

Chest Imaging Review

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Disclosures

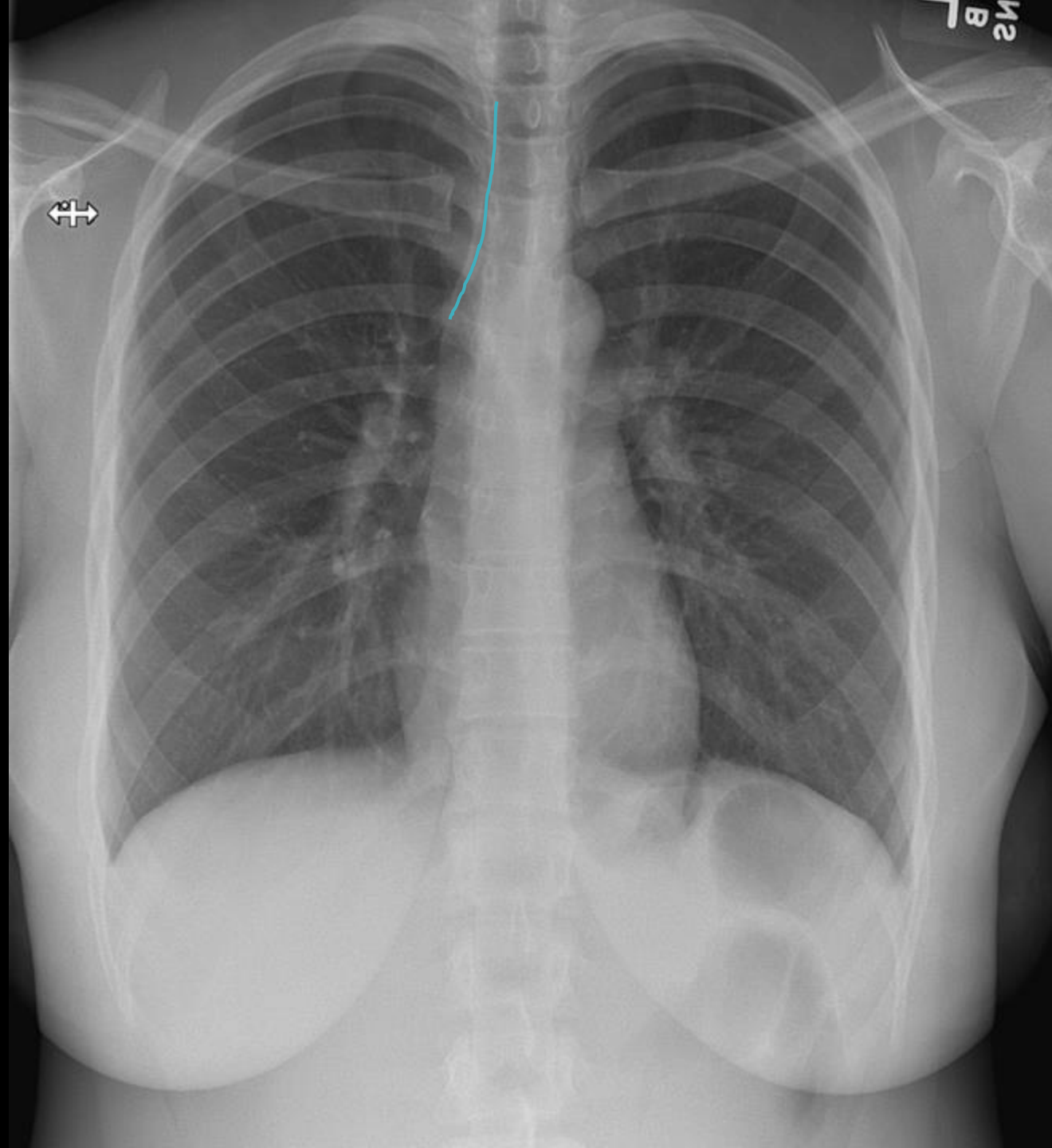
No relevant commercial relationships to disclose.

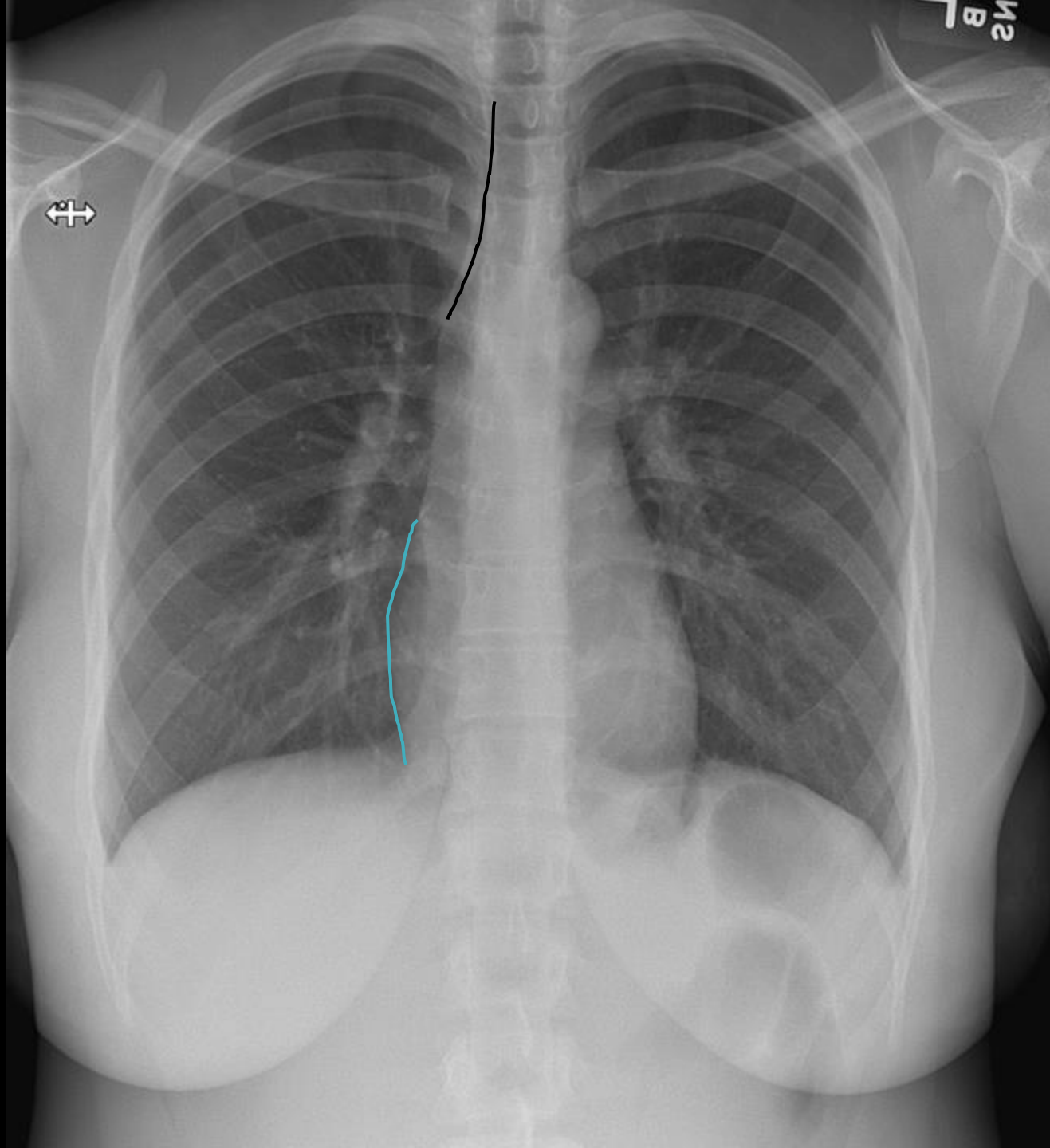
Learning Objectives

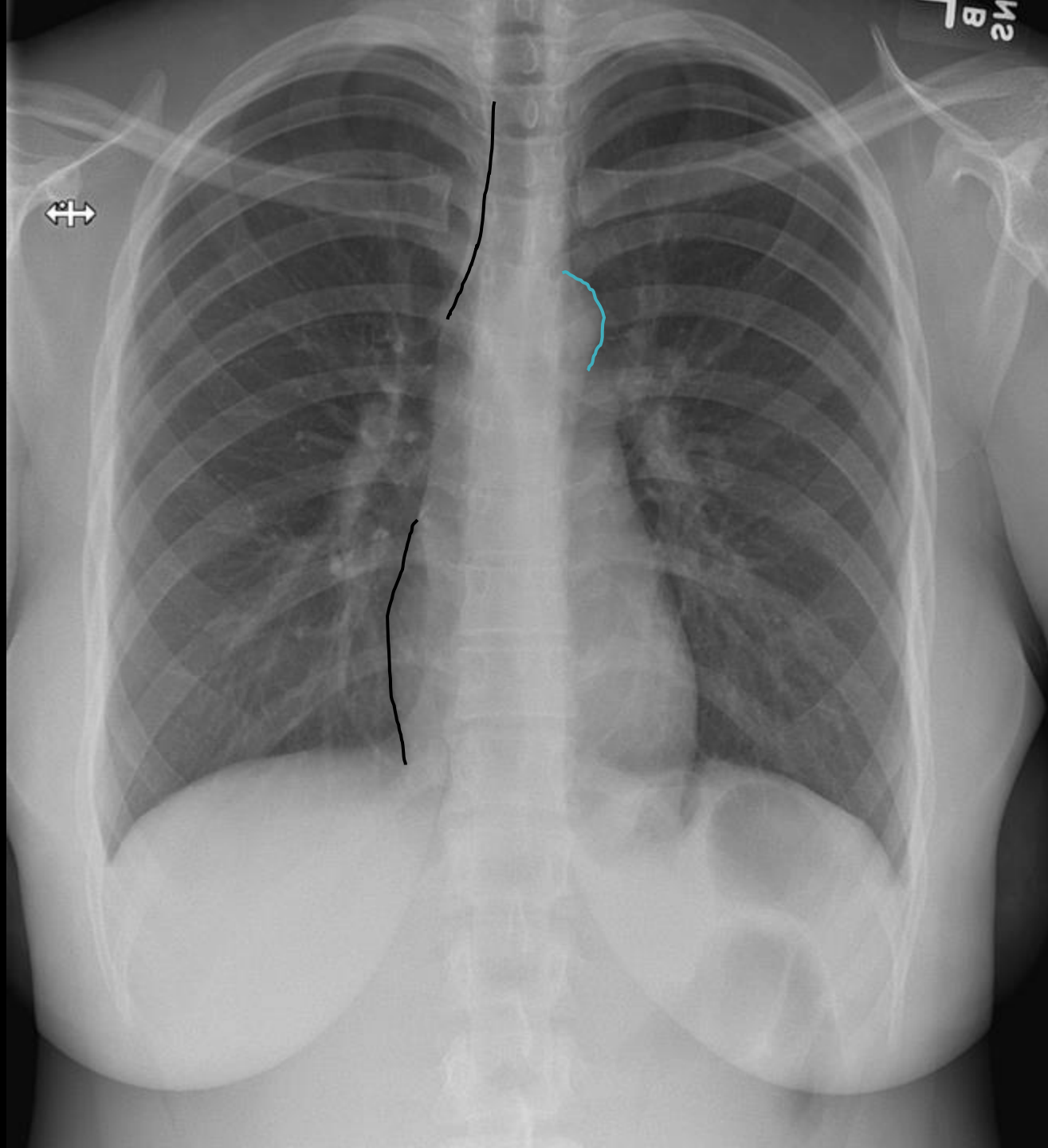
- Identify important anatomy on CXR
- Implement a CXR search pattern and a chest CT search pattern
- Identify and evaluate typical support devices seen on CXR
- Diagnose common pathologies seen on CXR
- Diagnose common pathologies seen on chest CT

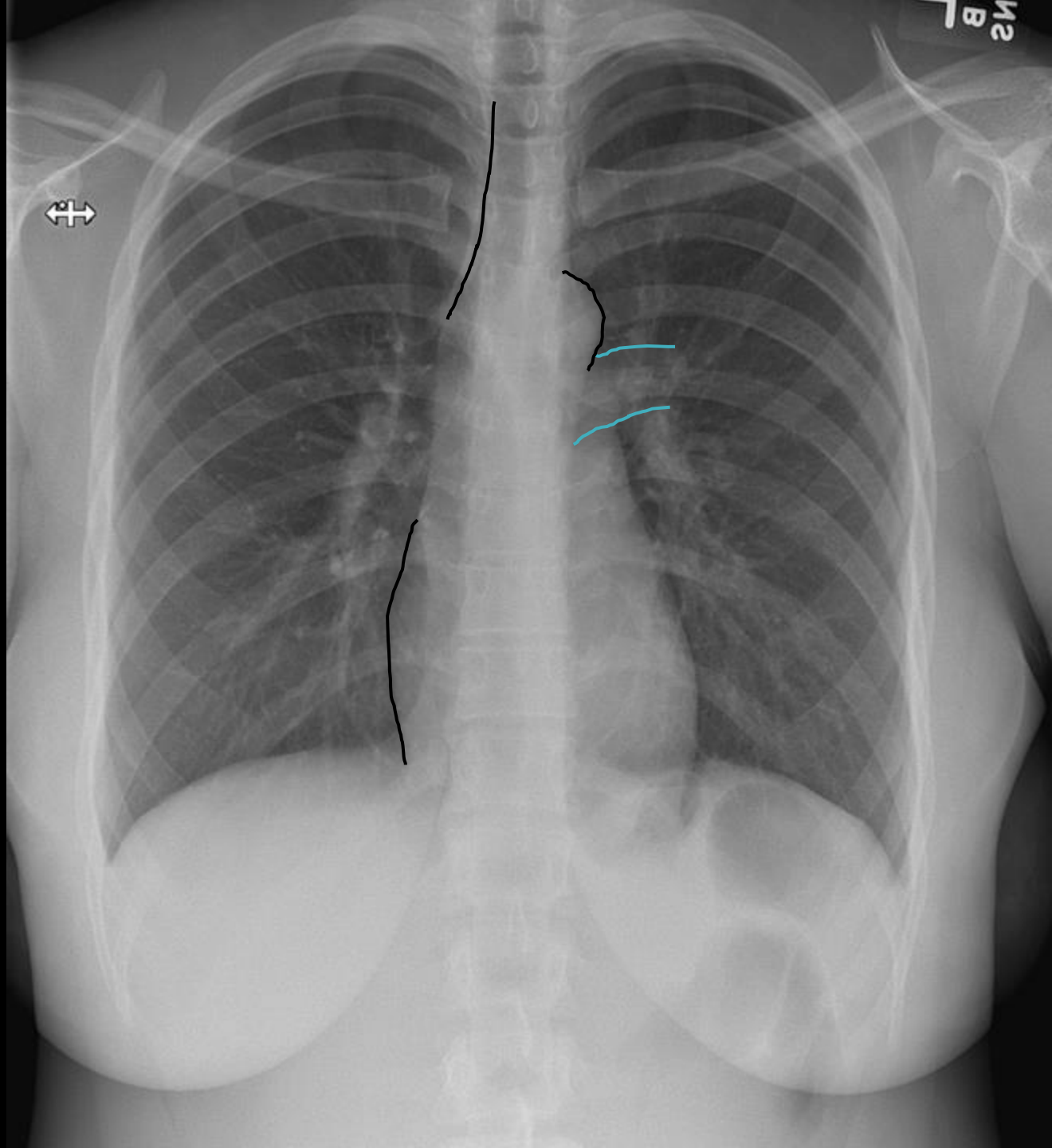
CXR Anatomy

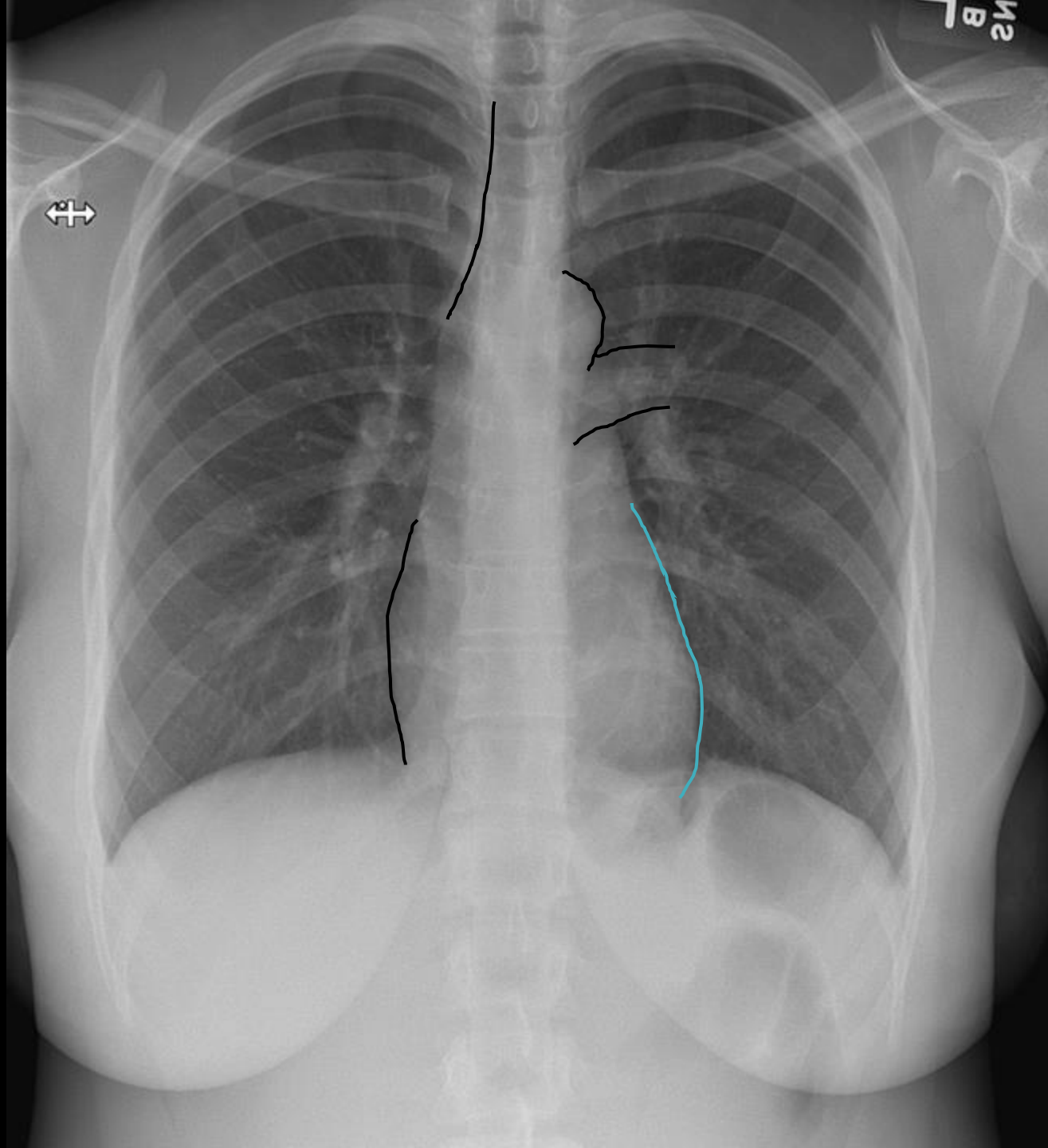
Frontal view (AP or PA)

