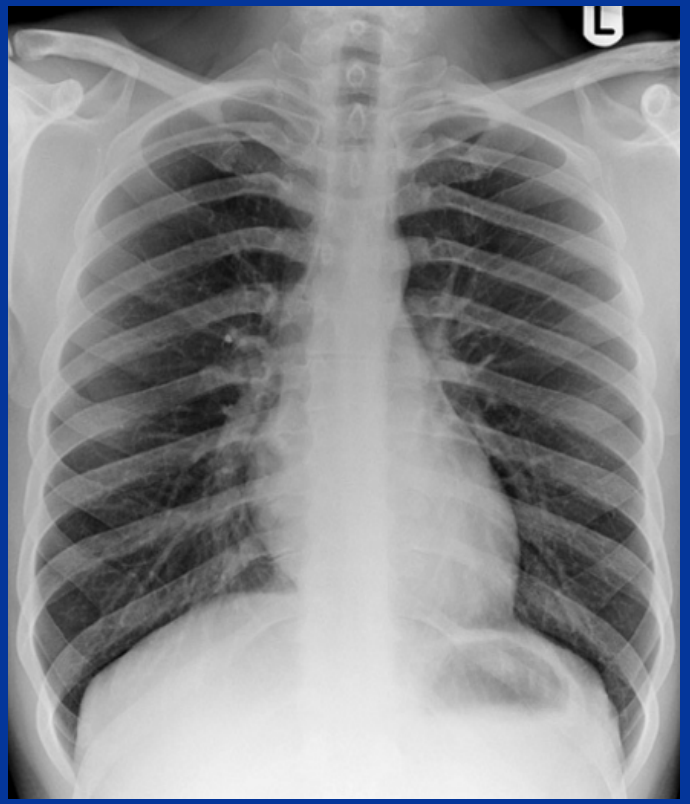
DIVIDING LUNG FIELDS

1-BY ZONES

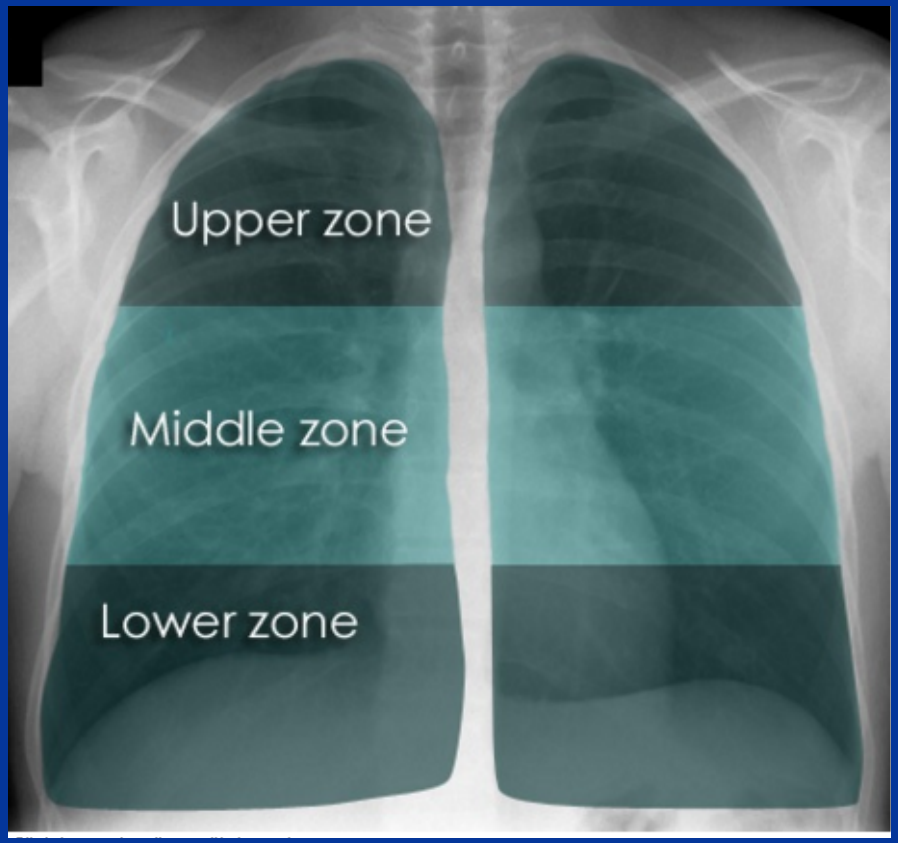
2-BY LOBES







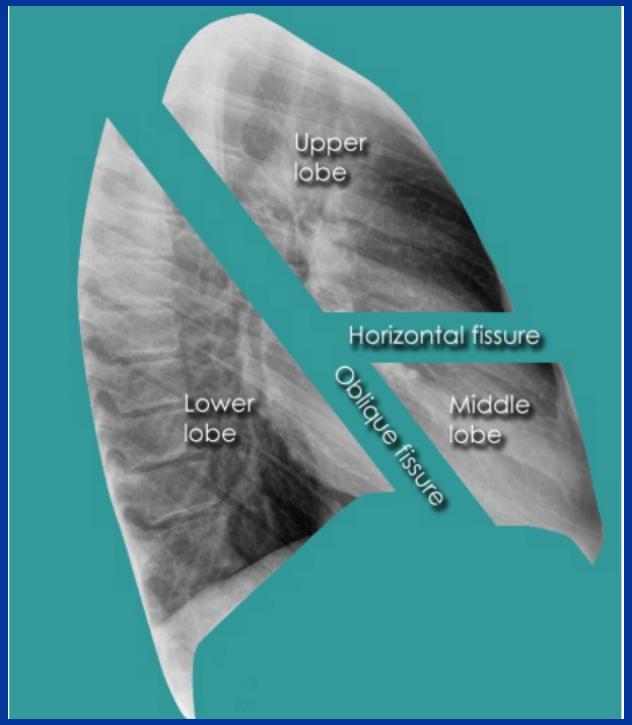
Assessing the lung zones
BY ZONES



- **Each zone is compared with its opposite side paying attention to any asymmetry.**
- If the lungs appear asymmetrical, it should be determined if this can be explained by asymmetry of normal structures, technical factors such as rotation, or lung pathology.
- If there is genuine asymmetry, decide which side is abnormal. Often a dense (whiter) area is abnormal, but some diseases cause reduced density (blacker). If there is an area that is different from the surrounding ipsilateral lung, then this is likely to be the abnormal area.You should also be aware that some diseases result in bilateral lung abnormalities, making comparison of left with right difficult. In these cases it is still important to assess each zone in turn, to avoid missing subtle abnormalities on the background of abnormal lung.

- <u>Lung zones</u>
- Dividing the lungs into zones allows more careful attention to be paid to each smaller area. If this is not done it is easy to ignore important abnormalities.
- Note that the lower zones reach below the diaphragm. This is because the lungs pass behind the dome of the diaphragm into the posterior sulcus of each hemithorax. Normal lung markings can be seen below the well defined edges of the diaphragm.

ASSESING LUNG FIELDS
BY LOBES

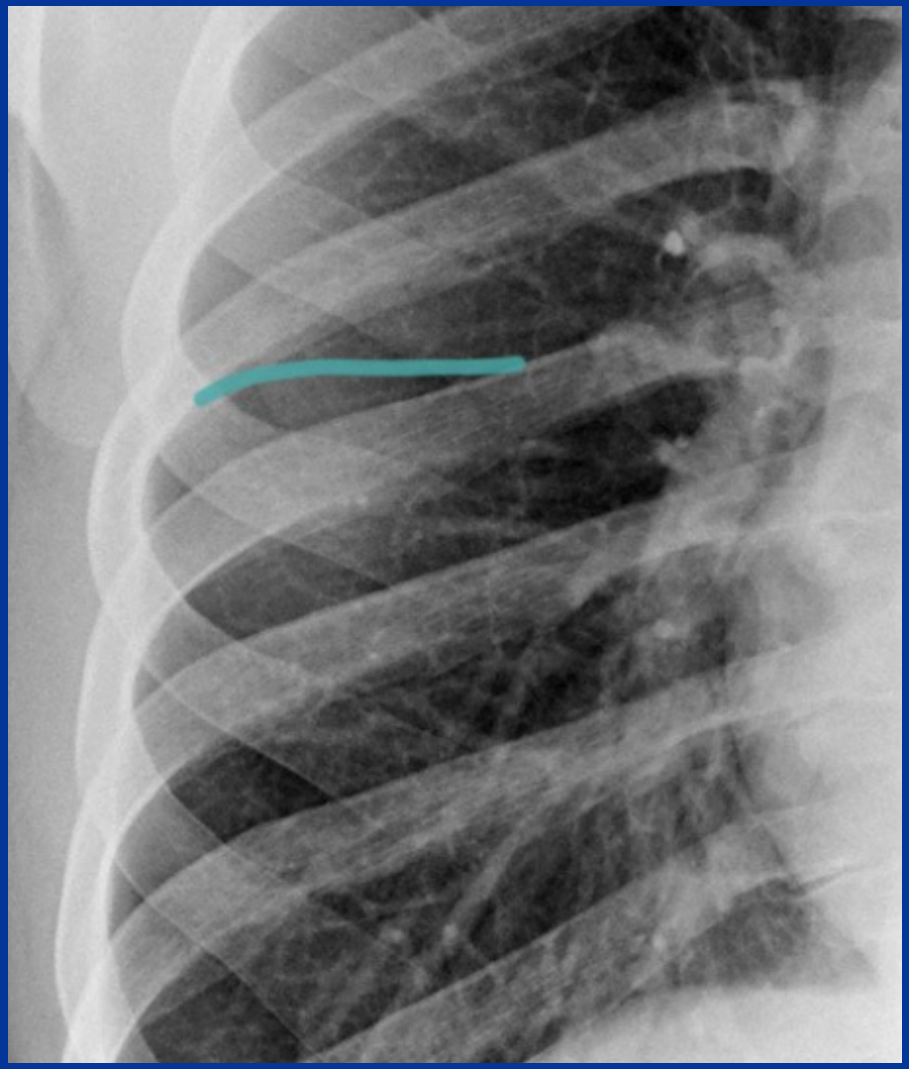


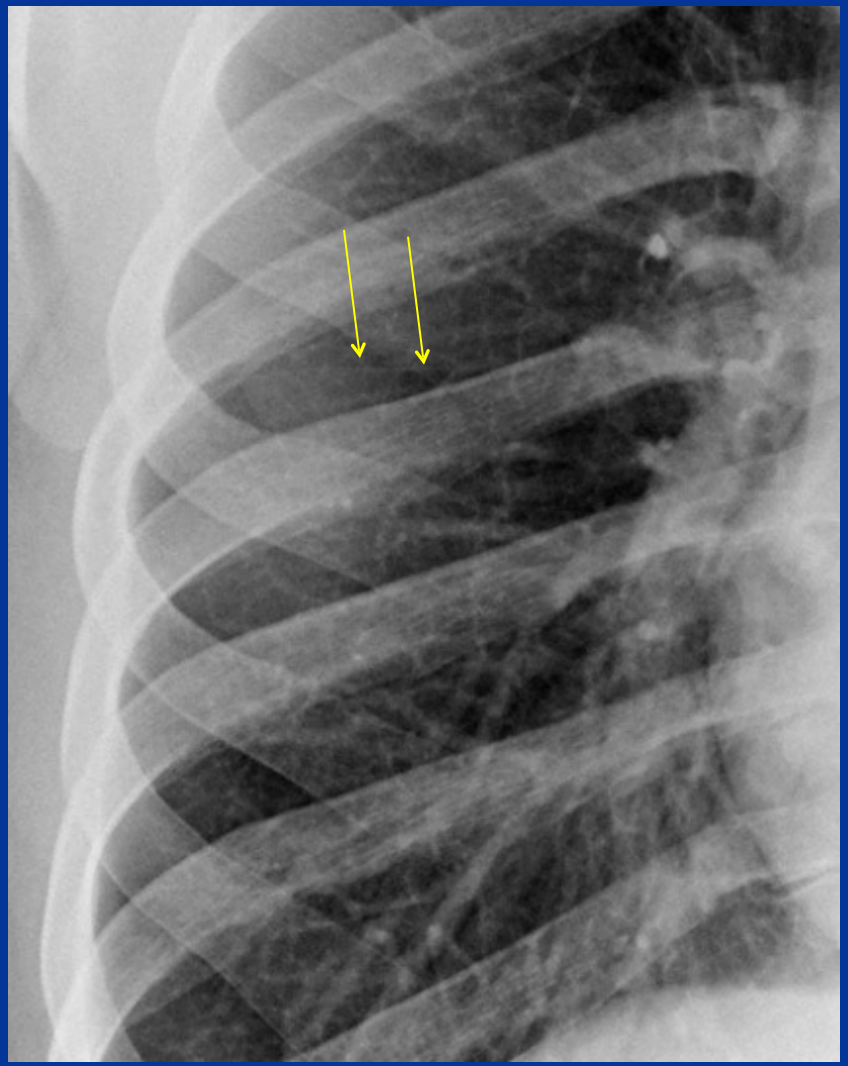
- The surface of the visceral pleura that covers the lung, is continuous with the visceral pleura that covers the fissures.The left lung is divided into two lobes, upper and lower. These lobes have their own pleural covering and these lie together to form the oblique (major) fissure.In the right lung there is an oblique fissure and a horizontal fissure, separating the lung into three lobes - upper, middle, and lower. Each lobe again has its own visceral pleural covering.
- Lateral chest X-rays are helpful in demonstrating the oblique fissures (also known as the major fissures)

Lobes and fissures

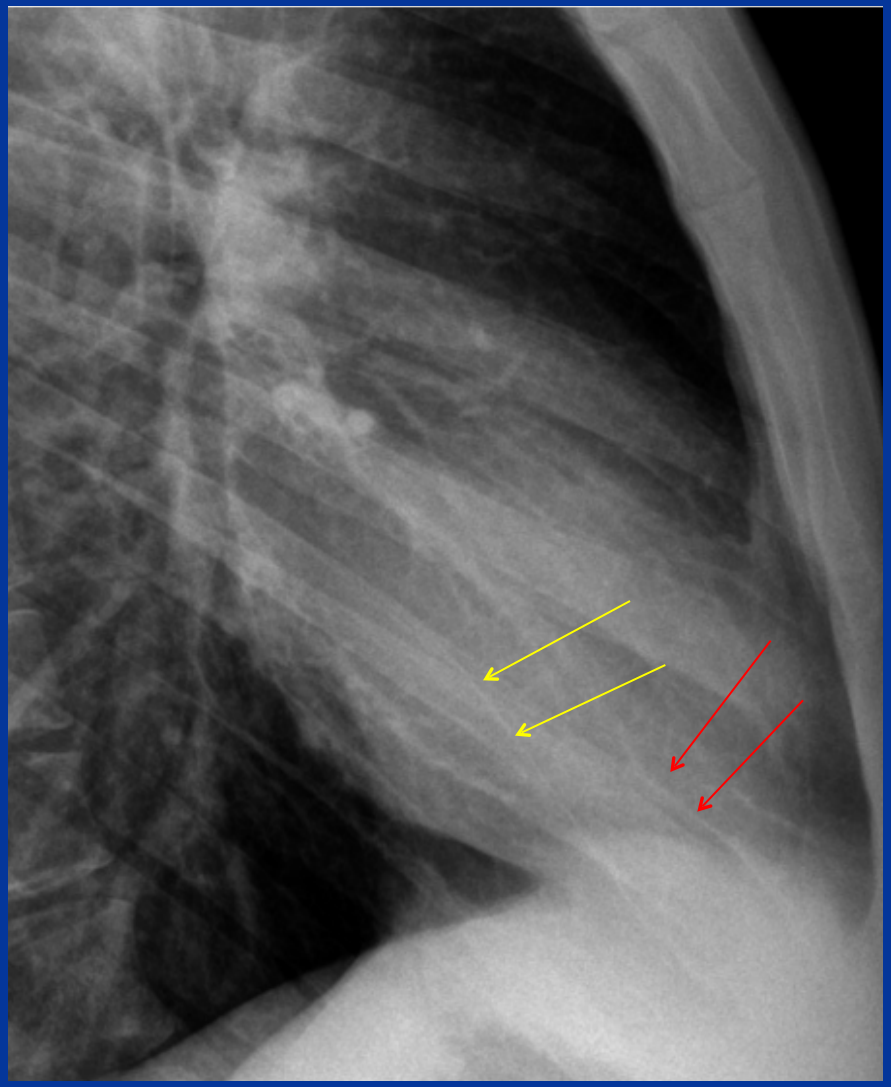
- **This cut-out of a lateral chest X-ray shows the positions of the lobes of the right lung**
- **On the left the oblique fissure is in a similar position but there is usually no horizontal fissure, and so there are only two lobes on the left**.

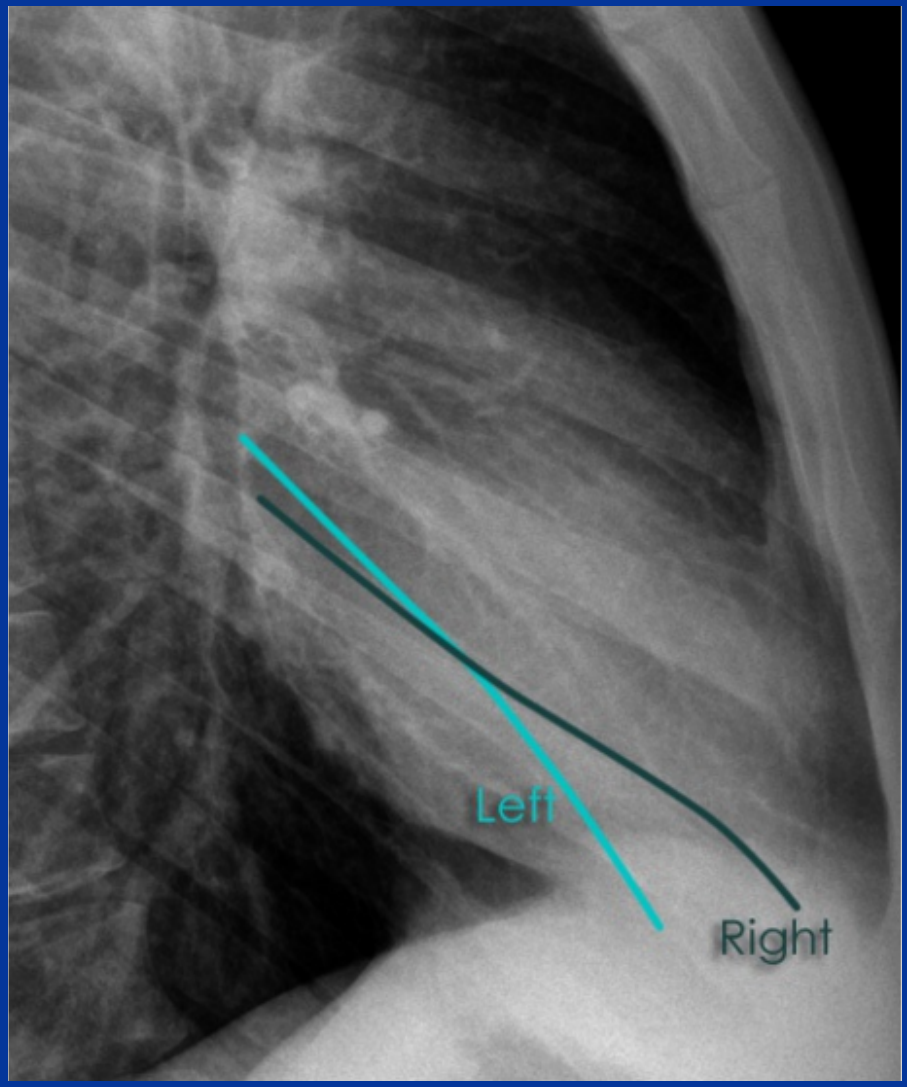
Transverse fissure



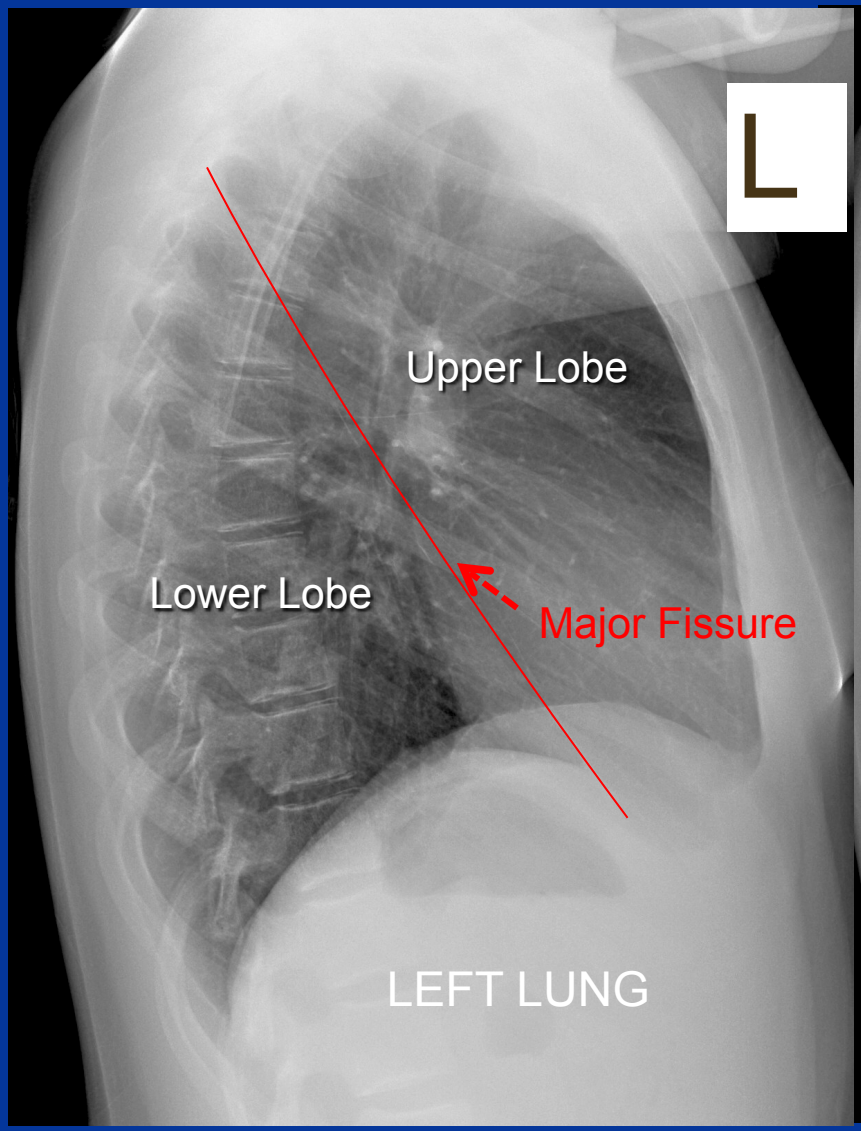


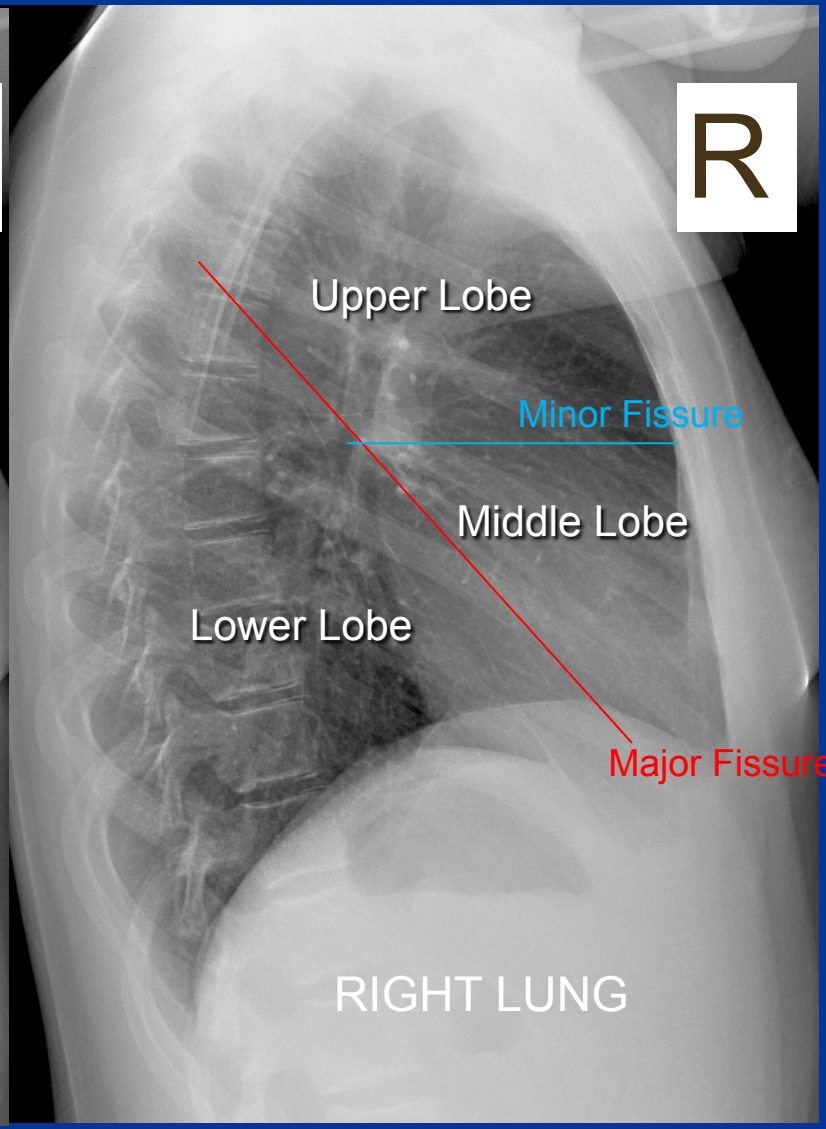
Oblique fissure





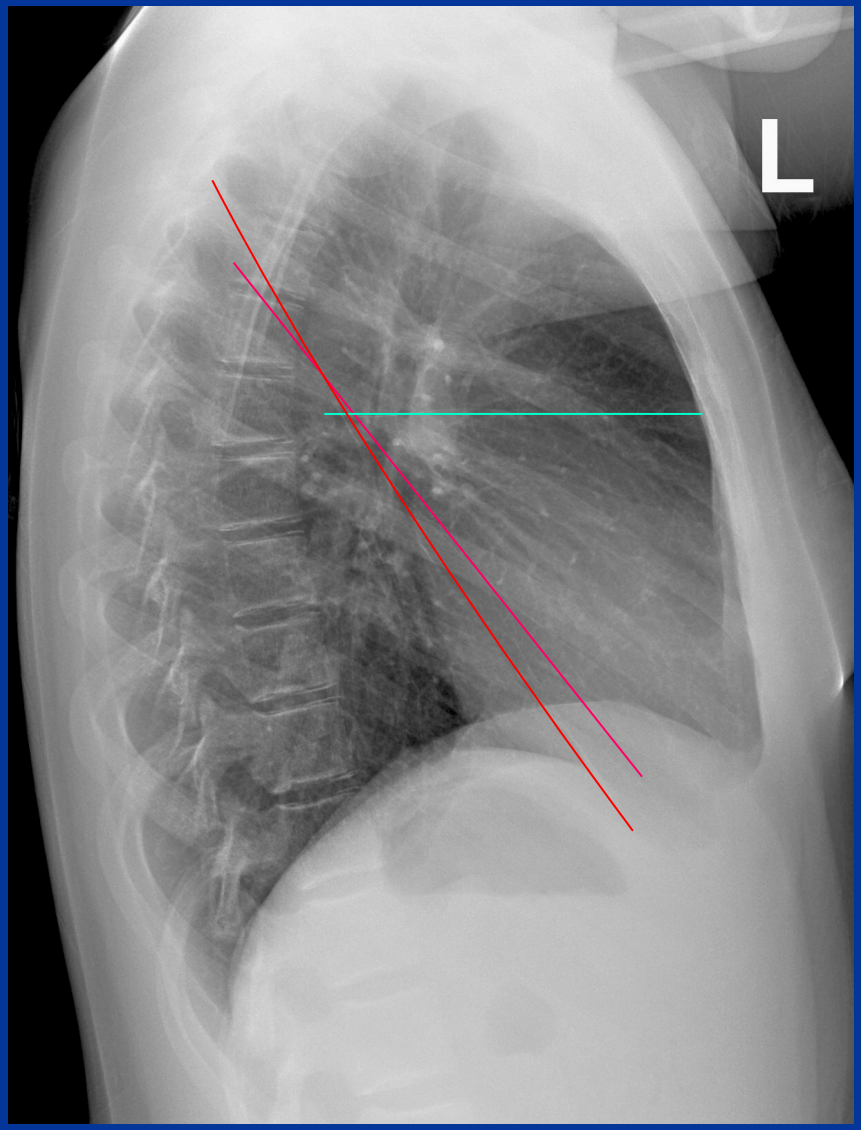
Radiological Anatomy of the Chest





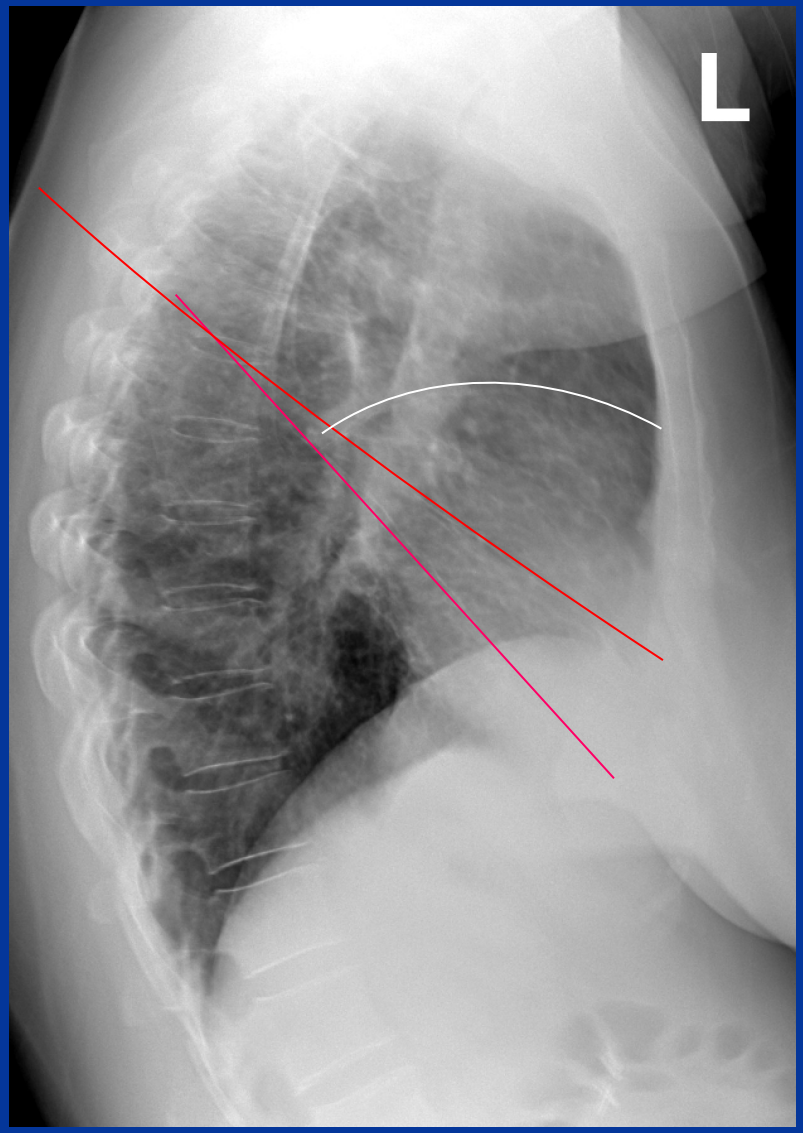
Radiological Anatomy of the Chest

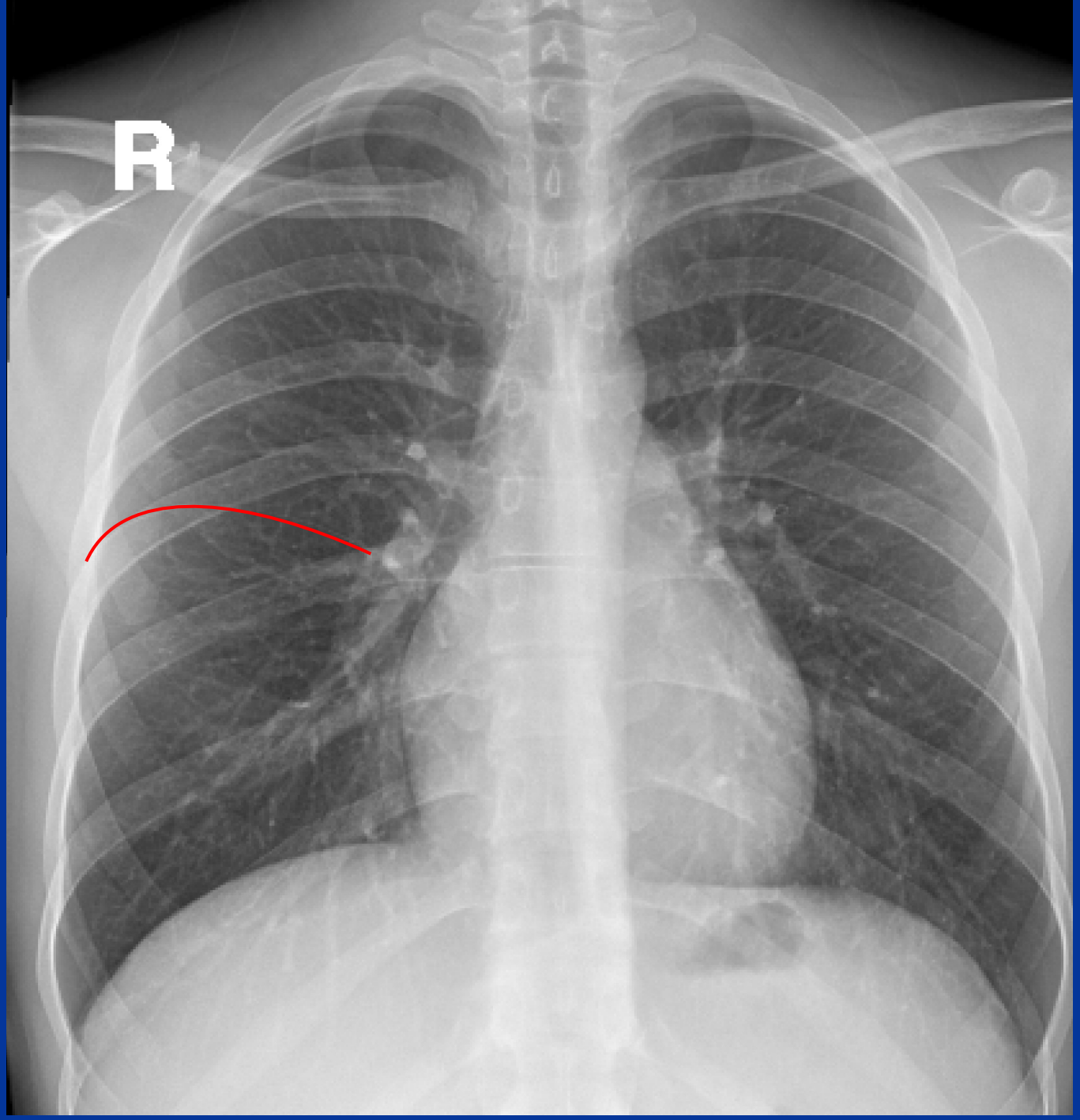
Fissures



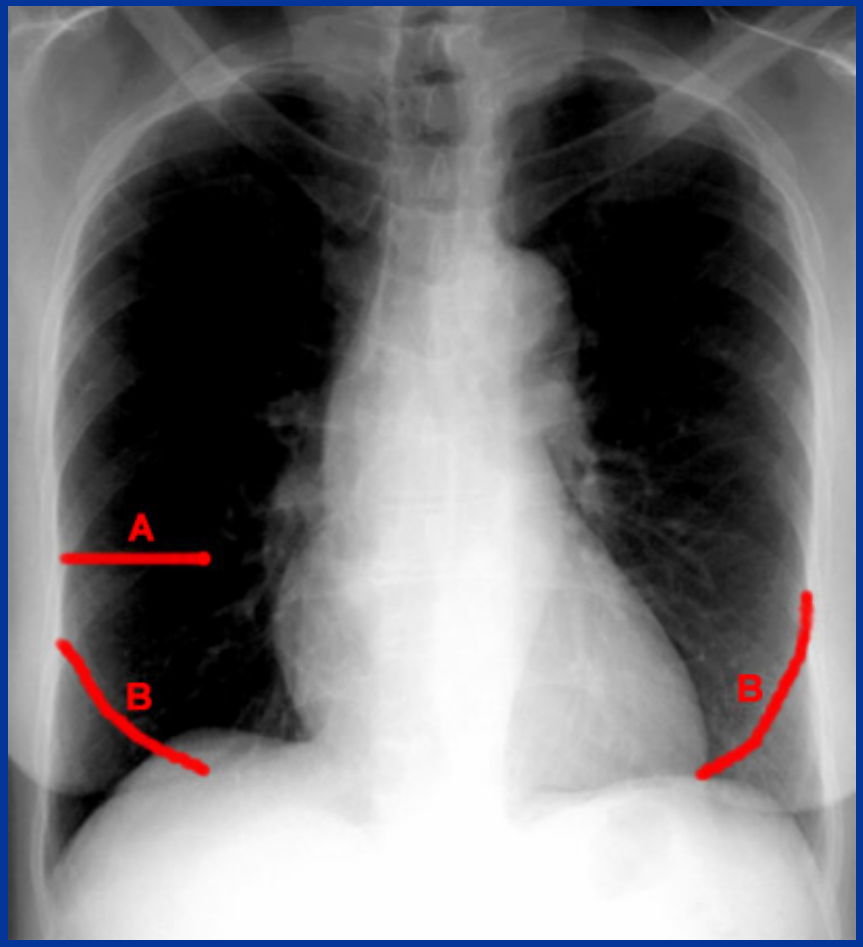
Radiological Anatomy of the Chest

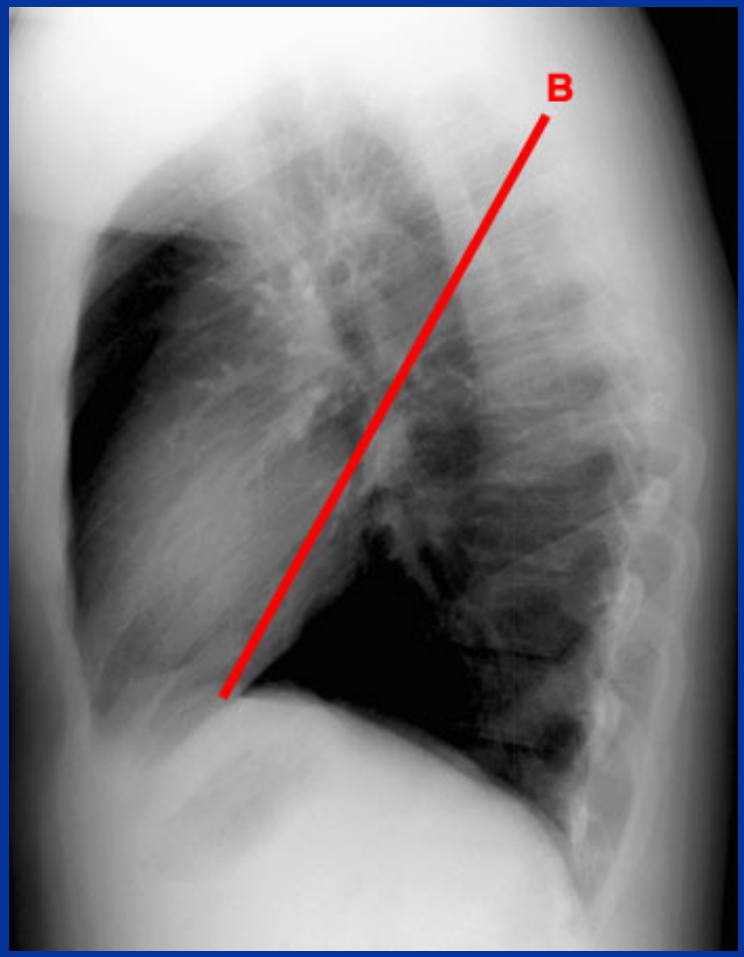
Fissures



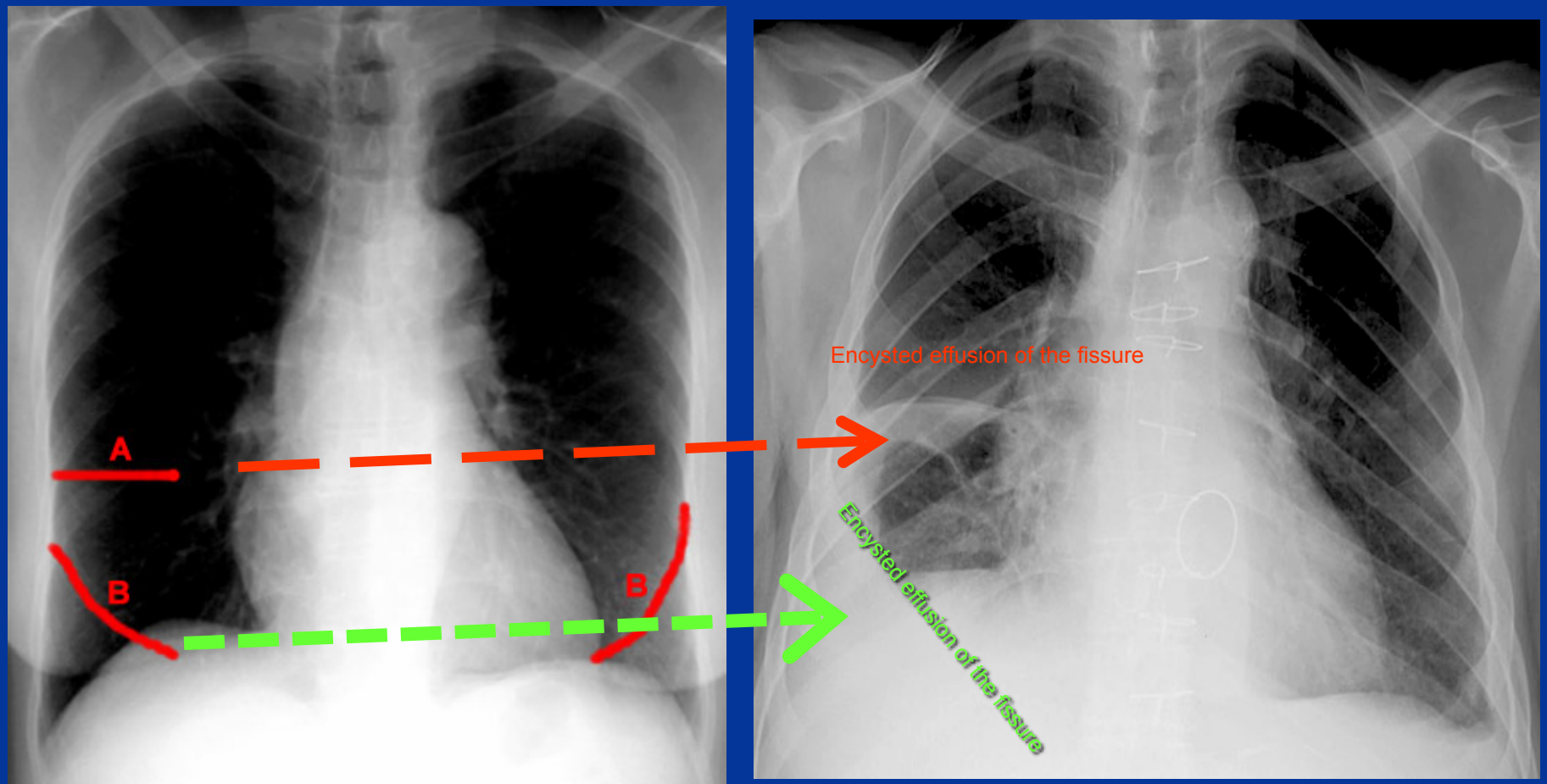

R

FISSURES

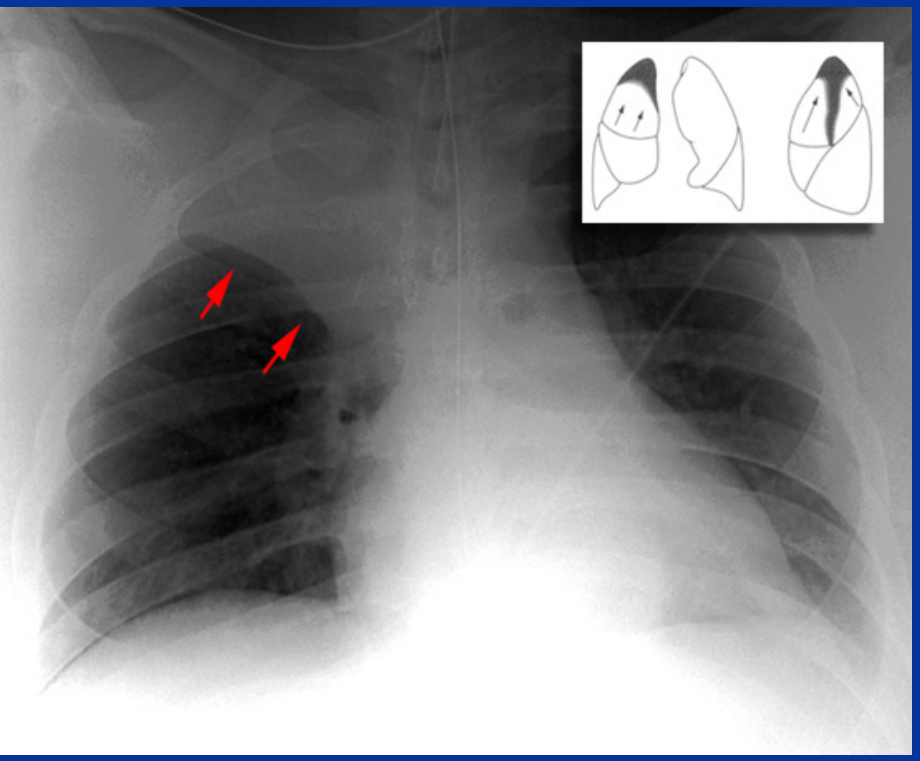


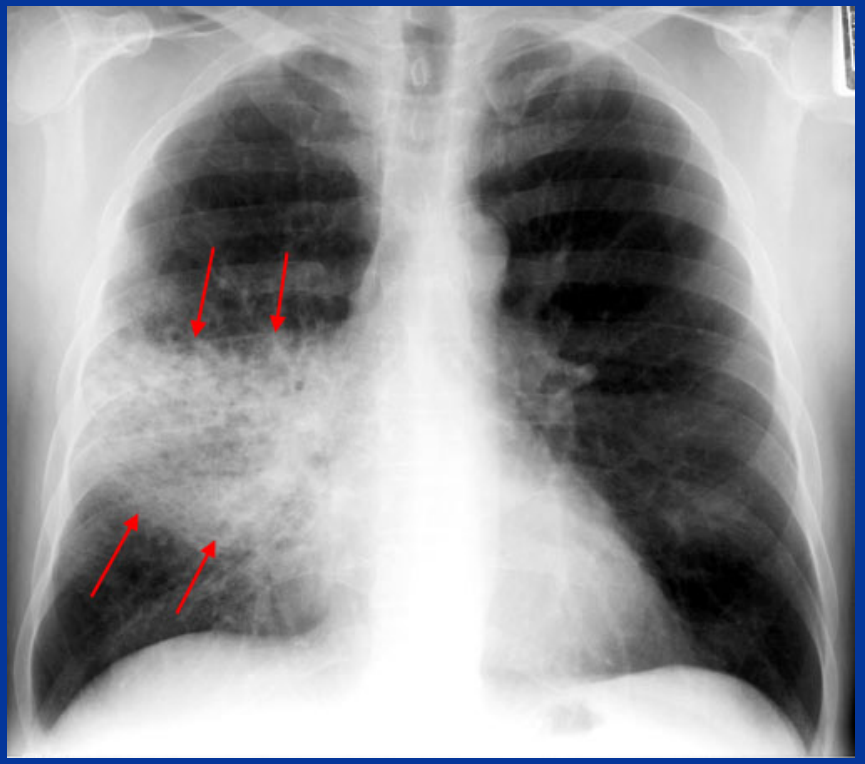


FISSURES


A
B
B
Encysted effusion of the fissure
Encysted effusion of the fissure

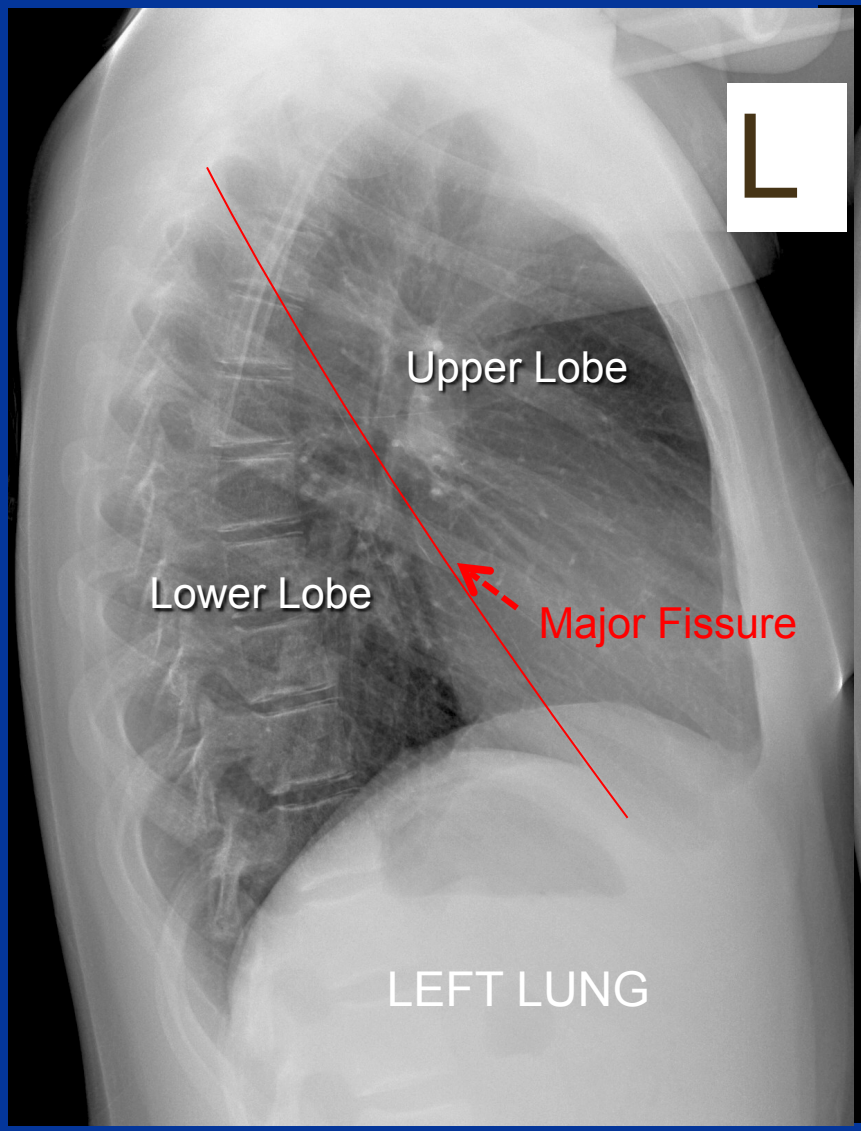
Fissures outlines segments
ATELECTASIS Vs *PNEUMONIA*

