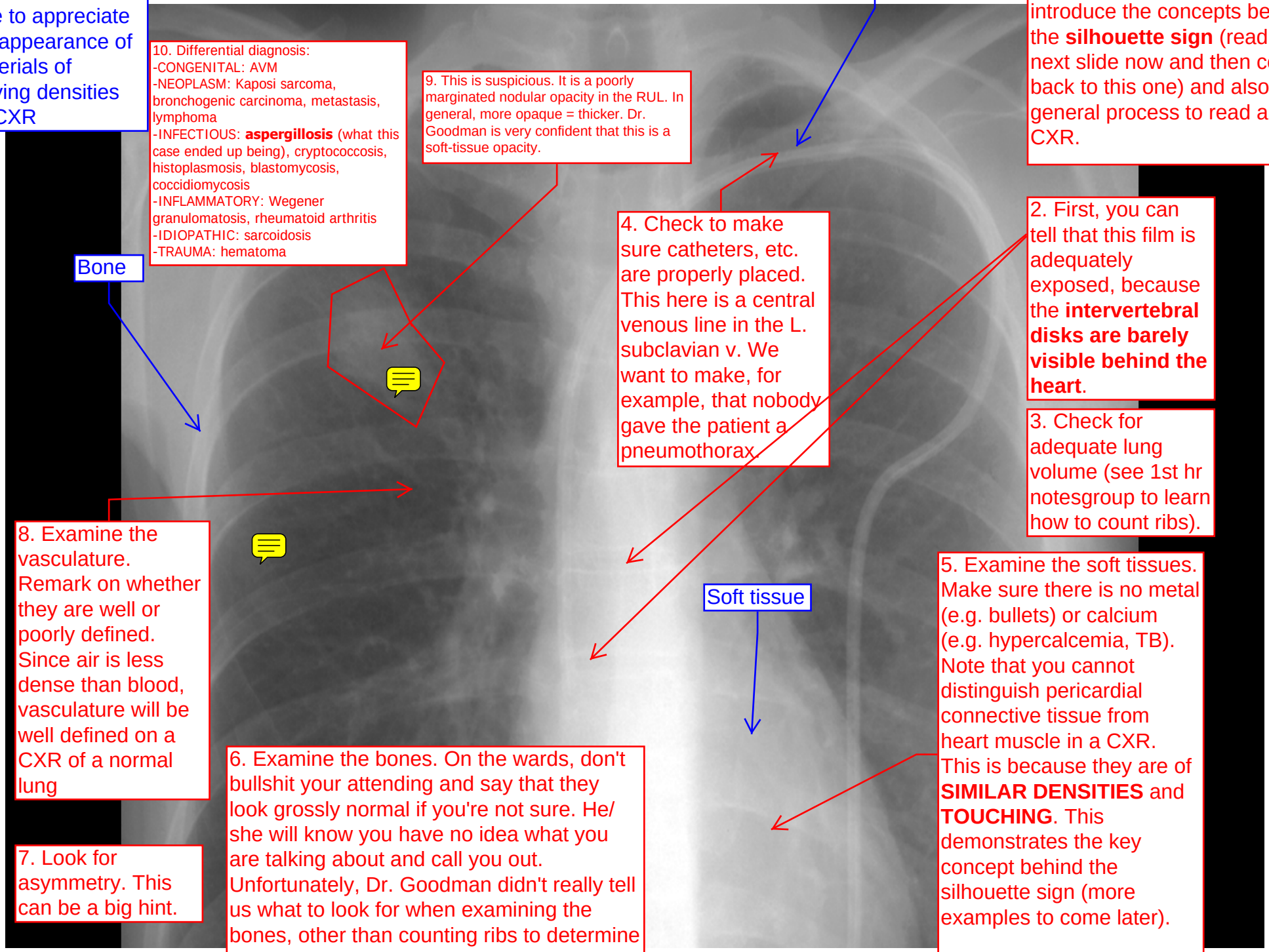
# Objectives

- Learn approach to the CXR
- Integrate aspects of etiology, pathogenesis, clinical history, and physical exam to CXR
- View variety of diseases
- Try to keep cursor out of LLQ

1. Slides 2-15 of the original presentation have been removed because they were covered in the 1st hour.
2. Slides 56-97 of the original presentation have been removed because they were not covered at all.



Take a look at the items marked in blue to appreciate the appearance of materials of varying densities on CXR

Metal

1. This slide is used to introduce the concepts behind the **silhouette sign** (read the next slide now and then come back to this one) and also the general process to read a CXR.

10. Differential diagnosis:
-CONGENITAL: AVM
-NEOPLASM: Kaposi sarcoma, bronchogenic carcinoma, metastasis, lymphoma
-INFECTIOUS: **aspergillosis** (what this case ended up being), cryptococcosis, histoplasmosis, blastomycosis, coccidiomycosis
-INFLAMMATORY: Wegener granulomatosis, rheumatoid arthritis
-IDIOPATHIC: sarcoidosis
-TRAUMA: hematoma

9. This is suspicious. It is a poorly marginated nodular opacity in the RUL. In general, more opaque = thicker. Dr. Goodman is very confident that this is a soft-tissue opacity.

4. Check to make sure catheters, etc. are properly placed. This here is a central venous line in the L. subclavian v. We want to make, for example, that nobody gave the patient a pneumothorax.

2. First, you can tell that this film is adequately exposed, because the **intervertebral disks are barely visible behind the heart**.

Bone

3. Check for adequate lung volume (see 1st hr notesgroup to learn how to count ribs).

8. Examine the vasculature. Remark on whether they are well or poorly defined. Since air is less dense than blood, vasculature will be well defined on a CXR of a normal lung

Soft tissue

5. Examine the soft tissues. Make sure there is no metal (e.g. bullets) or calcium (e.g. hypercalcemia, TB). Note that you cannot distinguish pericardial connective tissue from heart muscle in a CXR. This is because they are of **SIMILAR DENSITIES** and **TOUCHING**. This demonstrates the key concept behind the silhouette sign (more examples to come later).

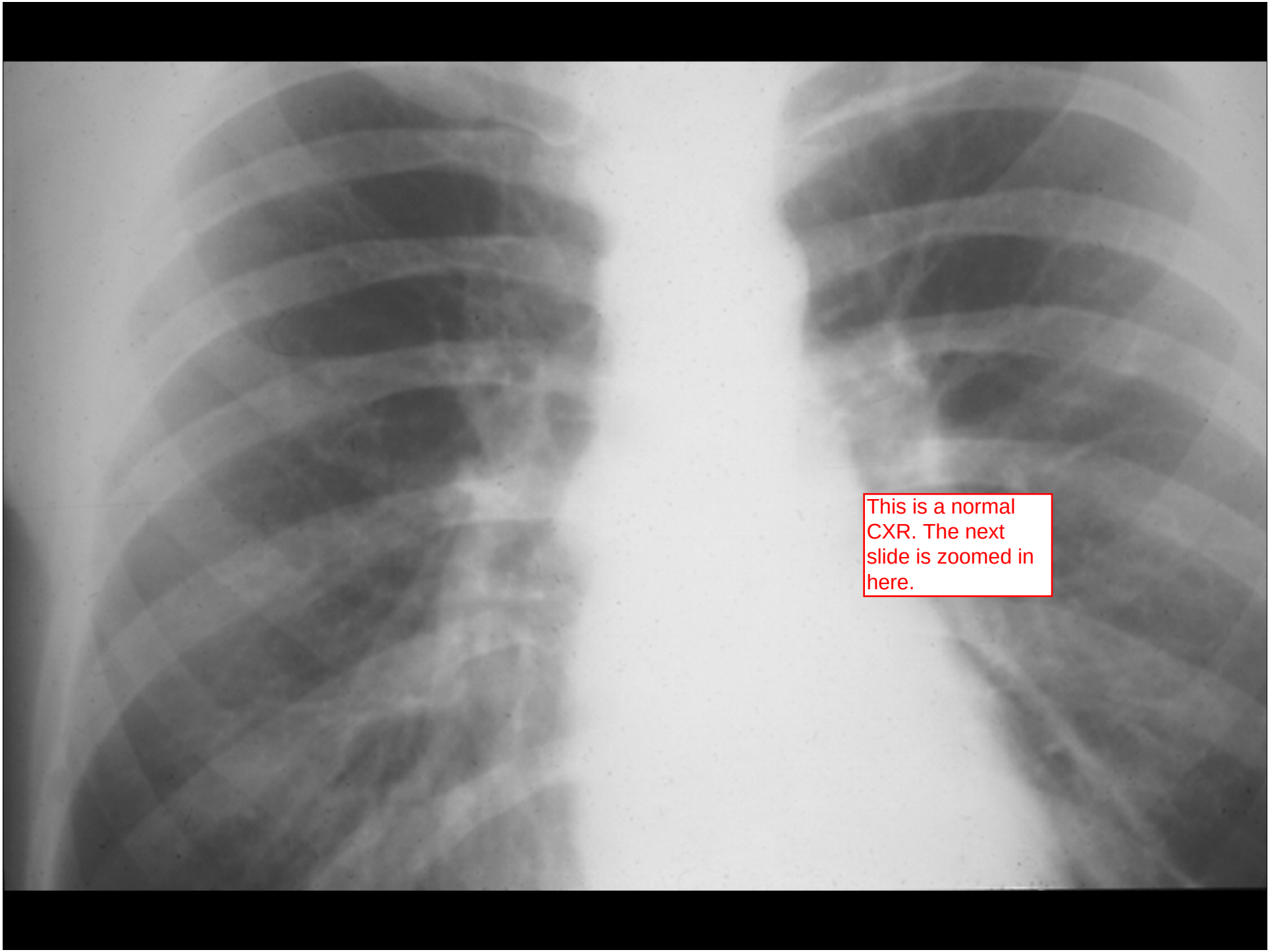
6. Examine the bones. On the wards, don't bullshit your attending and say that they look grossly normal if you're not sure. He/she will know you have no idea what you are talking about and call you out. Unfortunately, Dr. Goodman didn't really tell us what to look for when examining the bones, other than counting ribs to determine adequacy of lung volume. However, he promises to teach us on the wards later.

