

Basic chest X-ray interpretation

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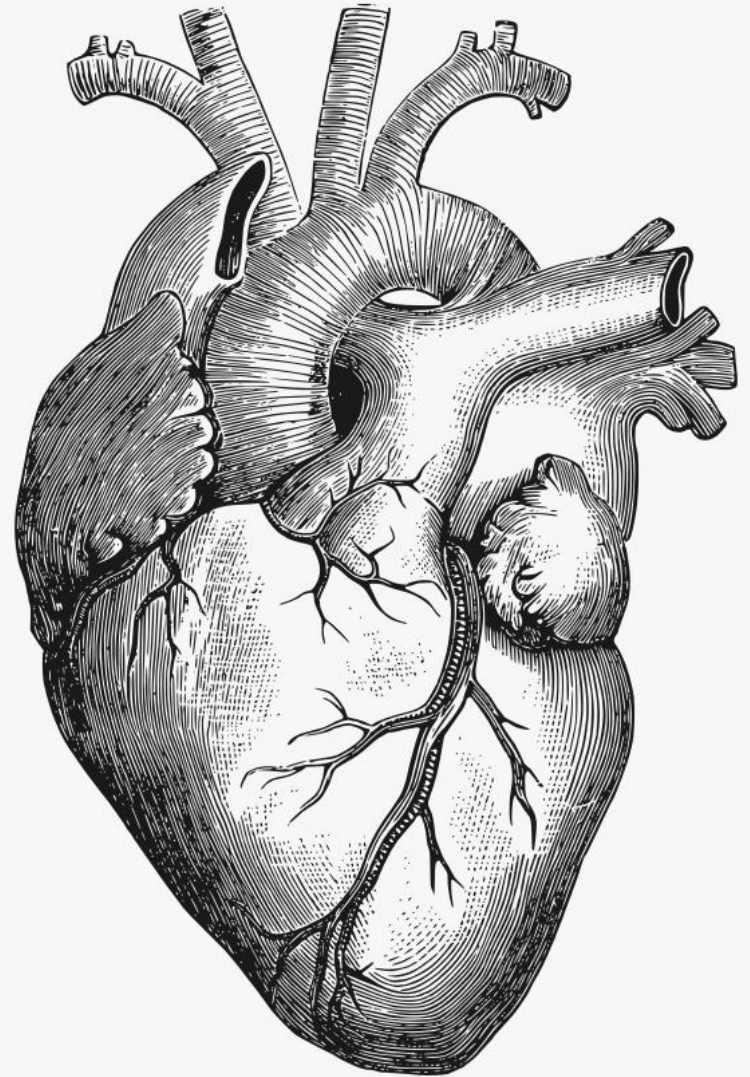
Part 3



Content



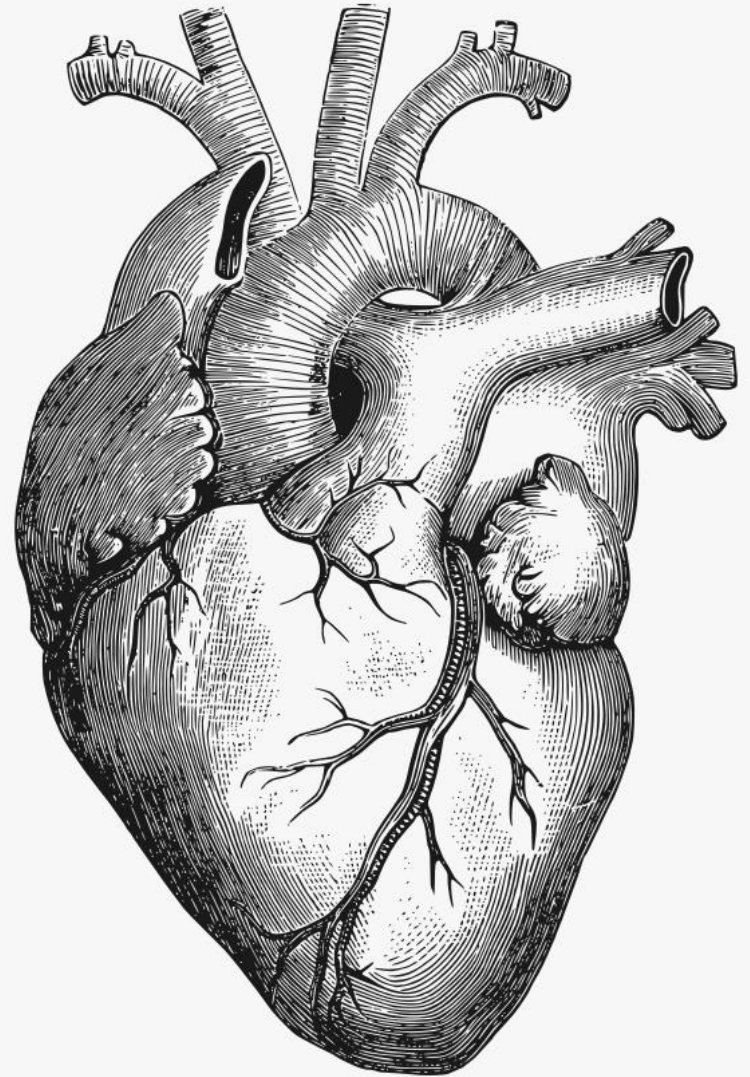
- Introduction
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- §8. Cardiothoracic ratio
- §9. Congestive heart failure
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Introduction



- **Introduction**



Introduction



- Chest X ray is a leading and prevailing method of chest cavity organs imaging.
- Allows to receive detailed and reliable data about the anatomic condition of cardiovascular, pulmonary and musculoskeletal systems.
- Along with CBC, urinalysis and ECG, chest radiography is one of the obligatory investigations provided to every in-patient who was admitted to healthcare units of various specializations.
- Cheap, accessible and still reliable and effective imaging method.



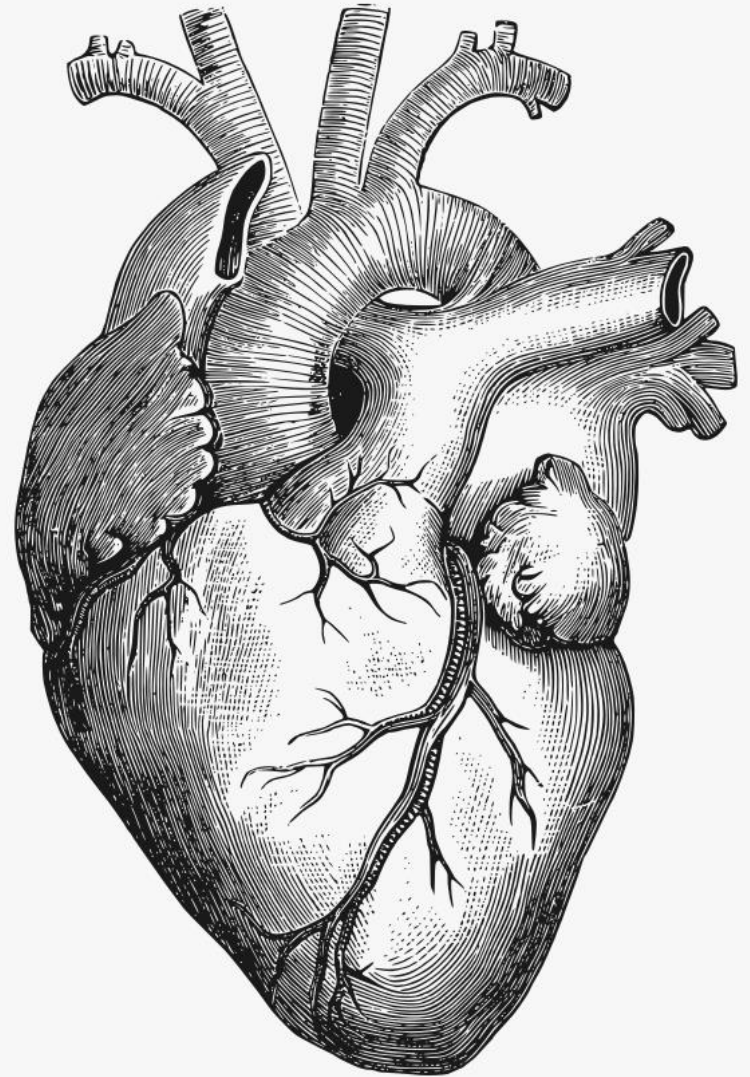
Introduction



- However, today **echocardiography** (ultrasound investigation of the heart) is the main and leading instrumental method in diagnosis of cardiovascular pathology.

§7. Cardiomedastinal outlines +

- **Cardiomedastinal outlines**

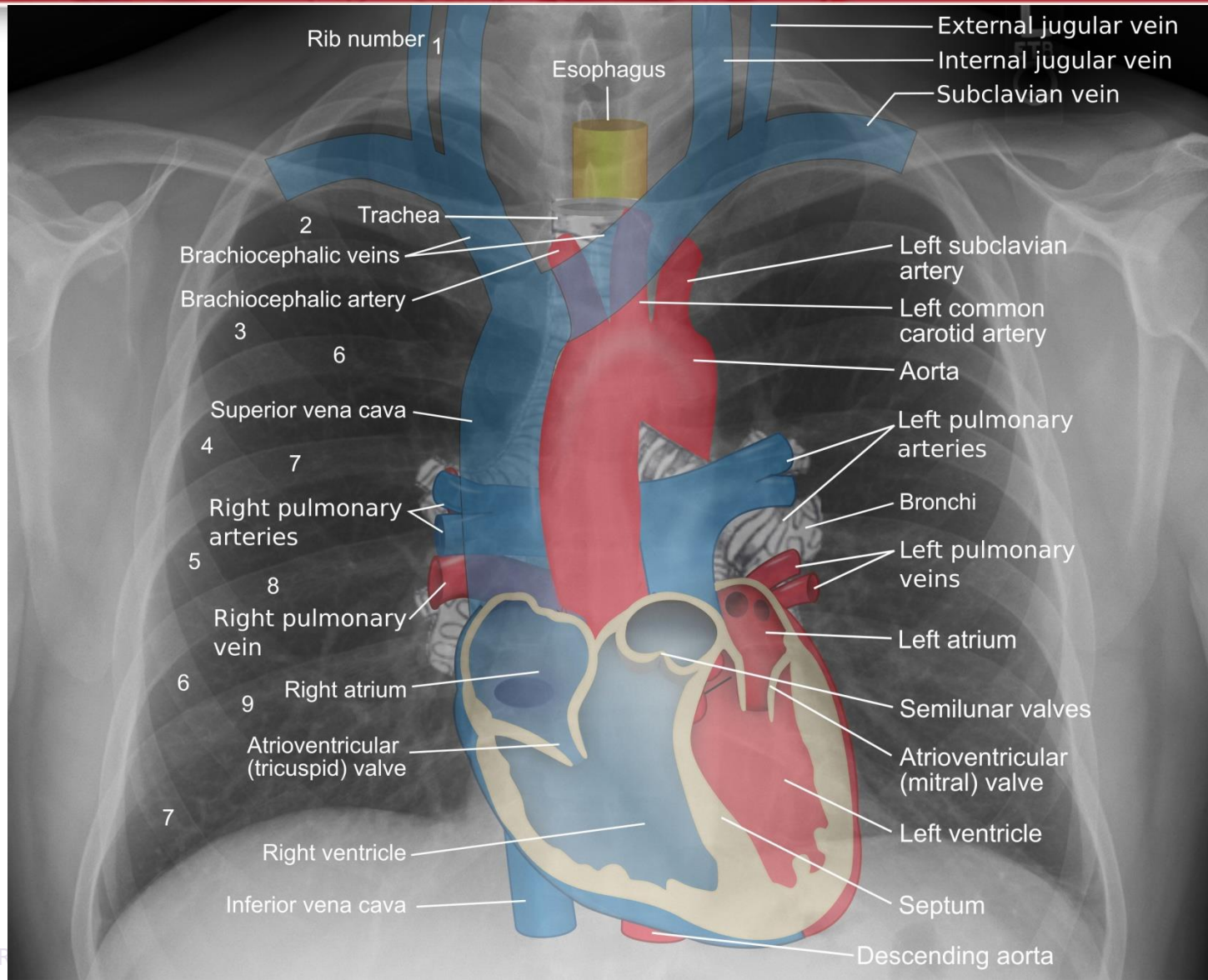


Cardiomediastinal outlines



- The understanding of the structures which normally contribute to **cardiomediastinal outline** is essential in being able to interpret chest x-rays and localize abnormalities.

