Radiologic investigation of Chest and CVS diseases

By

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KKUH

KING SAUD UNIVERSITY

LAST UPDATE
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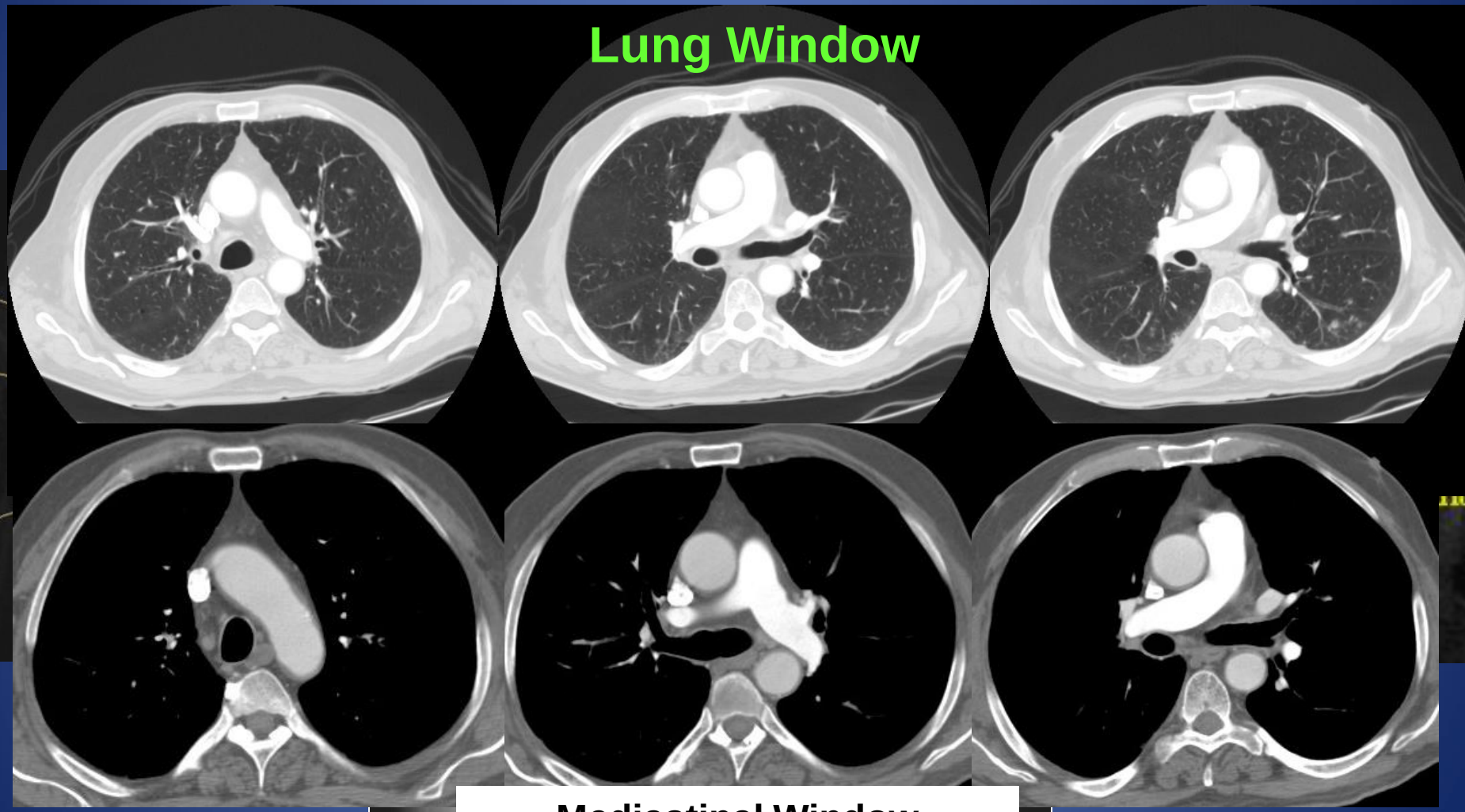
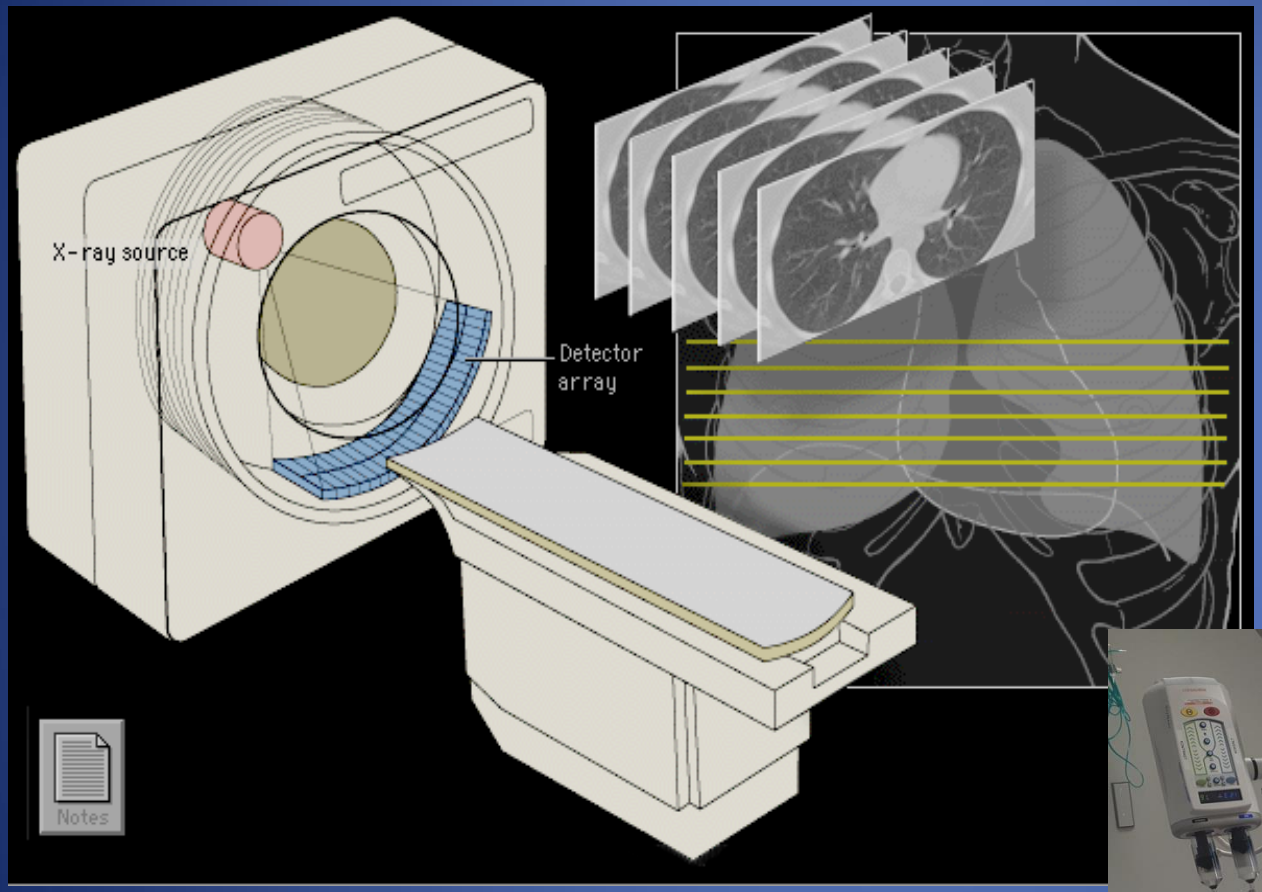
CARDIOVASCULAR IMAGING

Radiological Anatomy of the Chest



CT (COMPUTED TOMOGRAPHY)