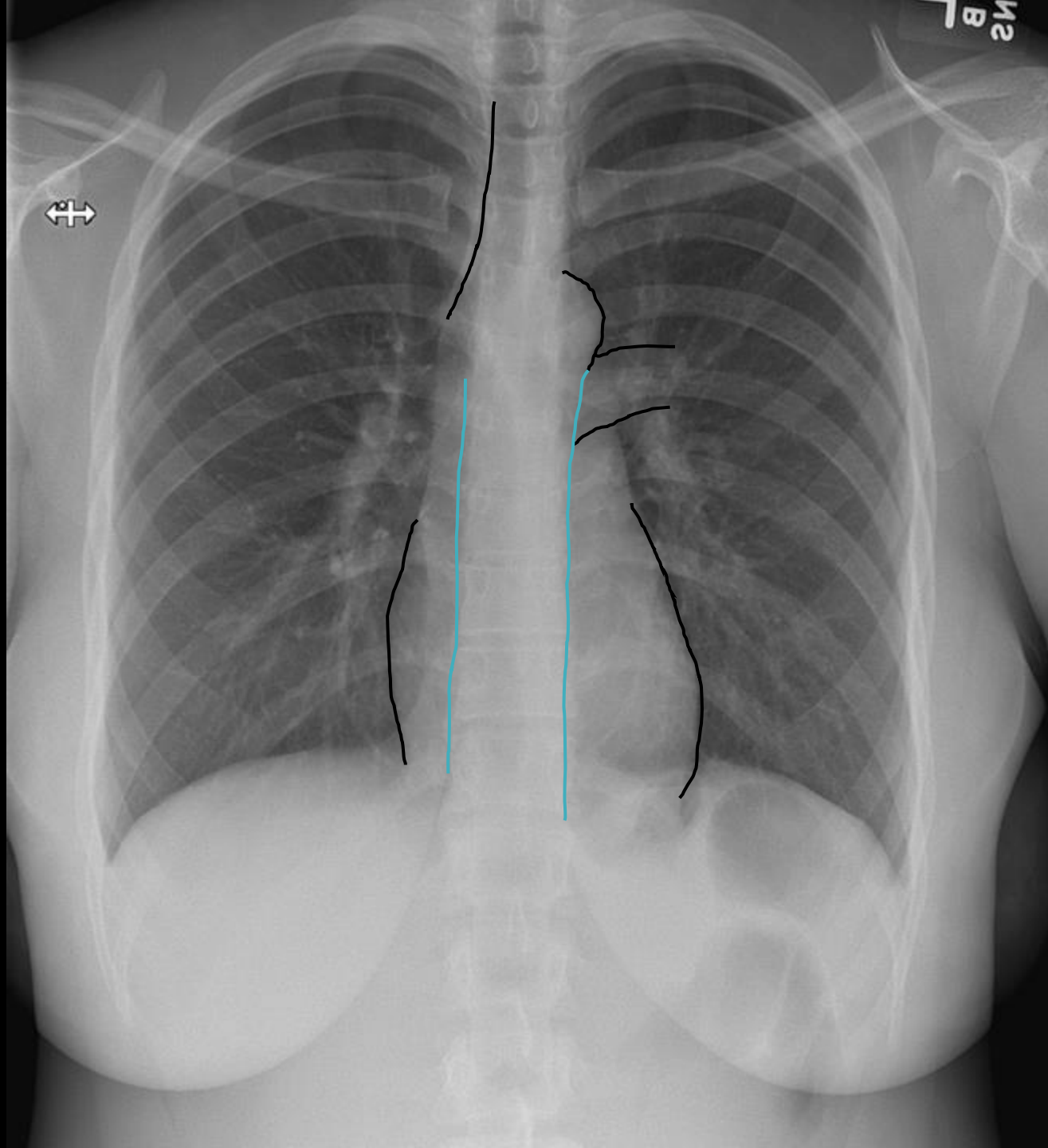


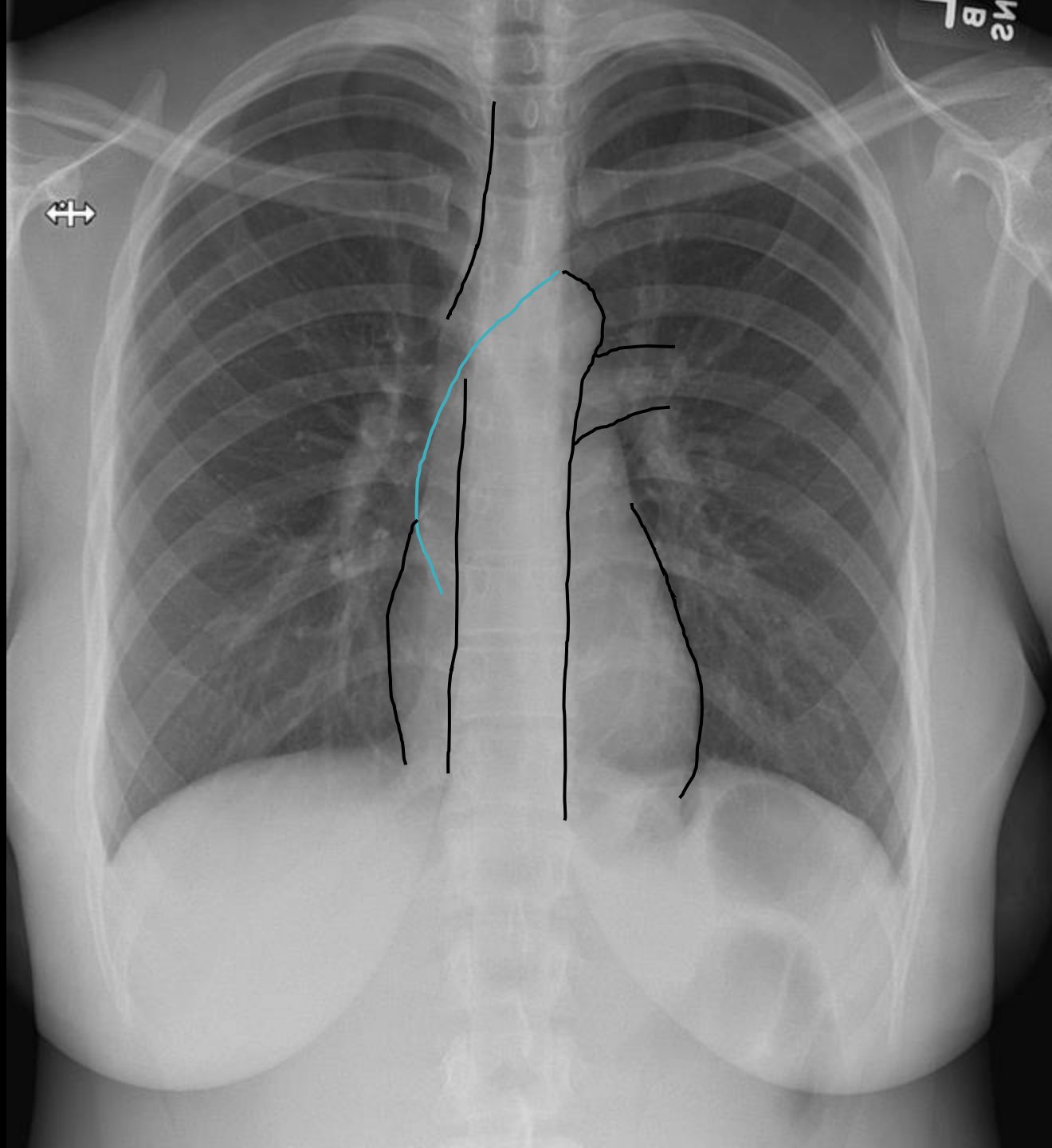


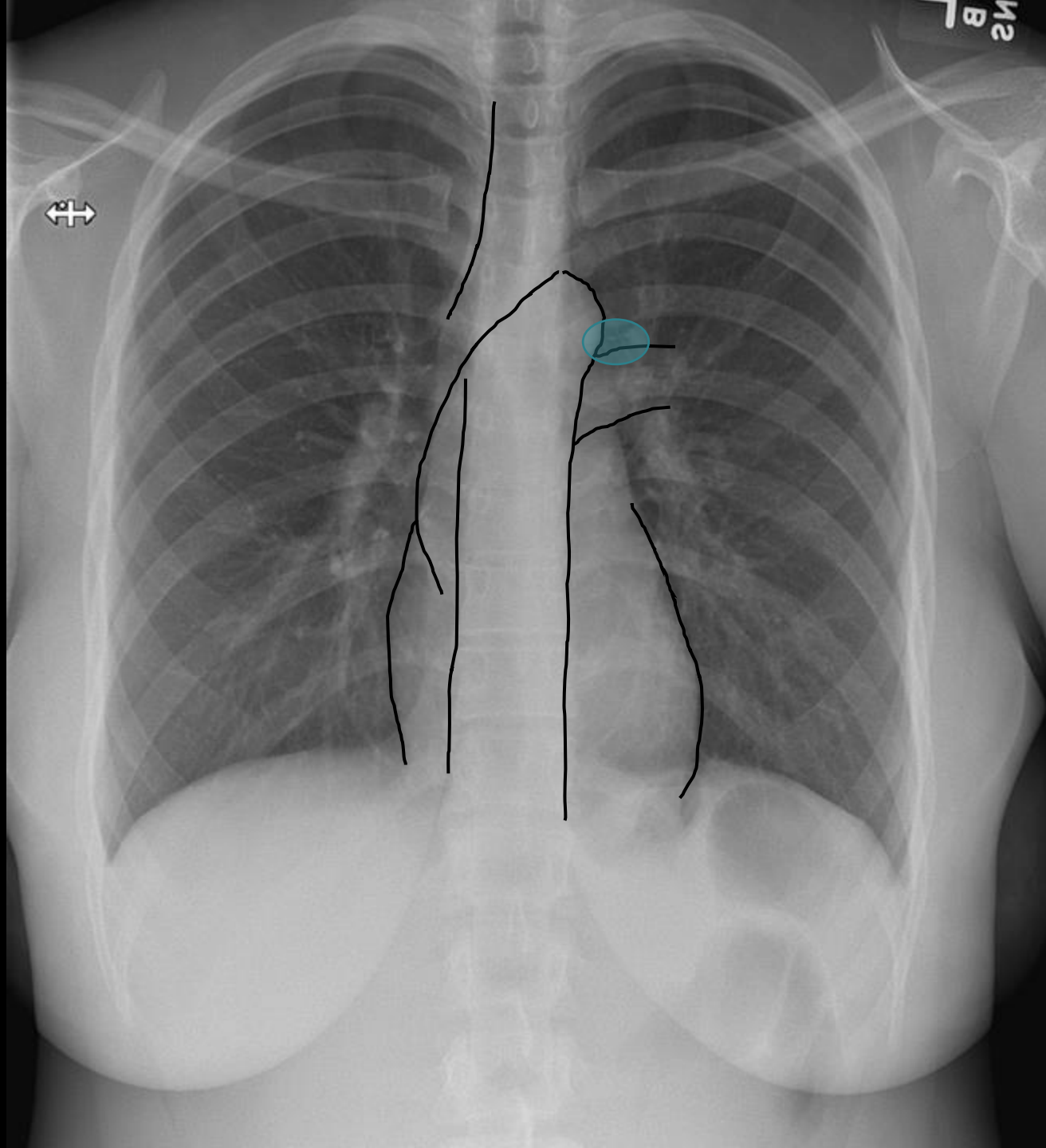


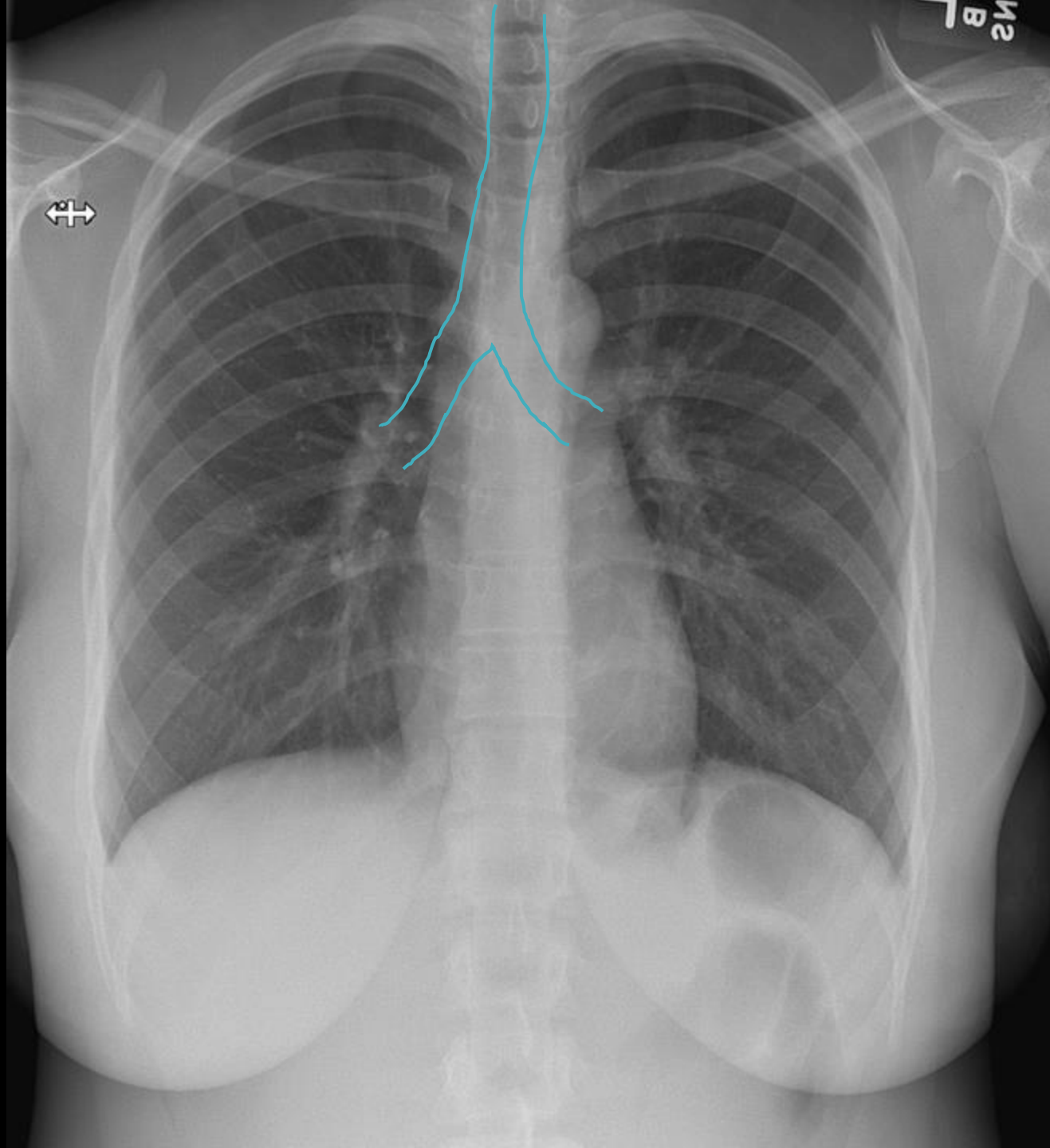


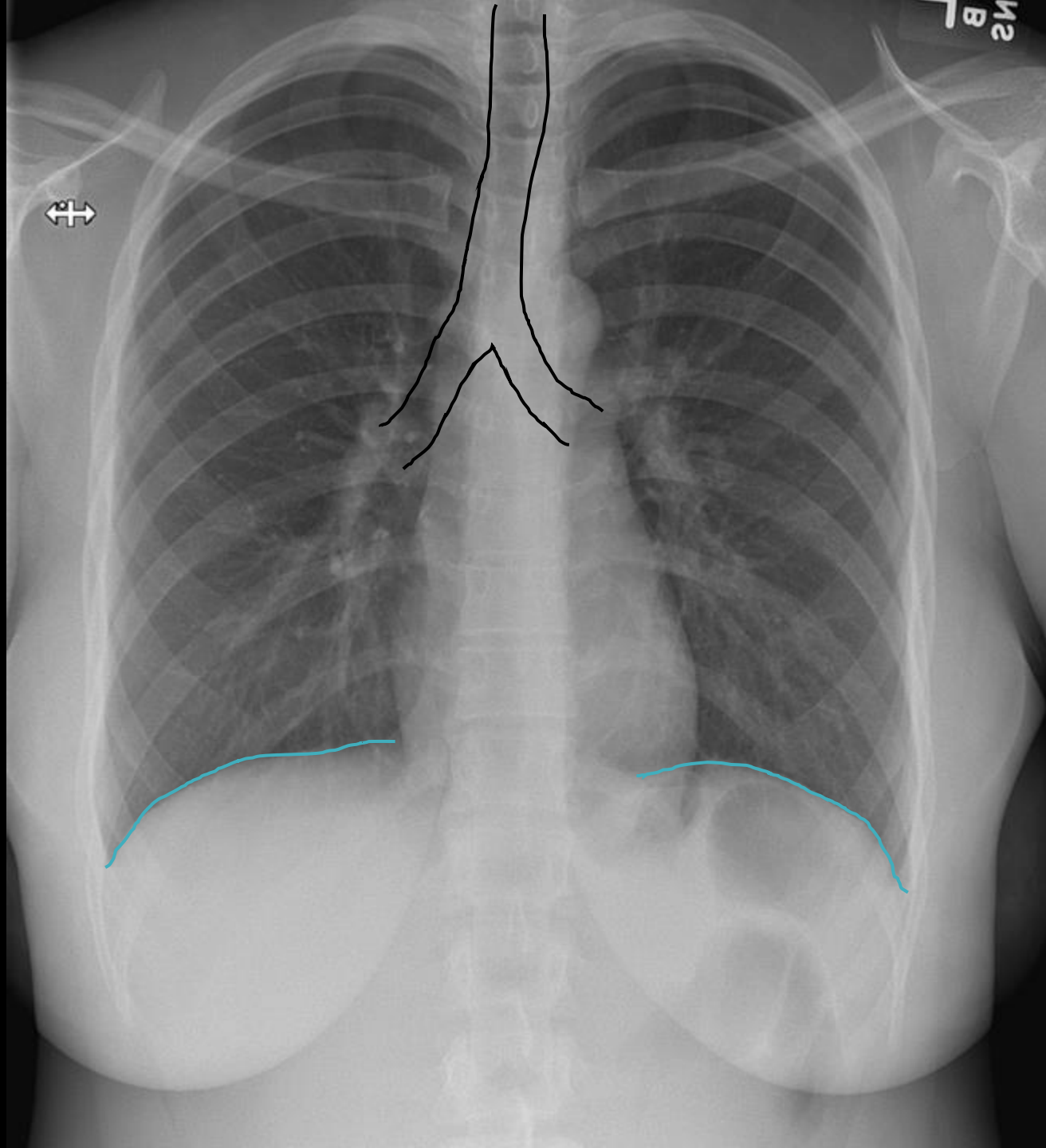






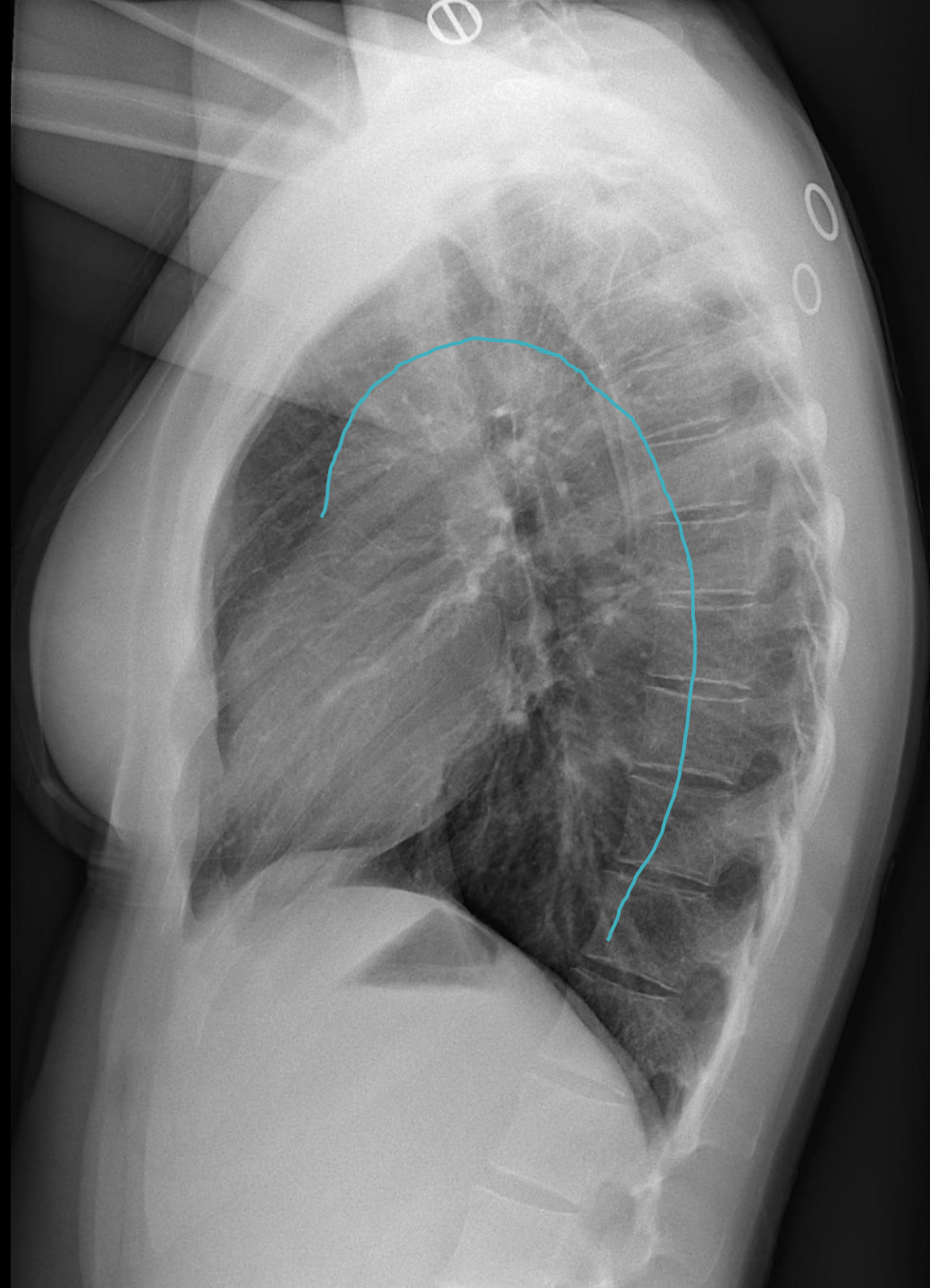


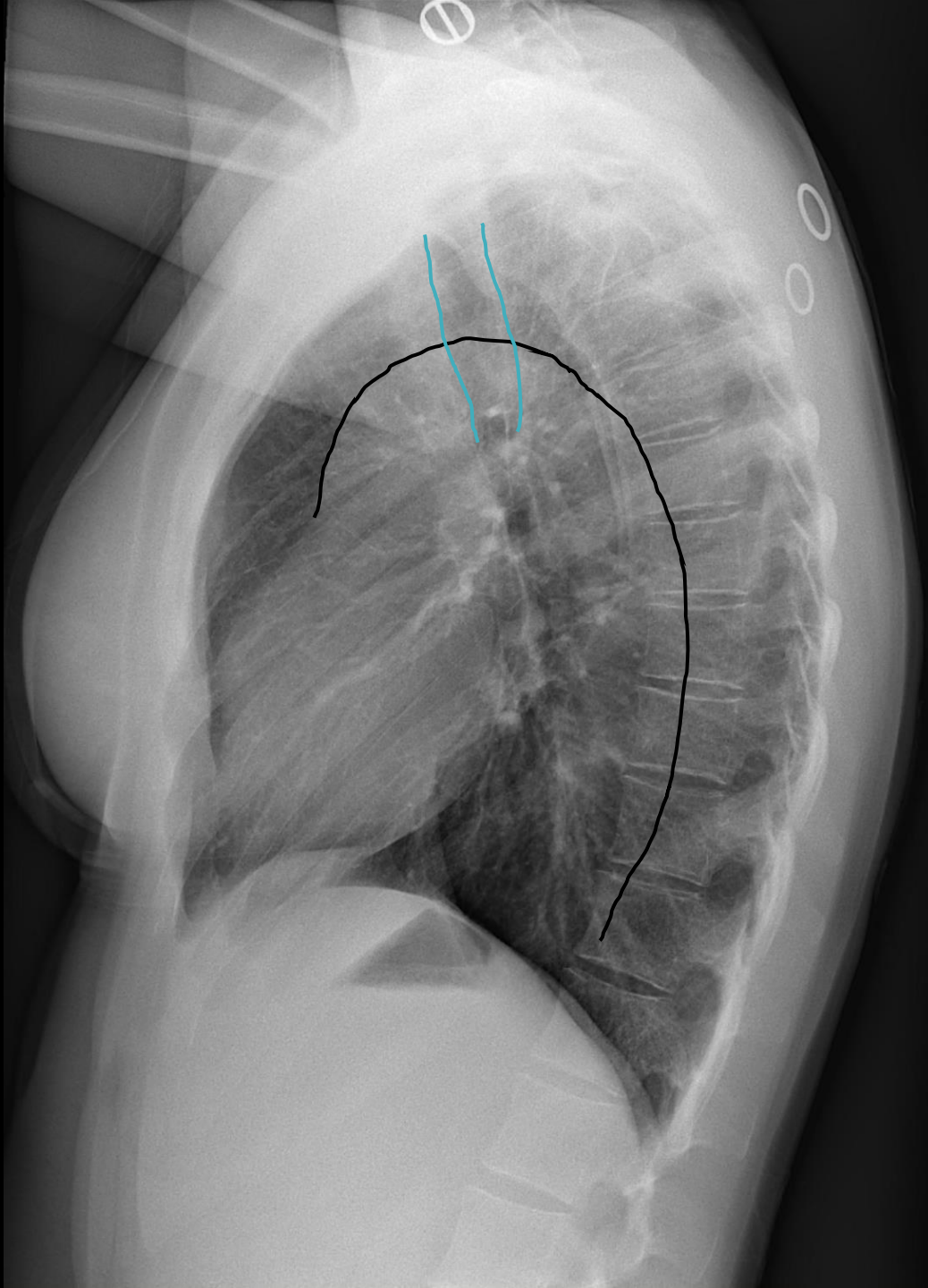


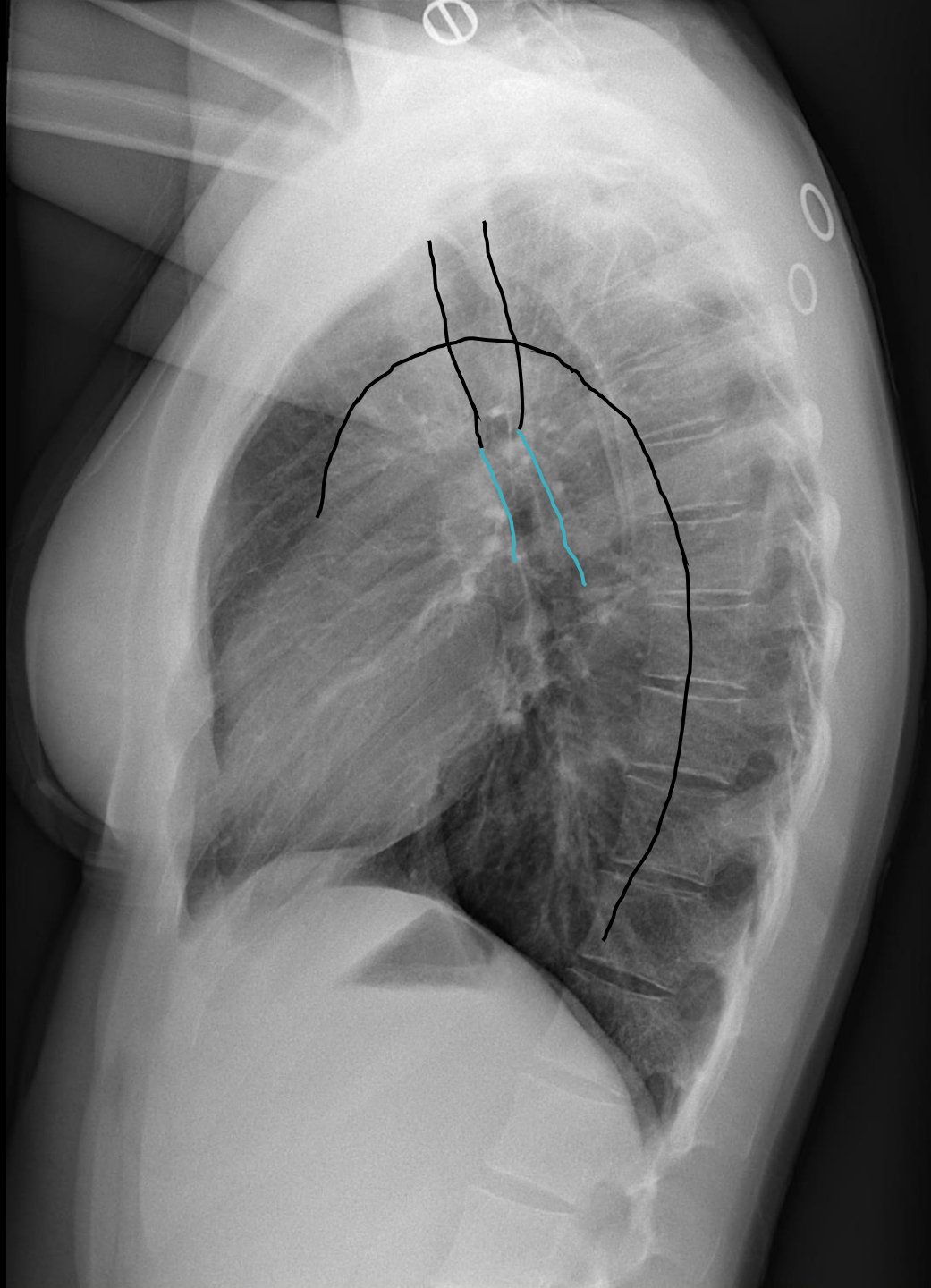


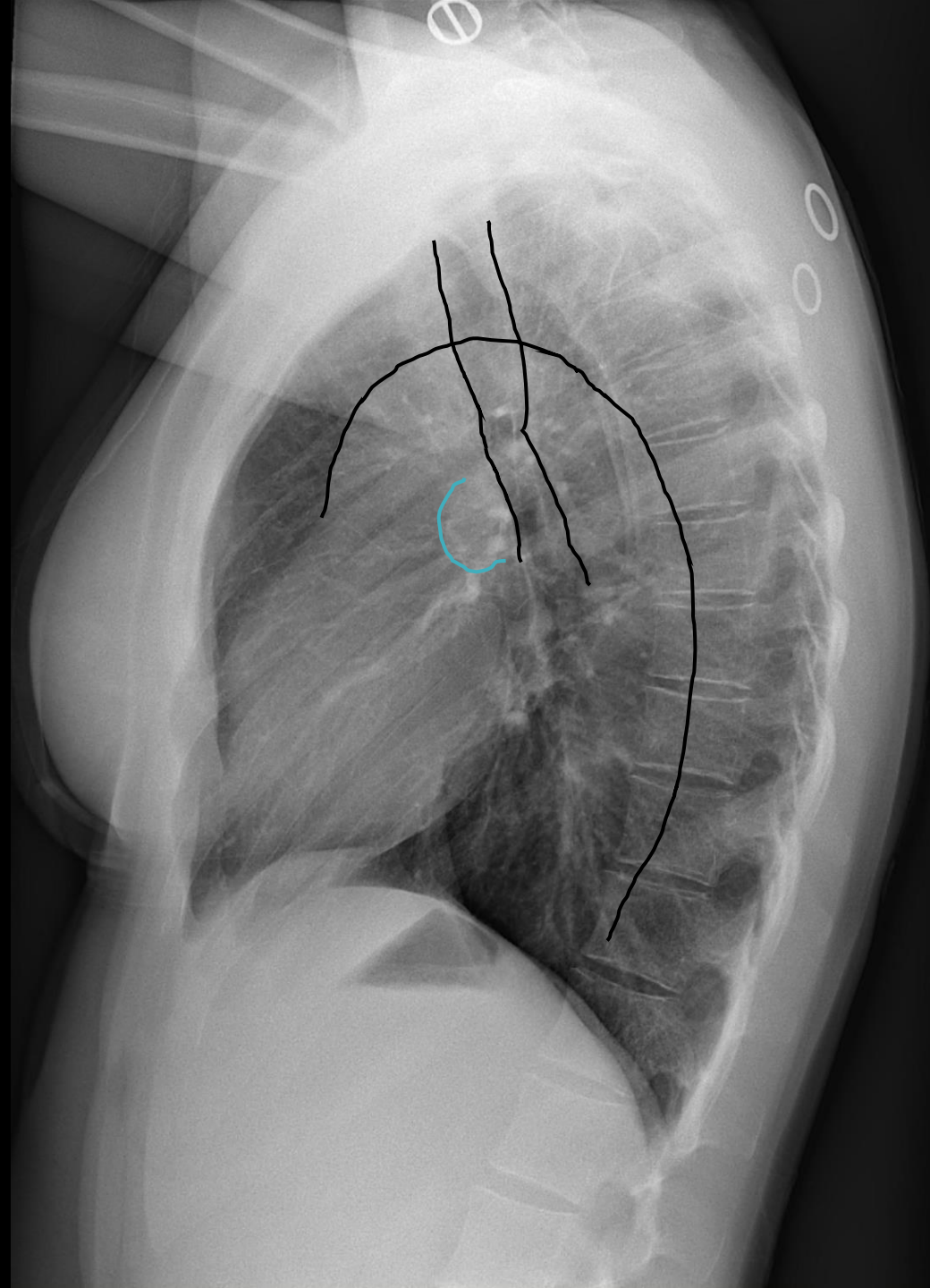
CXR Anatomy

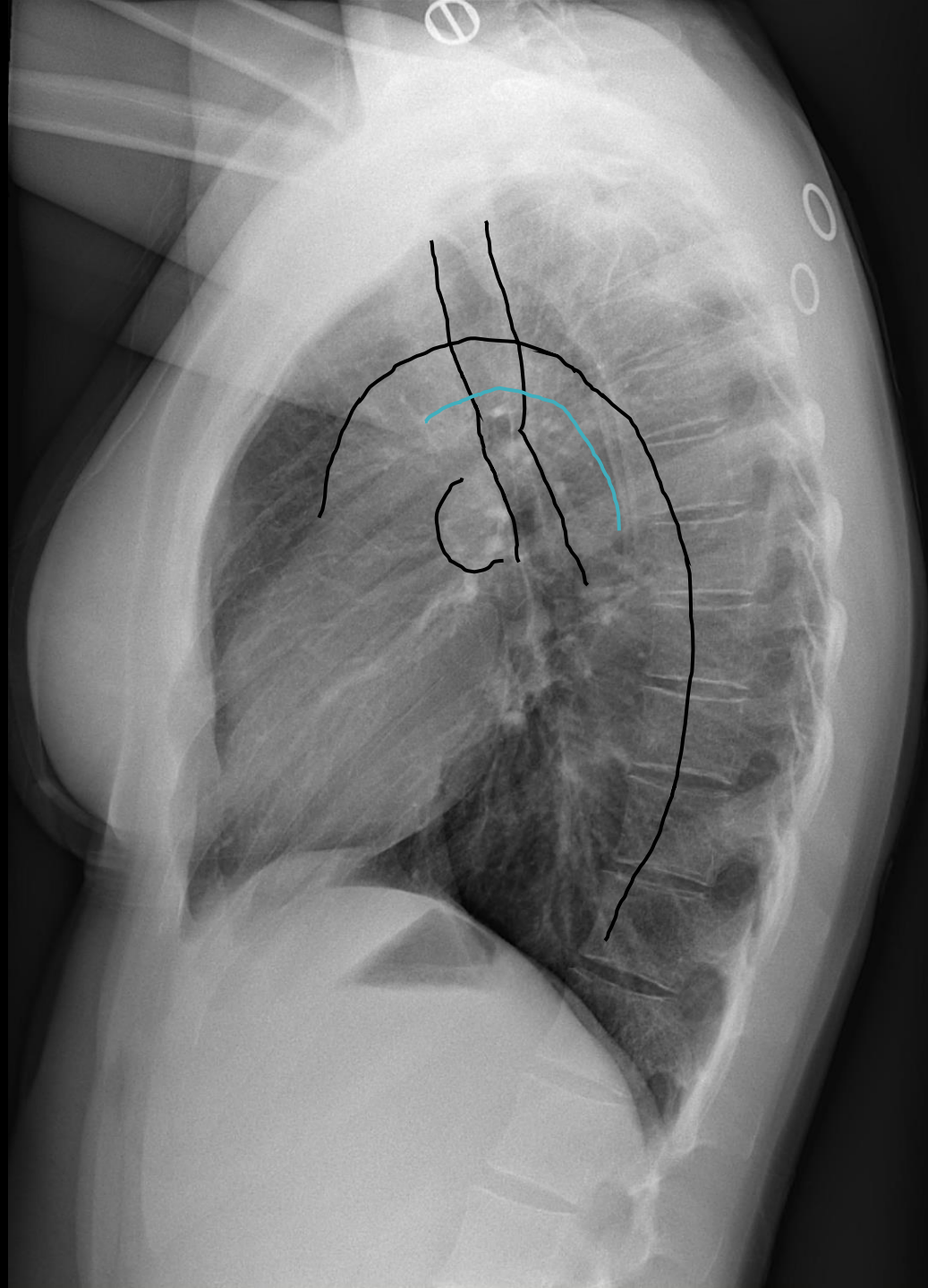
Lateral view

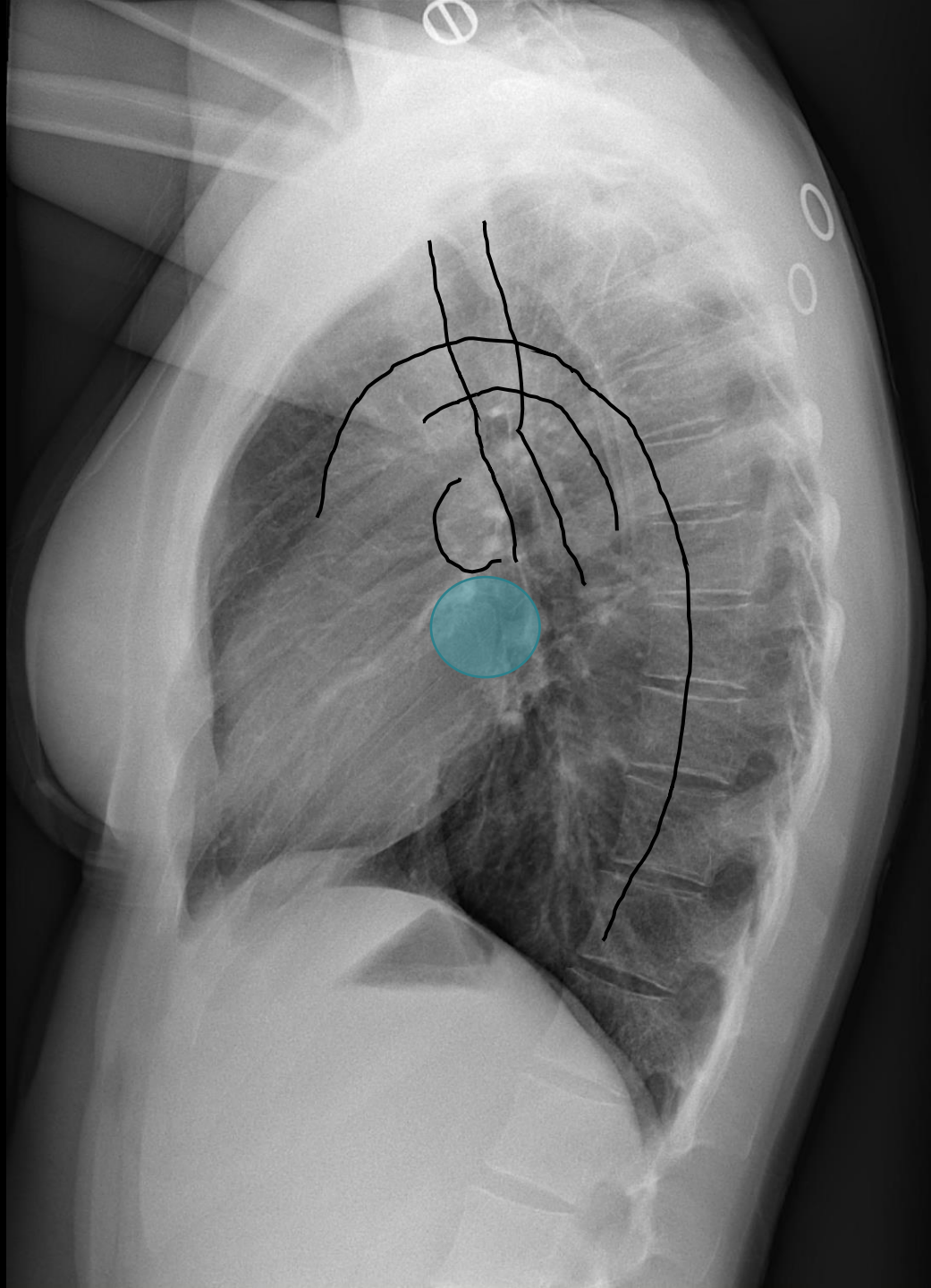


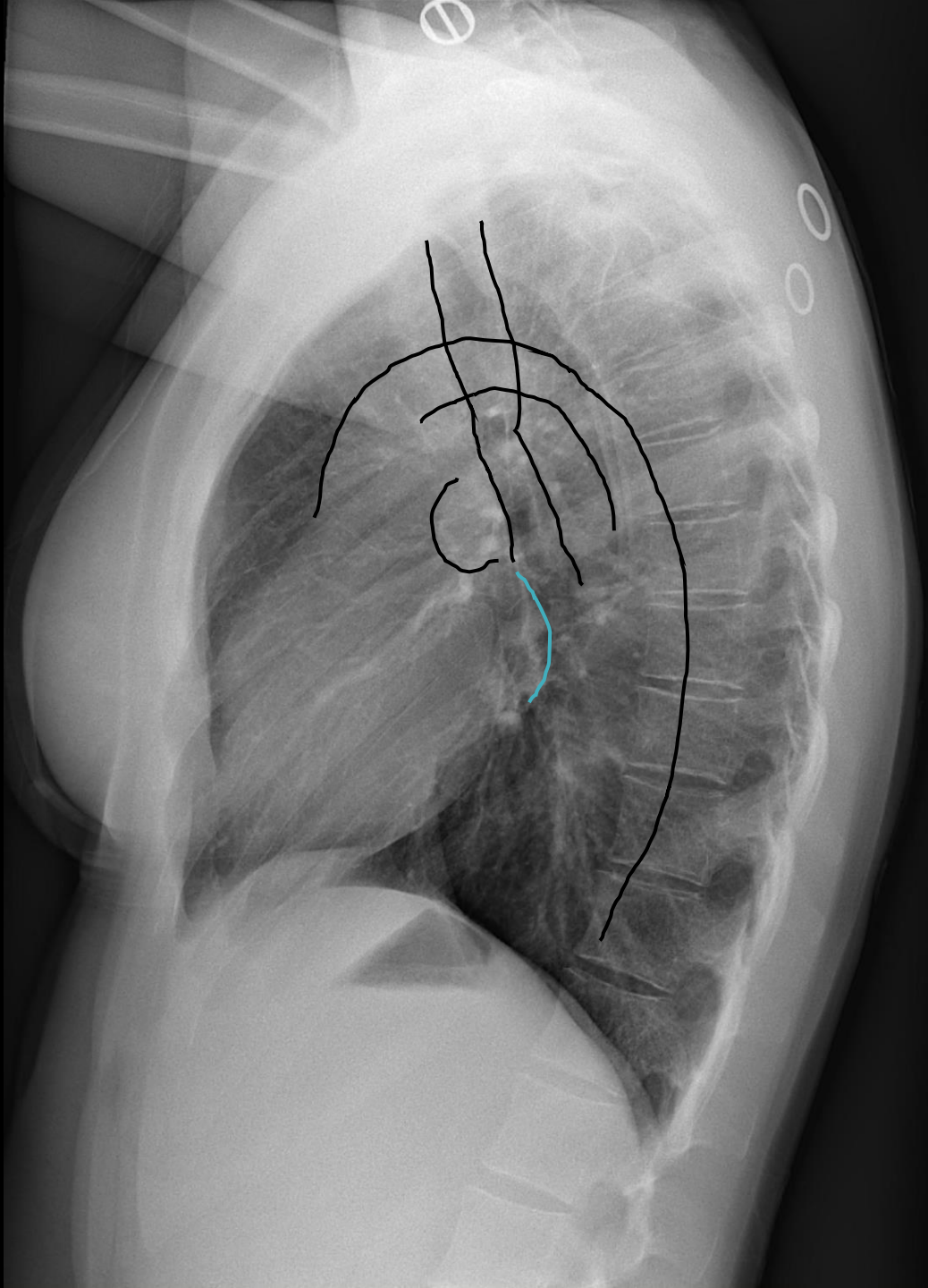


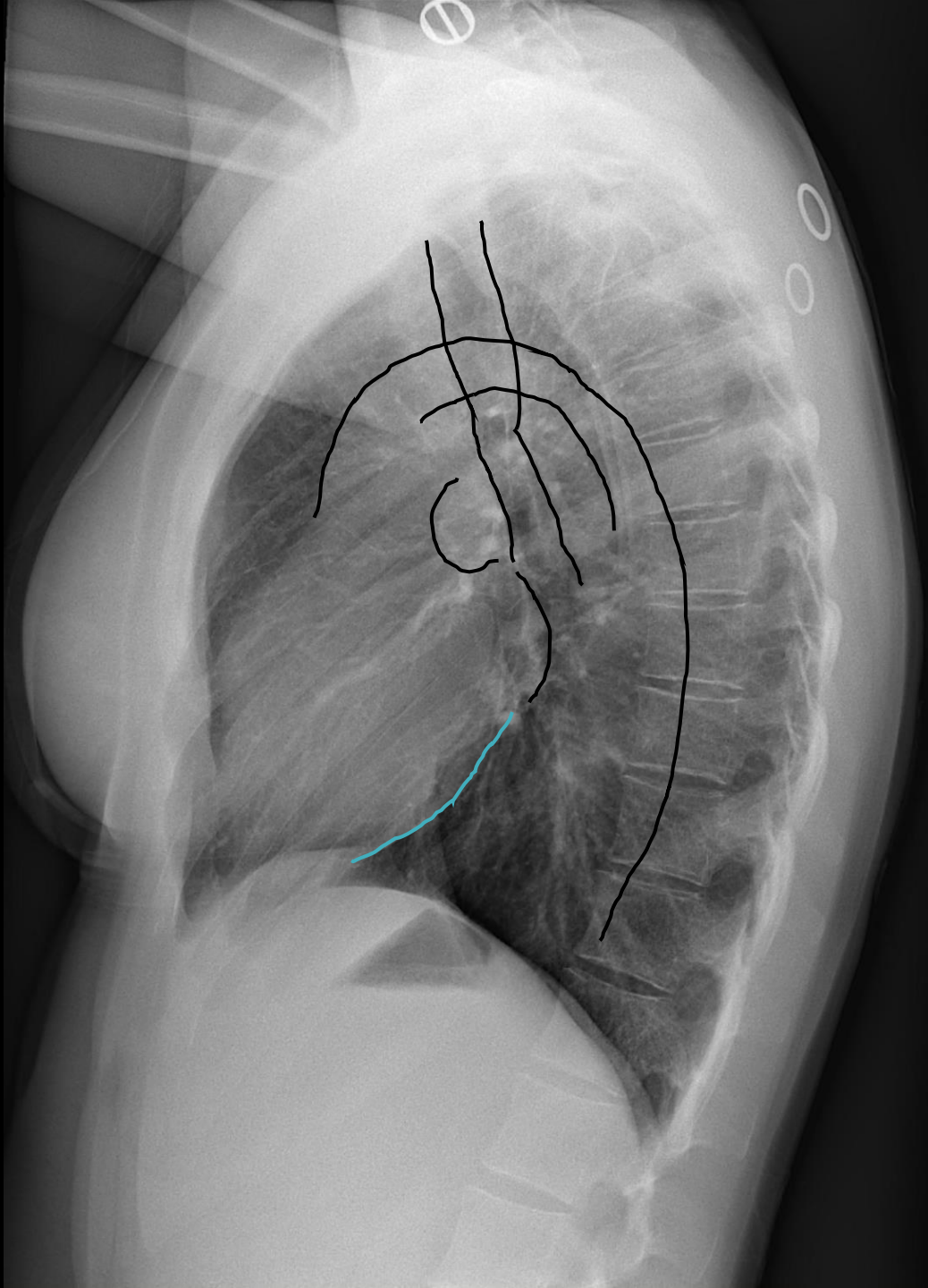


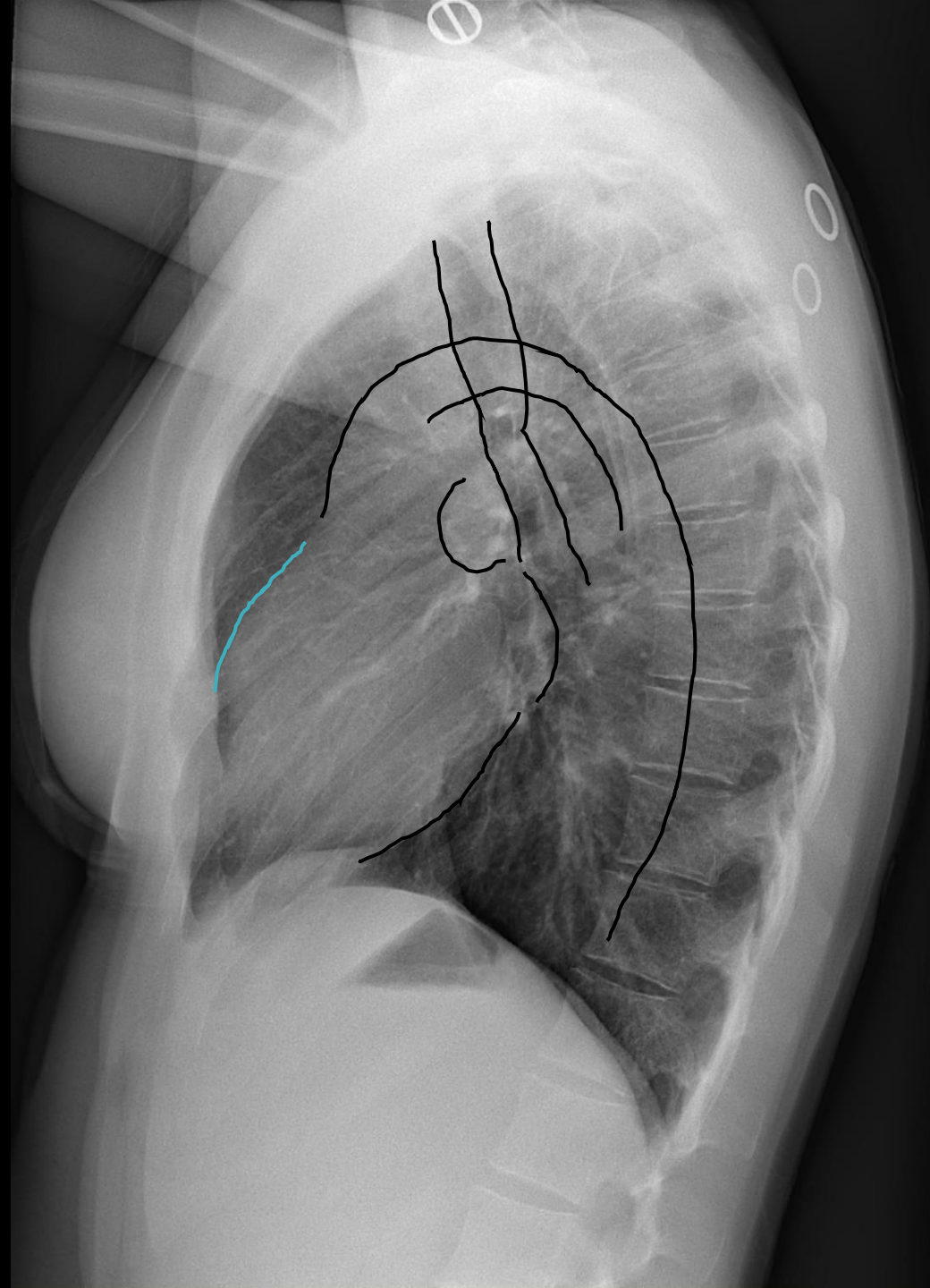


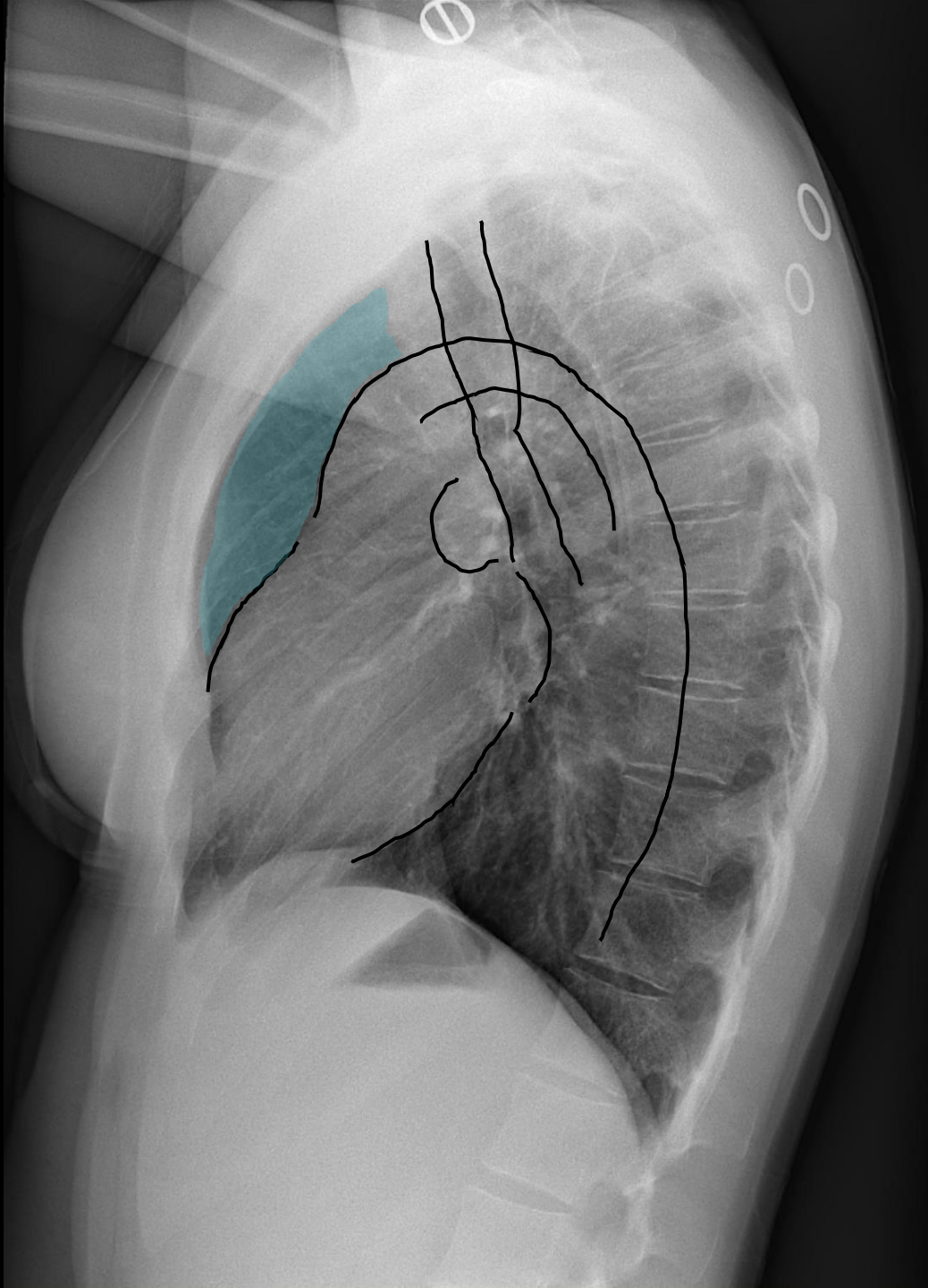


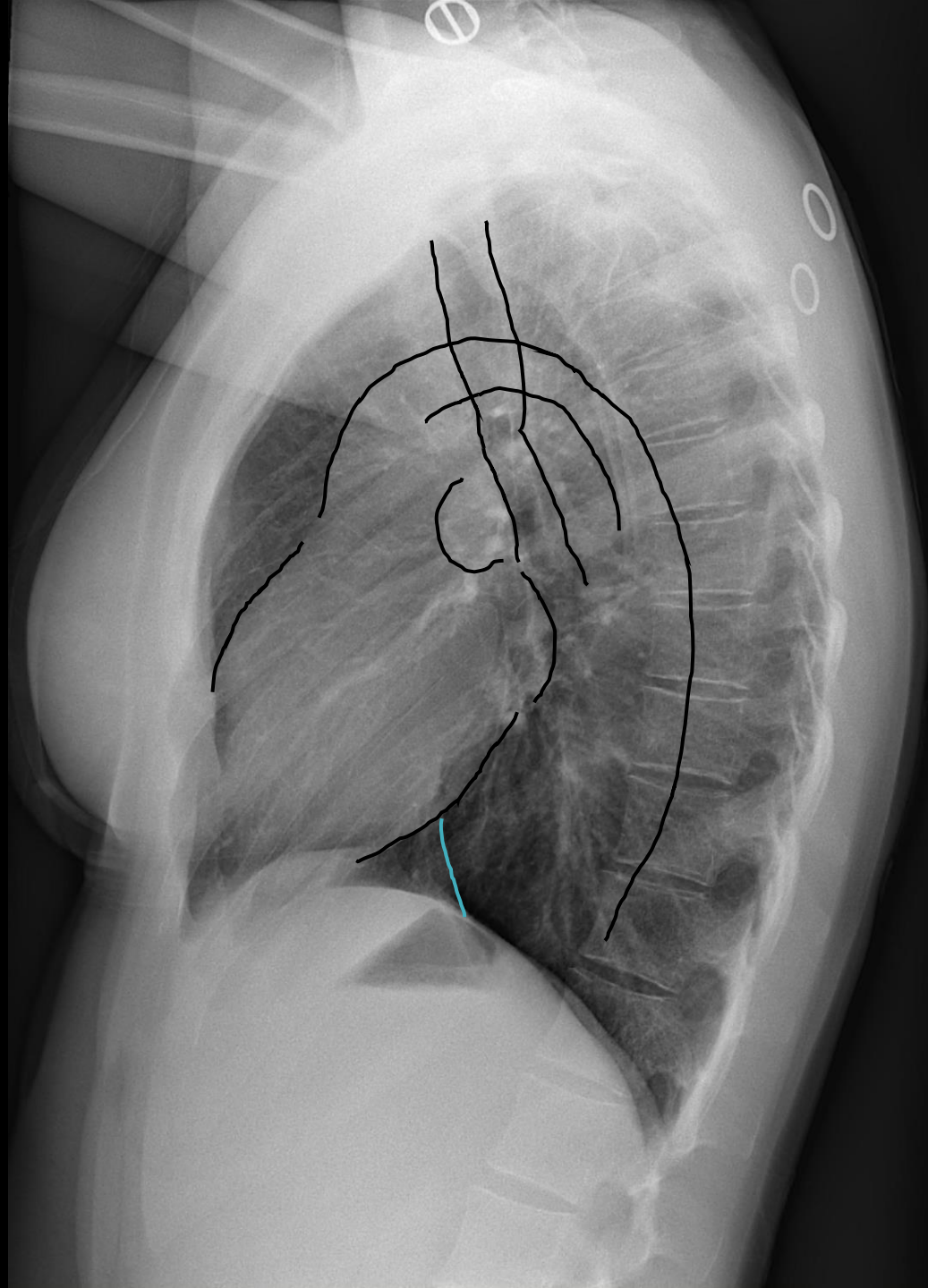


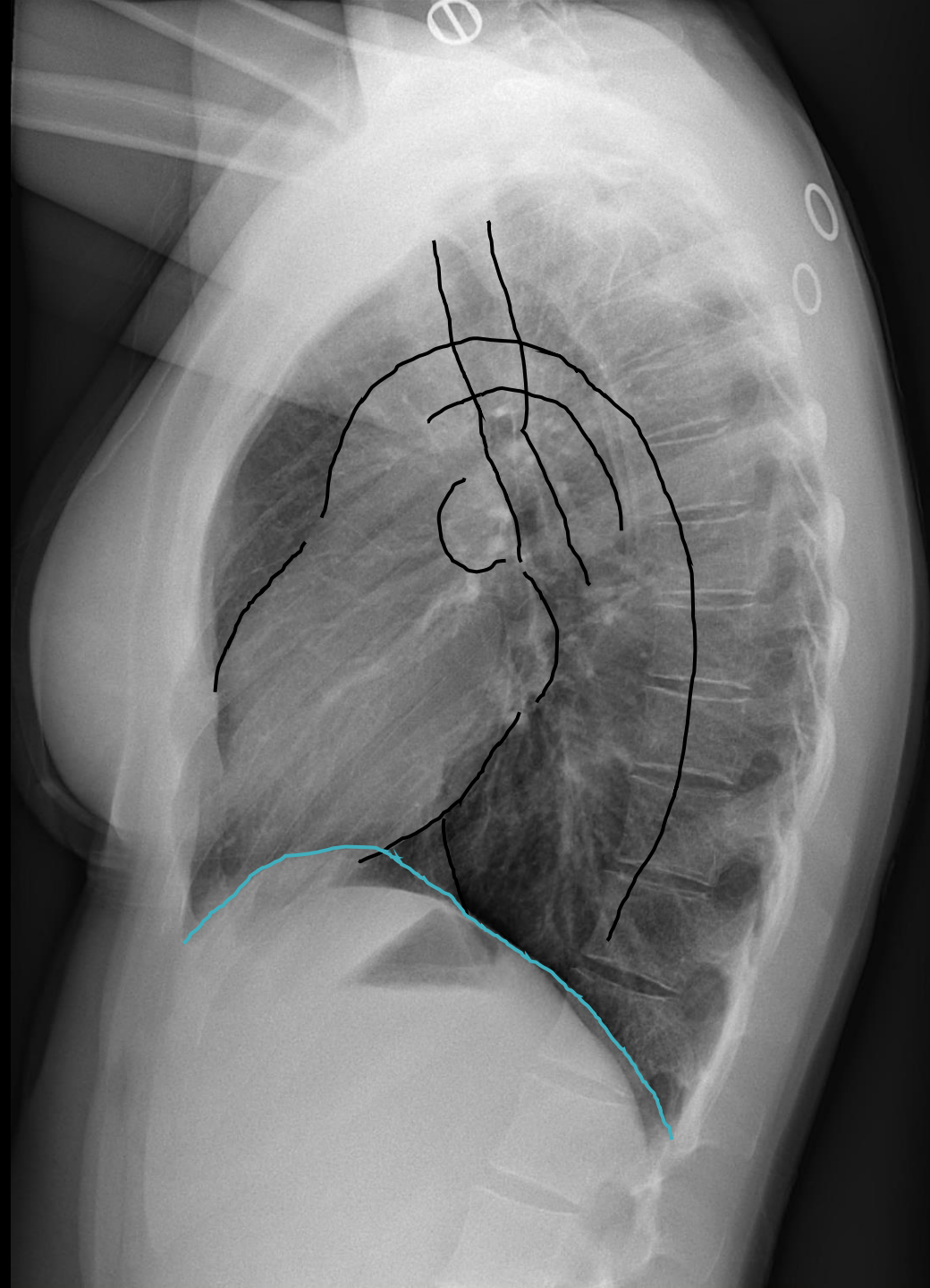


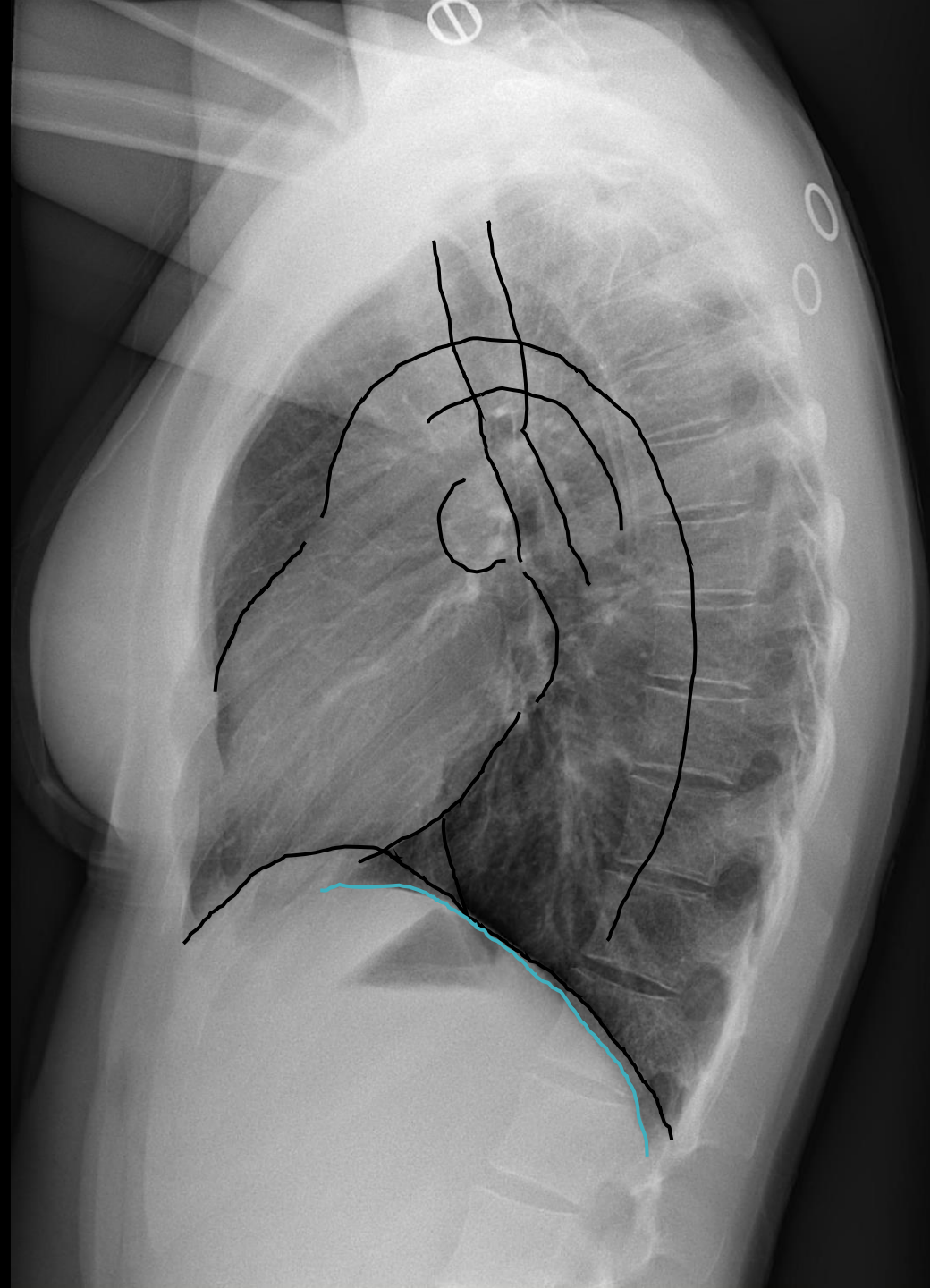


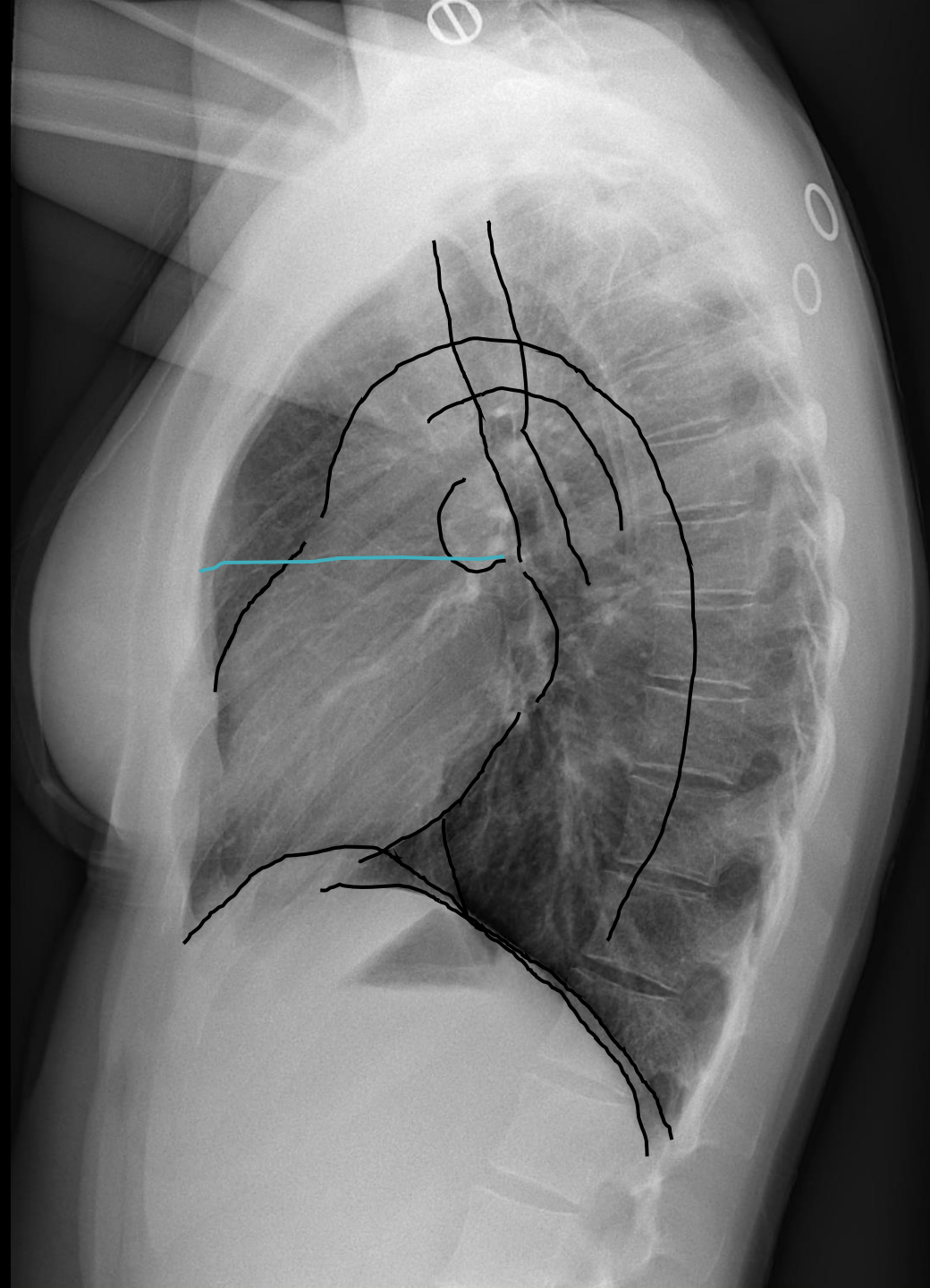


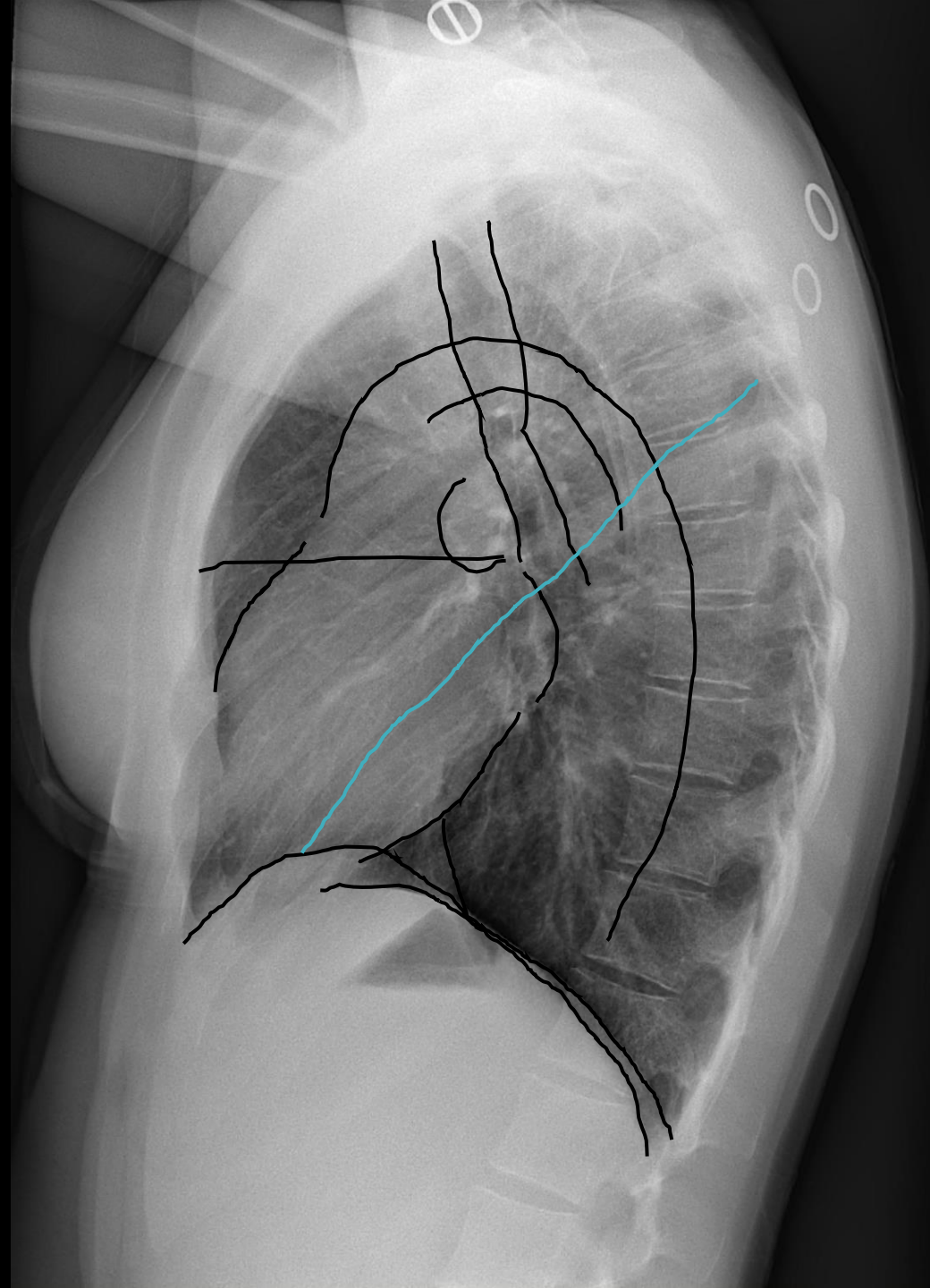












CXR Search Pattern

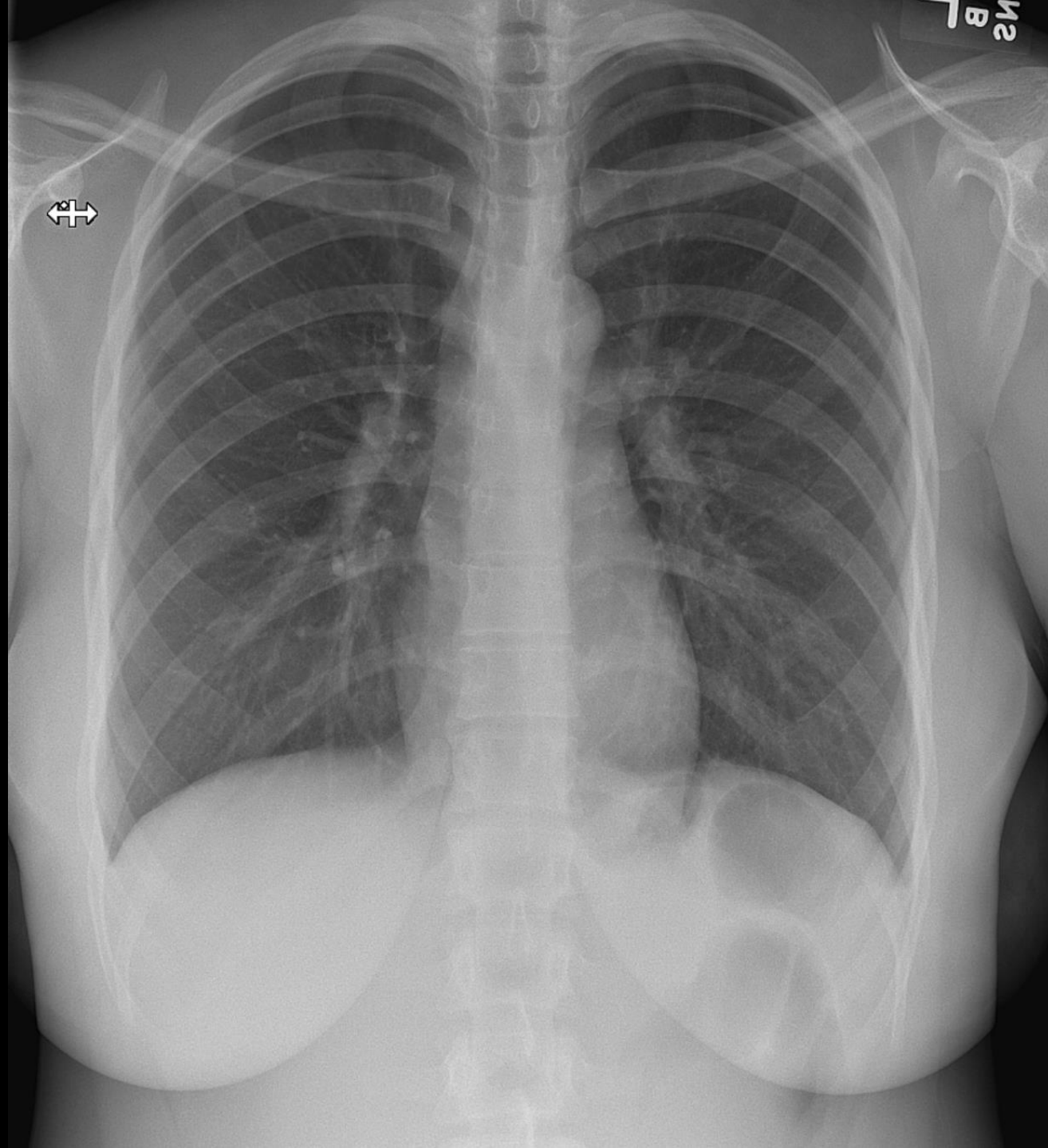
Just have one!

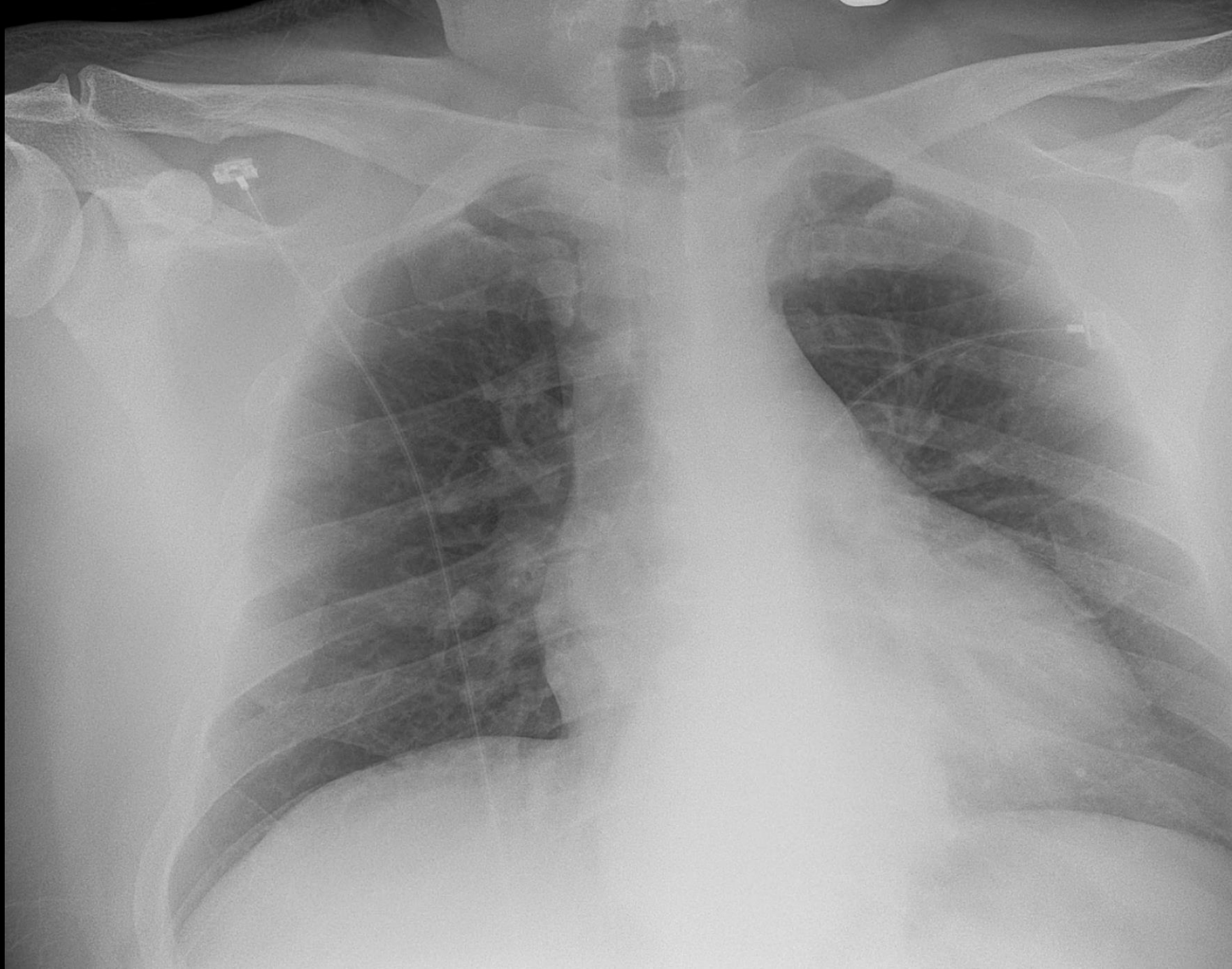
ABC

- A: Airway, Access
- B: Bones
- C: Cardiomeastinal silhouette
- D: Diaphragm
- E: Edges
- F: (lung) Fields
- G: Gut
- H: Hilum

Set the stage

- **Technique:** Position, exposure
- **Compare** to priors!



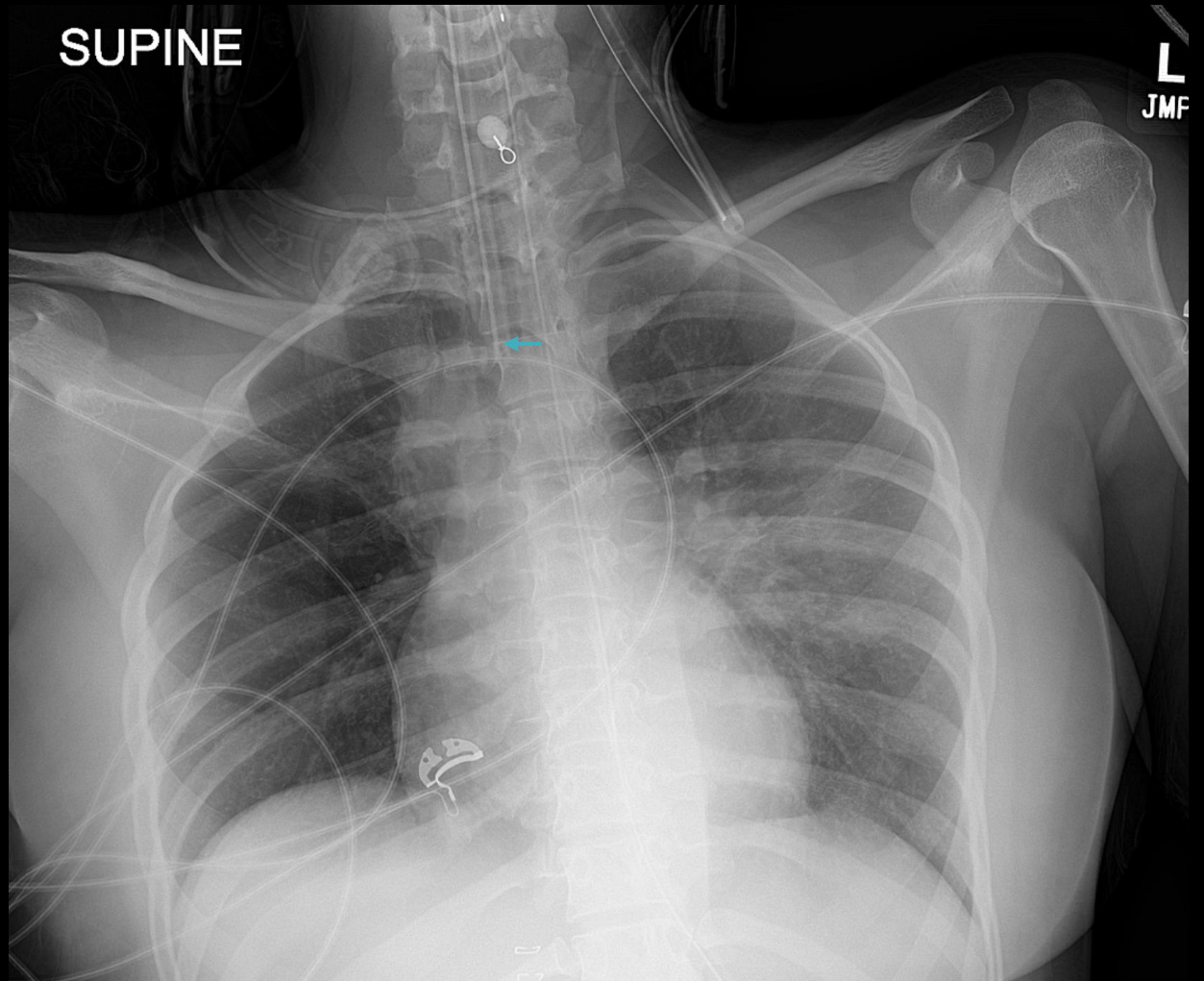


A: Access / Airway

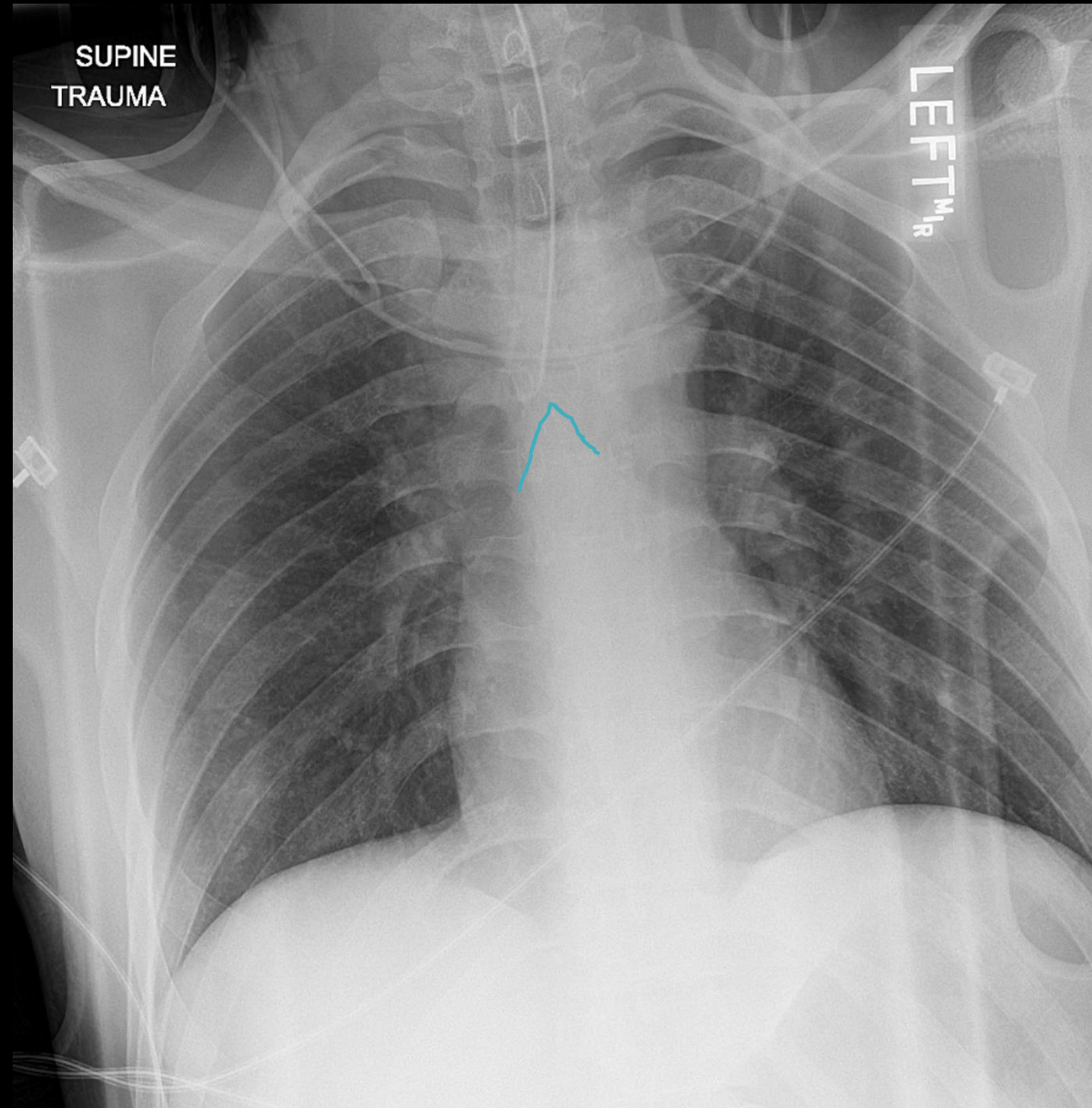
TUBES AND LINES

ENDOTRACHEAL TUBE (ET)

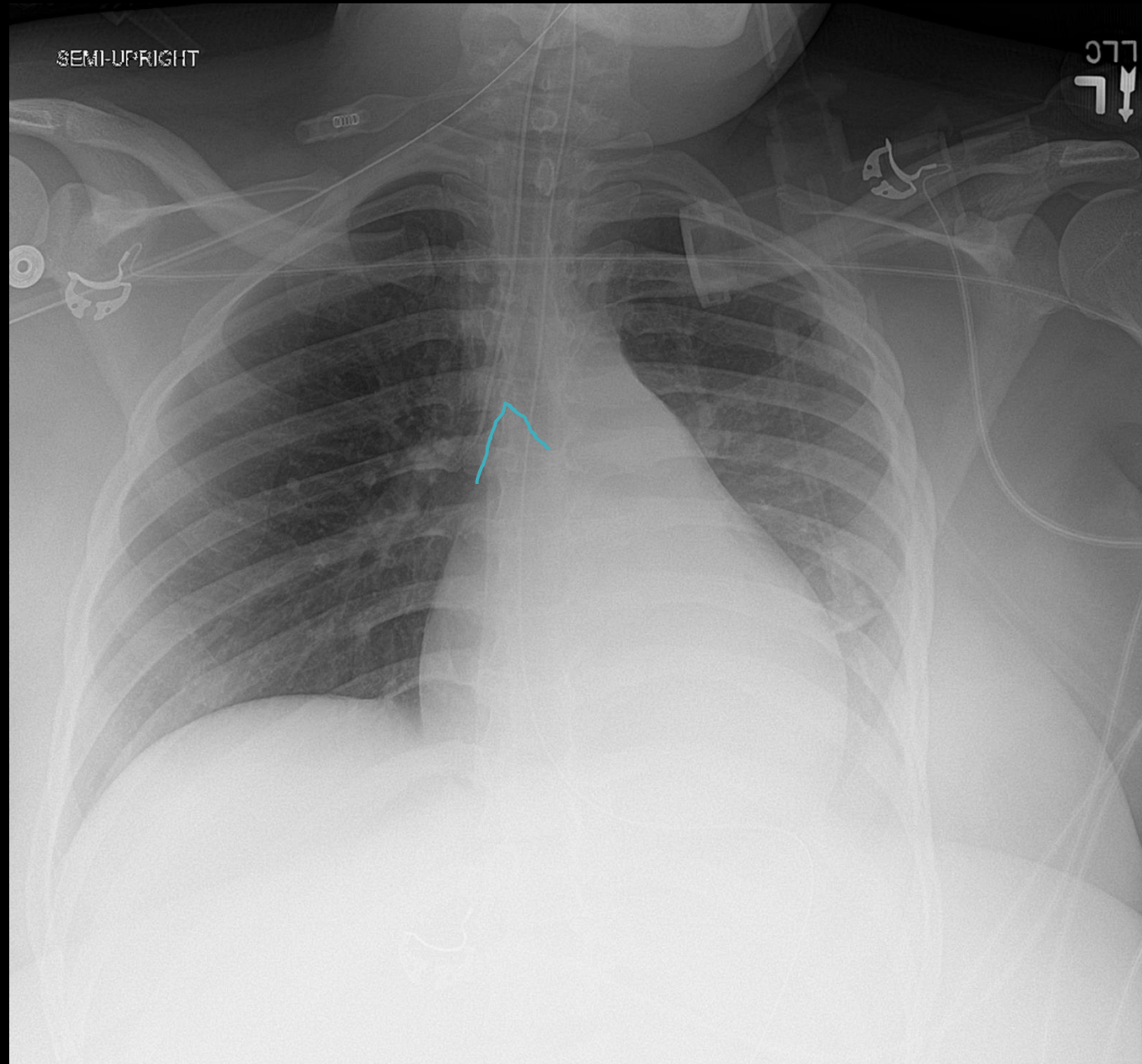
- Ideally 3-7 cm above the carina
 - >2 cm often accepted
- Normal excursion with neck flexion and extension ~ 2 cm
 - Hose follows nose
- Generally want ~level of the clavicular heads