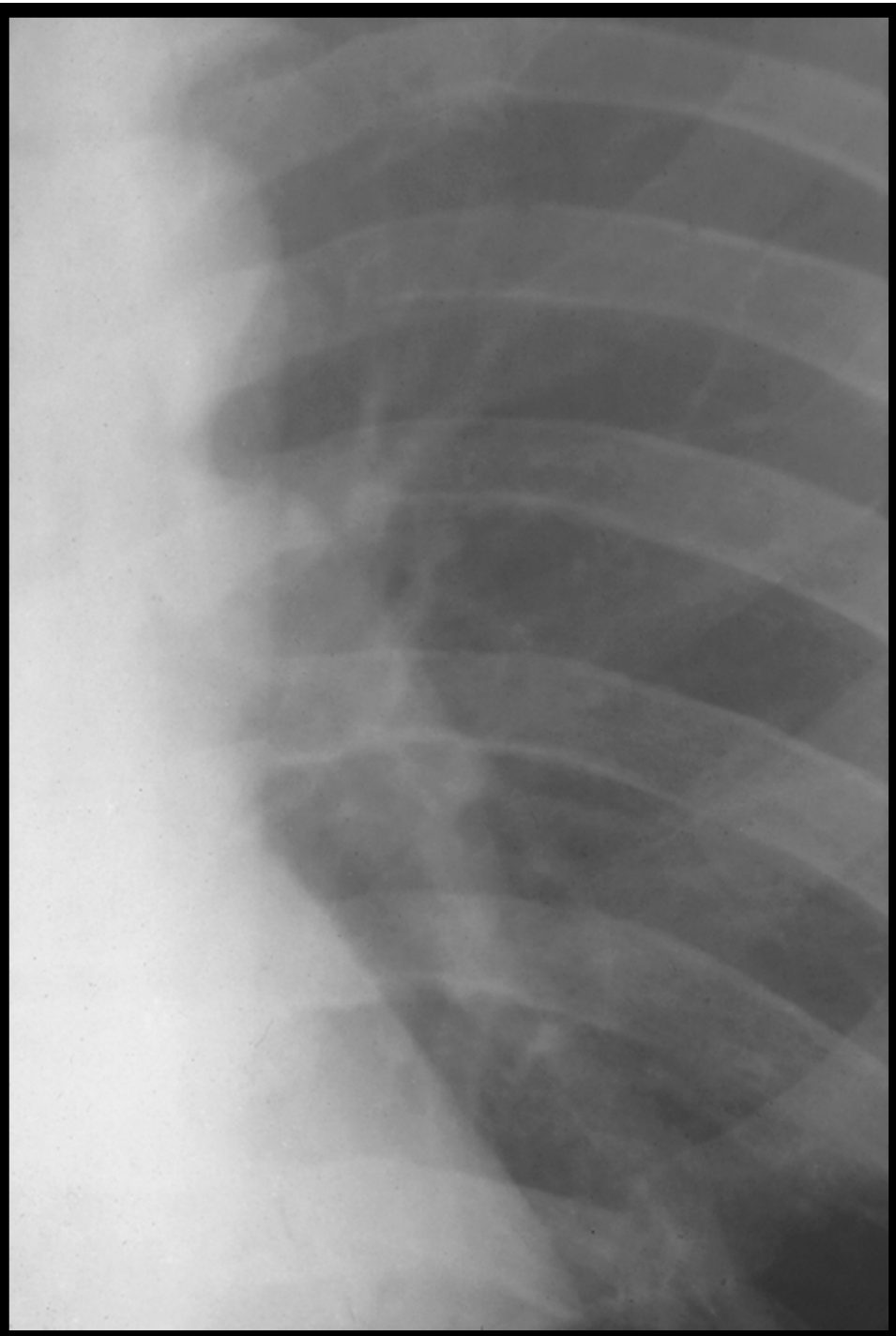
7. Look for asymmetry. This can be a big hint.

# Silhouette Sign

- When two structures of the same radiographic density touch, you don't see borders
- When two structures of dissimilar density touch, you do see borders

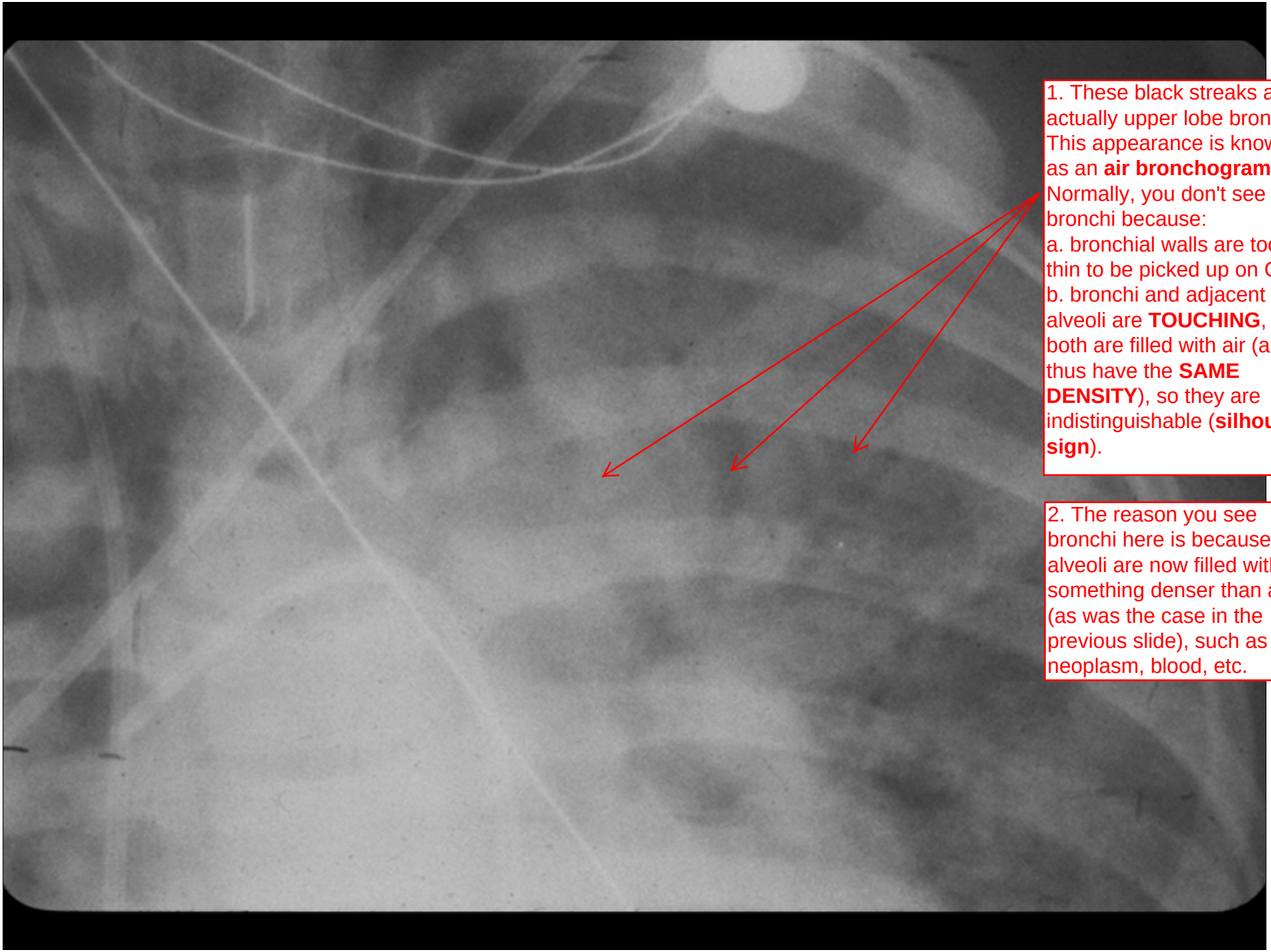
Density and touch are the two key factors. Review the previous slide.

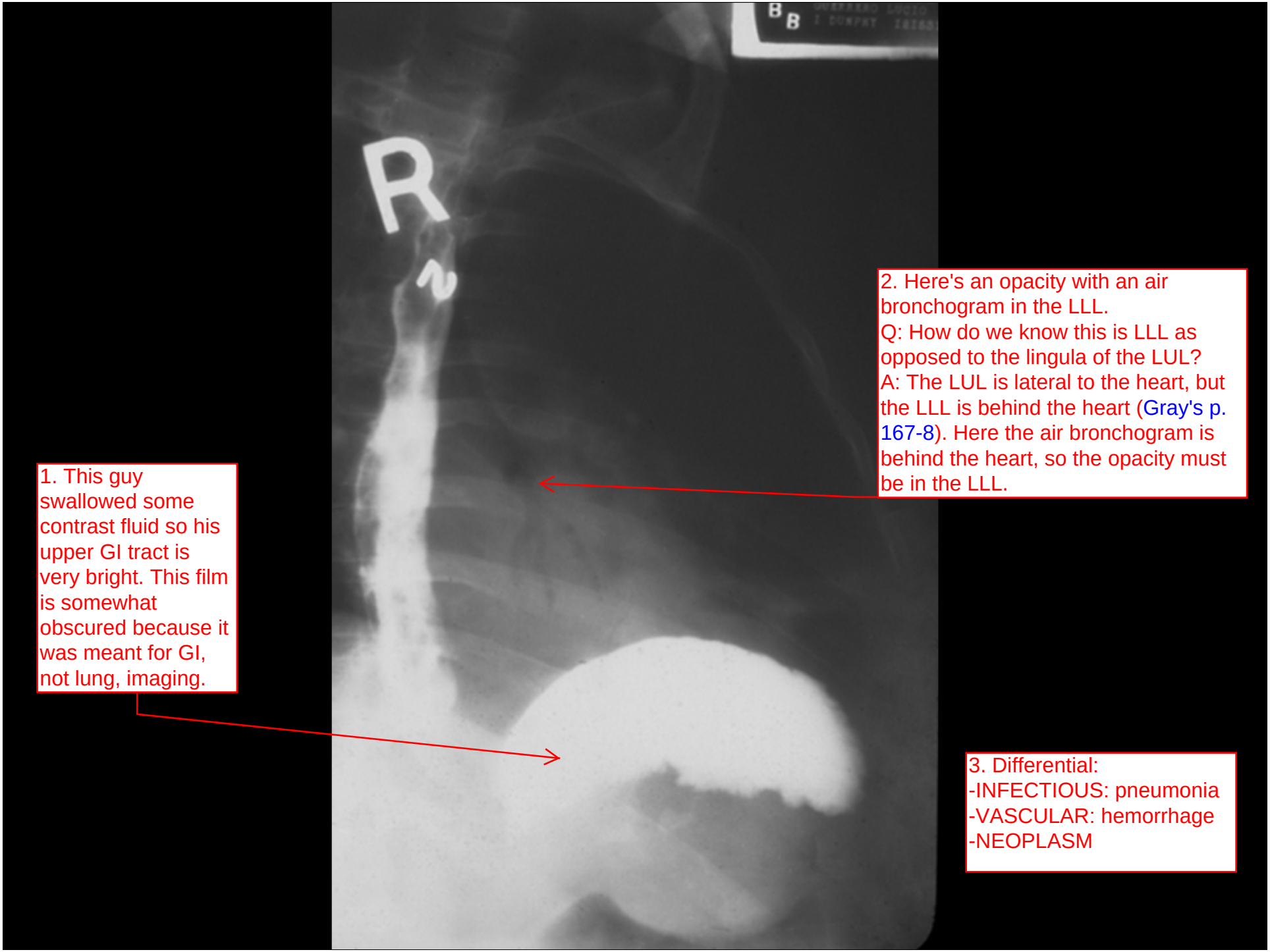

This is a normal CXR. The next slide is zoomed in here.