Ascending Aorta

Pulmonary Trunk

Mediastinal Fat & Fascia

Right Lung

Left Lung

Superior Vena Cava

Right Pulmonary Artery

Left Pulmonary Artery

Right Primary (Main) Bronchus

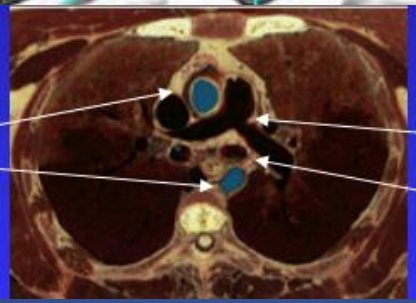
Esophagus

Left Primary (Main) Bronchus

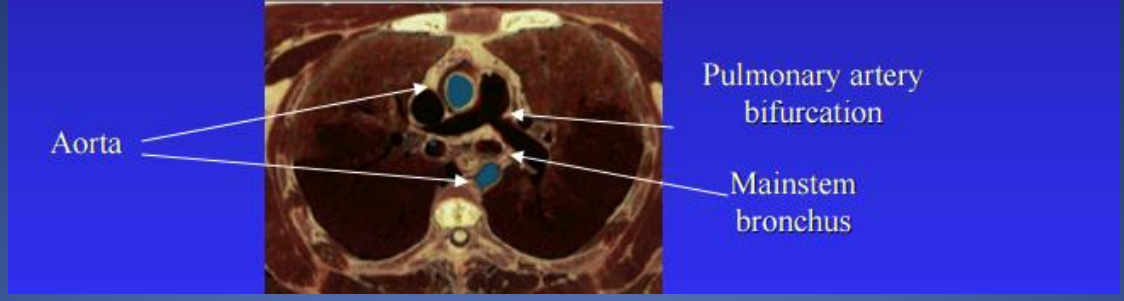
Azygos Vein

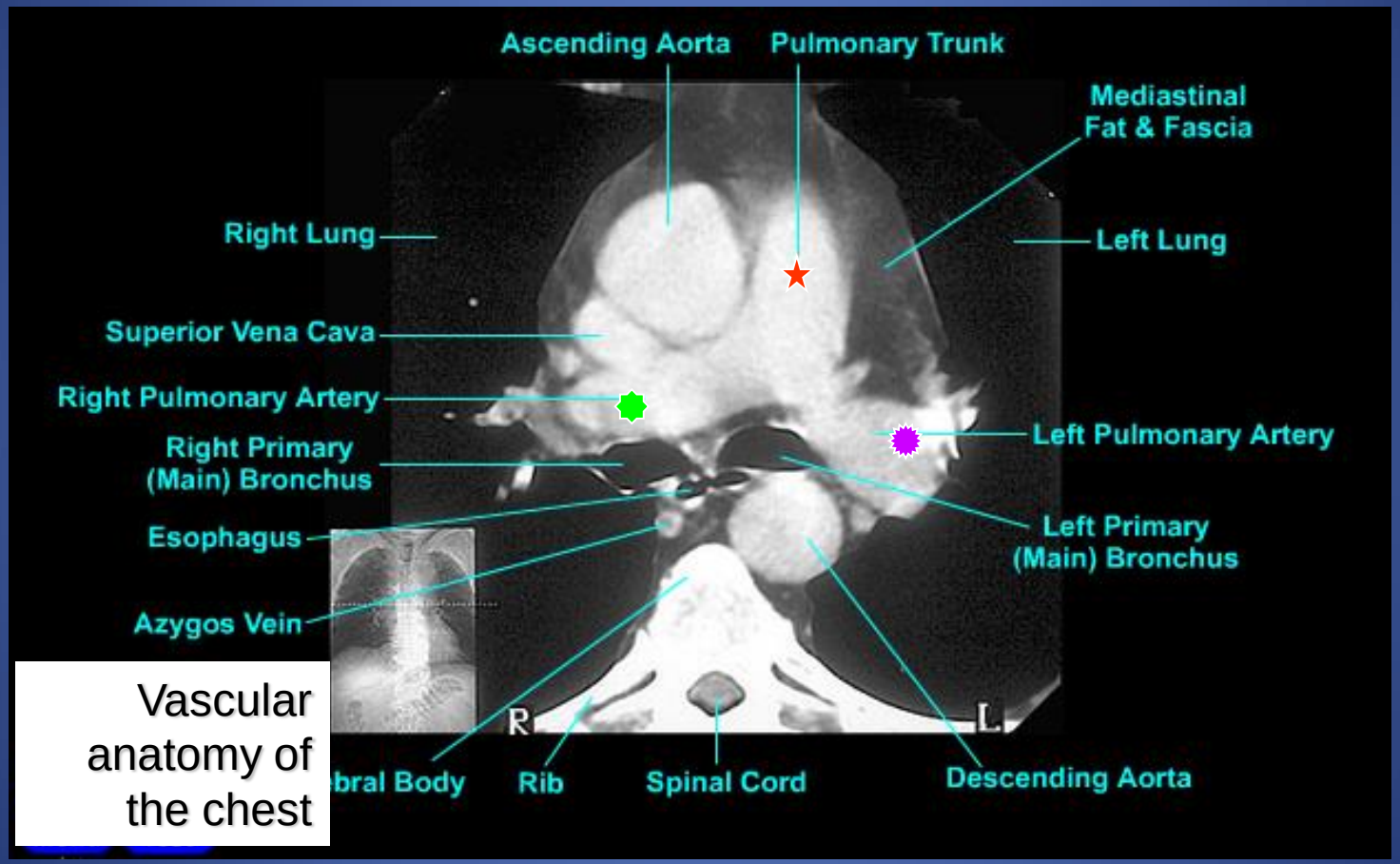
Vertebr

rta

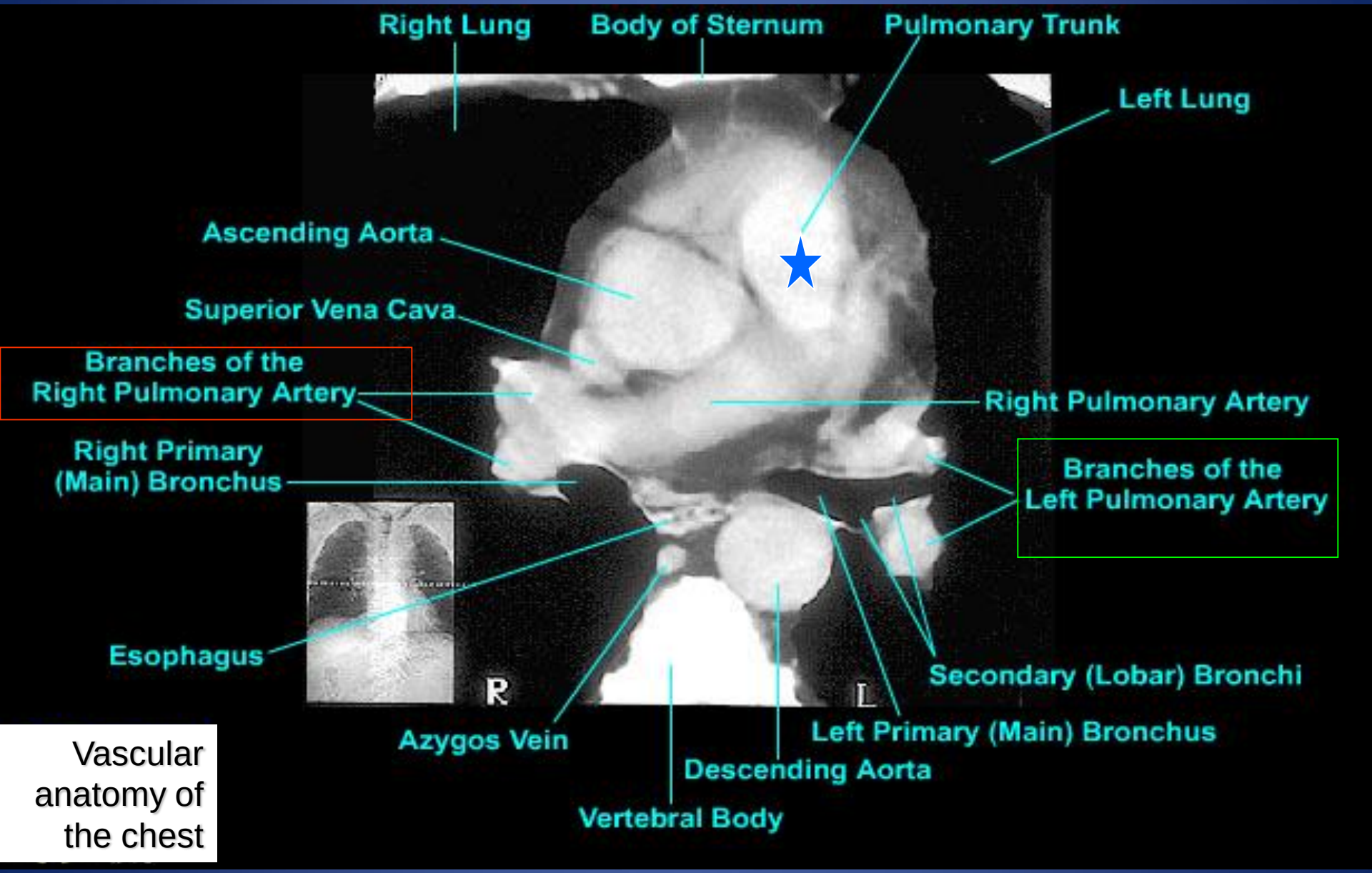


Vascular anatomy of the chest



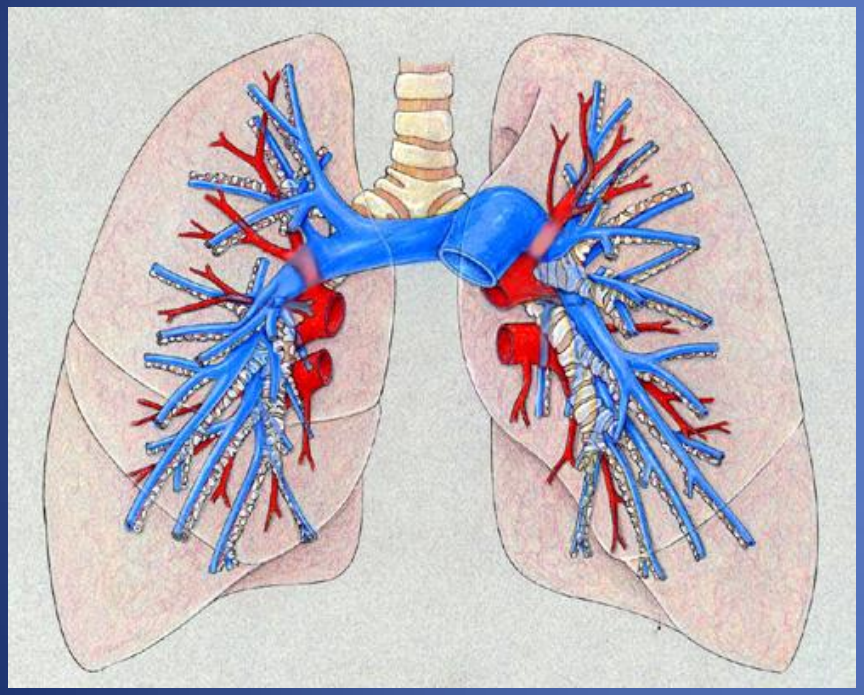


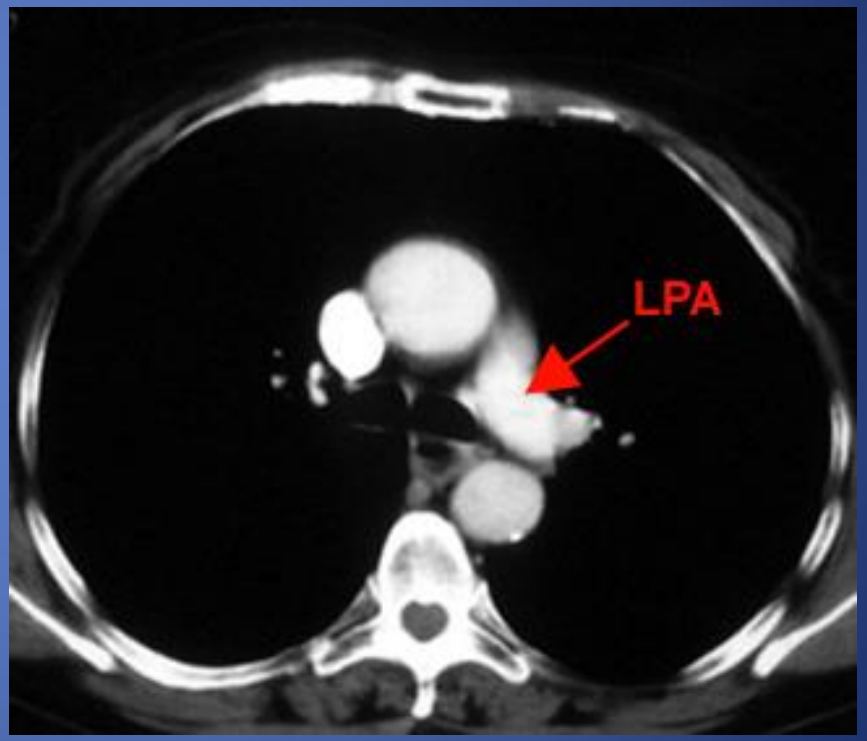
Vascular anatomy of the chest

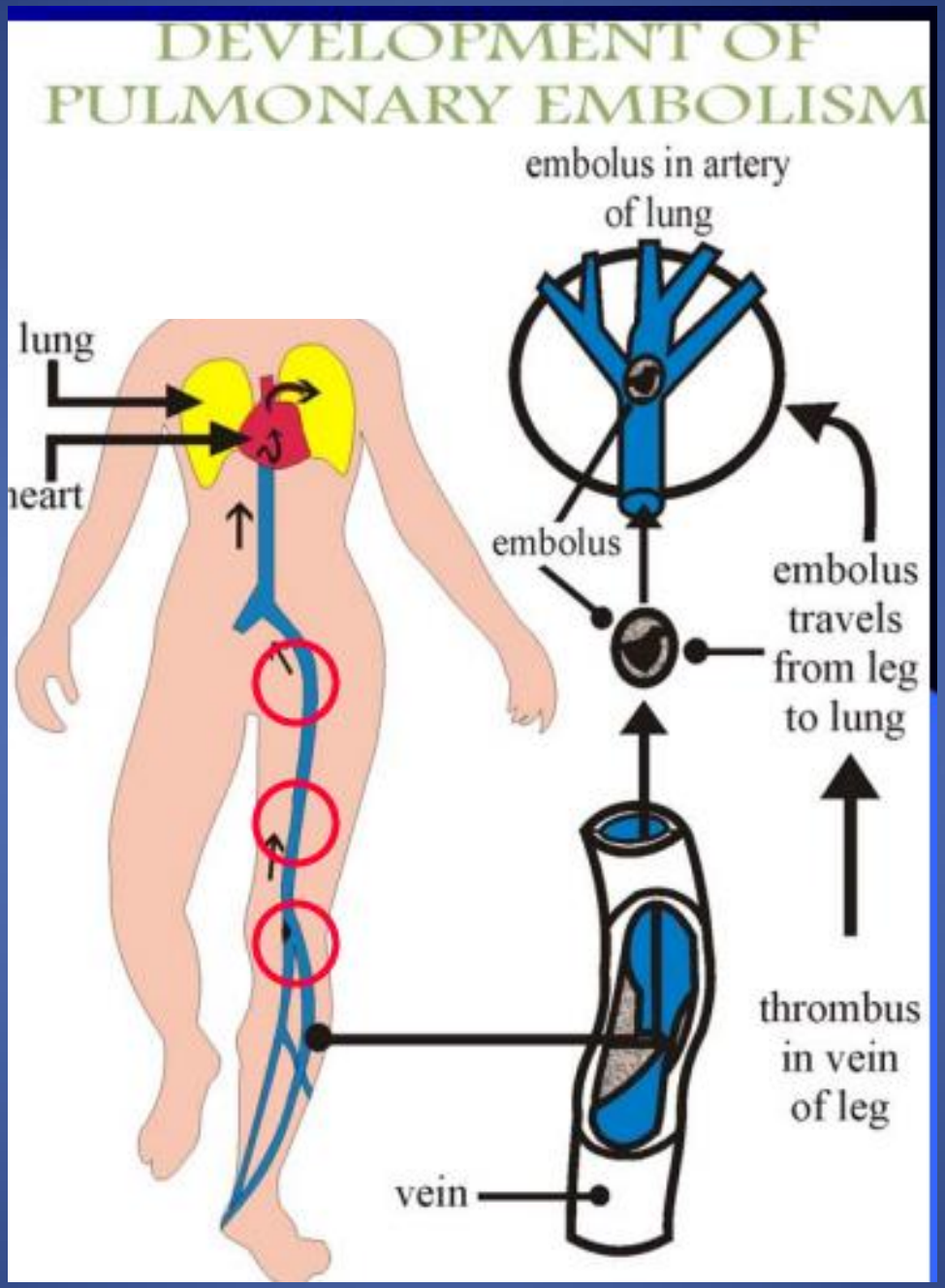


Vascular anatomy of the chest

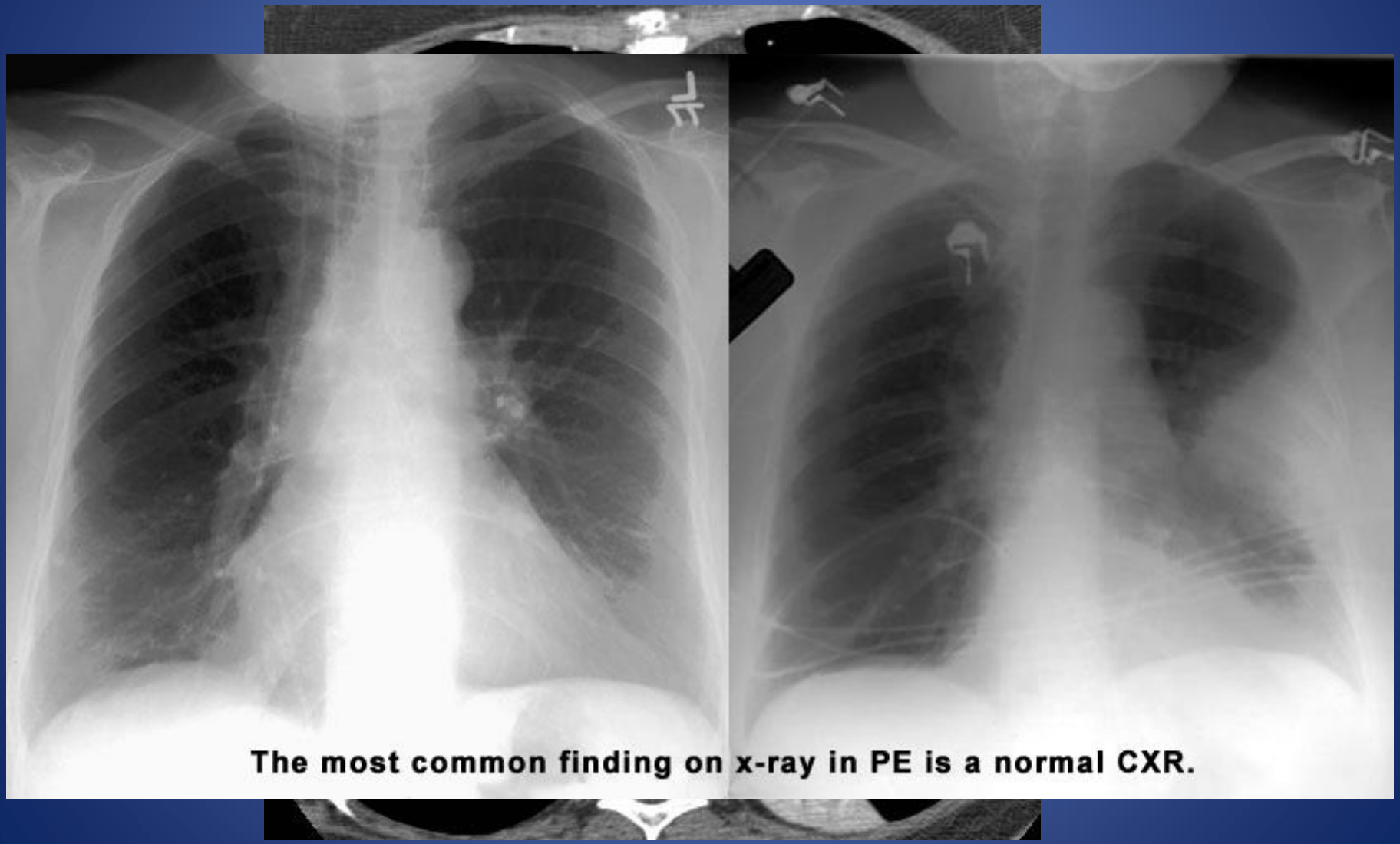
Pulmonary artery



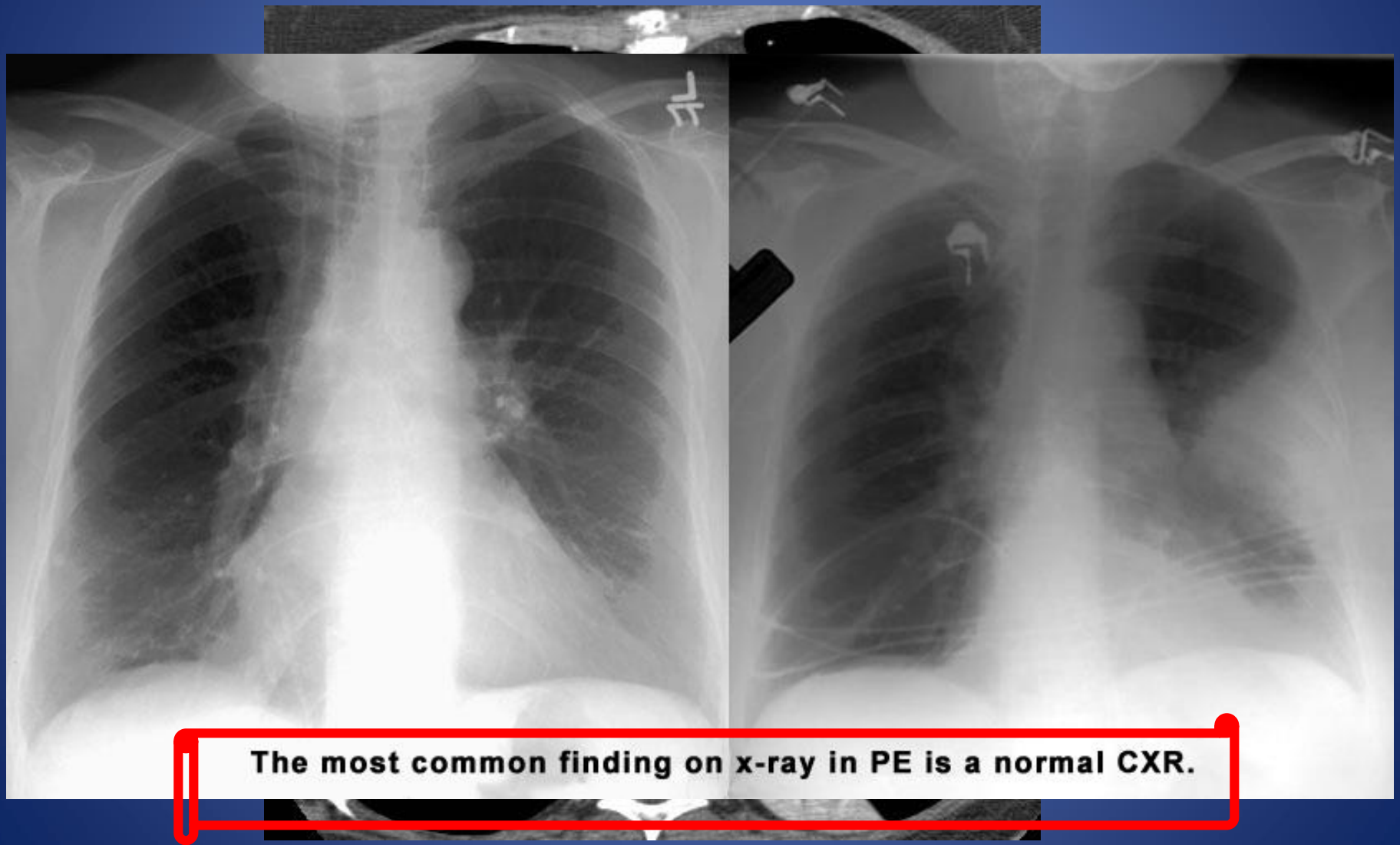



DEVELOPMENT OF
PULMONARY EMBOLISM
embolus in artery
of lung
lung
heart
embolus
embolus
travels
from leg
to lung
thrombus
in vein
of leg
vein

Pulmonary embolism

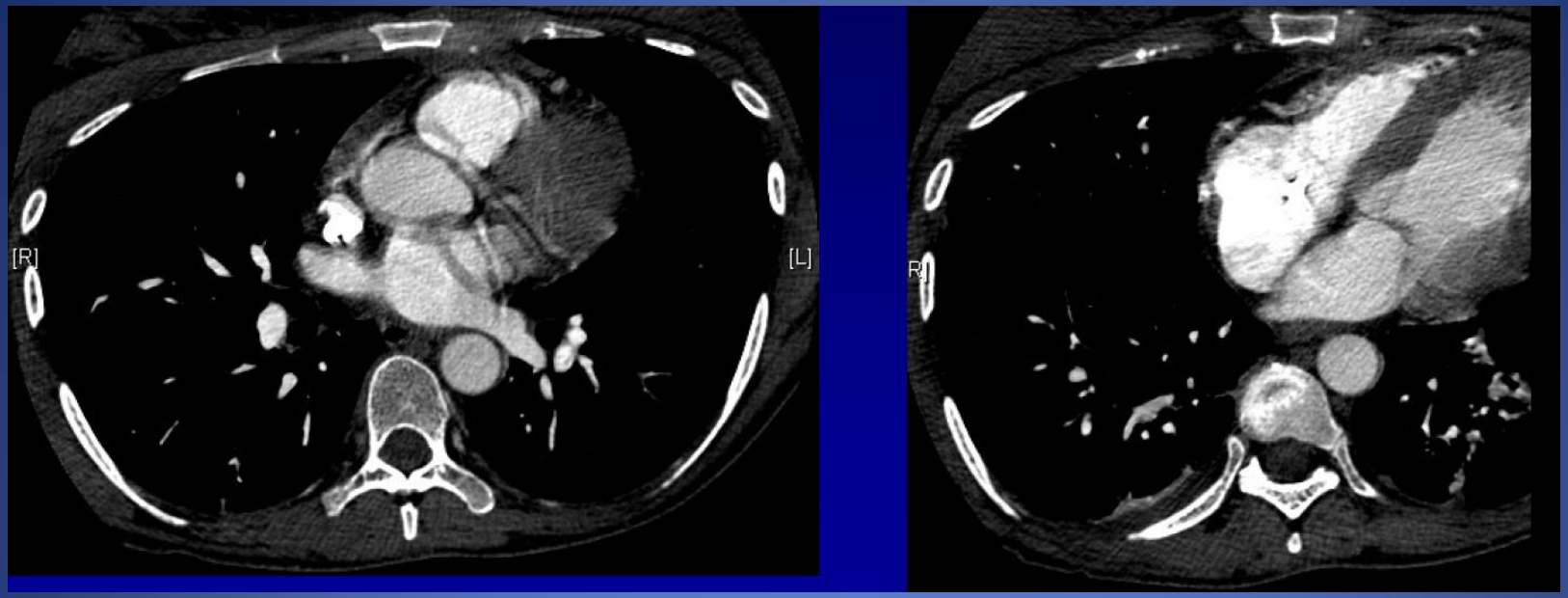


Pulmonary embolism



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

THE GOLD STANDARD FOR DIAGNOSIS OF PE IS CTA


[R]
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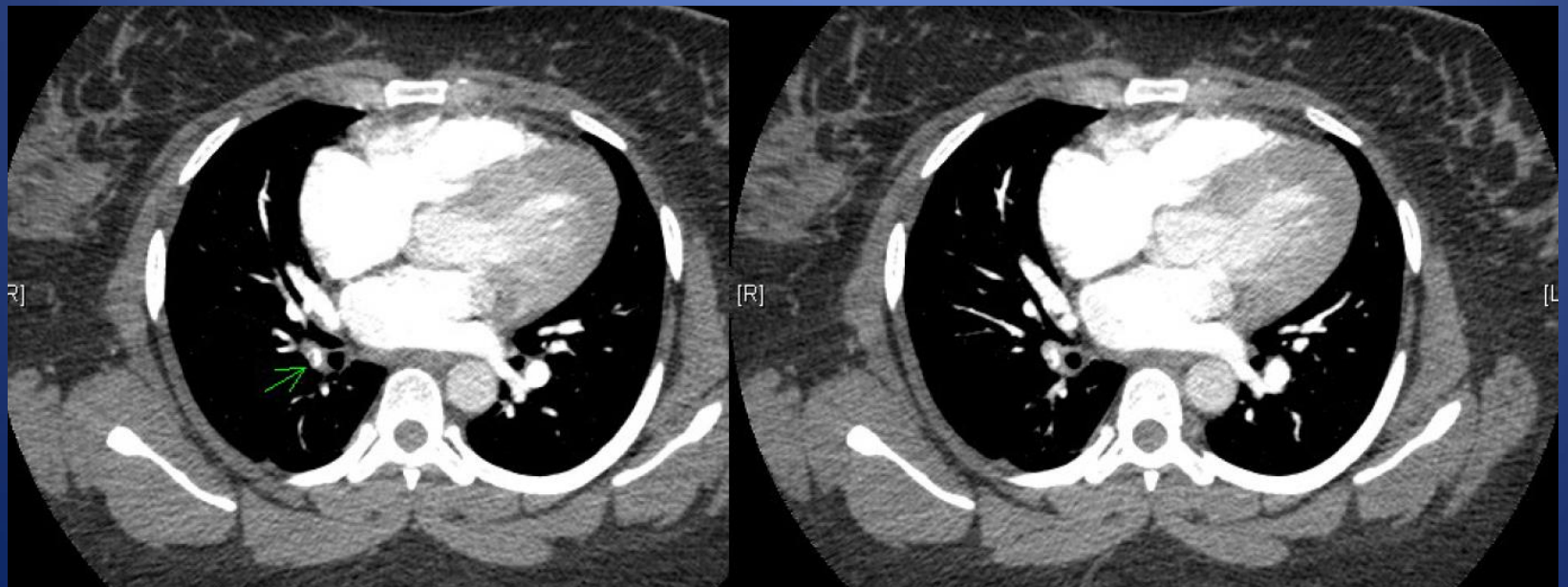
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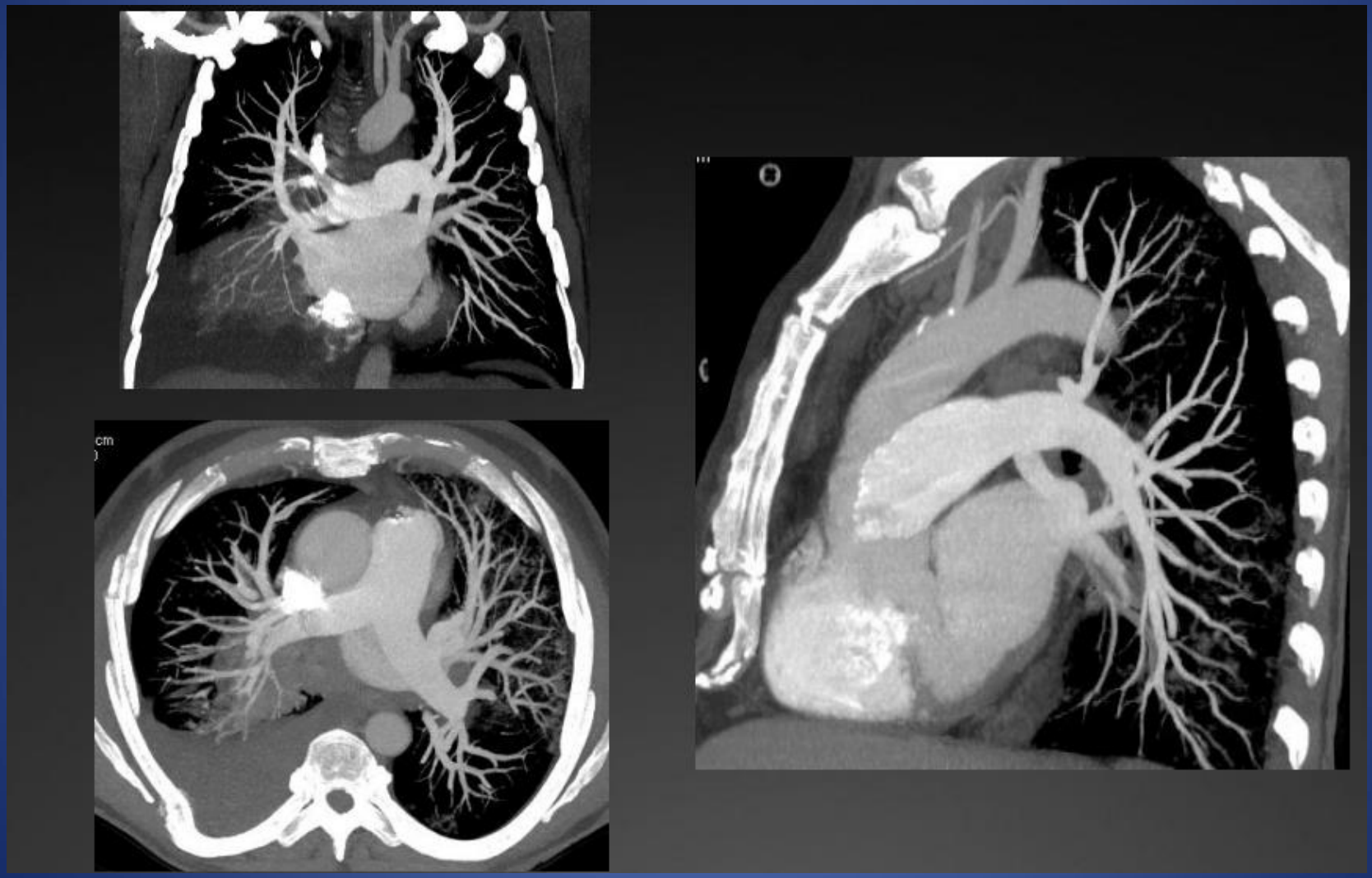
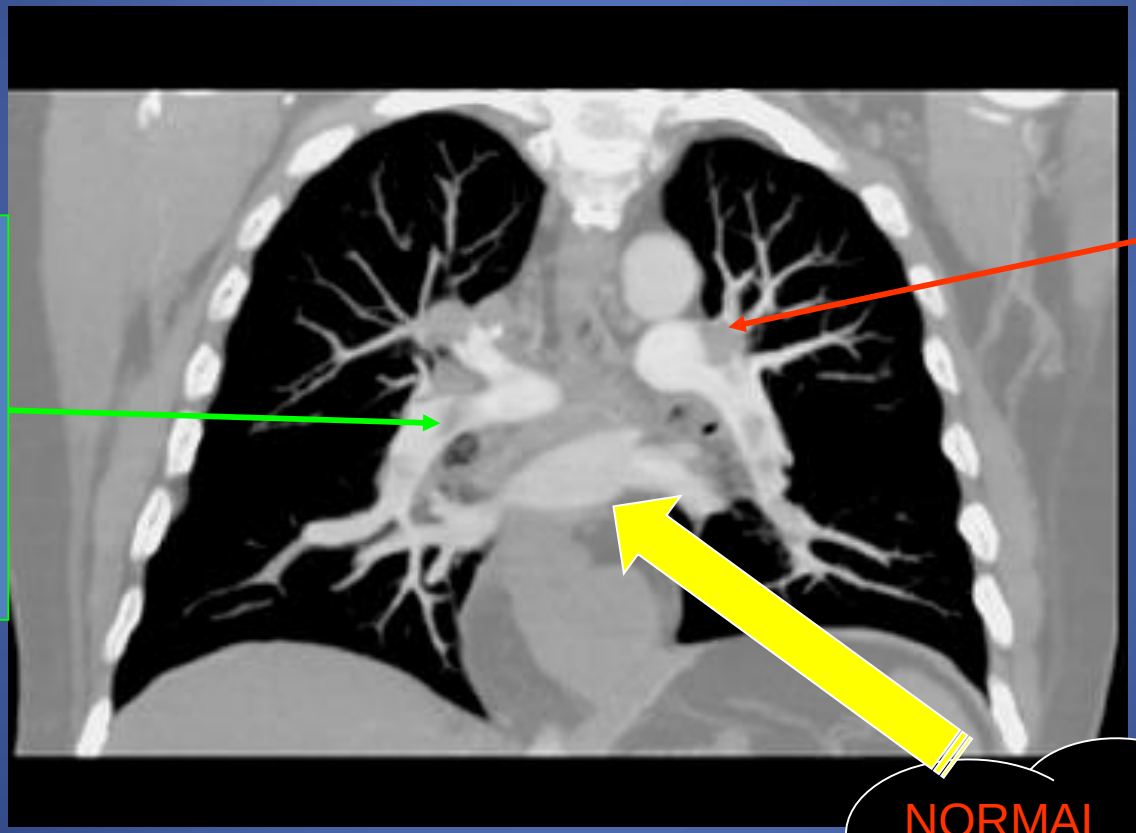
CTA PULMONARY VASCULATURE



CTA
(Coronal Reconstruction)