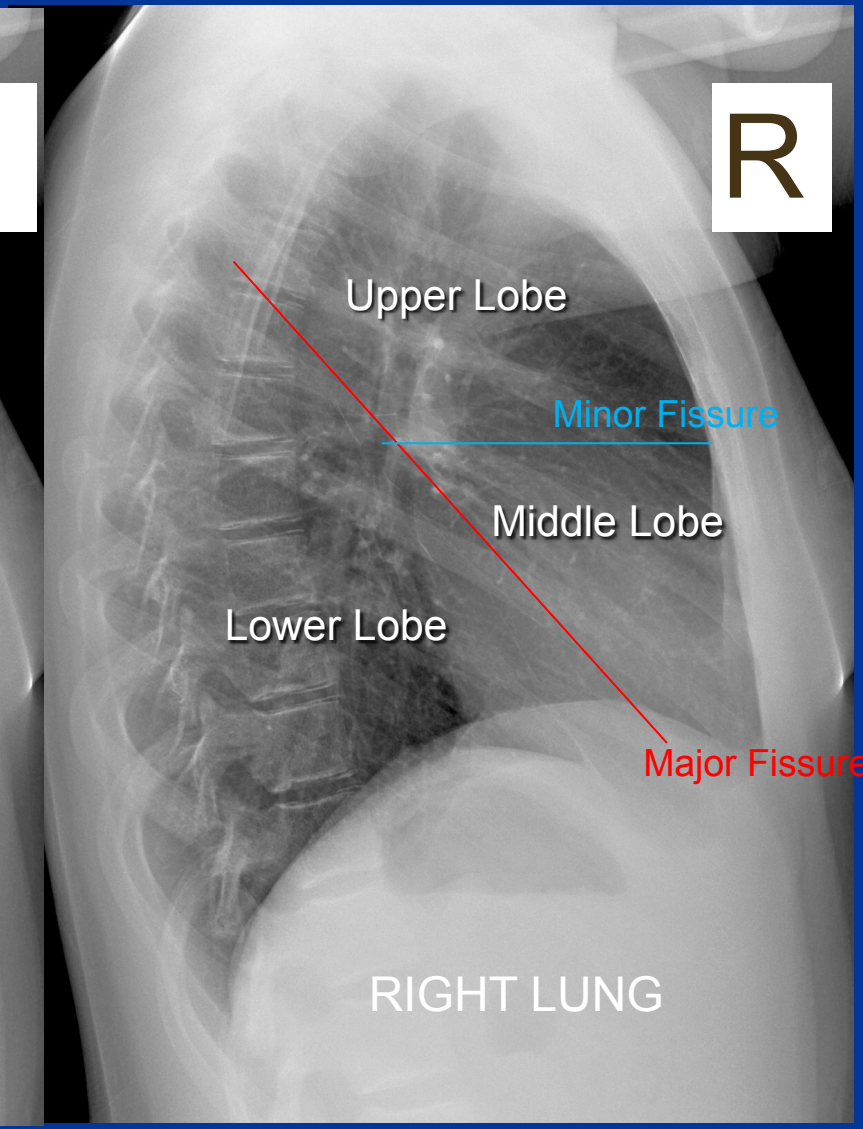




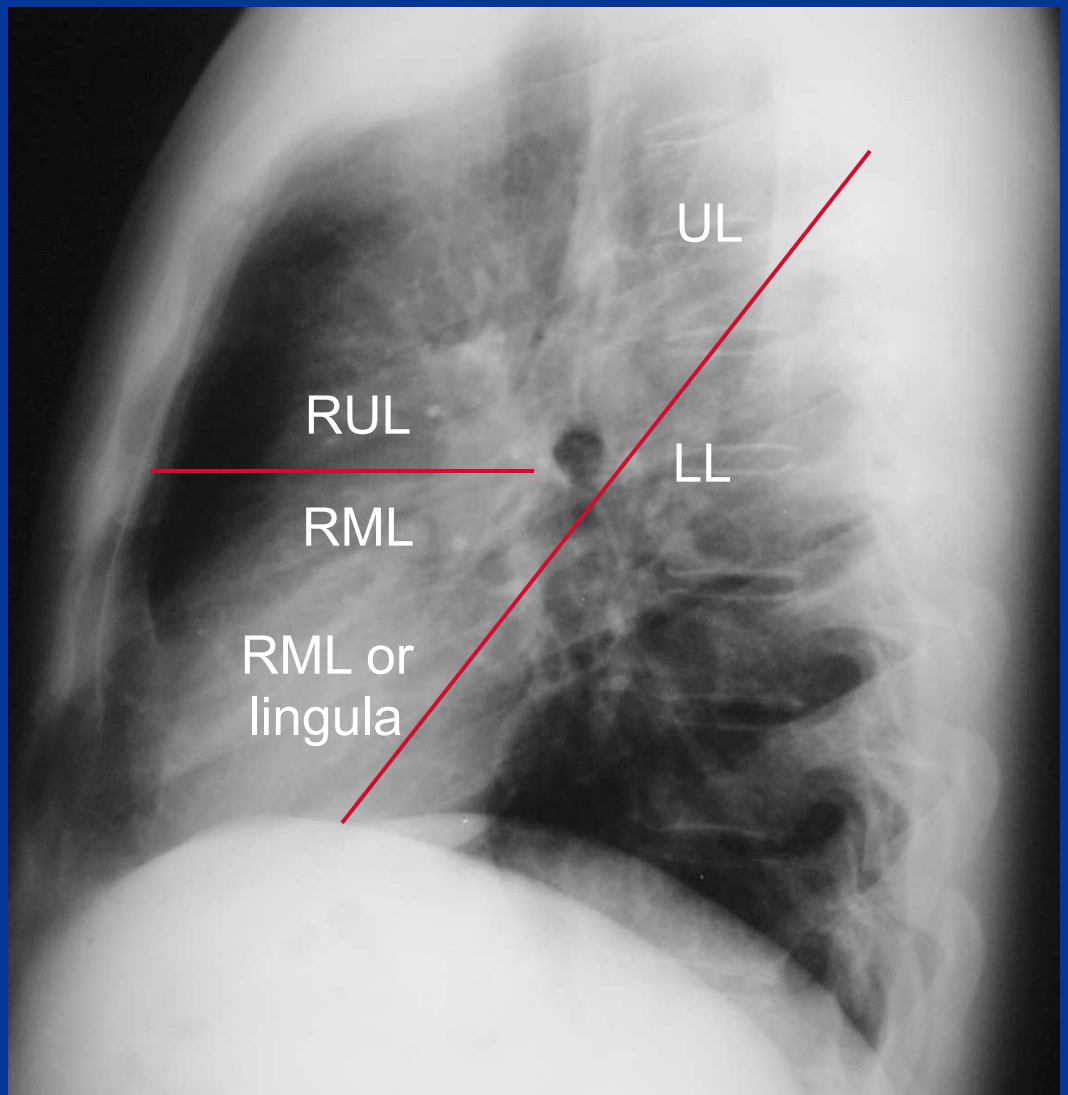
Radiological Anatomy of the Chest

Localizing disease by fissures

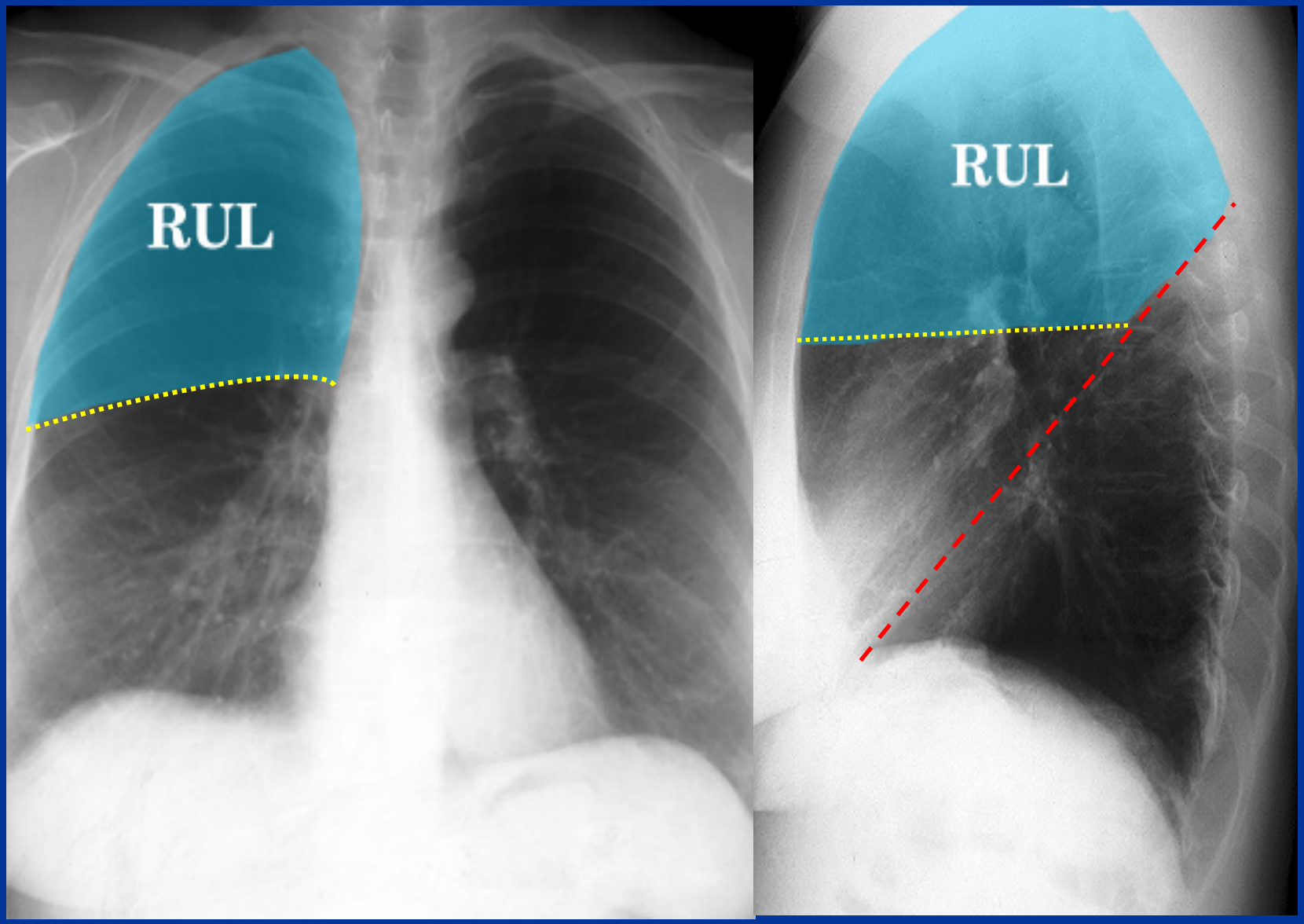




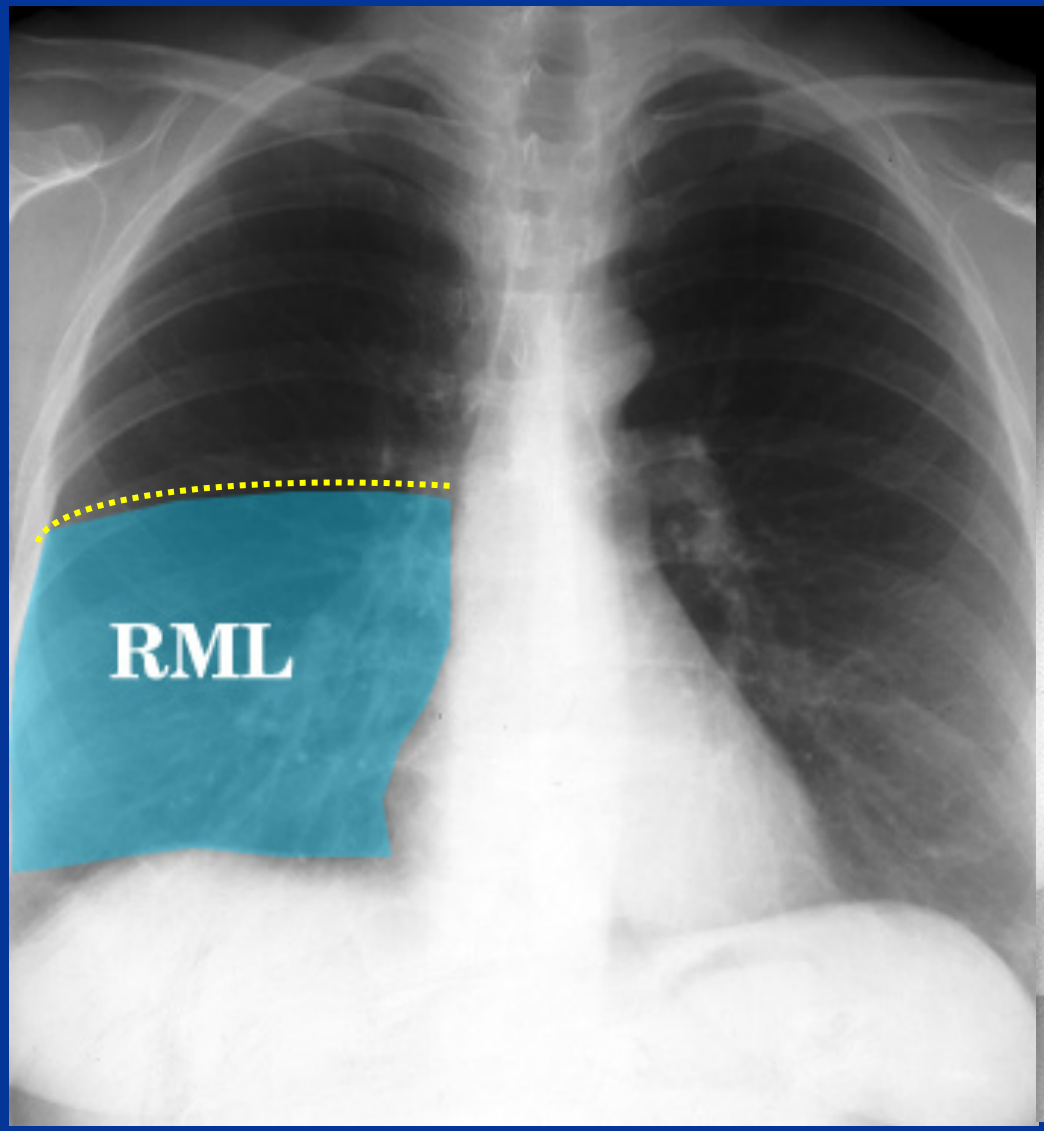
Localizing disease by fissures

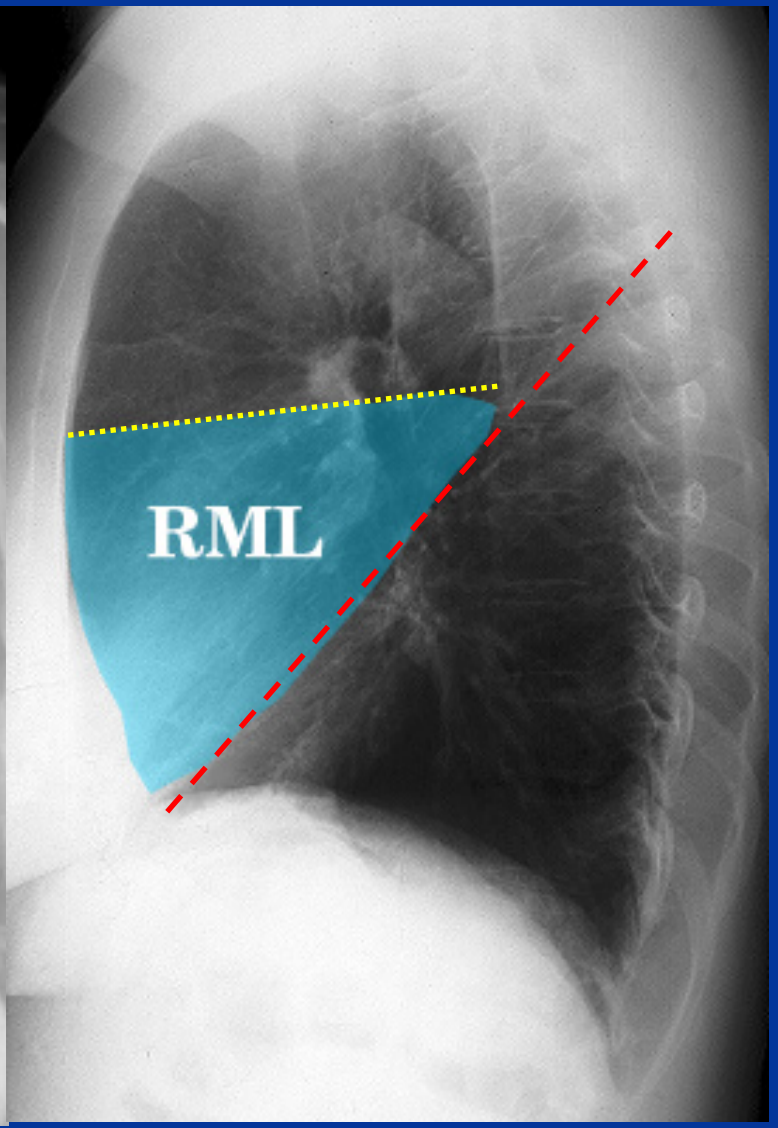


Radiological Anatomy of the Chest

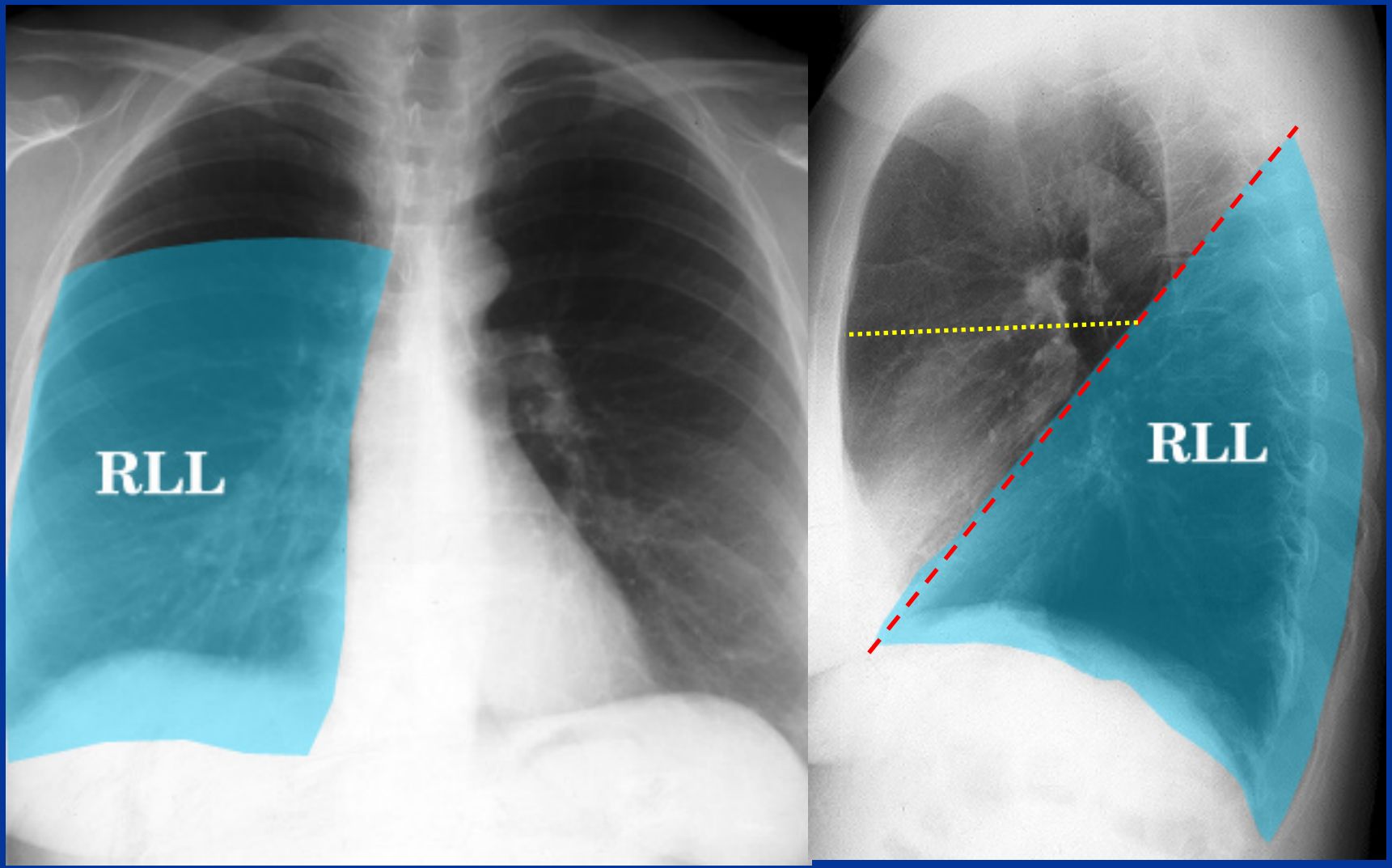


Radiological Anatomy of the Chest

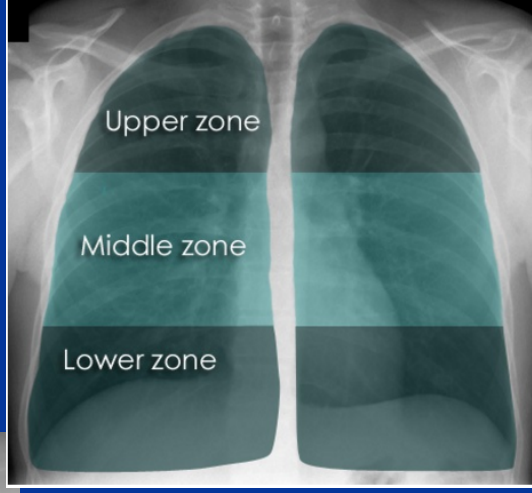




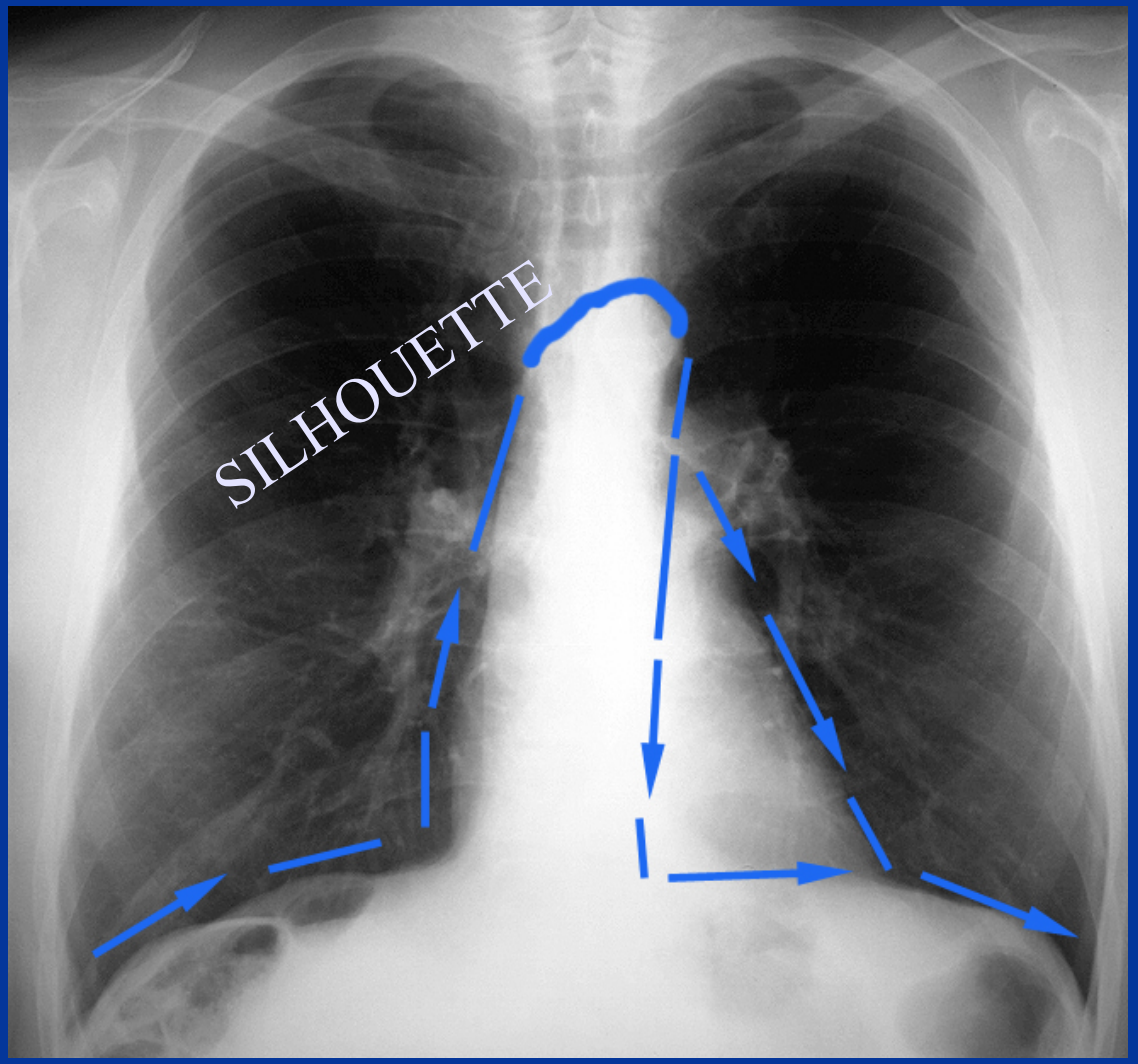
Radiological Anatomy of the Chest



How to read Frontal Chest X-Ray

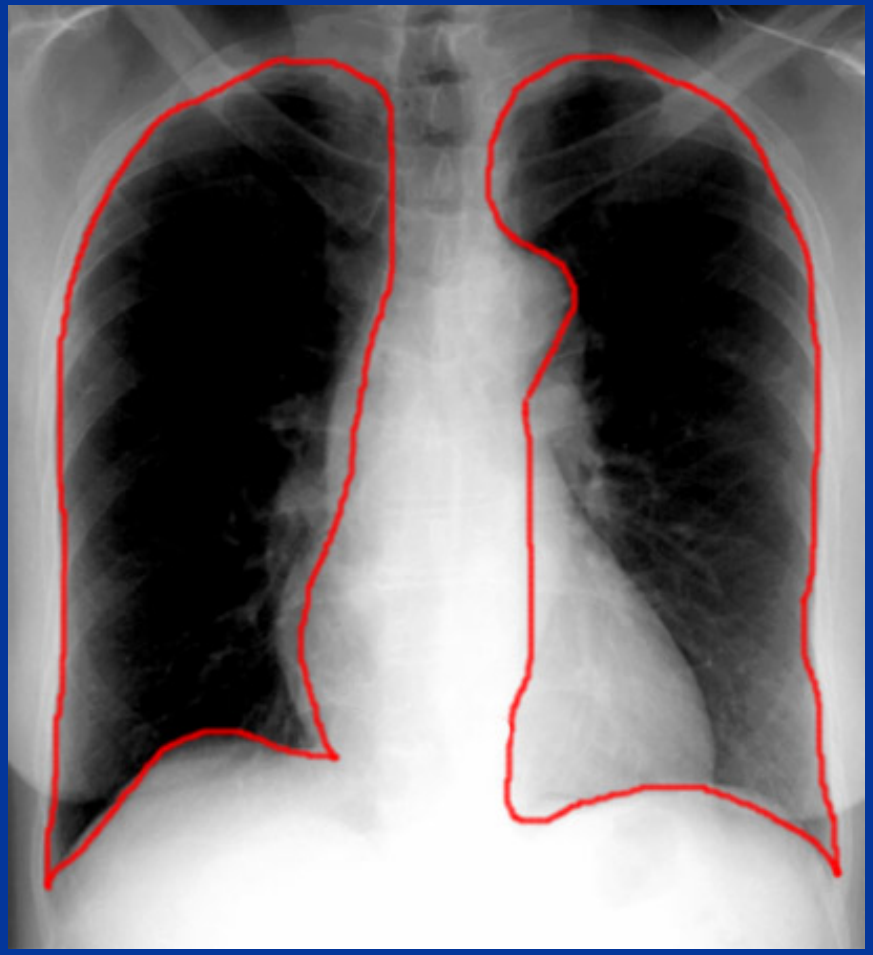


Frontal Chest X-Ray

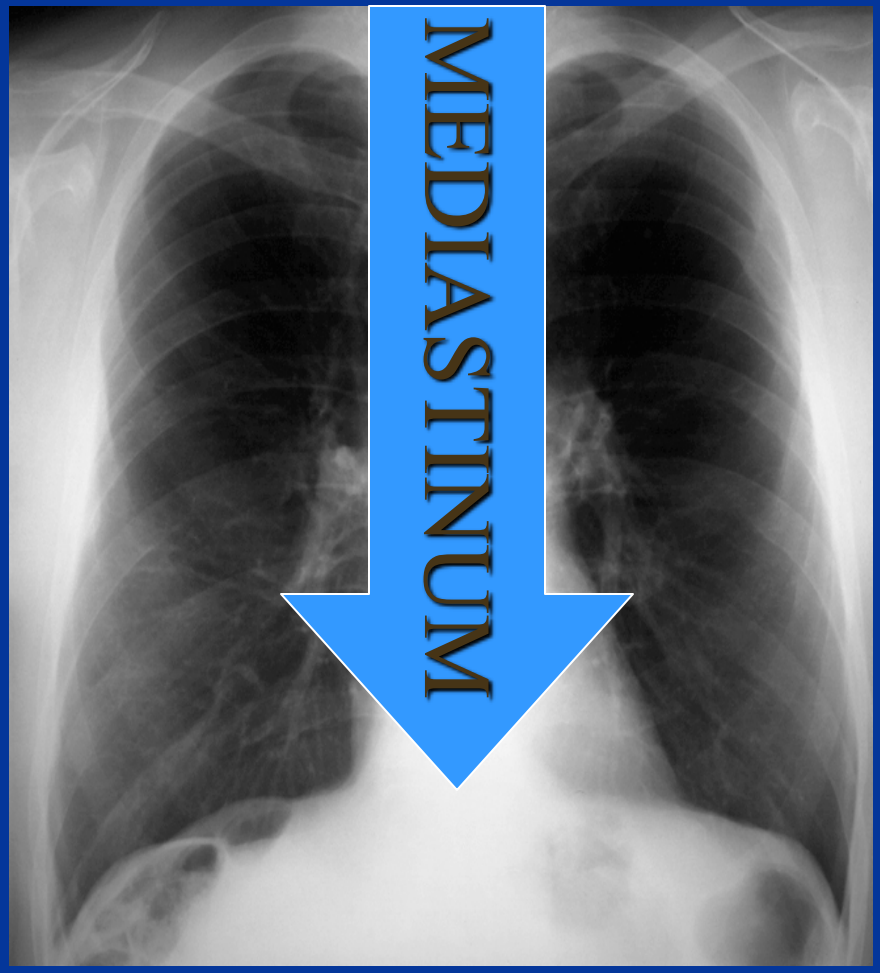


See
Section on the Silhouette Sign

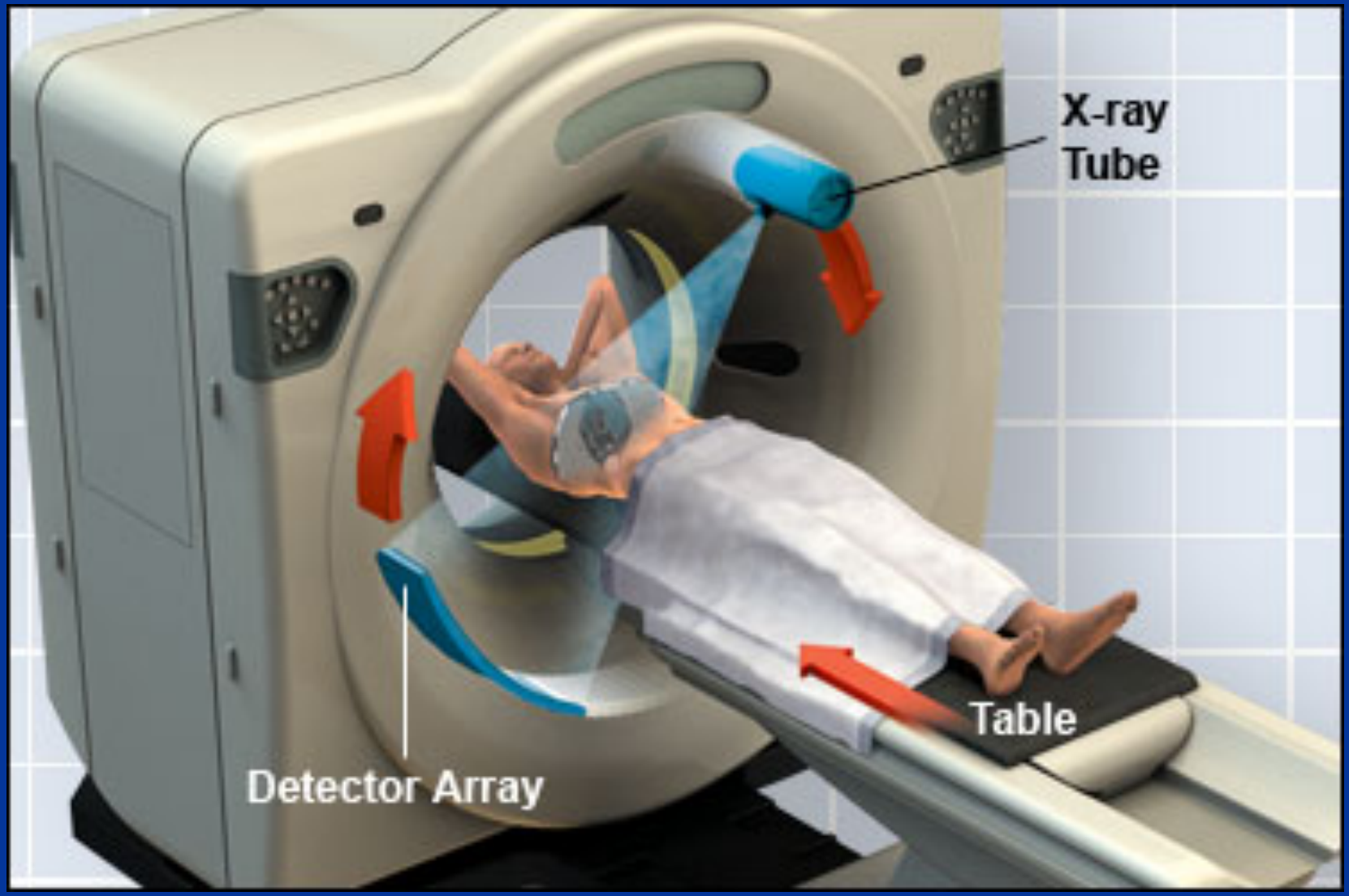
LUNGS



Frontal Chest X-Ray



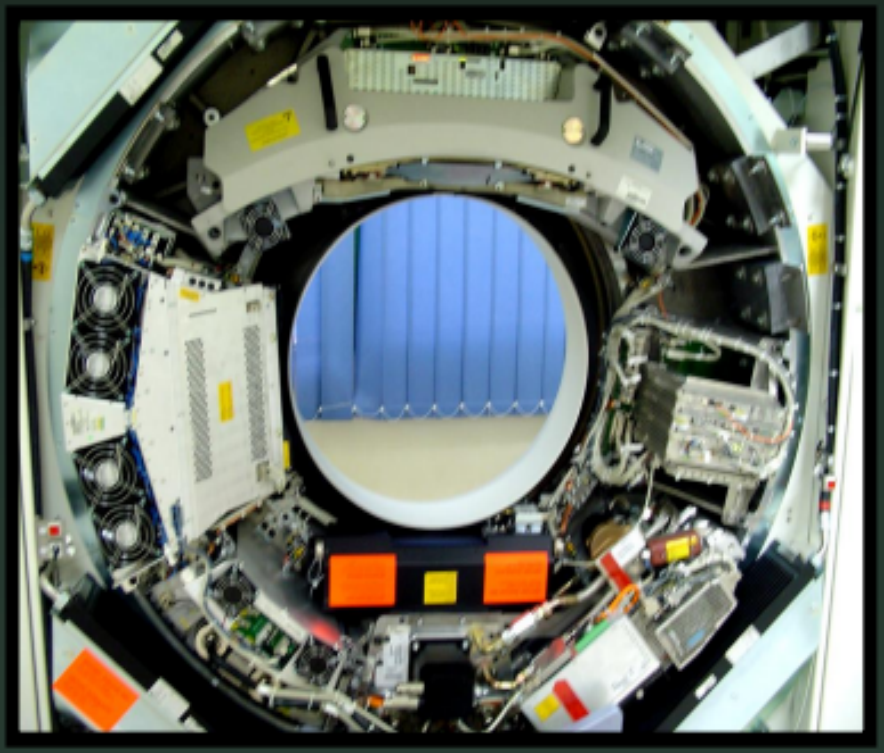
CT EXAMINATION OF THE CHEST



The Examination

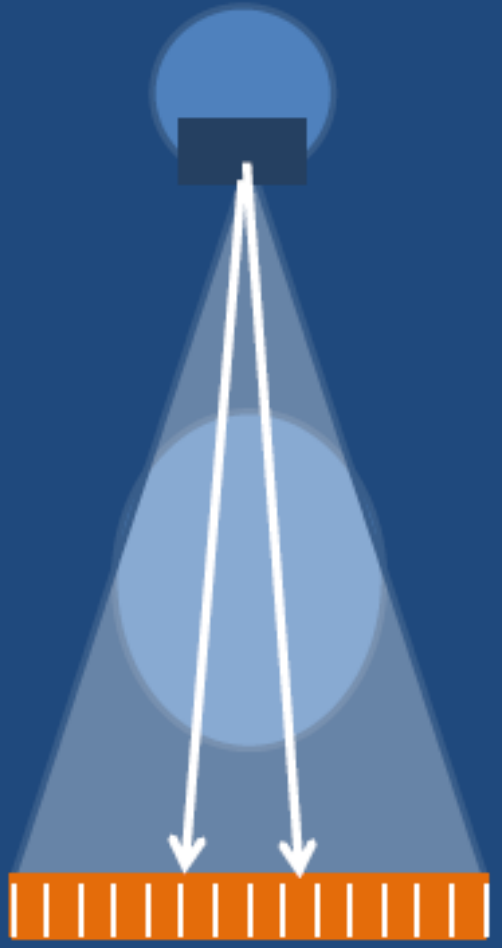
Scanning techniques

- Standard Examination
- High resolution [HRCT]



Third Generation CT

- Arc of detector elements
- Wider fan beam
- Translation of tube and detector
- Faster scan speed



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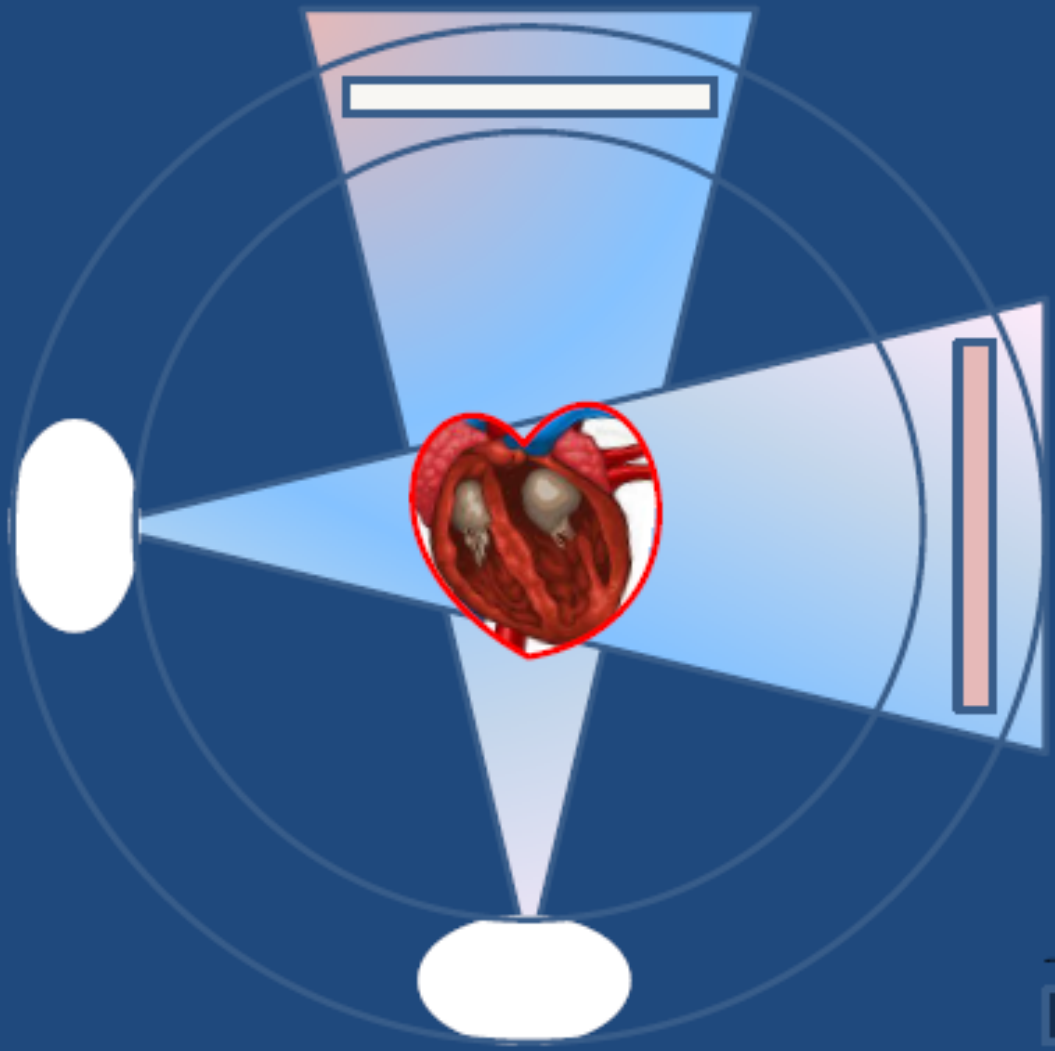
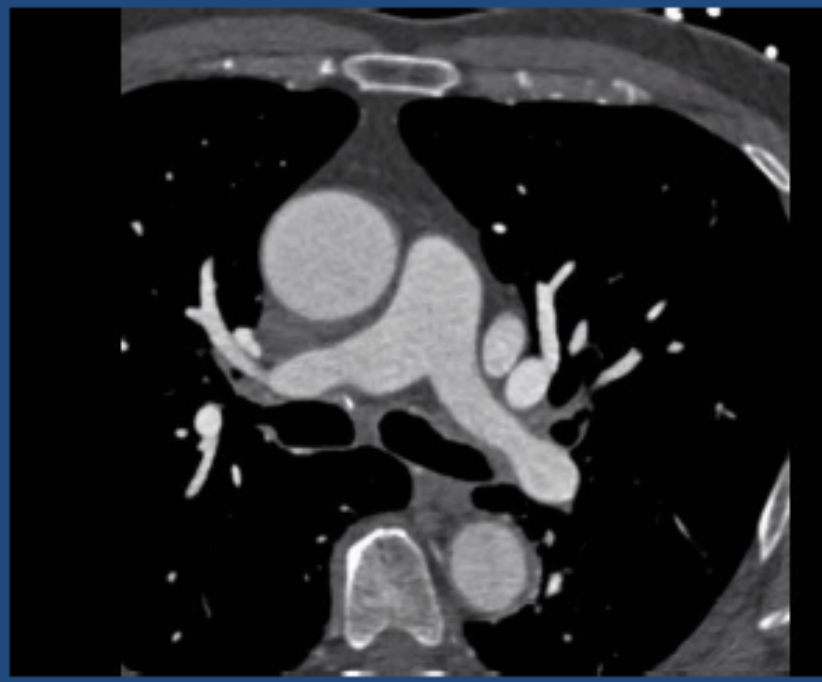
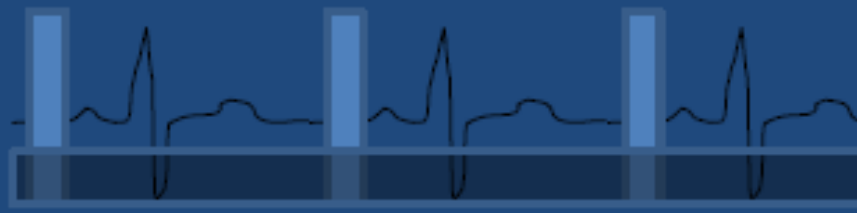
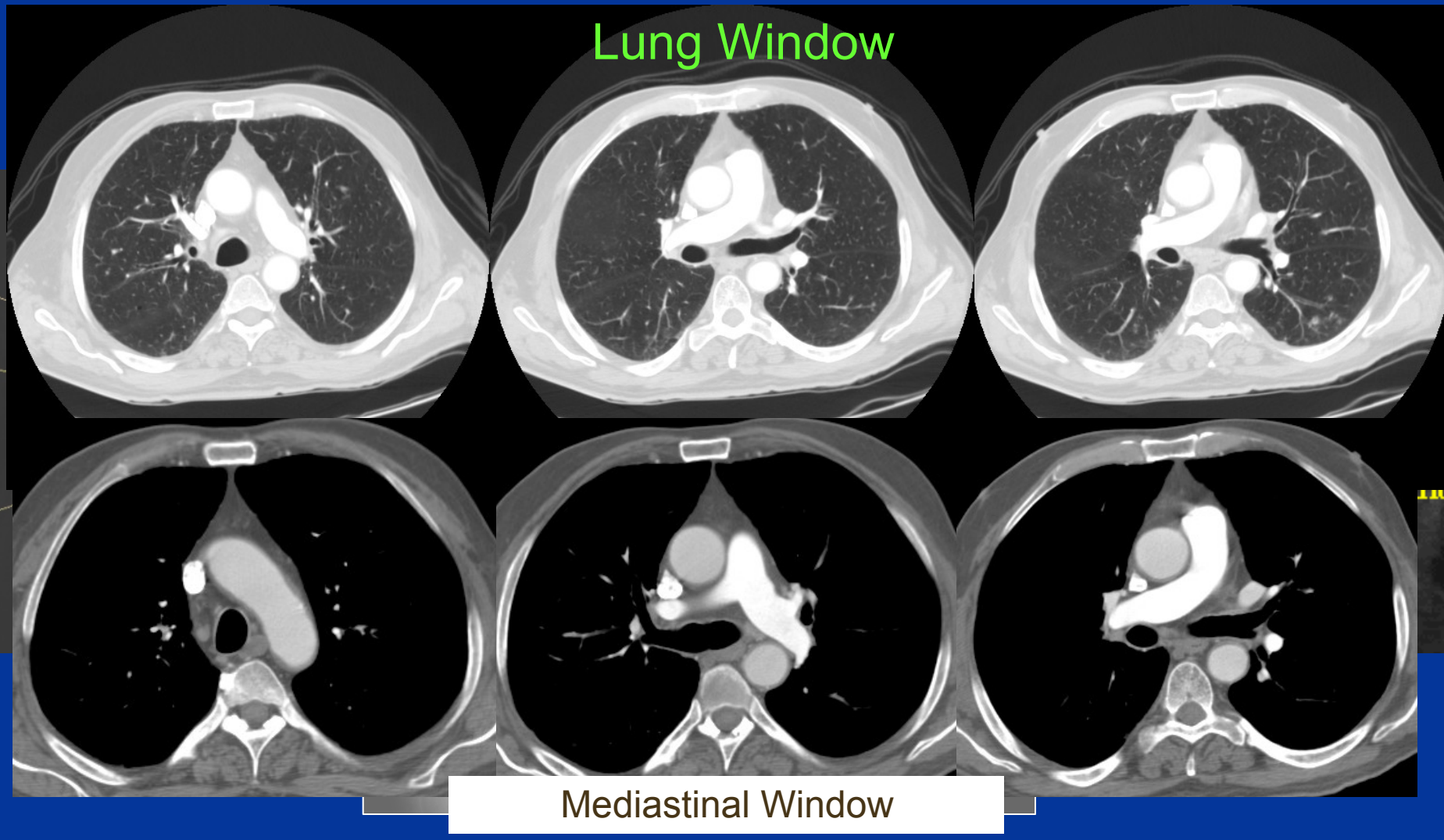


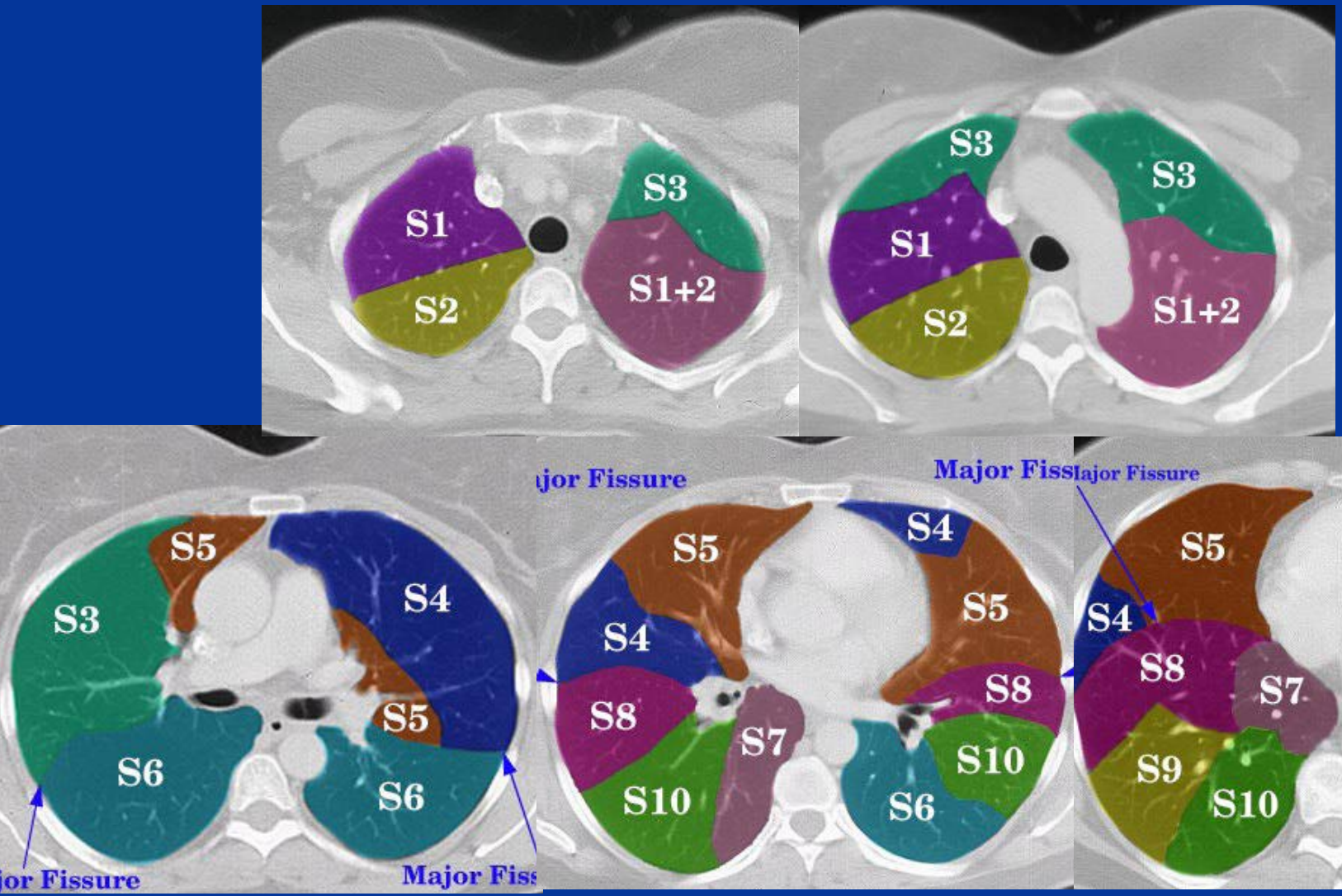




Radiological Anatomy of the Chest

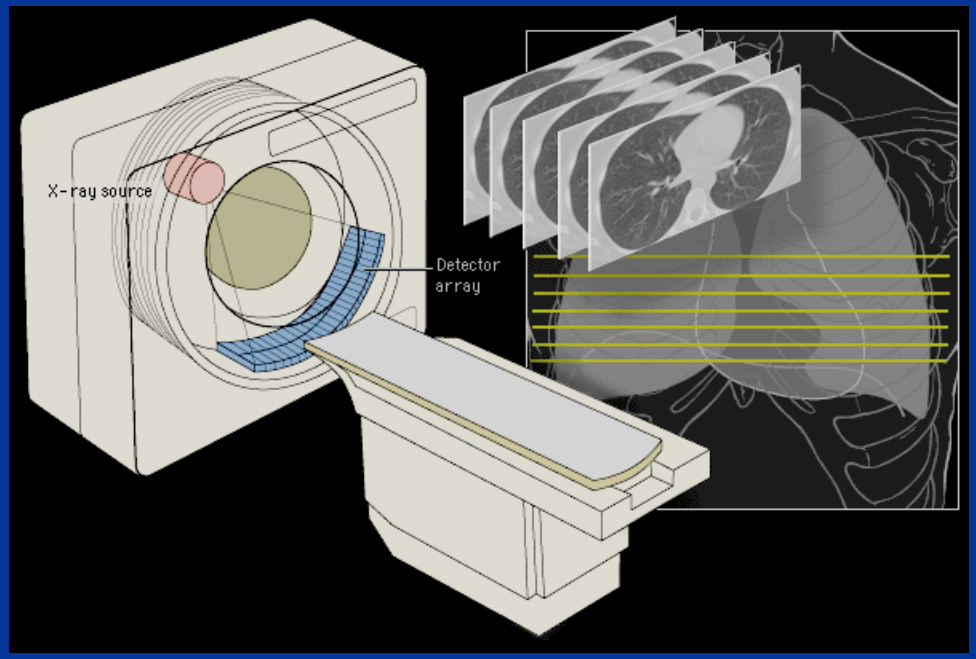


Radiological Anatomy of the Chest



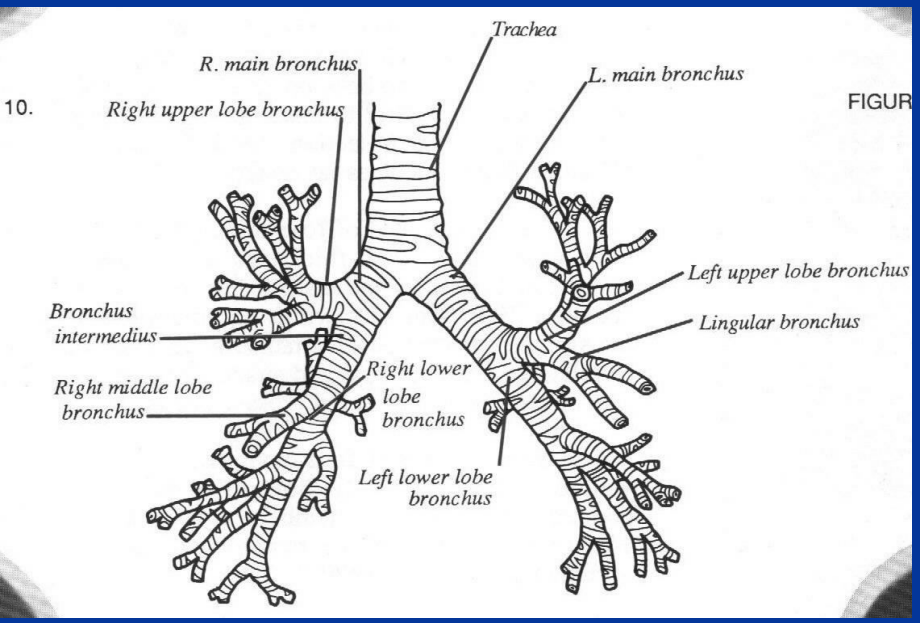
High Resolution CT Scan

- 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.

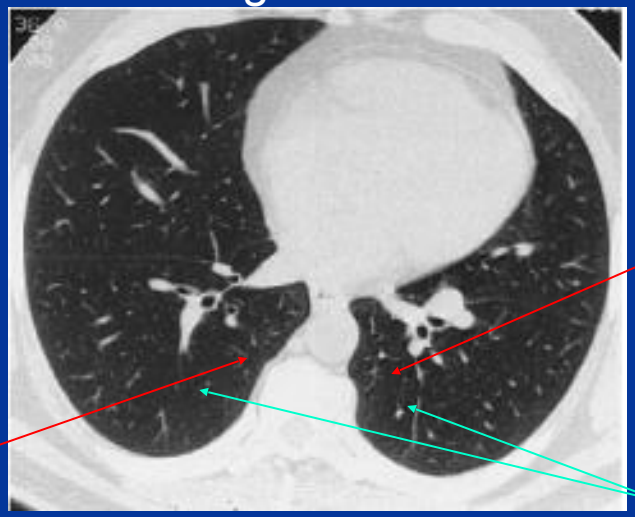


Normal Lung Anatomy

Tracheobronchial Tree



Normal lung at level inferior

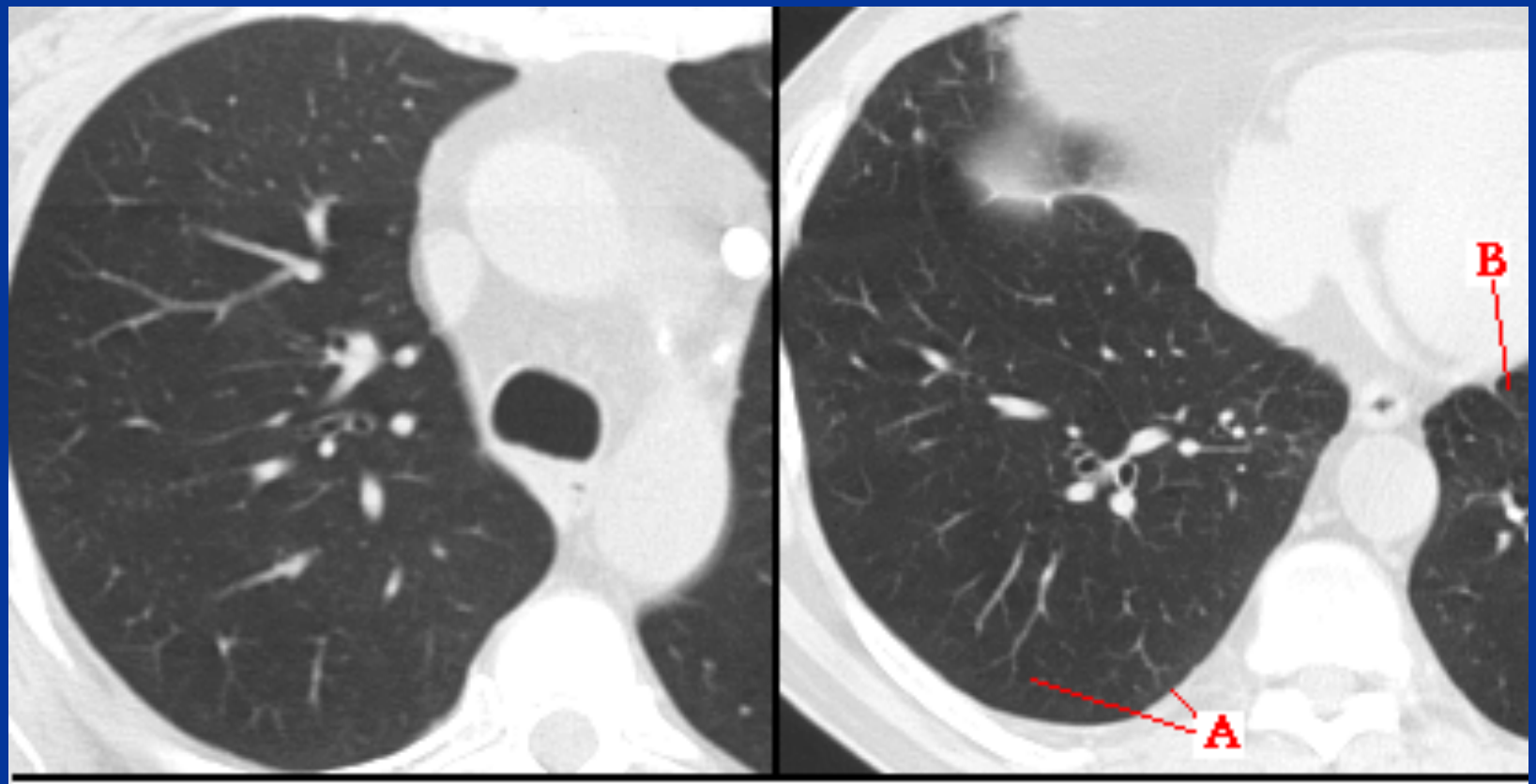


L inferior pulmonary vein

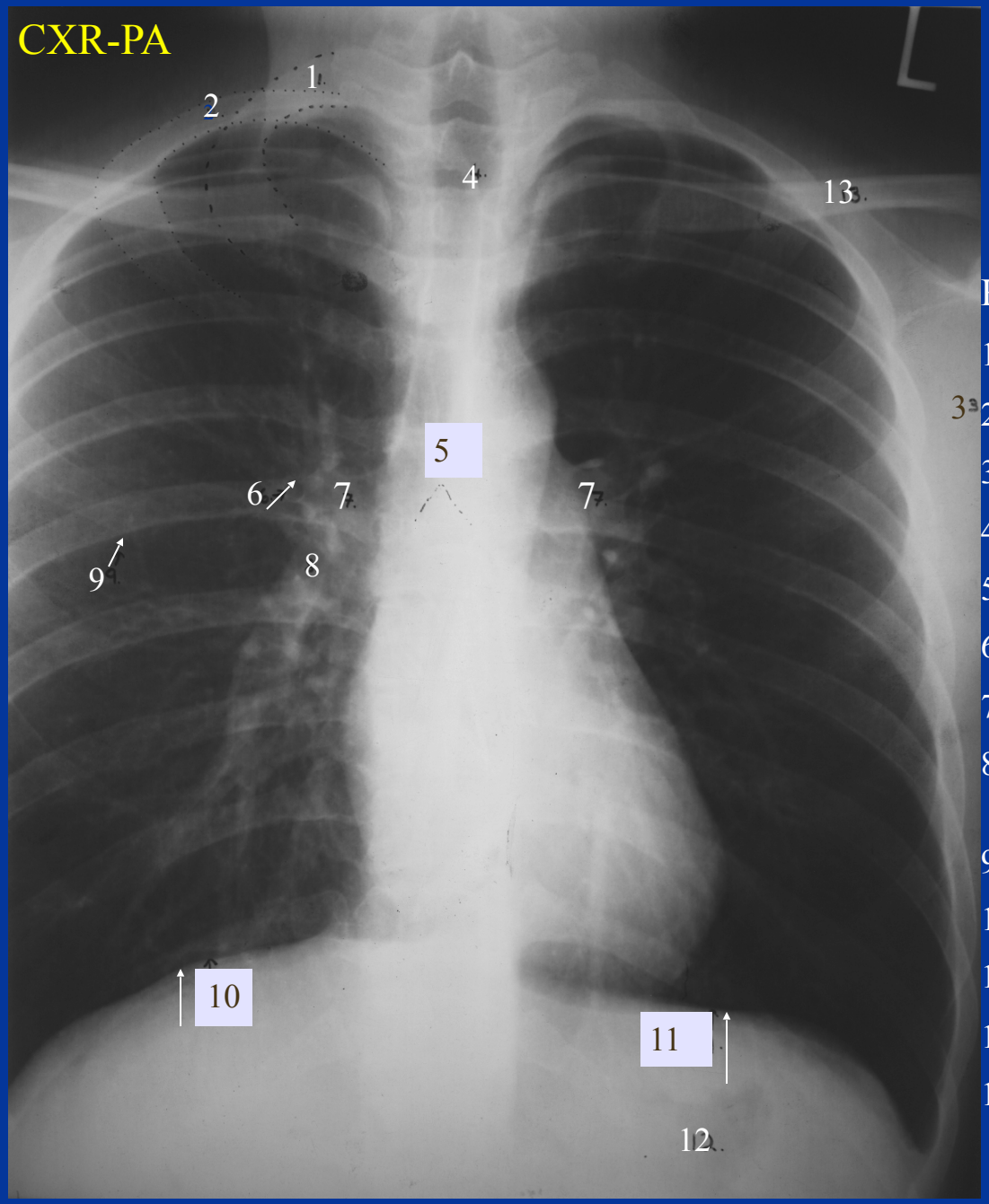
R inferior pulmonary vein

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.

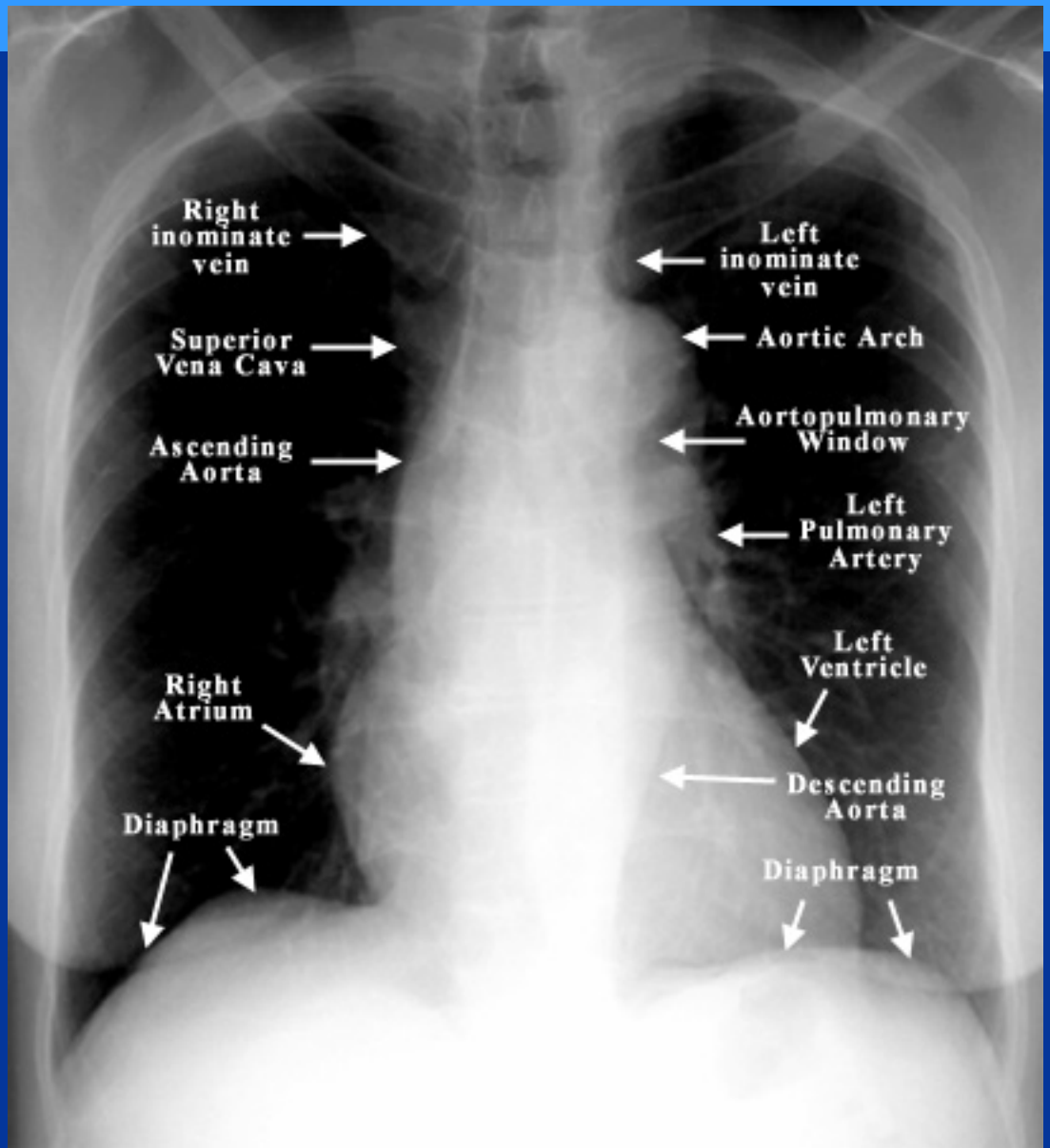


Anatomy on Normal Chest X-Ray

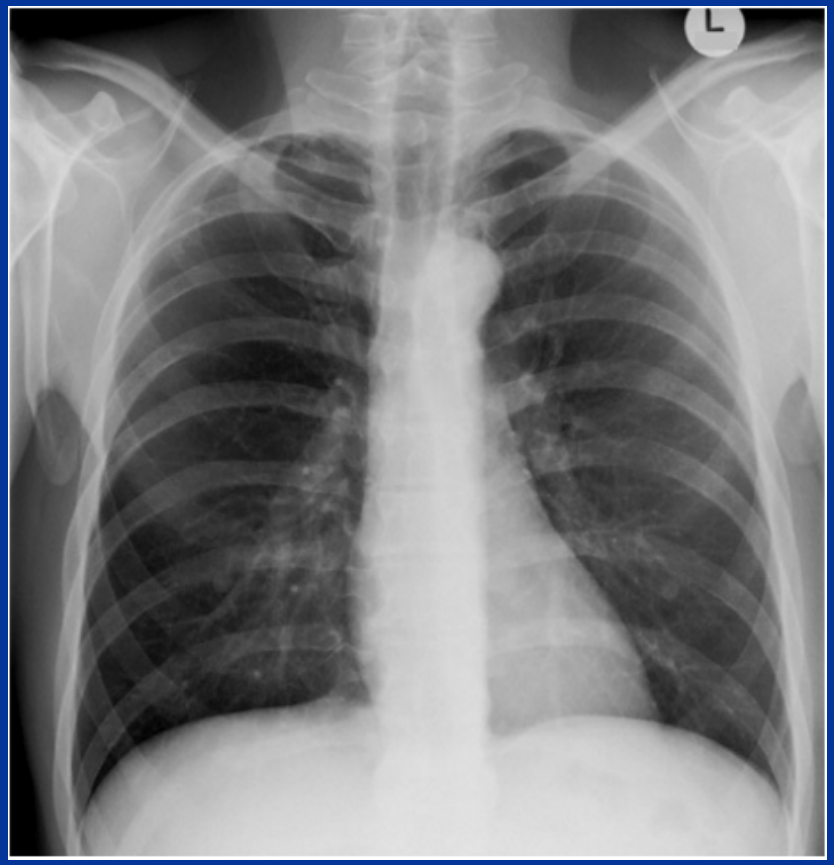
Key:

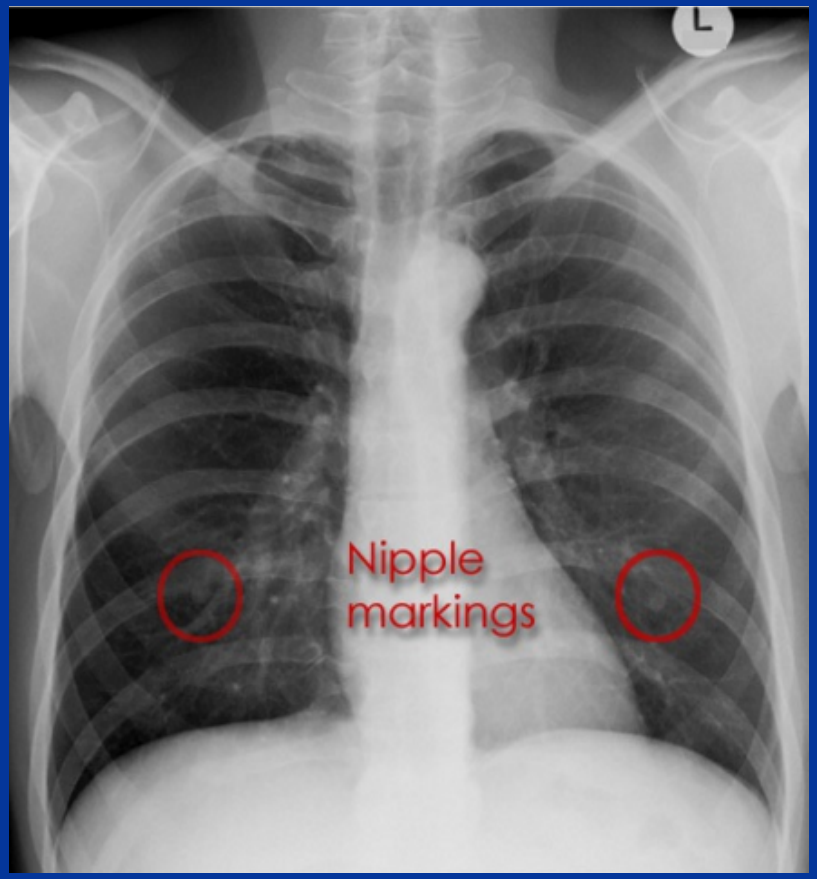
1. Right 1st rib
2. Right 2nd rib
3. Scapula
4. Trachea
5. Carina
6. Bronchus seen end on
7. Bilateral hila
8. Branch of right main descending pulmonary artery
9. Right minor (horizontal fissure)
10. Right hemi diaphragm
11. Left hemi diaphragm
12. Gastric air bubble
13. Left clavicle

PA VIEW ANATOMY

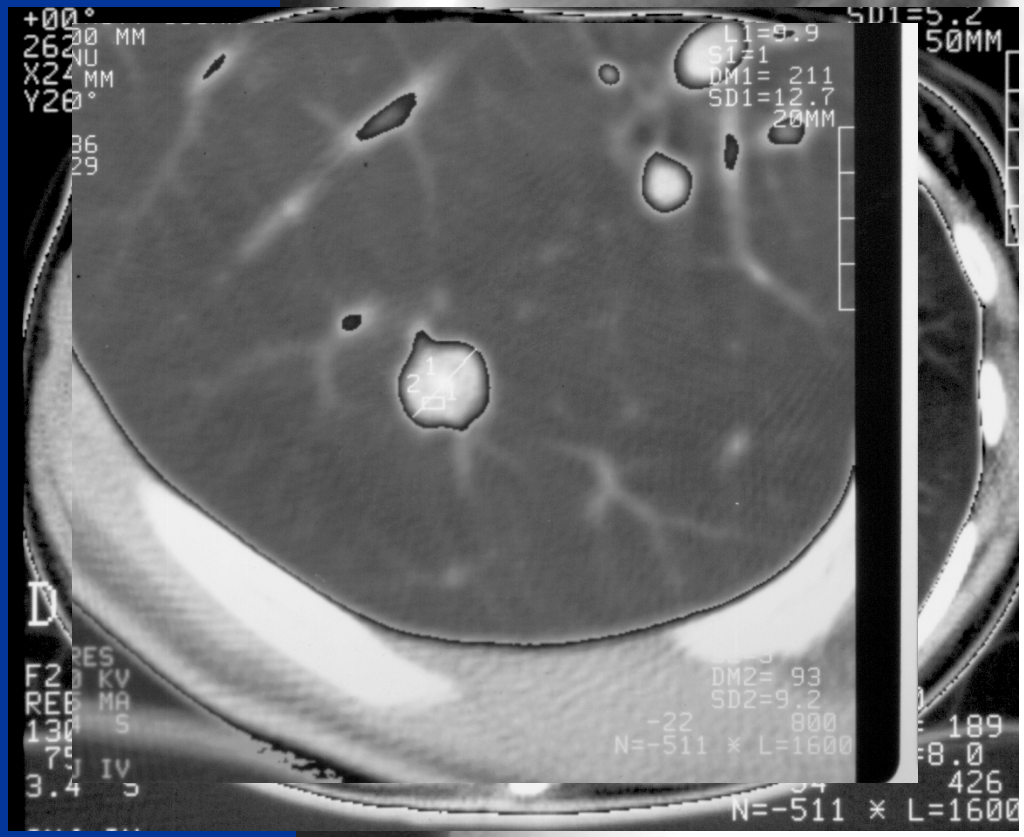


Nipple shadows





Frontal Chest X-Ray



Intrapulmonary nodule: hamartoma

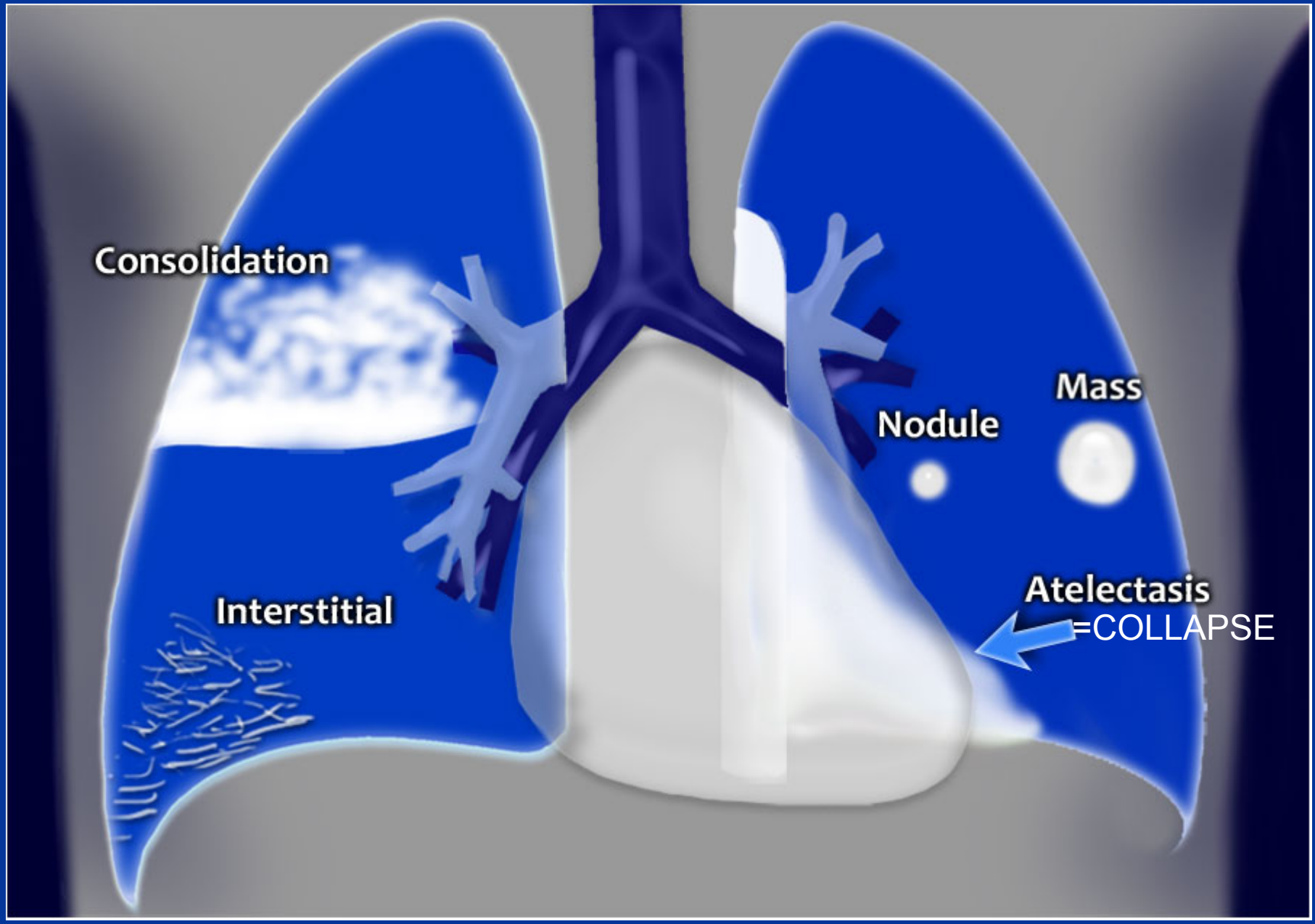
Nodule or right nipple ?

Remember

It's a chest x-ray,

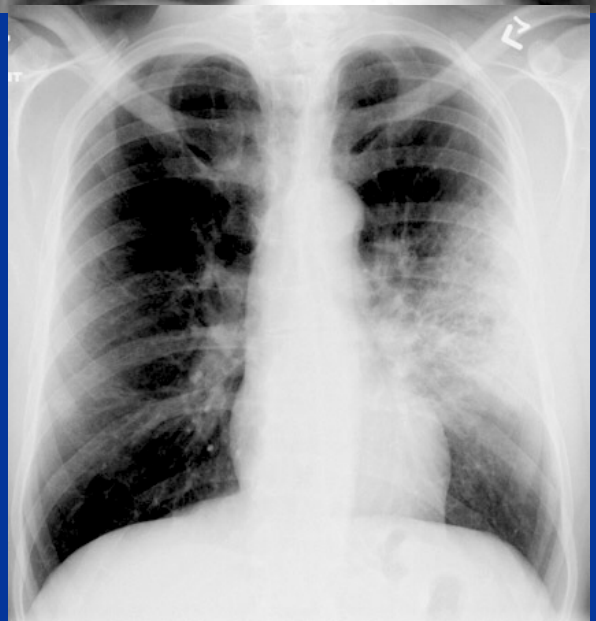
not a lung x-ray.

LUNG DISEAES

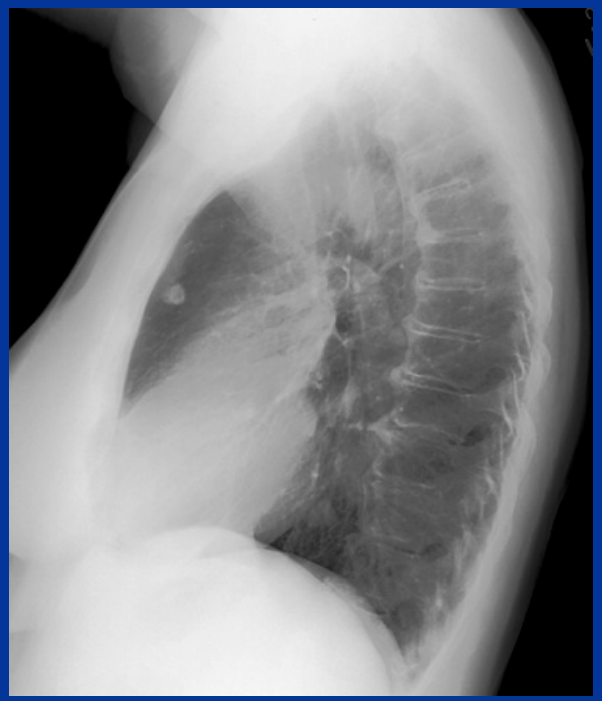

Consolidation
Mass
Nodule
Interstitial
Atelectasis
=COLLAPSE

MASS Vs DIFFUSE INFILTERATION

- The basic diagnostic instance is to detect an abnormality.
- In both of the cases, there is an abnormal opacity.
- In each of the cases, there is an abnormal opacity in the left upper lobe.
- In the case ABOVE , the opacity would best be described as a mass because it HAS EDGES well-defined 3-D STRUCTURE
- The case BELOW has an opacity that is poorly defined. This is airspace disease such as pneumonia.