This appearance of the vasculature is considered "well-defined." As mentioned before, good definition requires that the vasculature is surrounded by air. Keep this picture in mind as you view the next slide.


This is poorly defined vasculature. The loss of definition is due to the replacement of air in the alveoli by something closer in density to blood.


1. These black streaks are actually upper lobe bronchi. This appearance is known as an **air bronchogram**. Normally, you don't see bronchi because:
a. bronchial walls are too thin to be picked up on CXR.
b. bronchi and adjacent alveoli are **TOUCHING**, and both are filled with air (and thus have the **SAME DENSITY**), so they are indistinguishable (**silhouette sign**).
2. The reason you see bronchi here is because the alveoli are now filled with something denser than air (as was the case in the previous slide), such as pus, neoplasm, blood, etc.




1. This guy swallowed some contrast fluid so his upper GI tract is very bright. This film is somewhat obscured because it was meant for GI, not lung, imaging.

2. Here's an opacity with an air bronchogram in the LLL.
Q: How do we know this is LLL as opposed to the lingula of the LUL?
A: The LUL is lateral to the heart, but the LLL is behind the heart (Gray's p. 167-8). Here the air bronchogram is behind the heart, so the opacity must be in the LLL.

3. Differential:
-INFECTIOUS: pneumonia
-VASCULAR: hemorrhage
-NEOPLASM

# Chest Film Interpretation

**THINK!!**

CXR's are 2D. Keep in mind that multiple planes are superimposed on each other.

**Overlying**

**Soft Tissue**

**Pleural Space**

**Lung Parenchyma**

These will NOT obscure vessel definition. The only thing that can obscure pulmonary vascular definition is the adjacent tissue, which is LUNG PARENCHYMA.

See the next slide for examples of each.

# Increased Opacity

- Gauze, ECG leads, clothing
- Hematoma, abscess, lipoma
- Pleural fluid, fibrosis, neoplasm, (mesothelioma, metastases)
- Lung: Consolidation
  Atelectasis

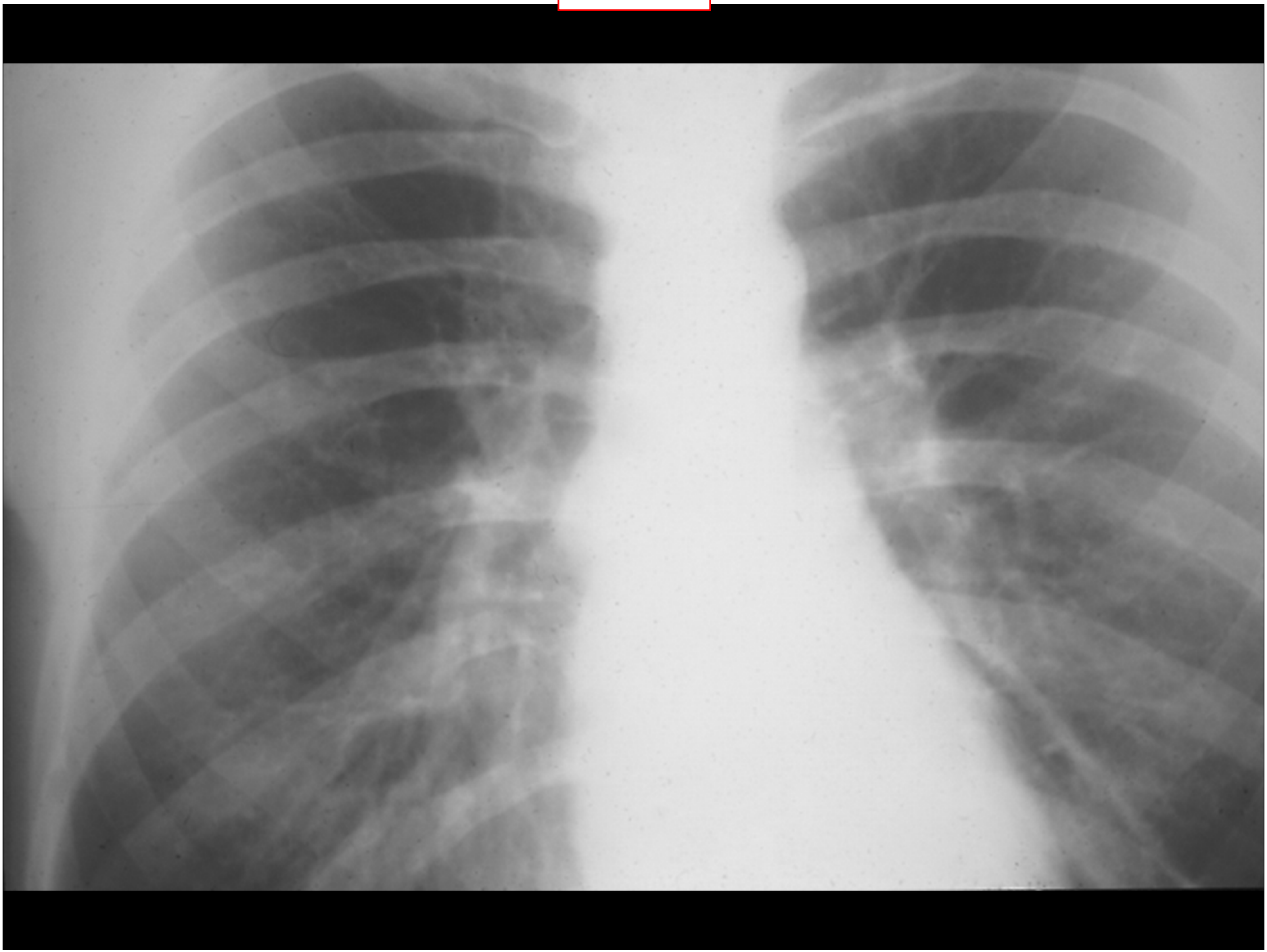
1. Consolidation occurs when air in the lung is removed, then replaced by another substance: pus, neoplasm, blood, etc.

2. Atelectasis occurs when air in the lung is removed, but not replaced

3. Consolidation and atelectasis produce indistinguishable increases in opacity.
The key difference btwn consolidation and atelectasis is that **atelectasis decreases lung volume**, while consolidation does not.

4. Decreases in lung volume manifest as mediastinal, diaphragmatic, or fissural shifts.

A normal CXR.



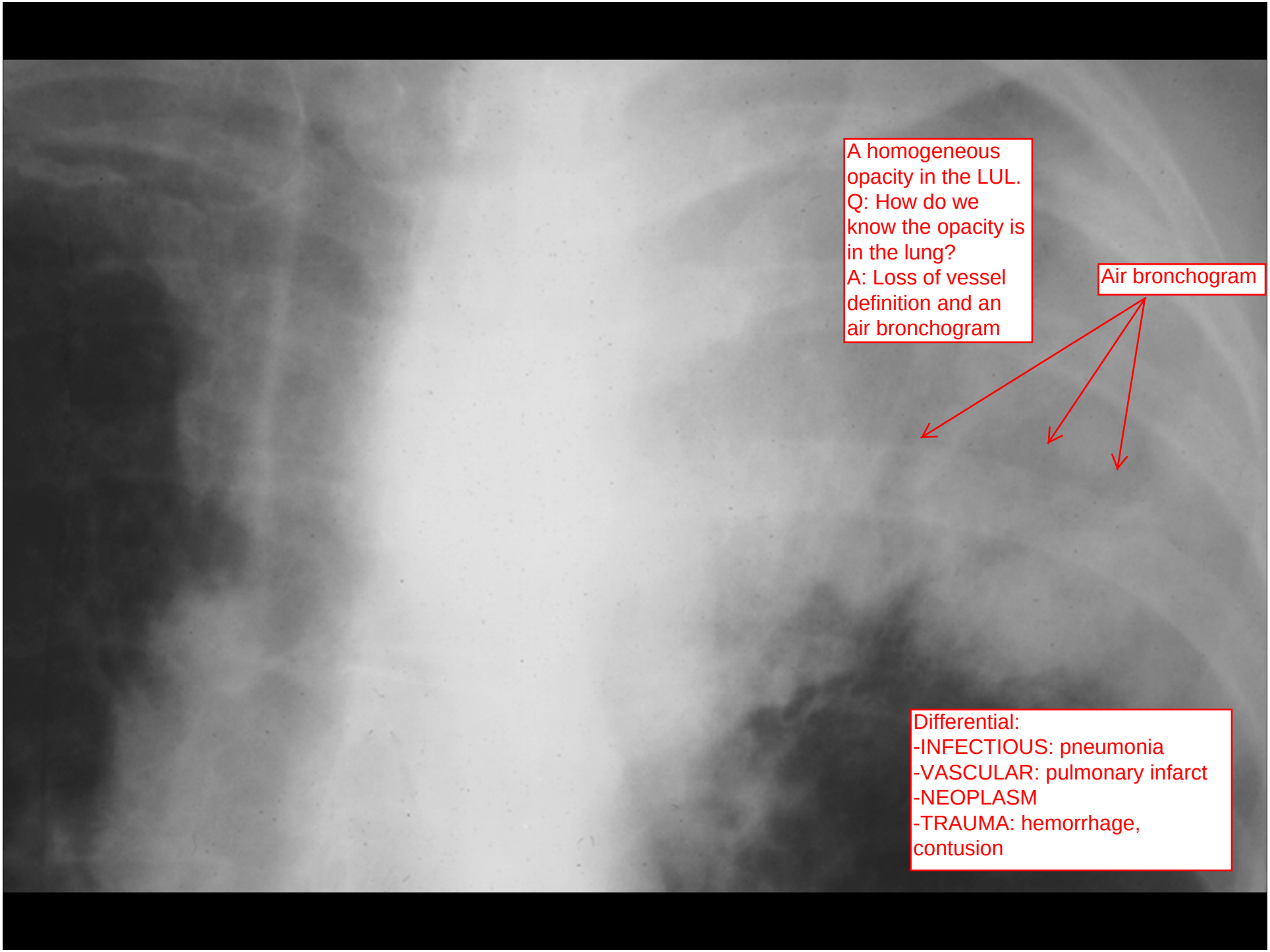
# Chest Examination

This slide and the next give a brief summary of exam findings in a normal individual.