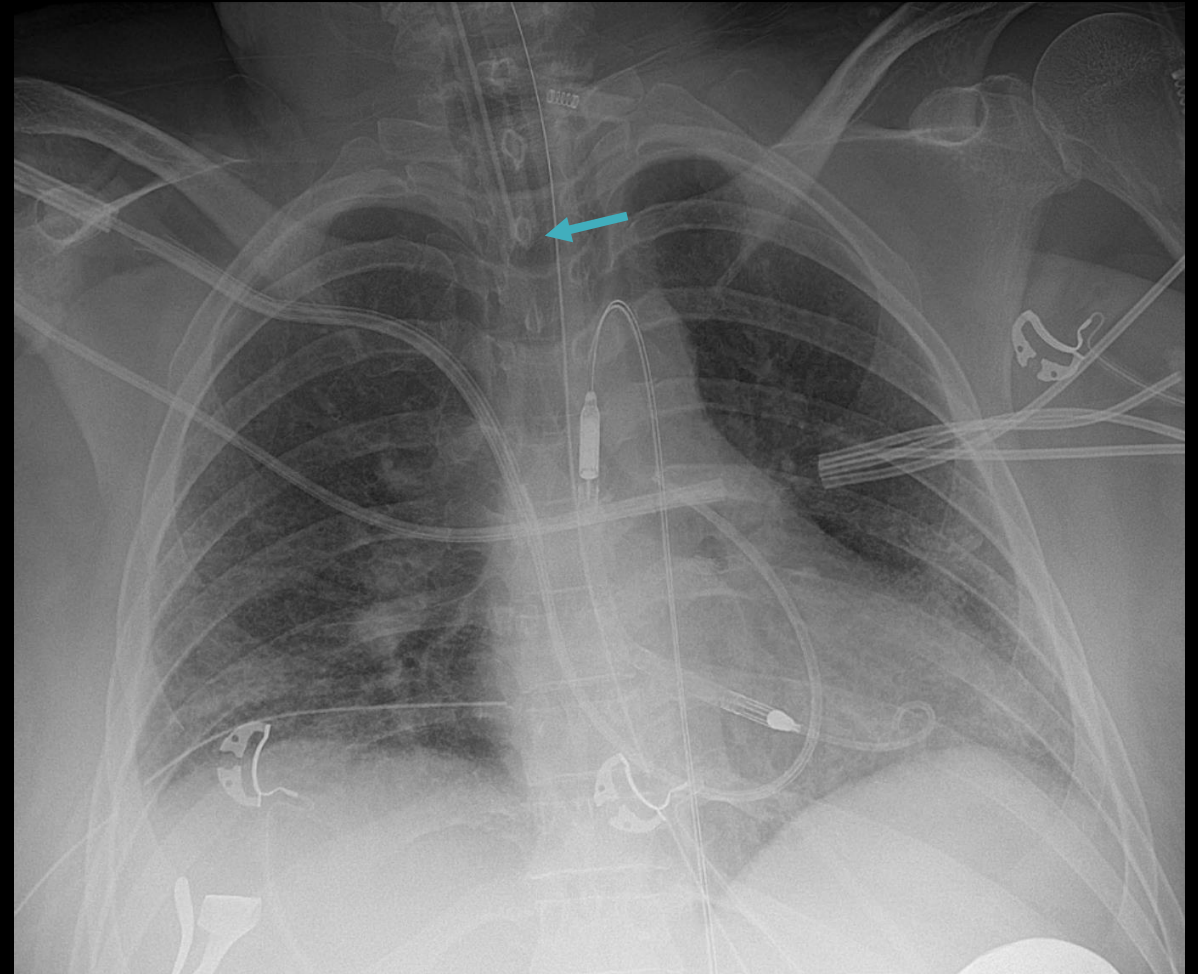
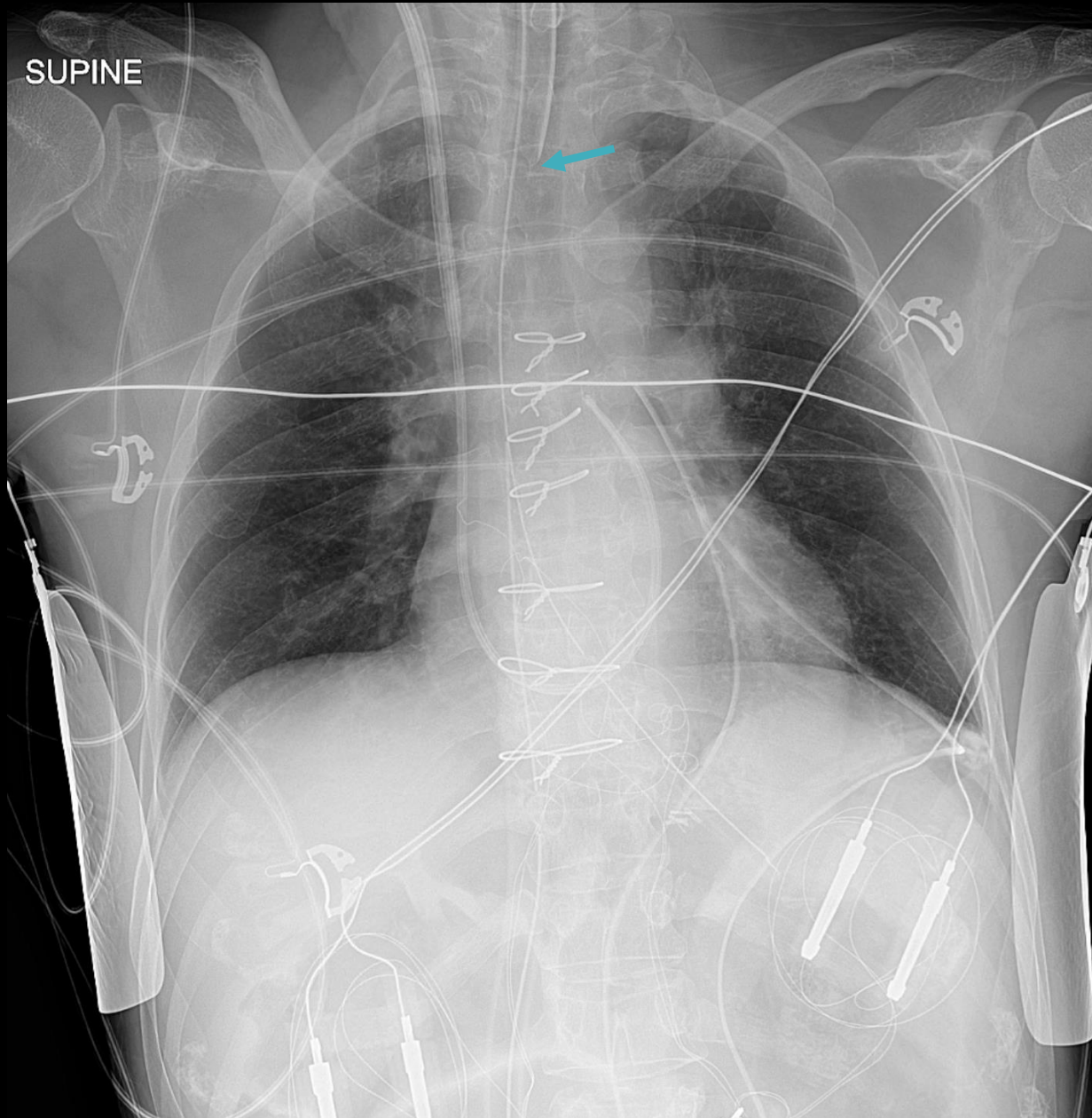
ET Tube Problems



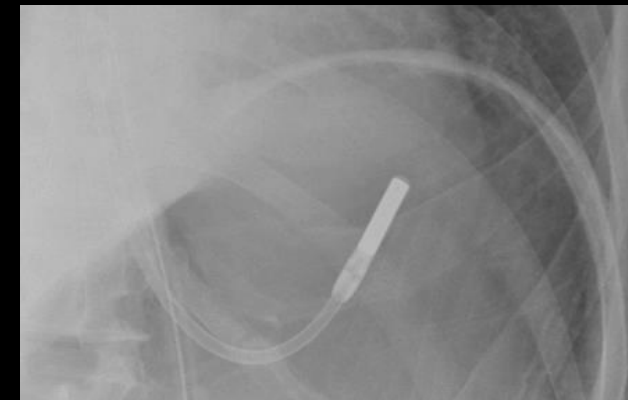
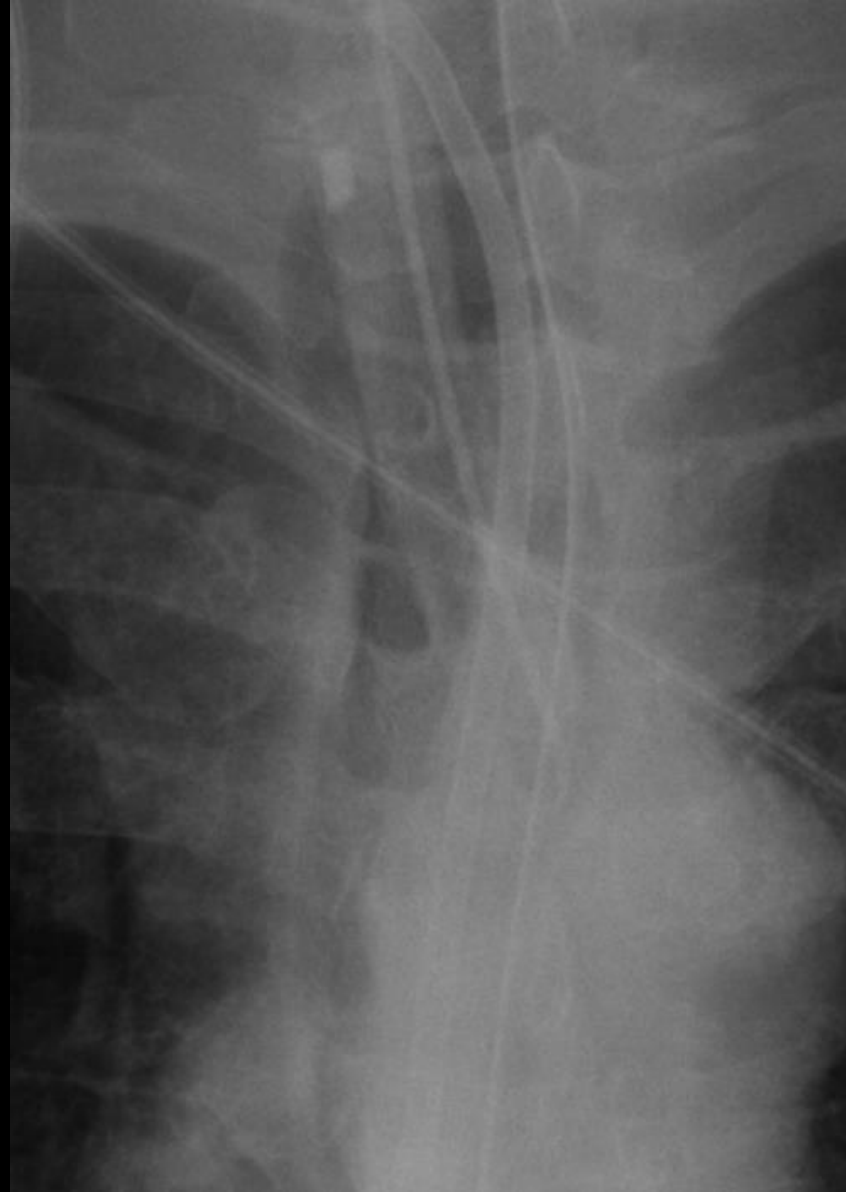
ET Tube Problems



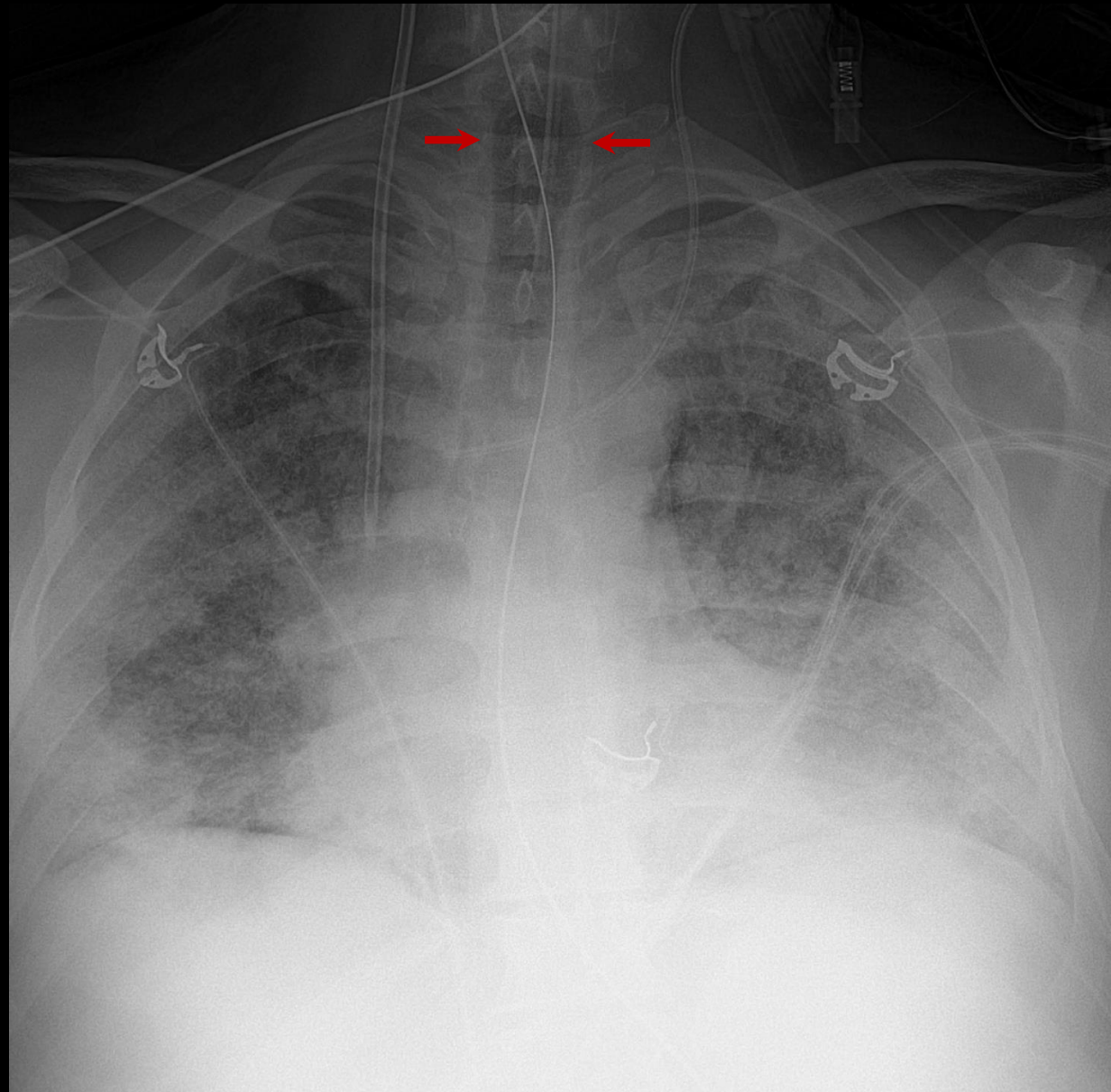
ET Tube Problems



ET Tube Problems

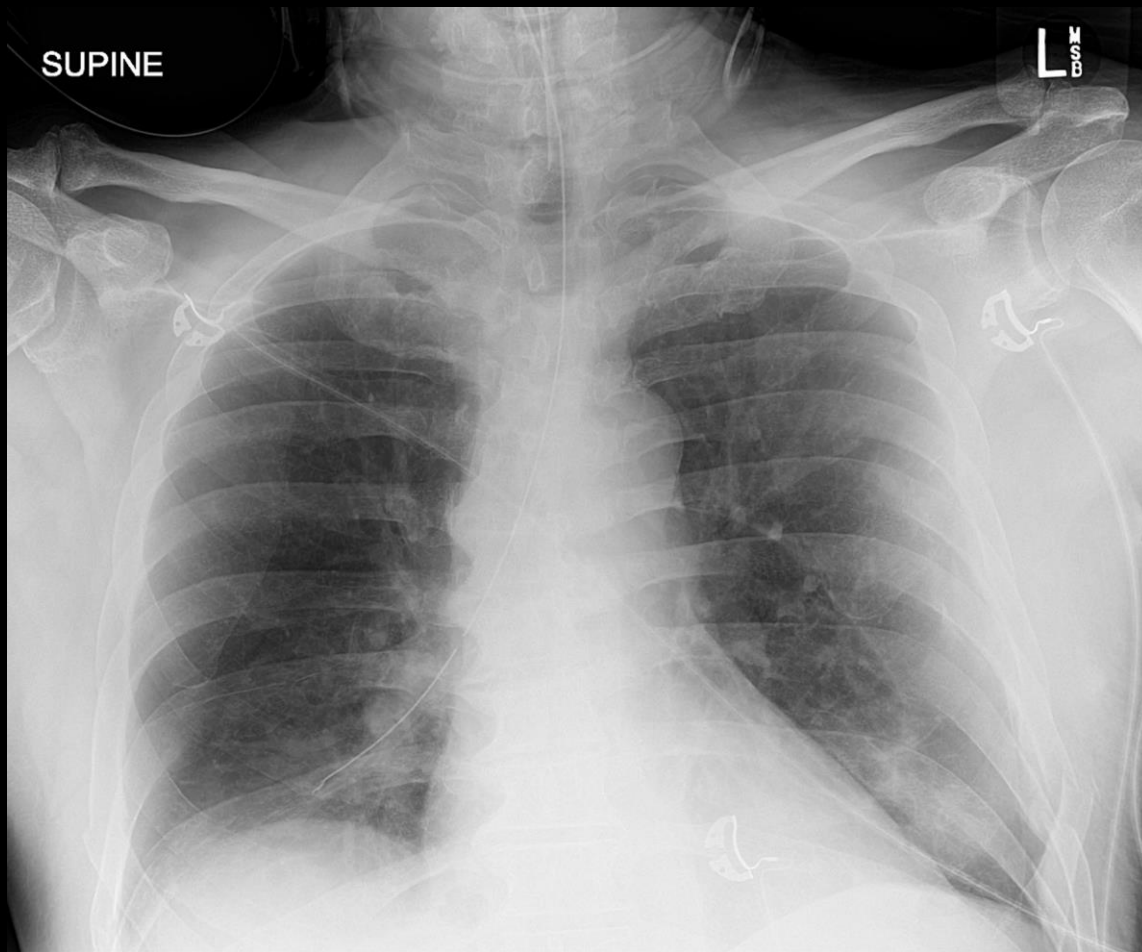


ET Tube Problems



A: ACCESS

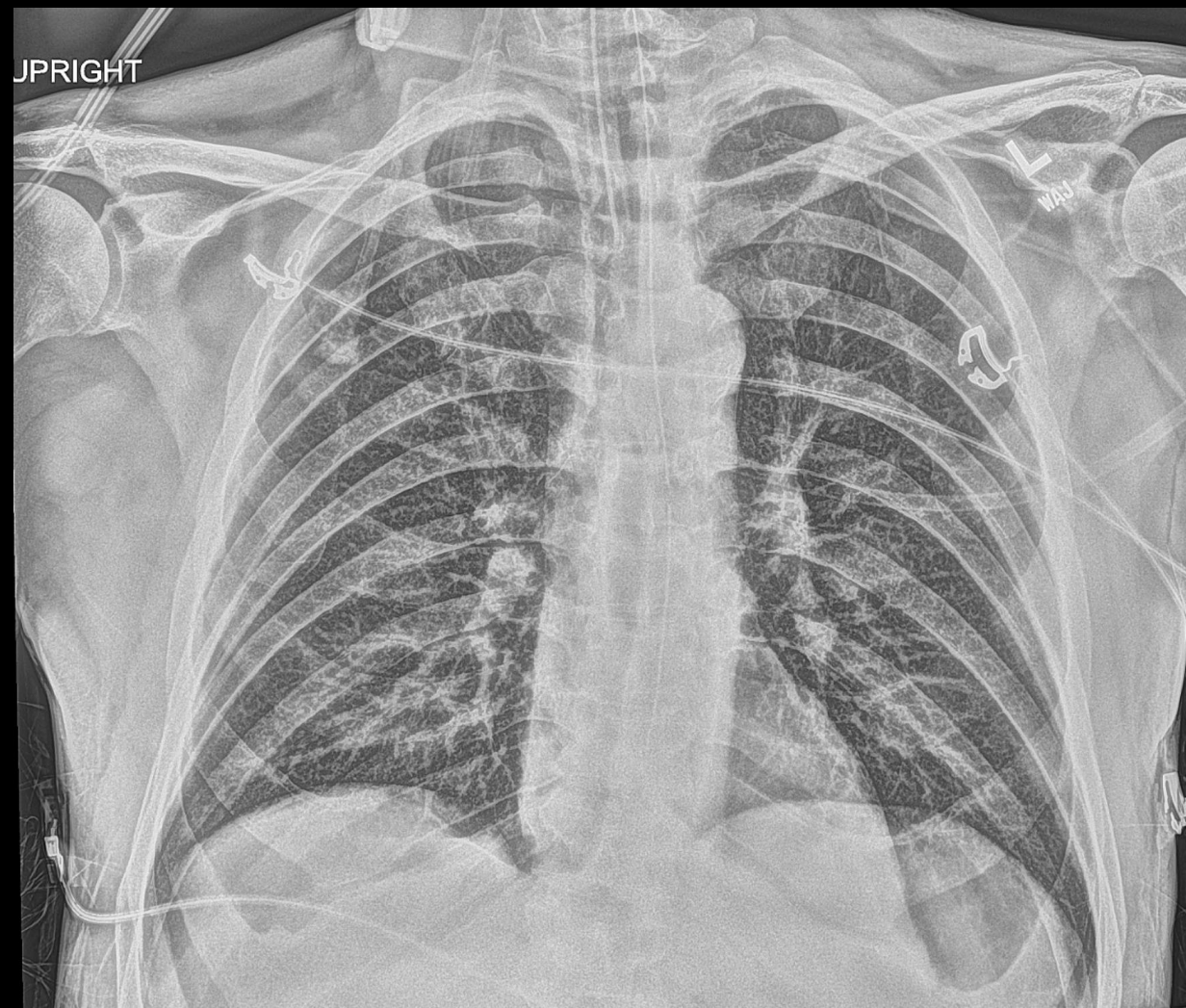
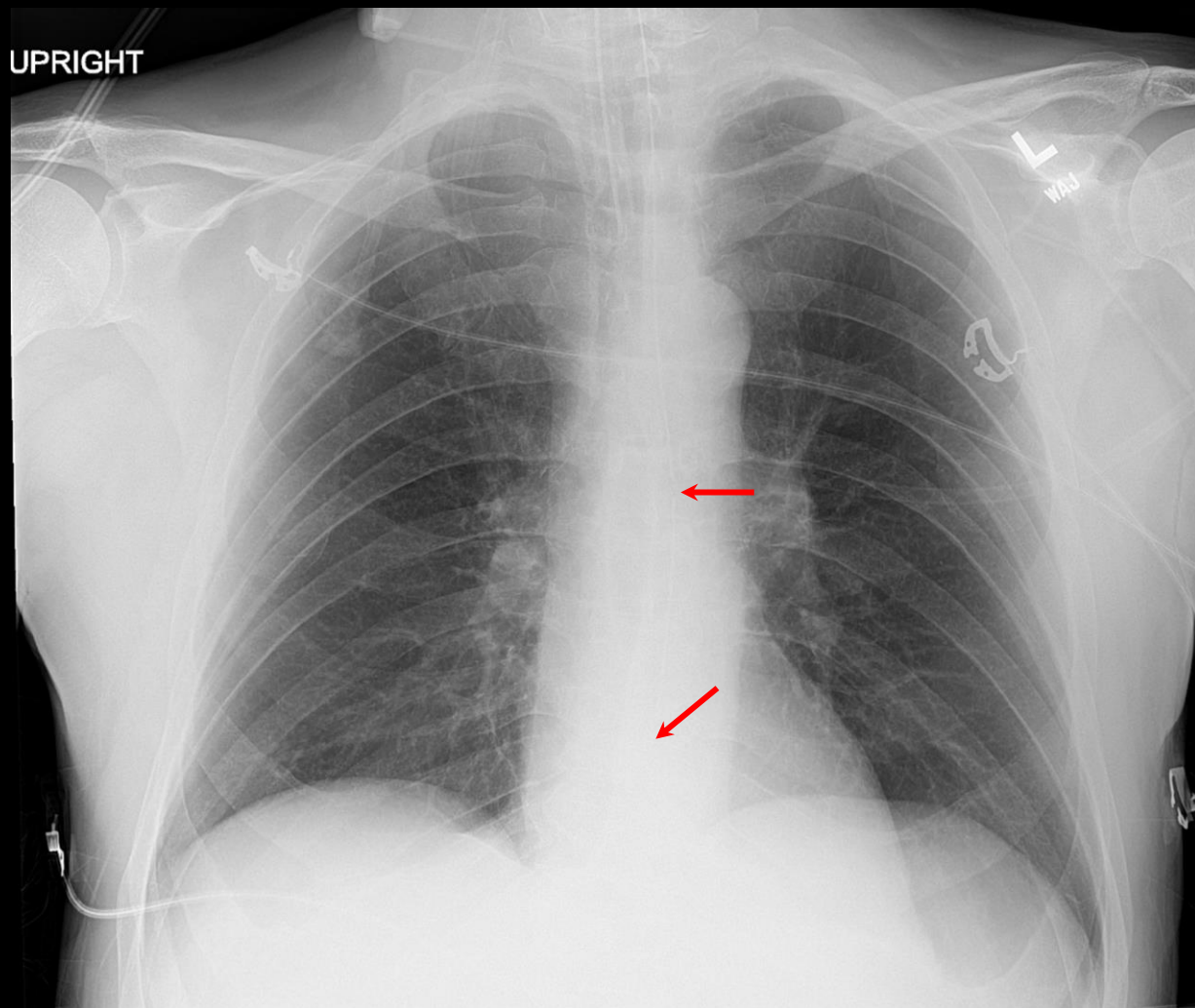
- NG/OG tube down right main bronchus



- Enteric feeding tube down left main bronchus

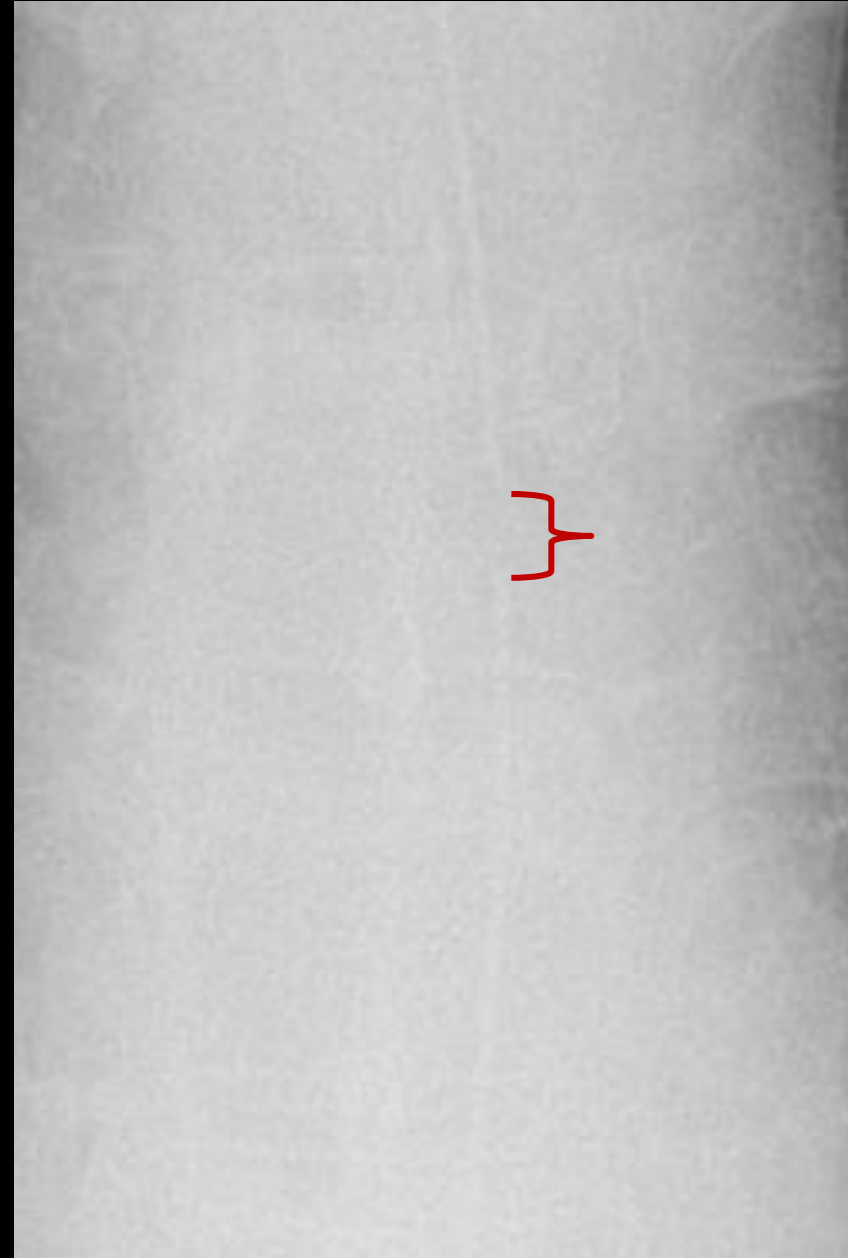


A: ACCESS



A: ACCESS

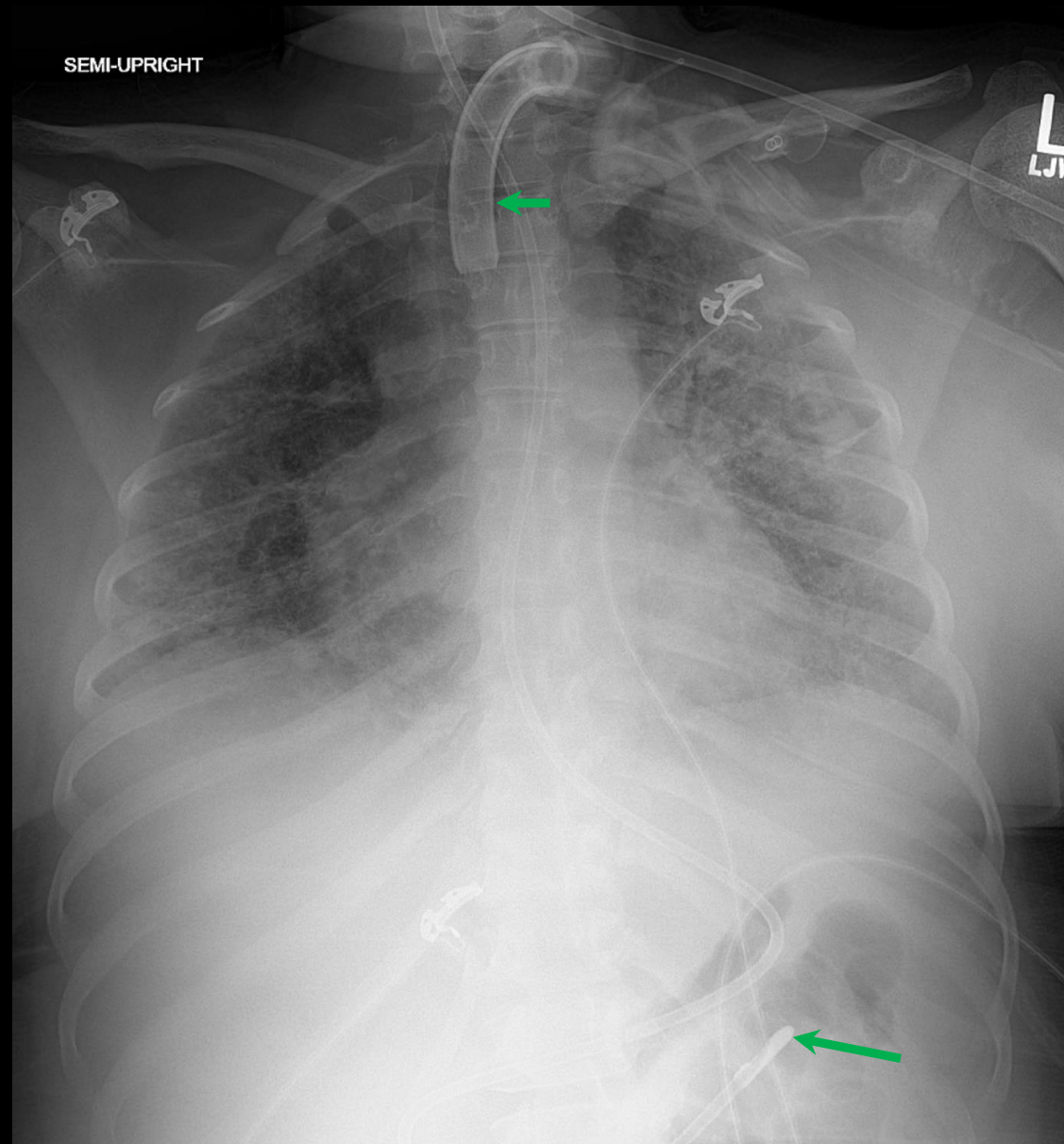
- Nasogastric (NG) and orogastric (OG) tubes are designed to decompress the stomach and reduce risk of aspiration
- Look for proximal side port
- Malpositioning can increase risk of aspiration – bypass GE junction



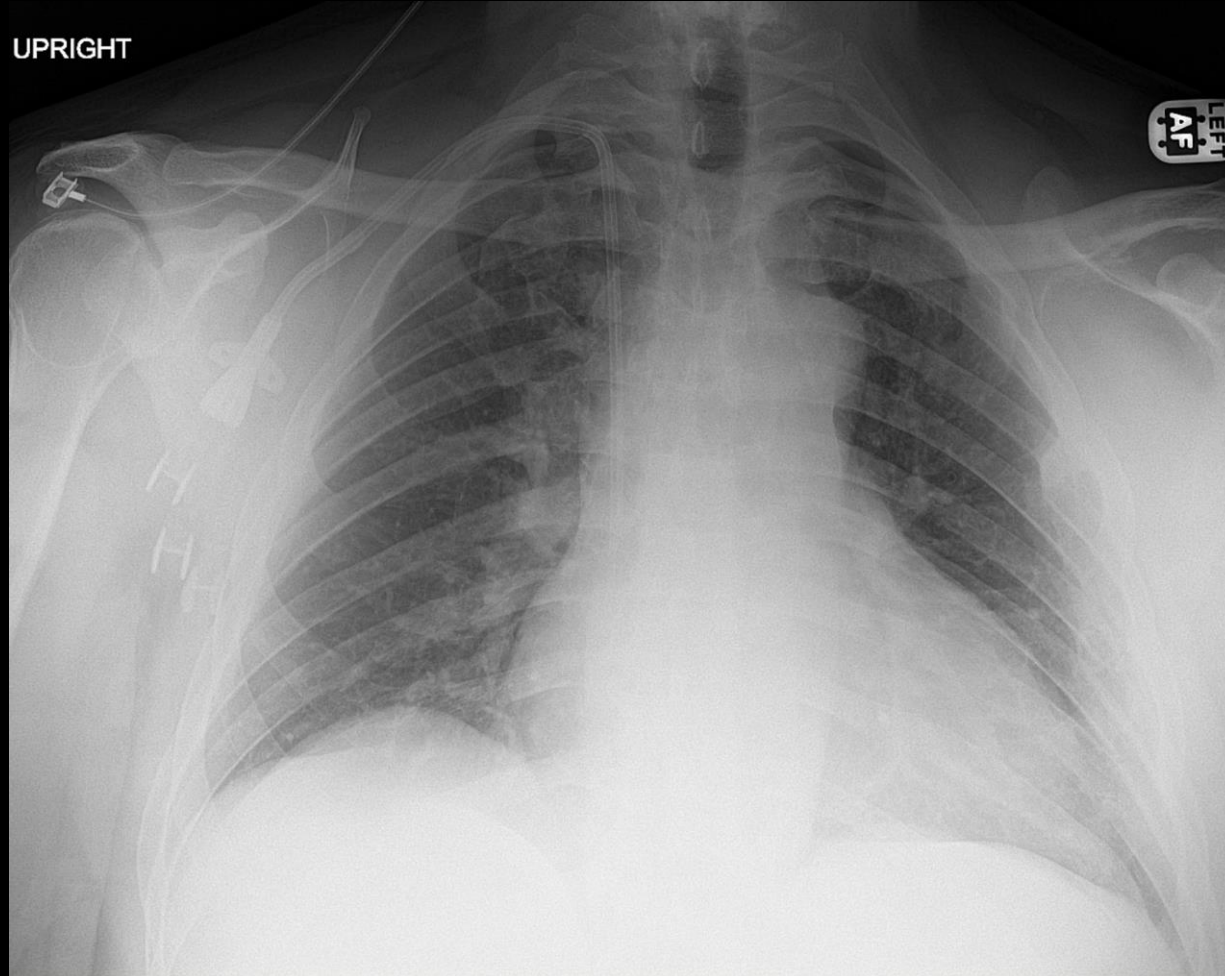
ENTERICTUBE POSITIONS



A: ACCESS

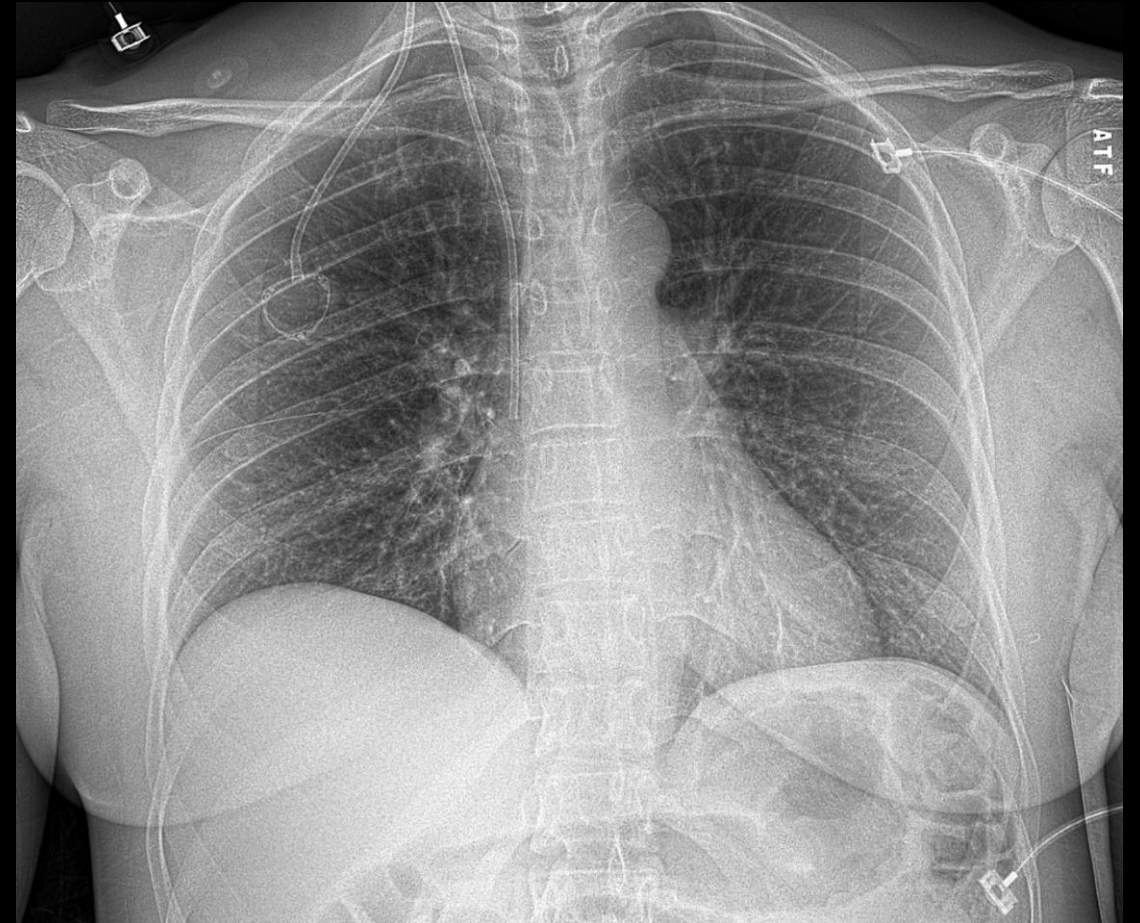
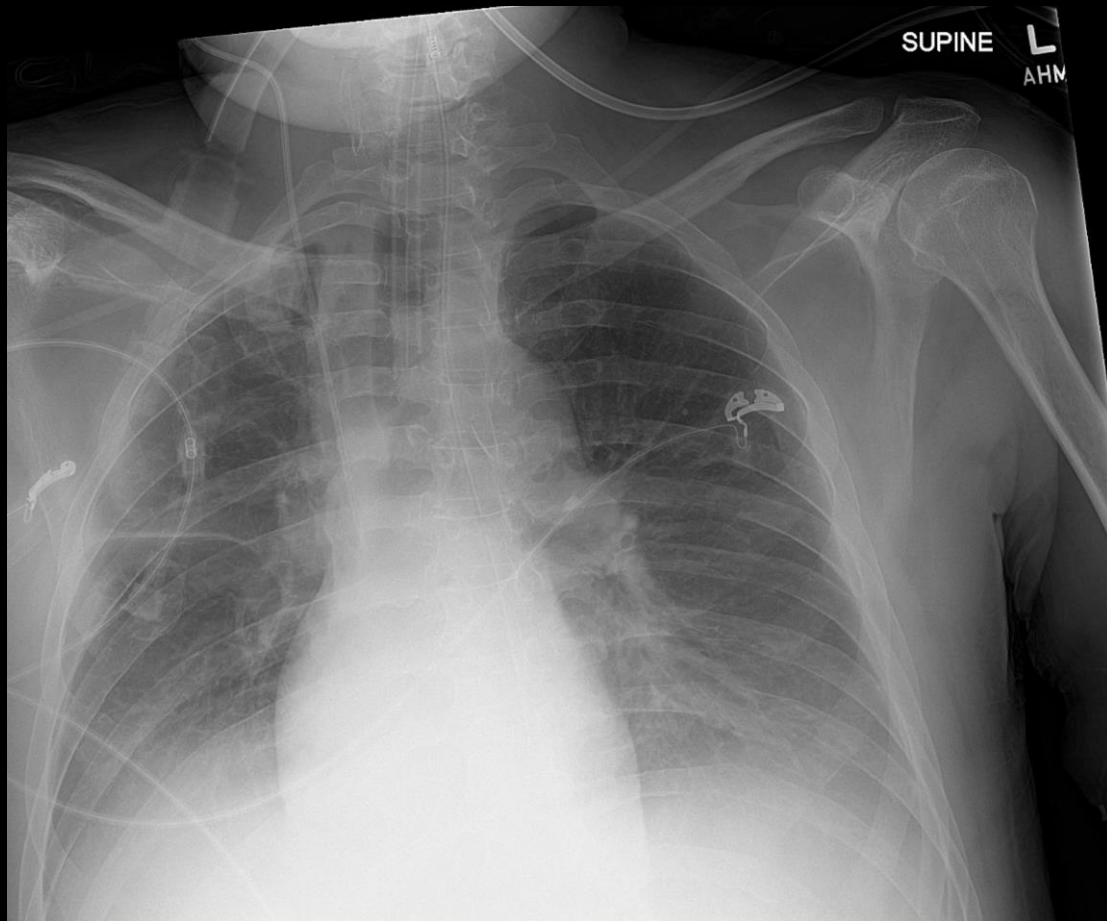


CENTRAL VENOUS LINES

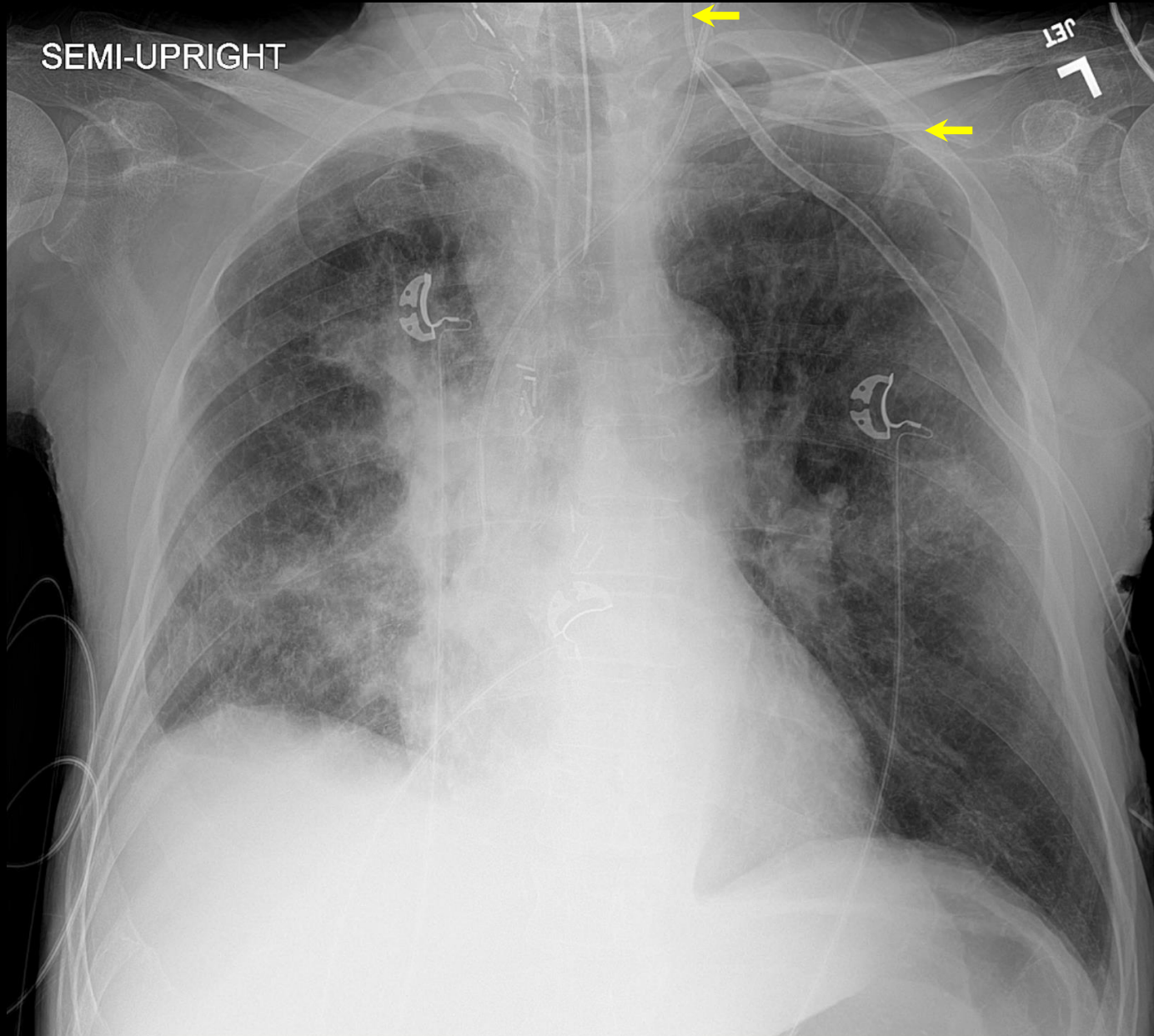


- Ideal location for tip is within SVC or at the superior cavoatrial junction
- Risk of thrombosis lower in central veins
- Catheter tip in atrium increases risk of arrhythmia, perforation

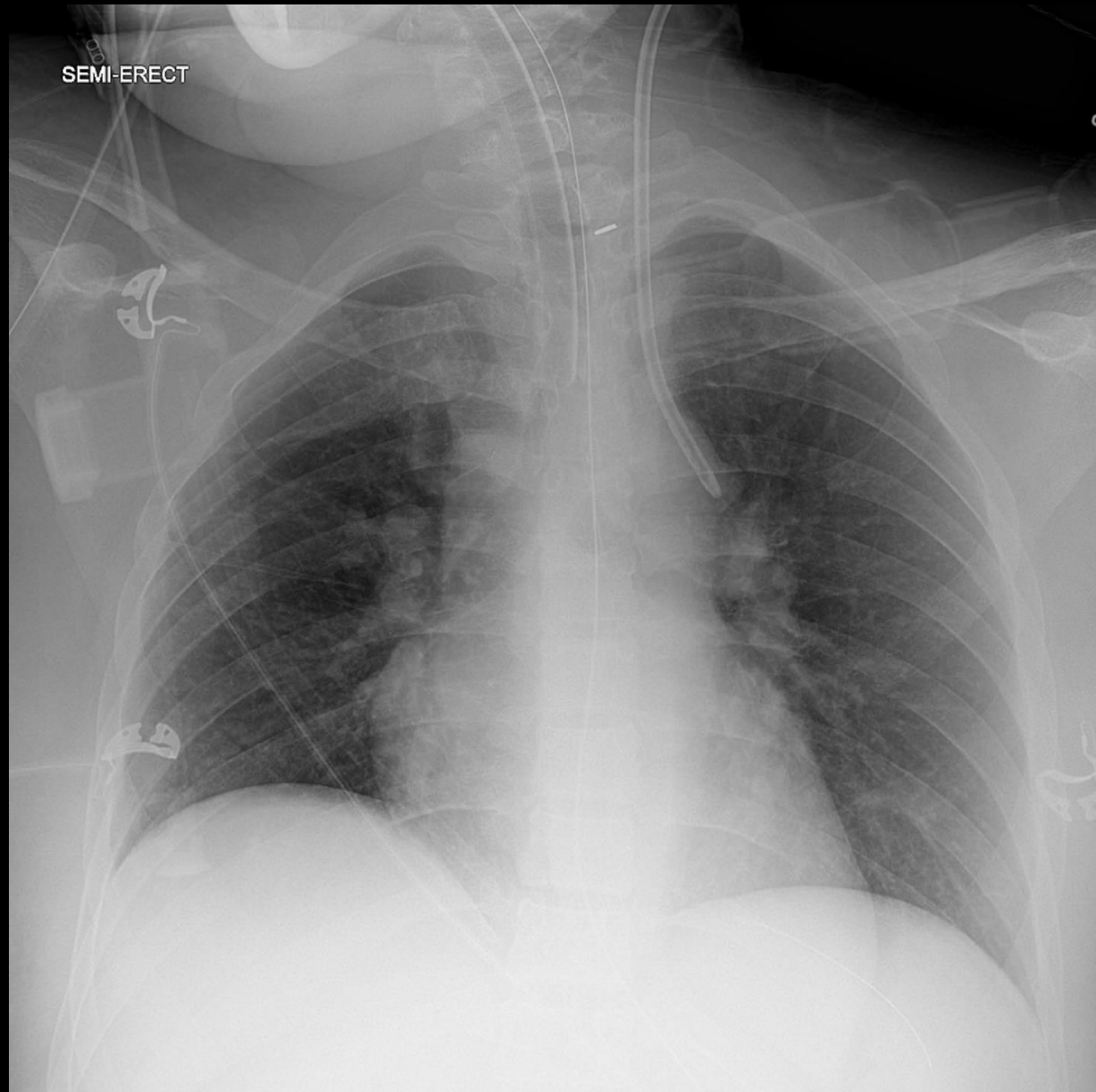
CENTRAL VENOUS LINES



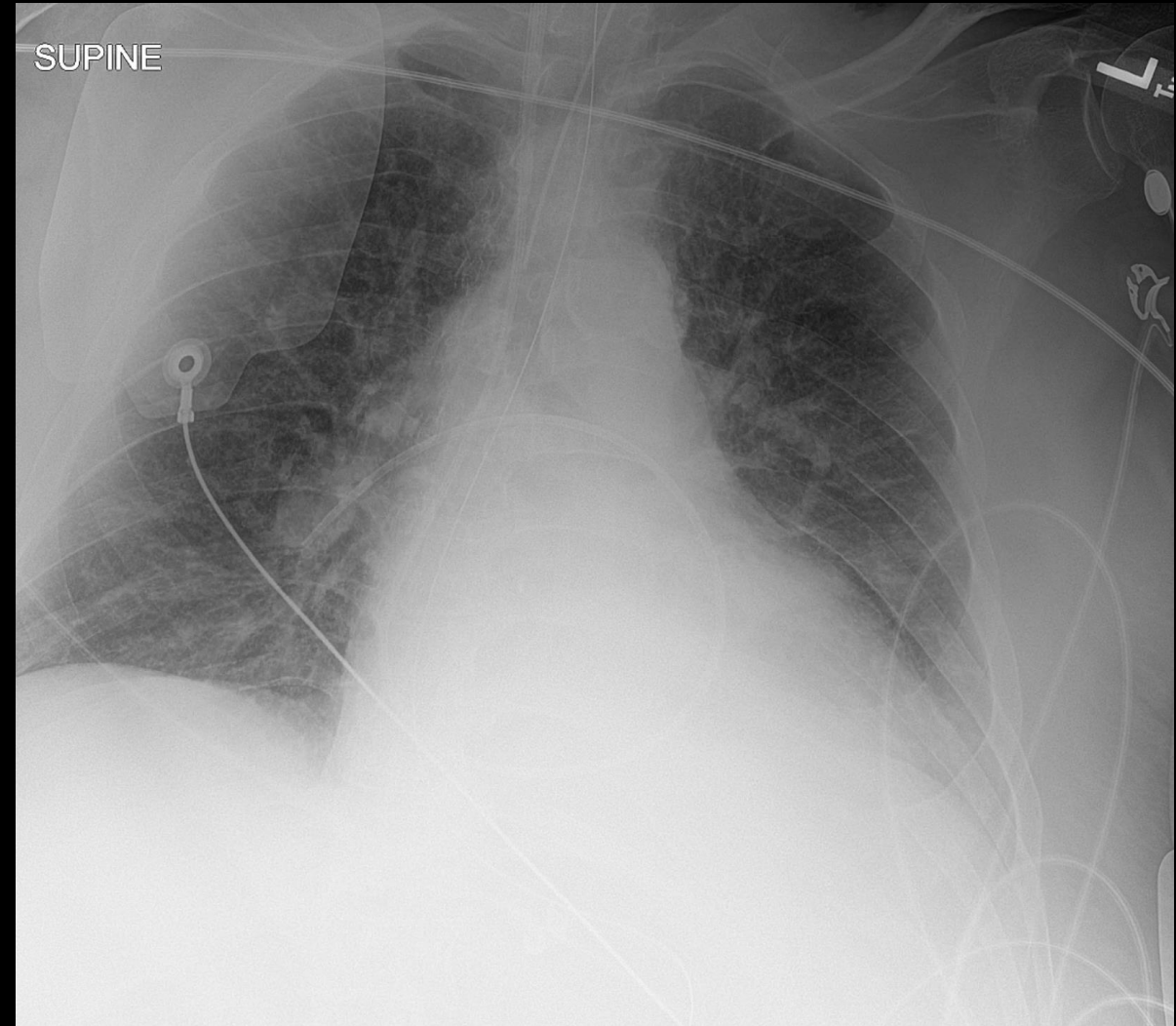
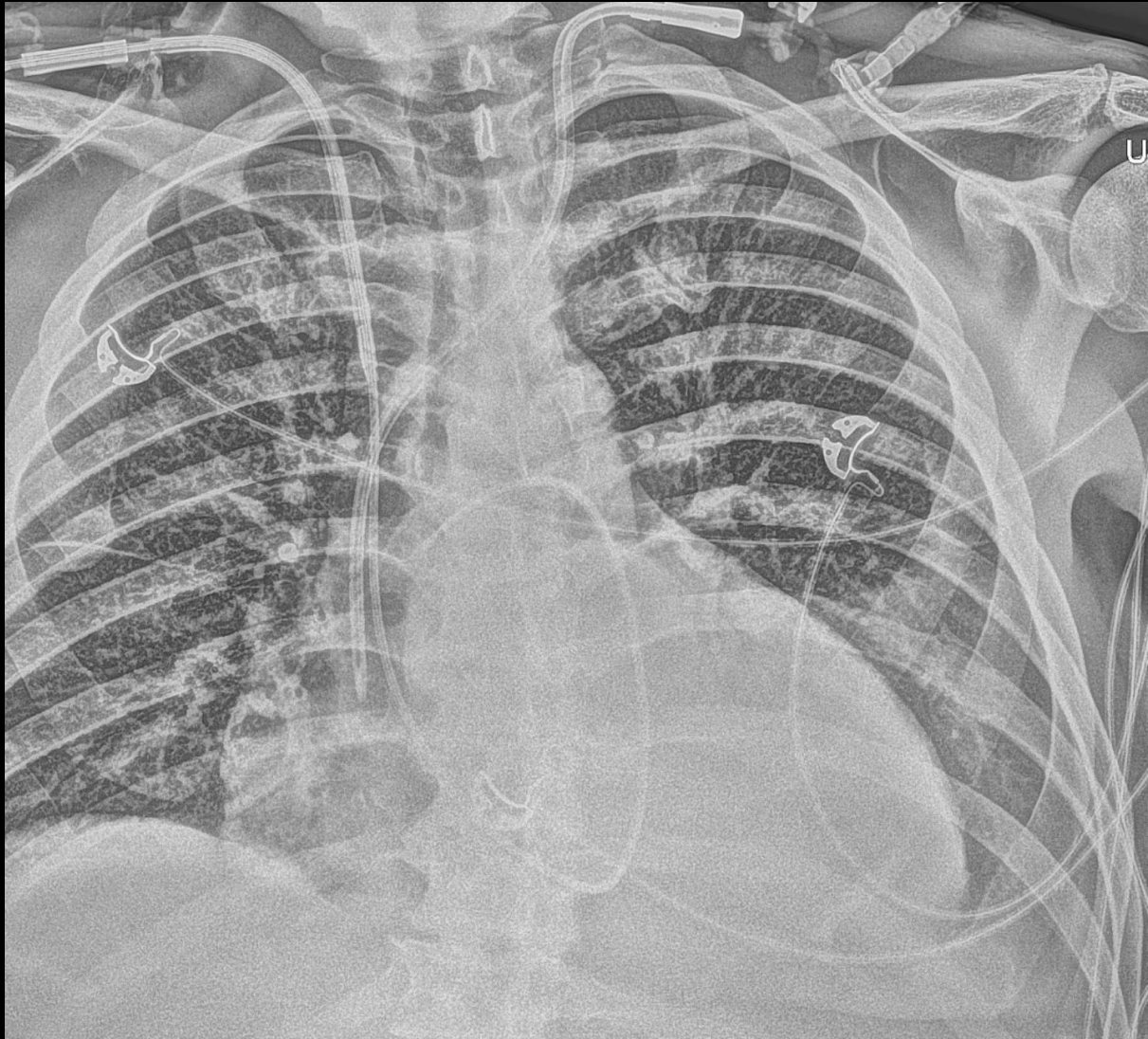
Central Line Problems