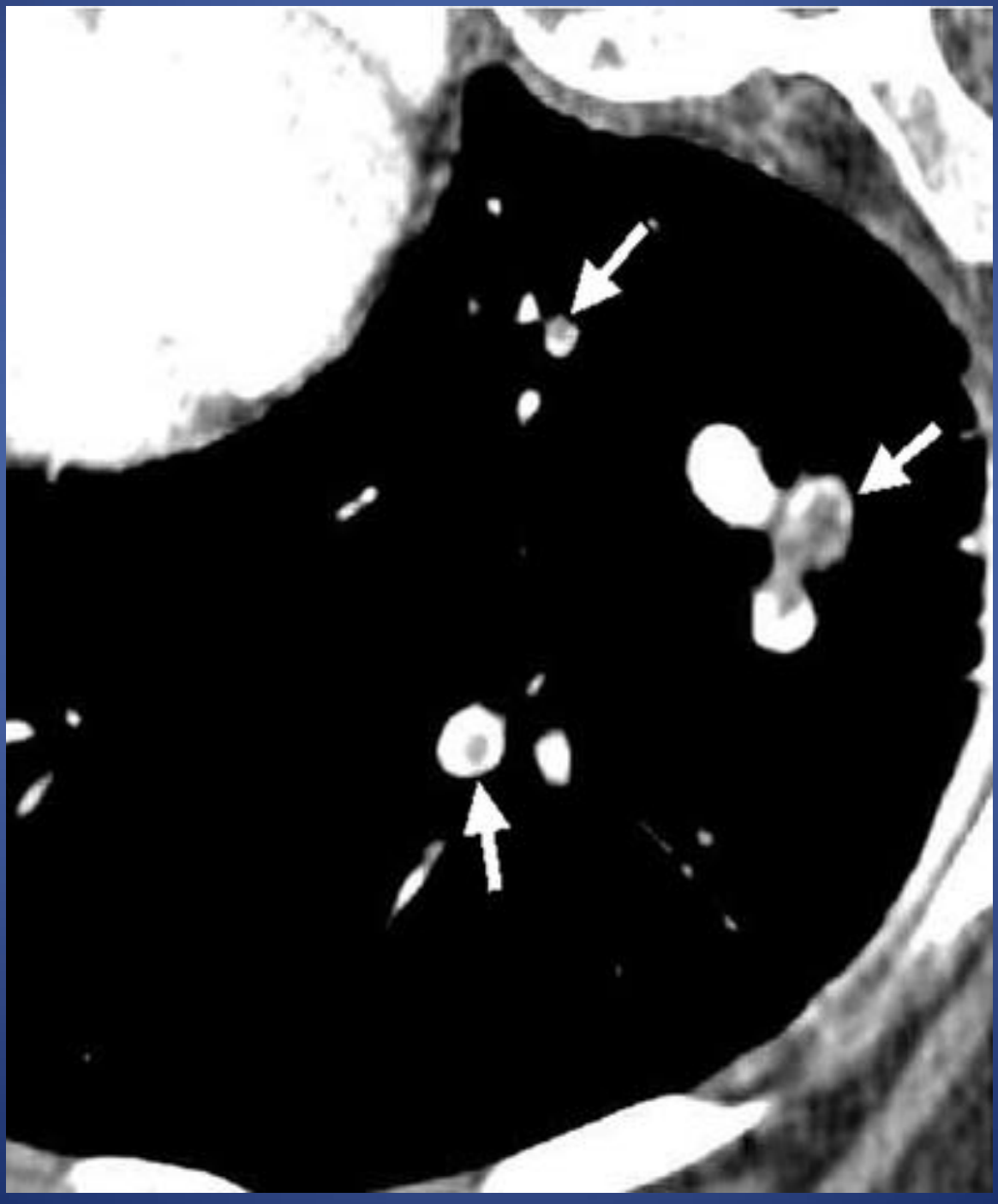


Embolus in descending right pulmonary artery

Embolus in left main pulmonary artery

NORMAL HOMOGENOUS FILLING OF THE VESSLES

CT Agiogram



AORTIC ARCH ANATOMY

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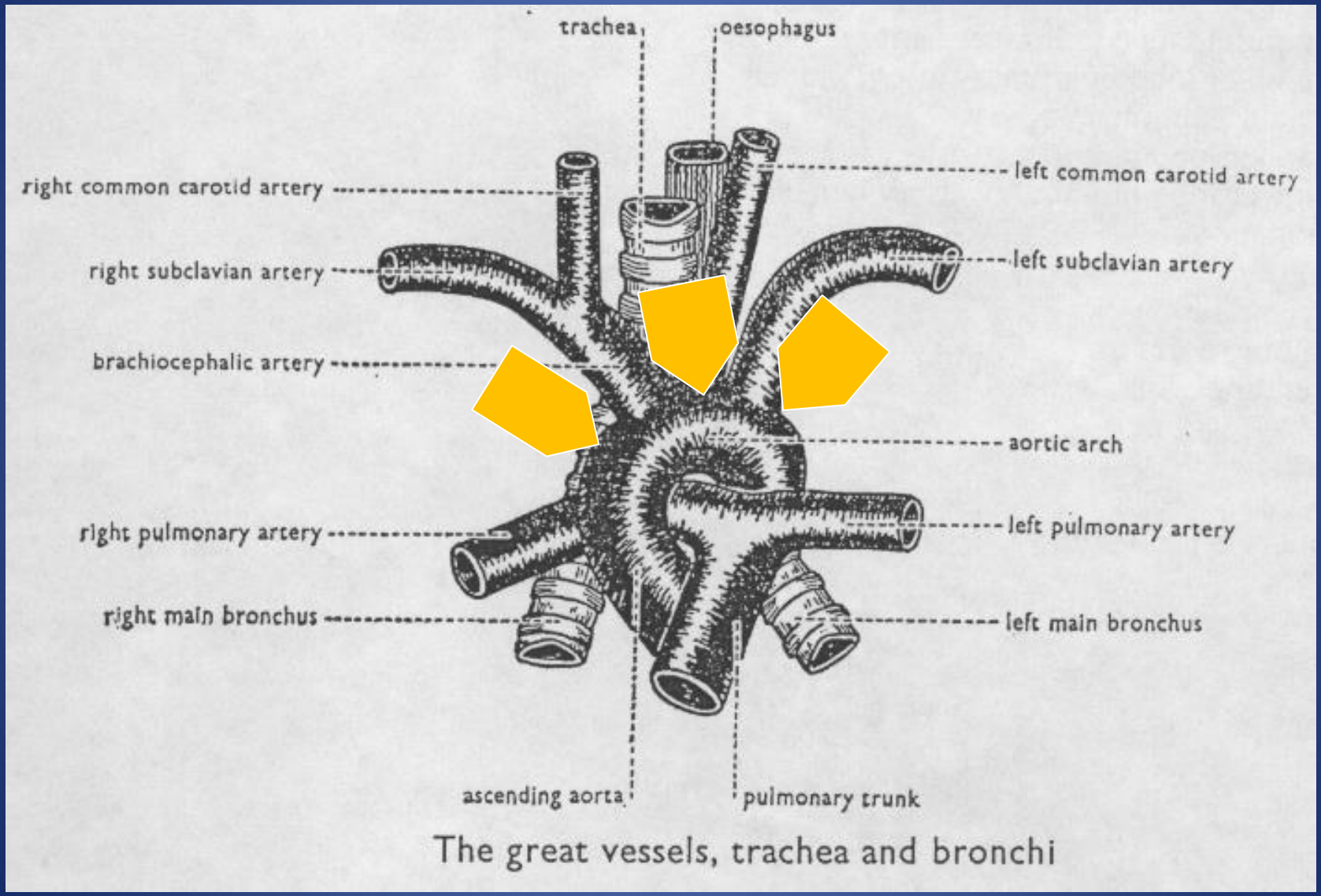
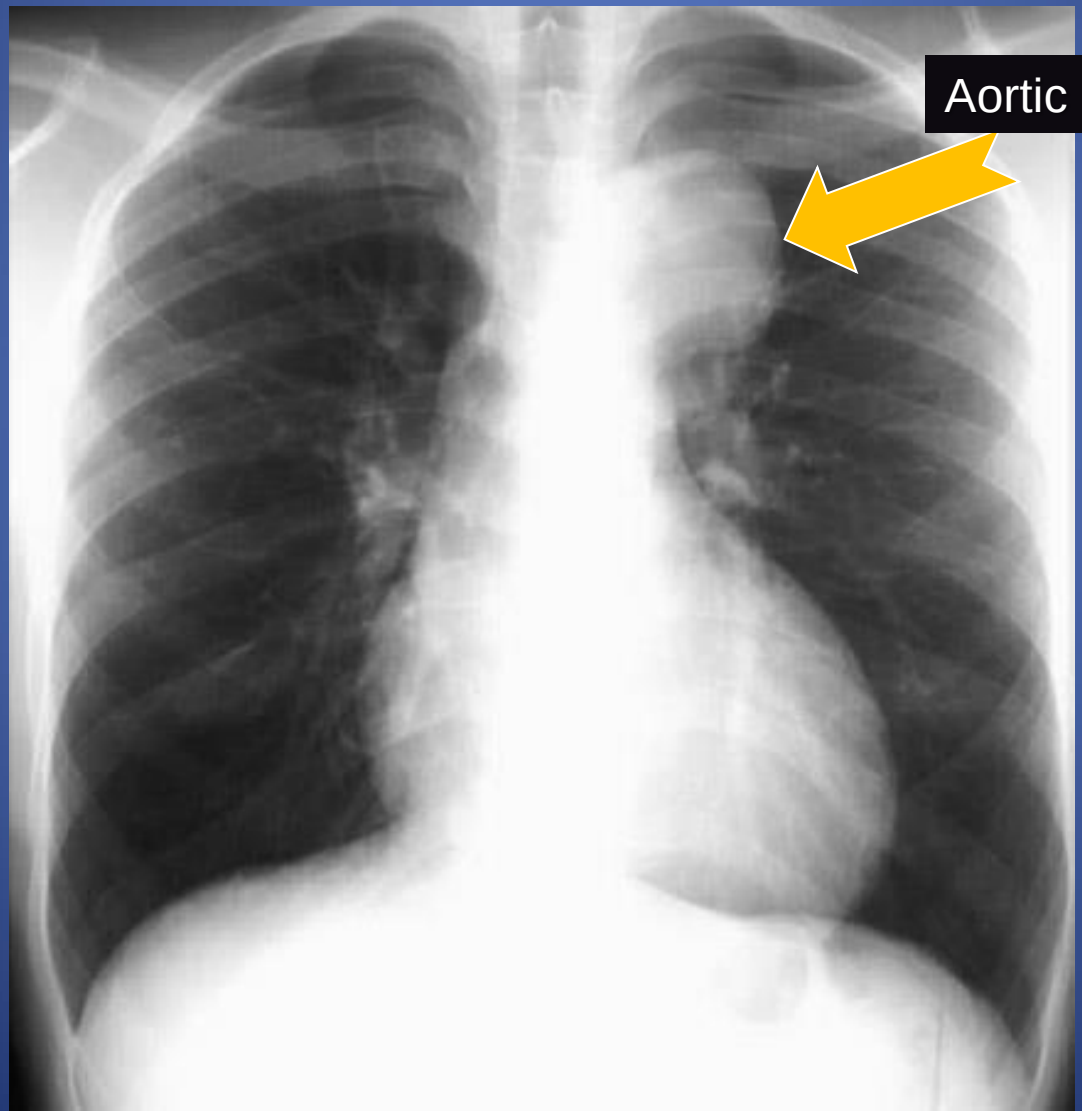
The Aortic arch/great vessels



The great vessels, trachea and bronchi

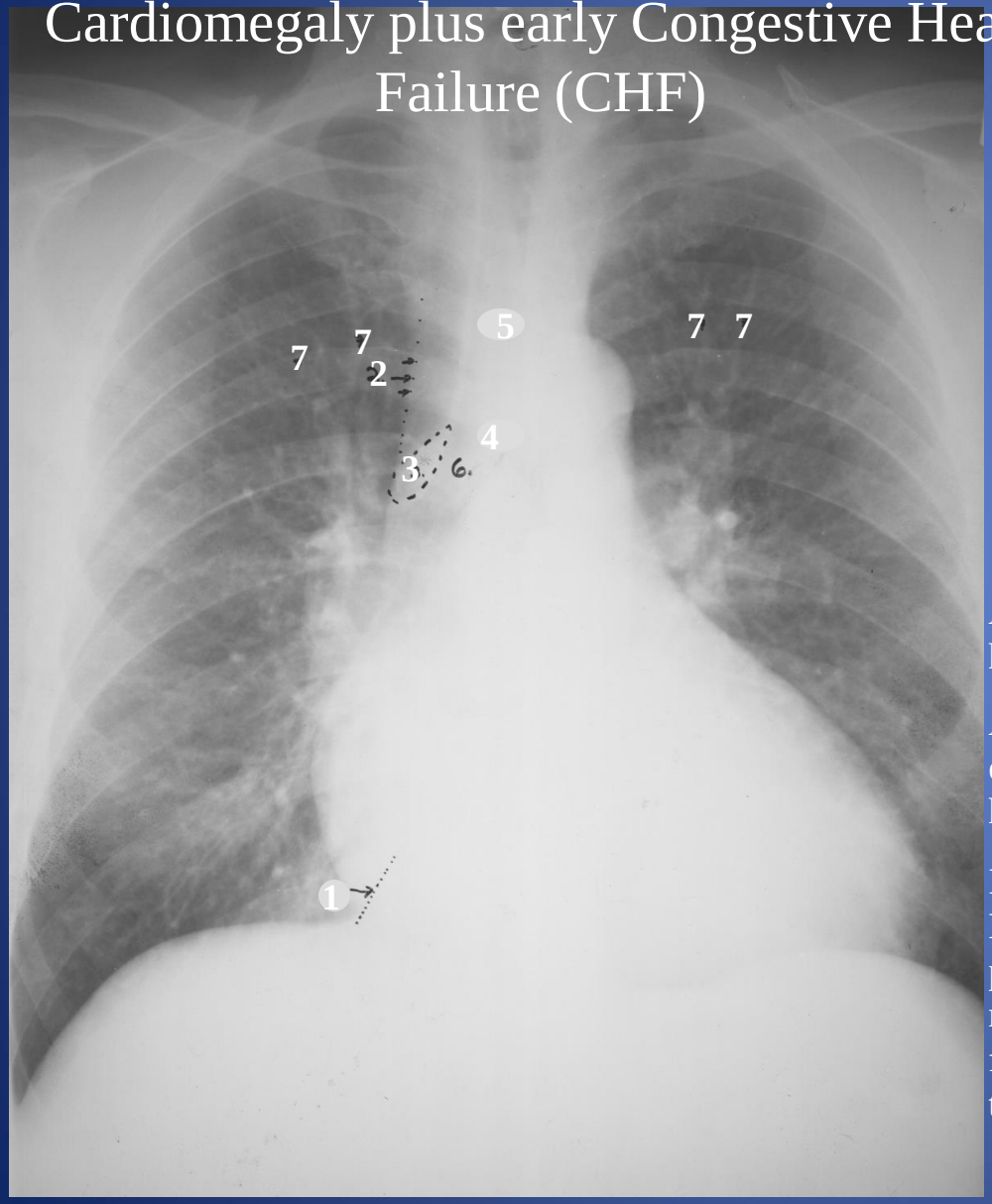
"Man's Anatomy by Tobias & Arnold

Aortic aneurysm



Heart and Vessels

Cardiomegaly plus early Congestive Heart Failure (CHF)



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

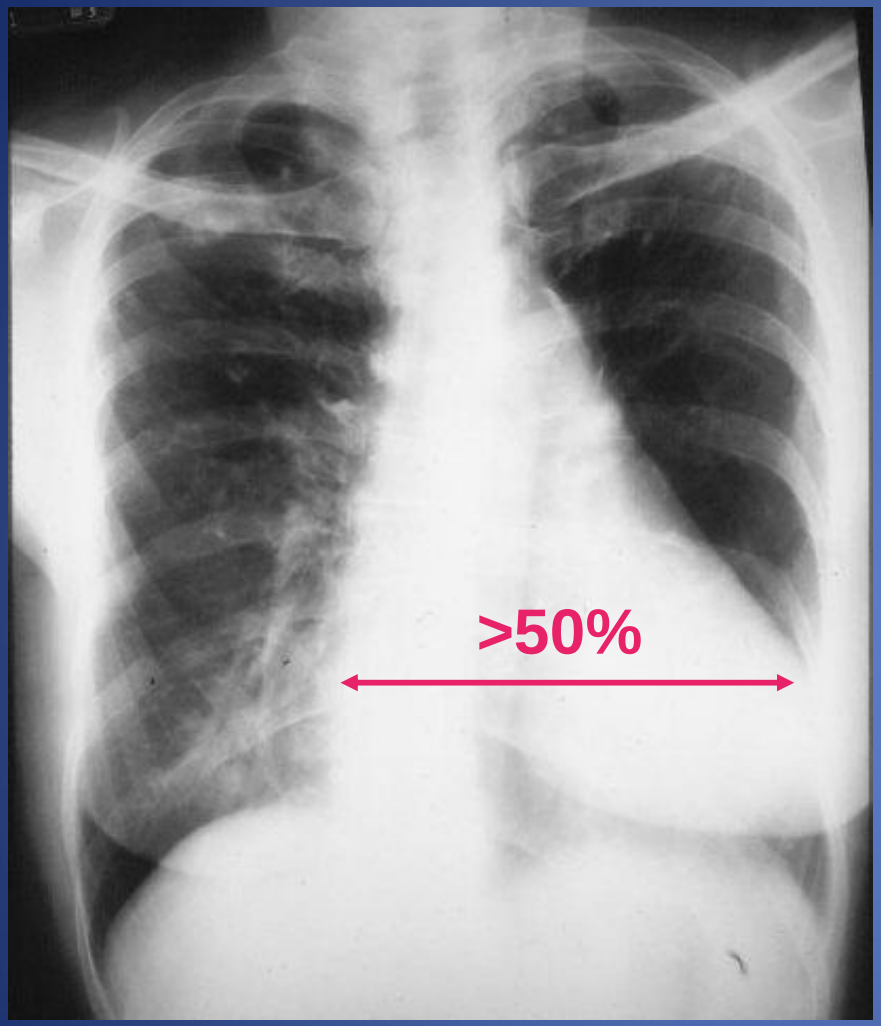
One of the easiest observations to make is something you already know: the cardio-thoracic ratio which is the widest diameter of the heart compared to the widest internal diameter of the rib cage

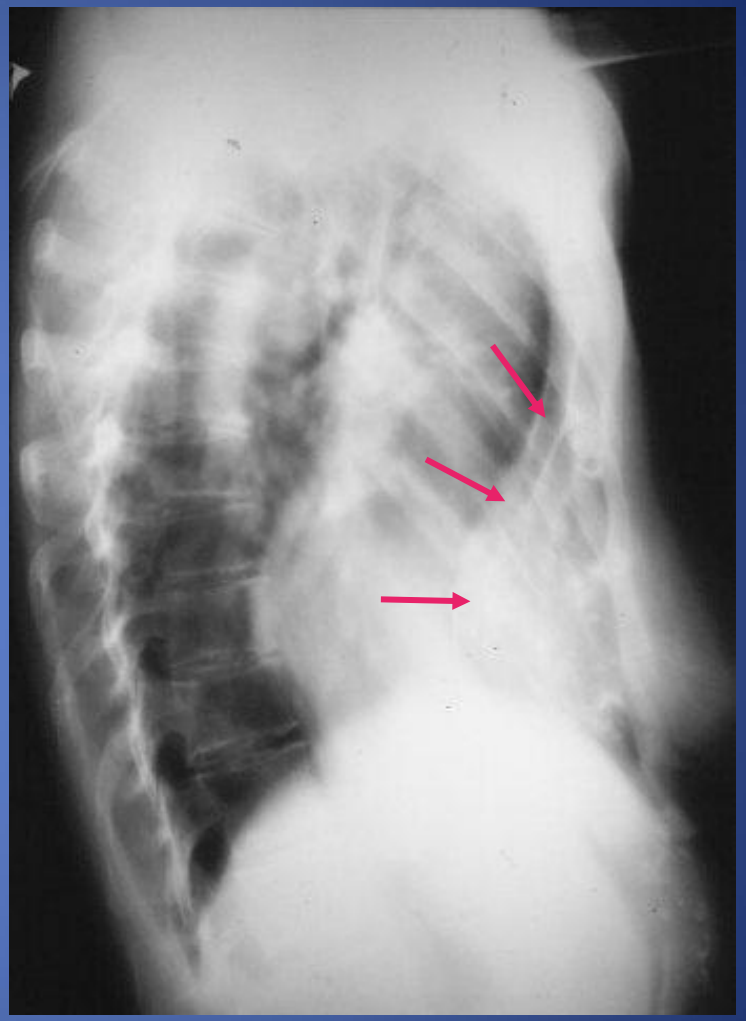
<50%

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



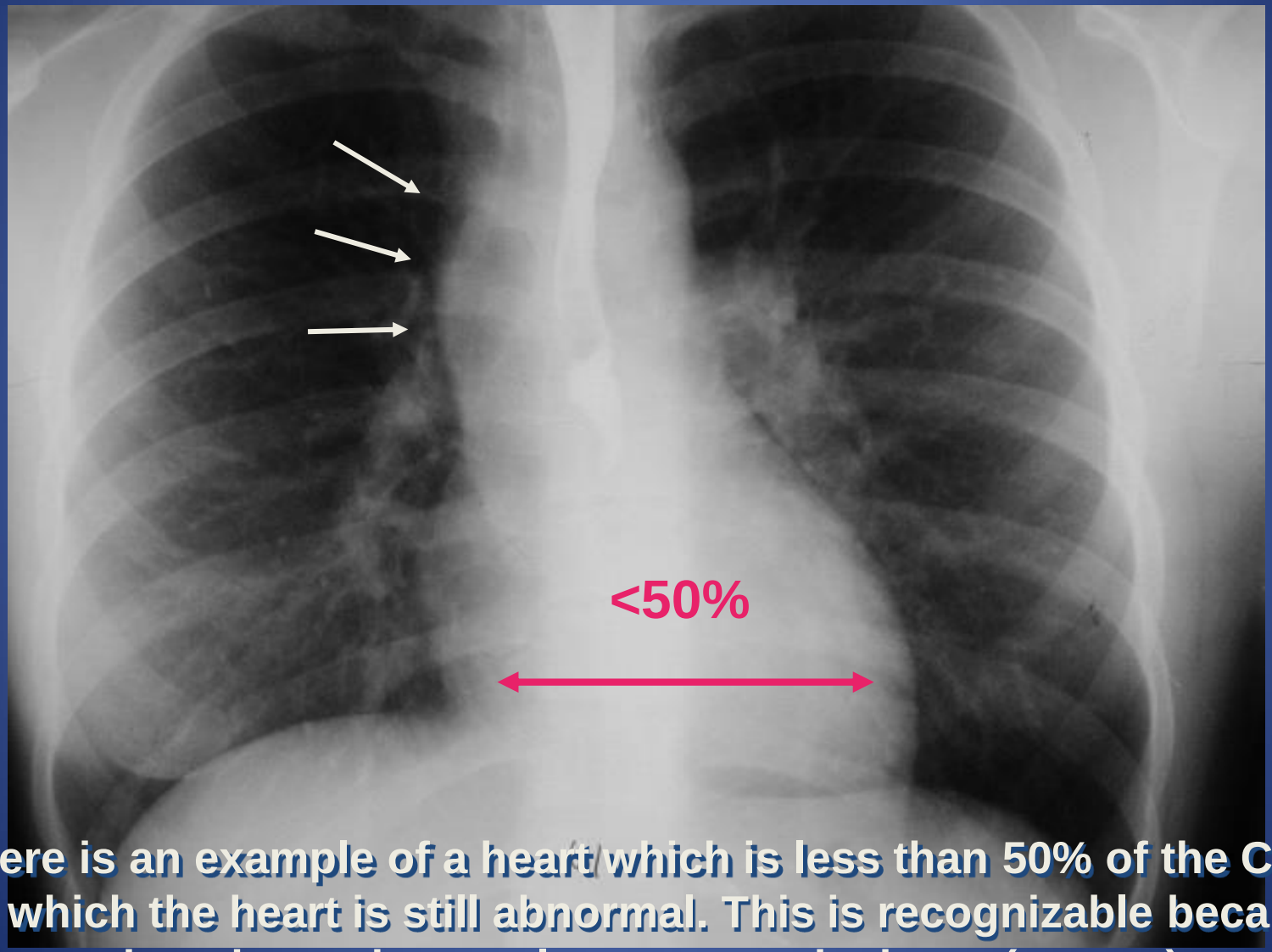


Here is a heart that is larger than 50% of the cardiothoracic ratio, but it is still a normal heart. This is because there is an extracardiac cause for the apparent cardiomegaly. On the lateral film, the arrows point to the inward displacement of the lower sternum in a pectus excavatum deformity.

Sometimes, CTR is less than 50%

But Heart is Abnormal

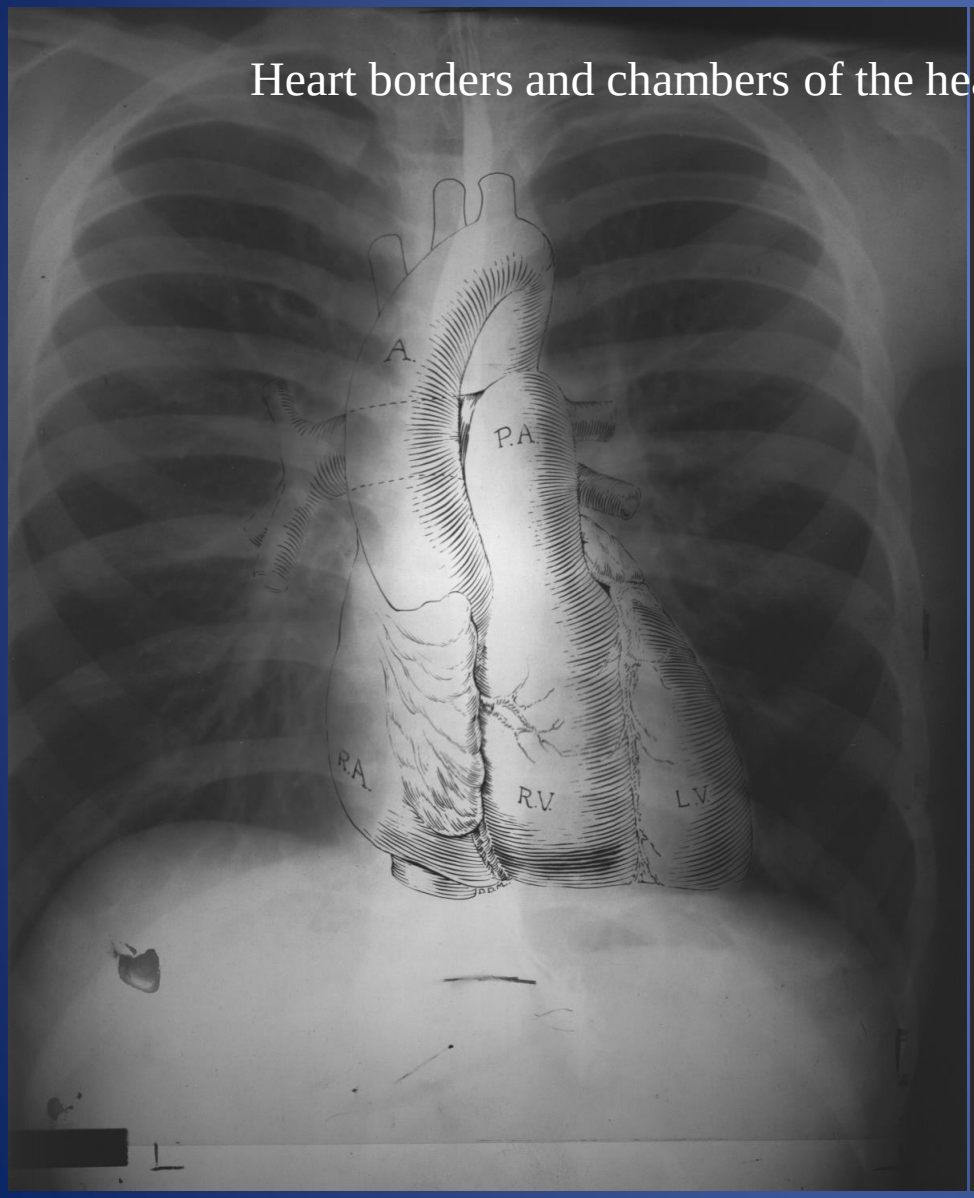
- Obstruction to outflow of the ventricles
  - Ventricular hypertrophy
- Must look at cardiac contours