- **Breath sounds will be normal, vesicular (longer, louder in inspiration)**
- **Percussion will be resonant**
- **Ausculatation - see next slide**

# Ausculatation

- Will be normal
- No Whispered Pectoriloquy
- No Bronchophony
- No Egophony
- No Rales, Rhonchi, Wheezes


A homogeneous opacity in the LUL.
Q: How do we know the opacity is in the lung?
A: Loss of vessel definition and an air bronchogram
Air bronchogram
Differential:
-INFECTIOUS: pneumonia
-VASCULAR: pulmonary infarct
-NEOPLASM
-TRAUMA: hemorrhage, contusion

# Auscultation

This slide and the next apply to the previous CXR.

a) Will be normal

b) Will have eee to aaa changes

c) Will reveal vesicular breath sounds

d) All of the above

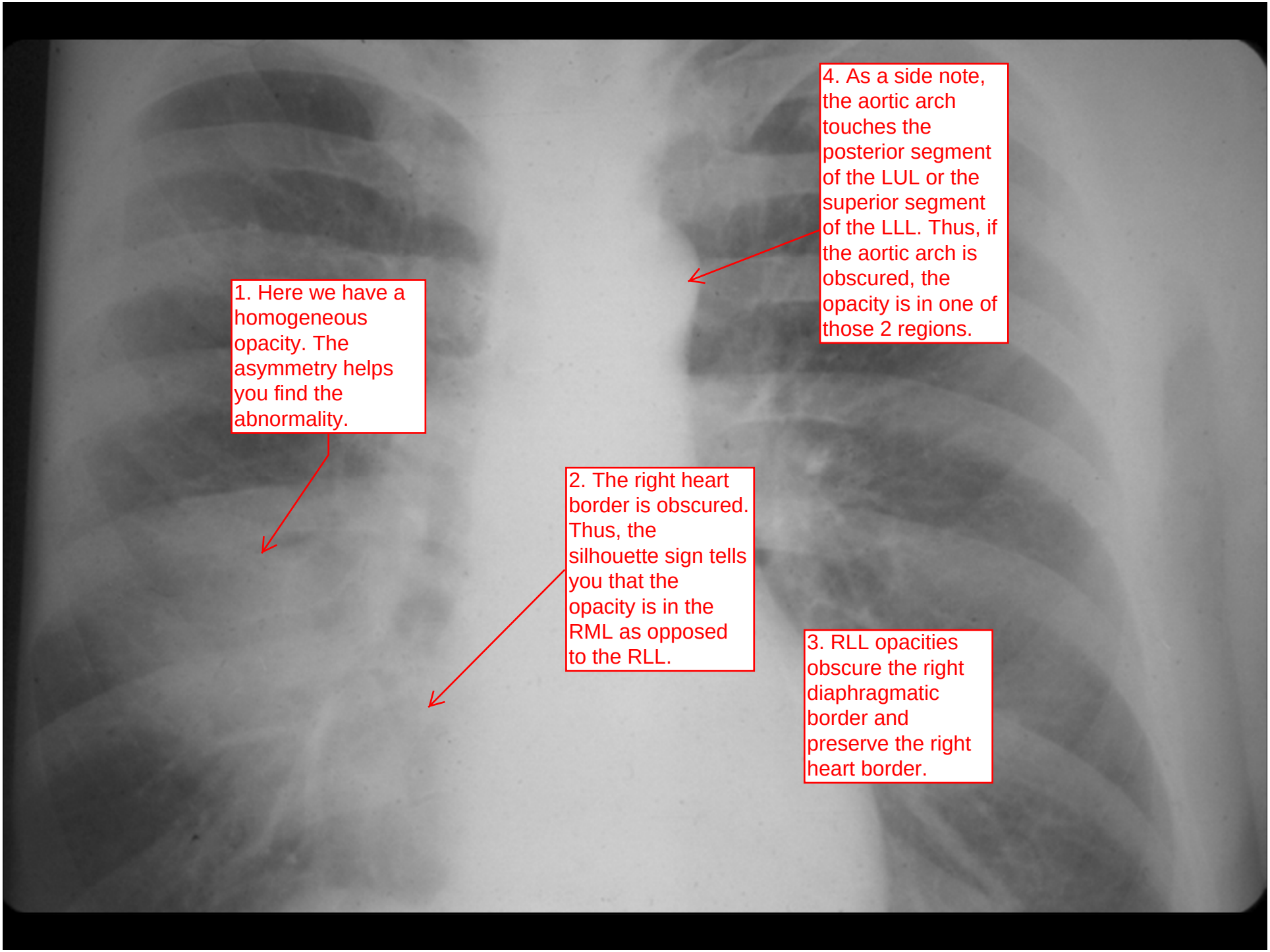
# Percussion

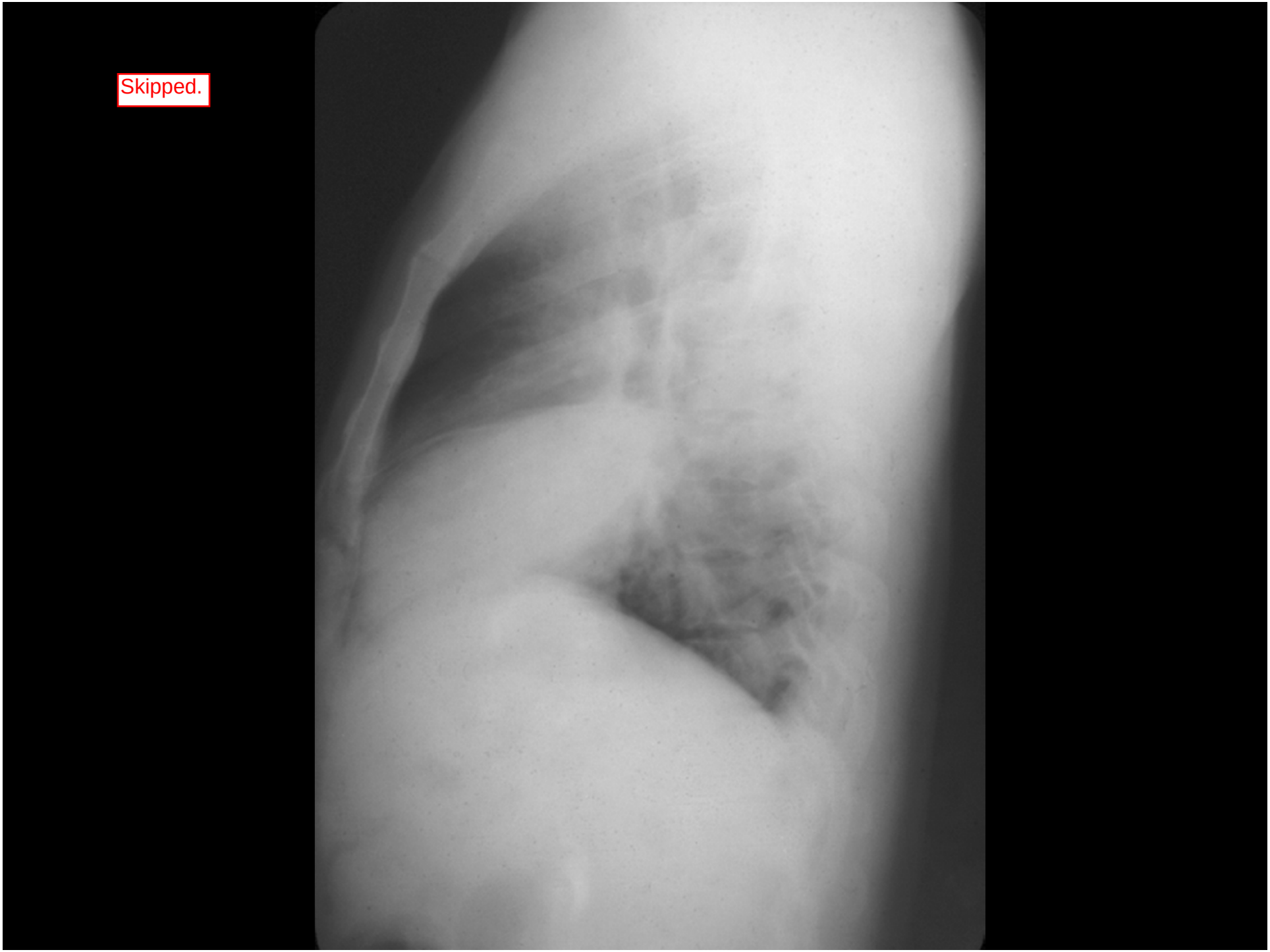
a) Will be dull