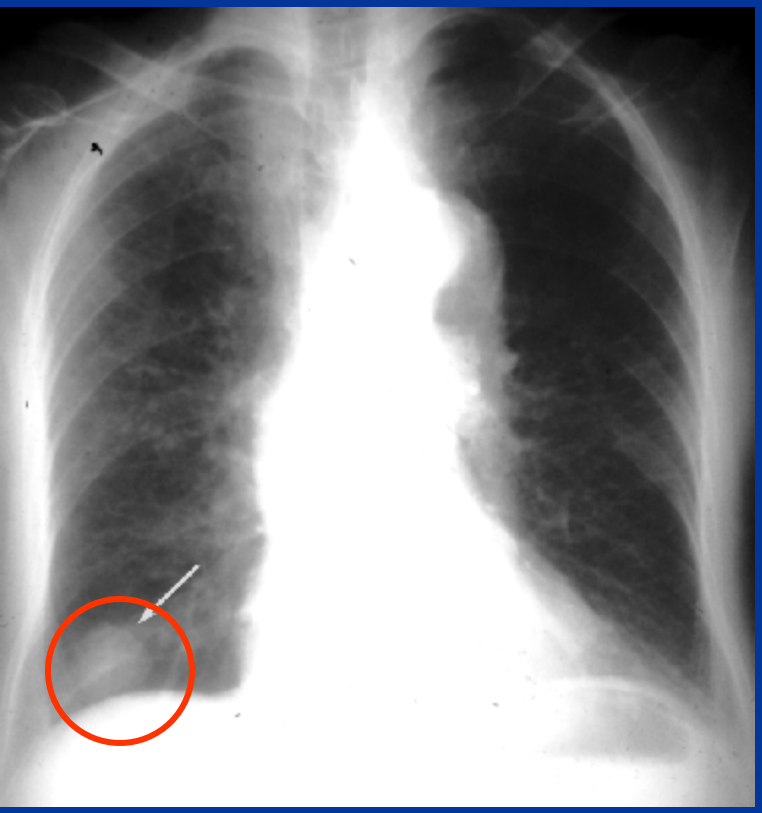


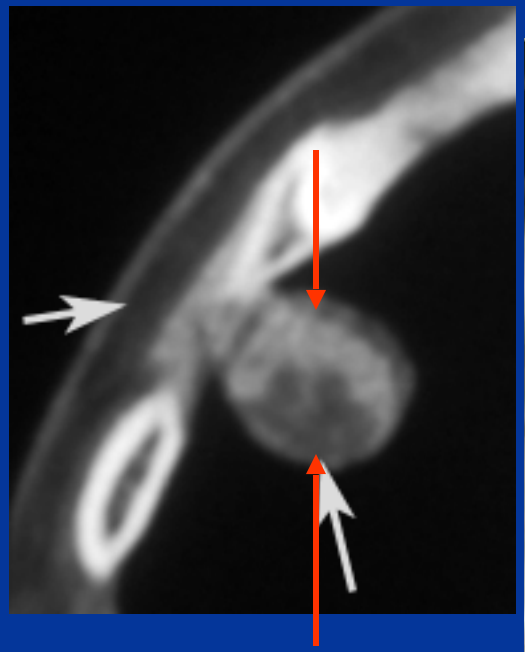
solitary nodule in the lung

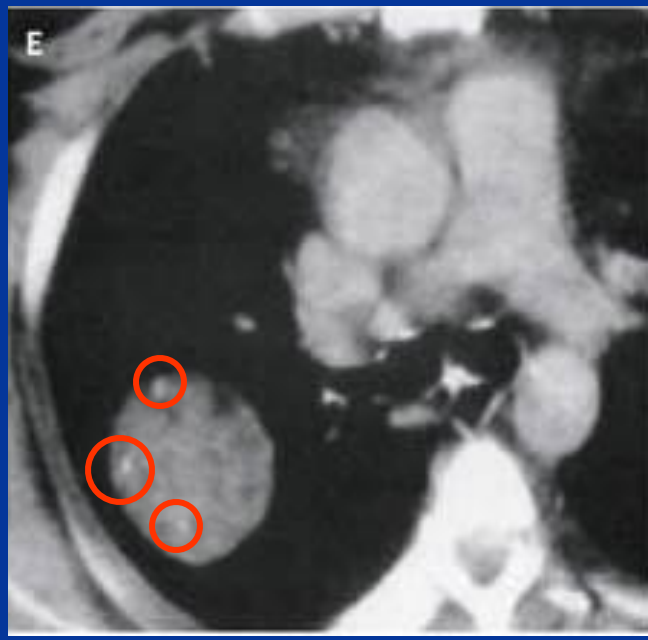


- A solitary nodule in the lung can be totally innocuous or potentially a fatal lung cancer. After detection the initial step in analyis is to compare the film with prior films if available. A nodule that is unchanged for two years is almost certainly benign. Be sure to evaluate for the presence of multiple nodules as this finding would change the differential entirely.
- If the nodule is indeterminate after considering old films and calcification, subsequent steps in the work-up include ordering a CT and a tissue biopsy.

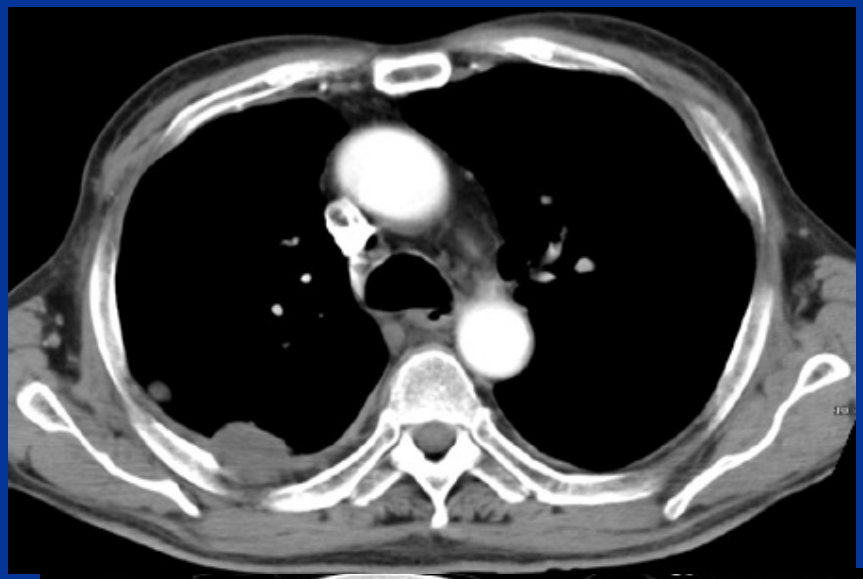
MASS



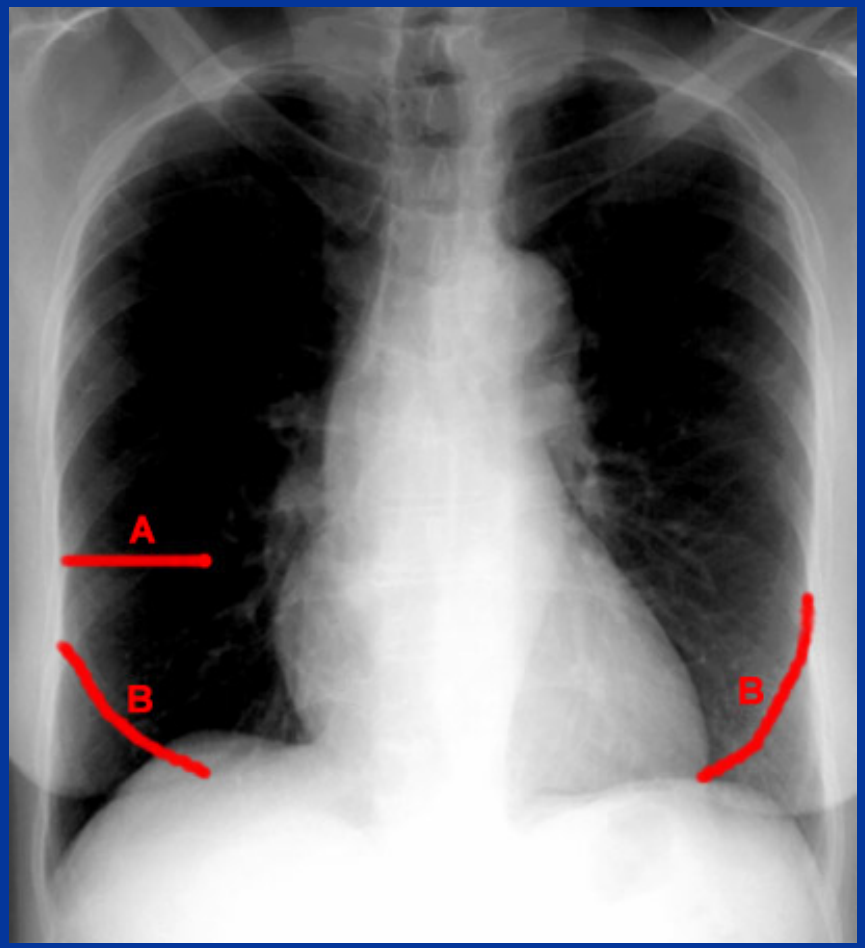


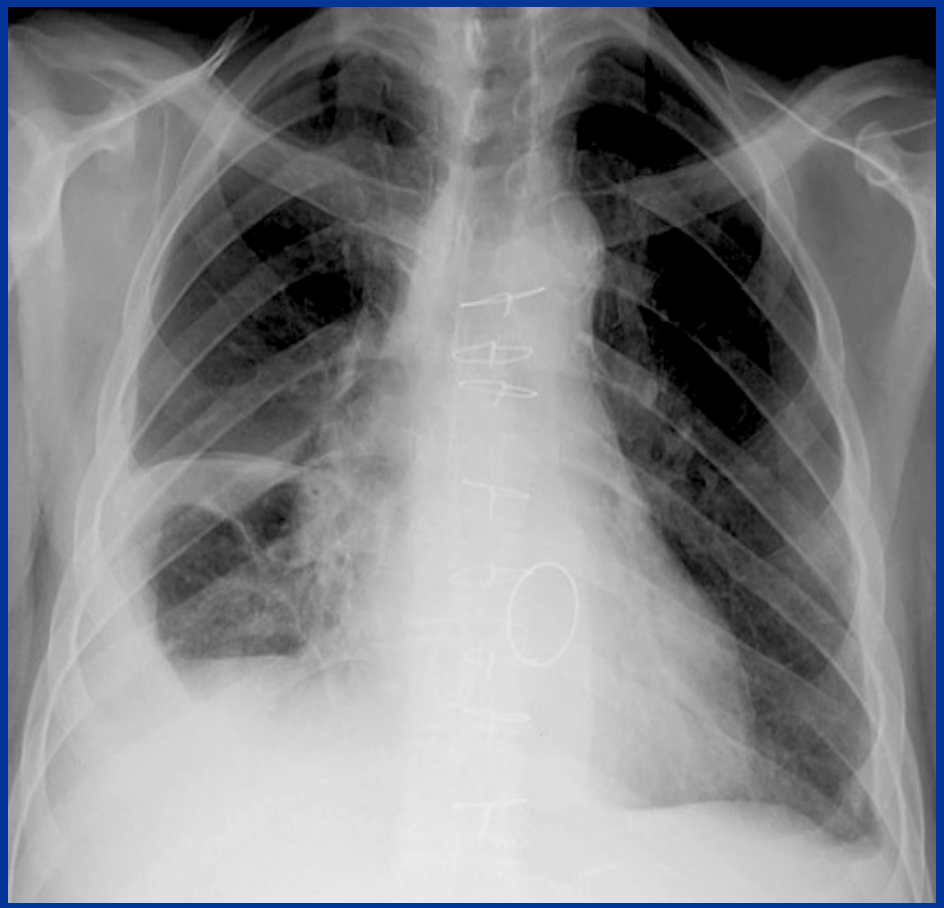


PLEURAL BASED LESION

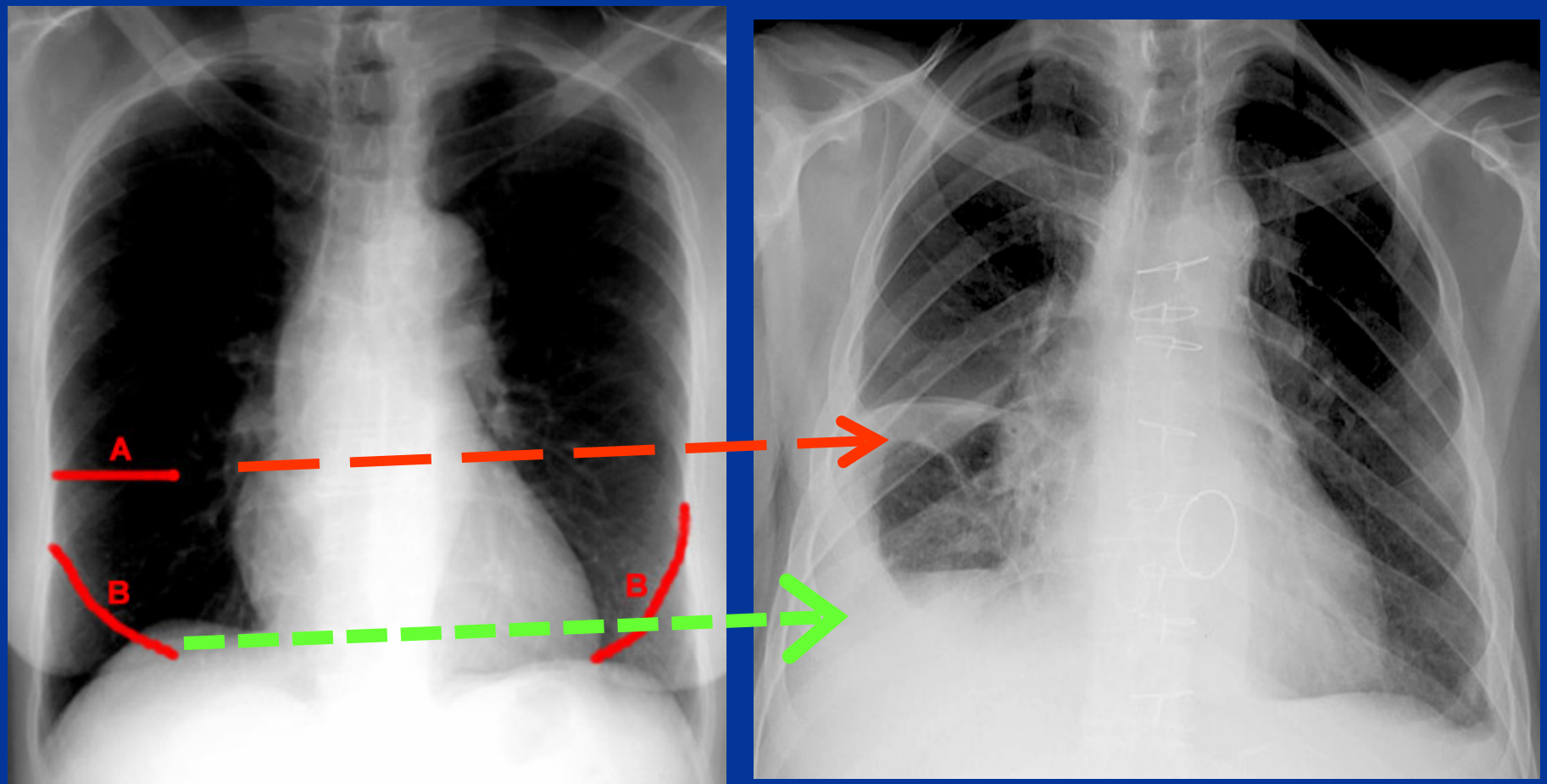


FISSURES





FISSURES



DEFINITIONS

- **ATELECTASIS**

Loss of volume of lobe, segment or sub segment of the lung.

Example collapse (lung)

- **Consolidation**

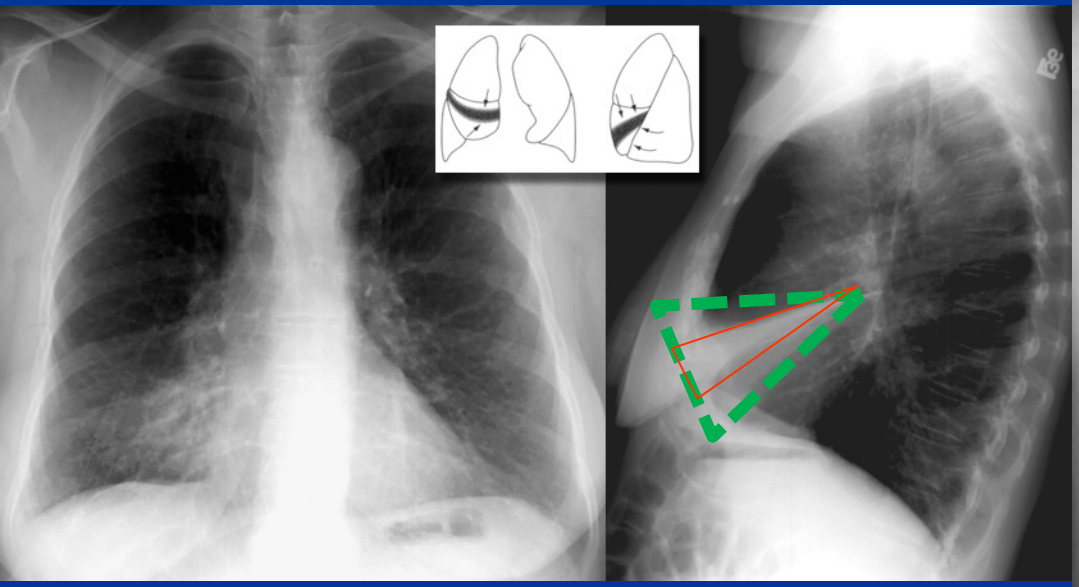
Loss of air in lobe, segment or sub segment of the lung.

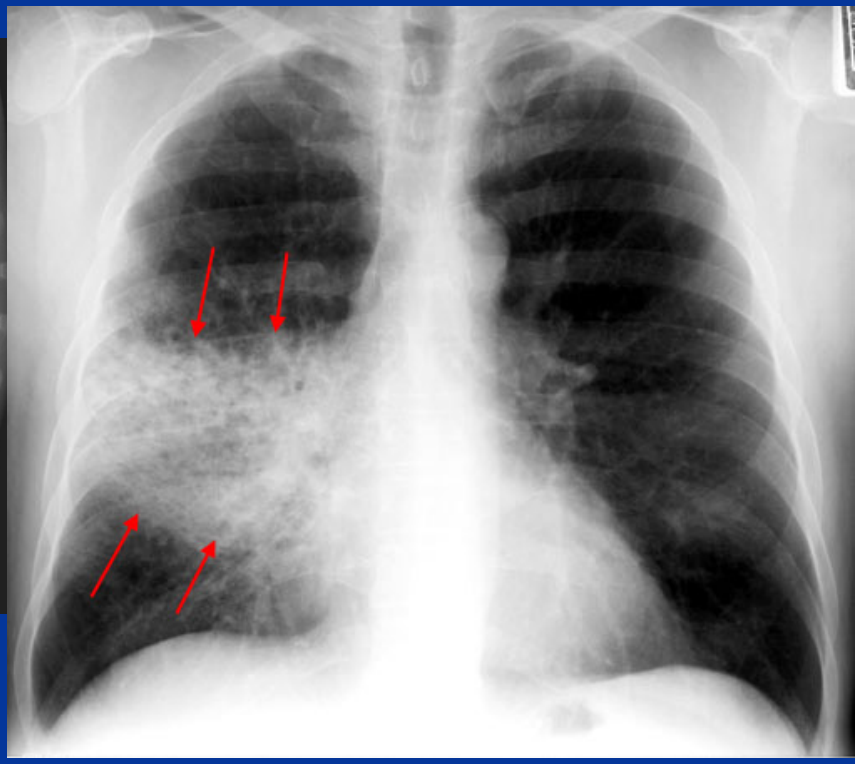
Example= pneumonia (lobe)

Major differentiating factors between atelectasis and pneumonia

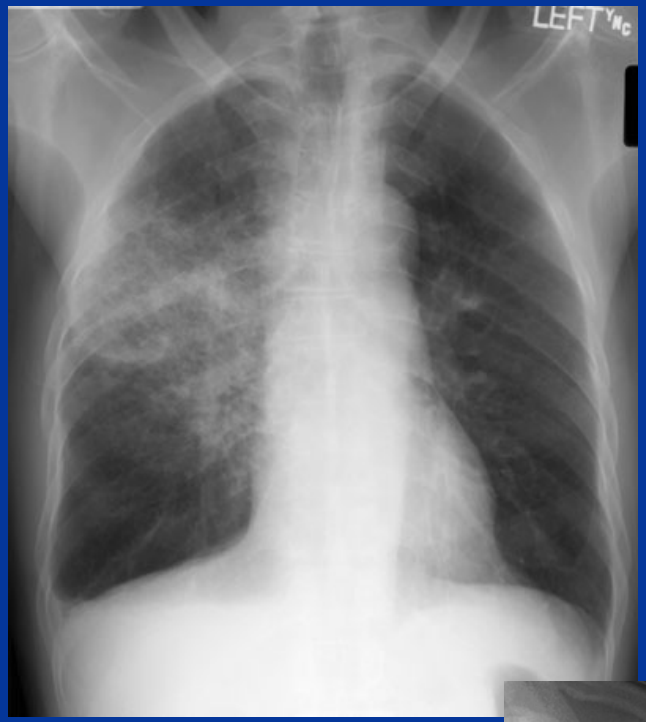
Atelectasis	Pneumonia
Volume Loss	Normal or Increased Volume
Associated Ipsilateral Shift	No Shift, or if Present Then Contralateral
Linear, Wedge-Shaped	Consolidation, Air Space Process
Apex at Hilum	Not Centered at Hilum
Air bronchograms can occur in both.	

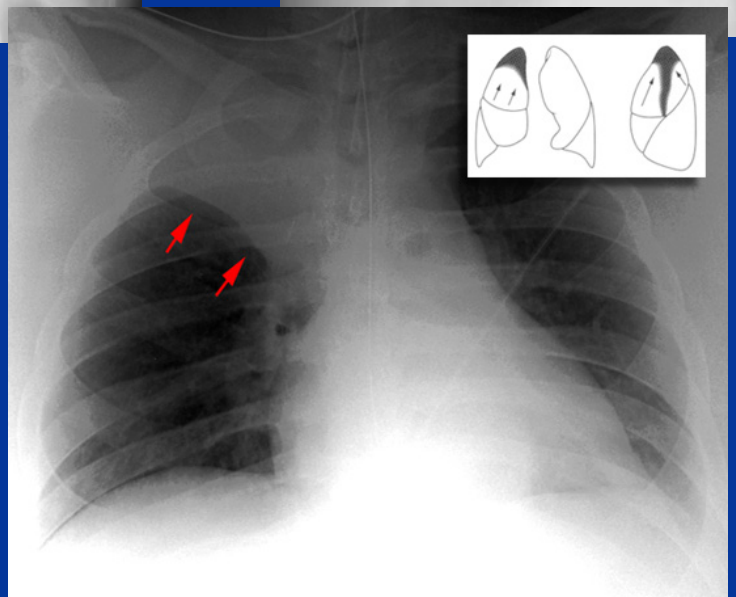
PNEUMONIA VS ***ATELECTASIS***



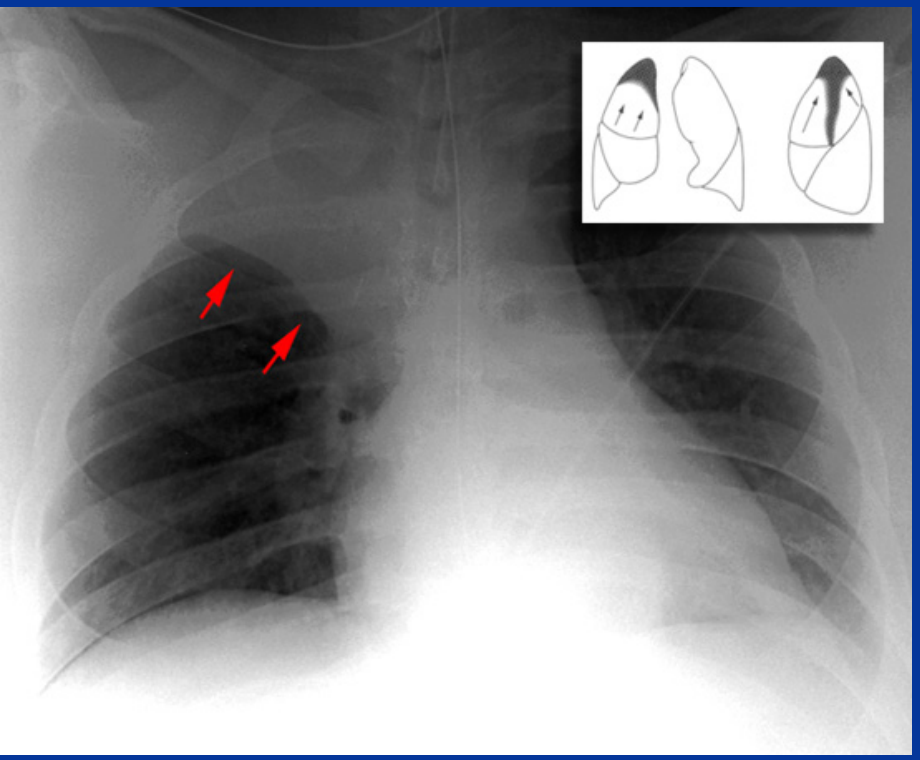


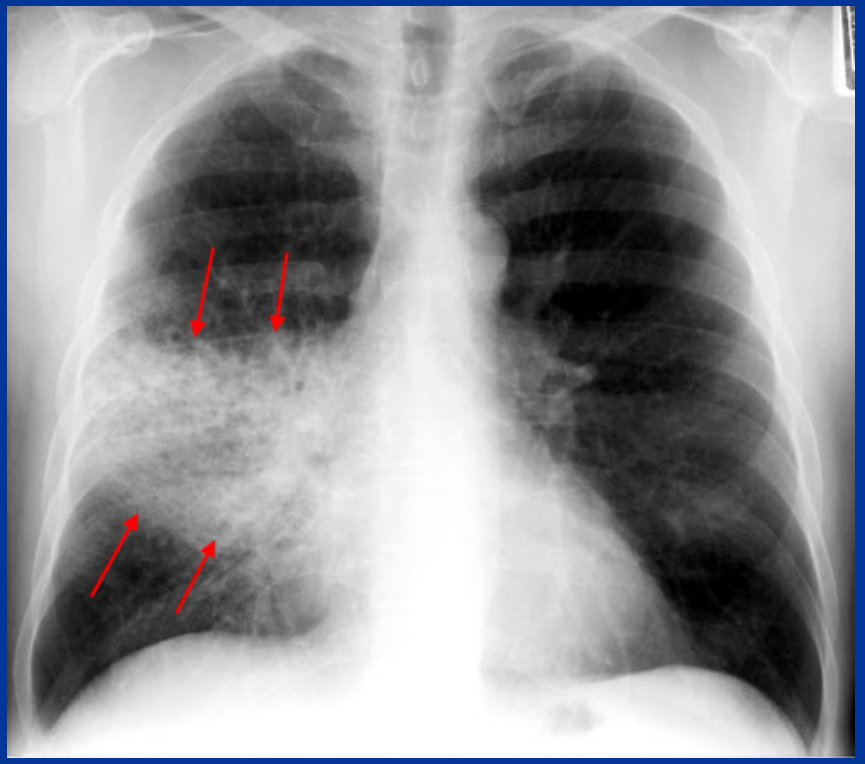
PNEUMONIA Vs *ATELECTASIS*





ATELECTASIS Vs *PNEUMONIA*





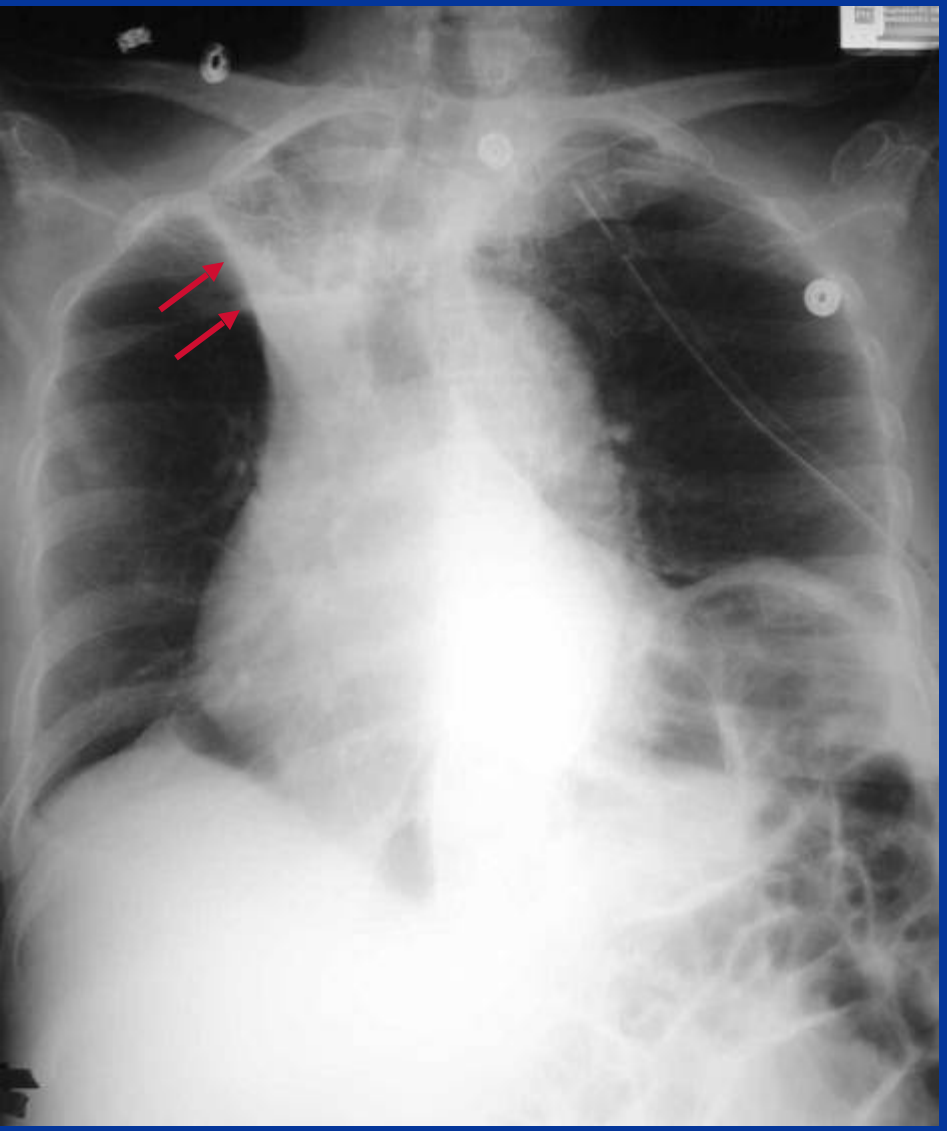
Recognizing air space disease

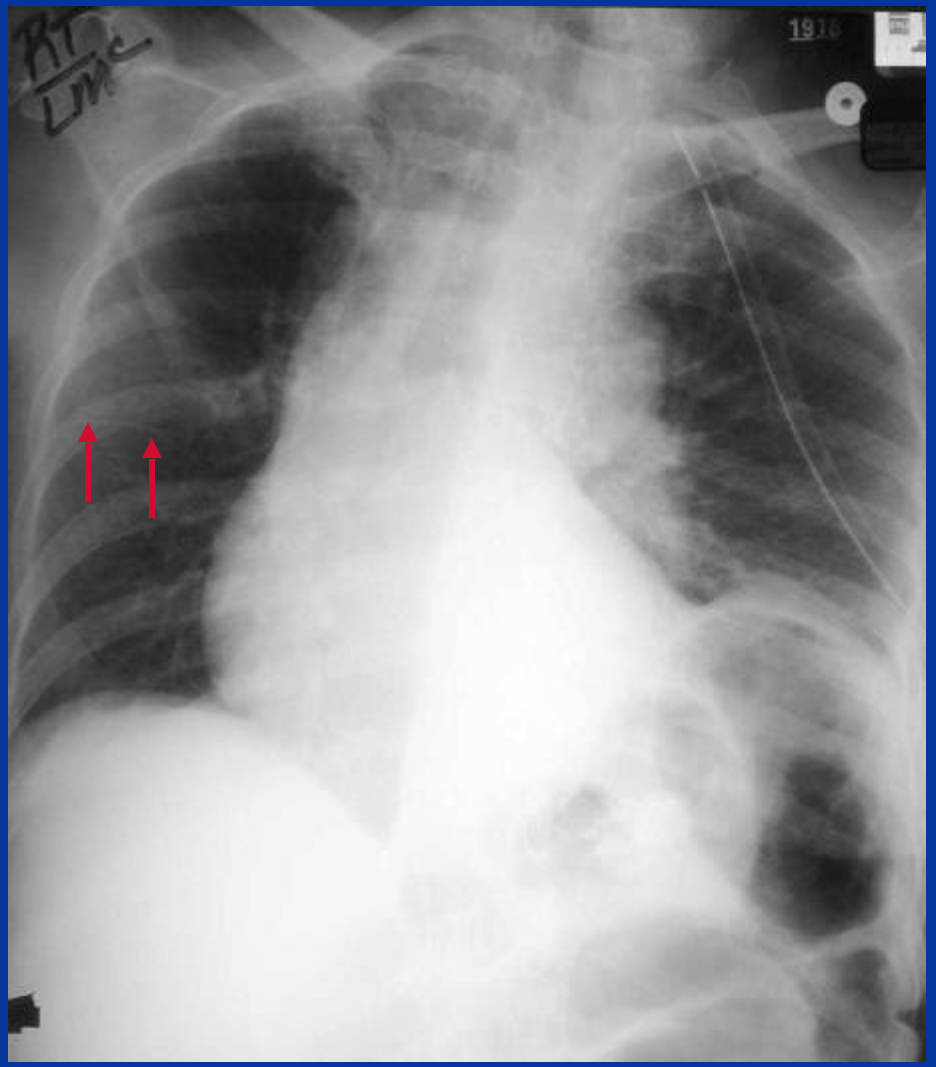
- Alveolar spaces filled with…something.
- Radiologist's report:
  - “consolidation”
  - “air space opacity”
  - “fluffy density”
  - “infiltrate”
- Nonspecific:
  - Atelectasis, pneumonia, bleeding, edema, tumor

Lobar Atelectasis

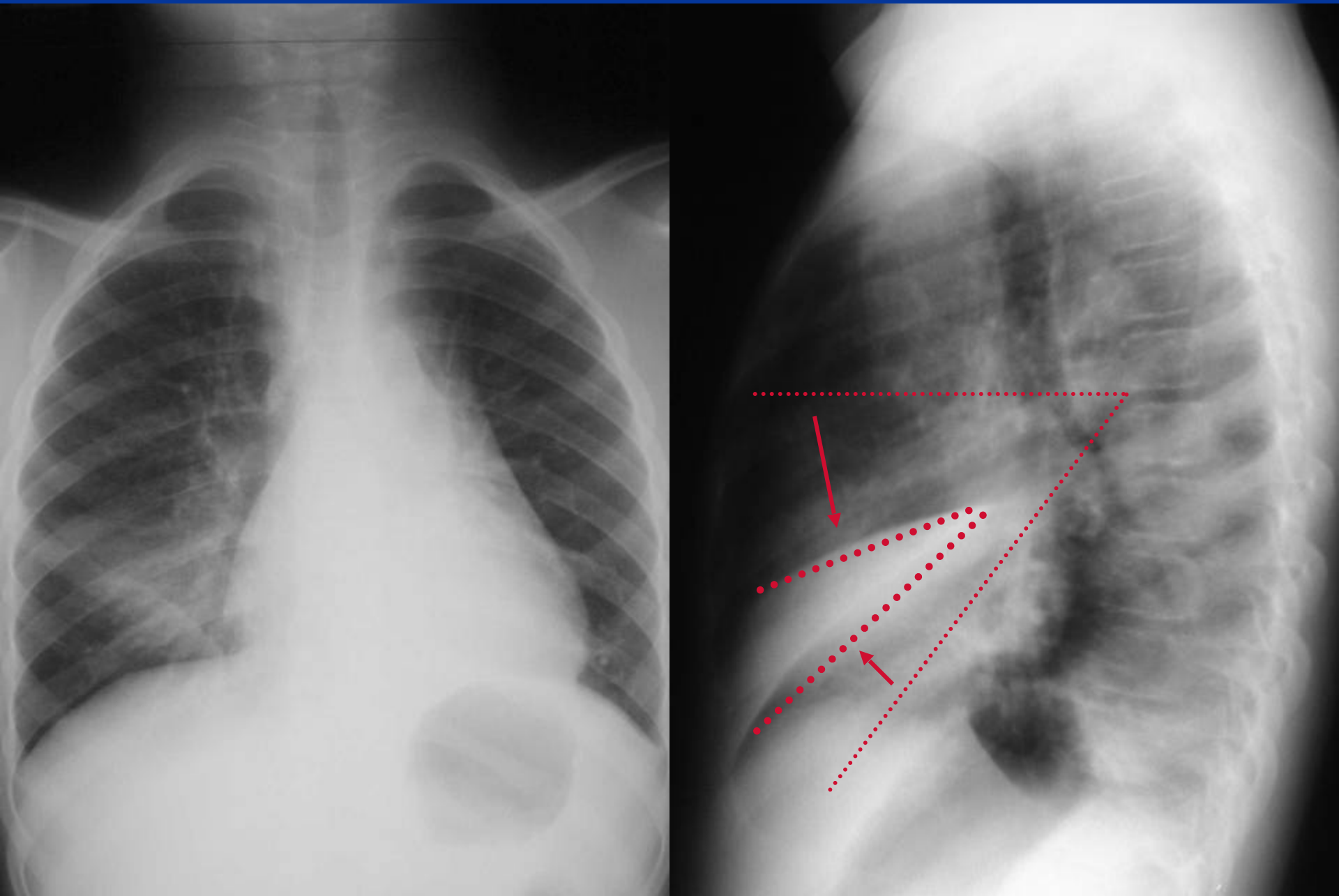
- Best sign – shift of a fissure
- Rapid development and clearance
- Air bronchograms if non-obstructive
- Secondary signs:
  - Mediastinal shift
  - Elevated diaphragm
  - Ribs closer together
  - Vague increased density

RUL Atx

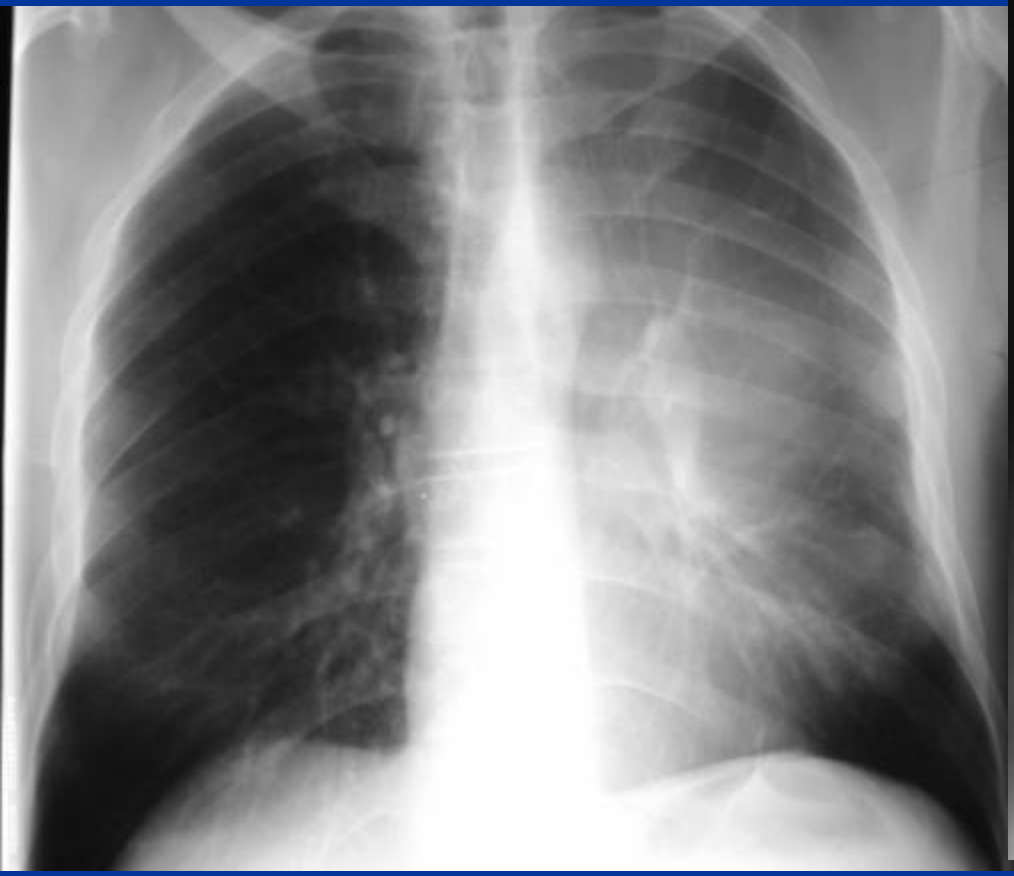


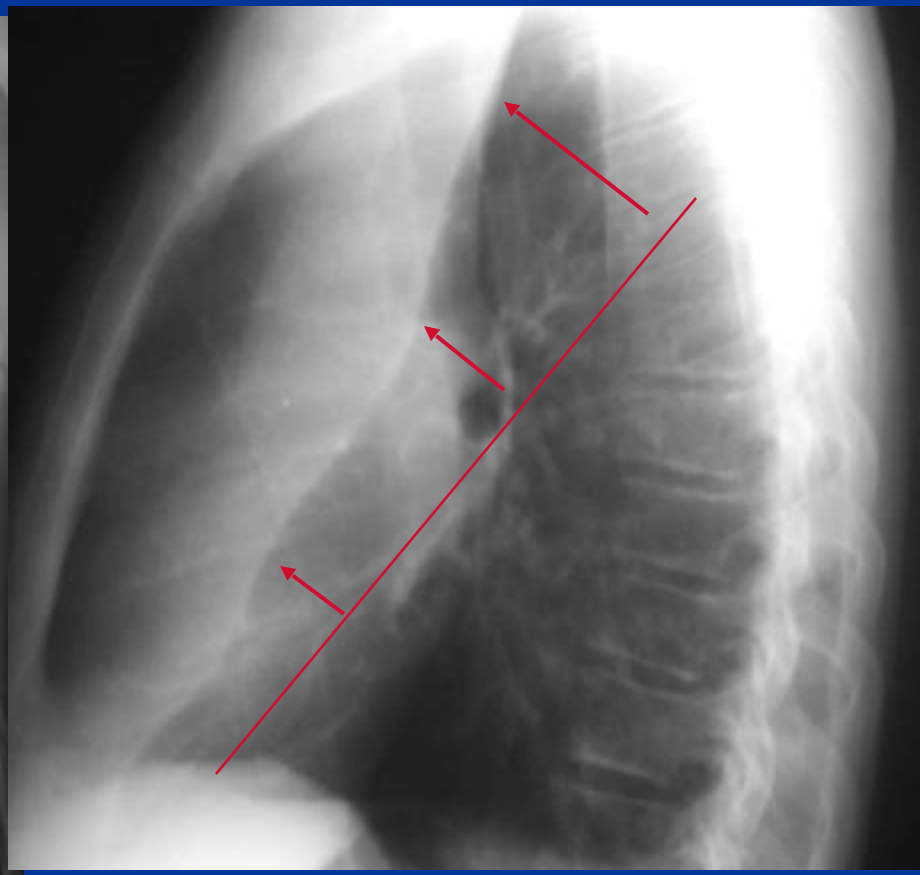


RML Atx

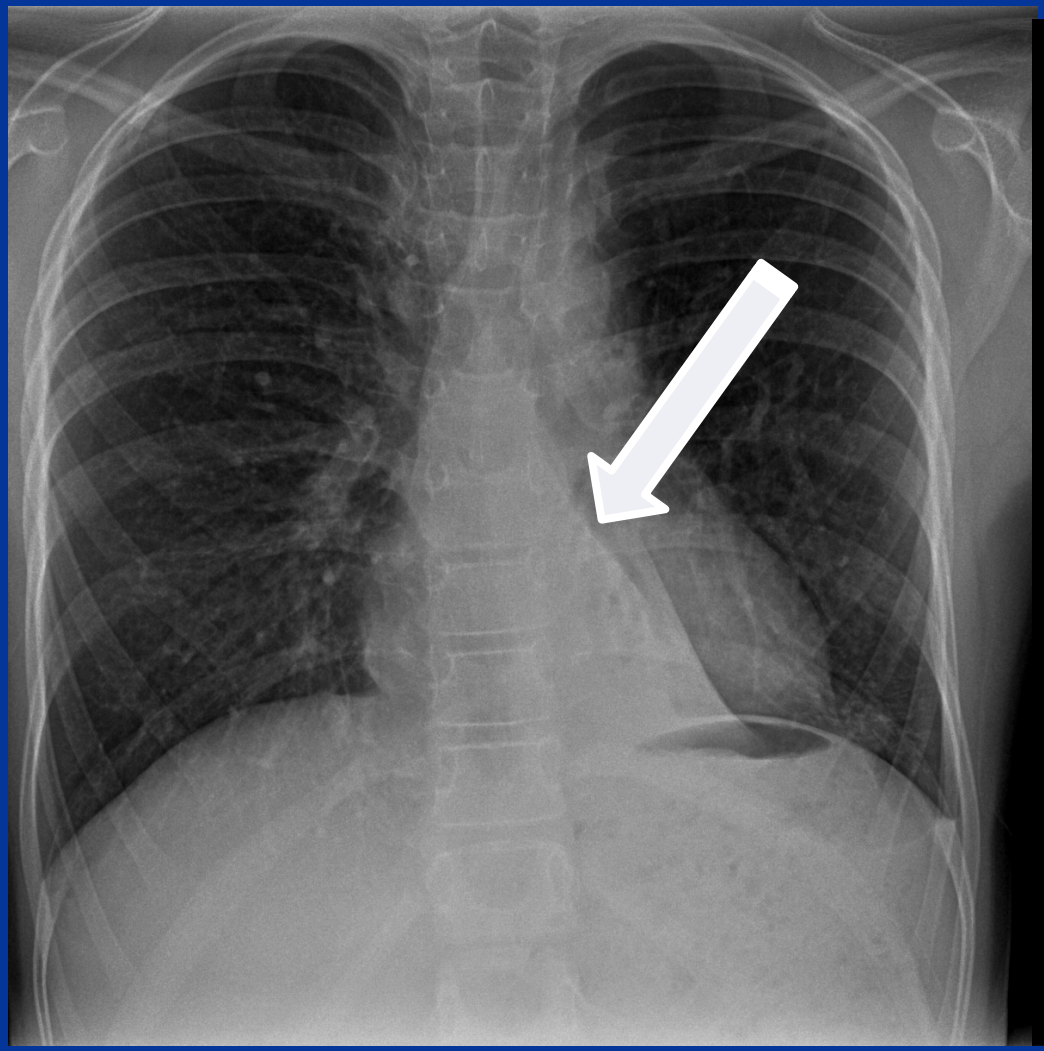


LUL Atx





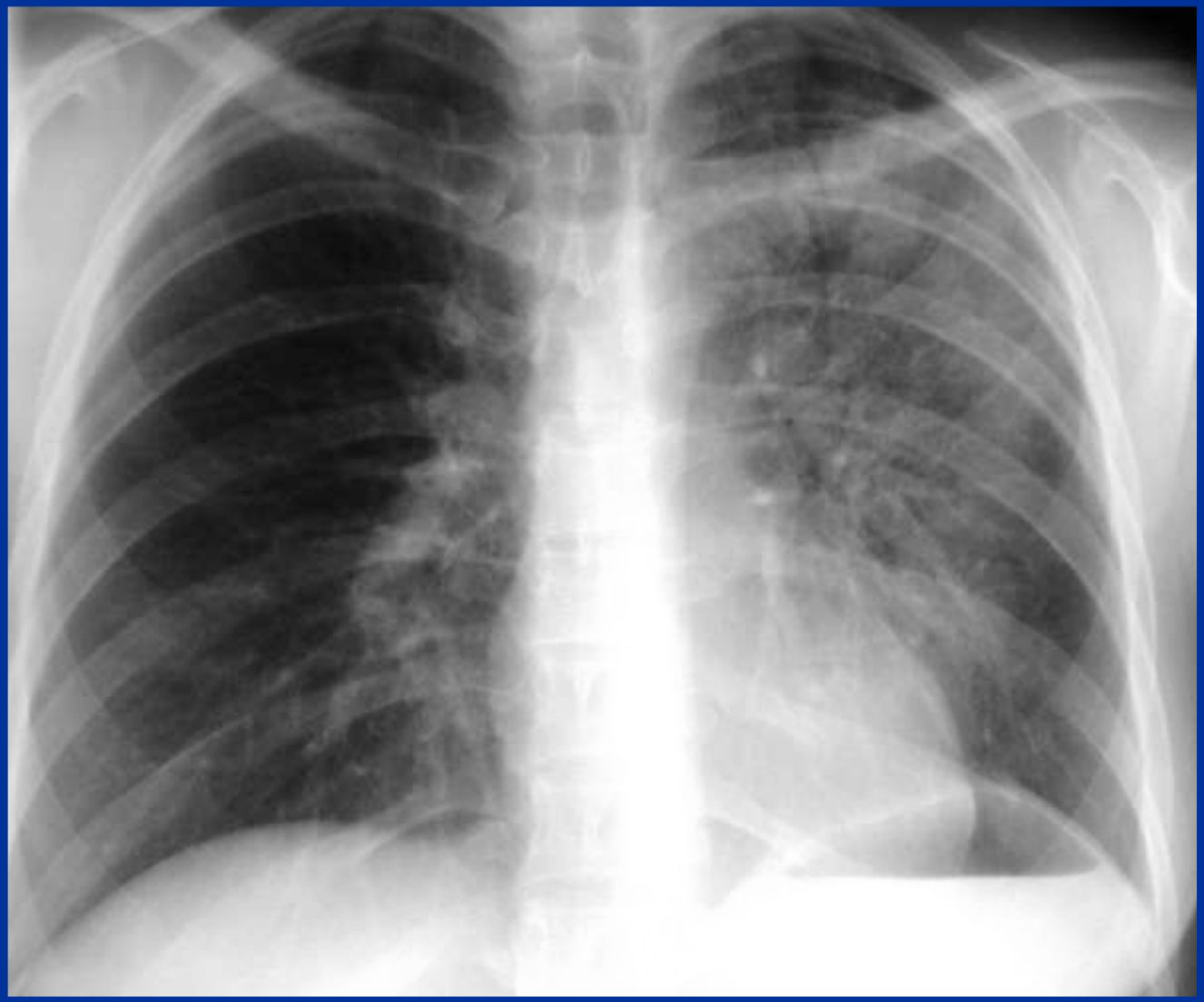
LLL COLLAPSE



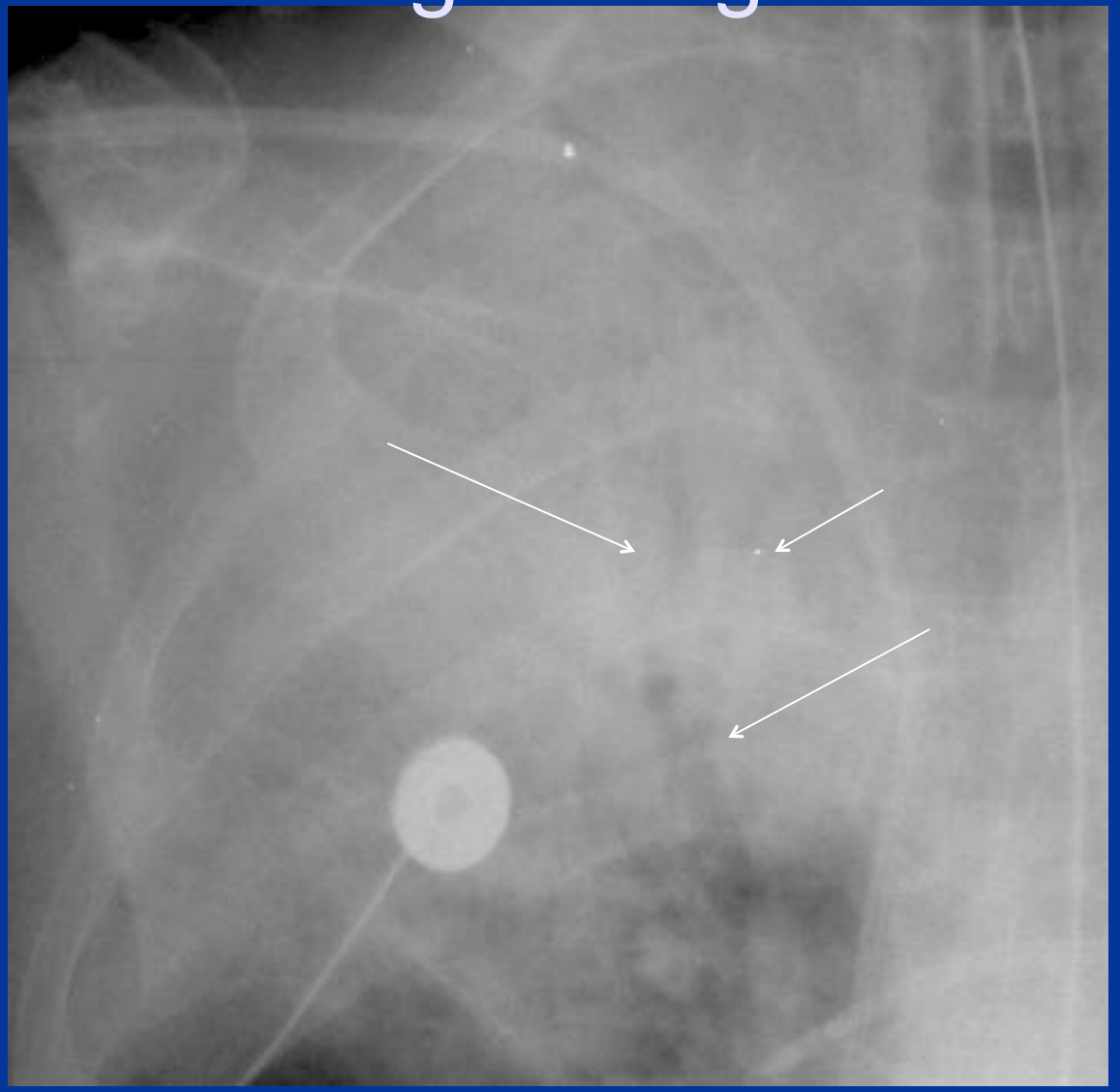
Pneumonia

- Signs:
  - Air bronchogram
  - **Silhouette -** "positive" or "negative"
  - Dense hilum
  - "Spine" sign
- All are signs of <u>any</u> air space process
- Dx of pneumonia depends on appropriate clinical scenario.