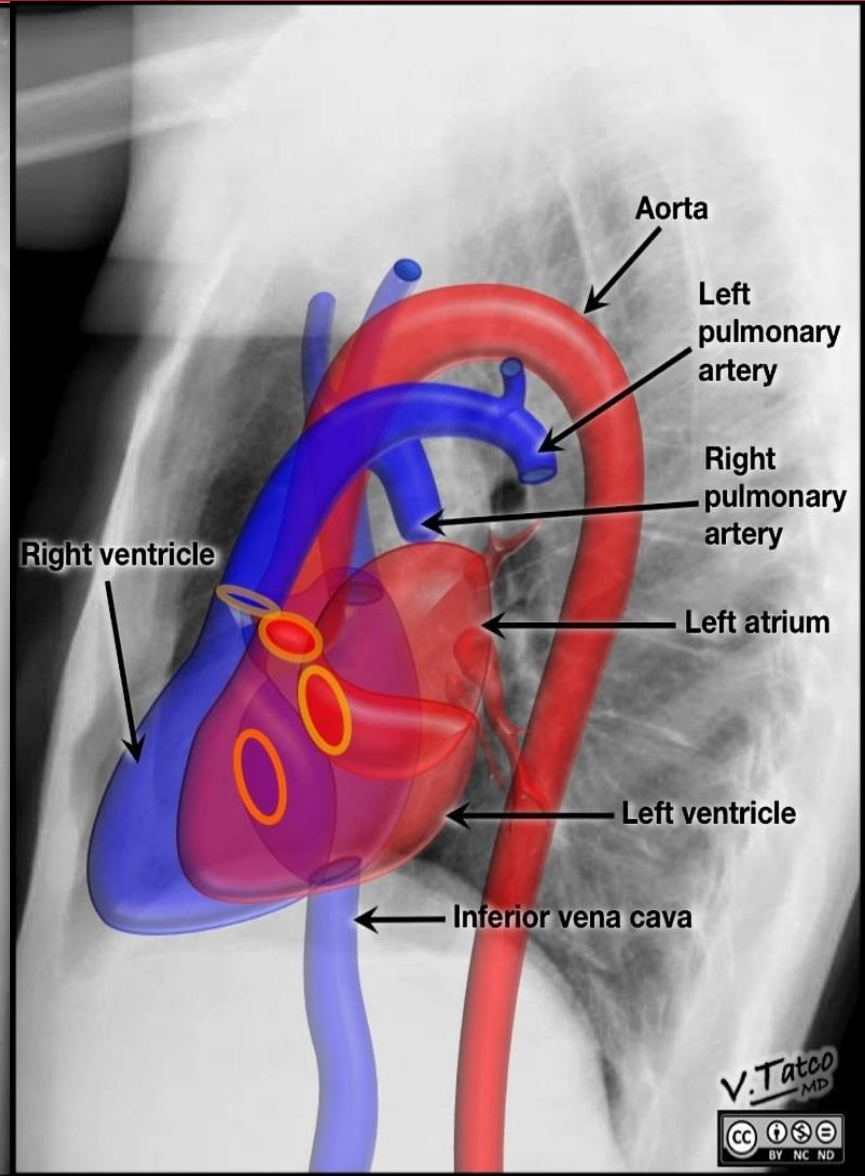
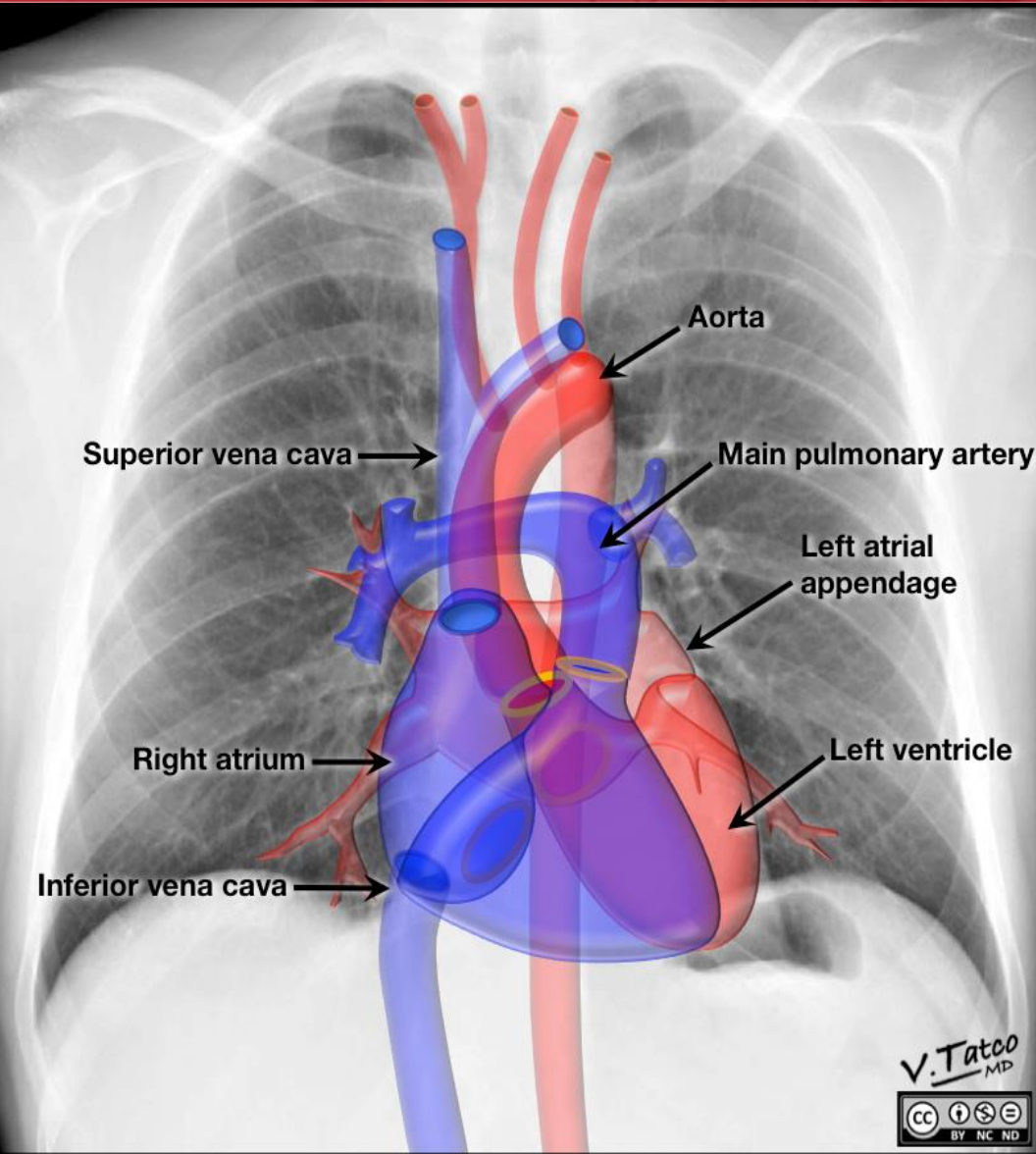
General topography



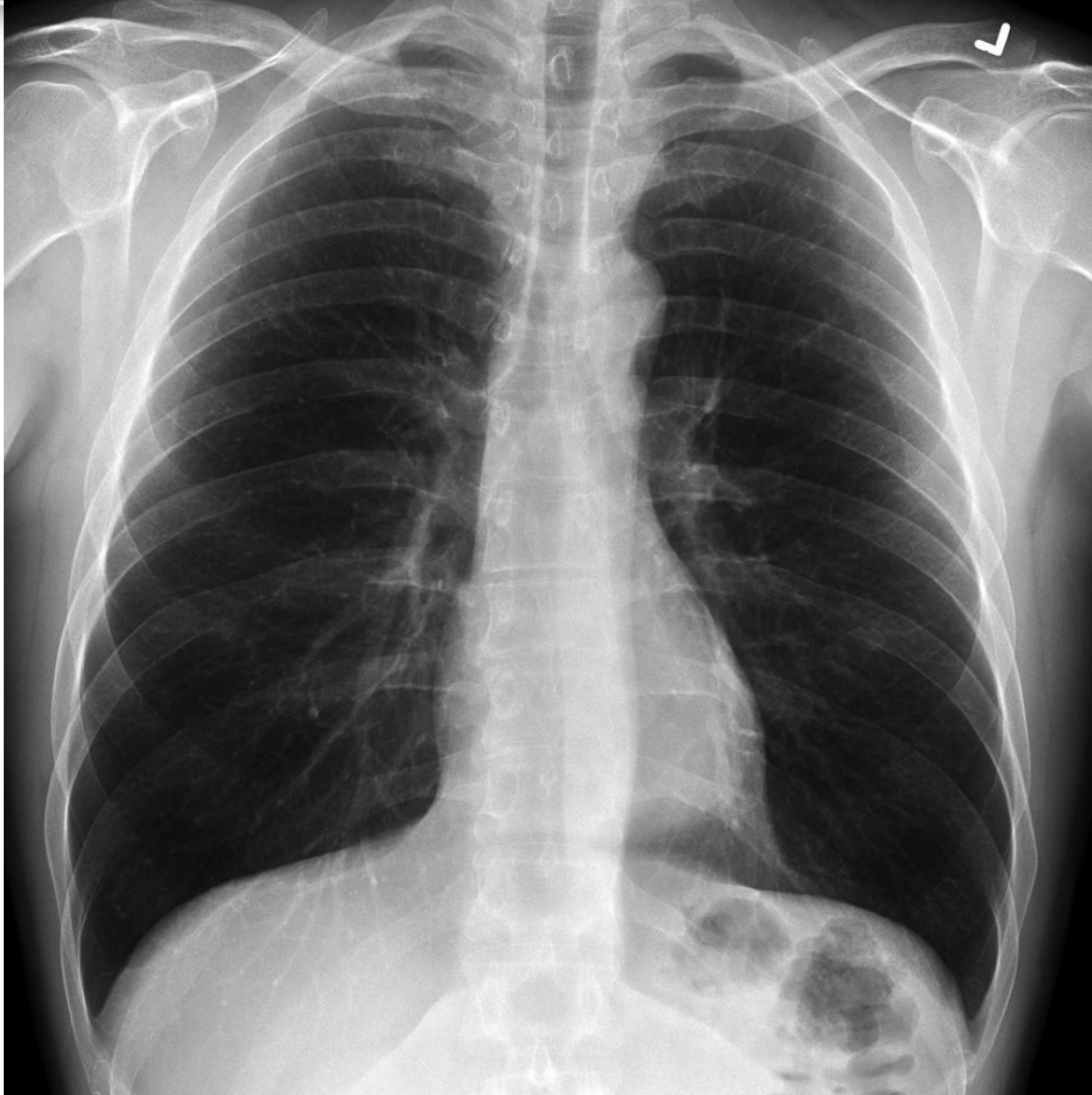
PA

view

Cardiomediastinal outlines



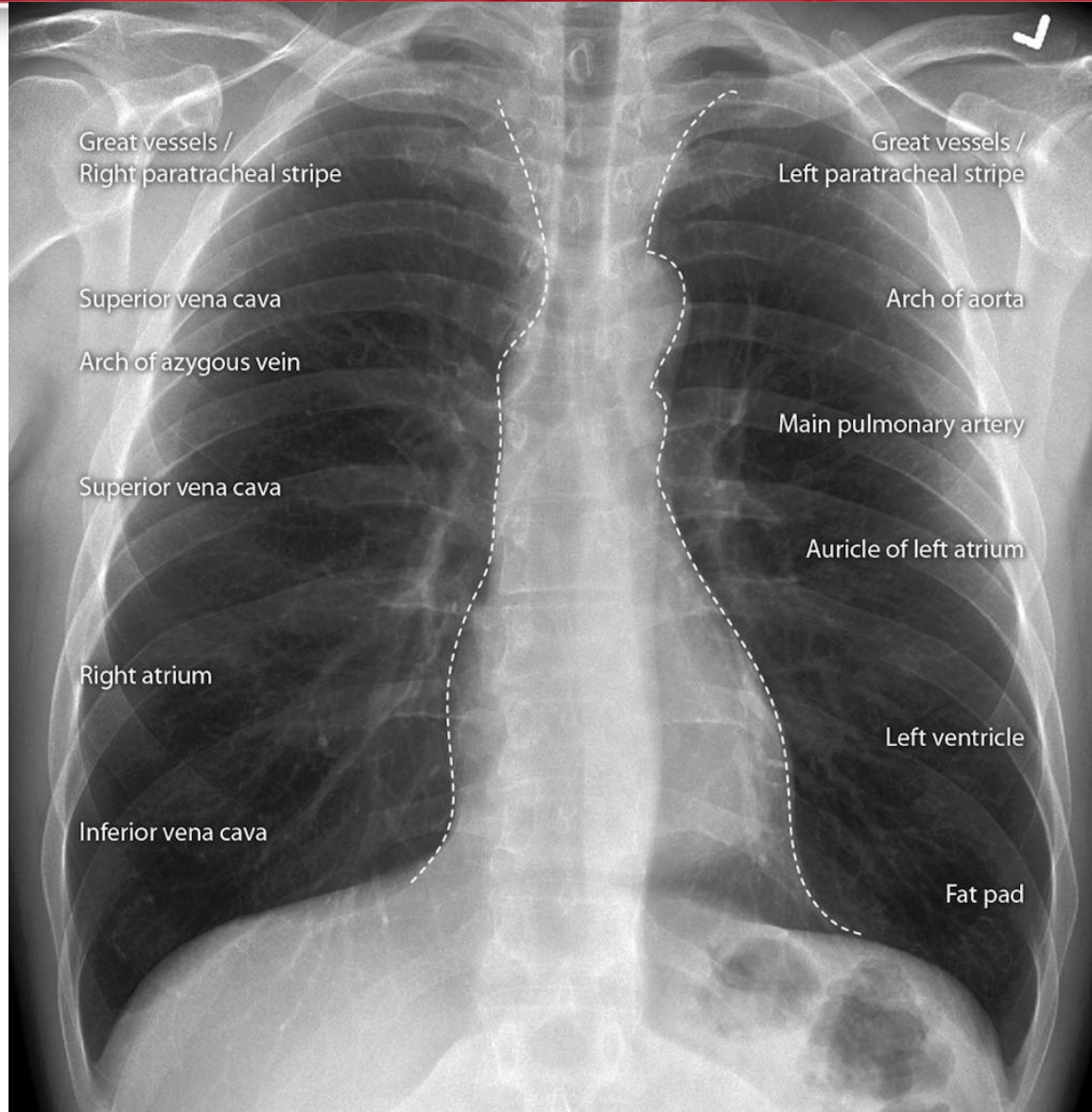
Cardiomediastinal outlines



PA

view

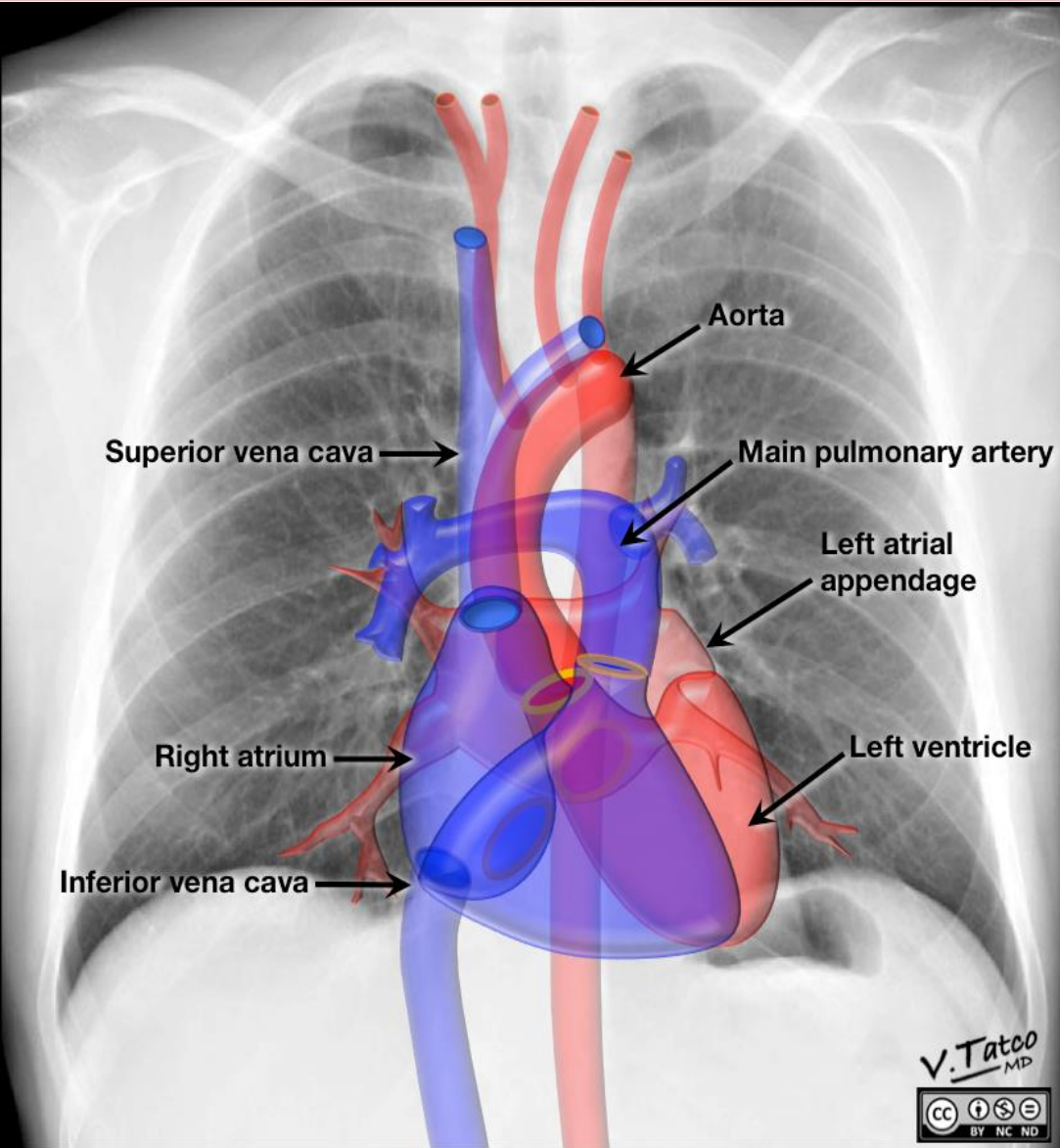
Cardiomediastinal outlines



PA

view

Cardiomediastinal outlines



Right cardiomedastinal contour

From superior to inferior:

- superior vena cava (SVC)
- right atrium (RA)
- inferior vena cava (IVC)

Left cardiomedastinal contour

From superior to inferior:

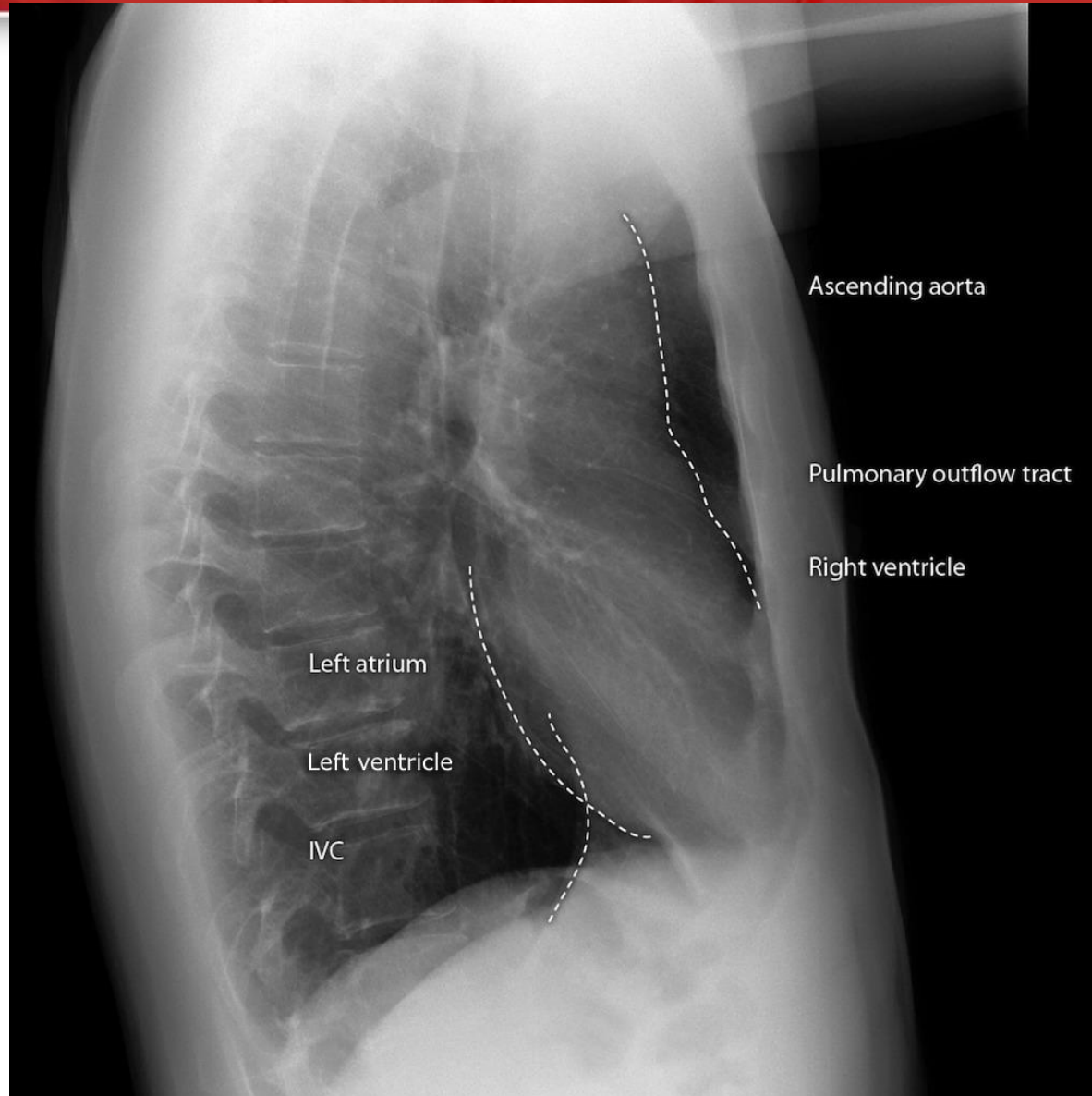
- aortic arch
- pulmonary trunk
- auricle of left atrium
- left ventricle (LV)

Cardiomediastinal outlines



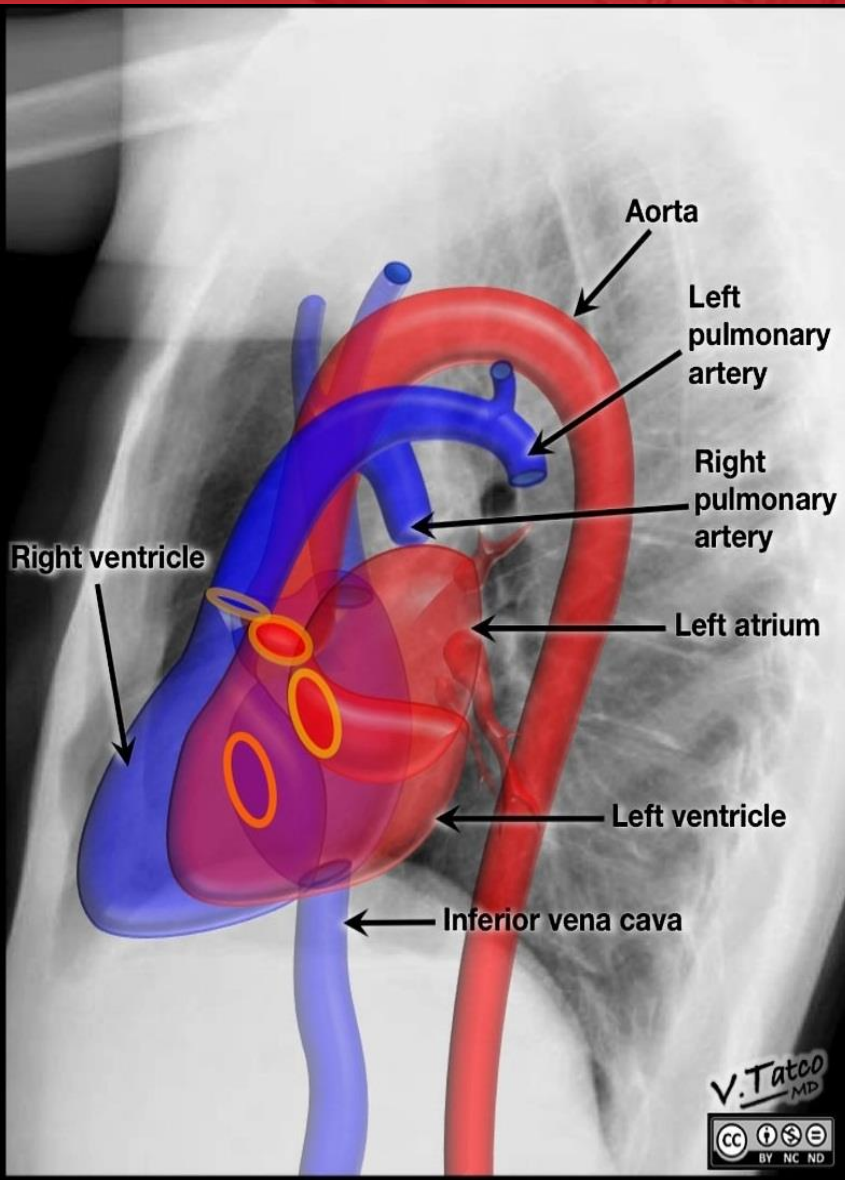
**Lateral
view**

Cardiomediastinal outlines



**Lateral
view**

Cardiomediastinal outlines



- **Anterior cardiomediastinal contour**

From superior to inferior:

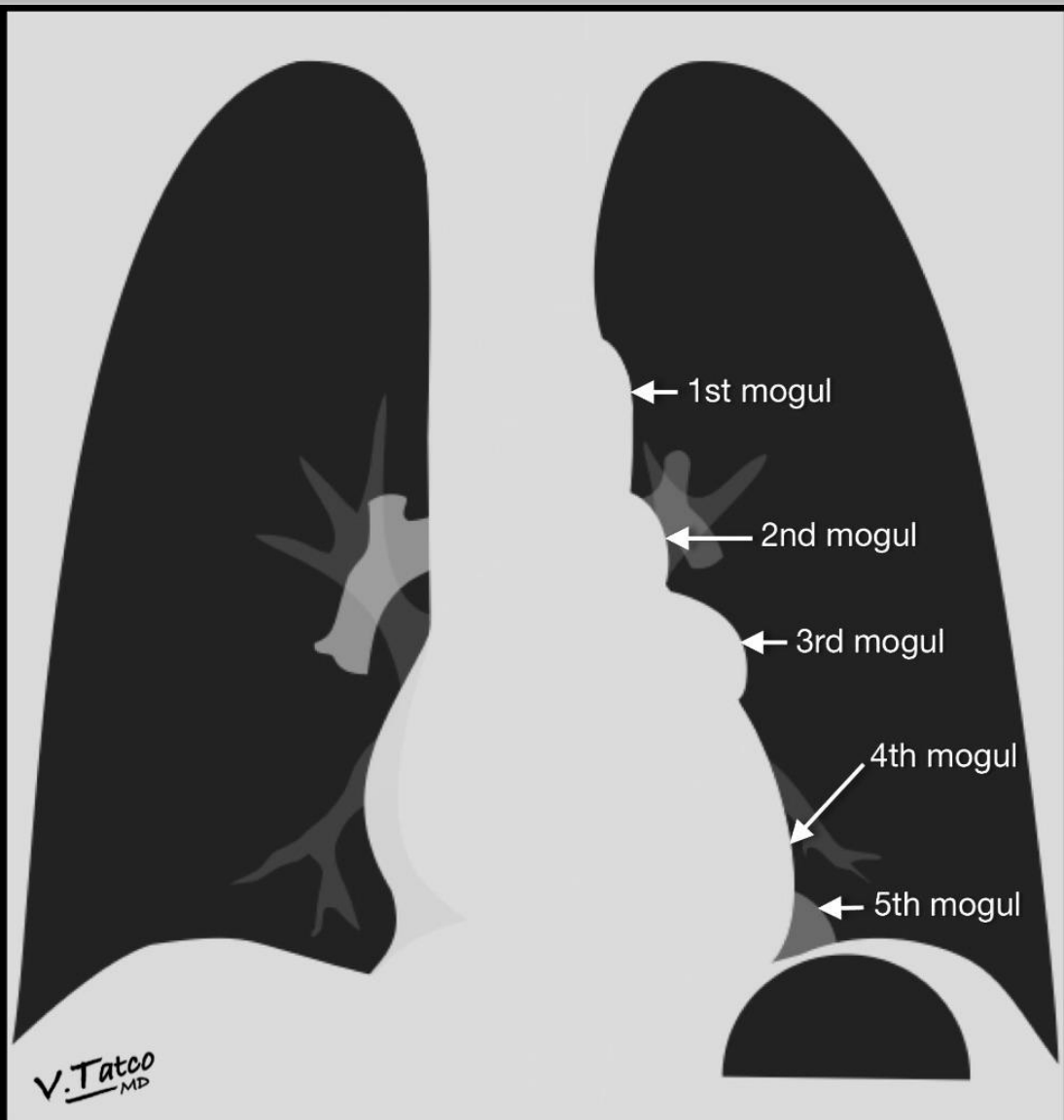
- ascending aorta
- right ventricular outflow tract
- right ventricle

- **Posterior cardiomediastinal contour**

From superior to inferior:

- left atrium and pulmonary veins
- left ventricle
- inferior vena cava

Moguls of heart



Moguls of the heart refer to the bulges of the cardiomeastinal contour on frontal CXR.

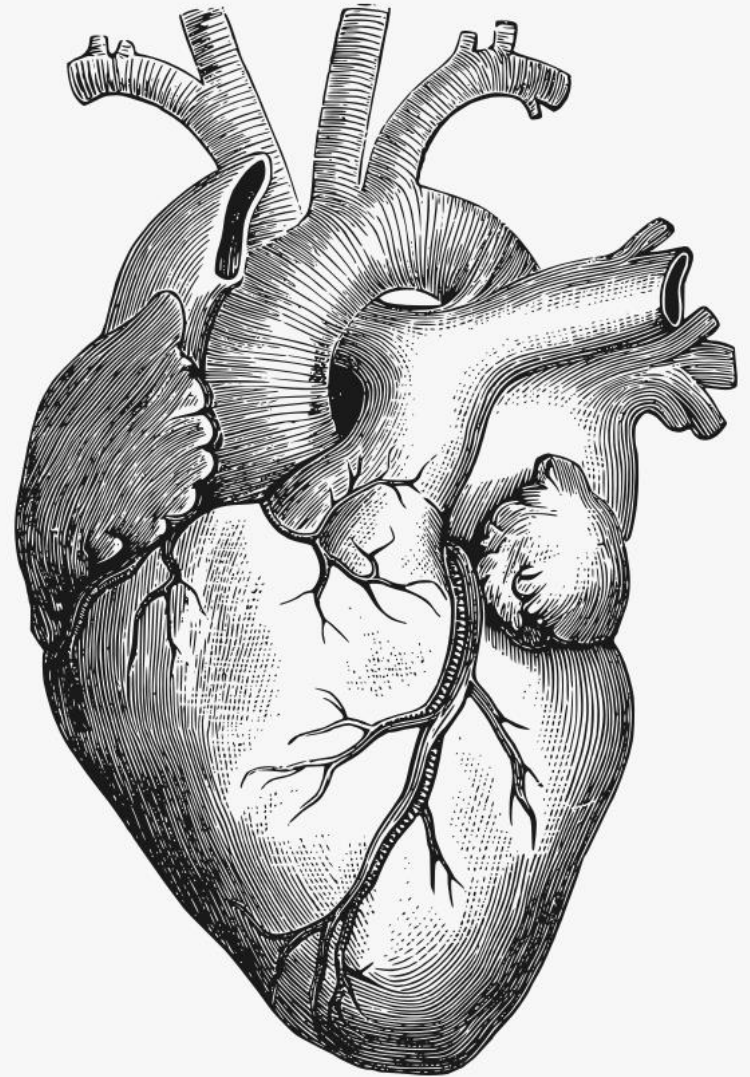
On the **left cardiomeastinal border**:

- **I mogul** - aortic knob
- **II mogul** - main pulmonary artery segment
- **III mogul** - dilated left atrial appendage (**never normal**)
- **IV mogul** - left ventricle
- **V mogul** - prominent pericardial fat pad

§8. Cardiothoracic ratio



- **Cardiothoracic ratio**



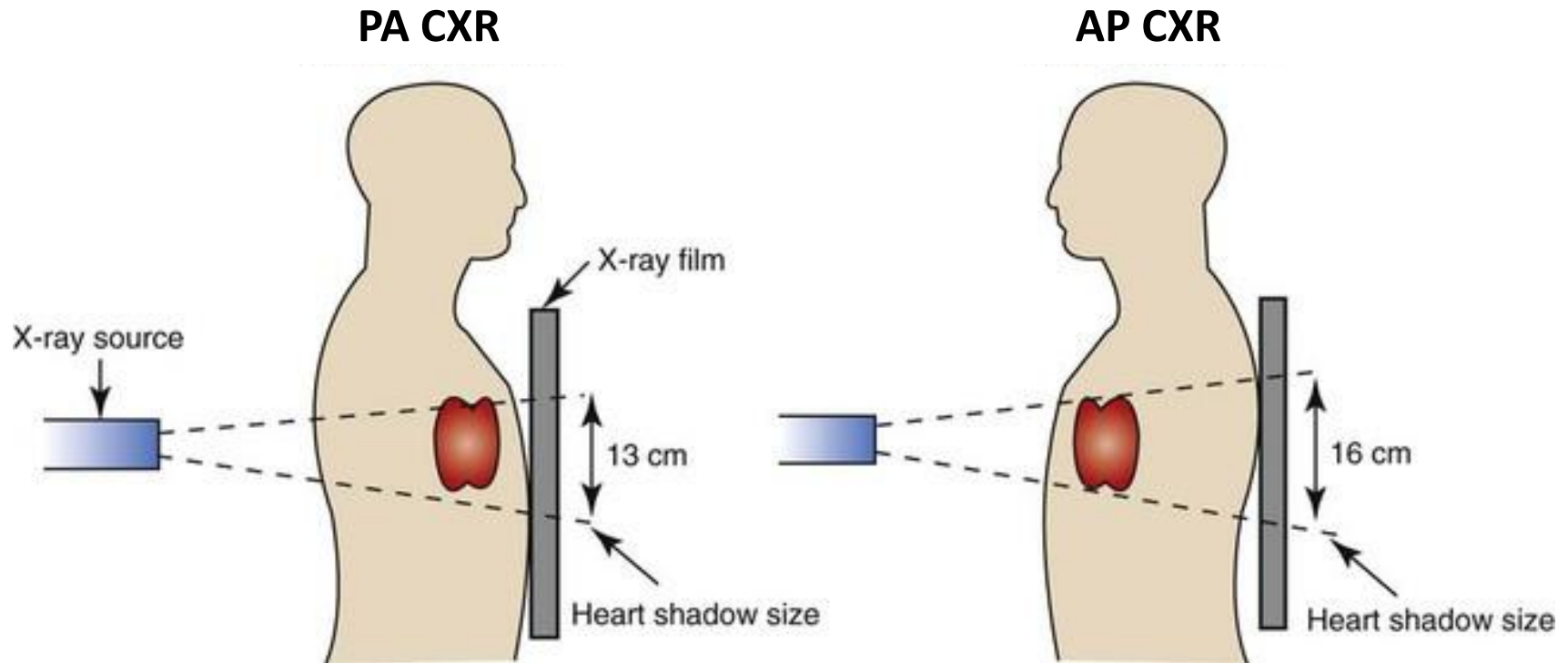
Cardiothoracic ratio



- **Cardiothoracic ratio (CTR)** helps to detect the enlargement of the cardiac silhouette, which is most commonly from *cardiomegaly*, *pericardial effusion (pericarditis/heart tamponade)*, *LV/RV hypertrophy*.
- The CTR is measured on a **PA* chest X-ray**.
- It is the ratio of maximal horizontal cardiac diameter to maximal horizontal thoracic diameter (inner edge of ribs / edge of pleura).
A normal measurement should be <0.5.

*Projections (including PA and AP) are explained in § 2, Part 1 of the current lecture.

Heart size. AP vs PA.



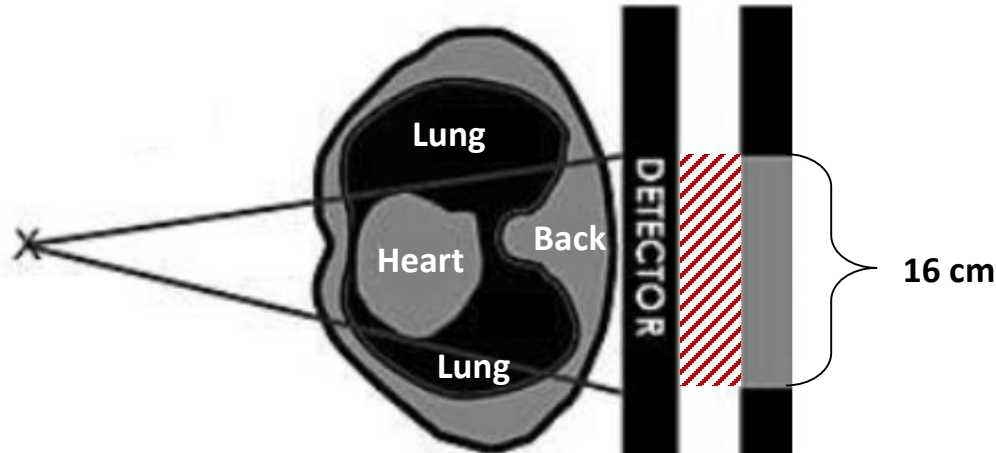
The CTR should not be measured on an AP chest x-ray.

Objects nearer the x-ray tube appear artificially enlarged due to divergence of the x-ray beam, resulting in the heart appearing artificially large on AP radiographs.

Heart size. AP vs PA.



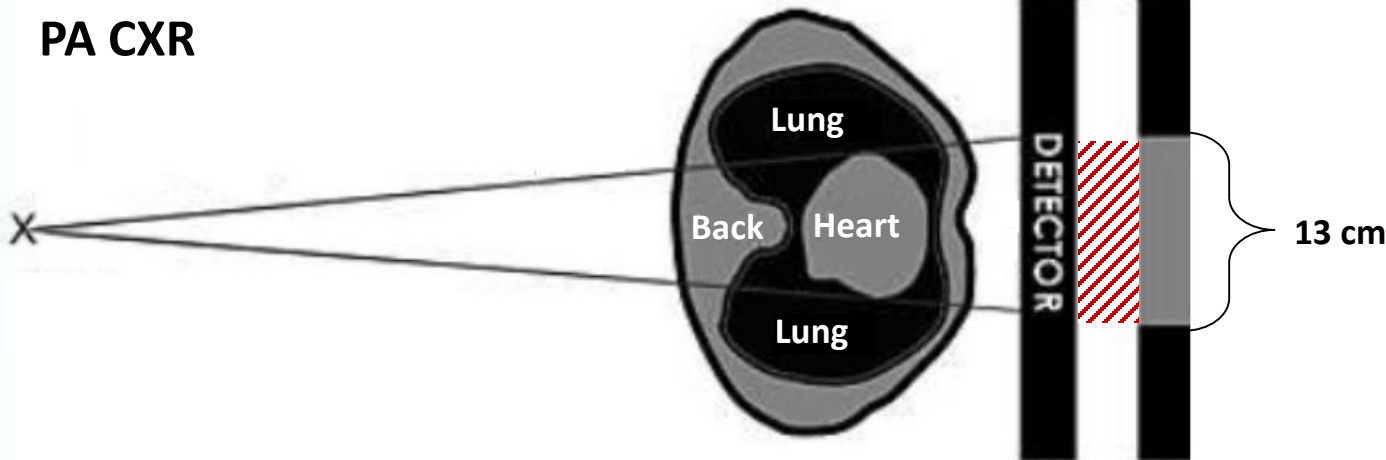
AP CXR



Heart size is exaggerated:

- heart is relatively farther from the detector;
- source is nearer the patient;
- X-ray beam is more divergent.

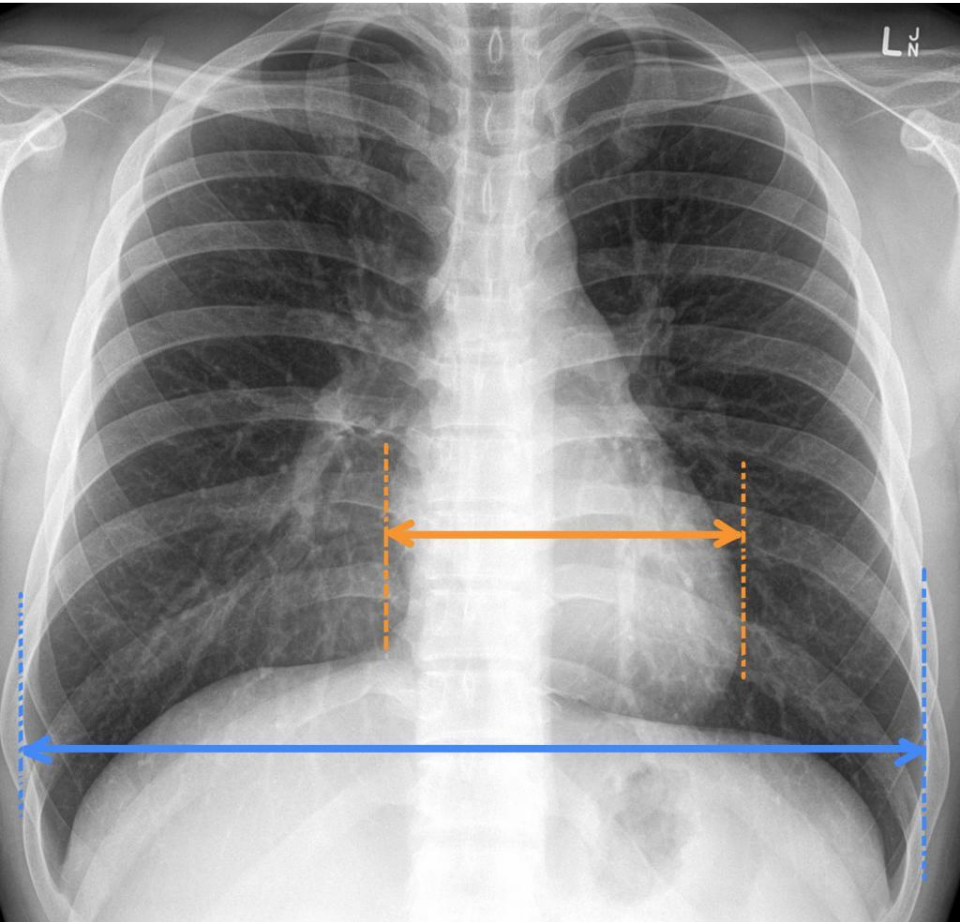
PA CXR



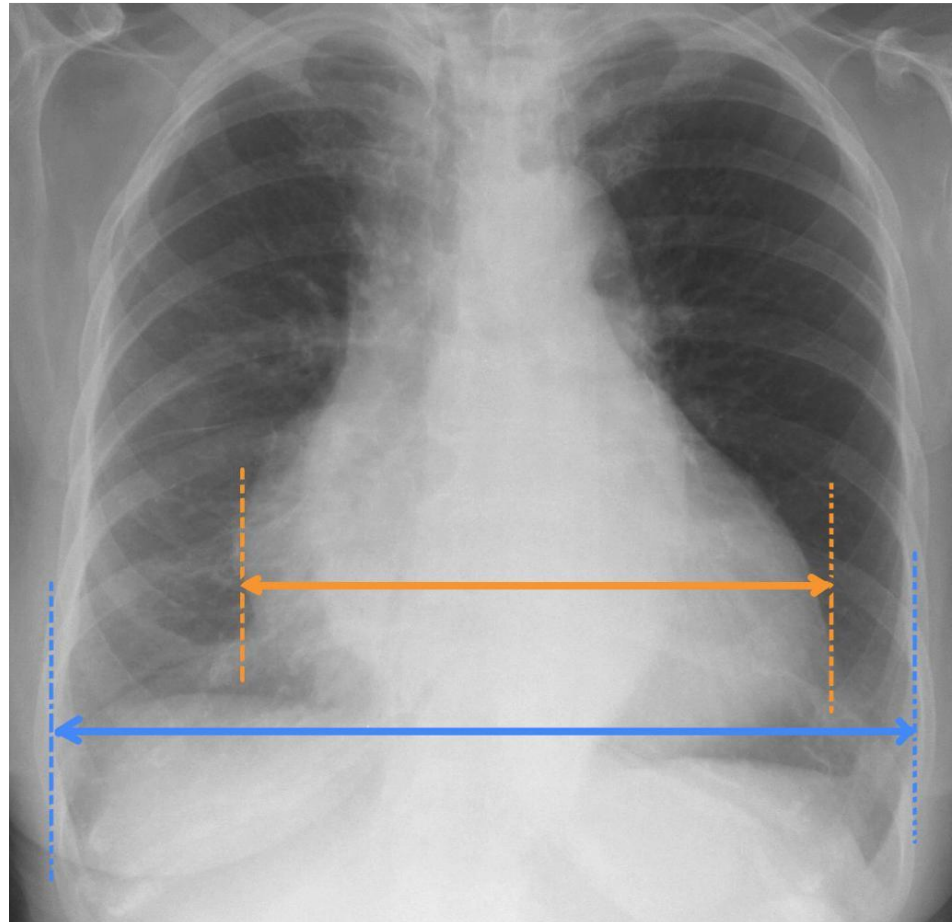
Heart size is nearer to the real size:

- heart is nearer the detector;
- narrower beam;
- increased distance between the source and the patient.