Central Line Problems

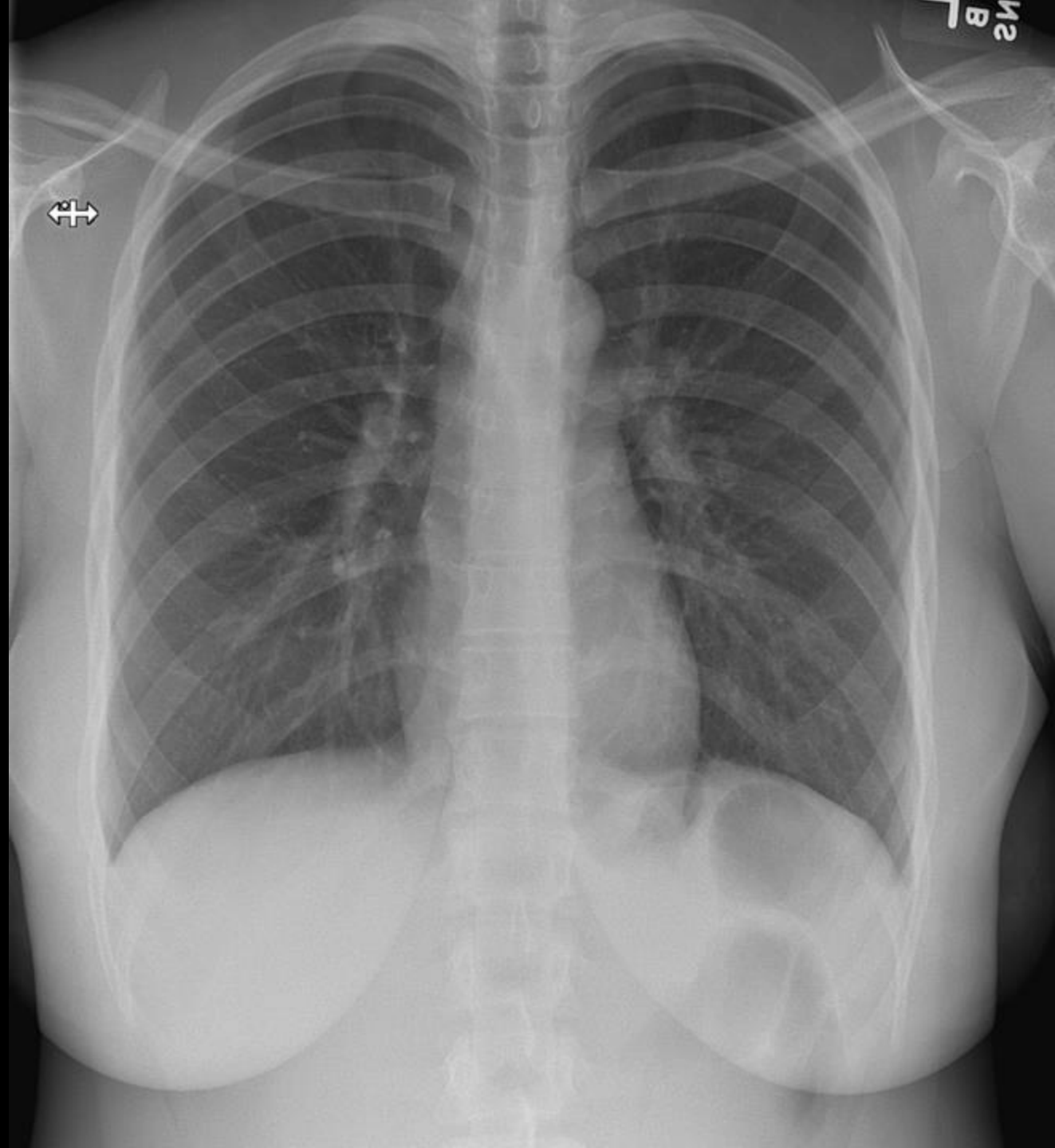


Central Line Problems

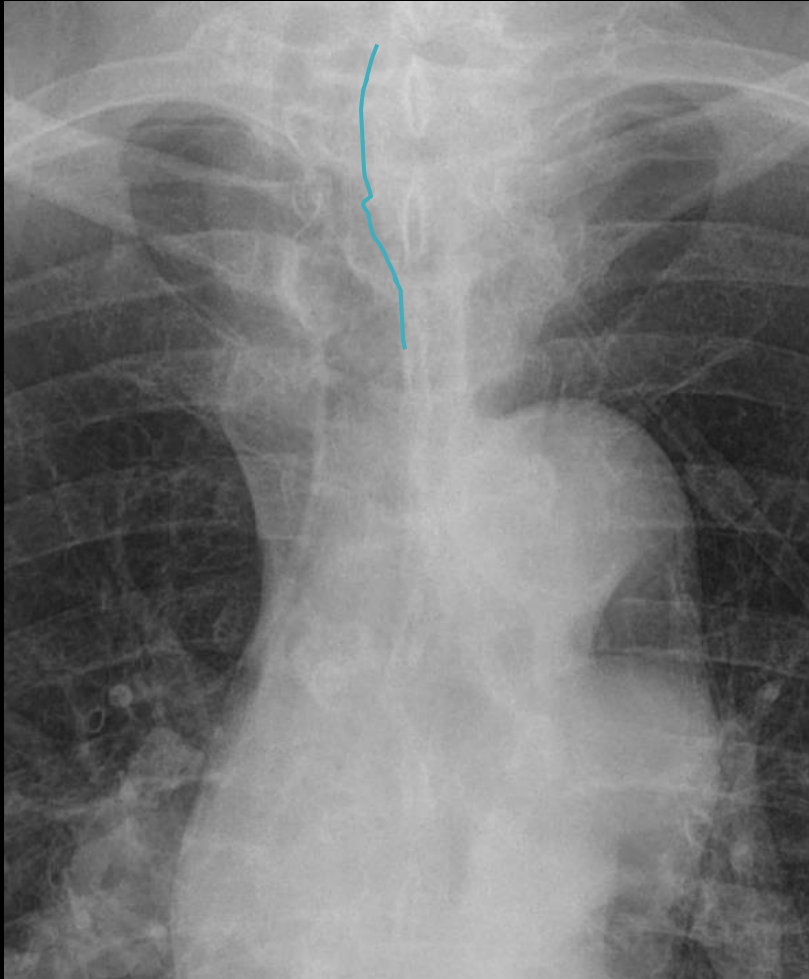


A:

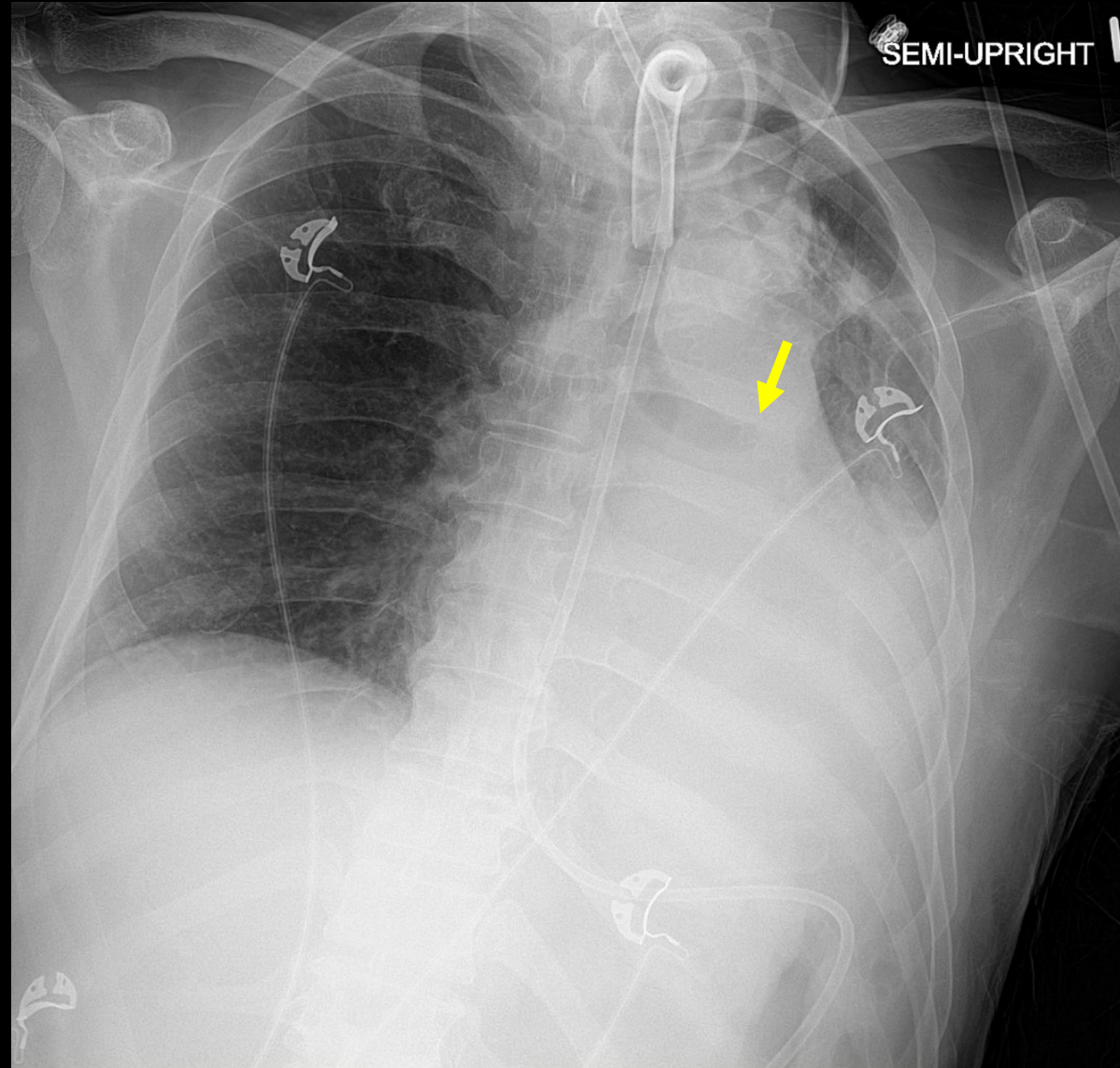
AIRWAY



A: AIRWAY PROBLEMS



Airway Problems

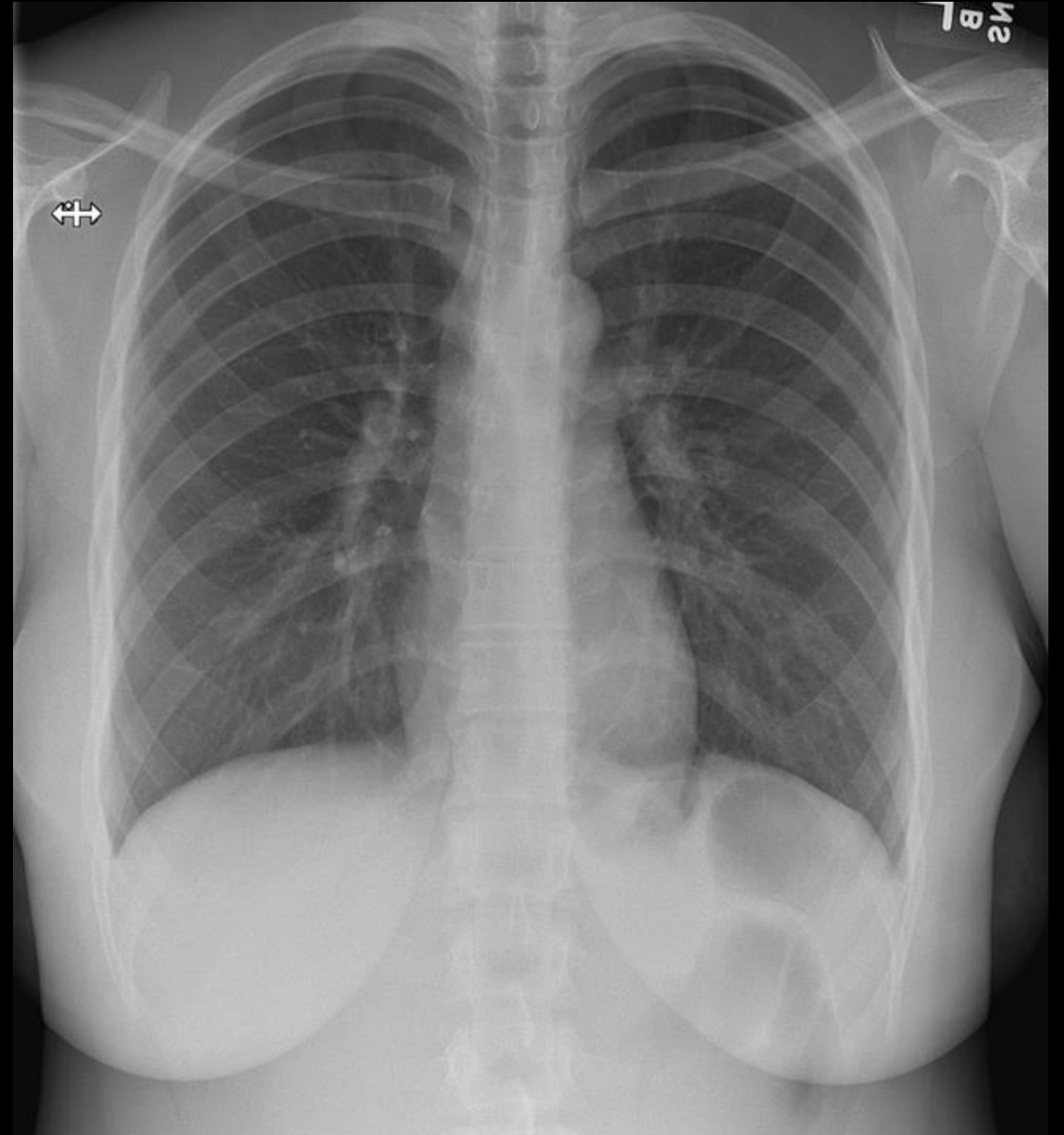


B:

BONES

B: BONES

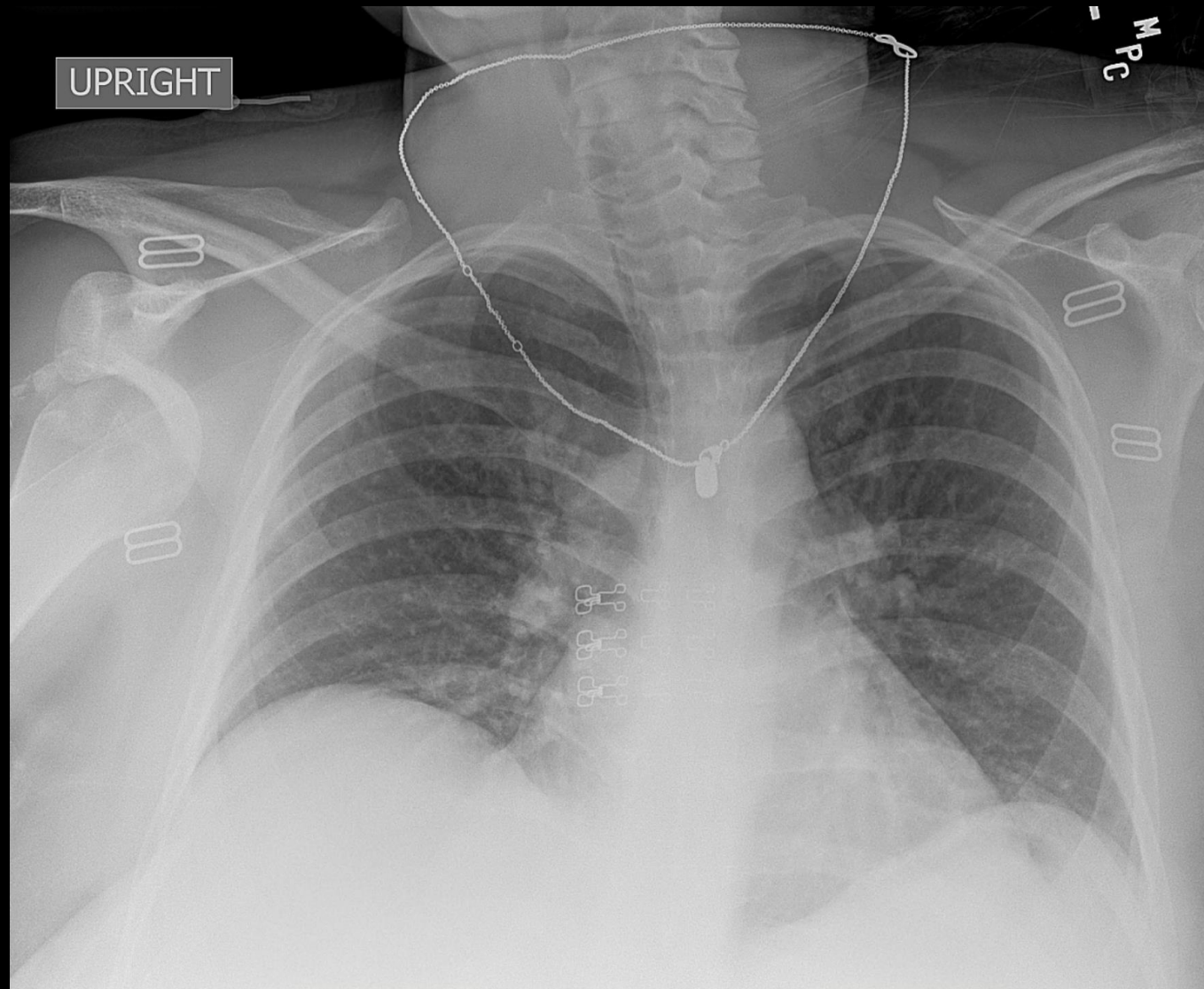
- Most important to look:
 - Trauma
 - Including after a code
 - Cancer
- Visible bones:
 - Ribs
 - Spine
 - Clavicles
 - Scapulae
 - Sometimes humeri



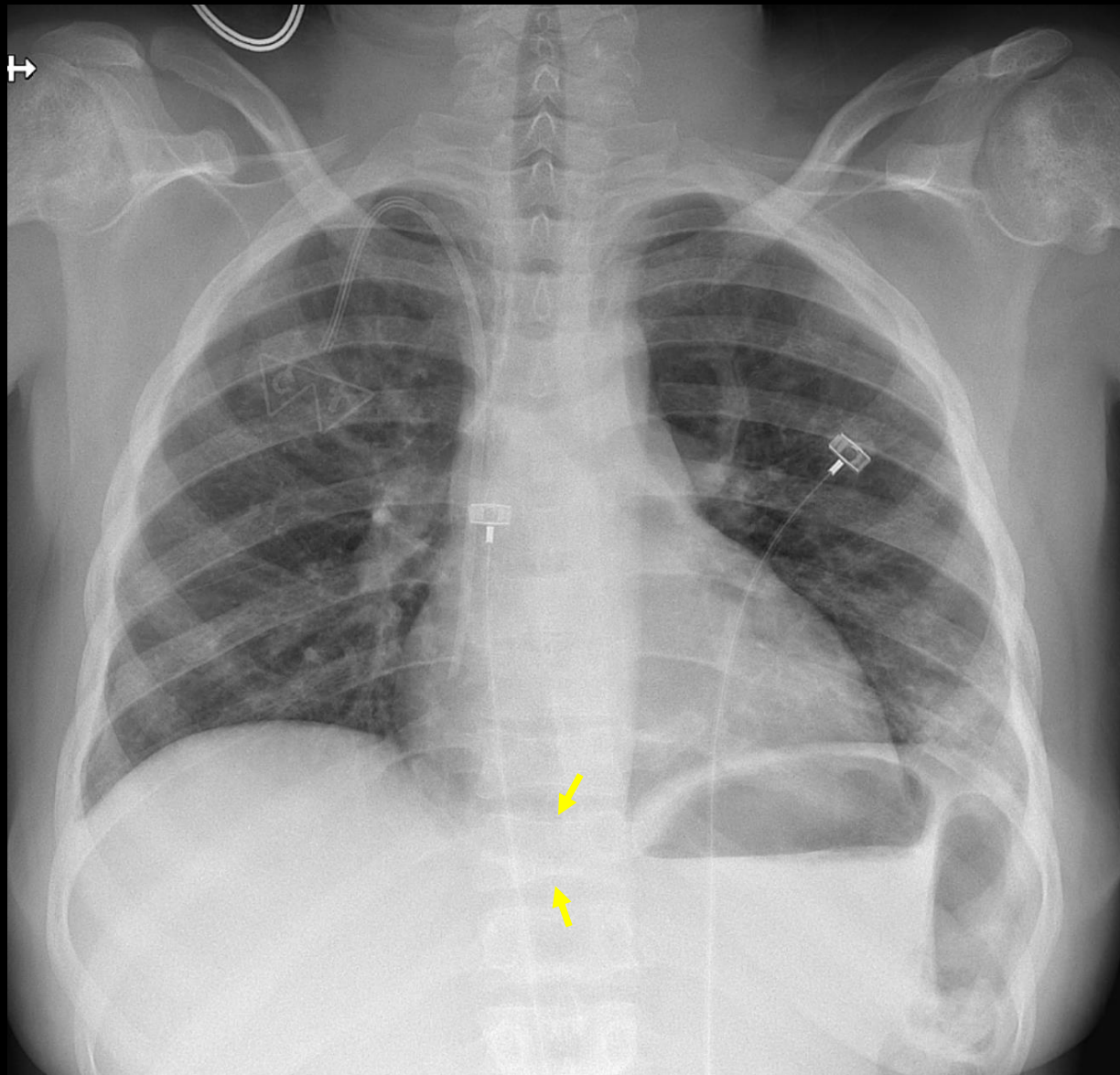
B: BONES



B: BONES



B: BONES



C:

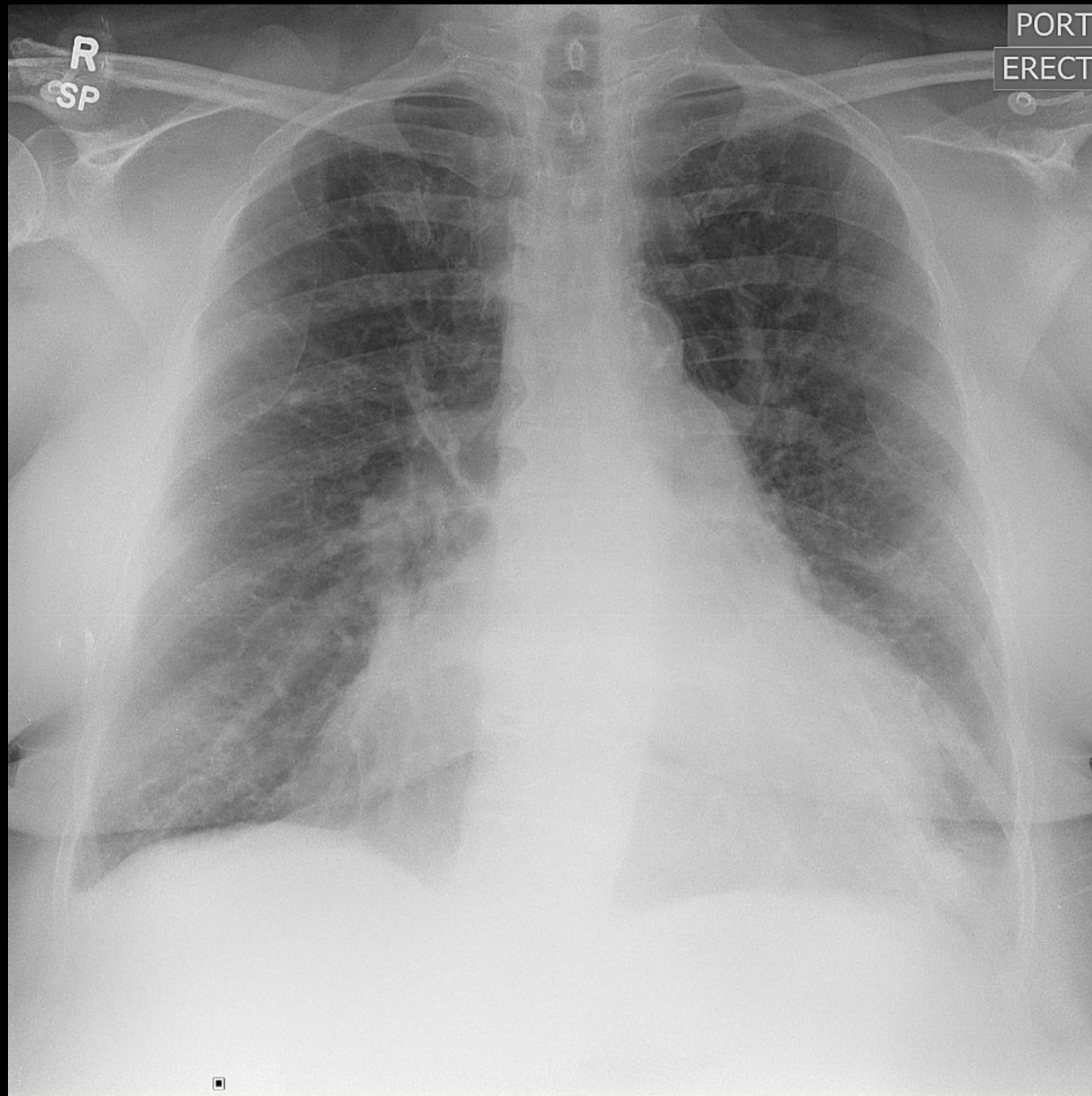
CARDIOMESIATINAL SILHOUETTE

C: CARDIOMEDIASTINAL

- Heart size
- Mediastinal size
- Contour
- Silhouetting



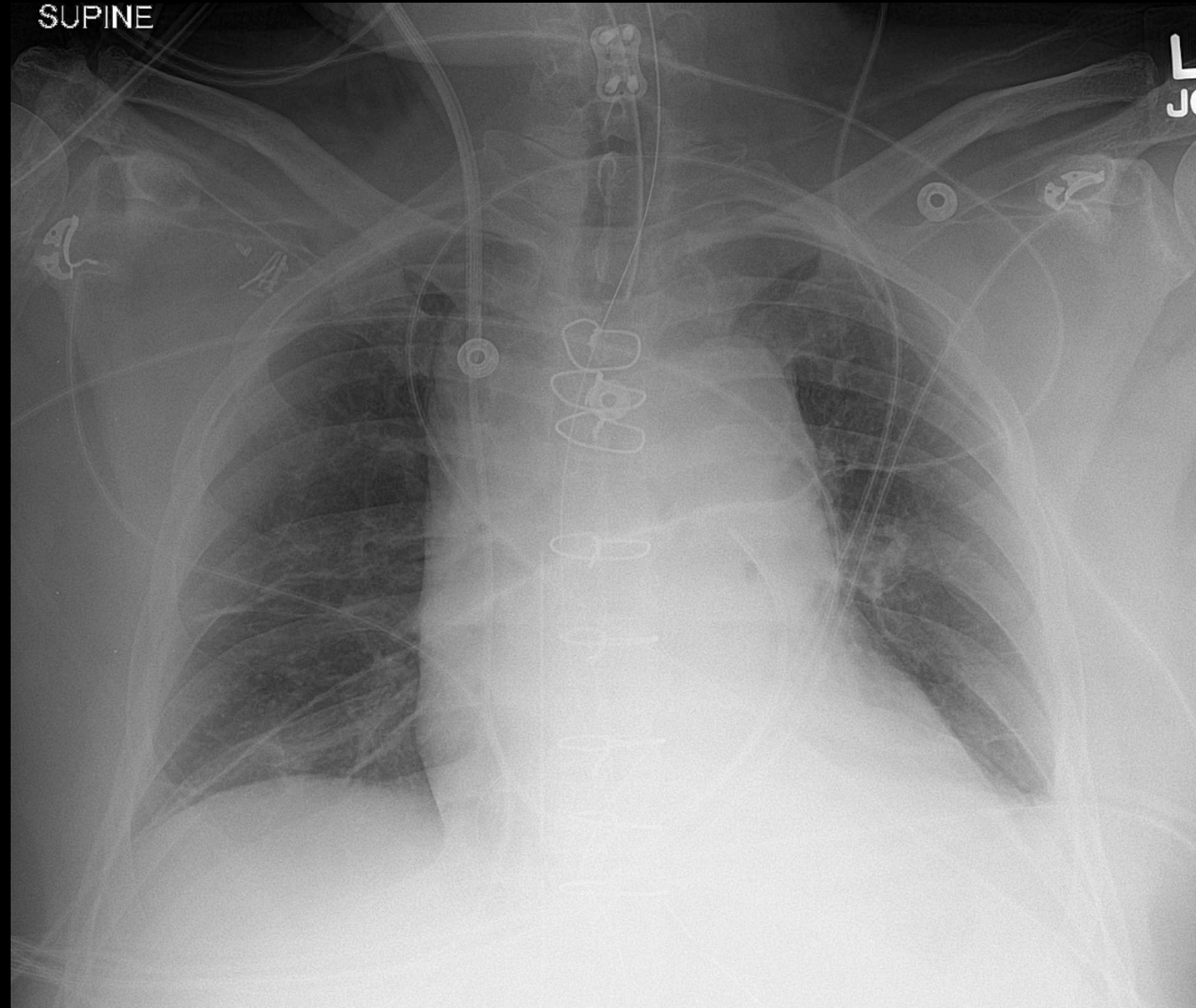
C: CARDIOMEDIASTINAL



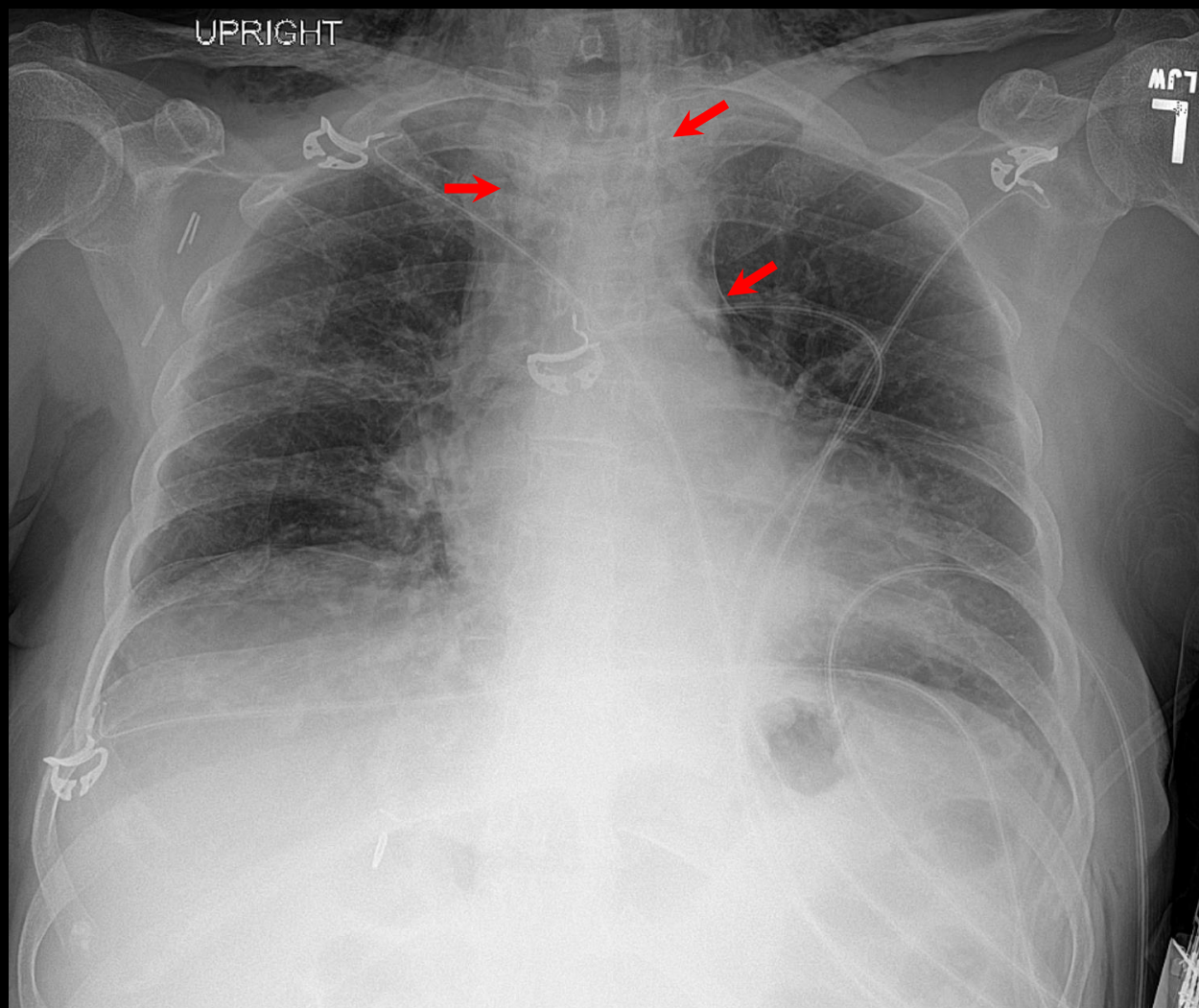
C: CARDIOMEDIASTINAL



C: CARDIOMEDIASTINAL



C: CARDIOMEDIASTINAL



D:

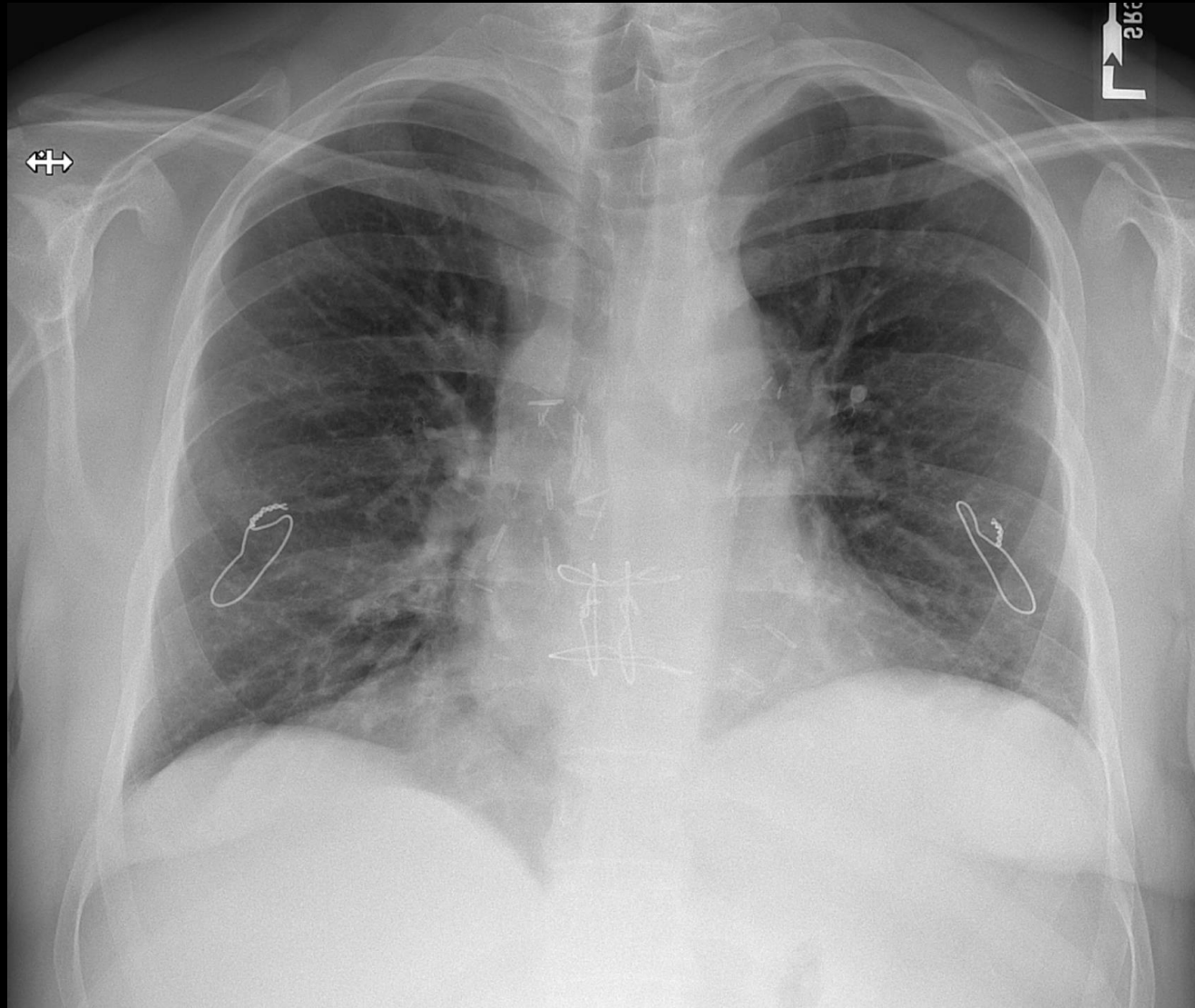
DIAPHRAGM

D: DIAPHRAGM

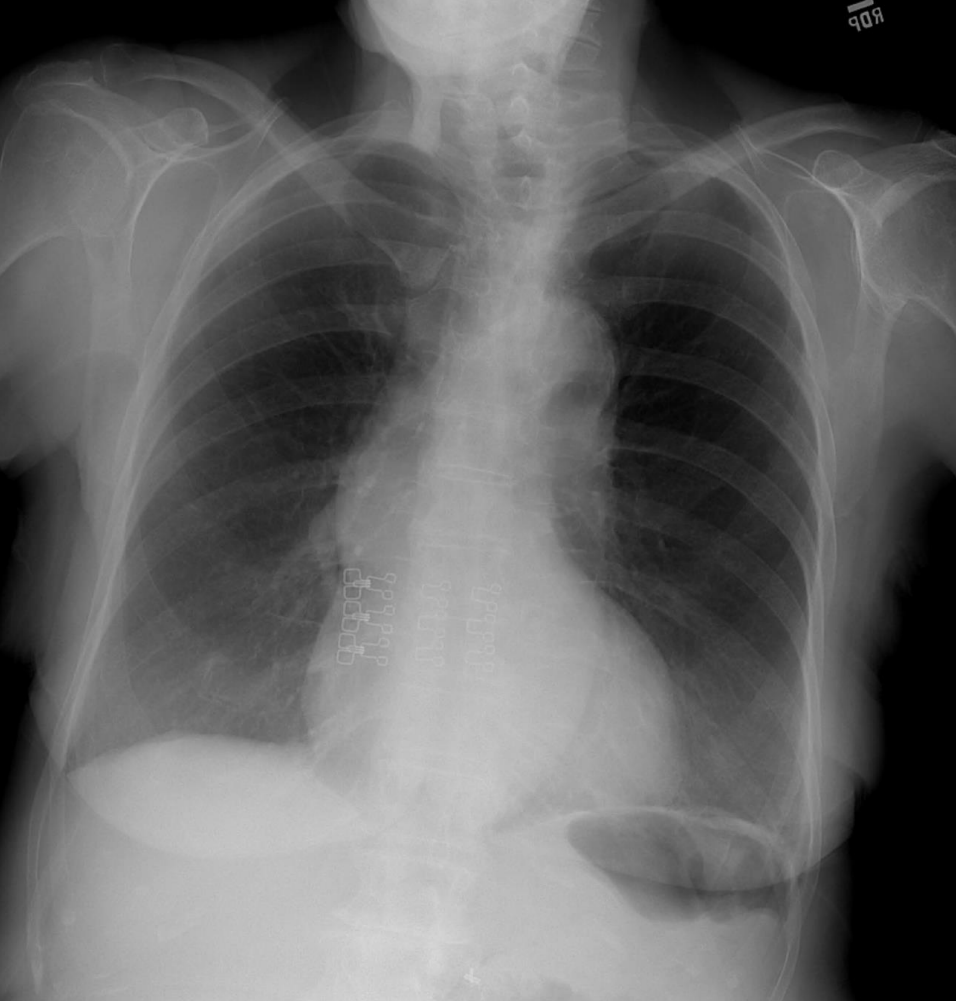
- Useful to evaluate for
 - Consolidation/atelectasis
 - Lung volumes
 - Effusions



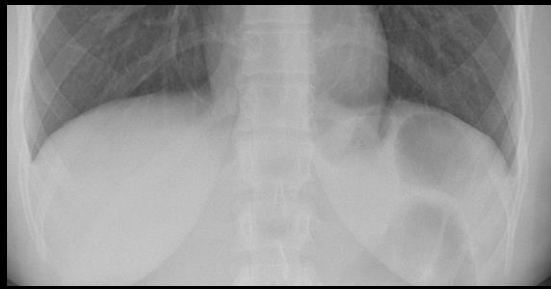
D: DIAPHRAGM



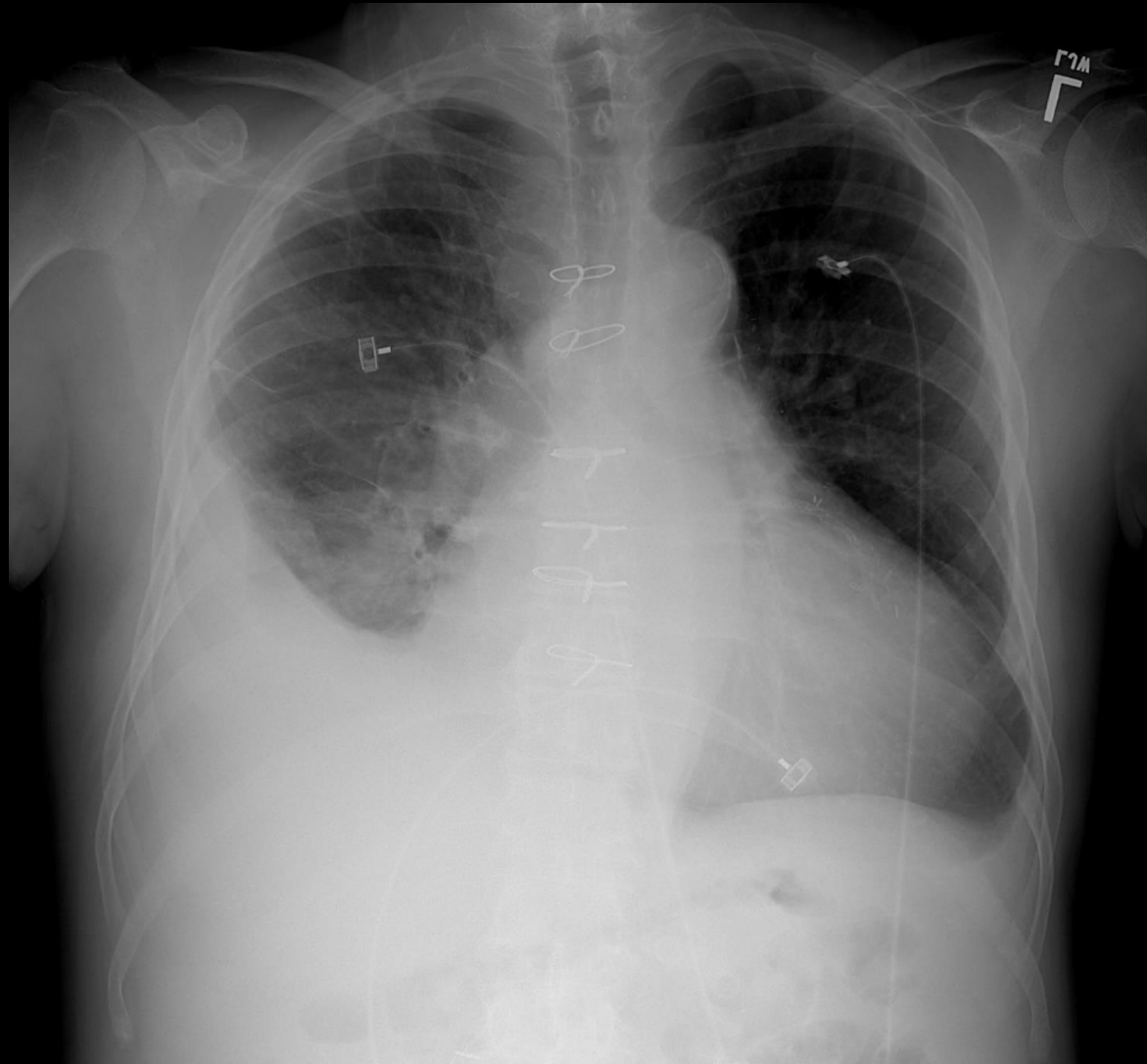
D: DIAPHRAGM



Normal



D: DIAPHRAGM

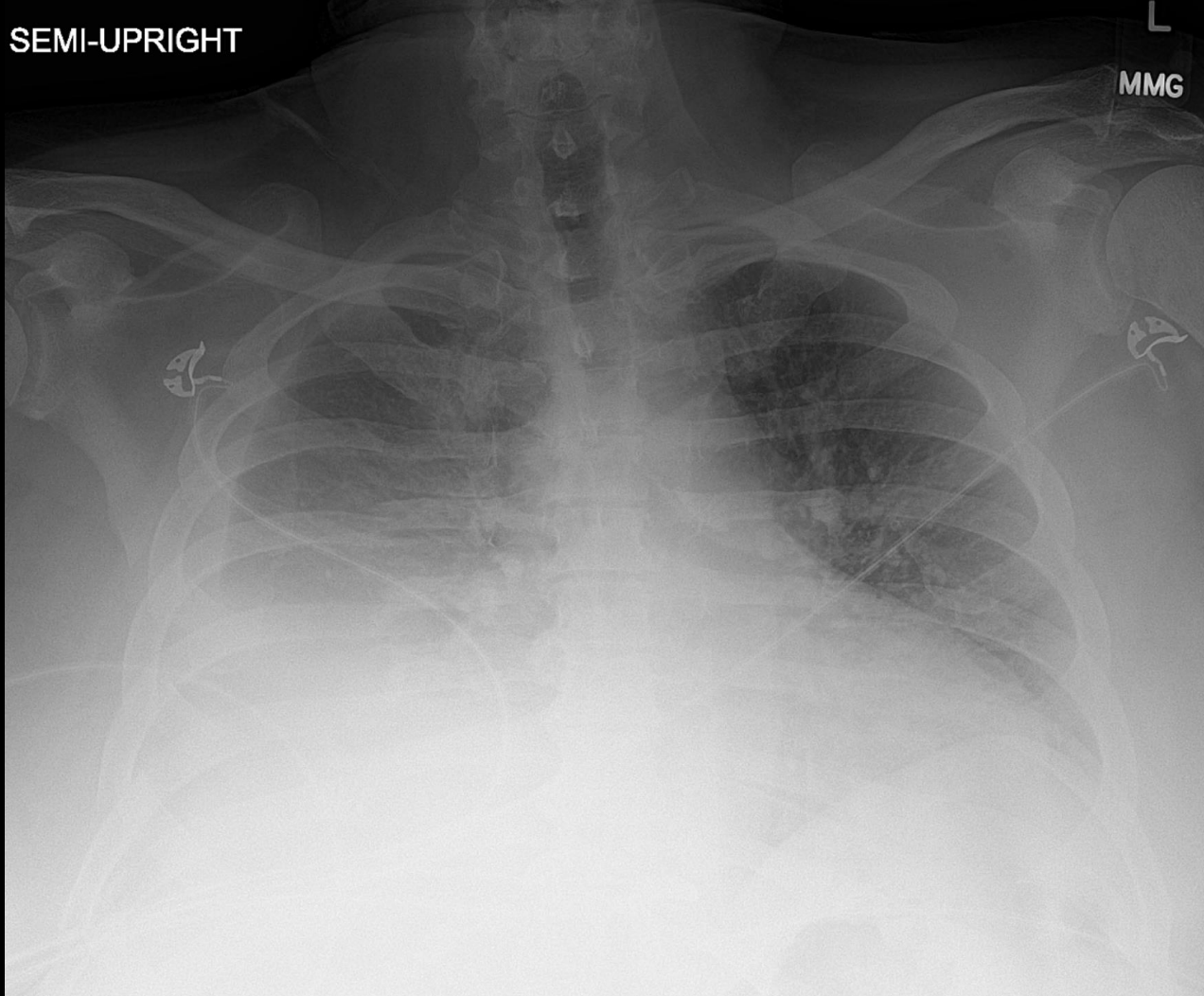


PLEURAL EFFUSION

- Unless loculated, will layer dependently
 - Different appearance in erect vs supine patient
- Can distinguish free vs loculated effusion with lateral decubitus film (affected side down)

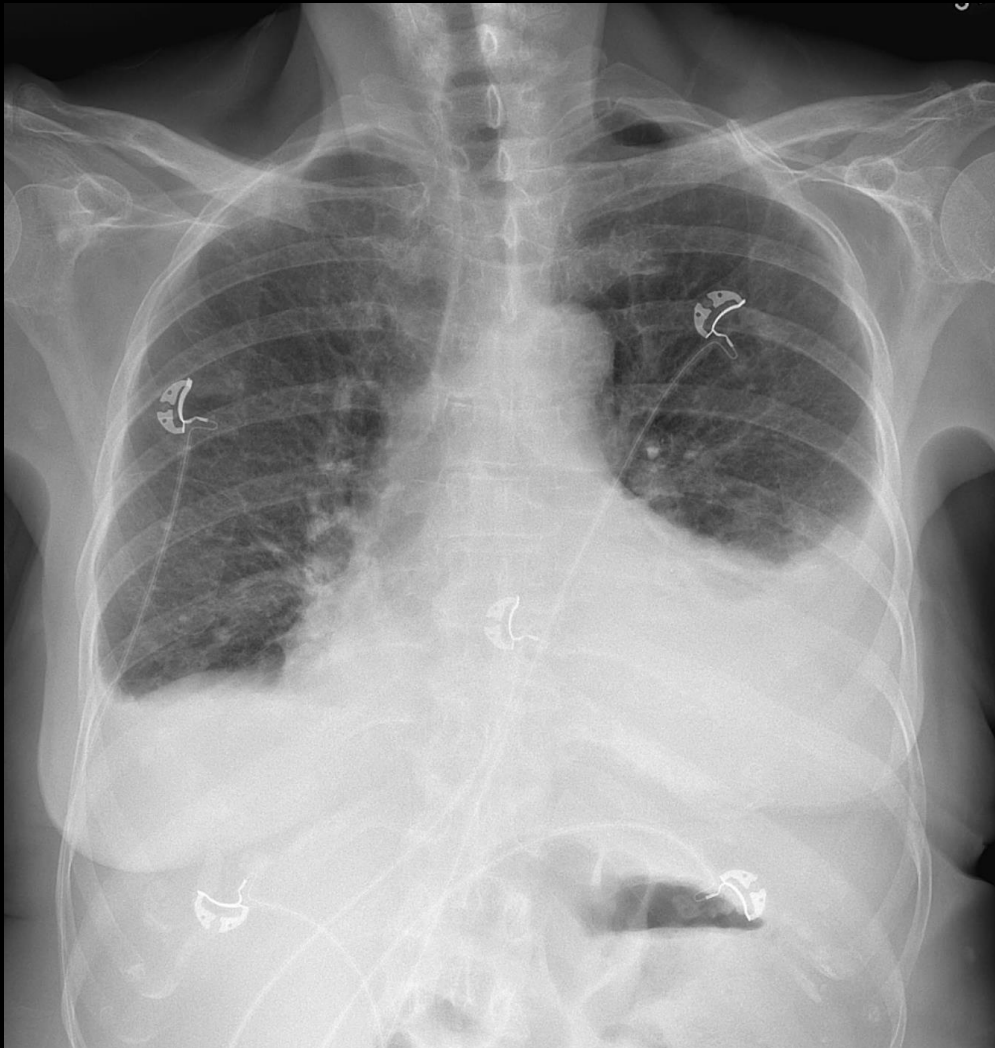
PLEURAL EFFUSION

SEMI-UPRIGHT



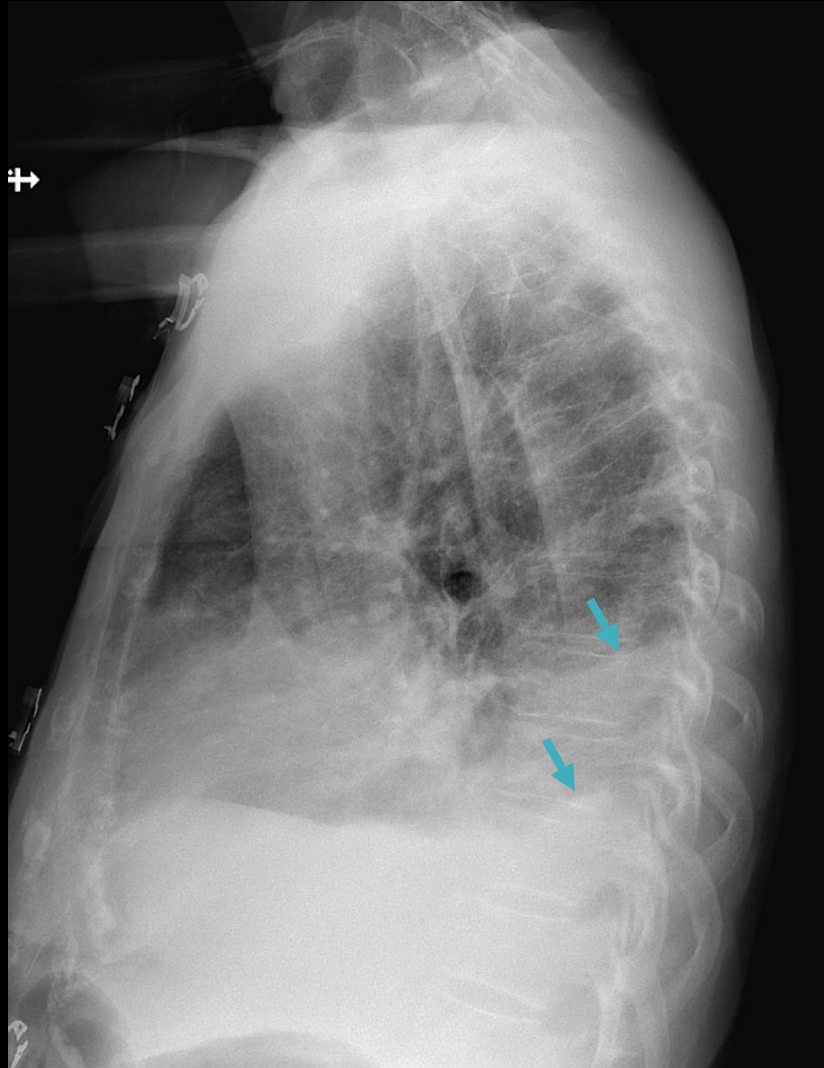
- Gradient density
 - Typical appearance in supine patient

