

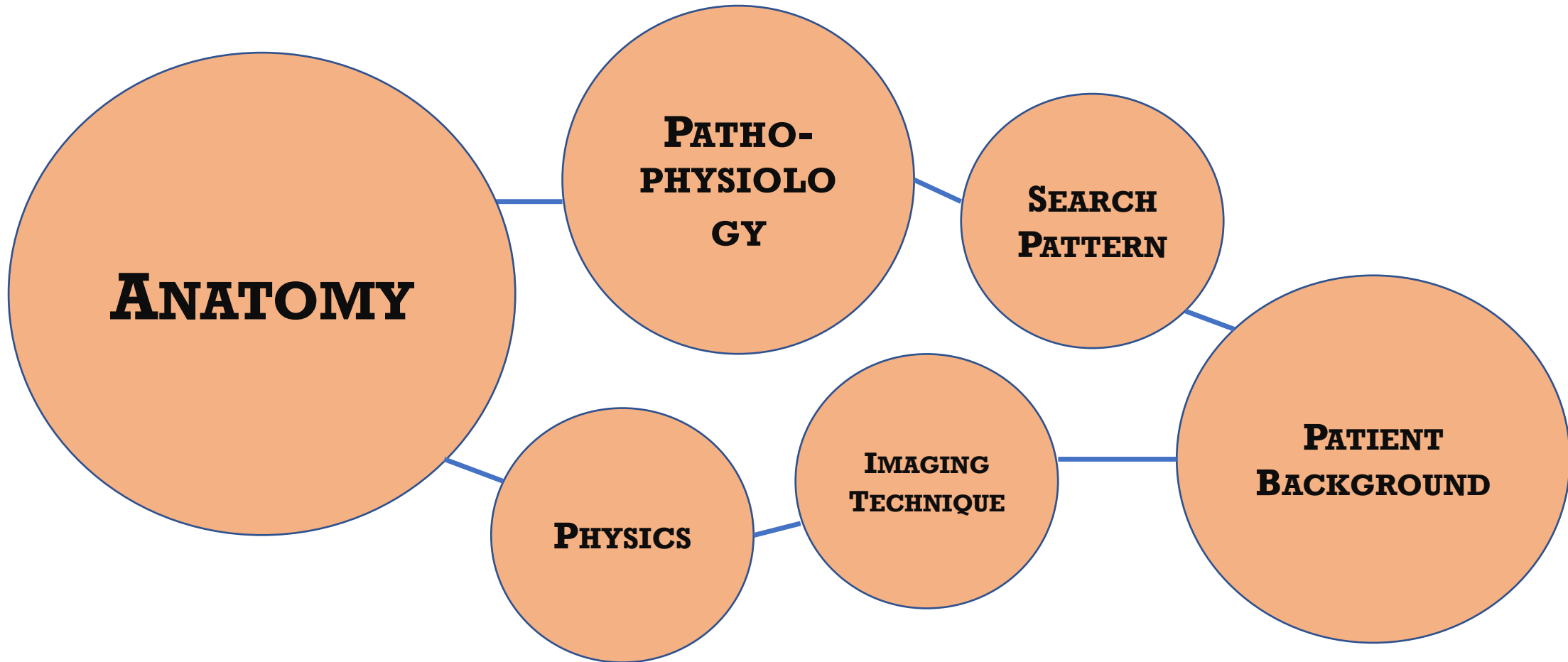
Radiography | An Introduction

Laith Alhyari, M.D.

Outline

- **Imaging Techniques & Quality Assessment**
- **Anatomy – Chest Radiography**
 - Airways
 - Mediastinum (Heart, Great Vessels, Lymph Nodes)
 - Lungs and Pleura
 - Bony Thorax
 - Soft tissues and upper abdomen
- **Common Findings and Diagnoses**
 - Atelectasis
 - Infections
- **Cases**

Radiograph Interpretation | The Mental Framework



When poll is active, respond at pollev.com/lalhyari676

Text **LALHYARI676** to **22333** once to join

Heart size measurements are more accurate on which view?

AP

PA

Lateral

Accuracy is the same on all views

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What's the diagnosis?



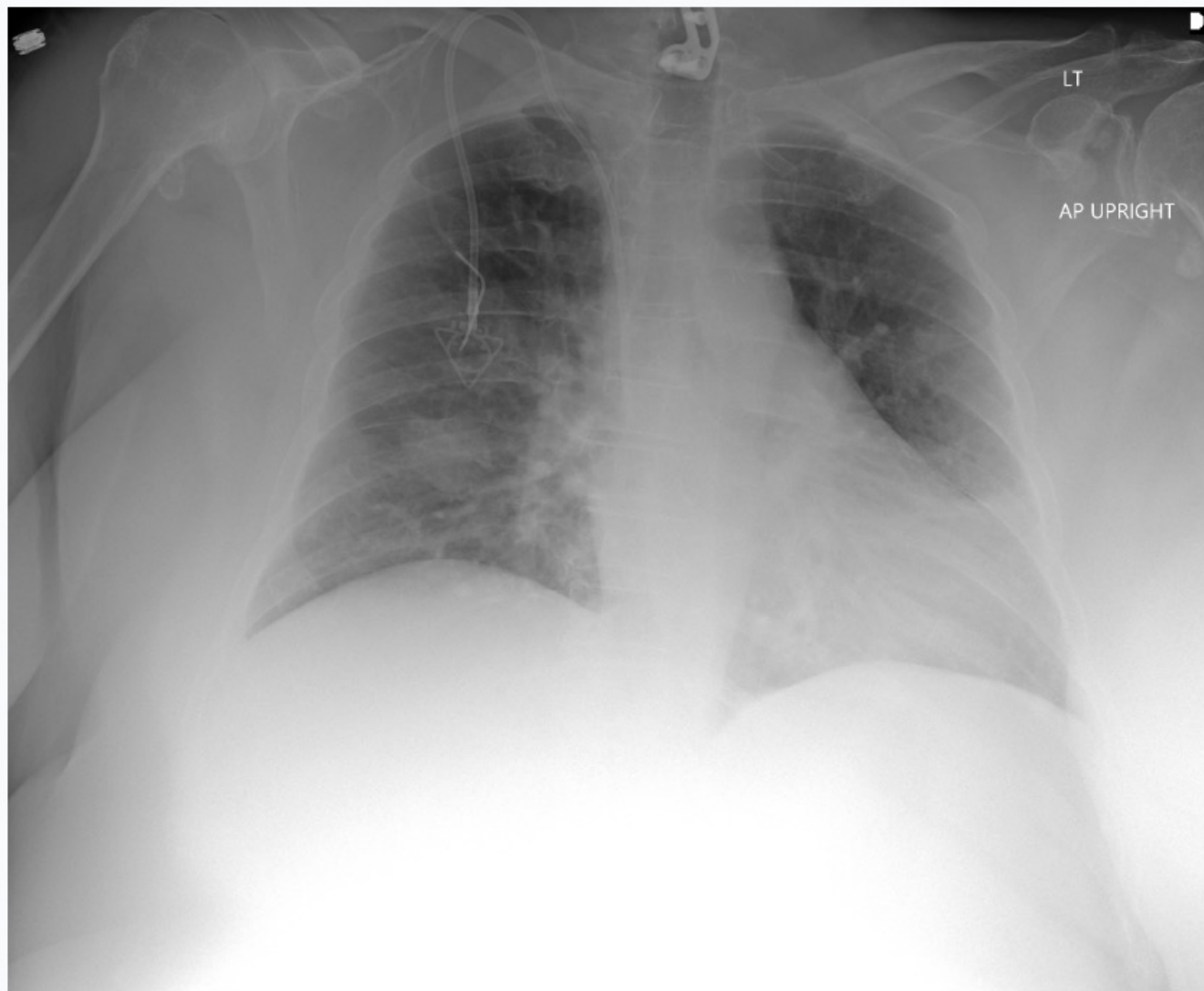
100%

Normal Chest X-ray	Right lower lobe pneumonia	Left upper lobe atelectasis	Hiatal Hernia
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Where is the abnormality?



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Imaging Techniques

Radiodensity as Function of Composition



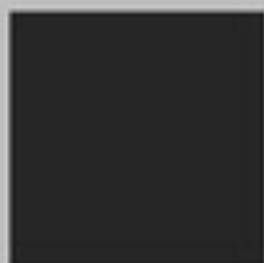
Metal



Bone
(Calcium)



Water/Soft
Tissue



Fat



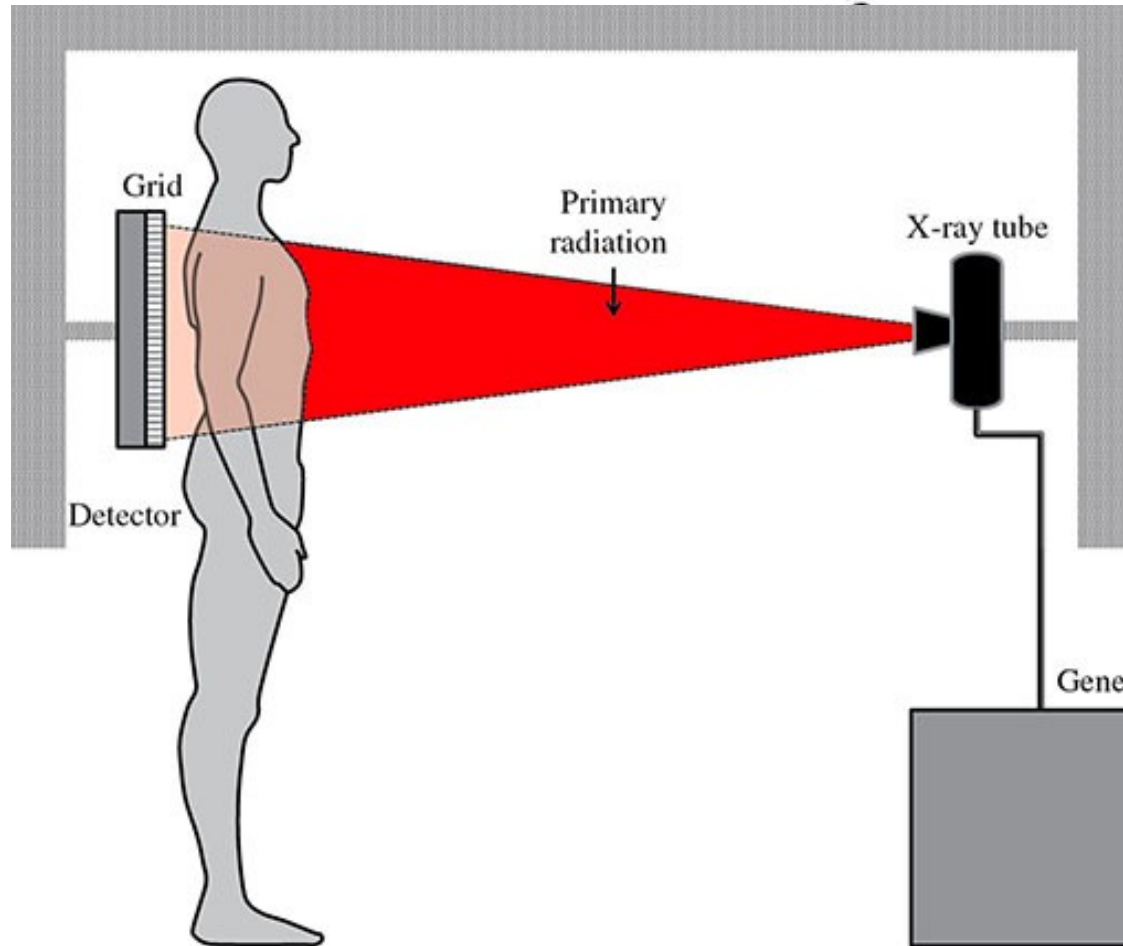
Gas

Radiopaque or
Radiodense

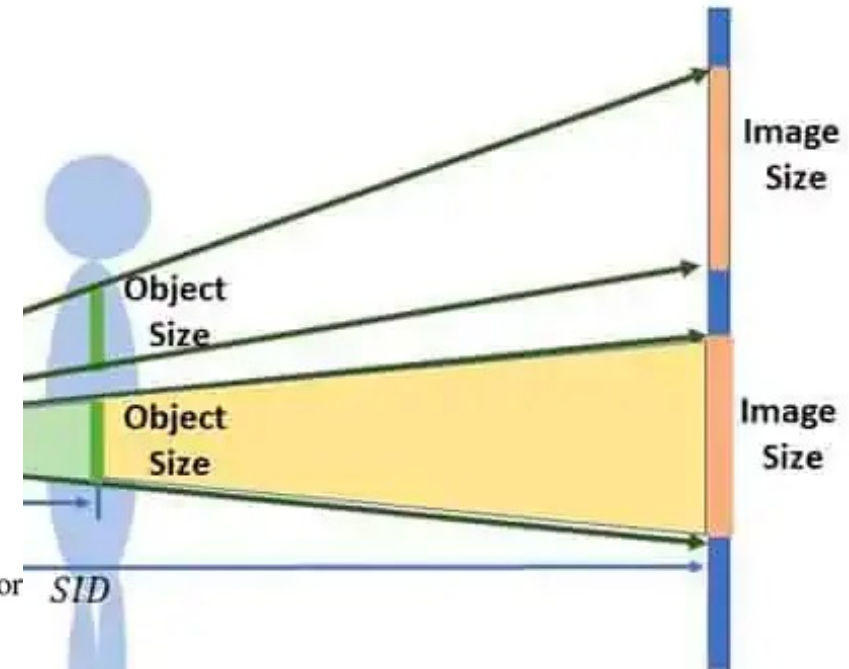


Radiolucent

Beam Characteristics



Definition



$$\text{mag} = \frac{\text{Image Size}}{\text{Object Size}} = \frac{\text{SID}}{\text{SOD}}$$

AP projection →

X
Source

Front

Heart

Lung

Back

Lung

DETECTOR

Apparent
heart size

PA projection →

X
Source

Back

Lung

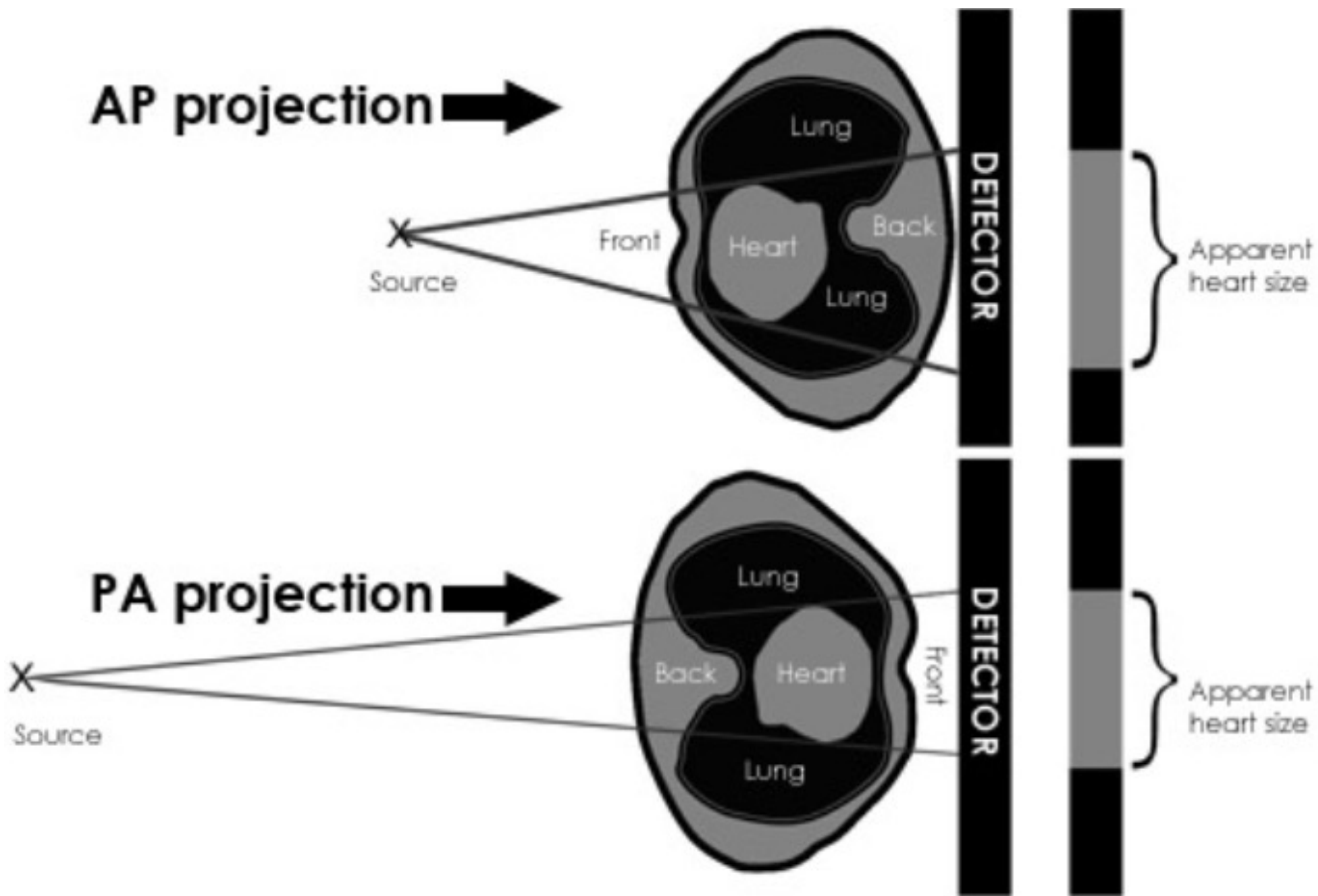
Lung

Heart

Front

DETECTOR

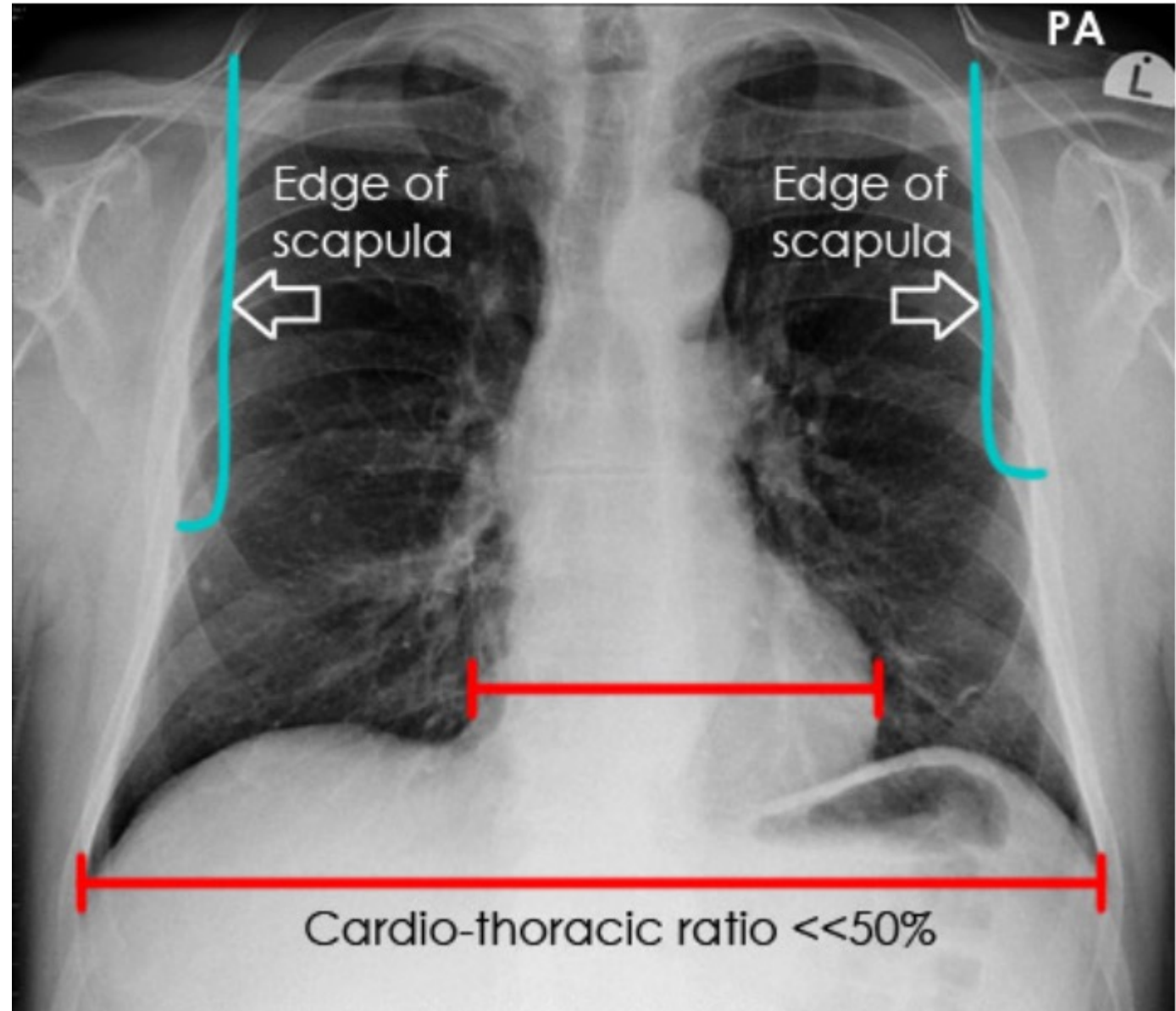
Apparent
heart size



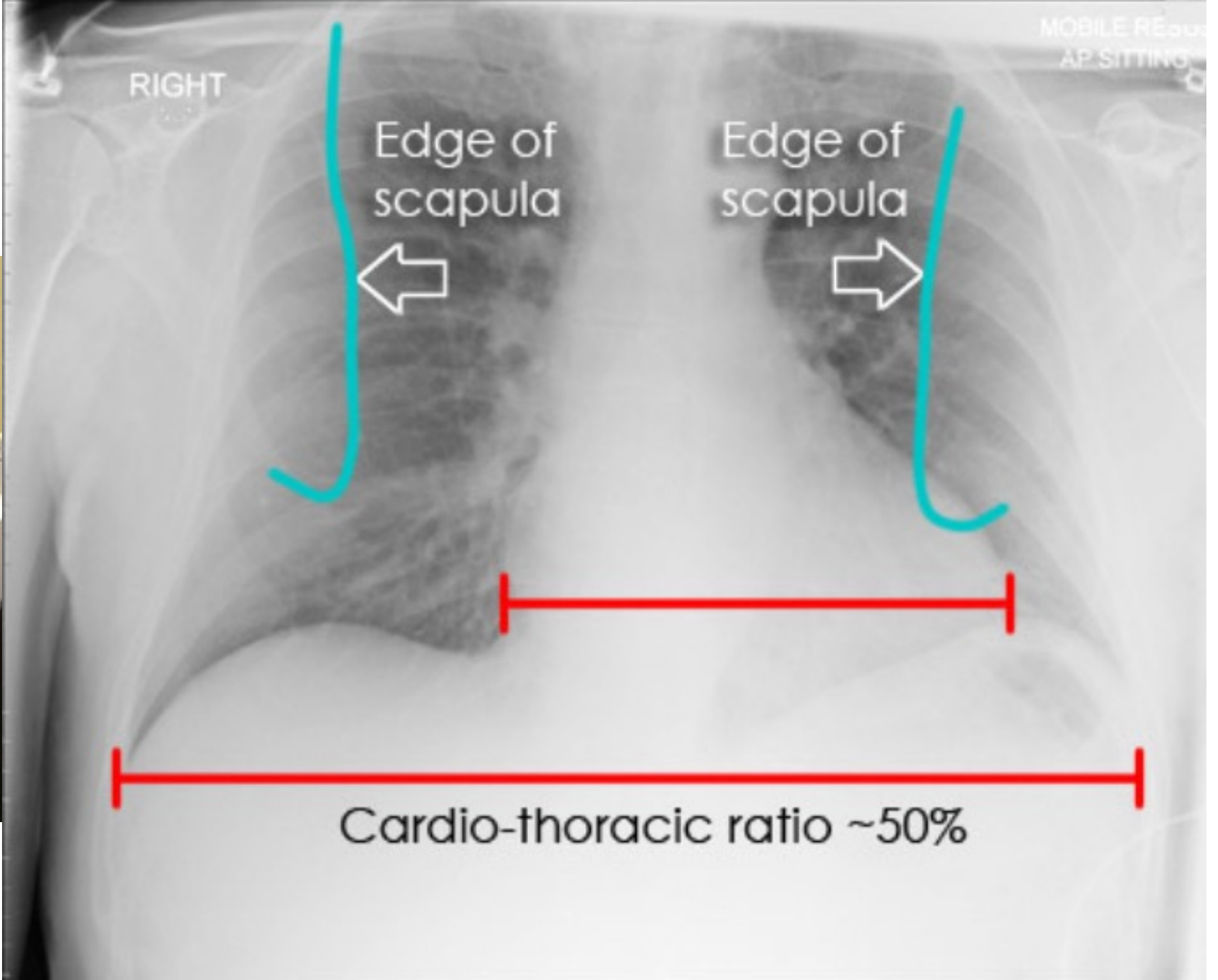
Imaging Techniques and Protocols

- Typical views for a chest x-ray:
 - AP/PA
 - Lateral
 - Lateral Decubitus
- Typical views for a shoulder:
 - Grashey
 - Scapular-Y
 - Axillary
- Typical views for extremities:
 - AP
 - Lateral
 - Oblique

