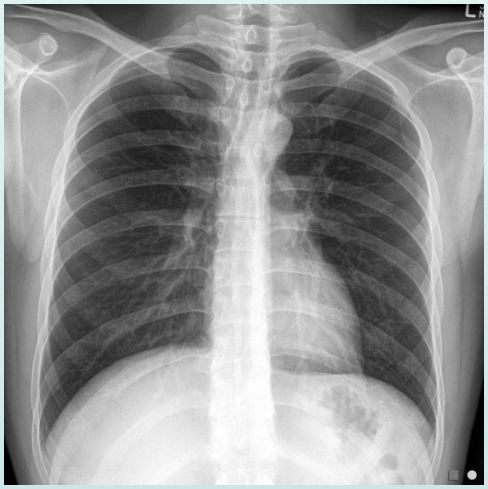


# Interpretation of Chest X-Rays

David R. Gibson BSCPS RRT

# Should RTs view CXRs?

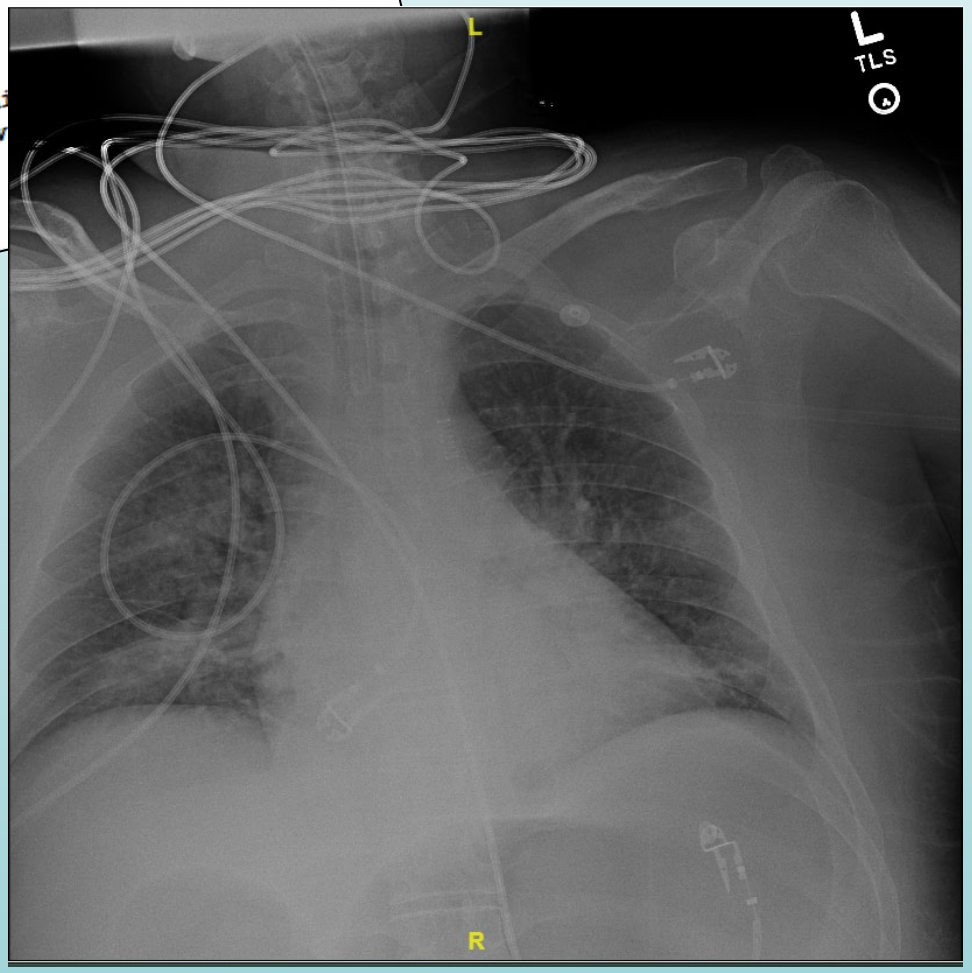
- CXR Indicators of quality are on the NBRC exam.
- Tube placement
- Guide CPT
- Evidence of condition improvement
- Weaning
- Advanced practice

TECHNIQUE: - CHEST 1 VIEW PORTABLE

COMPARISON: 10/2/2023

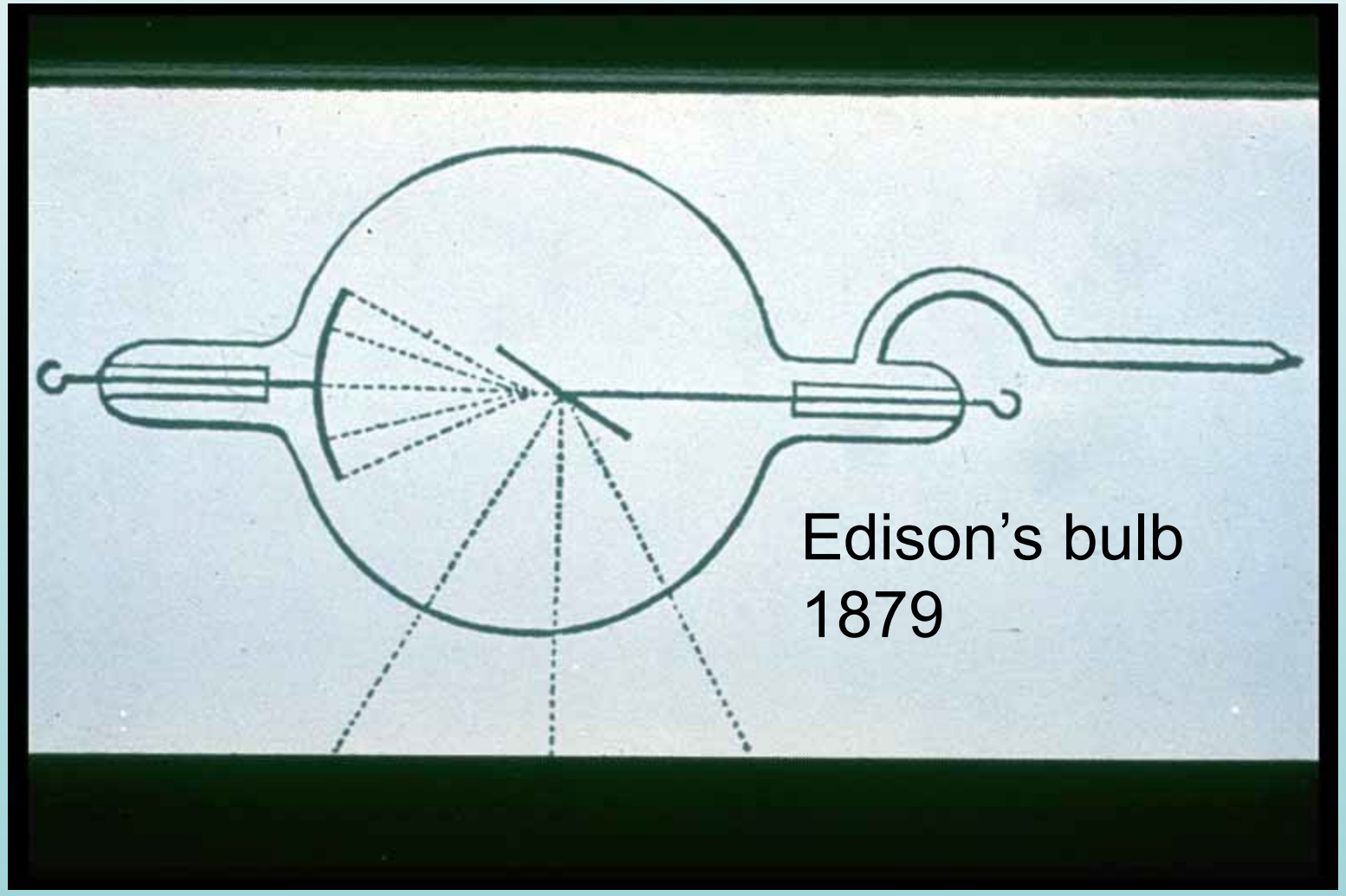
FINDINGS: Heart is stable. ET tube tip in mid trachea. Previously seen NG tube has been removed. Mild decreased aeration and worsening of perihilar and right lower lung confluent airspace opacities and haziness. No pleural effusions.

IMPRESSION:
Mild decreased aeration and worsening of right perihi
lung confluent airspace opacities and haziness. Prev
tube has been removed.



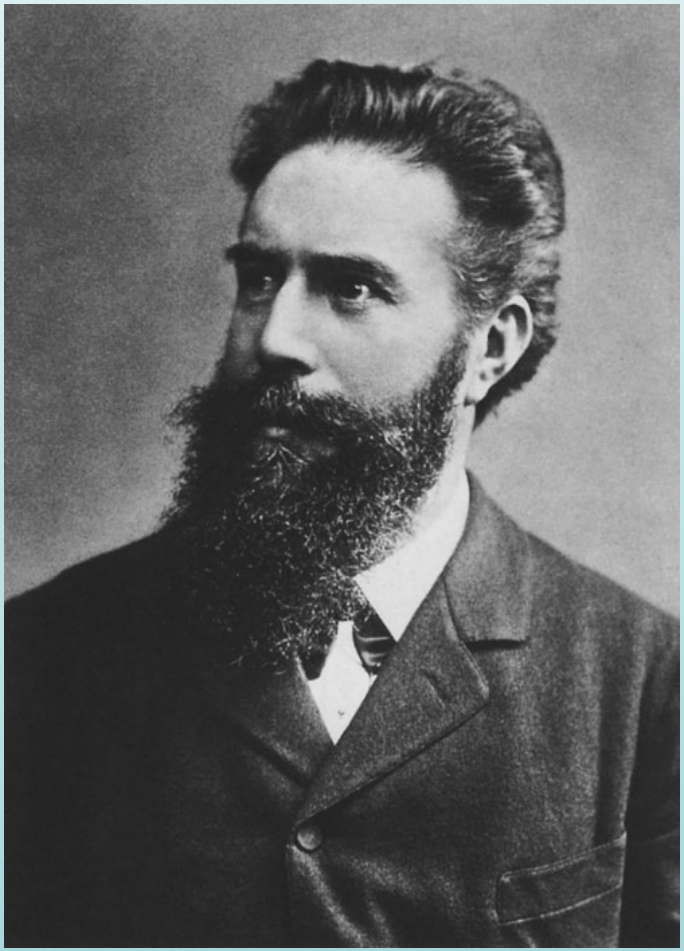

After you've looked at 1000 CXRs, you know what you're looking at!

# X-Ray, how it started

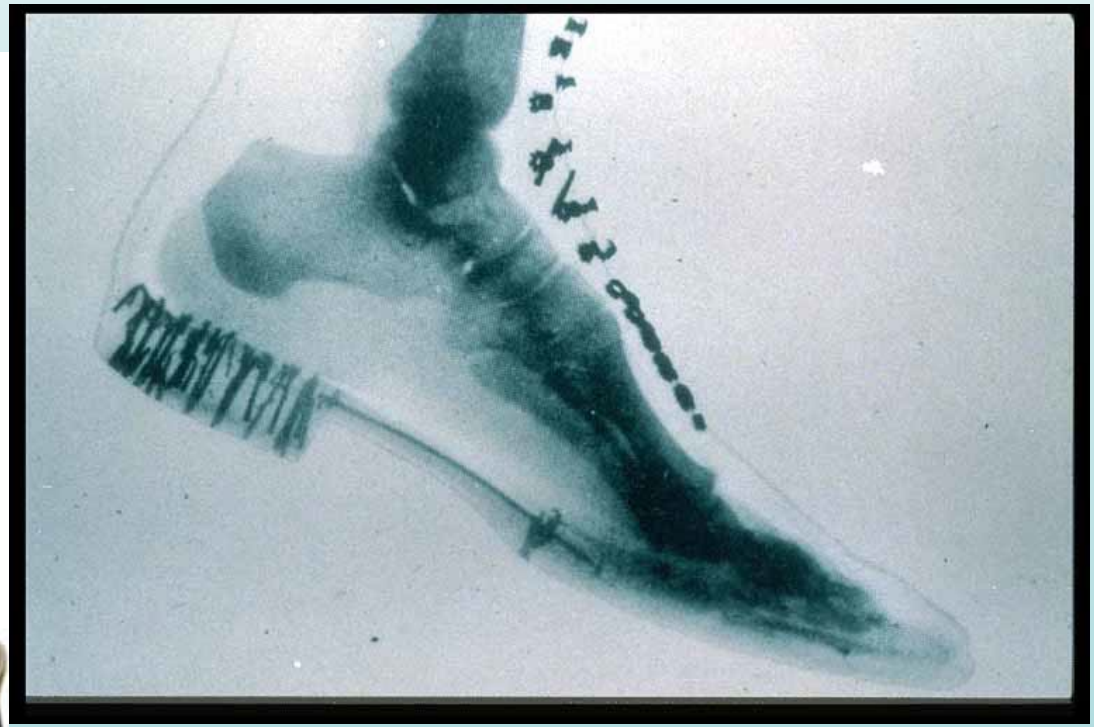


# X-Ray Timeline

- Wilhelm Conrad Roentgen discovers x-rays in 1895
- 1896: X-ray first used to diagnose fractures. Edison develops hand-held fluoroscope.
- By 1900 the dangers of large doses of gamma radiation were known.

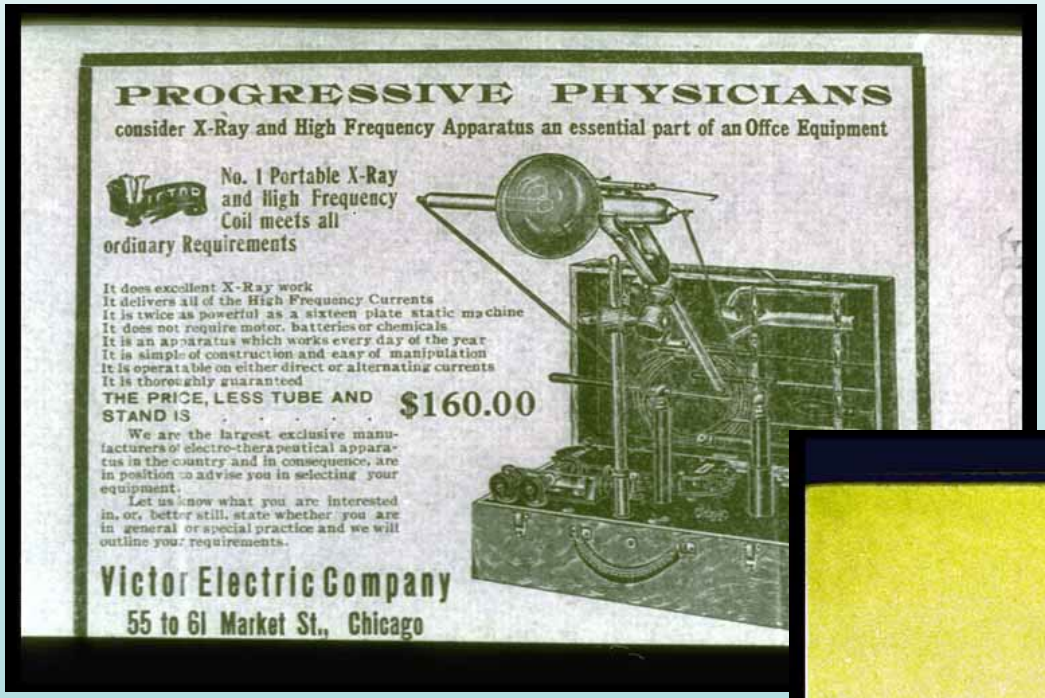


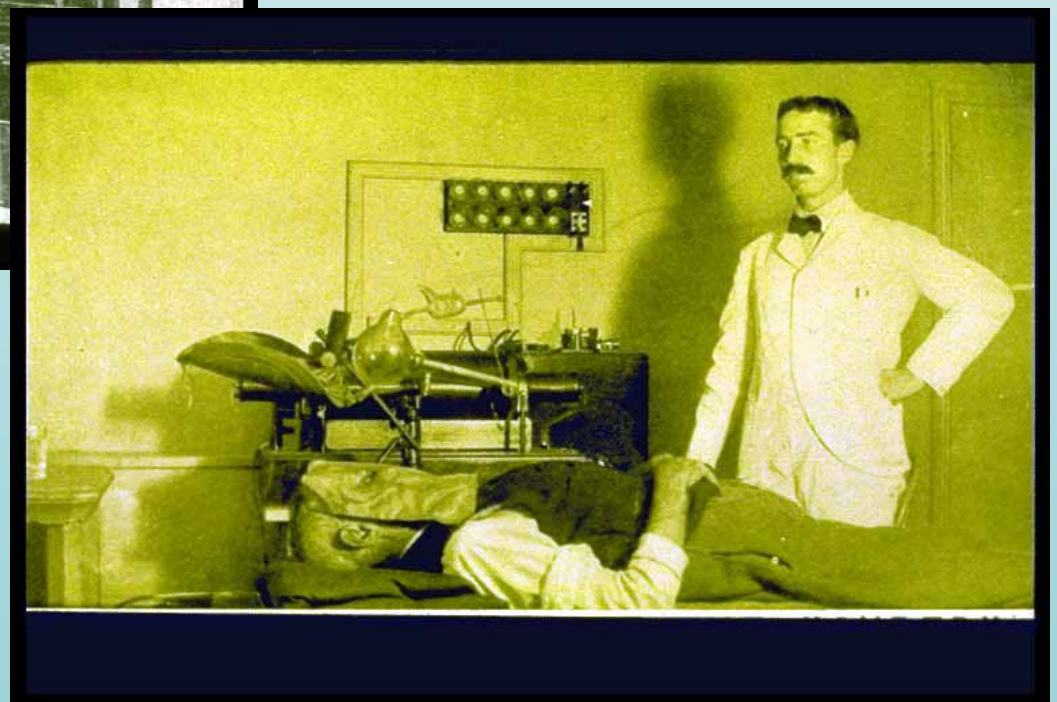
Despite the dangers, the casual use of x-rays for everything including shoe sizing continued until the late 1940's

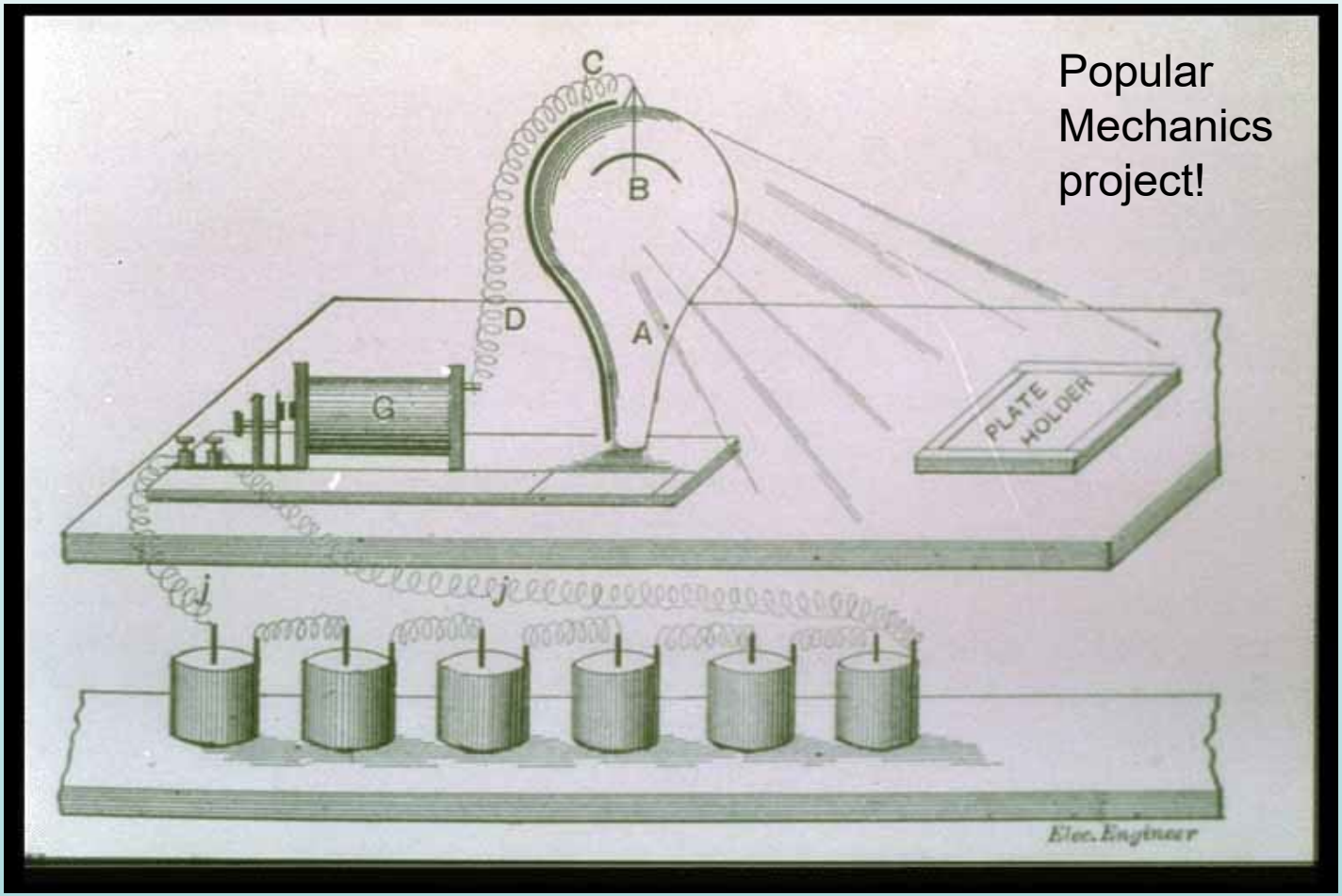



Early hand held
Fluoroscope

# The heart and lungs are the most radiographed part of the human anatomy





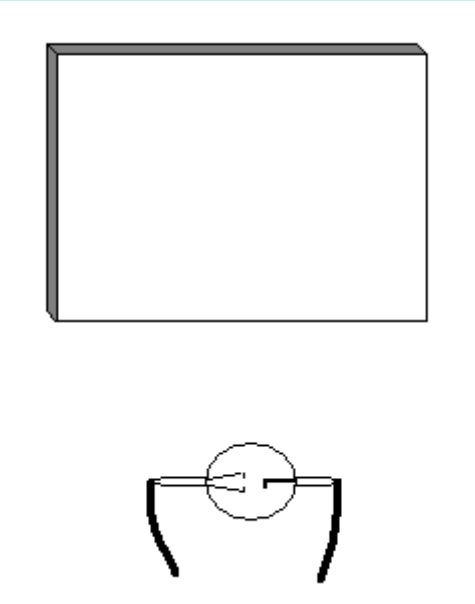

Popular Mechanics project!

# Physics of Chest X-Rays

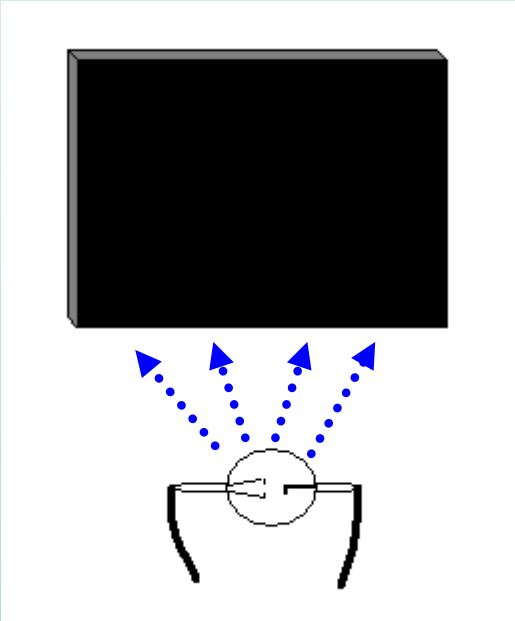
- Although now digital, originally, X-ray film was coated with a light (x-ray) sensitive chemical (silver halides) that changes properties when “exposed”.
- Like photographic film, essentially, the x-ray film remains “white” until exposed to x-rays.
- X-ray film turns black when exposed to x-rays.