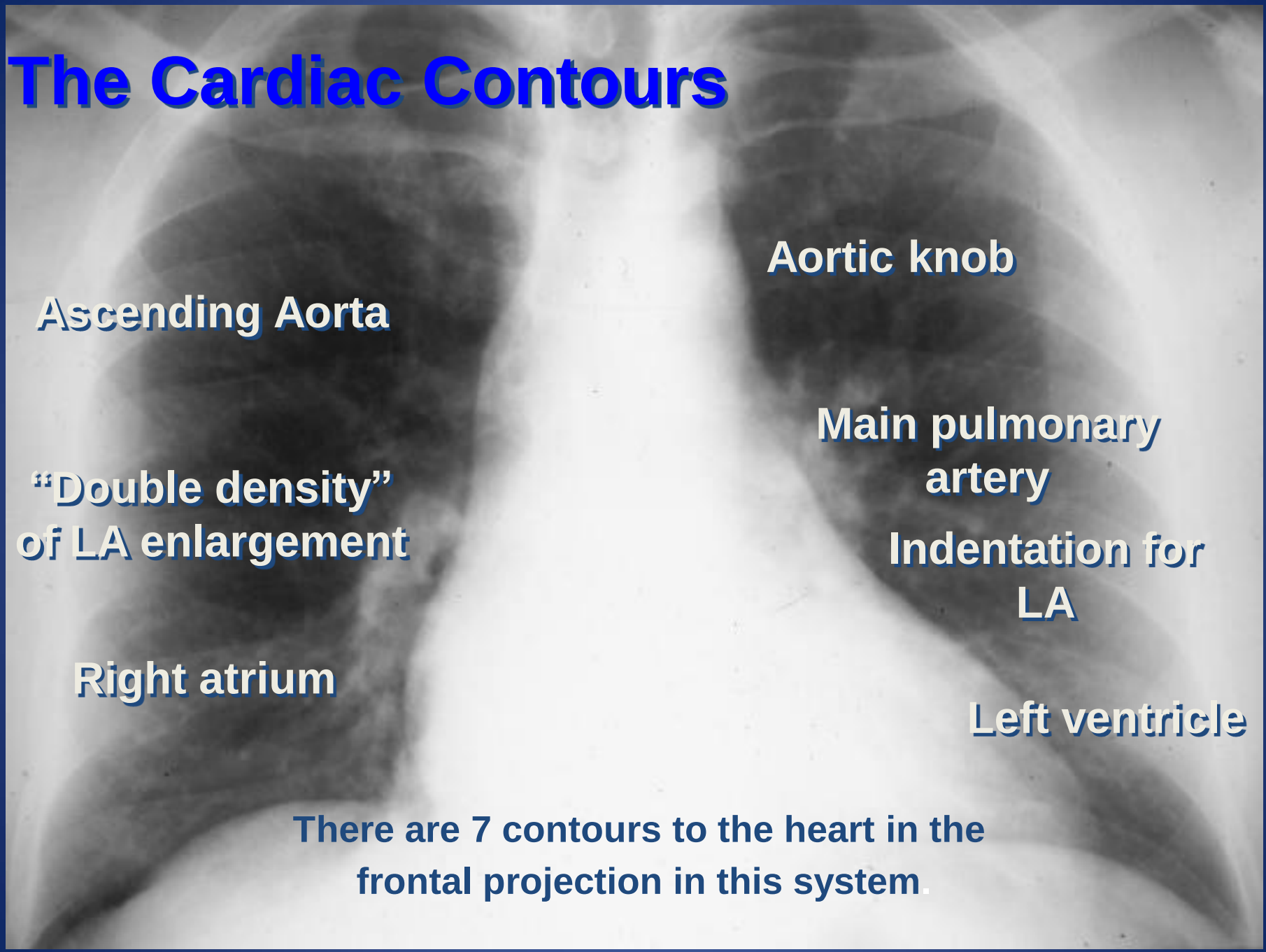
Here is an example of a heart which is less than 50% of the CTR in which the heart is still abnormal. This is recognizable because there is an abnormal contour to the heart (arrows).

Anatomy on Normal Chest X-Ray

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

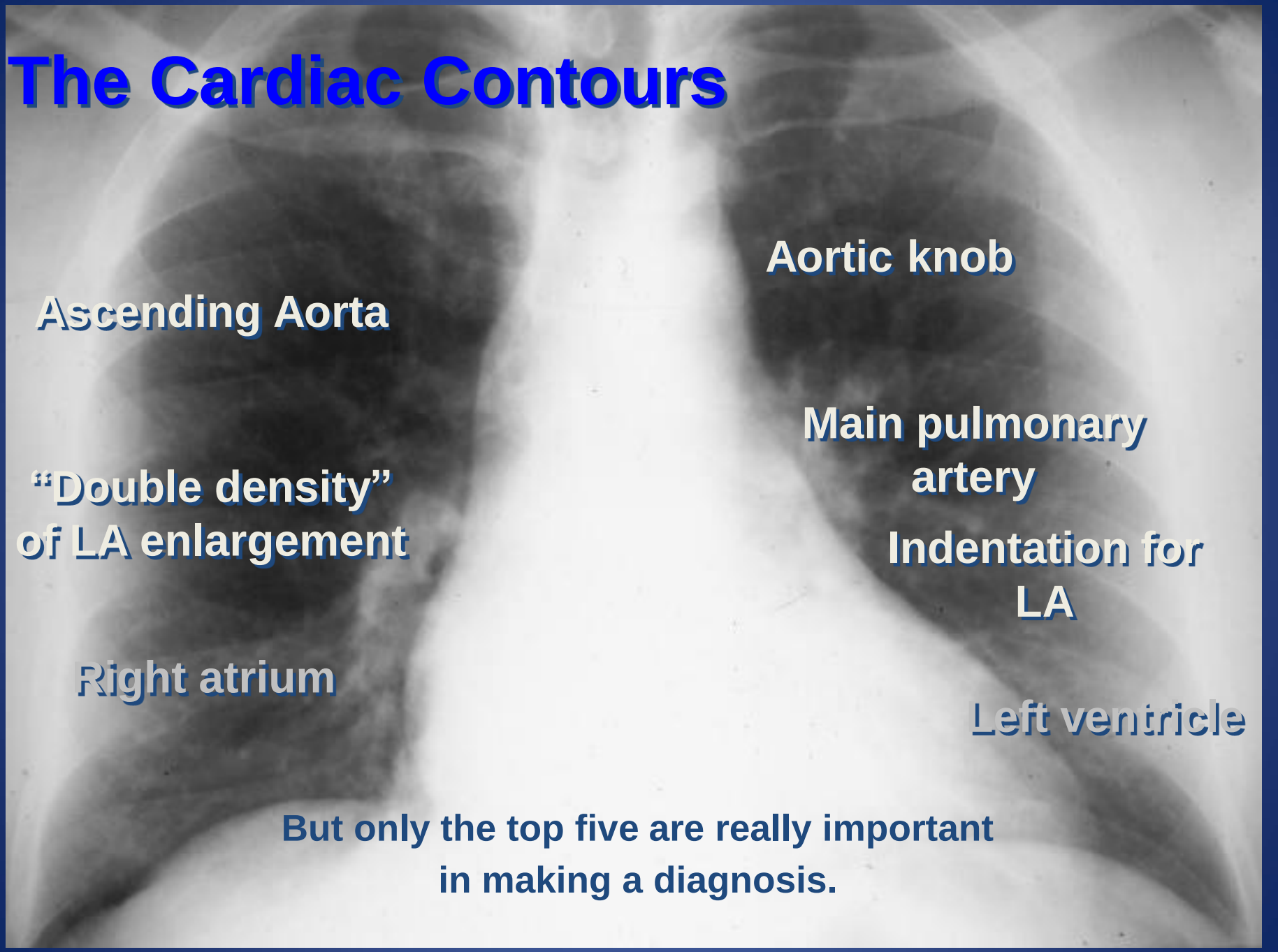


The Cardiac Contours



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

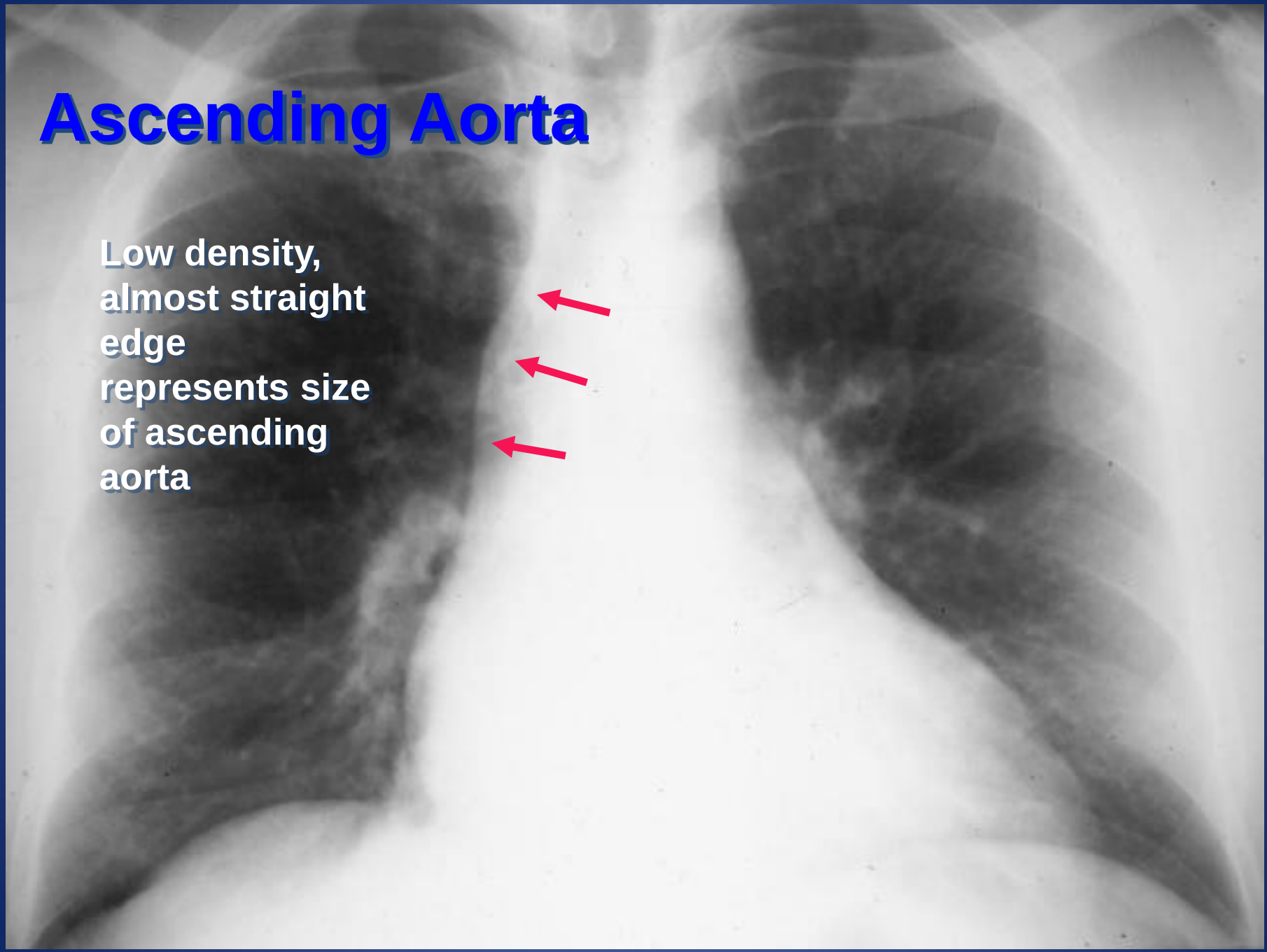
The Cardiac Contours



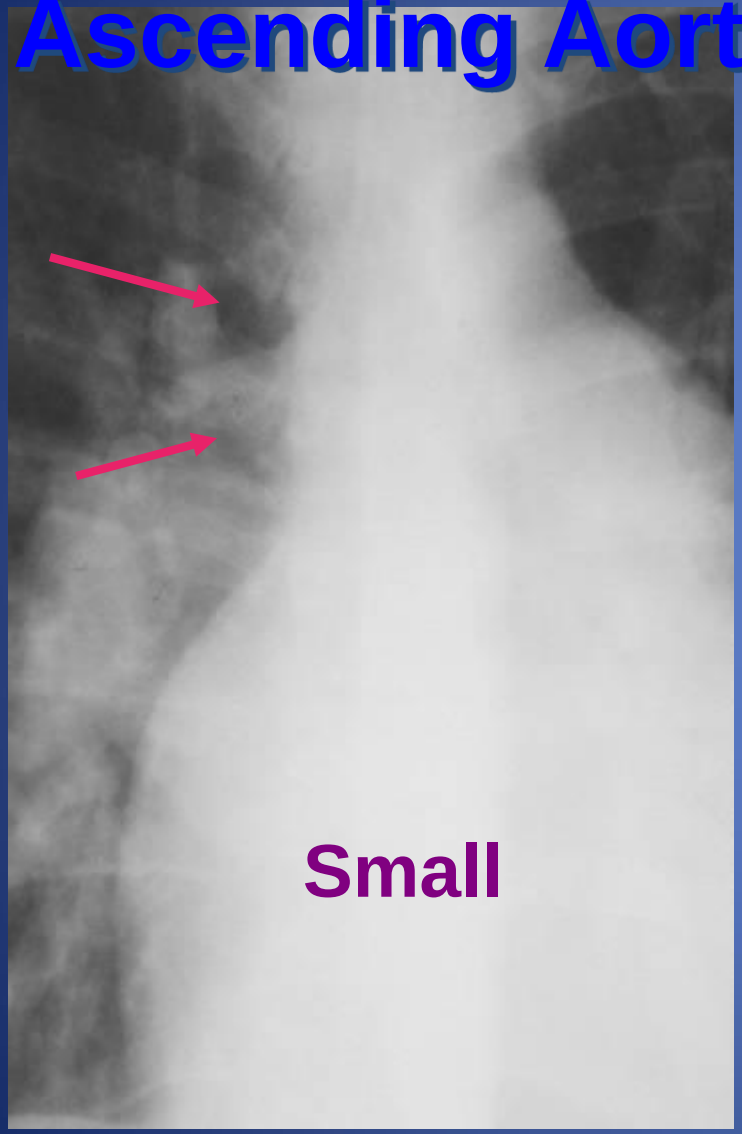
But only the top five are really important in making a diagnosis.

Ascending Aorta

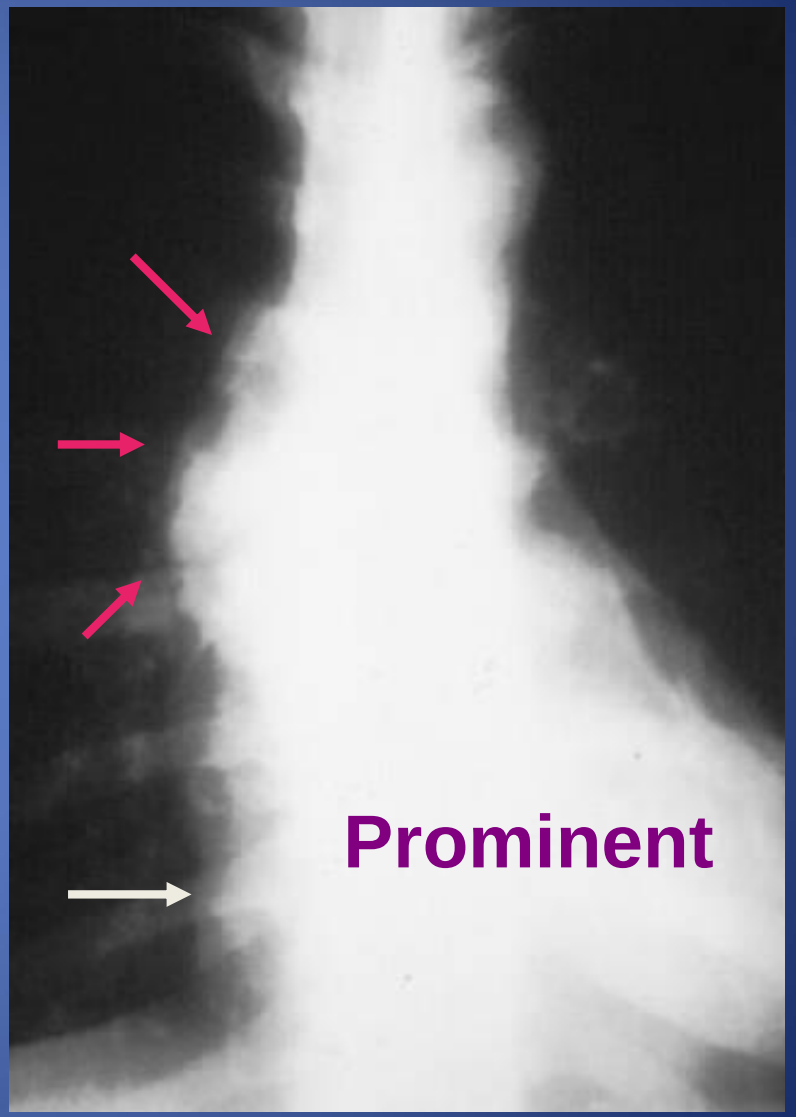
Low density, almost straight edge represents size of ascending aorta



Ascending Aorta



Small

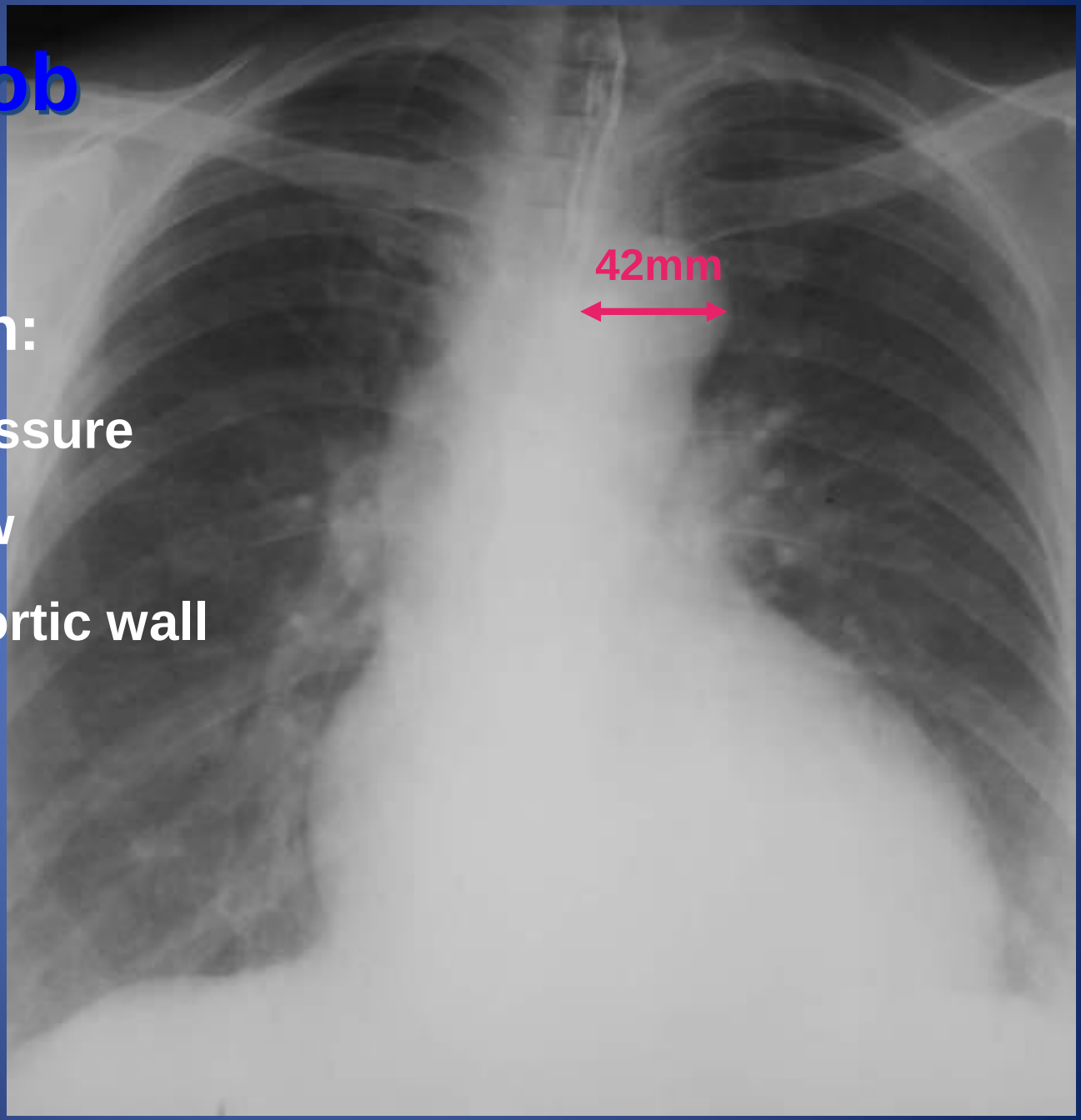


Prominent

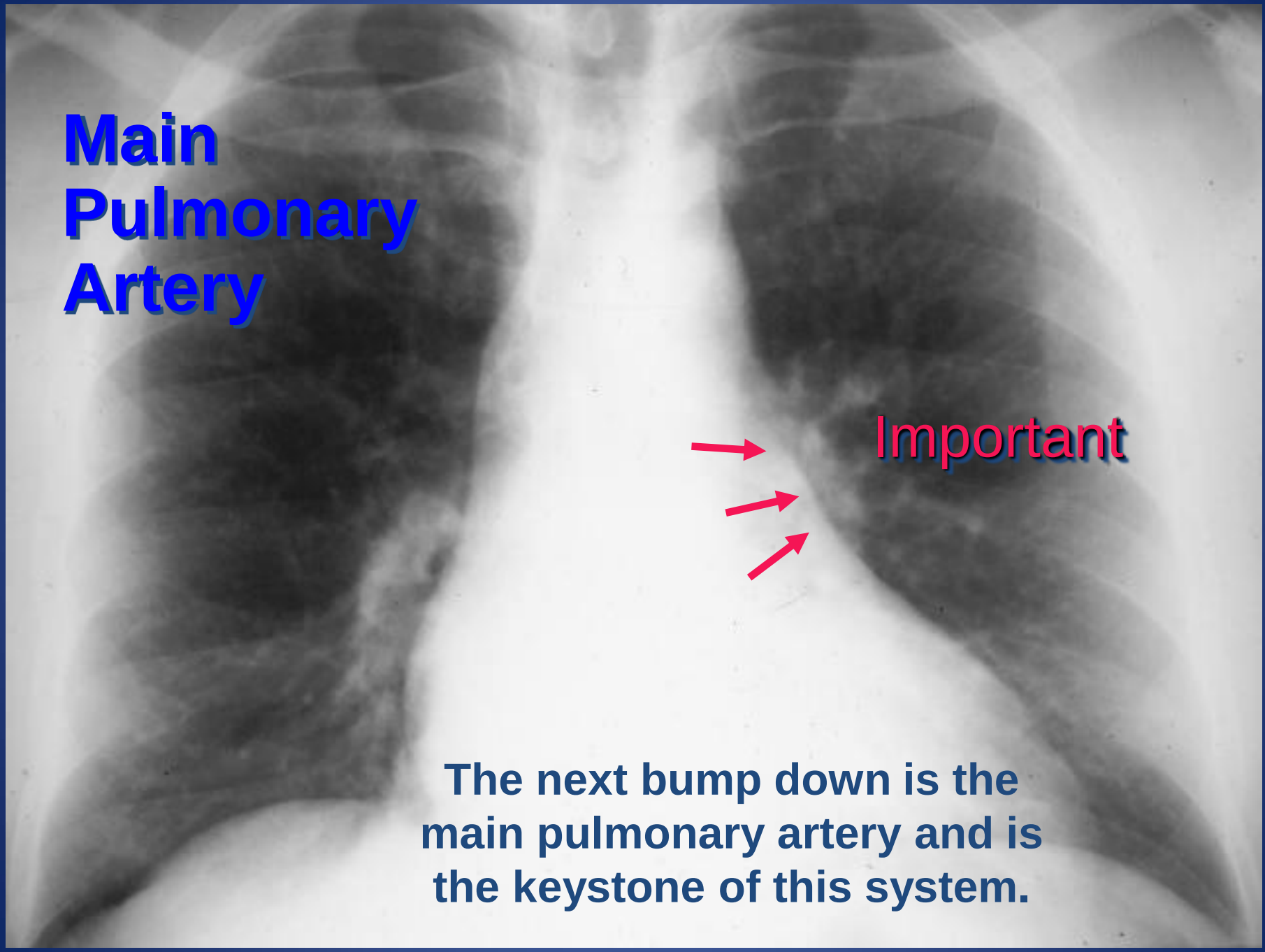
Aortic Knob

Enlarged with:

- **Increased pressure**
- **Increased flow**
- **Changes in aortic wall**

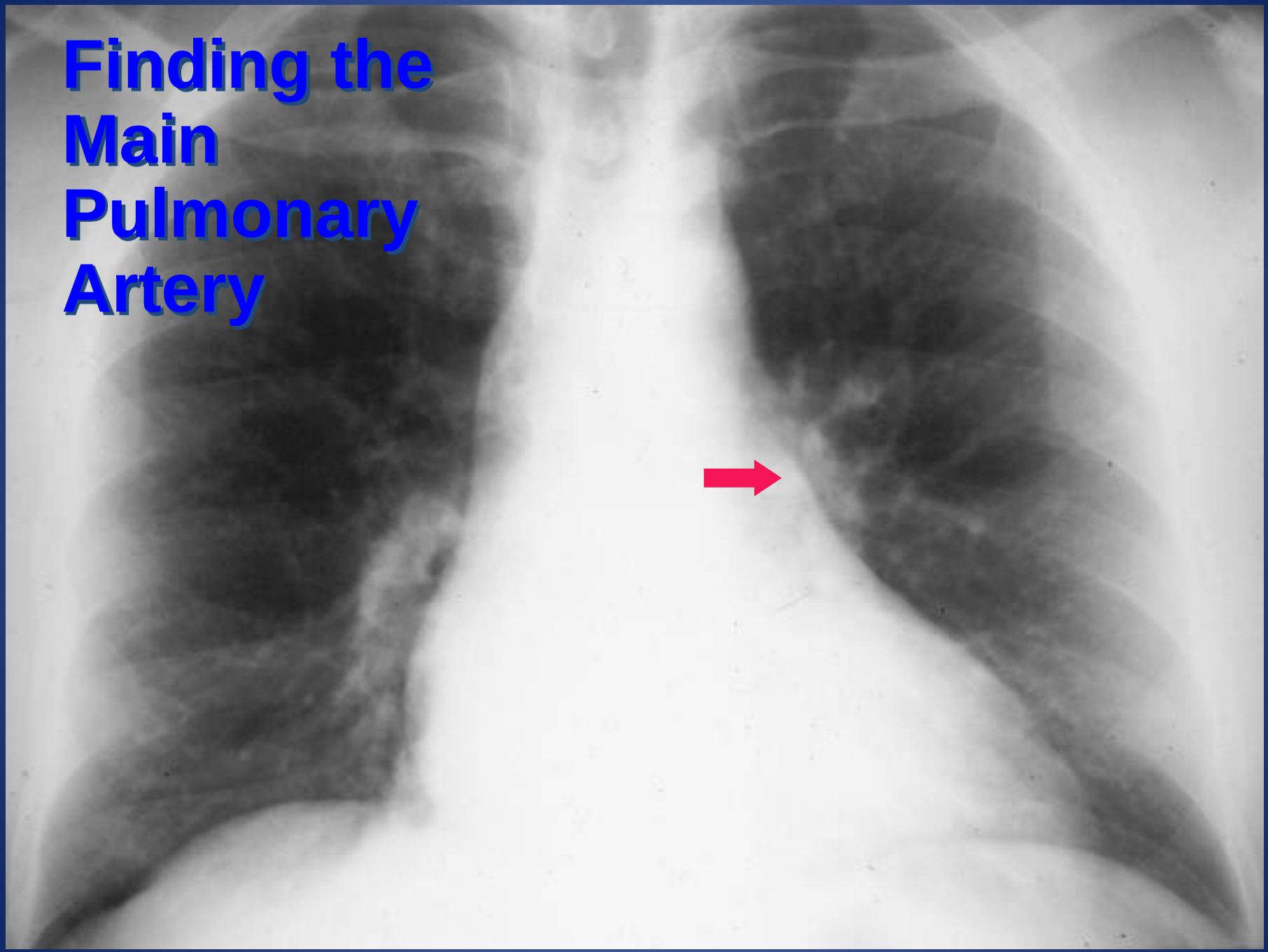


Main Pulmonary Artery

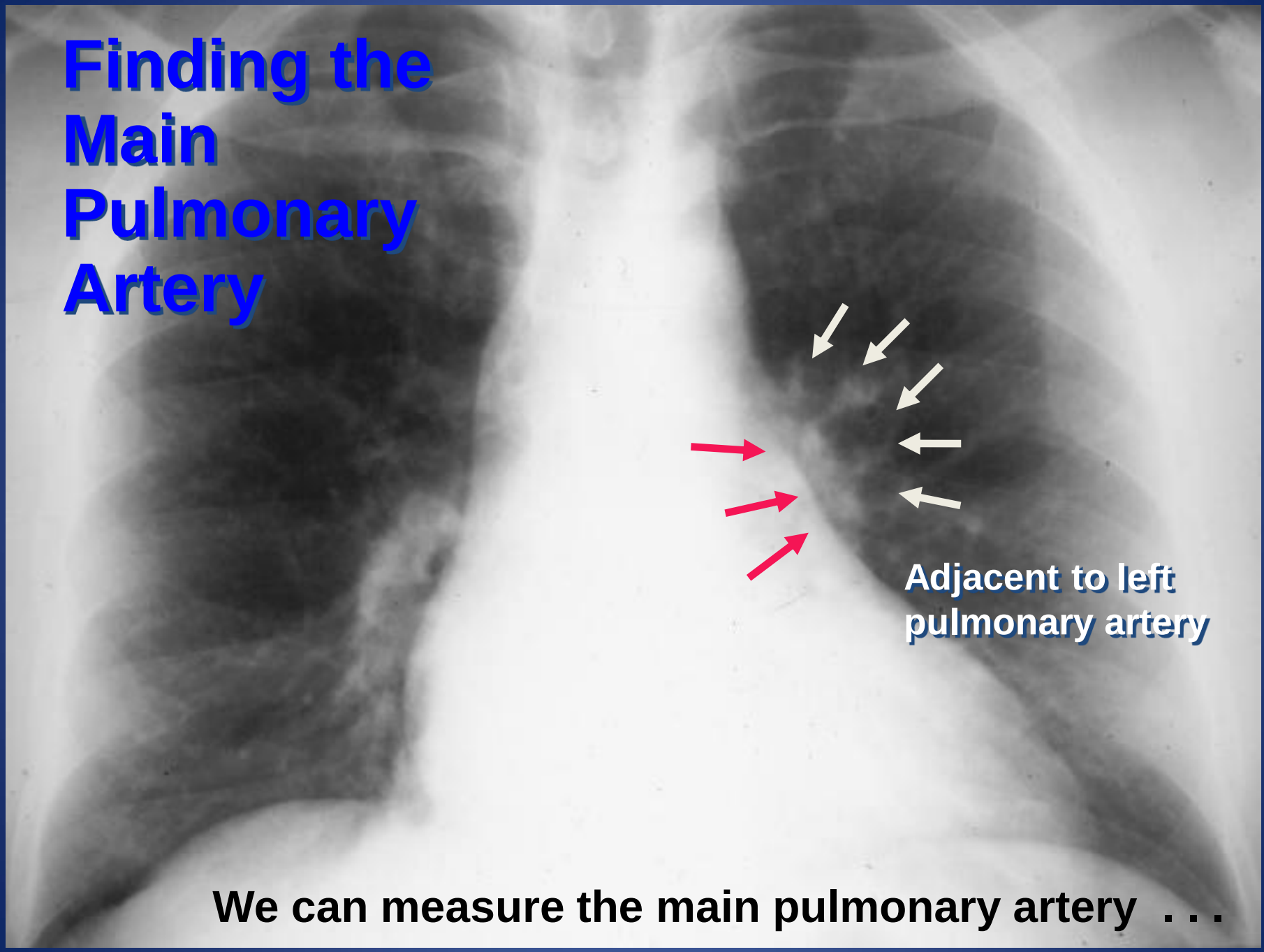


The next bump down is the main pulmonary artery and is the keystone of this system.

Finding the Main Pulmonary Artery

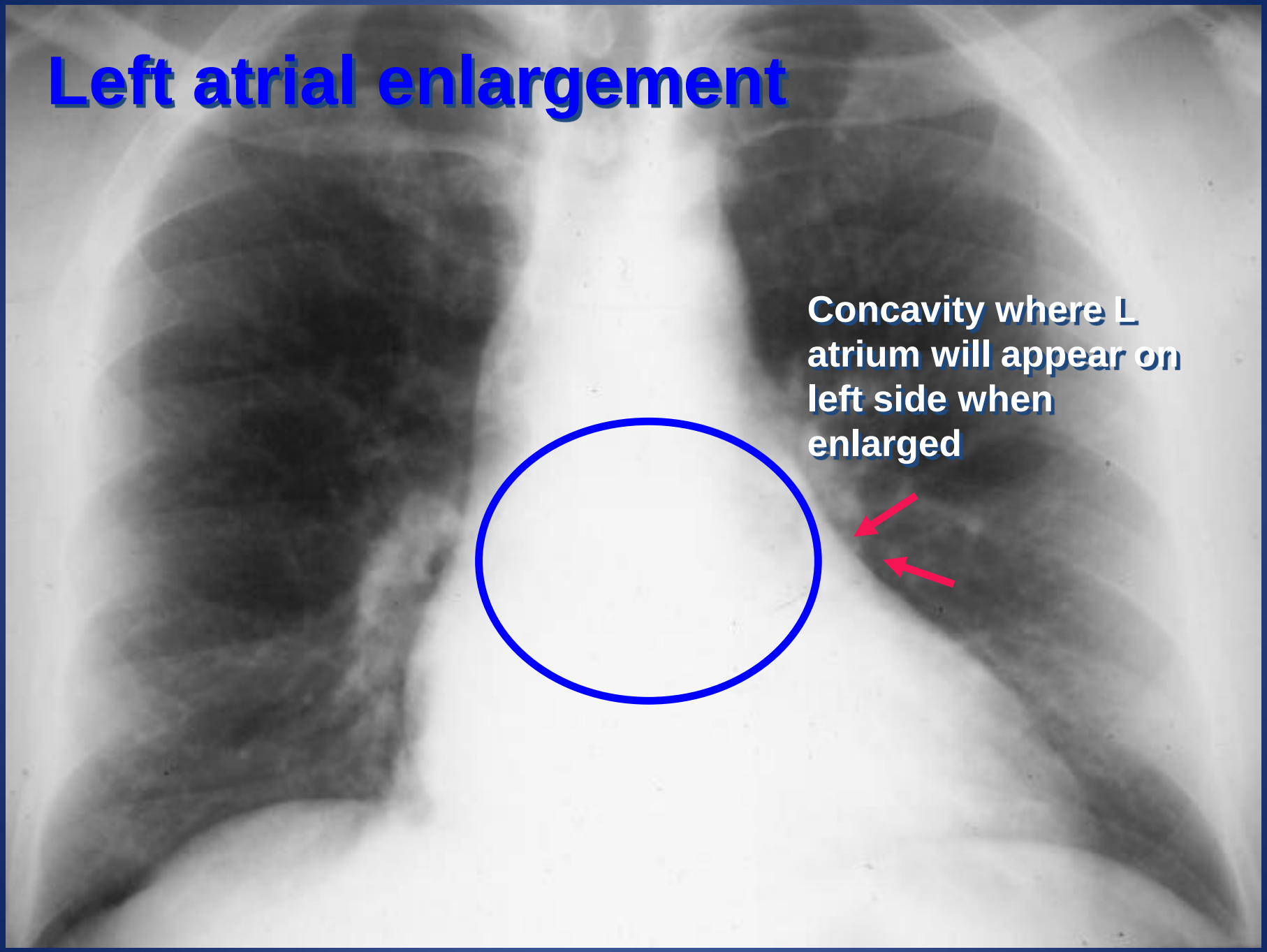


Finding the Main Pulmonary Artery



We can measure the main pulmonary artery . . .

Left atrial enlargement

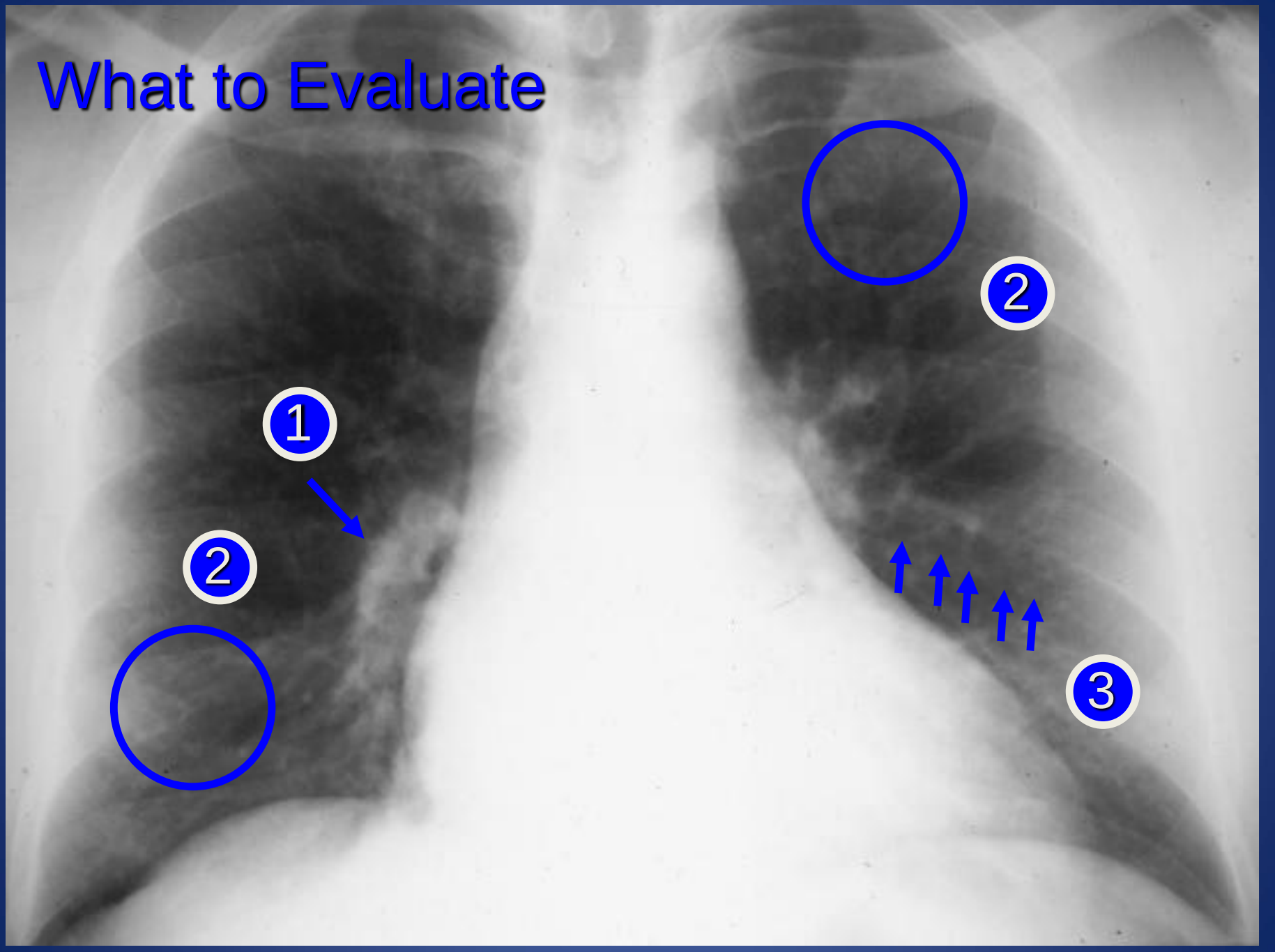


The Pulmonary Vasculature

Five States of the Pulmonary Vasculature

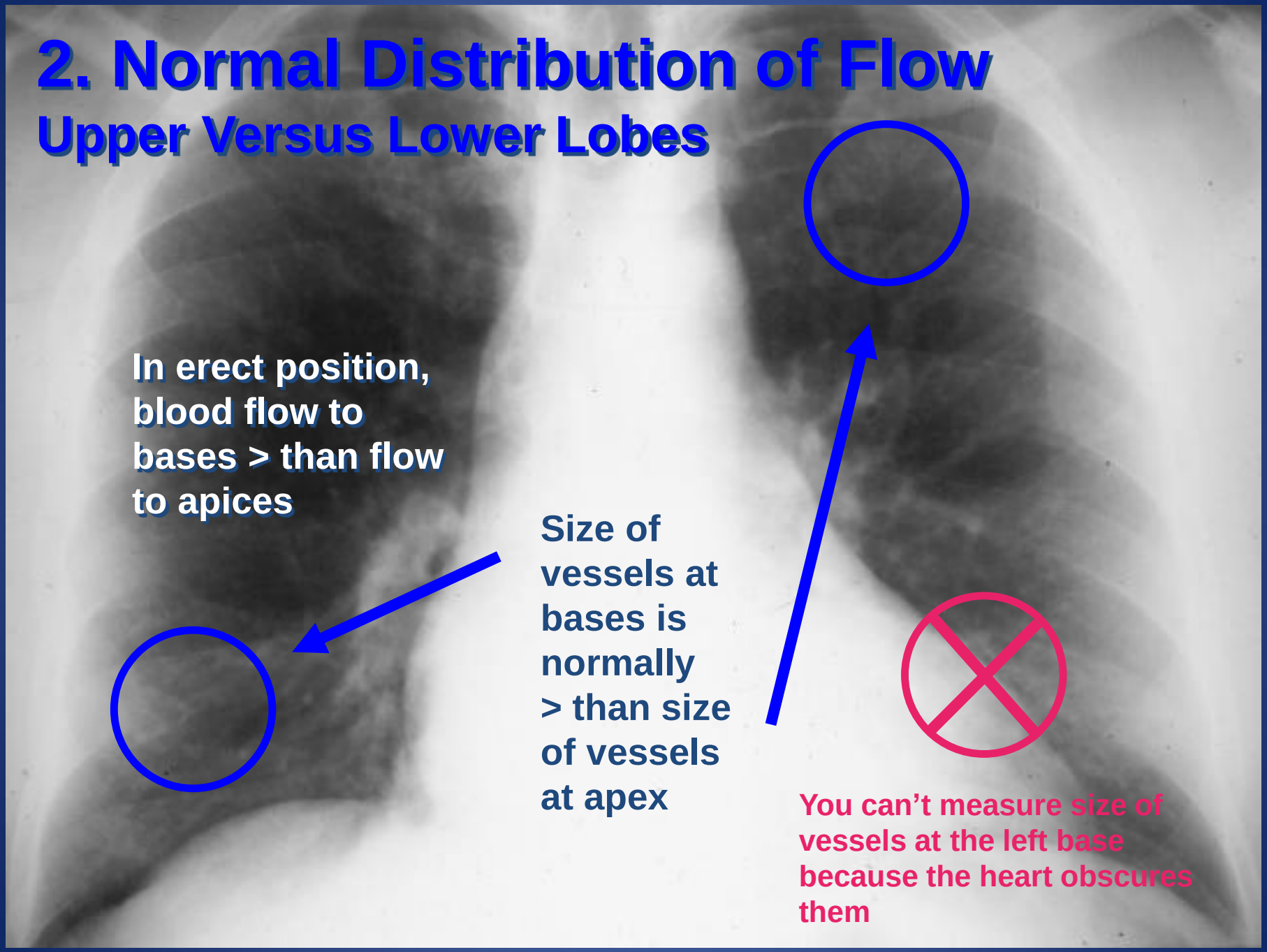
- Normal
- Pulmonary venous hypertension
- Pulmonary arterial hypertension
- Increased flow
- Decreased flow