Cardiothoracic ratio



Normal CTR (<0.5)



Abnormal CTR (>0.5)

Cardiothoracic ratio

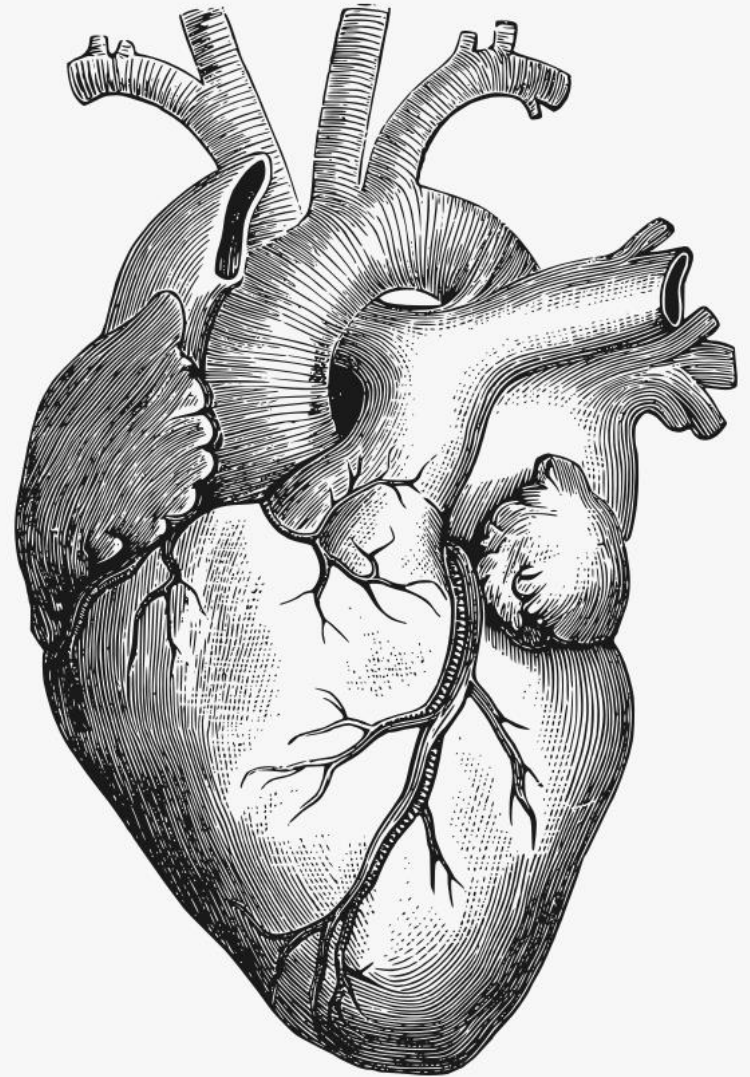


- **Enlargement of the cardiac silhouette** on a PA CXR can be due to:
 - **Cardiomegaly** (most common cause by far)
 - **Pericardial effusion**
 - **Anterior mediastinal mass**
 - **Prominent epicardial fat pad**
 - **Expiratory radiograph**
 - **AP projection**

§9. Congestive heart failure



- **Congestive heart failure**



Congestive heart failure



- **Congestive heart failure (CHF)** - a clinical syndrome caused by inherited or acquired abnormalities of heart structure and function.
- Leading reasons of CHF are **coronary artery disease, hypertension, heart valve disease, cardiomyopathies**.
- CXR is still informative in diagnostics of CHF, especially in case of pulmonary complications.



Congestive heart failure

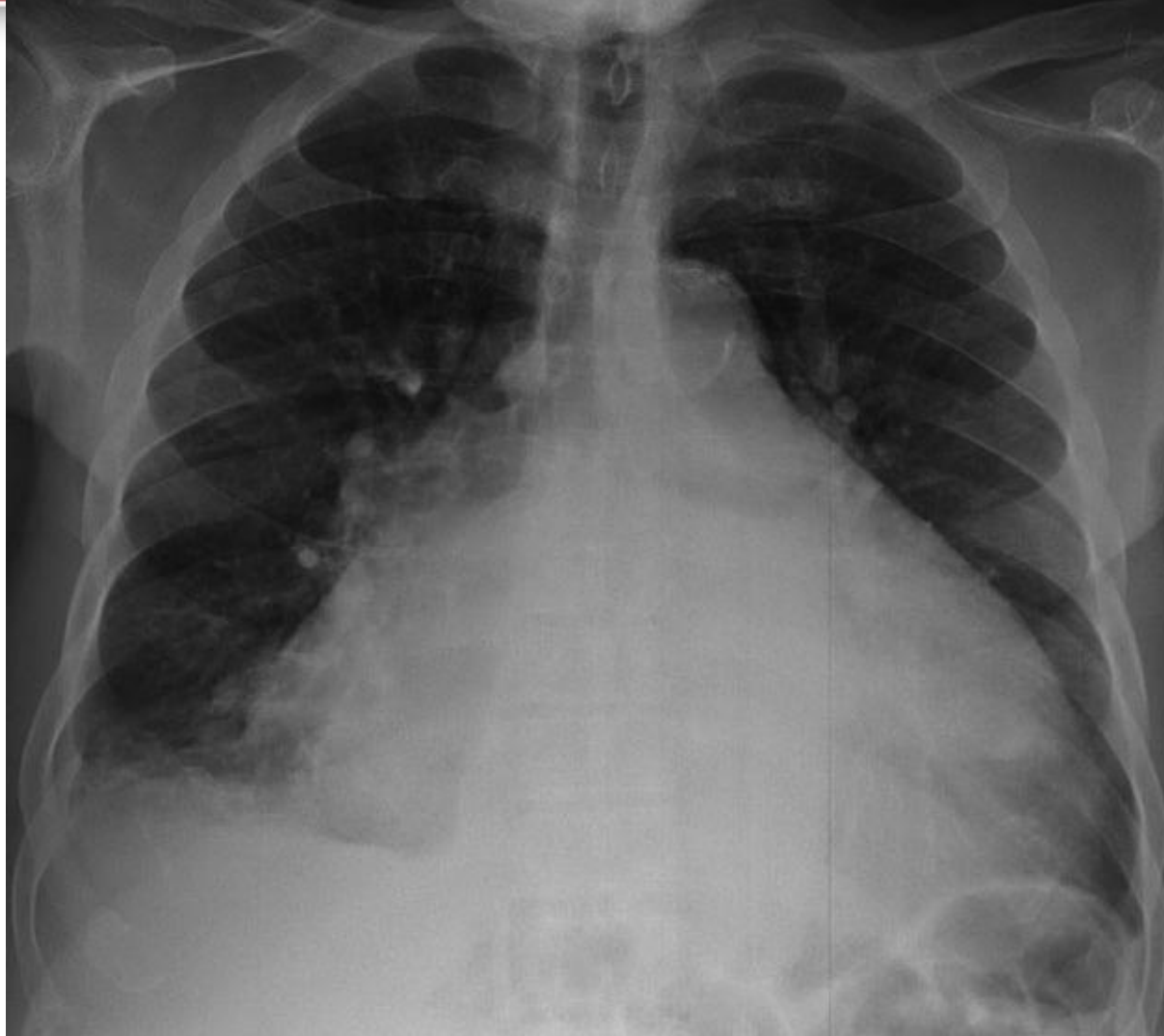


- Most important signs of CHF in CXR include:
 - **Cardiomegaly**
 - **Pulmonary edema***
 - **Pleural effusions***



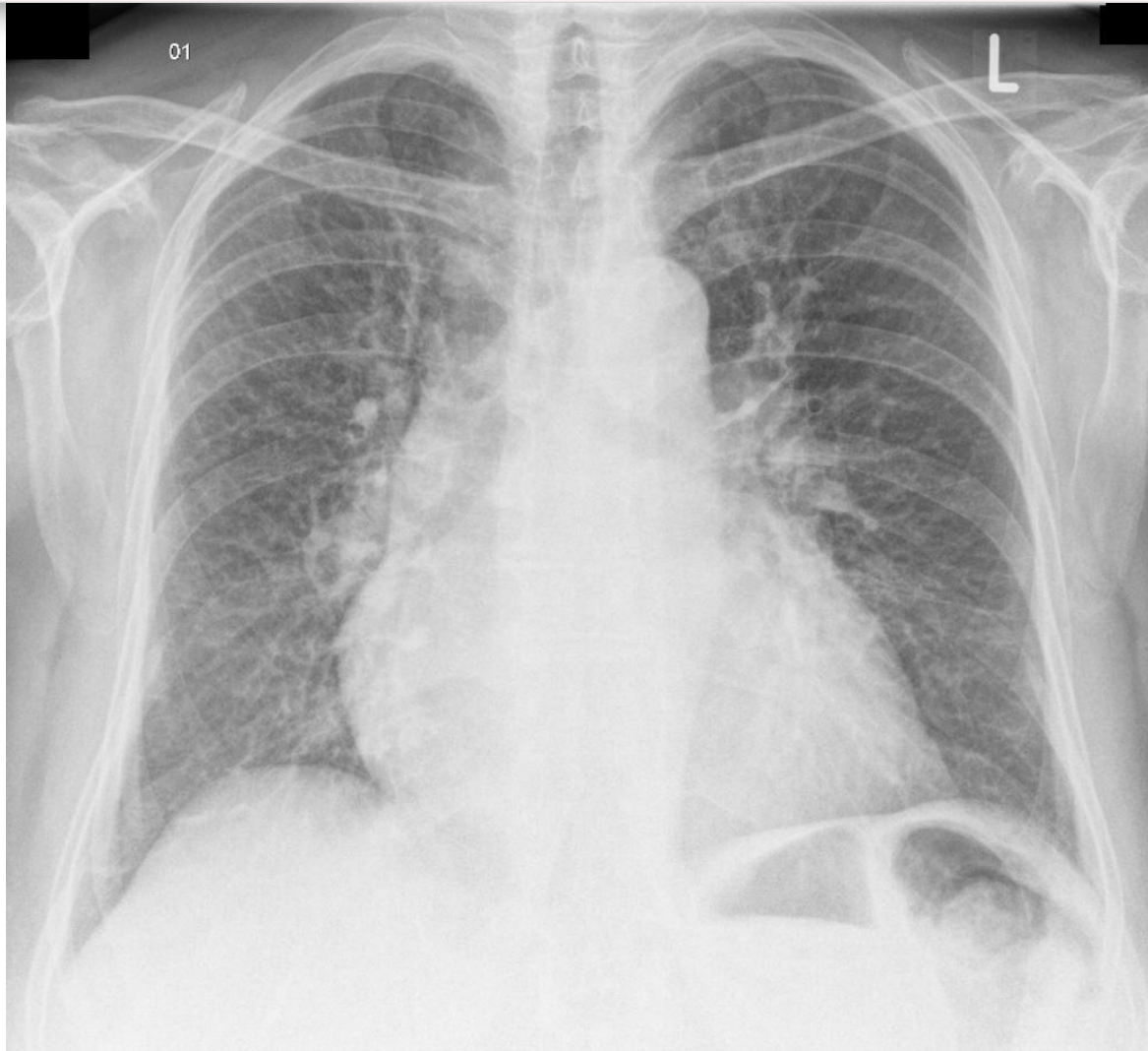
**Pulmonary edema and pleural effusions are explained in Part 1 and Part 2 of the current lecture.*

Cardiomegaly



Ds: Cor bovinum (bull's heart) refers to a massively dilated heart.

Congestive heart failure

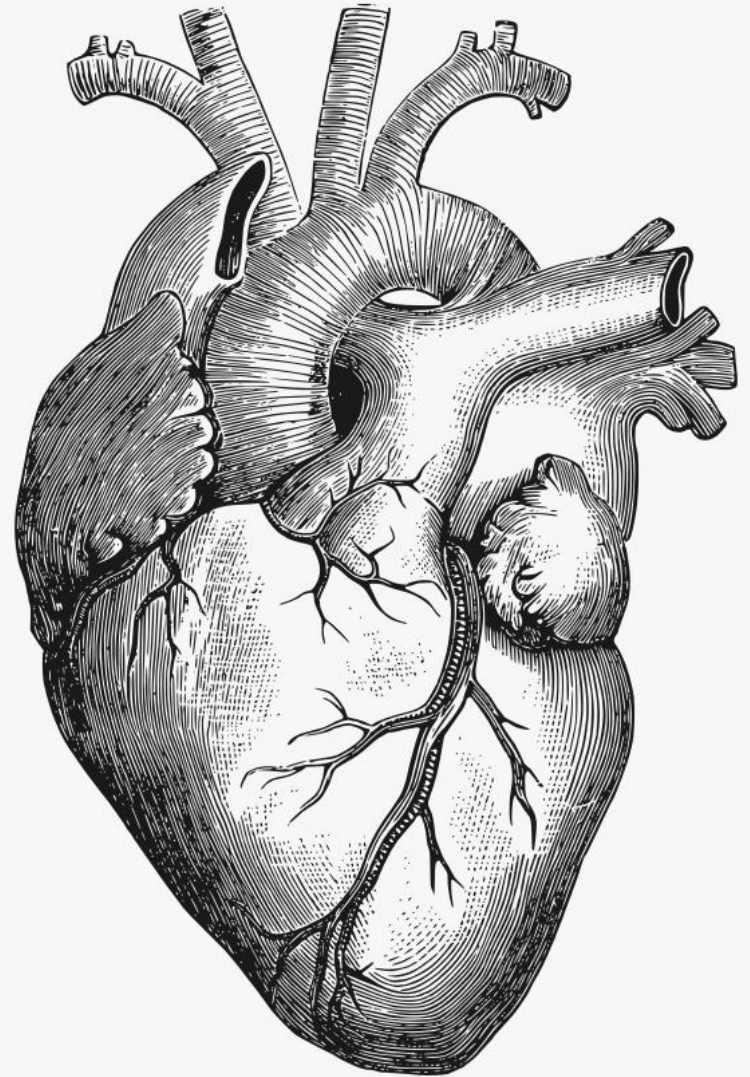


Ds: CTR>0.5. Cephalisation of the lung vasculature. Kerley B lines.