# *For example:*

Unexposed



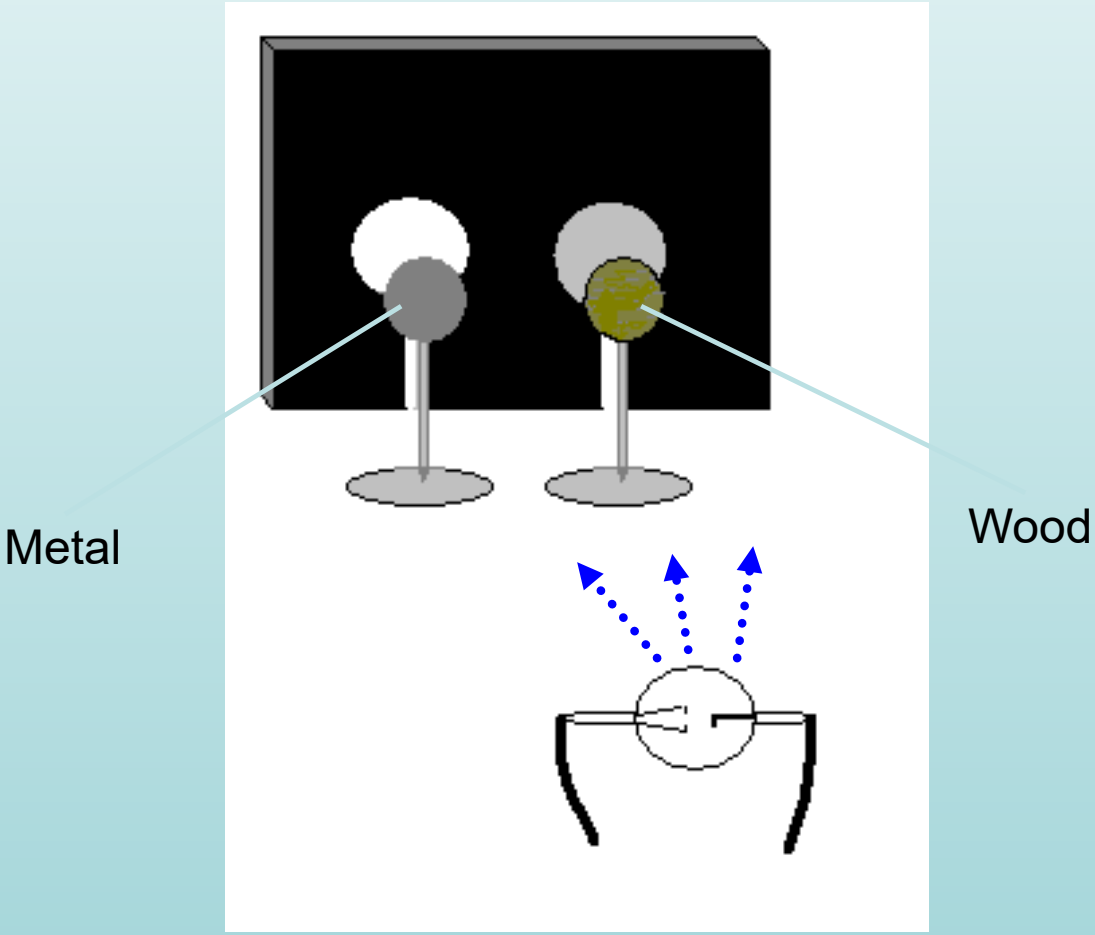
Exposed



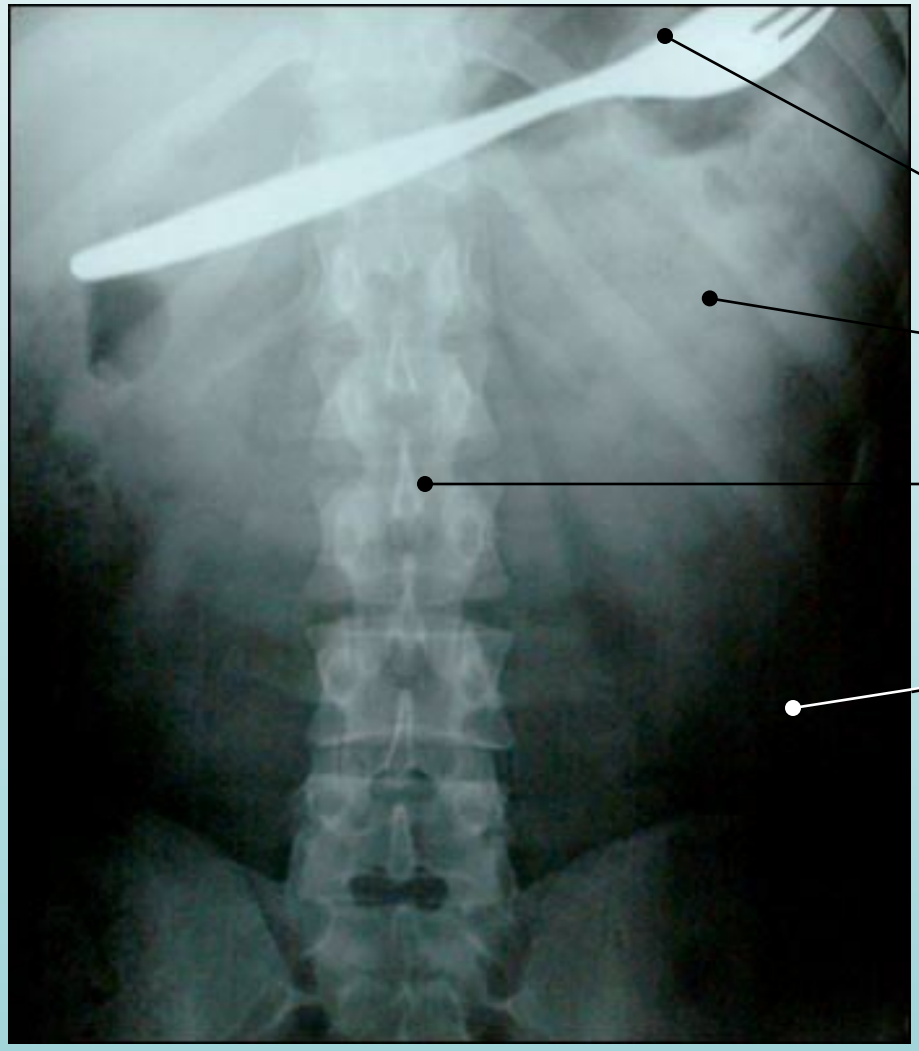
# Physics of Chest X-Rays

- Objects placed in front of the plate will leave a shadow on the film.
- The black/white shade of the shadow depends upon the density of the object.
- Denser objects/substances block more x-rays and leave the plate white.

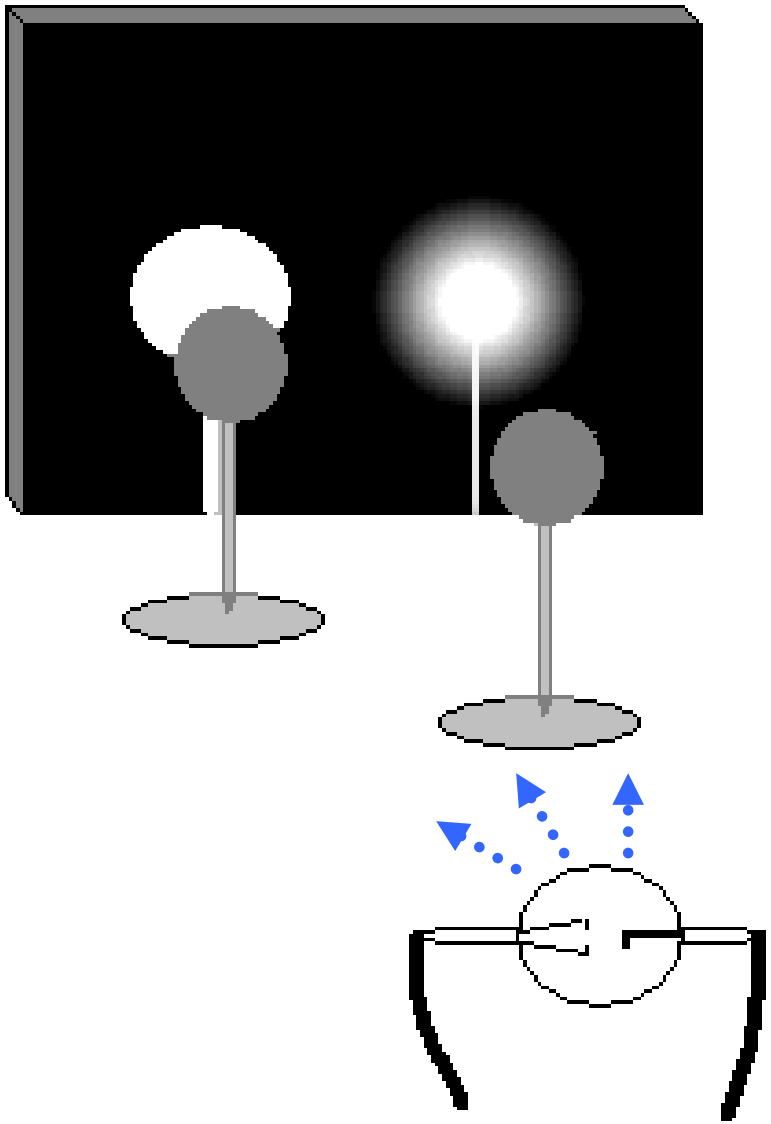
# *For example:*



# The four densities

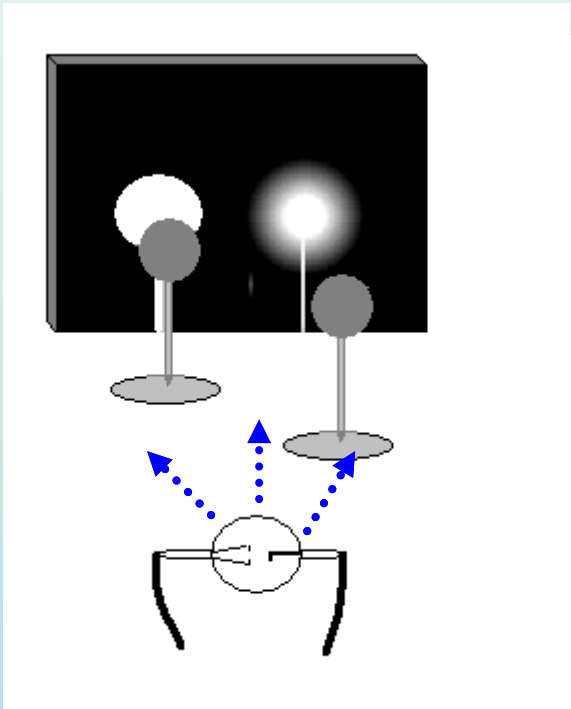


- Metal (White)
- Fluid (Shade of Grey)
- Bone (Lighter shade of Grey)
- Air (black)

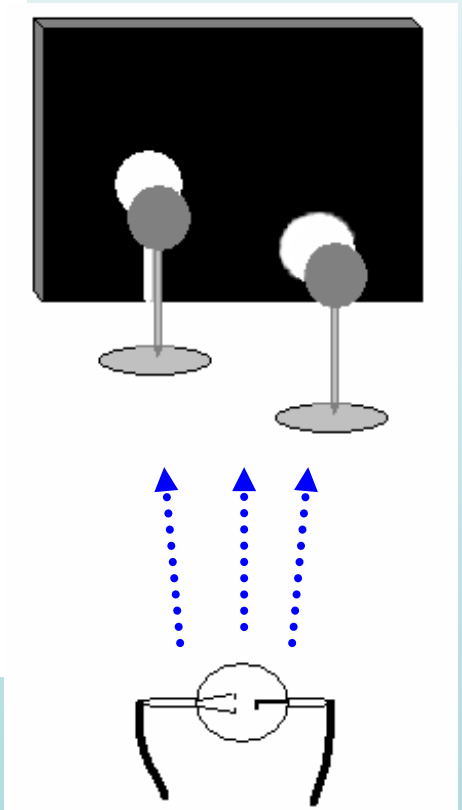


Objects closer to the plate tend to be more distinct than objects further away.

***Concept***



Example of a A-P chest, the xray tube is close to the chest causing foreground objects to be more distorted



Example of a P-A chest, the xray tube is far from to the chest causing foreground objects to be less distorted than A-P Chest.

Distance improves picture quality:

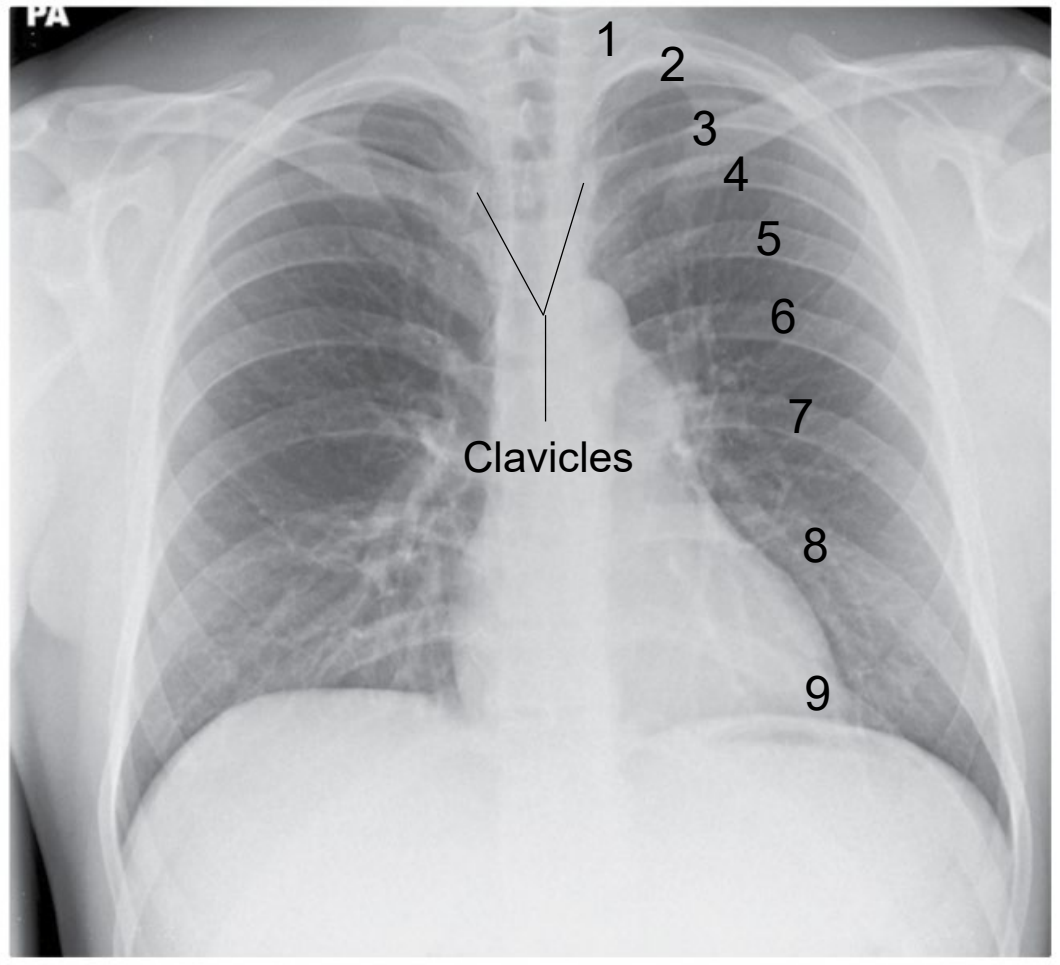
Less *enlargement distortion*

Objects in foreground have better resolution.

***Concept***

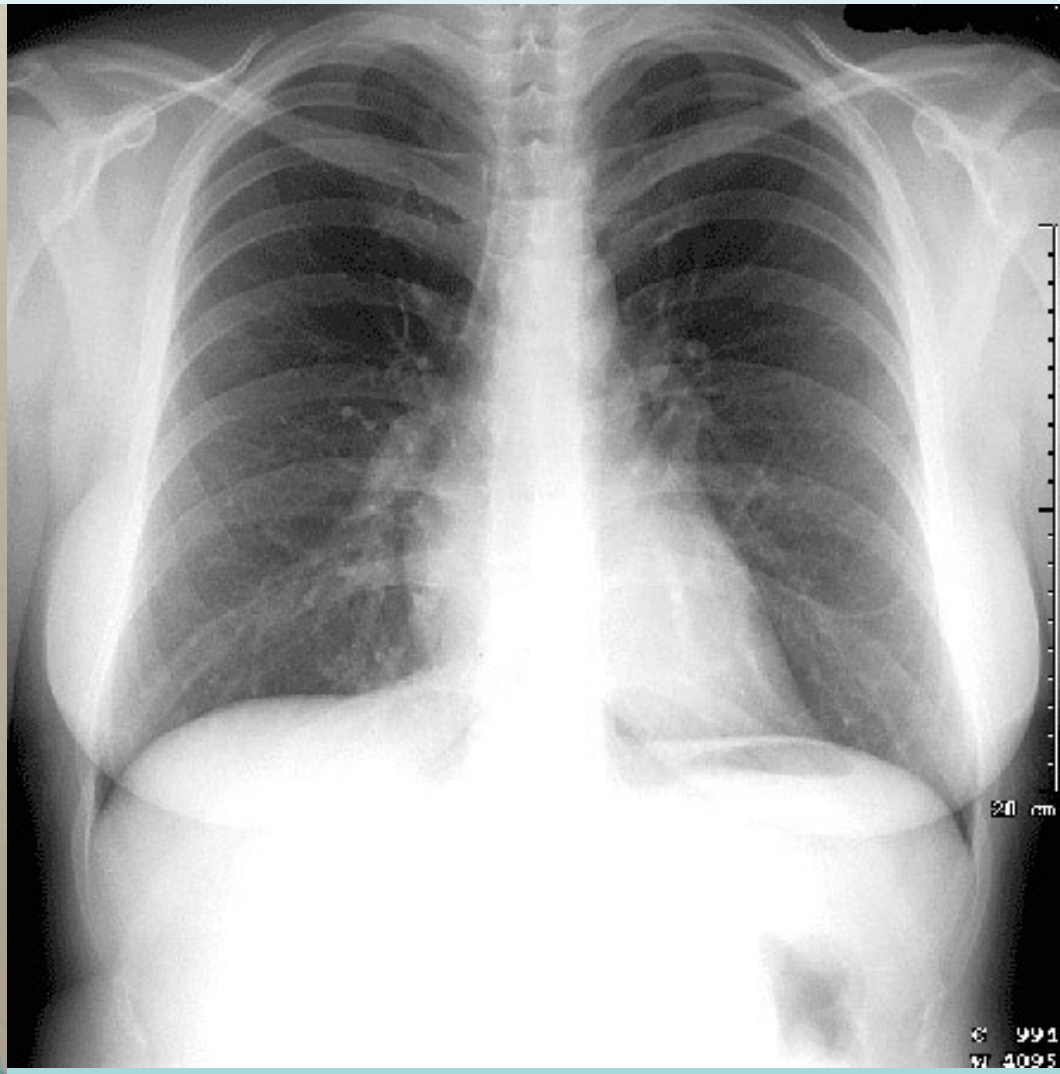
# Indicators of Quality

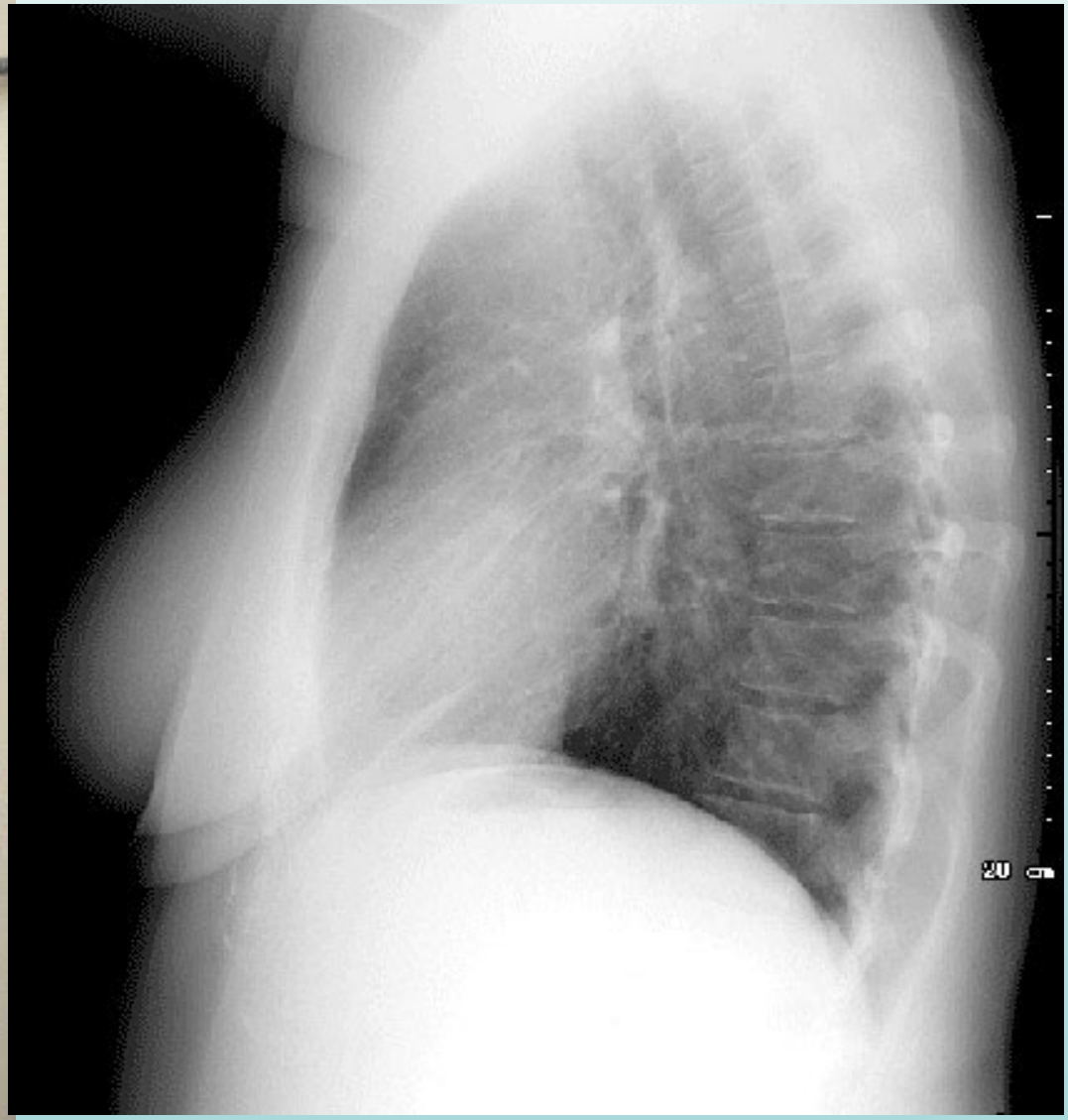
- P – Position
- I – Inspiration
- E – Exposure
- R - Rotation