What to Evaluate



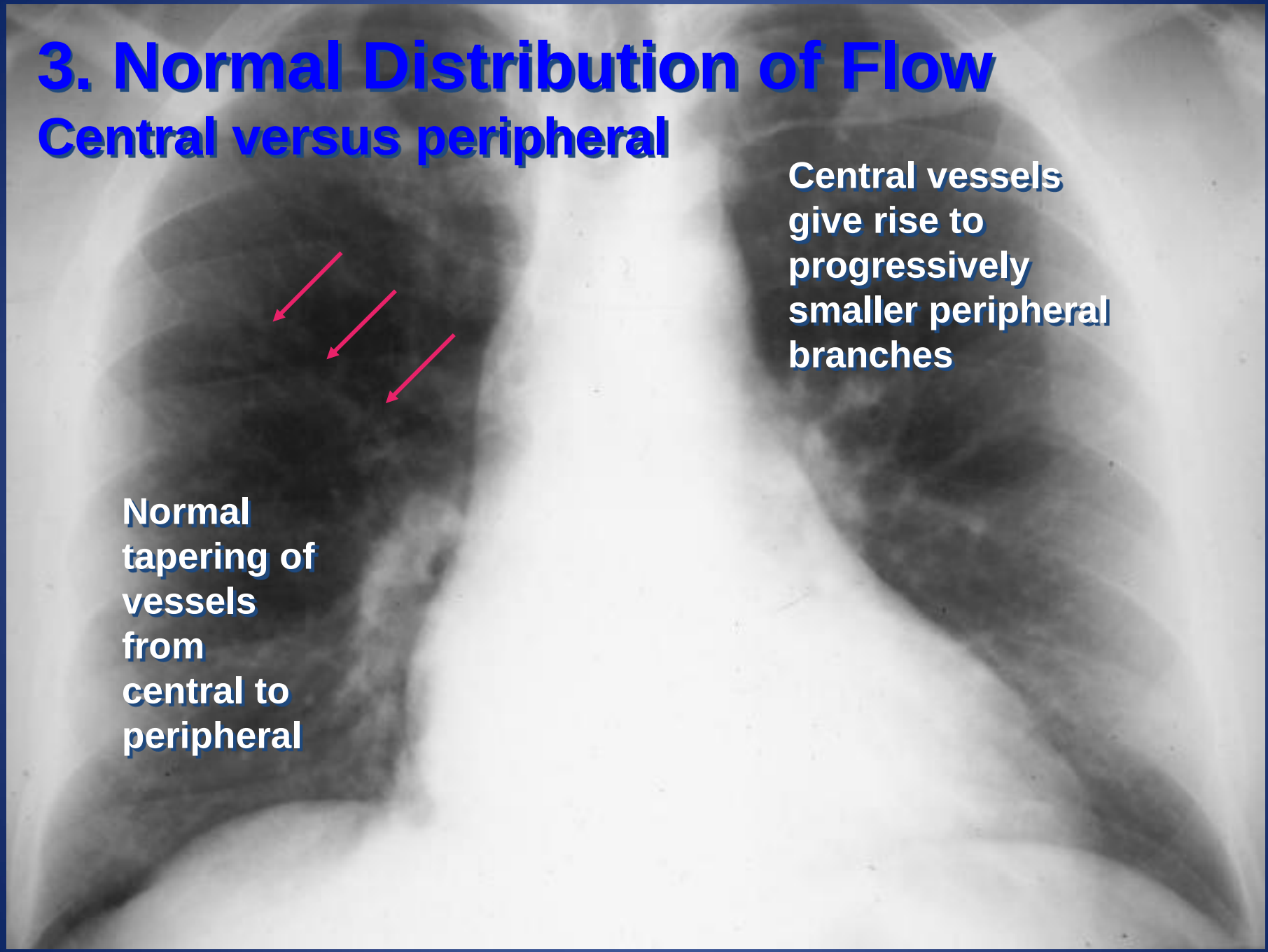
2. Normal Distribution of Flow

Upper Versus Lower Lobes



3. Normal Distribution of Flow

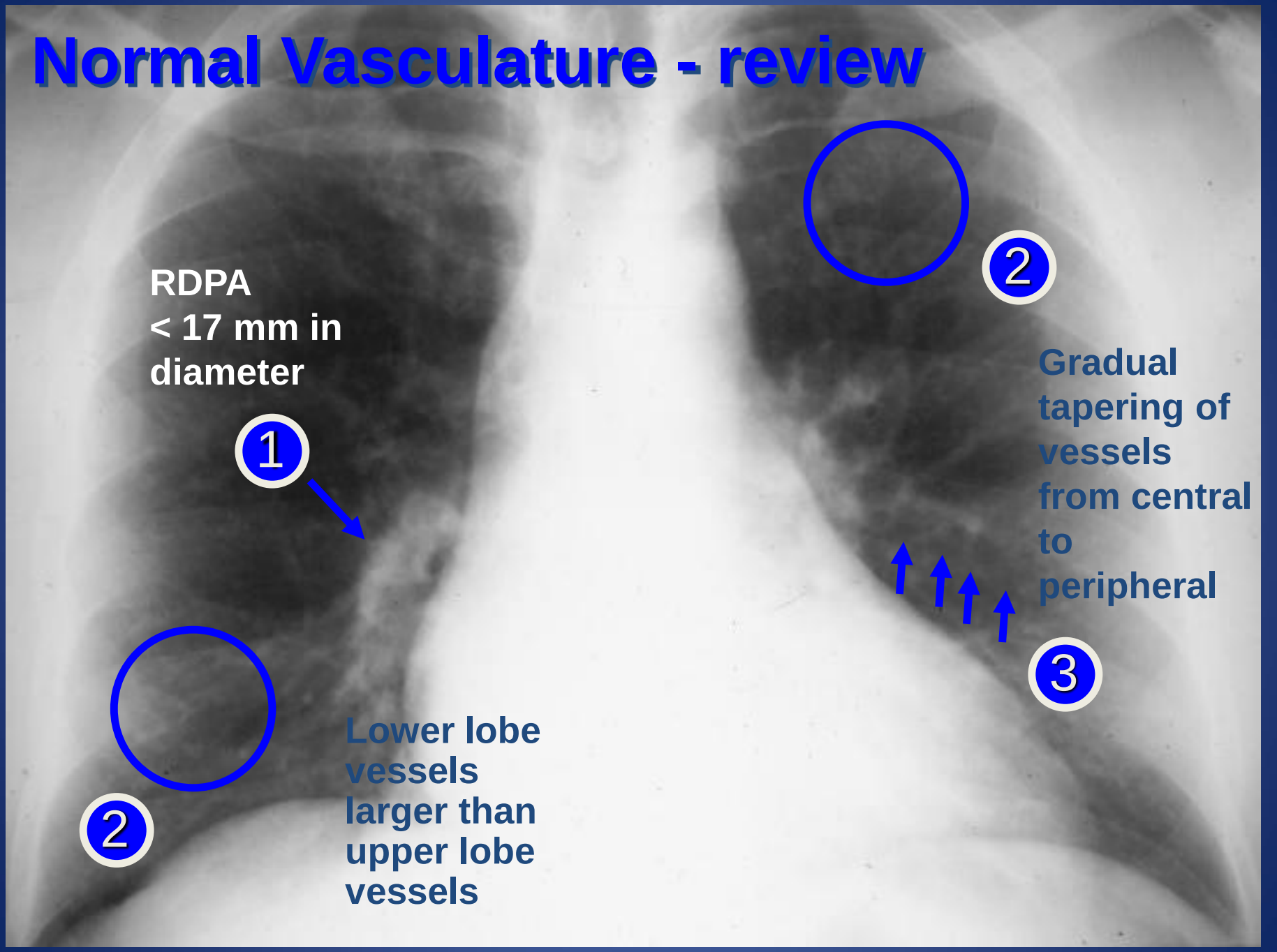
Central versus peripheral



Central vessels give rise to progressively smaller peripheral branches

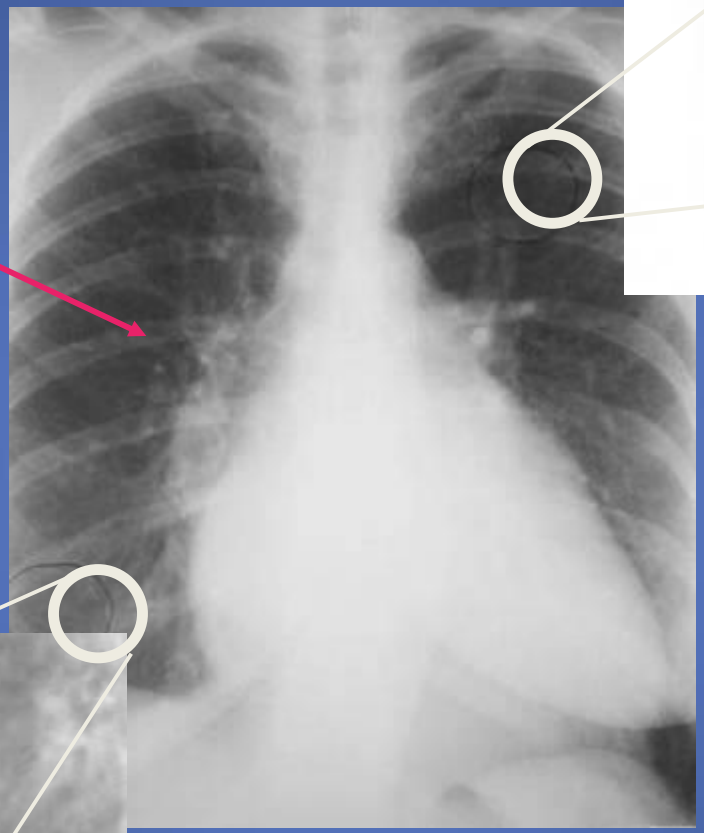
Normal tapering of vessels from central to peripheral

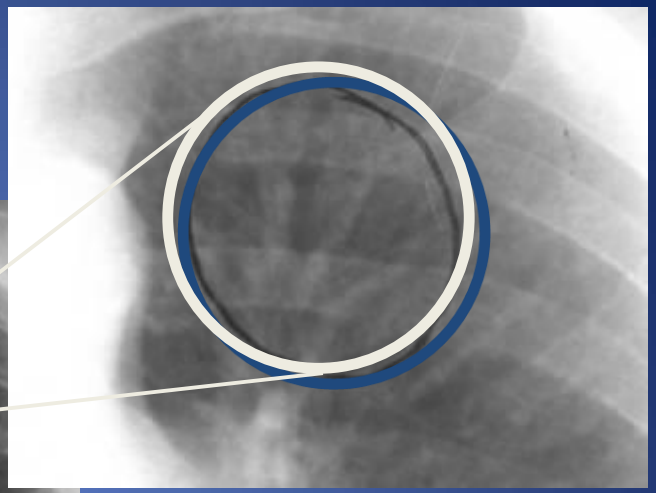
Normal Vasculature - review

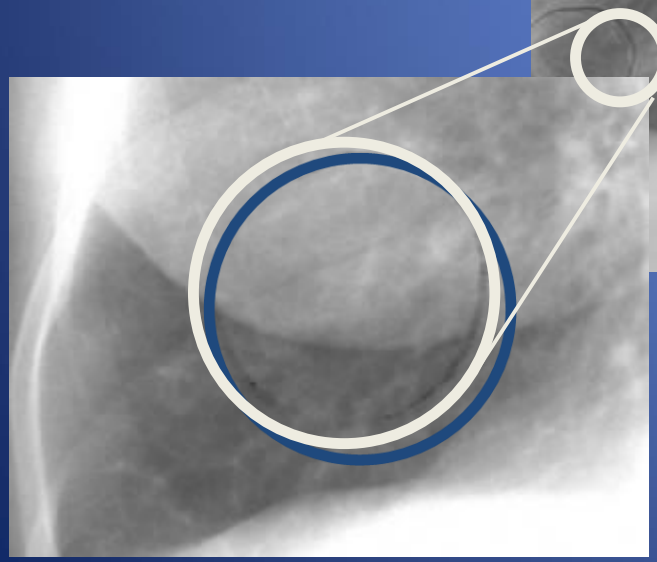


Venous Hypertension

RDPA usually
> 17 mm





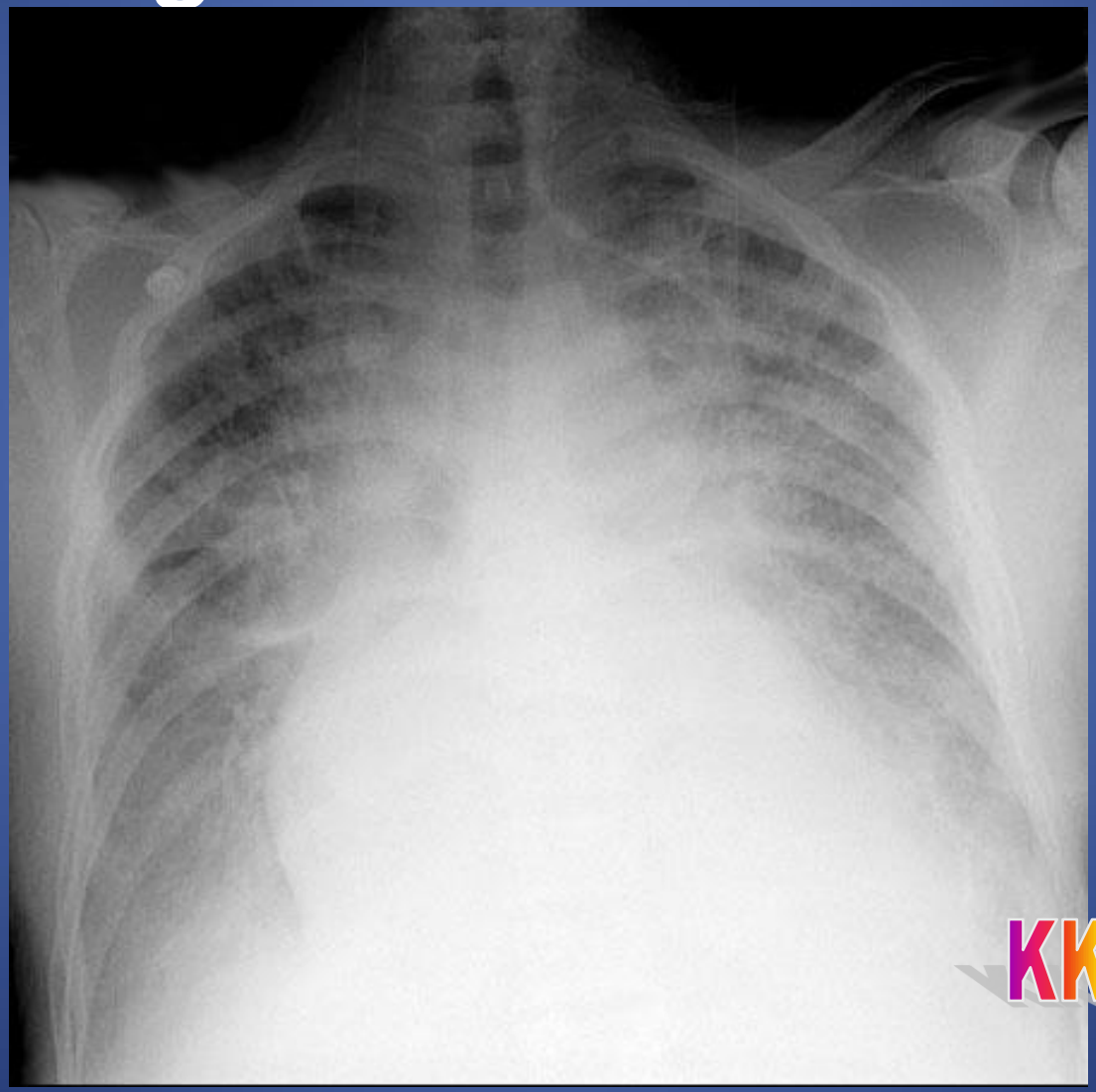


Upper lobe vessels equal to or larger than size of lower lobe vessels = Cephalization

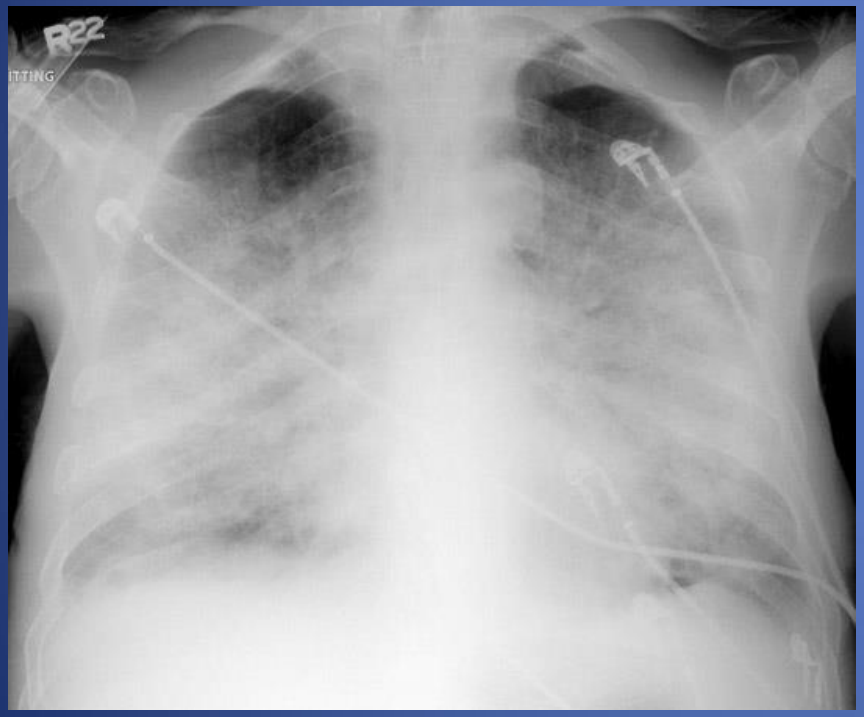
The Pulmonary Vasculature

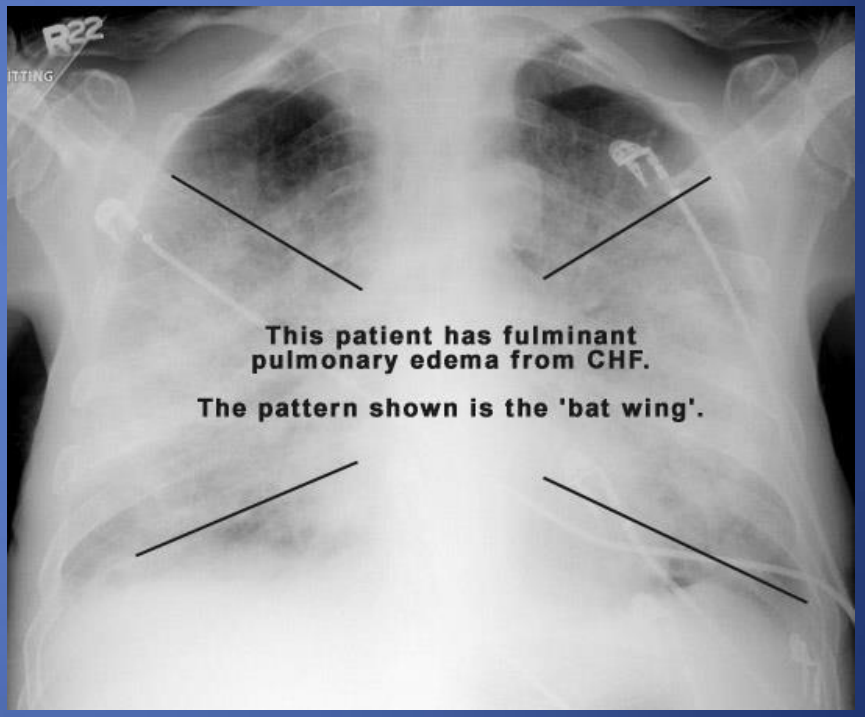
- Normal
- Pulmonary venous hypertension
- Pulmonary arterial hypertension
- Increased flow
- Decreased flow - mostly unrecognizable even when it is present

CHF
(congestive heart failure)