AIR-BRONCHOGRAM

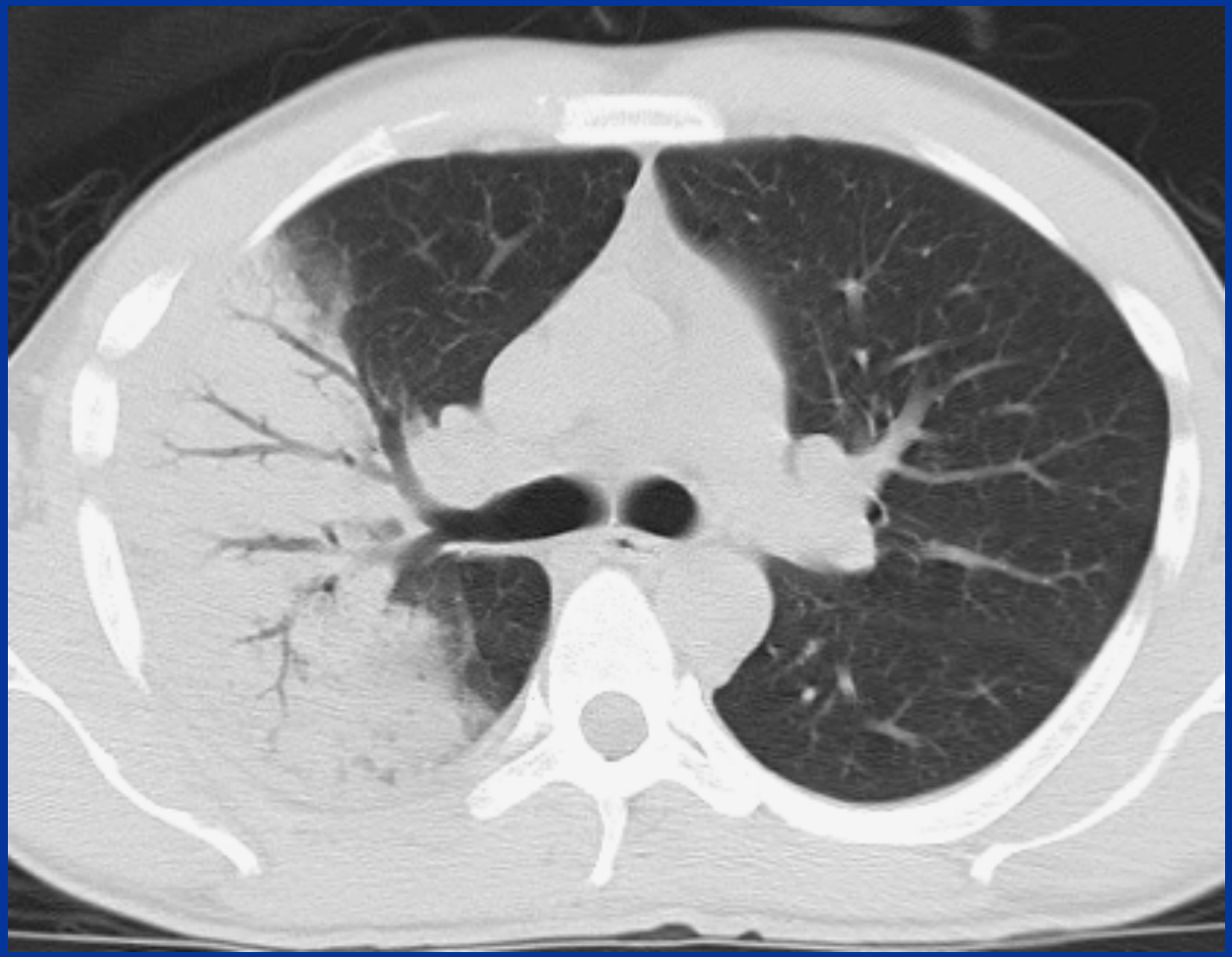


Air bronchogram sign



Pseudomonas pneumonia

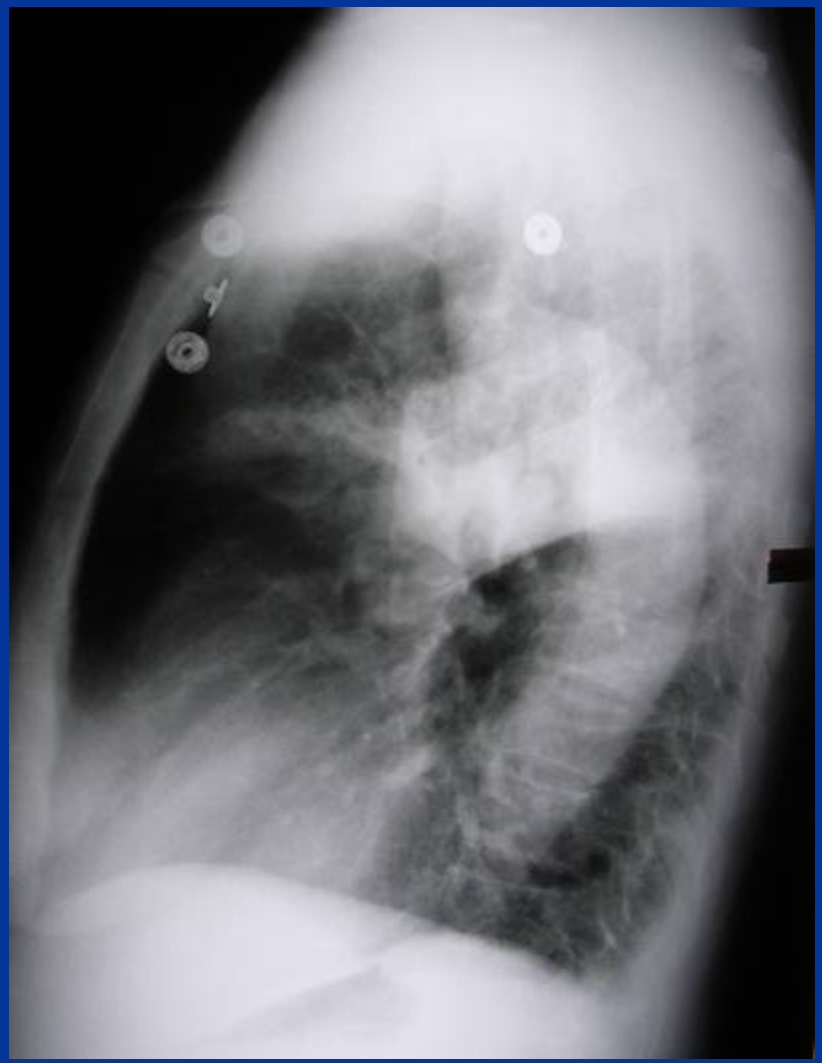
Air bronchograms — CT



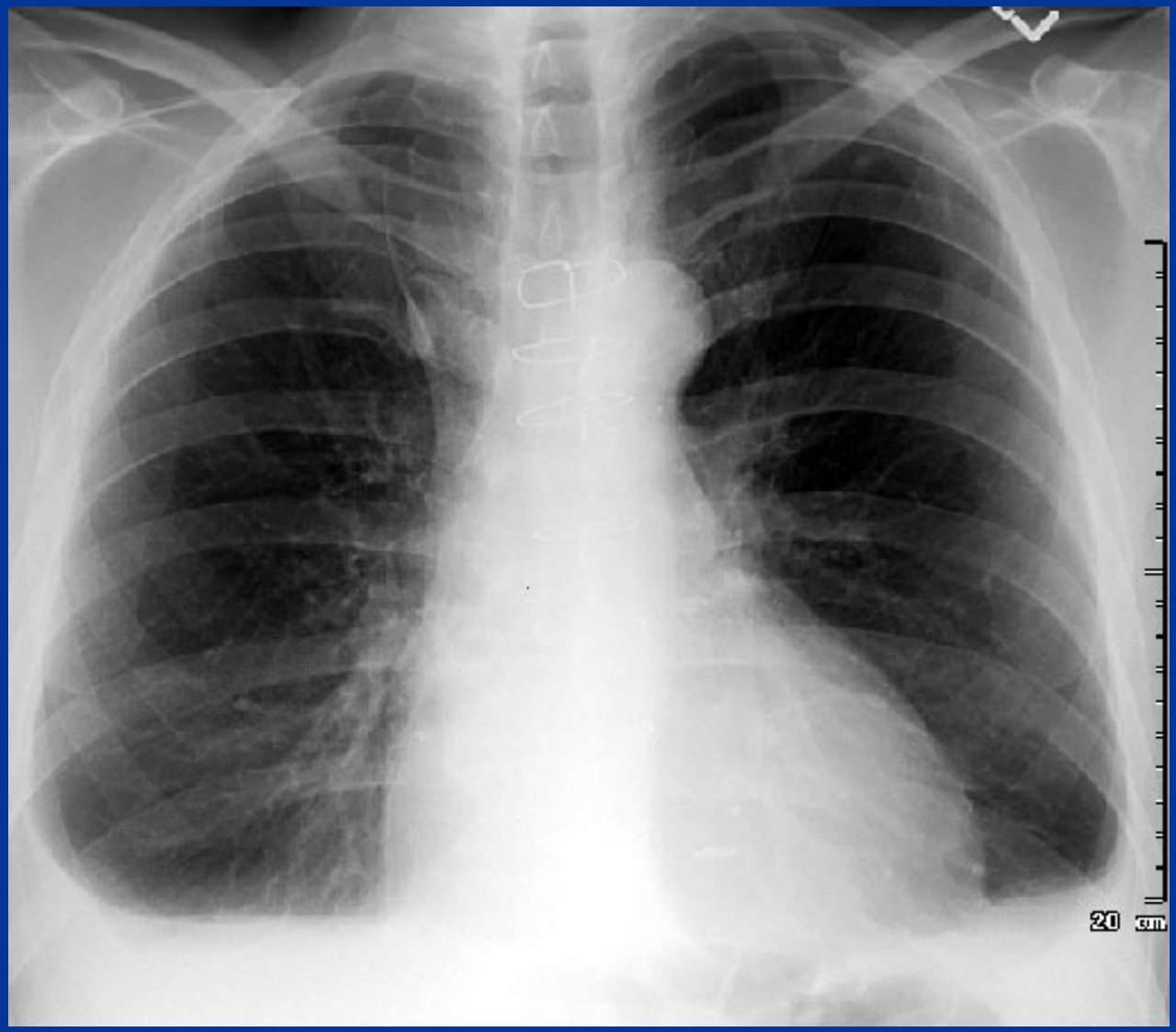
Pneumonia

Right middle lobe

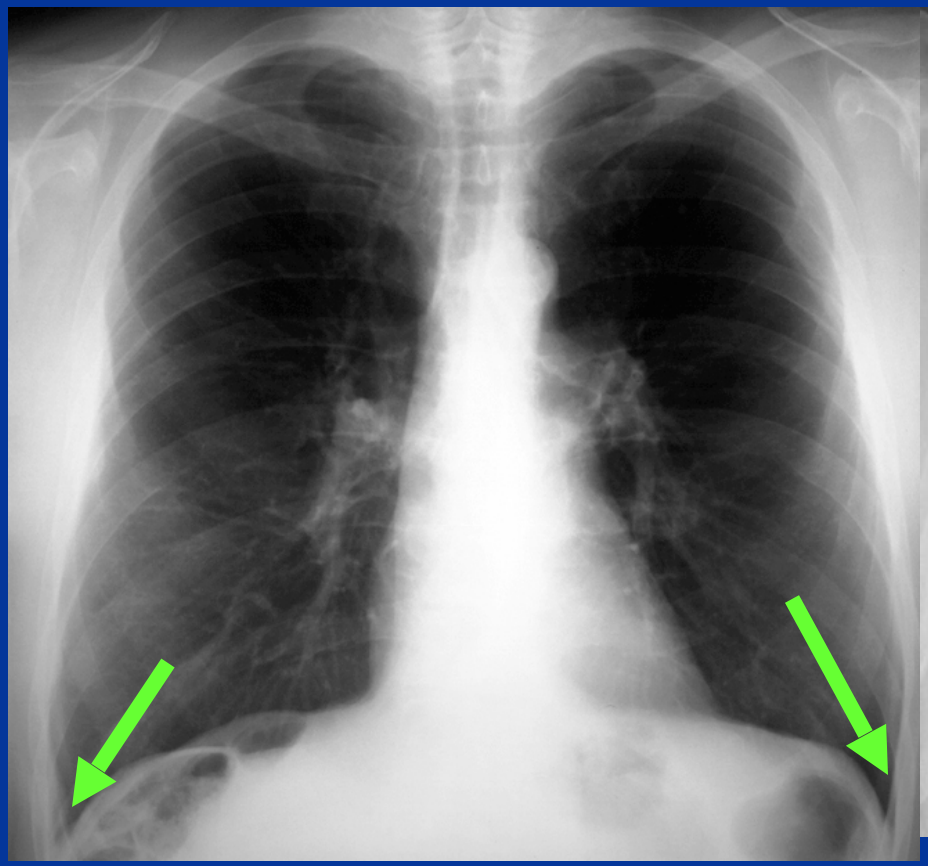
Right upper lobe

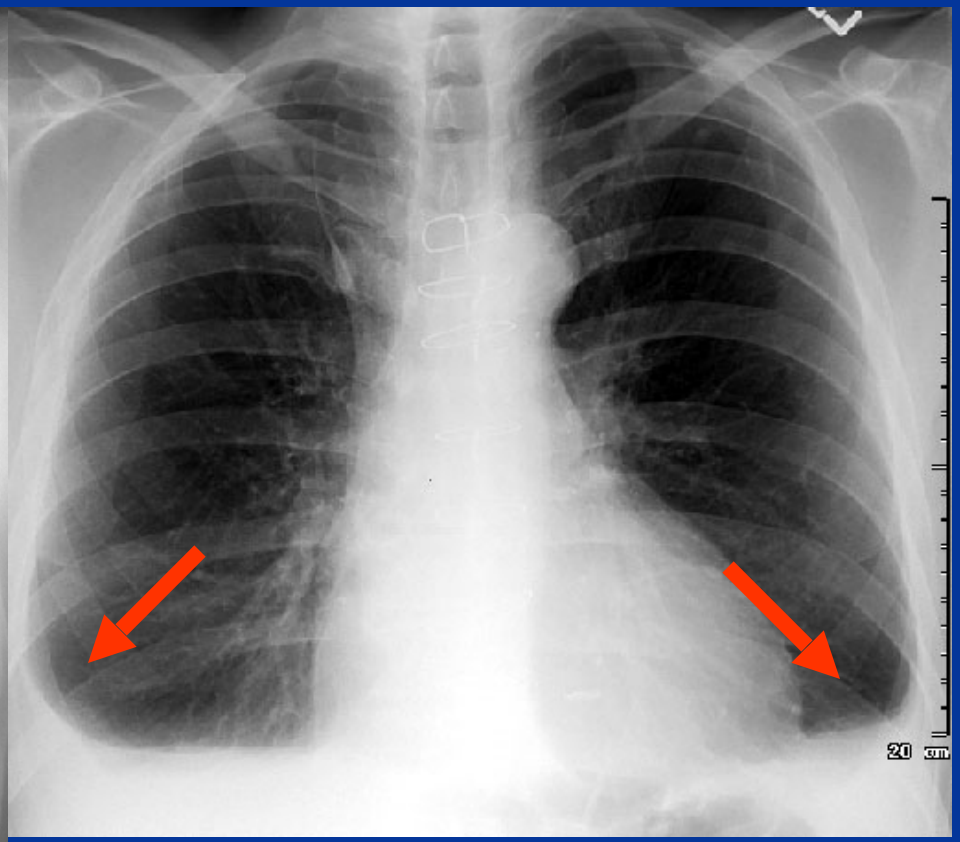


PLEURAL EFFUSION

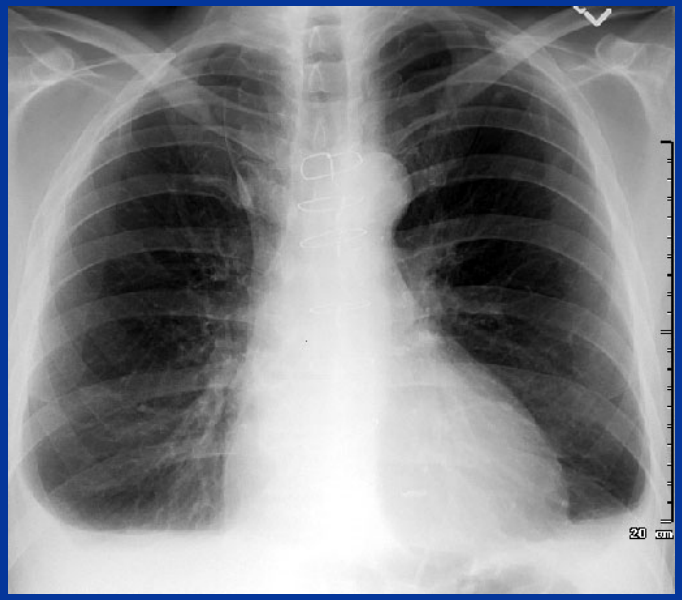


COMPARE COSTO-PHRENIC ANGLES



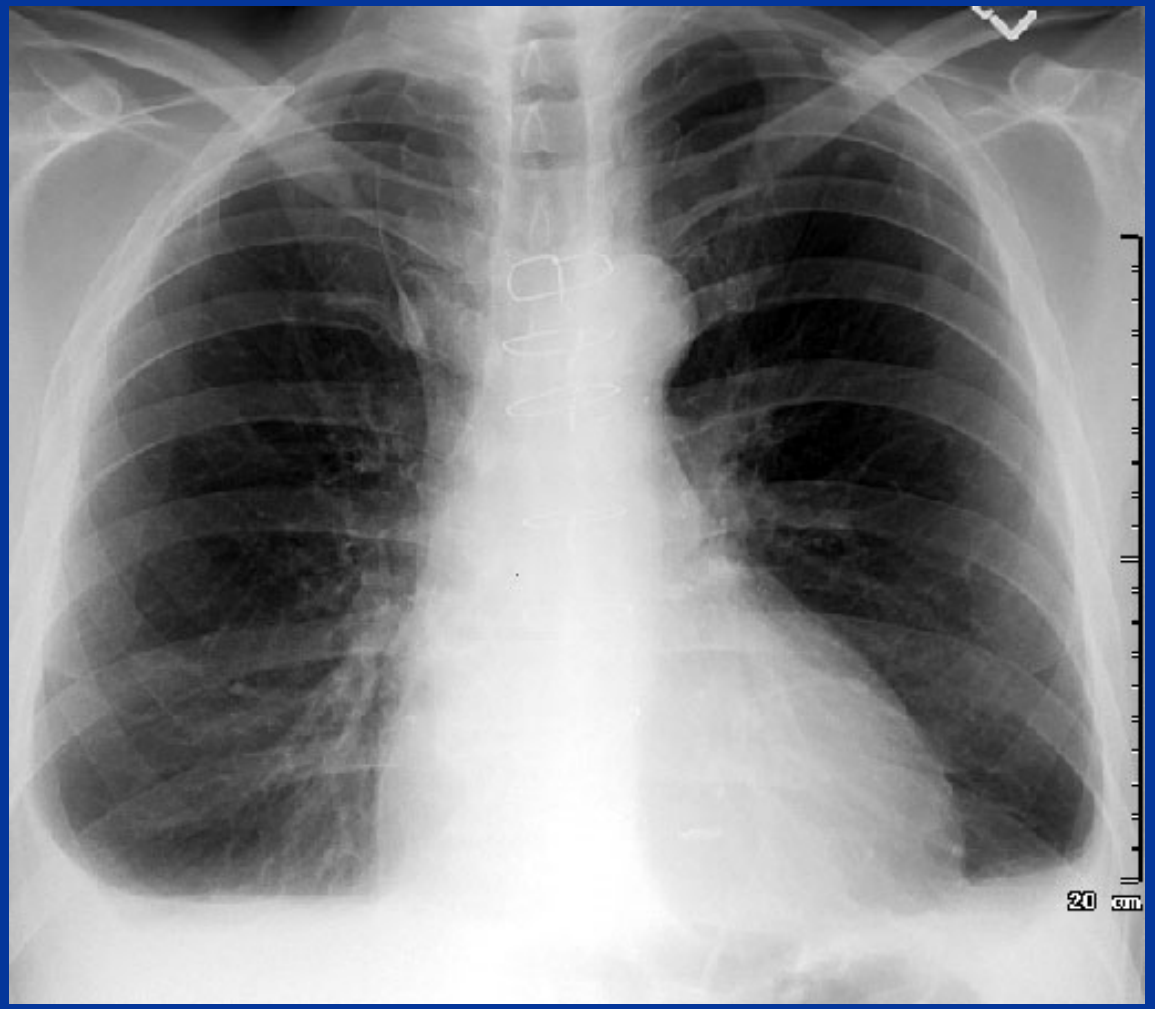


PLEURAL EFFUSION

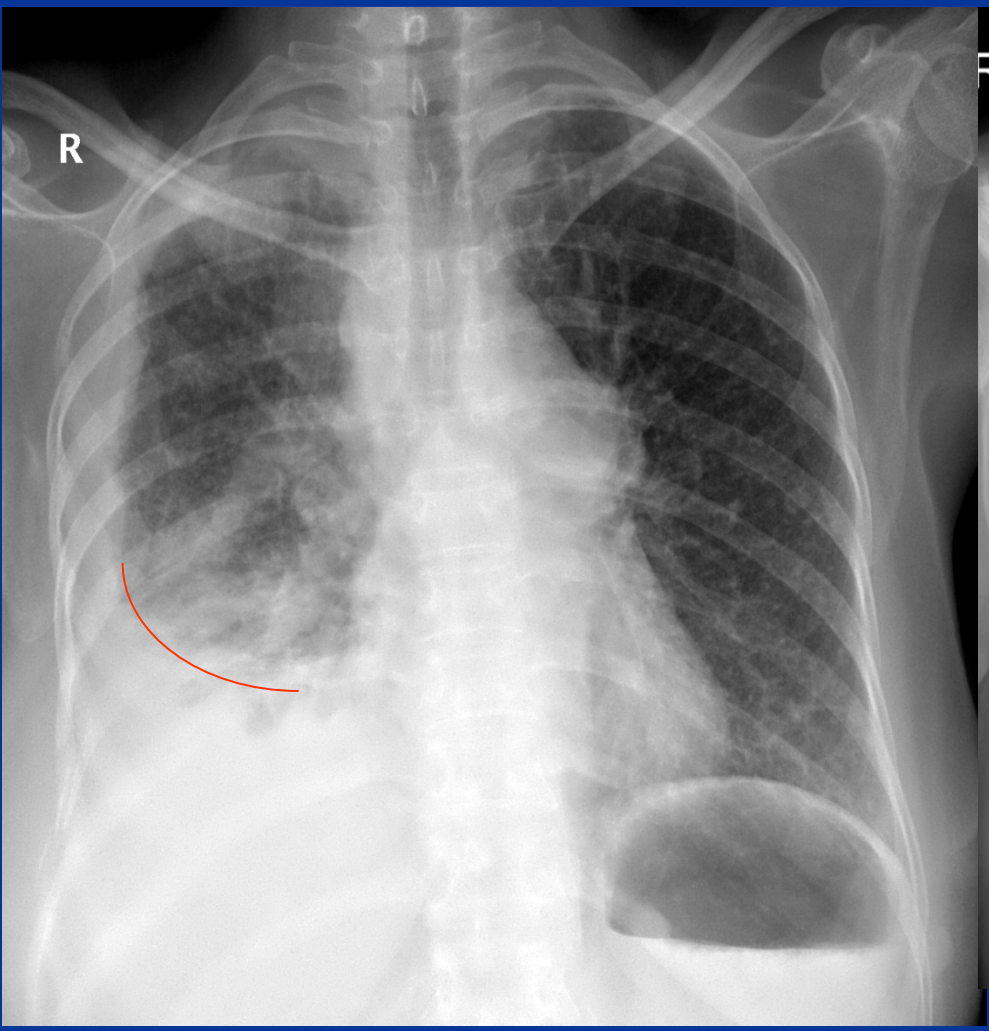


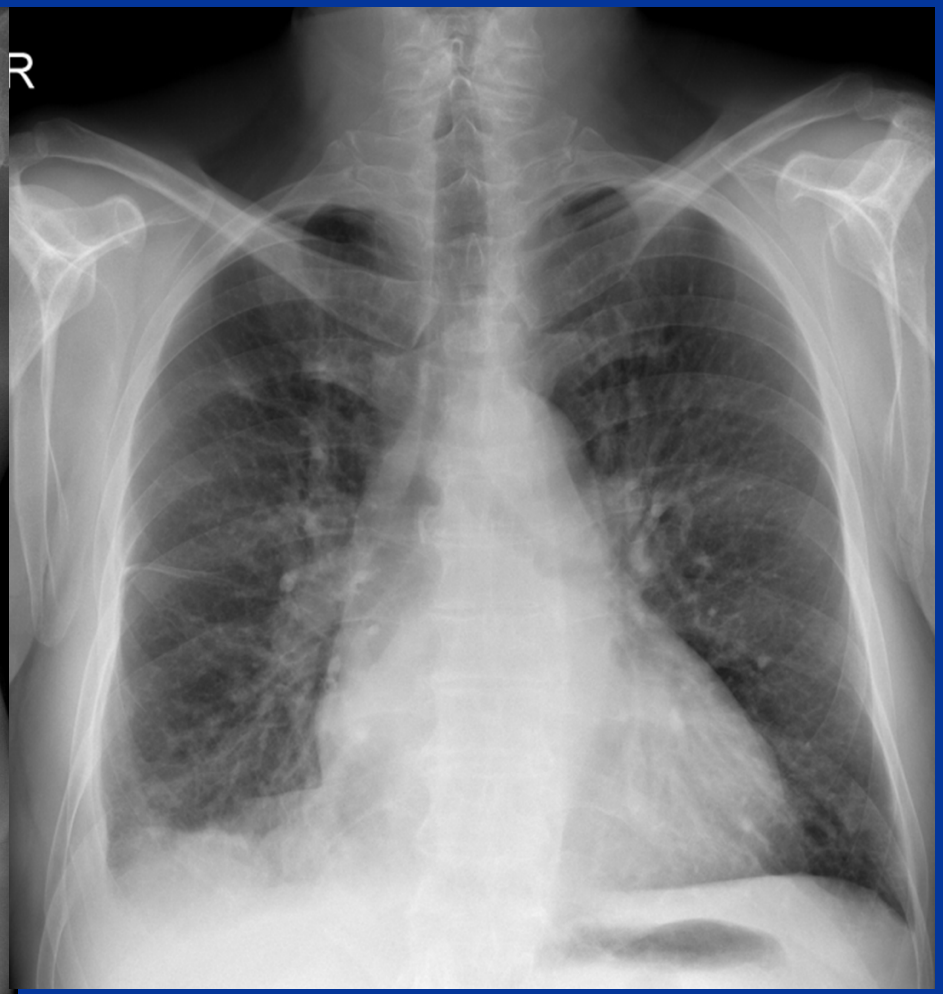
- **On an upright film, an effusion will cause blunting on the lateral and if large enough, the posterior costophrenic sulci. Sometimes a depression of the involved diaphragm will occur. A large effusion can lead to a mediastinal shift away from the effusion and opacity the hemithorax. Approximately 200 ml of fluid are needed to detect an effusion in the frontal film vs. approximately 75ml for the lateral. Larger effusions, especially if unilateral, are more likely to be caused by malignancy than smaller ones.**

BLUNTED C/P ANGLE BOTH SIDES

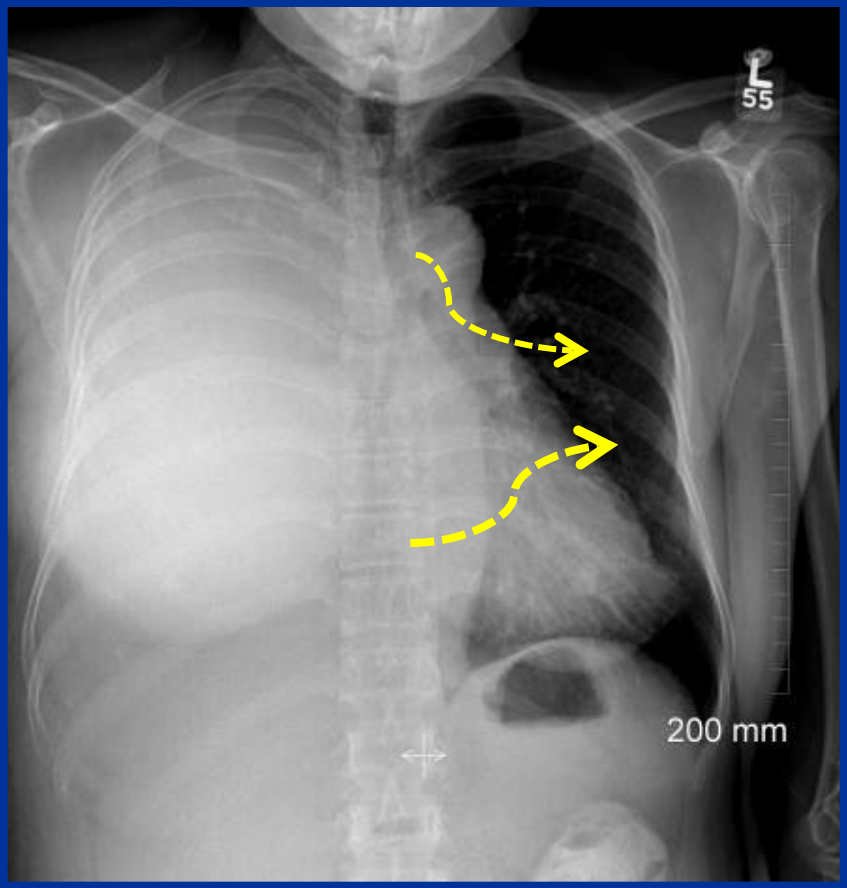


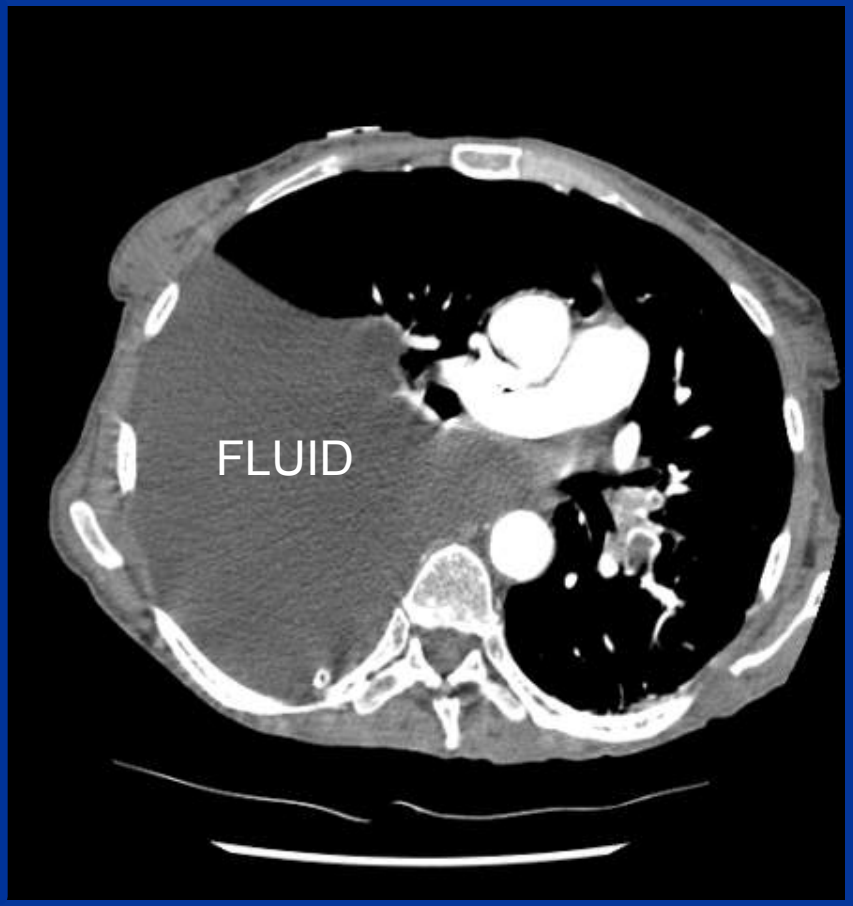
PLEURAL EFFUSION





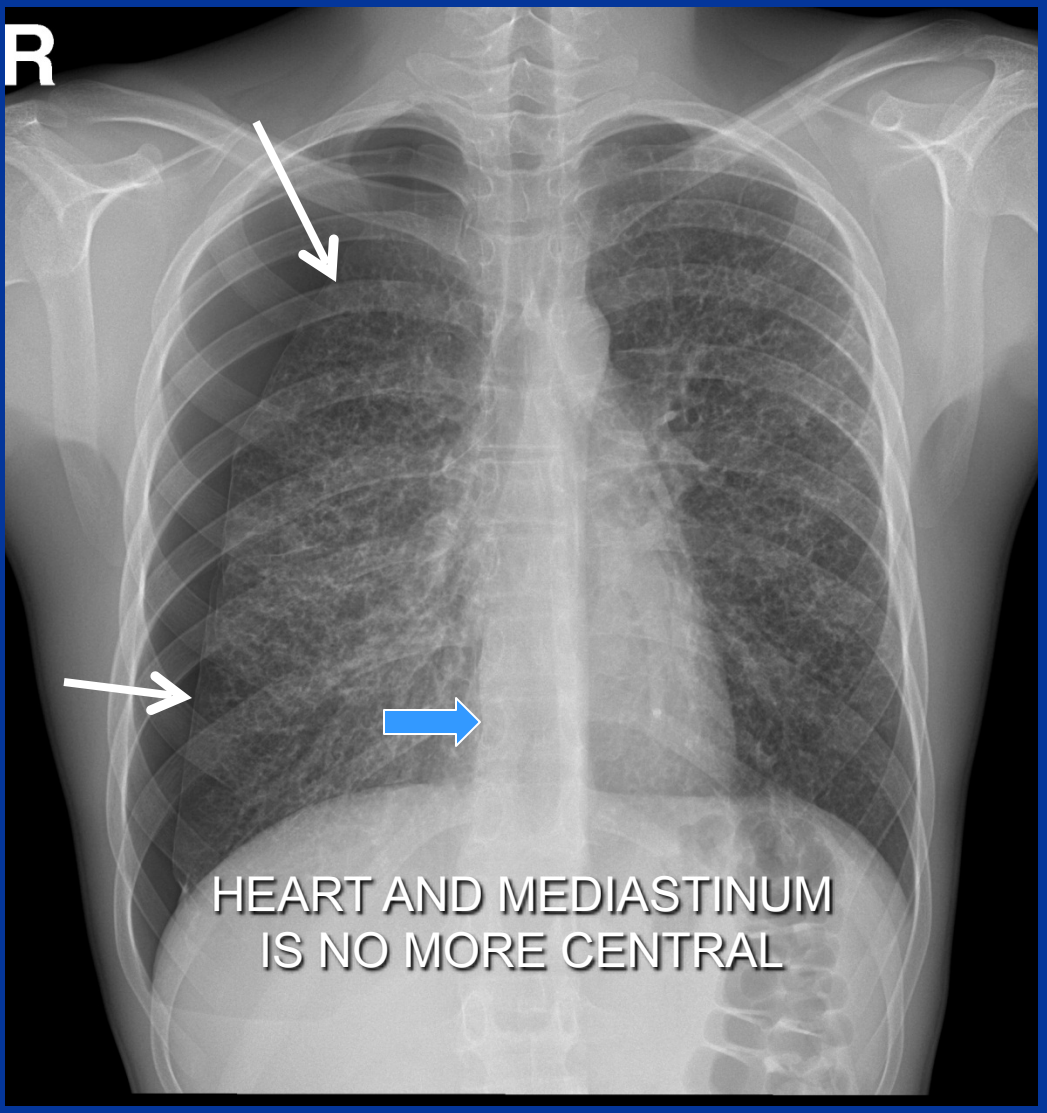
SEVER PLEURAL EFFUSION

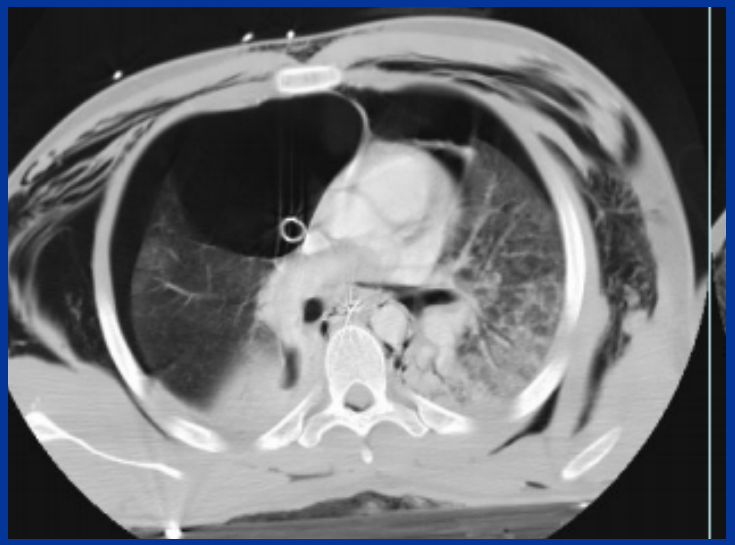




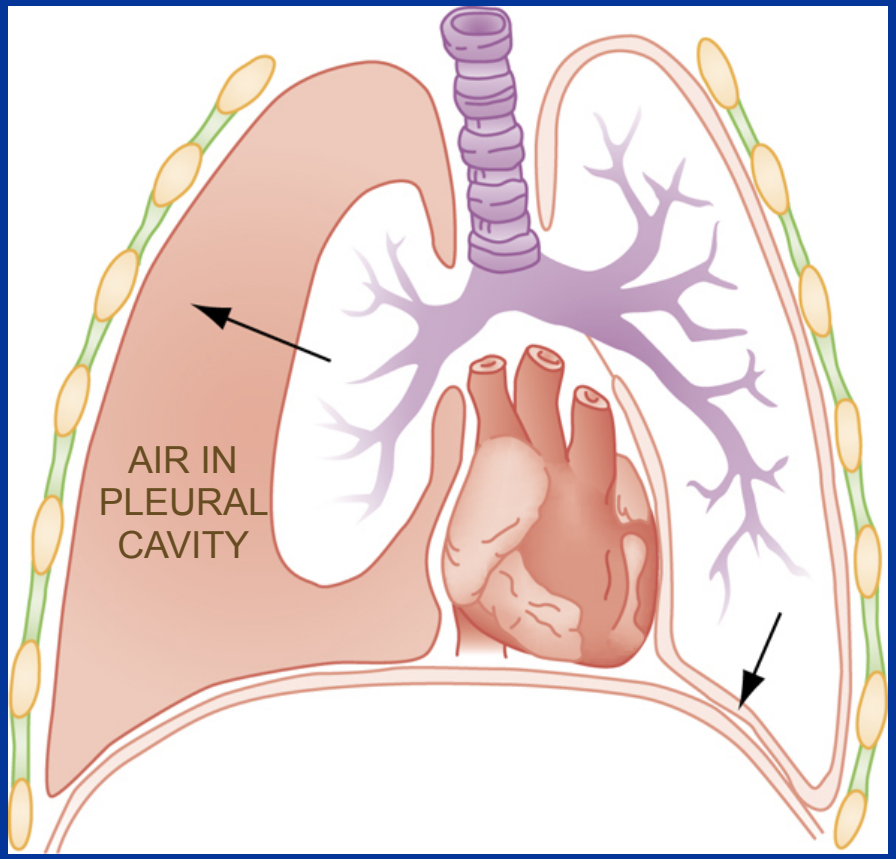
PNEUMOTHORAX

A pneumothorax is defined as air inside the thoracic cavity but outside the lung.
A spontaneous pneumothorax is one that occurs without an obvious inciting incident.

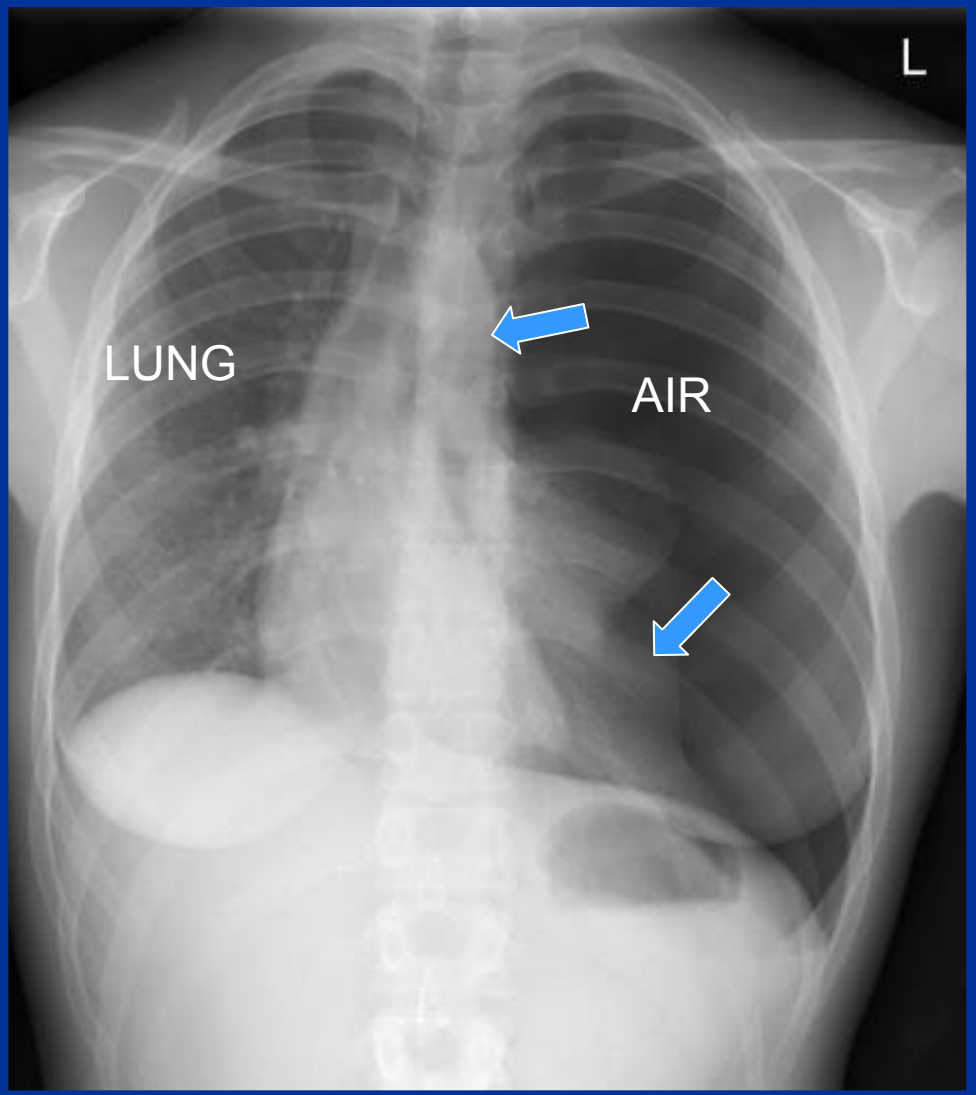




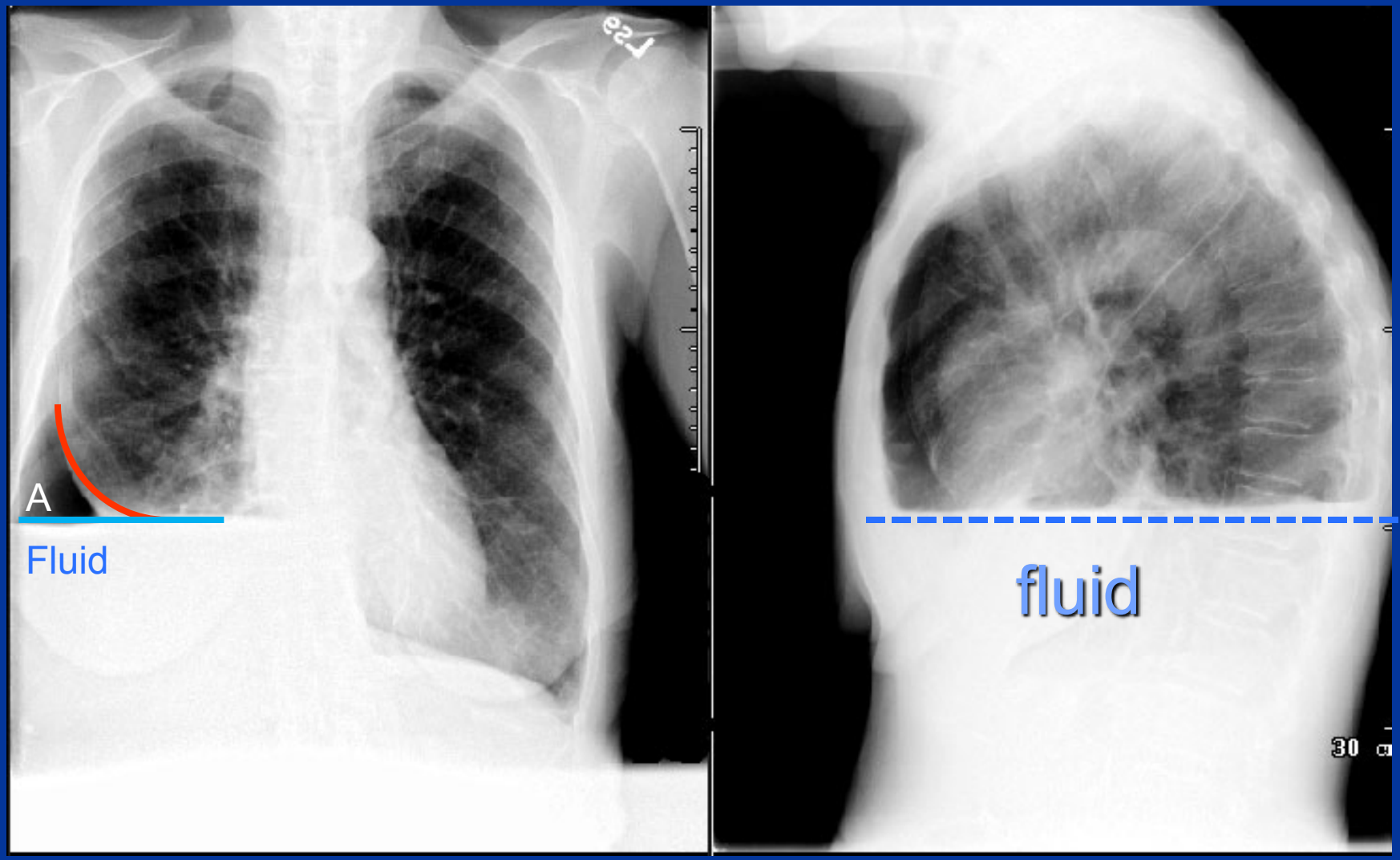
PNEUMOTHORAX

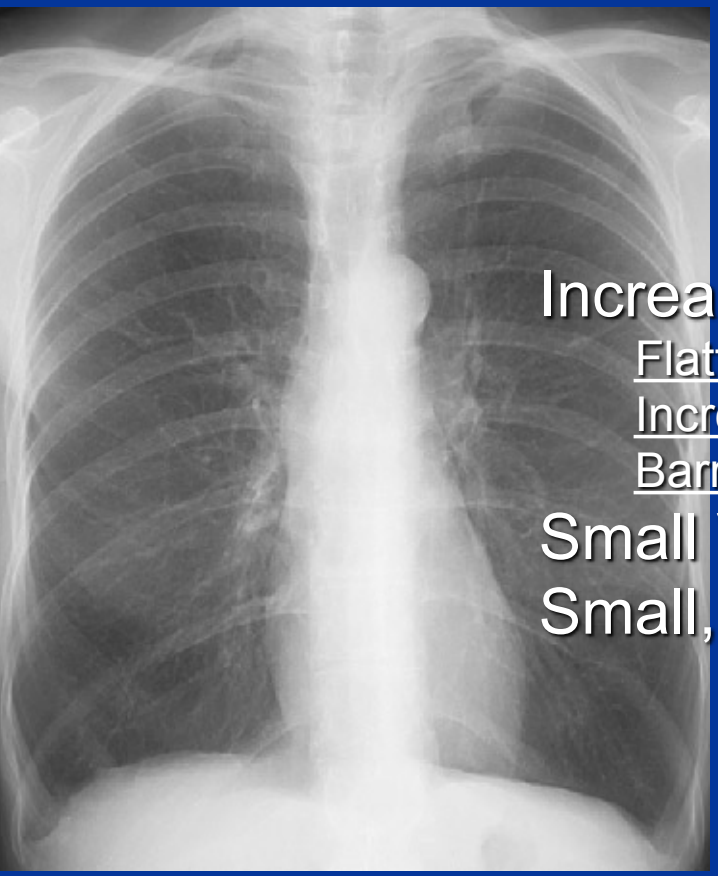


PNEUMOTHORAX



Hydro-pneumo-thorax





EMPHYSEMA

Increased Lung Volume
- Flattened Diaphragms
- Increase in Retrosternal Airspace
- Barrel chest

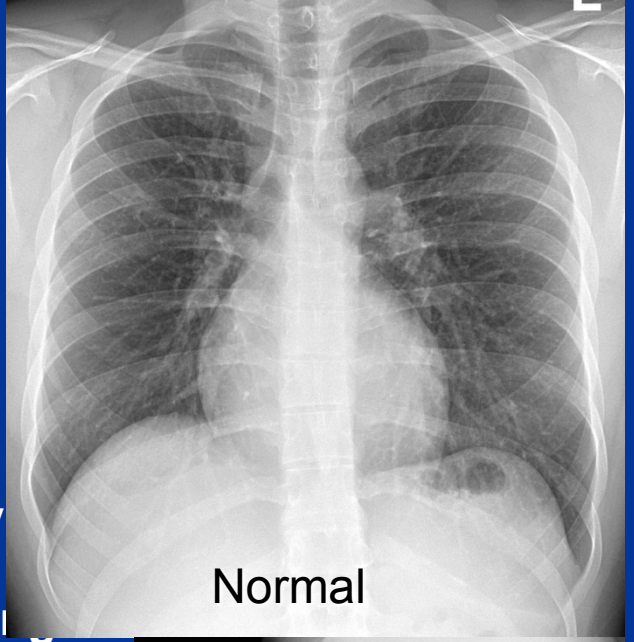
Small Vessels

Small, narrow cardiac SHADOW

- **Emphysema is loss of elastic recoil of the lung with destruction of pulmonary capillary bed and alveolar septa. It is caused most often by cigarette smoking and less commonly by alpha-1 antitrypsin deficiency.**

EMPHYSEMA

- Emphysema is commonly seen on CXR as diffuse hyperinflation with flatteni of diaphragms, increased retrosternal space, bullae (lucent, air-containing spaces that have no vessels that are not perfused)

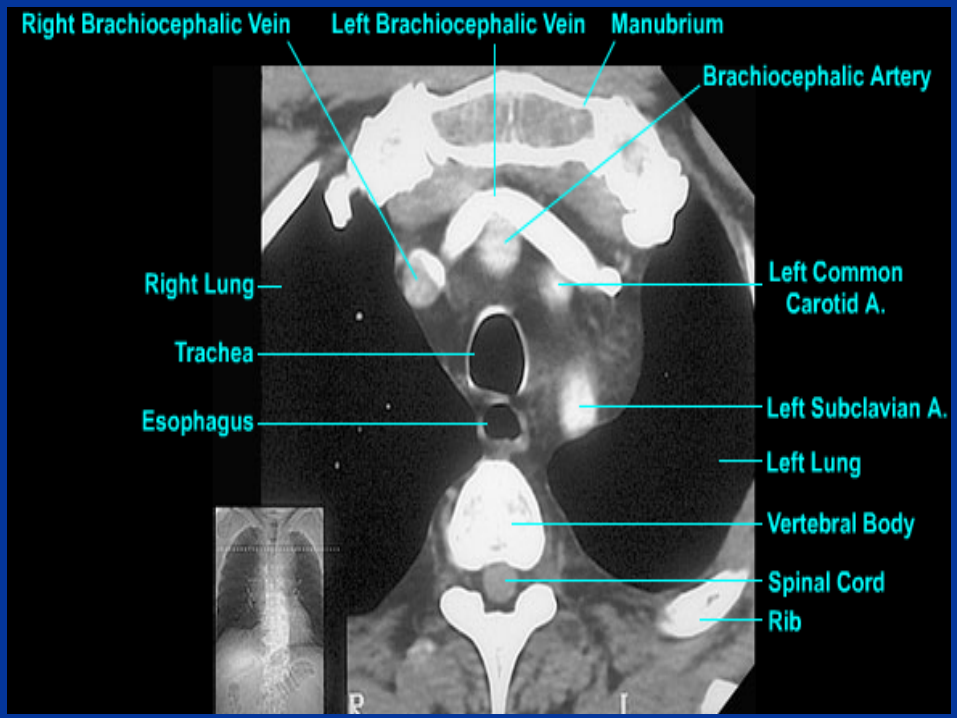


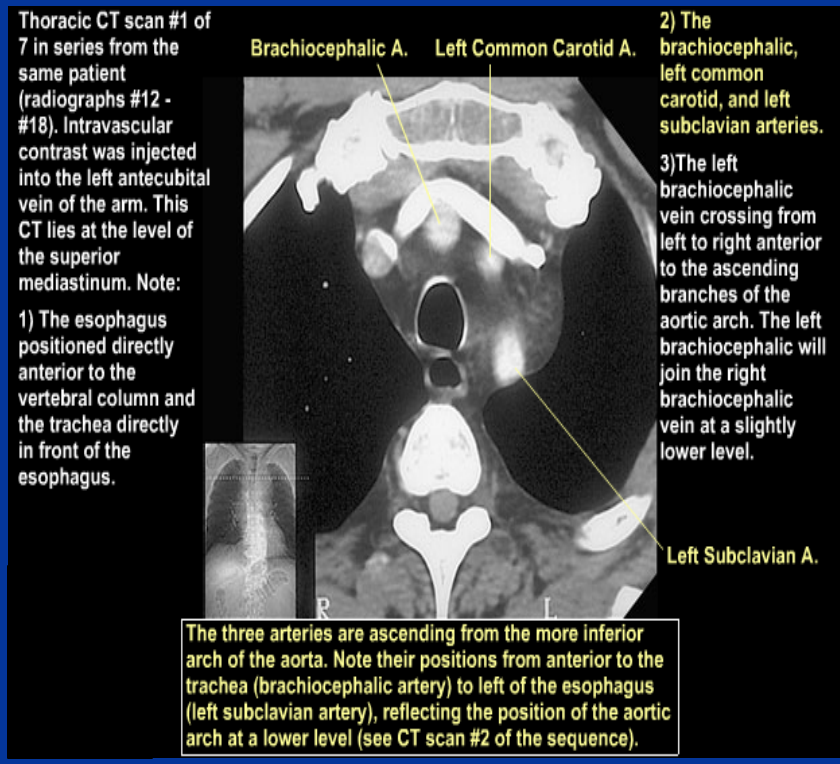
Normal

EMPHYSEMA

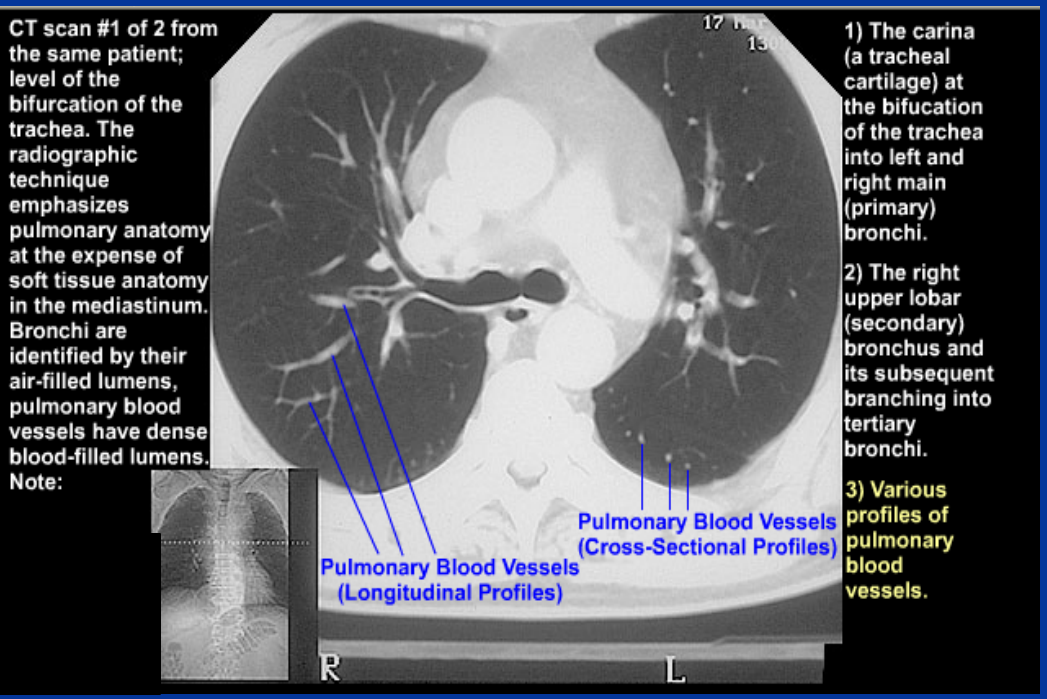
- **Emphysema is commonly seen on CXR as diffuse hyperinflation with flattening of diaphragms, increased retrosternal space, bullae (lucent, air-containing spaces that have no vessels that are not perfused) and enlargement of PA/ RV (secondary to chronic hypoxia) an entity also known as cor pulmonale. Hyperinflation and bullae are the best radiographic predictors of emphysema.**

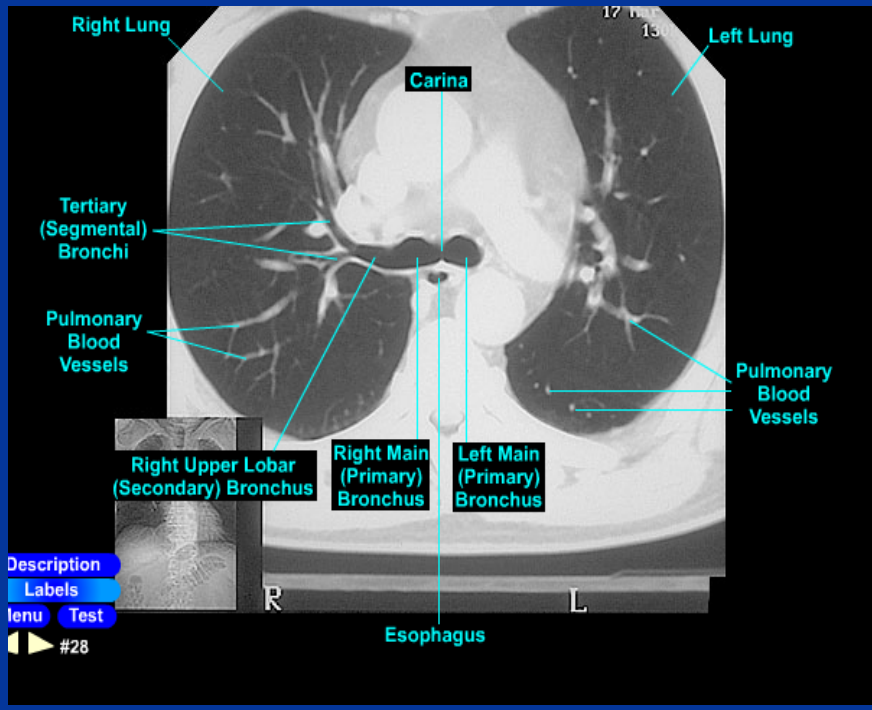
CT anatomy


Right Brachiocephalic Vein
Left Brachiocephalic Vein
Manubrium
Brachiocephalic Artery
Right Lung
Left Common Carotid A.
Trachea
Esophagus
Left Subclavian A.
Left Lung
Vertebral Body
Spinal Cord
Rib
R
L

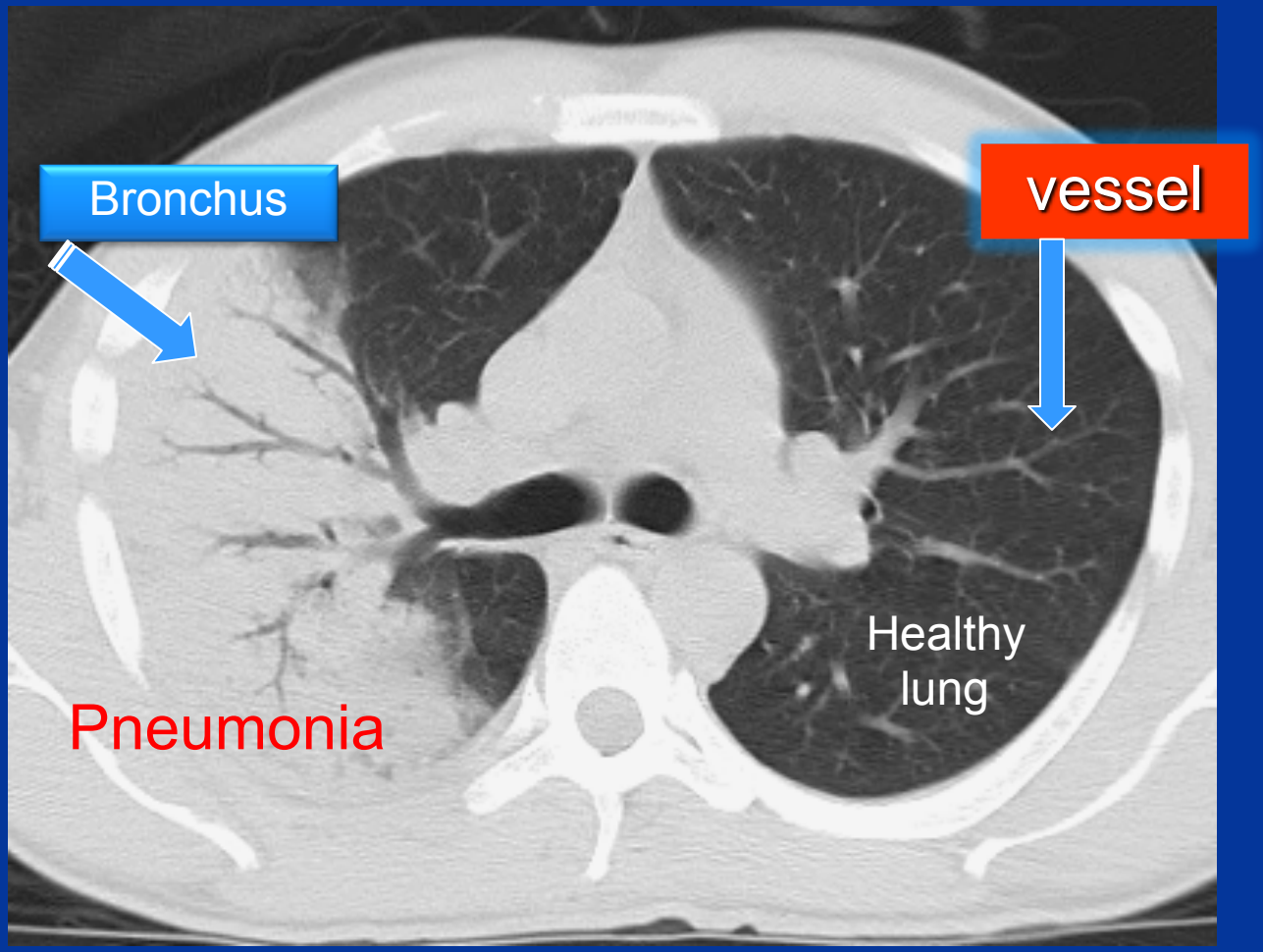

Thoracic CT scan #1 of 7 in series from the same patient (radiographs #12 - #18). Intravascular contrast was injected into the left antecubital vein of the arm. This CT lies at the level of the superior mediastinum. Note:
1) The esophagus positioned directly anterior to the vertebral column and the trachea directly in front of the esophagus.
Brachiocephalic A.
Left Common Carotid A.
2) The brachiocephalic, left common carotid, and left subclavian arteries.
3)The left brachiocephalic vein crossing from left to right anterior to the ascending branches of the aortic arch. The left brachiocephalic will join the right brachiocephalic vein at a slightly lower level.
Left Subclavian A.
R
L
The three arteries are ascending from the more inferior arch of the aorta. Note their positions from anterior to the trachea (brachiocephalic artery) to left of the esophagus (left subclavian artery), reflecting the position of the aortic arch at a lower level (see CT scan #2 of the sequence).

CT

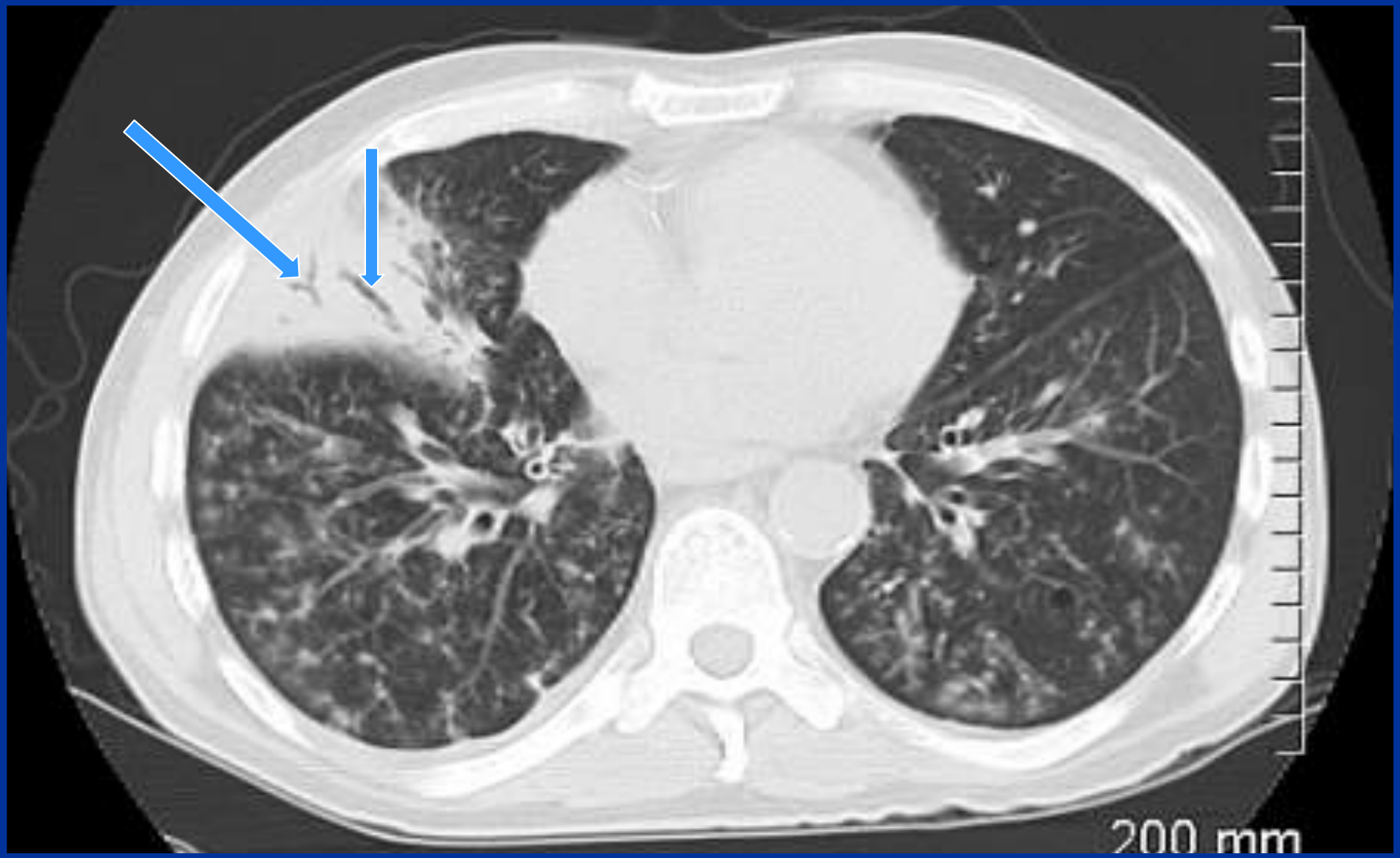

CT scan #1 of 2 from the same patient; level of the bifurcation of the trachea. The radiographic technique emphasizes pulmonary anatomy at the expense of soft tissue anatomy in the mediastinum. Bronchi are identified by their air-filled lumens, pulmonary blood vessels have dense blood-filled lumens. Note:
1) The carina (a tracheal cartilage) at the bifucation of the trachea into left and right main (primary) bronchi.
2) The right upper lobar (secondary) bronchus and its subsequent branching into tertiary bronchi.
3) Various profiles of pulmonary blood vessels.
Pulmonary Blood Vessels (Cross-Sectional Profiles)
Pulmonary Blood Vessels (Longitudinal Profiles)
R
L


Right Lung
Left Lung
Carina
Tertiary (Segmental) Bronchi
Pulmonary Blood Vessels
Pulmonary Blood Vessels
Right Upper Lobar (Secondary) Bronchus
Right Main (Primary) Bronchus
Left Main (Primary) Bronchus
Description
Labels
Test
#28
R
L
Esophagus

Air bronchograms — CT



Air bronchograms — CT



CARDIOVASCULAR IMAGING

Radiologic investigation of Chest and CVS diseases

By

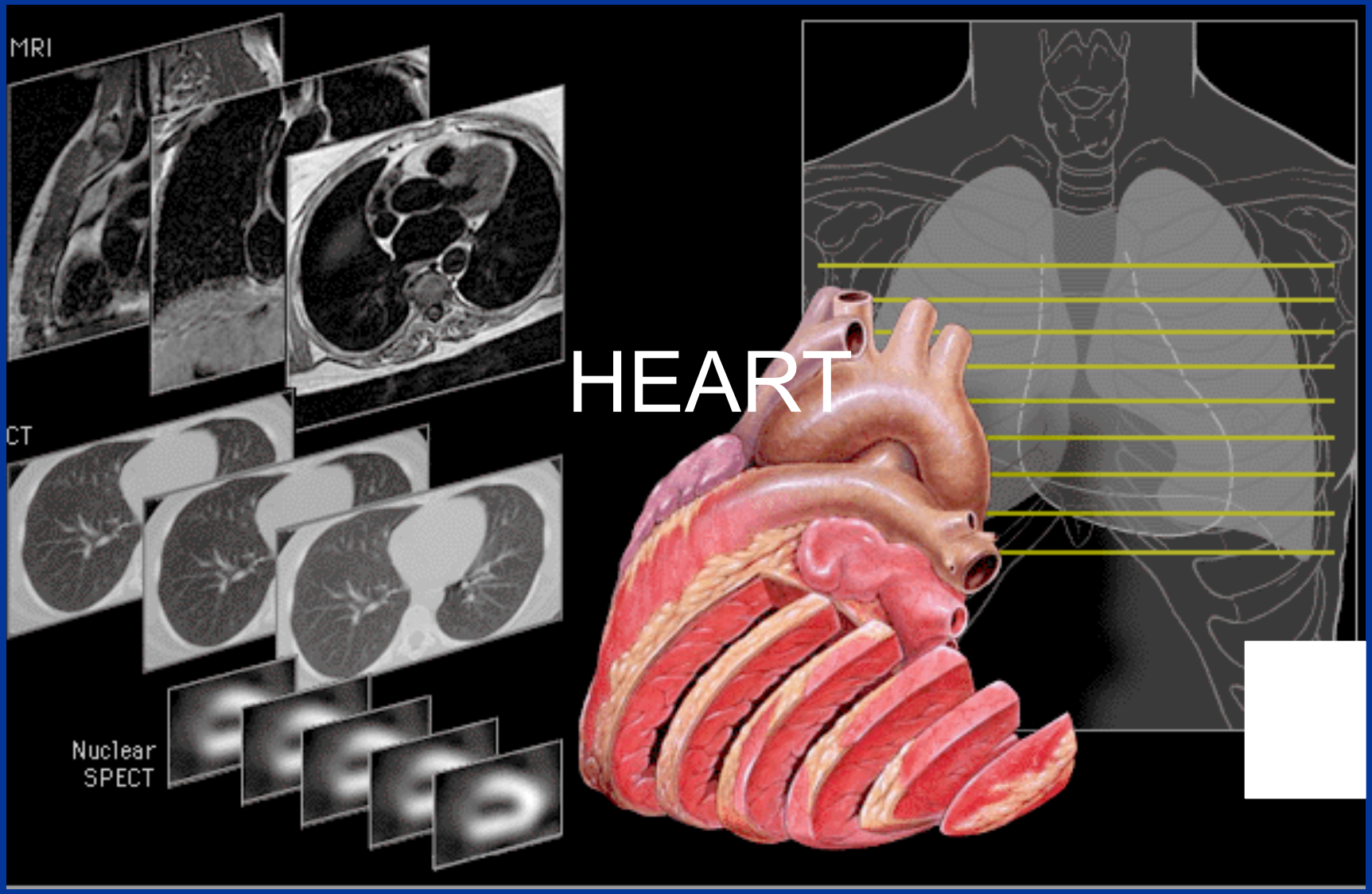
Dr Mohamed Sherif El-Sharkawy

ASSOCIATE PROF. and Consultant Radiologist

KKUH

KING SAUD UNIVERSITY

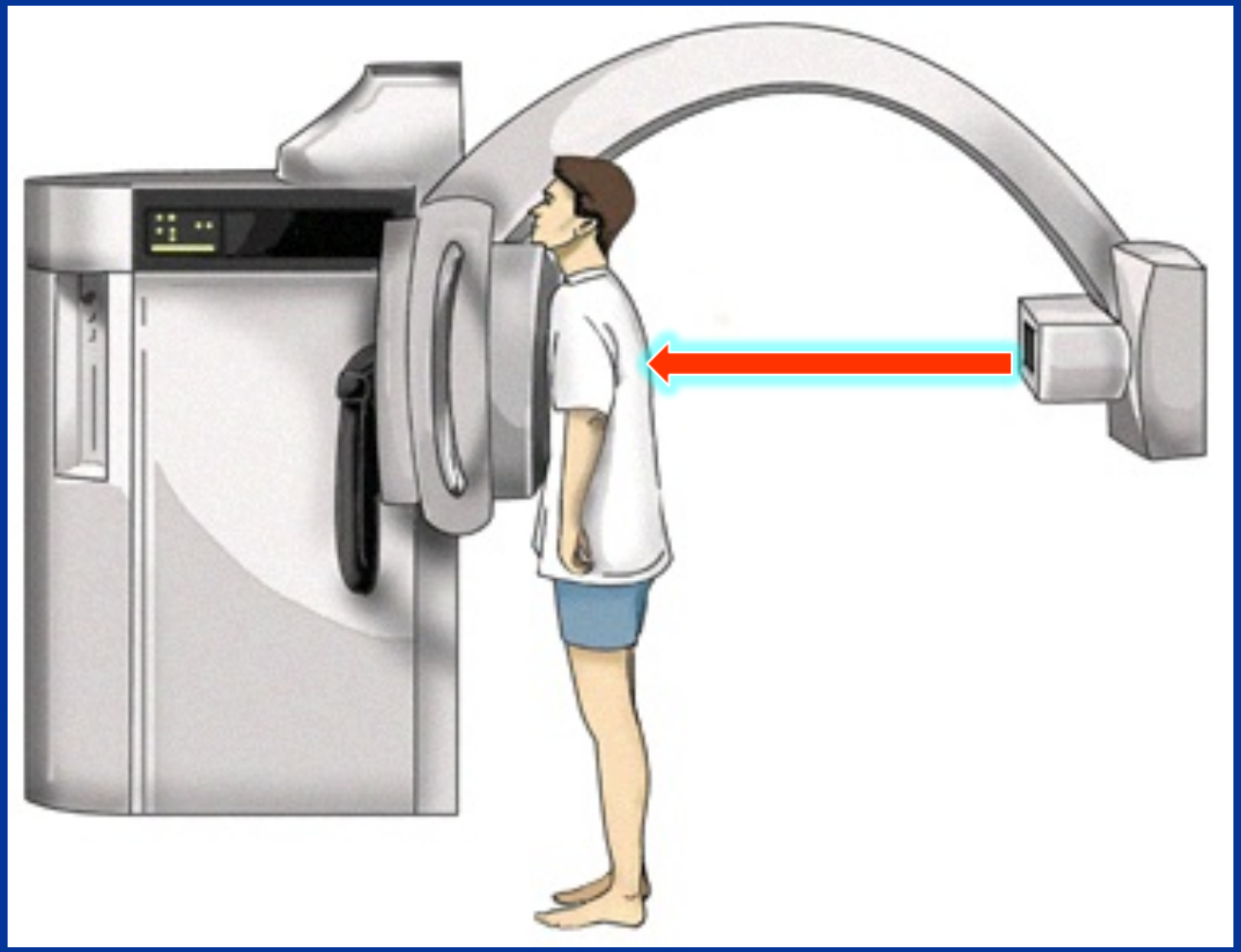
LAST UPDATE
SEPT 2013


MRI
CT
Nuclear
SPECT
HEART

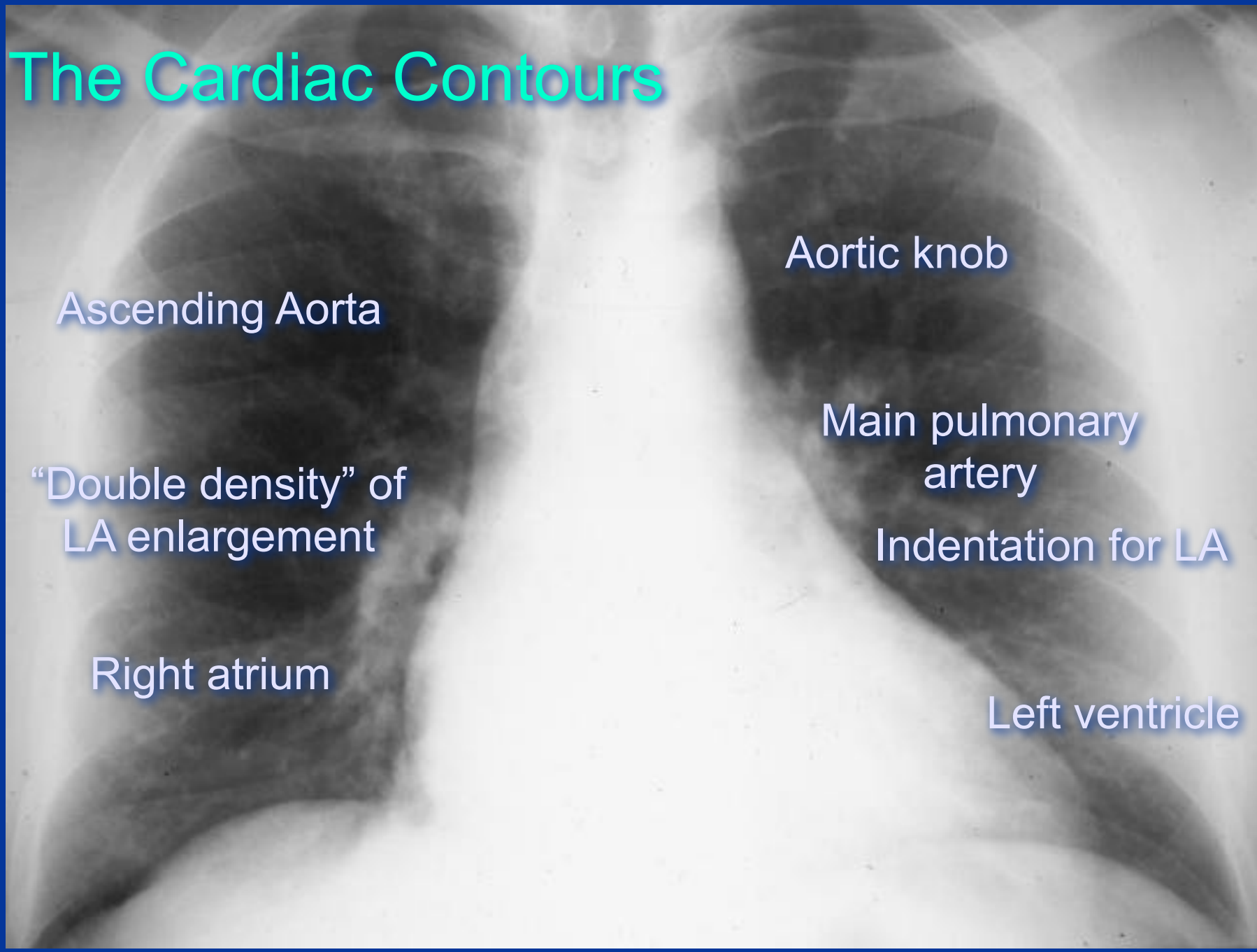
BASIC CHEST EXAM FOR THE HEART AND GREAT VESSELES

- PLAIN FILM=CHEST X-RAY(CXR)
- CT FOR HEART AND MEDIASTINUM
- ANGIOGRAMS
- MRI
- ULTRASOUND (ECHOCARDIOGRAPHY)
- ISOTOPIC SCANNING