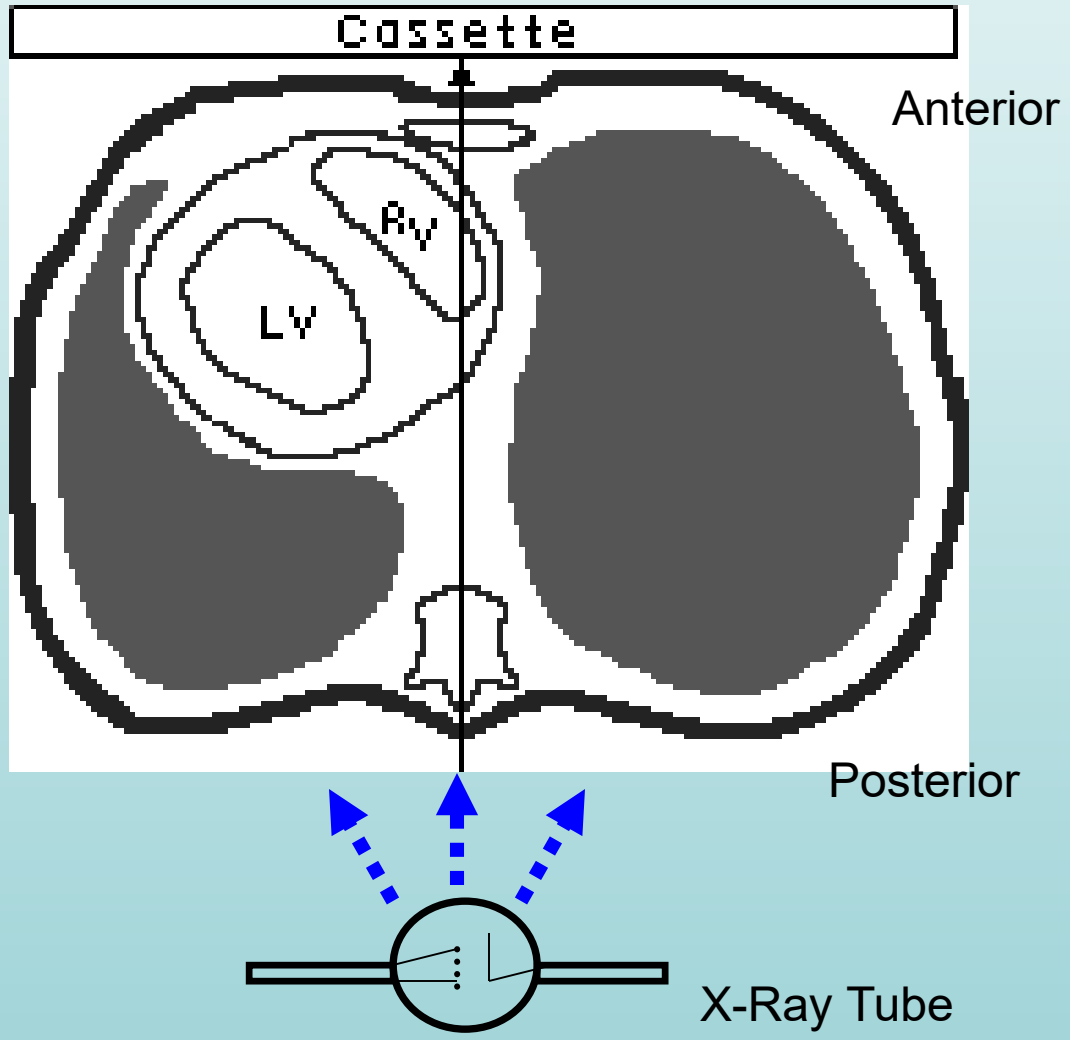
# Types of Chest X-Rays

# PA Chest

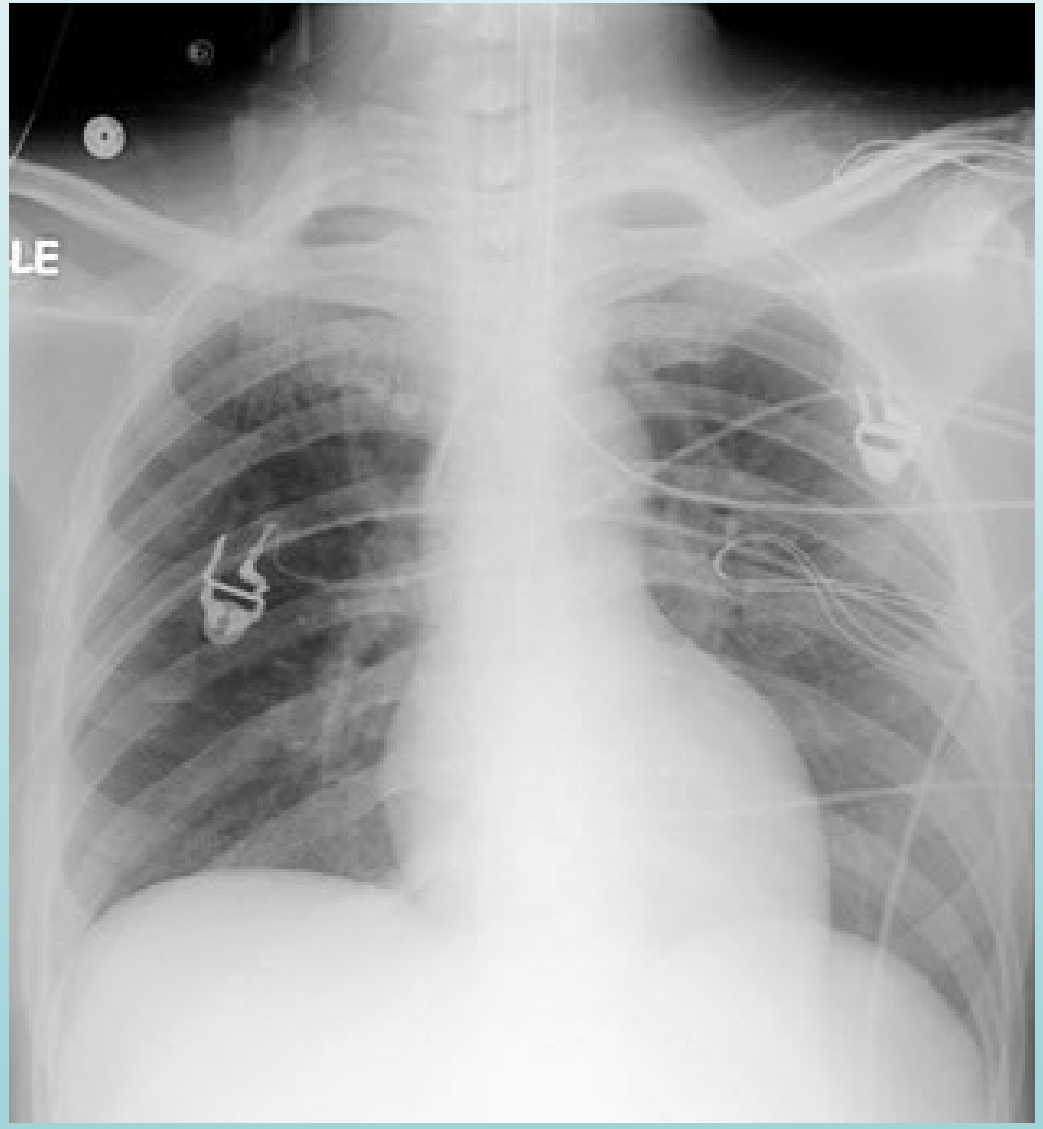

20 cm


20

# PA Chest



# AP Chest



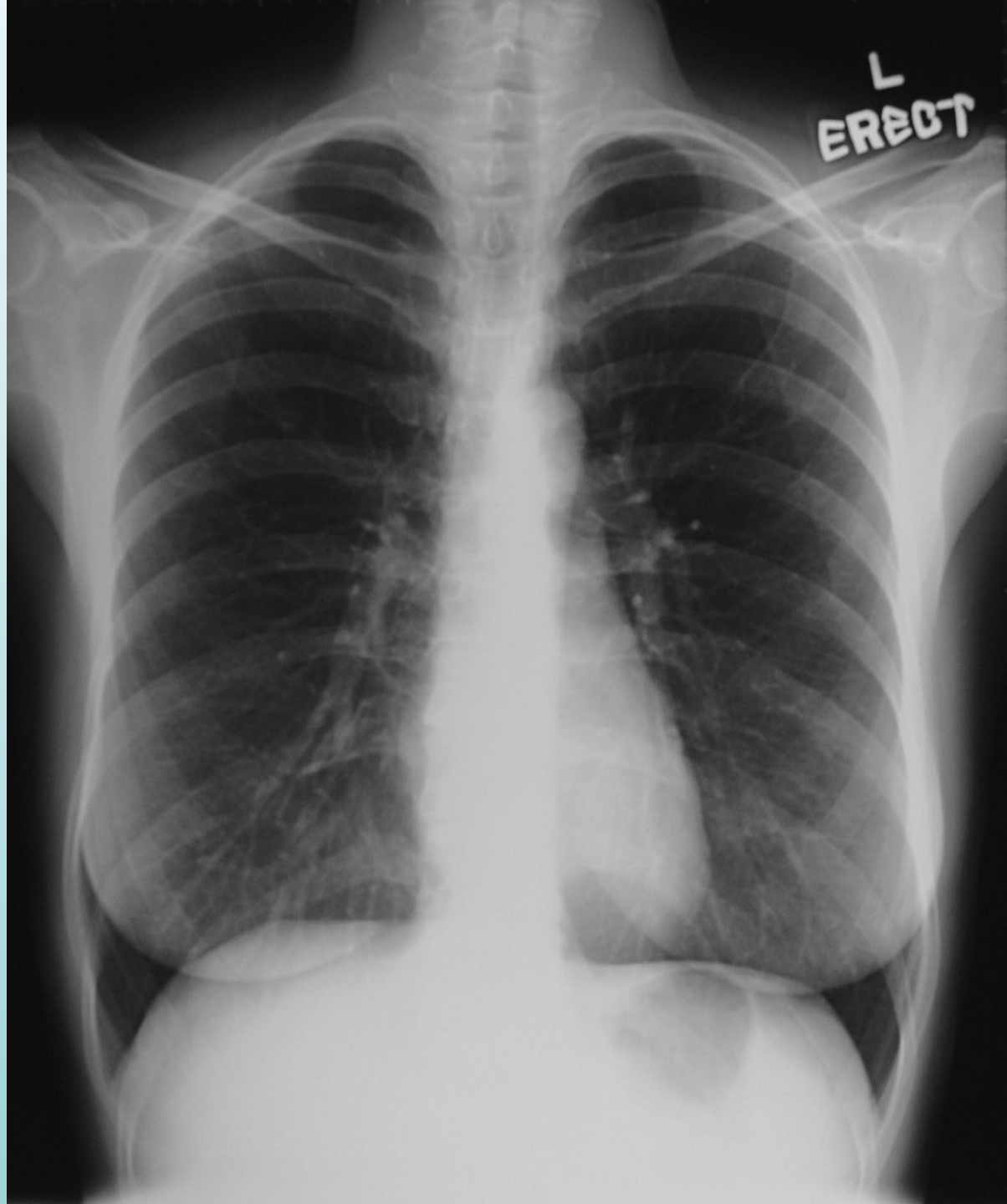
This is the view commonly seen in ICU patients

# AP versus PA

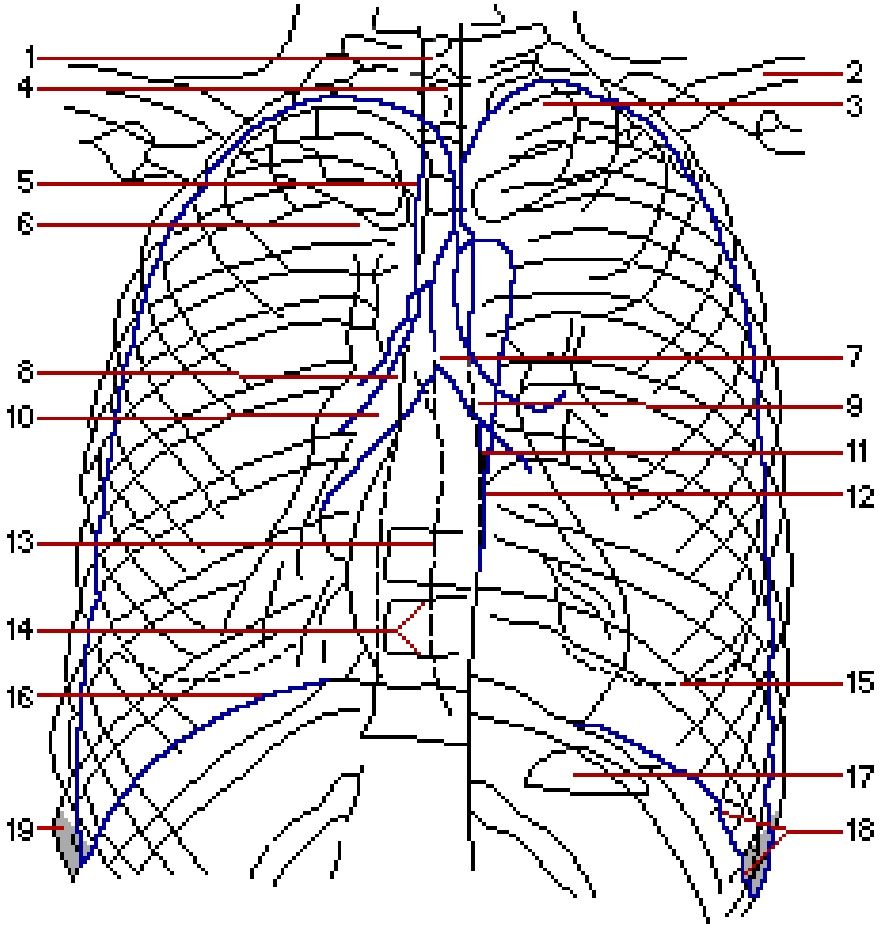
- AP – Heart enlarged (anterior structure)
- PA – Better resolution of all structures
- AP – Portable, easy to do.
- AP – Anterior structures tend to be enlarged and/or distorted or absent.

# Identification of normal Landmarks

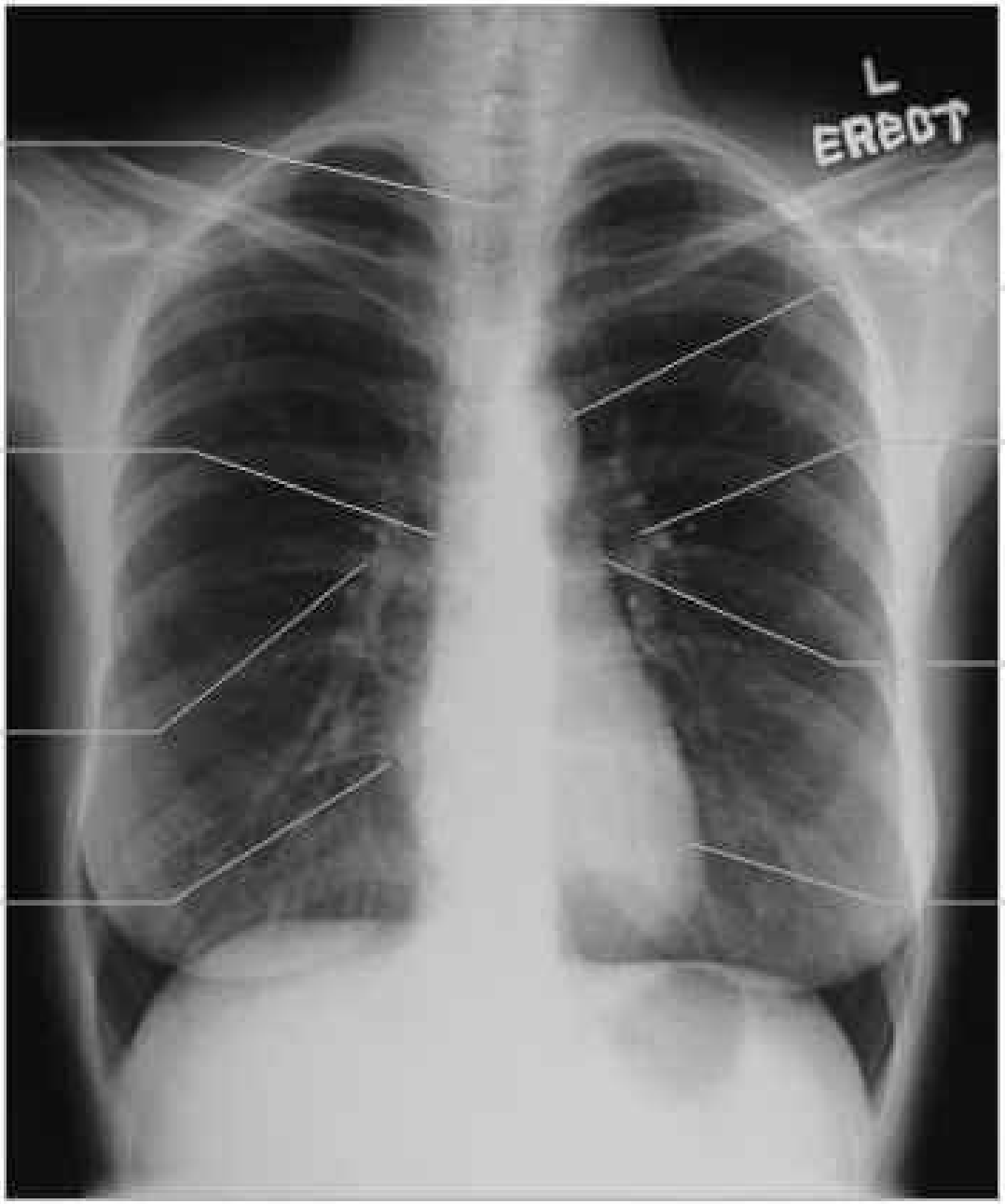
1. Bones – Clavicles, scapula, Ribs, vertebrae
2. Left and right heart borders
3. Left and right hemi-diaphragm and costophrenic angles.
4. Aortic knob
5. Trachea & Tracheal bifurcation
6. Hilum