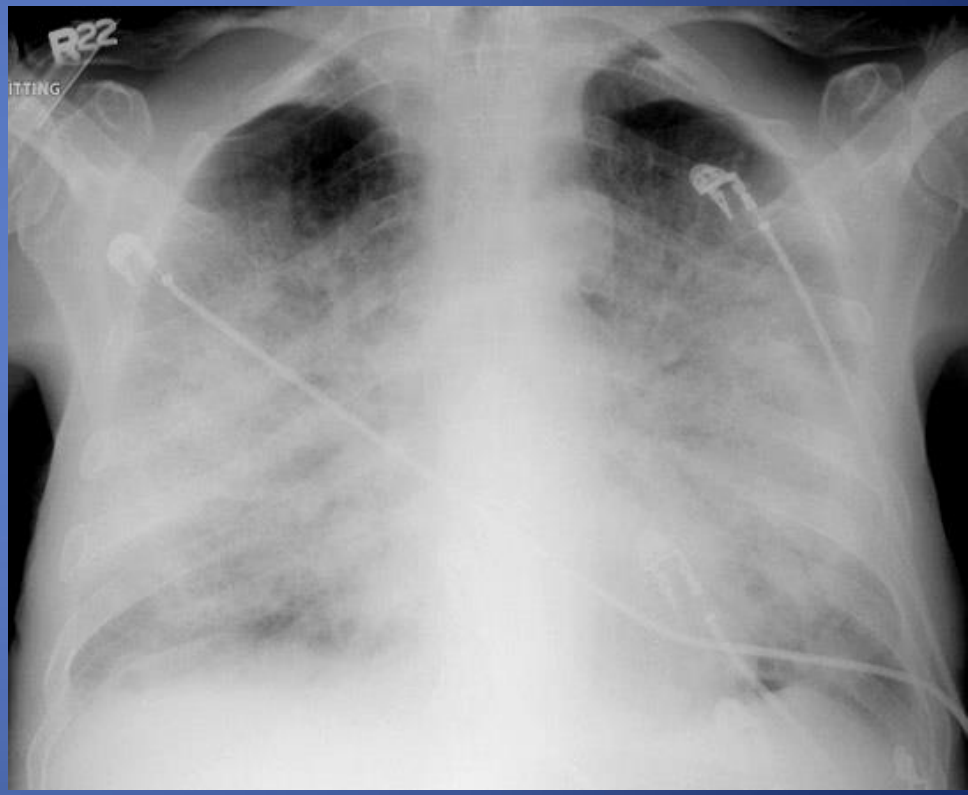


ACUTE PULMONARY EDEMA

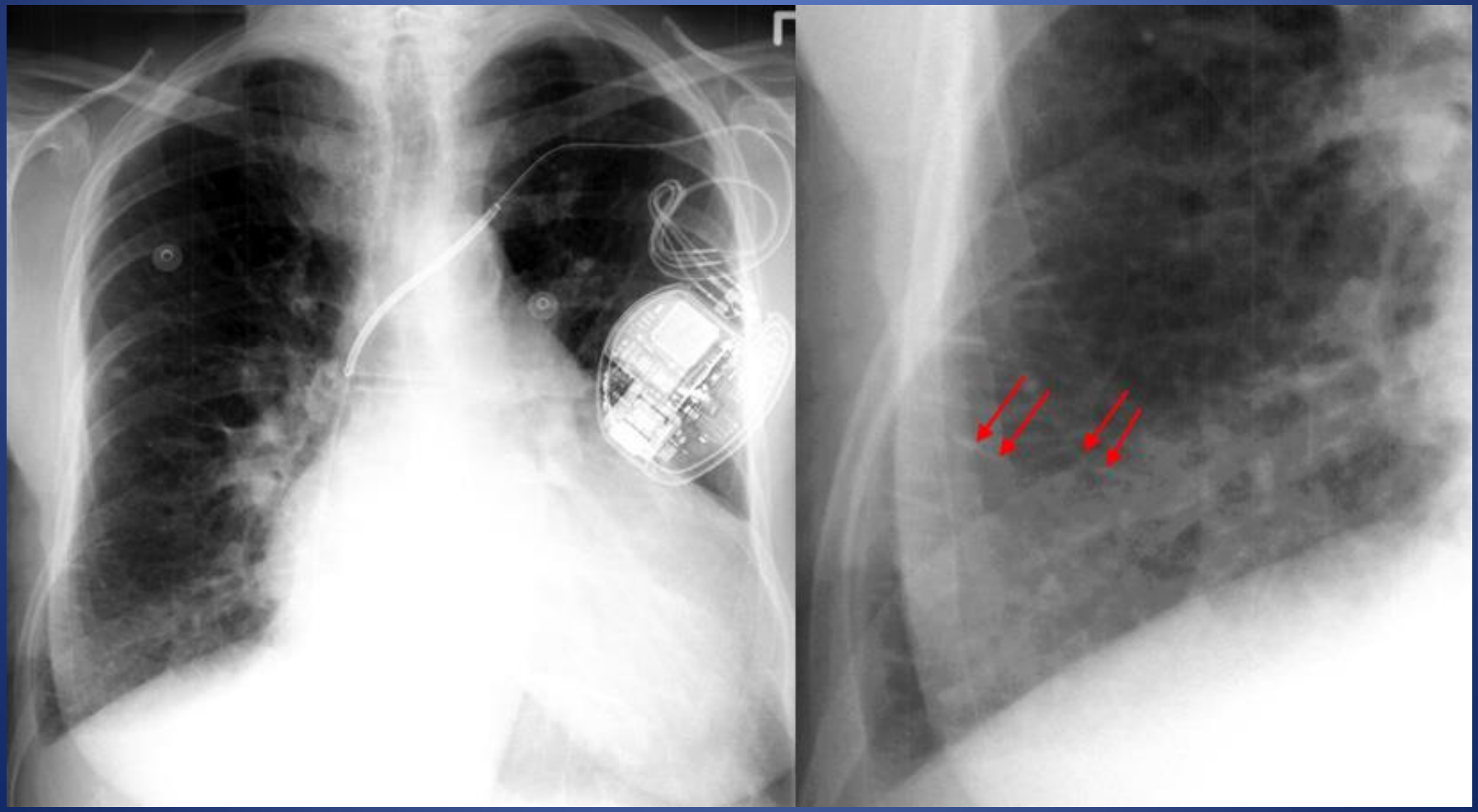




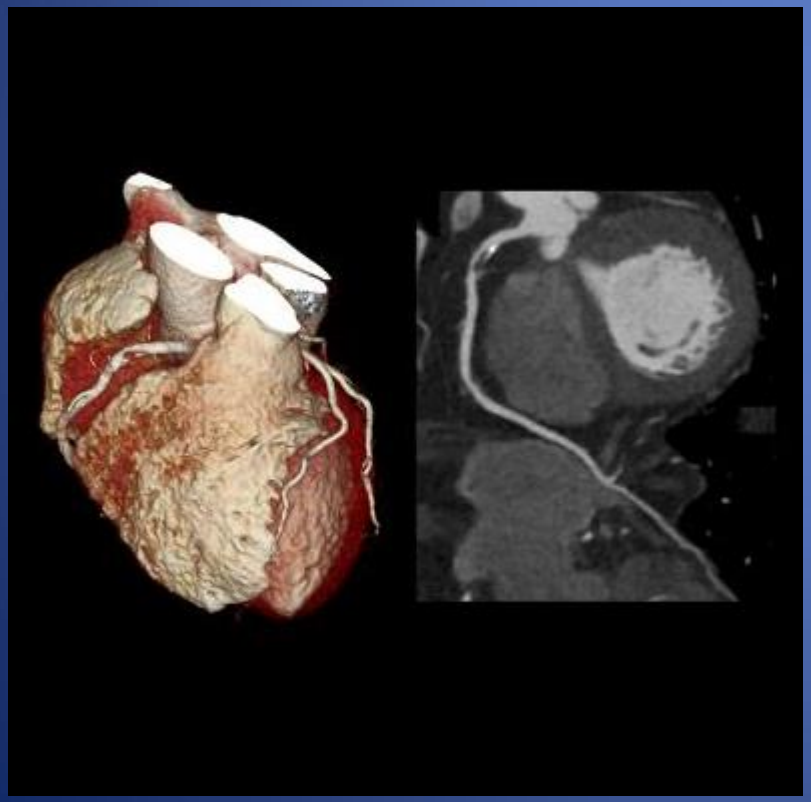
CLEARED APE



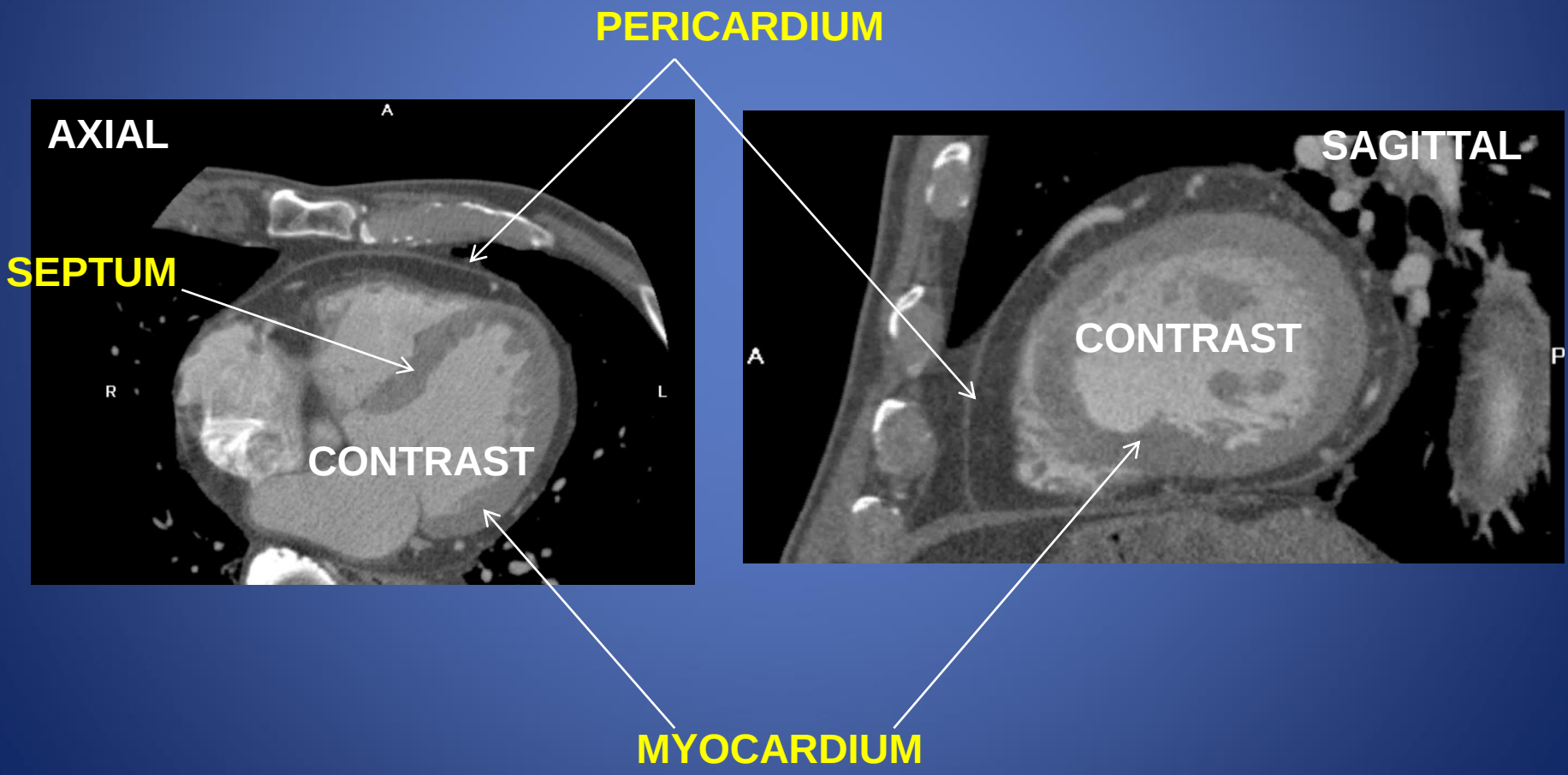
KERELY'S B-LINES



CARDIAC CT
FOR THE HEART AND CRONARY VESSLES



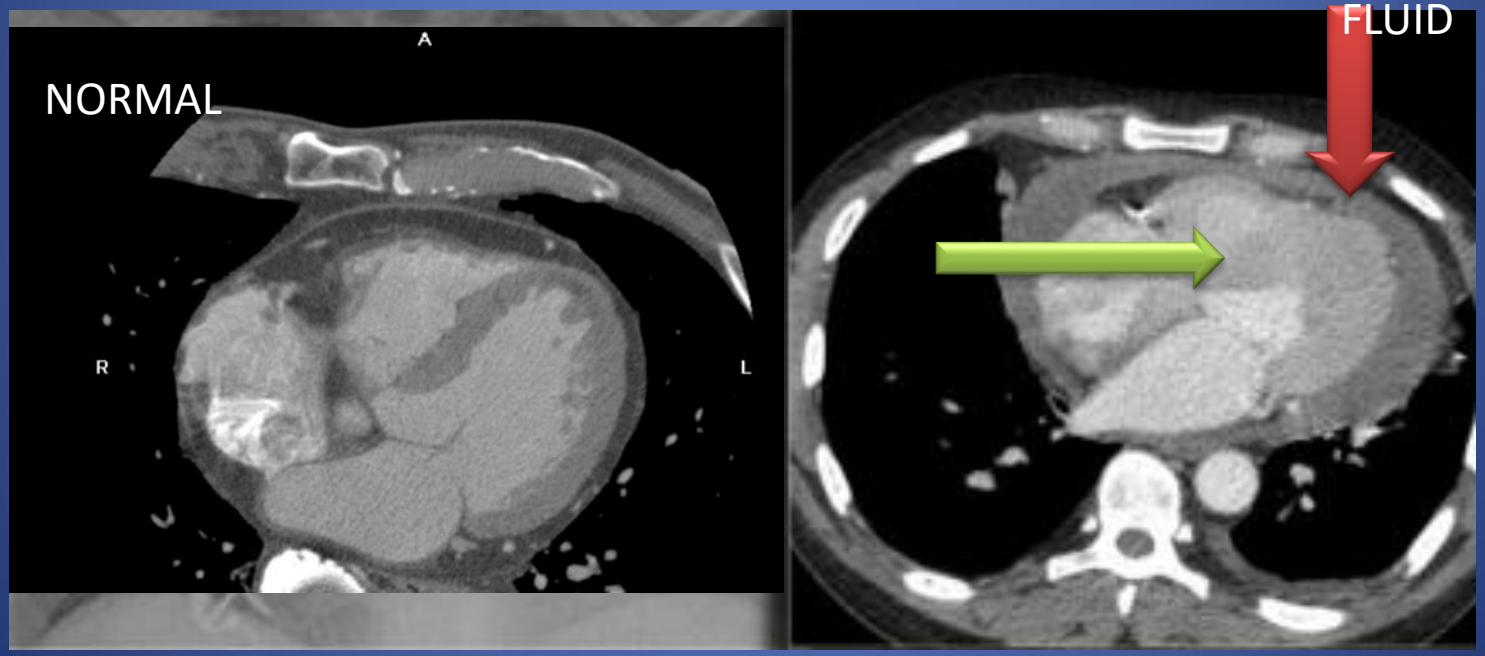
PERICARDIUM



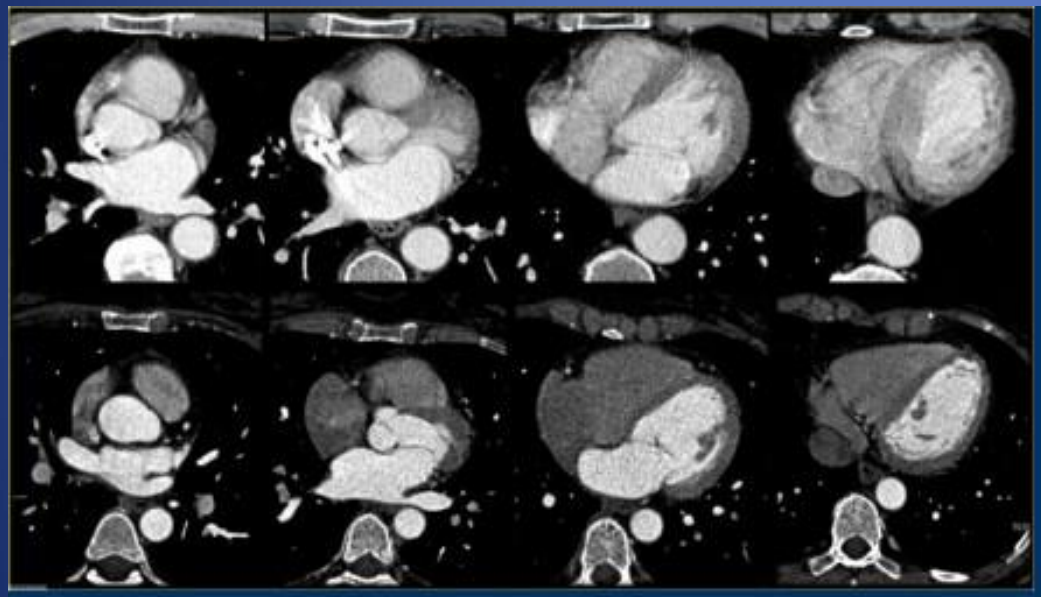
Pericardial effusion

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

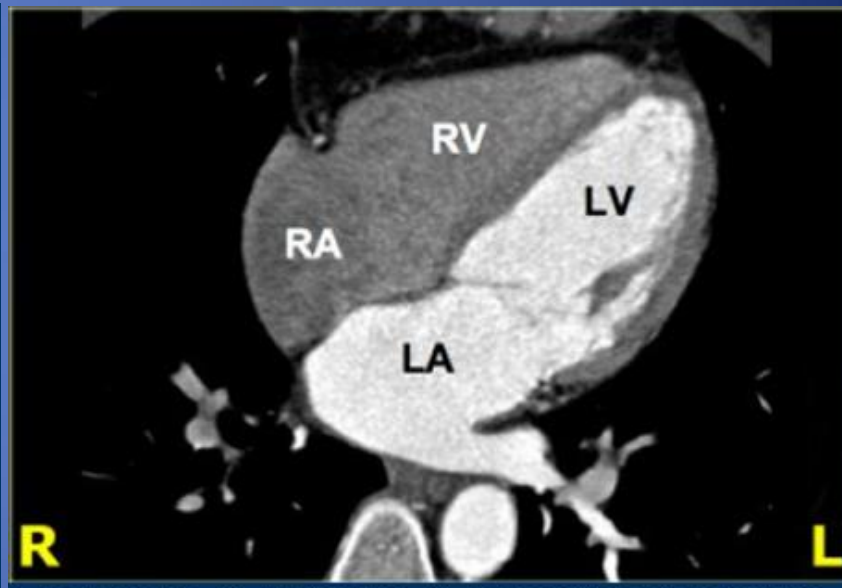
On the chest x-ray it looks as if this patient has a dilated heart while on the CT it is clear, that it is the pericardial effusion that is responsible for the enlarged heart figure.



CARDIAC CHAMBERS

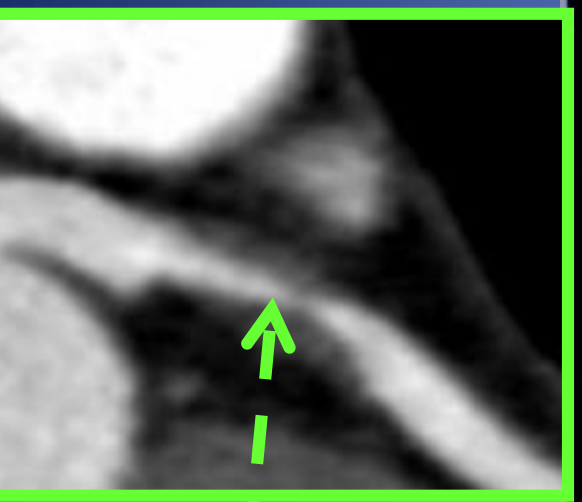


Axial slices through the heart

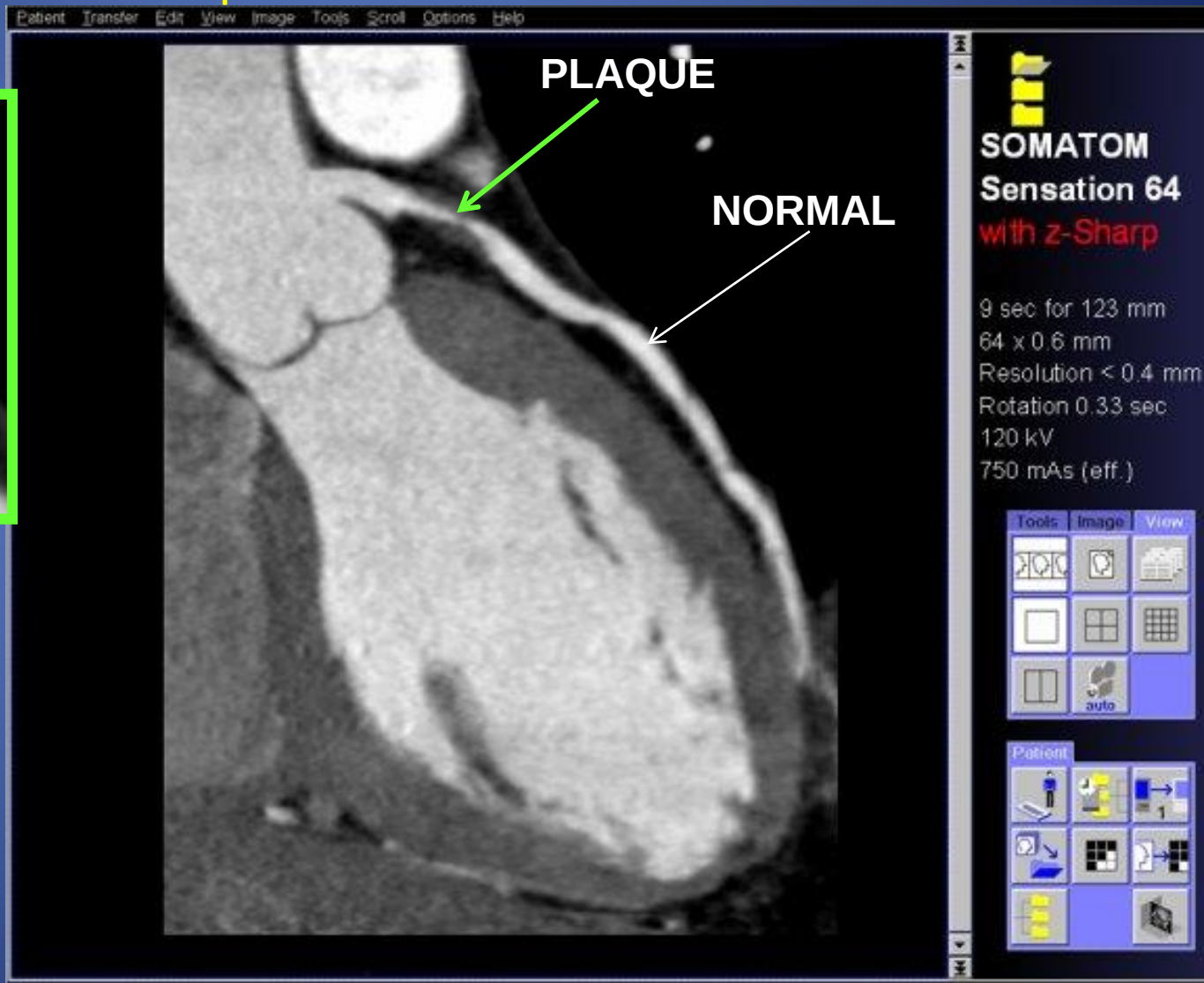


4-chamber view. RA=right atrium, RV=right ventricle, LA=left atrium, LV=left ventricle

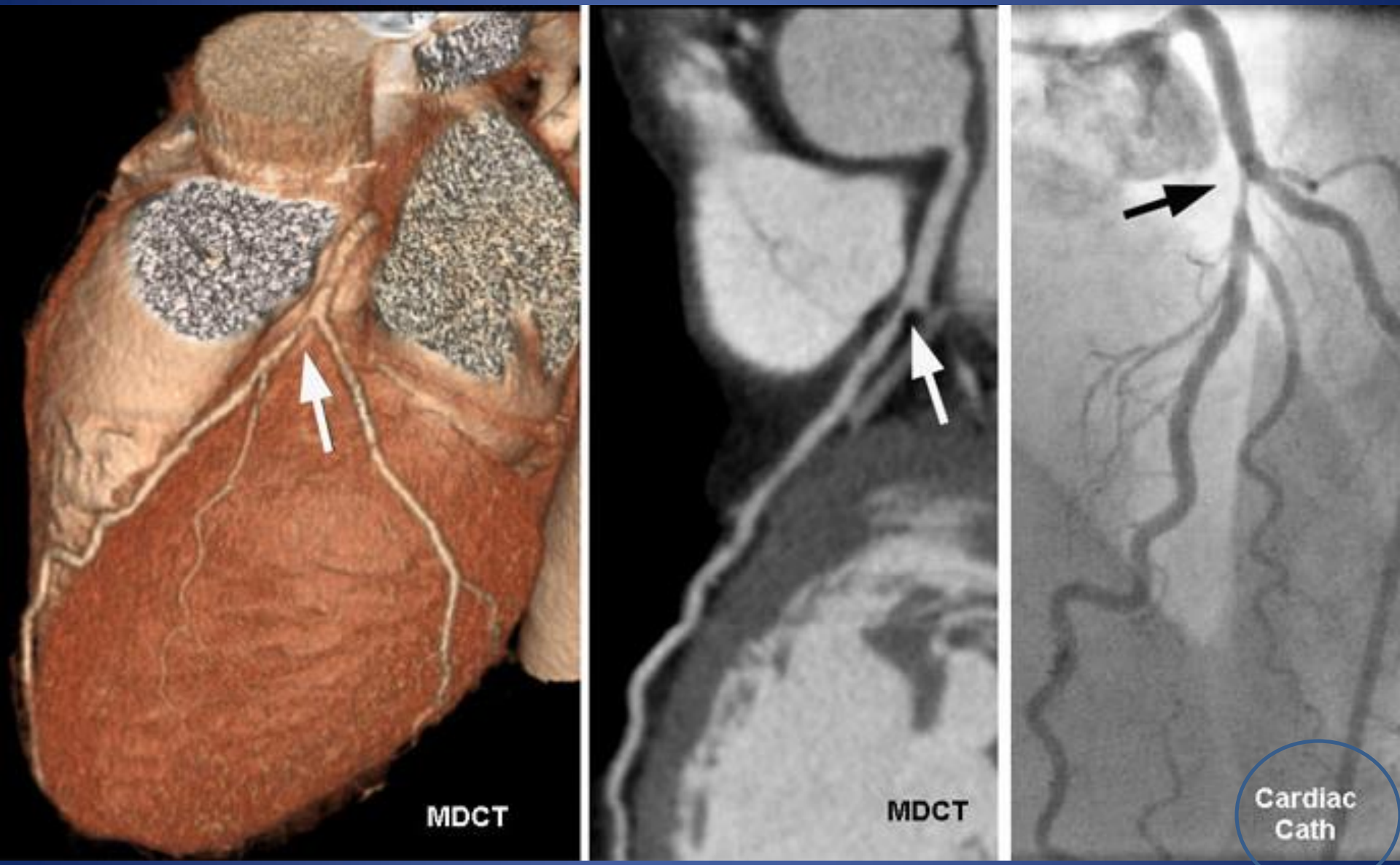
CORONARY ARTERIES
Maximum Intensity Projection
Soft Plaque in Proximal LAD



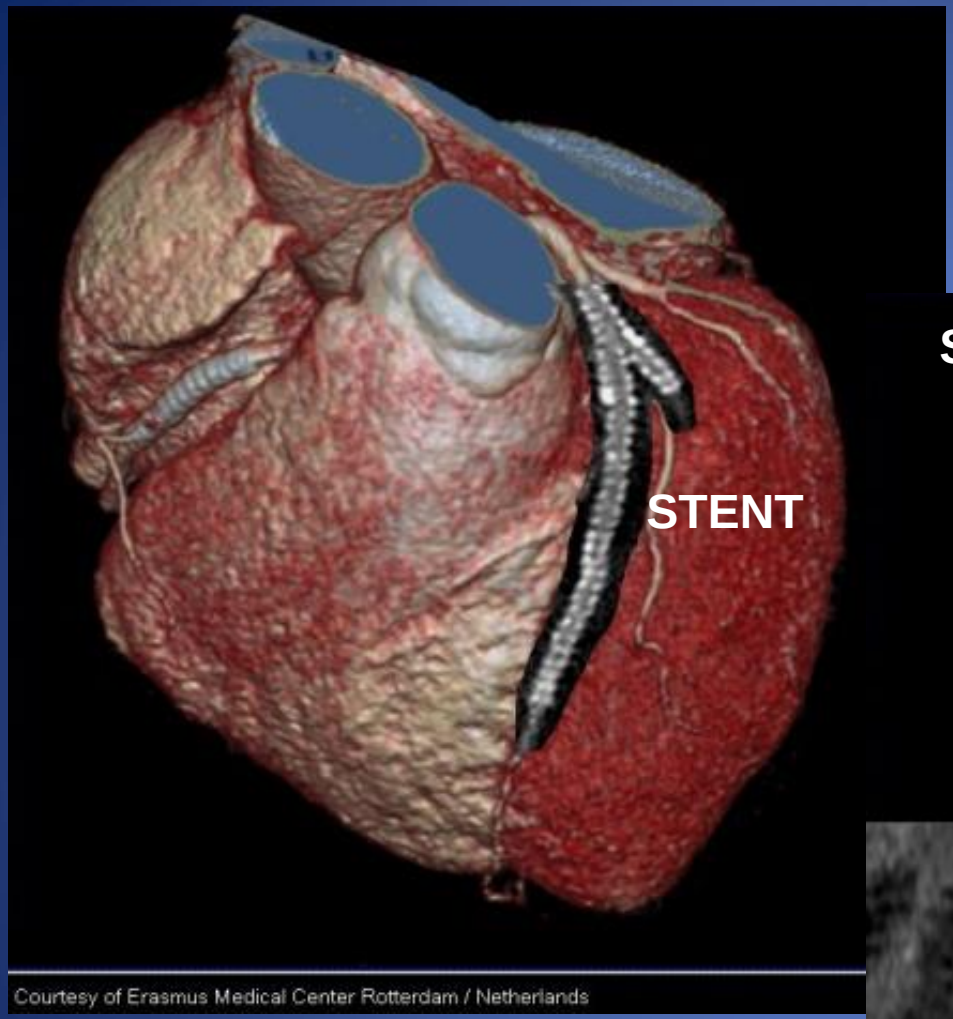
NARROWED LUMEN



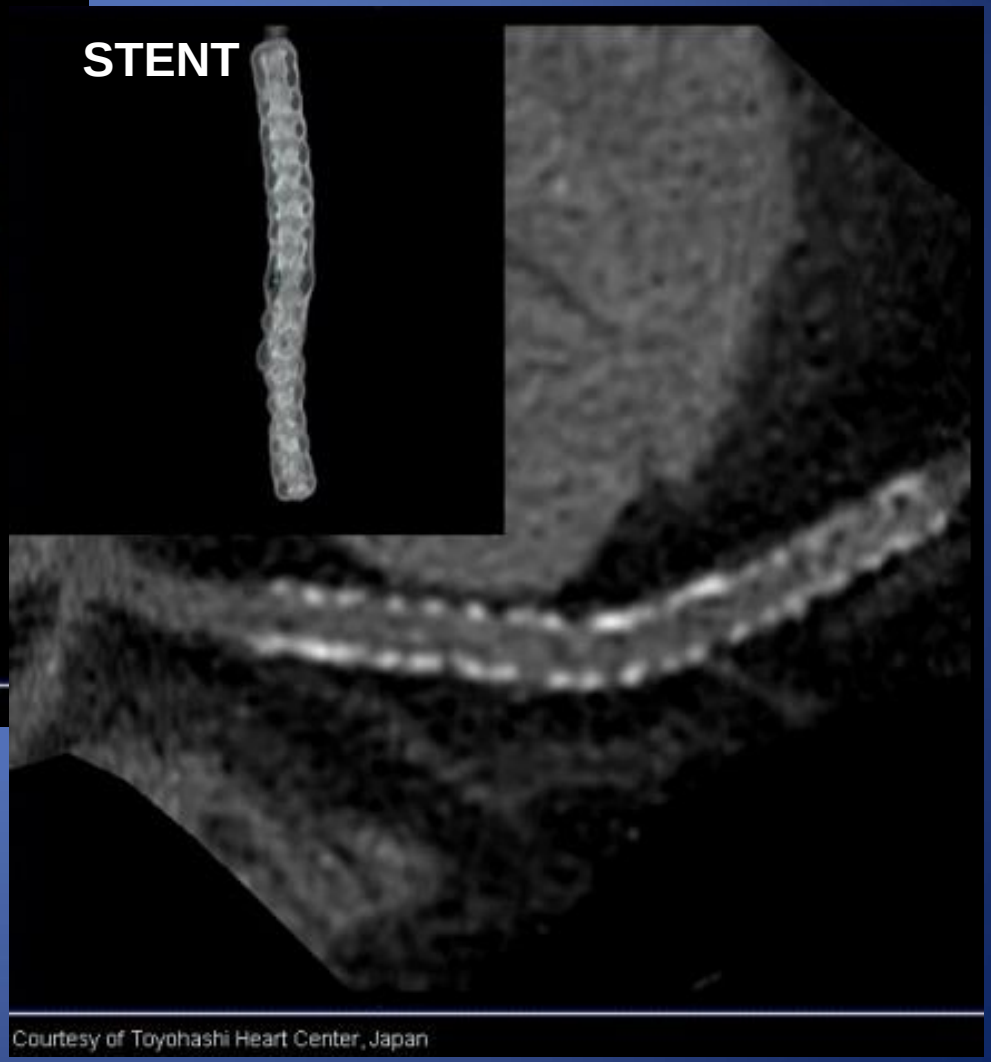
Courtesy of University of Erlangen / Germany