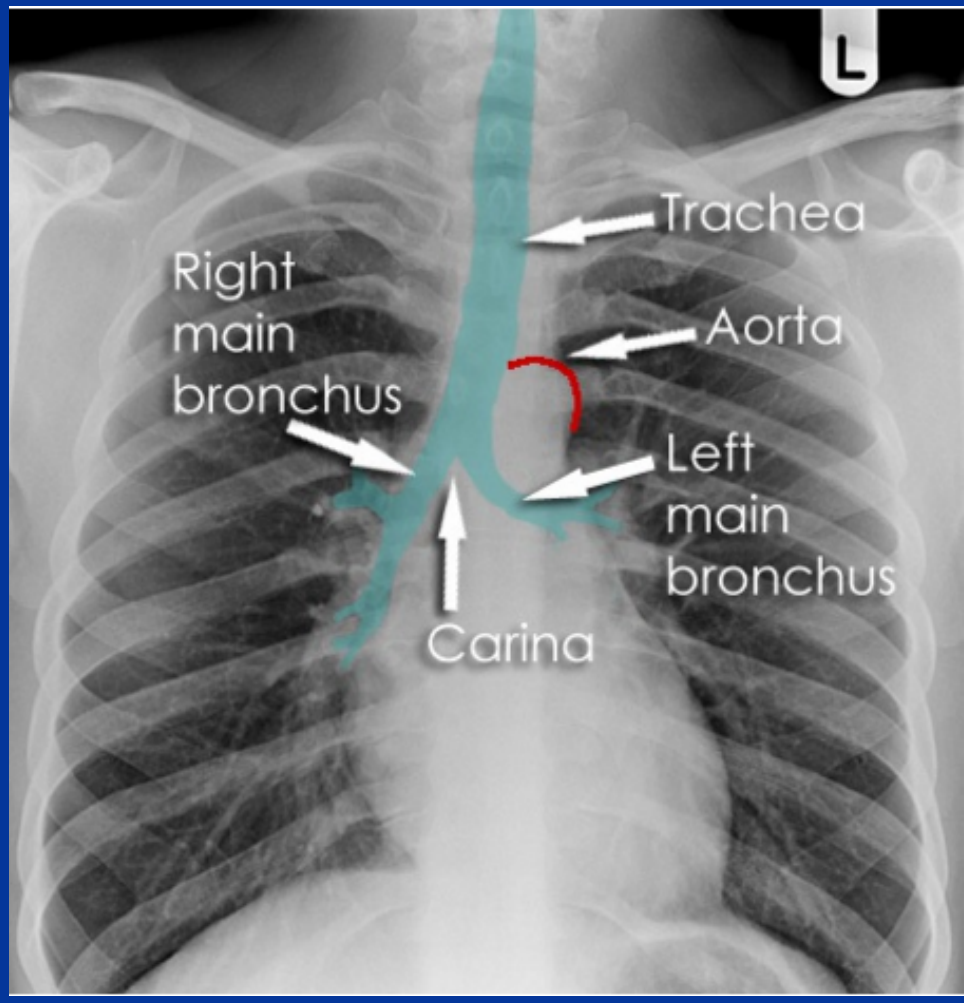
Basic Chest X-Ray



The Cardiac Contours

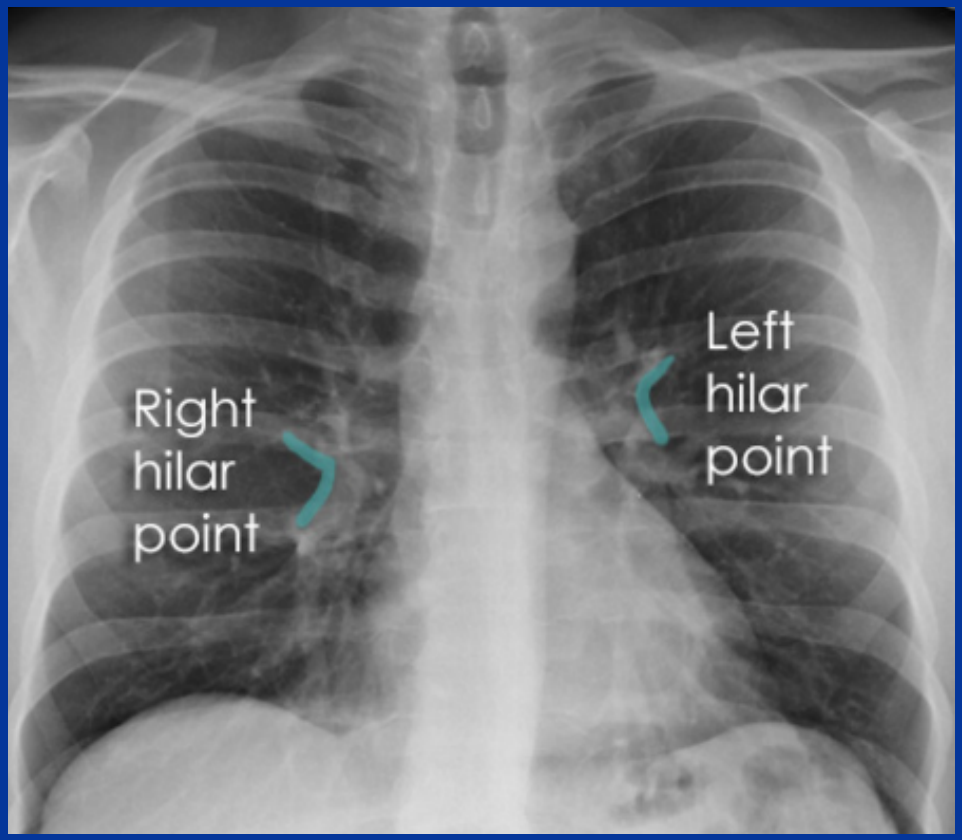


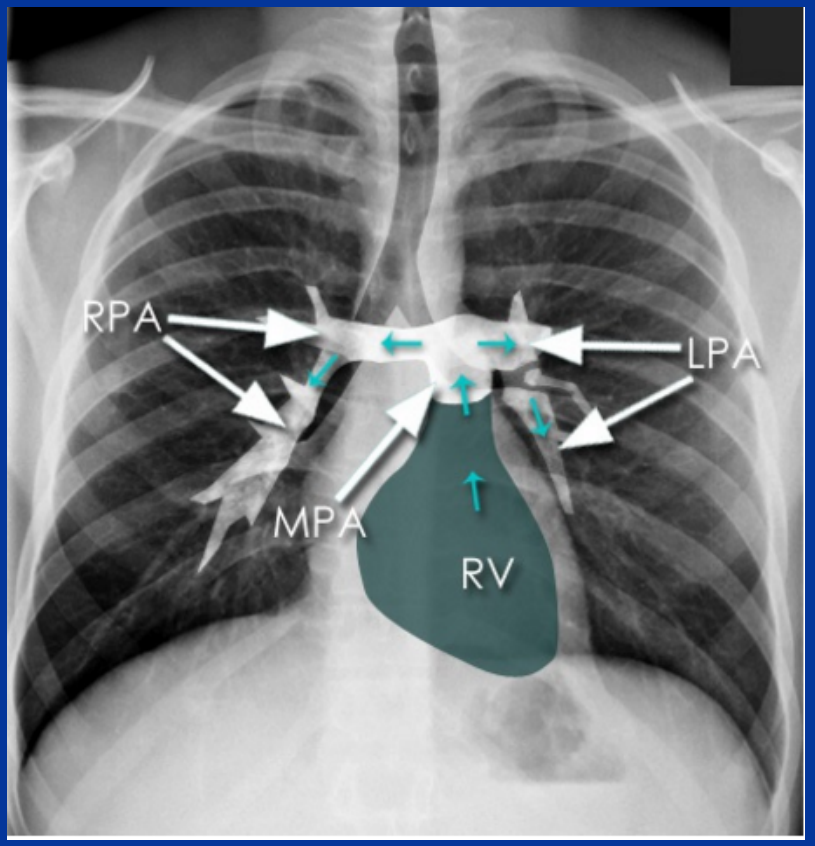

L


L
Trachea
Right main bronchus
Aorta
Left main bronchus
Carina

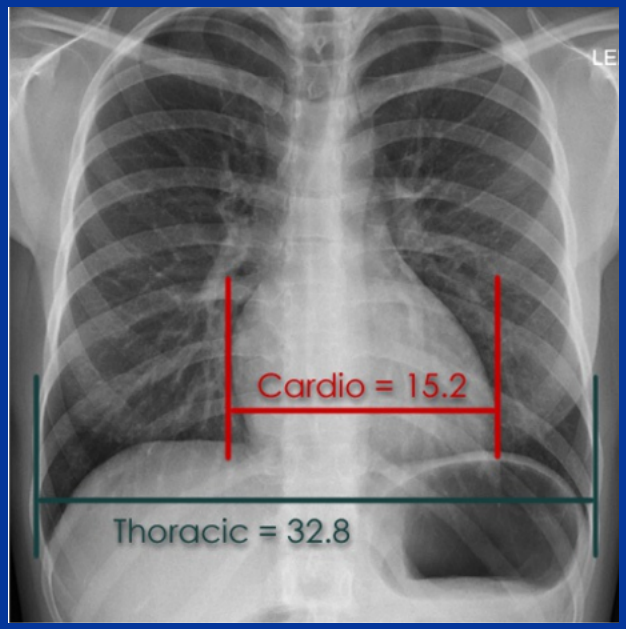
Hilar levels

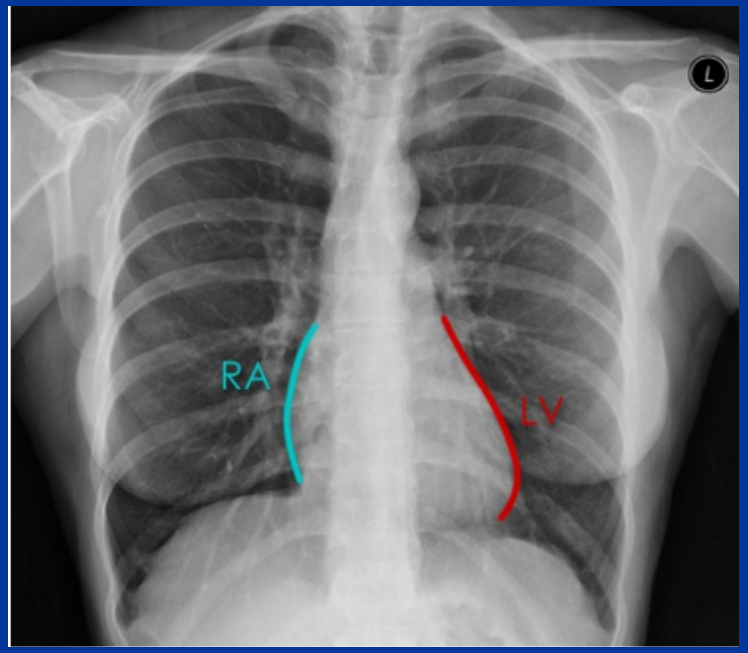
- look for increase in density as well as size. If the hila are out of position, ask yourself if they are pushed or pulled, just as you would when assessing the trachea.



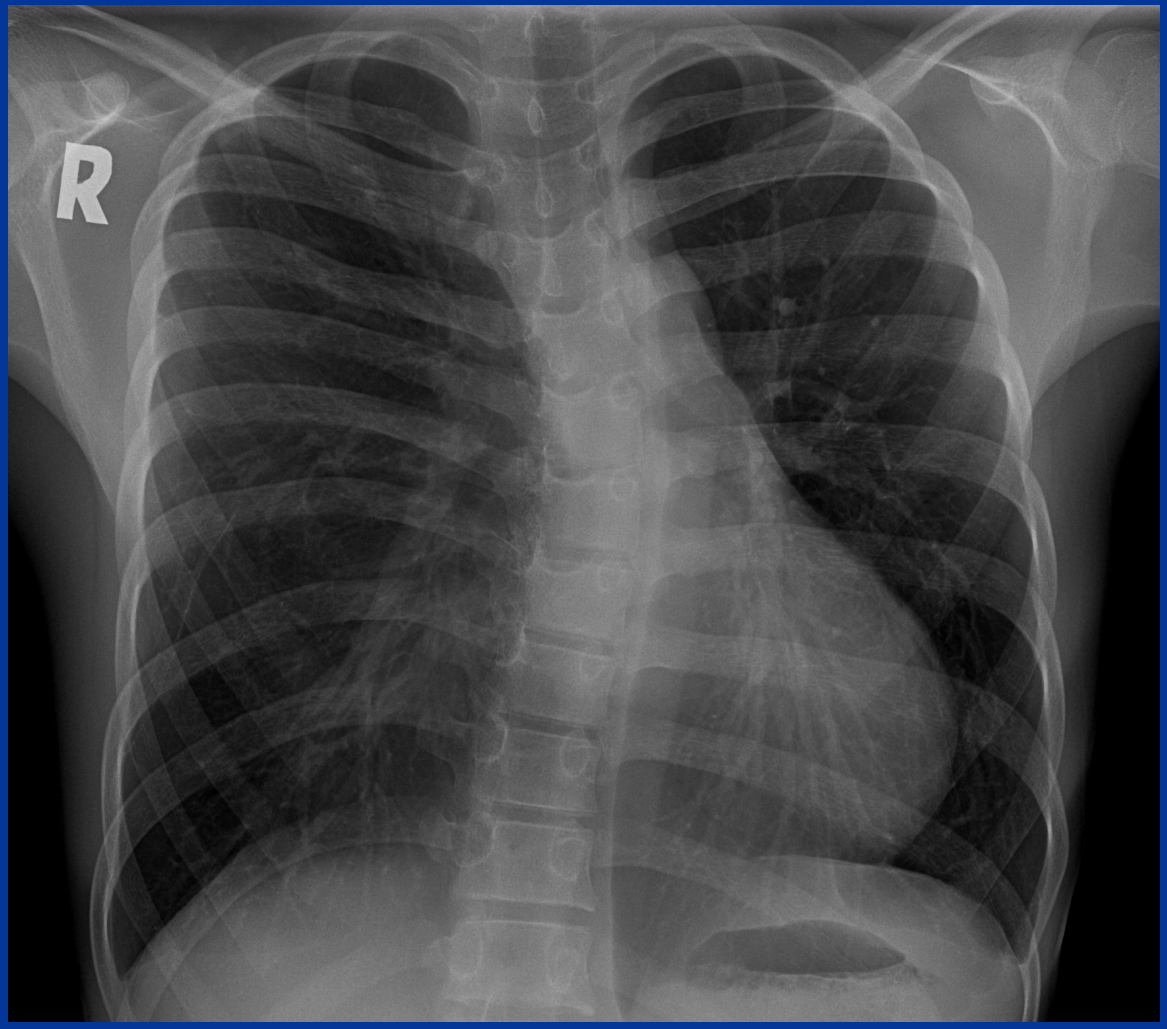


Cardiac contours

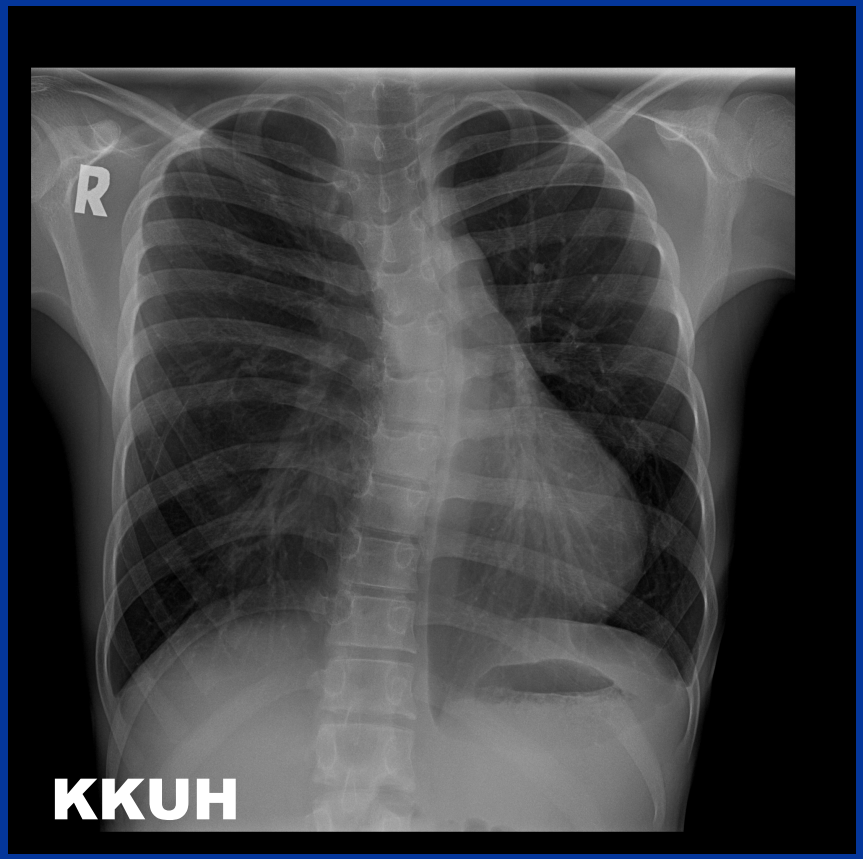




Cardiac displacement

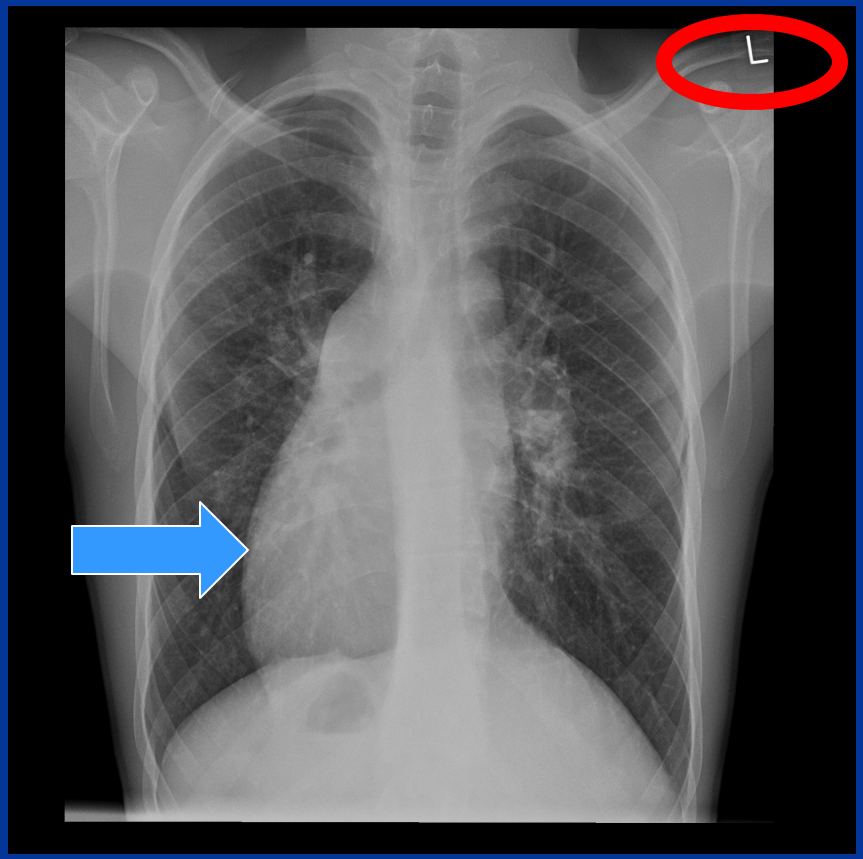


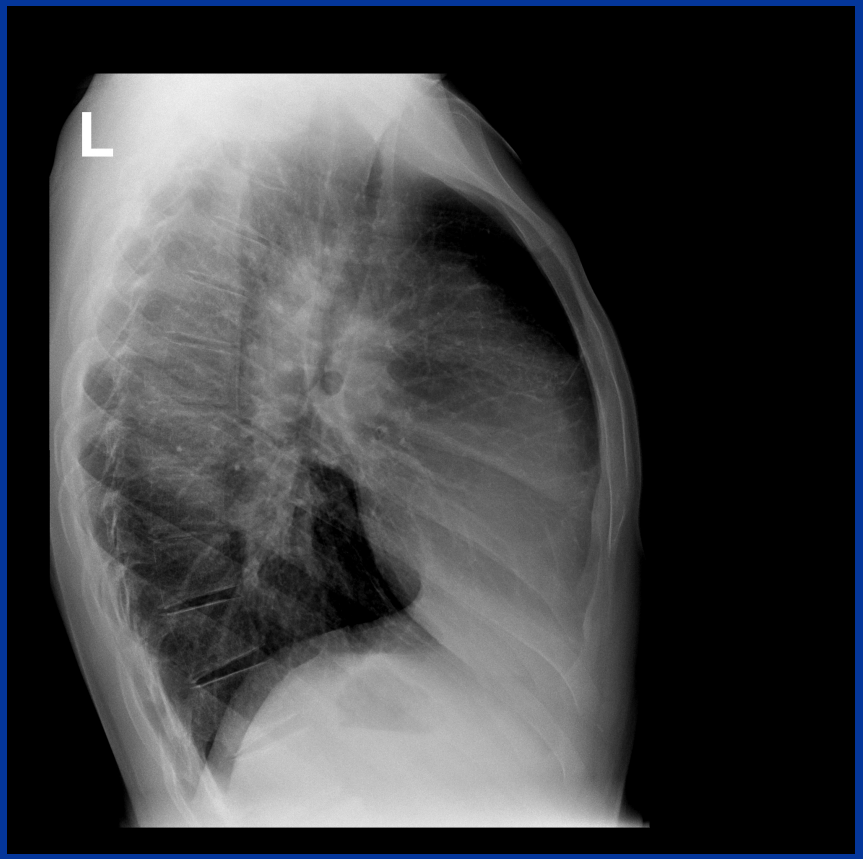
Cardiac displacement

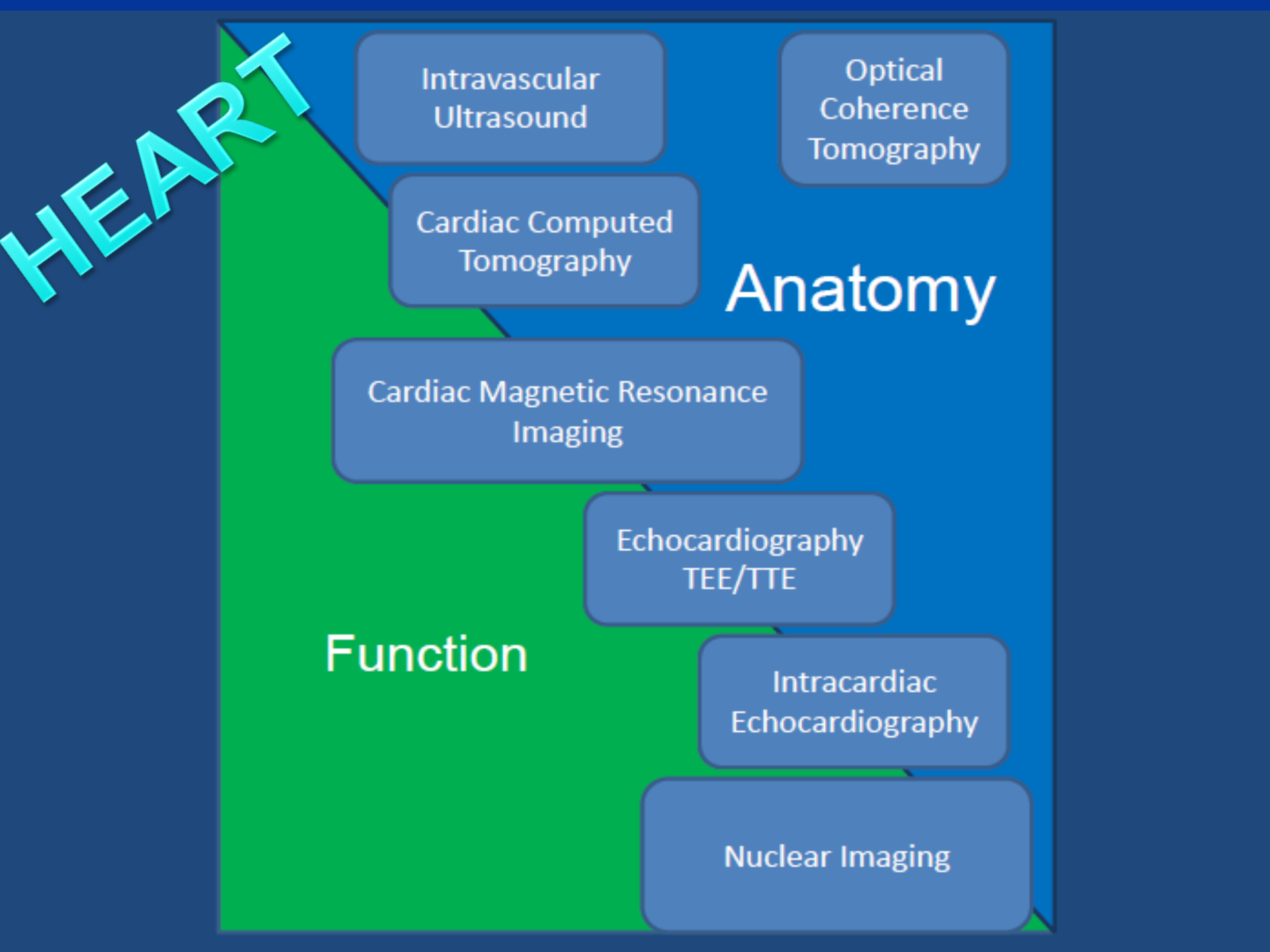


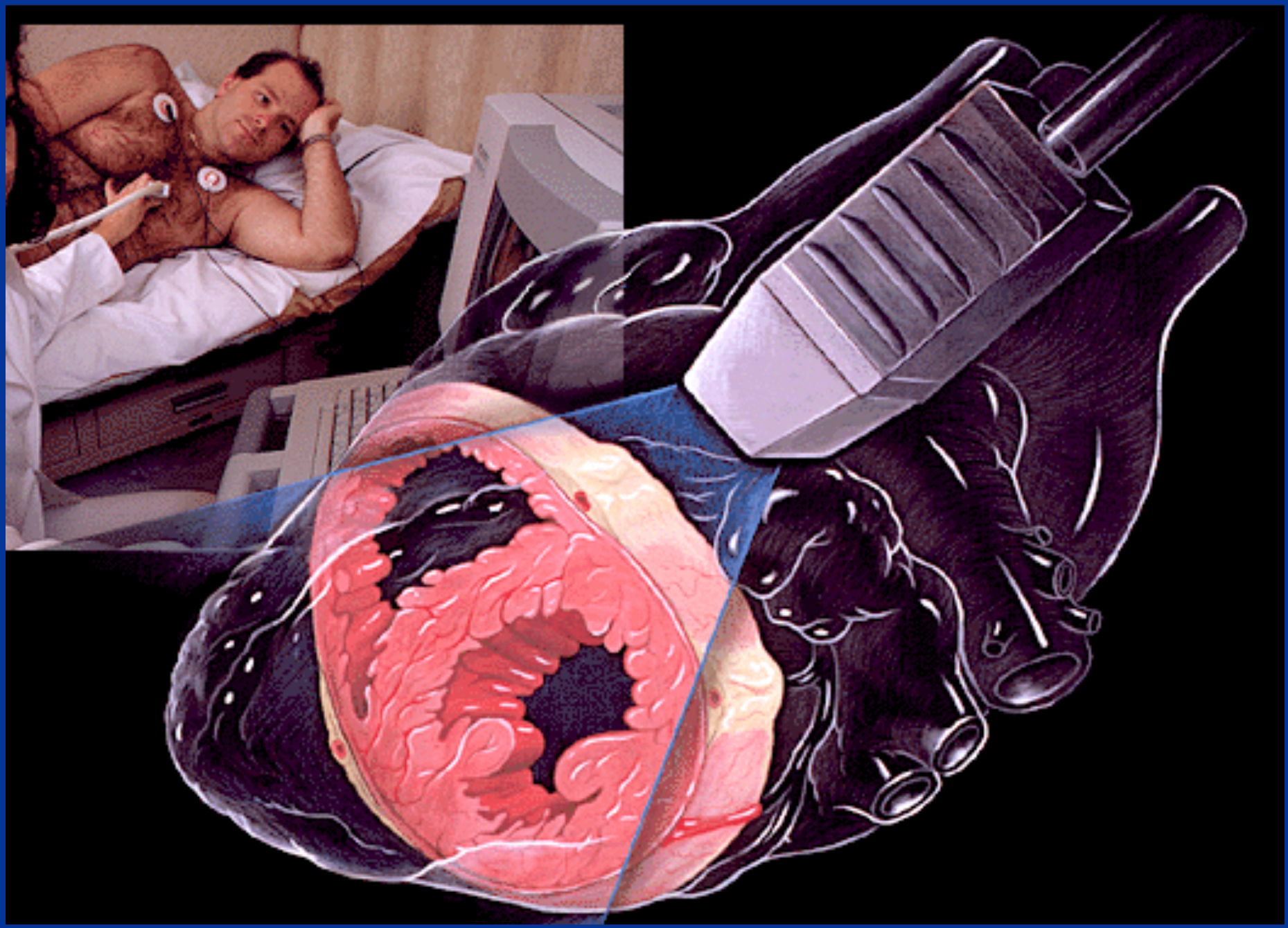
Pectus excavatum

DEXTROCARDIA



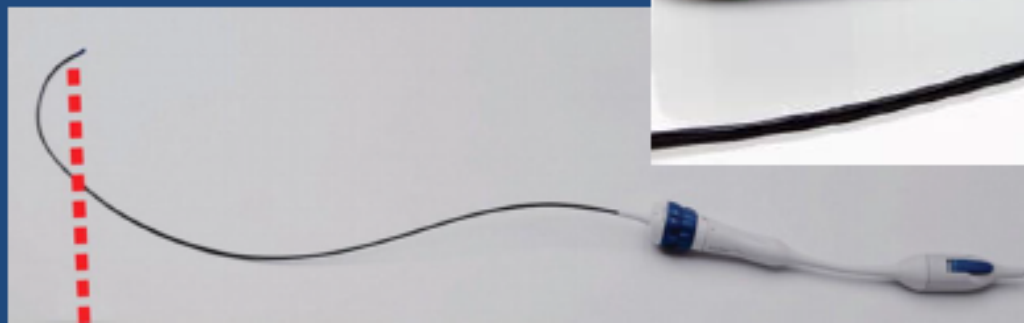



HEART
Intravascular Ultrasound
Optical Coherence Tomography
Cardiac Computed Tomography
Anatomy
Cardiac Magnetic Resonance Imaging
Echocardiography TEE/TTE
Function
Intracardiac Echocardiography
Nuclear Imaging



Echocardiography Methods

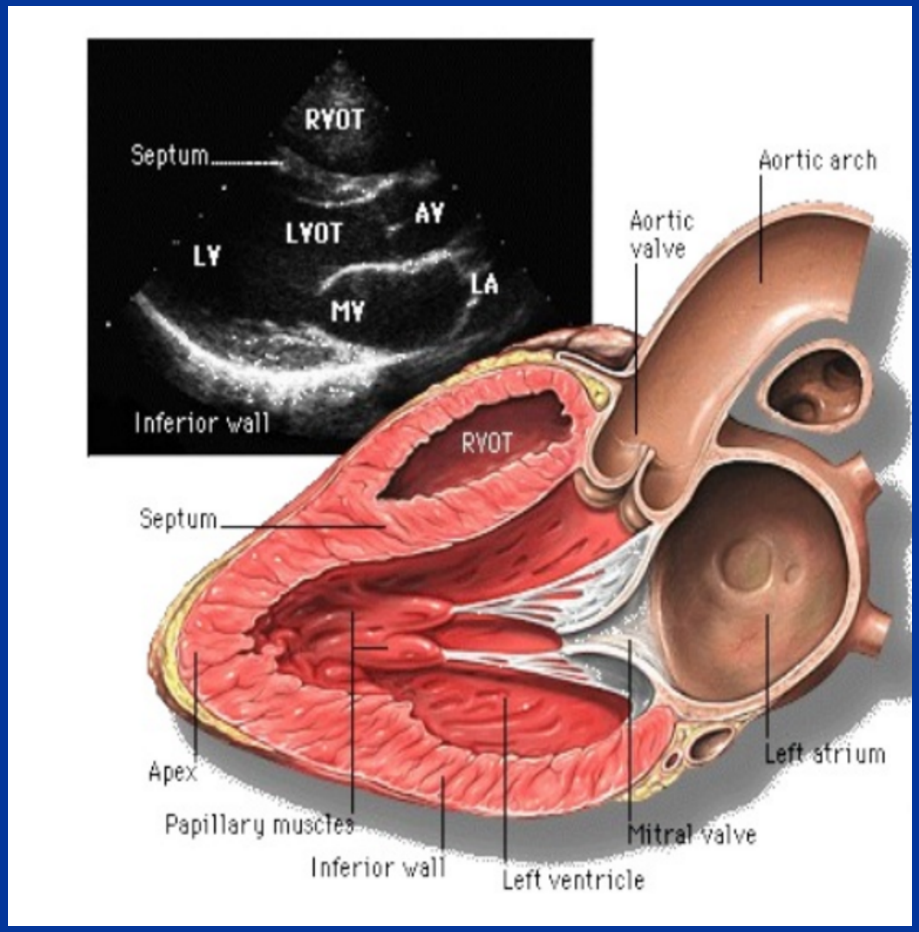
- Transthoracic echocardiography
- Transesophageal echocardiography
- Intracardiac echocardiography
- Intravascular echocardiography

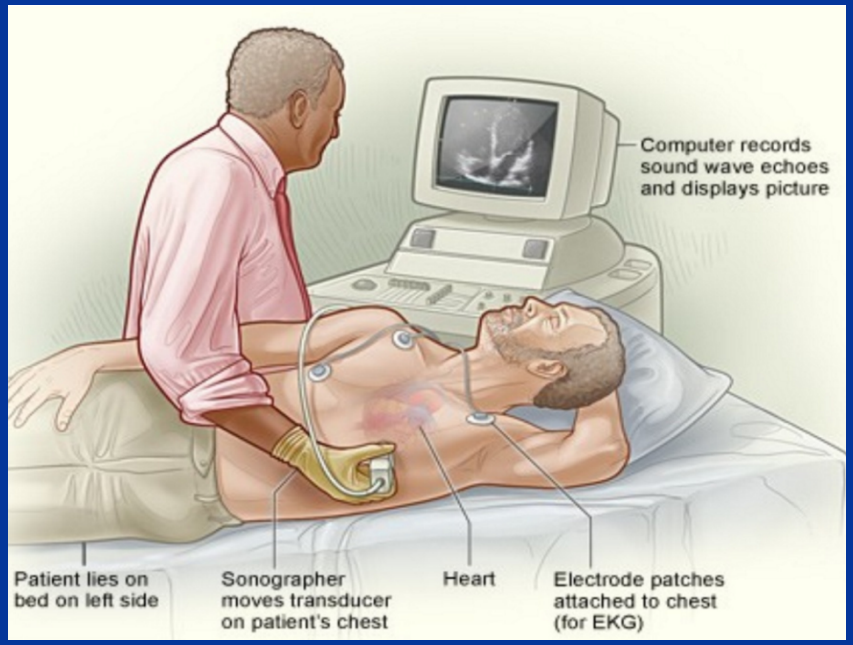


Transesophageal Echocardiography

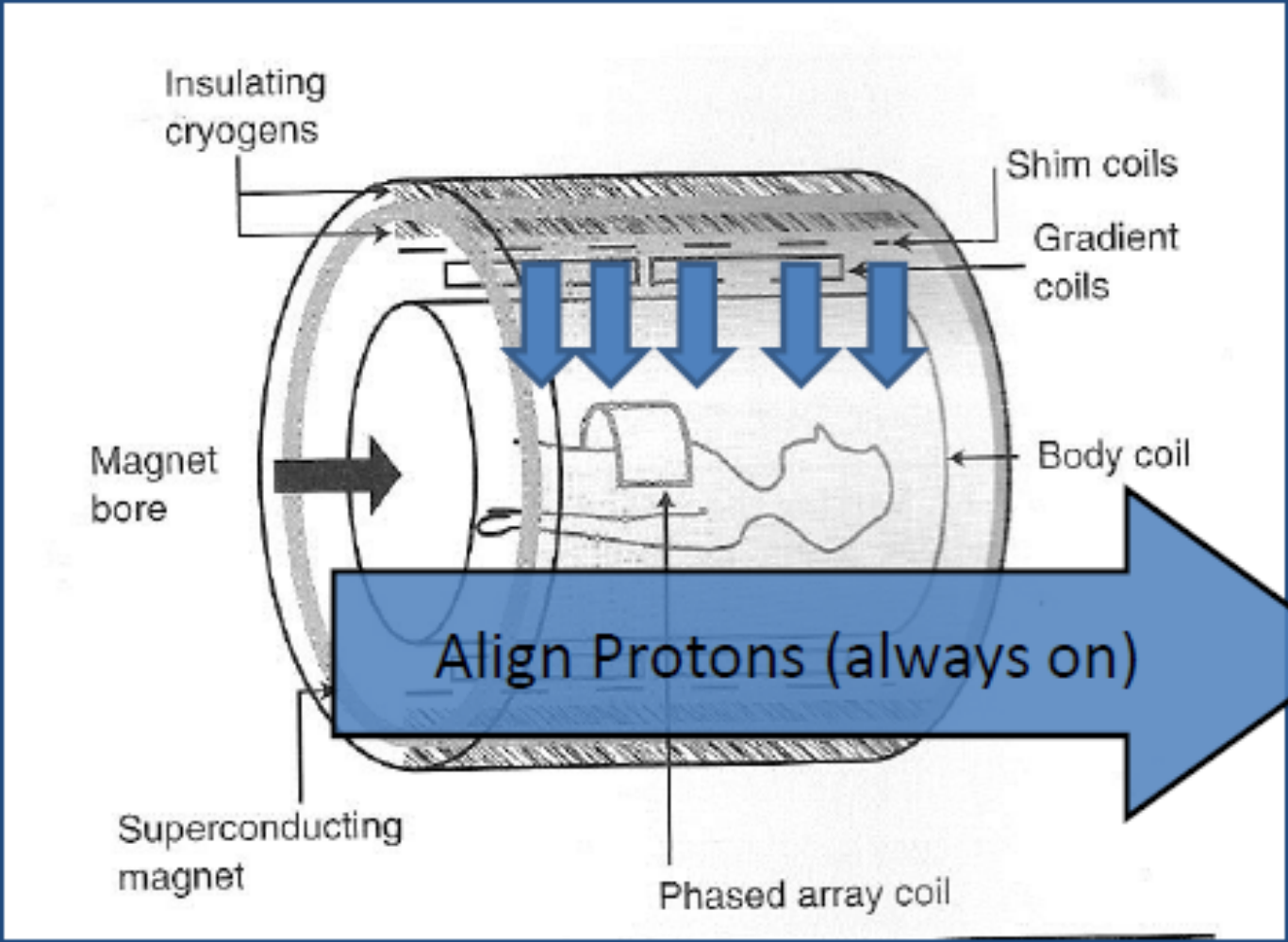
- **Evaluate for cardiac source of embolism (36%)**
- **Endocarditis (14%)**
- **Prosthetic valve function (12%)**
- Valvular disease, aortic dissection or aneurysm, tumor, mass or thrombus (6-8% each).
- Congenital heart disease (4%)
- **Interventional cardiology guidance**
- Intraoperative evaluation cardiothoracic surgery.

TRANS-THORACIC ECHOCARDIOGRAPHY

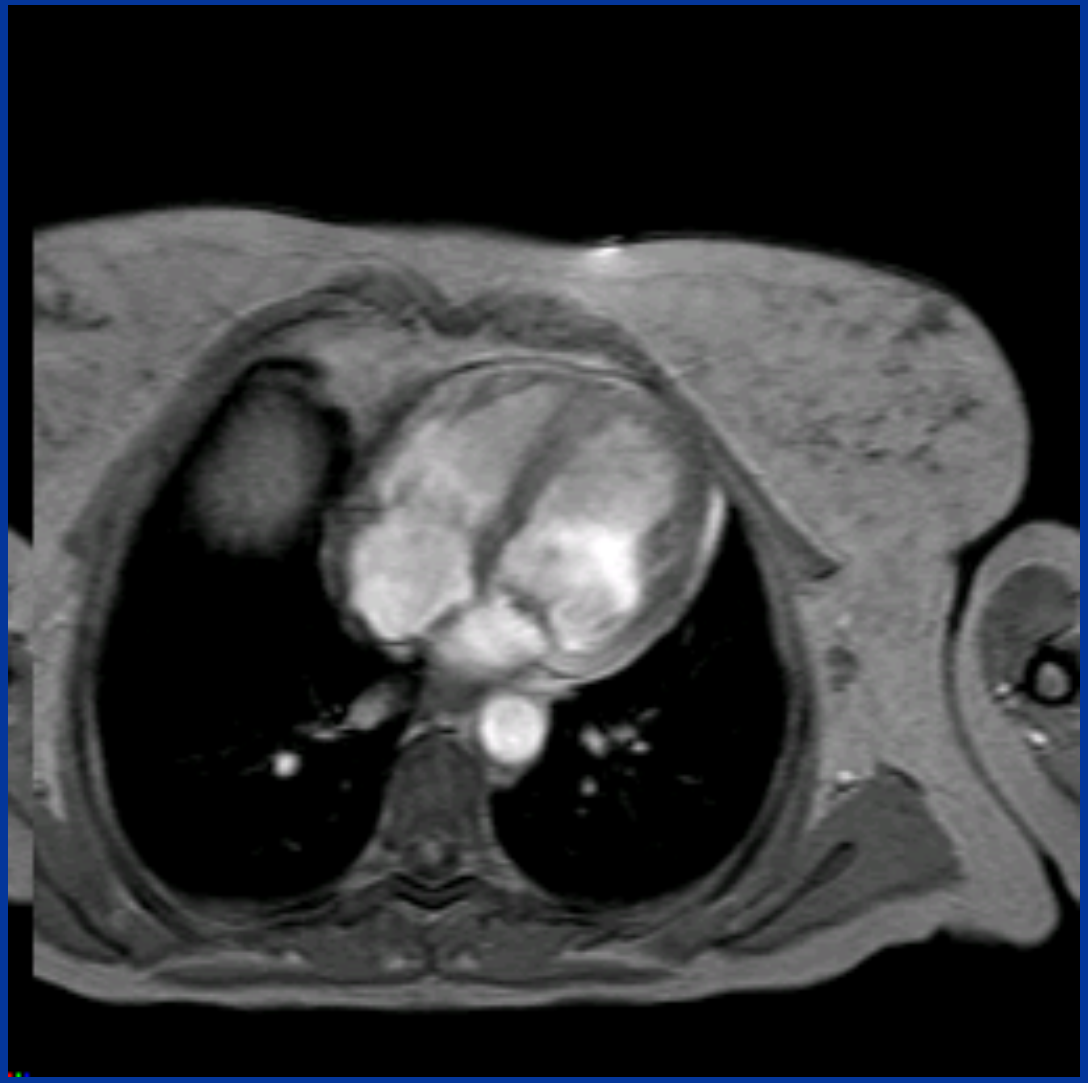




MRI

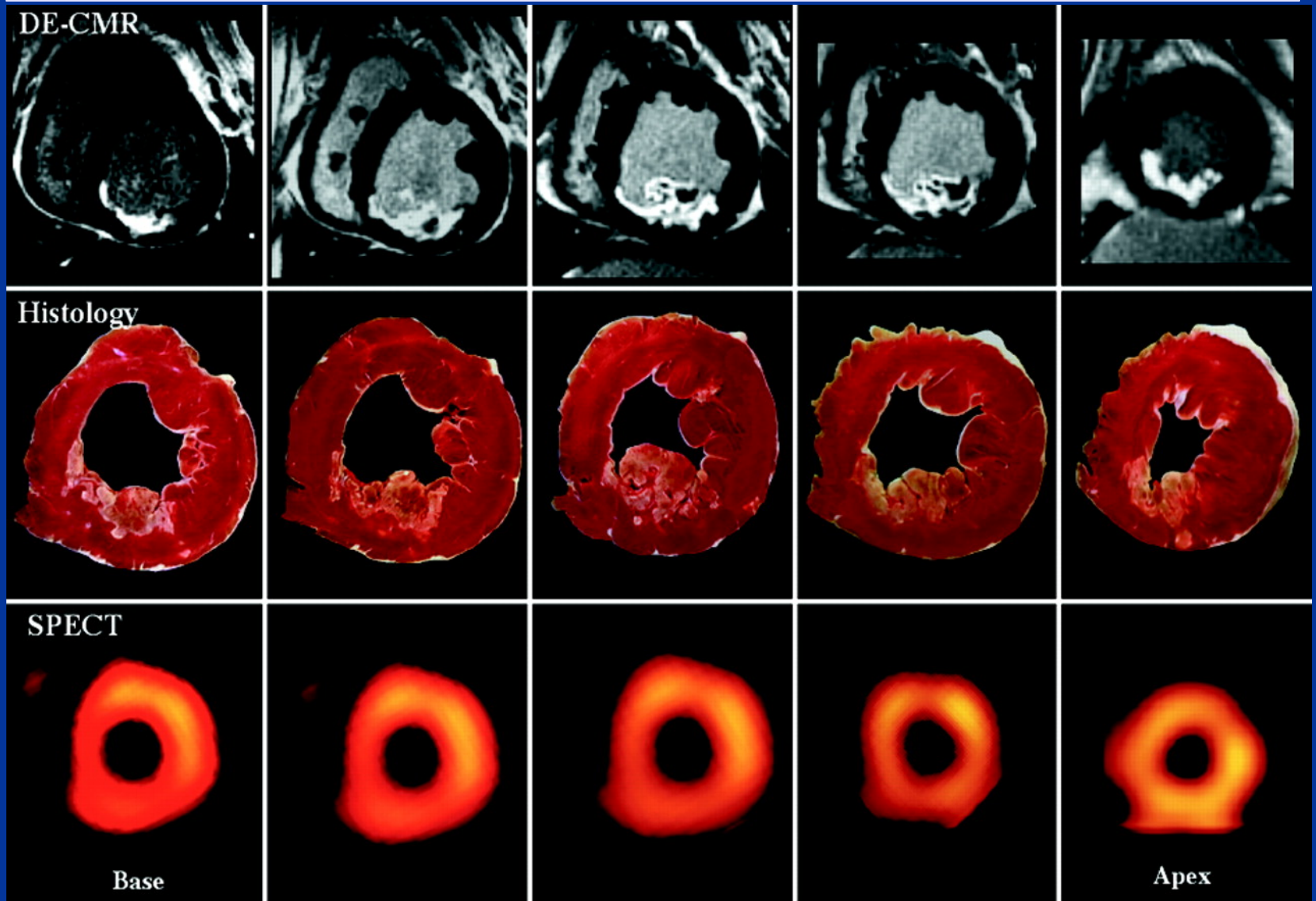

Insulating cryogens
Shim coils
Gradient coils
Magnet bore
Body coil
Align Protons (always on)
Superconducting magnet
Phased array coil

Cardiac Magnetic Resonance



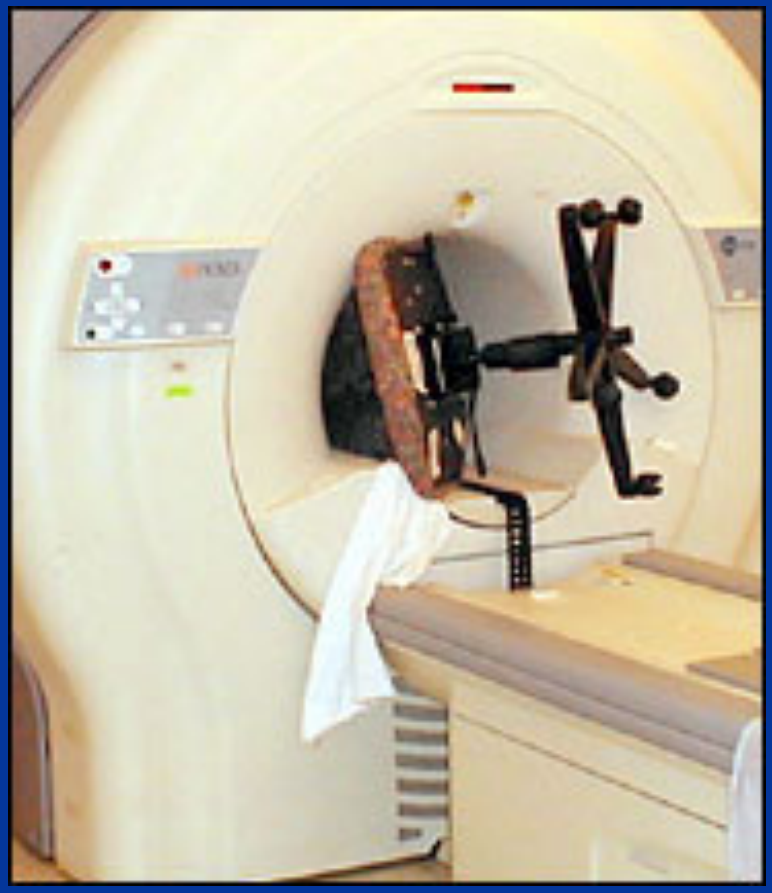
Viability Assessment

CMR Delayed Hyper-Enhancement



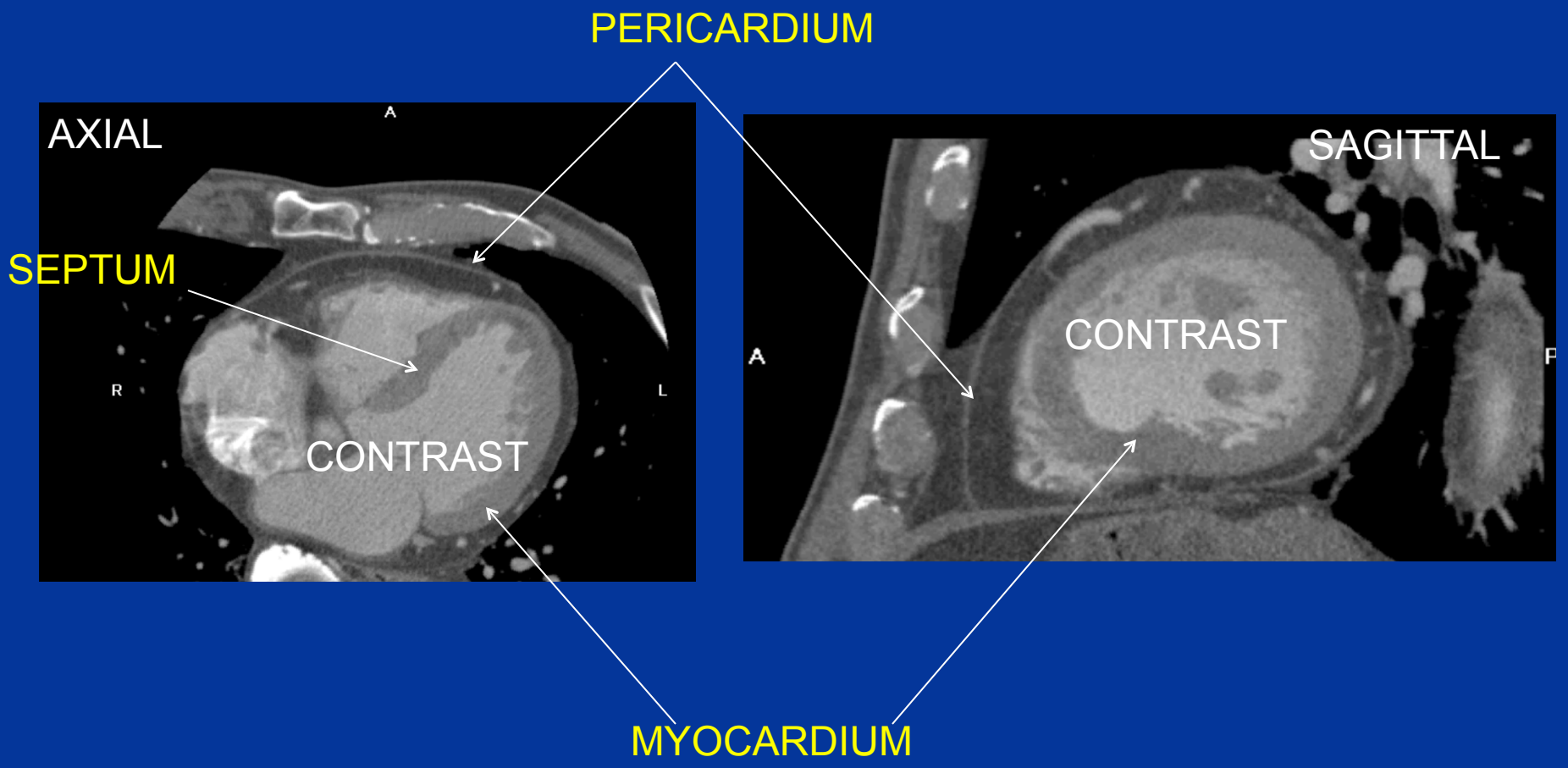
Hazards of MRI

Magnet-Seeking Projectiles



CARDIAC CT
FOR THE HEART AND CORONARY VESSLES

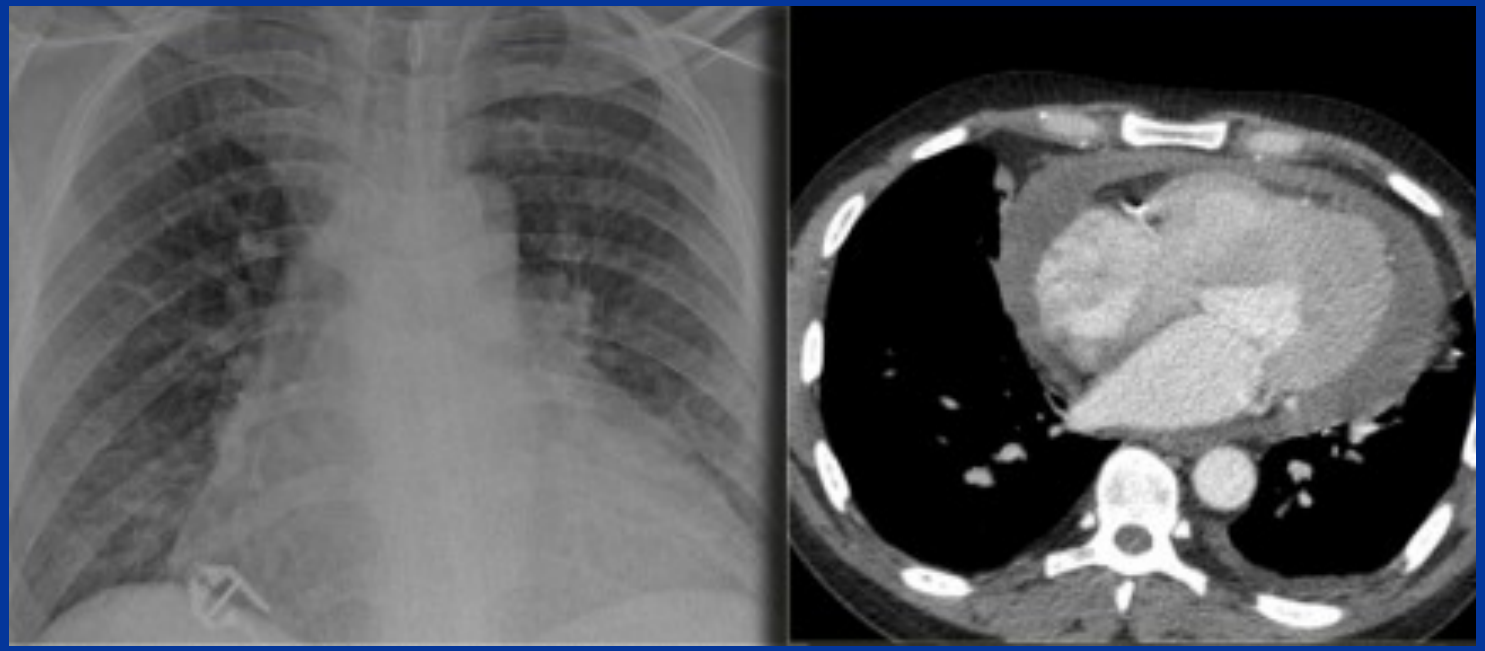
PERICARDIUM



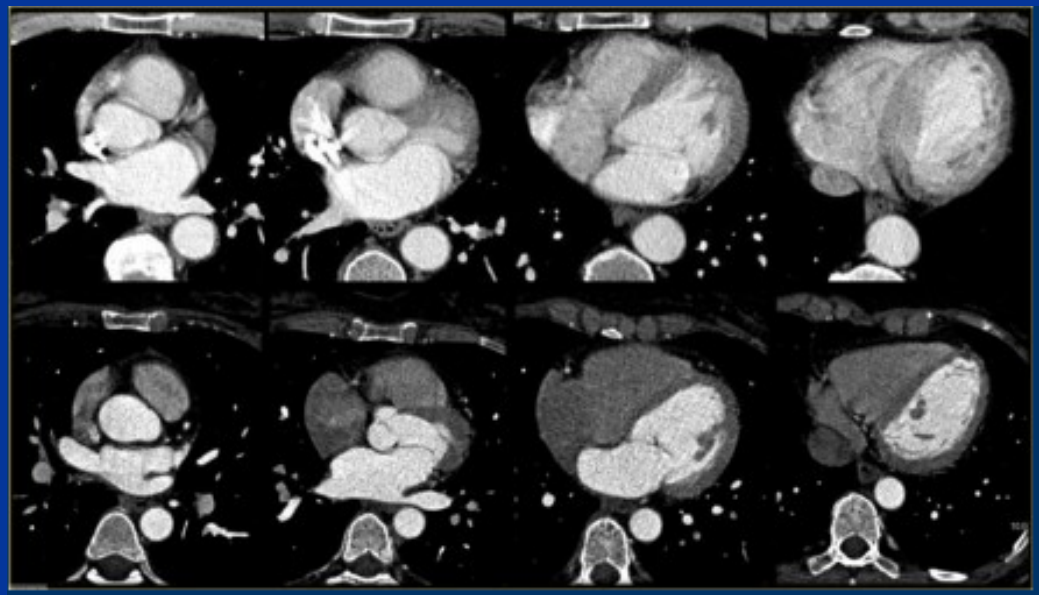
Pericardial effusion

Whenever we encounter a large heart figure, we should always be aware of the possibility of pericardial effusion simulating a large heart.

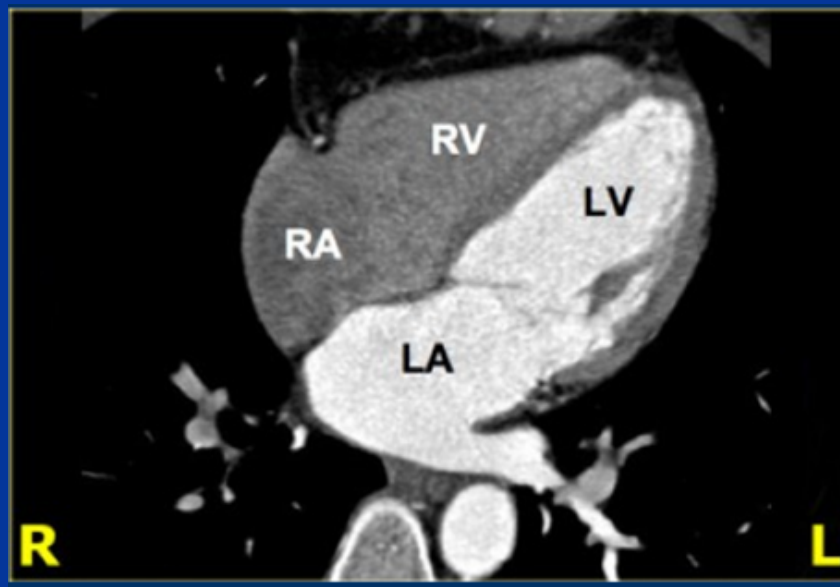
On the chest x-ray it looks as if this patient has a dilated heart while on the CT it is clear, that it is the pericardial effusion that is responsible for the enlarged heart figure.