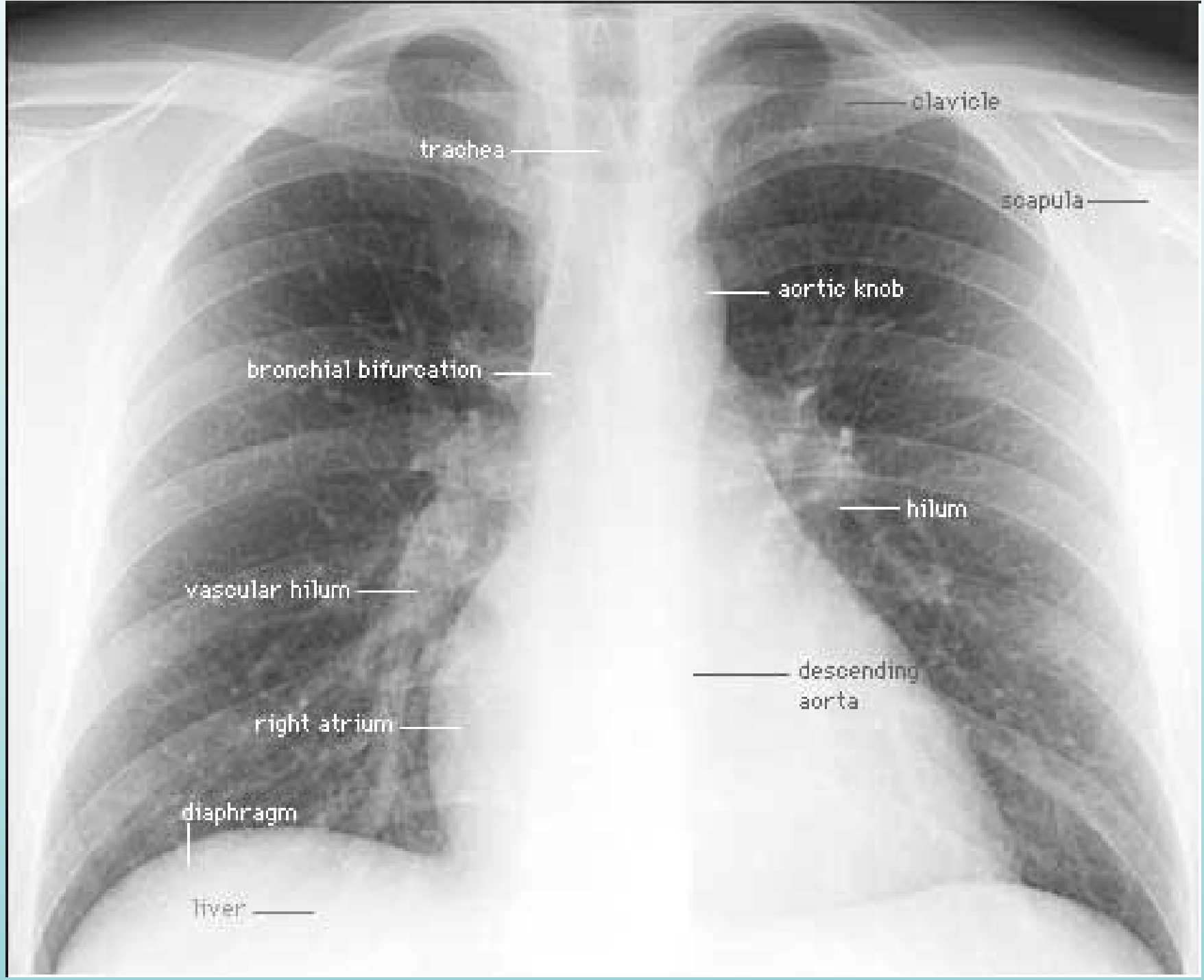


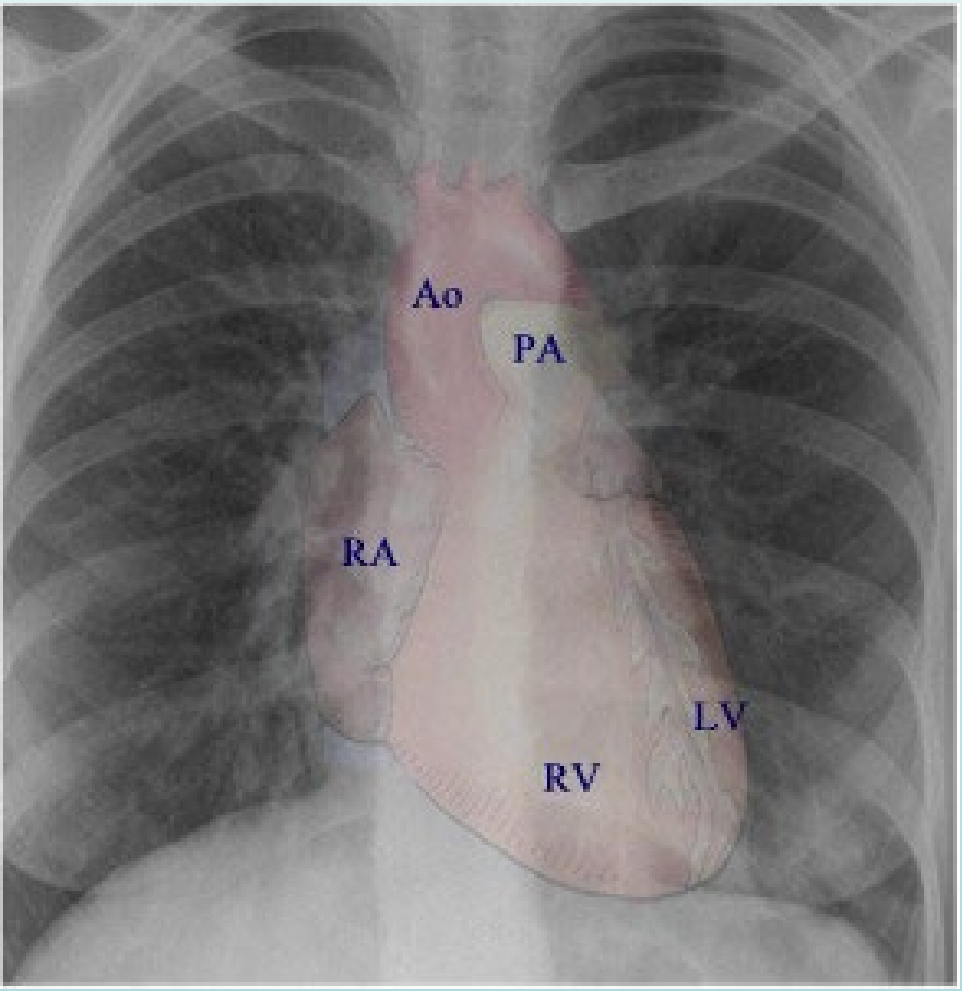
## Chest, Frontal View

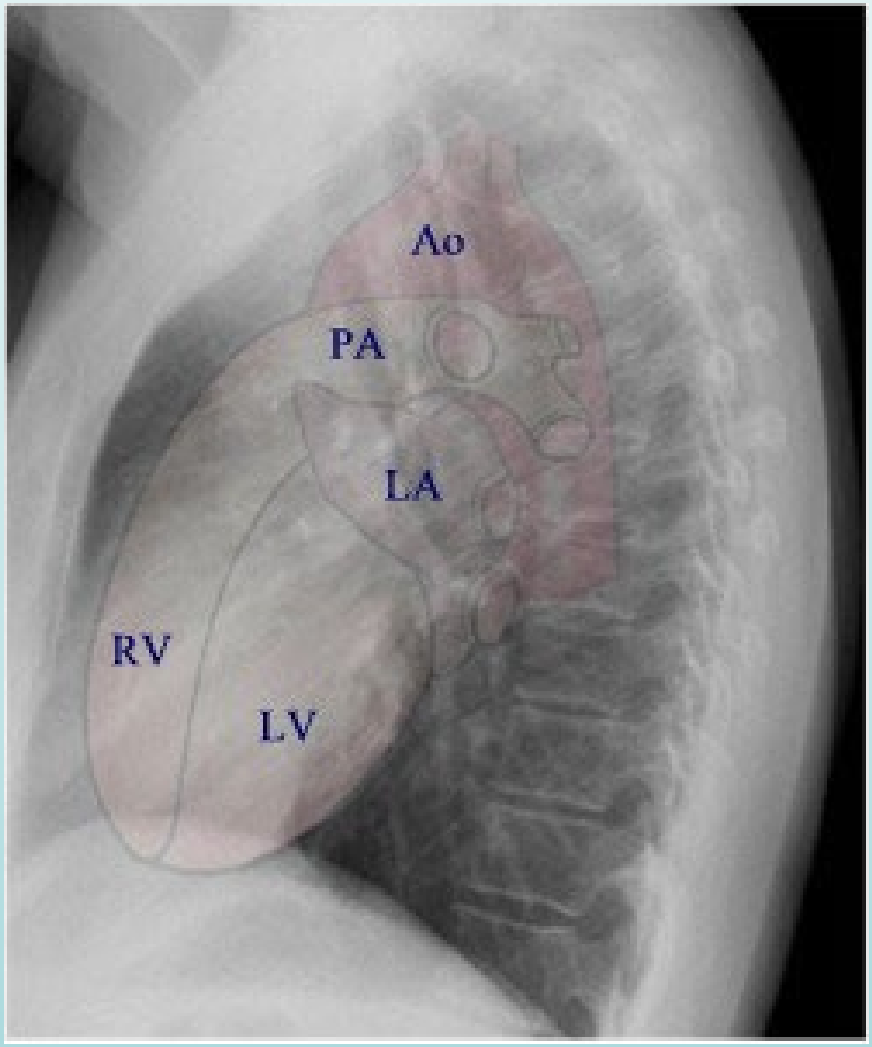



1 Trachea
2 Clavicle
3 Lung apex
4, 5 Posterior superior junction-line complex
6 Right paratracheal stripe
7 Tracheal carina
8 Right main stem bronchus
9 Left main stem bronchus
10 Bronchus intermedius
11 Preaortic stripe
12 Descending aorta
13 Azgoesophageal stripe
14 Paraspinal stripe
15 Breast contour
16 Dome of the diaphragm
17 Stomach bubble
18 Diaphragmatic muscle slips
19 Costophrenic sulcus

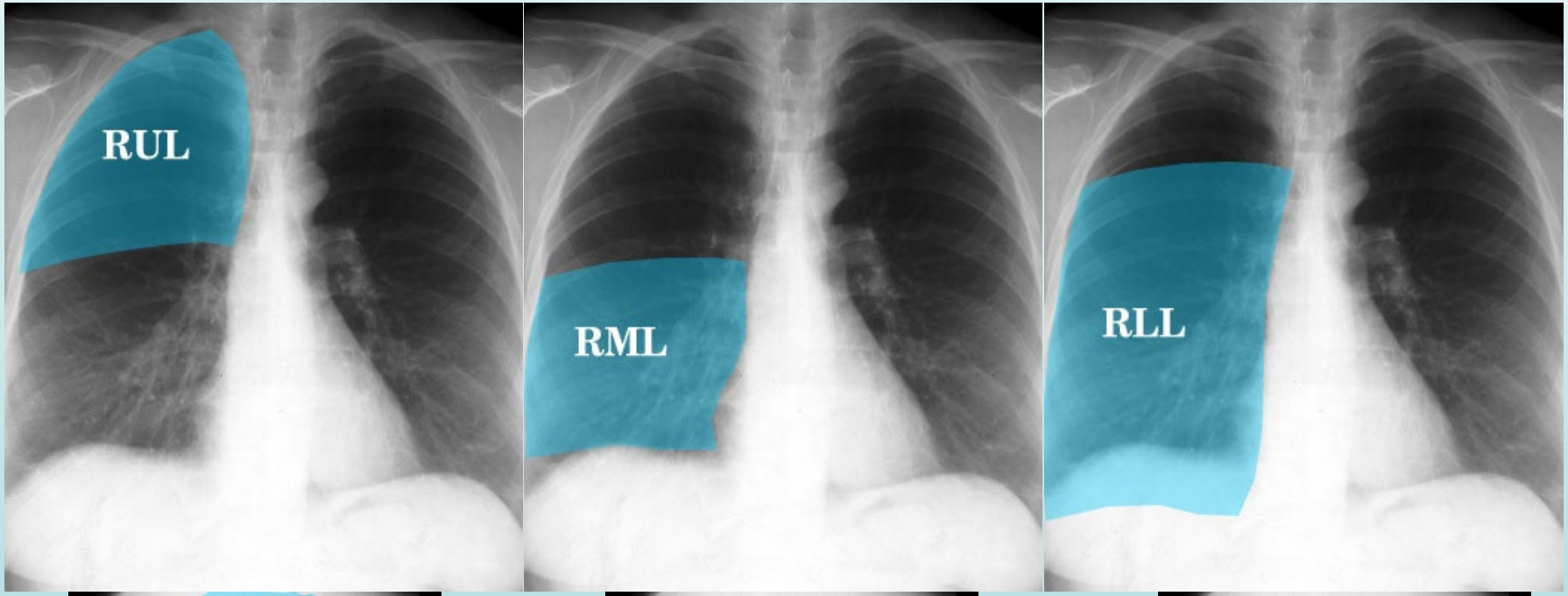

L
ERECT
Trachea
Superior vena cava
Pulmonary artery
Right ventricle
Aortic arch
Pulmonary artery
Left atrial appendage
Left ventricle

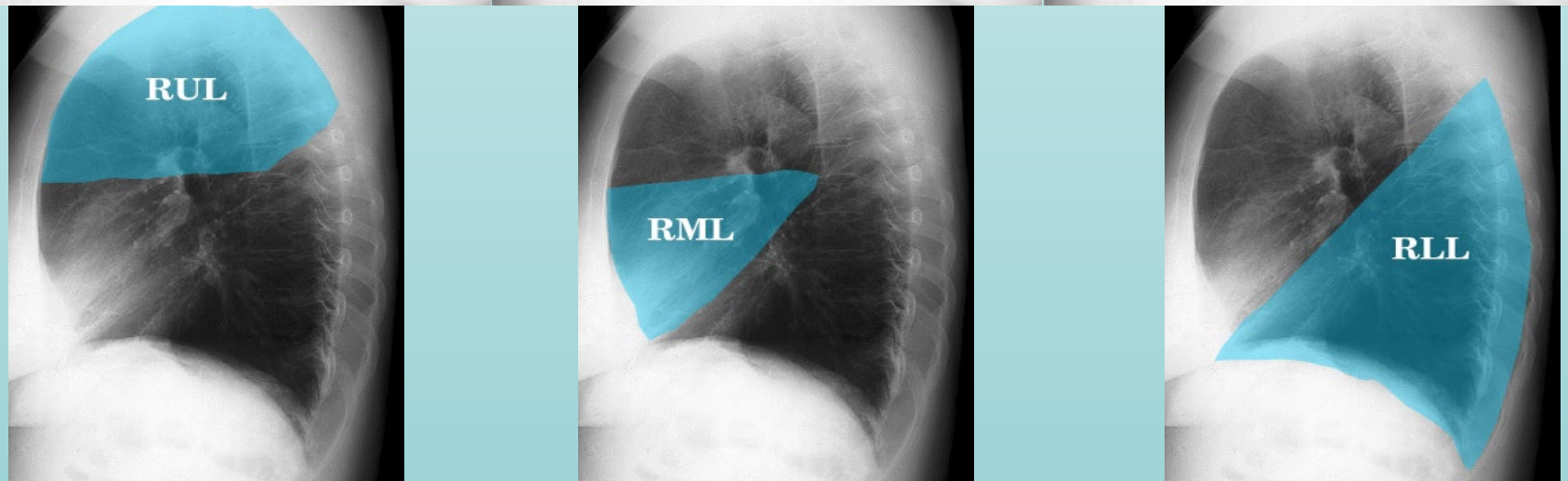

clavicle
trachea
scapula
aortic knob
bronchial bifurcation
hilum
vascular hilum
descending aorta
right atrium
diaphragm
liver


Ao
PA
RA
LV
RV

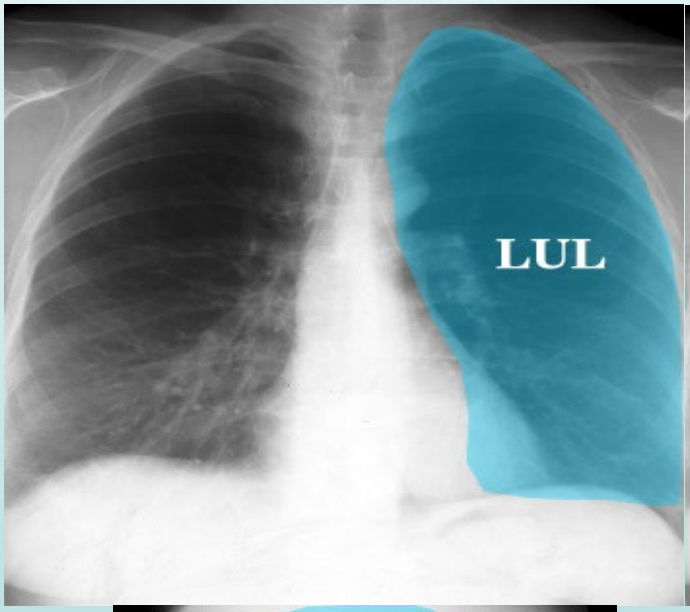

Ao
PA
LA
RV
LV

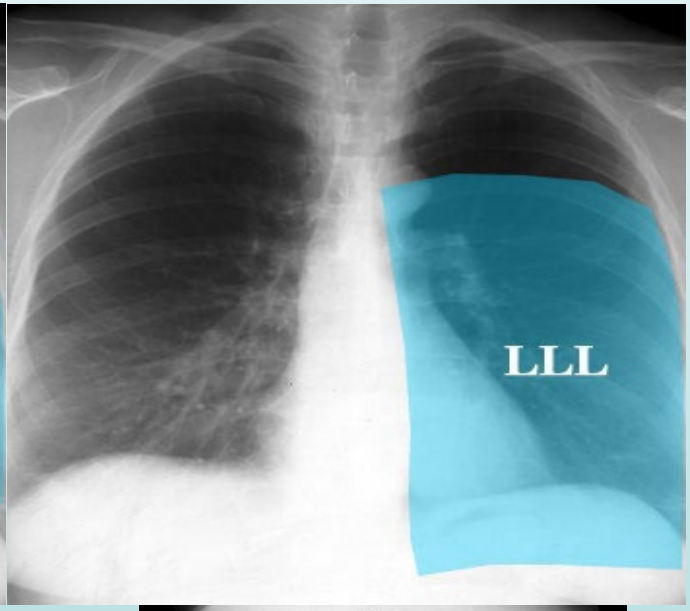
# Right Lobe Position

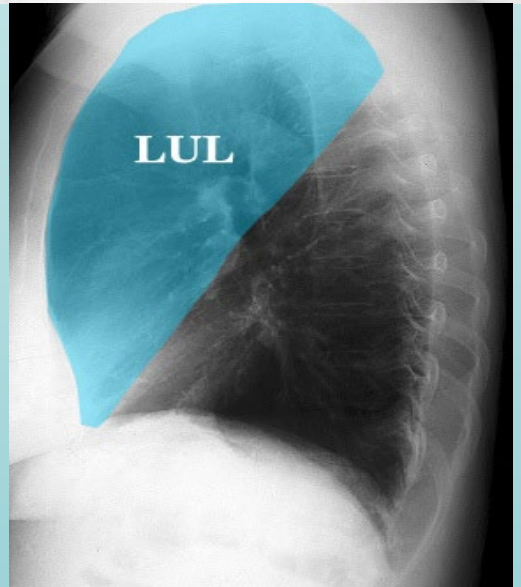


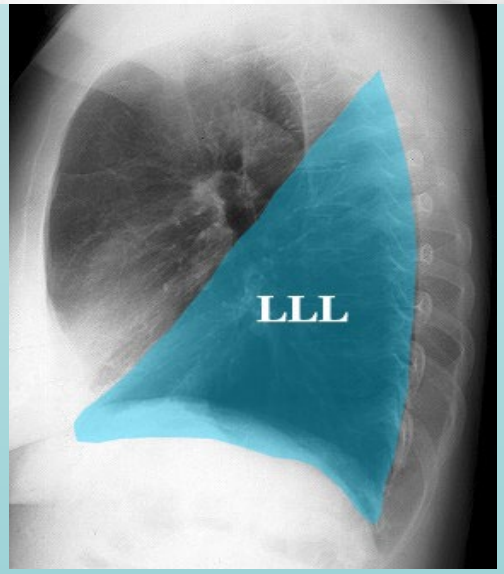



# Left Lobe Position



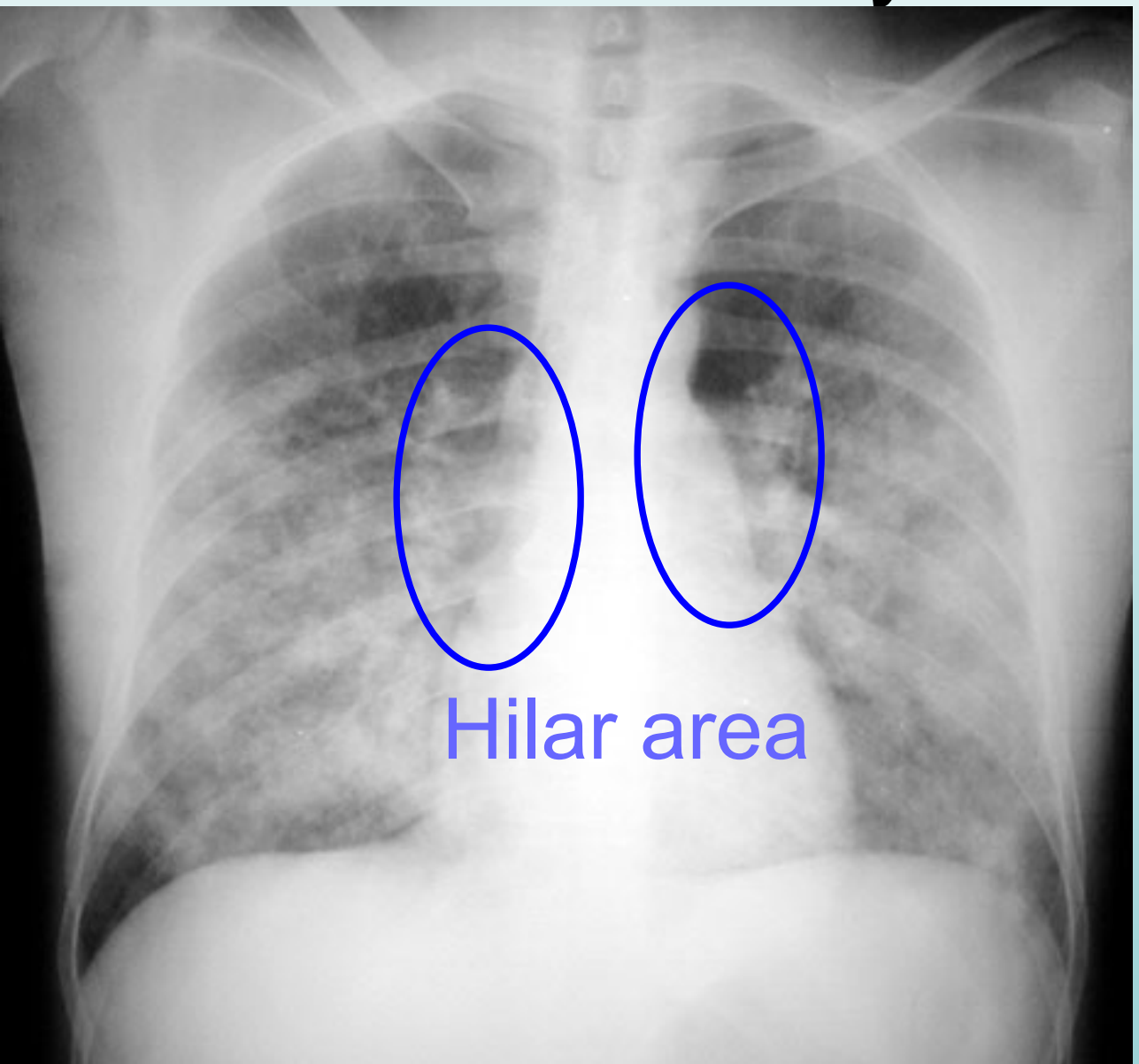



# Common CXR Pathologies

- Diffuse disease processes (throughout both the lung fields)
  - Pulmonary Edema
  - ARDS
- Unilateral disease processes (one area affected)
  - Pneumonia
  - Pleural effusion

# Diffuse Disease Processes

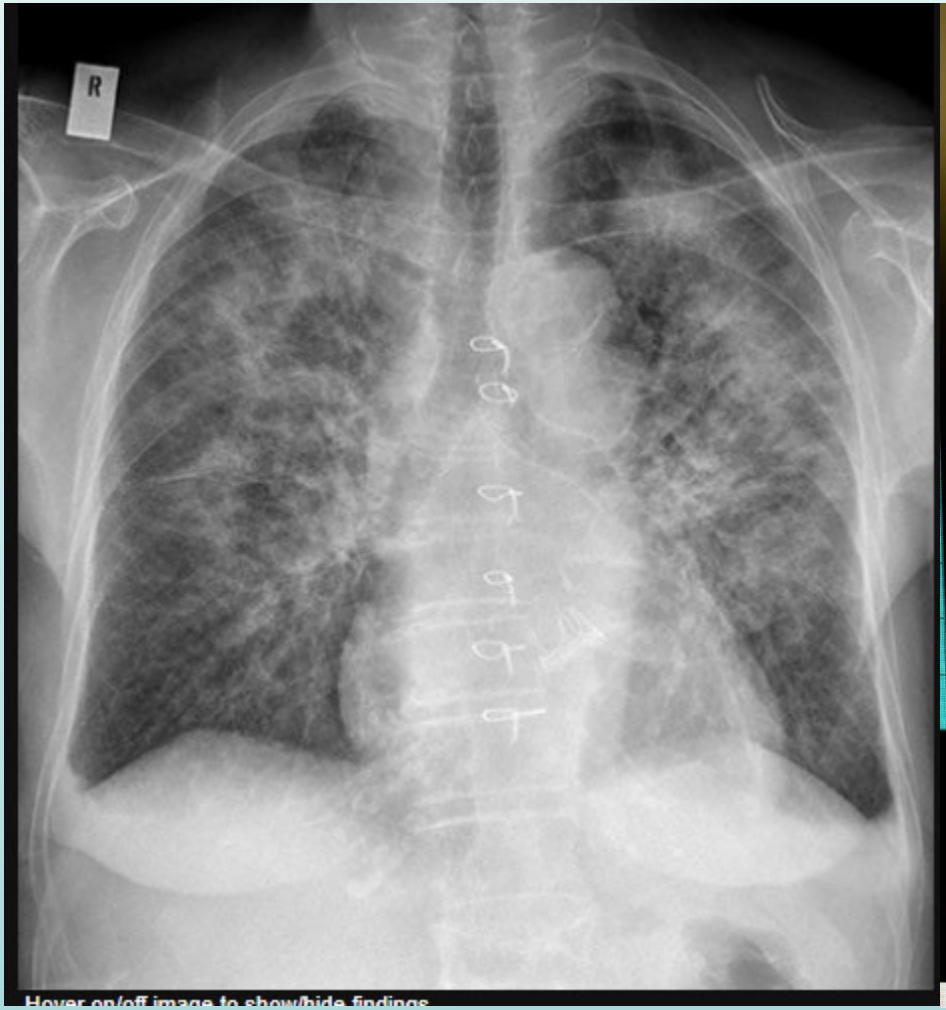
# Pulmonary Edema

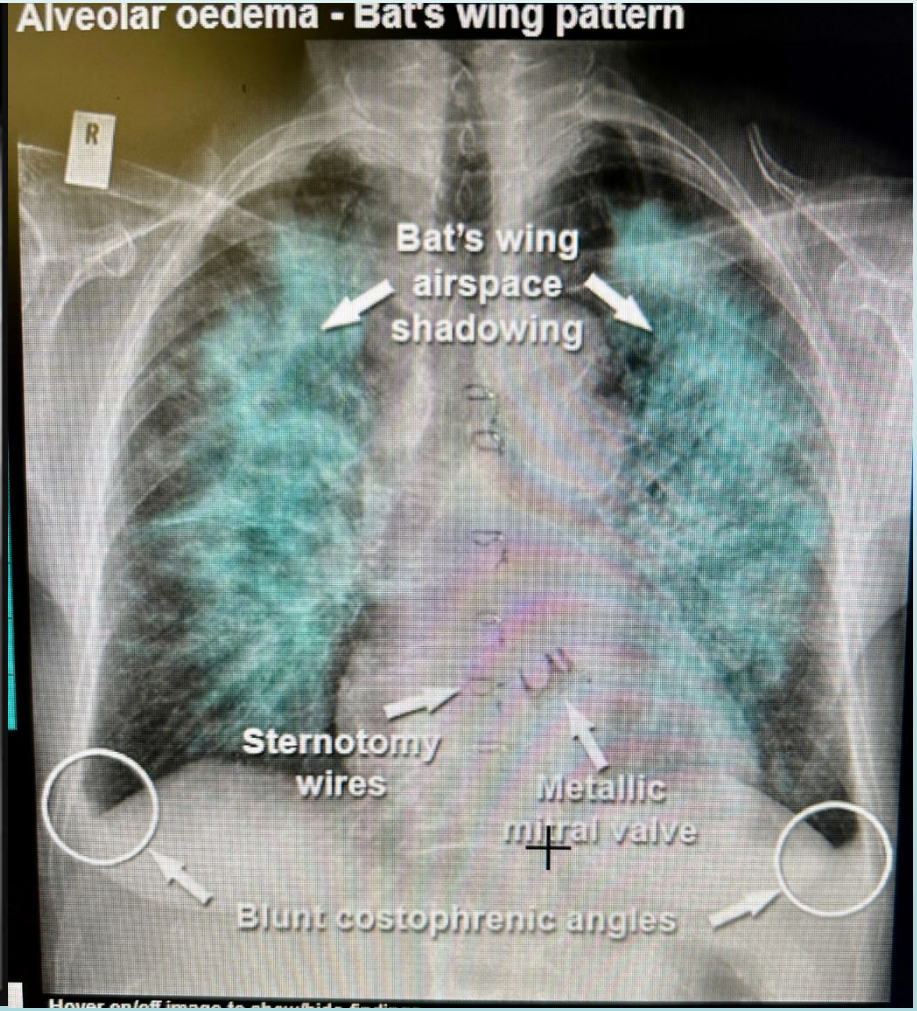



Engorged vasculature (cottony appearance) radiating from the hilum bilaterally.