PLAQUE = VASCULAR NARROWING

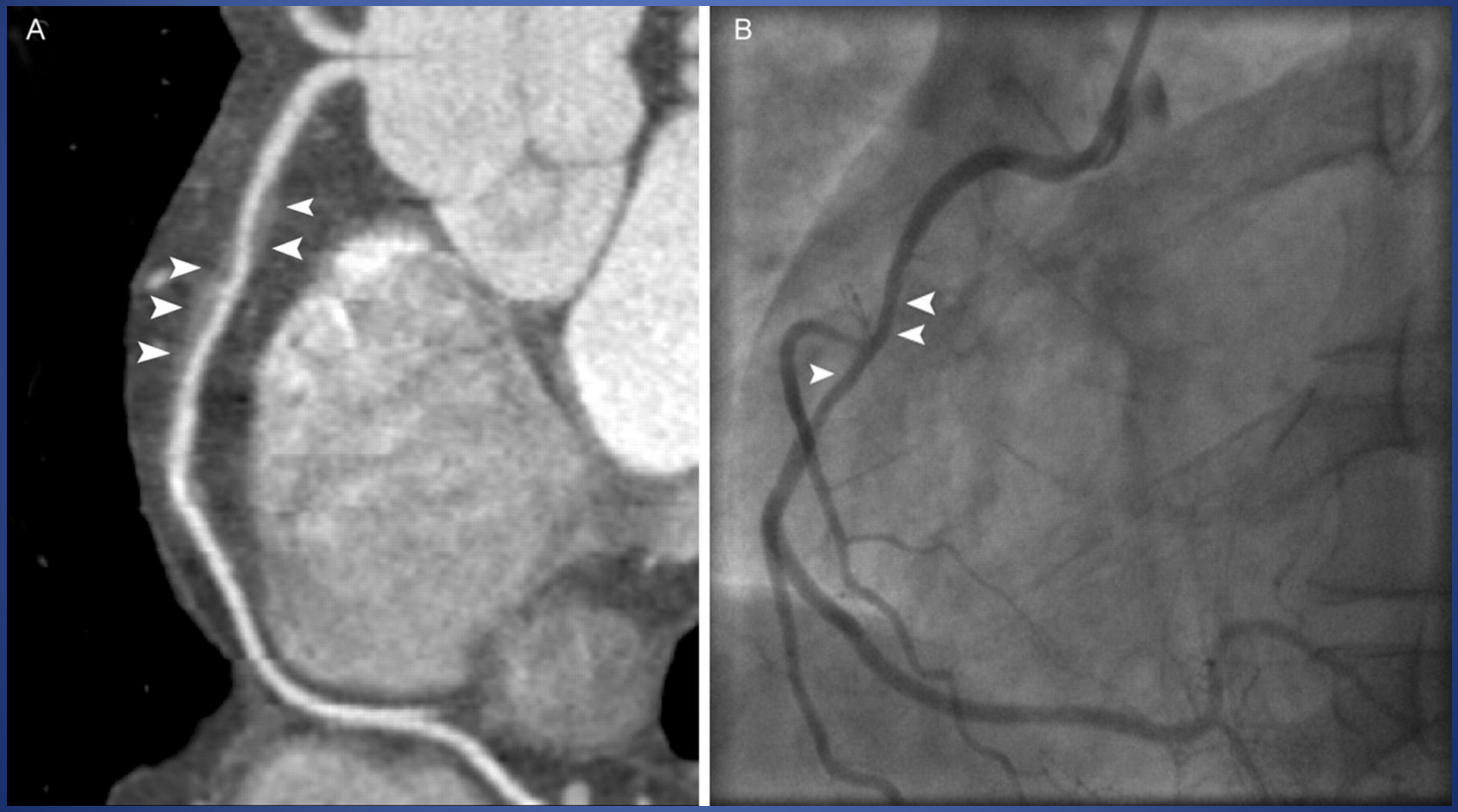


Courtesy of Erasmus Medical Center Rotterdam / Netherlands



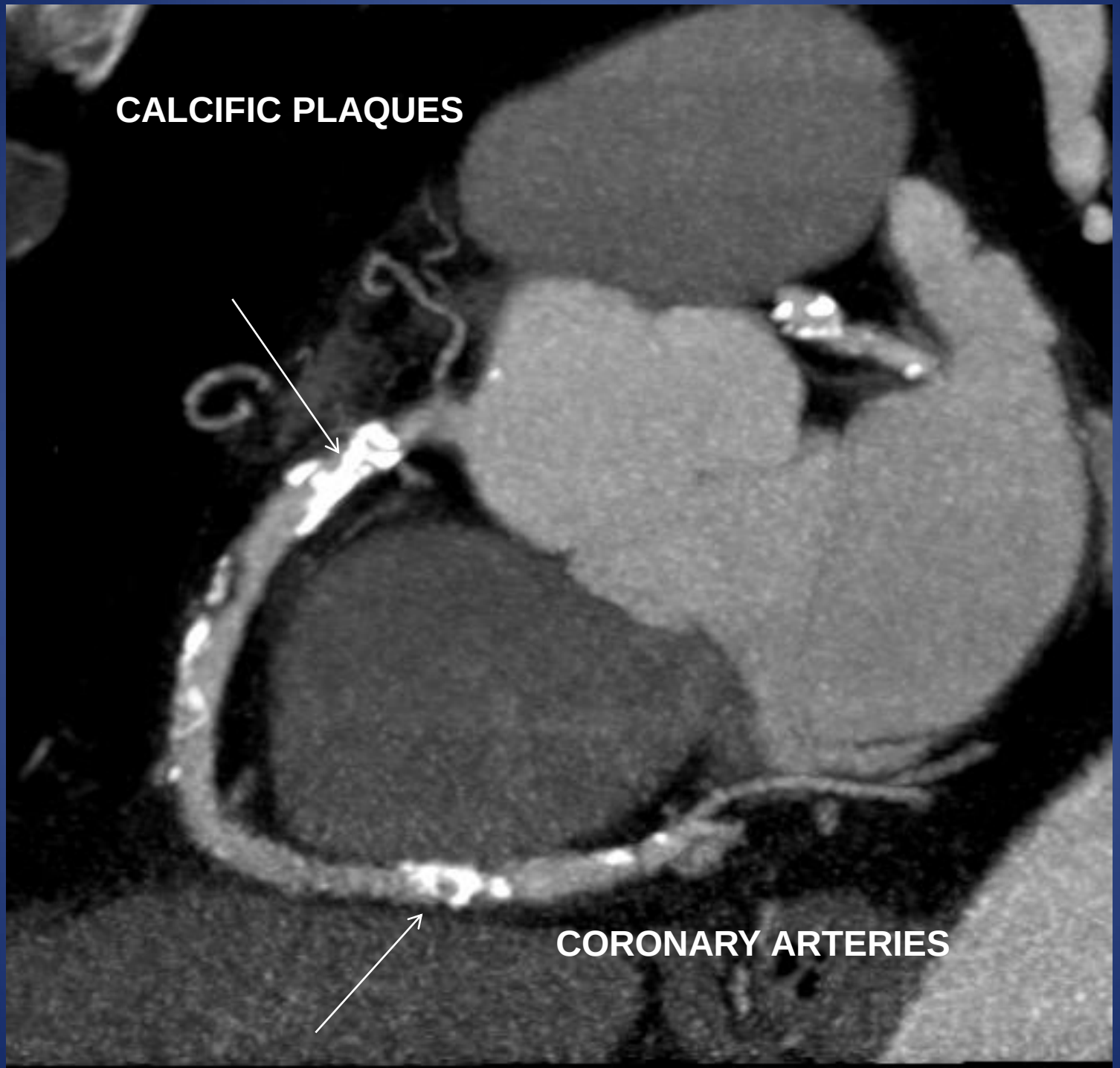
Courtesy of Toyohashi Heart Center, Japan

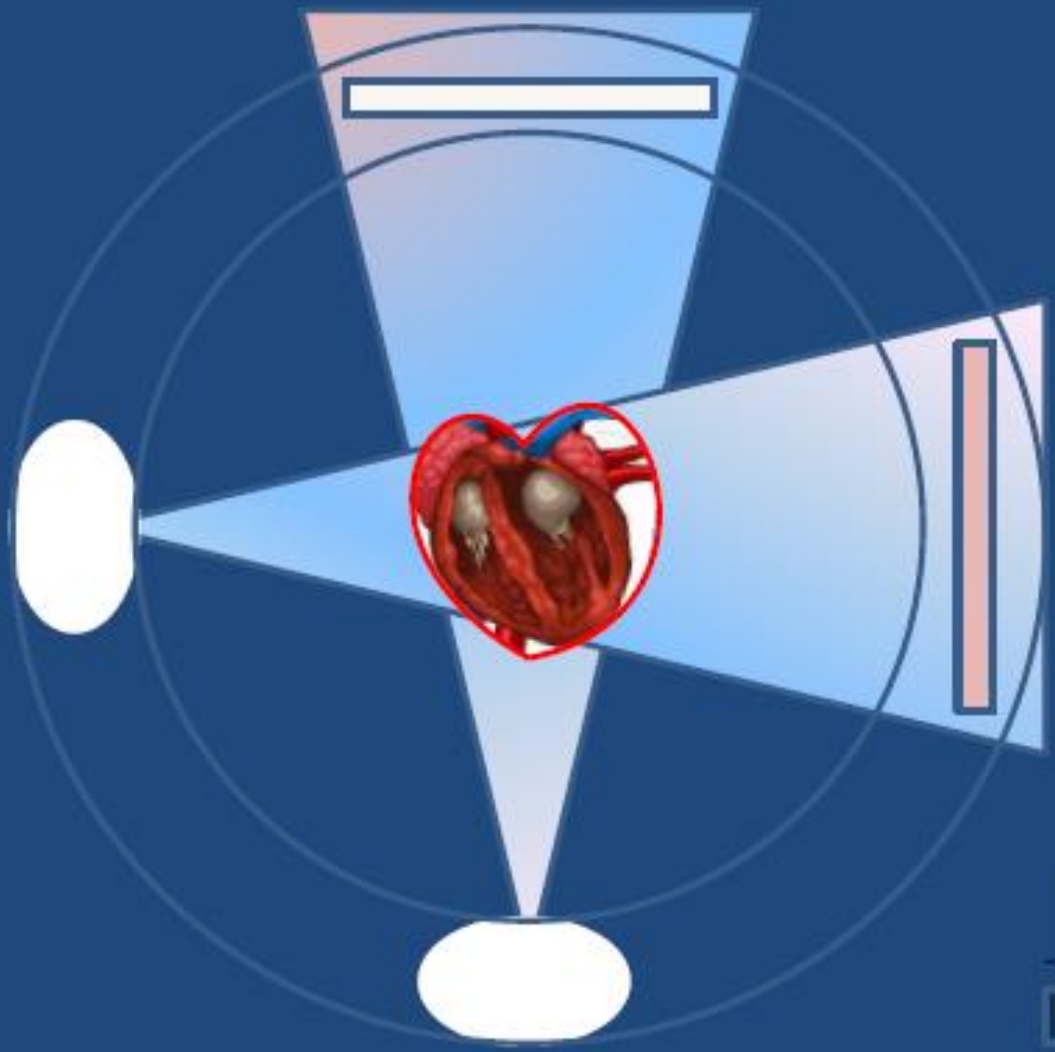
Soft Plaque Visualization



CTA

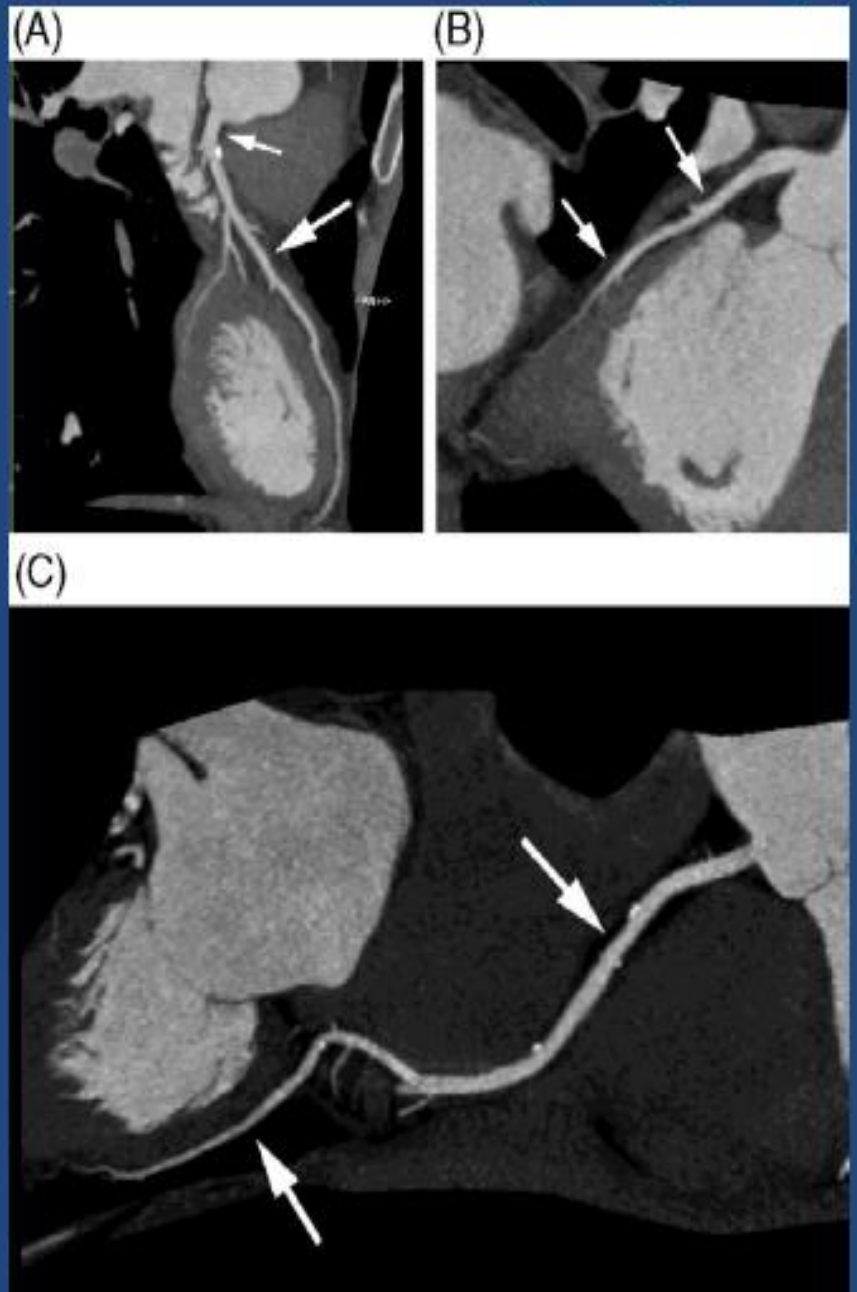
CATHETER ANGIOGRAPHY


CALCIFIC PLAQUES
CORONARY ARTERIES

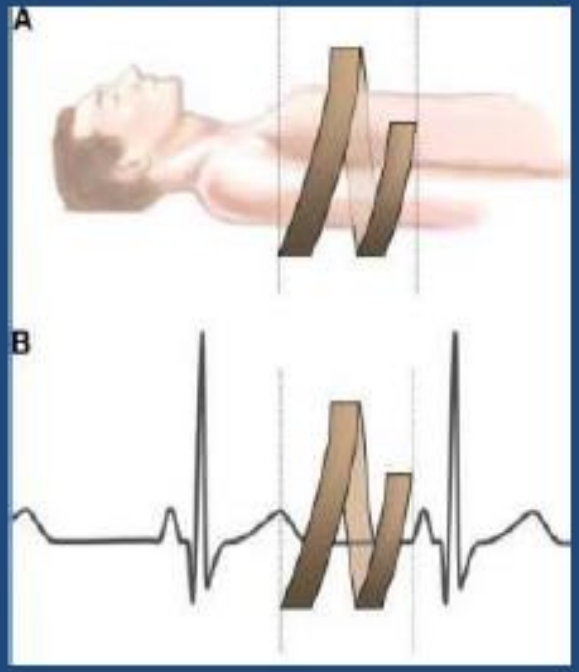


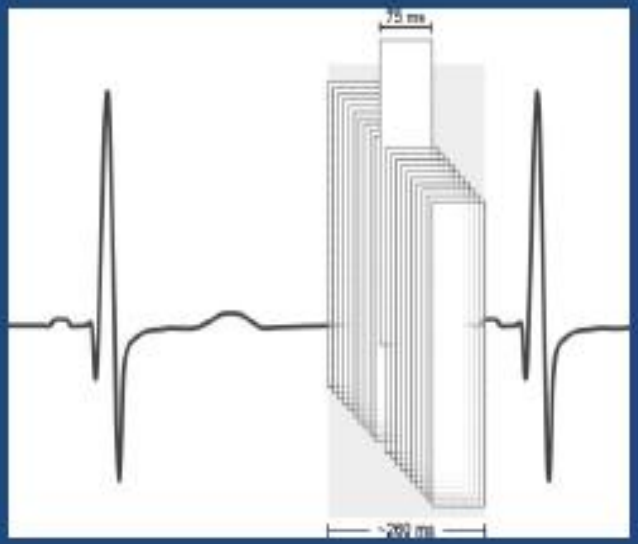
High Pitch Coronary CT Scanning

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

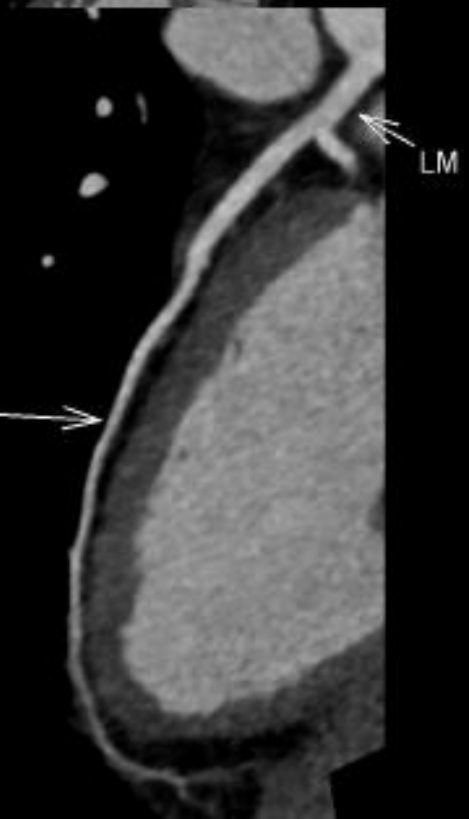


0.89 mSv

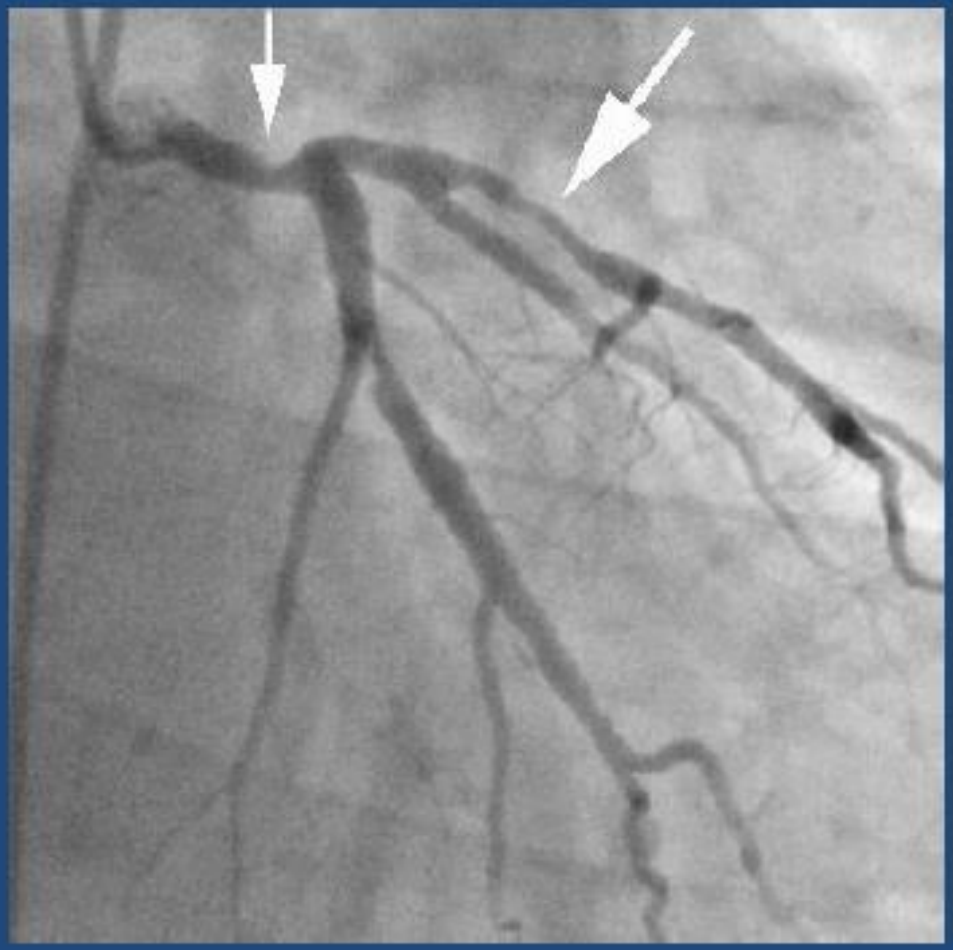


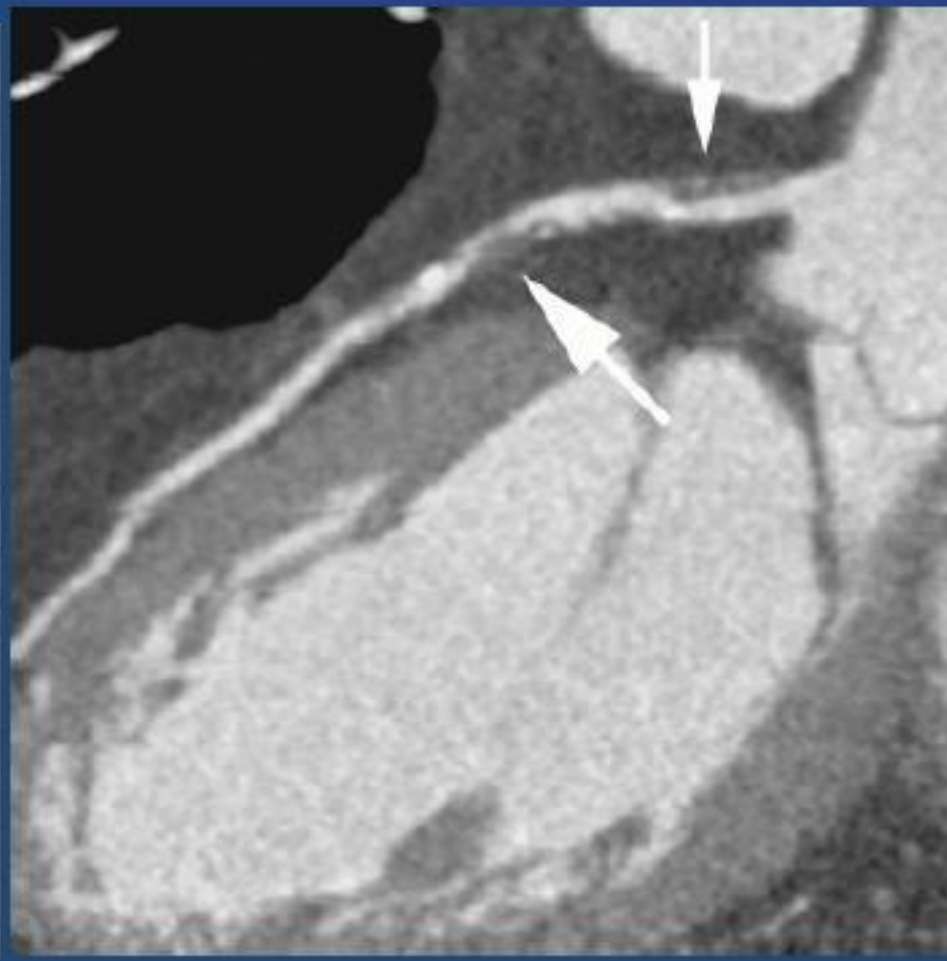


Gated with contrast



Plaque visualization





THANK YOU

DR SHARKAWY