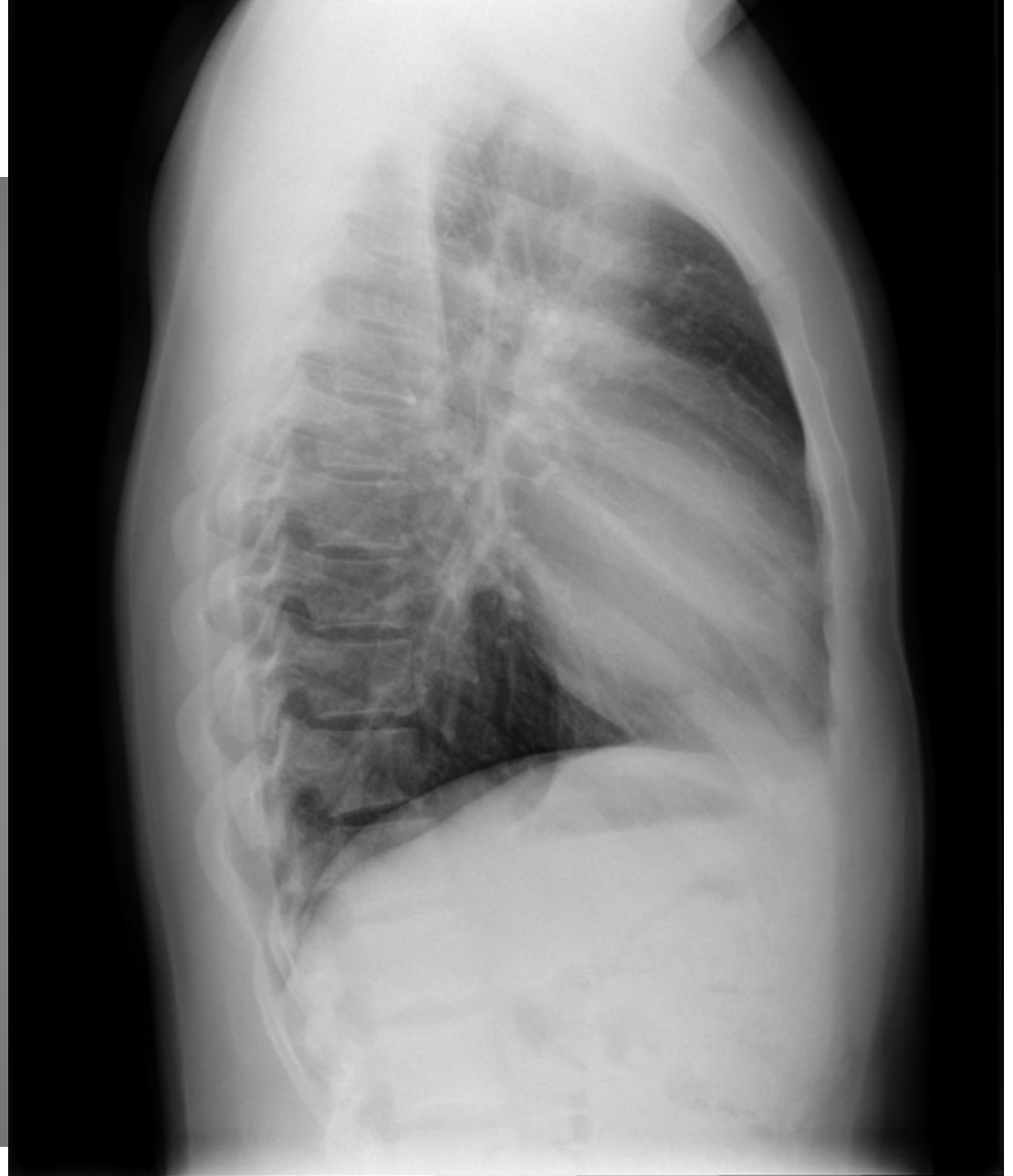
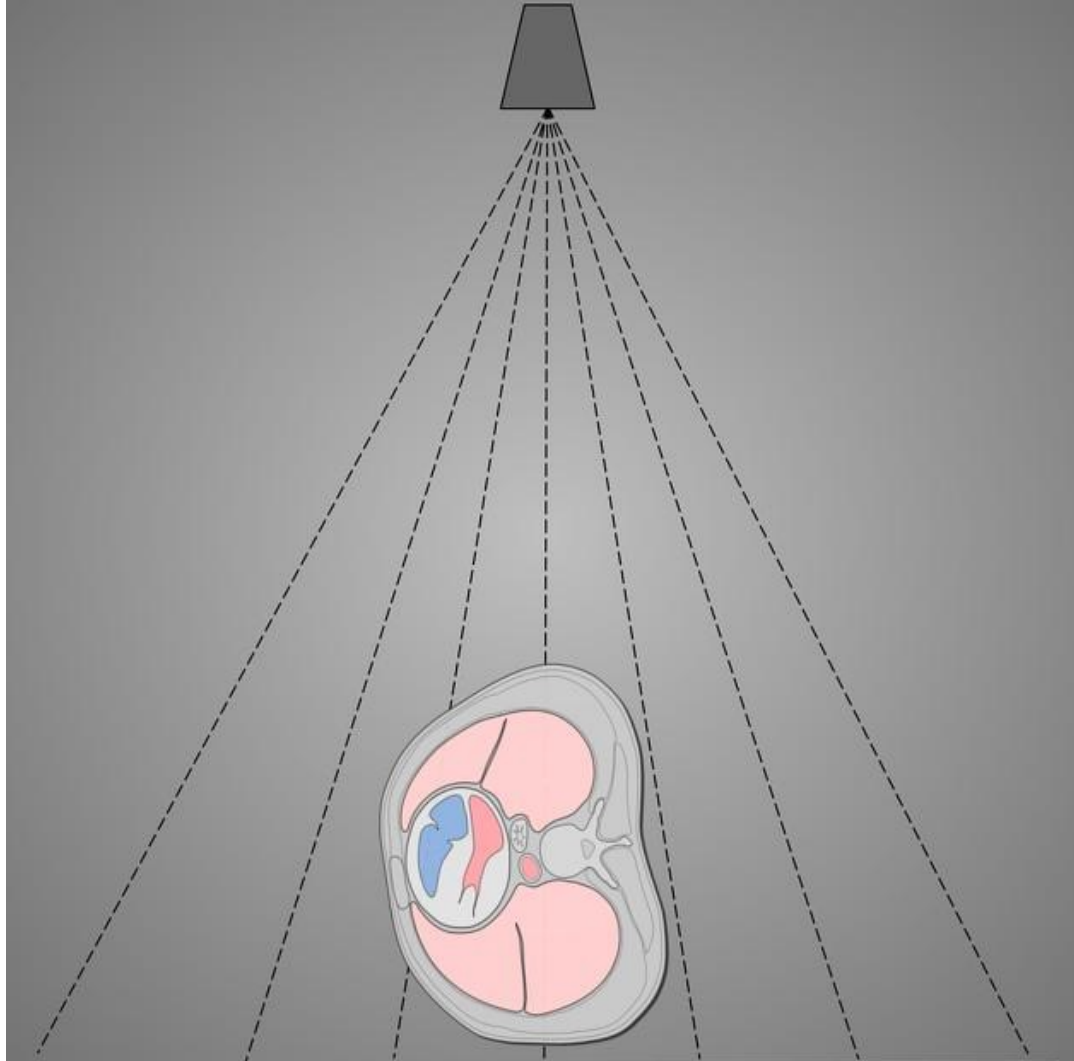
CXR - PA View



AP View

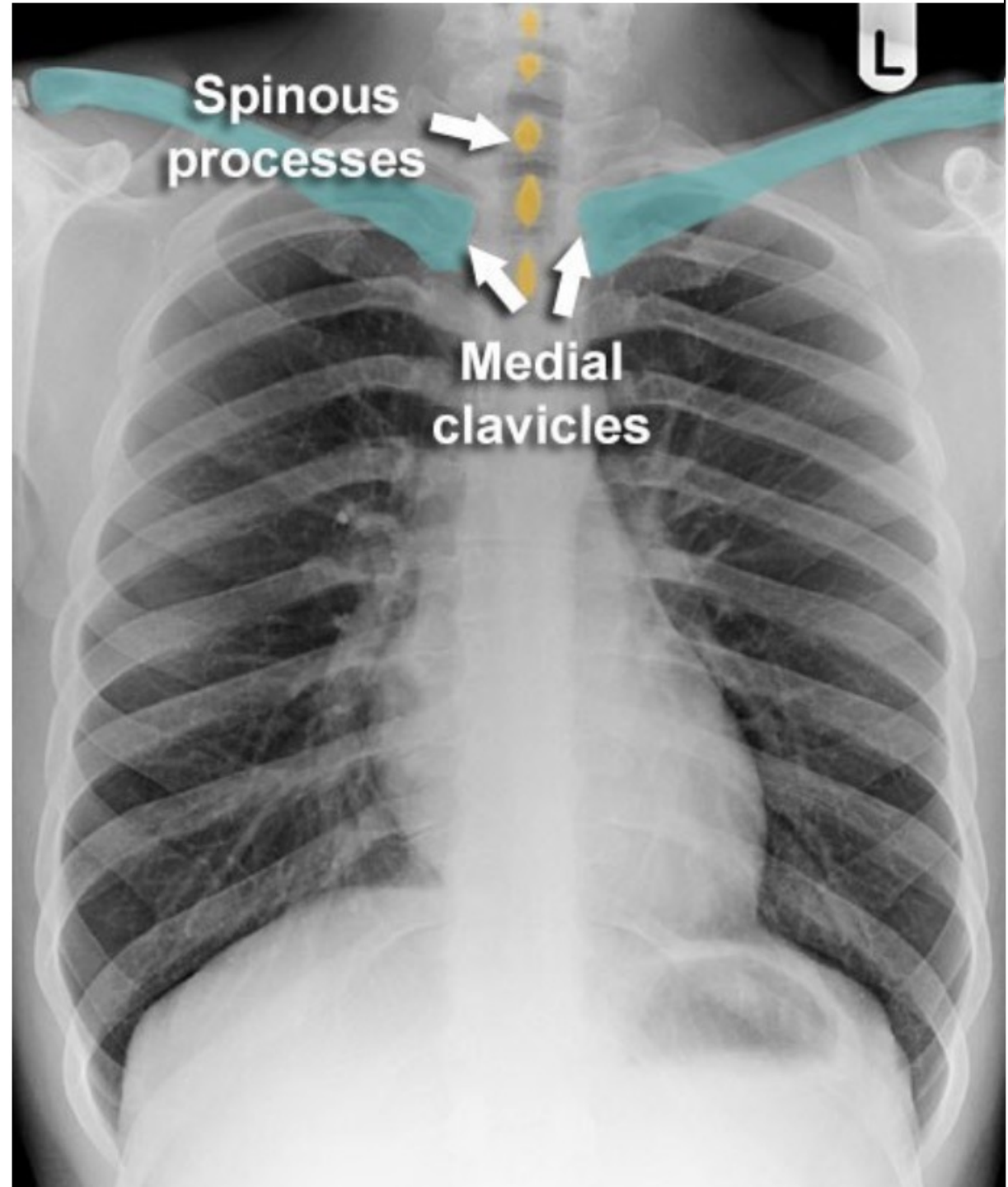


Lateral View

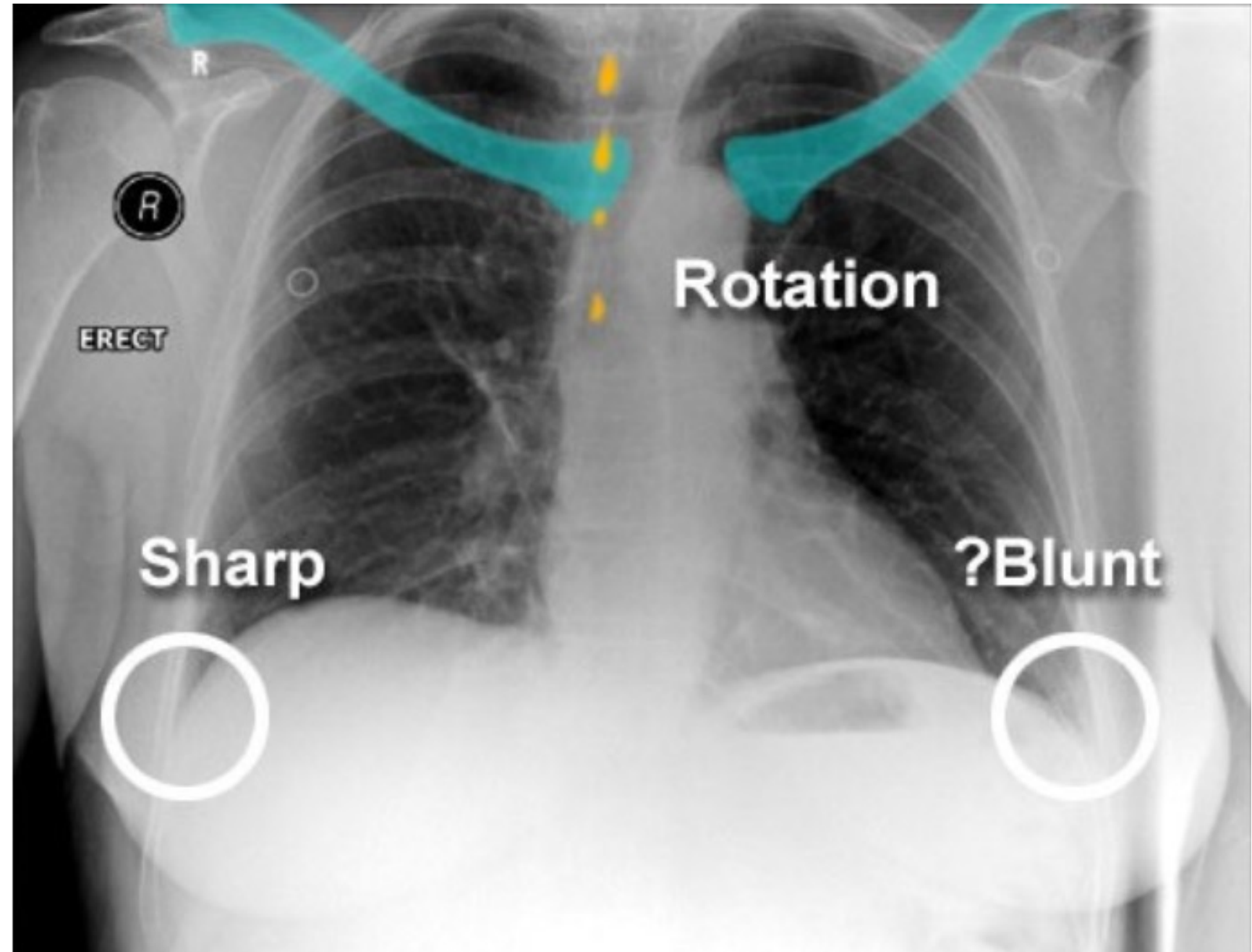


Rotation

- Rotation may lead to misinterpretation of heart contours, tracheal position and lung appearances.
- It may be difficult to know if the trachea is deviated to one side by a disease process.
- It also becomes difficult to comment accurately on the **heart size**.
- Changes in **lung density** due to asymmetry of overlying soft-tissue may be incorrectly interpreted as lung disease.

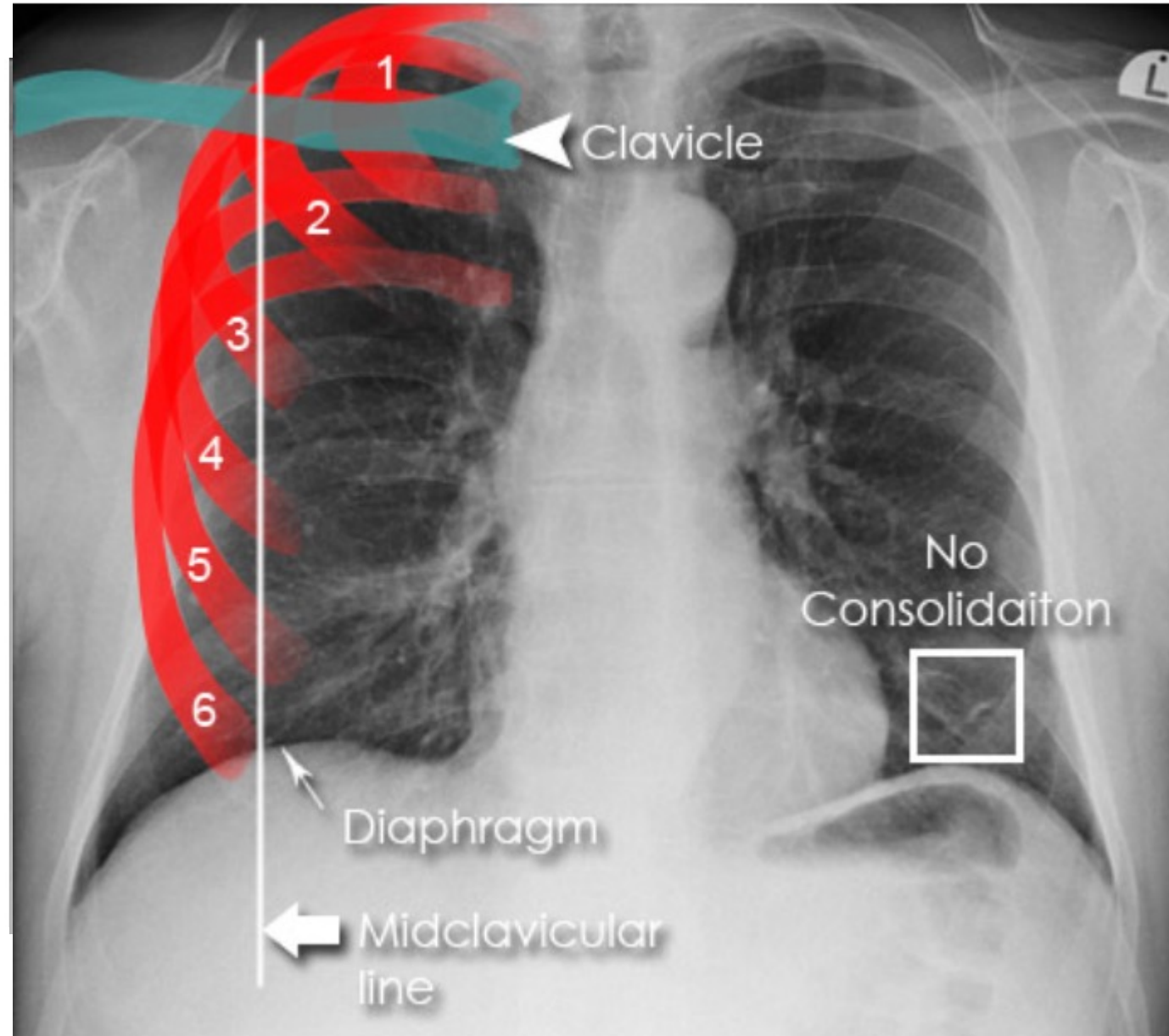


Rotation



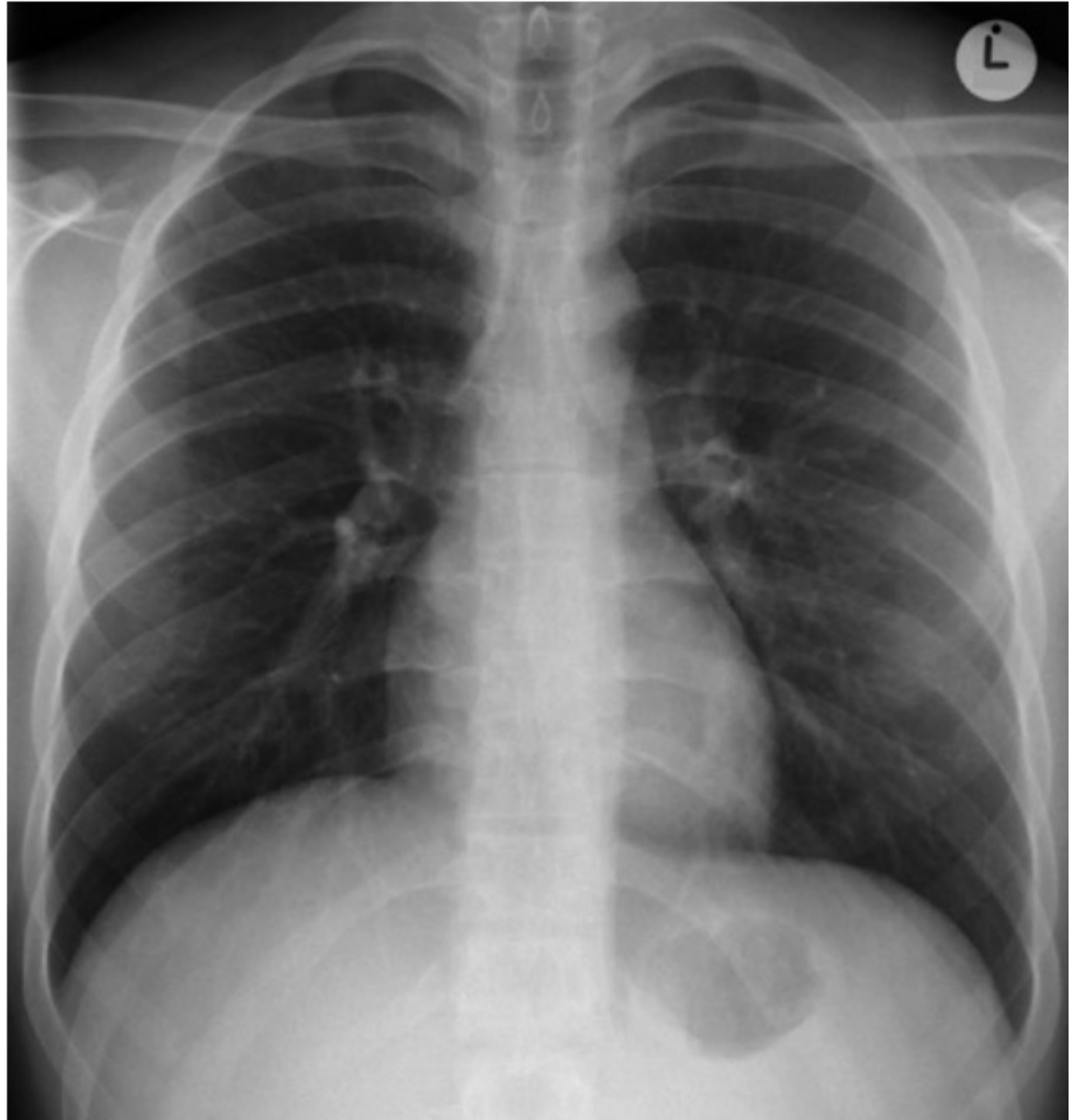
Depth of Inspiration

- Always assess inspiration and lung volumes
- Incomplete inspiration can lead to exaggeration of lung markings and heart size



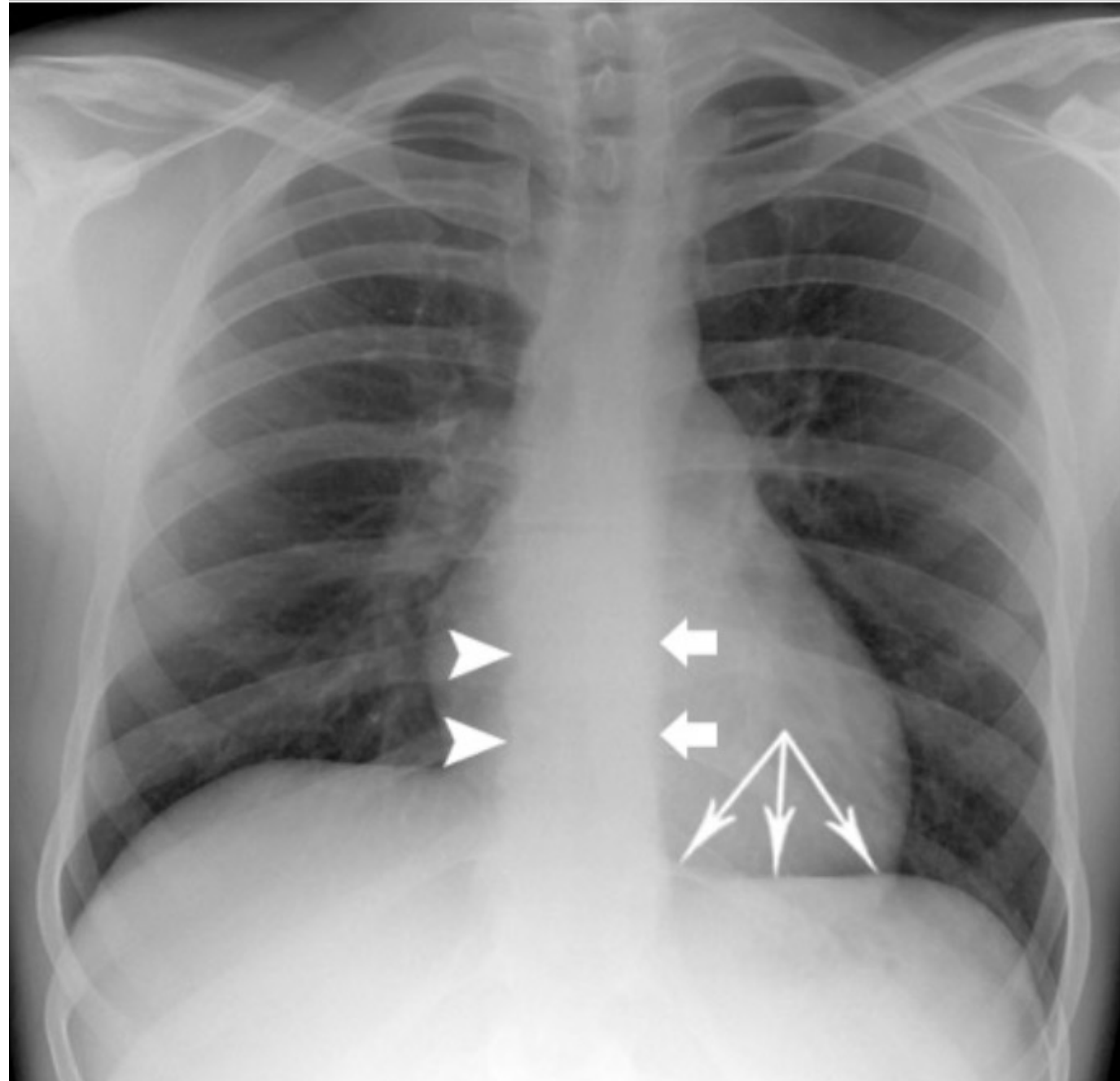
Depth of Inspiration

- Lung hyperexpansion is a sign of obstructive lung disease



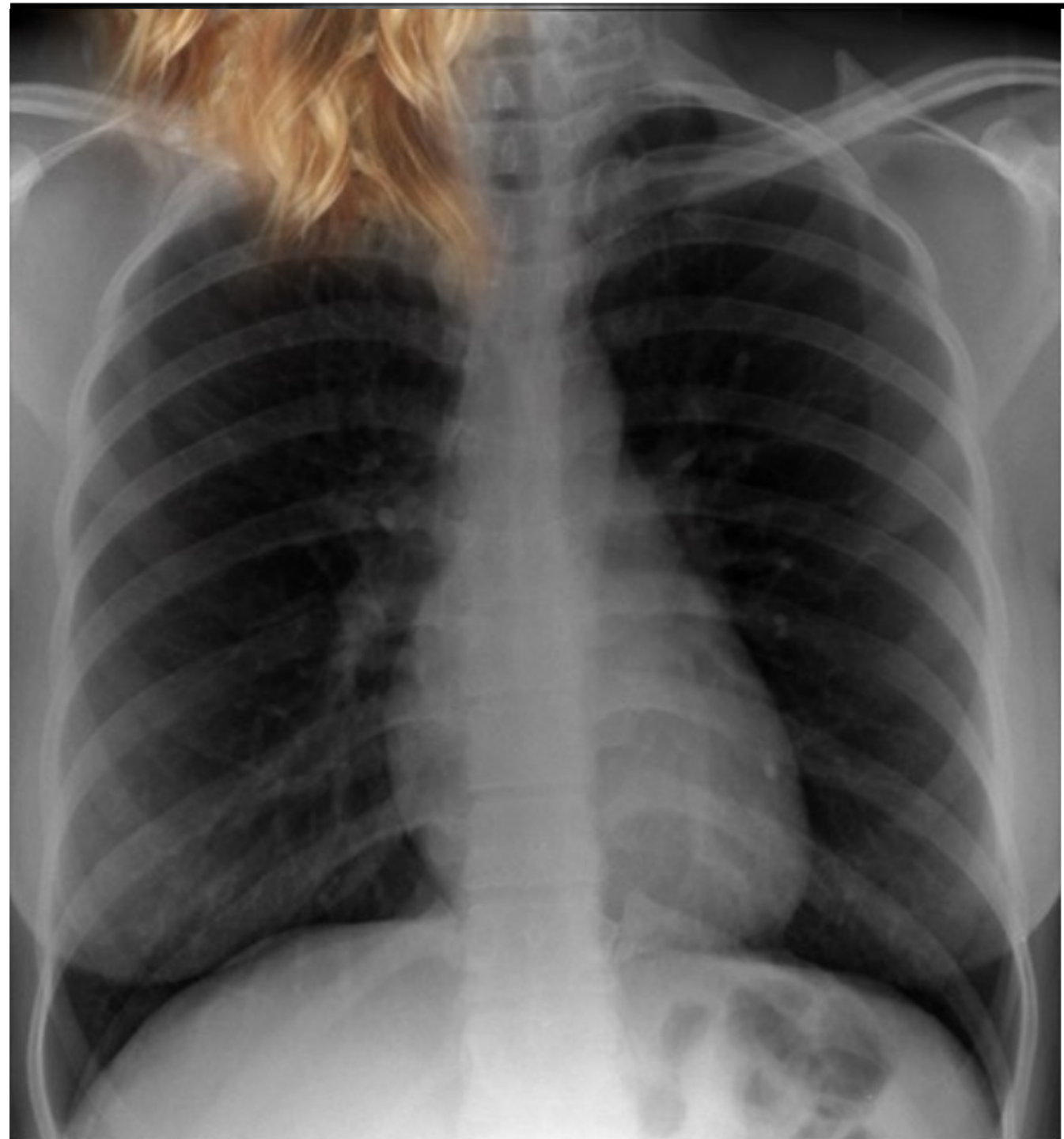
Penetration

- A well penetrated chest X-ray is one where **the vertebrae are just visible behind the heart.**
- Although X-rays are still occasionally over or under exposed, a discussion of penetration now best serves as a reminder to check behind the heart.
- The left hemidiaphragm should be visible to the edge of the spine.
- Loss of the hemidiaphragm contour or of the paravertebral tissue lines may be due to lung or mediastinal pathology.