CARDIAC CHAMBERS



Axial slices through the heart



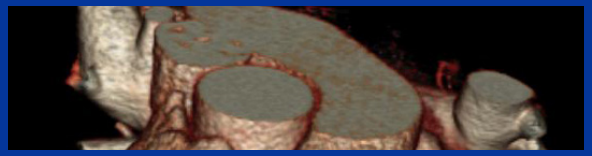
4-chamber view. RA=right atrium, RV=right ventricle, LA=left atrium, LV=left ventricle

4 to 64 Slice Scans

Five Heart Beats

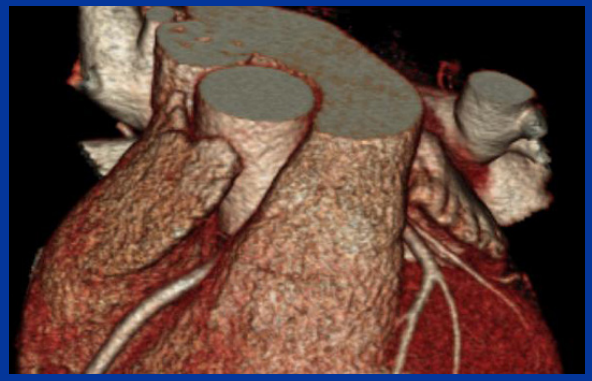
10 mm detector
Pitch ~0.25

3 cm in 5 sec



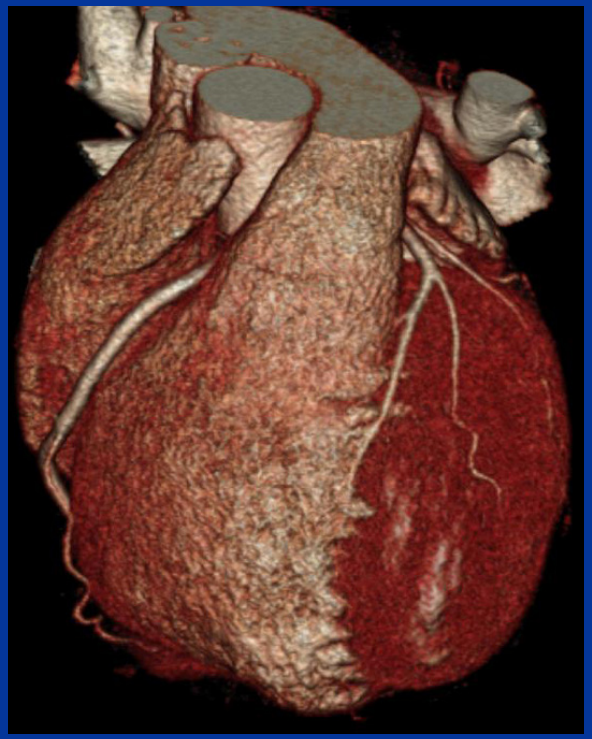
20 mm detector
Pitch ~0.25

6.2 cm in 5 sec

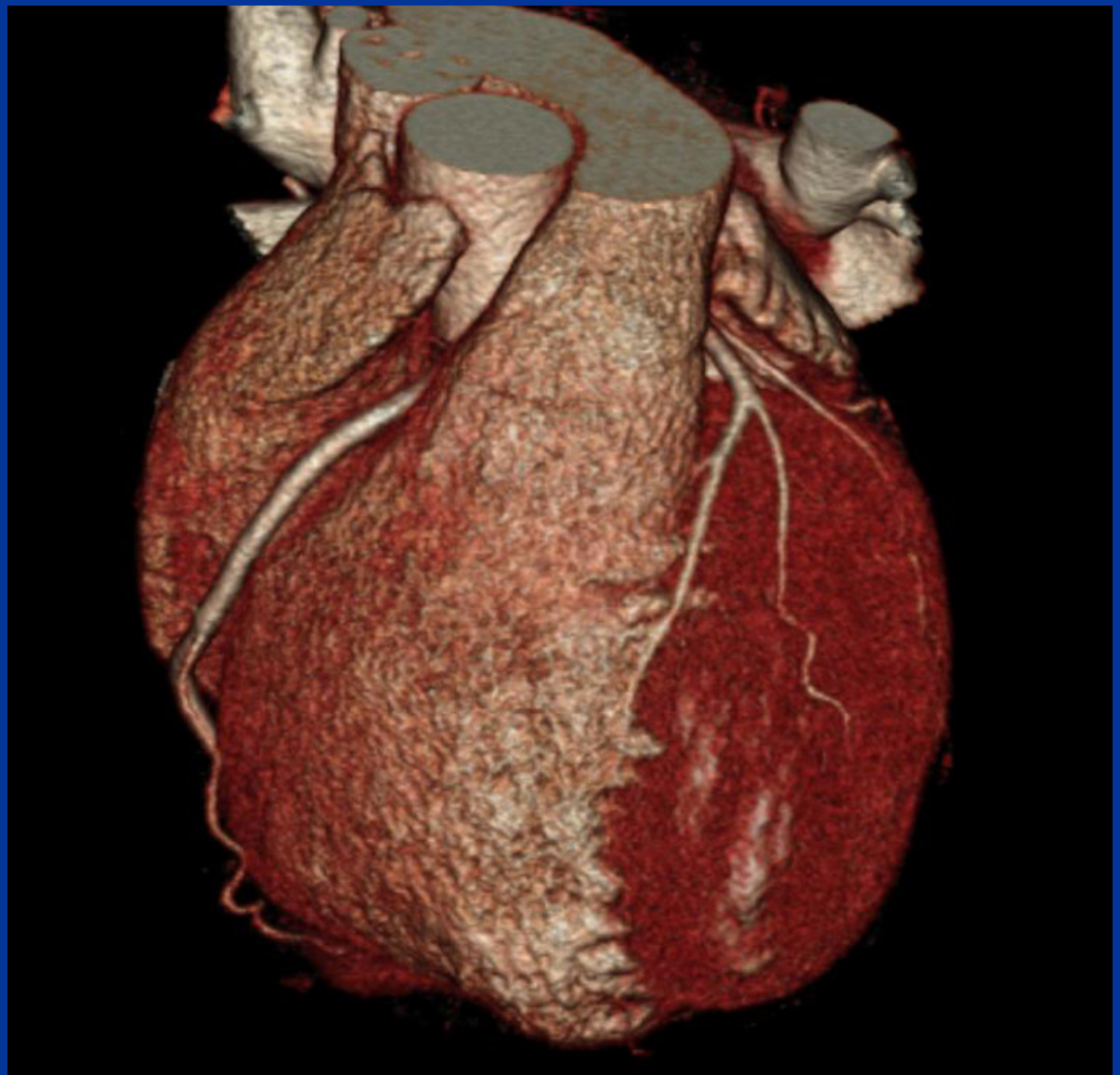


40 mm detector
Pitch ~0.25

12.5 cm in 5 sec

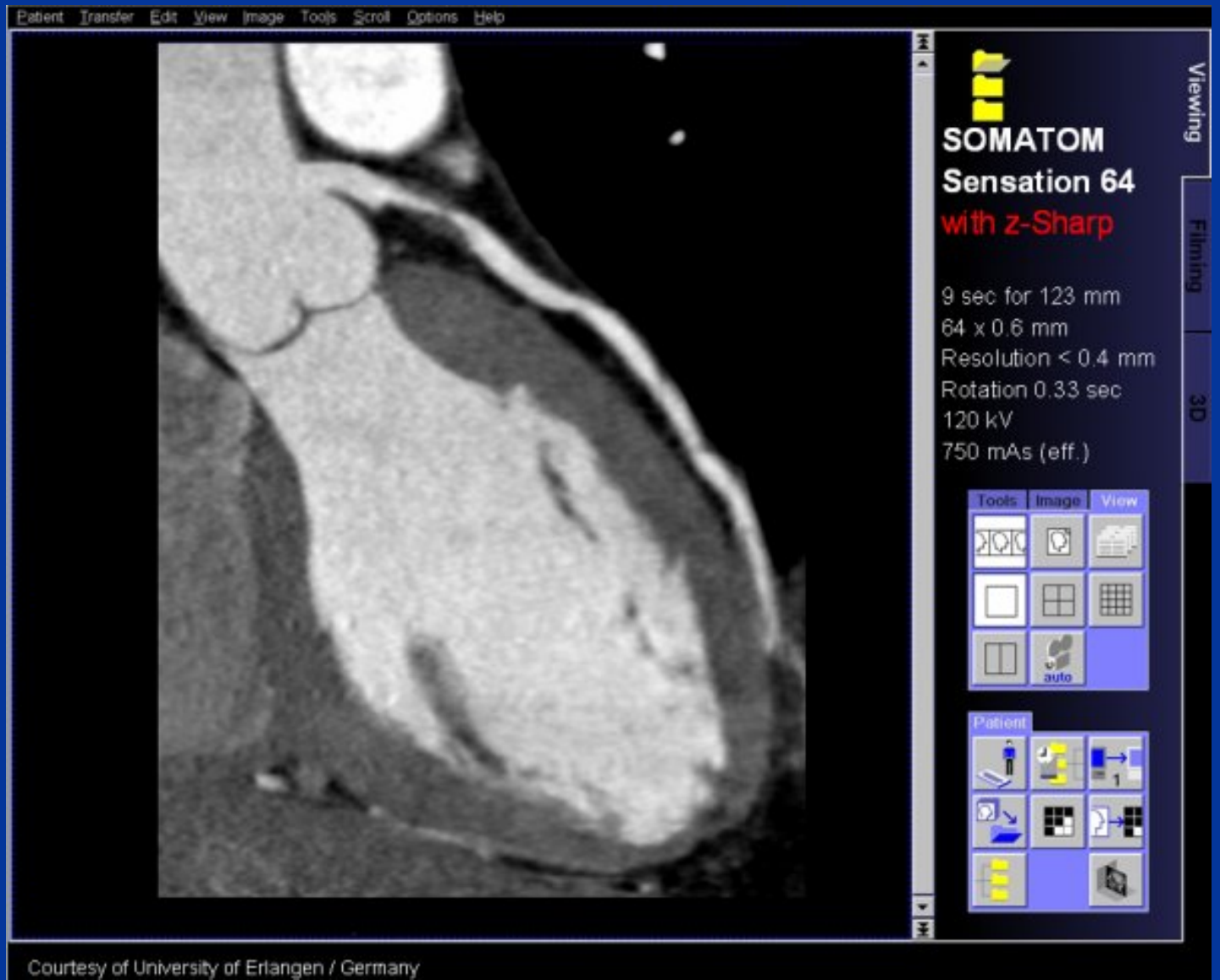


3-D Volume Rendered Image

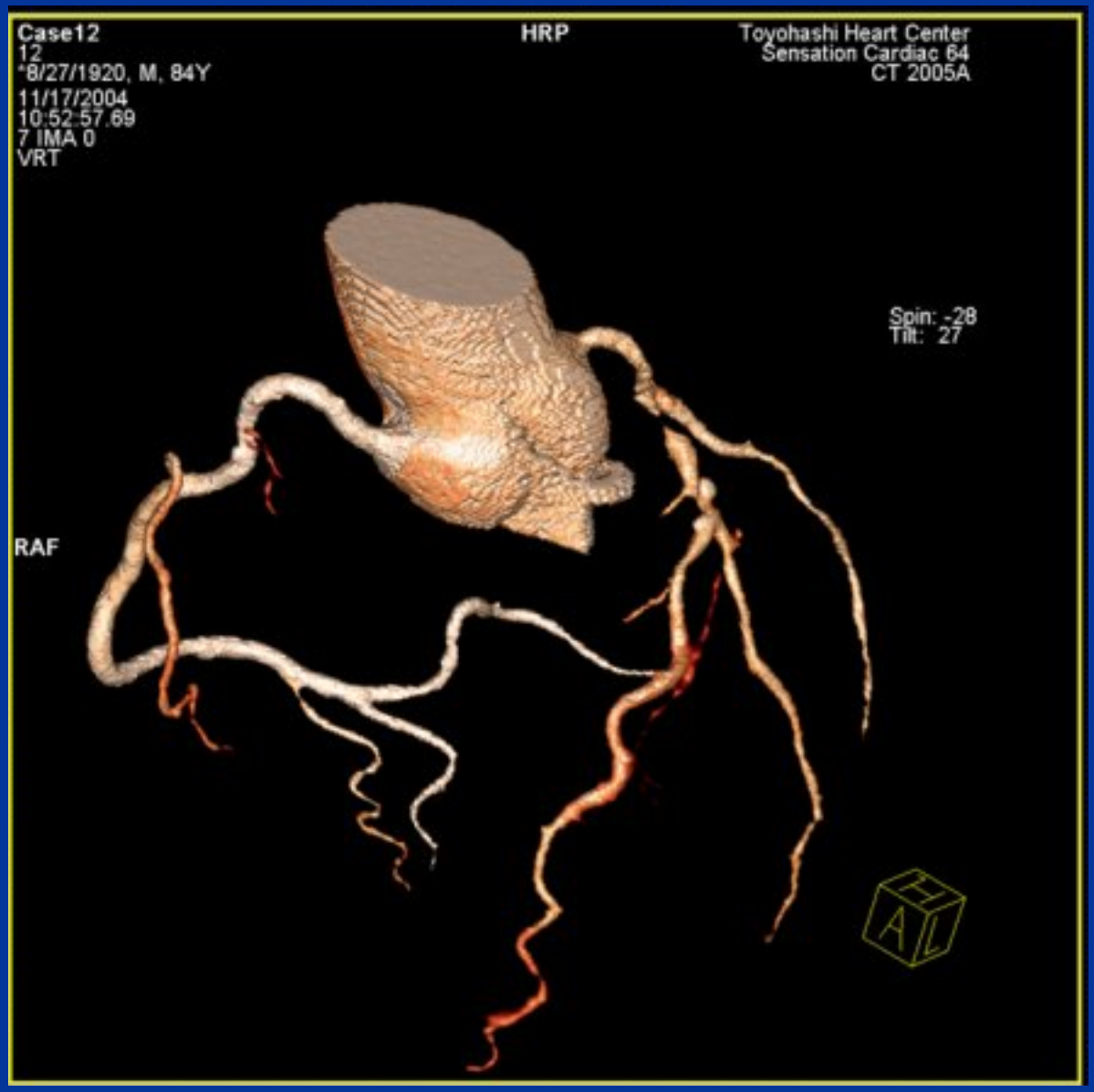


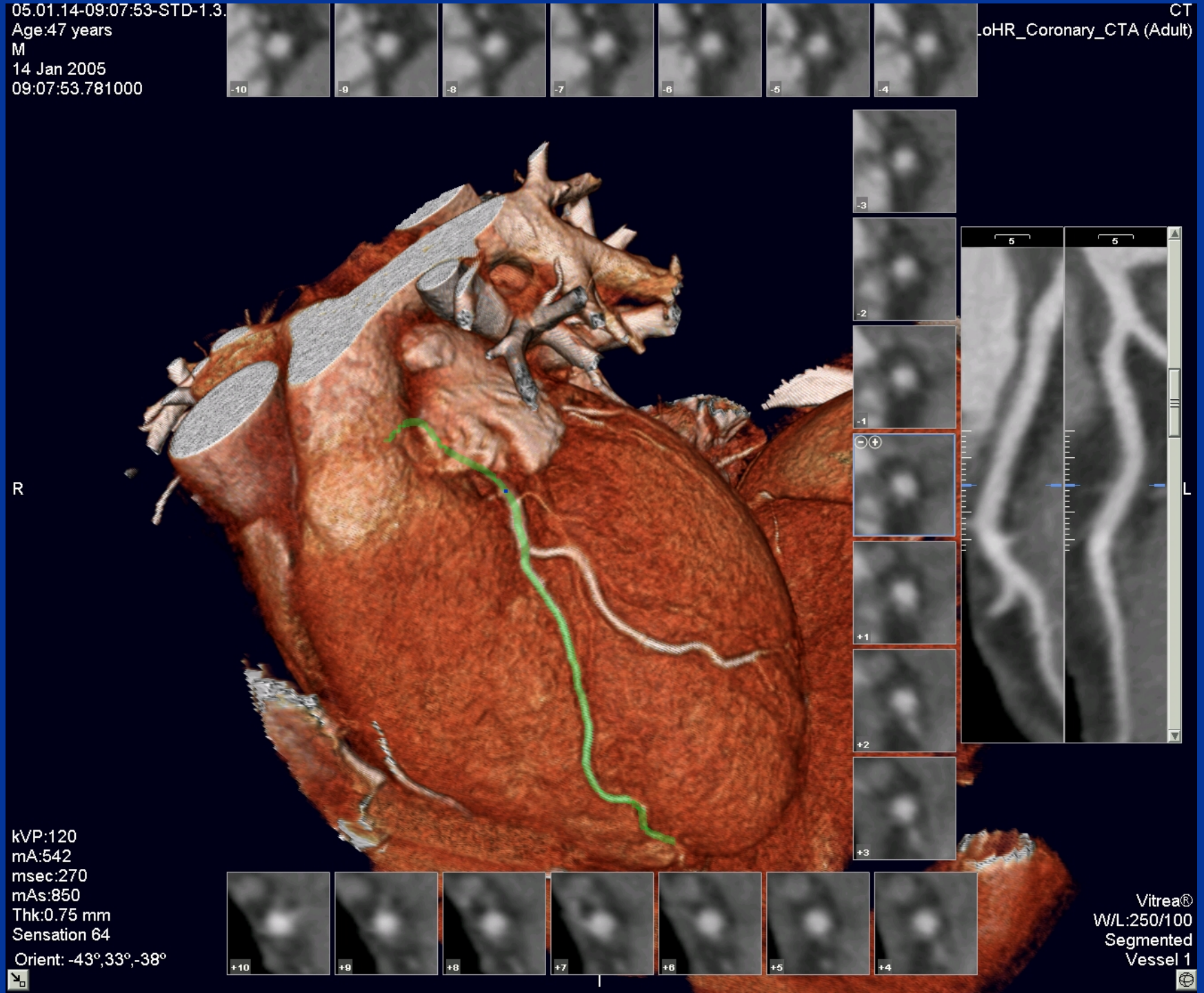
Maximum Intensity Projection

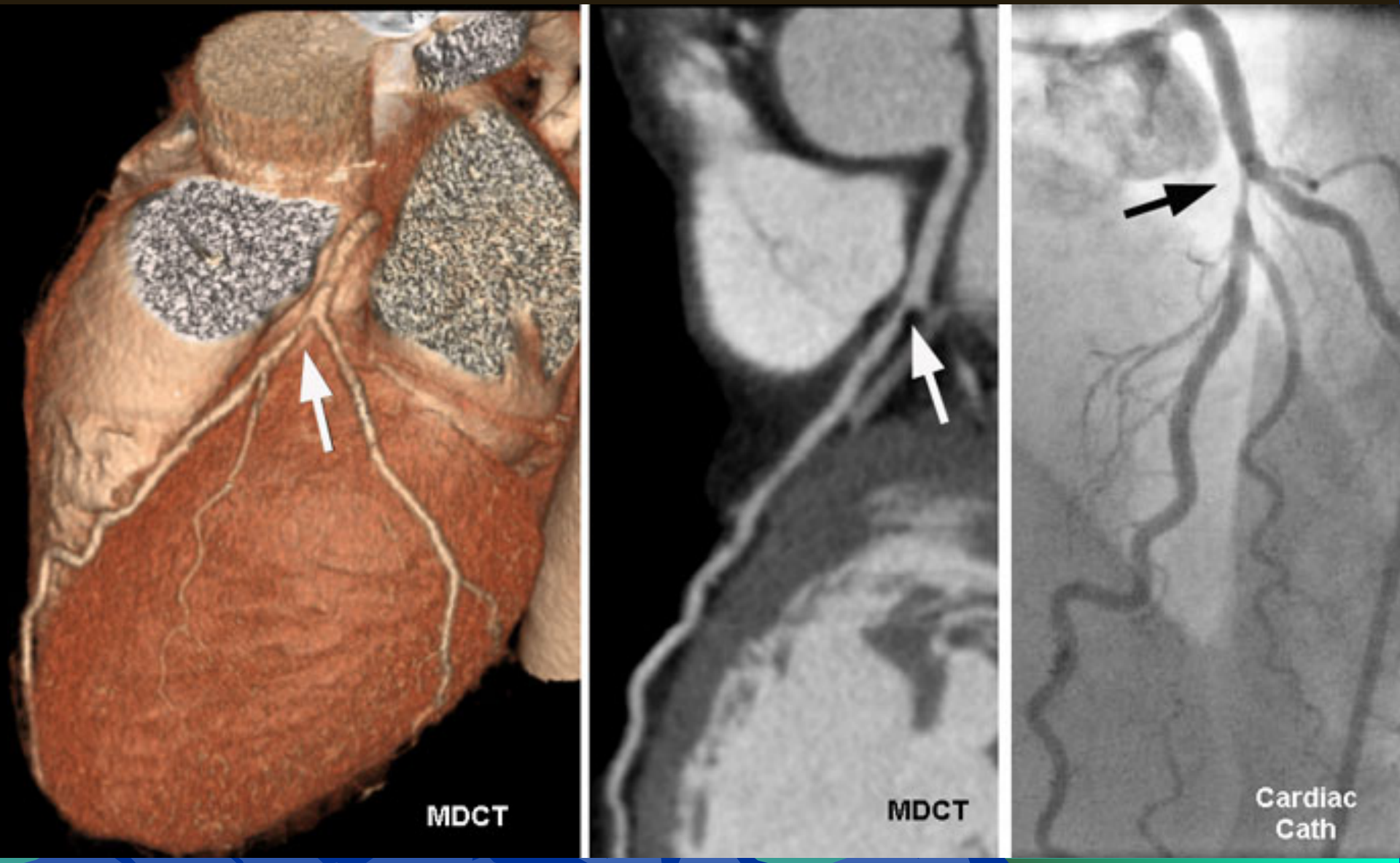
Soft Plaque in Proximal LAD

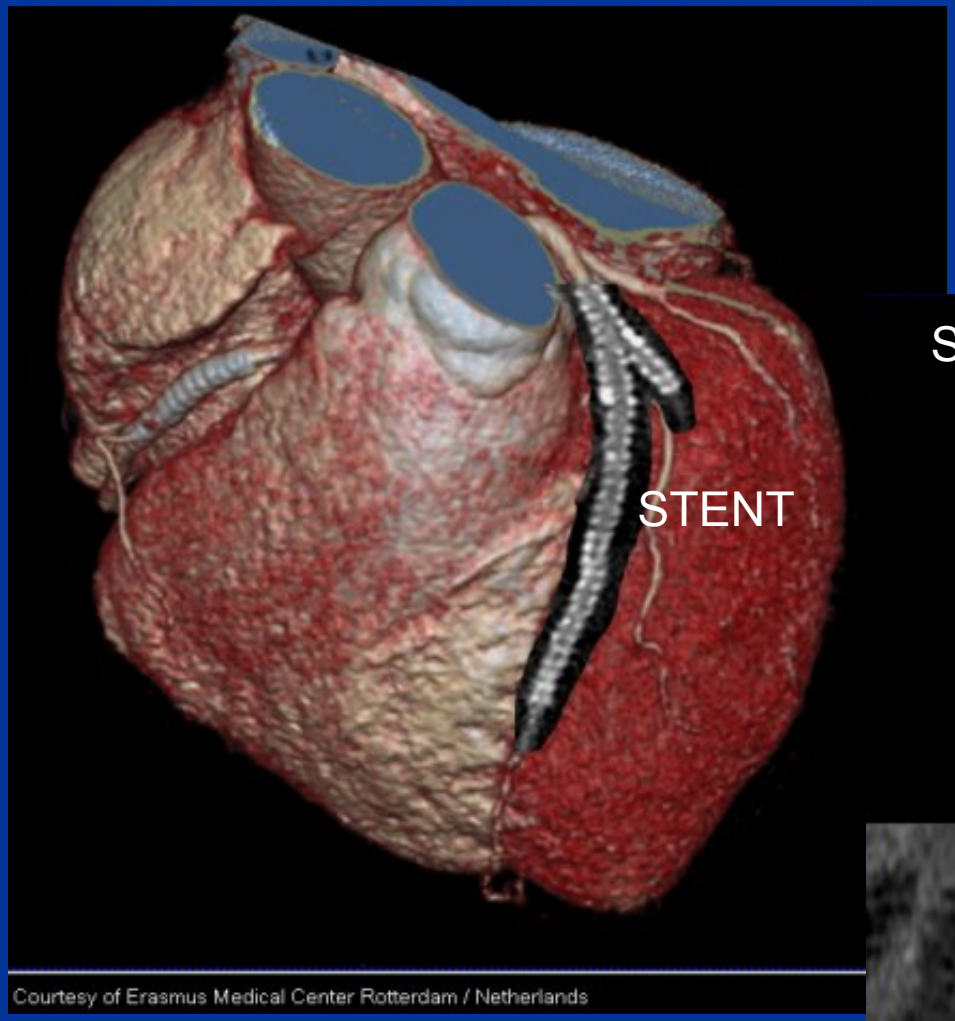


Curved Planar Image

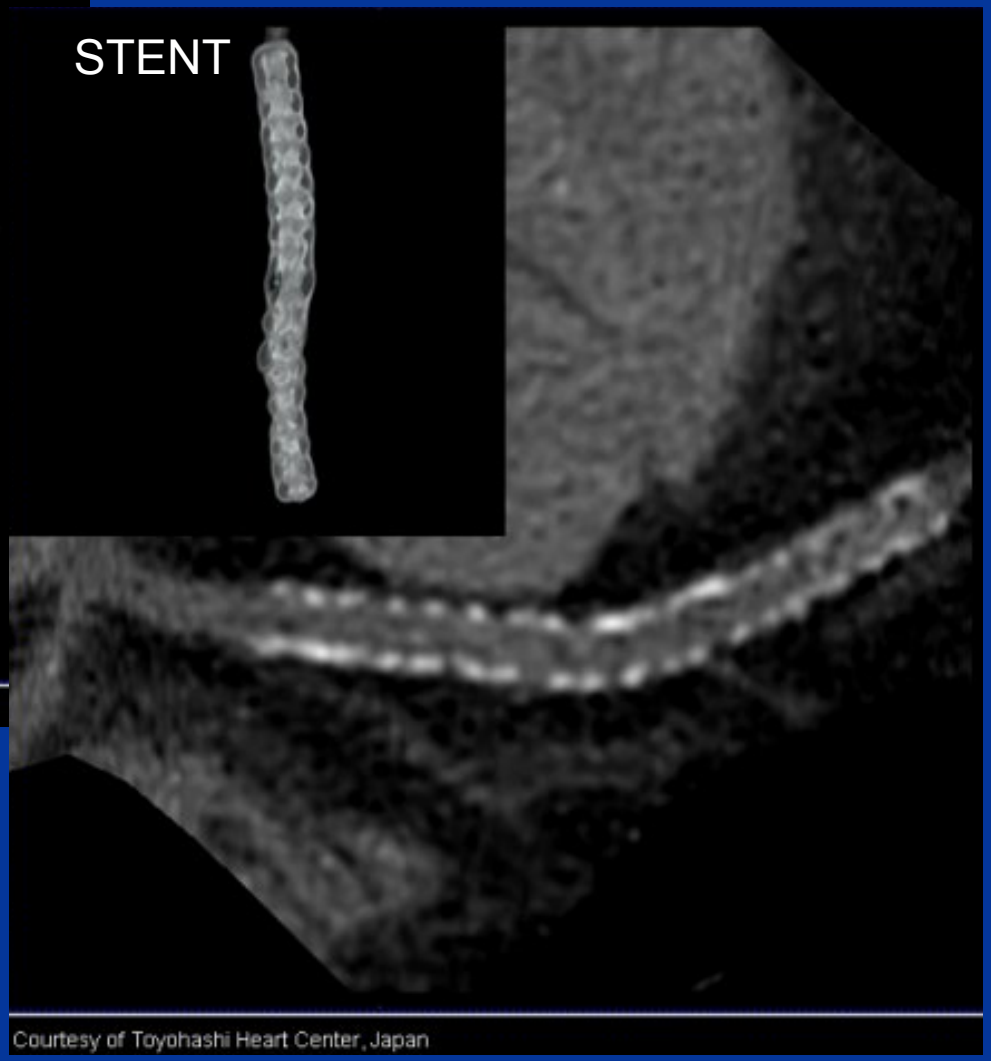

Case12
12
*8/27/1920, M, 84Y
11/17/2004
10:52:57.69
7 IMA 0
VRT
HRP
Toyohashi Heart Center
Sensation Cardiac 64
CT 2005A
Spin: -28
Tilt: 27
RAF
A
L


05.01.14-09:07:53-STD-1.3.
Age:47 years
M
14 Jan 2005
09:07:53.781000
CT
LoHR_Coronary_CTA (Adult)
R
L
kVP:120
mA:542
msec:270
mAs:850
Thk:0.75 mm
Sensation 64
Orient: -43°,33°,-38°
Vitrea®
W/L:250/100
Segmented
Vessel 1


MDCT
MDCT
Cardiac
Cath

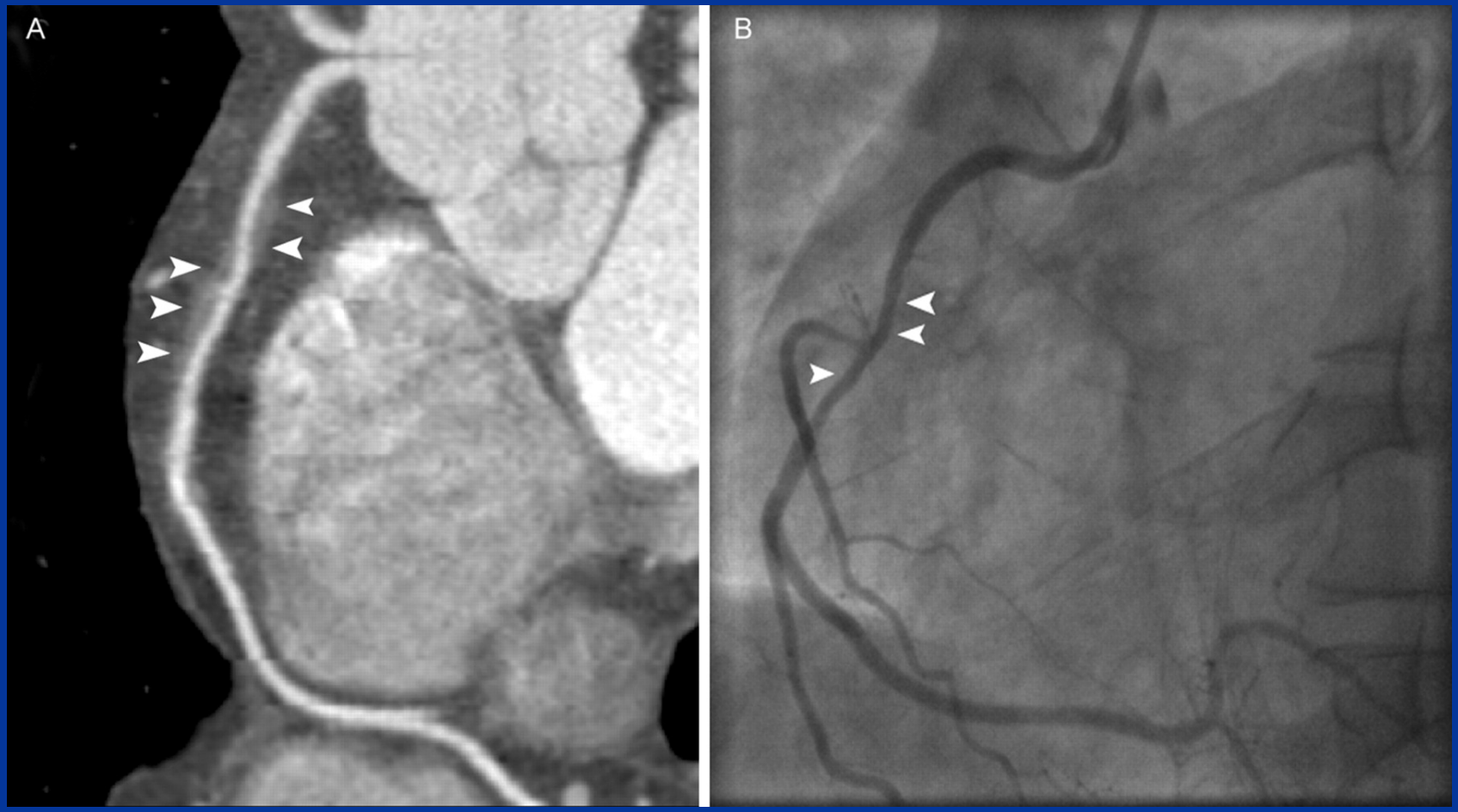


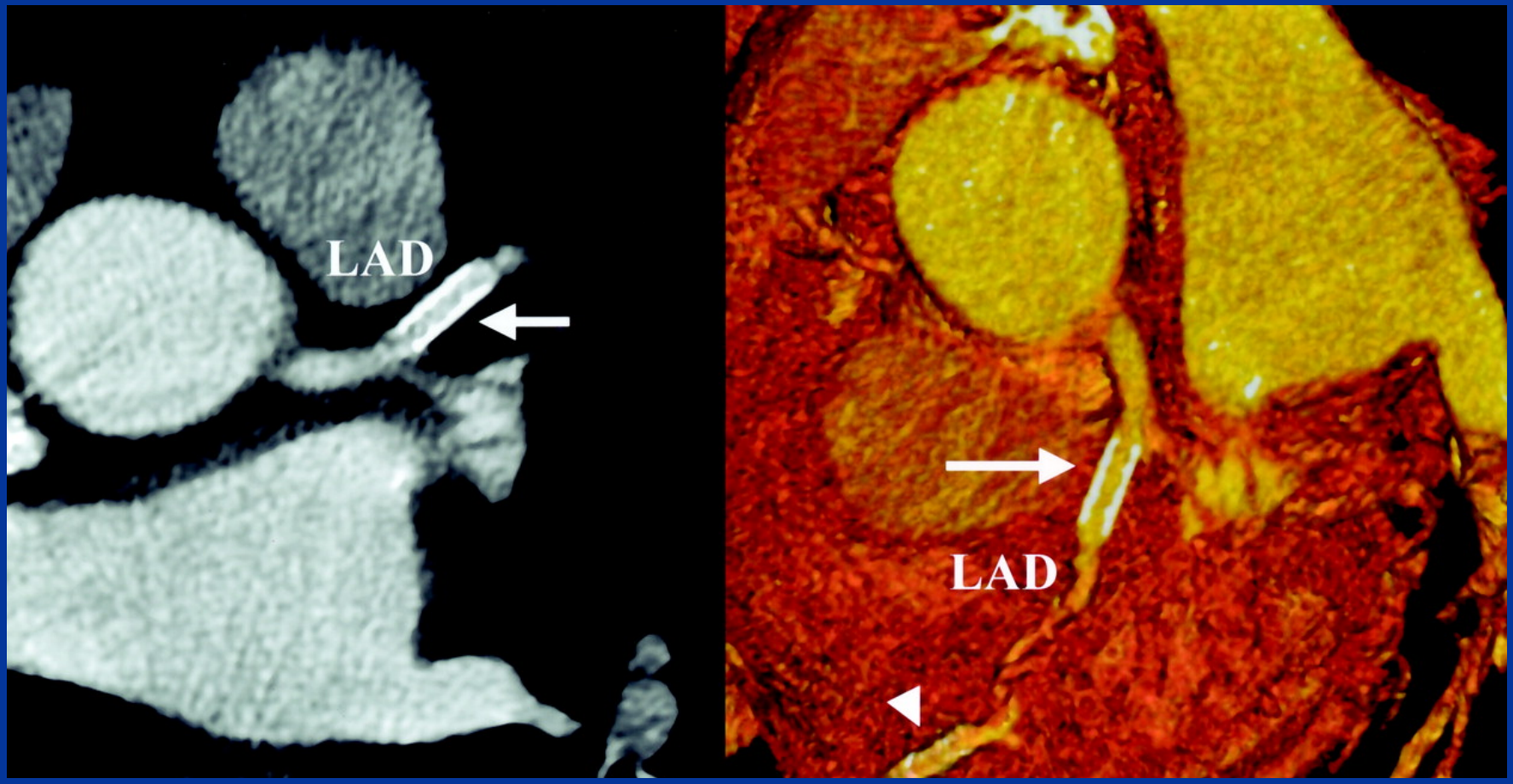
Courtesy of Erasmus Medical Center Rotterdam / Netherlands

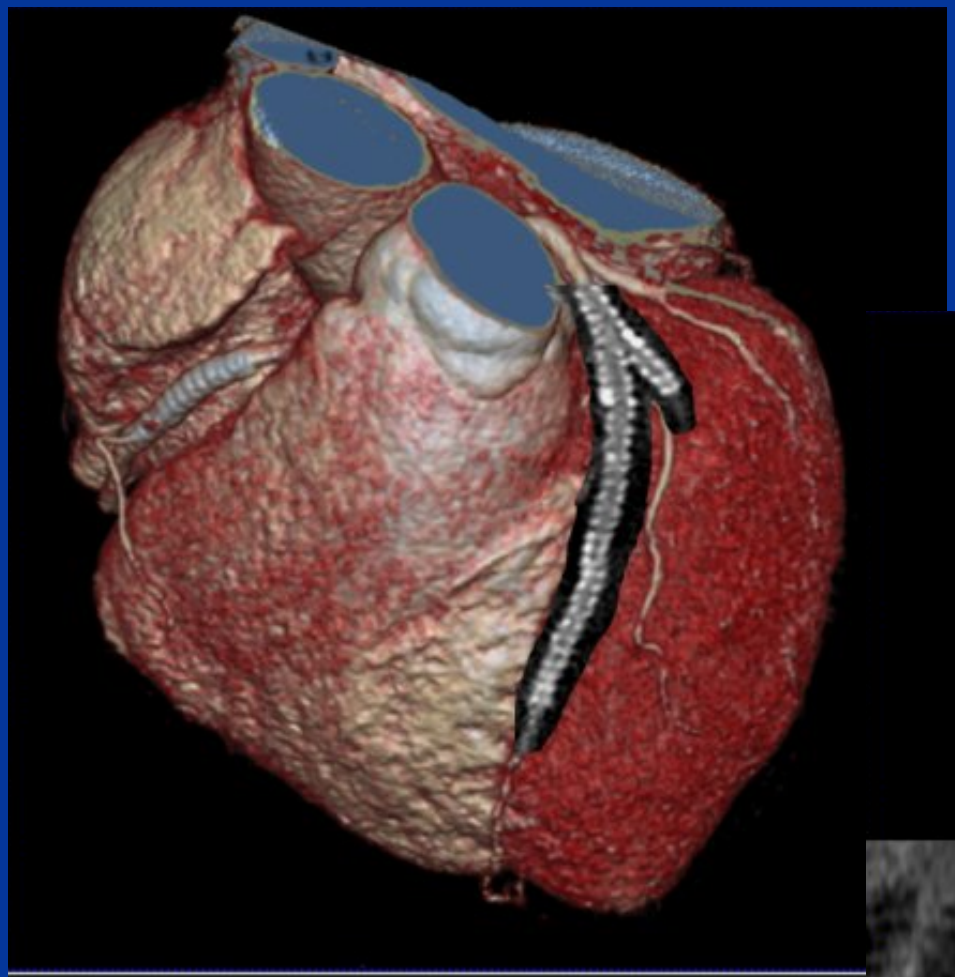


Courtesy of Toyohashi Heart Center, Japan

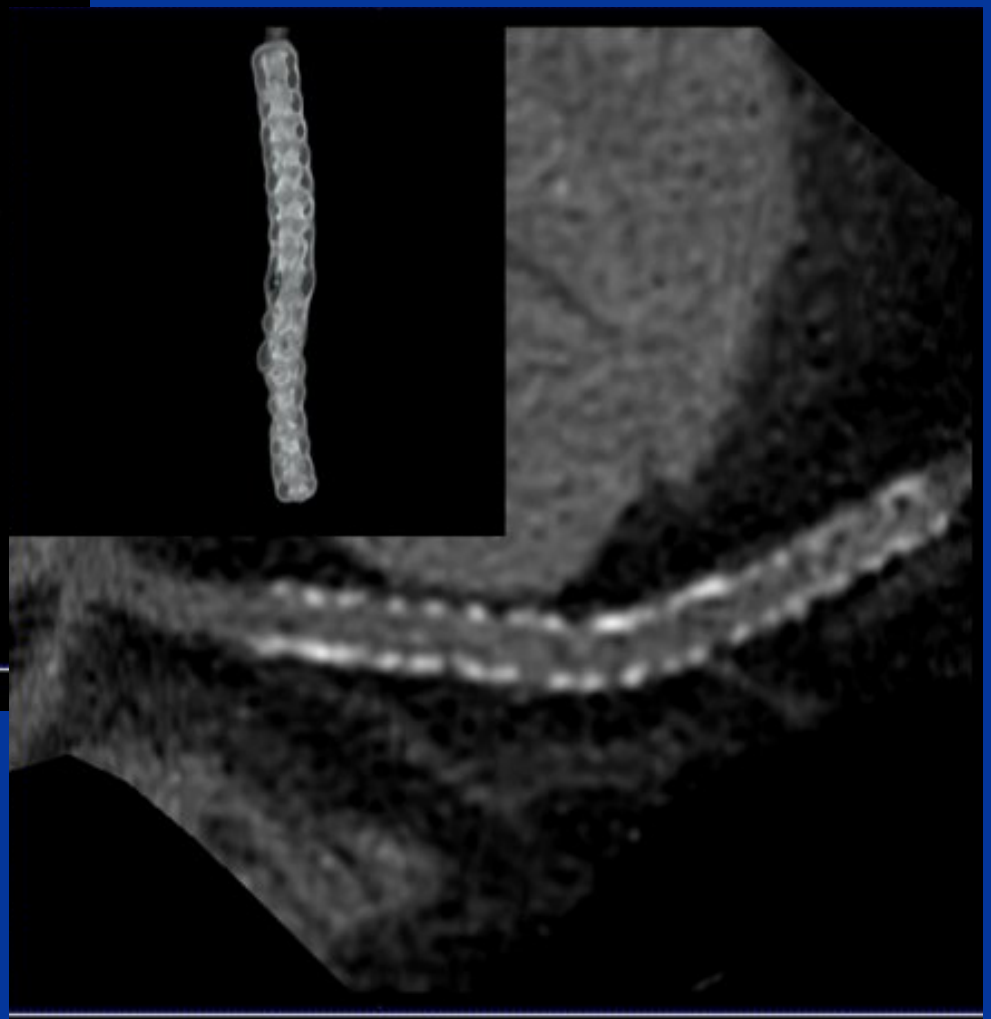
Soft Plaque Visualization



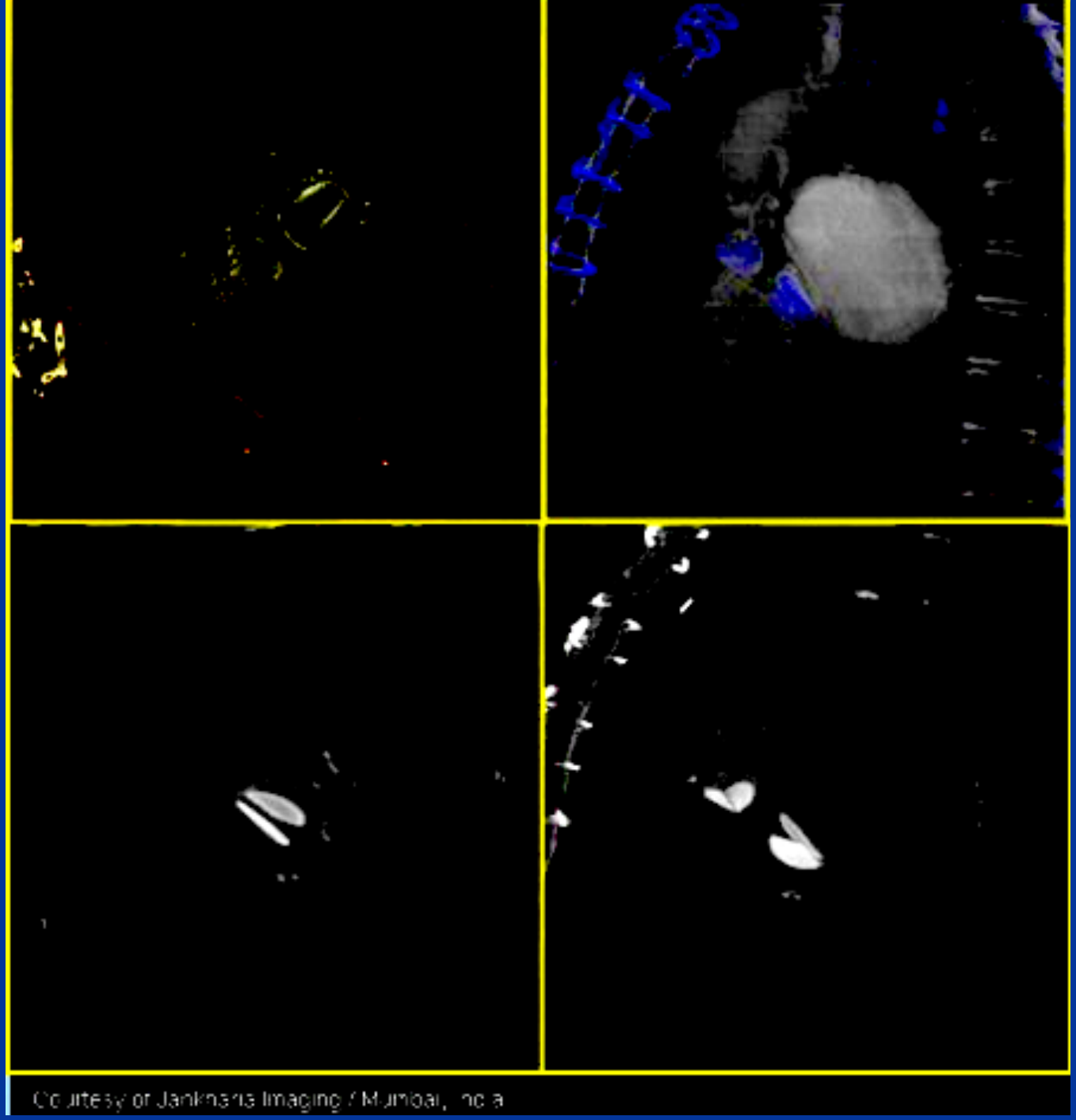

LAD
LAD



Courtesy of Erasmus Medical Center Rotterdam / Netherlands



Courtesy of Toyohashi Heart Center, Japan



Courtesy of Jankharia Imaging / Mumbai, India

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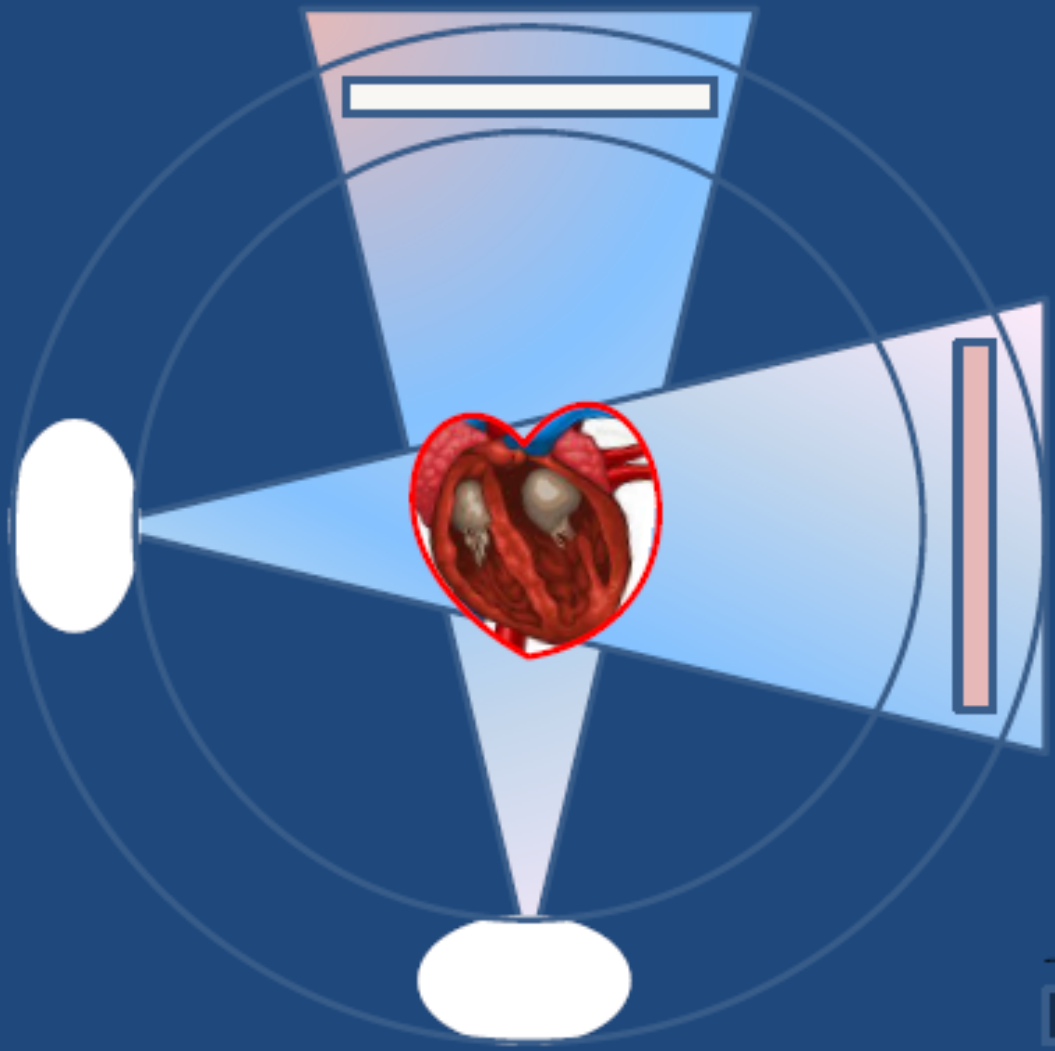
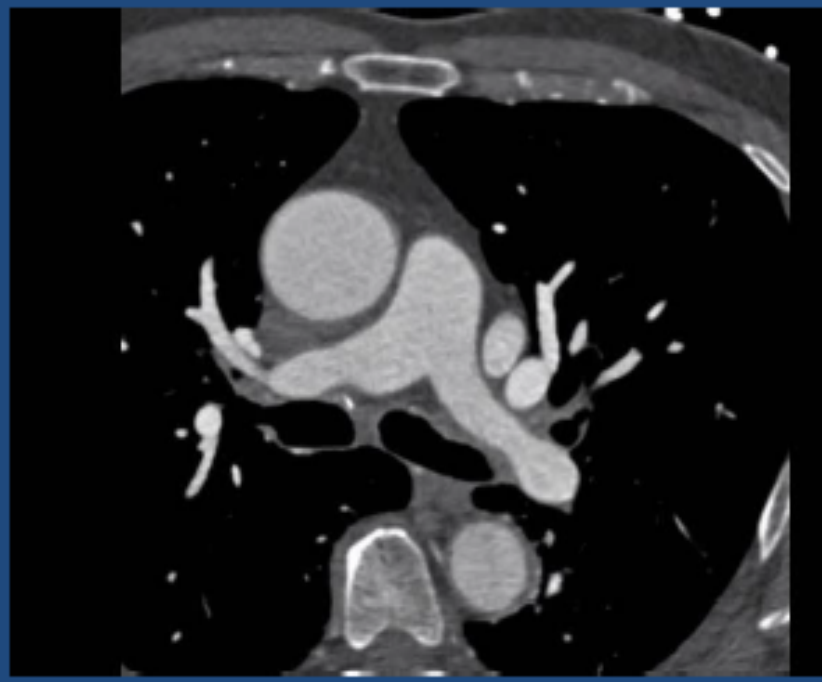
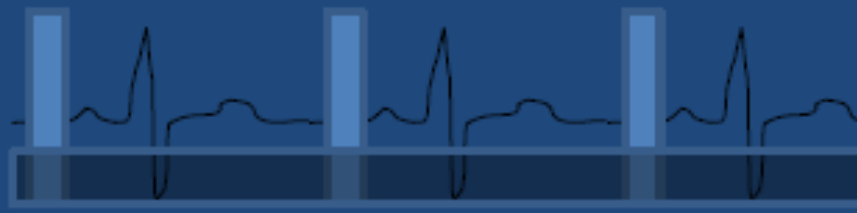
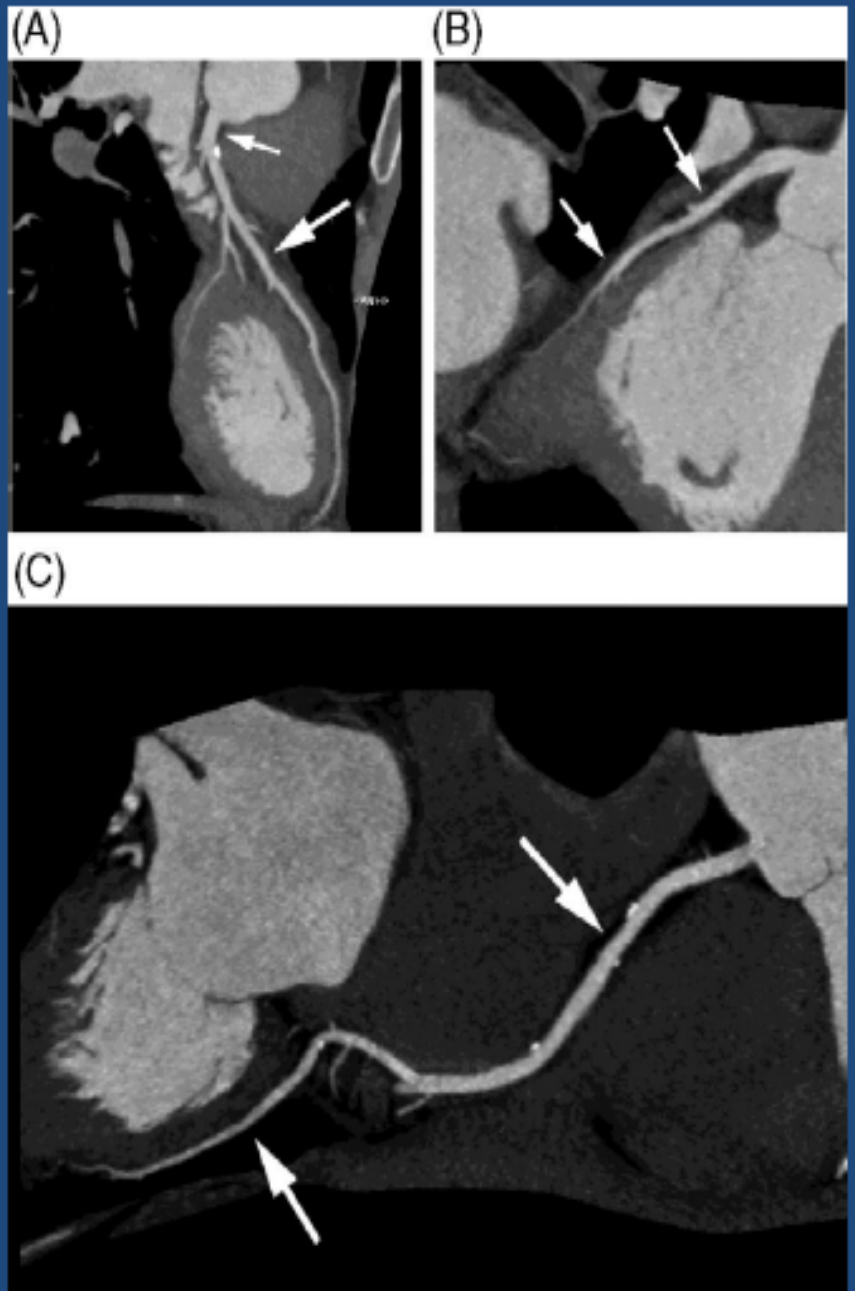




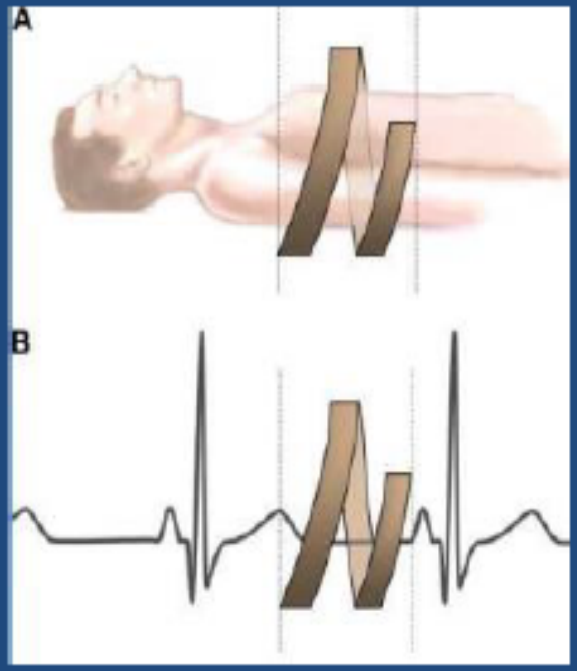


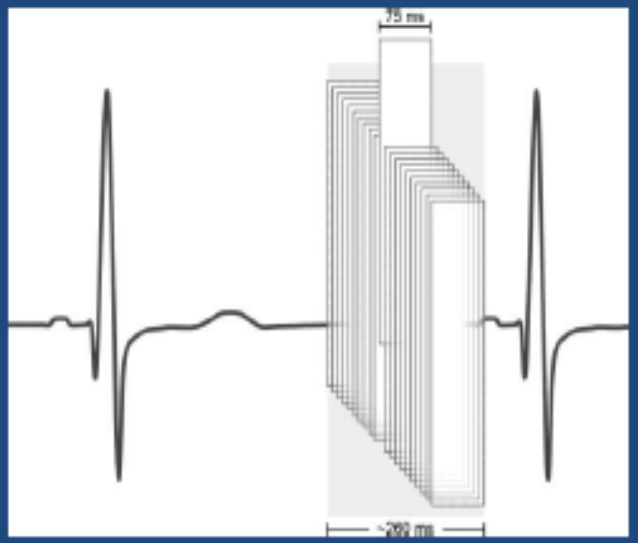
High Pitch Coronary CT Scanning

Male patient (183 cm, 78 kg, heart rate 54 b.p.m.).

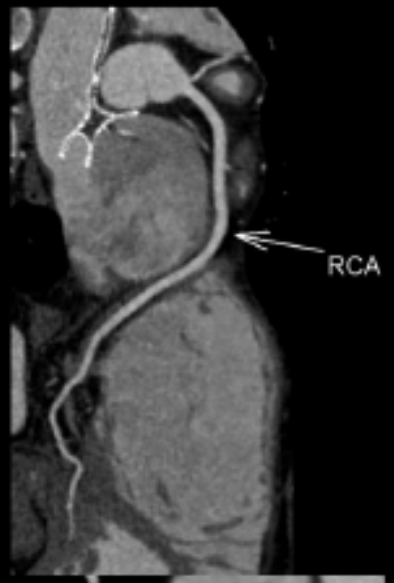


0.89 mSv

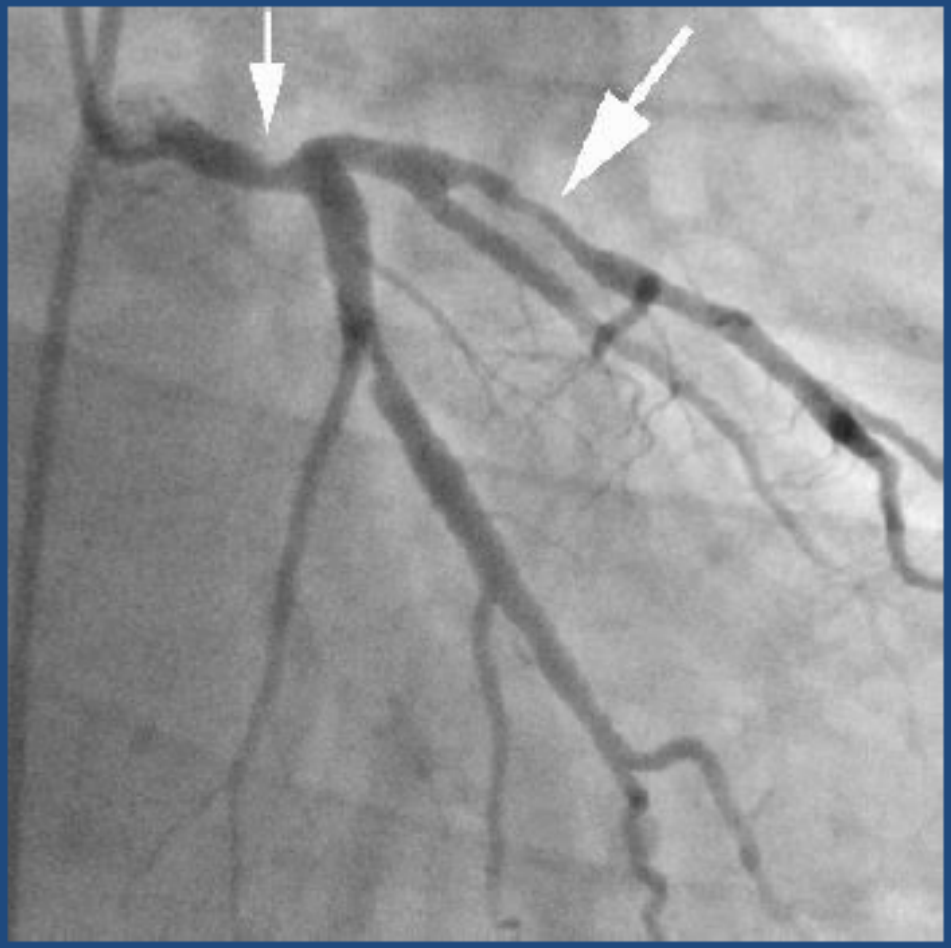


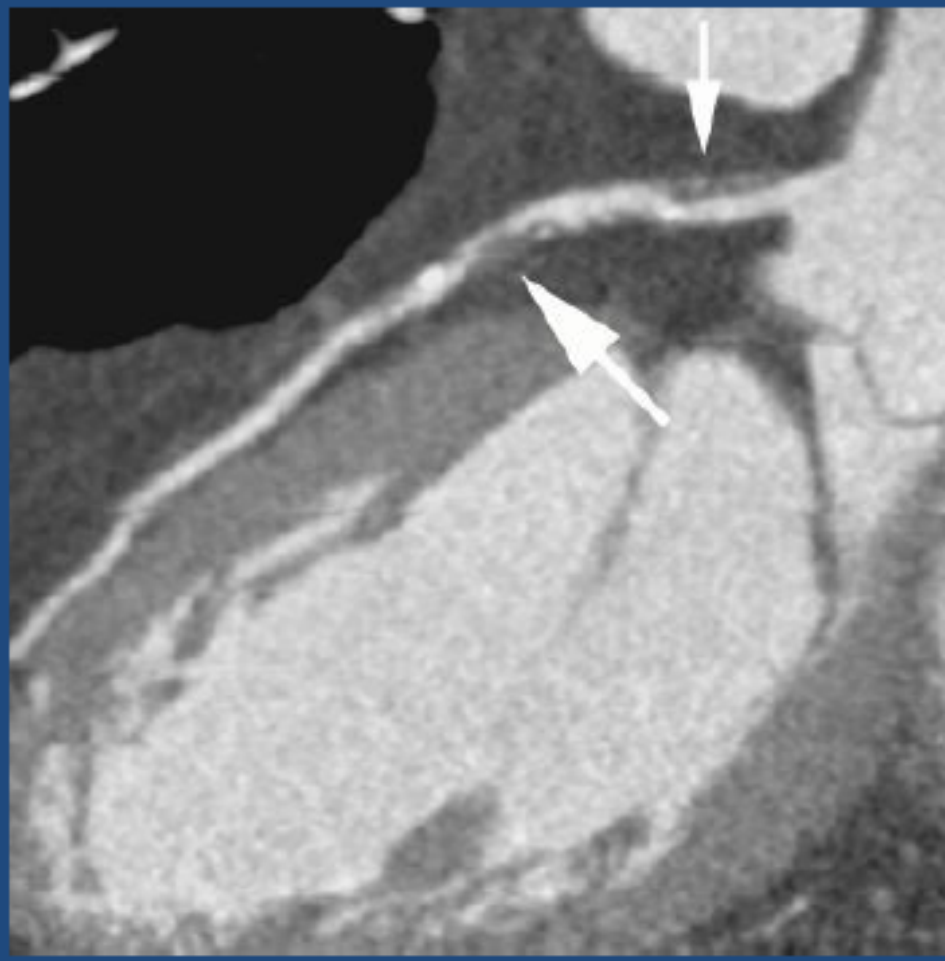


Gated with contrast

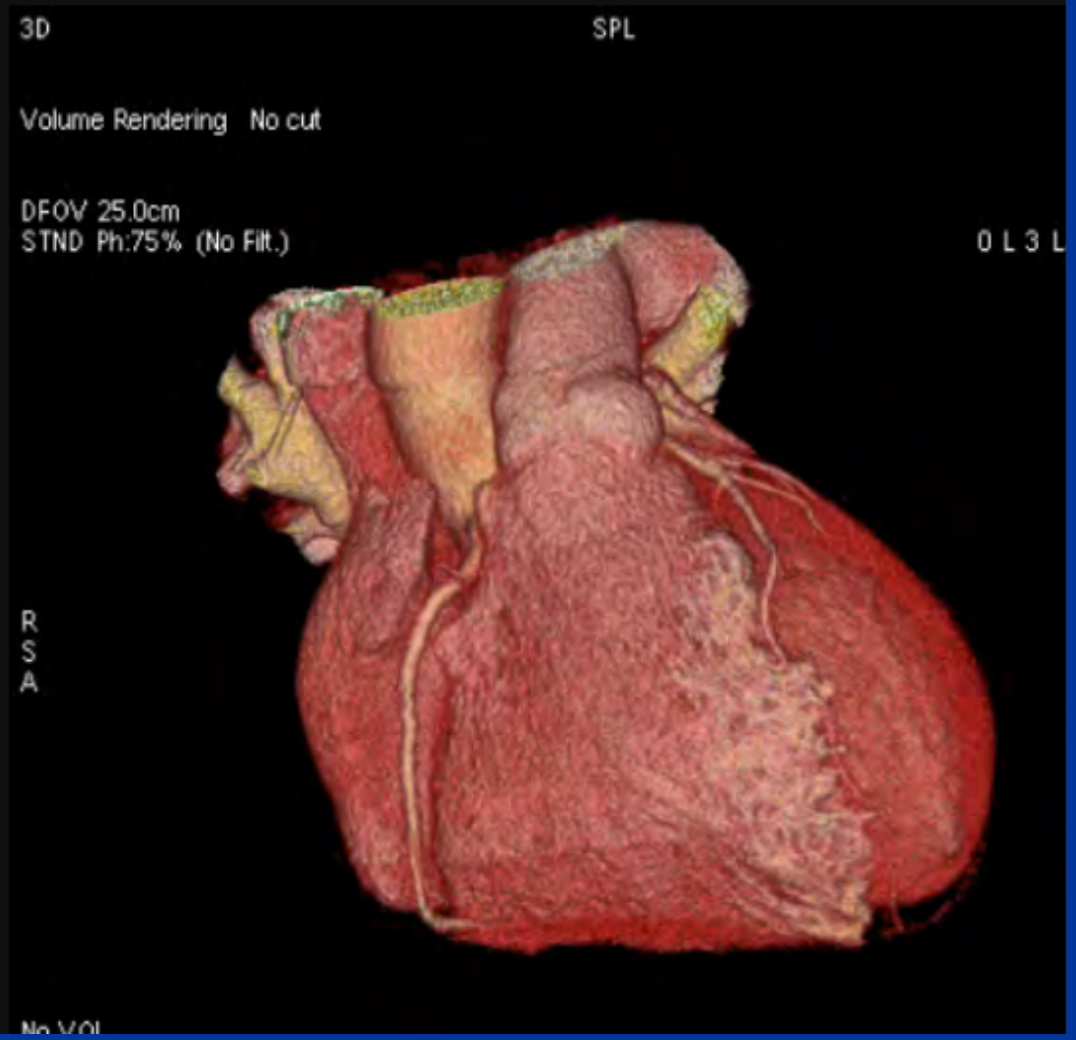


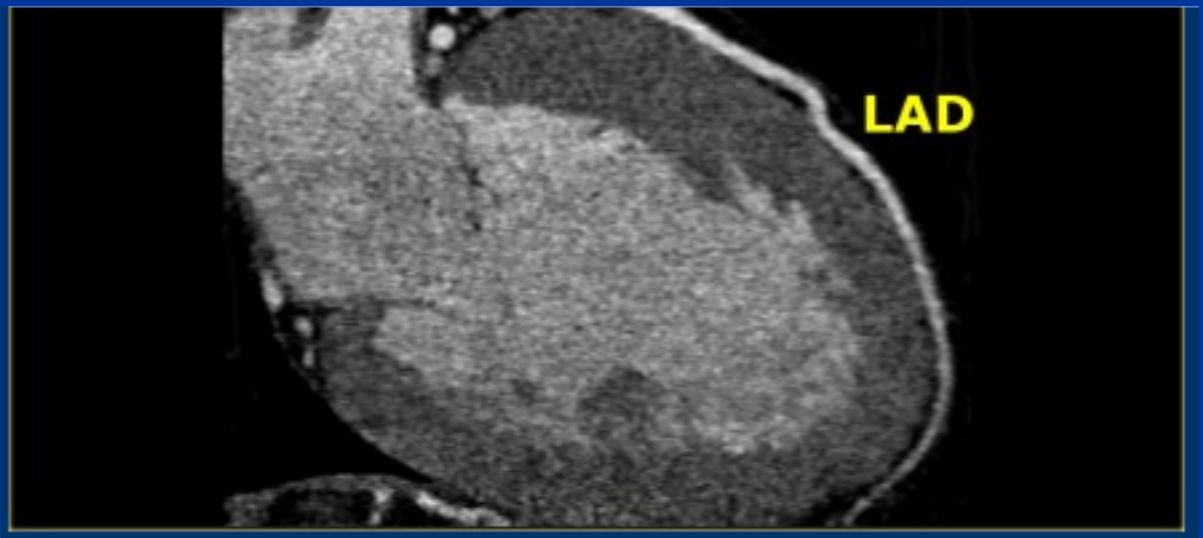
Plaque visualization



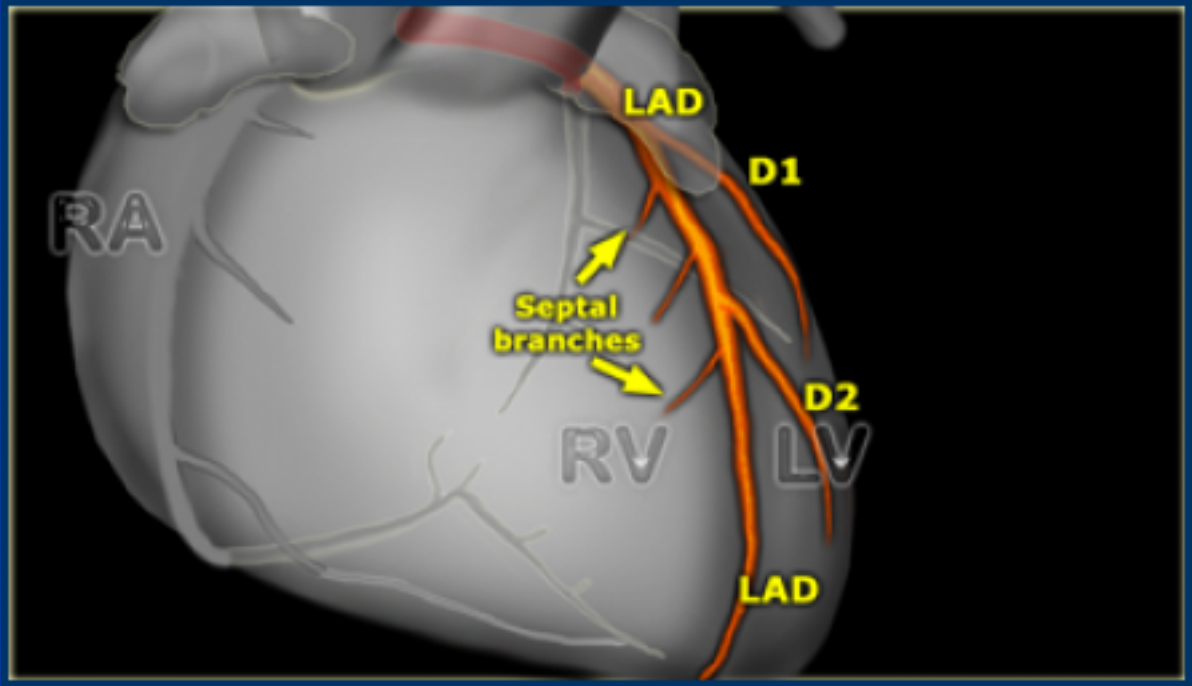


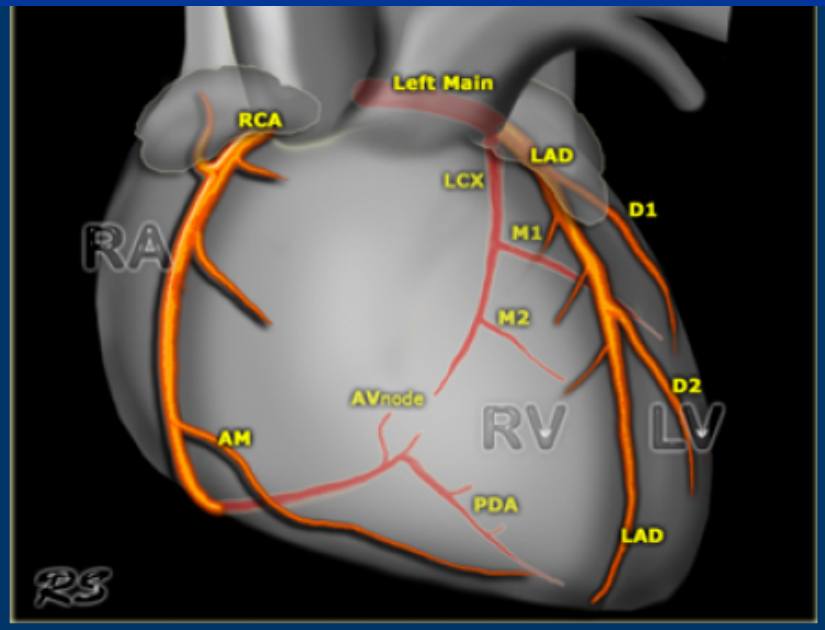
- Knowledge of normal anatomy will allow for ideal imaging planes and sections.
- Knowledge of normal anatomy will allow for the identification of pathology and proper CT scan interpretation.