b) Will be resonant

c) Will be tympanitic

d) All of the above


4. As a side note, the aortic arch touches the posterior segment of the LUL or the superior segment of the LLL. Thus, if the aortic arch is obscured, the opacity is in one of those 2 regions.
1. Here we have a homogeneous opacity. The asymmetry helps you find the abnormality.
2. The right heart border is obscured. Thus, the silhouette sign tells you that the opacity is in the RML as opposed to the RLL.
3. RLL opacities obscure the right diaphragmatic border and preserve the right heart border.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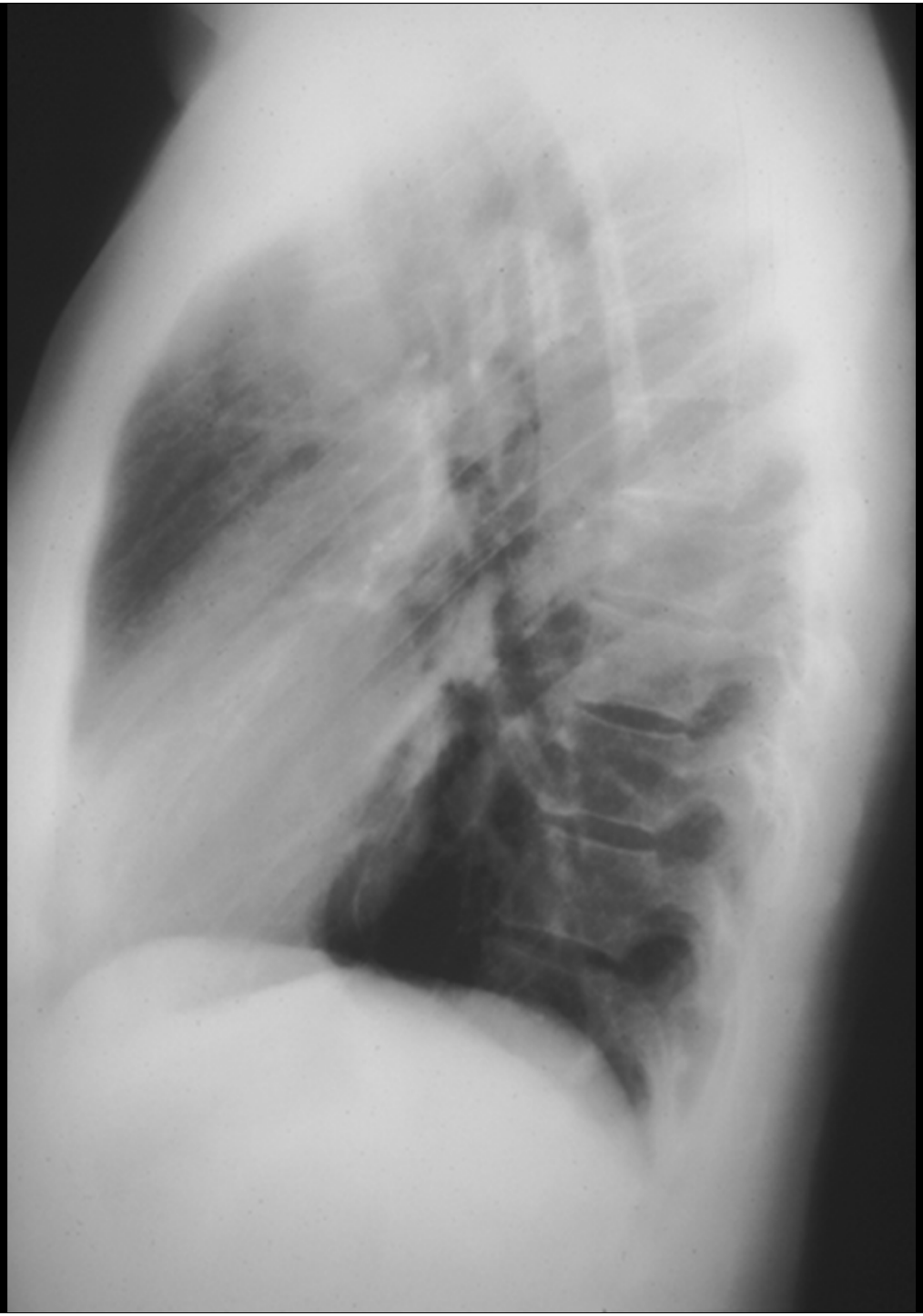
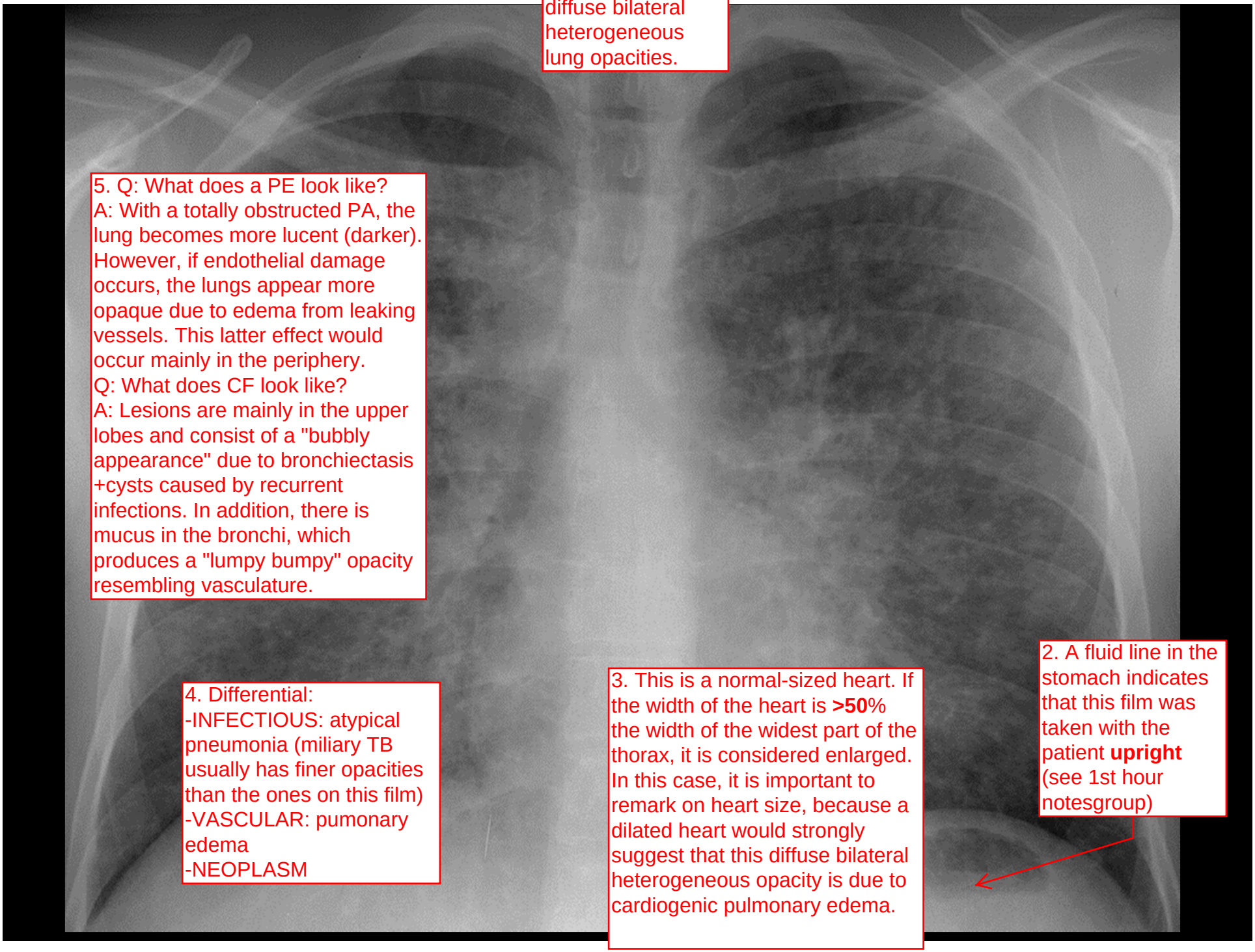




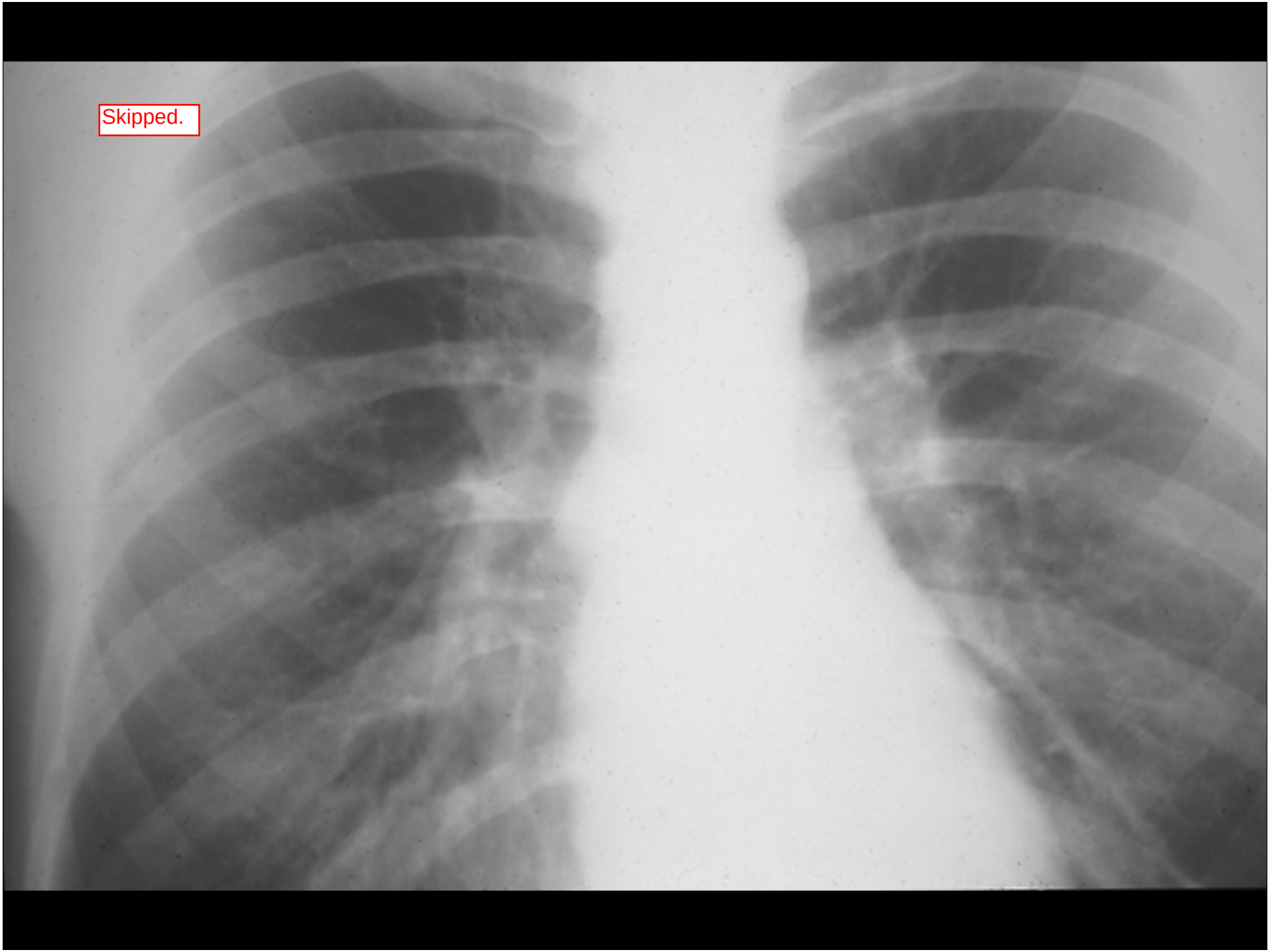
1. Here we have diffuse bilateral heterogeneous lung opacities.