Artifacts

- Some artifacts are unavoidable
- Ask yourself if artifact limits image interpretation
- Can the question clinical question still be answered?



Develop a System or Pattern

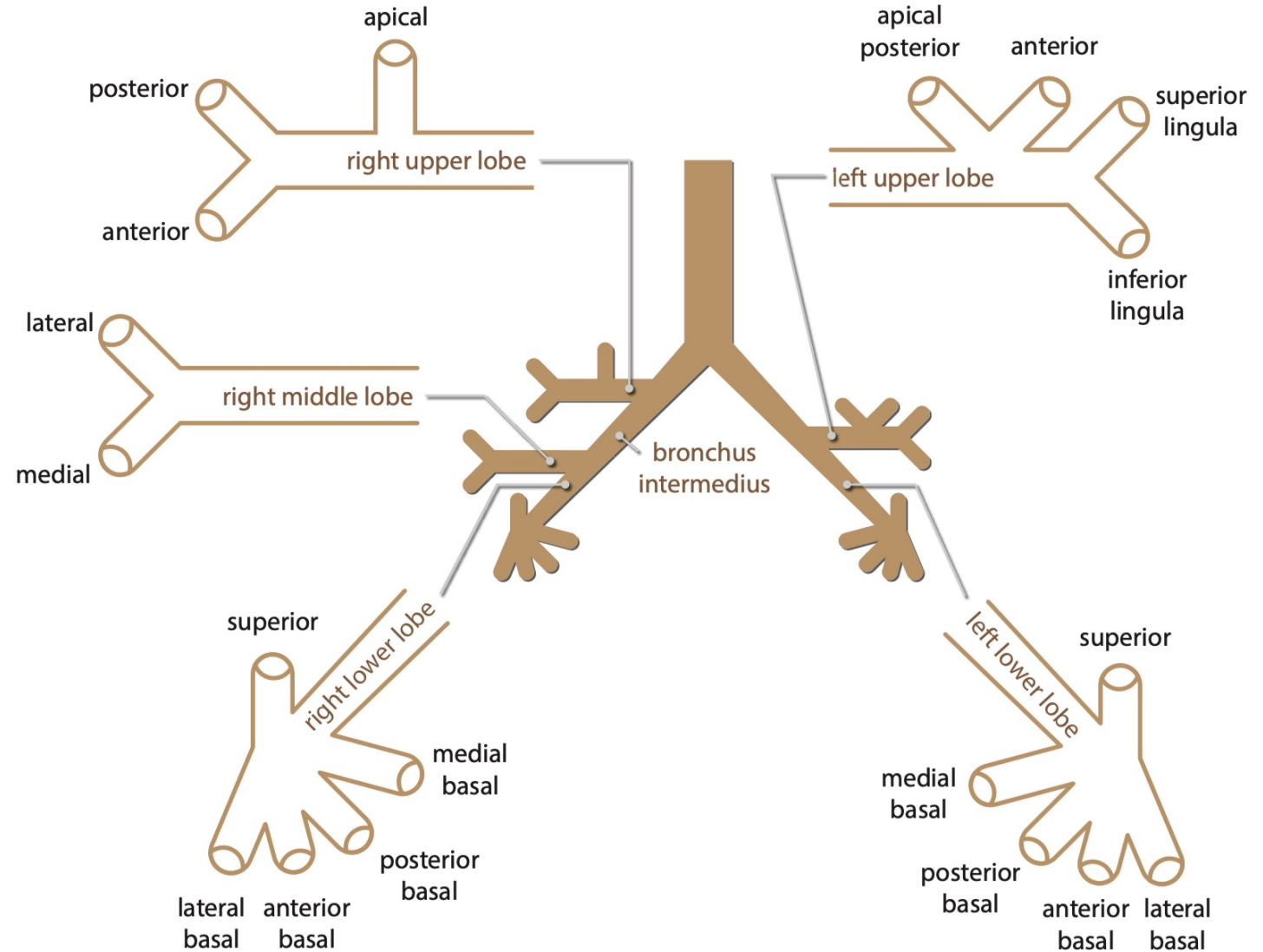


Avoid “Tunnel Vision”

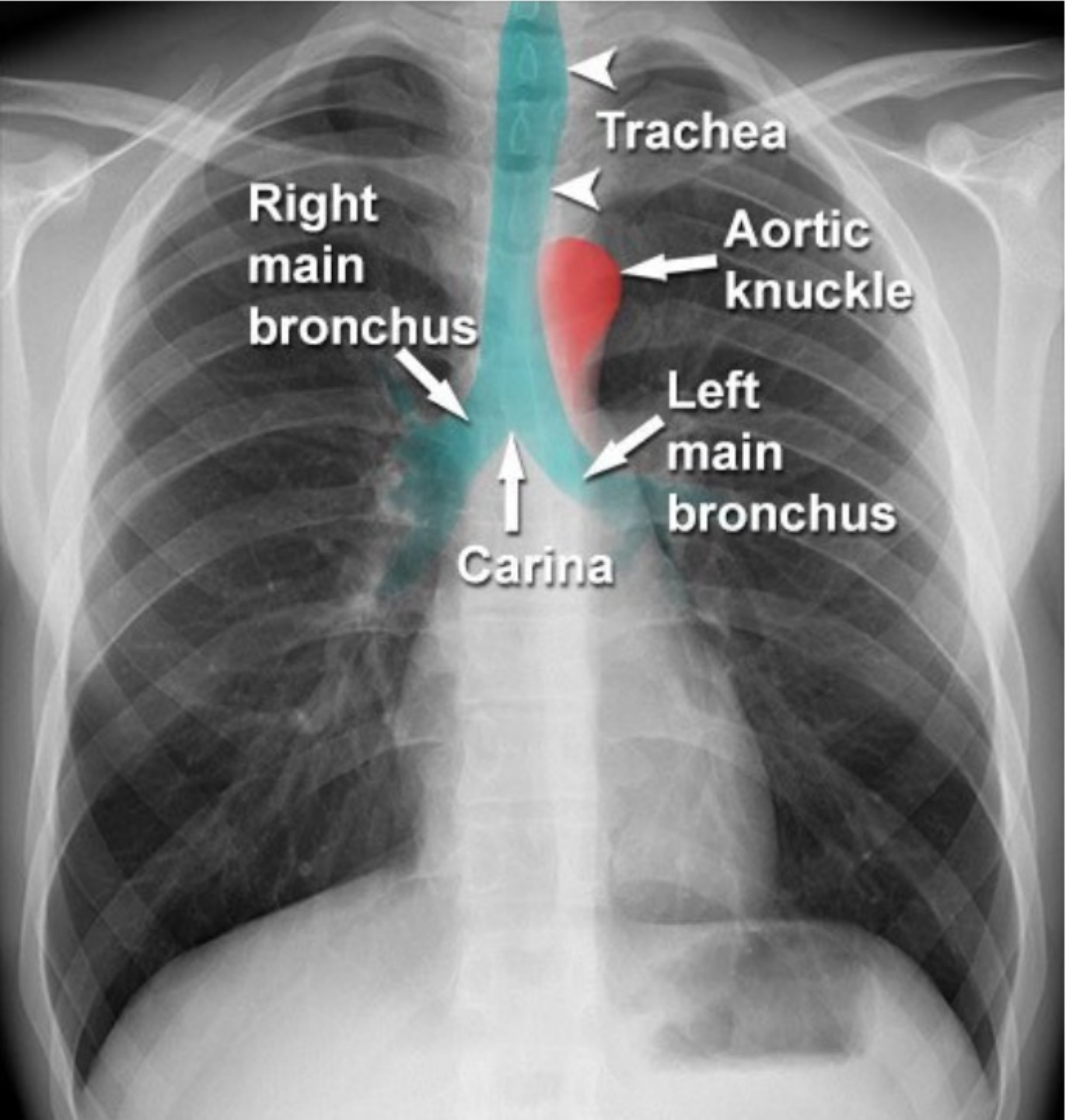
Anatomy

Anatomy - Air

- The **right main bronchus** is shorter, wider and more vertical than the left bronchus.

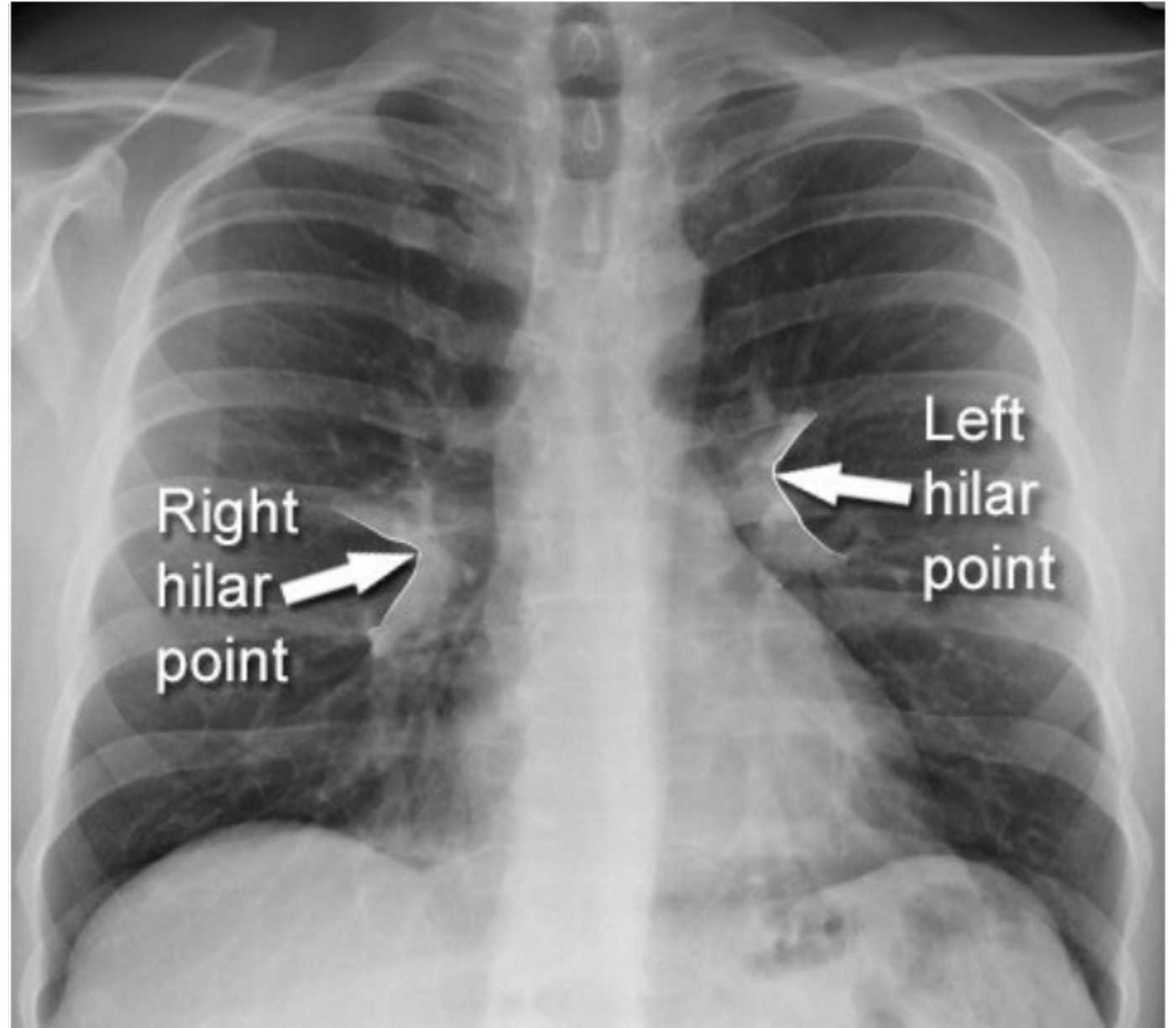


Anatomy | Airways

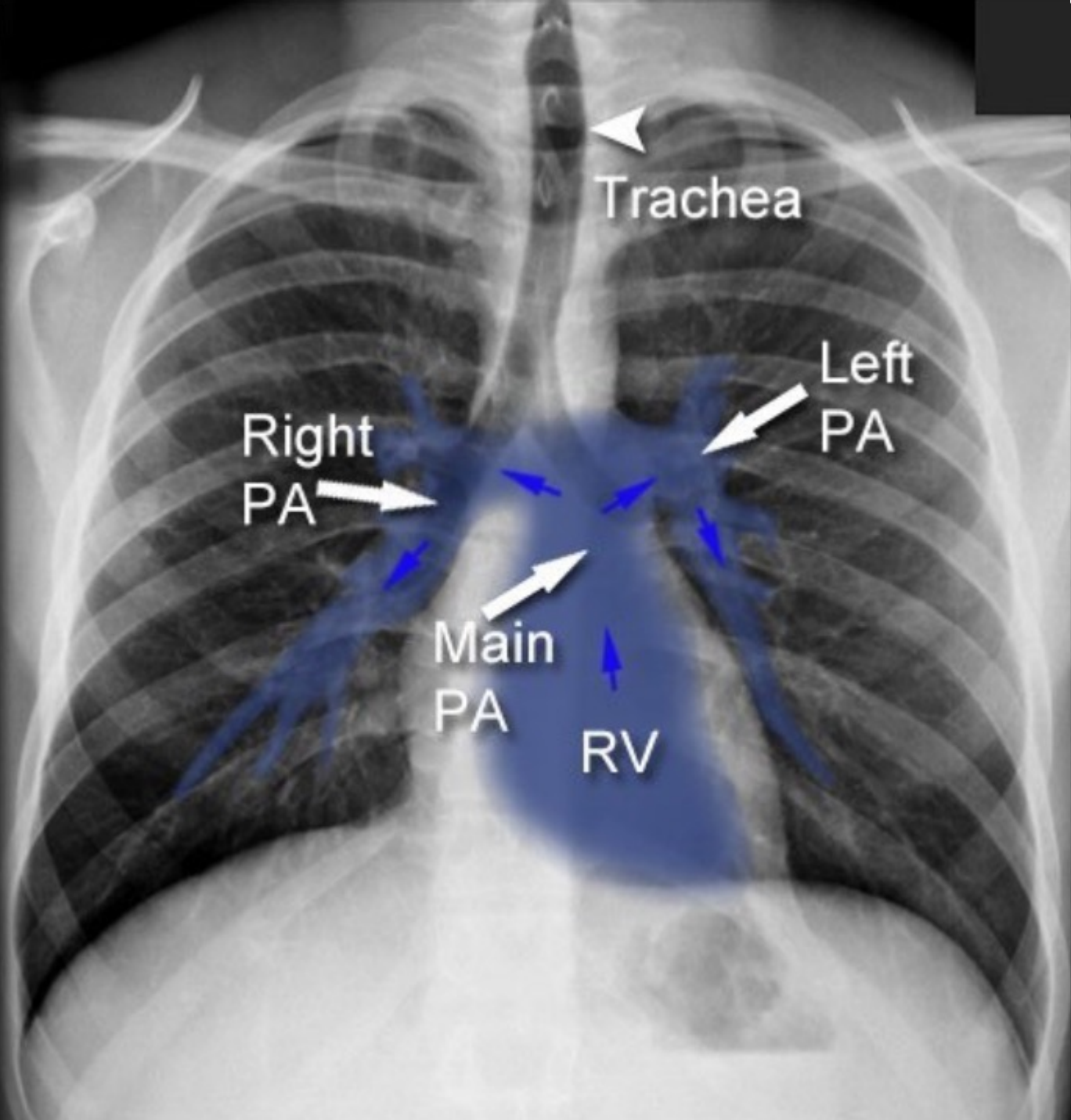


Anatomy | Hila

- Commonly the left hilum is higher than the right
- Look for abnormal **size** and **density**.

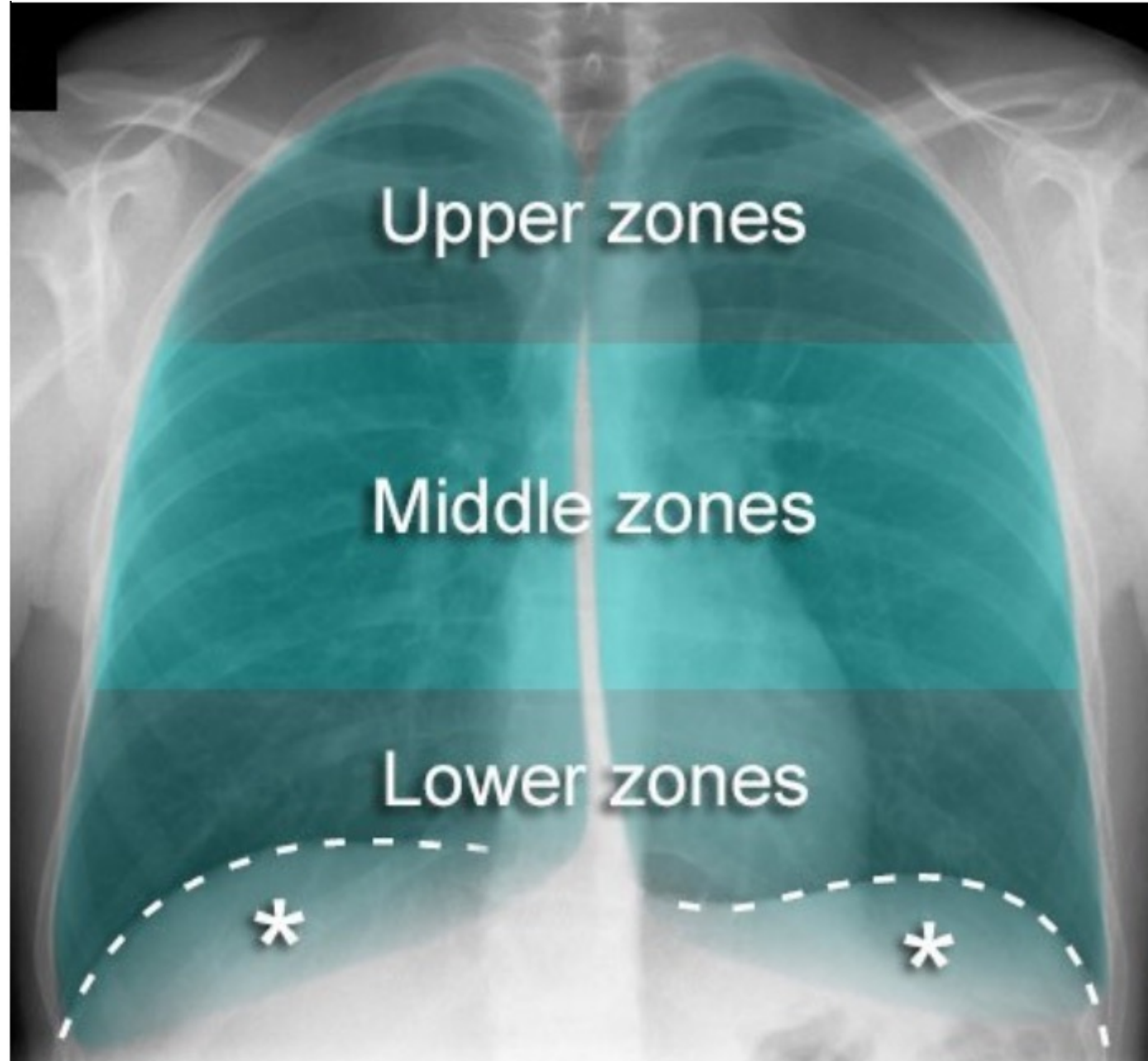


Anatomy | PA



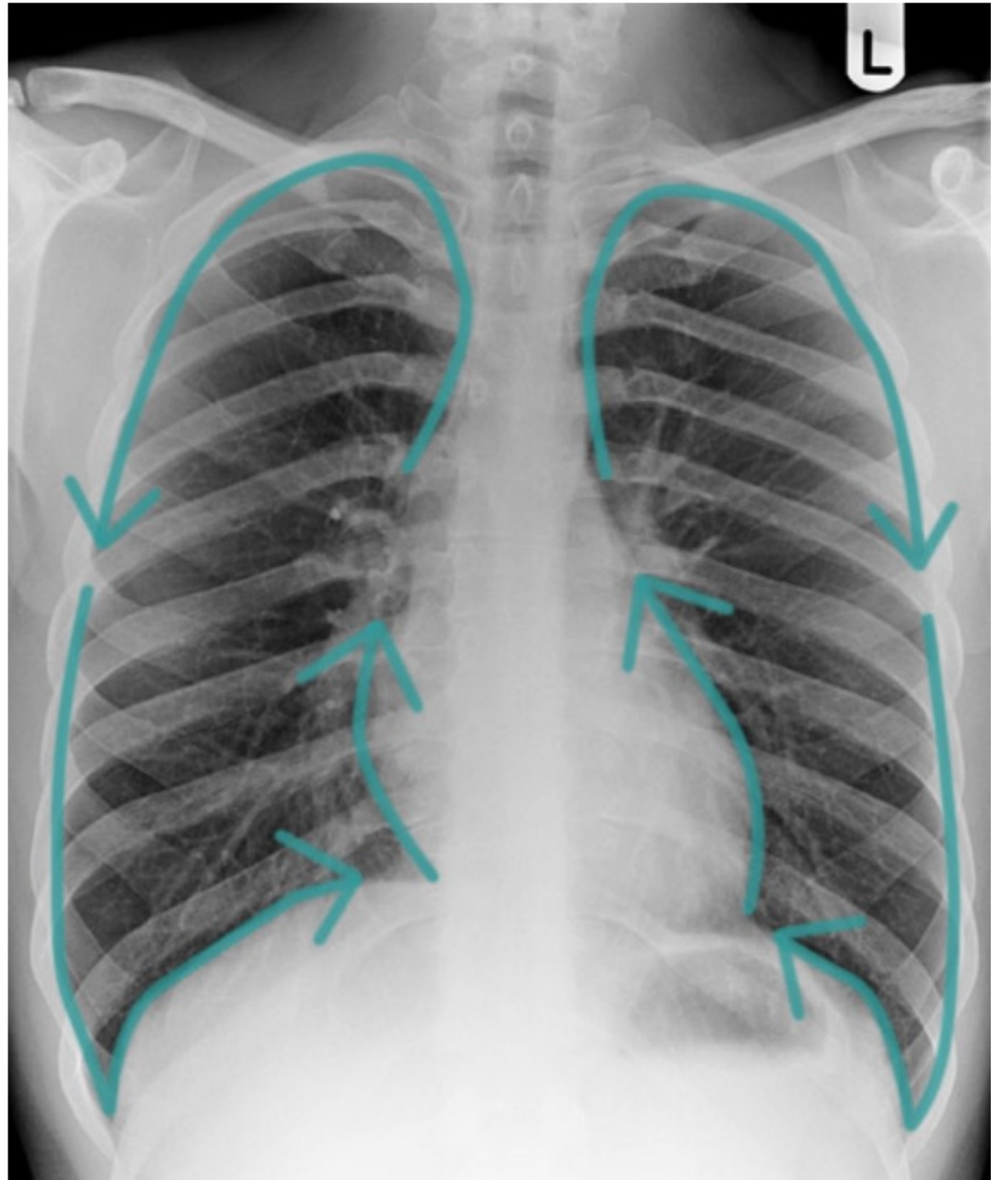
Anatomy | Lung Zones

- If you only have a single view
- Each zone is compared with its opposite side.