PLEURAL EFFUSION

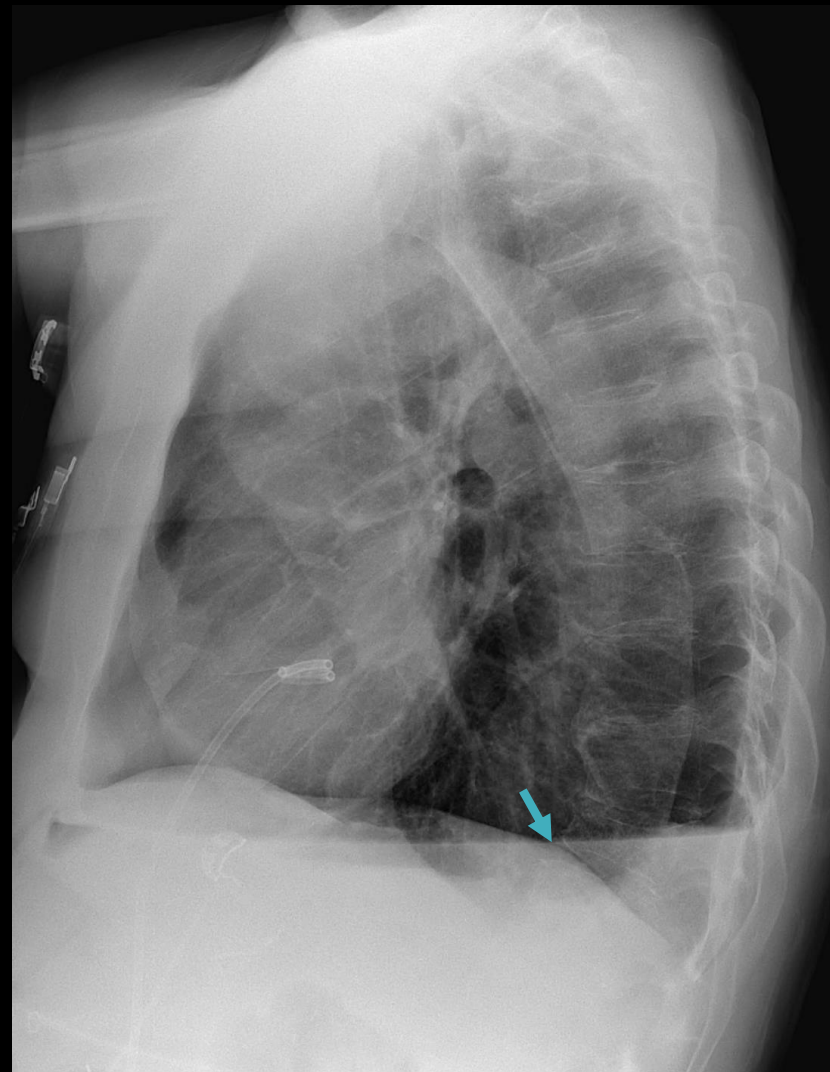
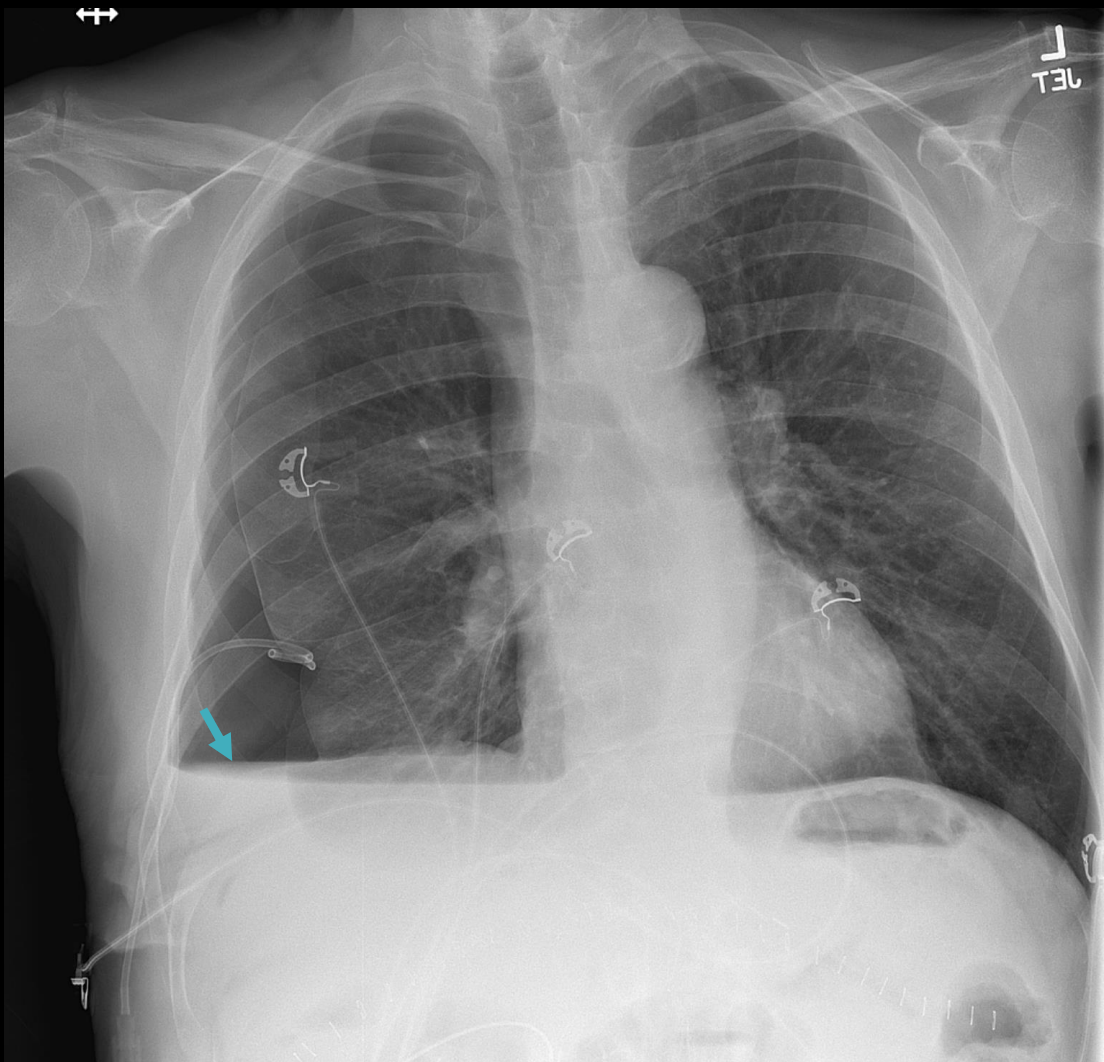


- Meniscus
 - Erect patient

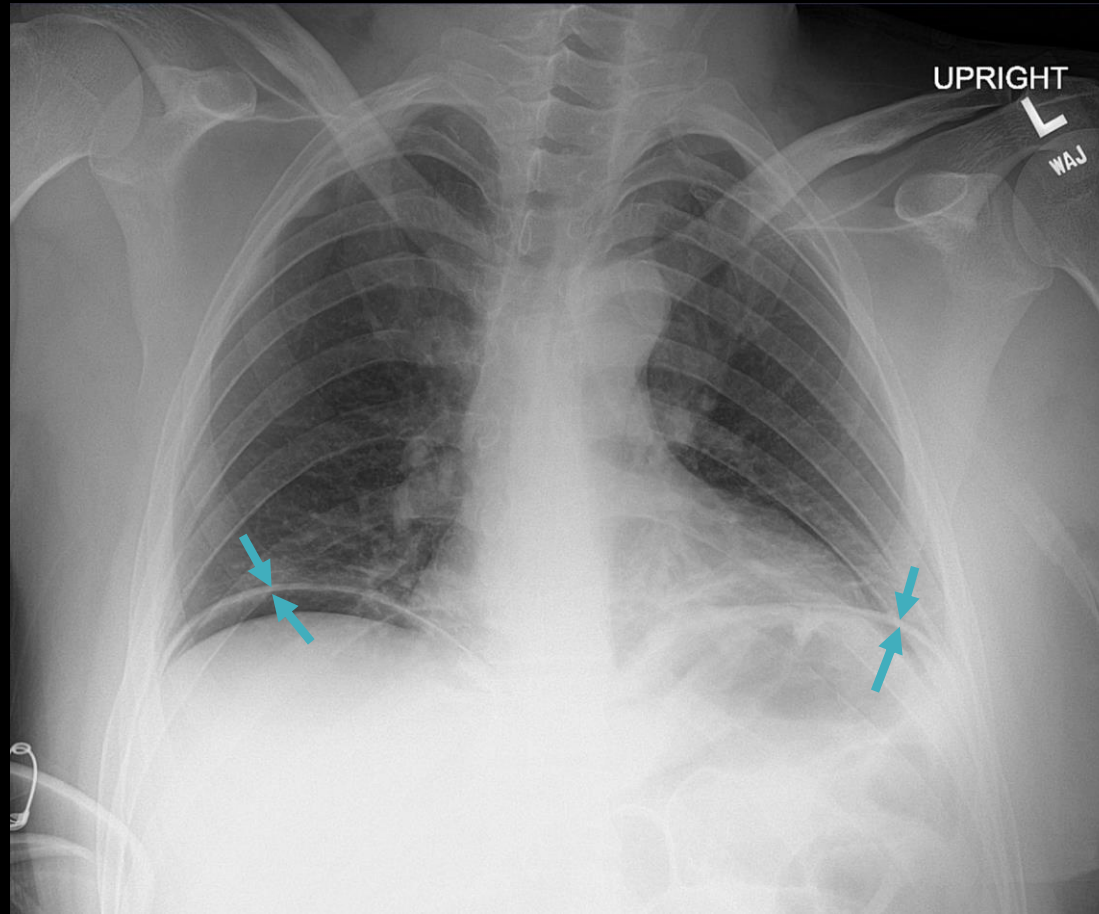
PLEURAL EFFUSION



HYDROPNEUMOTHORAX



D: DIAPHRAGM



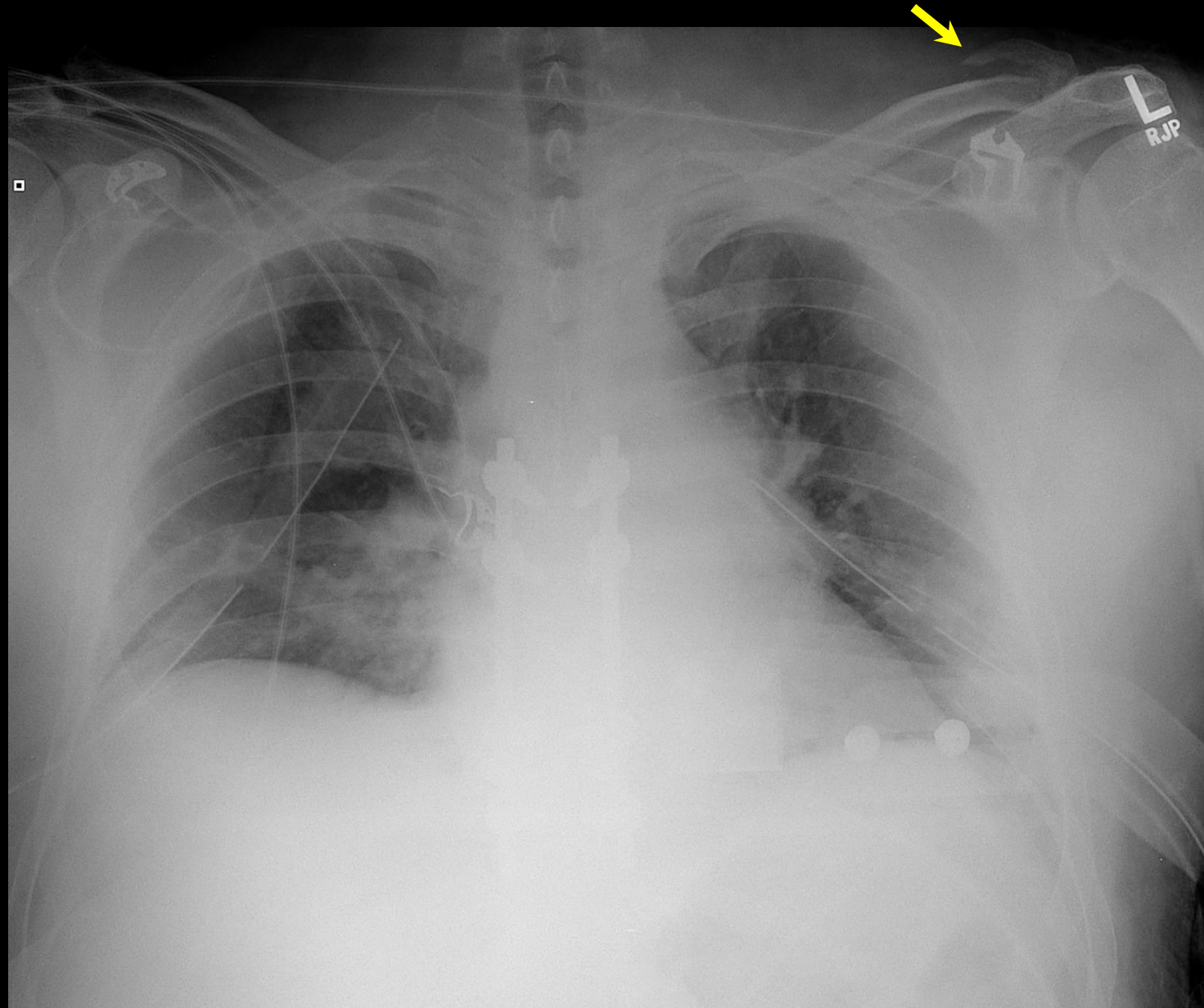
If both sides of the diaphragm are visible or the hemi-diaphragms connect it is a sign of pneumoperitoneum

E:

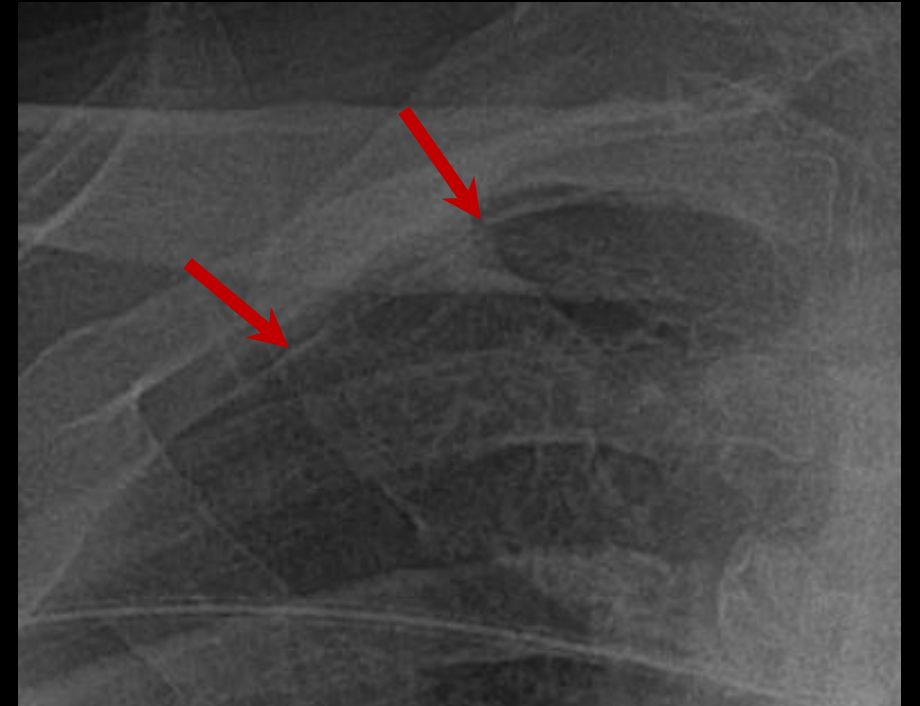
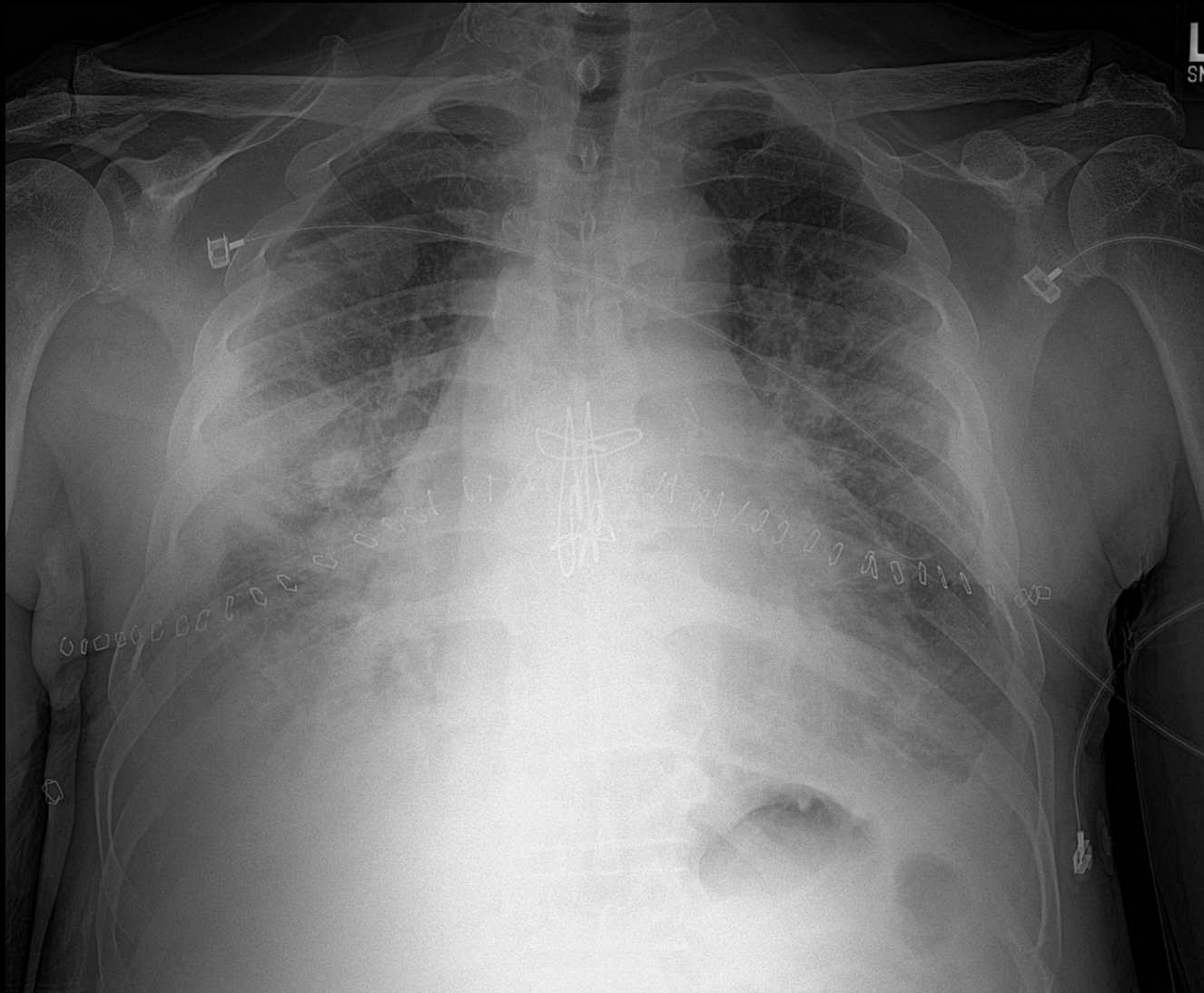
EDGES

Check both the film edges and
anatomical edges

E: EDGES



E: EDGES

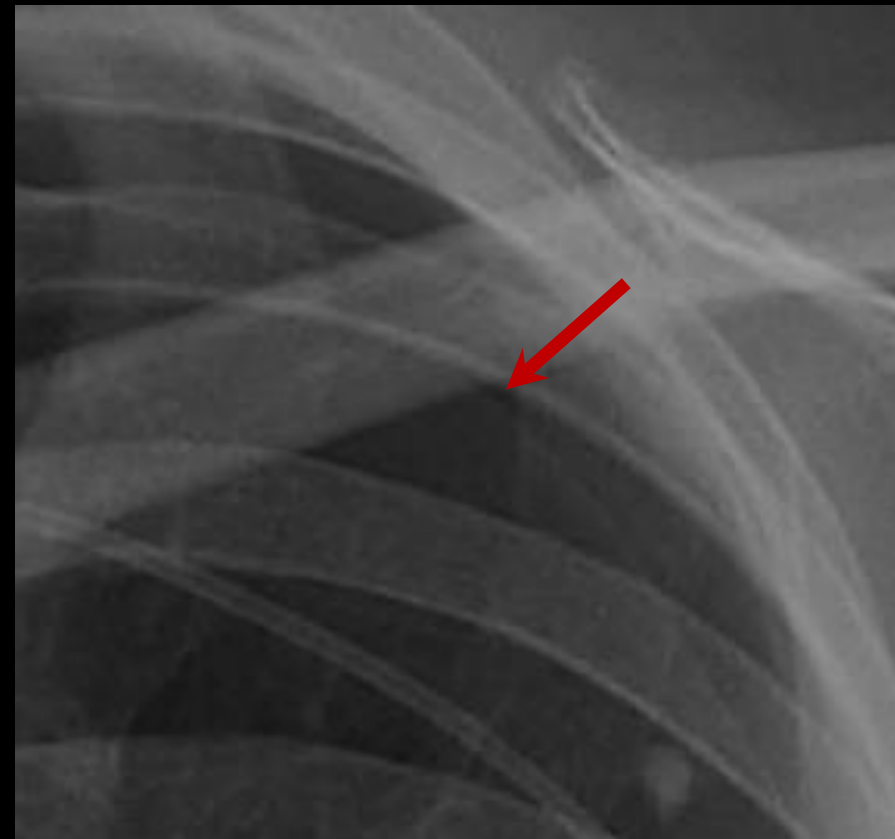
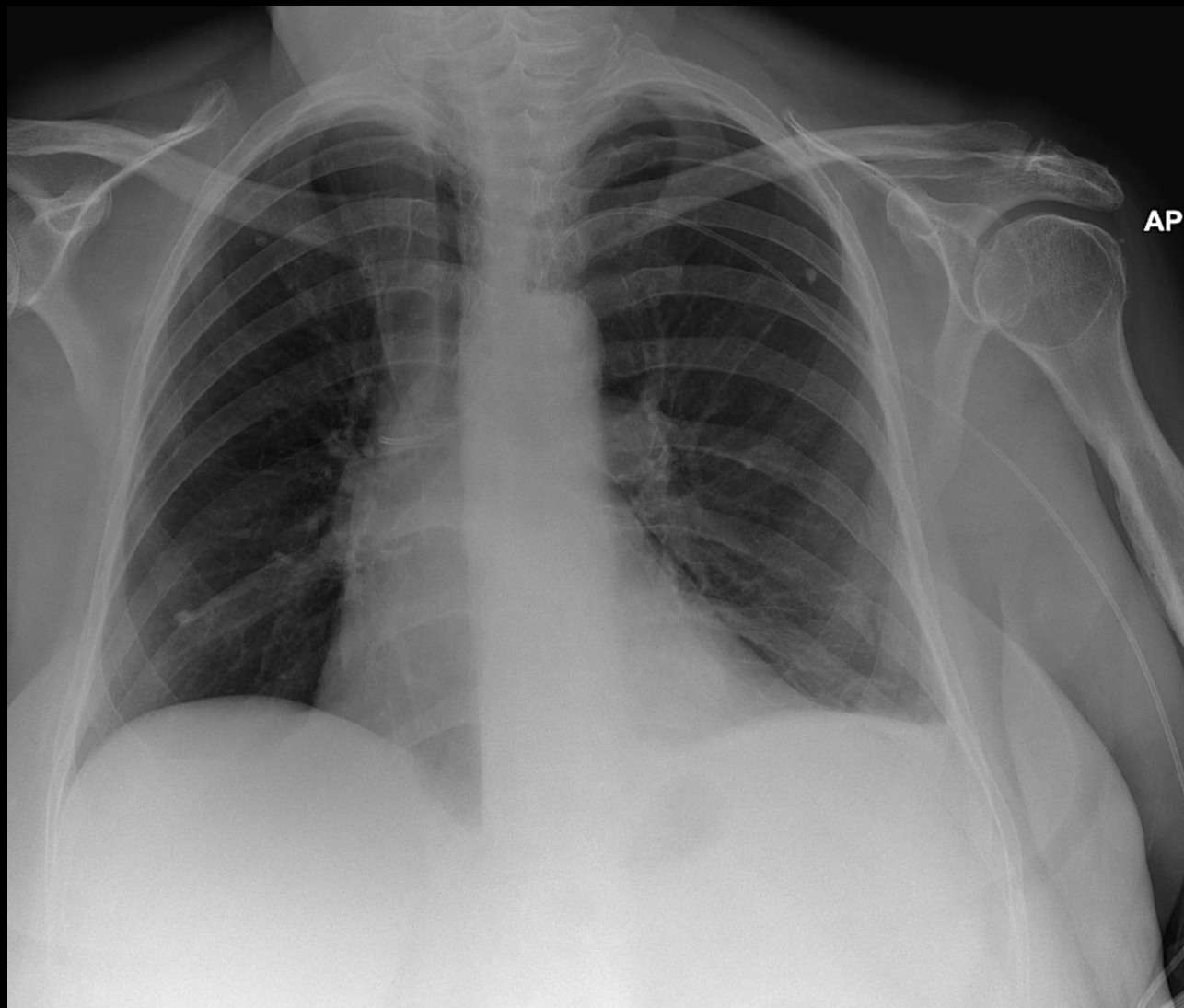


"Anatomic edges": Pleura, mediastinum and right paratracheal stripe

PNEUMOTHORAX

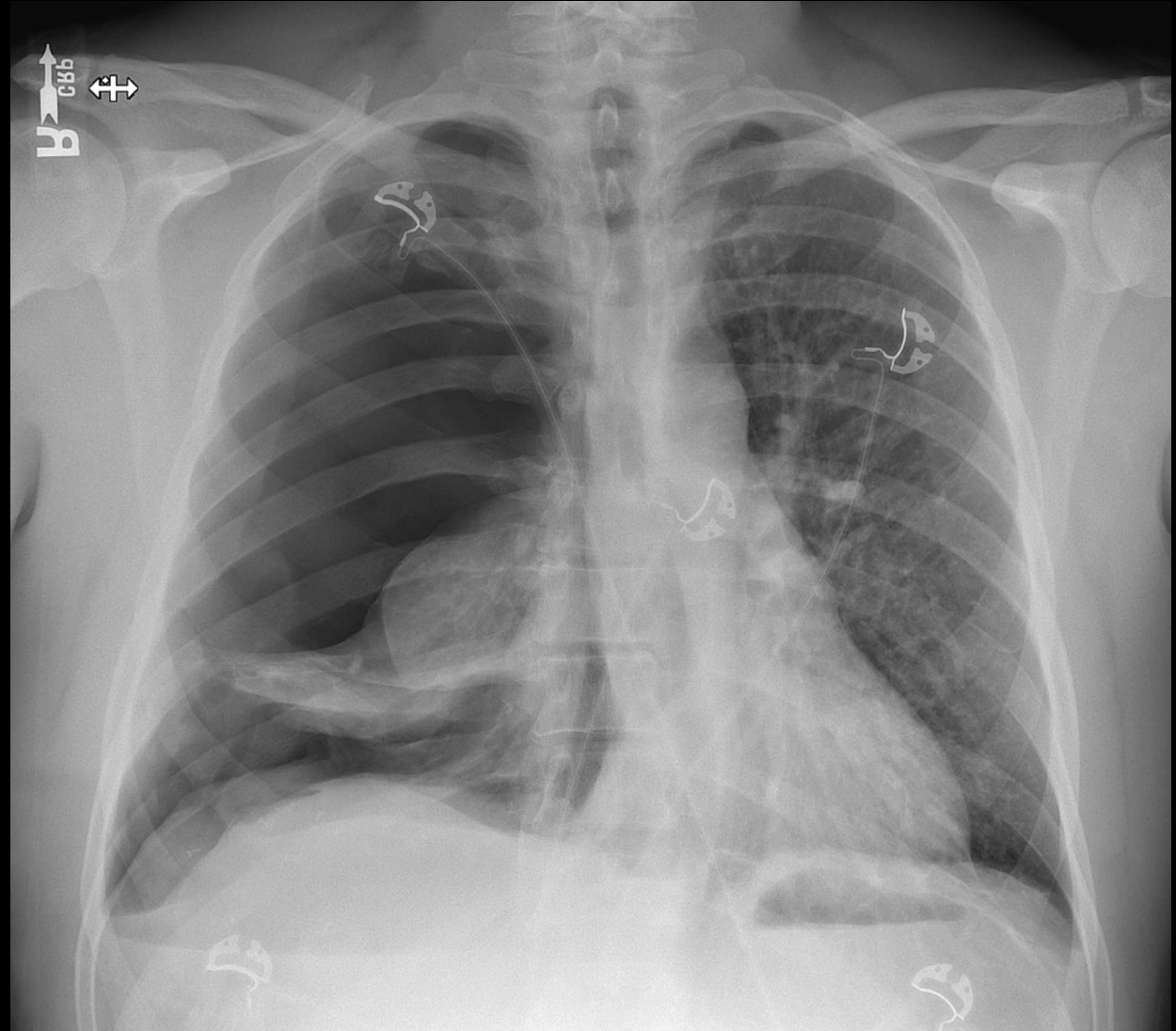
- Nondependent
 - Different in erect vs supine patient
- Signs
 - Thin white line*
 - No lung markings beyond
 - Deep sulcus sign
 - Hyperlucent lung (anterior pneumothorax)
 - Mediastinal shift associated with hyperlucency
 - Tension
 - Sharp diaphragm (subtle)

THIN WHITE LINE



TENSION PNEUMOTHORAX

- Hyperlucency
- Mediastinal **shift**
- Can have deep sulcus sign



E: EDGES

PNEUMOTHORAX

- PTX should be thin sharp white line
- On upright views, no vascular markings peripheral to the line
- Will not extend past the chest wall

SKIN FOLD

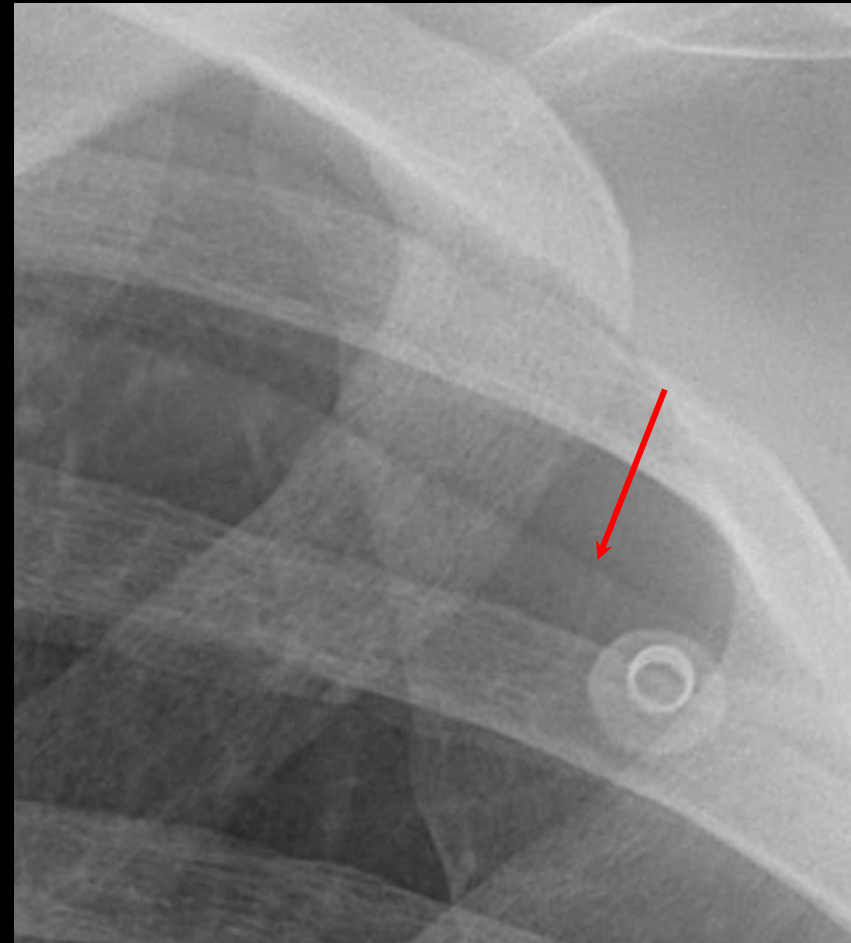
- Vascular markings peripheral to the line
- May extend outside thoracic cavity

E: EDGES

PNEUMOTHORAX



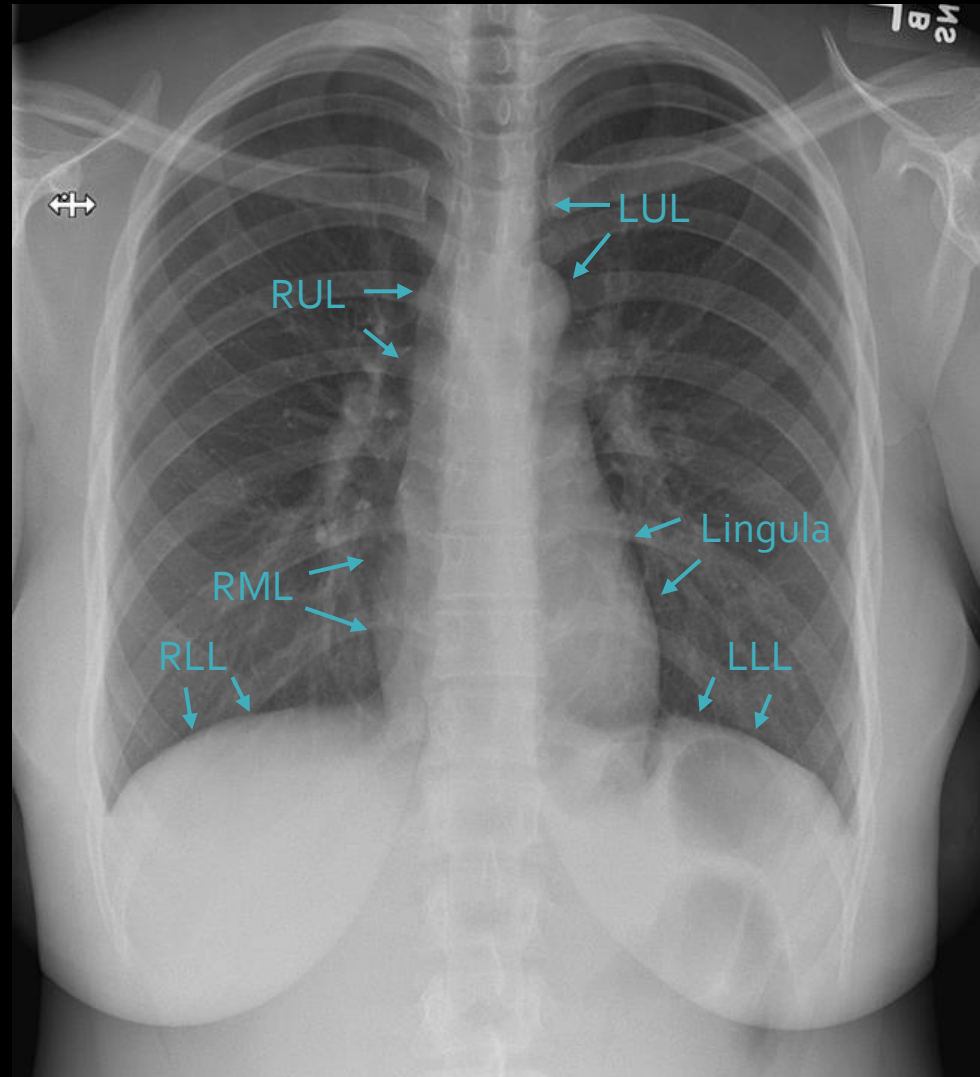
SKIN FOLD



F:

(LUNG) FIELDS

SILHOUETTE SIGN



ATELECTASIS VS PNEUMONIA: THE BOOK VERSION

Atelectasis

Volume loss

Ipsilateral shift

Linear, wedge-shaped

Apex at hilum*

Vascular crowding

No air bronchograms*

Pneumonia

Normal or increased volume

No shift

Consolidation

Not hilum-centered

No vascular crowding

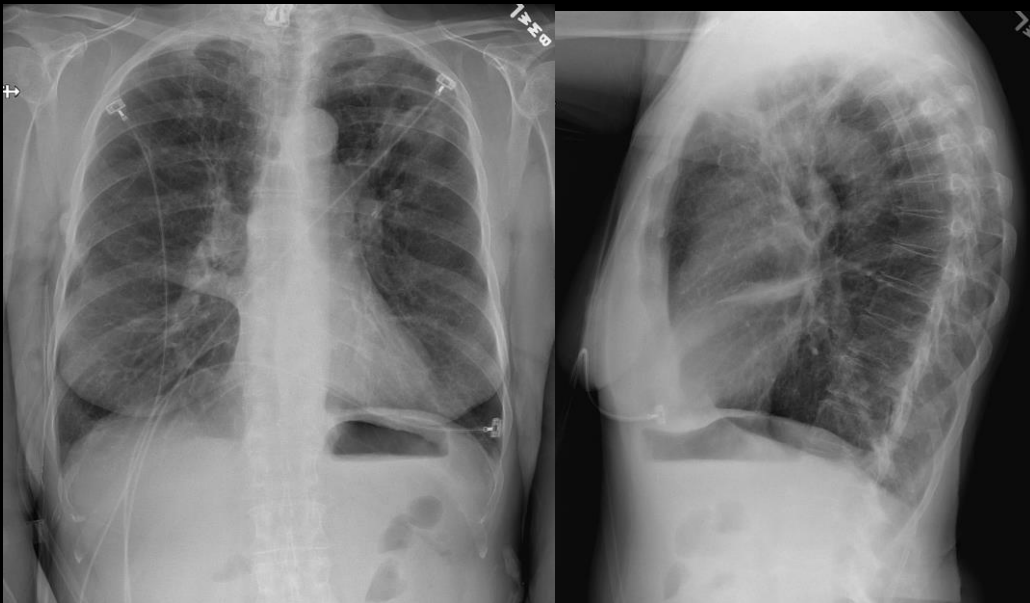
Air bronchograms*

ATELECTASIS VS PNEUMONIA: REAL VERSION

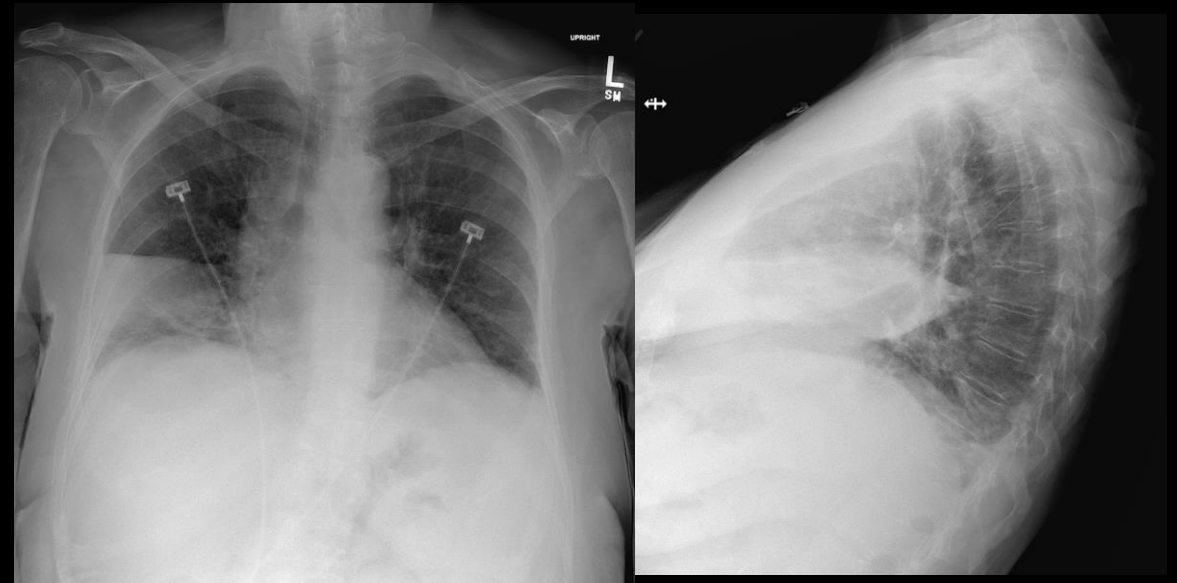
- “There is an area of increased opacification in the right/left lung base which may represent atelectasis or pneumonia”
- In reality, the two are frequently found together and are difficult and often impossible to separate

RML PNEUMONIA VERSUS ATELECTASIS

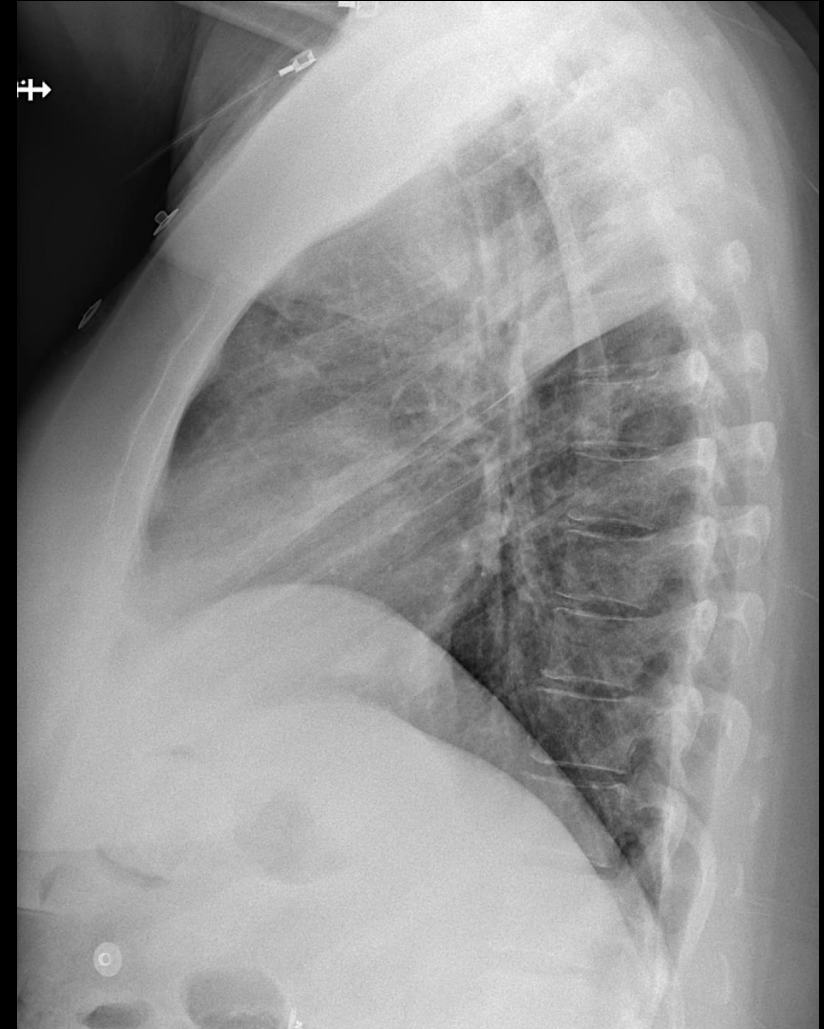
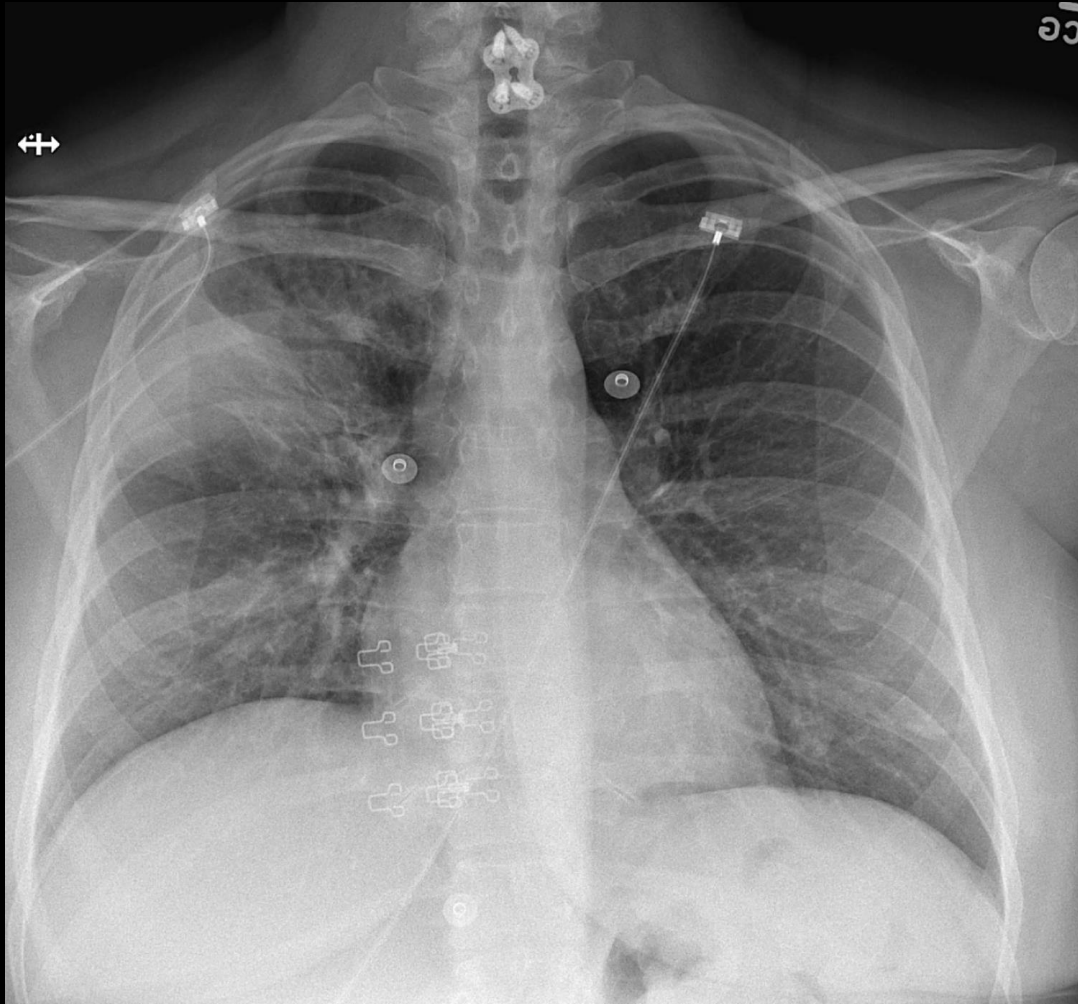
Atelectasis



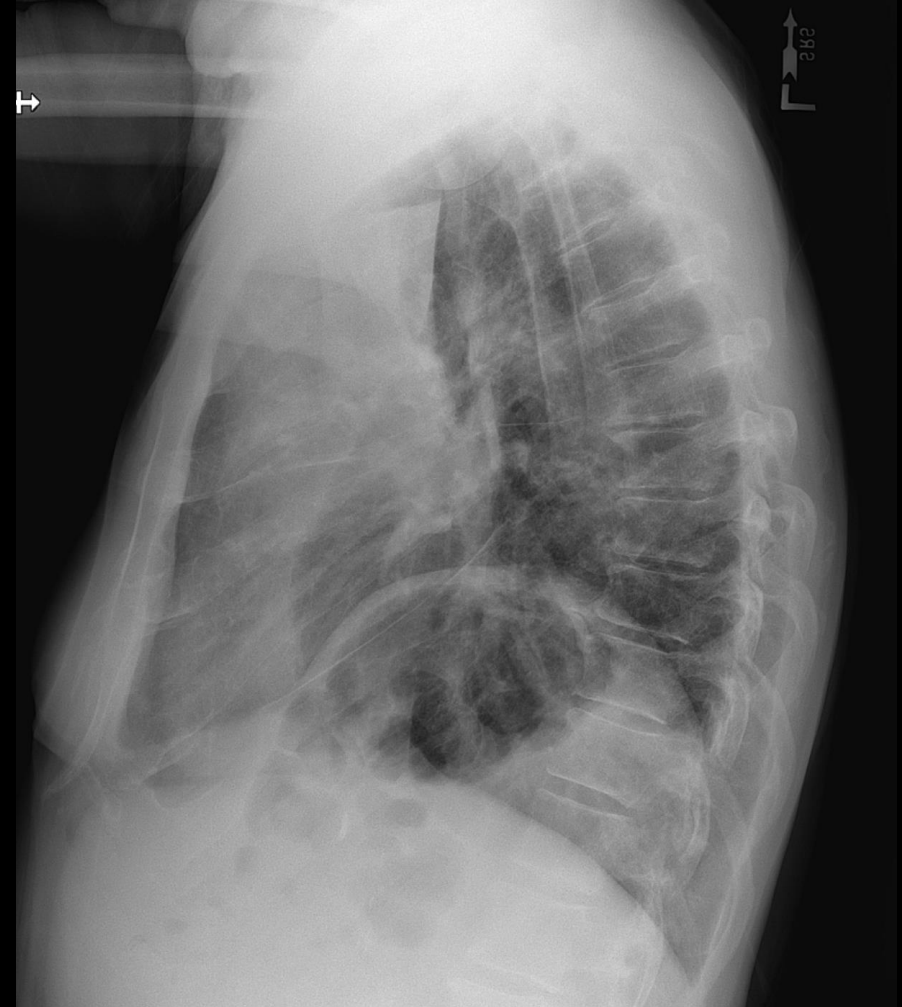
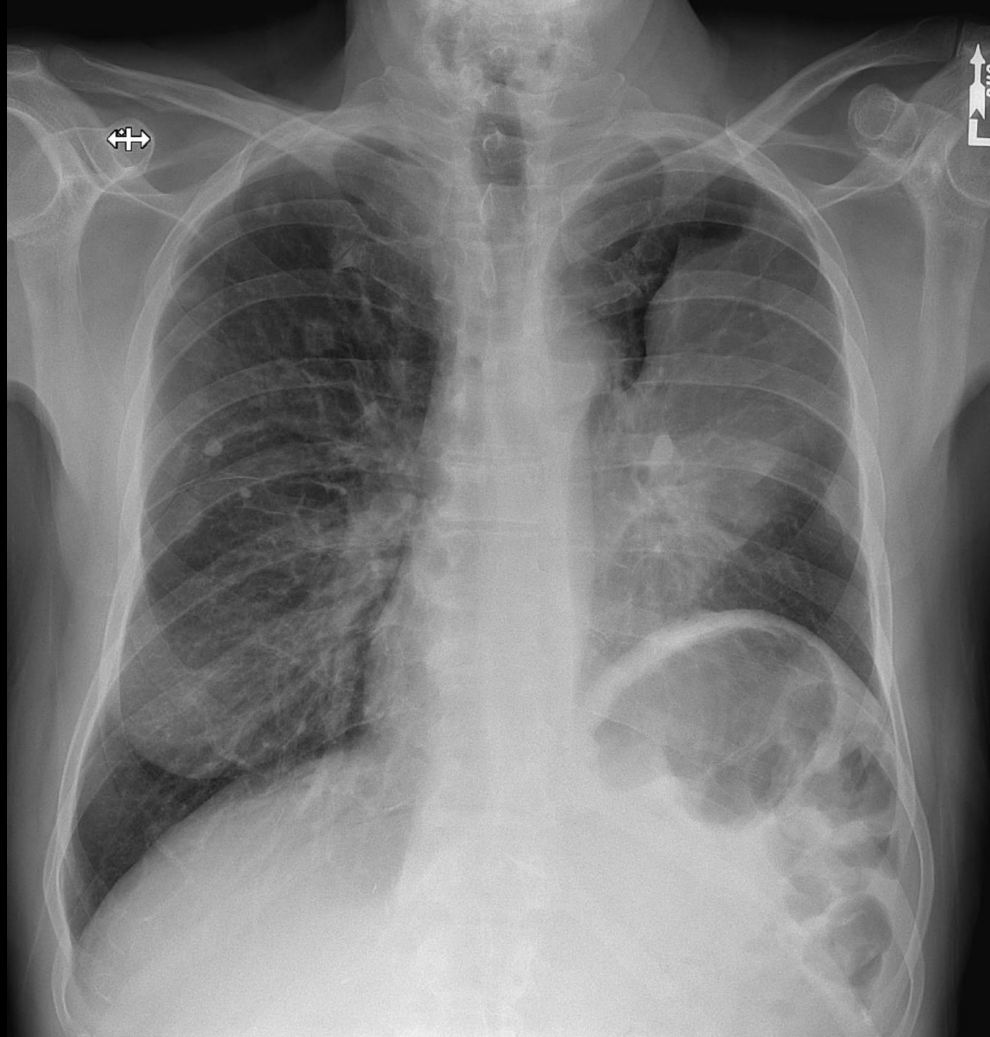
Pneumonia