5. Q: What does a PE look like?
A: With a totally obstructed PA, the lung becomes more lucent (darker). However, if endothelial damage occurs, the lungs appear more opaque due to edema from leaking vessels. This latter effect would occur mainly in the periphery.
Q: What does CF look like?
A: Lesions are mainly in the upper lobes and consist of a "bubbly appearance" due to bronchiectasis +cysts caused by recurrent infections. In addition, there is mucus in the bronchi, which produces a "lumpy bumpy" opacity resembling vasculature.

4. Differential:
-INFECTIOUS: atypical pneumonia (miliary TB usually has finer opacities than the ones on this film)
-VASCULAR: pumonary edema
-NEOPLASM

3. This is a normal-sized heart. If the width of the heart is **>50**% the width of the widest part of the thorax, it is considered enlarged. In this case, it is important to remark on heart size, because a dilated heart would strongly suggest that this diffuse bilateral heterogeneous opacity is due to cardiogenic pulmonary edema.

2. A fluid line in the stomach indicates that this film was taken with the patient **upright** (see 1st hour notesgroup)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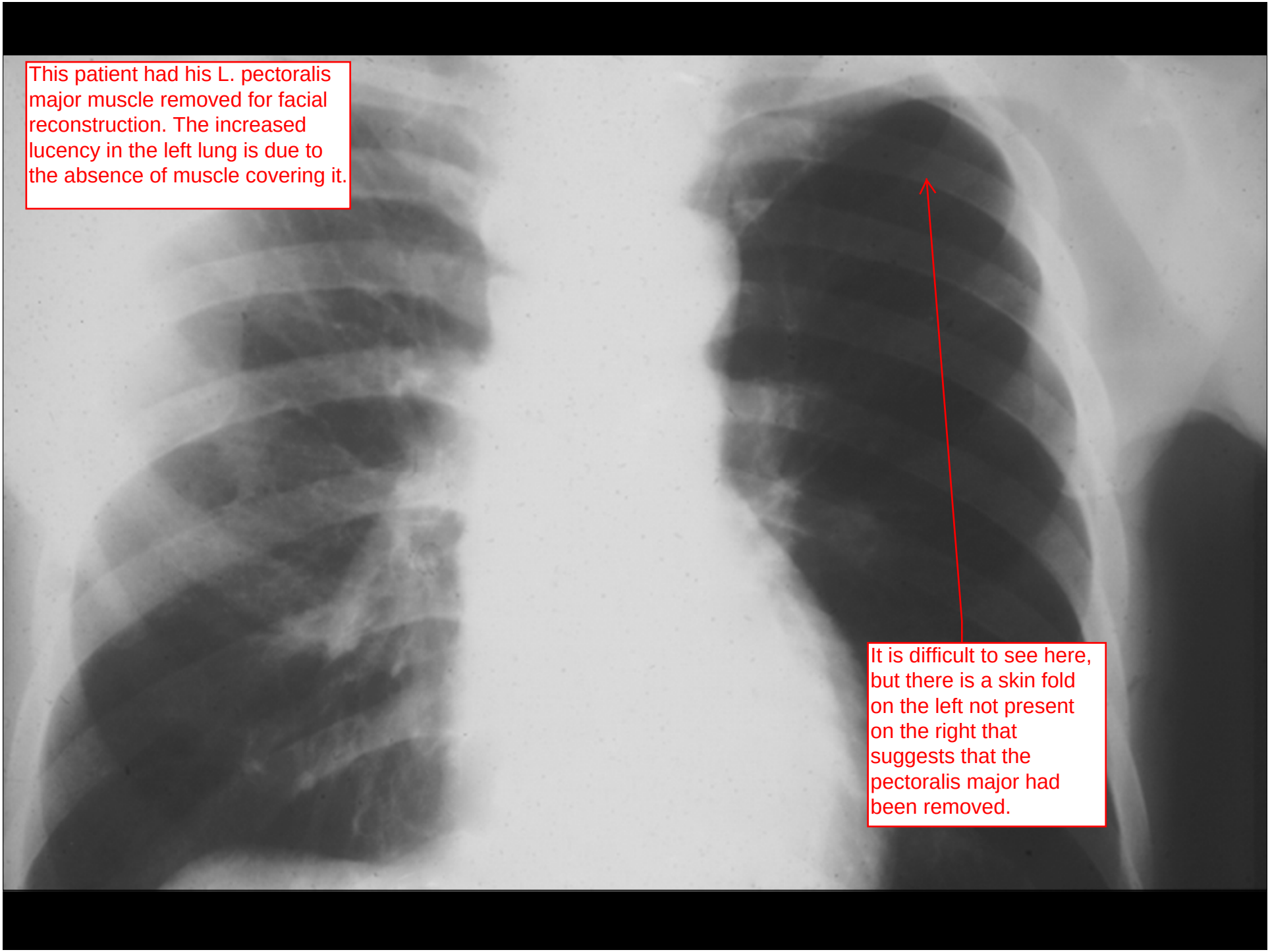
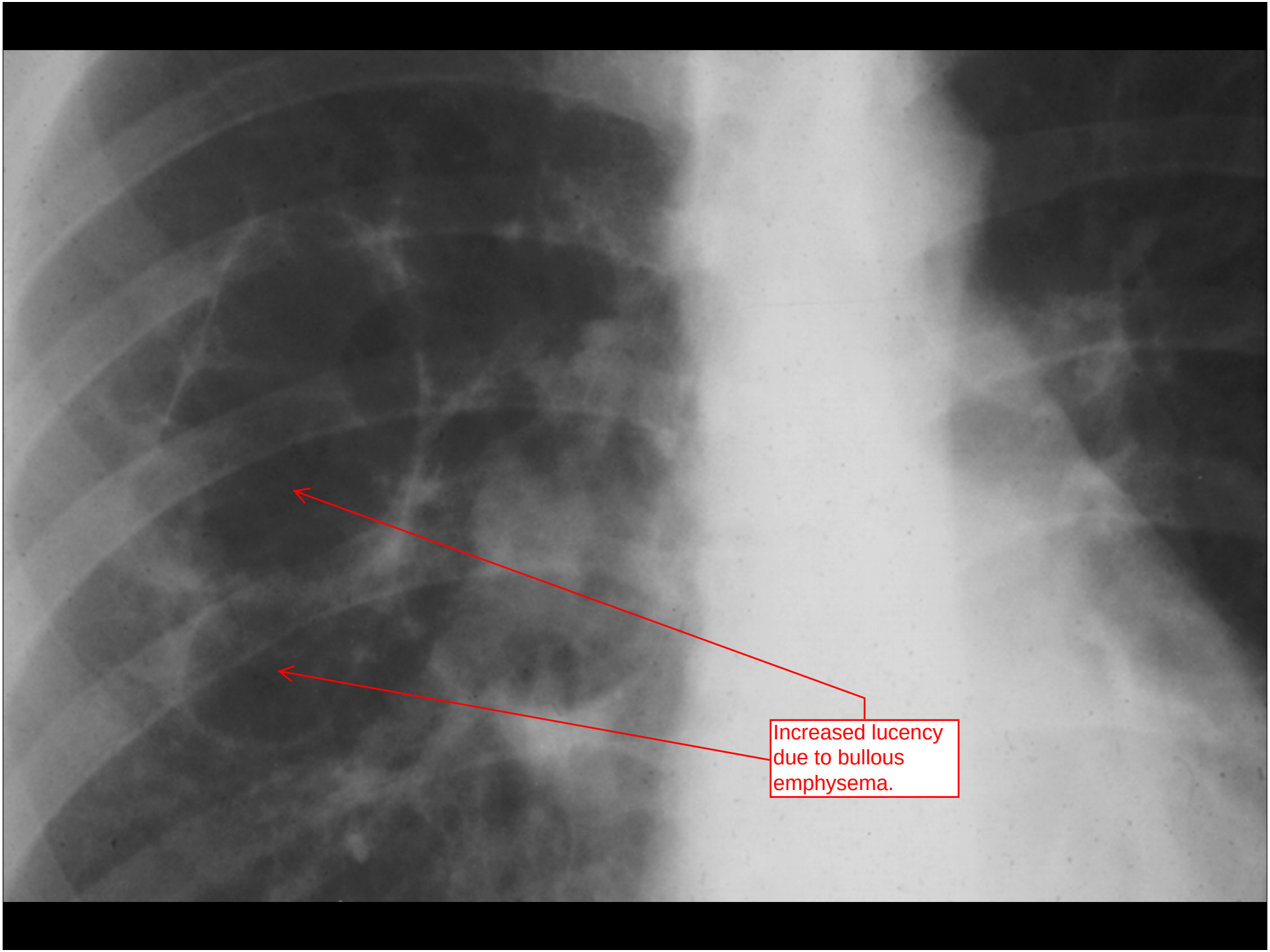
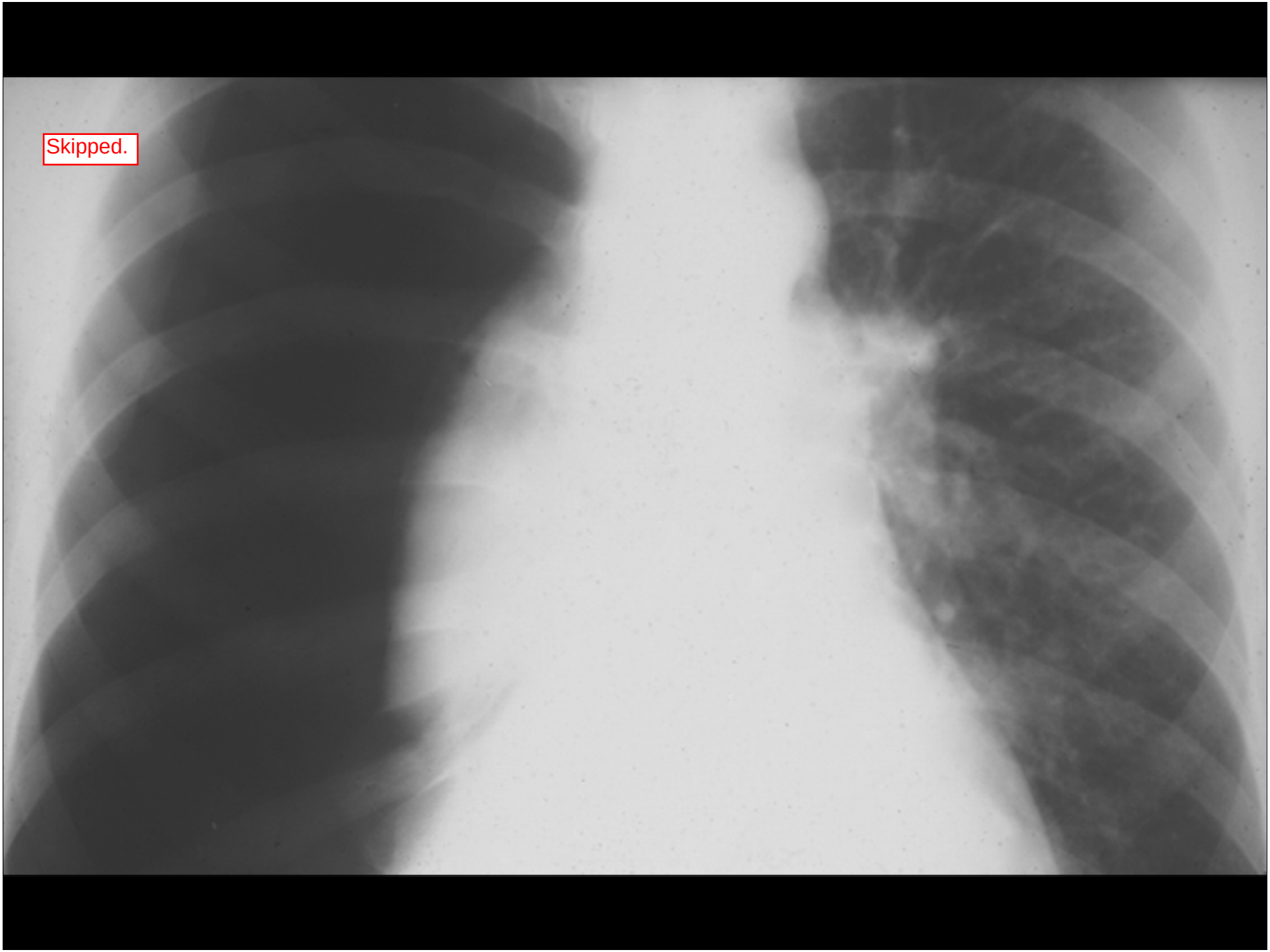
# Decreased Opacity