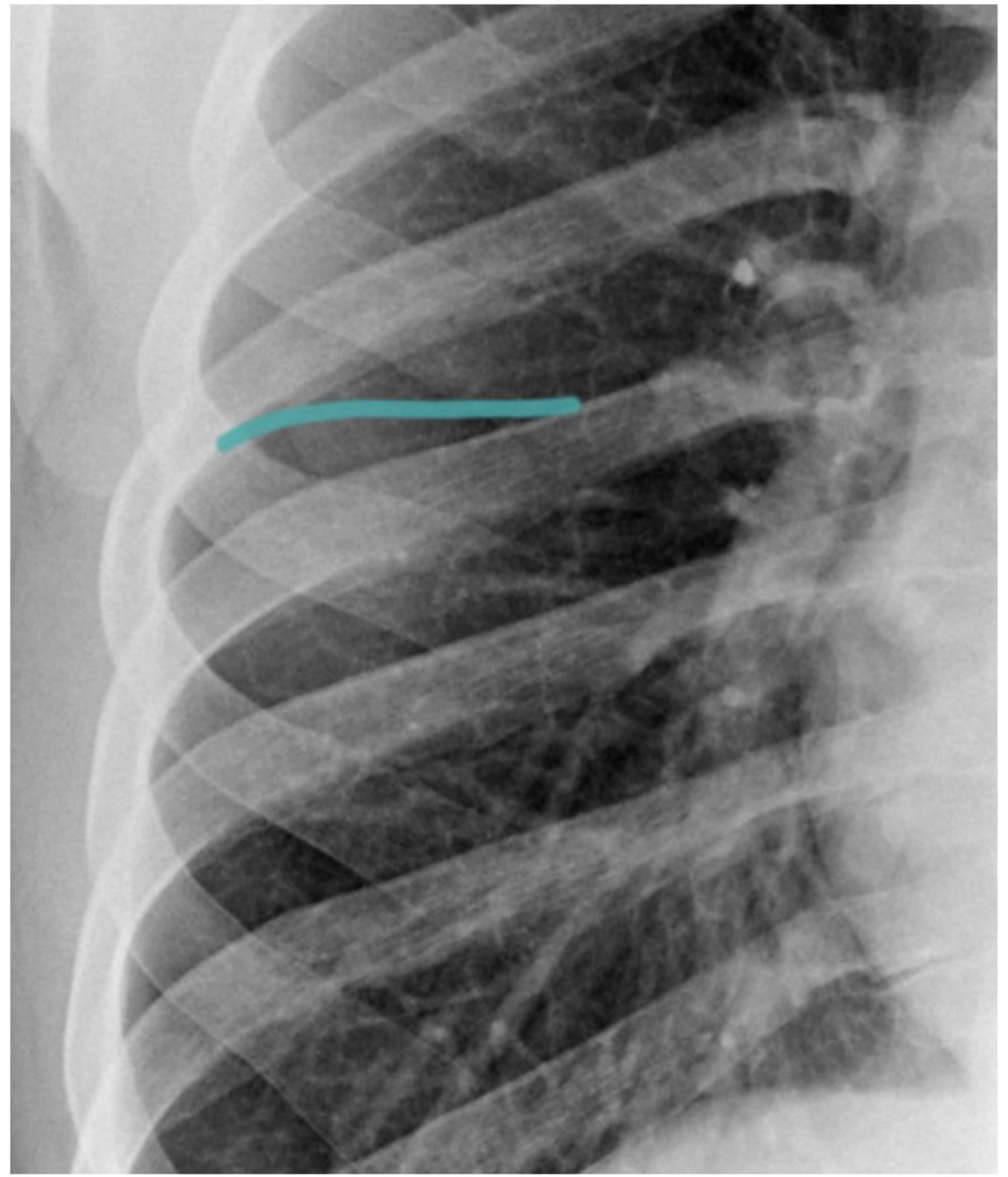
Anatomy | Pleura

- The pleura are only clearly visible when abnormal
- Lung markings should reach the thoracic wall



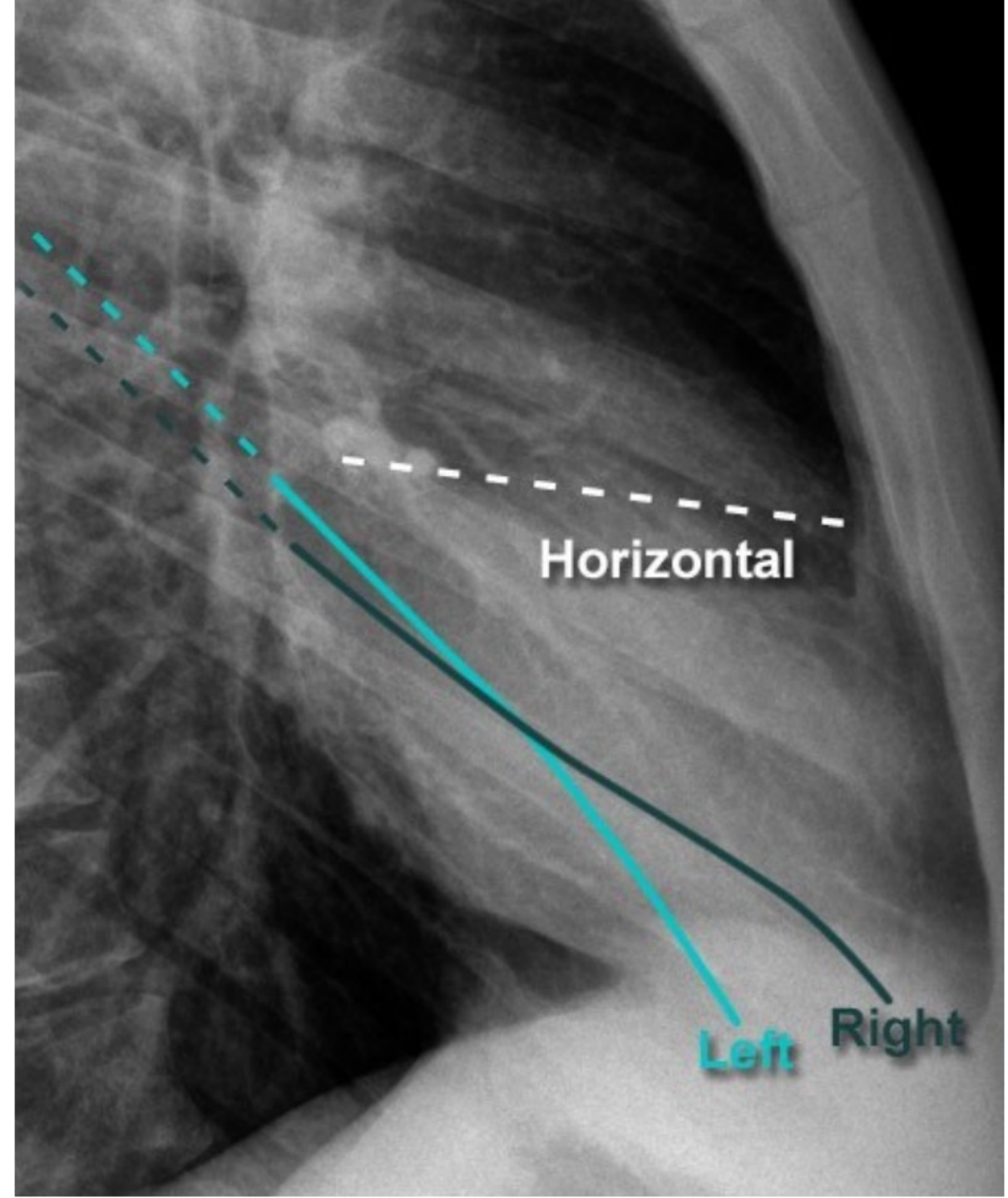
Anatomy | Fissures

- Only the horizontal fissure is commonly seen on a frontal chest X-ray.
- The the major fissures may be visible on lateral images.



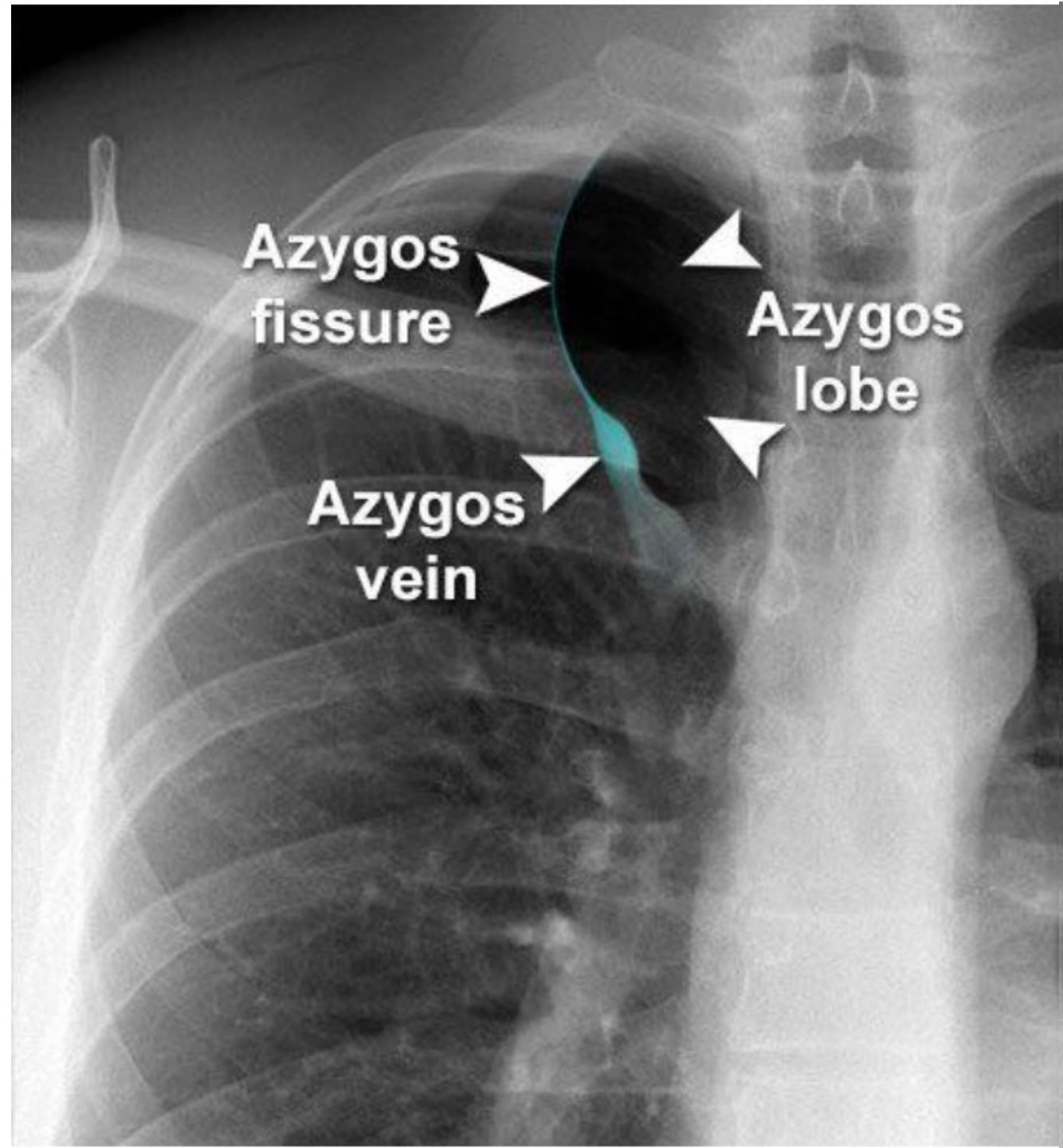
Anatomy | Fissures

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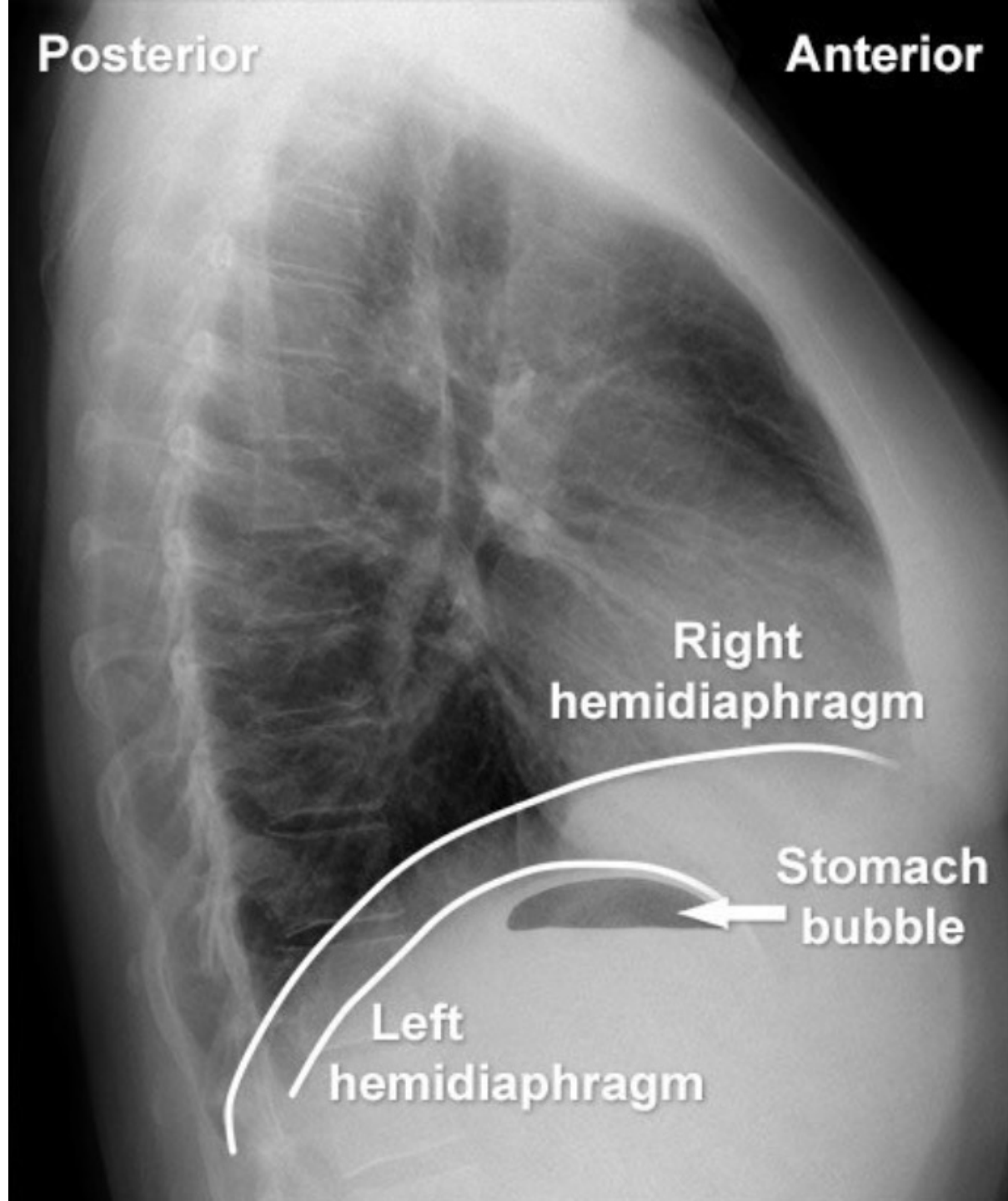
Anatomy | Fissures

- The azygos fissure is the most common accessory fissure visible on a chest X-ray (1-2% of individuals)

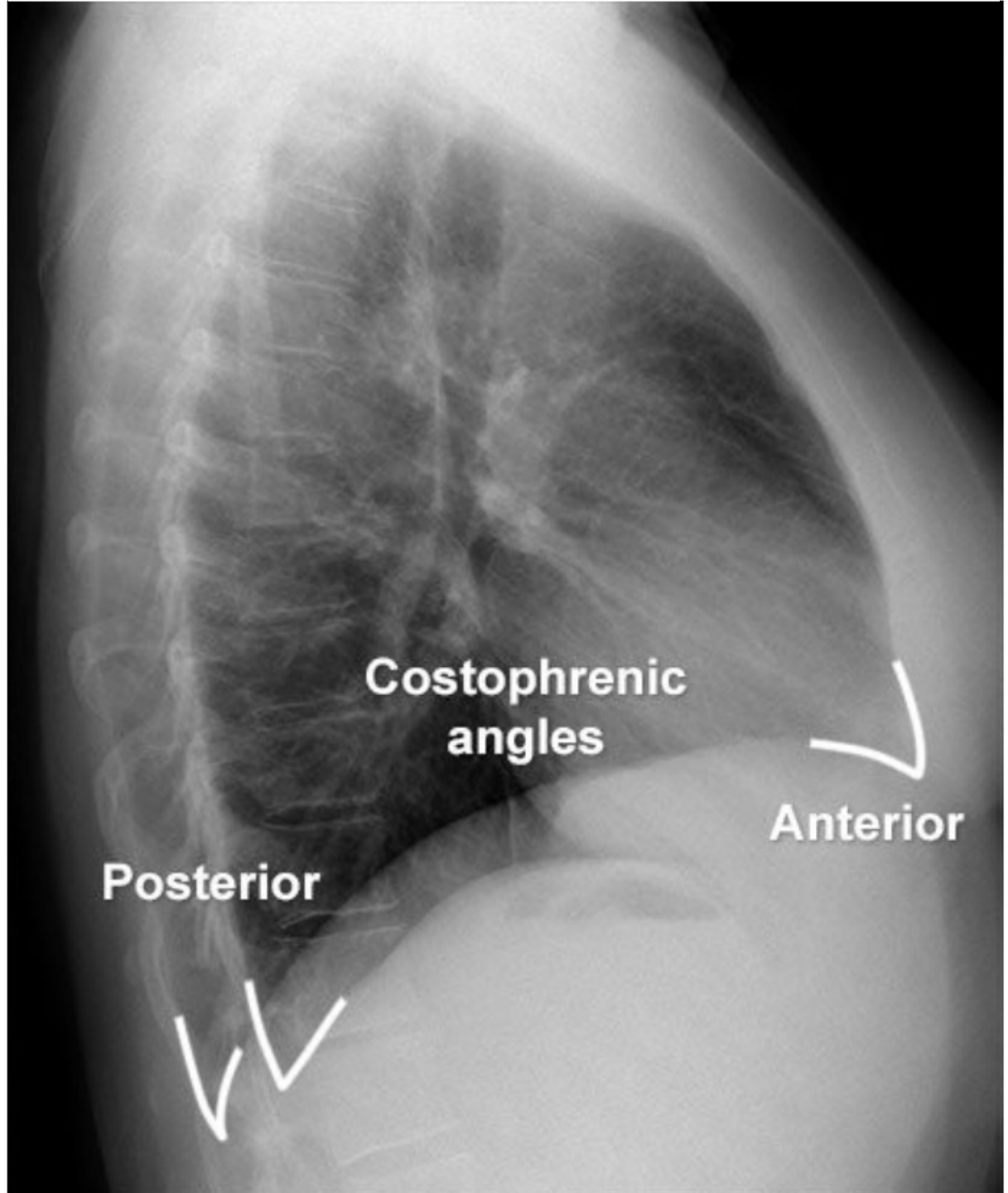


Anatomy | Diaphragm

- The hemidiaphragms are domed structures that should be well defined and visible to the midline on a frontal view.
- The contours of the hemidiaphragms do not demarcate the bottom of the lungs; lung markings can be seen below the hemidiaphragms.
- Each hemidiaphragm should be well defined
- The right hemidiaphragm is slightly higher than the left

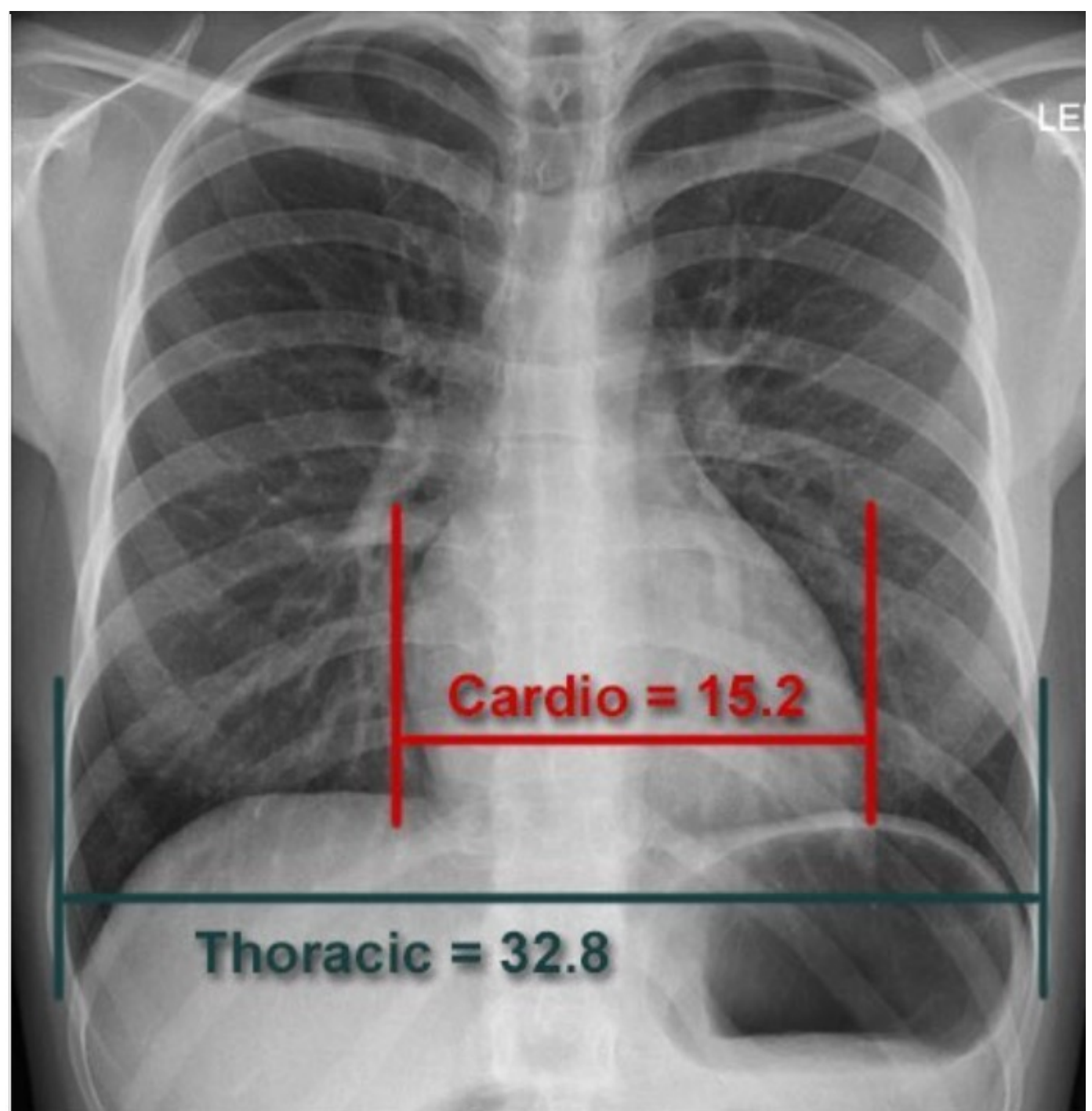


Anatomy | Costophrenic Recess



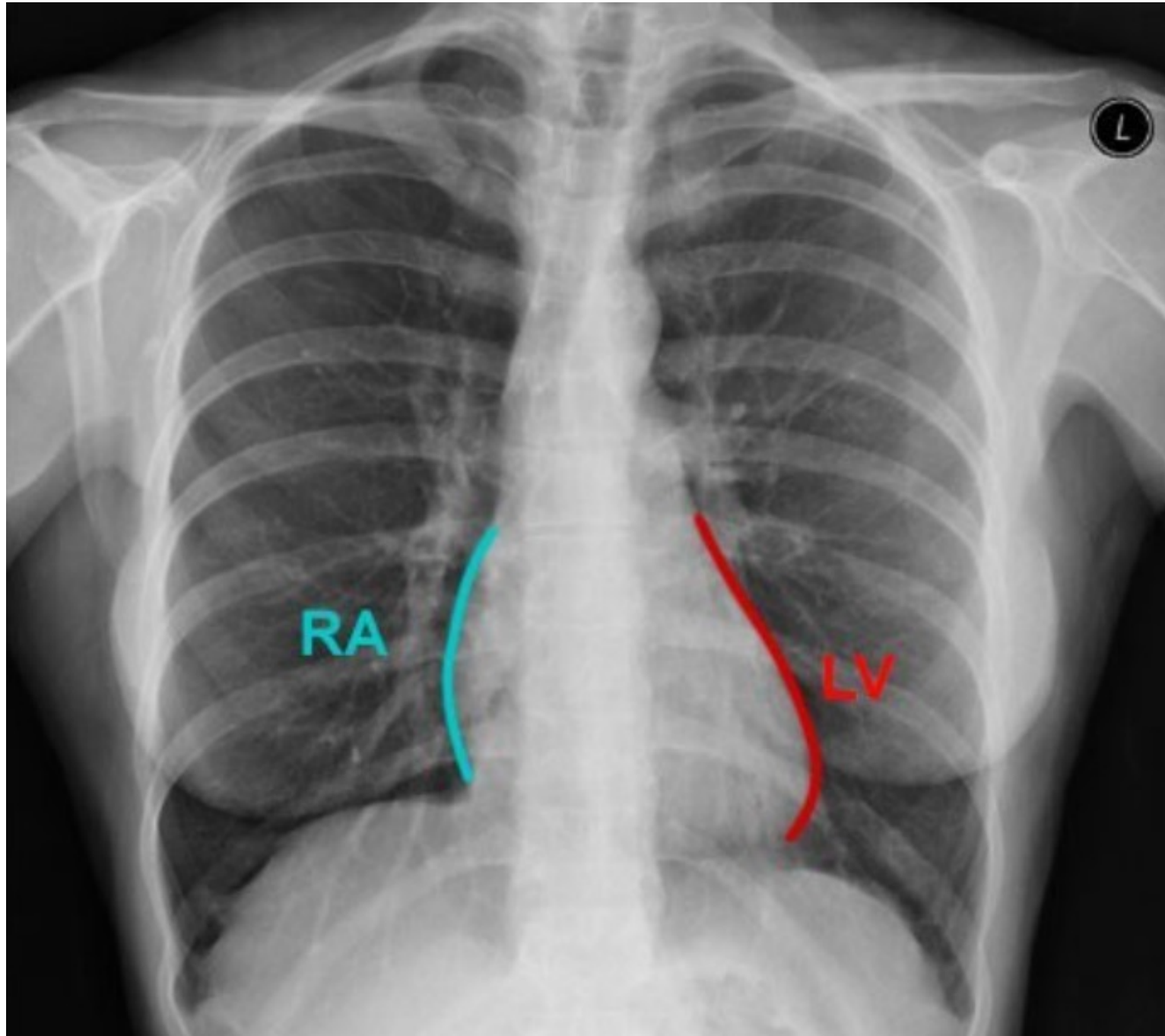
Anatomy | Heart

- The heart size is assessed as the cardiothoracic ratio (CTR)
- A CTR of $>50\%$ is abnormal - PA view only
- The left hemidiaphragm should be visible behind the heart