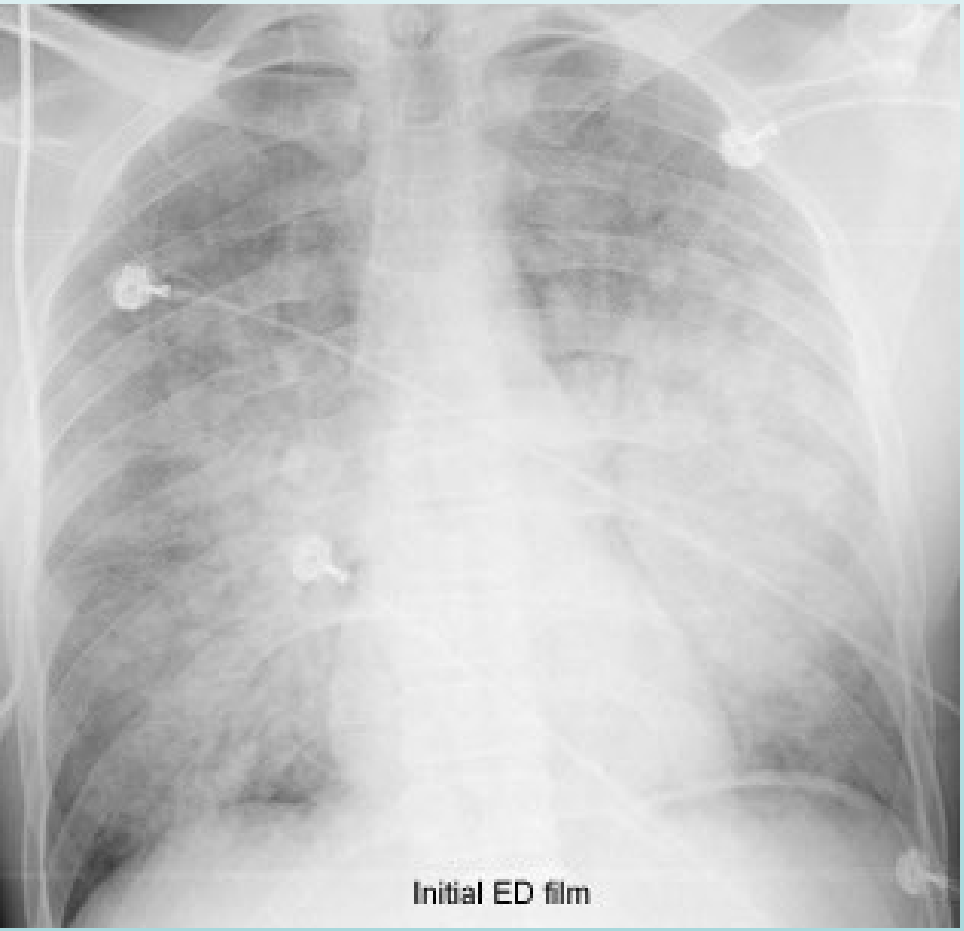
This film might be easily mistaken for ARDS

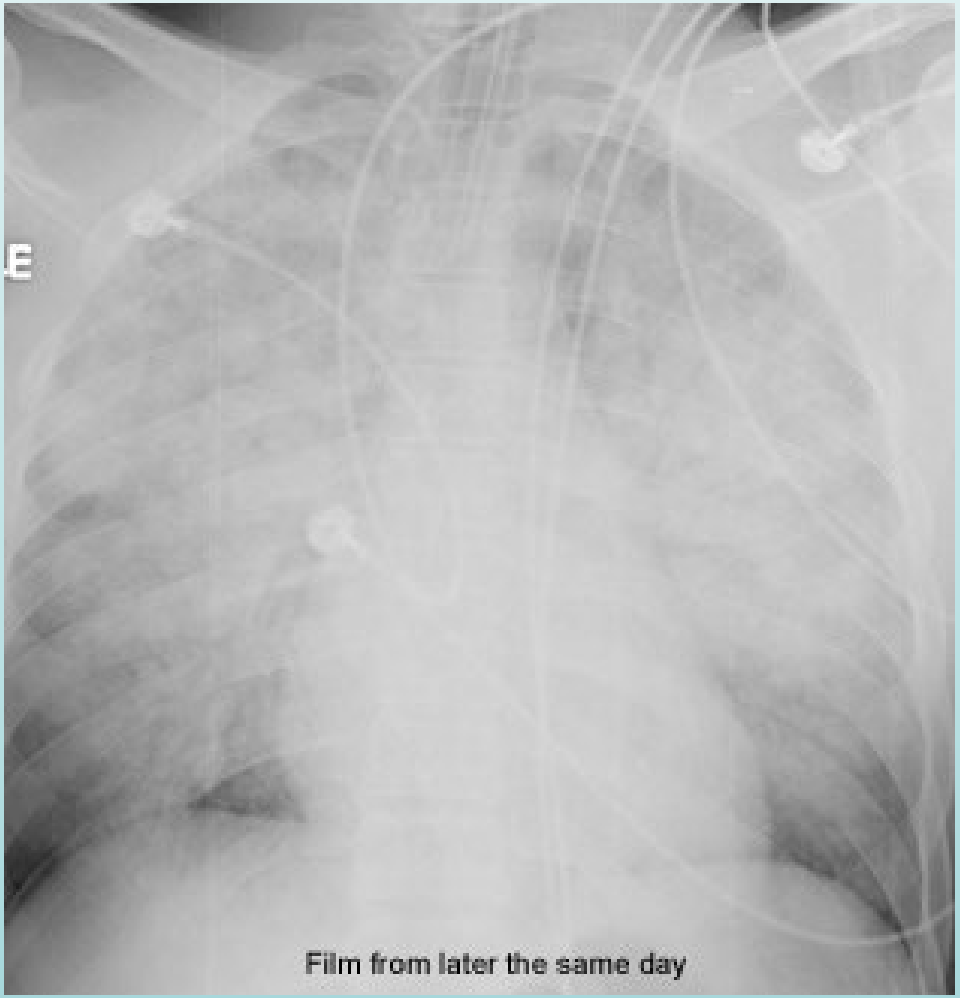
The heart is considered enlarged when it occupies more than 50% of the diameter of the chest.

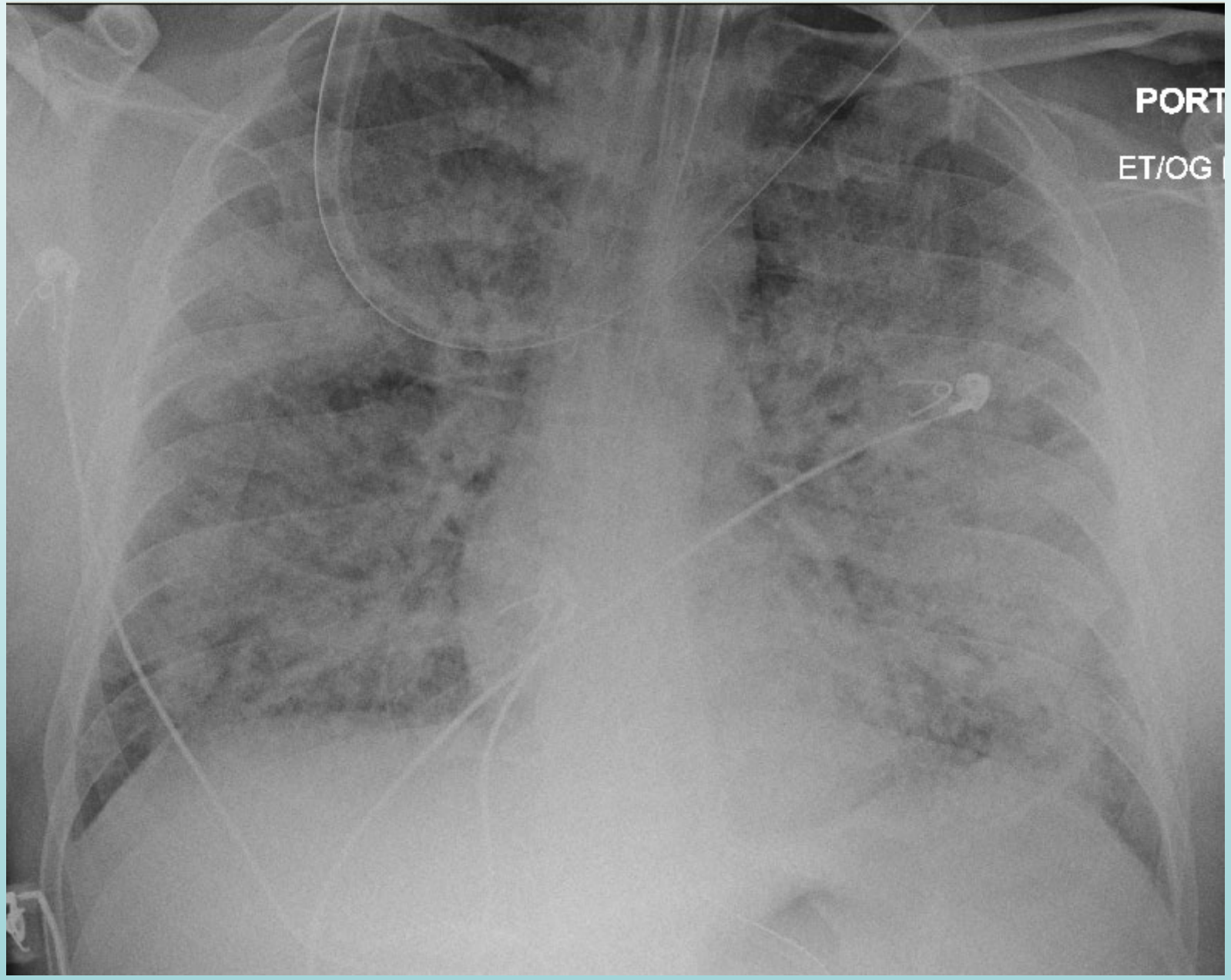

R
Hover on/off image to show/hide findings


Alveolar oedema - Bat's wing pattern
R
Bat's wing airspace shadowing
Sternotomy wires
Metallic mitral valve
Blunt costophrenic angles

# ARDS

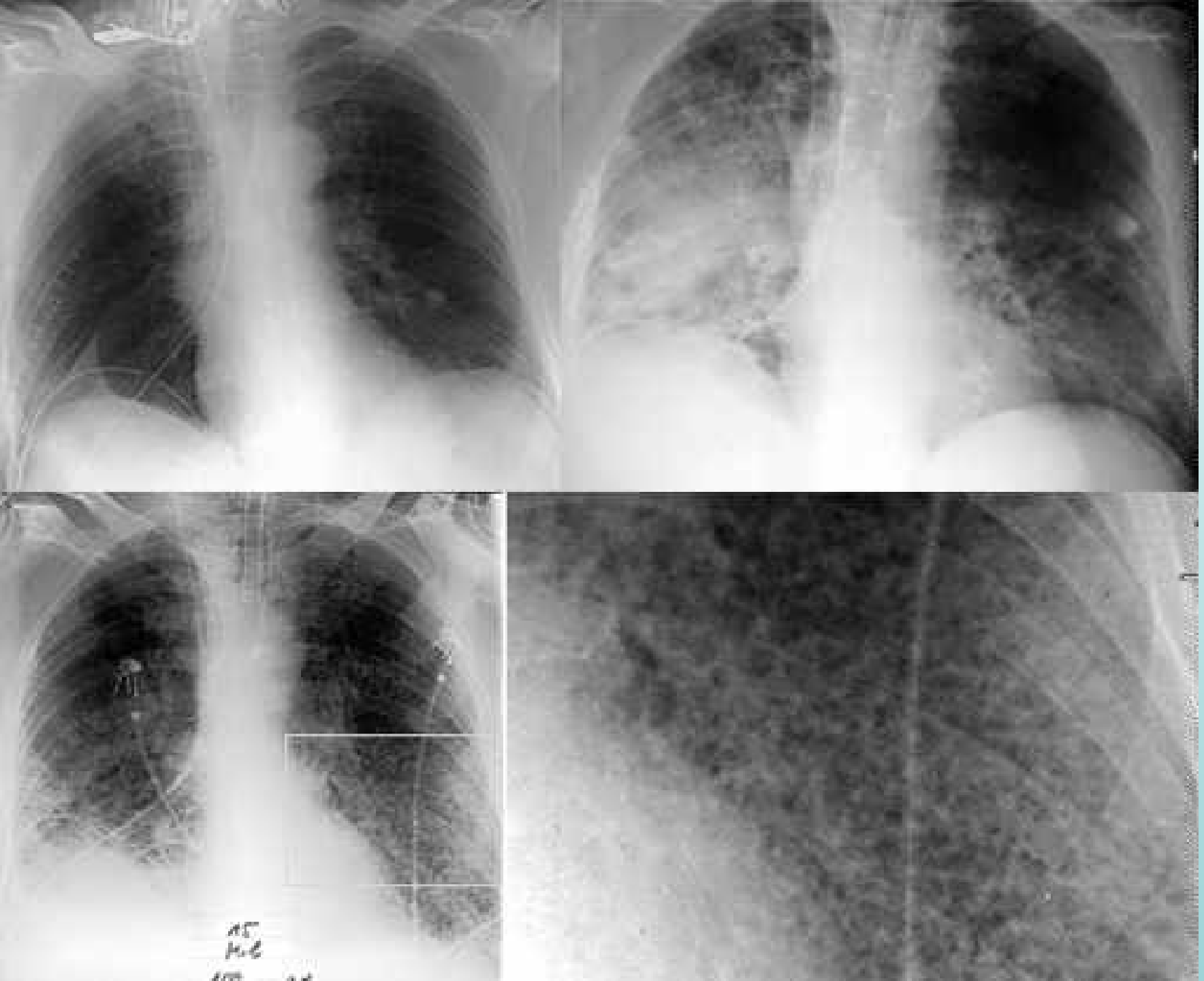



PORT
ET/OG

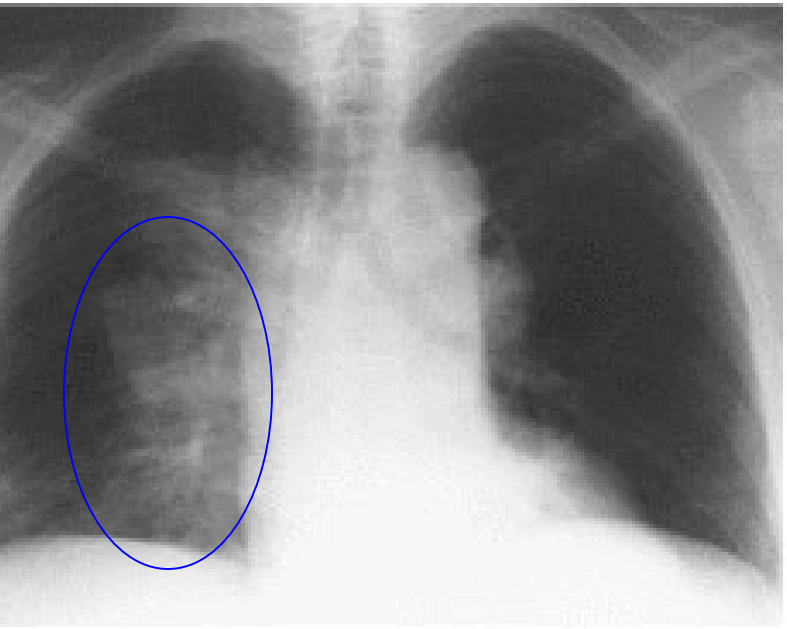
# ARDS

- Often, but not always, bilateral fluffy (white) densities
- “Ground Glass” appearance or “Honeycombing” is typical.
- Sometimes called “whiteout”.
- Often mistaken for pulmonary edema



# Unilateral Disease Processes

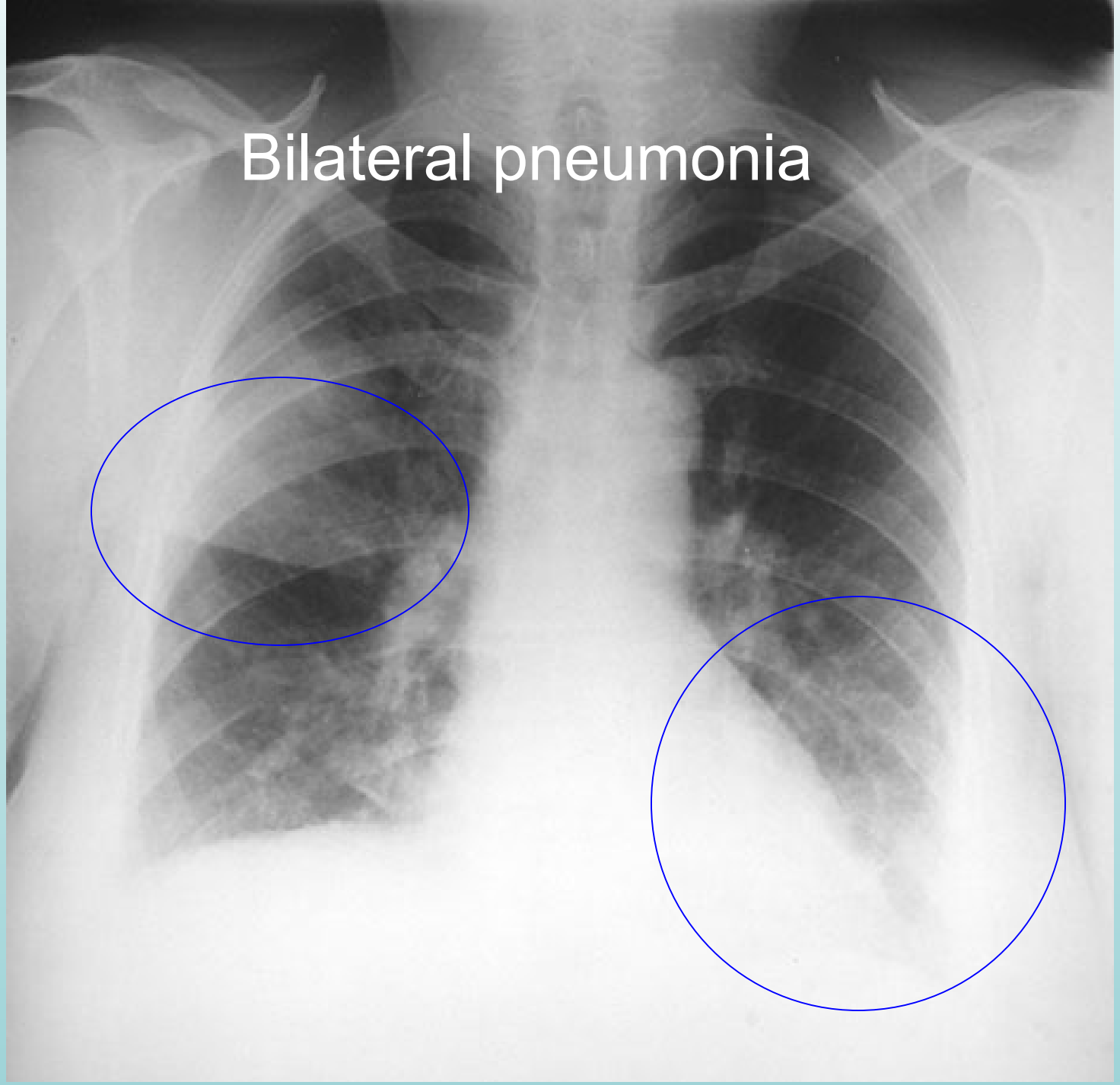
# Pneumonia



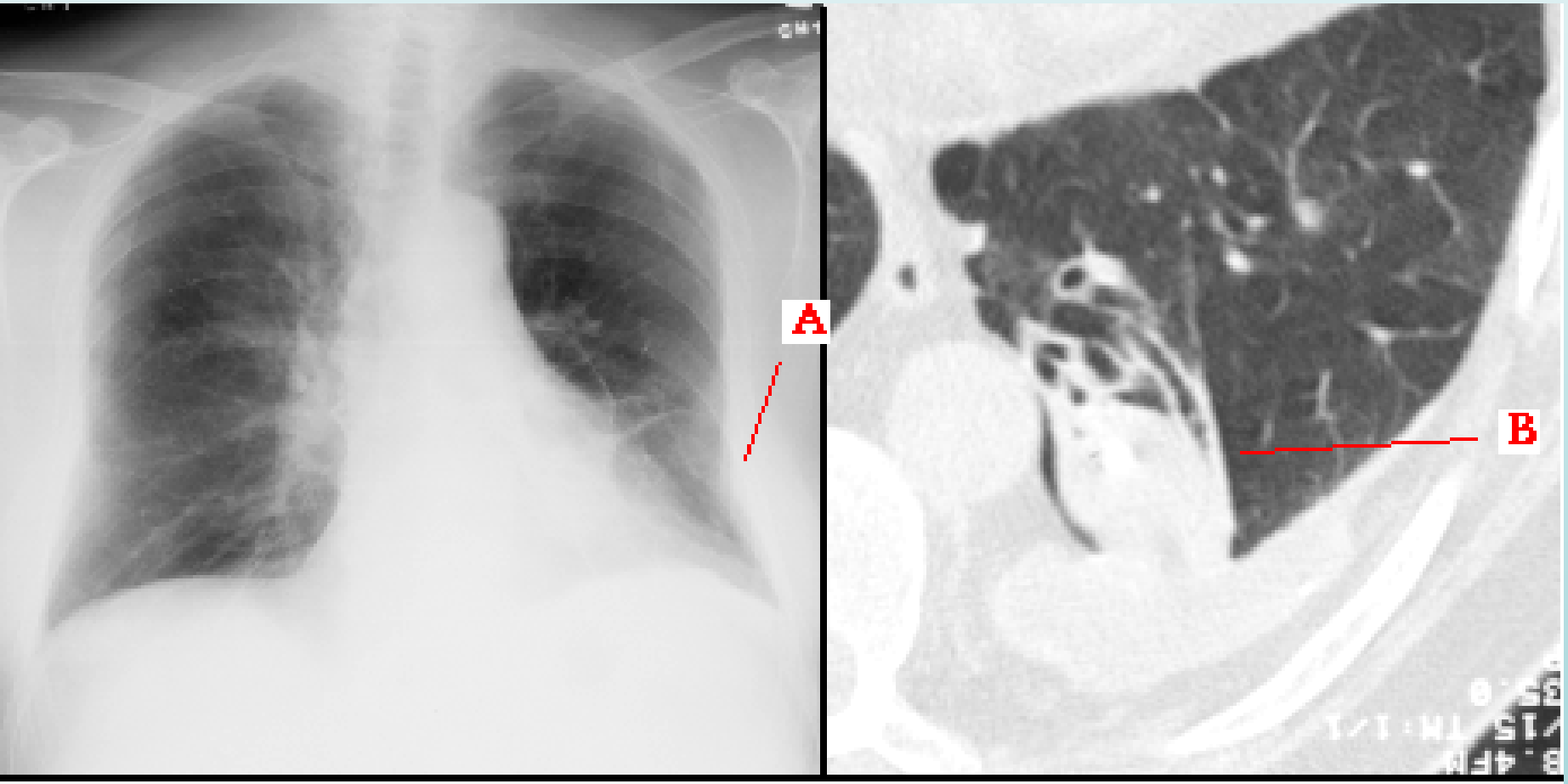
Comparison of sides reveals an area of increased density adjacent to the hilum on the right side.