- This means increased lucency
- Mastectomy
- Pneumothorax
- Emphysema, pulmonary embolism


This patient had his L. pectoralis major muscle removed for facial reconstruction. The increased lucency in the left lung is due to the absence of muscle covering it.
It is difficult to see here, but there is a skin fold on the left not present on the right that suggests that the pectoralis major had been removed.


This is a pneumothorax.
1. This is all air.
2. THIS is the collapsed lung!


Increased lucency due to bullous emphysema.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# Breath sounds

(in a pneumothorax)

a) Will be normal

b) Will be increased

c) Will be decreased

d) All of the above

# Percussion

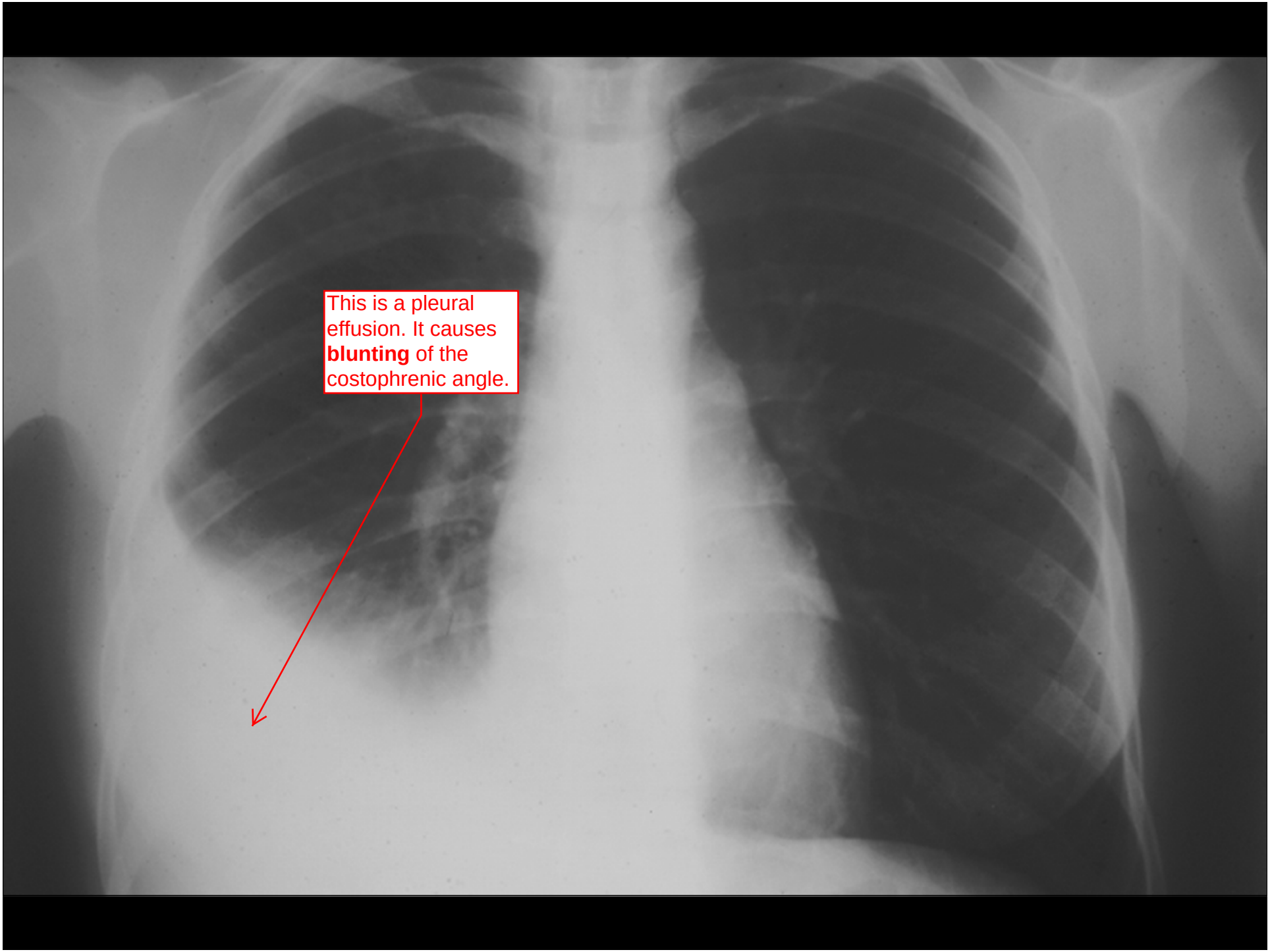
(in pneumothorax)