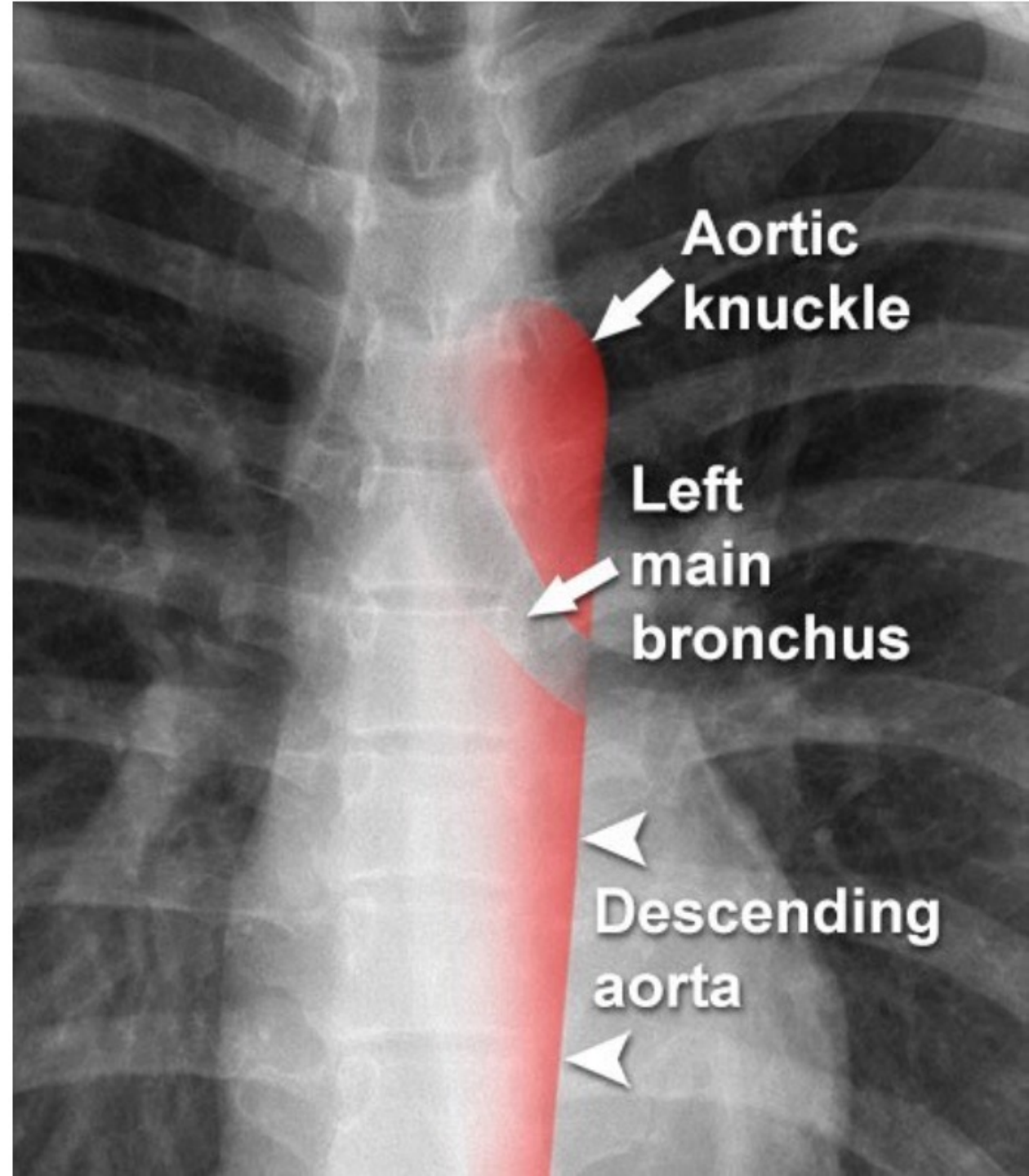
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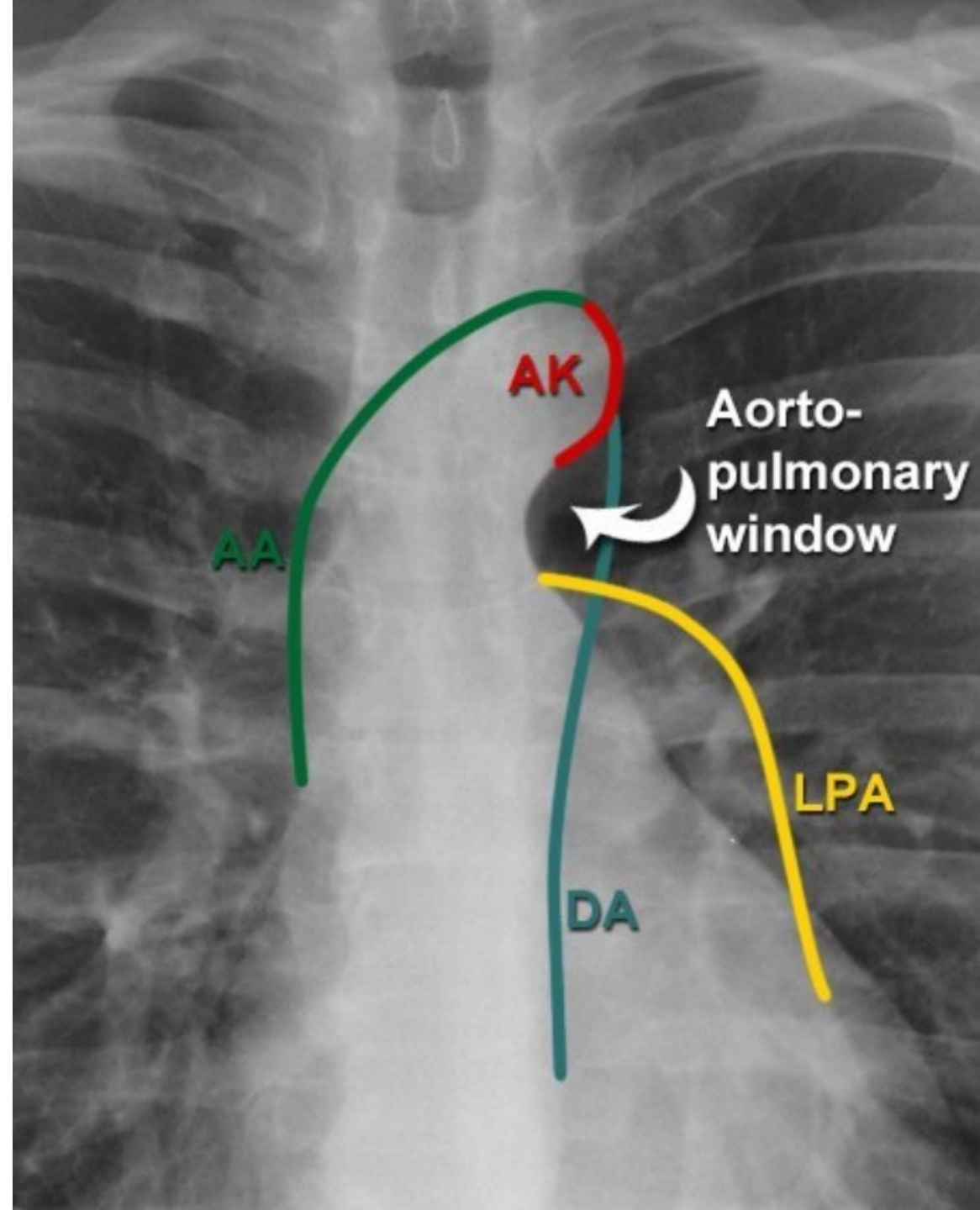
Anatomy | Mediastinal Contours

- Whenever you look at a chest X-ray it is well worth looking for abnormalities in the region of the aortic knuckle, the aortopulmonary window, and the right paratracheal stripe.

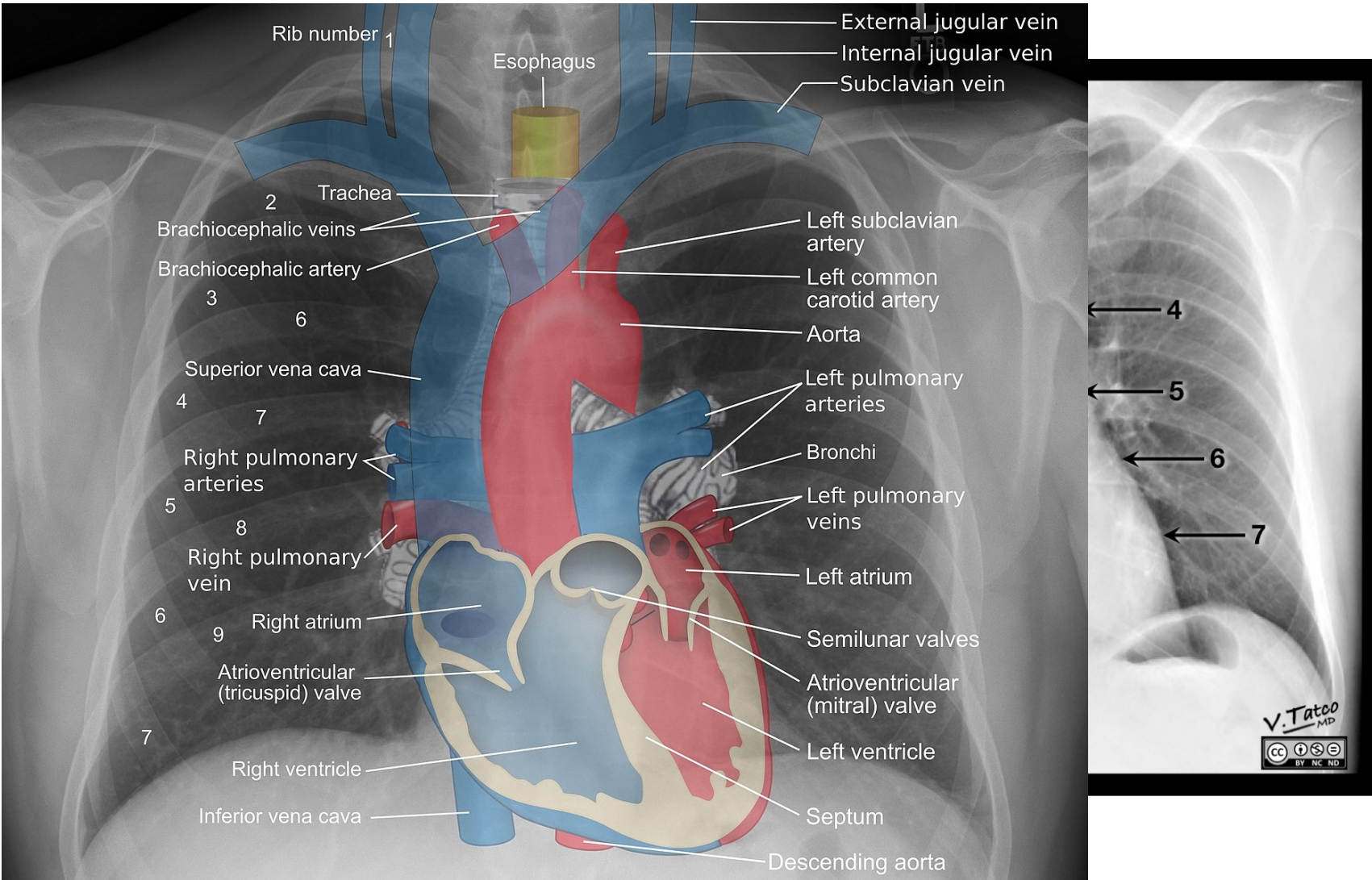


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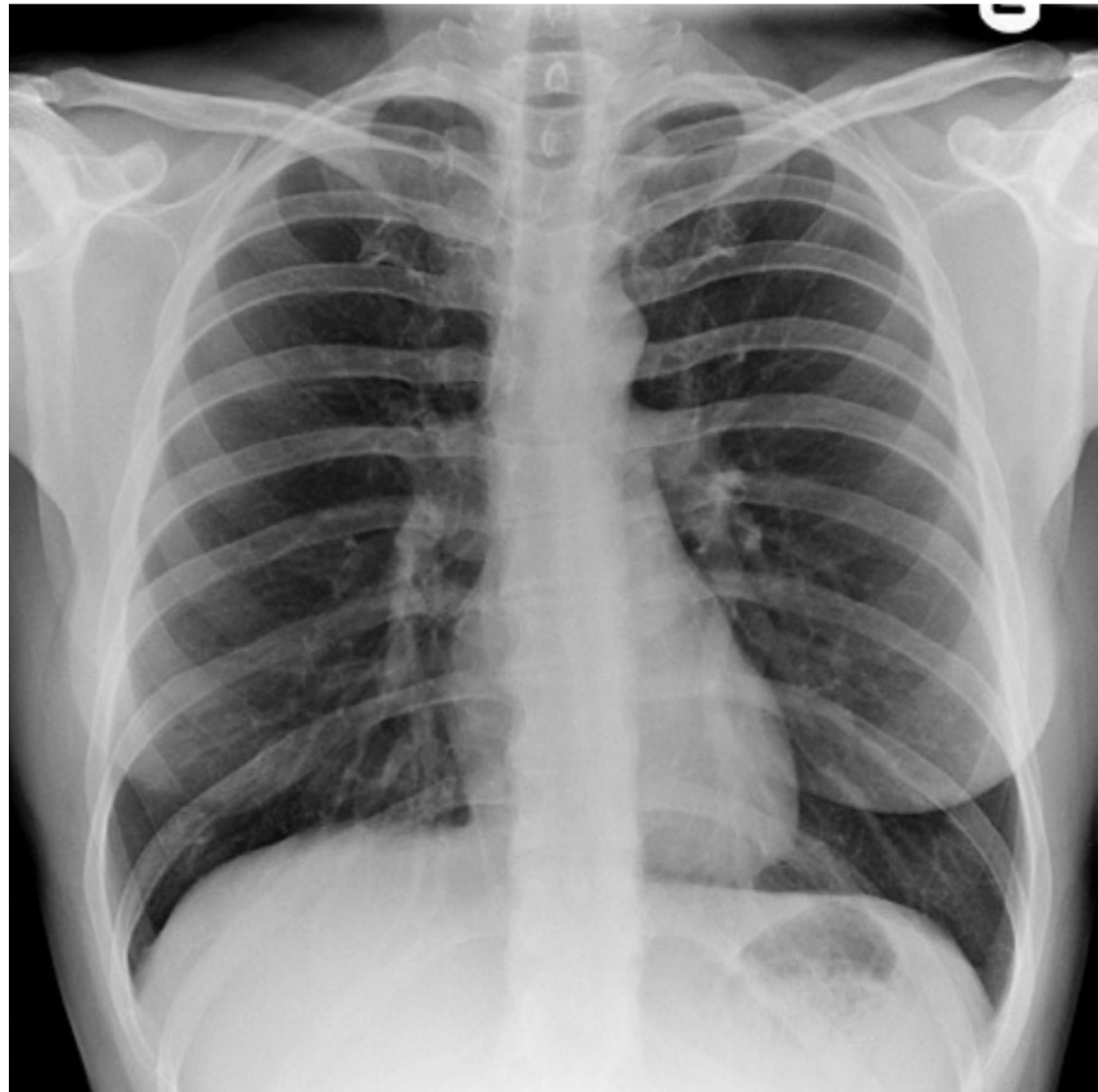


Anatomy | Mediastinum – Putting it all together



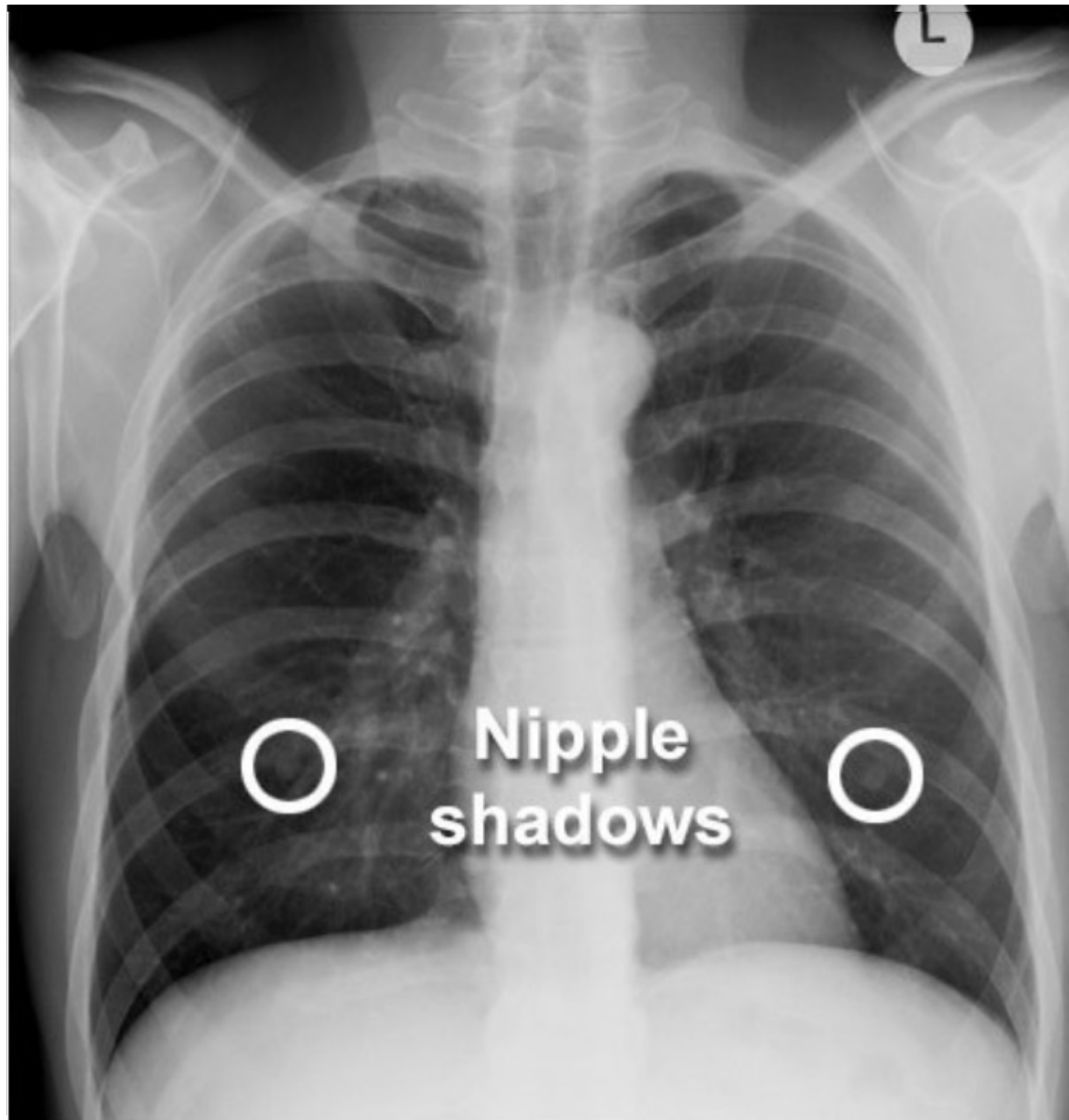
Anatomy | Soft Tissues

- If a patient has very thick soft tissue due to obesity, underlying structures such as the lung markings may be obscured.
- Large breasts may obscure the costophrenic angles giving the impression of the presence of pleural effusions.

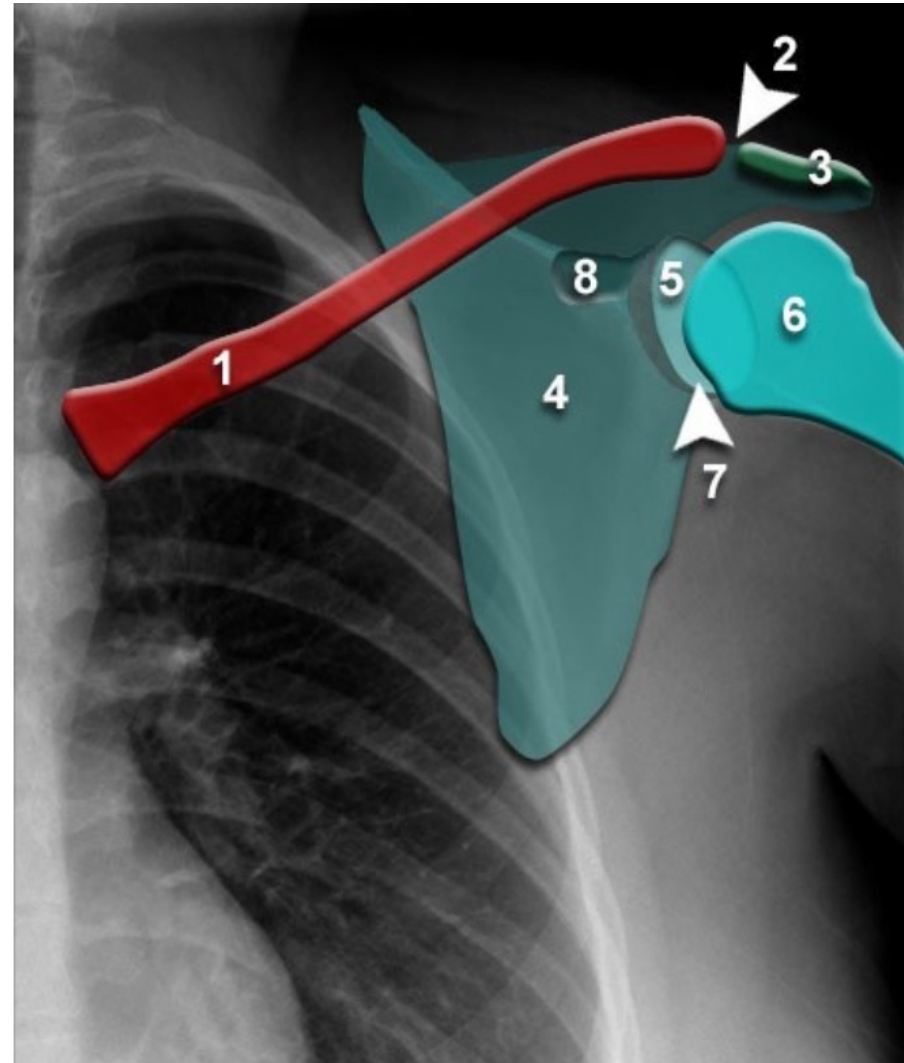
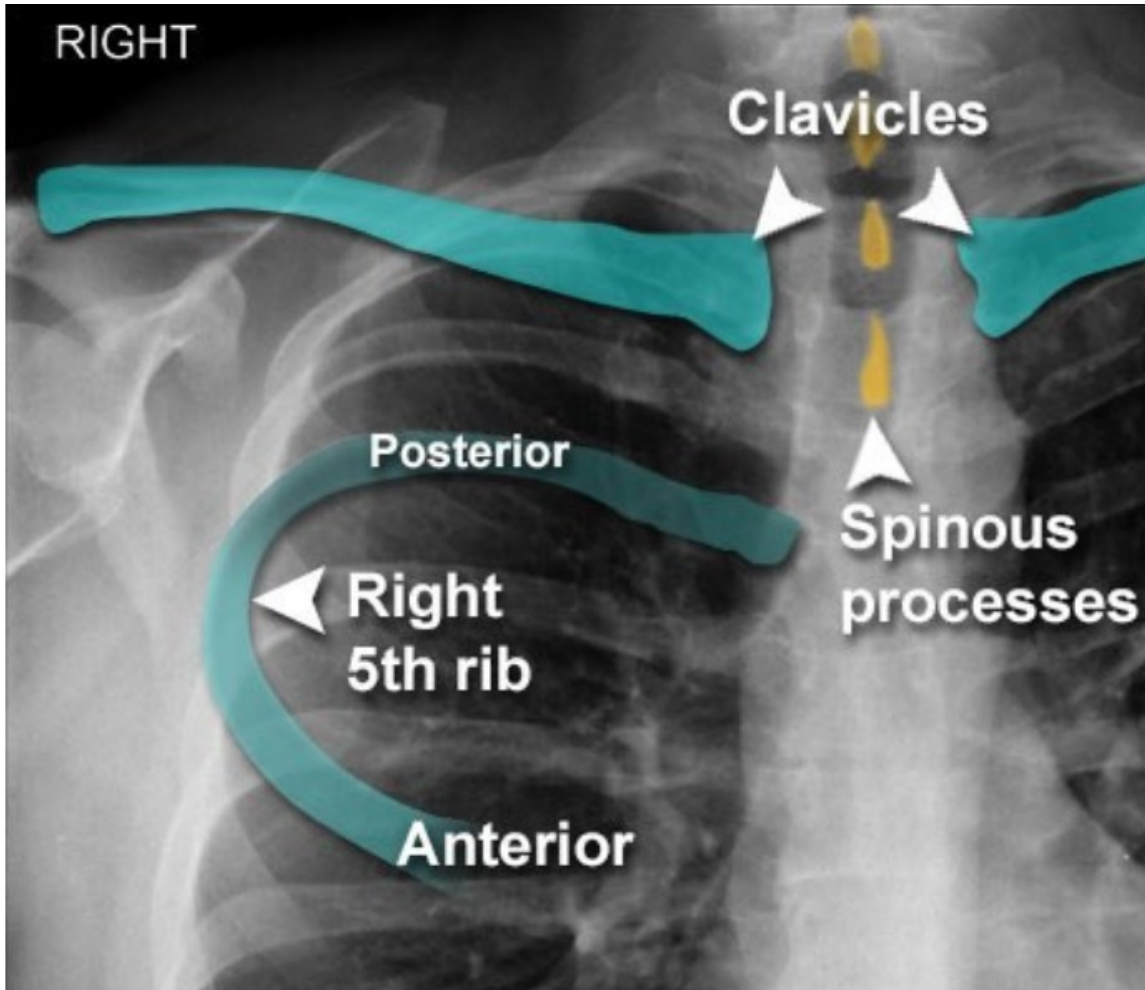


Anatomy | Soft Tissues

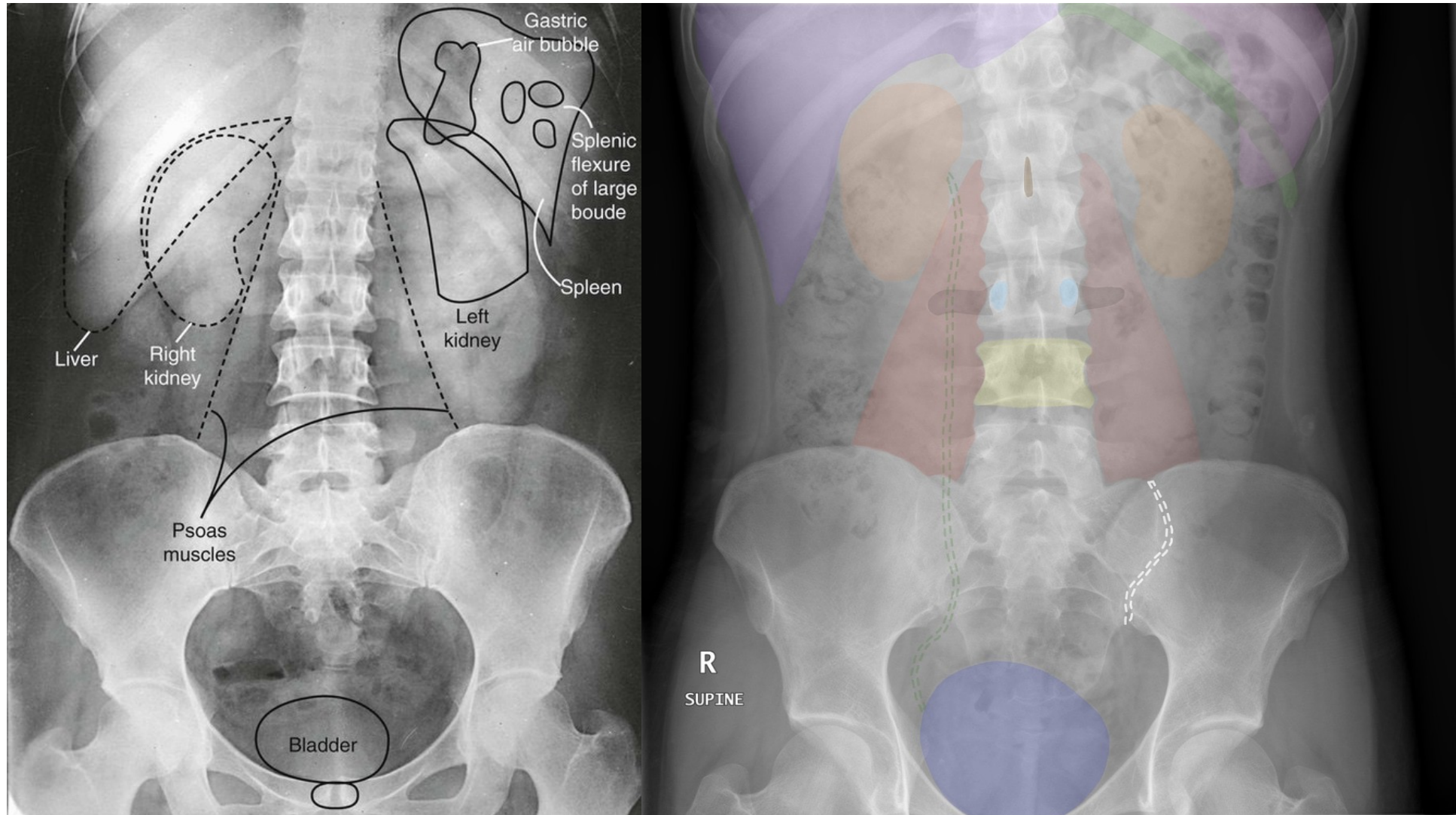
- The nipples are clearly seen on this chest X-ray
- If there is any doubt that a nipple shadow could be a lung nodule then a repeat chest X-ray should be performed
- Metallic 'nipple markers' are used to indicate the position of the nipples



Anatomy | Bony Thorax



Upper Abdomen and Soft Tissues | Anatomy



Common CXR Findings and Diagnoses

Atelectasis

Direct signs of atelectasis are from lobar volume loss and include:

Displacement of the fissures.