RIGHT UPPER LOBE PNEUMONIA



LEFT UPPER LOBE ATELECTASIS



PULMONARY EDEMA

Fluid-related

Heart failure

Volume overload

Low oncotic pressure

Lymphatic insufficiency

Mitral regurgitation

Arrhythmia

Misc

Inhalation injury

Neurogenic

Re-expansion

DIC

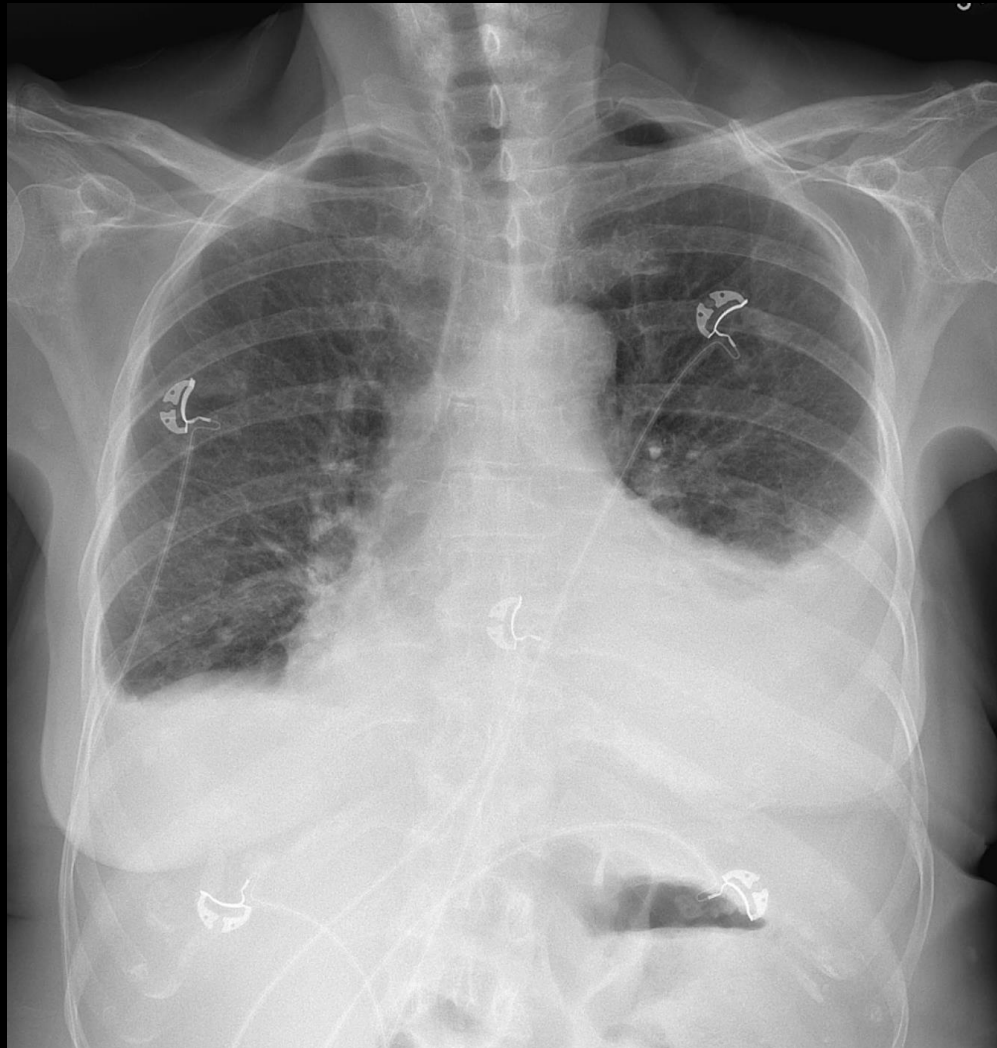
Near-drowning

ARDS

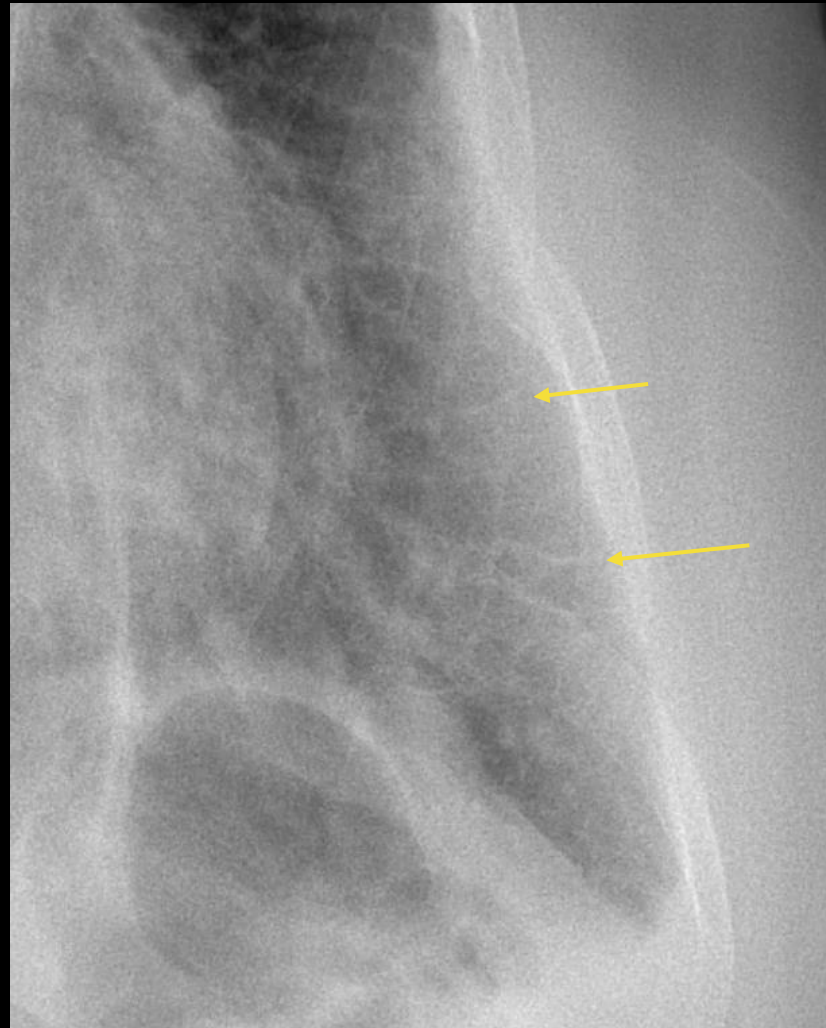
CHF and Pulmonary Edema

Stage	Findings
1 : Redistribution	(Cephalization) Cardiomegaly
2: Interstitial edema Volume overload	Kerley B lines Fissural thickening
3: Alveolar edema	Airspace opacity Air bronchograms "Cottonwool" Pleural effusion

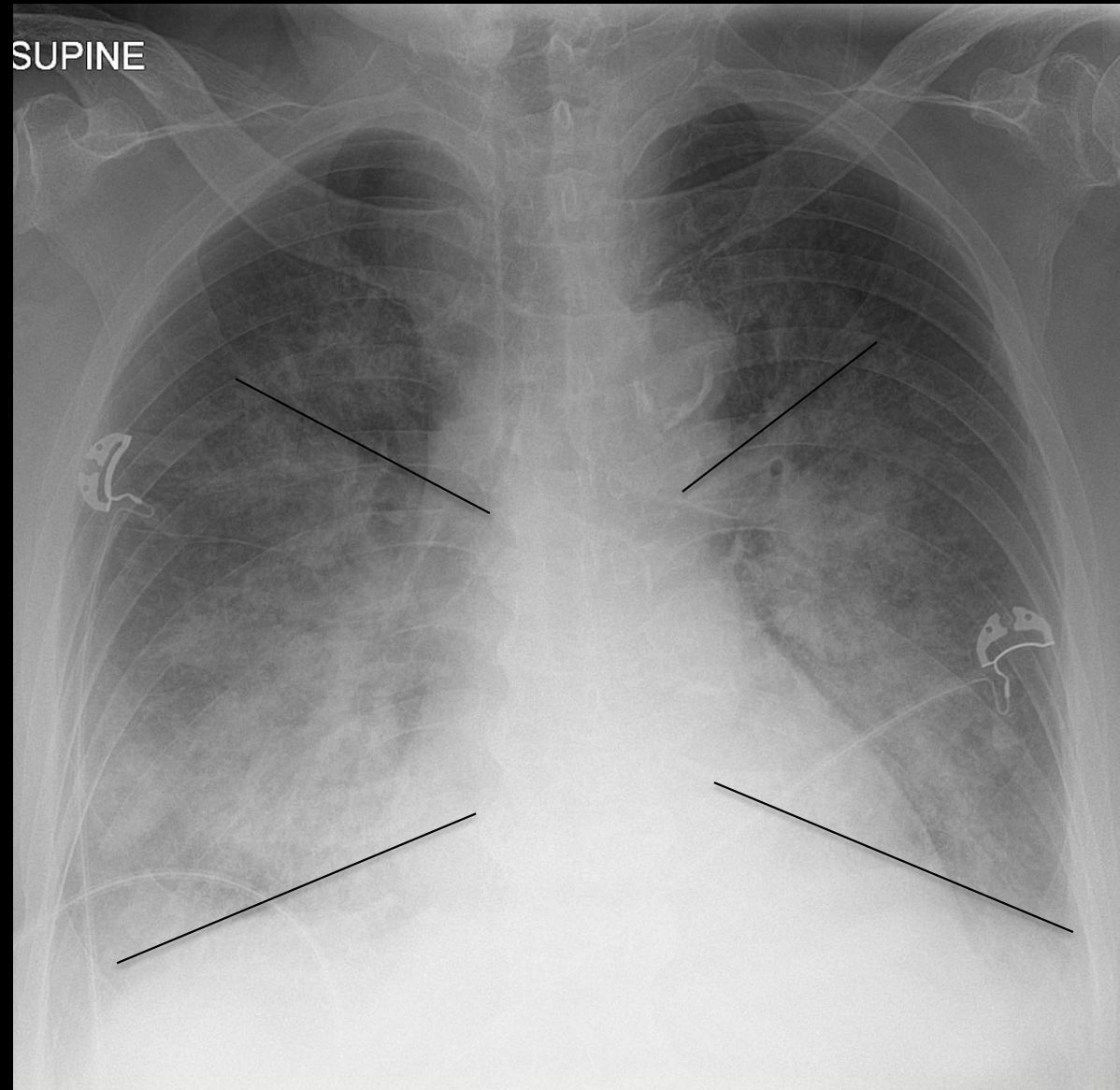
PULMONARY EDEMA



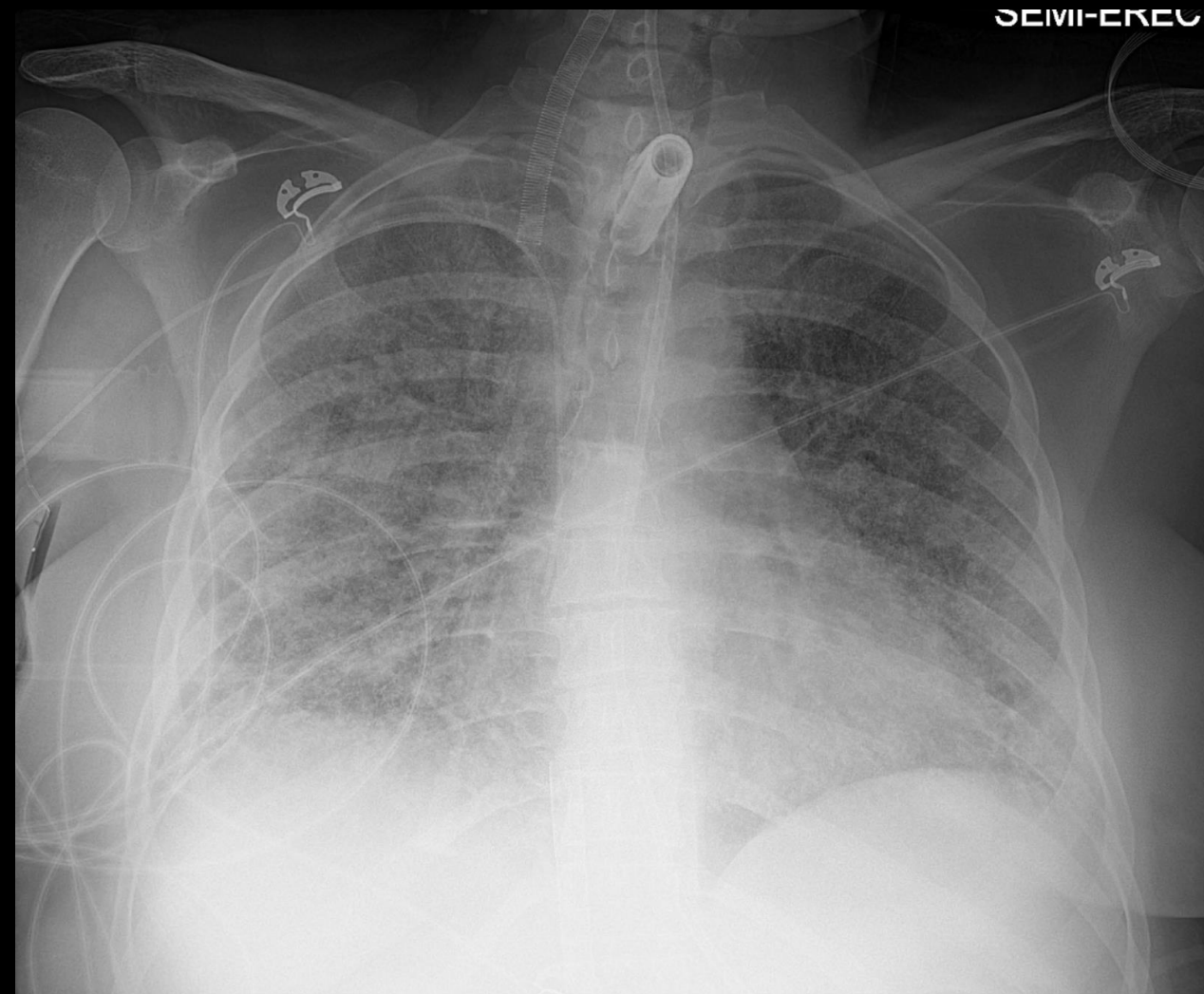
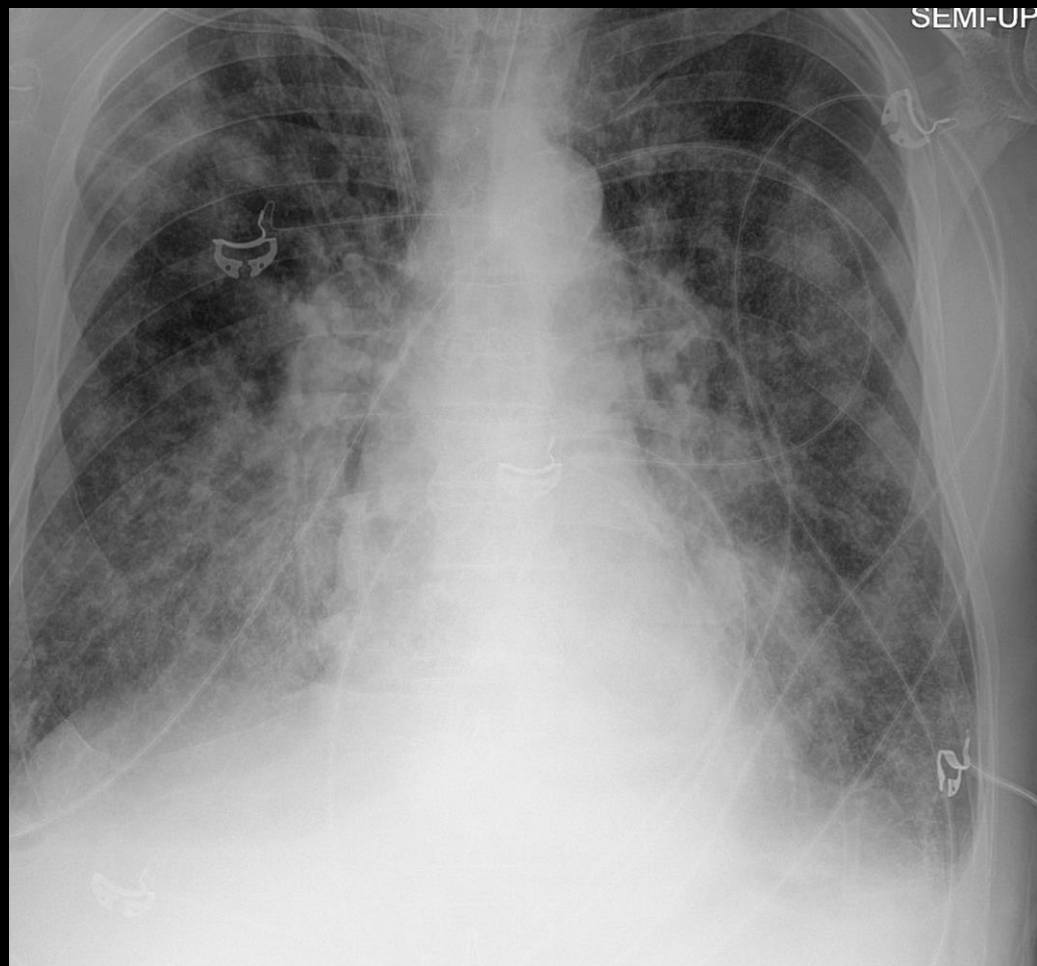
SEPTAL LINES (AKA KERLEY B LINES)



ALVEOLAR EDEMA

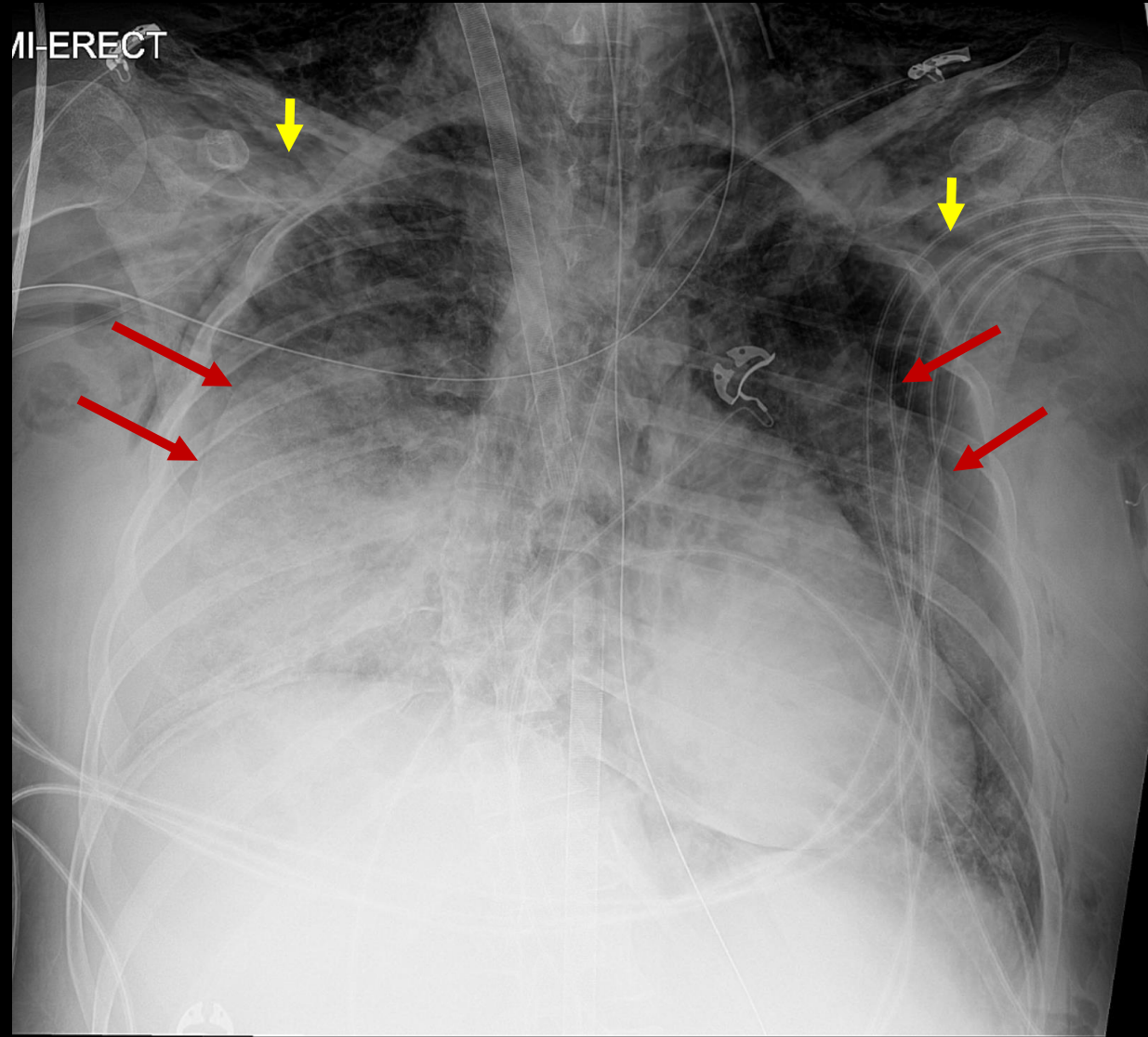


ARDS



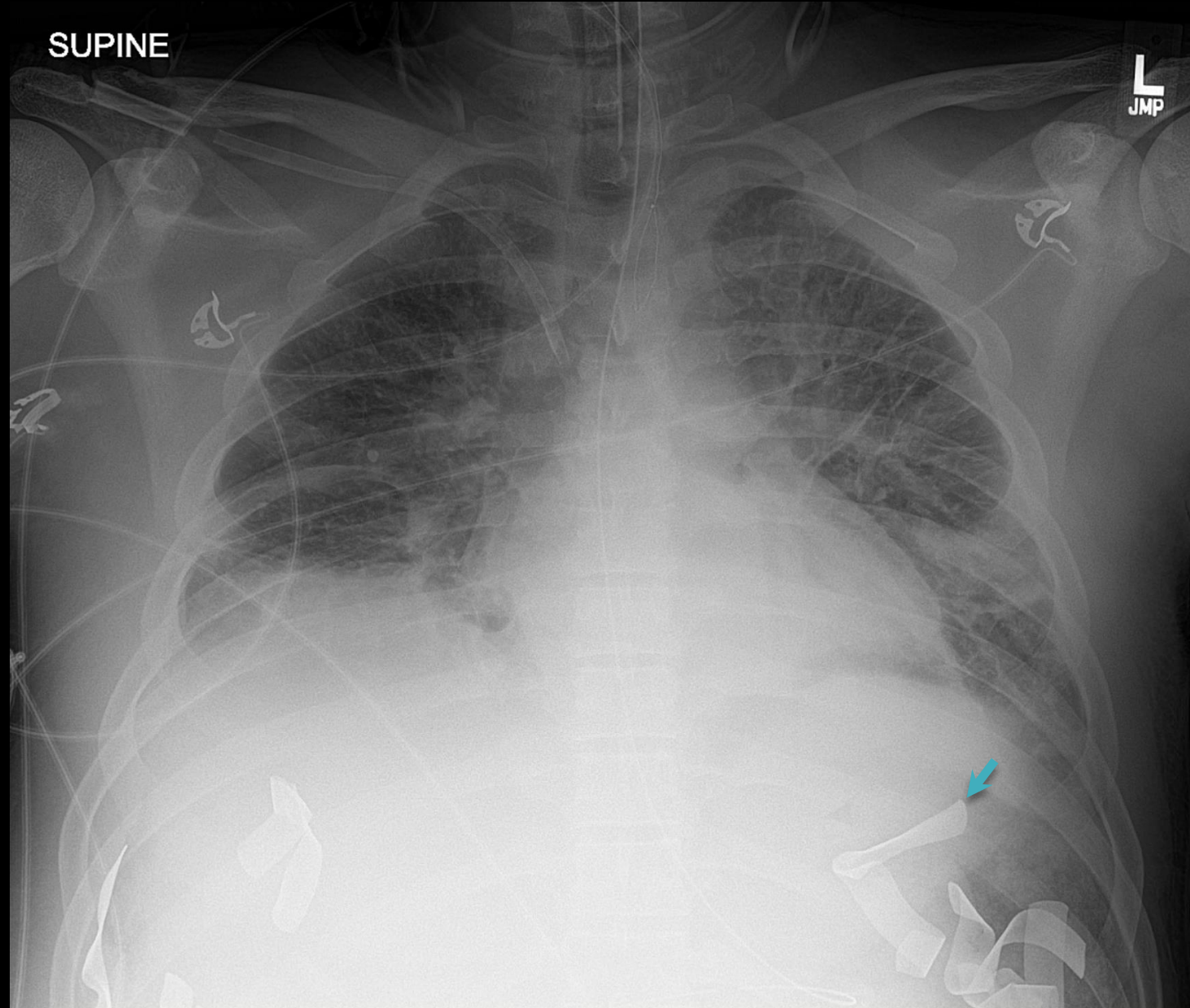
ARDS

AND PNEUMOTHORACES, SUBCUTANEOUS EMPHYSEMA

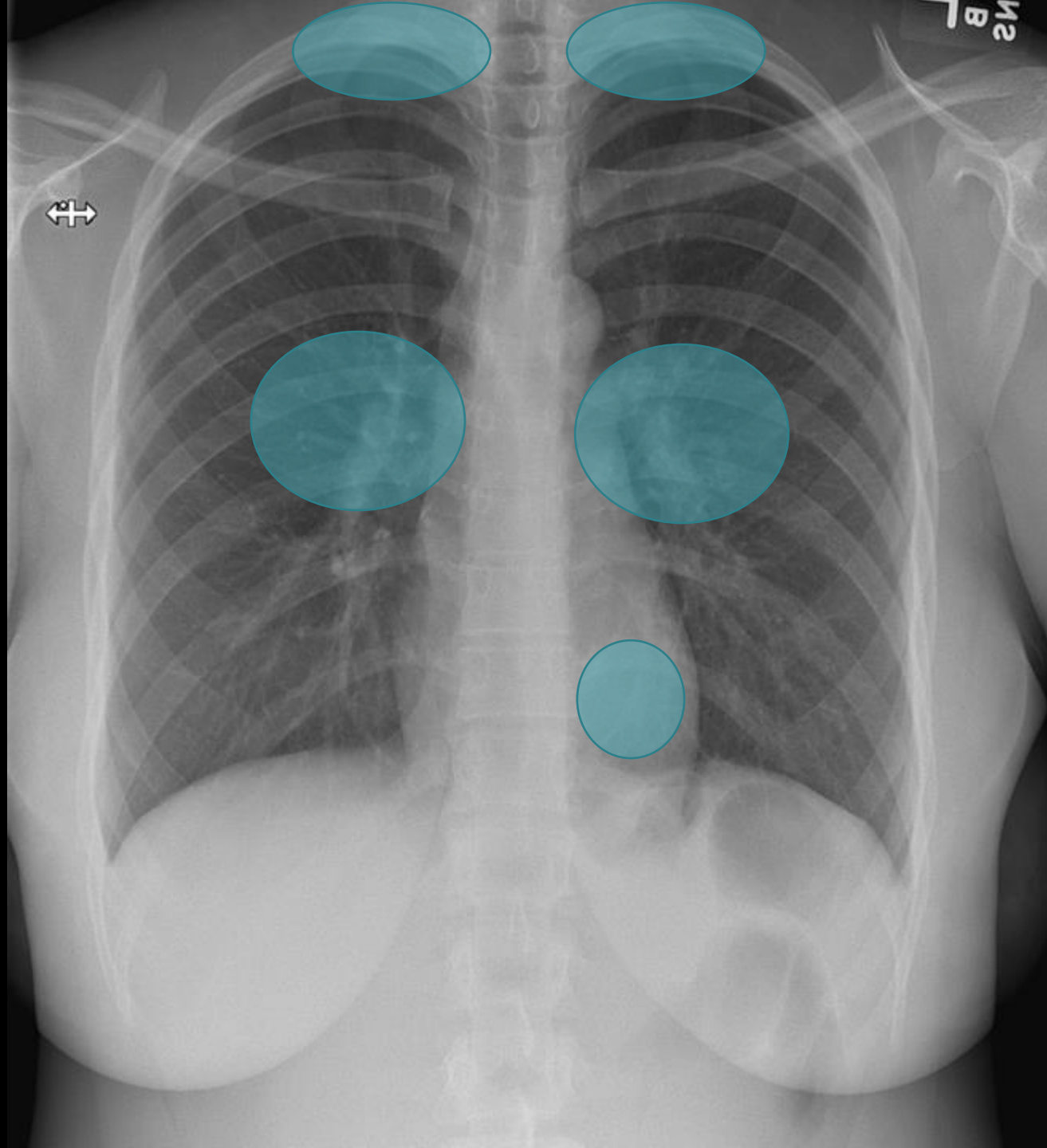


G: GUT

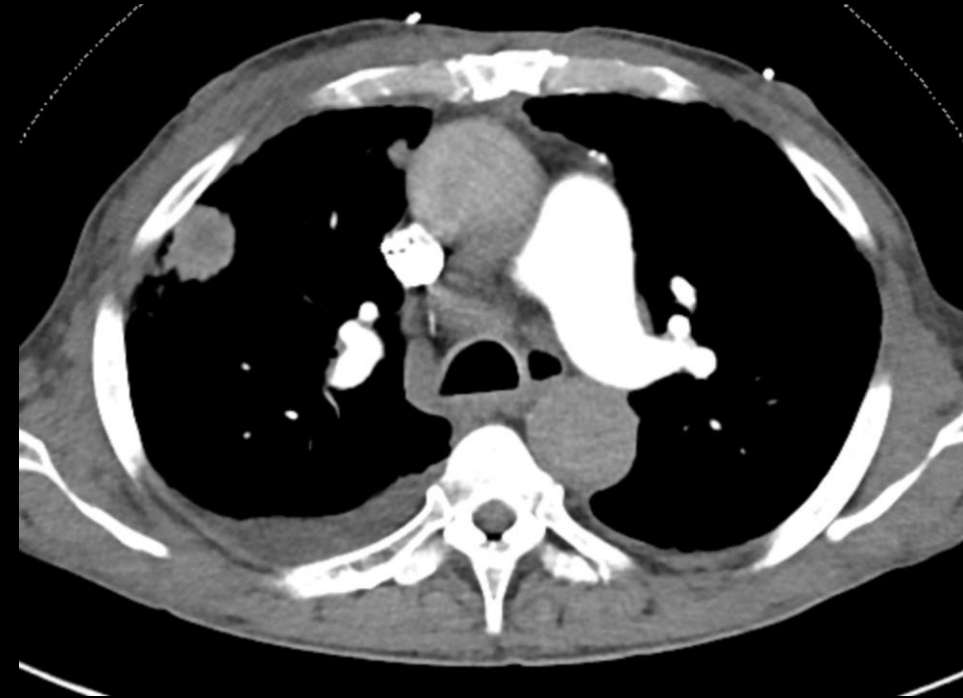
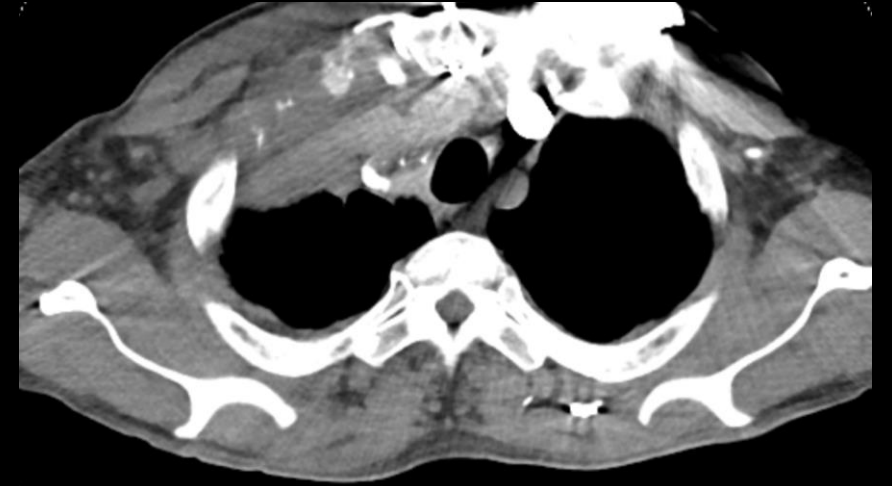
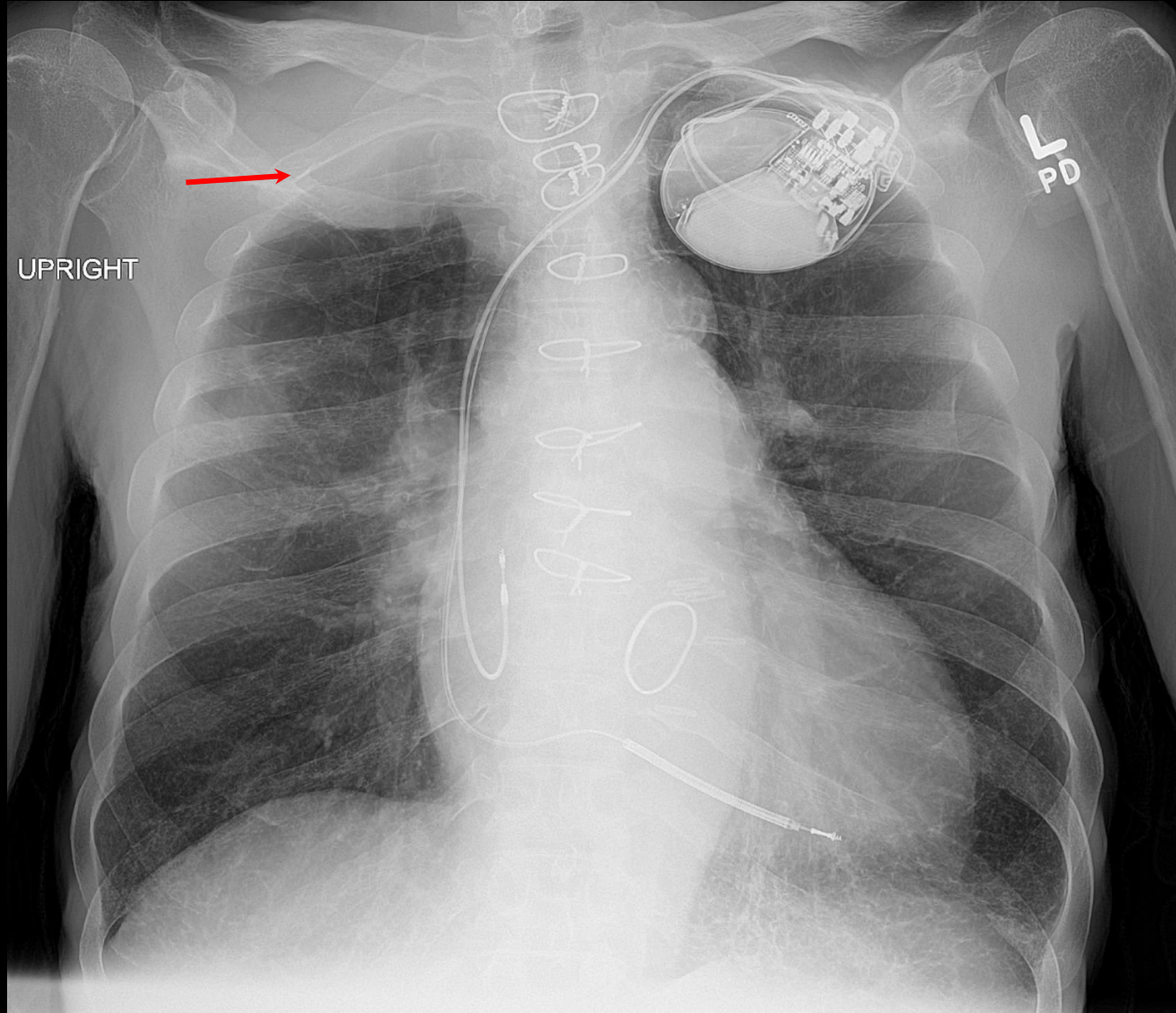
DON'T STOP AT THE DIAPHRAGM



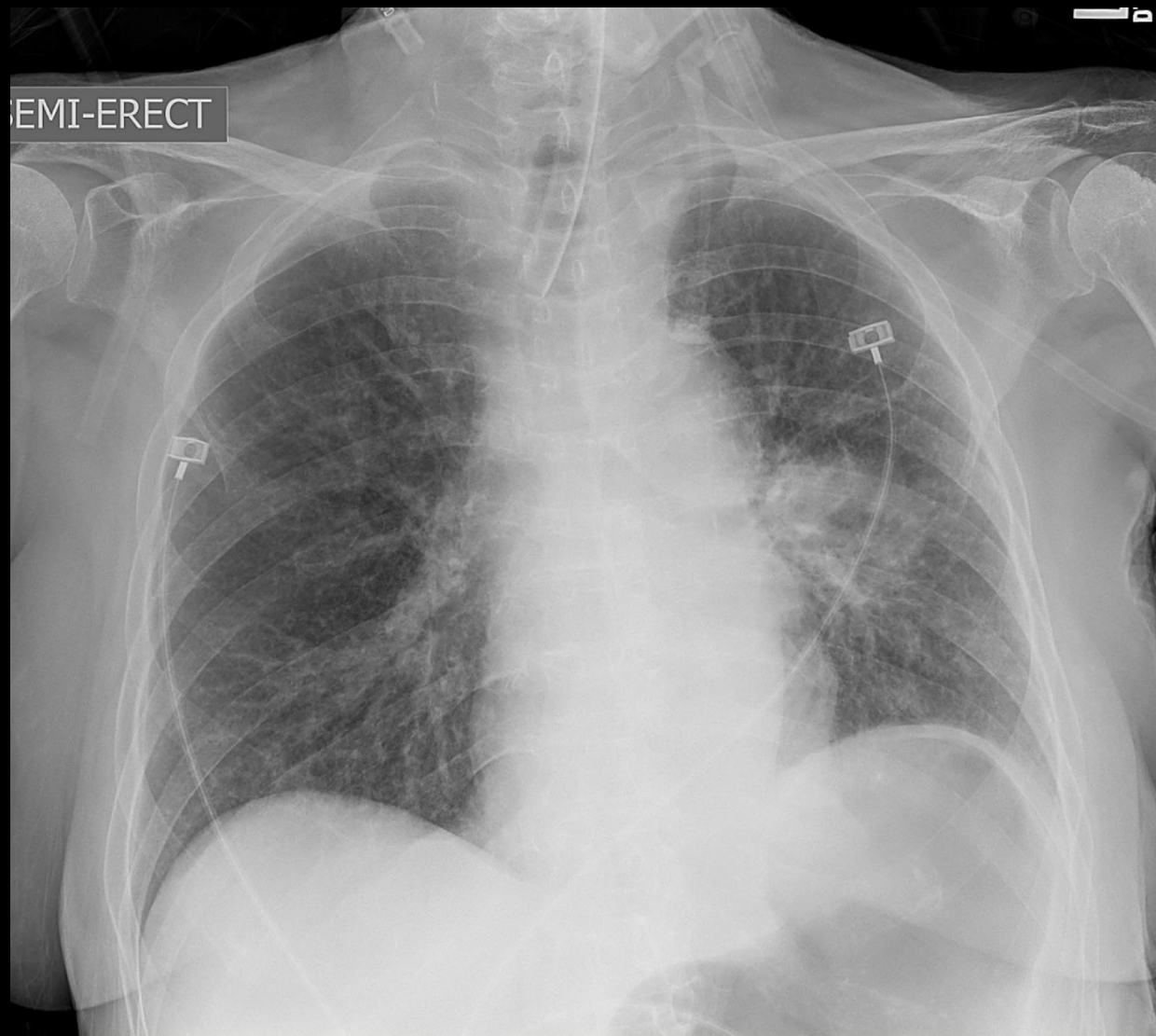
H: HIDDEN
AREAS



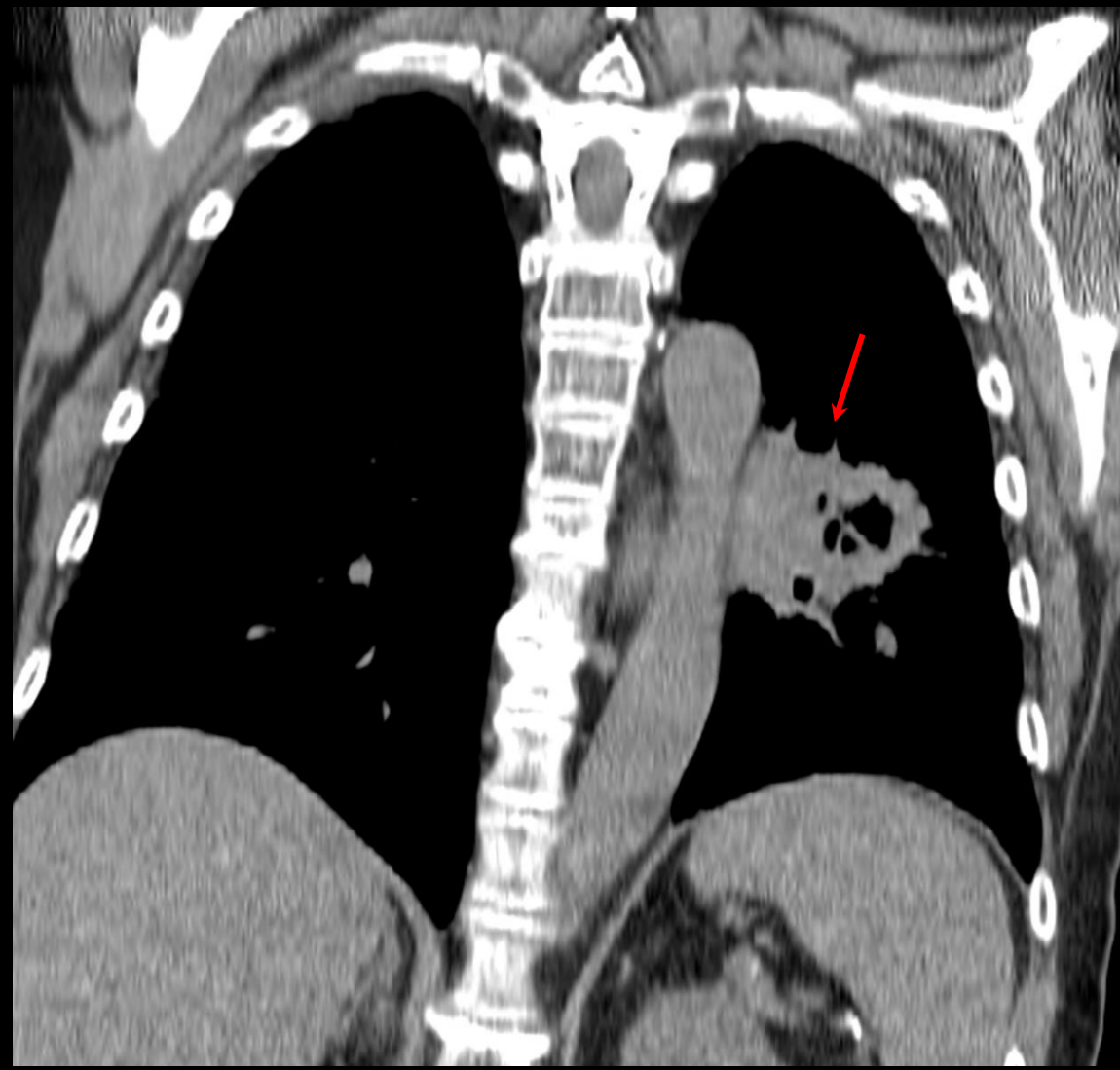
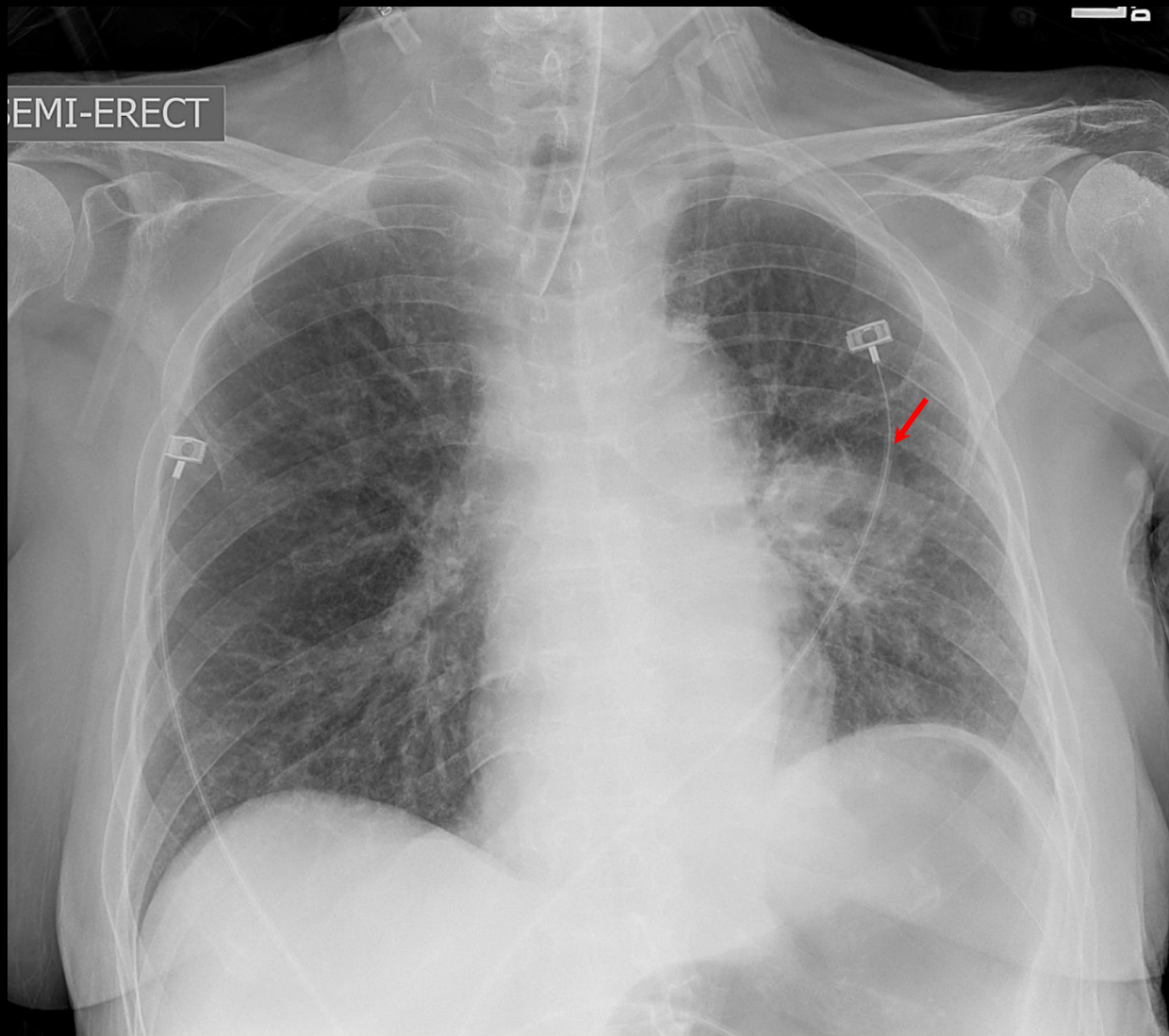
H: HIDDEN



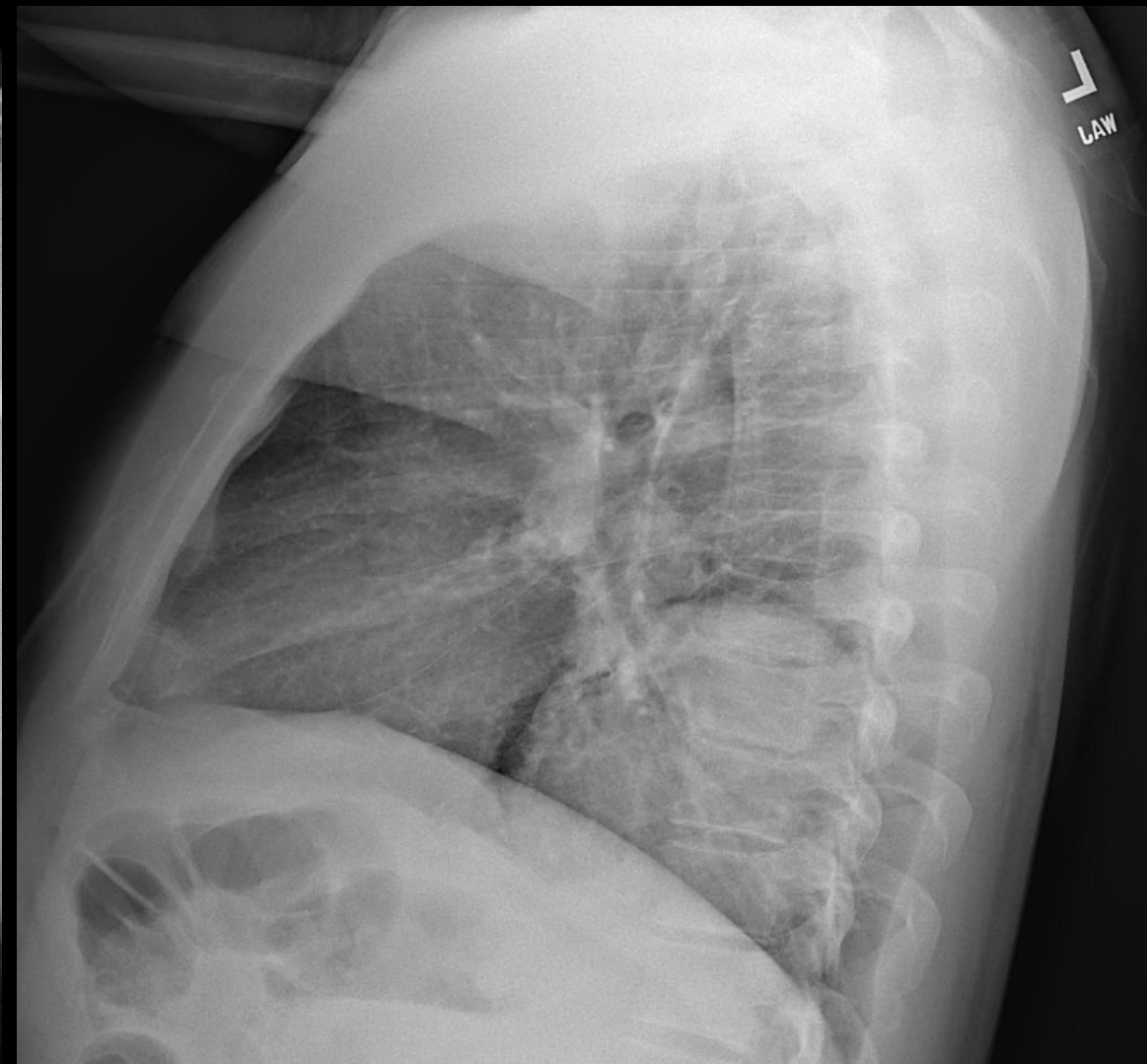
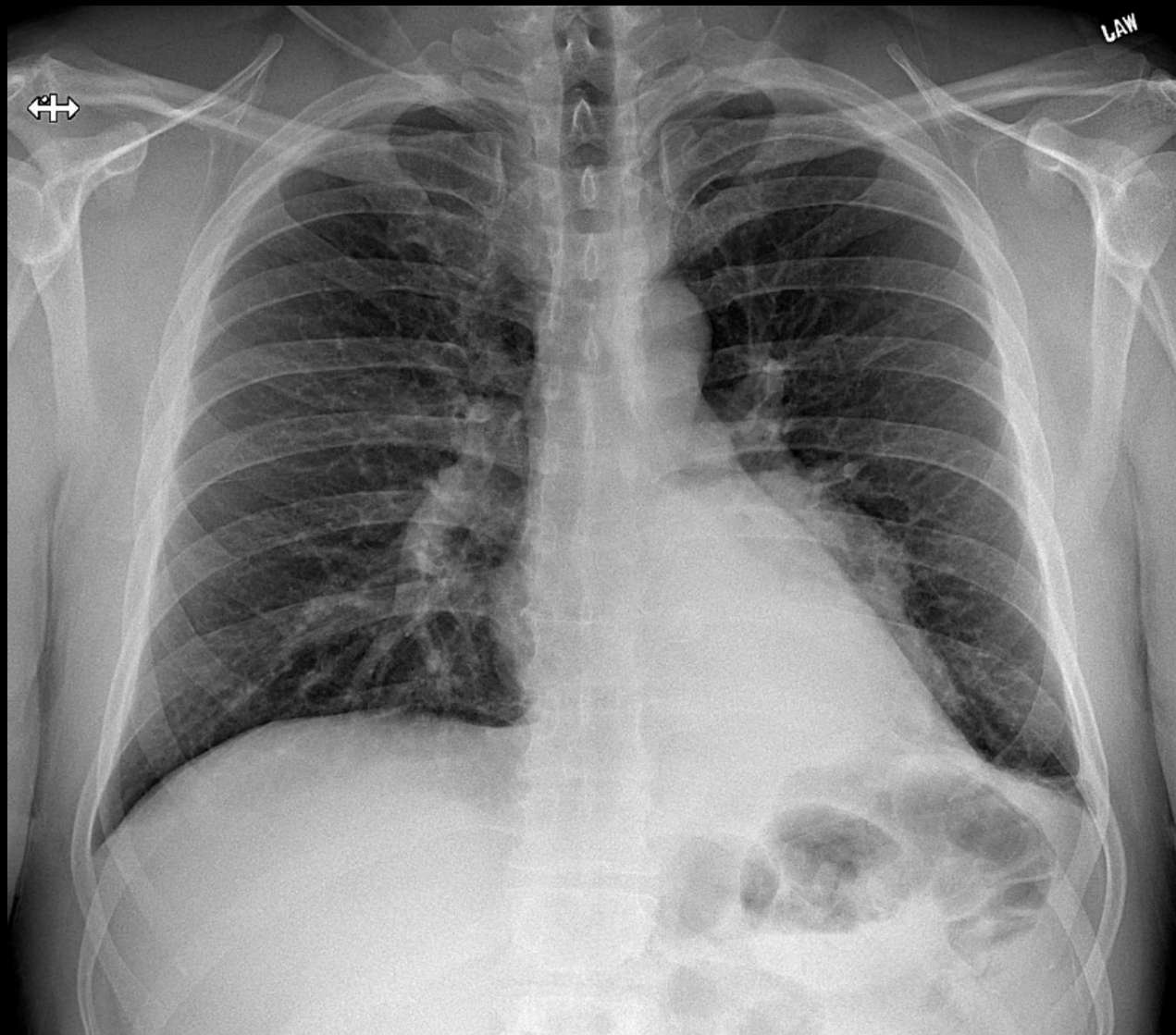
H: HIDDEN



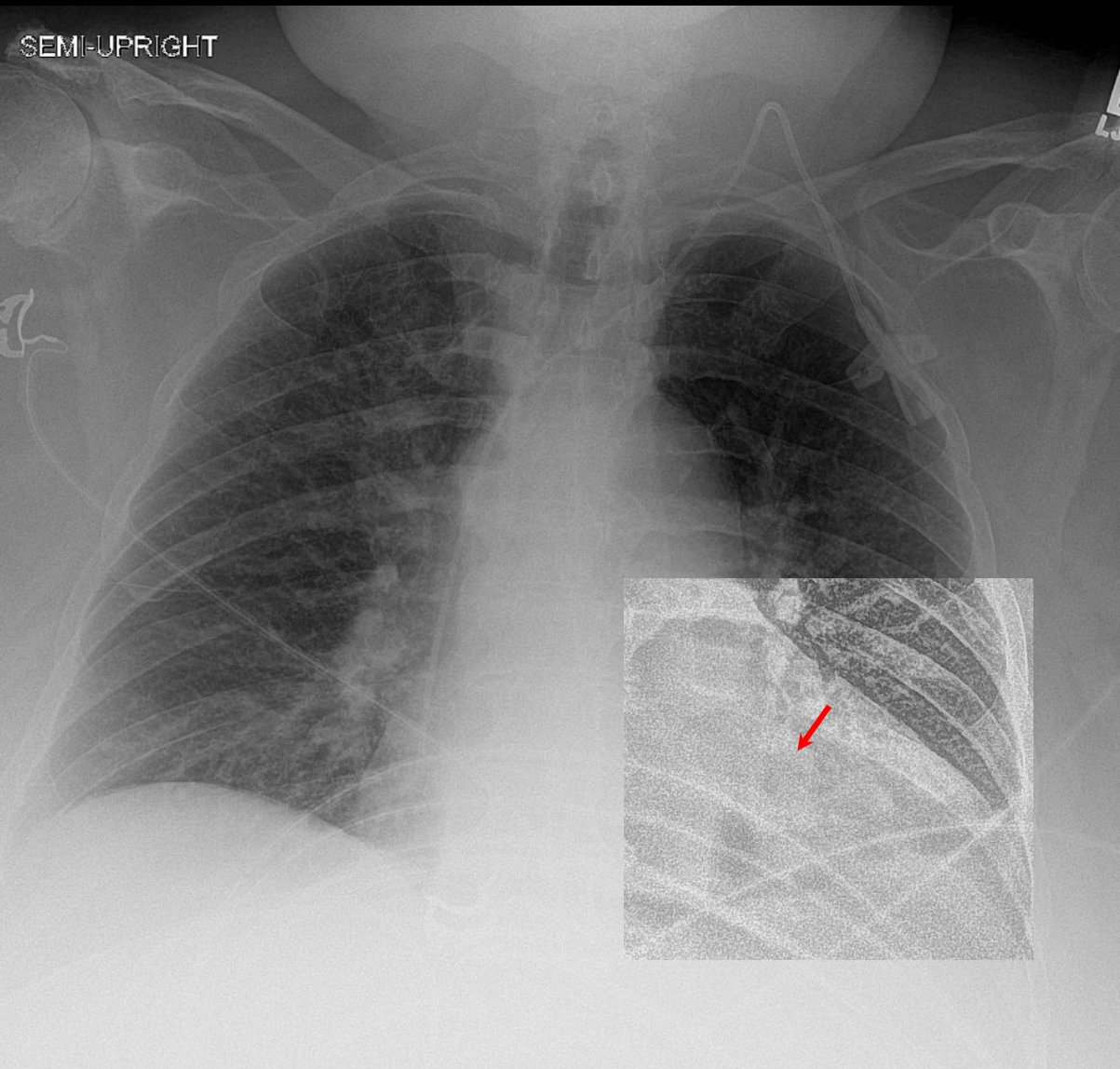
H: HIDDEN



H: HIDDEN



H: HIDDEN



CXR: Common Pathologies

Cases!