§10. Heart configuration



- **Heart configuration:**
 - **Mitral heart configuration**
 - **Aortic heart configuration**



Heart configuration



- **Heart configuration** - is the shape of the heart's silhouette that projects onto the anterior chest wall.
- **Heart configuration = shape of heart's shadow/silhouette.**

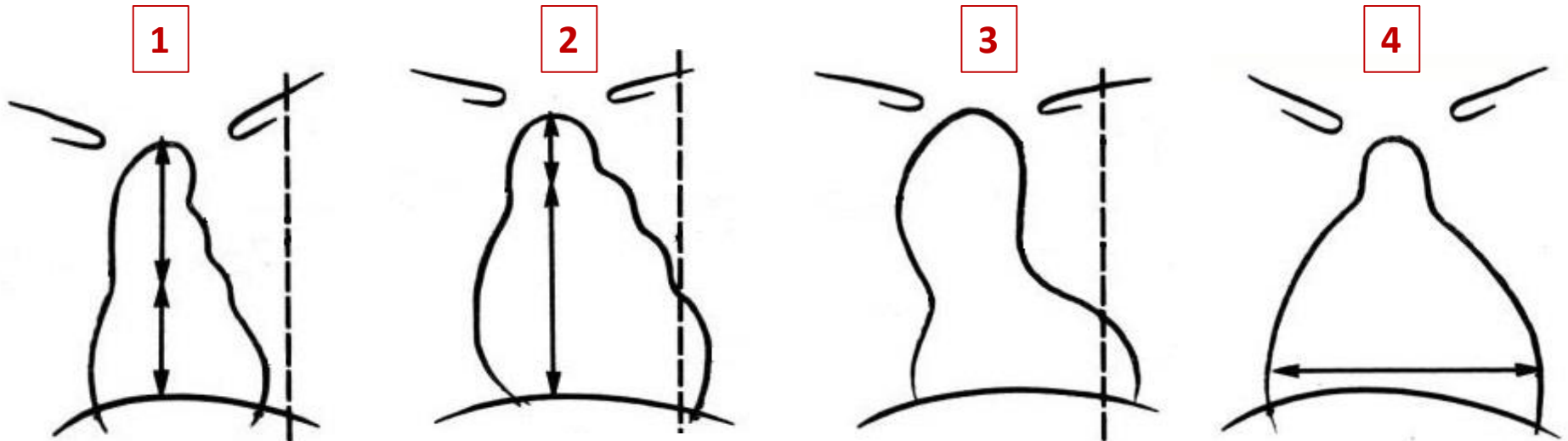
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Heart configuration



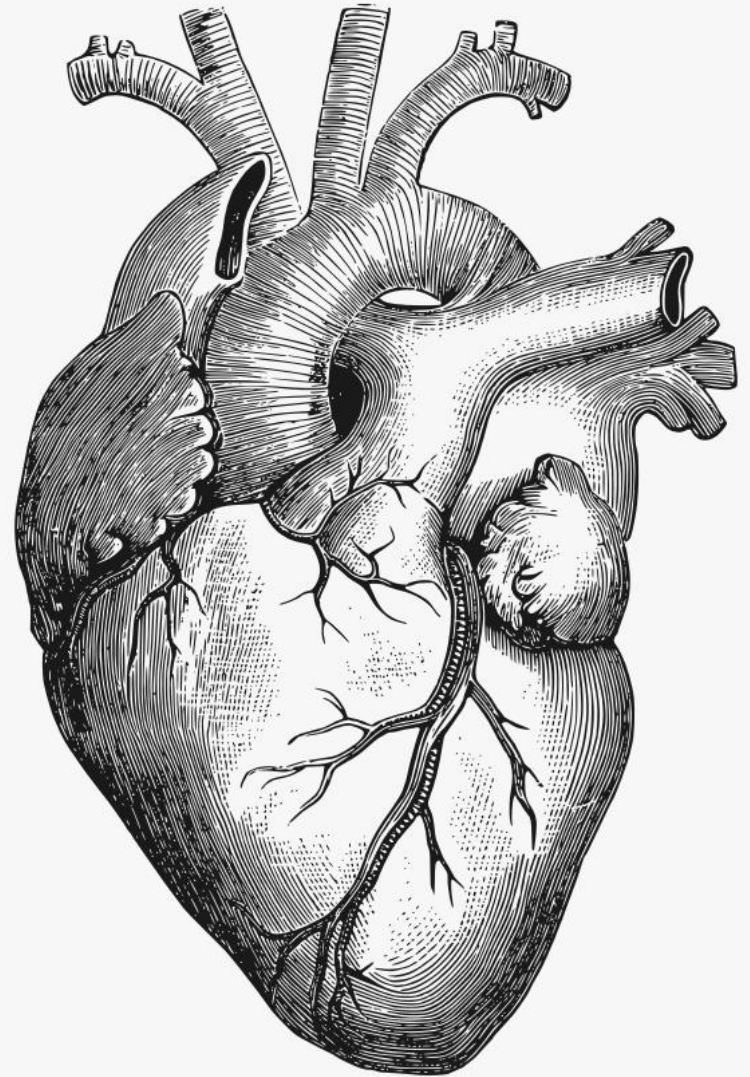
- There are four major types of heart configuration:
 - 1. Normal heart configuration;**
 - 2. Mitral heart configuration** (*mitral defects*);
 - 3. Aortic heart configuration** (*aortic defects, ischemic cardiac disease, arterial hypertension*);
 - 4. Water bottle configuration*** (*pericardial effusion*).



*Water bottle configuration is explained in § 11, Part 3 of the current lecture.



- **Mitral heart configuration**



Mitral heart configuration



- **Mitral valve regurgitation** and **mitral valve stenosis** are the common complications of carditis in **rheumatic heart disease** and lead to forming of **mitral heart**.
- **Mitral heart configuration** is characterized by **left atrial enlargement** with the next signs:
 - **Double-density sign**;
 - **Third mogul sign**/convex left atrial appendage/disappearing of heart waist;
 - Oblique measurement > 7 cm;
 - Carina angle $> 90^\circ$.

Double-density sign

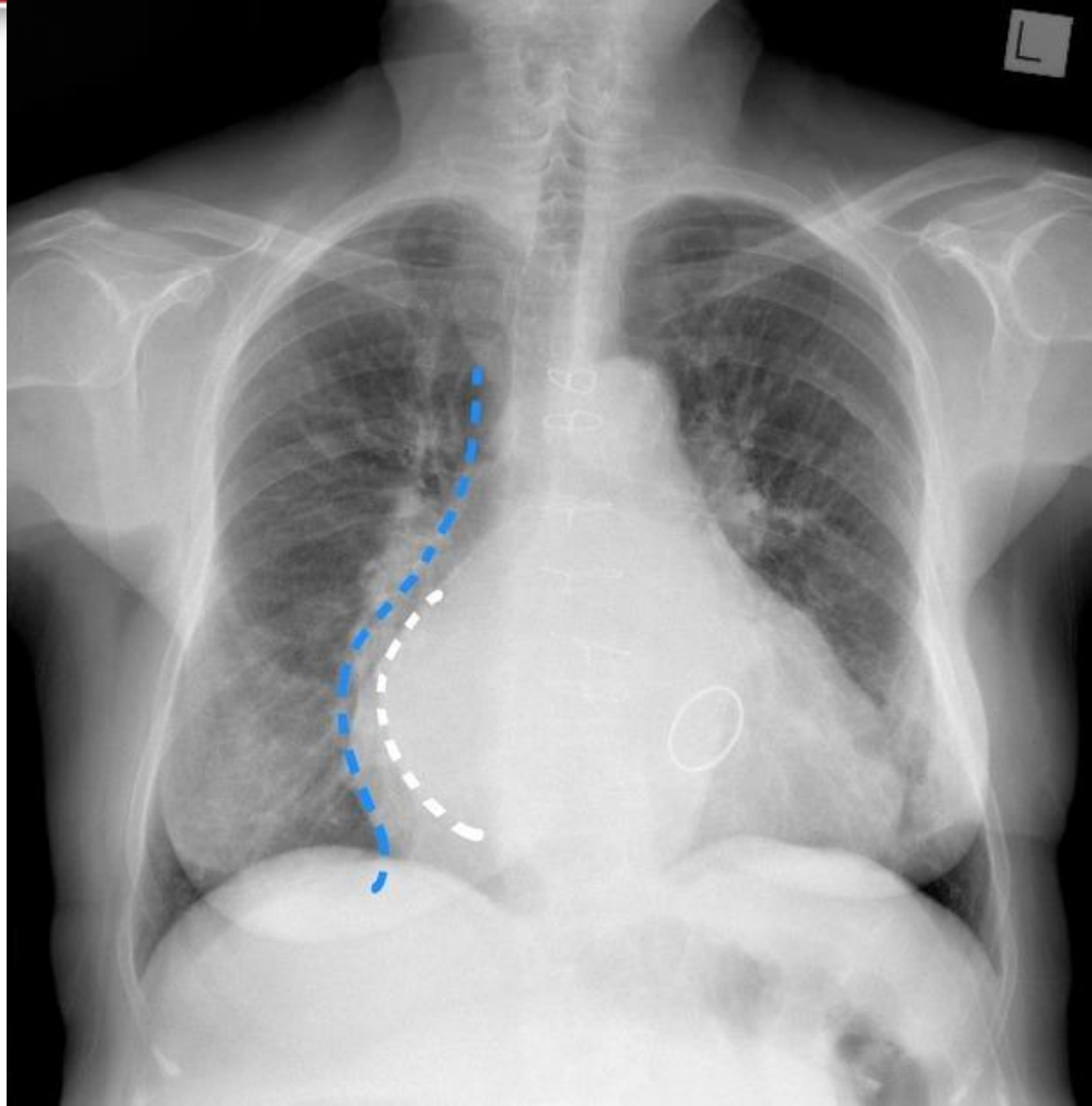


- **Double-density sign (double right heart border)** - is seen on frontal chest radiographs in the presence of left atrial enlargement; occurs when the right side of the left atrium pushes behind the right cardiac shadow, indenting the adjacent lung and forming its own distinct silhouette
- **Atrial escape** refers to a chest x-ray sign of massive left atrial enlargement and is an exaggerated version of the double density sign.