Plate-like or triangular opacity from the collapsed lung itself.

Vascular crowding.

Indirect signs of atelectasis are due to the effect of volume loss on adjacent structures and include:

Elevation of the diaphragm.

Rib crowding on the side with volume loss.

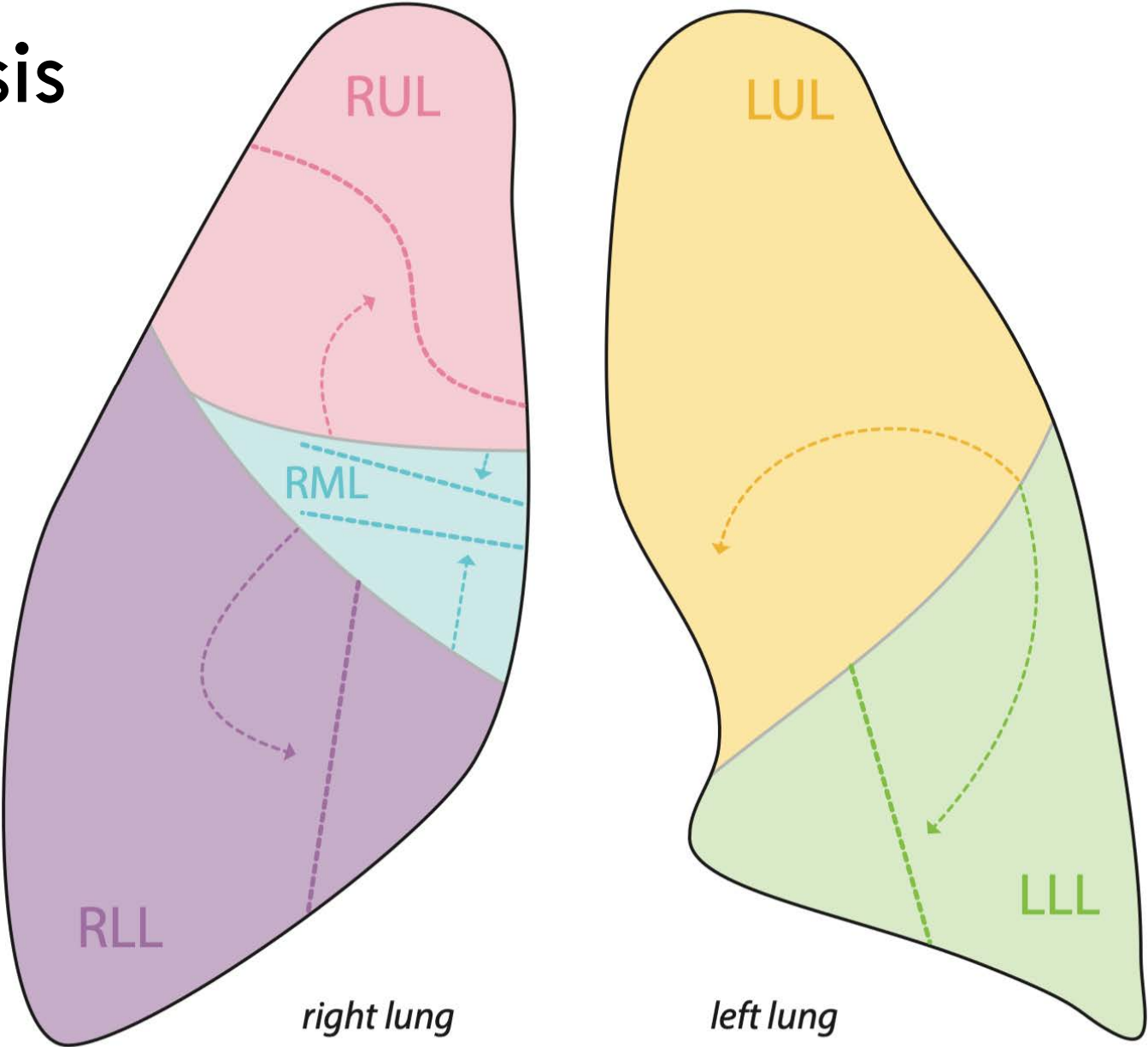
Mediastinal shift to the side with volume loss.

Overinflation of adjacent or contralateral lobes.

Hilar displacement.

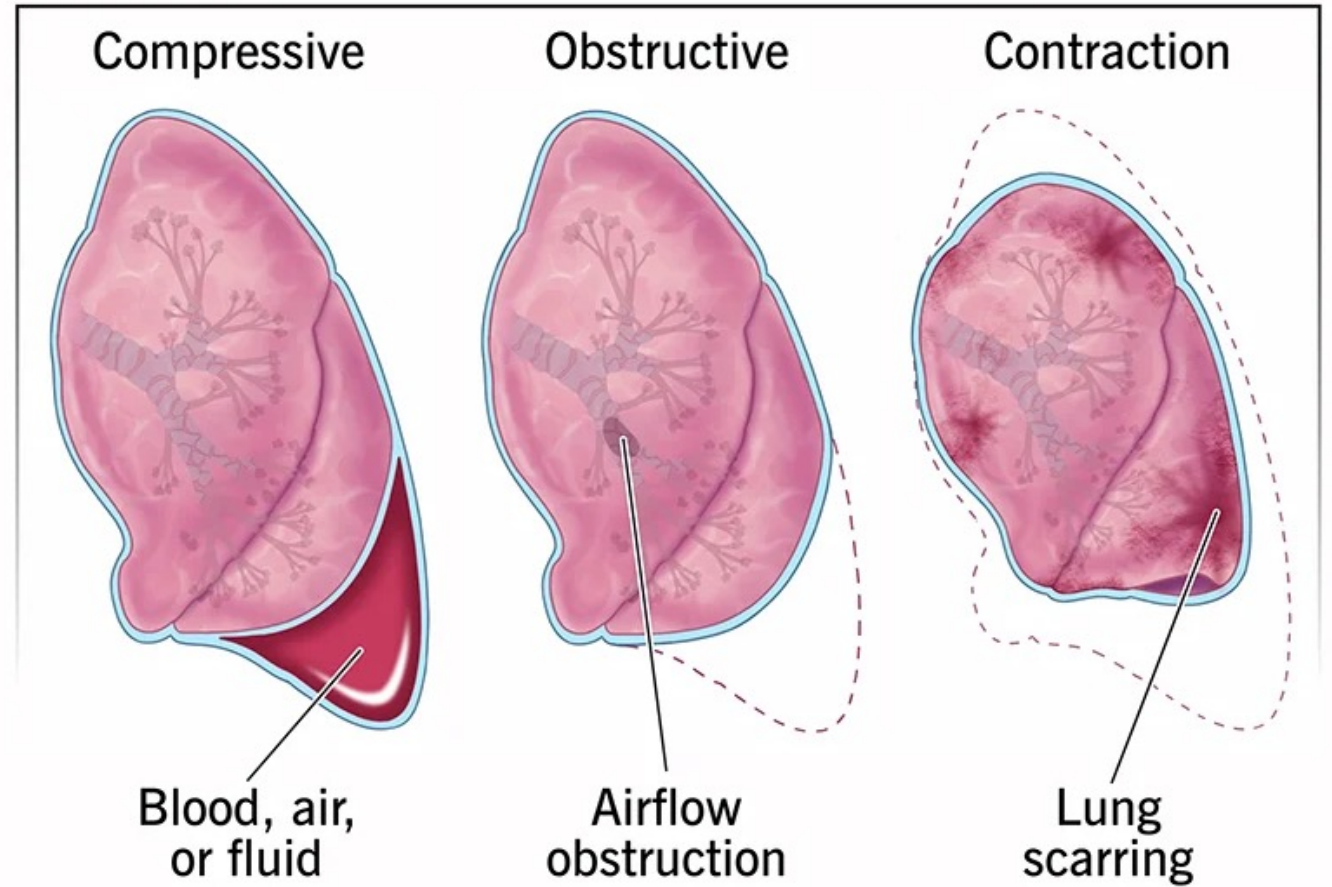
frontal schematic

Atelectasis

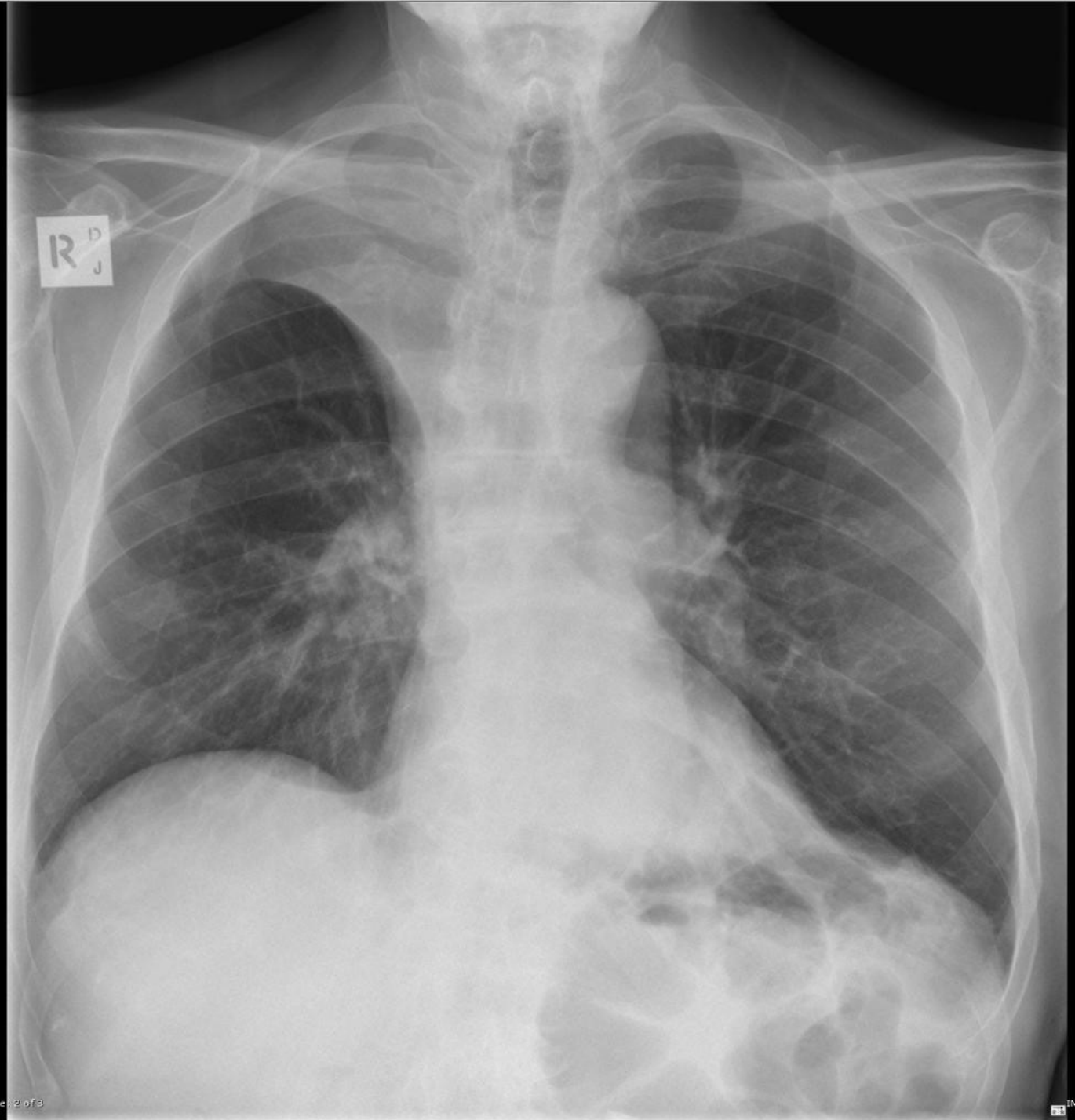


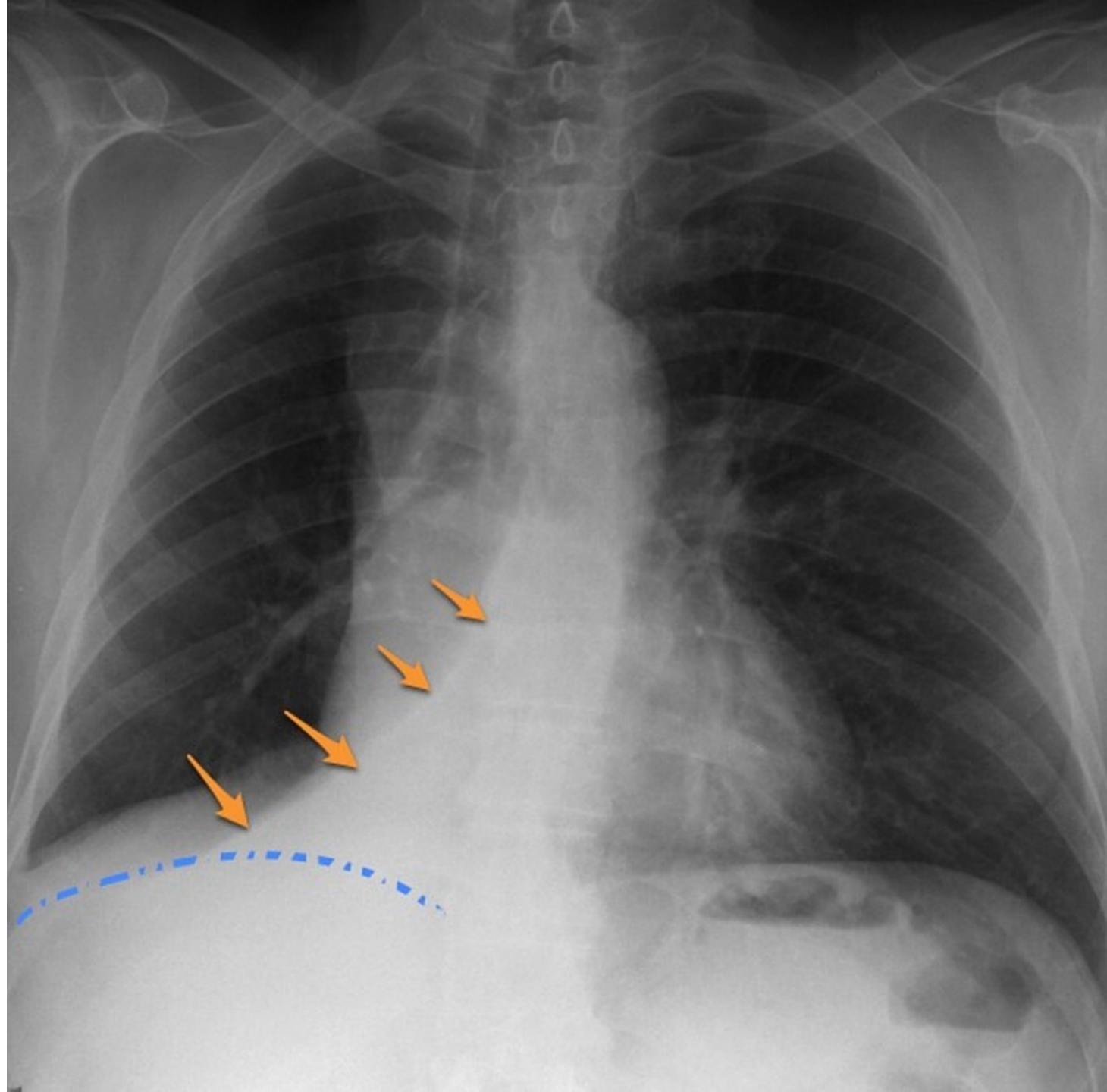
Atelectasis - Types

Atelectasis types



**What's your
diagnosis?**





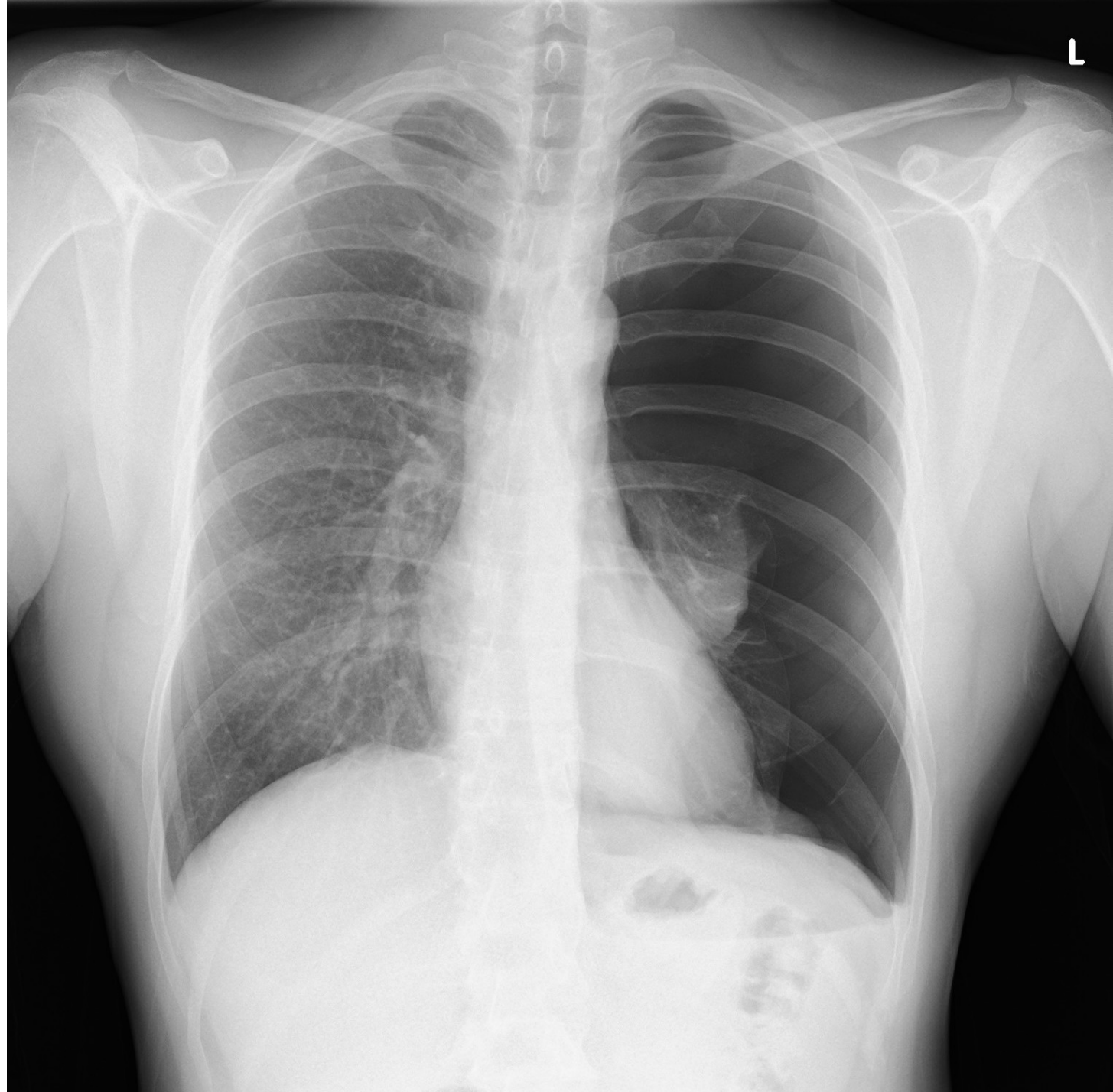
Lobar Pneumonia

- Consolidation of a single lobe.
- Usually bacterial in origin



Patient with proven Pneumococcal Pneumonia

**What is the
diagnosis?**



Primary Findings:

Patient is slightly rotated

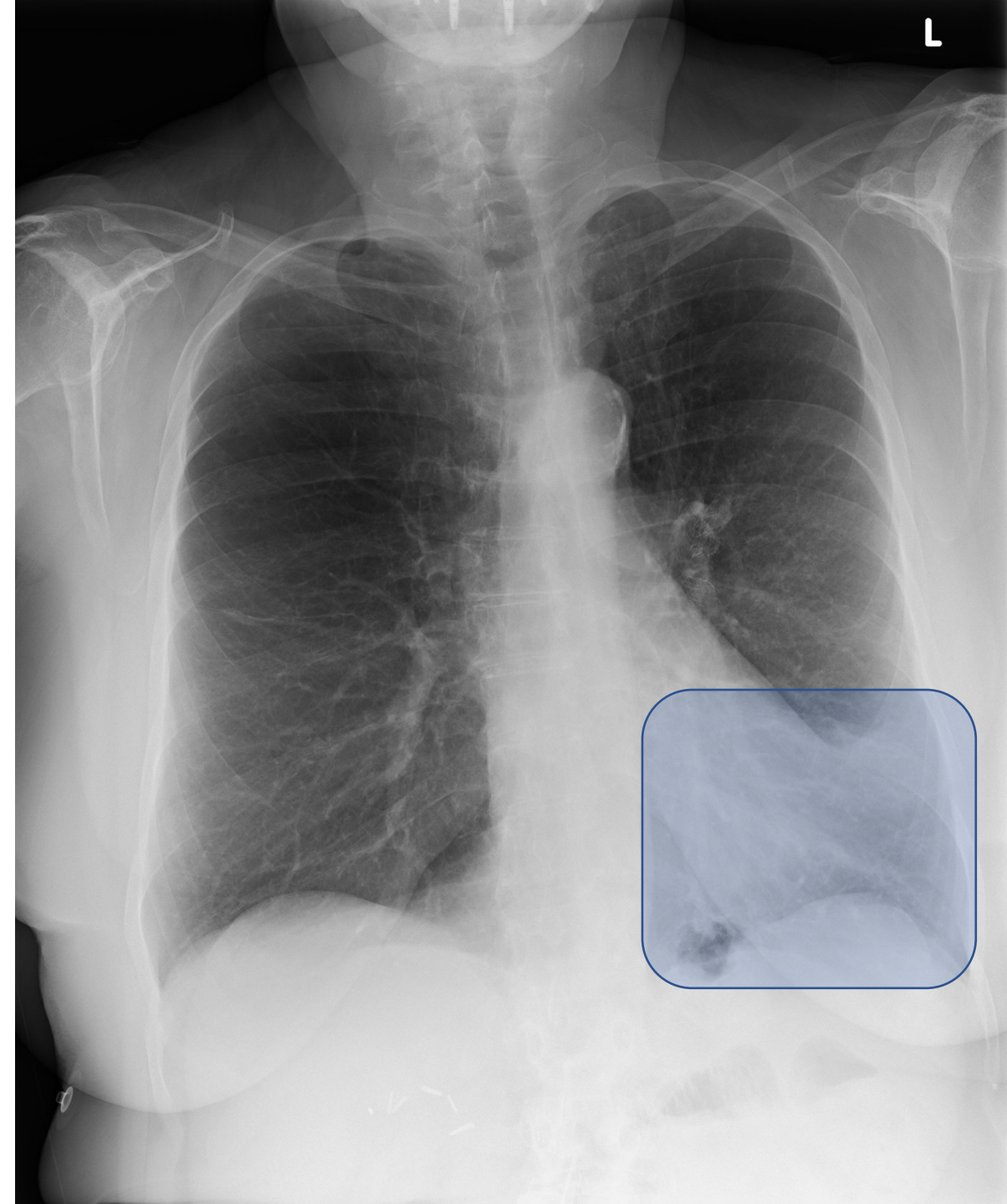
Left Lower Lobe hazy opacification

Elevation of the left hemidiaphragm

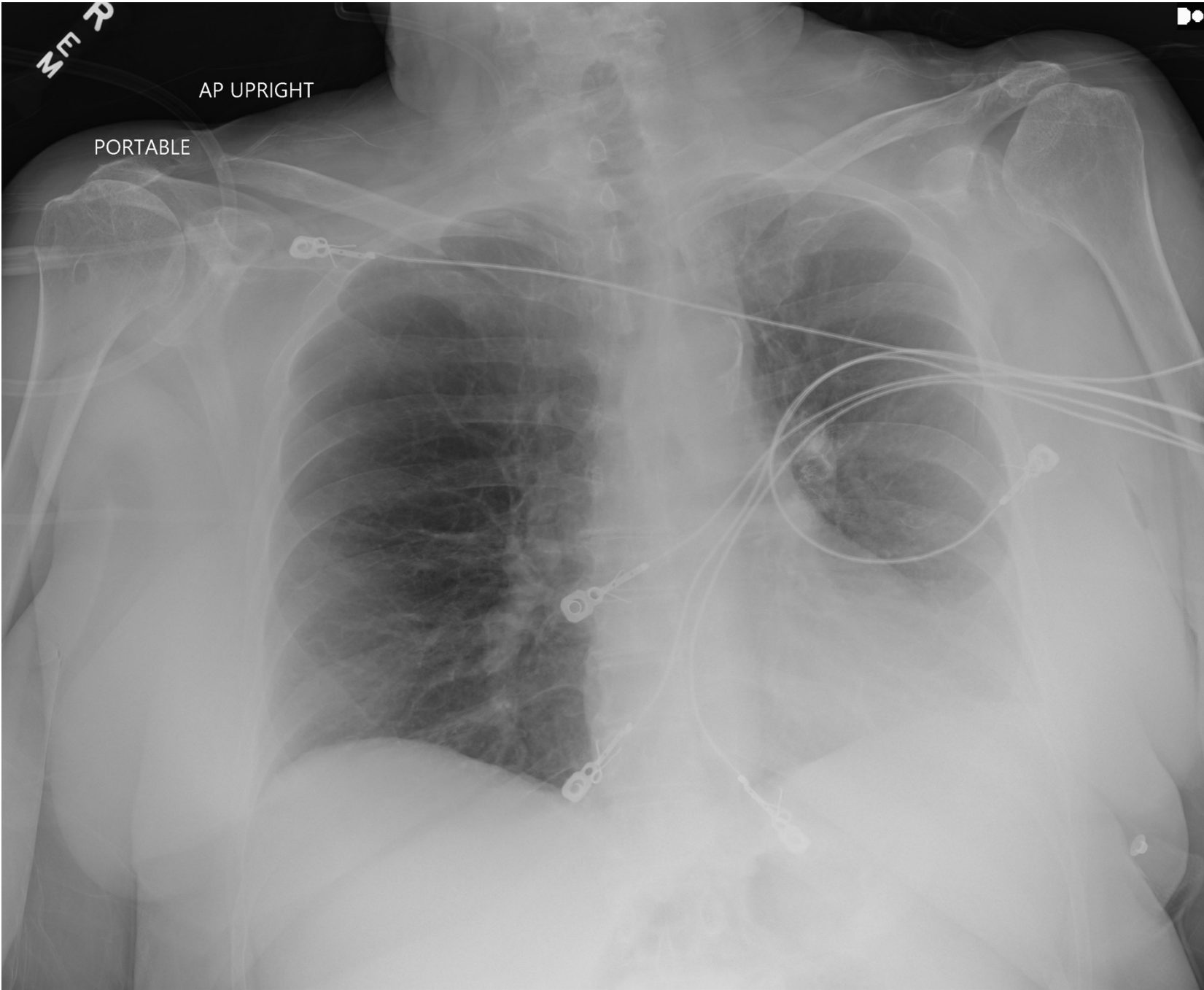
Secondary Findings:

Calcifications in the Aortic Knob

Impression: Left Lower Lobe Atelectasis



Companion Case



Primary Findings:

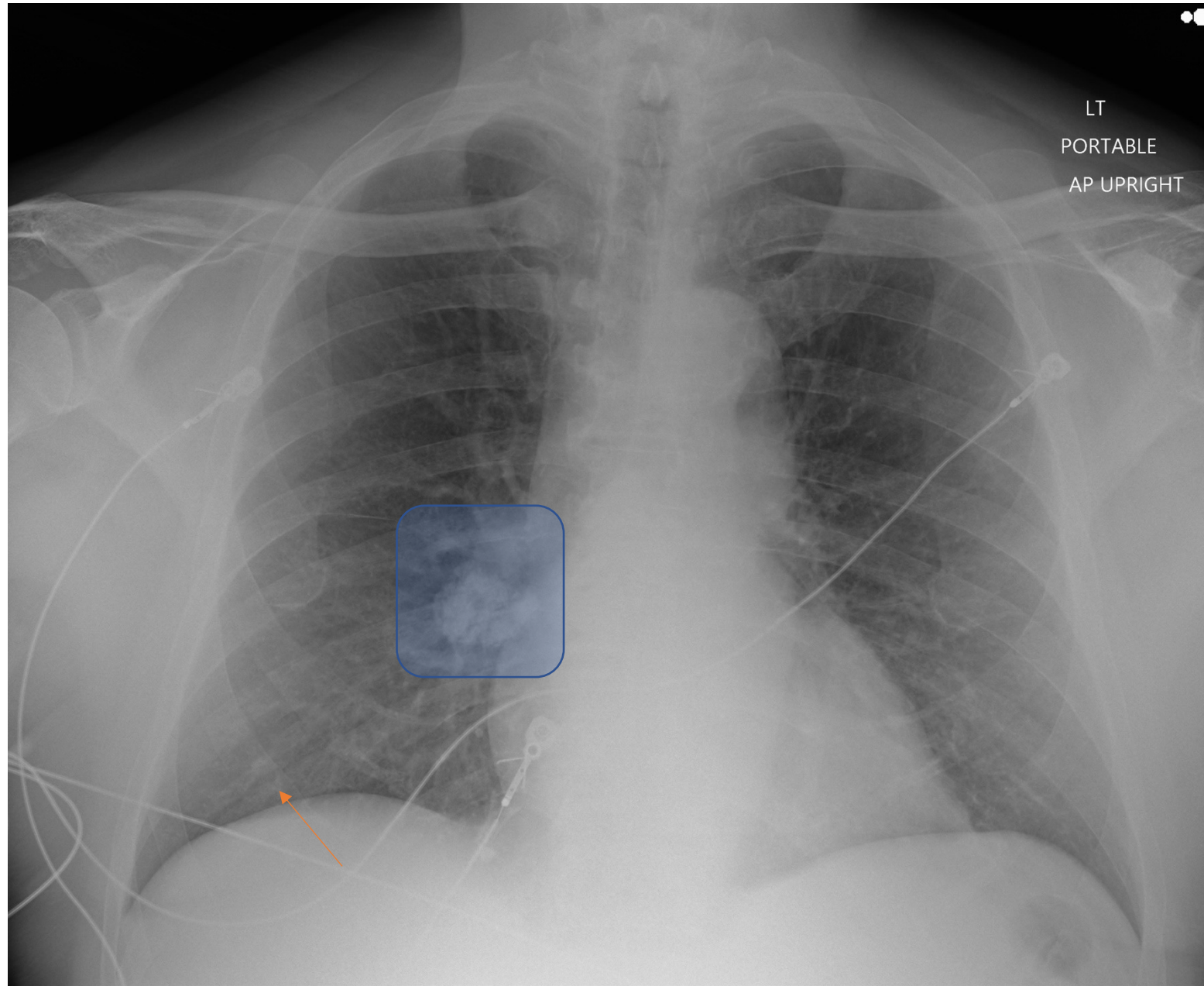
Reticulonodular opacities in the bibasilar lungs

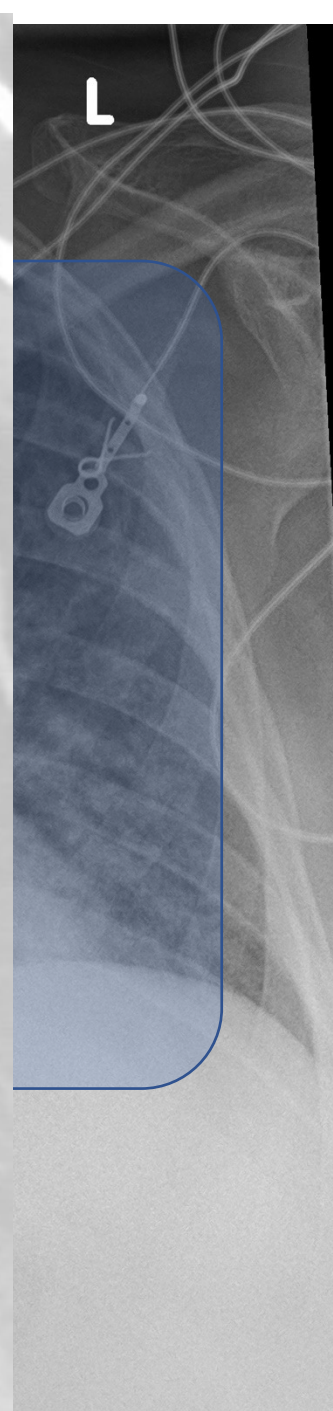
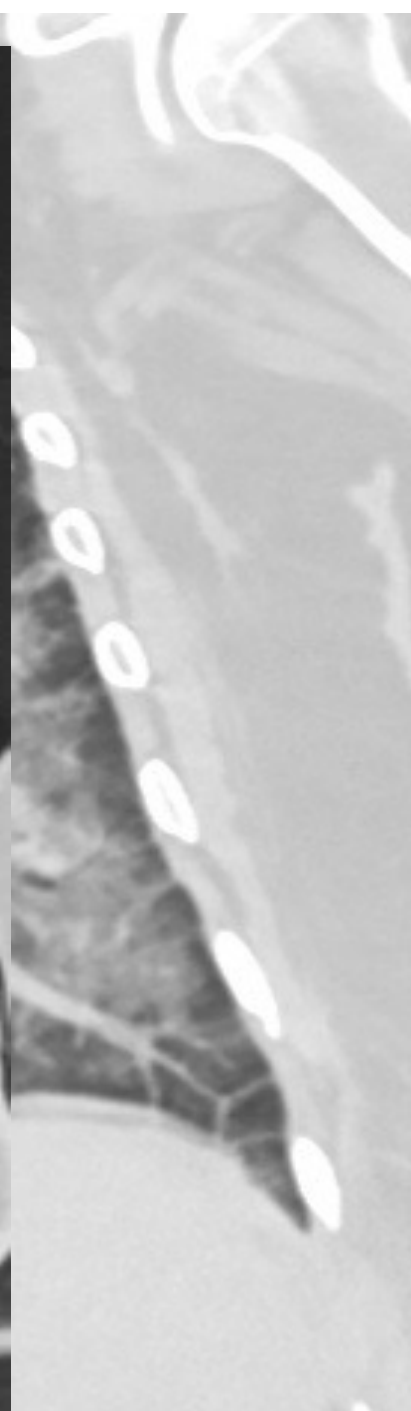
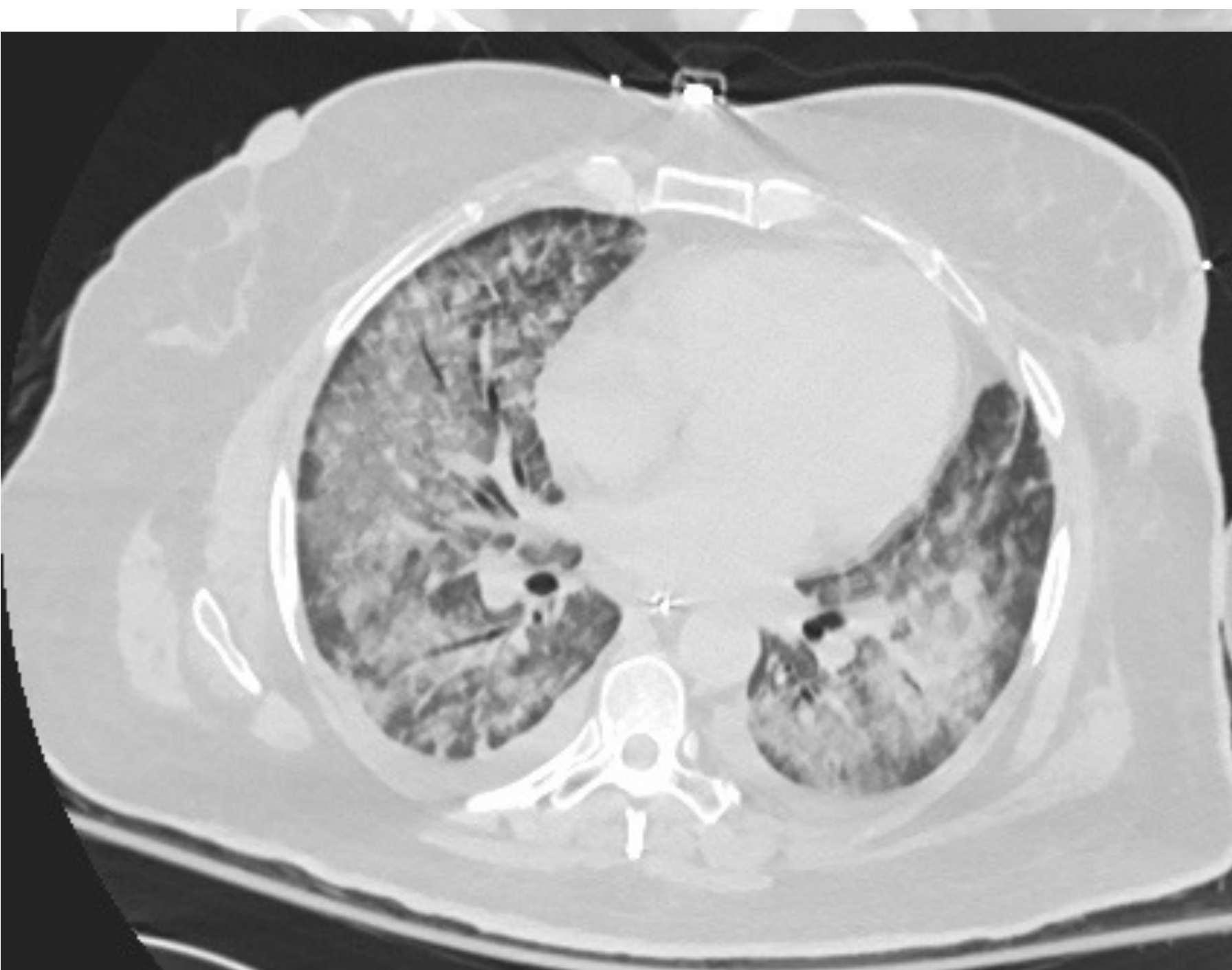
Secondary Findings:

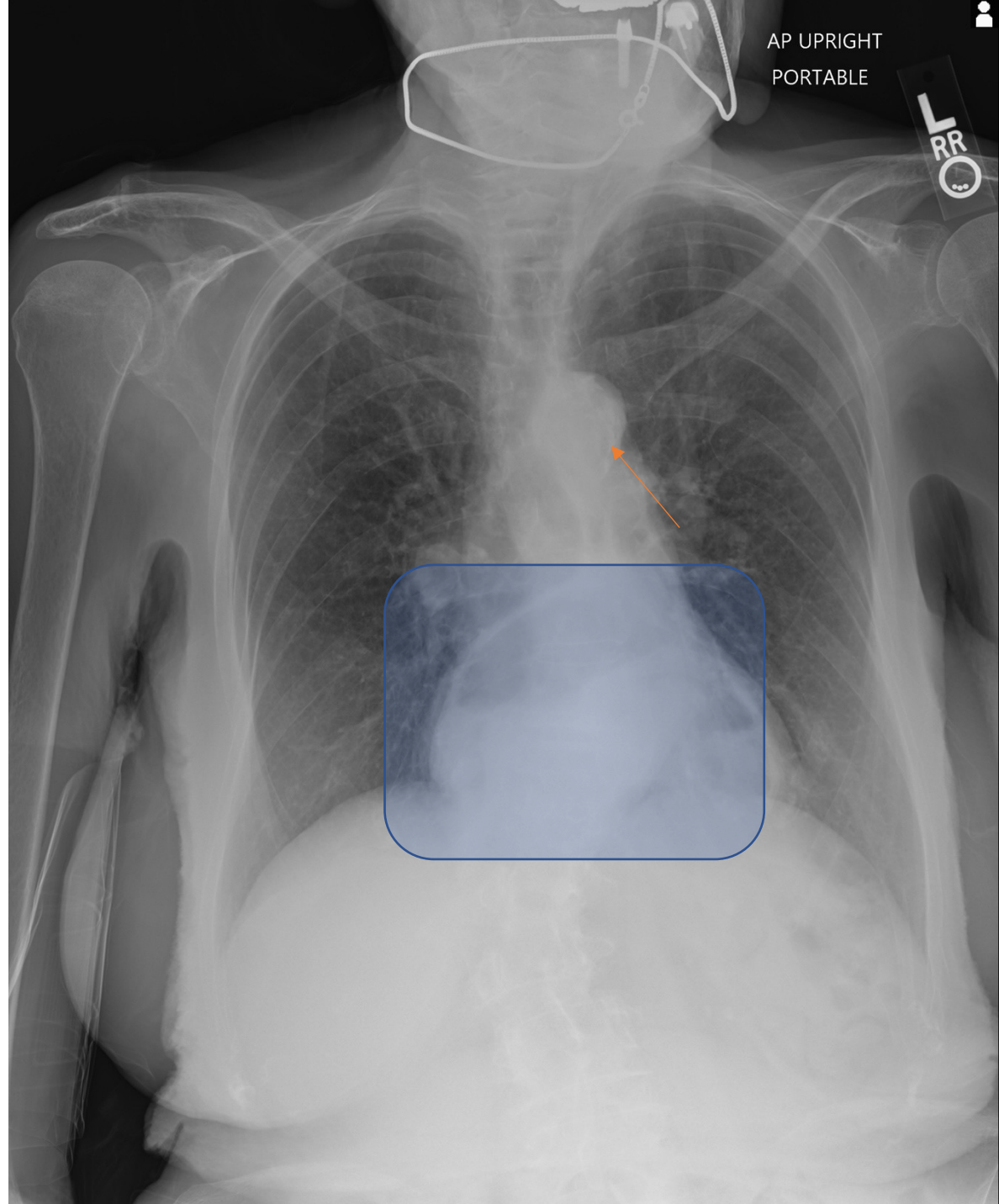
Calcified right hilar lymph nodes

Impression: Granulomatous Process

Patient has underlying Sarcoidosis







Primary Findings:

Opacity behind the heart with air-fluid level

Secondary Findings:

Calcified aortic knob

Impression: Hiatal Hernia

Preoperative Assessment

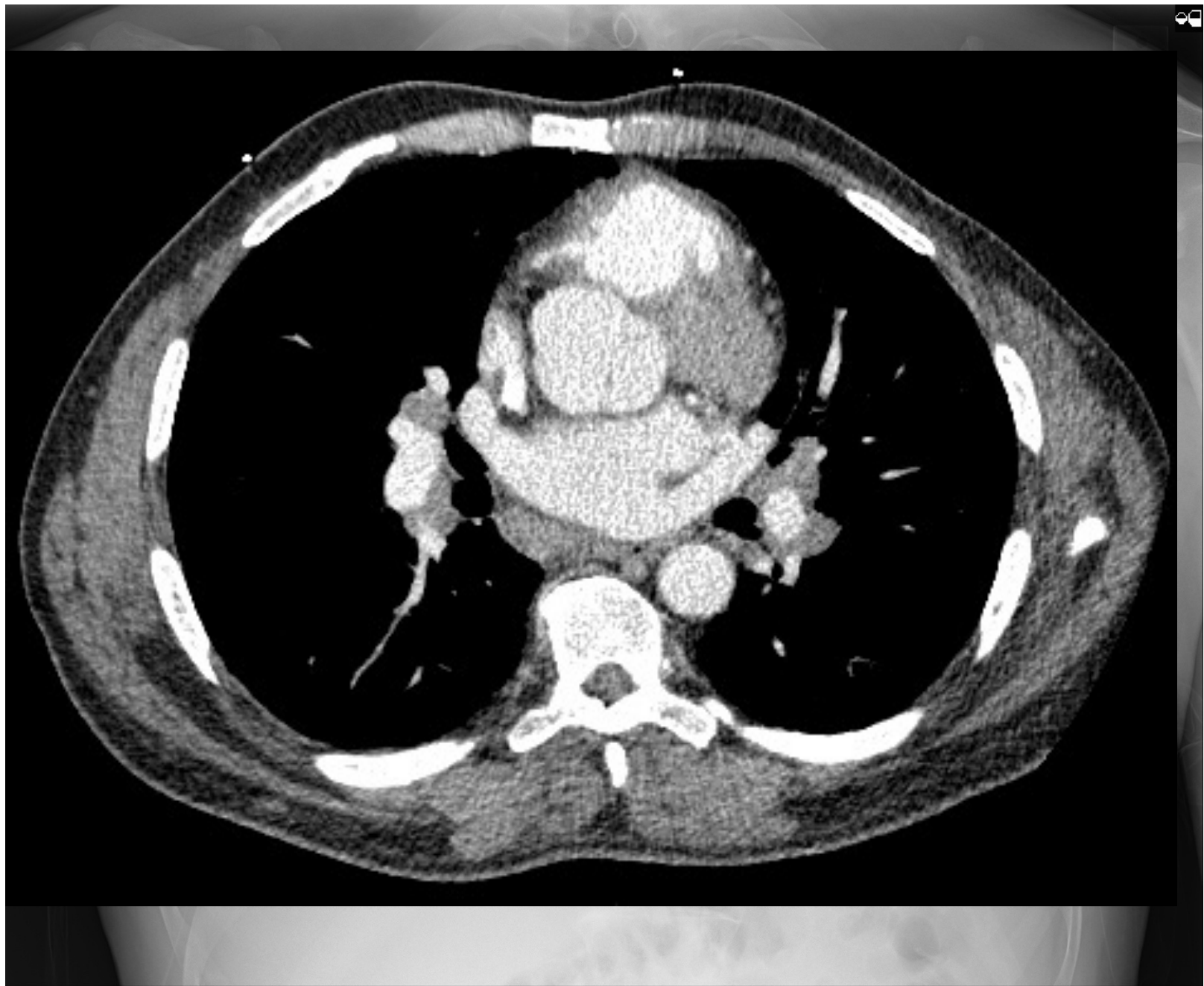
Primary Findings:

Prominent hilar silhouette bilaterally

Secondary Findings:

None

Impression: Bilateral Hilar Lymphadenopathy



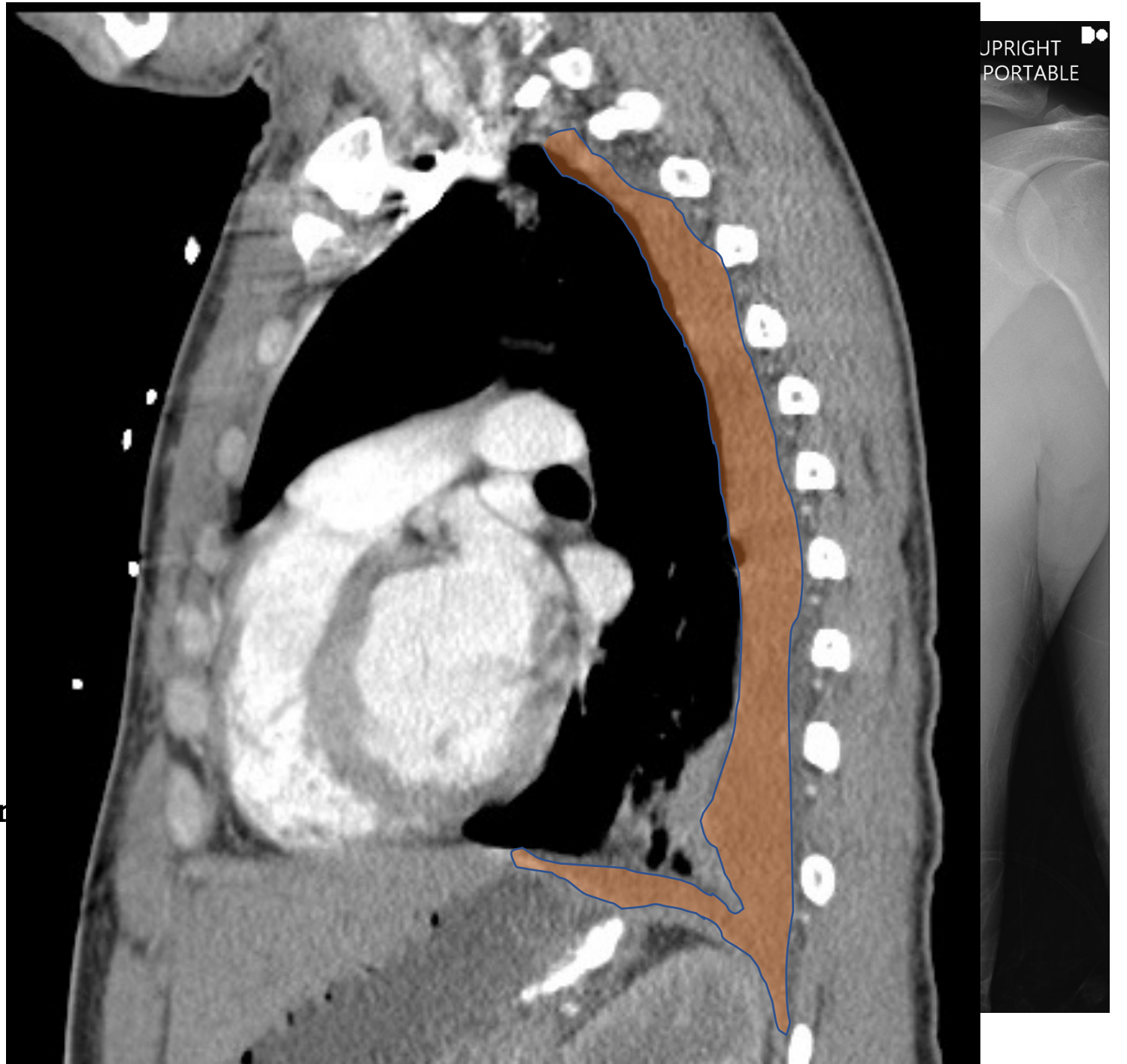
Primary Findings:

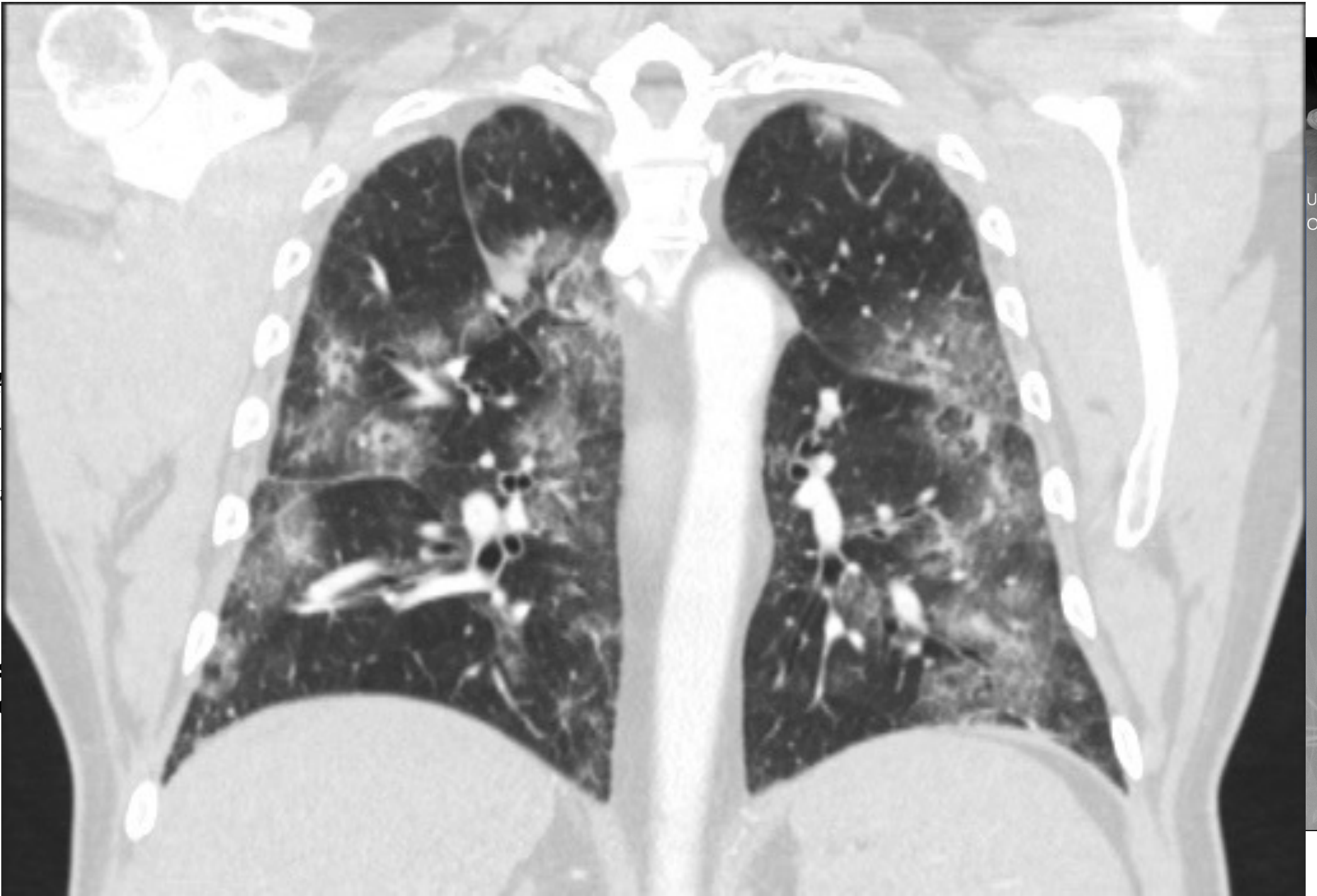
Blunting of the left costophrenic angle

Secondary Findings:

Exaggerated heart size due to AP position

Impression: Left sided pleural effusion





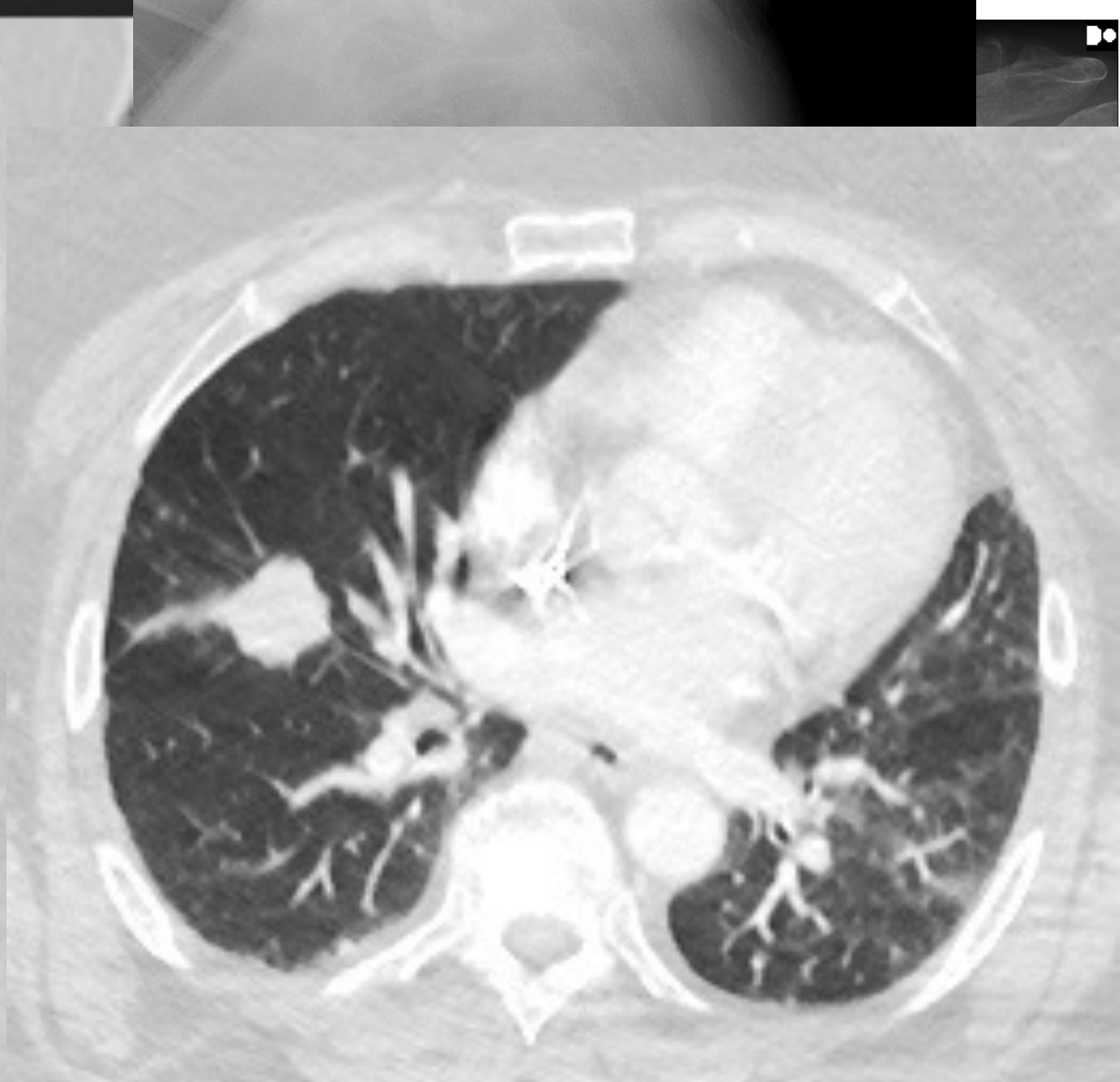
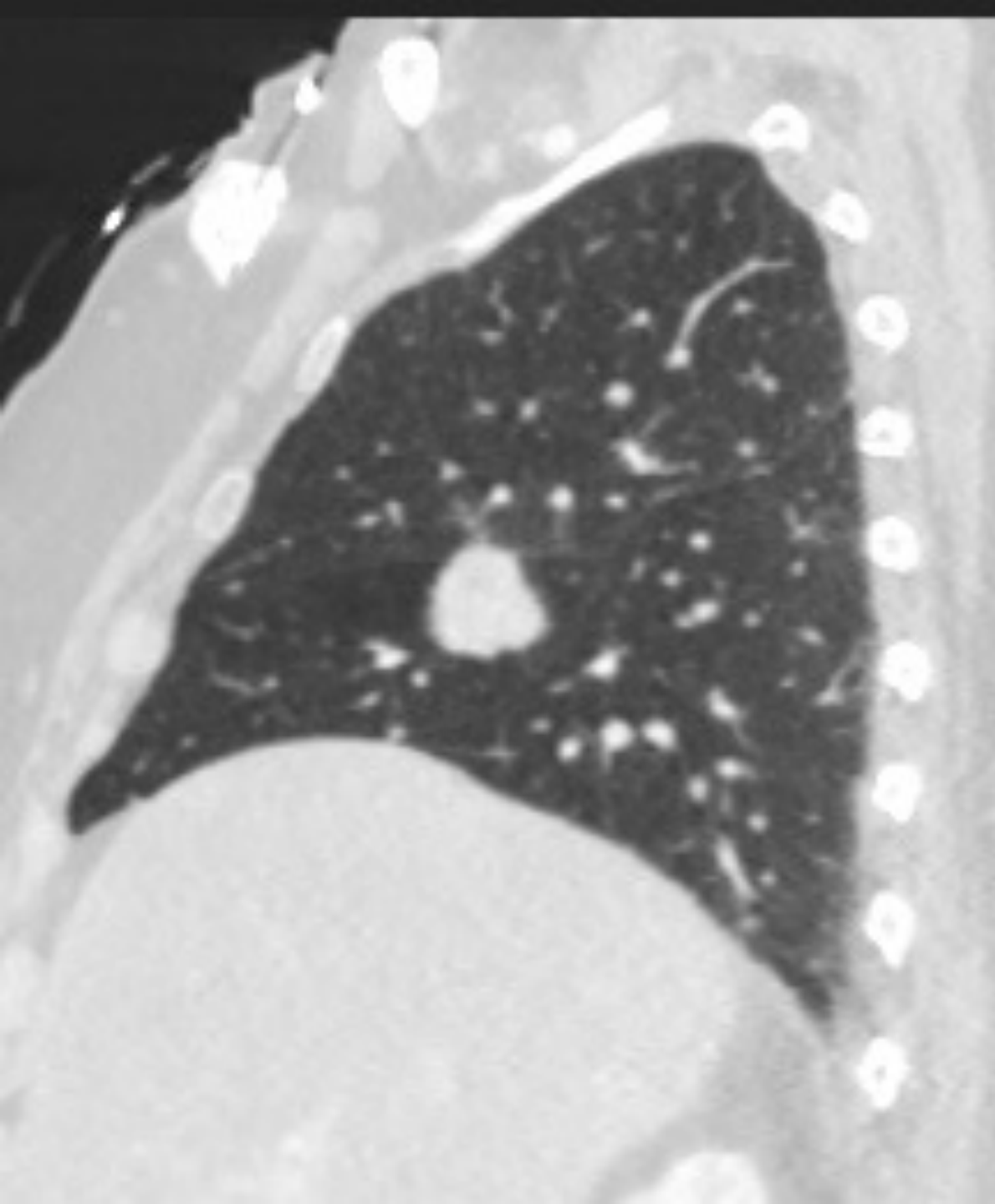
Primary
Patchy A
bilatera

Second
Azygos

Impres
Bronch

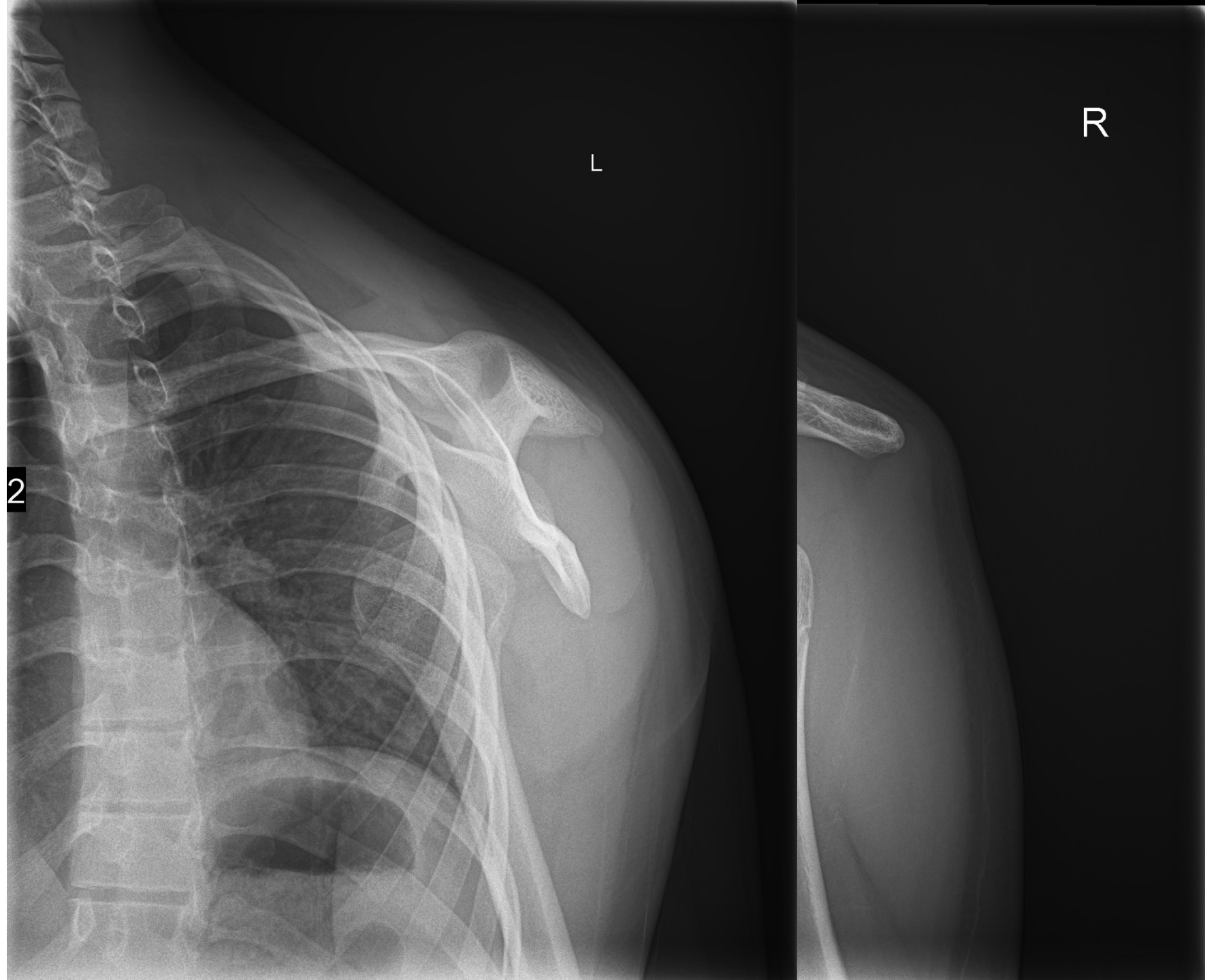


UPRIGHT
ORTABLE

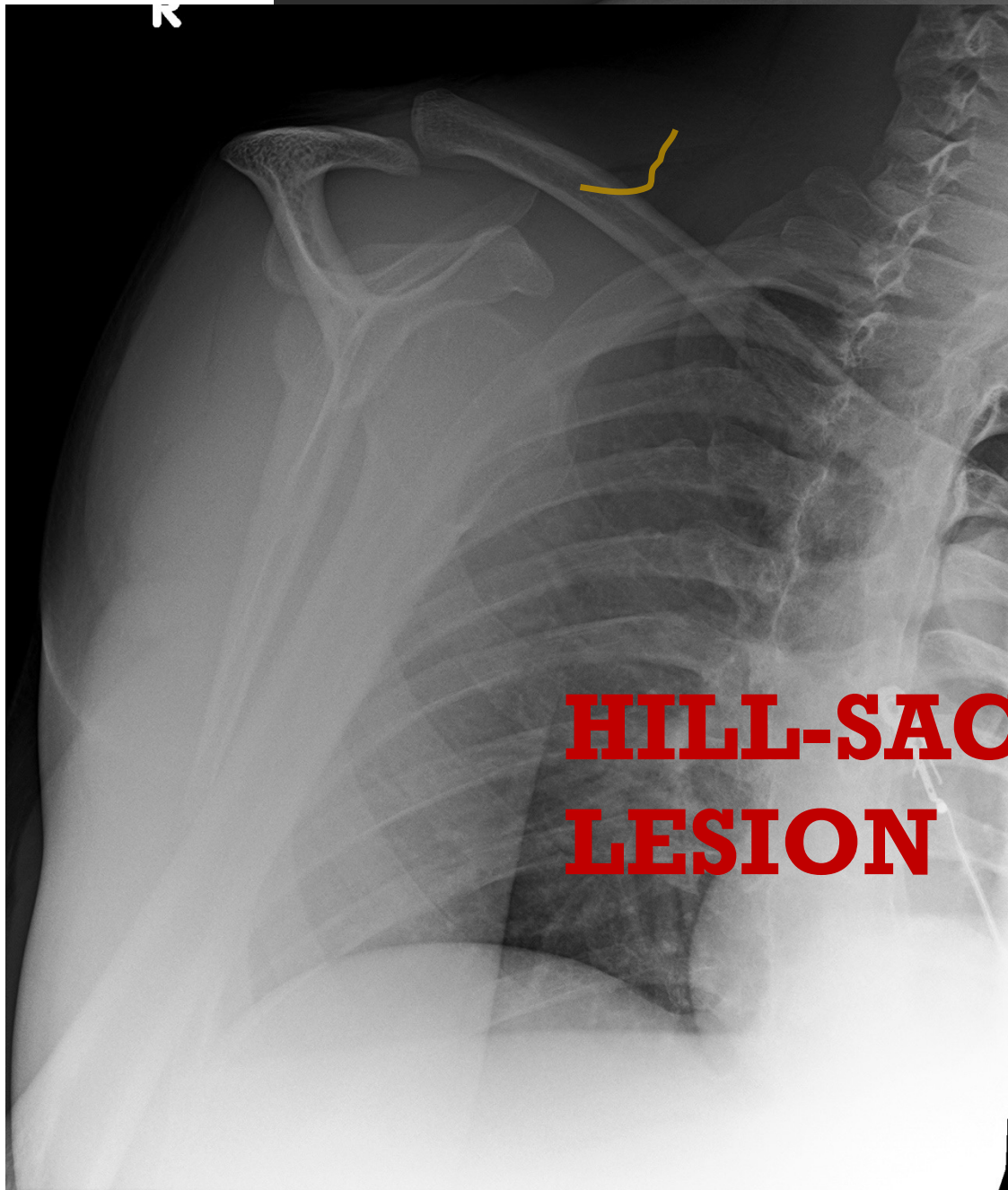


What is the diagnosis?

**Anterior
Glenohumeral Joint
Dislocation**

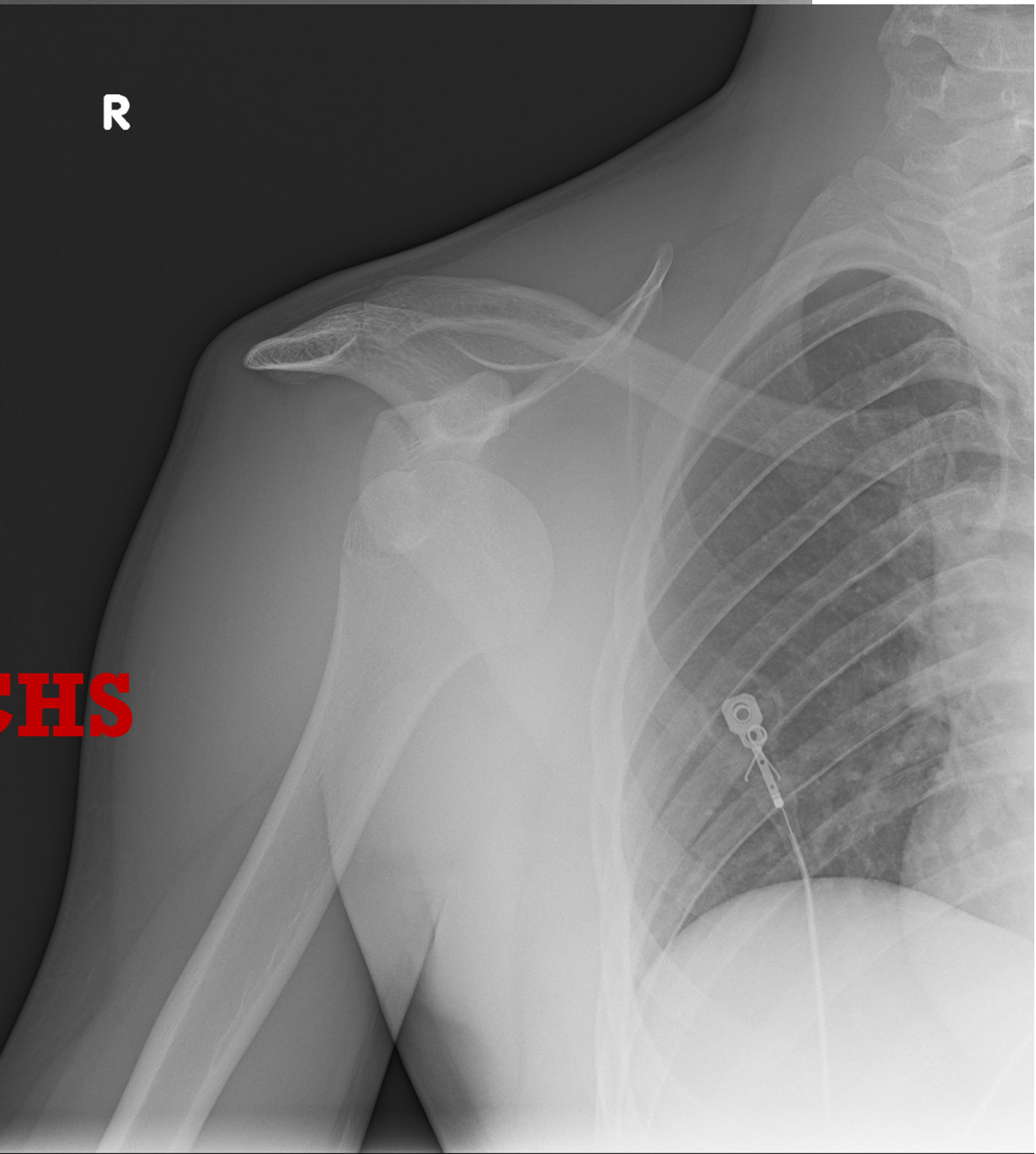


R



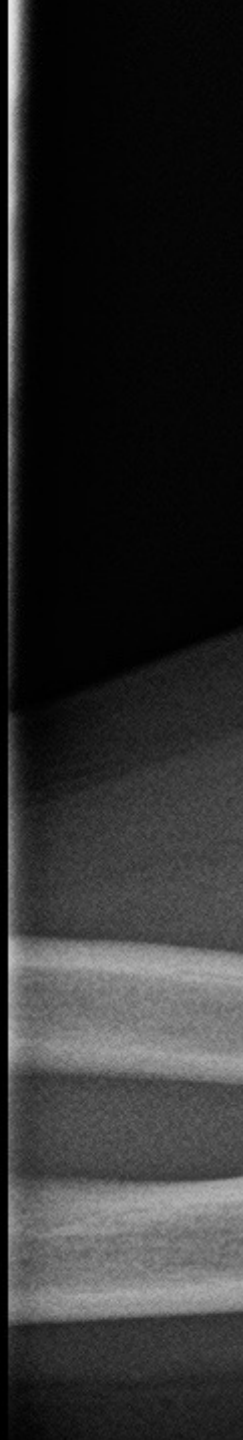
**HILL-SACHS
LESION**

R



Long-stem Total Knee Arthroplasty





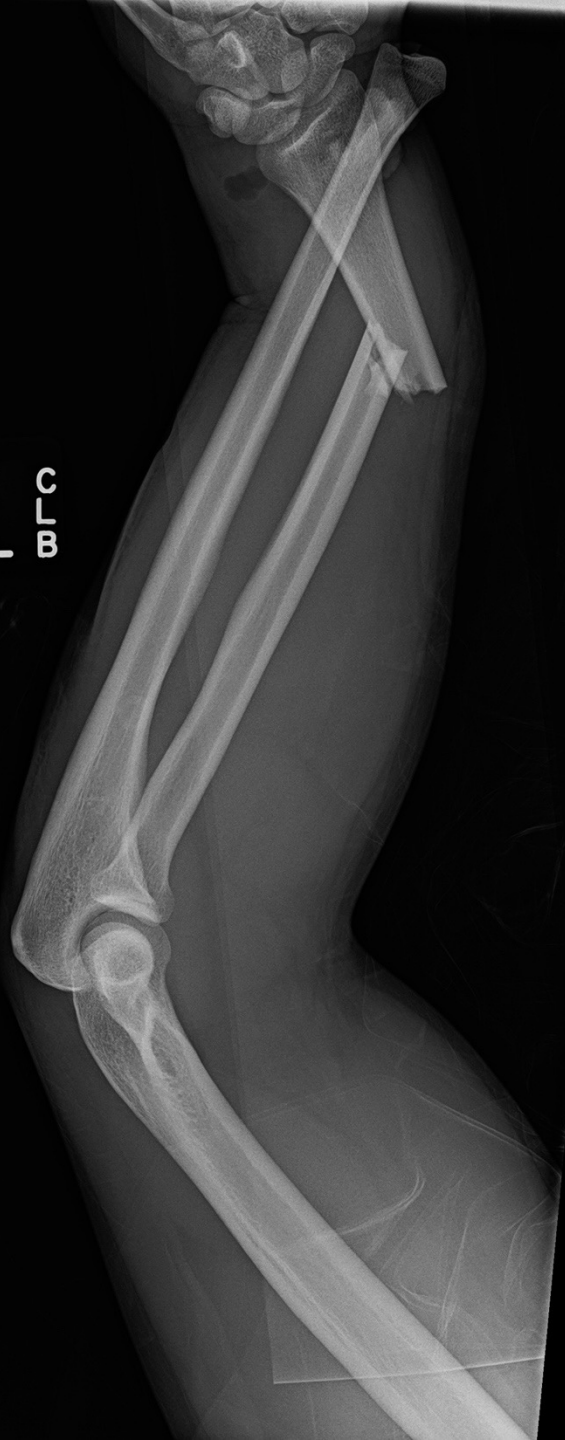




Patella Baja – Quadriceps Tendon Tear

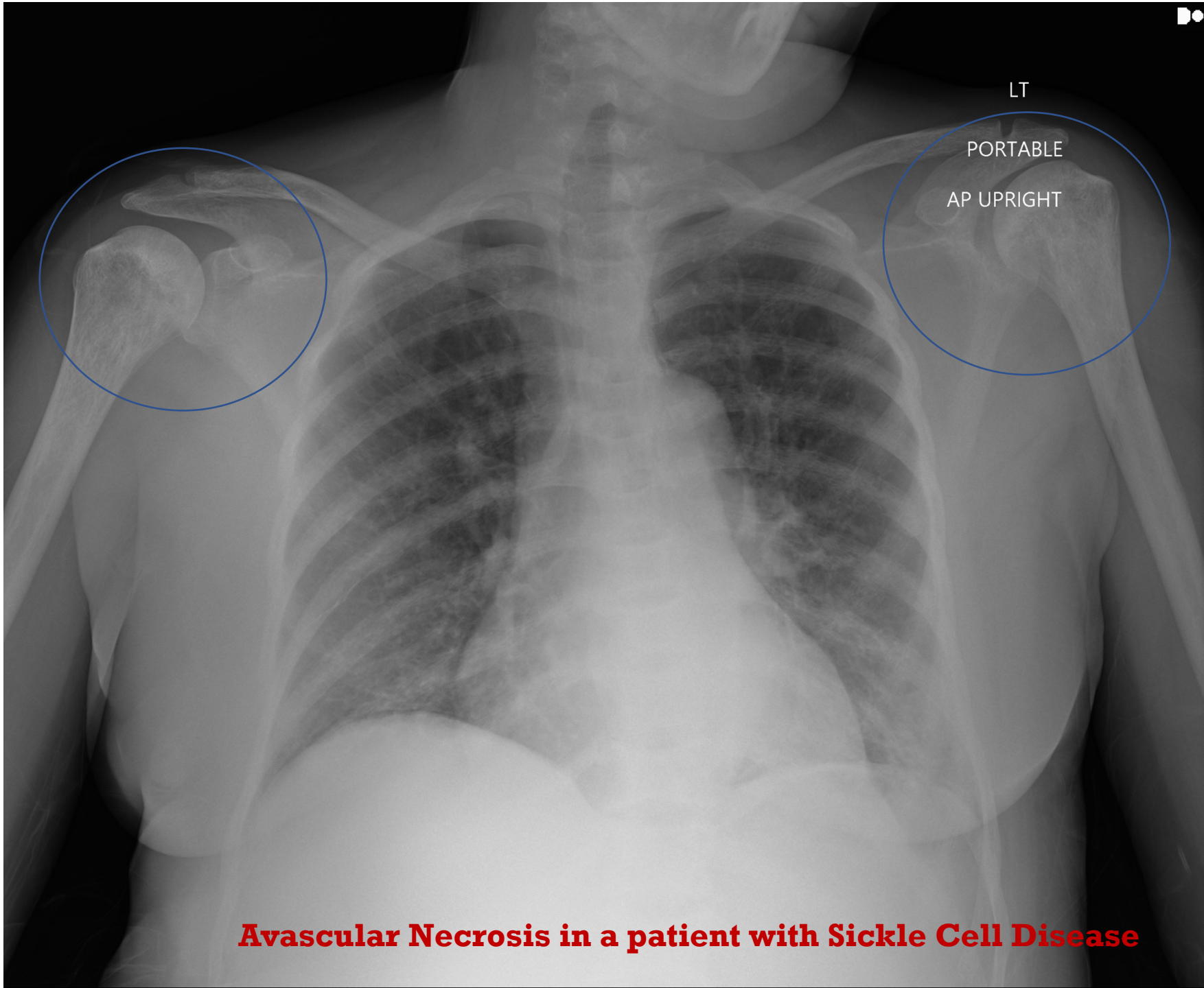


L
BFC



R
FO





Avascular Necrosis in a patient with Sickle Cell Disease

Thank you