This area of fluid consolidation does not obscure the right heart border and is therefore posterior (away from the heart—an anterior structure)

Aspiration pneumonia in a 52 y/o male patient.


Bilateral pneumonia

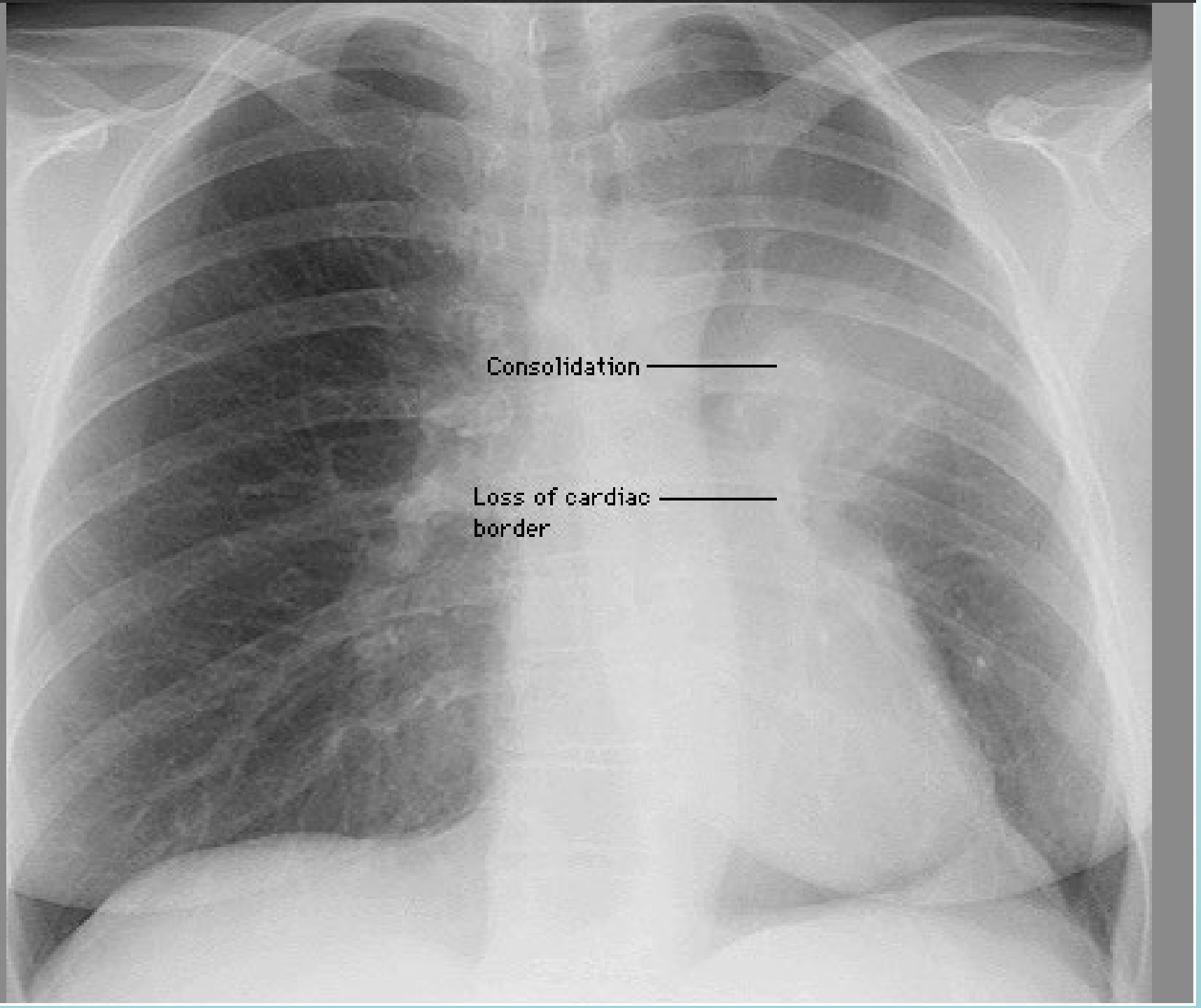
# Atelectasis

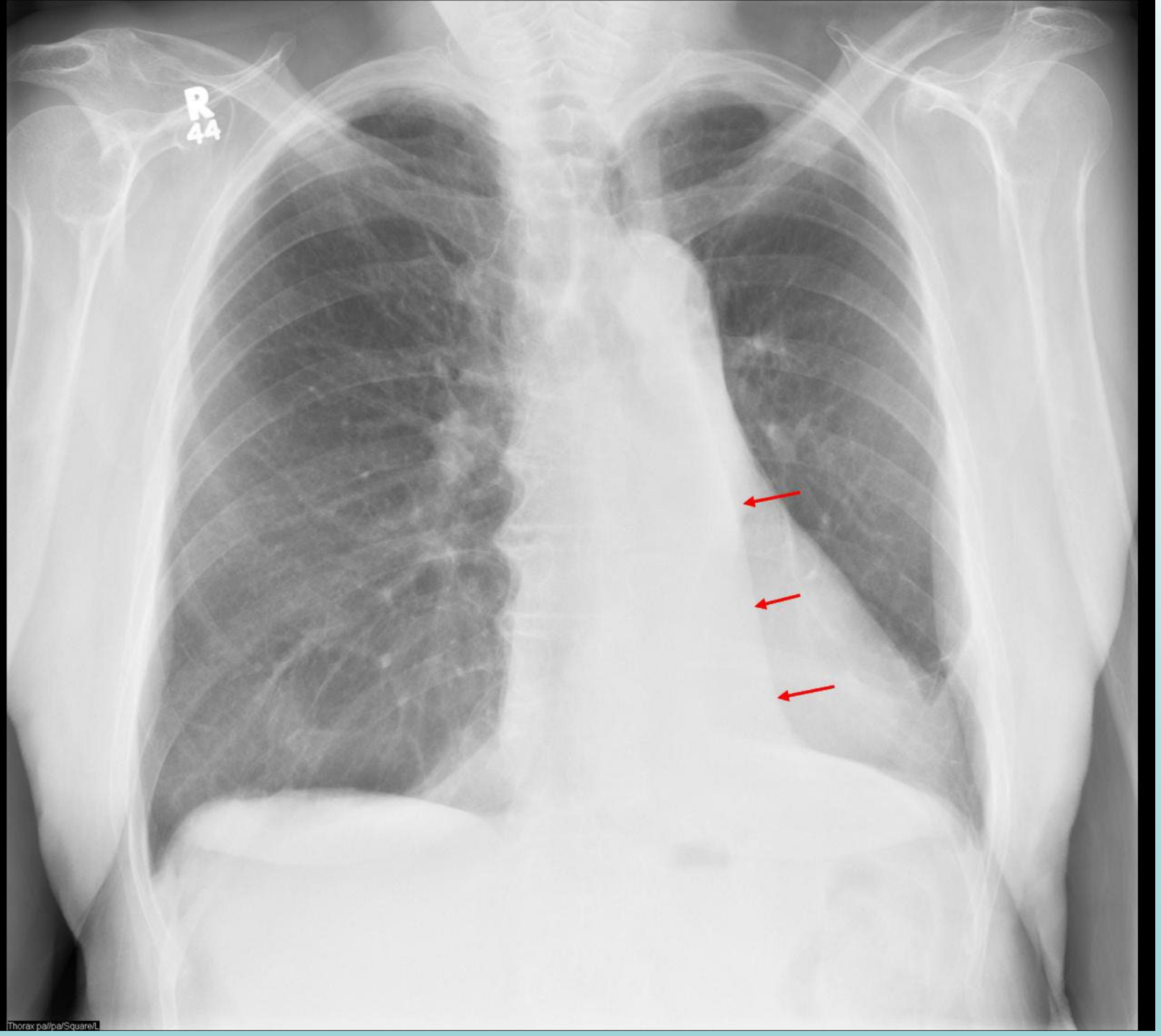



PA radiograph (left) which shows a localized area of pleural thickening along the left lateral chest wall (A). HRCT scan left shows an area of "rounded atelectasis" (B) that is contiguous with a large pleural plaque.

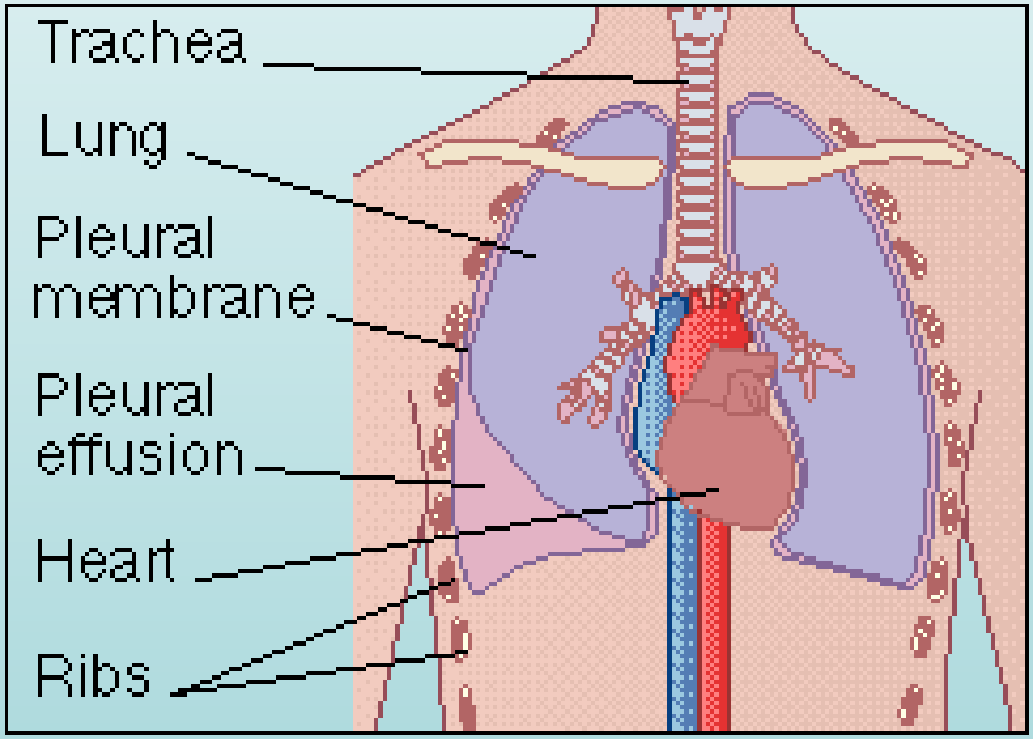
# Properties of Atelectasis

- Compressed lung tissue has increased density that may appear as a streak/s or plate-like areas of whiteness
- Compression of lung tissue tends to pull surronding objects toward the atelectasis…such as the heart border and diaphragm.
- X-rays showing distortion of the position of normal landmarks could be atelectasis.


Consolidation
Loss of cardiac border


R
44
Thorax pa/lpa/Square/L

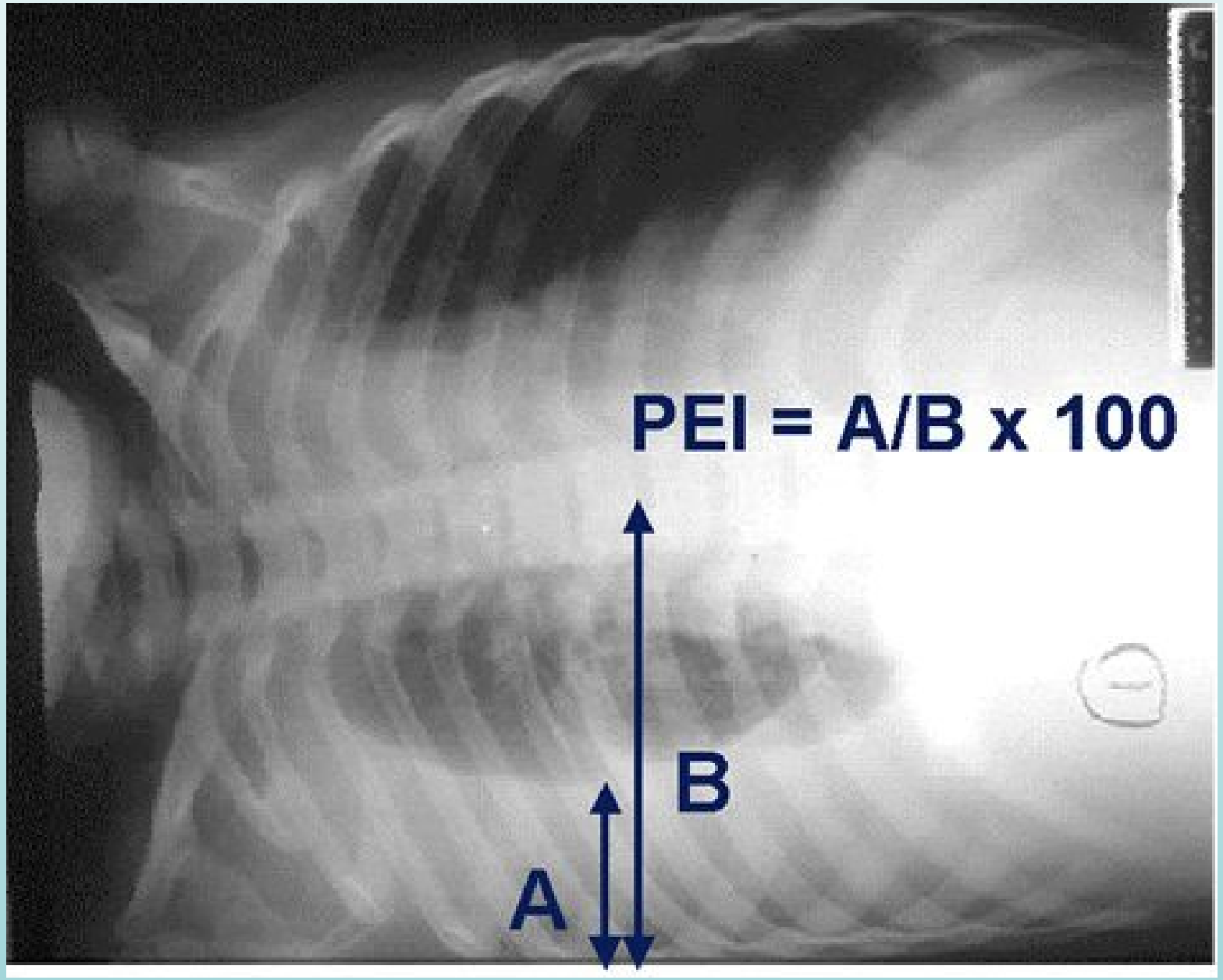
# Pleural Effusion



Pleural Effusion:

Blunting of the costophrenic angle

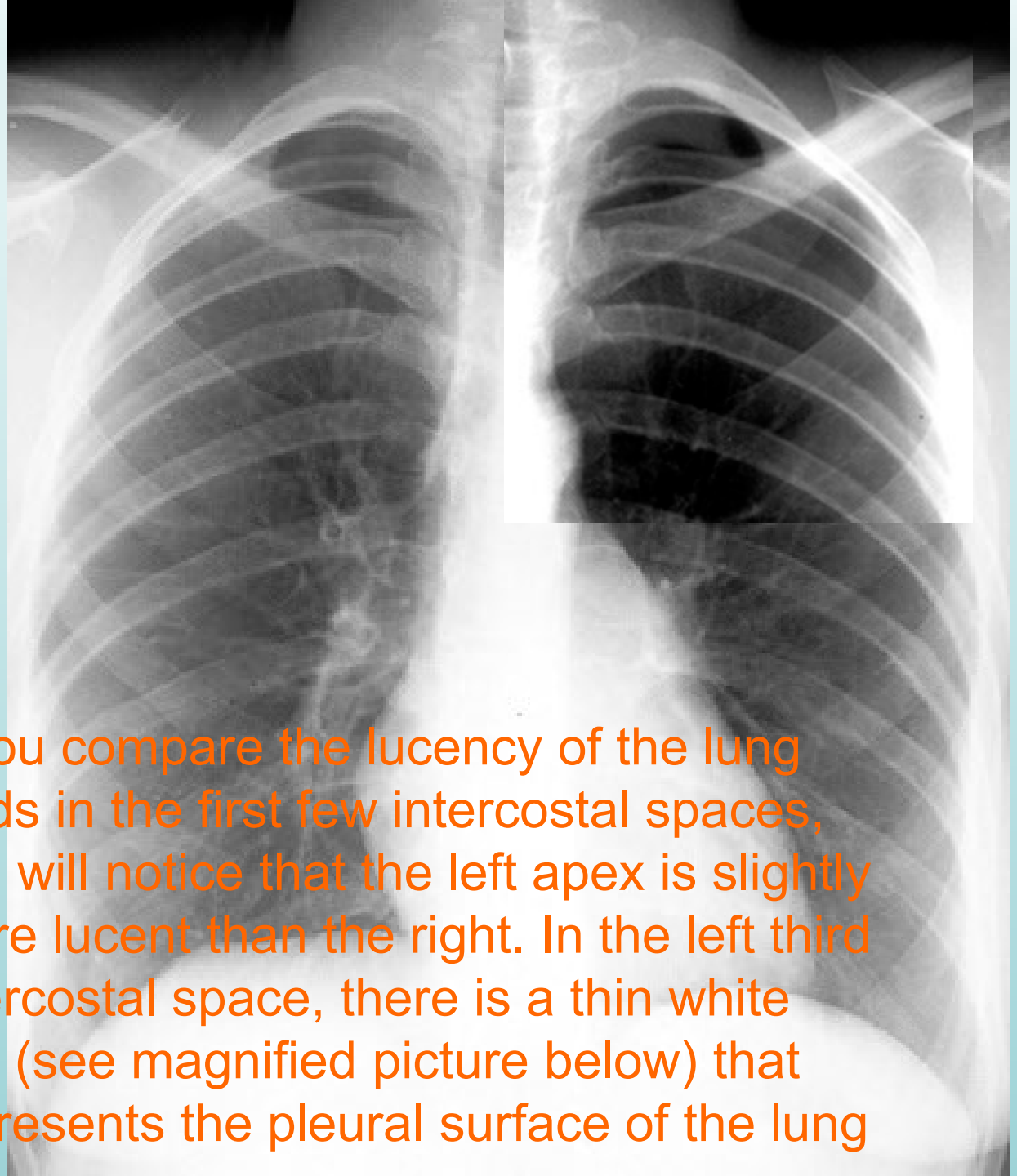

L


PEI = A/B x 100
B
A

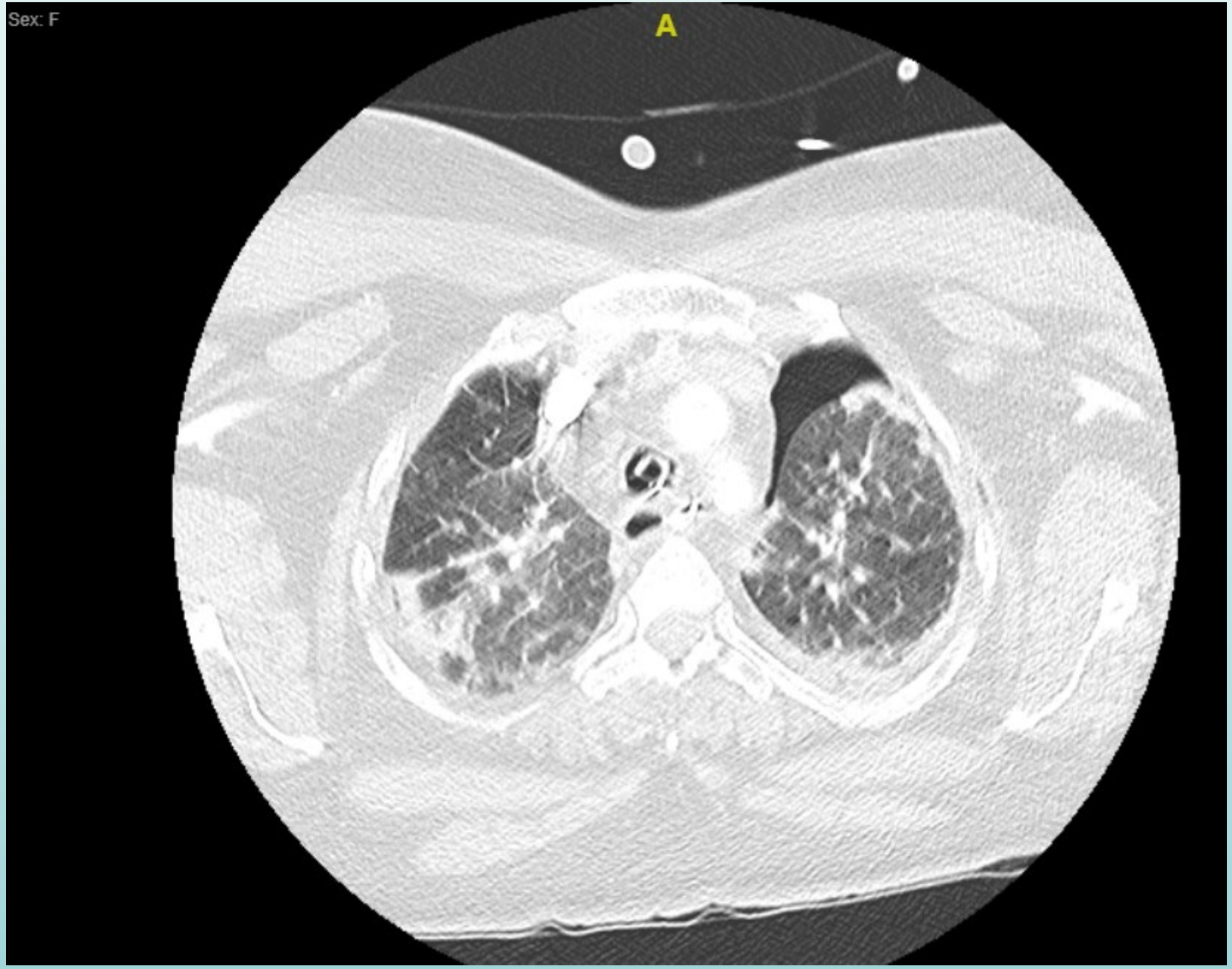
Guess what this is.