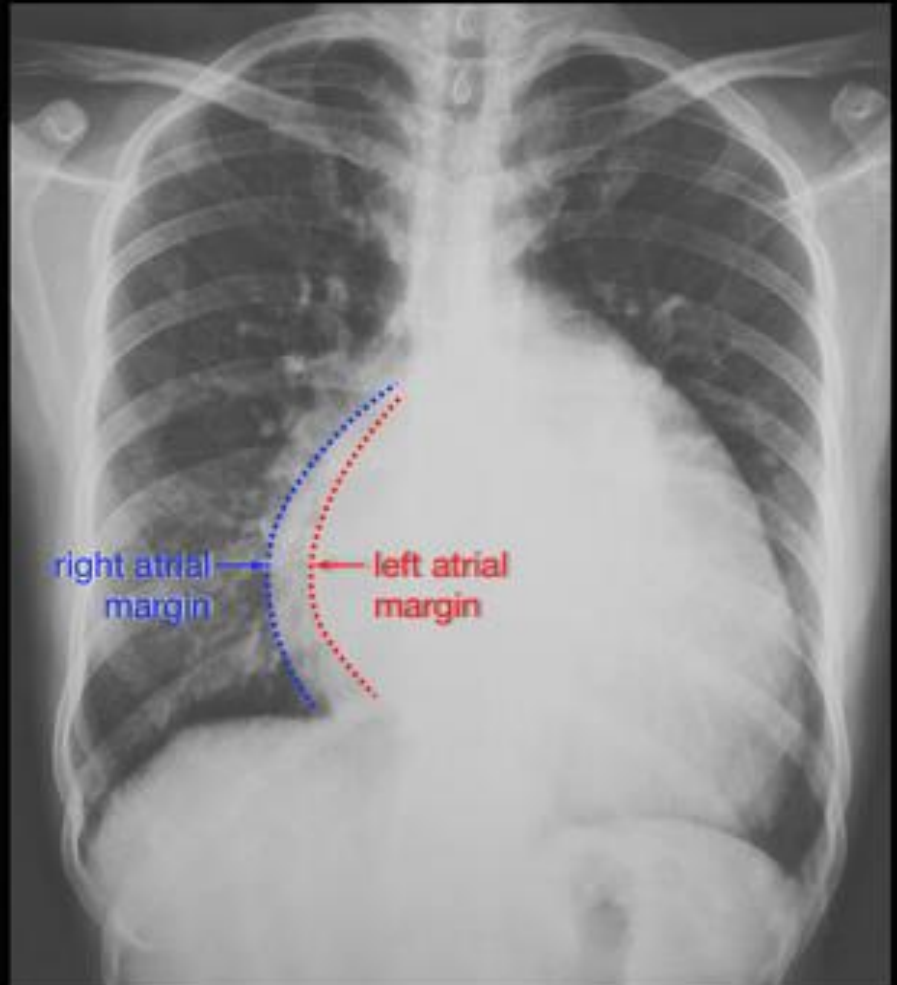
Double-density sign



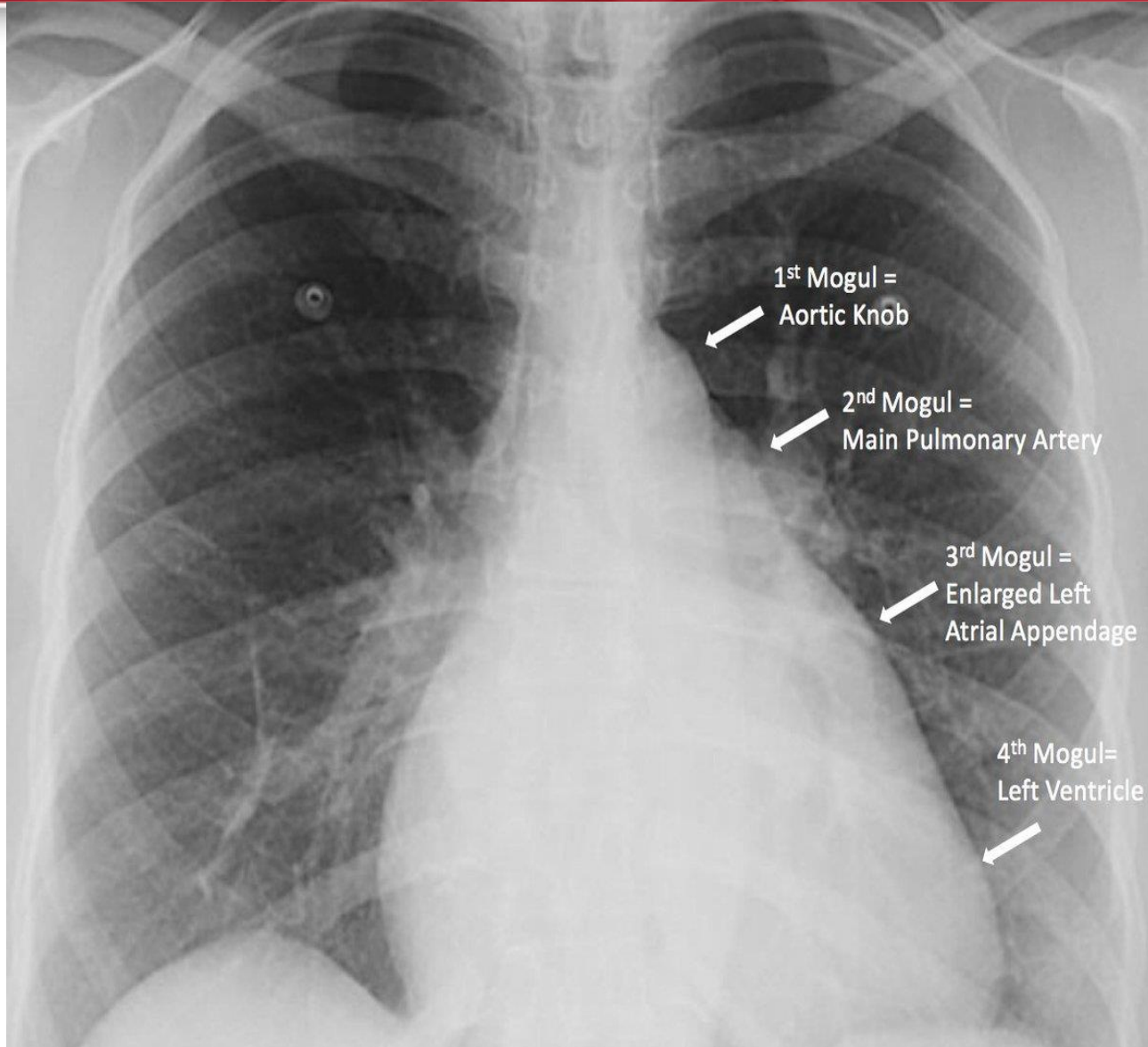
Double-density sign



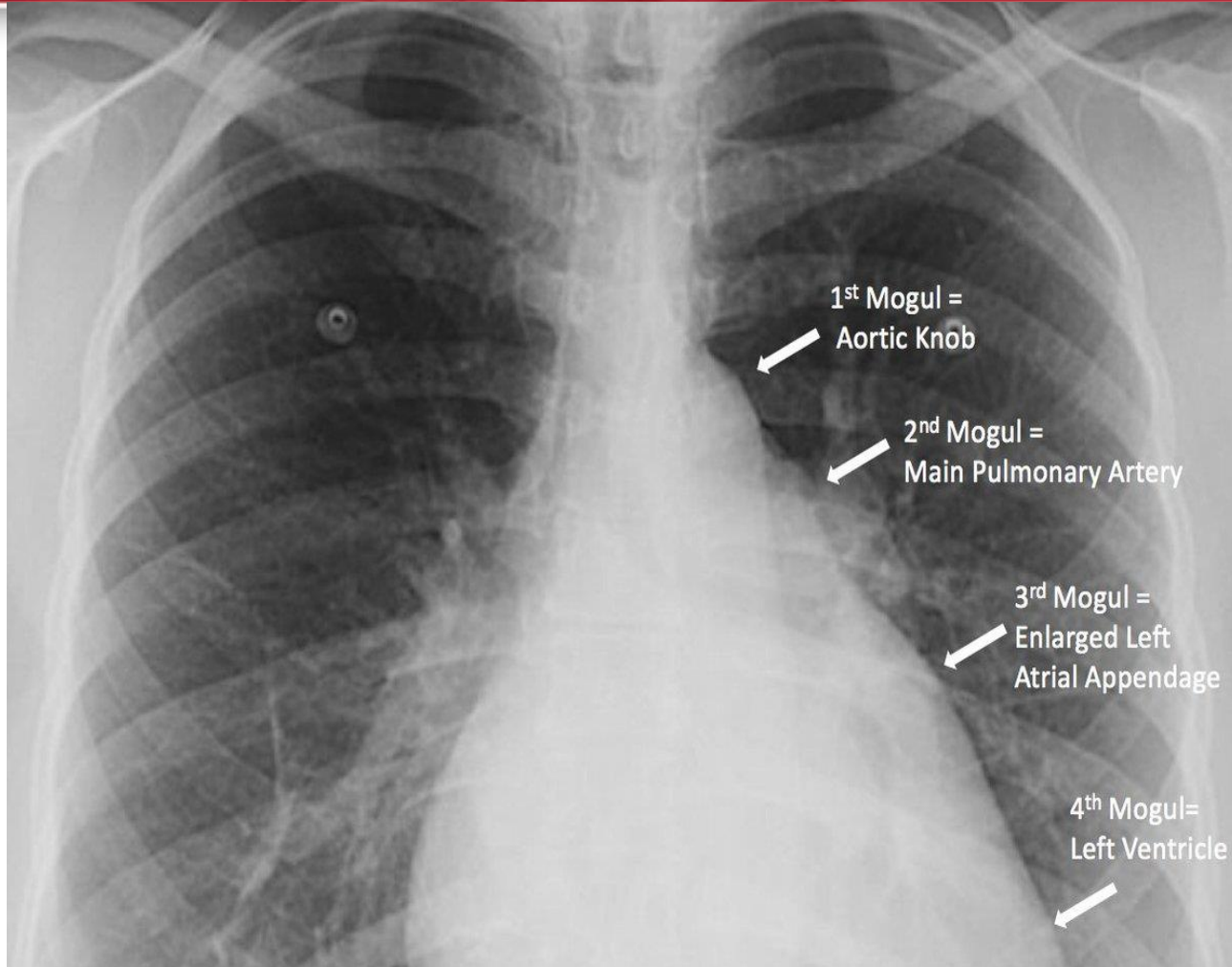
Double-density sign



Third mogul sign

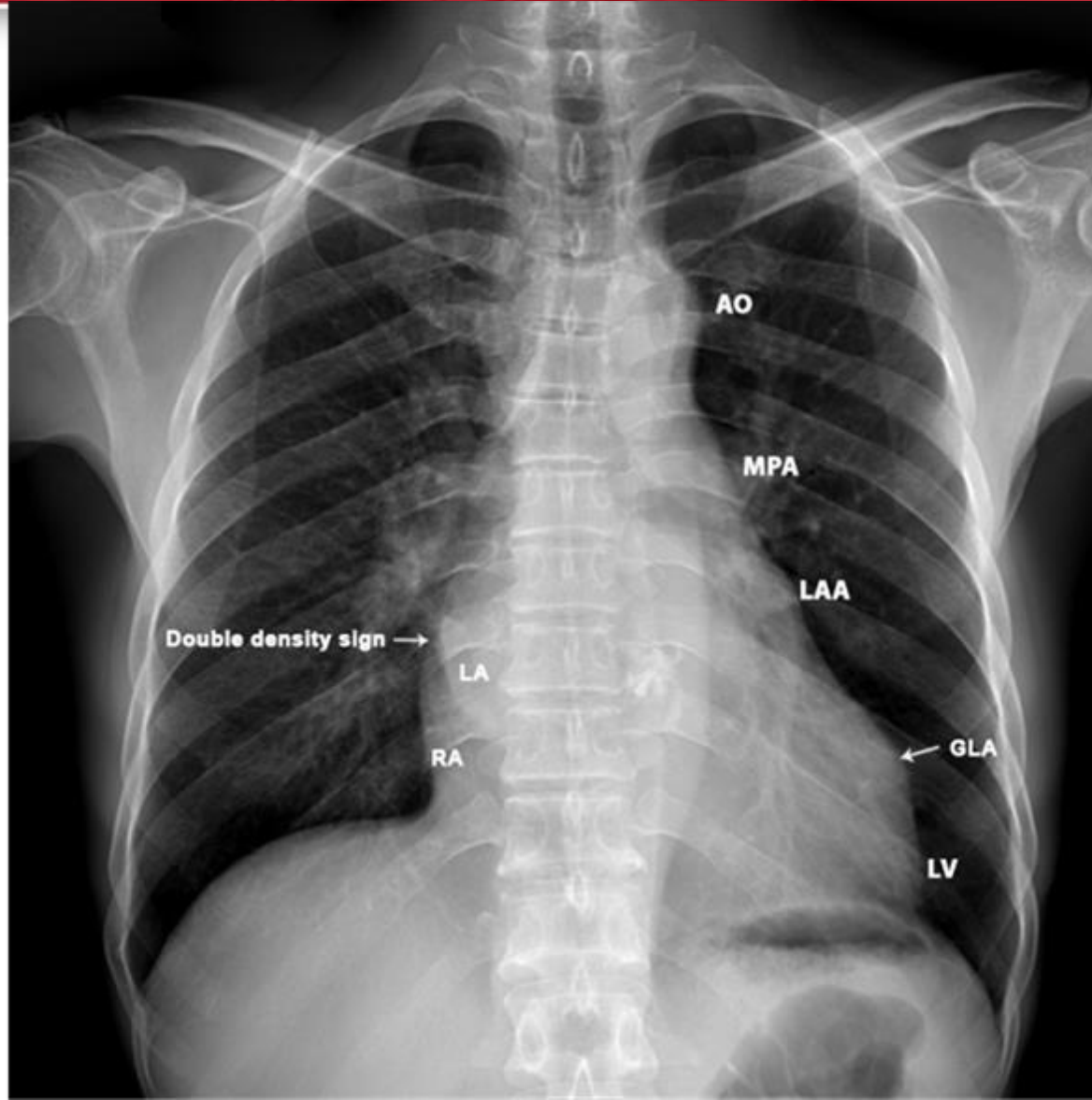


Third mogul sign

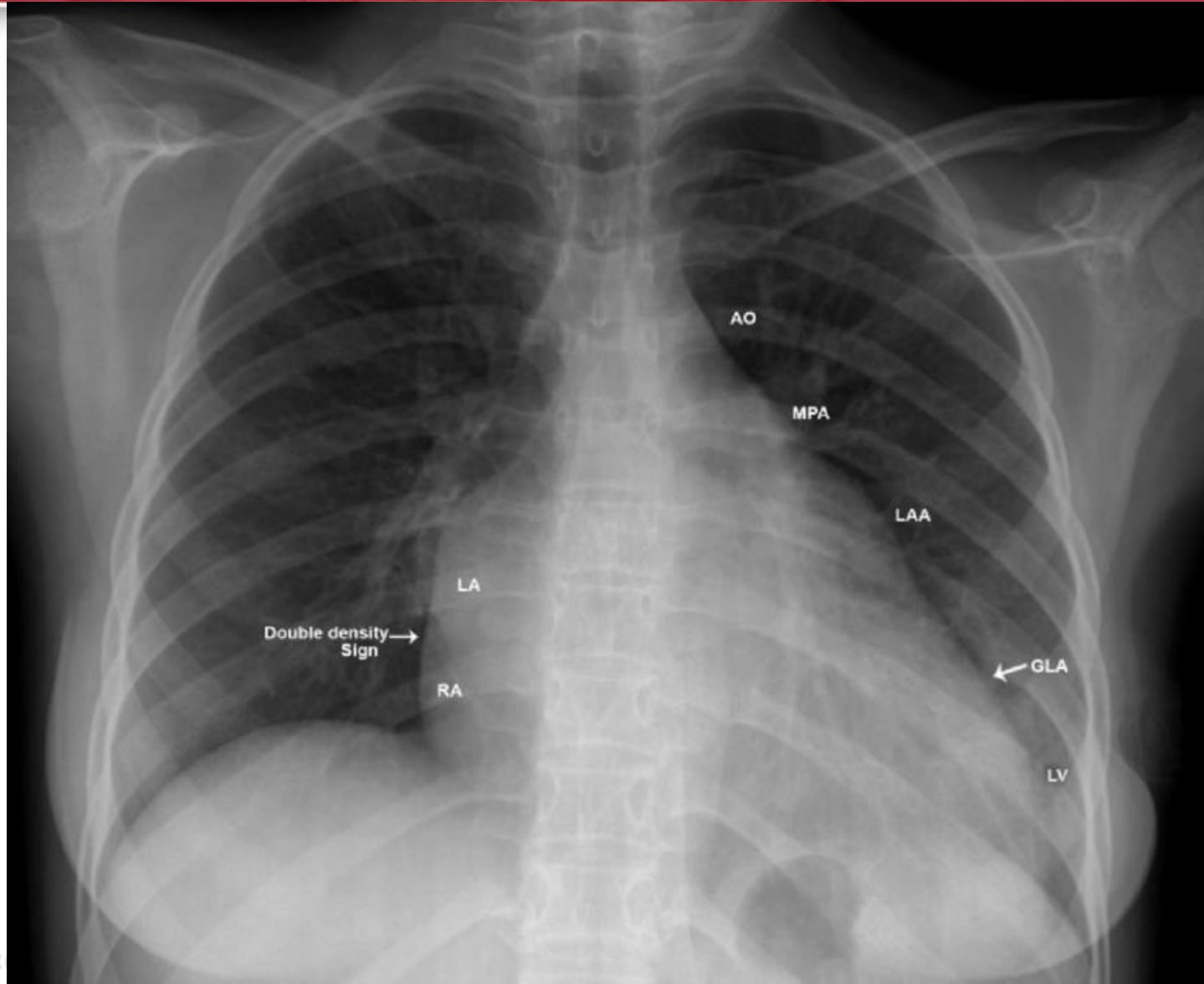


- **Third mogul sign** (convex left atrial appendage, disappearing of heart waist) can be seen on frontal CXR in the presence of left atrial enlargement; represents the enlarged left atrial appendage, particularly in patients with rheumatic heart disease.