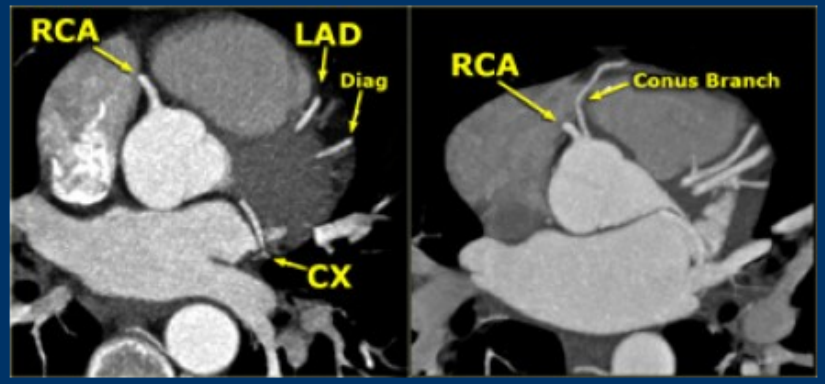


CT image of the LAD in RAO projection

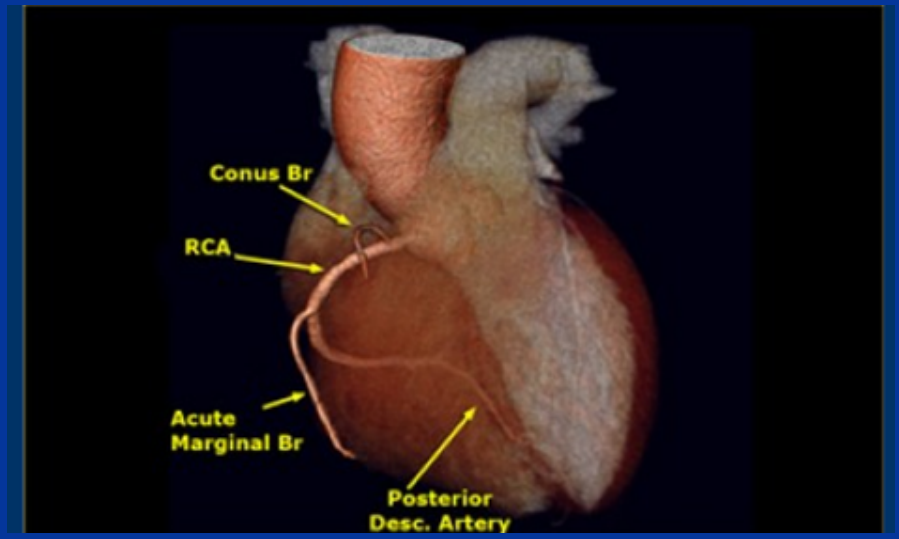




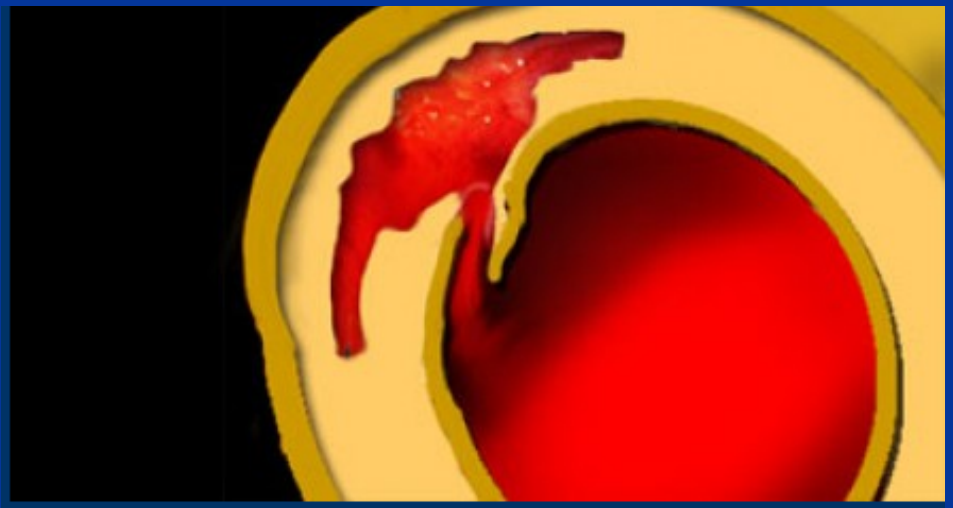
RCA, LAD and LCx in Anterior projection



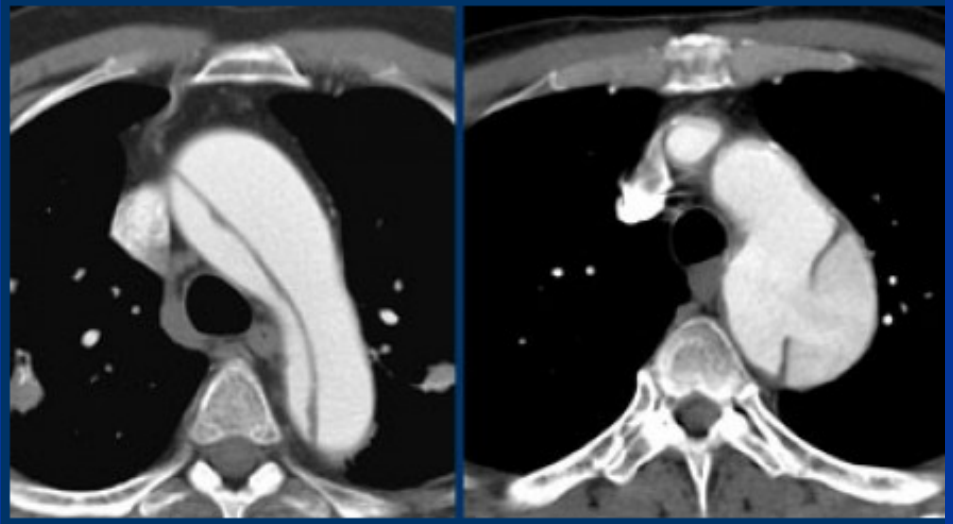
LEFT: RCA comes off the right sinus of ValsalvaRIGHT: Conus artery comes off directly from the aorta



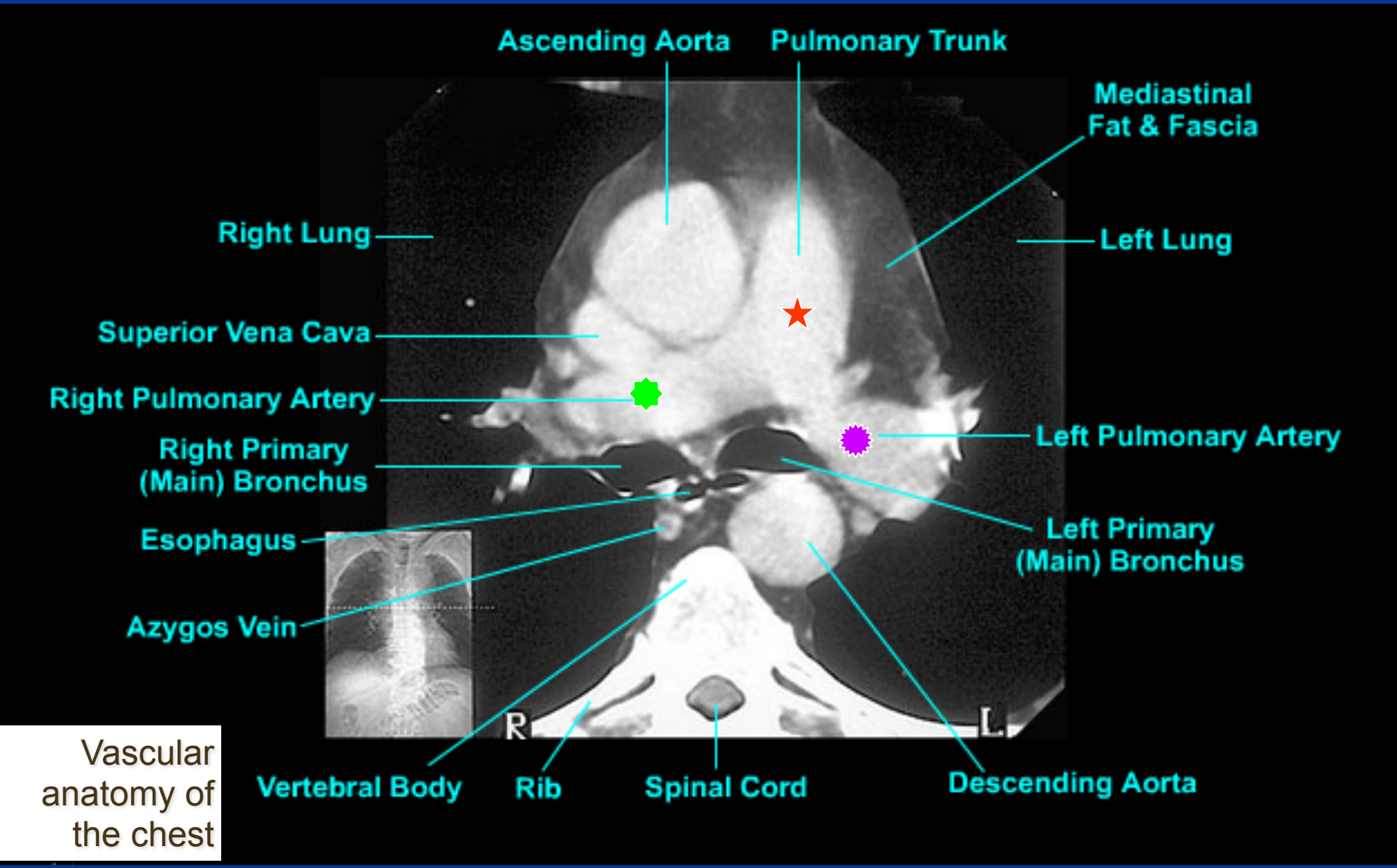
AORTIC DISSECTION



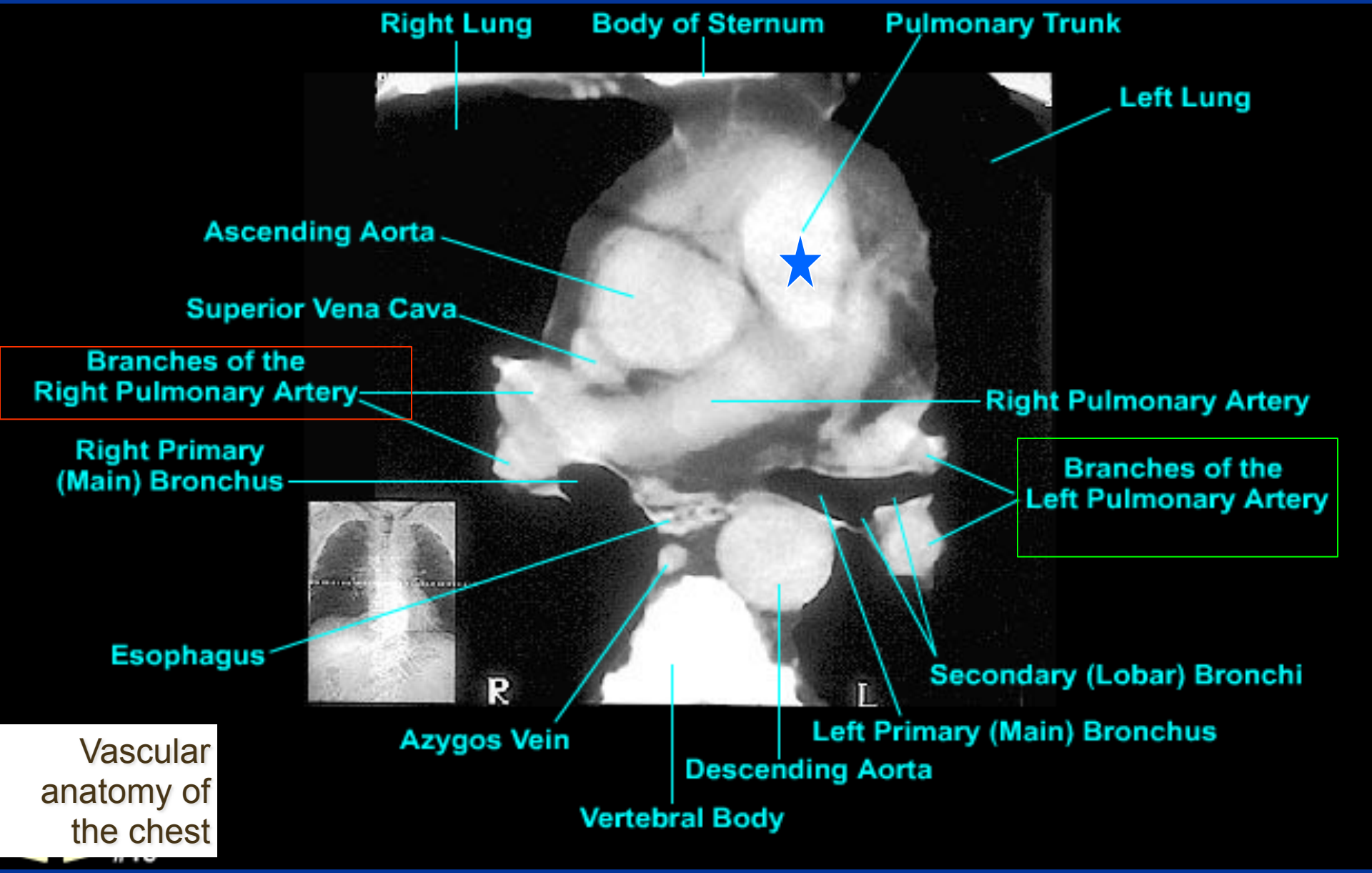
Classic Aortic Dissection



LEFT: Type A dissection with clear intimaflap seen within the aortic arch.RIGHT: Type B dissection. Entry point distal to left subclavian artery.

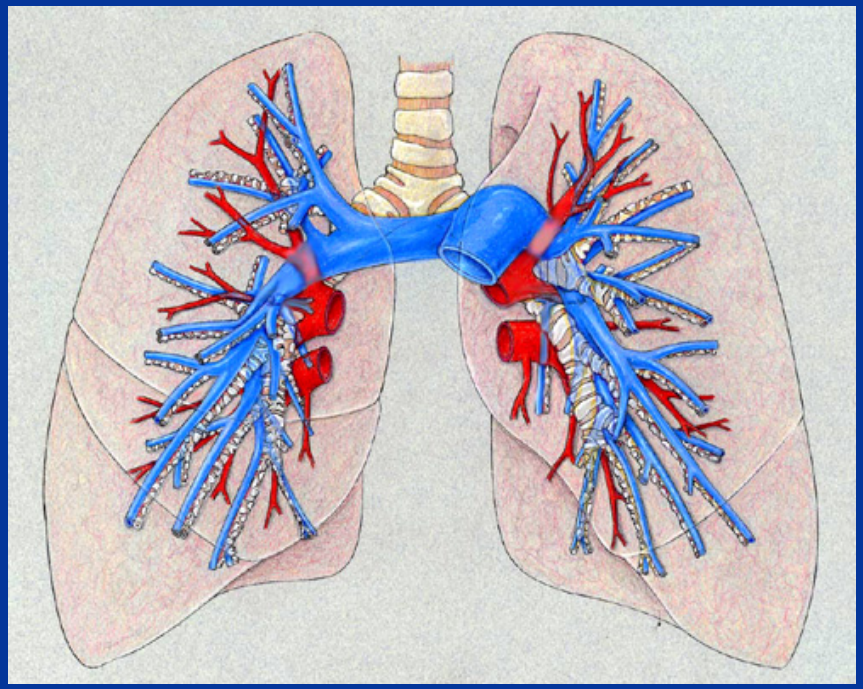


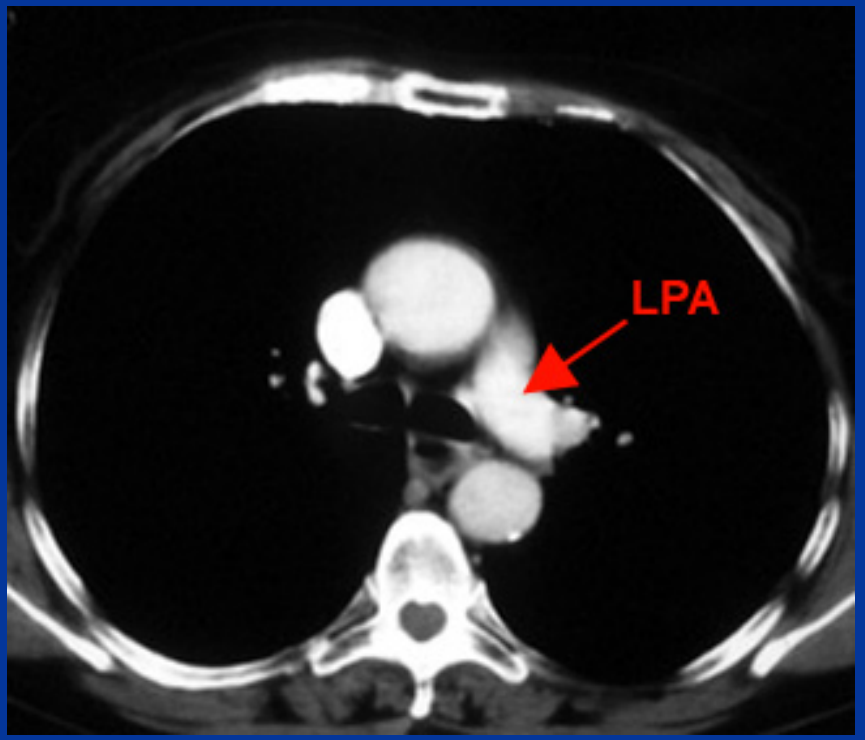
Vascular anatomy of the chest



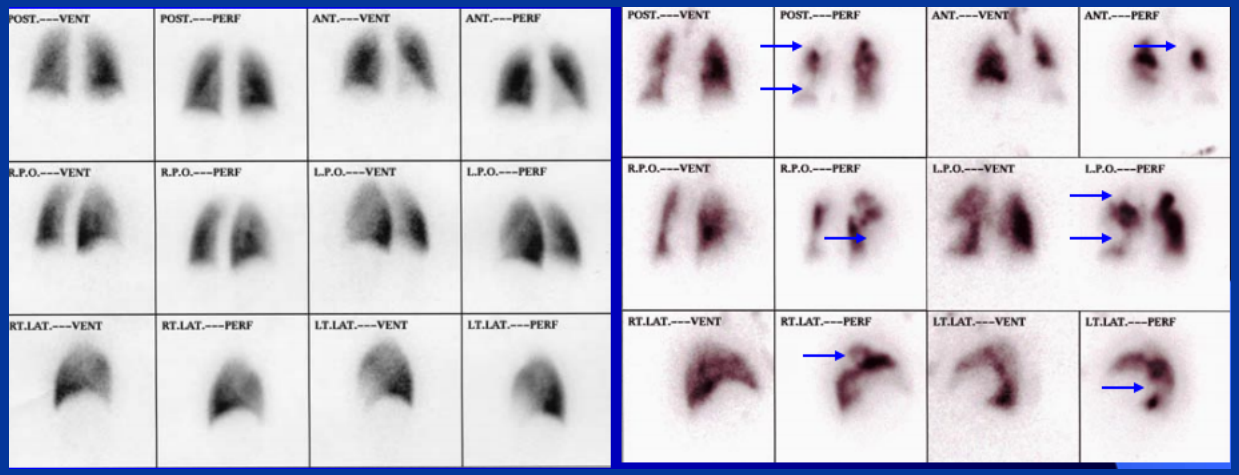
Vascular anatomy of the chest

Pulmonary artery



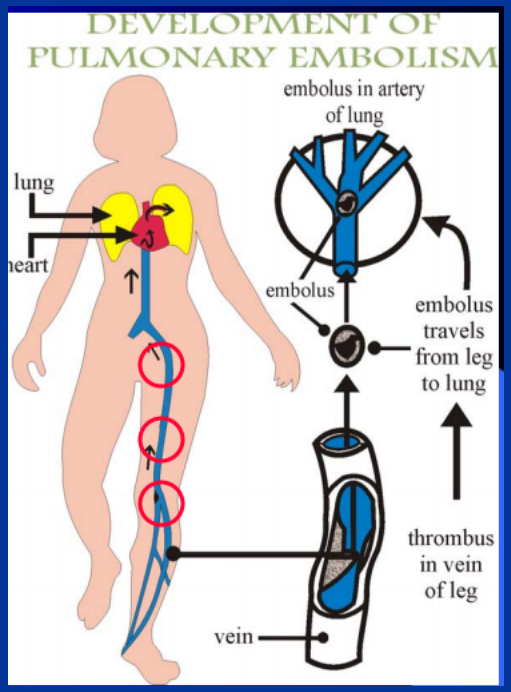


V/Q SCAN

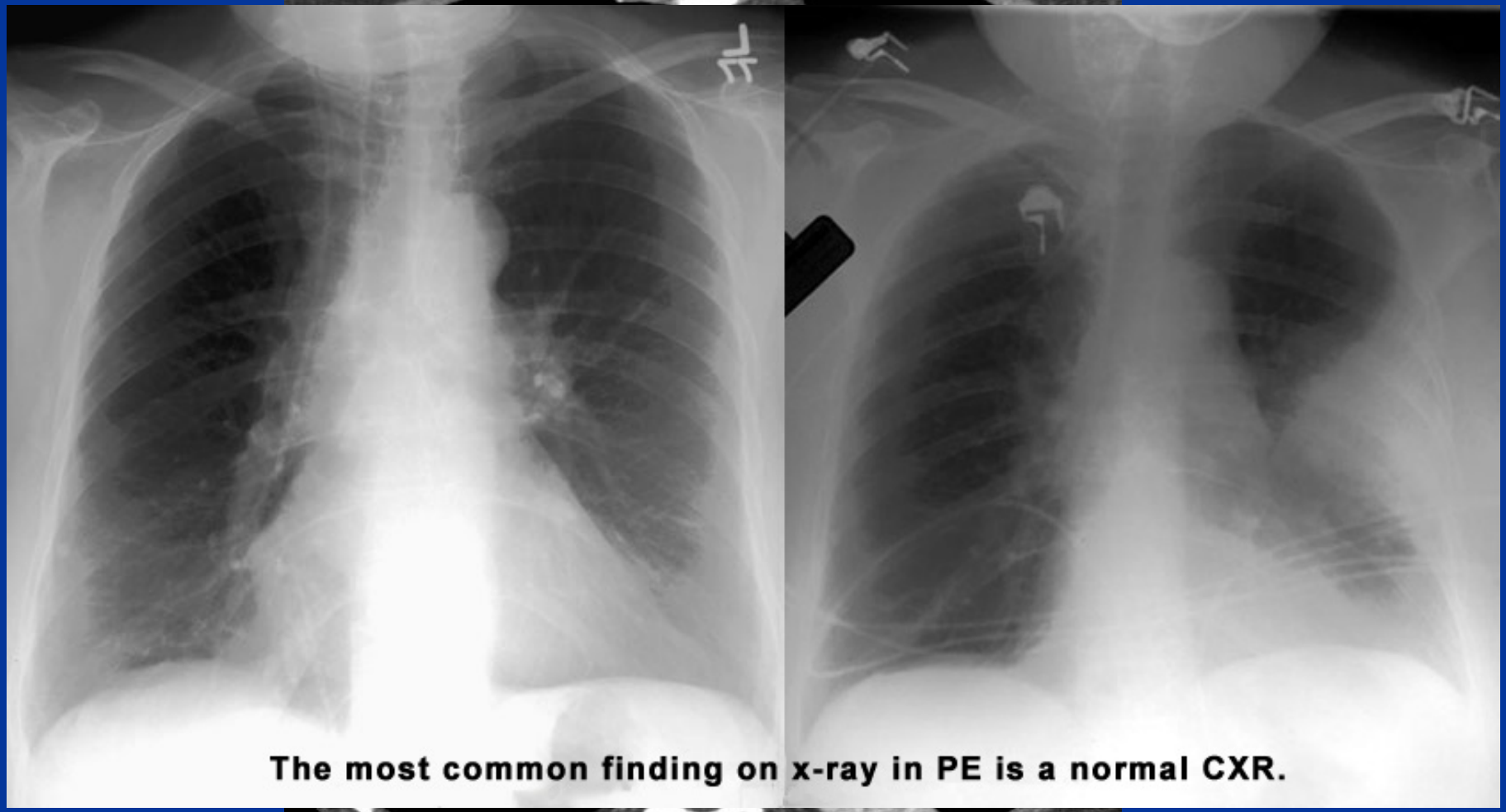


NORMAL

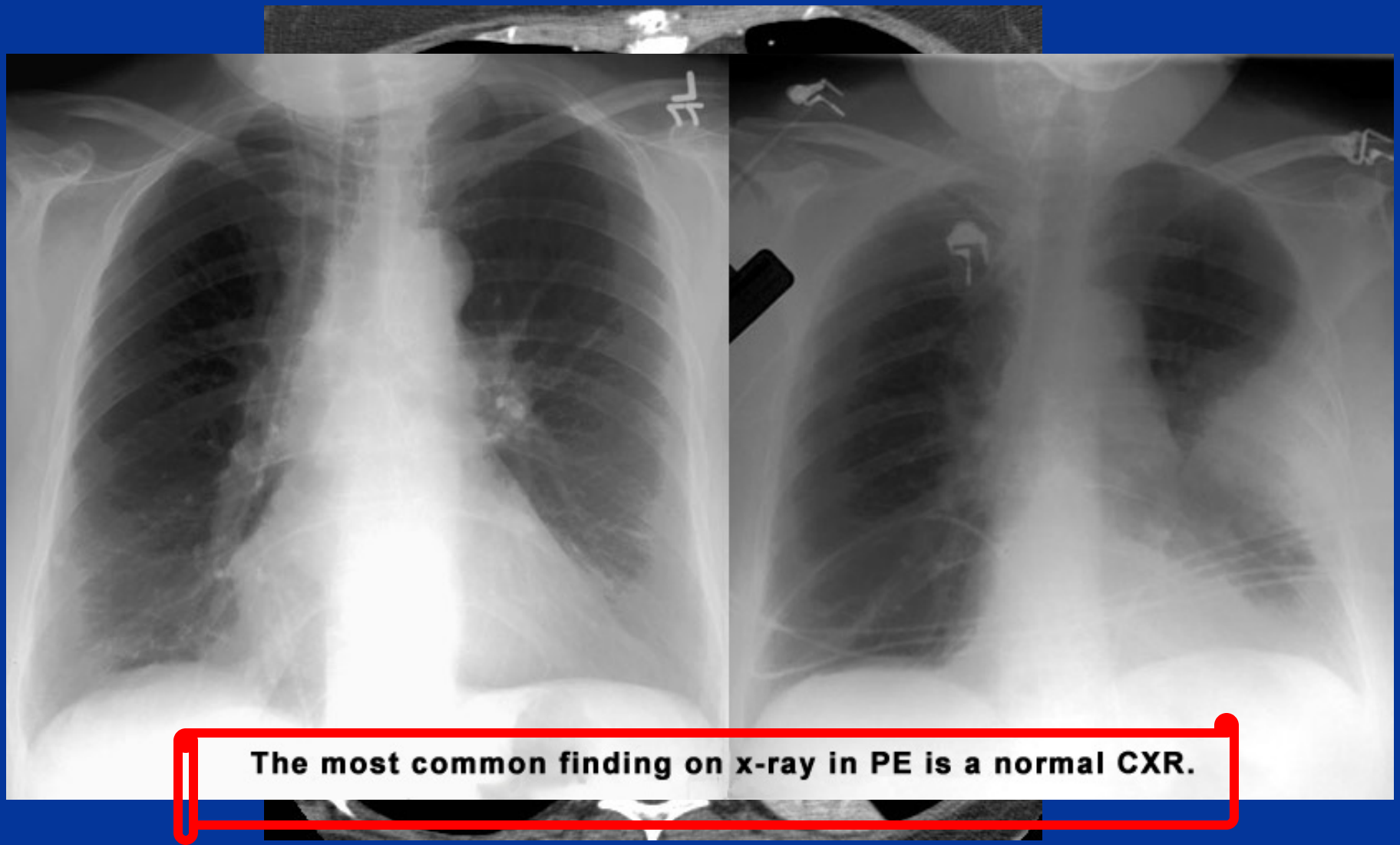
HIGH PROBABILITY OF PE



Pulmonary embolism

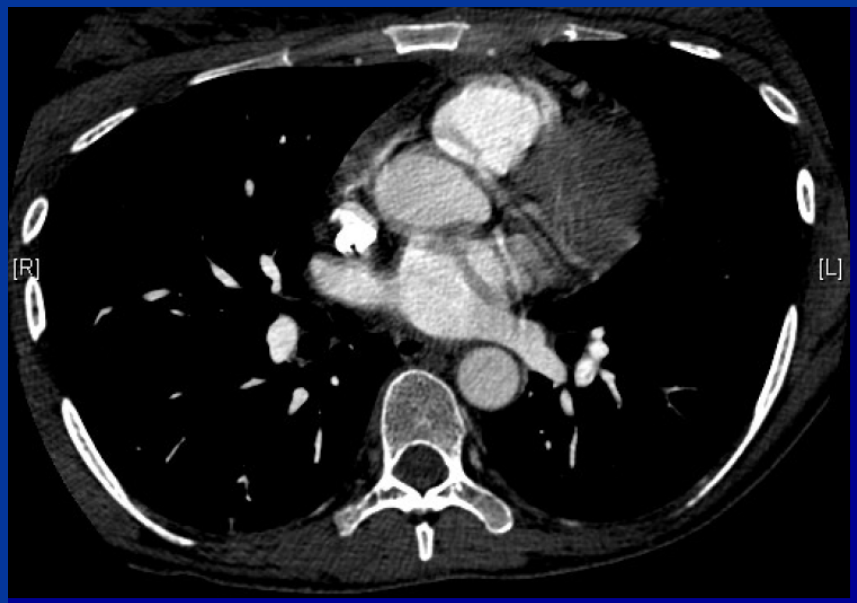


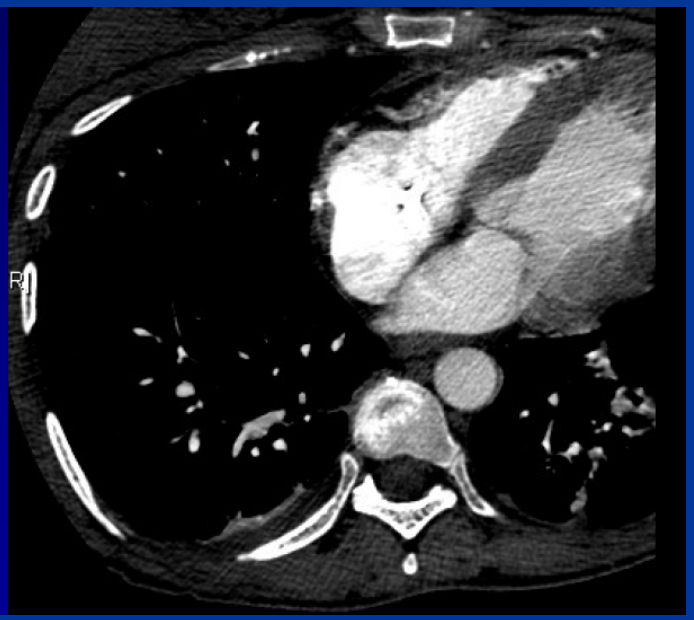
Pulmonary embolism



The most common finding on x-ray in PE is a normal CXR.

THE GOLD STANDARD FOR DIAGNOSIS OF PE IS CTA


[R]
[L]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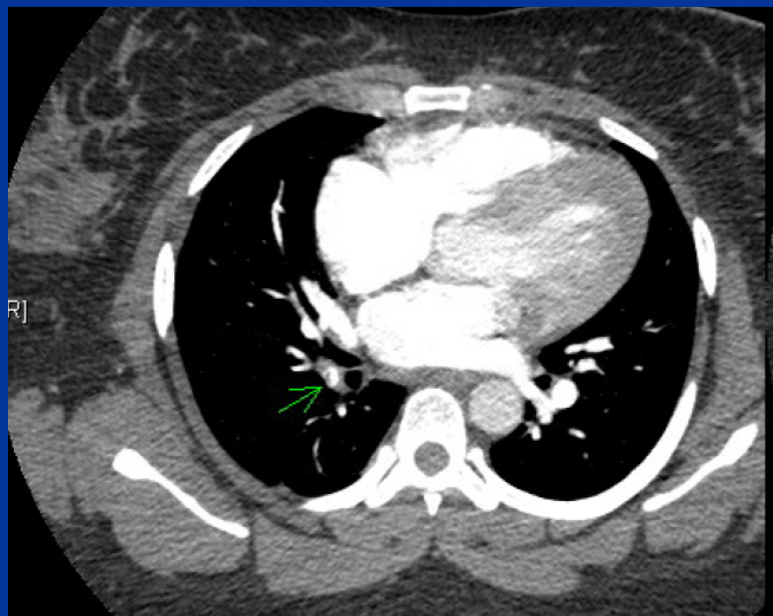
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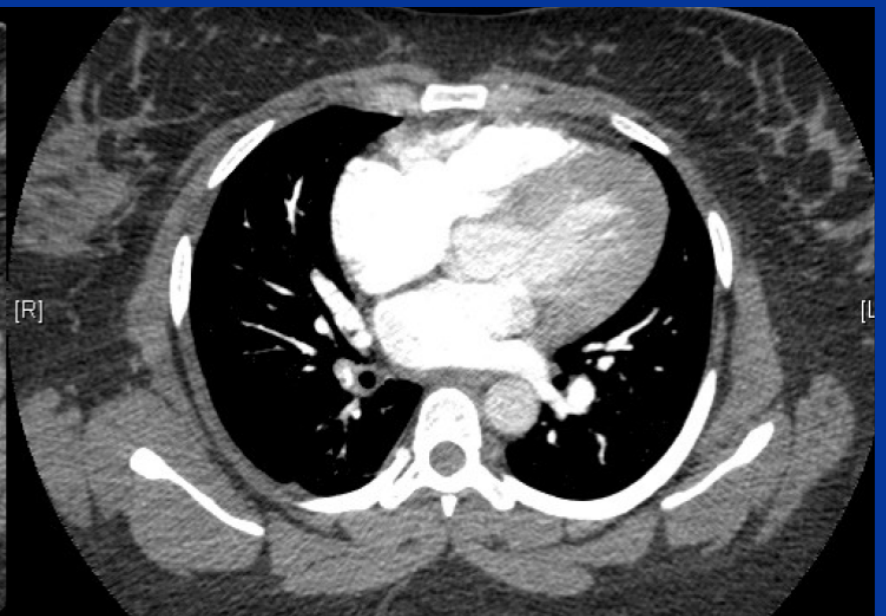
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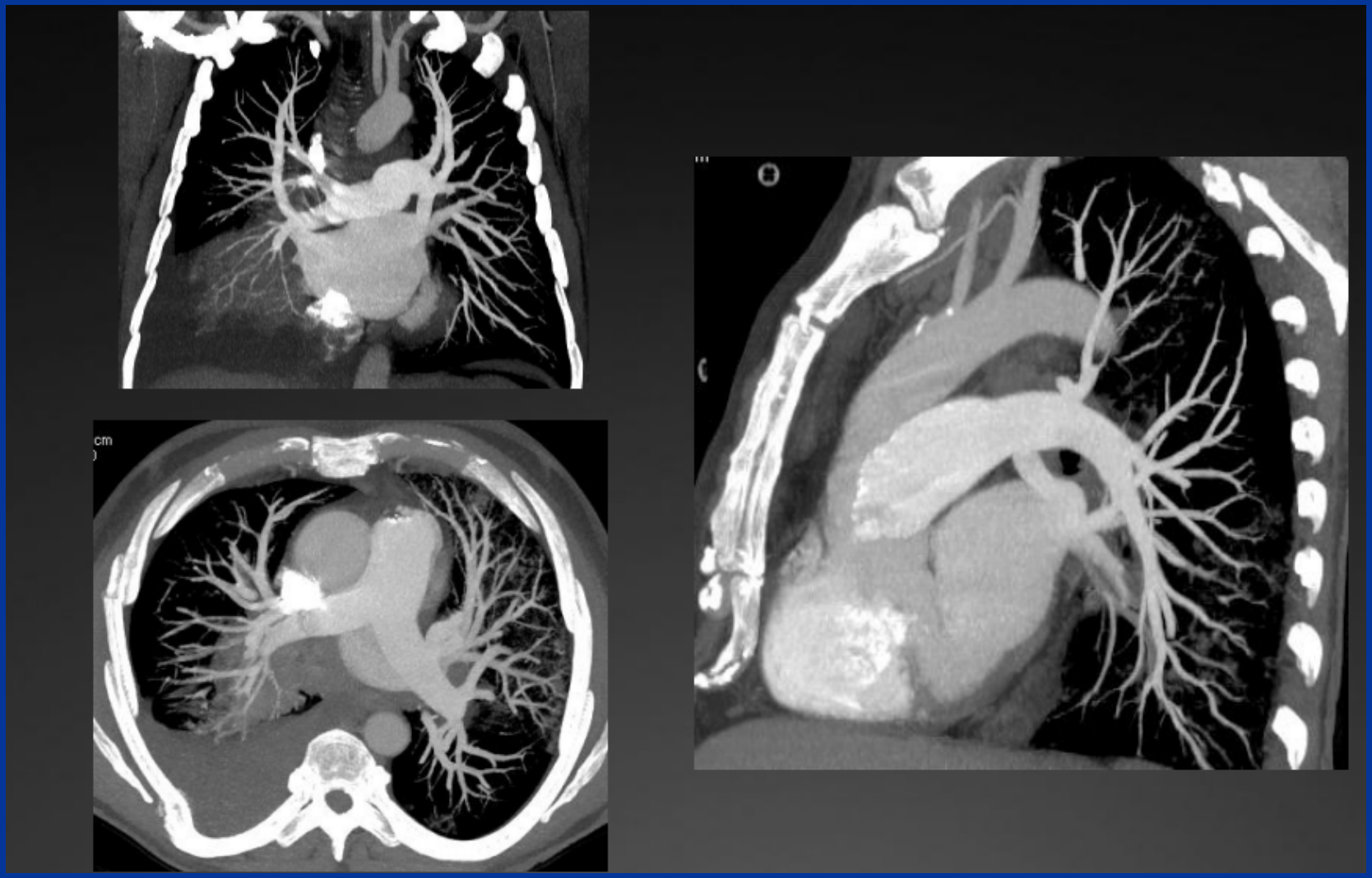
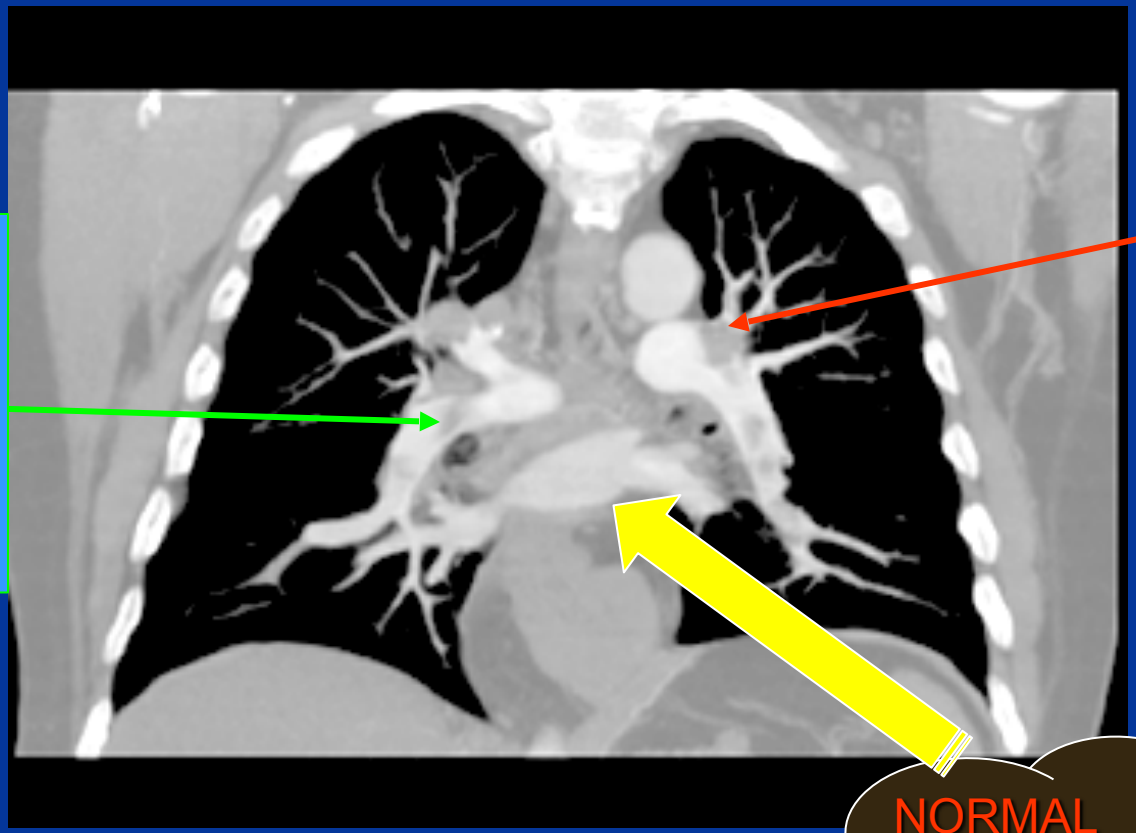
CTA PULMONARY VASCULATURE



CTA
(Coronal Reconstruction)

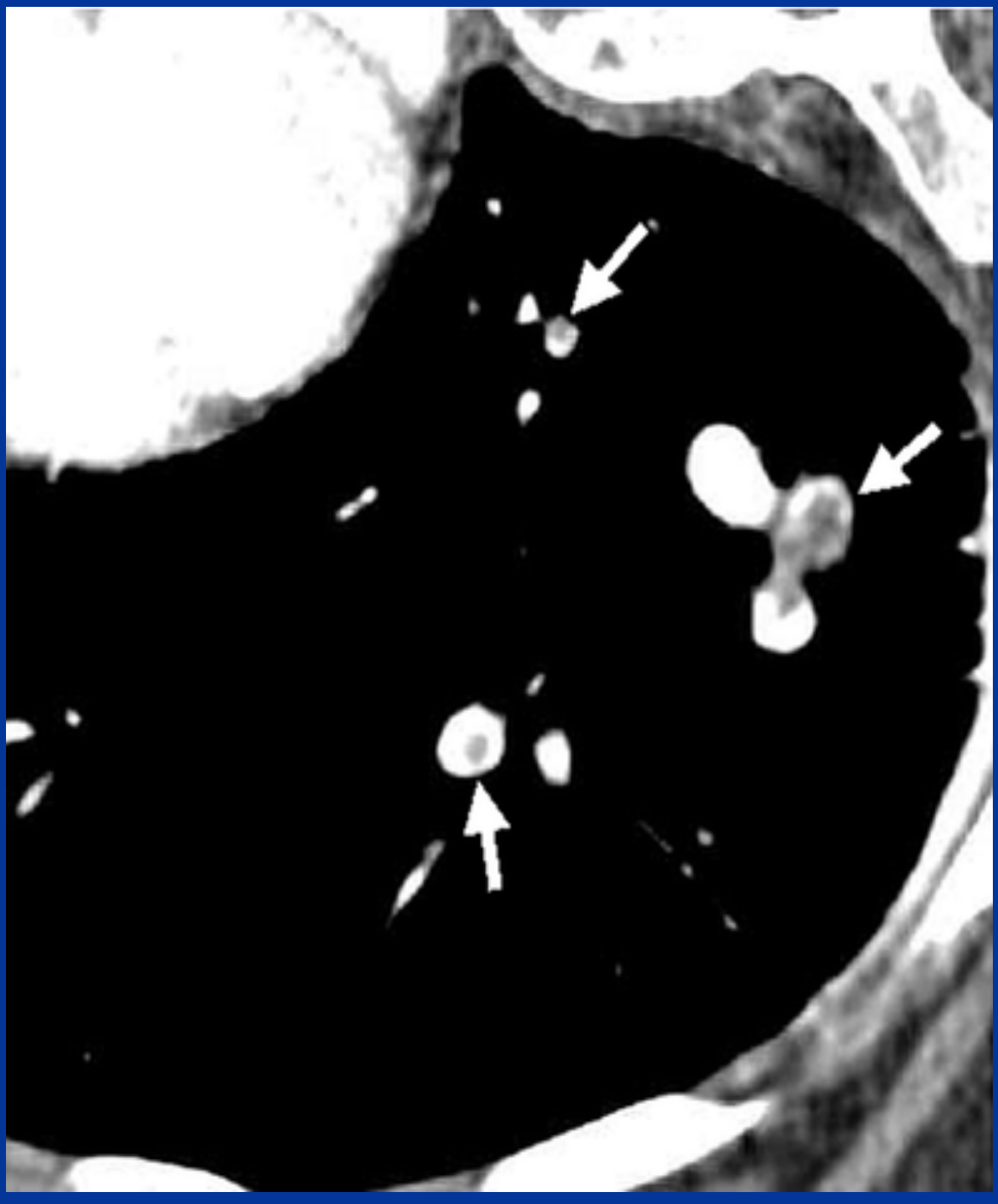


Embolus in descending right pulmonary artery

Embolus in left main pulmonary artery

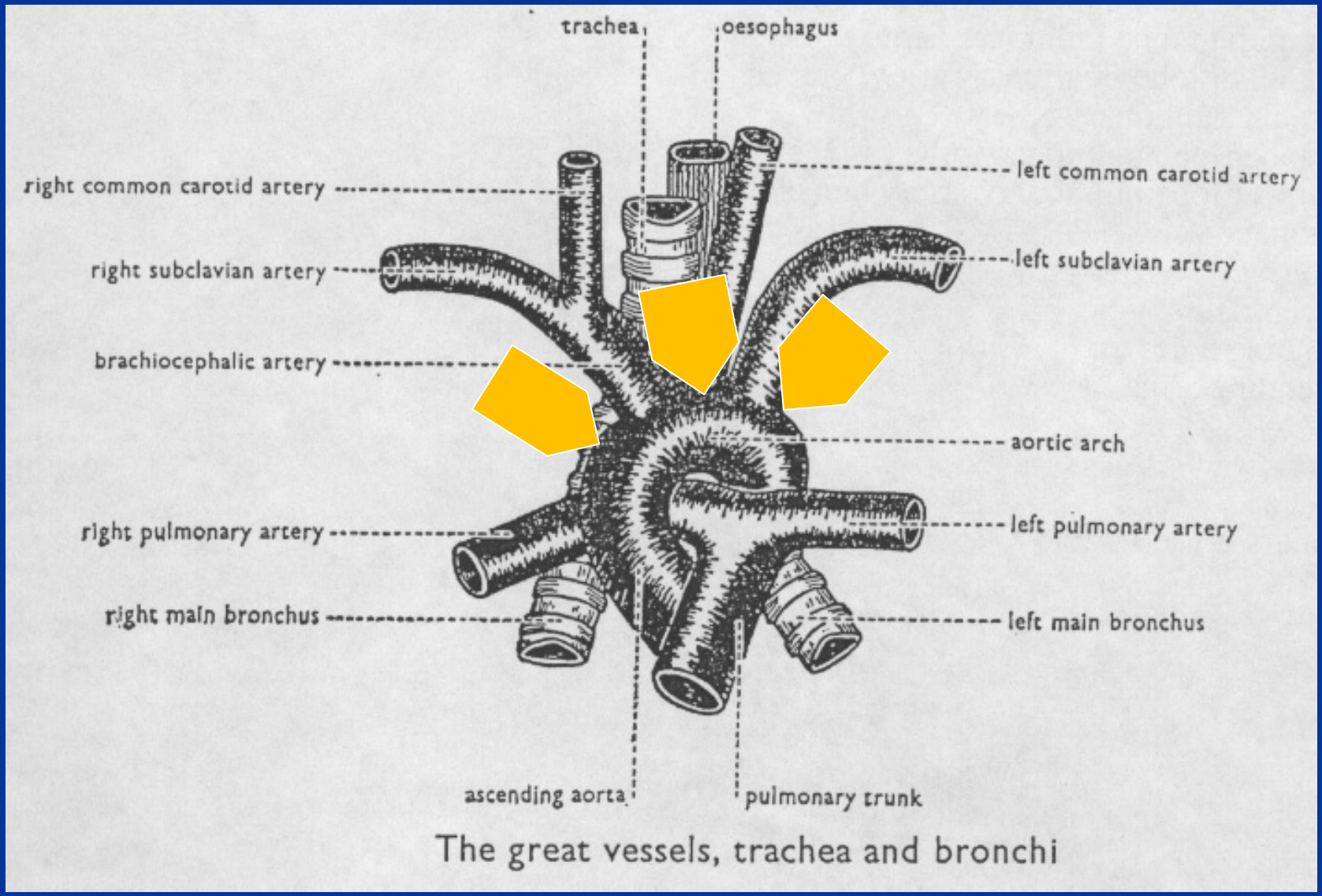
NORMAL HOMOGENOUS FILLING OF THE VESSLES

CT Agiogram



AORTIC ARCH ANATOMY

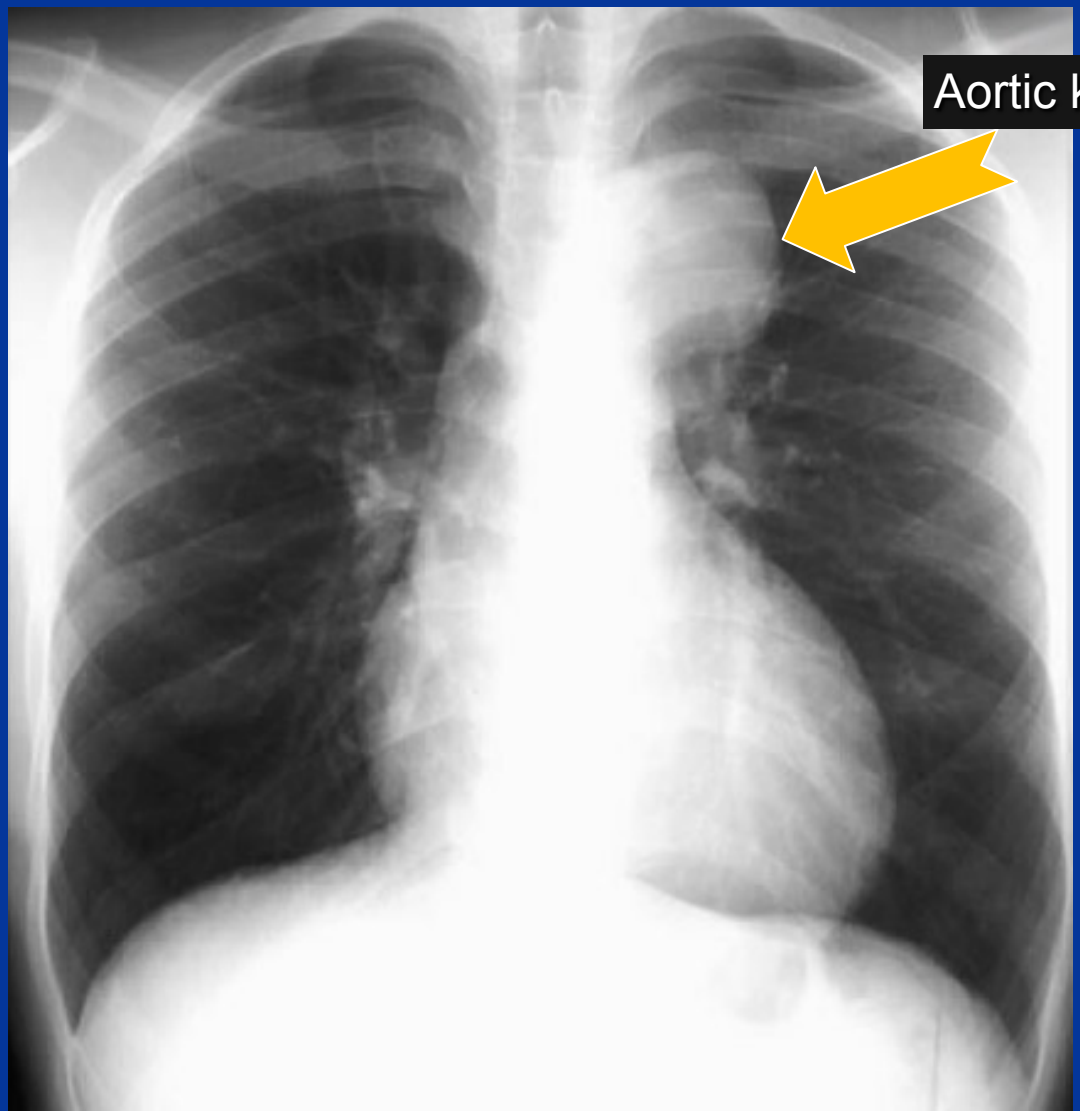
The Aortic arch/great vessels



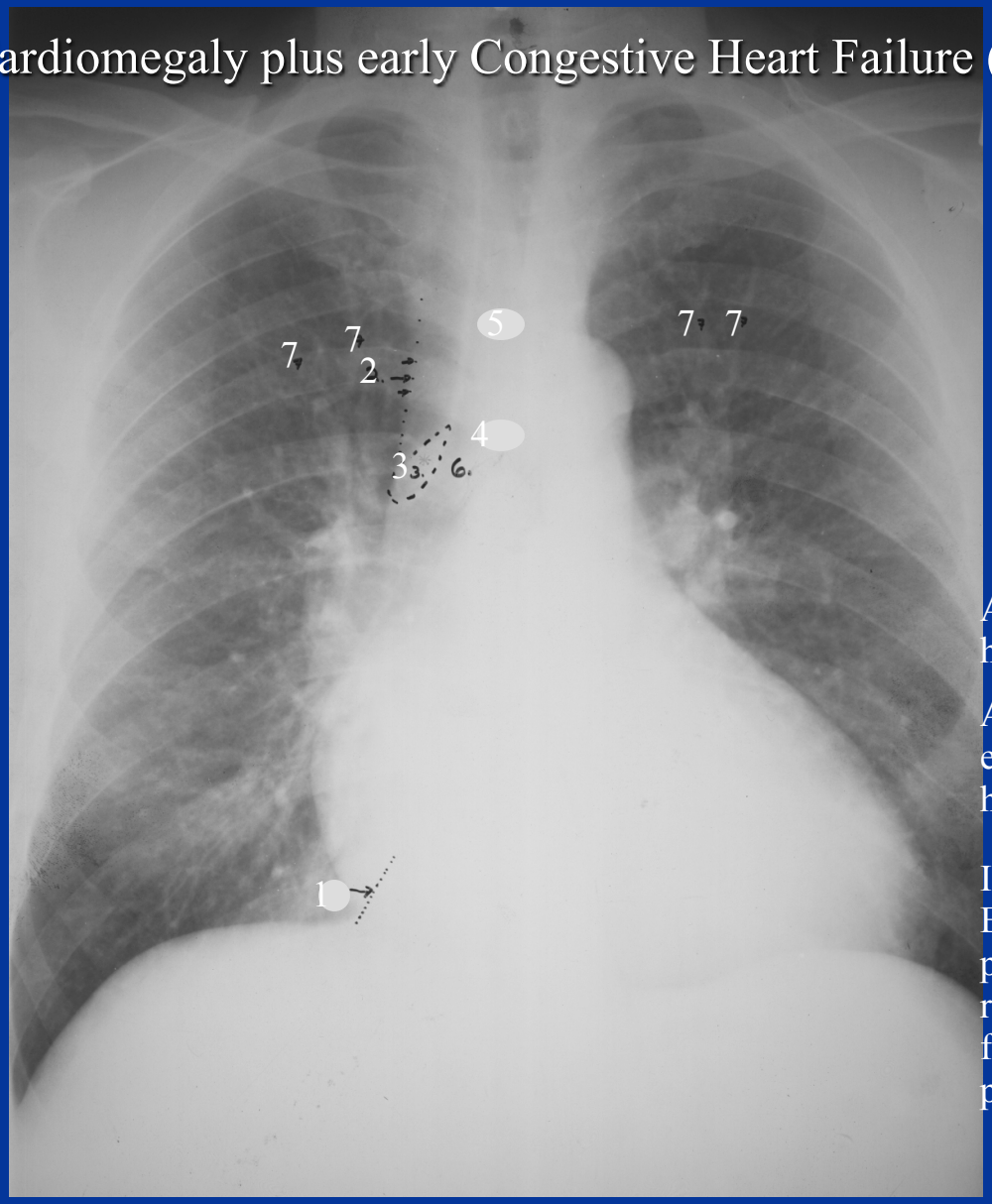
The great vessels, trachea and bronchi

"Man's Anatomy by Tobias & Arnold

Aortic aneurysm



Heart and Vessels



Key:

1. Inferior vena cava (IVC)
2. Superior vena cava (SVC)
*3. Azygos vein
4. Carina
5. Trachea
6. Right main stem bronchus
7. Prominent pulmonary vessels

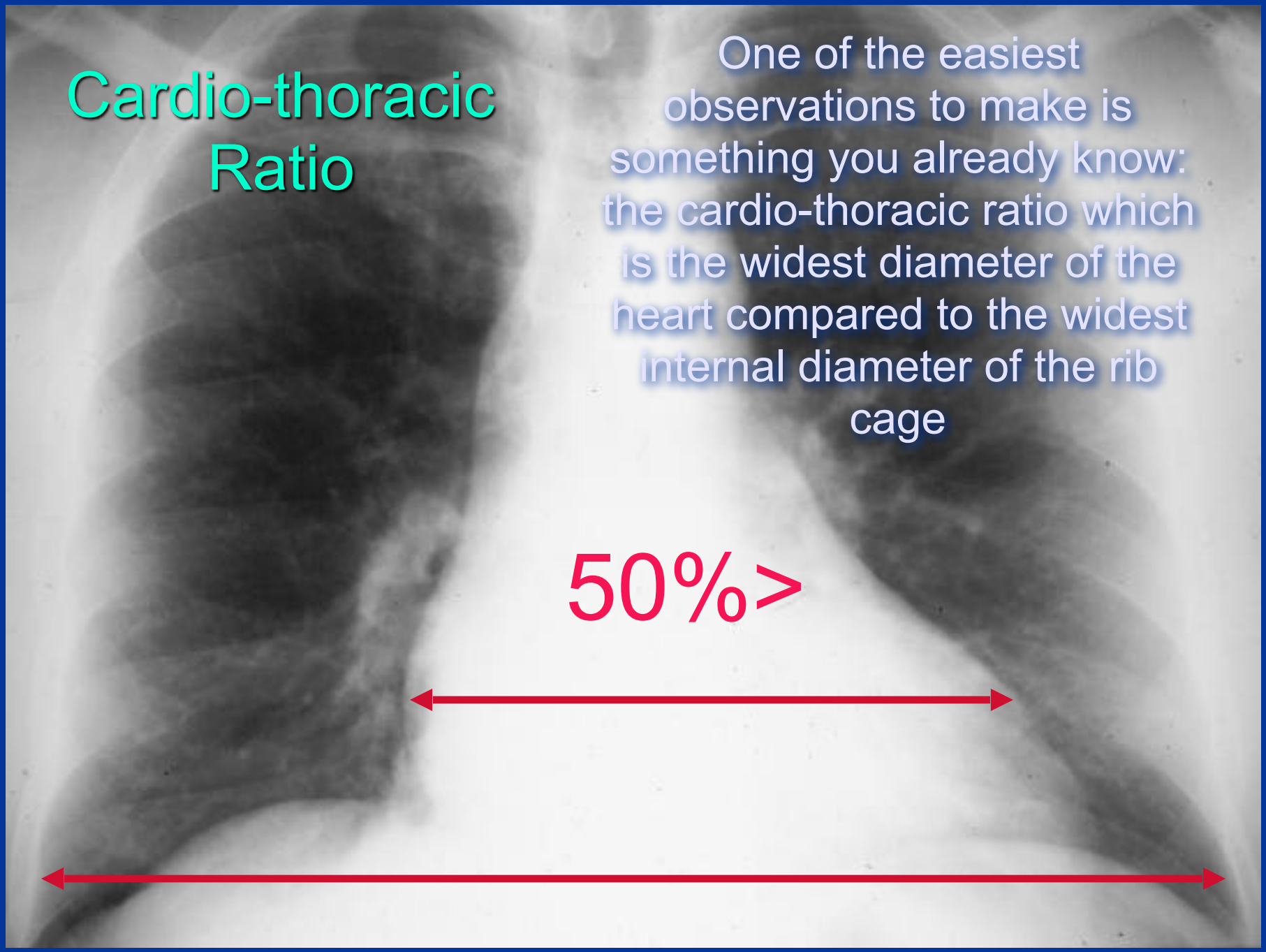
Any and or all heart chambers may enlarge when the heart becomes diseased. Cardiomegaly = a big heart.

A patient's heart enlarges due to a number of diseases e.g. valve disease, high blood pressure, congestive heart failure.

If the heart fails, the lung often become congested. Early on the pulmonary vessels appear more prominent as in this case. More advanced failure can result in a condition of pulmonary edema which is fluid flooding into the alveoli of the lungs causing the patient marked shortness of breath.

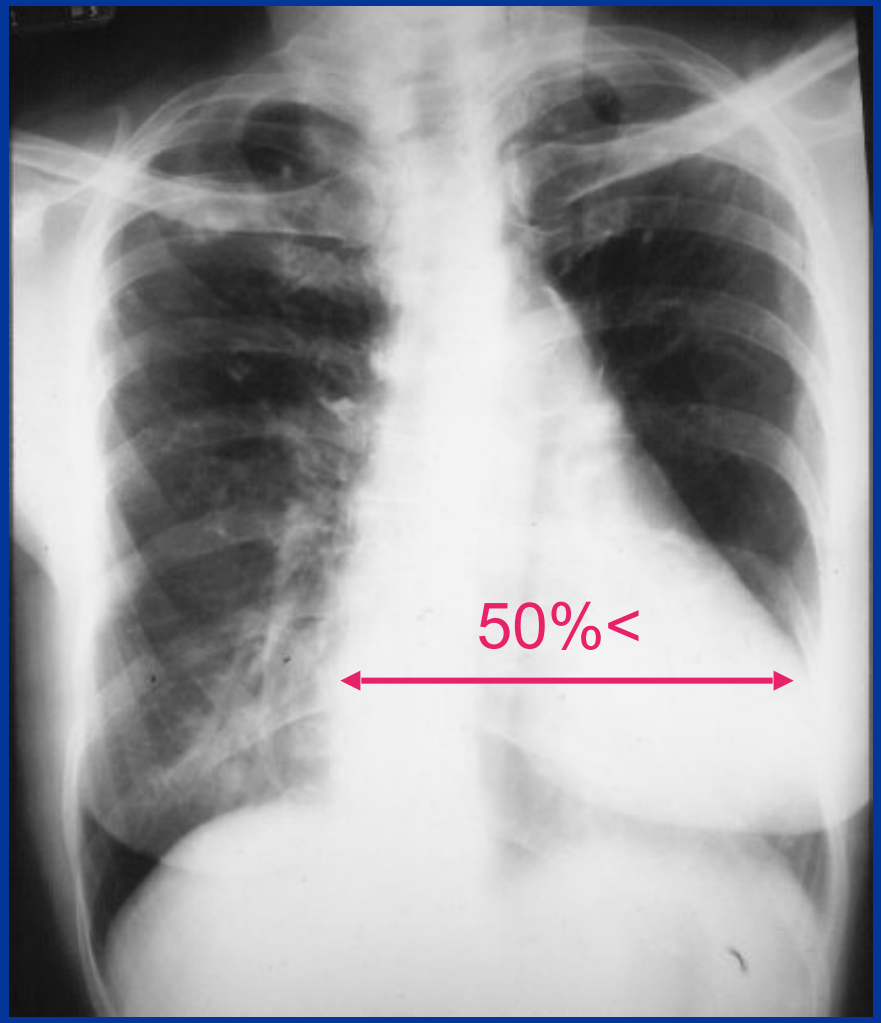
Cardio-thoracic Ratio

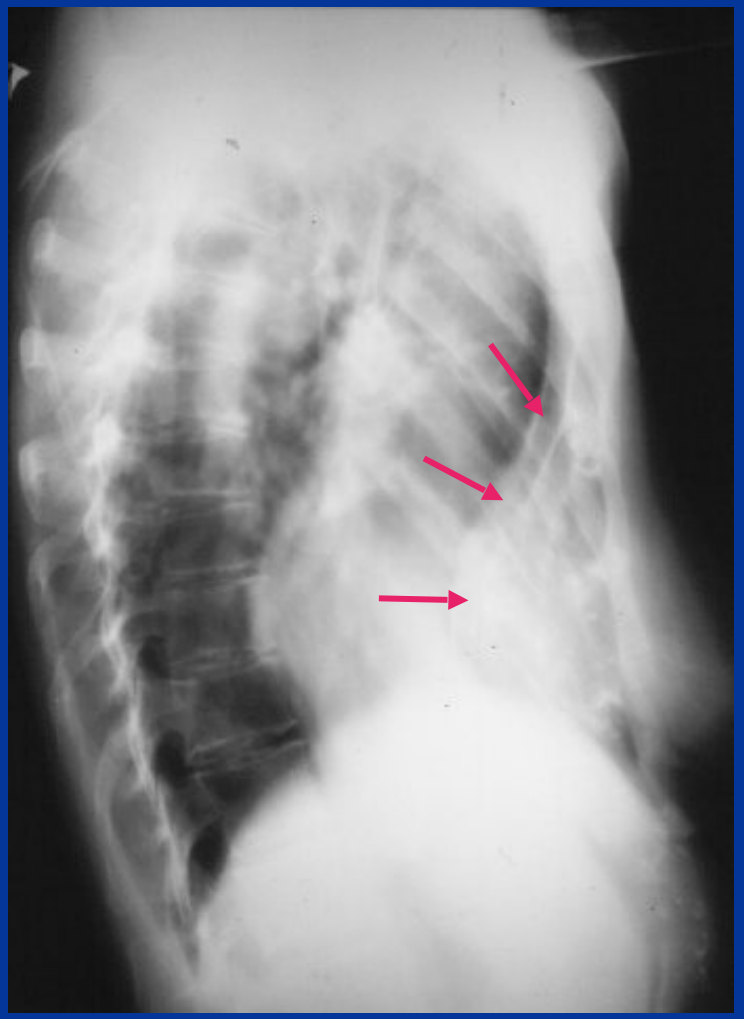
One of the easiest observations to make is something you already know: the cardio-thoracic ratio which is the widest diameter of the heart compared to the widest internal diameter of the rib cage



Sometimes, CTR is more than 50%
But Heart is Normal

- Extracardiac causes of cardiac enlargement
  - –Portable AP films
  - –Obesity
  - –Pregnant
  - –Ascites
  - –Straight back syndrome
  - –Pectus excavatum





Here is a heart that is larger than 50% of the cardiothoracic ratio, but it is still a normal heart. This is because there is an extracardiac cause for the apparent cardiomegaly. On the lateral film, the arrows point to the inward displacement of the lower sternum in a pectus excavatum deformity.