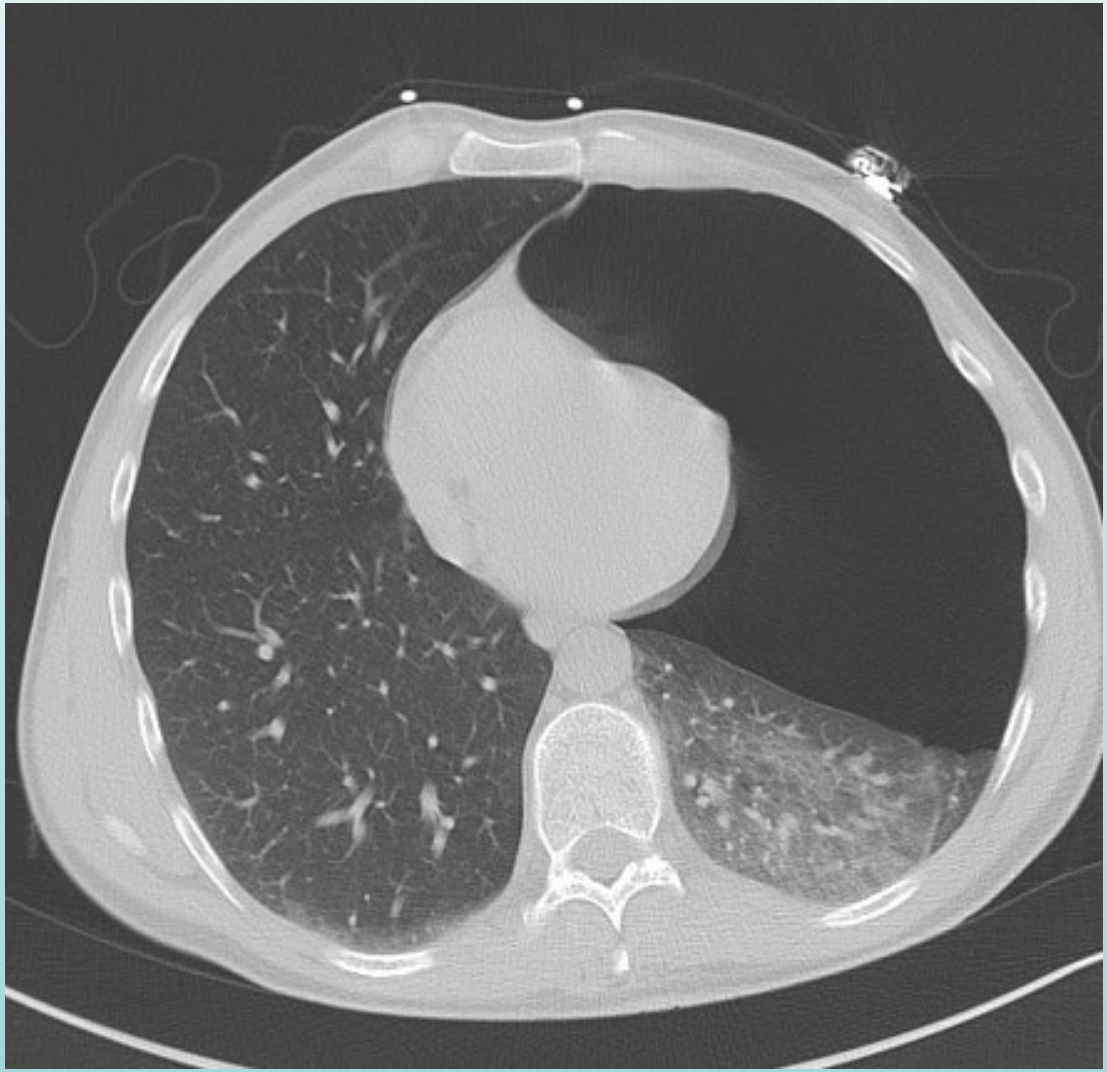
# Pneumothorax

- Come in simple and tension varieties.
  - Tension pneumothorax is an acute emergency!
- Increased blackness....no lung markings.
- A small pneumothorax can be hard for anyone but a radiologist to spot.



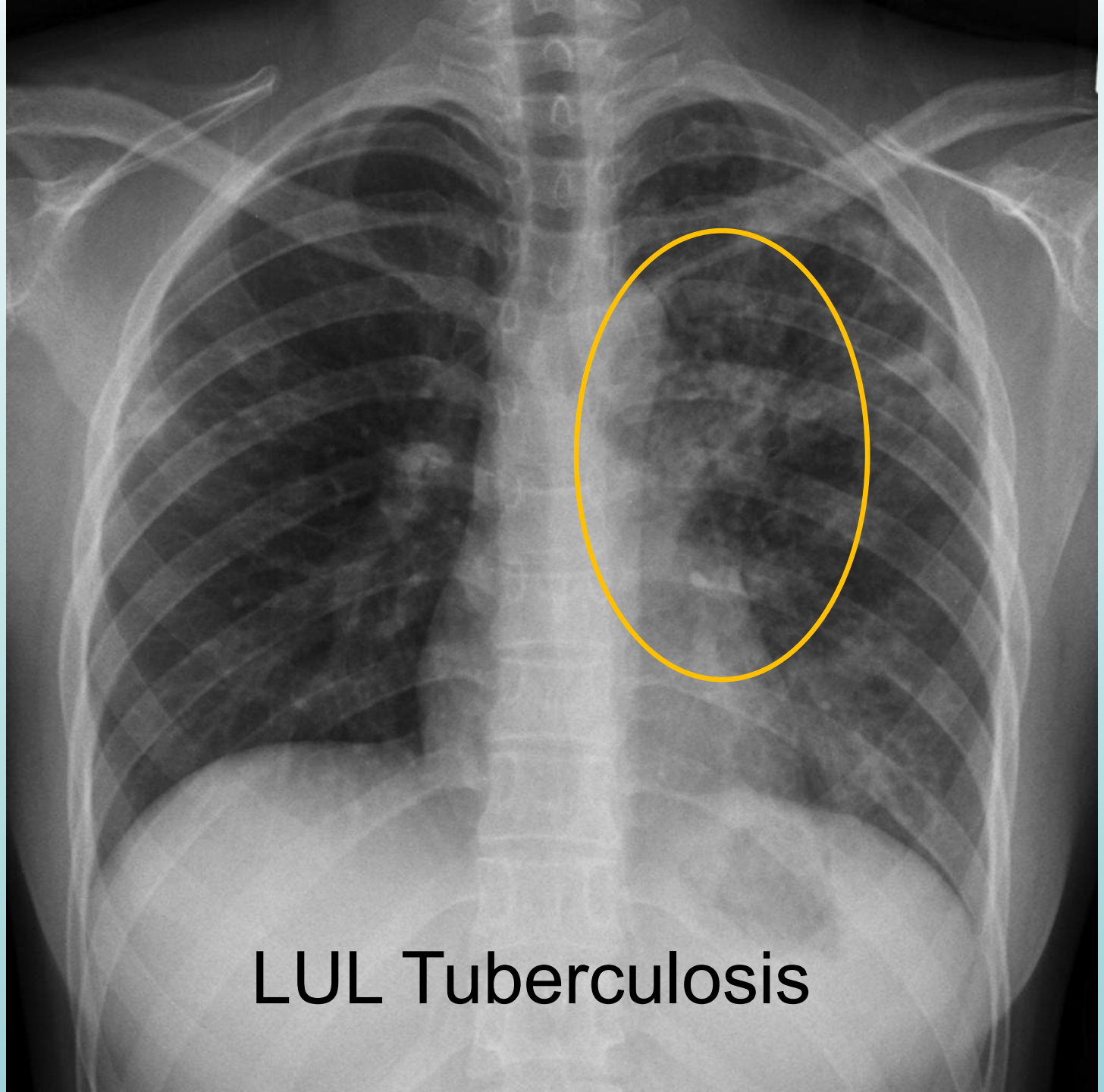
If you compare the lucency of the lung fields in the first few intercostal spaces, you will notice that the left apex is slightly more lucent than the right. In the left third intercostal space, there is a thin white line (see magnified picture below) that represents the pleural surface of the lung

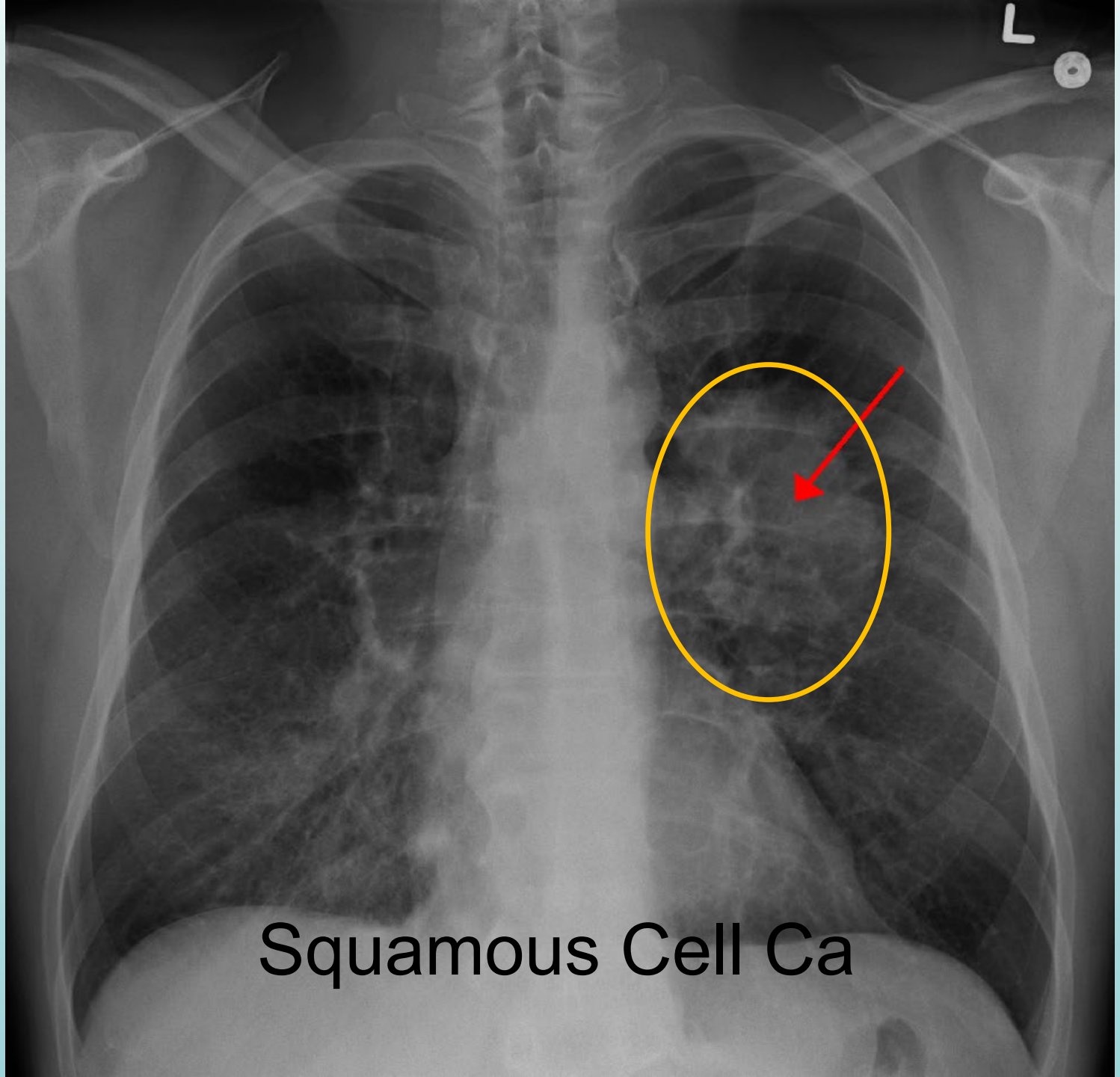

Sex: F
A

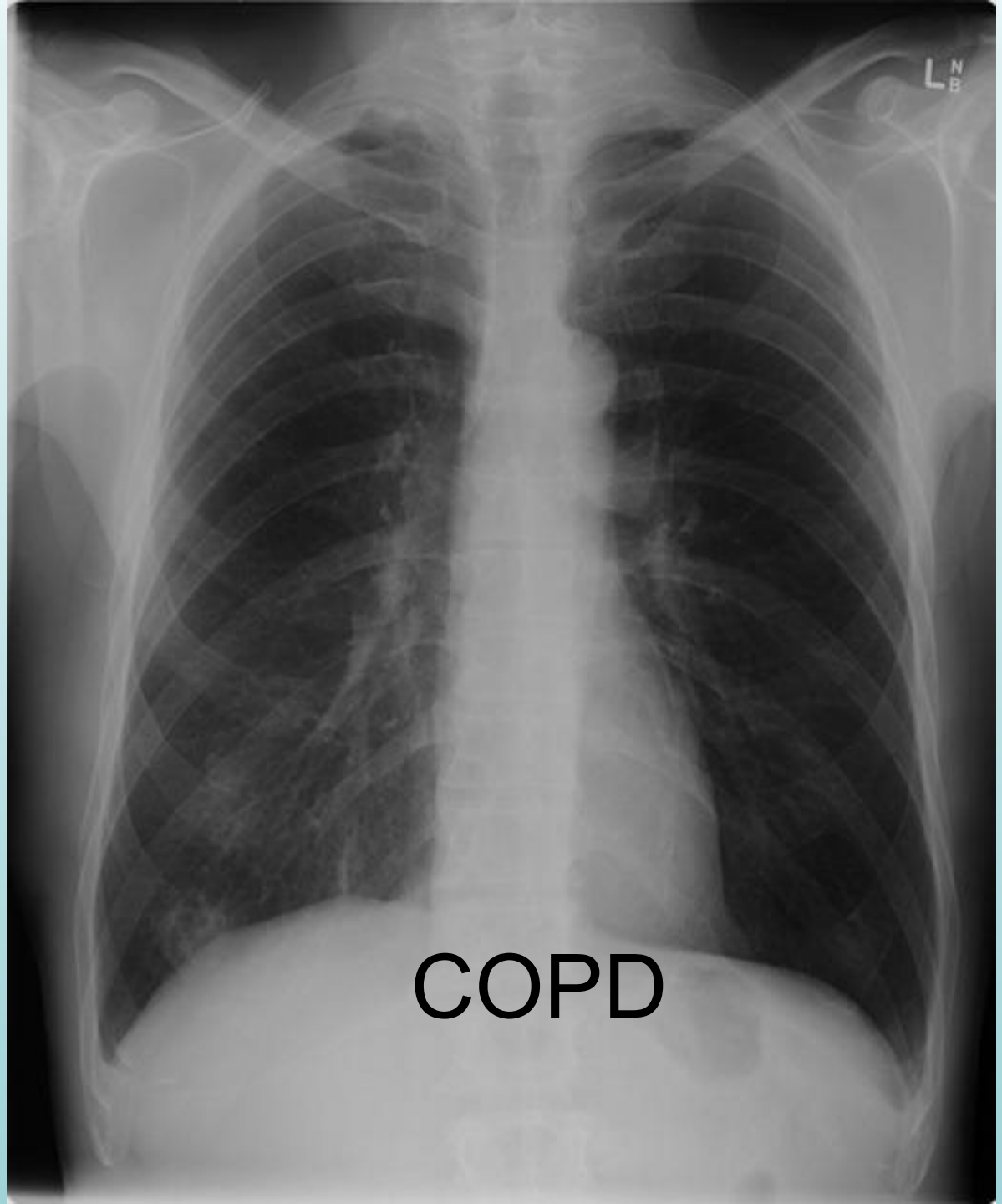


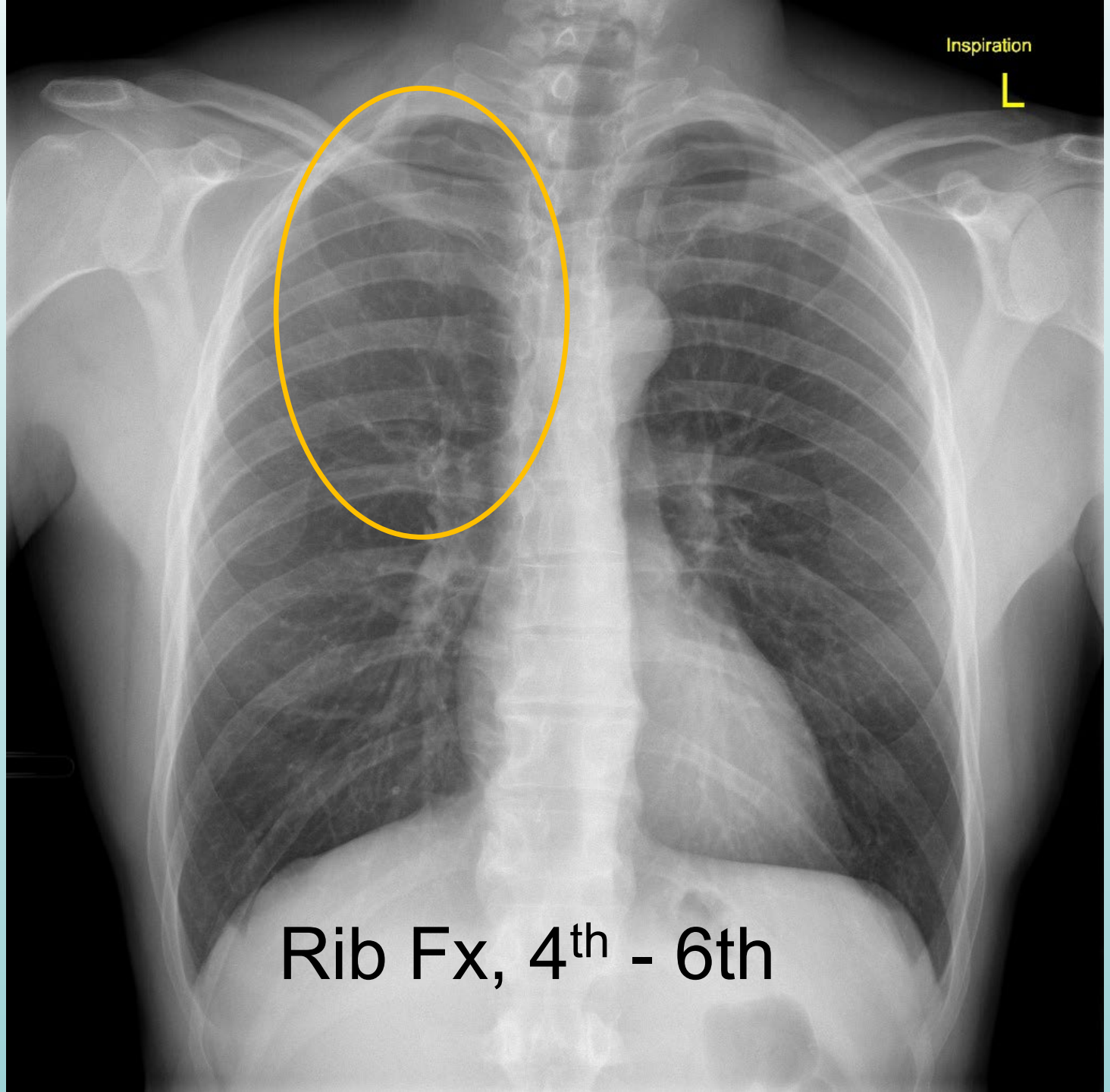
# Also see:

- Tuberculosis
- Lung Ca
- COPD
- Rib Fractures
- Sarcoidosis
- Others?