UPRIGHT

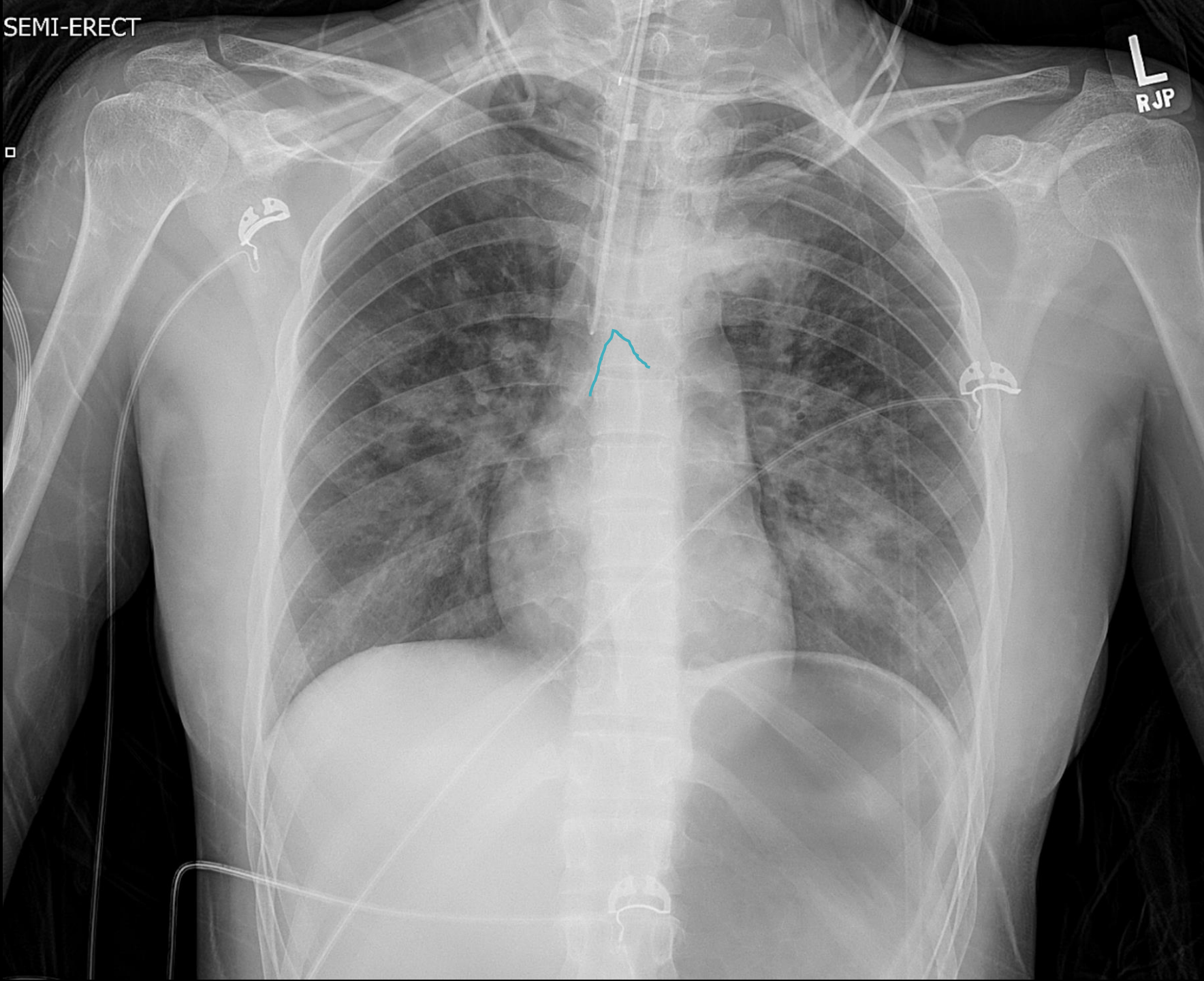
L
WAJ



SEMI-ERECT

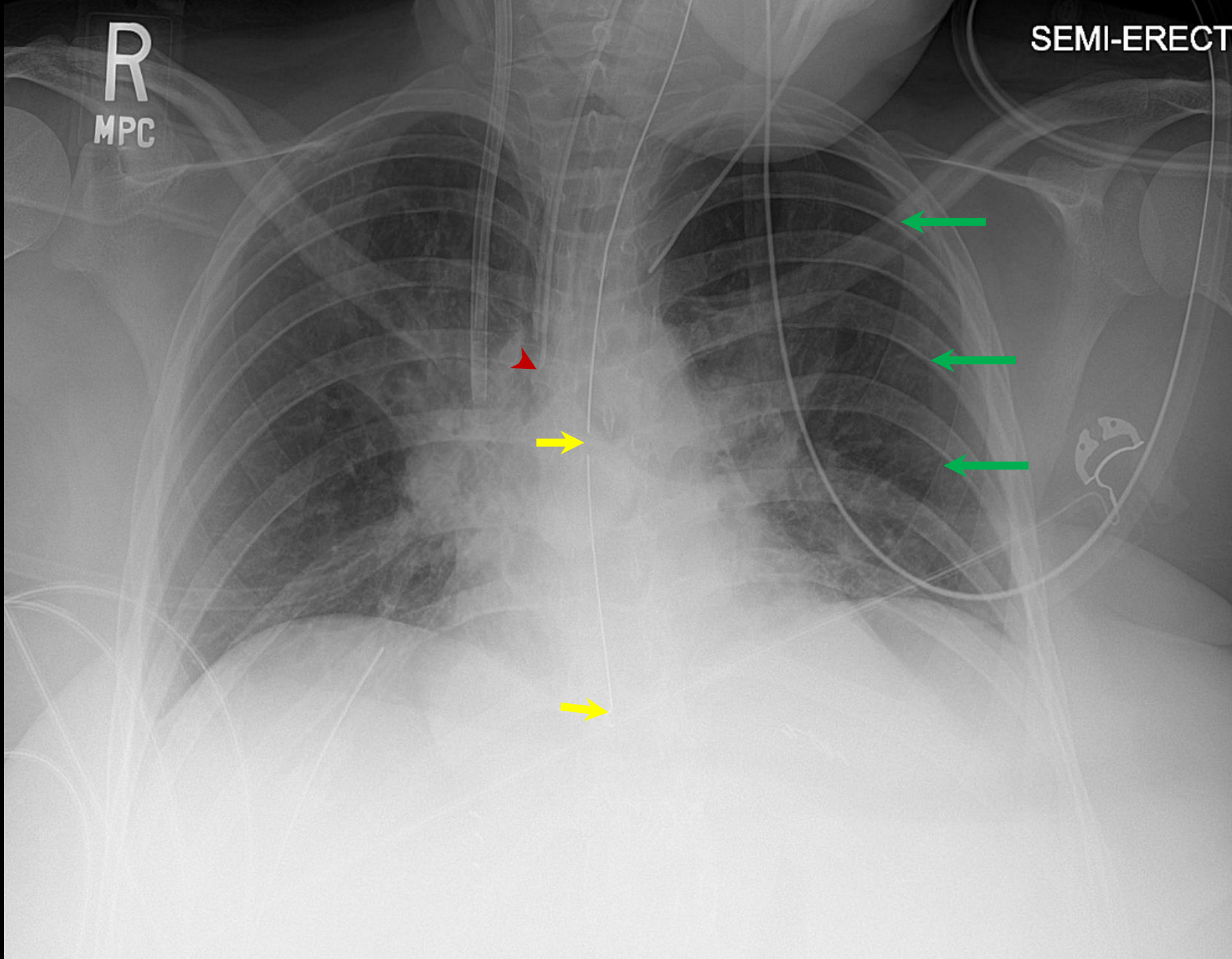
L
RJP

□



R
MPC

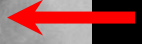
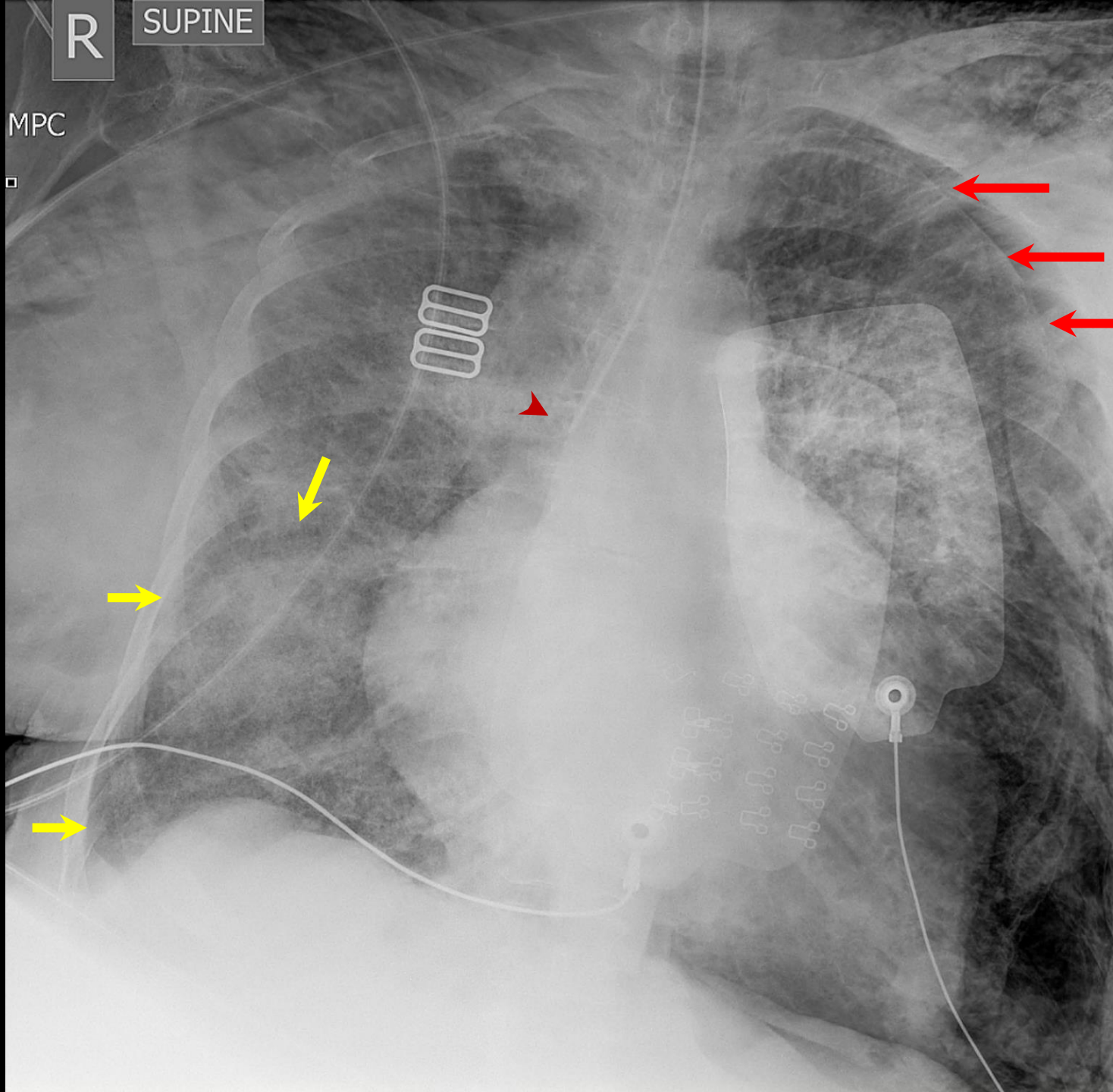
SEMI-ERECT



R

SUPINE

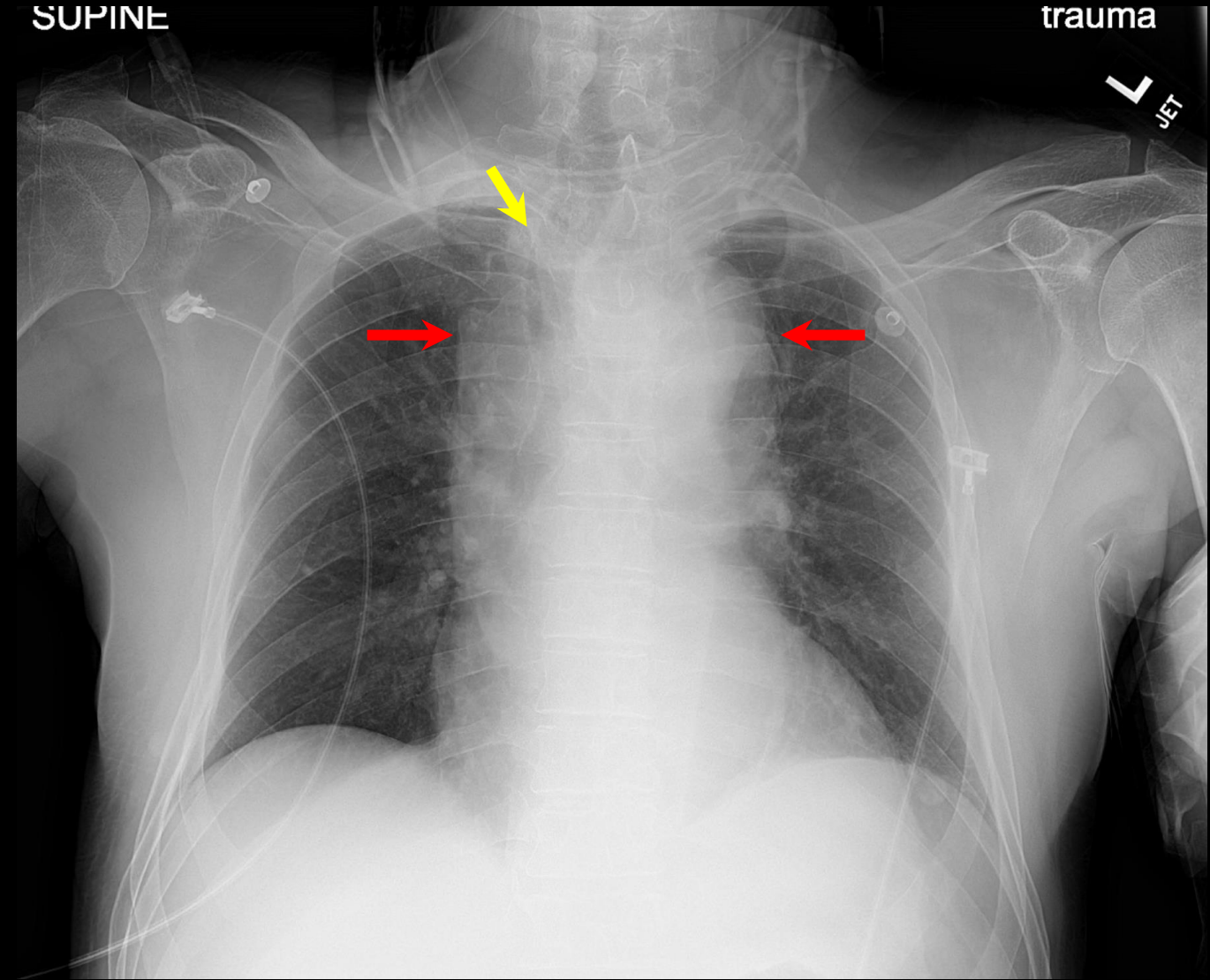
MPC

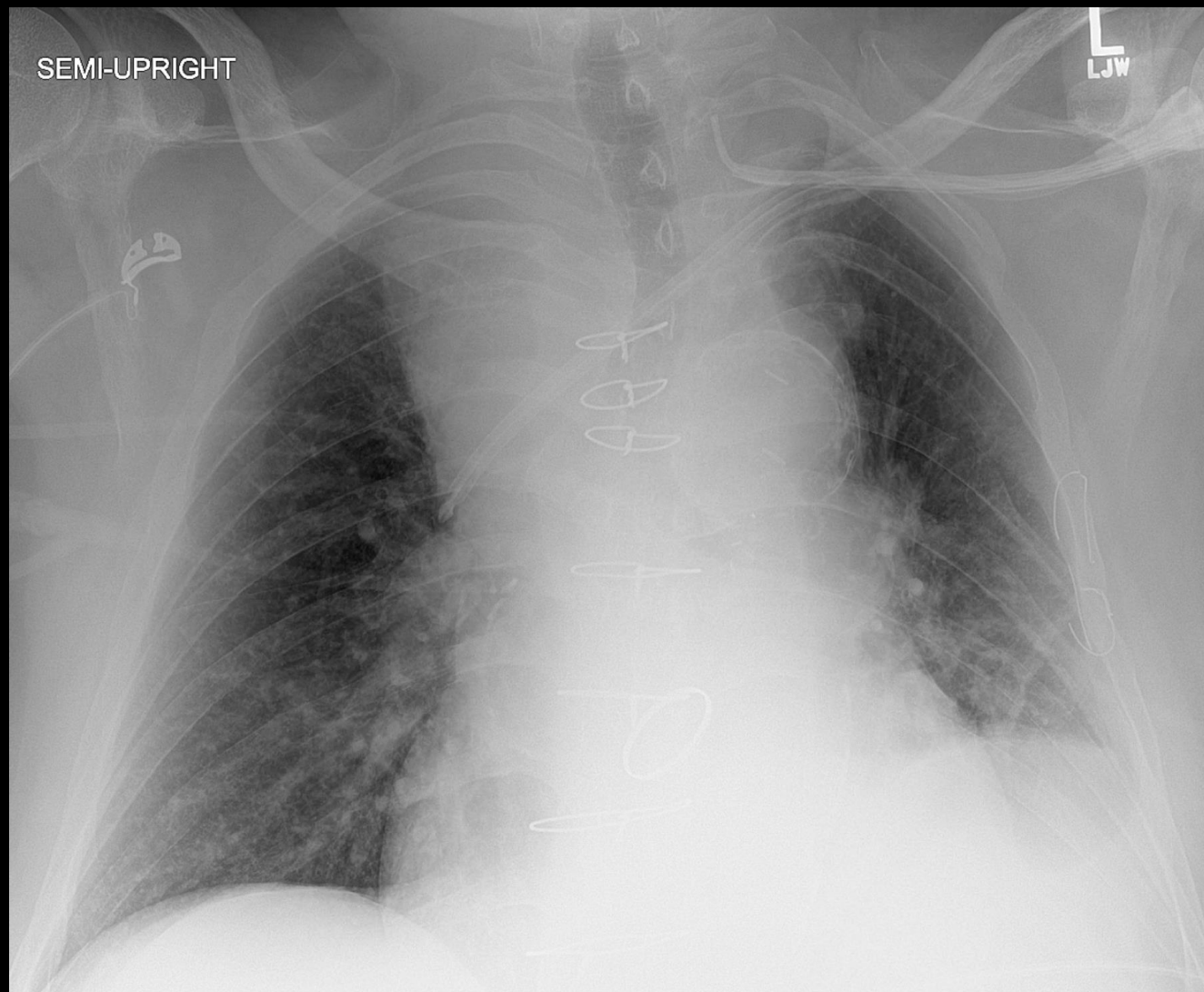


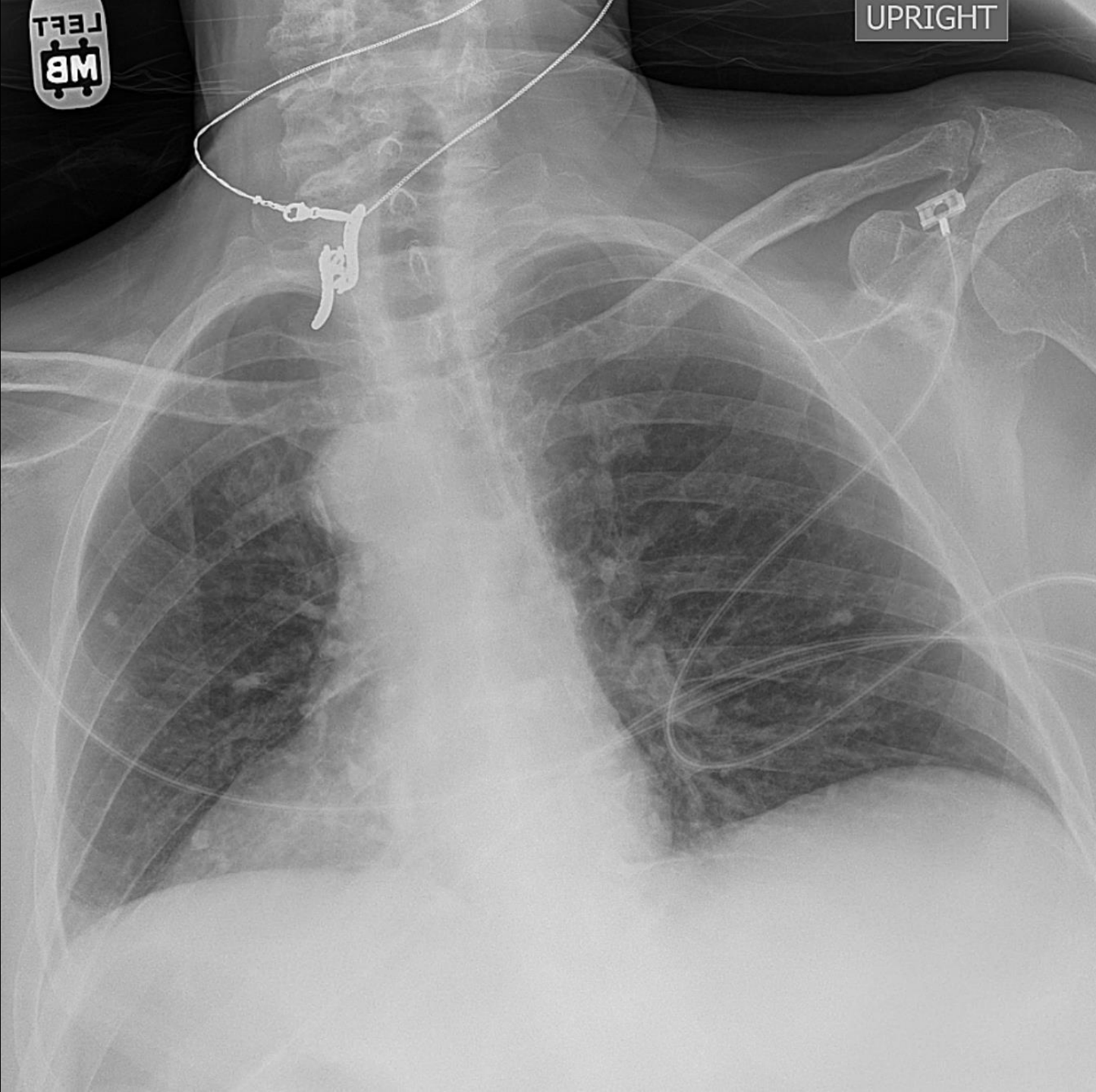
SUPINE

trauma

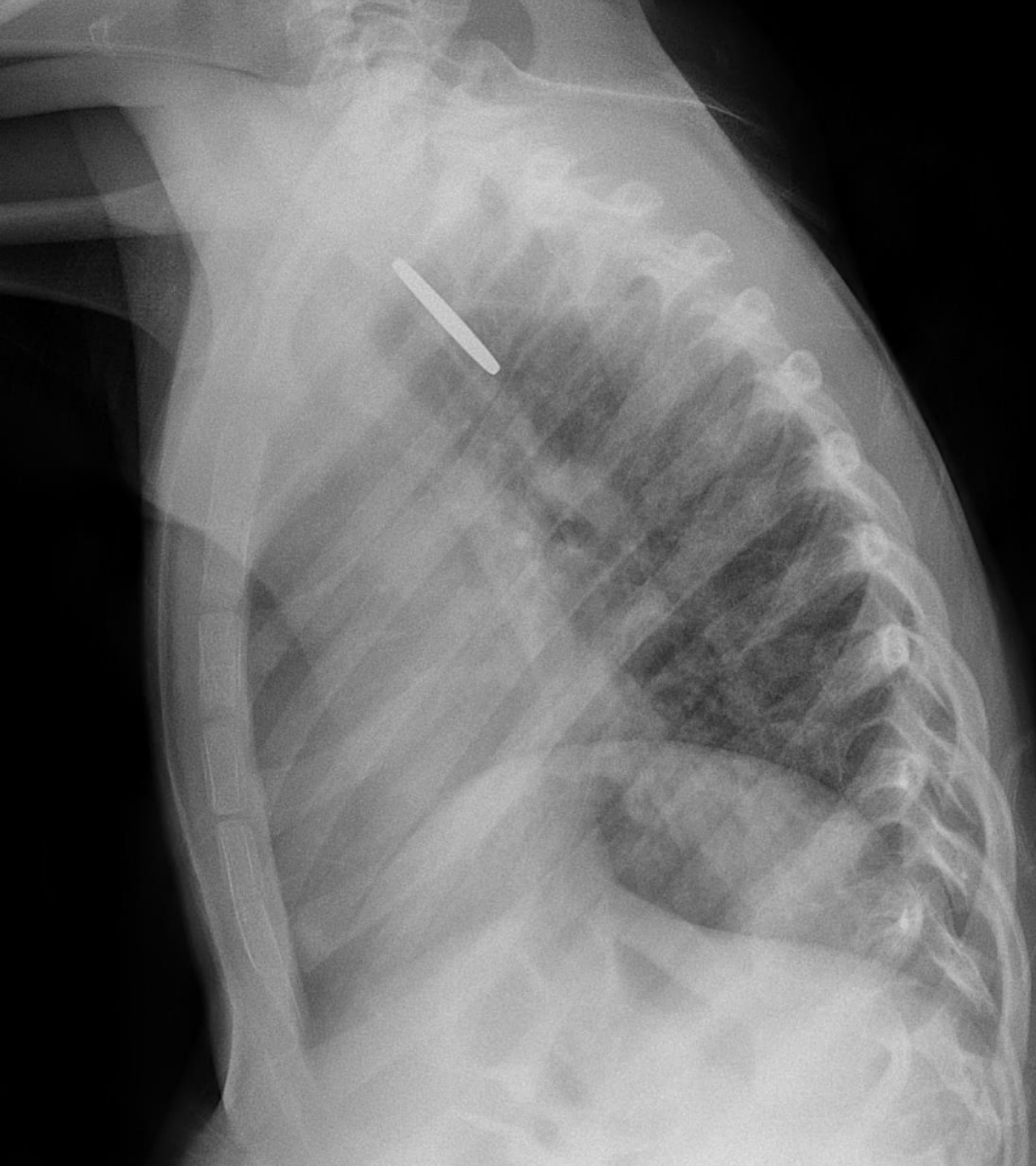
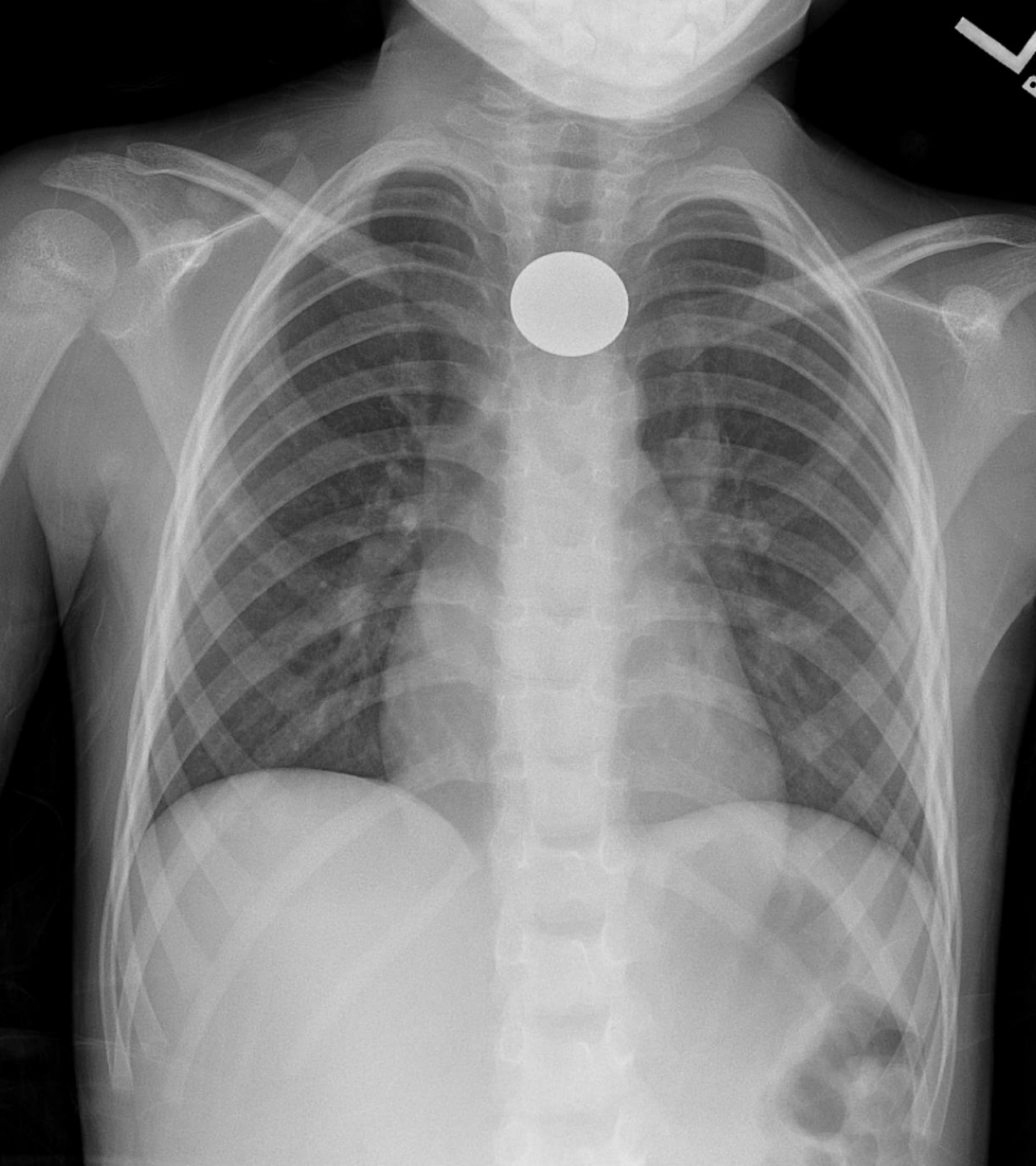
L
JET

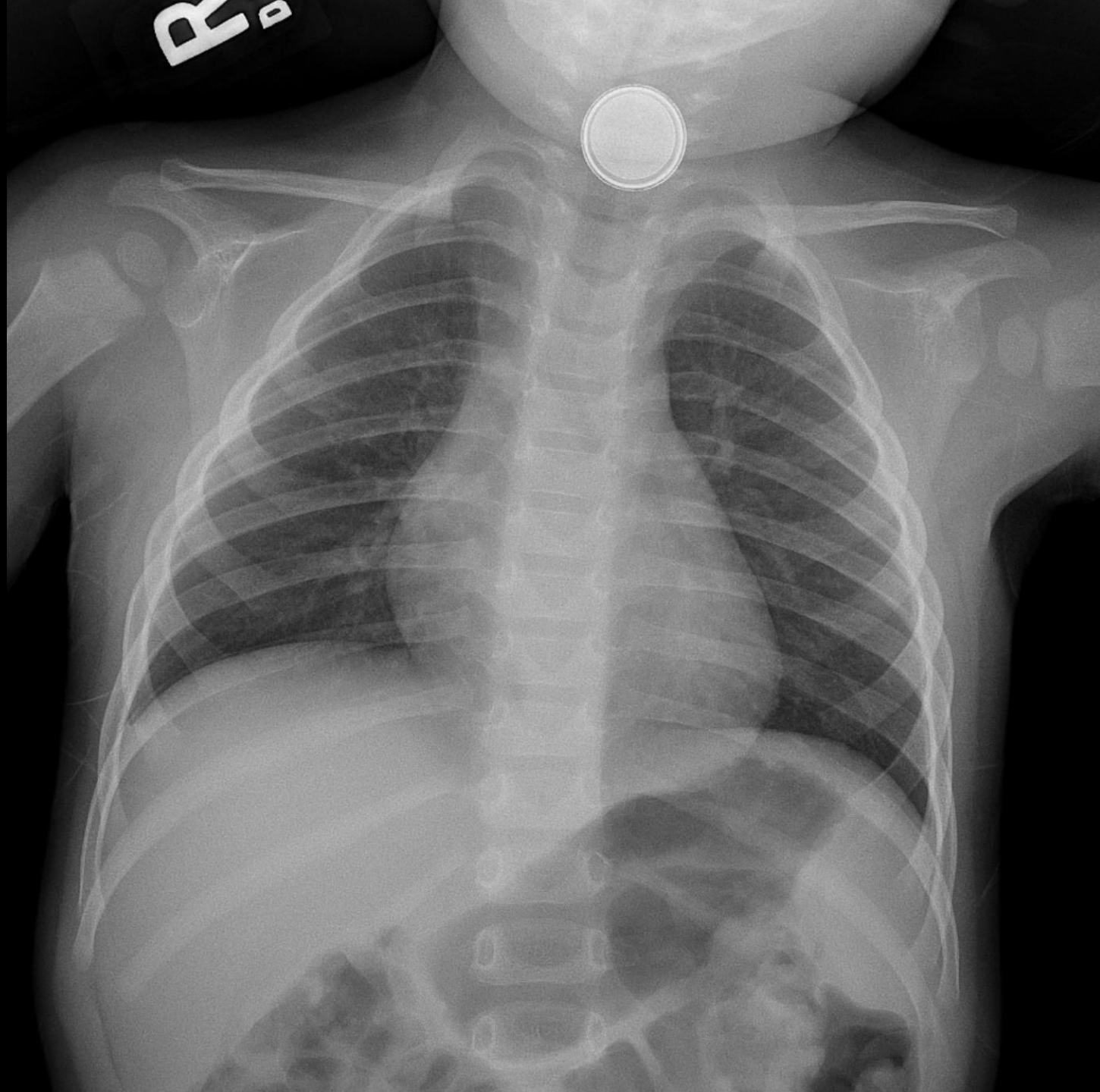


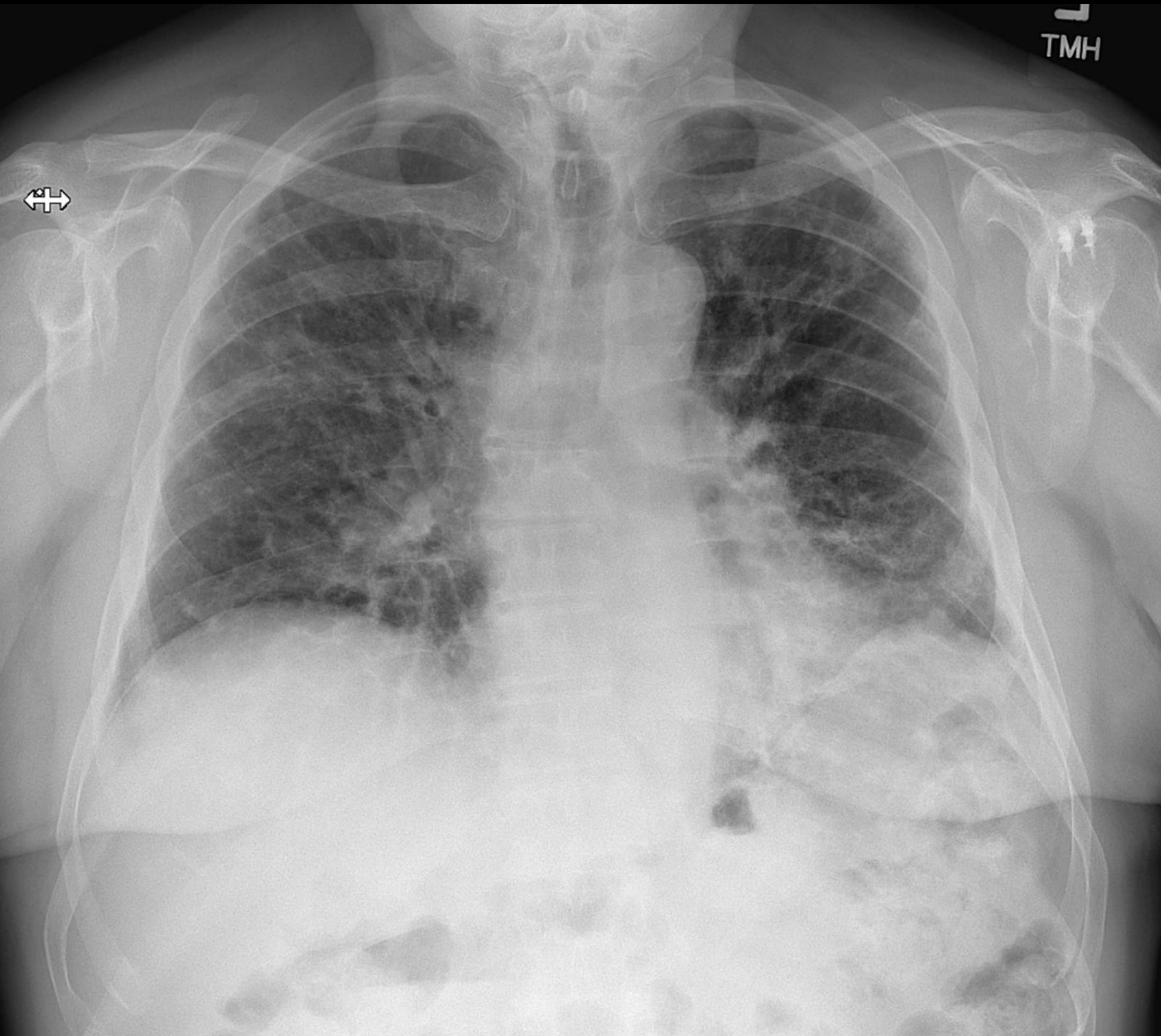


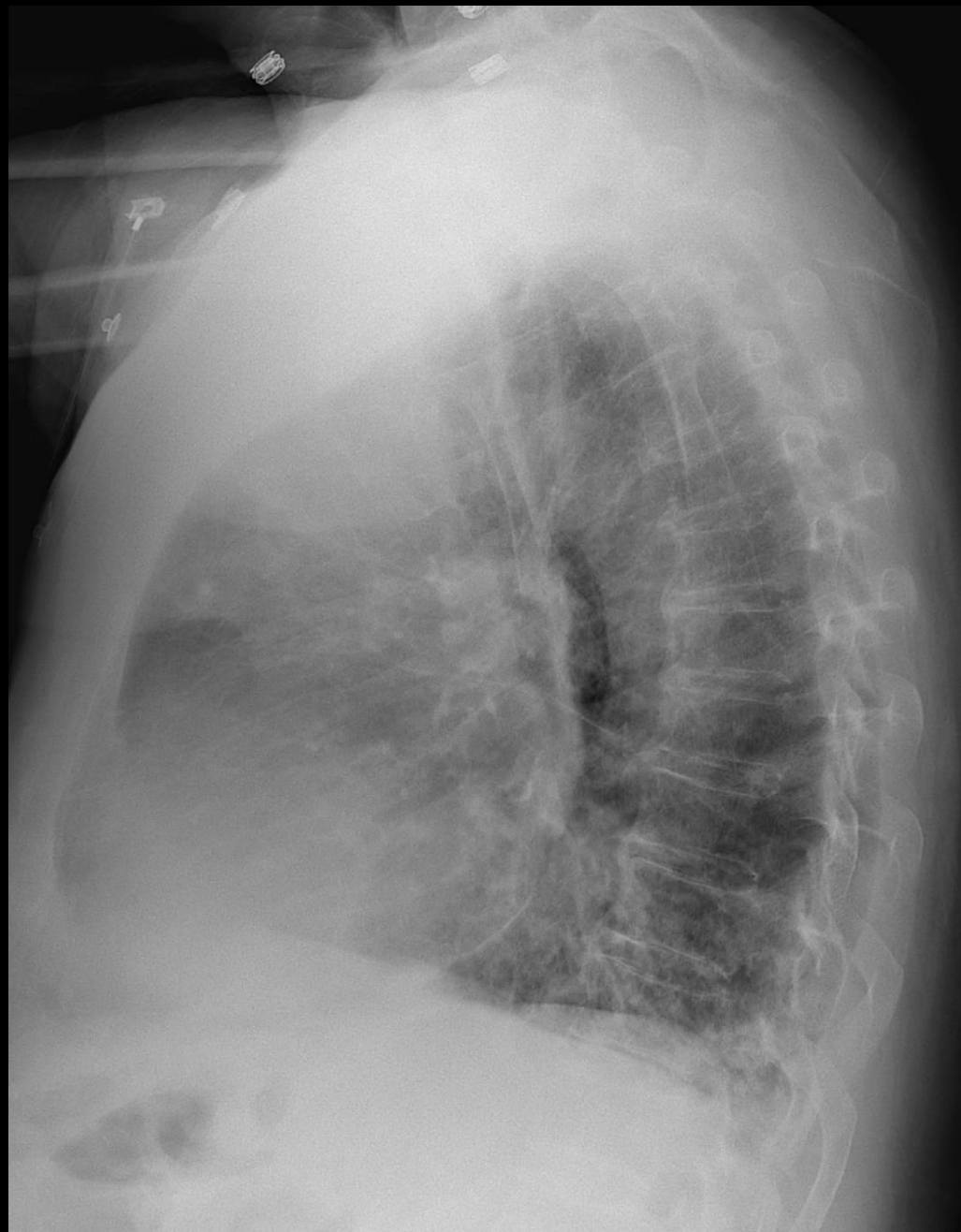
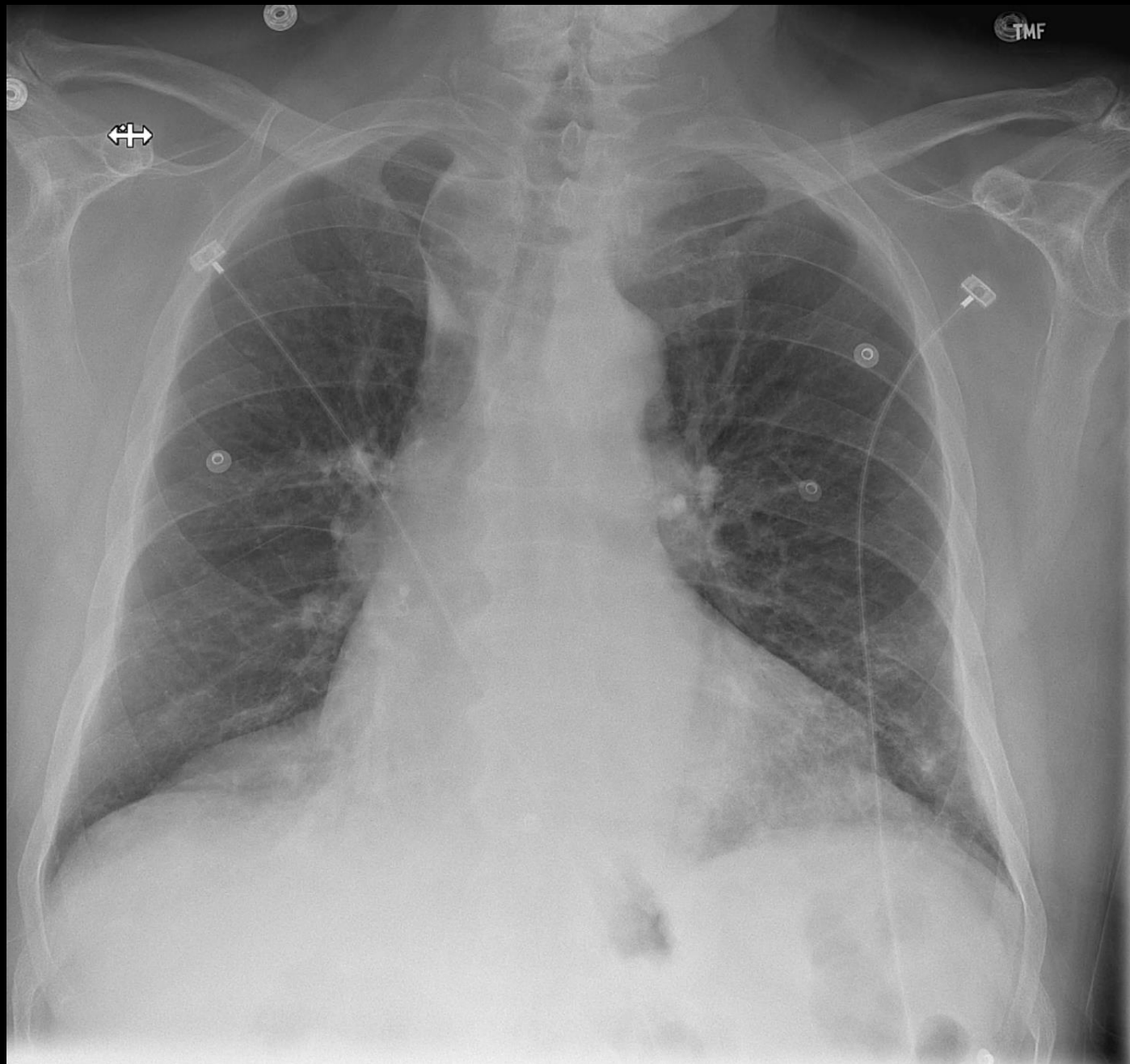


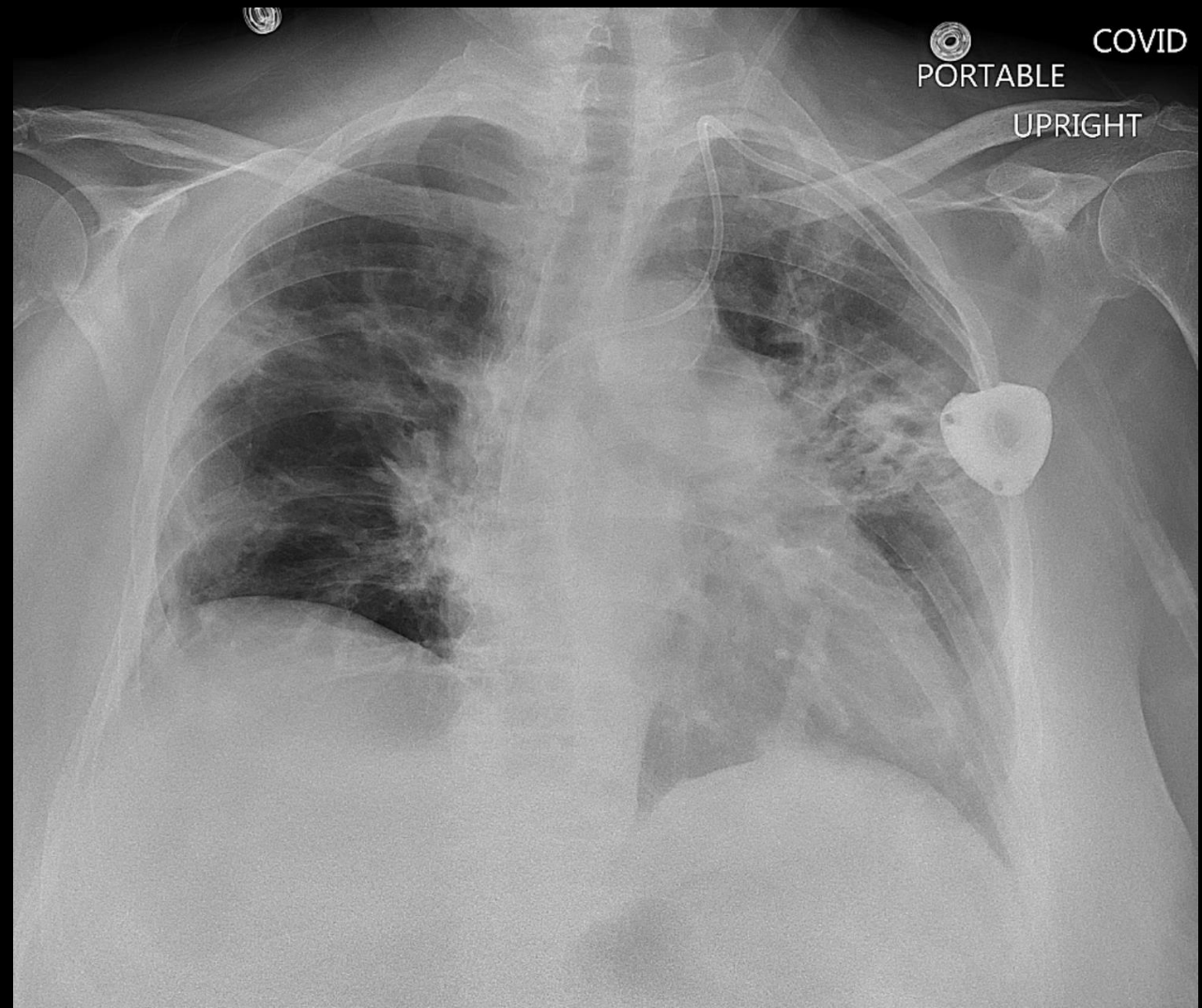
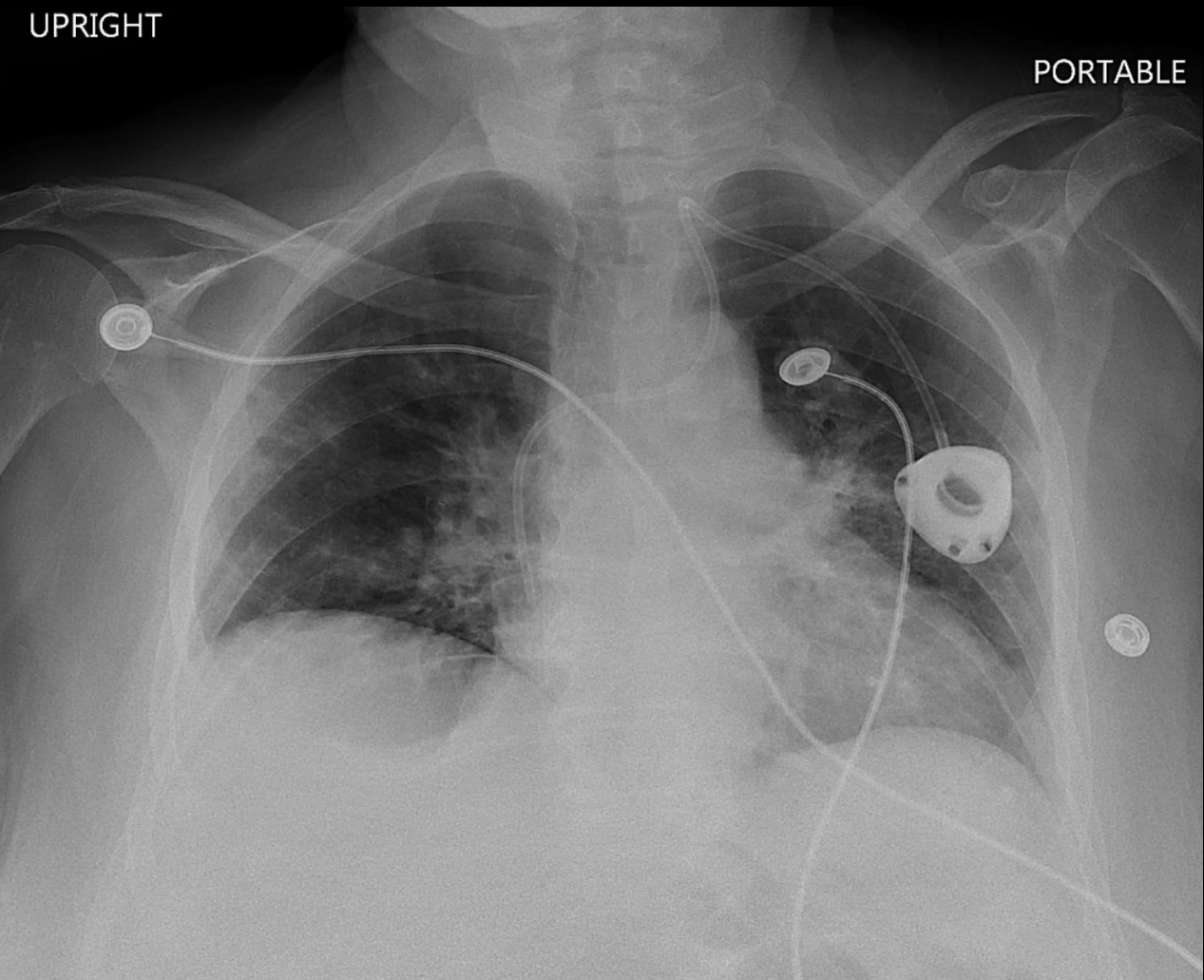