Mitral heart configuration



Mitral heart configuration

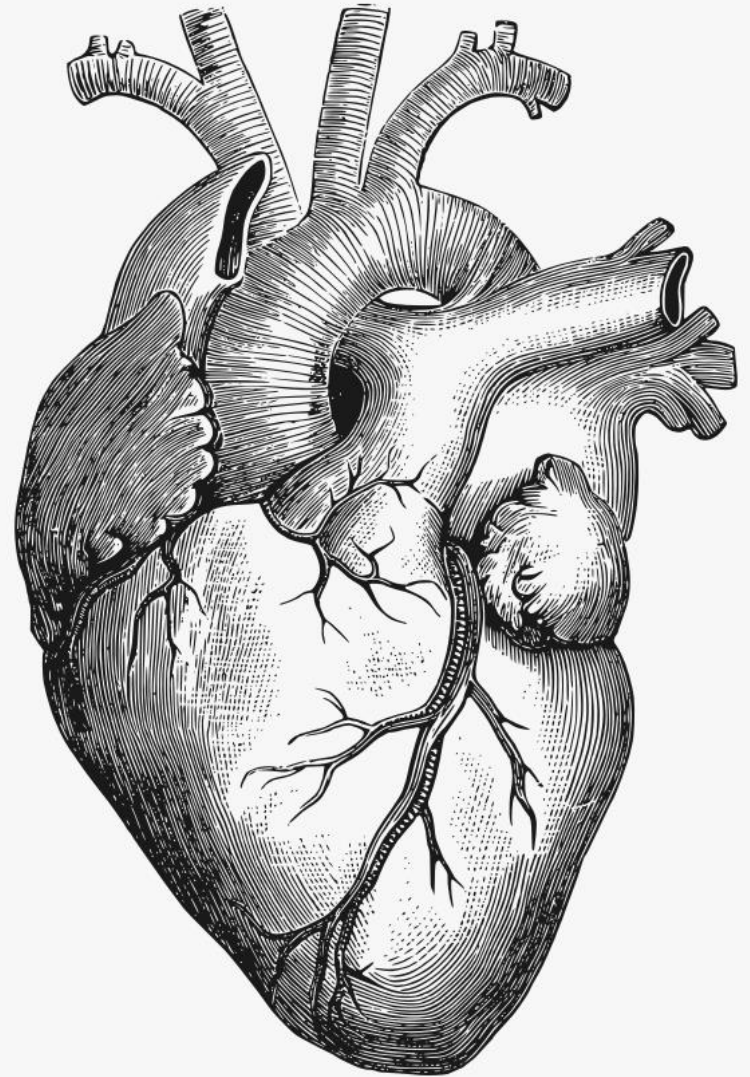


Mitral heart configuration





- **Aortic heart configuration**

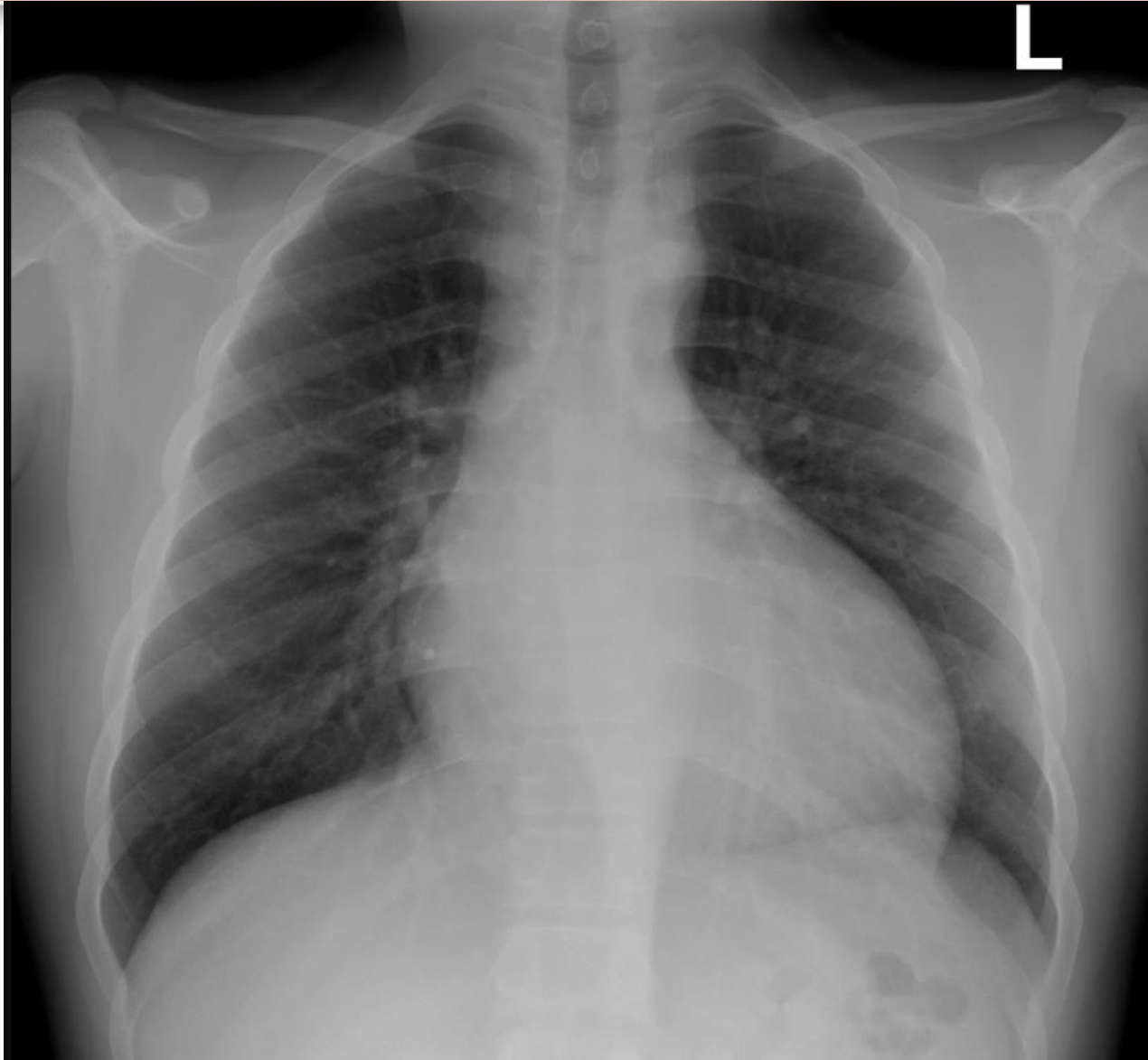


Aortic heart configuration

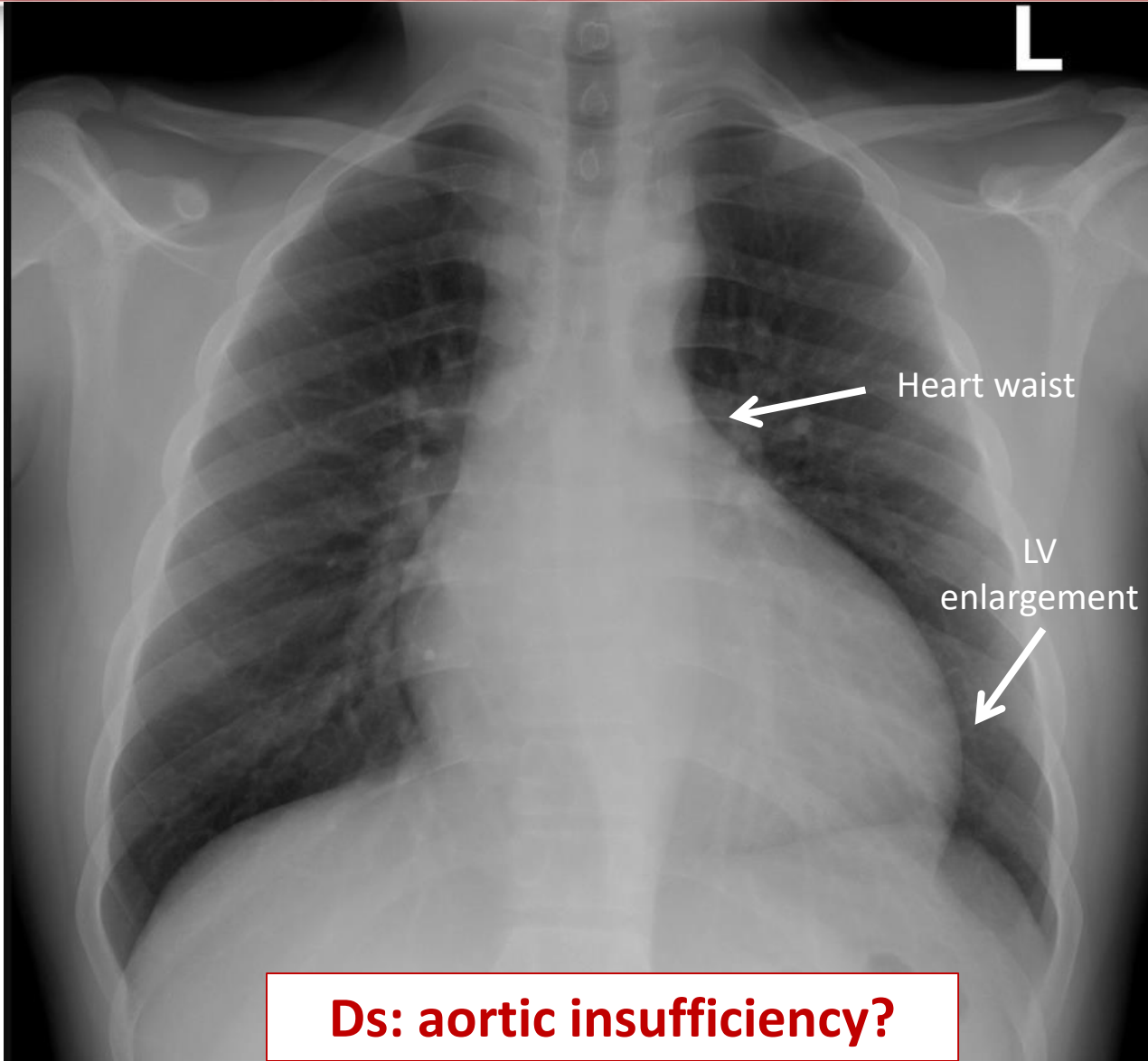


- **Aortic stenosis** and **aortic regurgitation** are usually the complications of **rheumatic fever** and **atherosclerosis**, and along with **ICD** are the major reasons of **aortic heart** forming.
- **Aortic heart configuration** is characterized by:
 - **Heart waist is intact**;
 - **Hypertrophy/dilation of the left ventricle** (\Rightarrow ***aortic insufficiency***);
 - **Dilatation of ascending aorta** with normal heart size (\Rightarrow ***aortic stenosis***);
 - Combination of previous 2 signs.

Aortic heart configuration

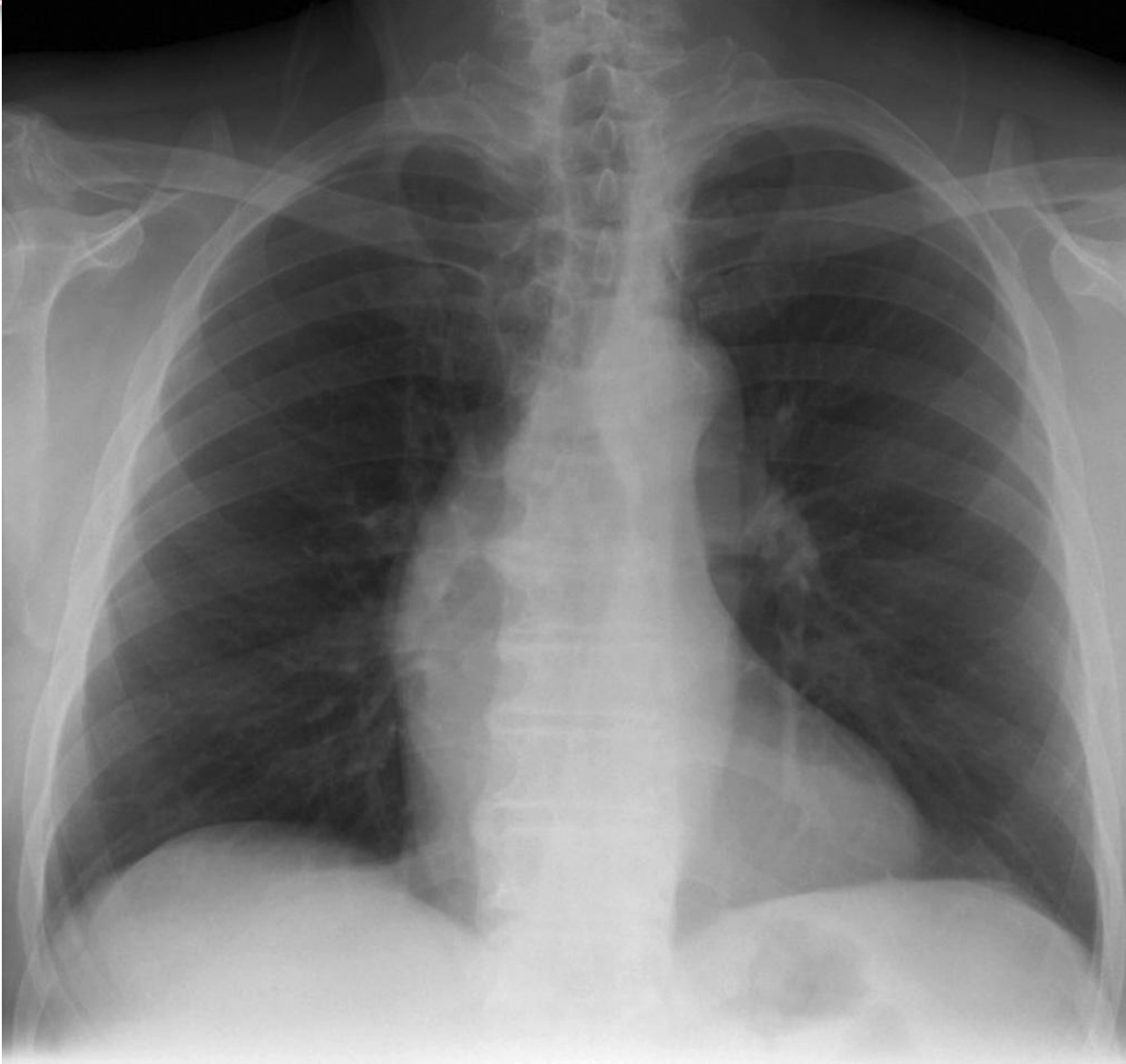


Aortic heart configuration

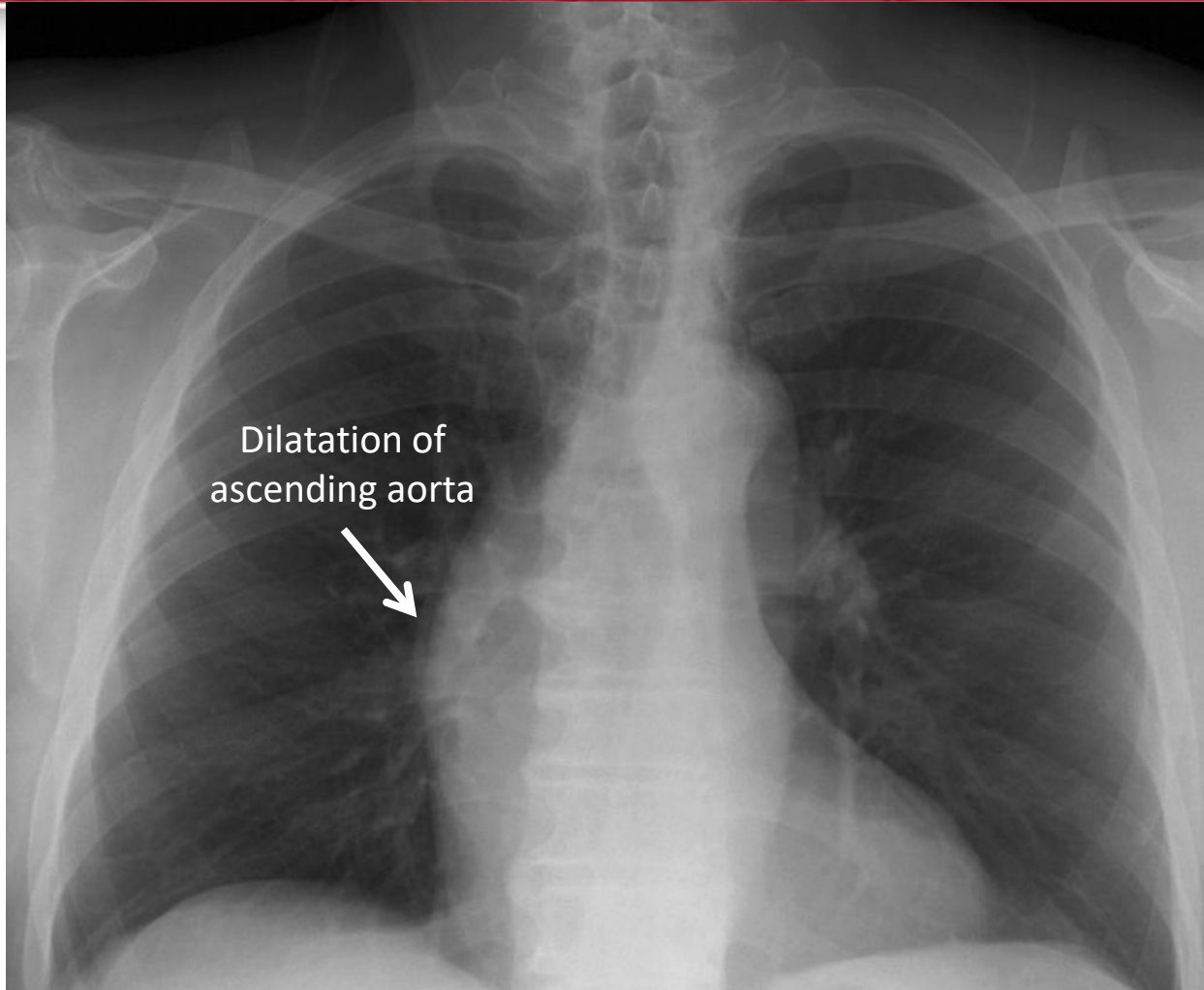


Ds: aortic insufficiency?

Aortic heart configuration



Aortic heart configuration



Ds: aortic stenosis?

Conclusion: prominent of the right mediastinal border occupied by the ascending aorta. Heart size is normal. No lung or pleural abnormality.



Thank you!



To be continued...