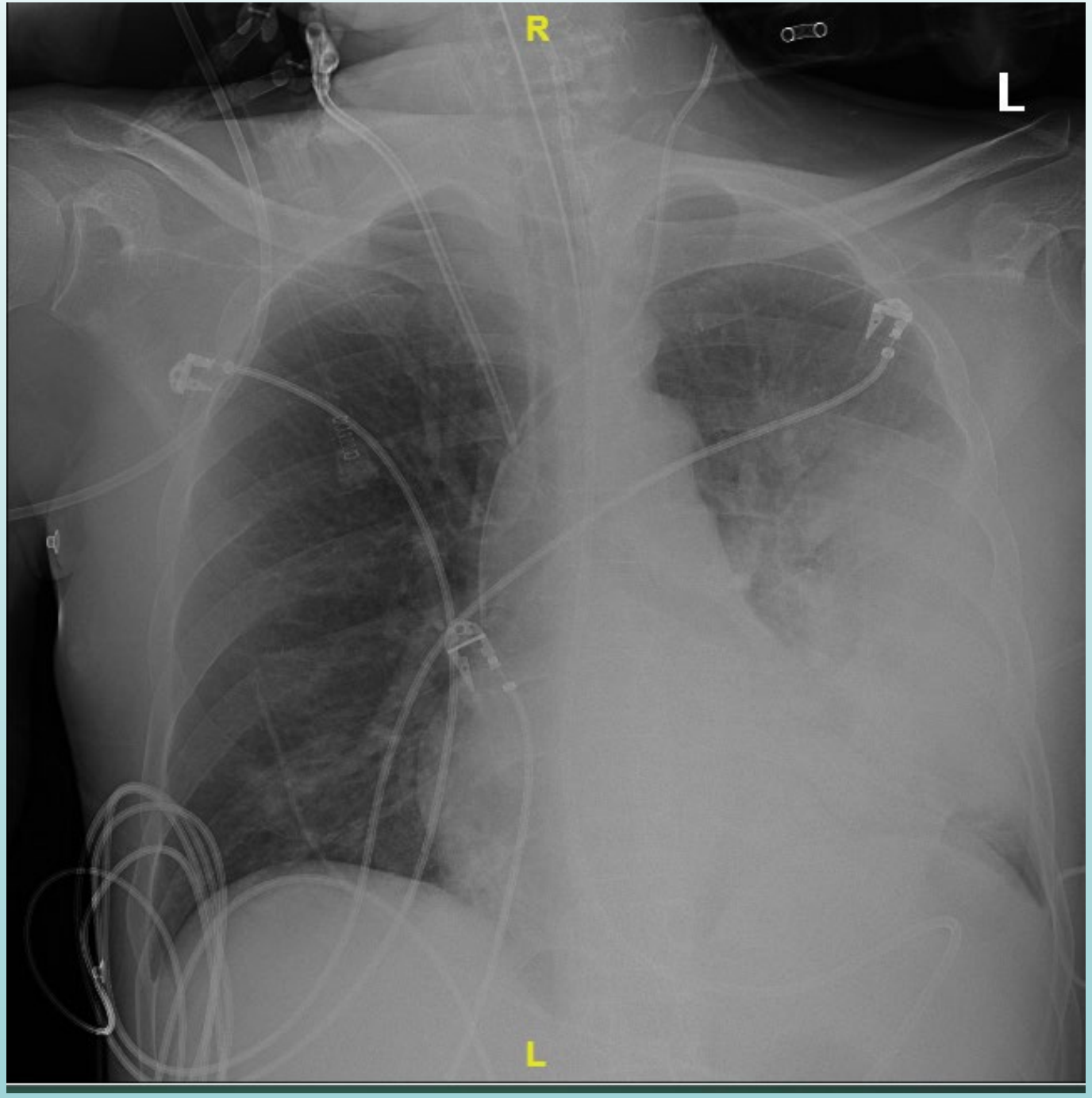

LUL Tuberculosis


L
Squamous Cell Ca


COPD

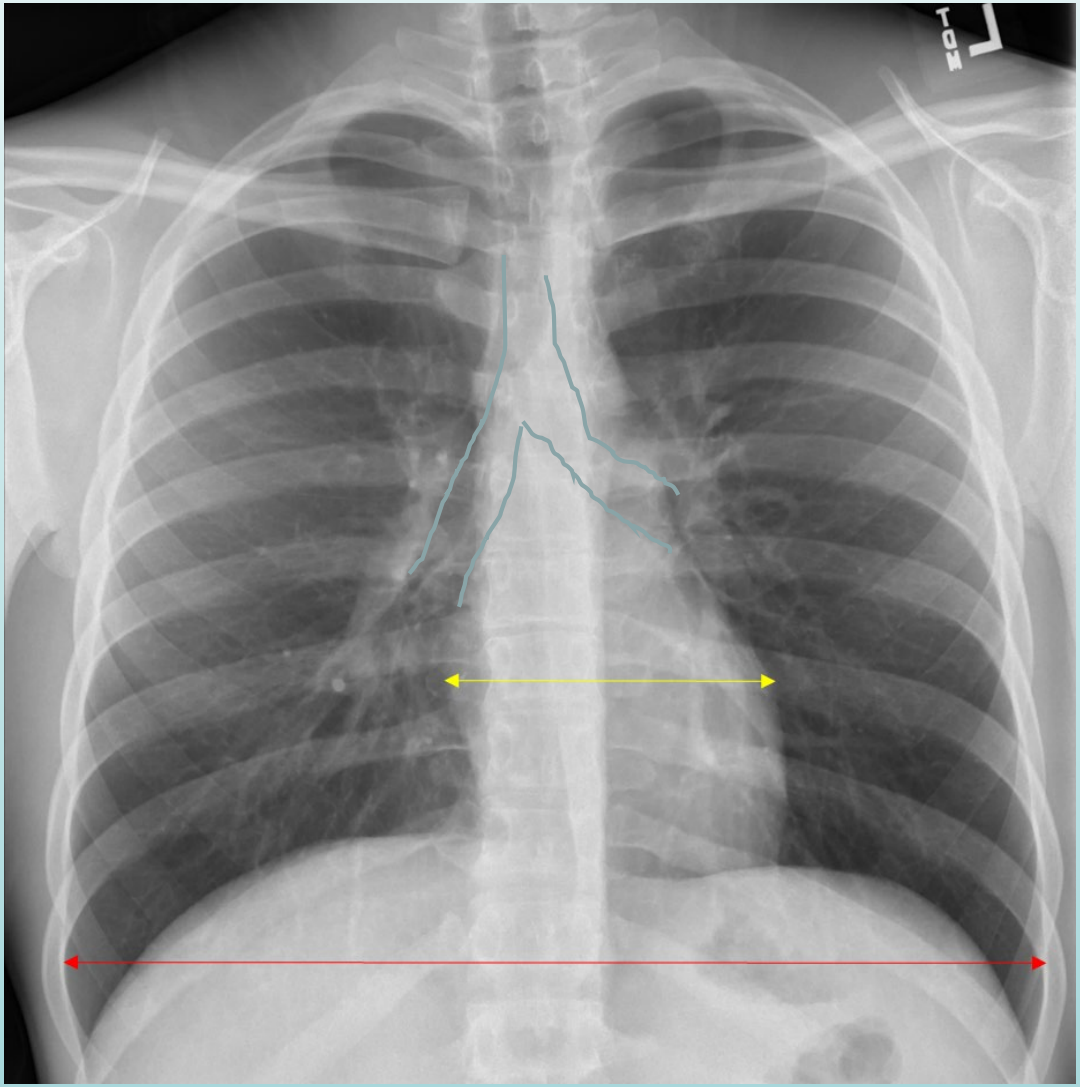



Rib Fx, 4th - 6th

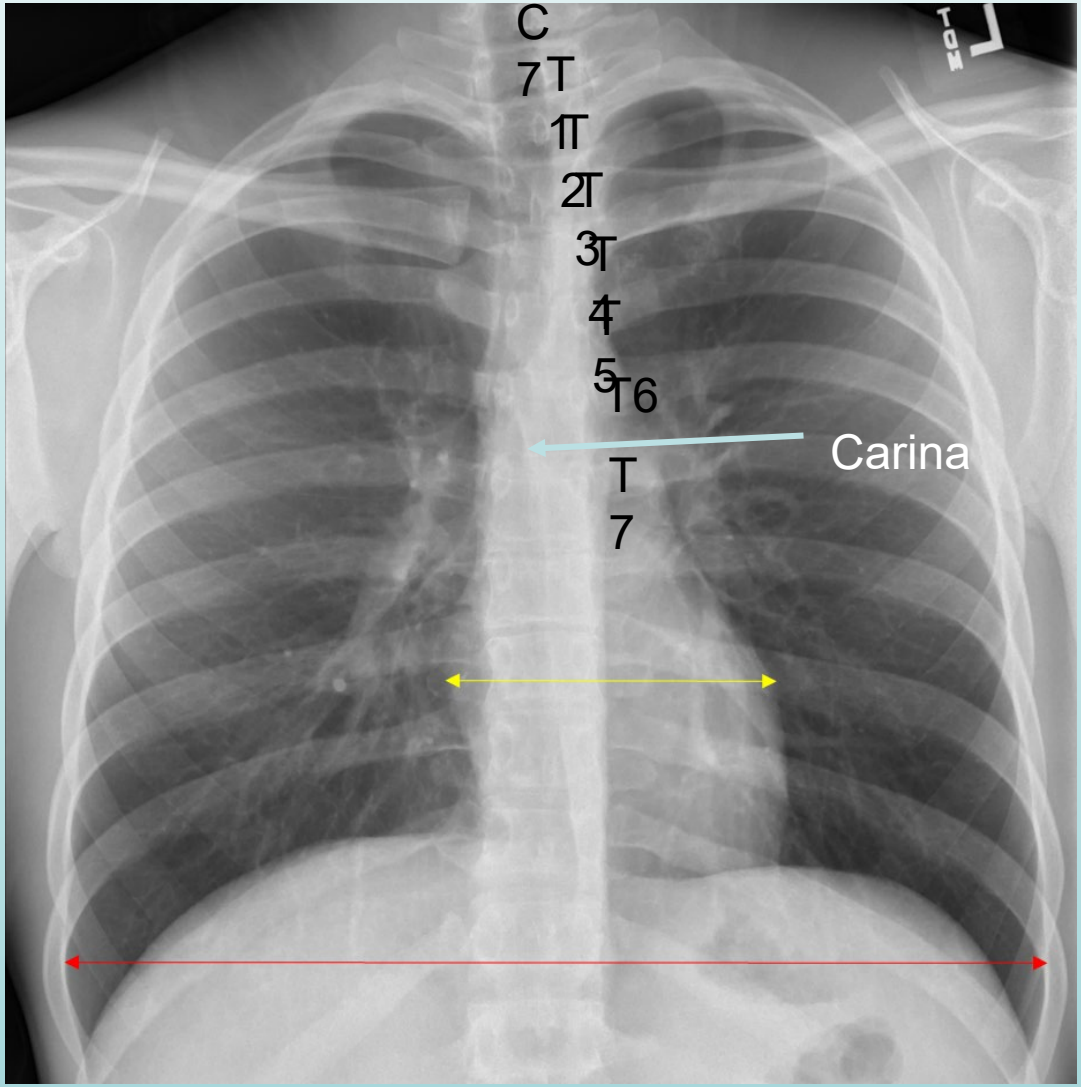

R
L
L

# Proper ETT Placement on CXR

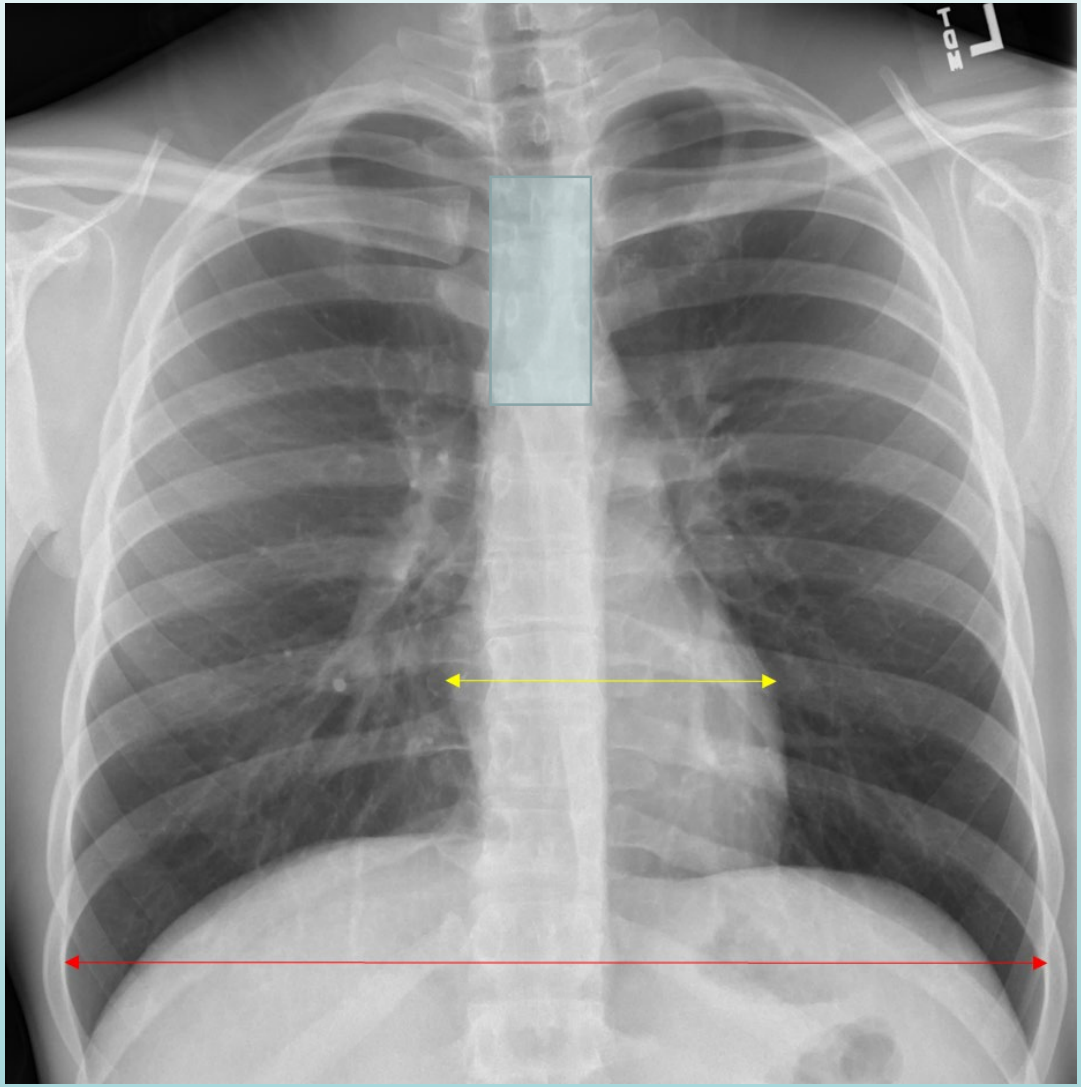
Can you see the trachea and carina?



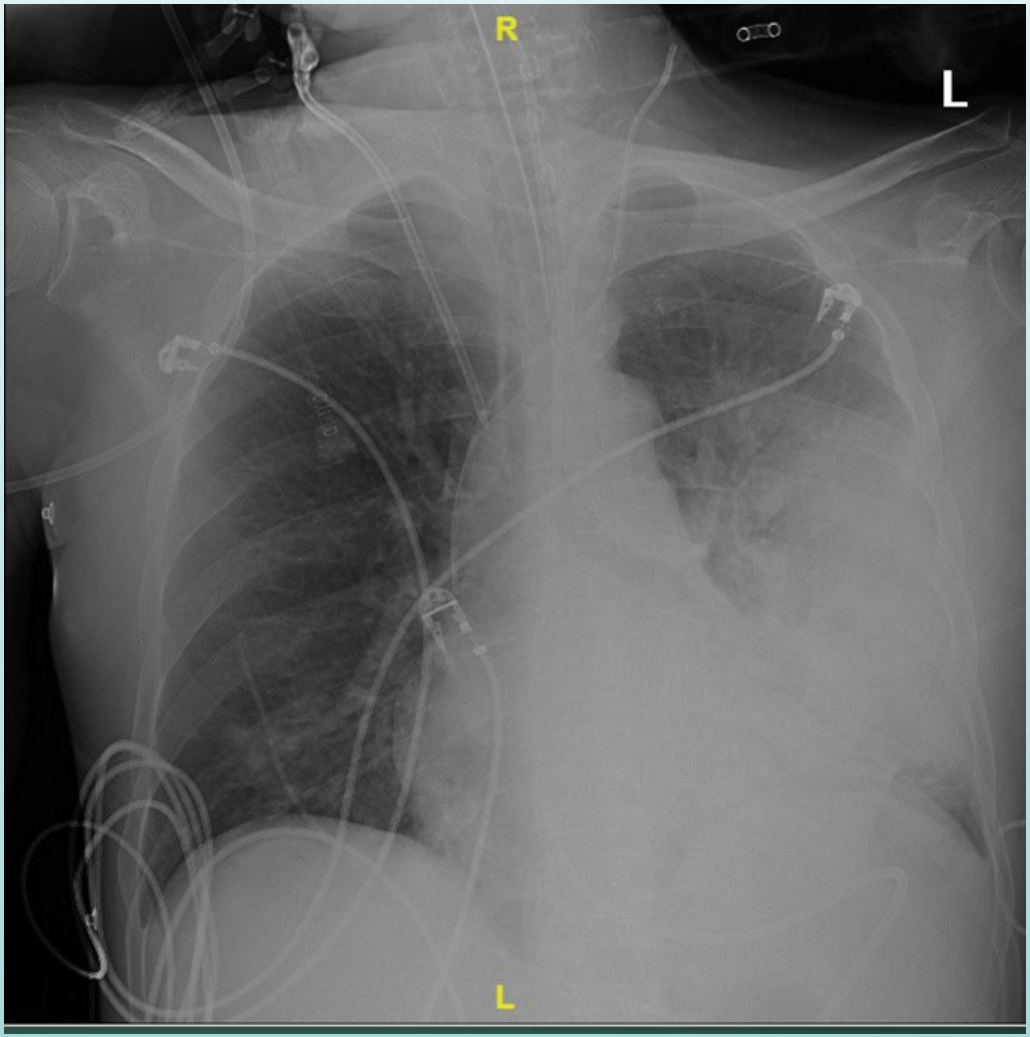
Carina between T6-T7



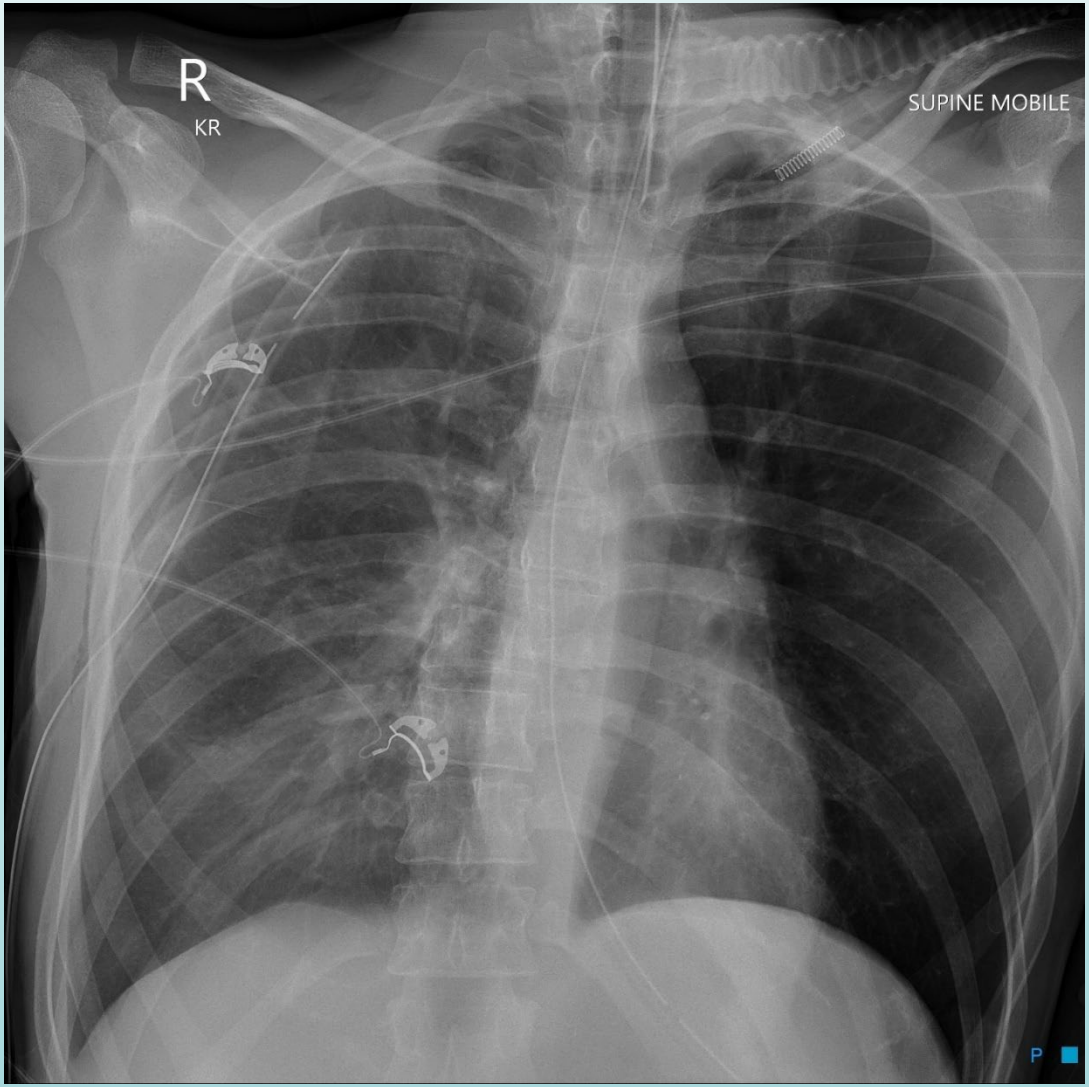
ETT Placement in the box



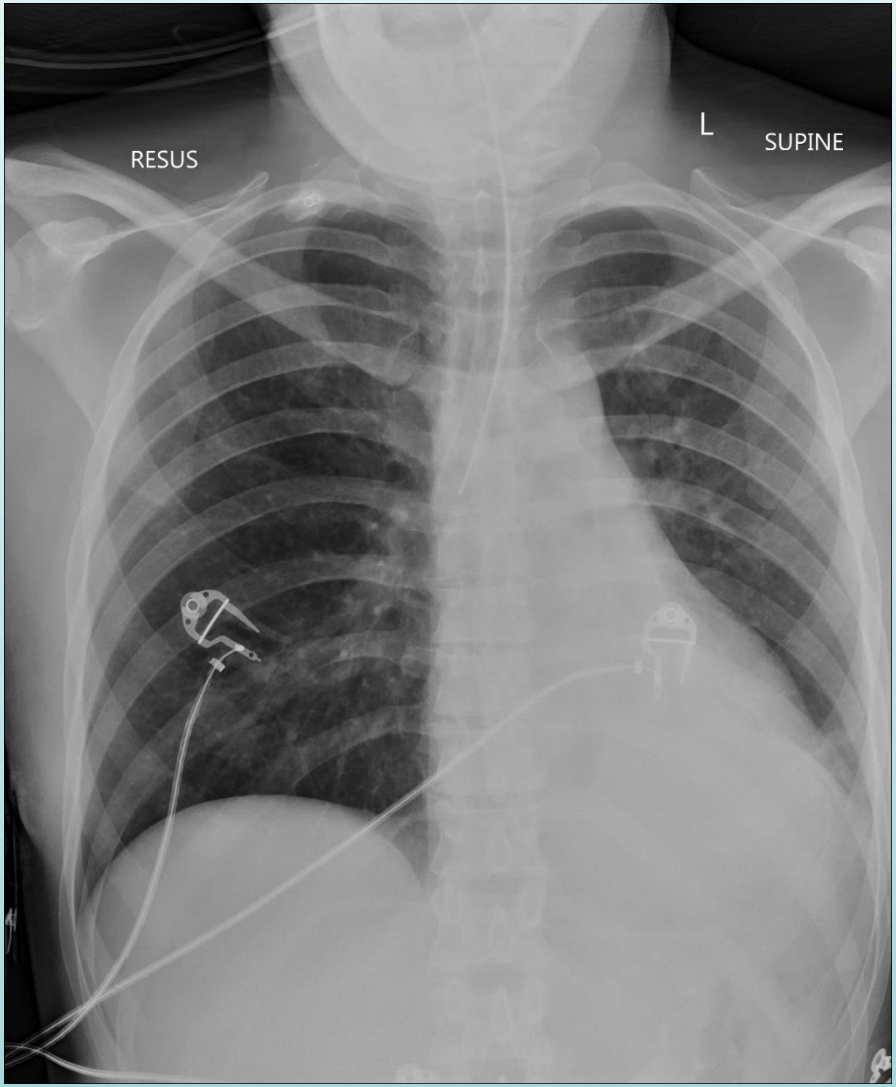
ETT Placement:
Just right



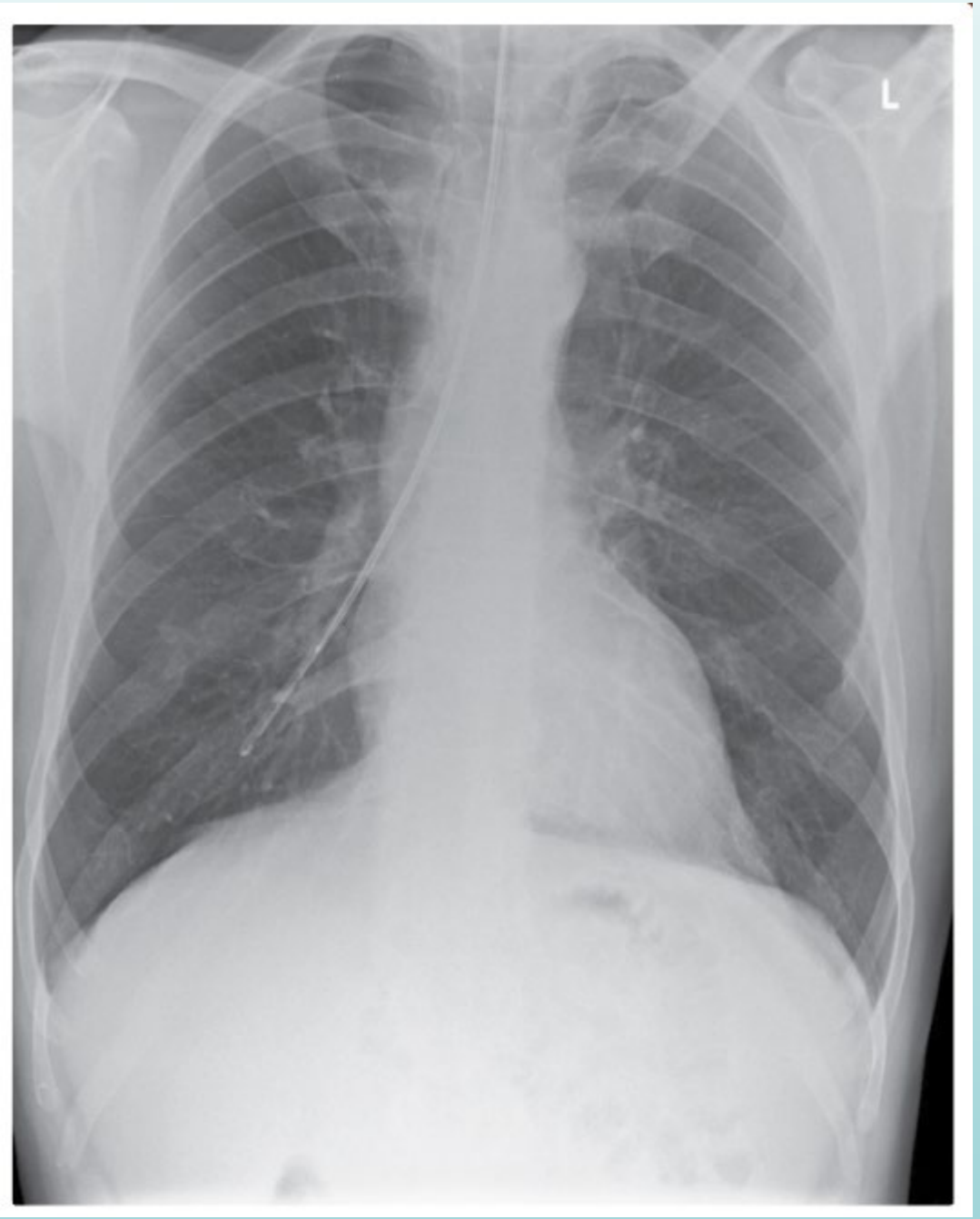
ETT Placement:
Too high



ETT Placement:
Too far down – In right mainstem



- What's Happening here?



# In Summary

Should RTs be competent in basic CXR analysis?

In these days of digital films, it's easier than ever to look at CXRs

Look at the chest X-ray, It will be immensely helpful in guiding your practice

Questions?