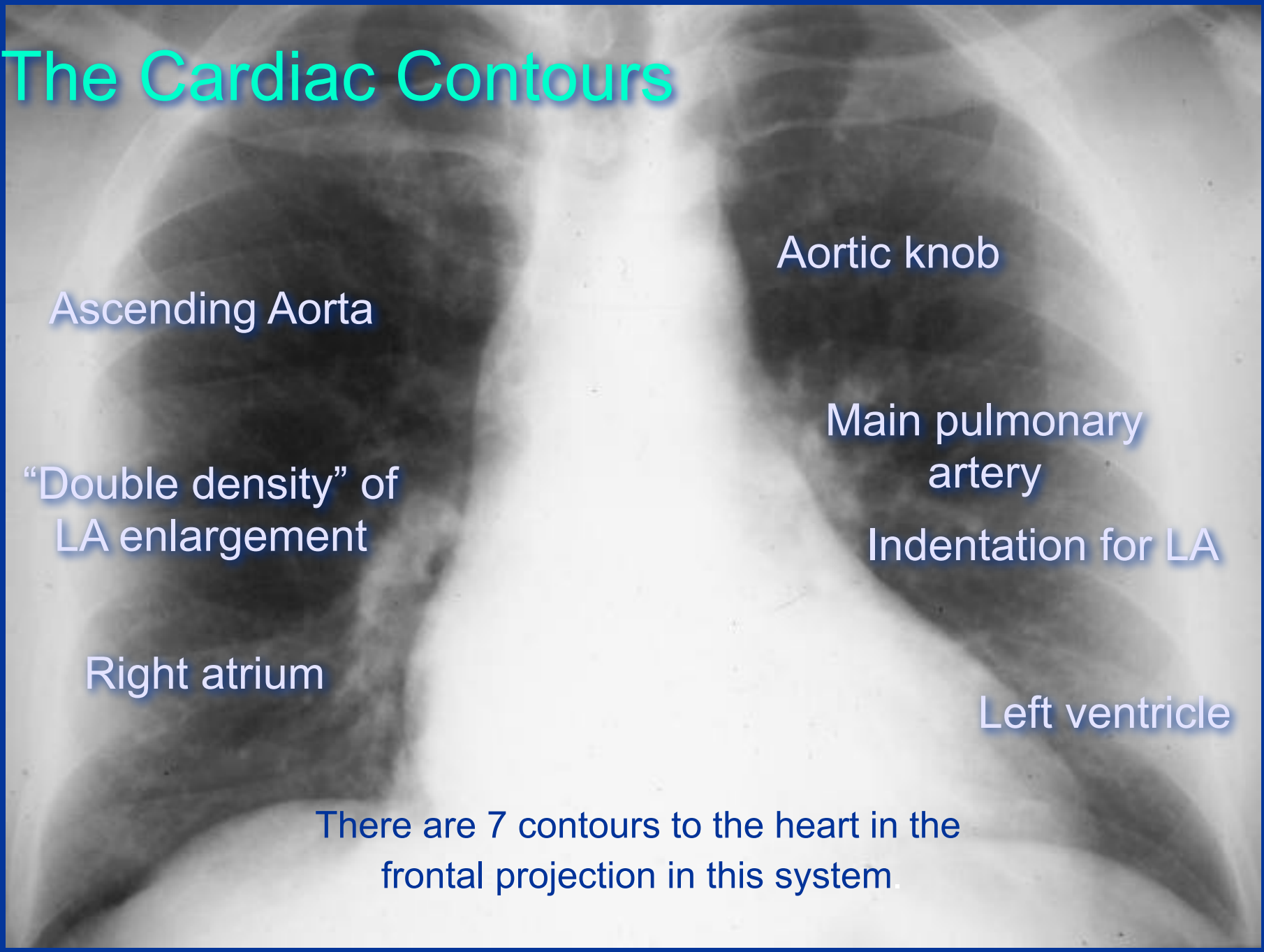
Sometimes, CTR is less than 50%
But Heart is Abnormal

- Obstruction to outflow of the ventricles
  - Ventricular hypertrophy
- Must look at cardiac contours

Anatomy on Normal Chest X-Ray

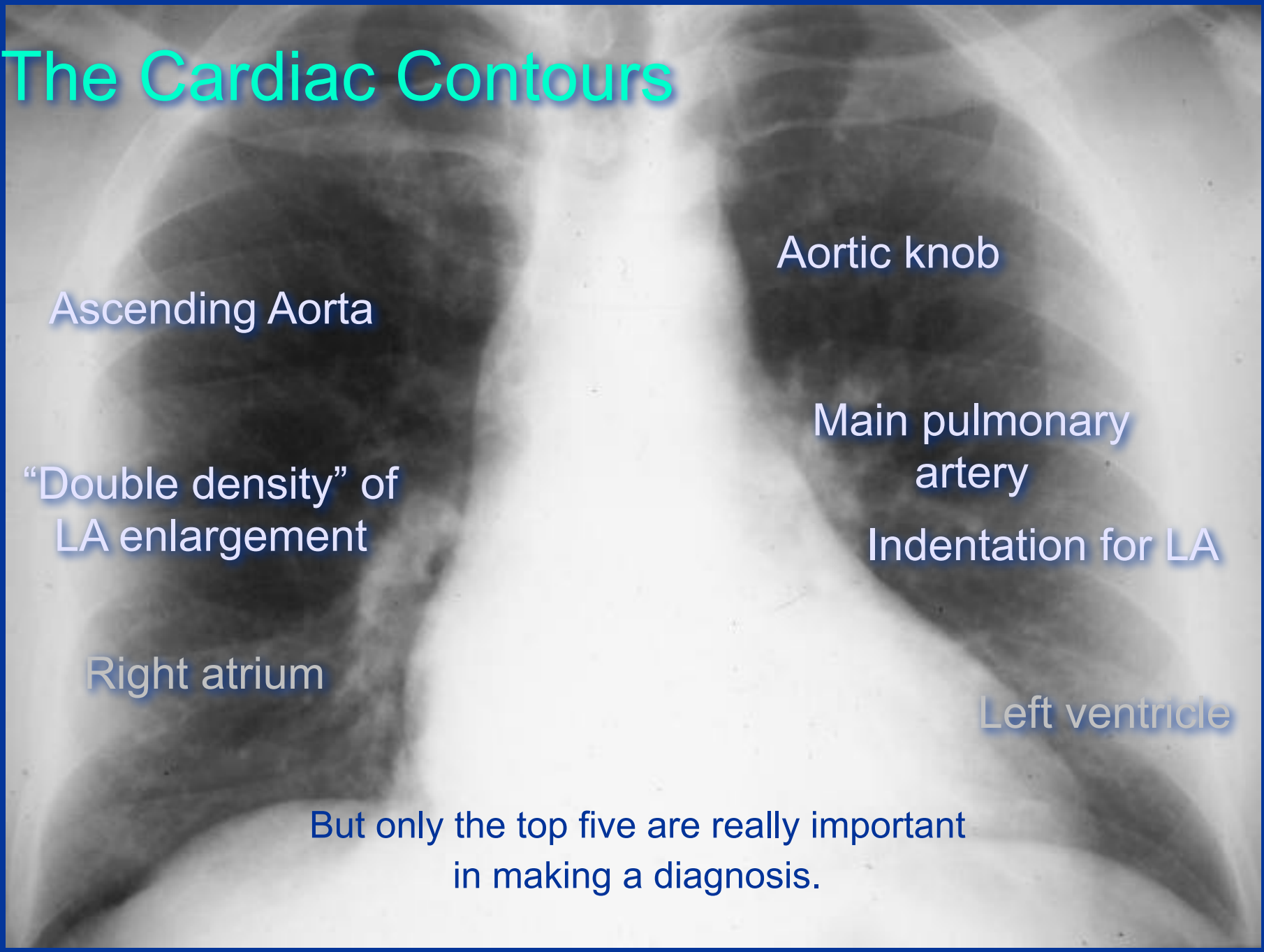
Heart borders and chambers of the heart on PA and lateral views.

The Cardiac Contours



There are 7 contours to the heart in the frontal projection in this system.

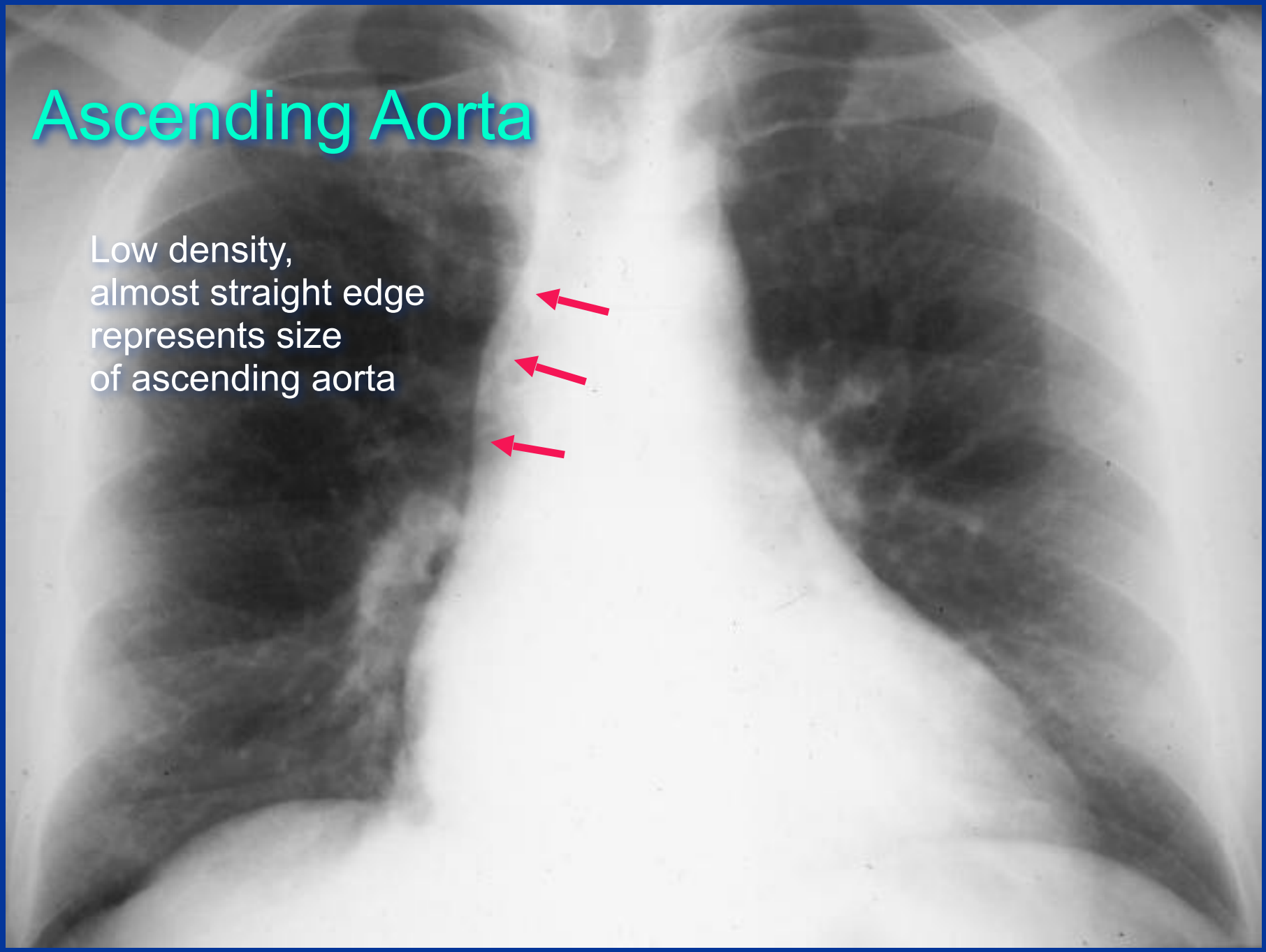
The Cardiac Contours



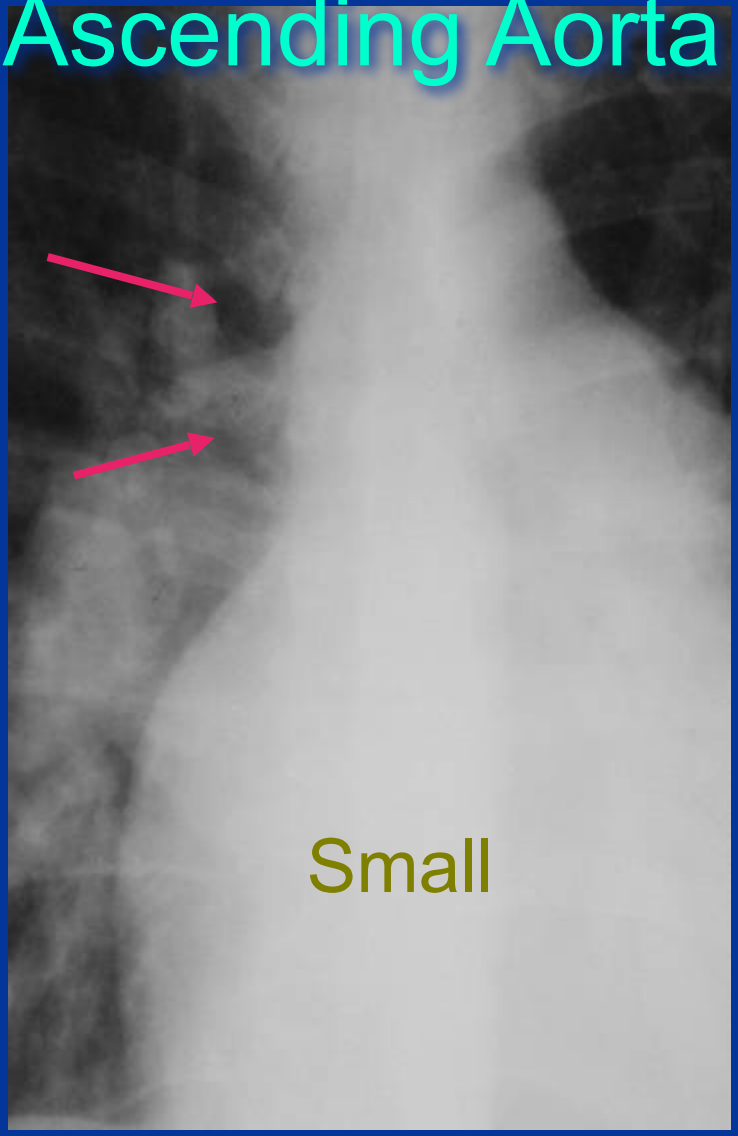
But only the top five are really important in making a diagnosis.

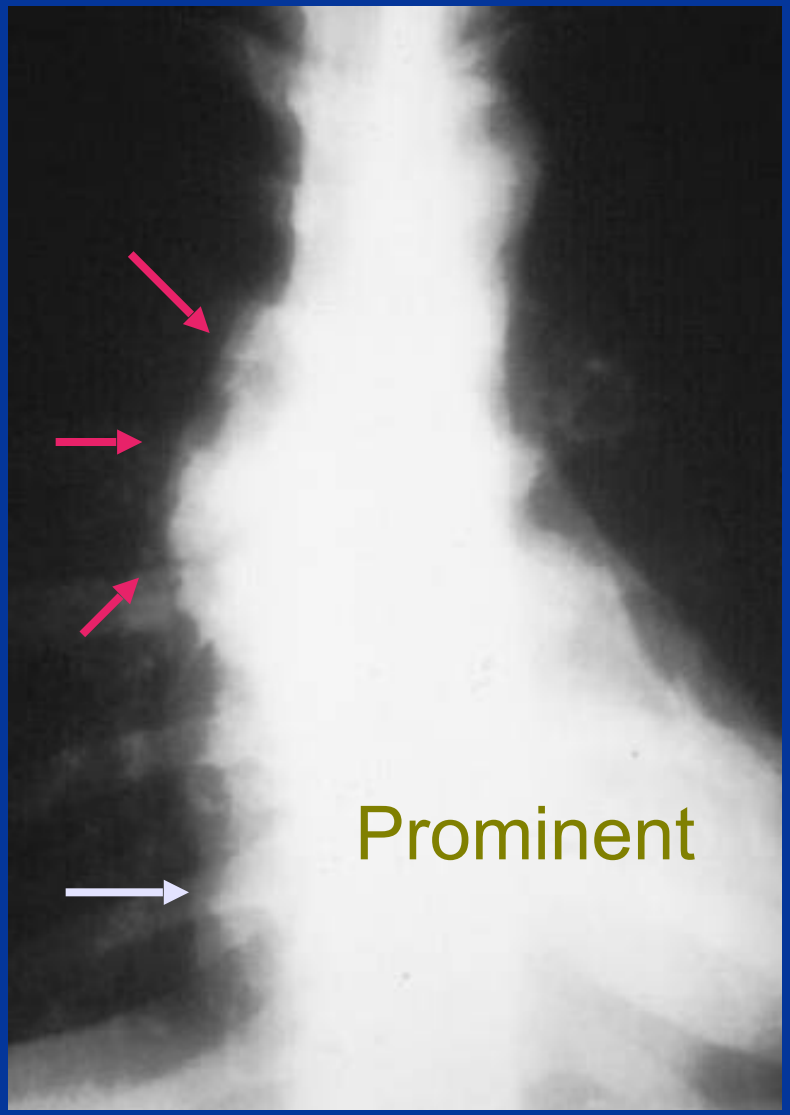
Ascending Aorta

Low density,
almost straight edge
represents size
of ascending aorta



Ascending Aorta

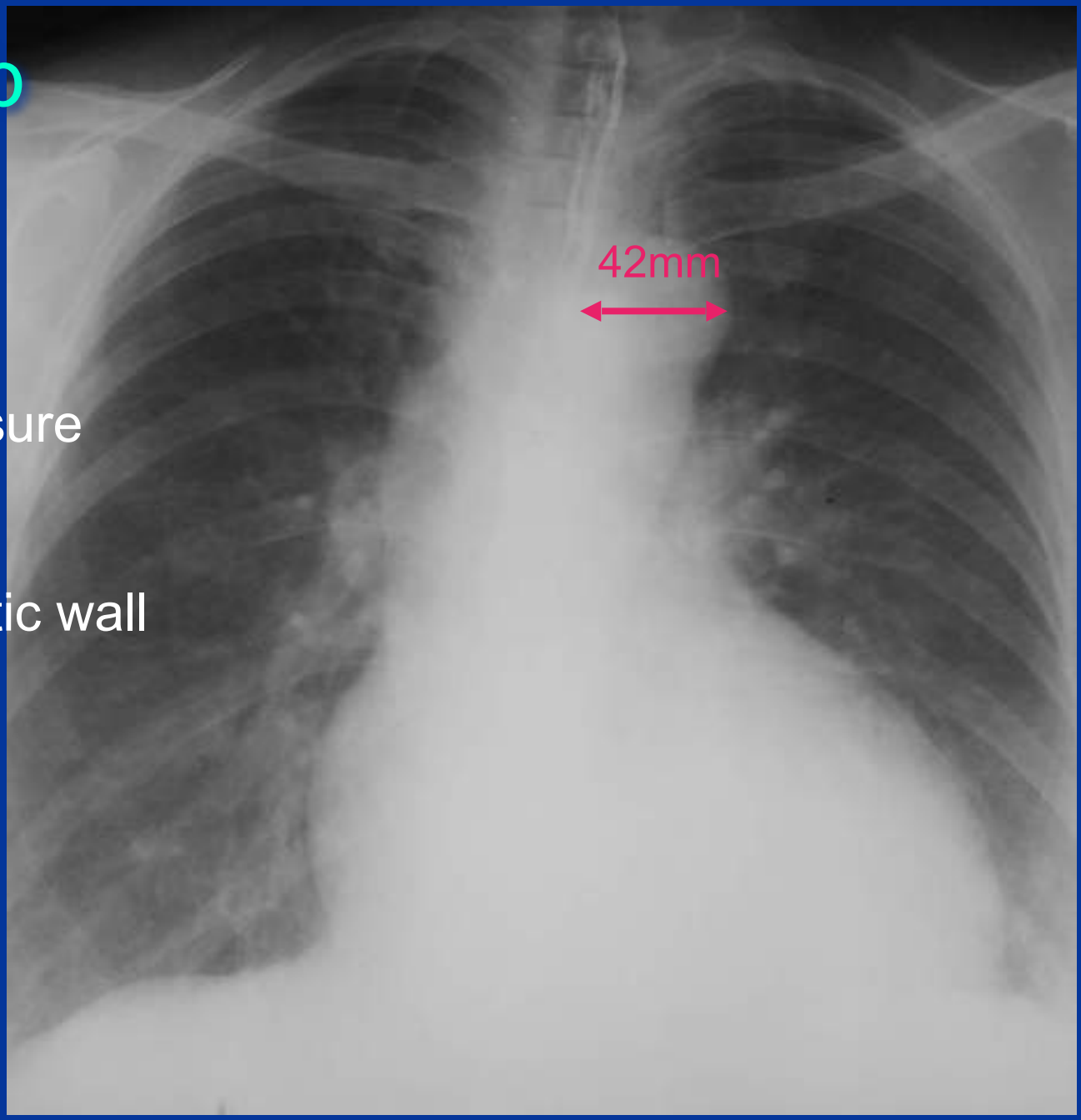


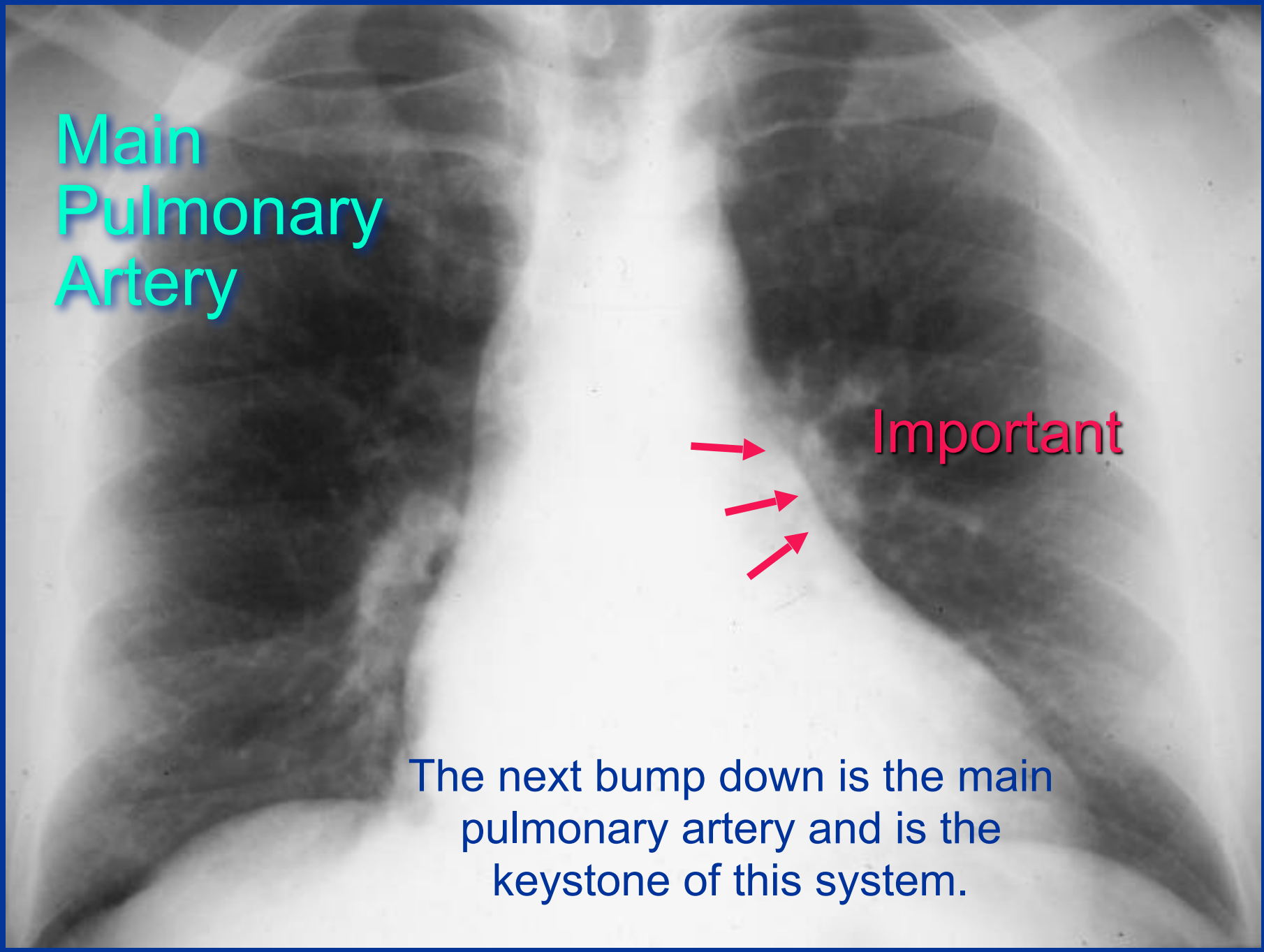


Aortic Knob

Enlarged with:

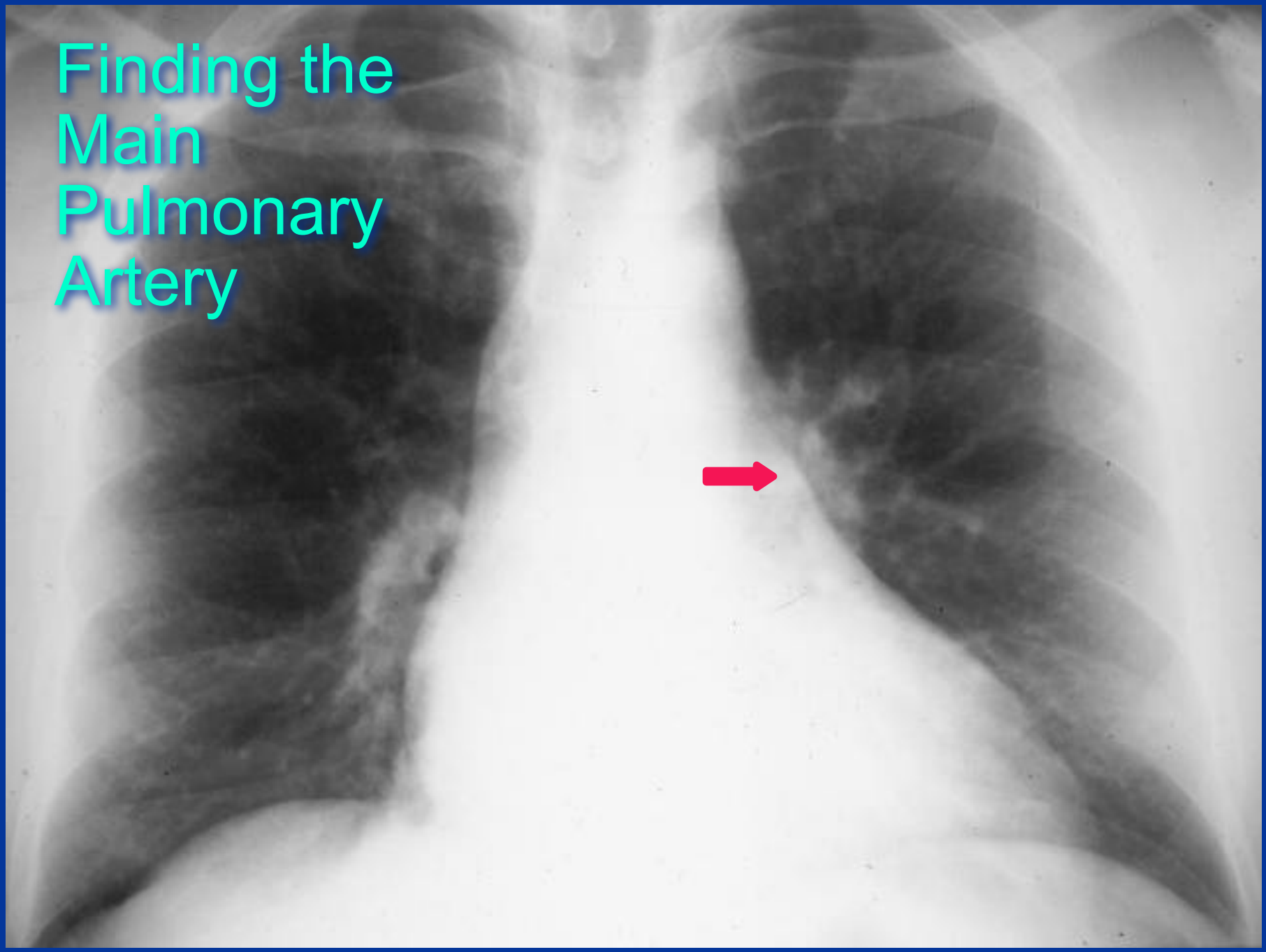
- Increased pressure
- Increased flow
- Changes in aortic wall



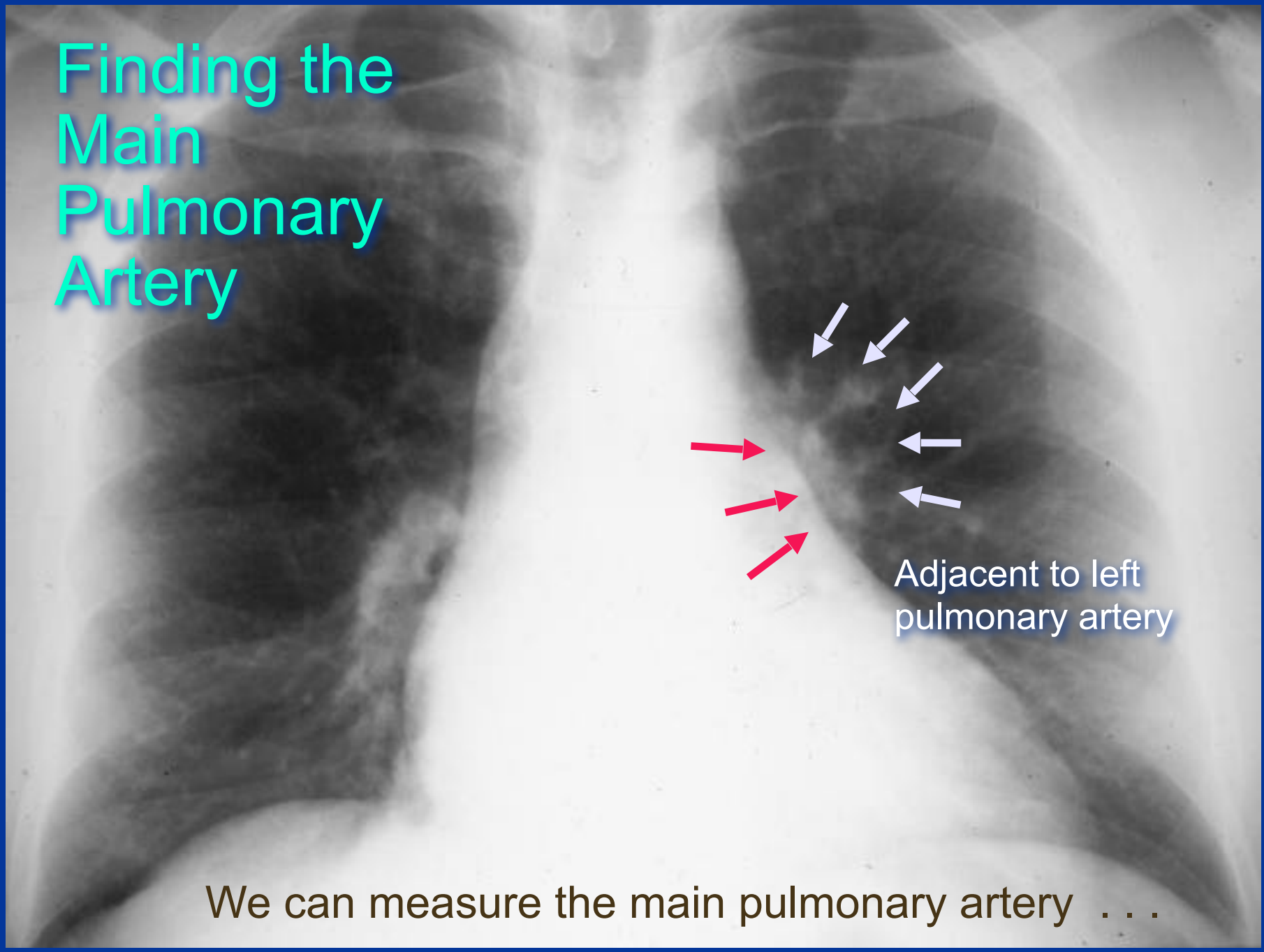


The next bump down is the main pulmonary artery and is the keystone of this system.

Finding the Main Pulmonary Artery

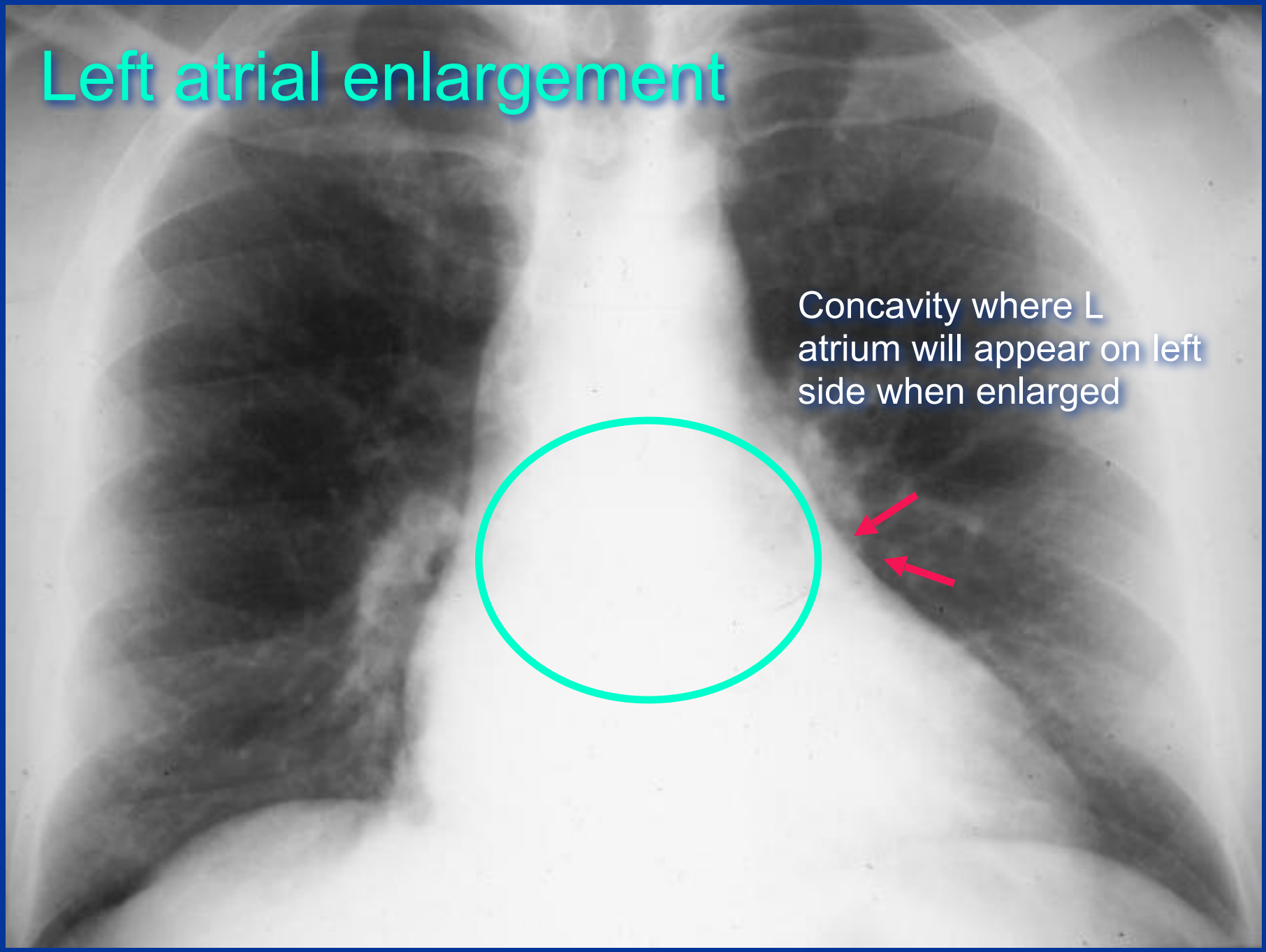


Finding the Main Pulmonary Artery



We can measure the main pulmonary artery . . .

Left atrial enlargement

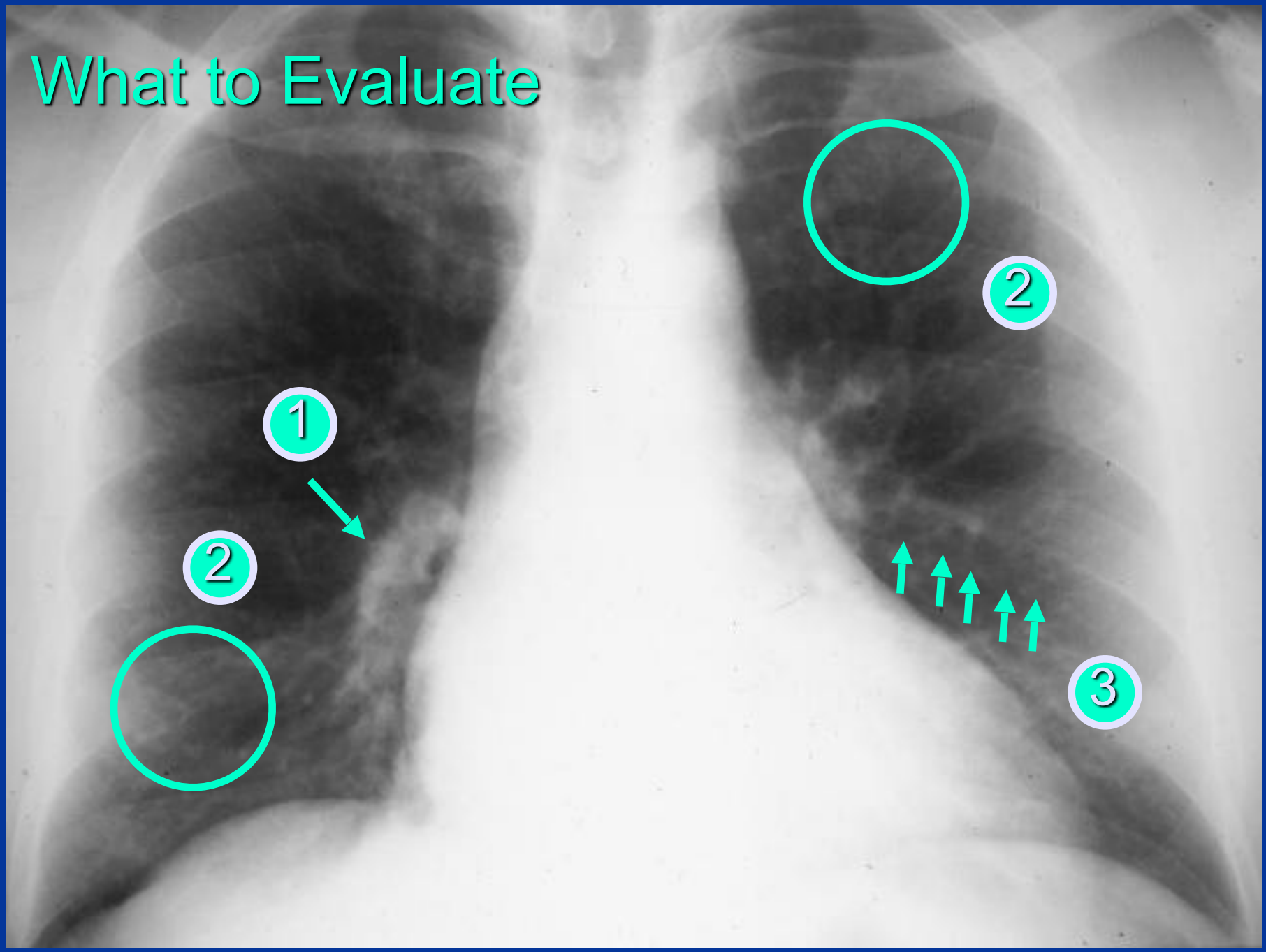


The Pulmonary Vasculature

Five States of the Pulmonary Vasculature

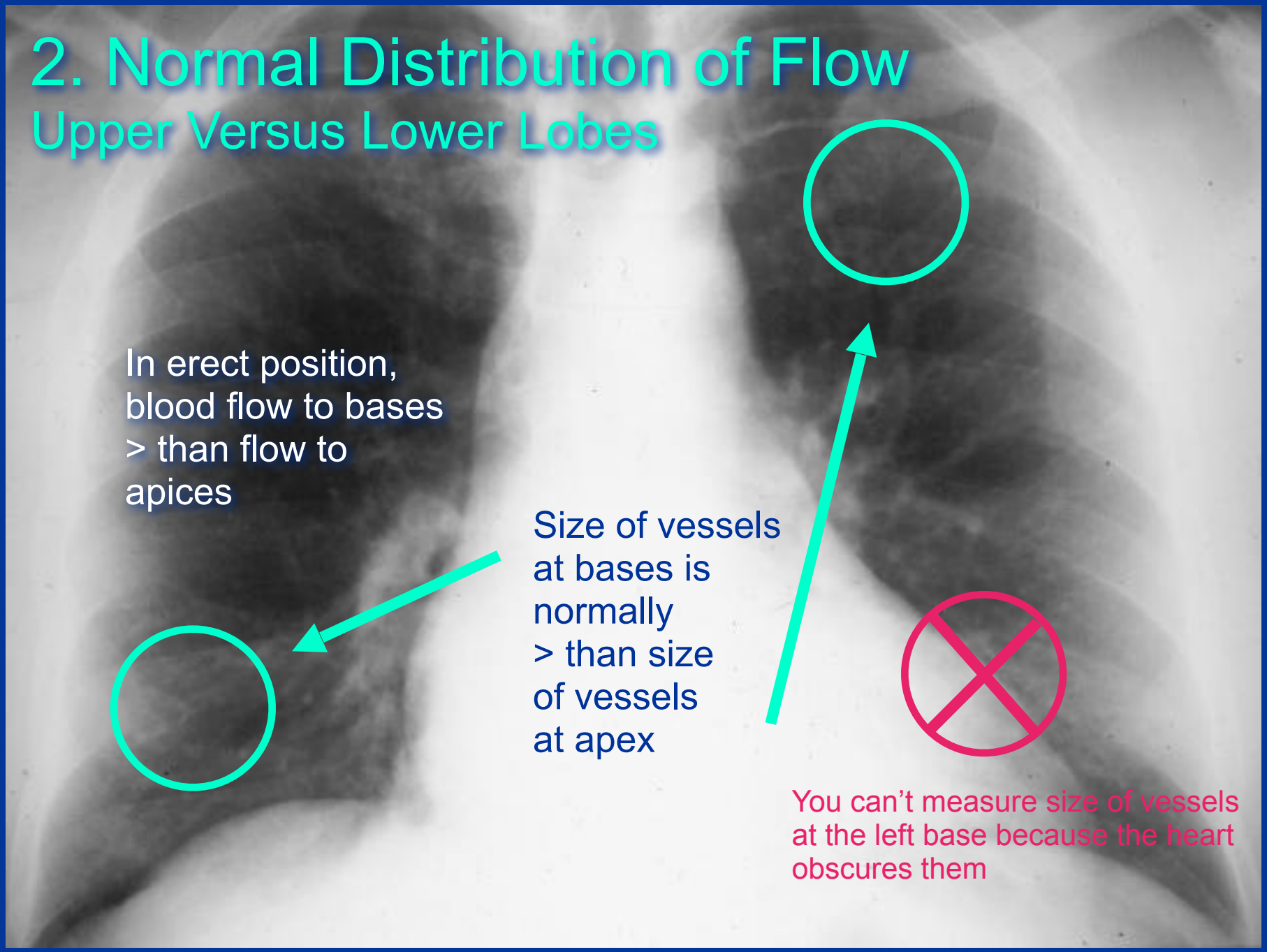
- Normal
- Pulmonary venous hypertension
- Pulmonary arterial hypertension
- Increased flow
- Decreased flow

What to Evaluate



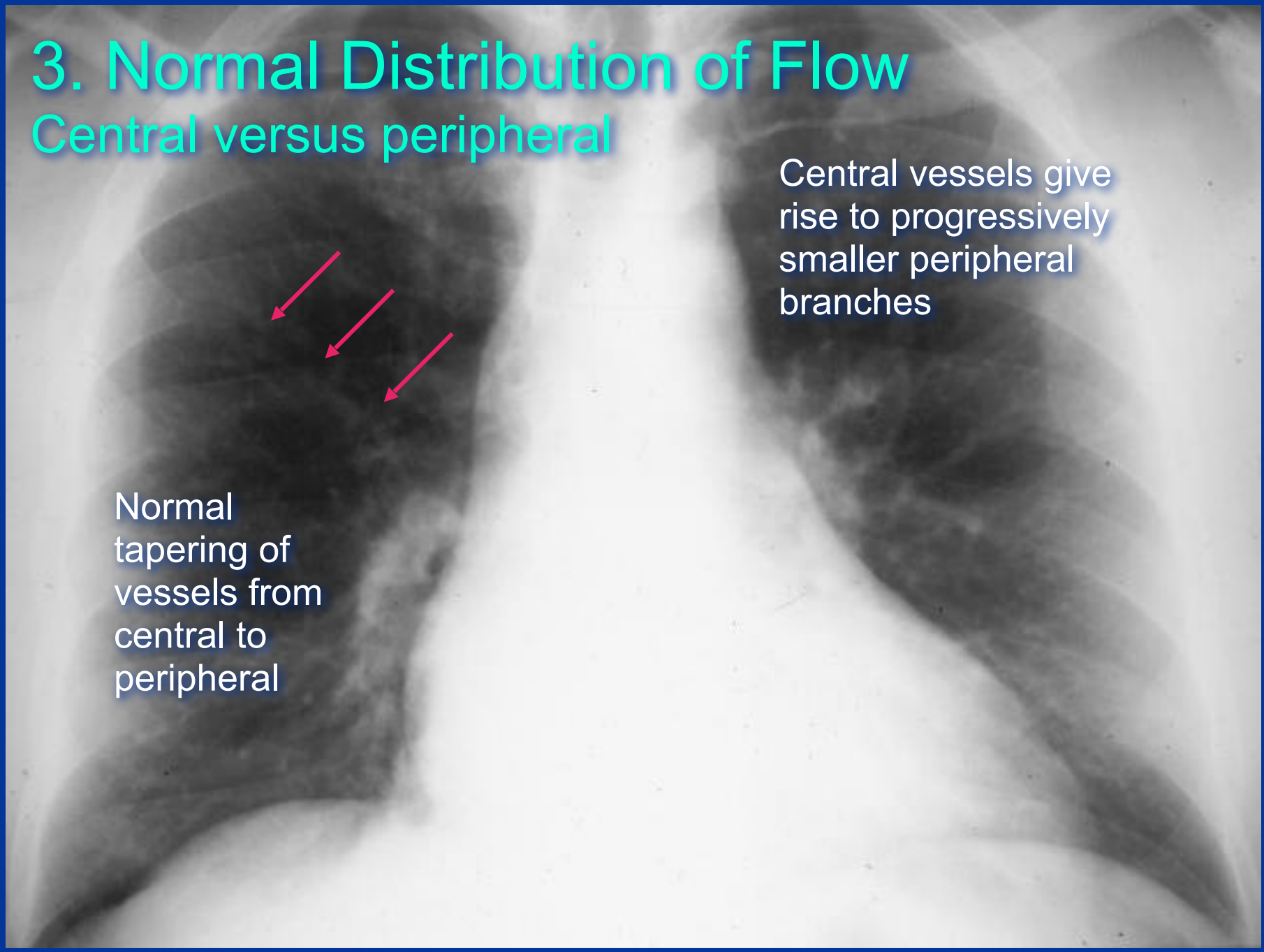
2. Normal Distribution of Flow

Upper Versus Lower Lobes



3. Normal Distribution of Flow

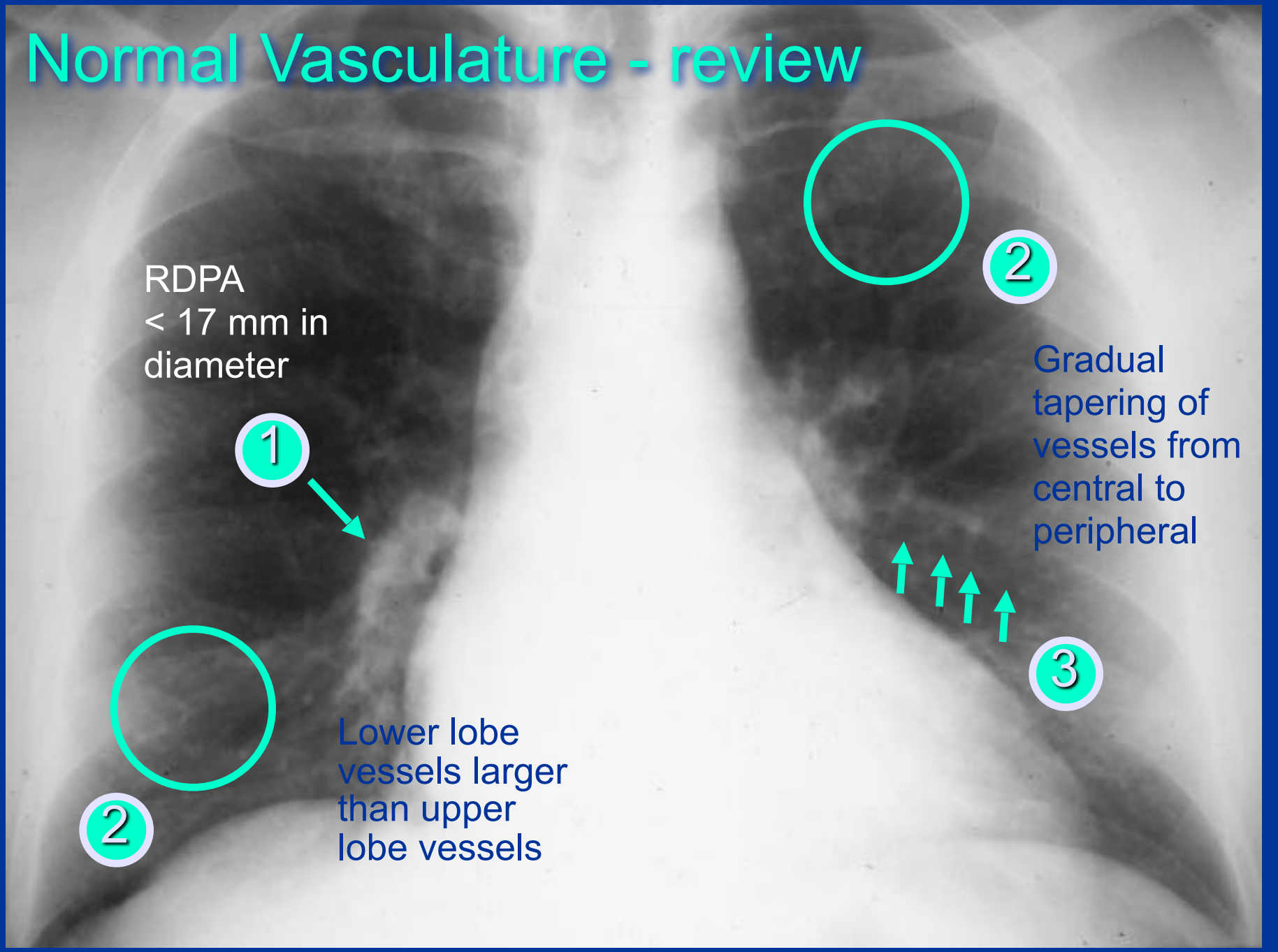
Central versus peripheral



Central vessels give rise to progressively smaller peripheral branches

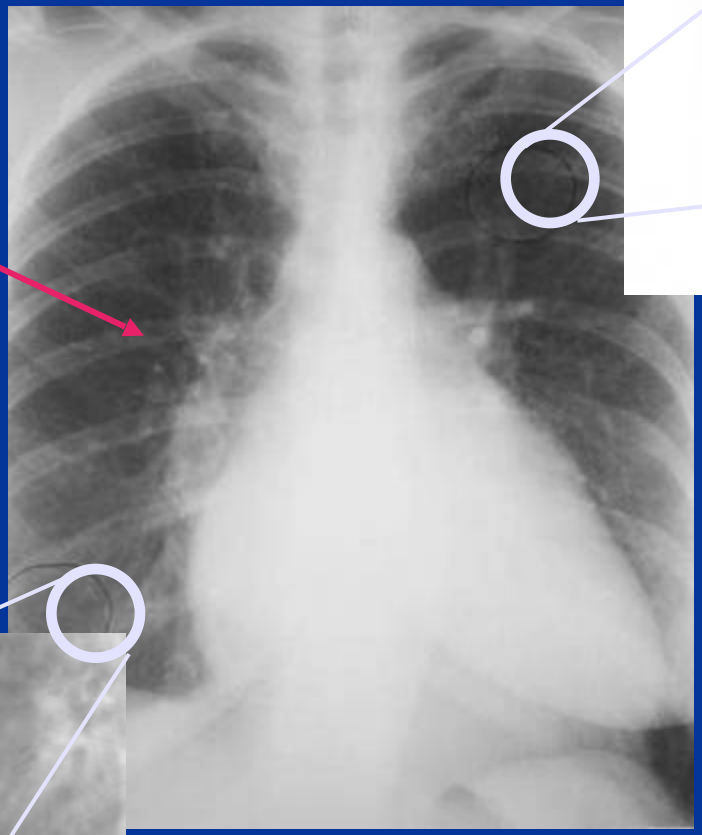
Normal tapering of vessels from central to peripheral

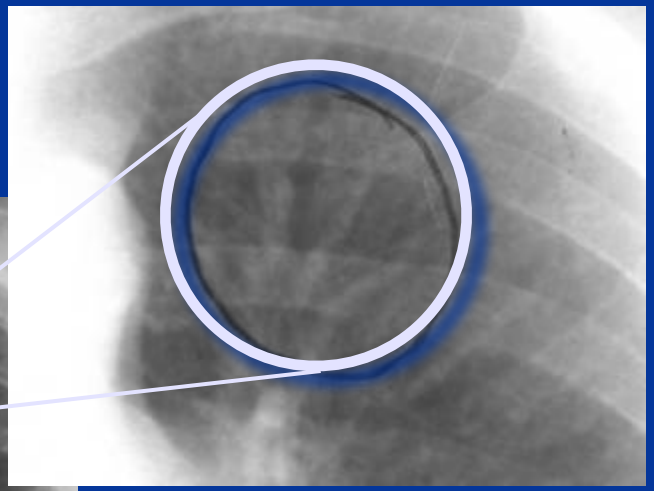
Normal Vasculature - review

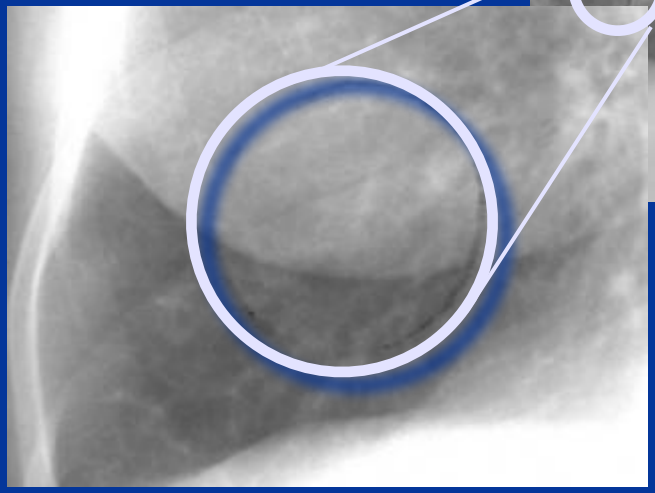


Venous Hypertension

RDPA usually
> 17 mm





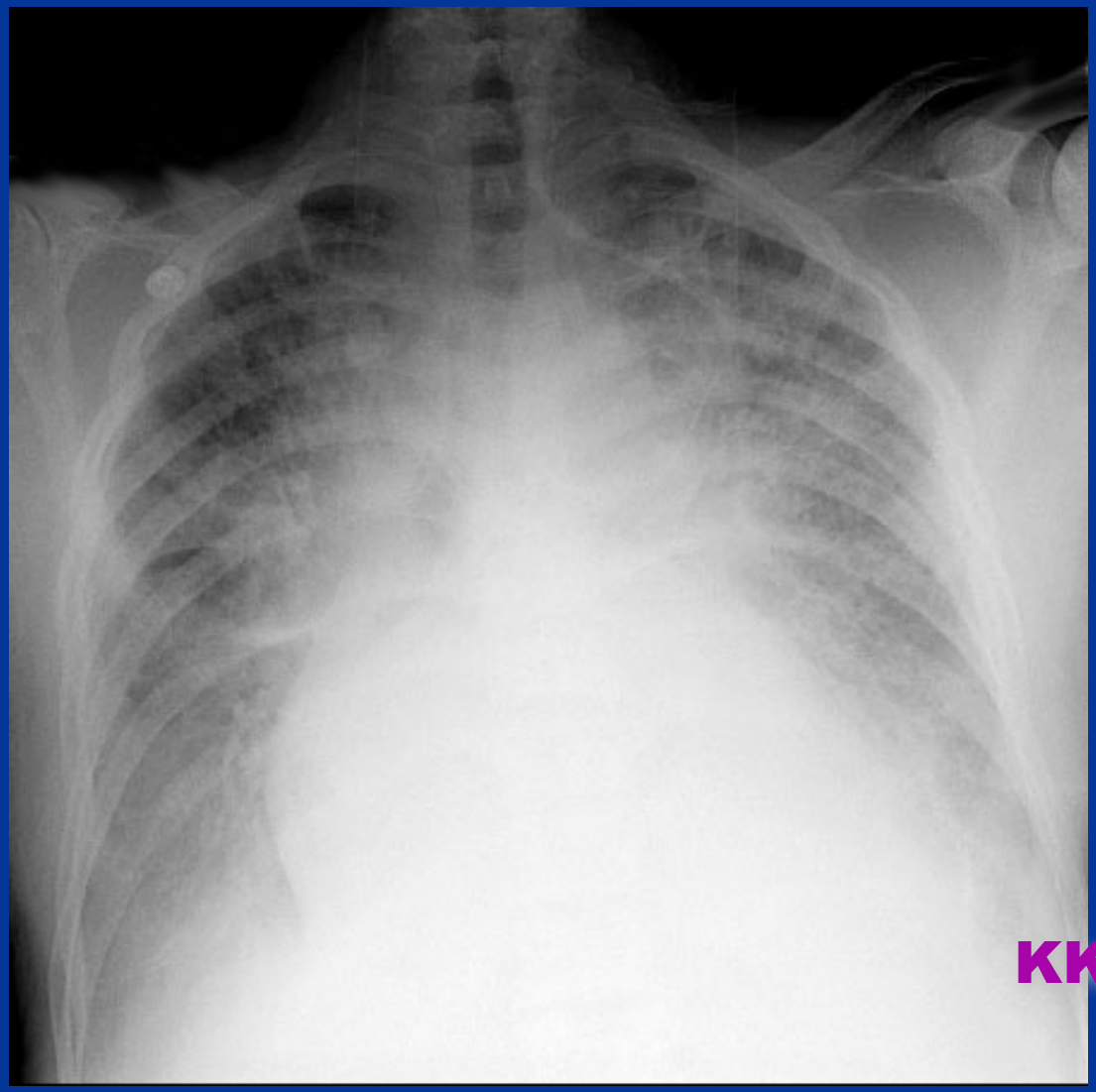


Upper lobe vessels equal to or larger than size of lower lobe vessels = Cephalization

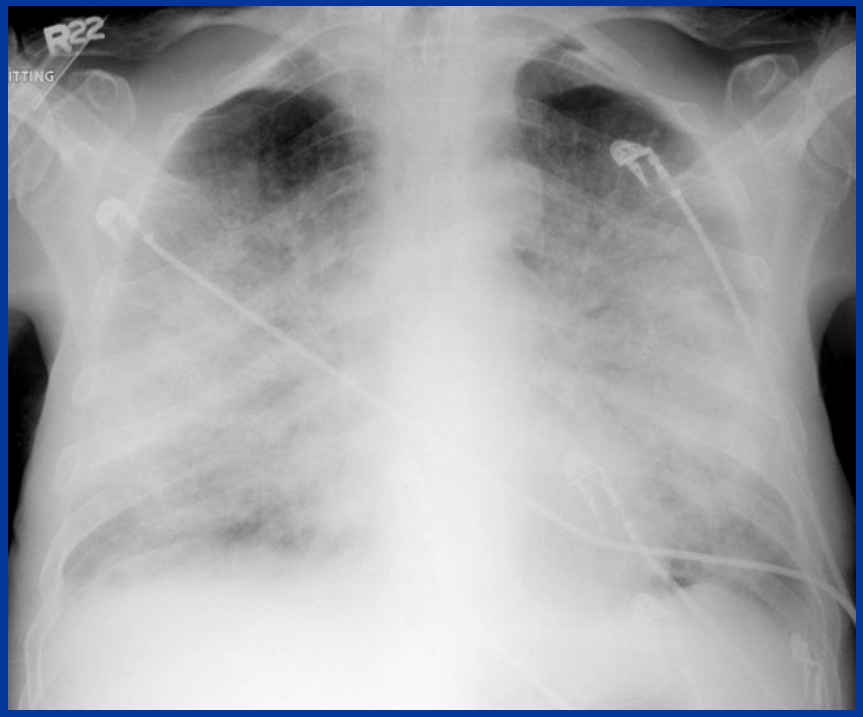
The Pulmonary Vasculature

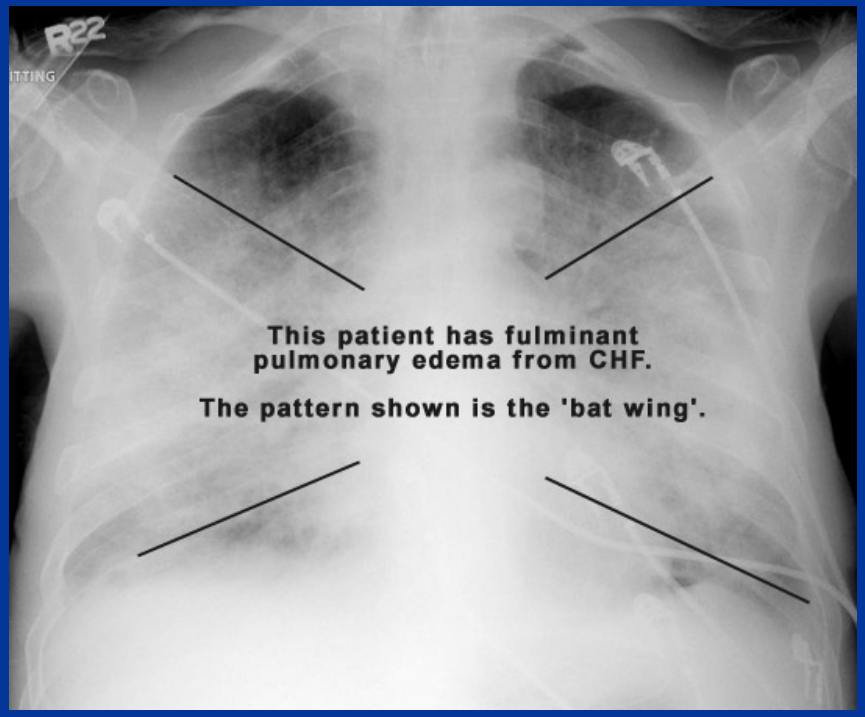
- Normal
- Pulmonary venous hypertension
- Pulmonary arterial hypertension
- Increased flow
- Decreased flow - mostly unrecognizable even when it is present

CHF

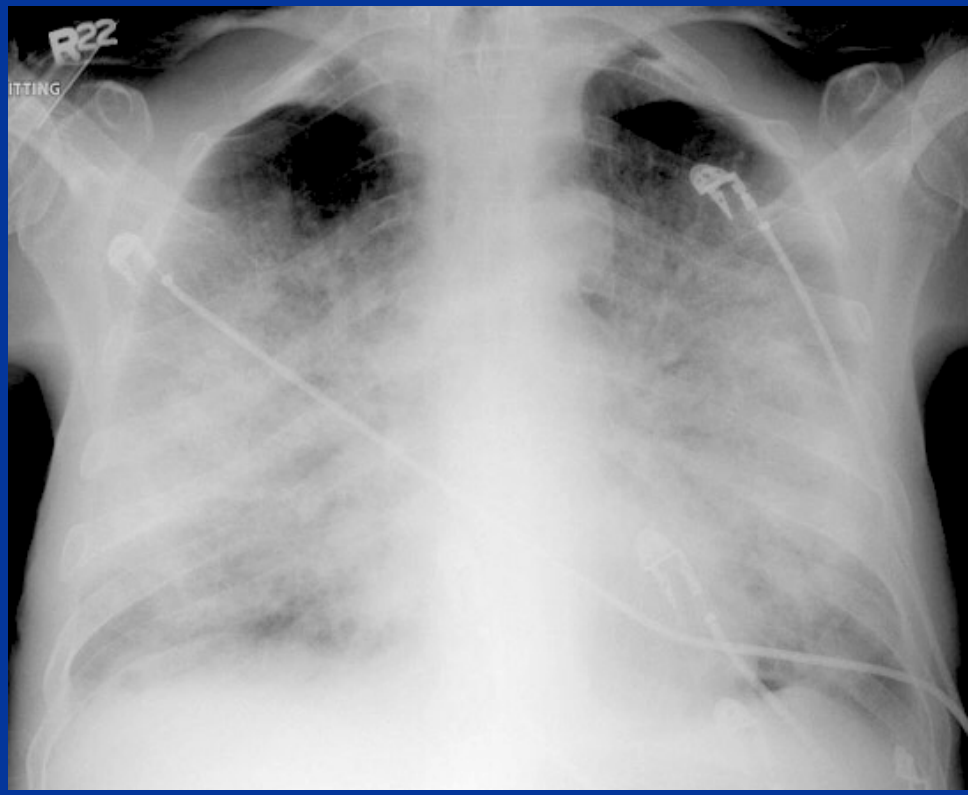


ACUTE PULMONARY EDEMA

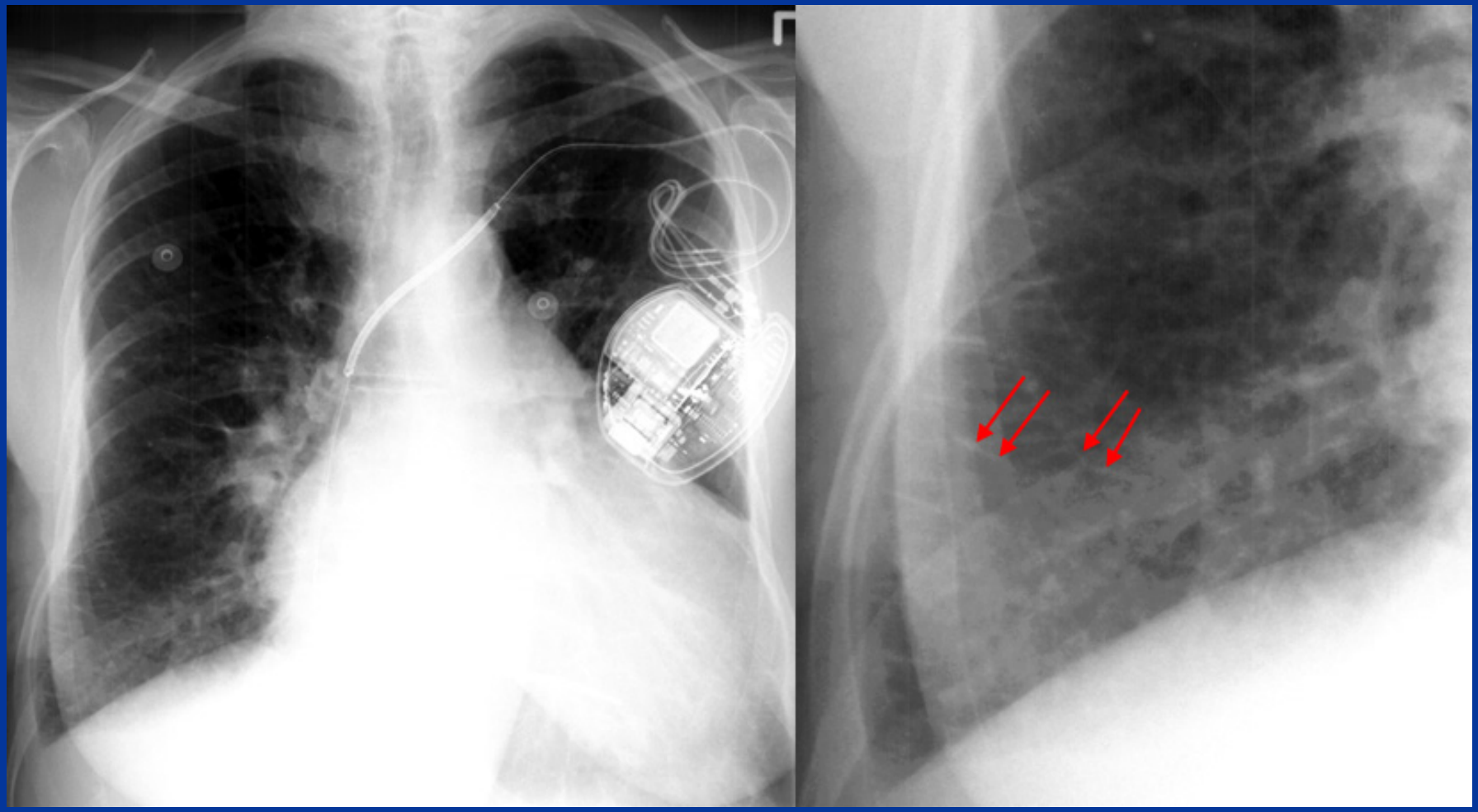




CLEARED APE



KERELY'S B-LINES



THANK YOU

DR SHARKAWY