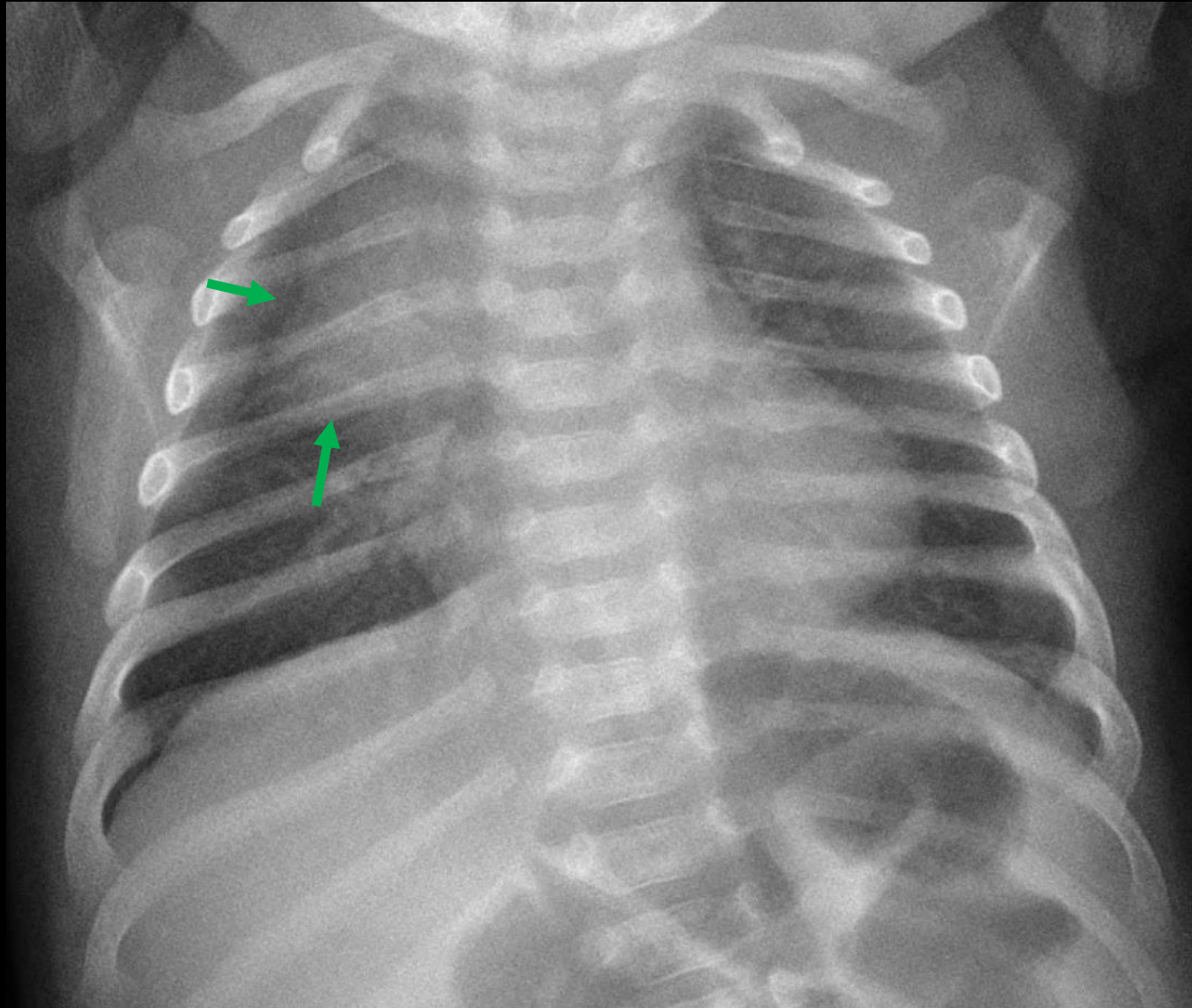




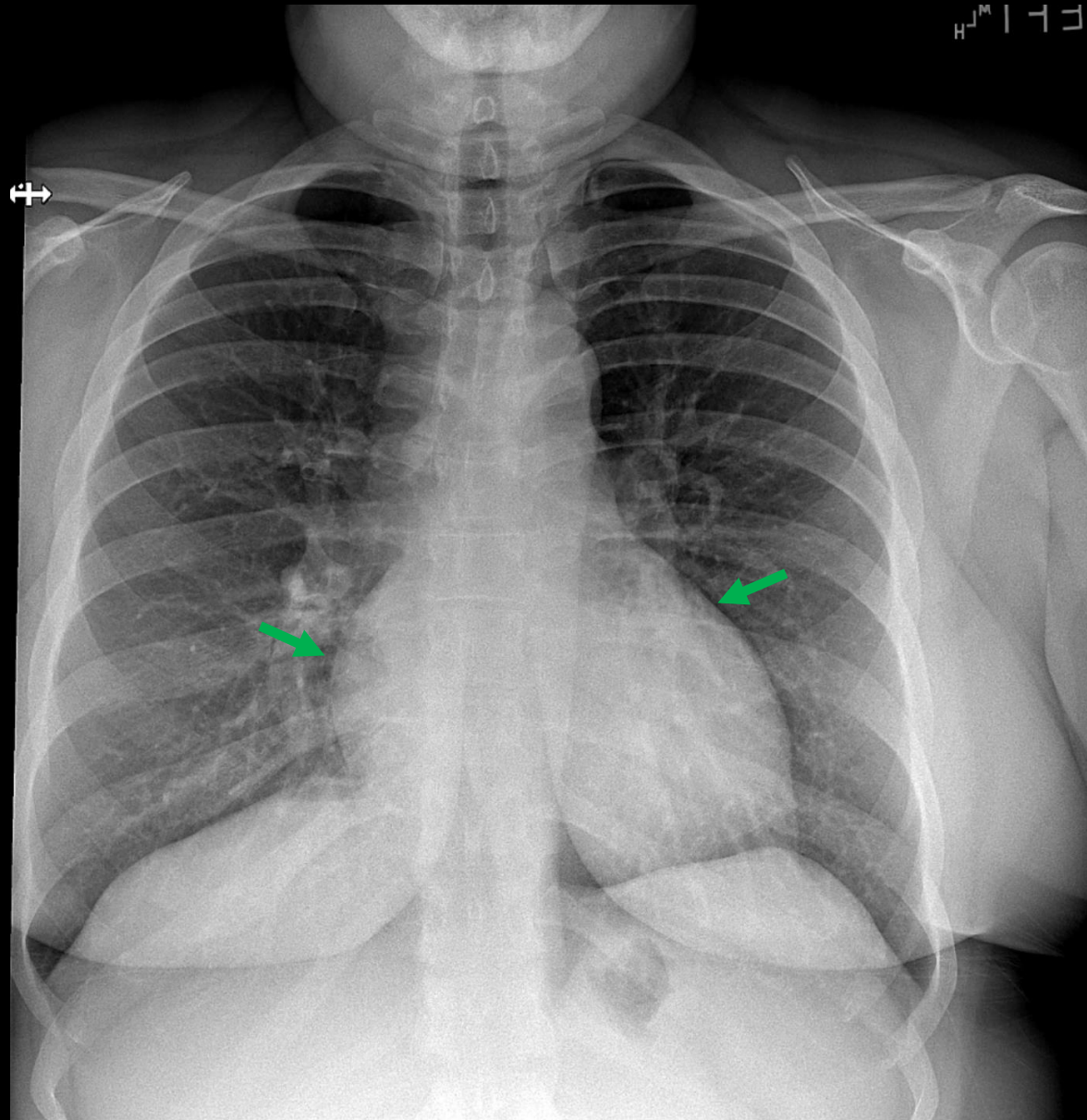




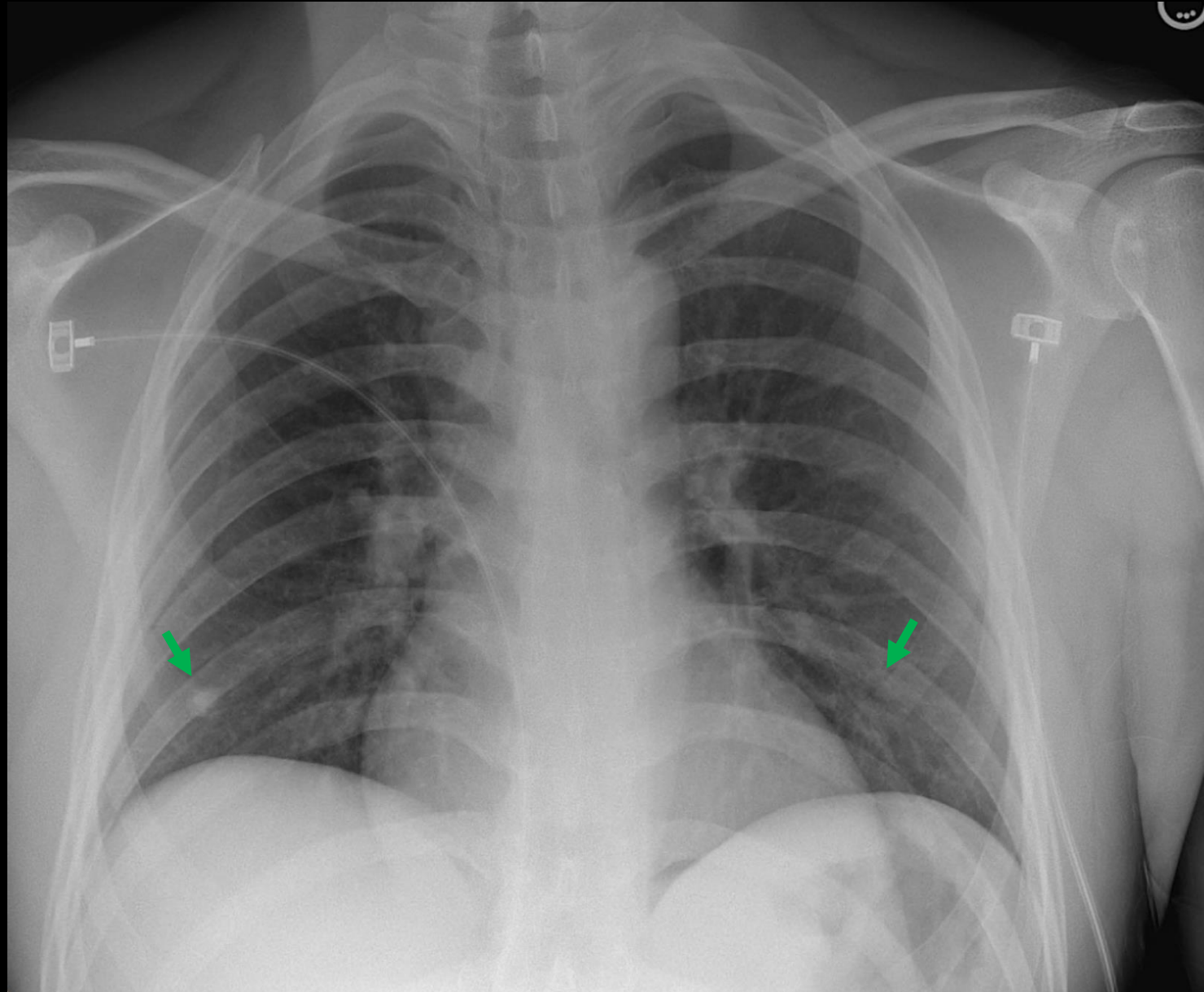
QUICK ASIDE: THINGS THAT ARE NORMAL



QUICK ASIDE: THINGS THAT ARE NORMAL



QUICK ASIDE: THINGS THAT ARE NORMAL

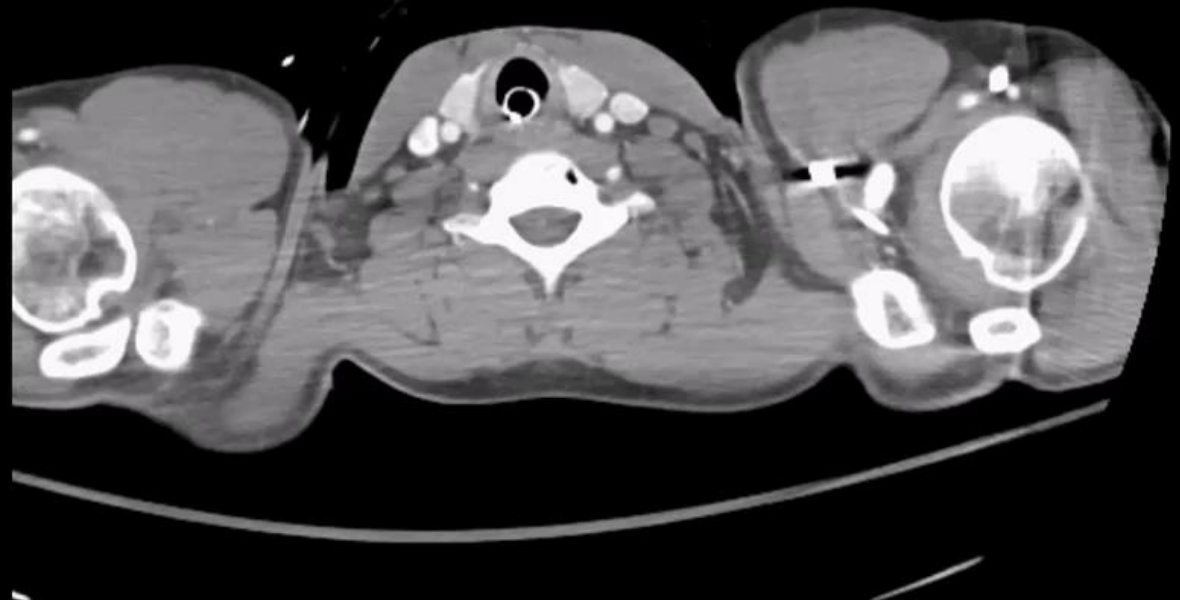


Chest CT Anatomy

A brief overview

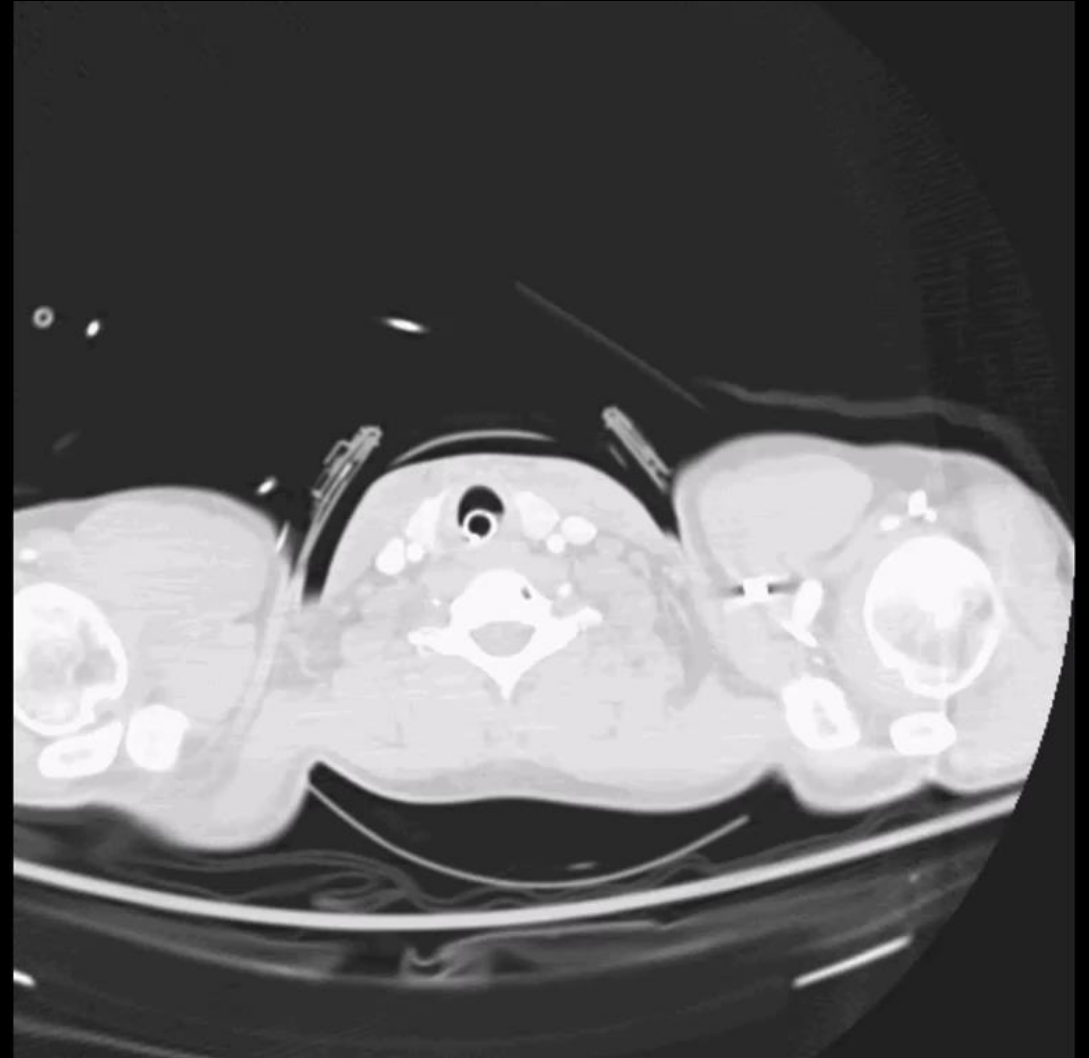
Chest CT Anatomy

- Cardiovascular
 - Jugular and brachiocephalic veins
 - SVC
 - Carotids and vertebral arteries
 - Aorta
 - Pulmonary arteries
 - Heart
- Nodes
 - Hilar, mediastinal, supraclavicular
- Esophagus
- Front and back (along pleura)
- Bones and soft tissues



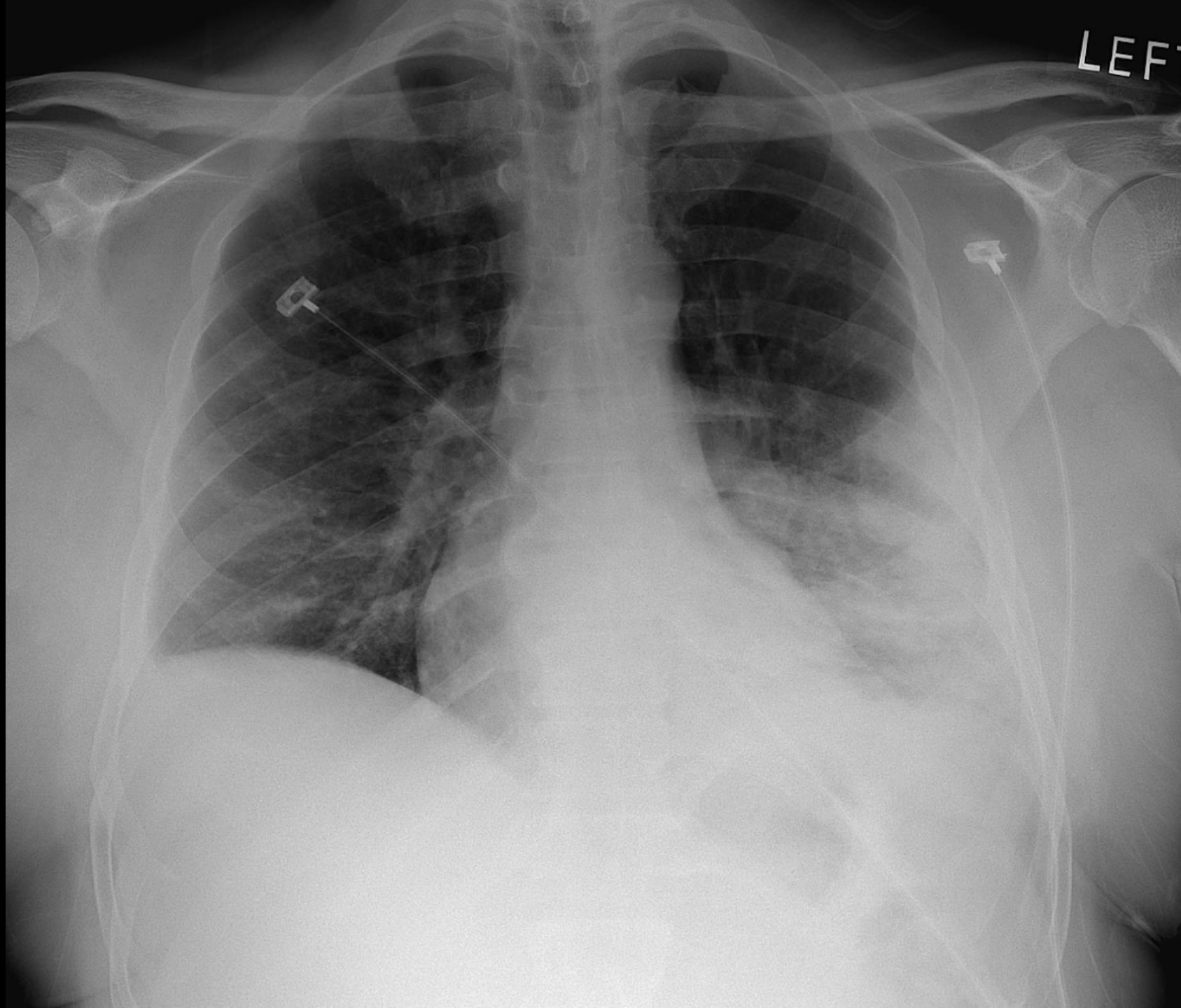
Chest CT Anatomy

- Cardiovascular
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 - Heart
- Nodes
 - Hilar, mediastinal, supraclavicular
- Esophagus
- Front and back (along pleura)
- Bones and soft tissues
- Lung and Airways
 - 4 quadrants versus by lobe



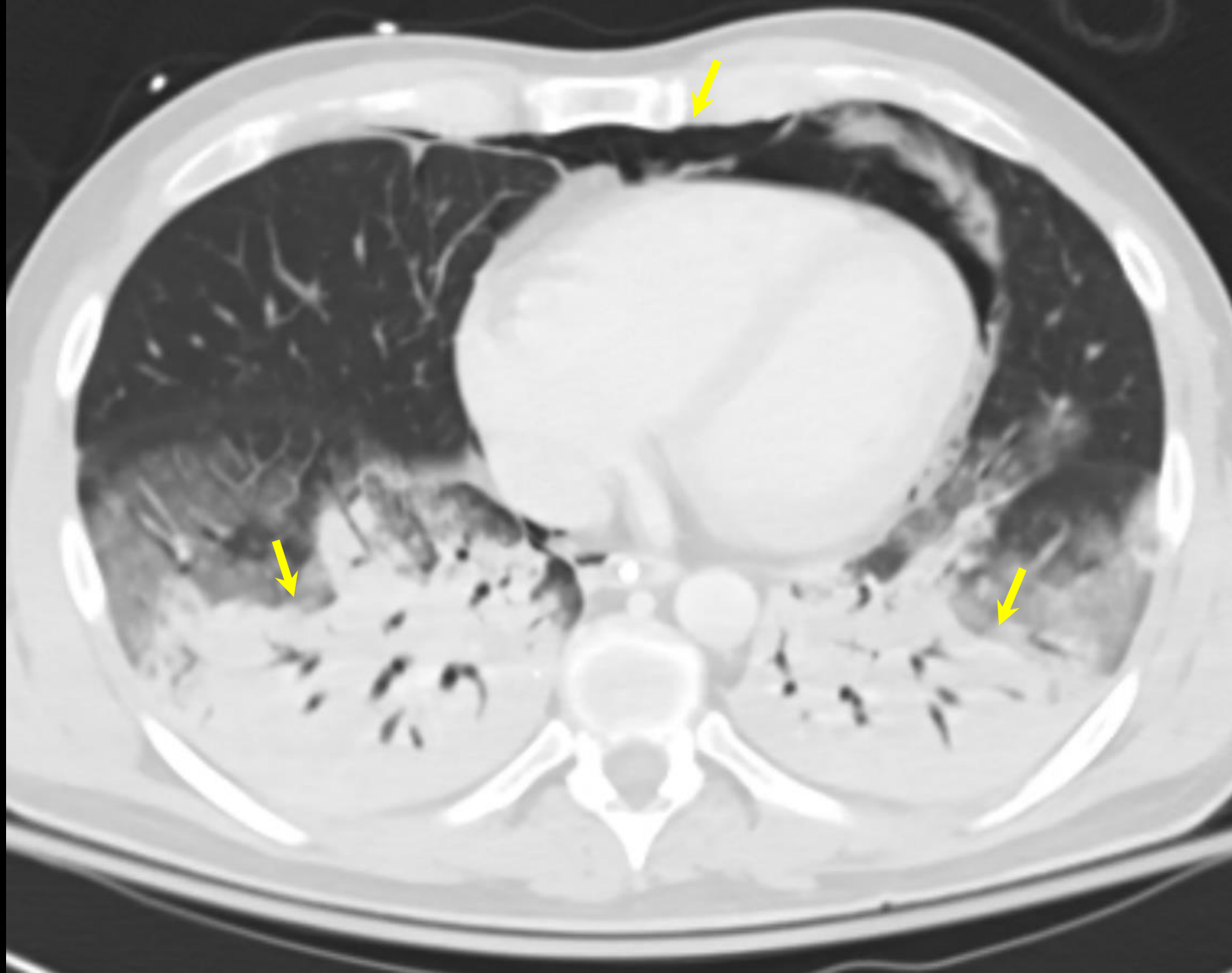
Chest CT: Common Pathologies

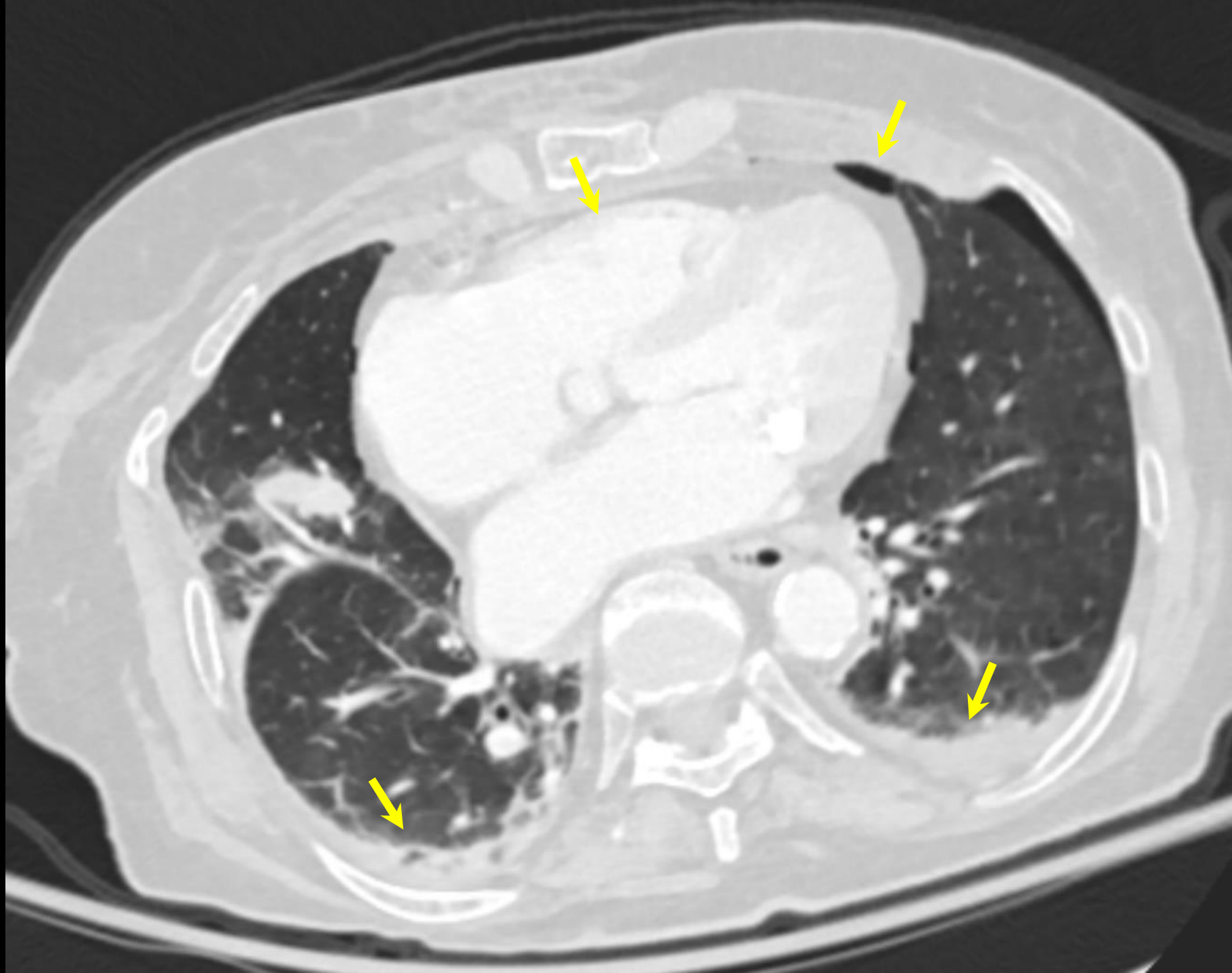
Cases!



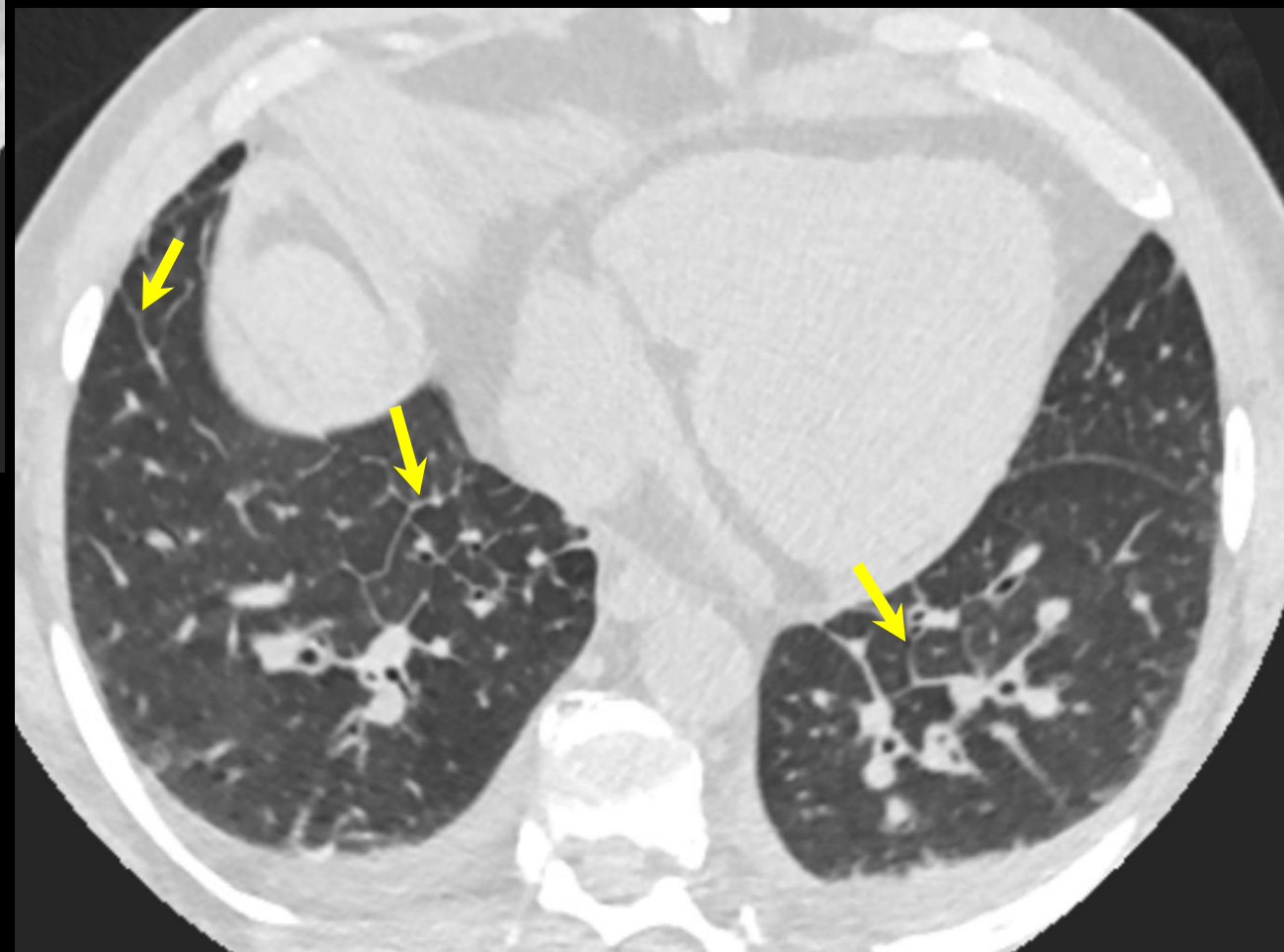
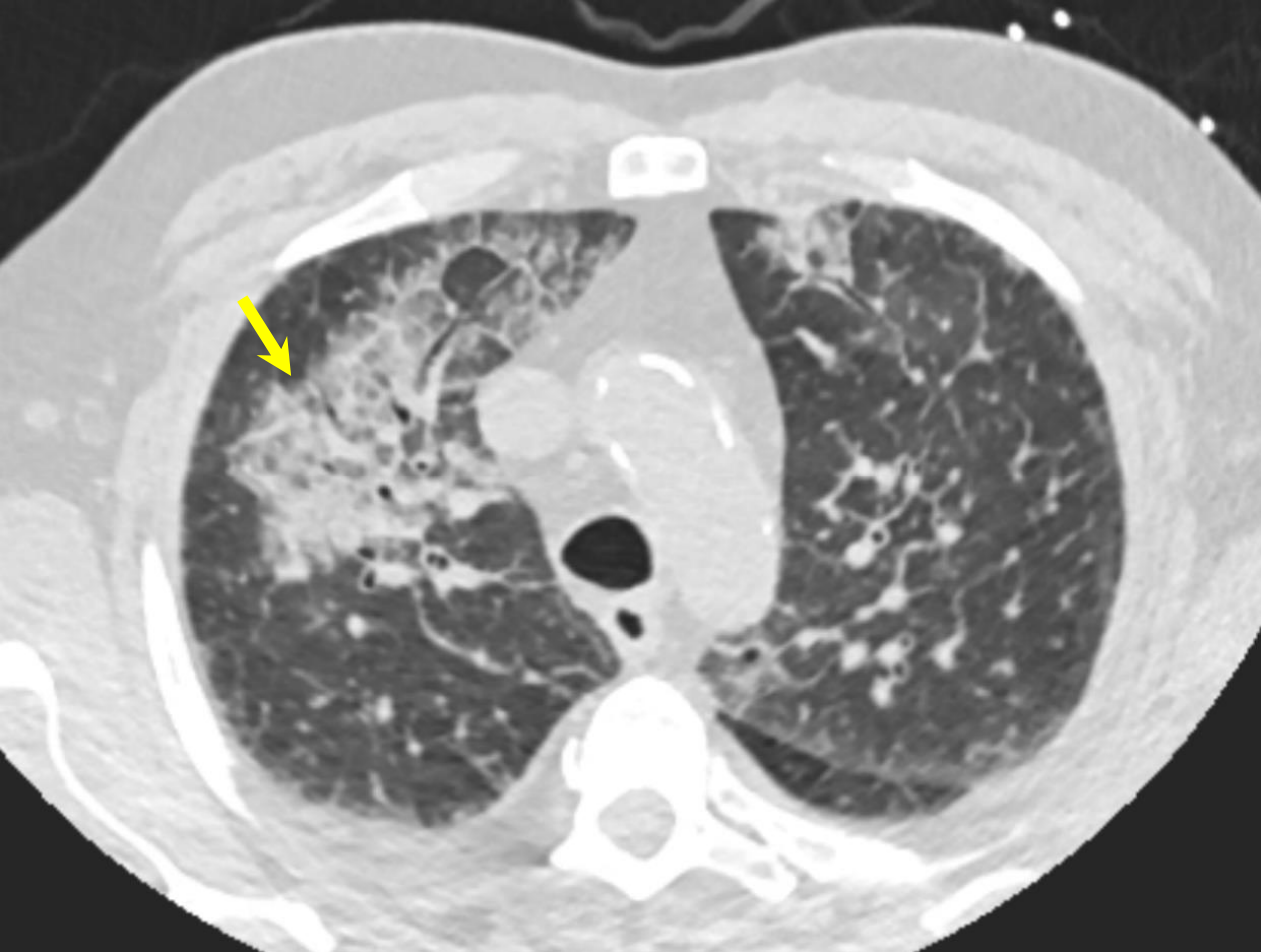
LEFT

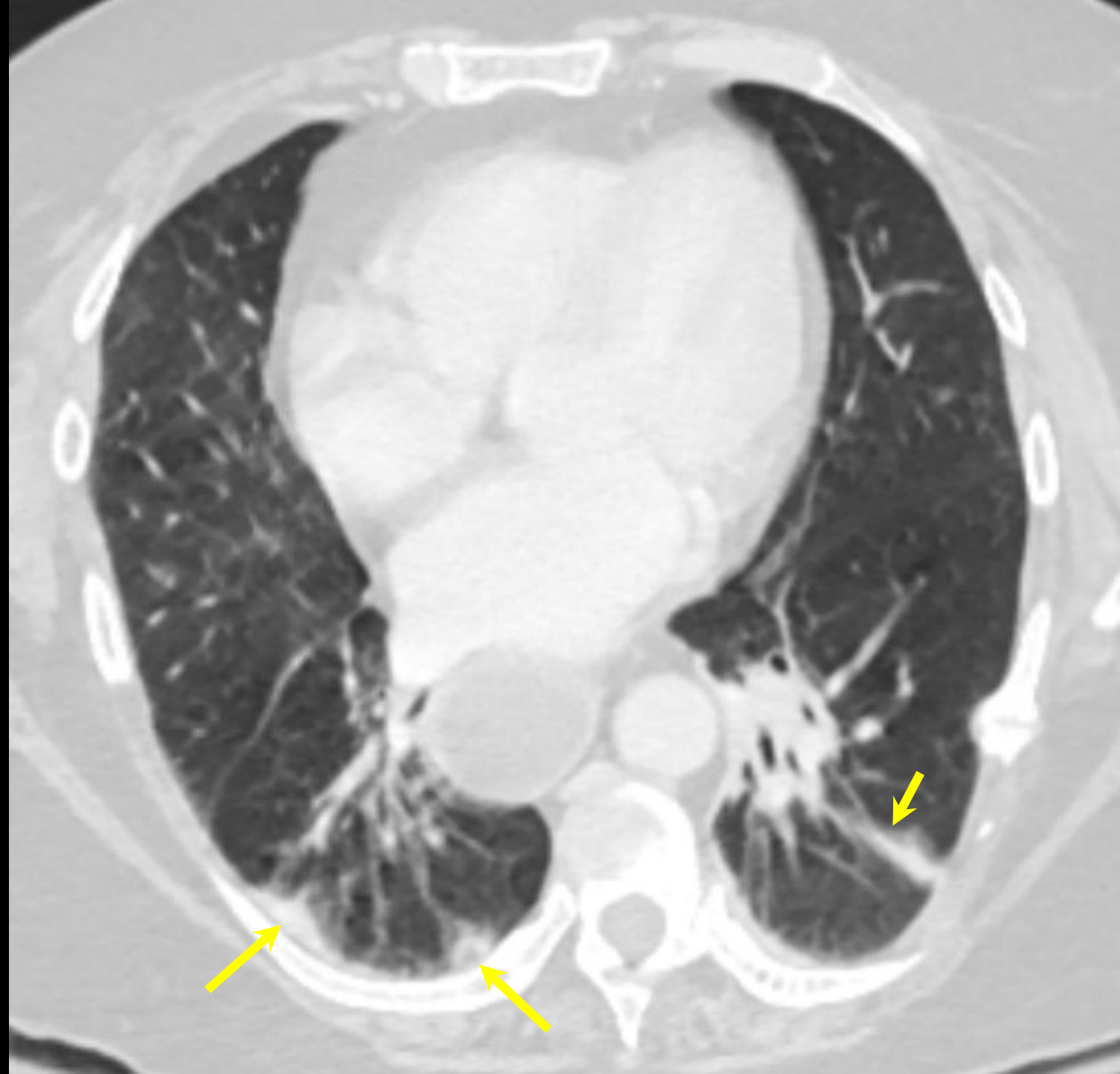


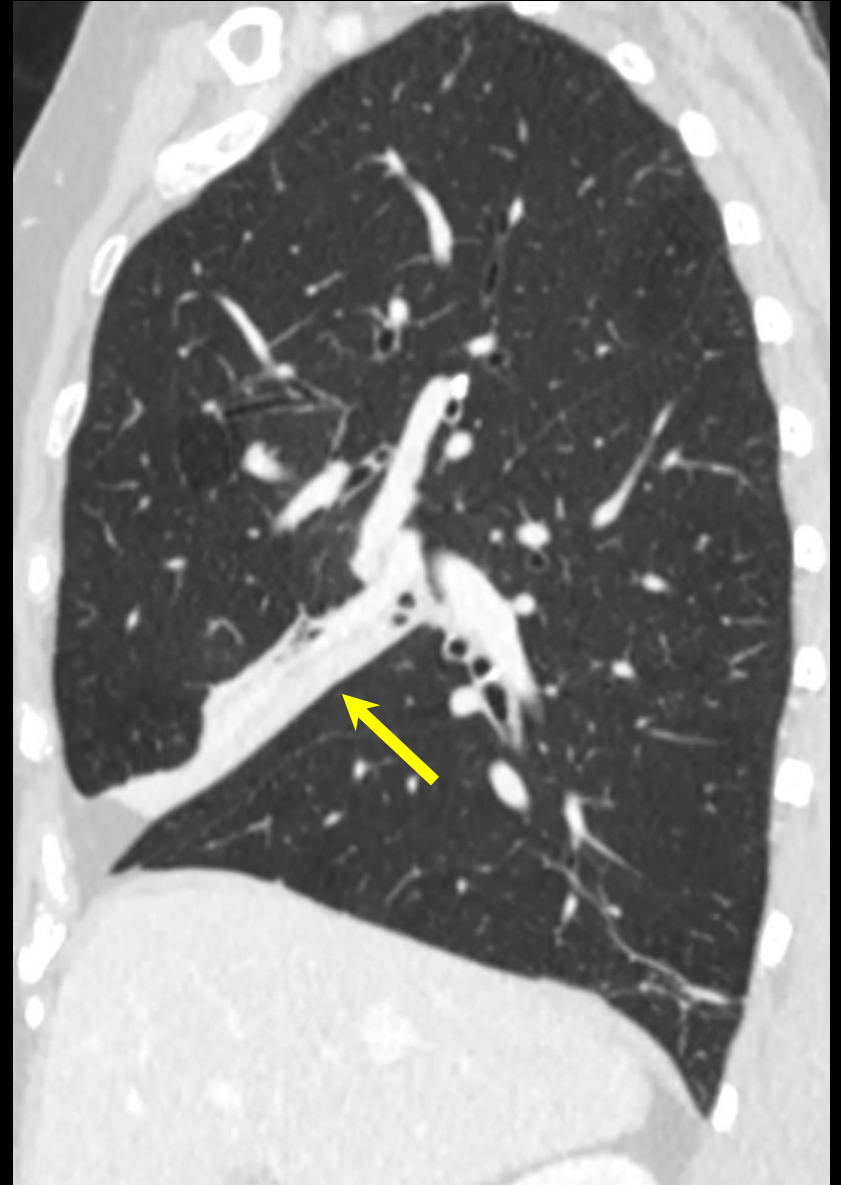
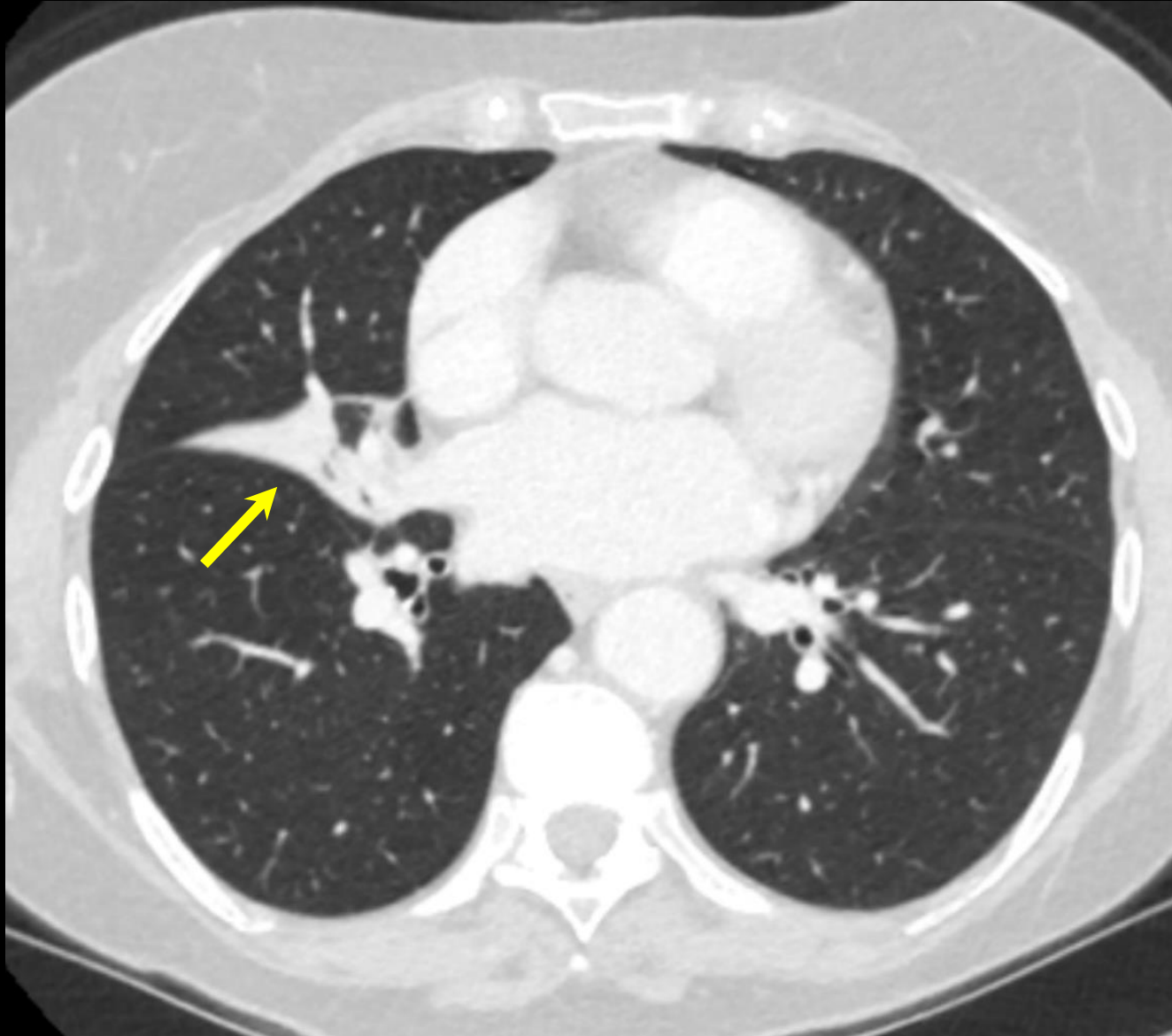


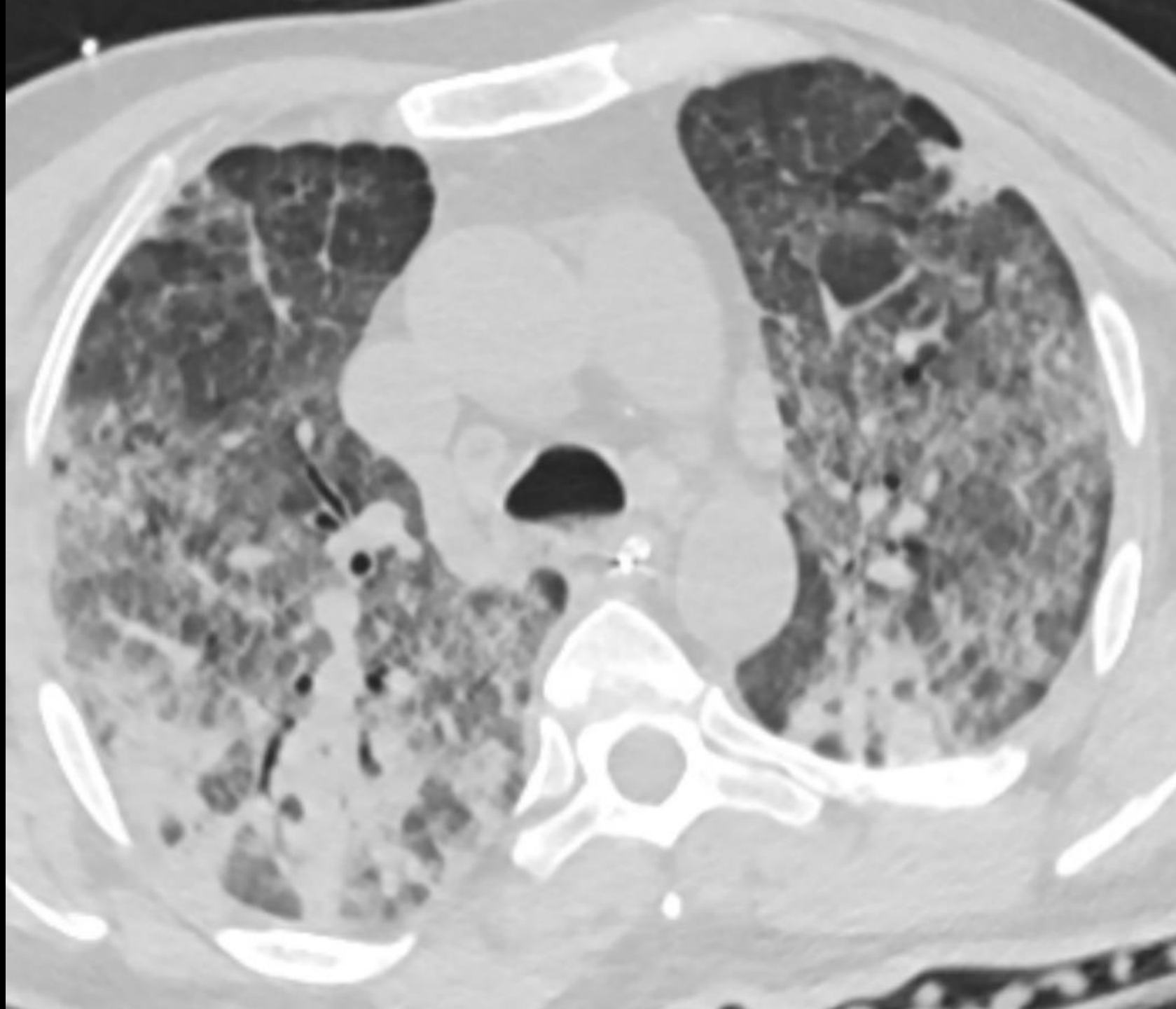


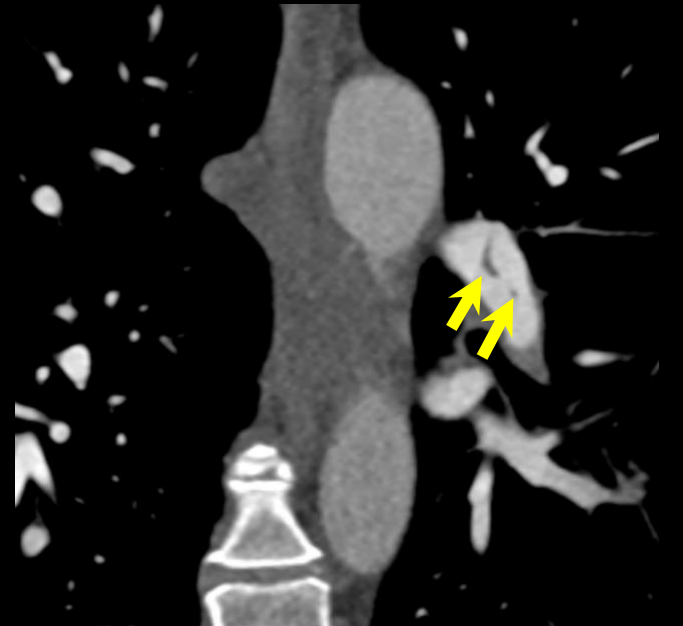
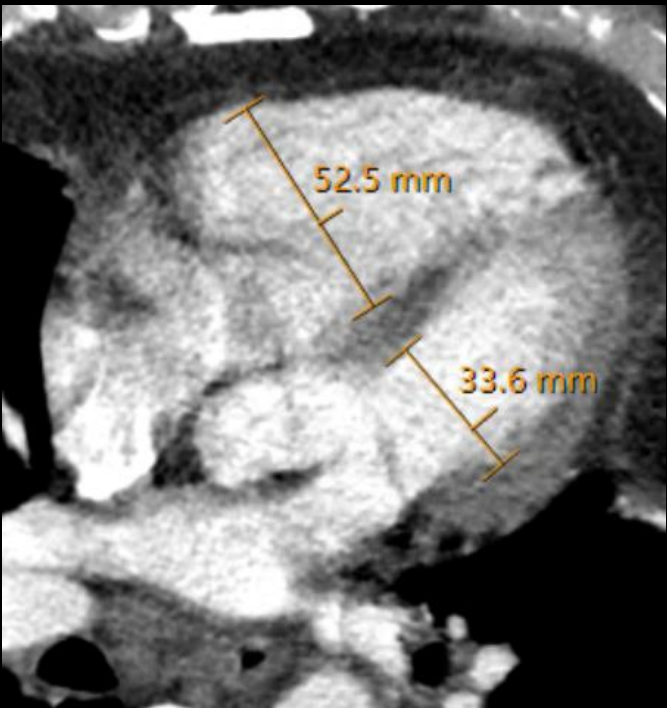
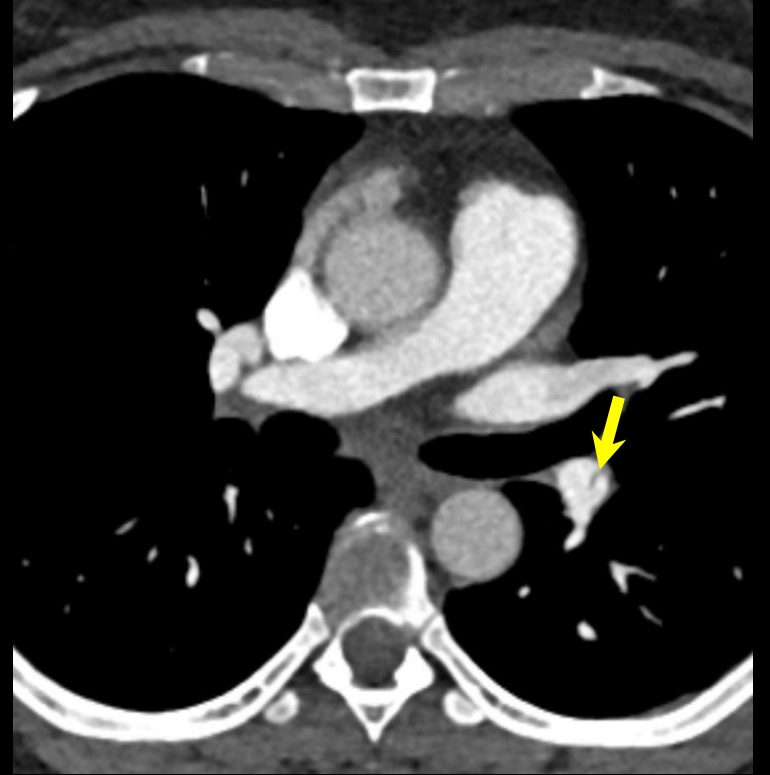
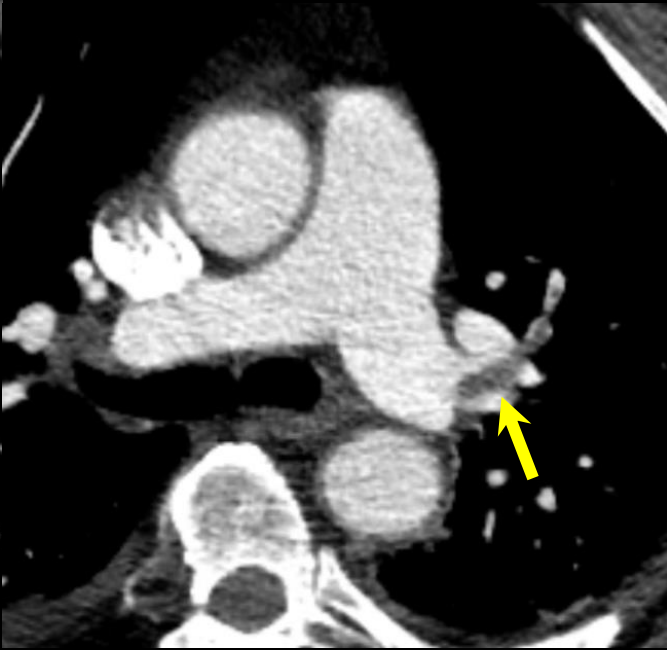
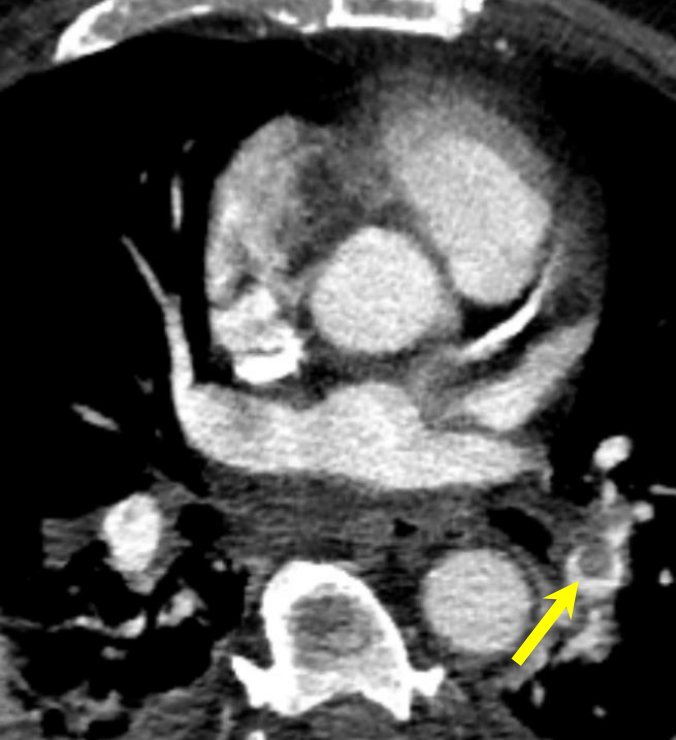














Take-home points

- Knowing the **anatomy** helps localize pathology
- Have a **search pattern** and stick to it
- Know the **appearances** of the most common **pathologies**
- **Atelectasis** comes with **volume loss** but can be **hard to tell** from **PNA**
- **Silhouetting** is your friend
- Use the **lateral!**

References

- Bradshaw J, Cremers S, Herfkens F. "Heart Failure." *Radiology Assistant*, 1 Sept 2010, <https://radiologyassistant.nl/chest/chest-x-ray/heart-failure>. Accessed 10 Aug 2021.
- Delden O, Smithuis R. "Basic Interpretation." *Radiology Assistant*, 18 Feb 2013, <https://radiologyassistant.nl/chest/chest-x-ray/basic-interpretation>. Accessed 10 Aug 2021.
- Goodman LR, Felson B (2015). *Felson's principles of chest roentgenology: A programmed text*. Philadelphia , Elsevier Saunders, 2015.
- Smithuis R. "Lung disease." *Radiology Assistant*, 1 Feb 2014, <https://radiologyassistant.nl/chest/chest-x-ray/lung-disease>. Accessed 10 Aug 2021.
- Special thanks to Kim Sandler MD, Vanderbilt University Medical Center

Questions?