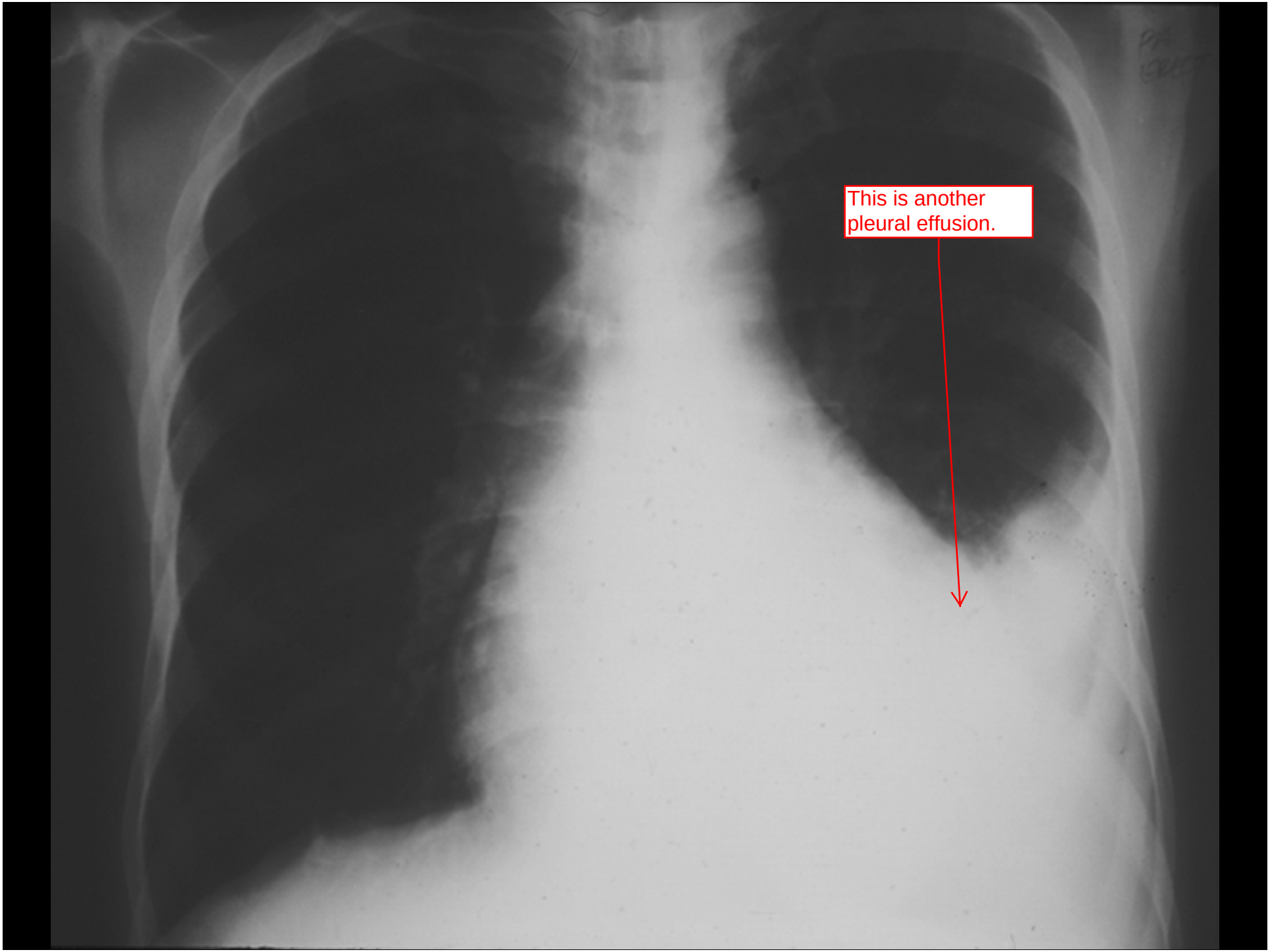
a) Will be dull

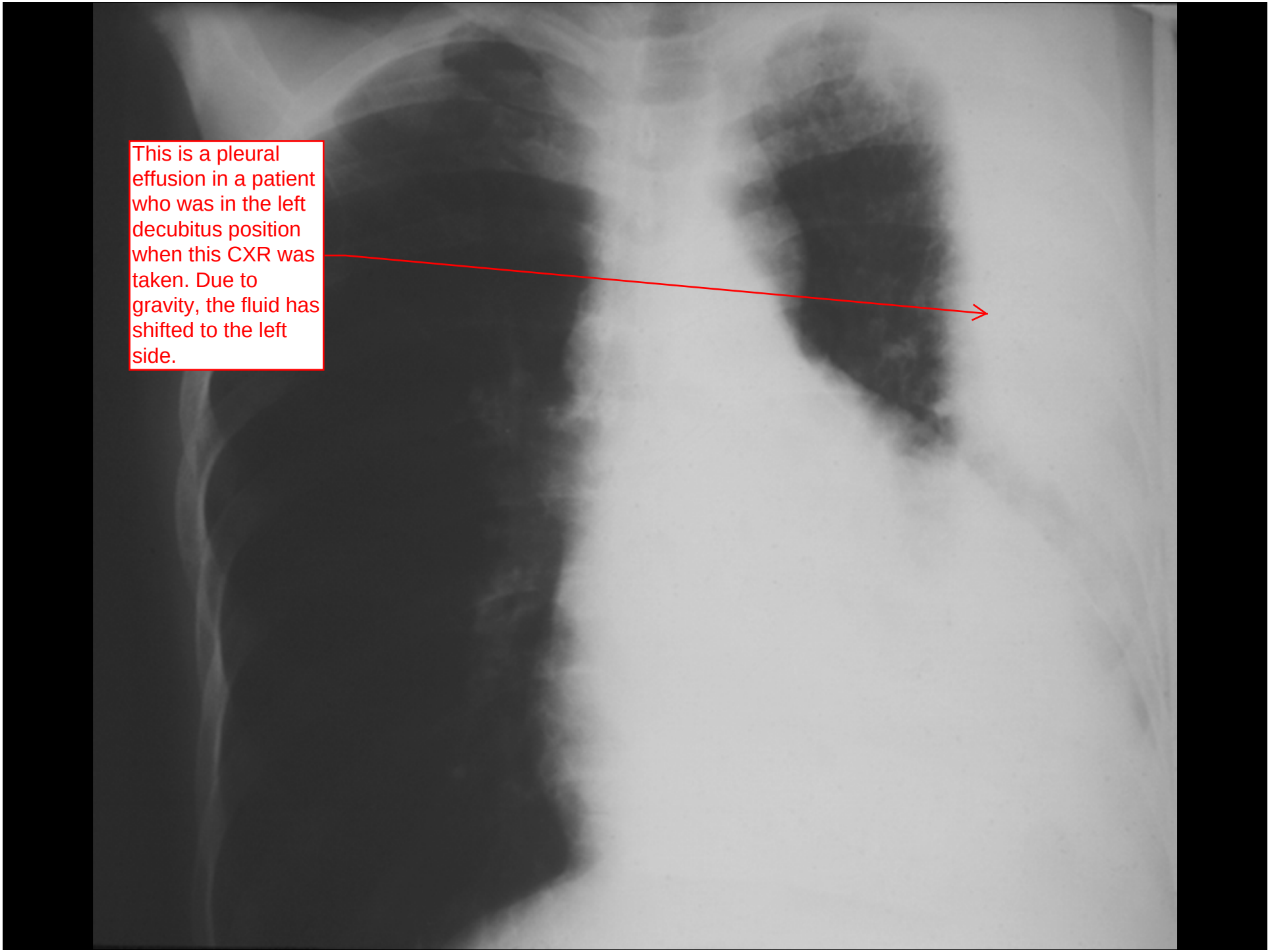
b) Will be resonant

c) Will be tympanic

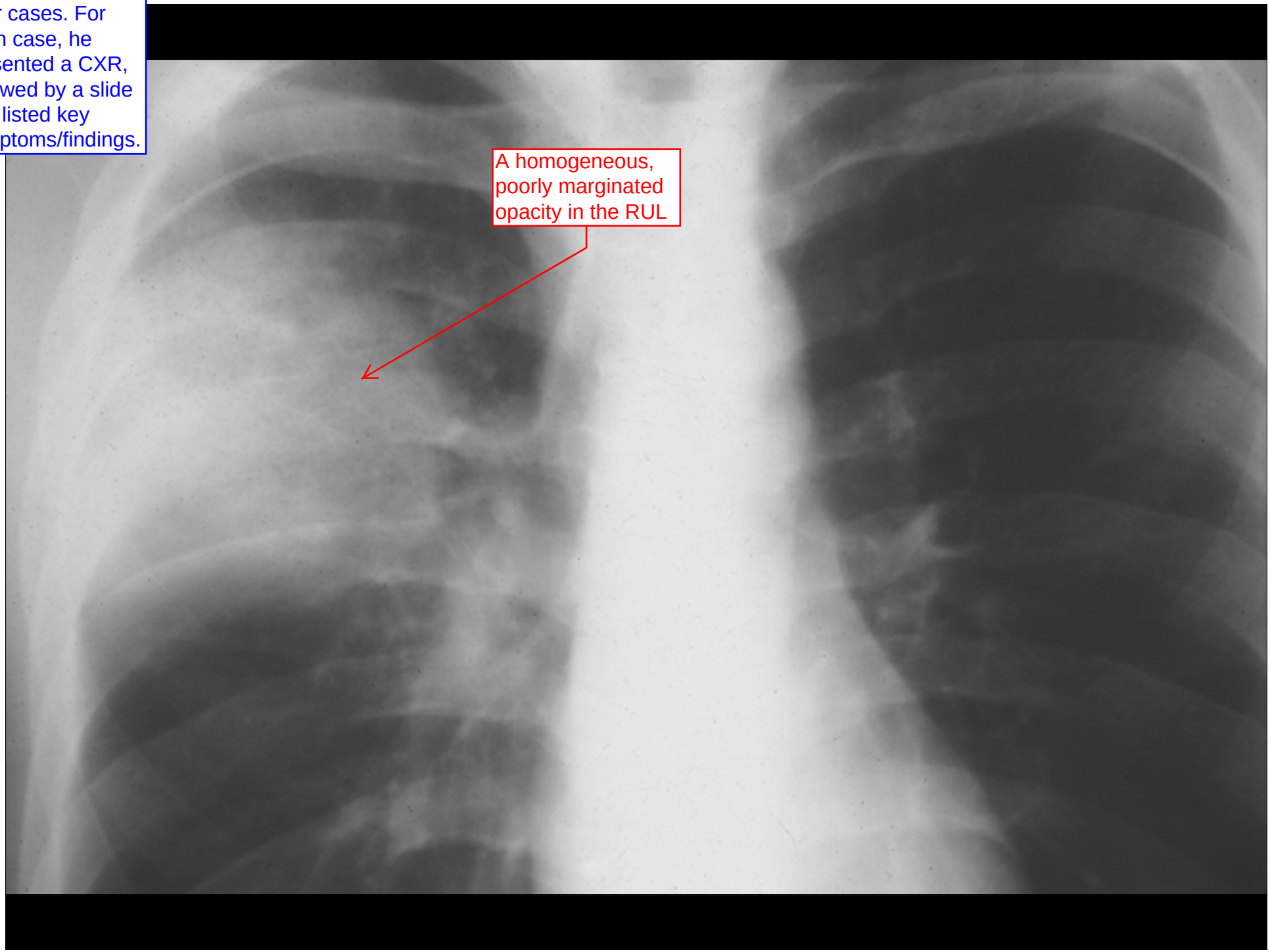
d) All of the above


This is a pleural effusion. It causes **blunting** of the costophrenic angle.


This is another
pleural effusion.

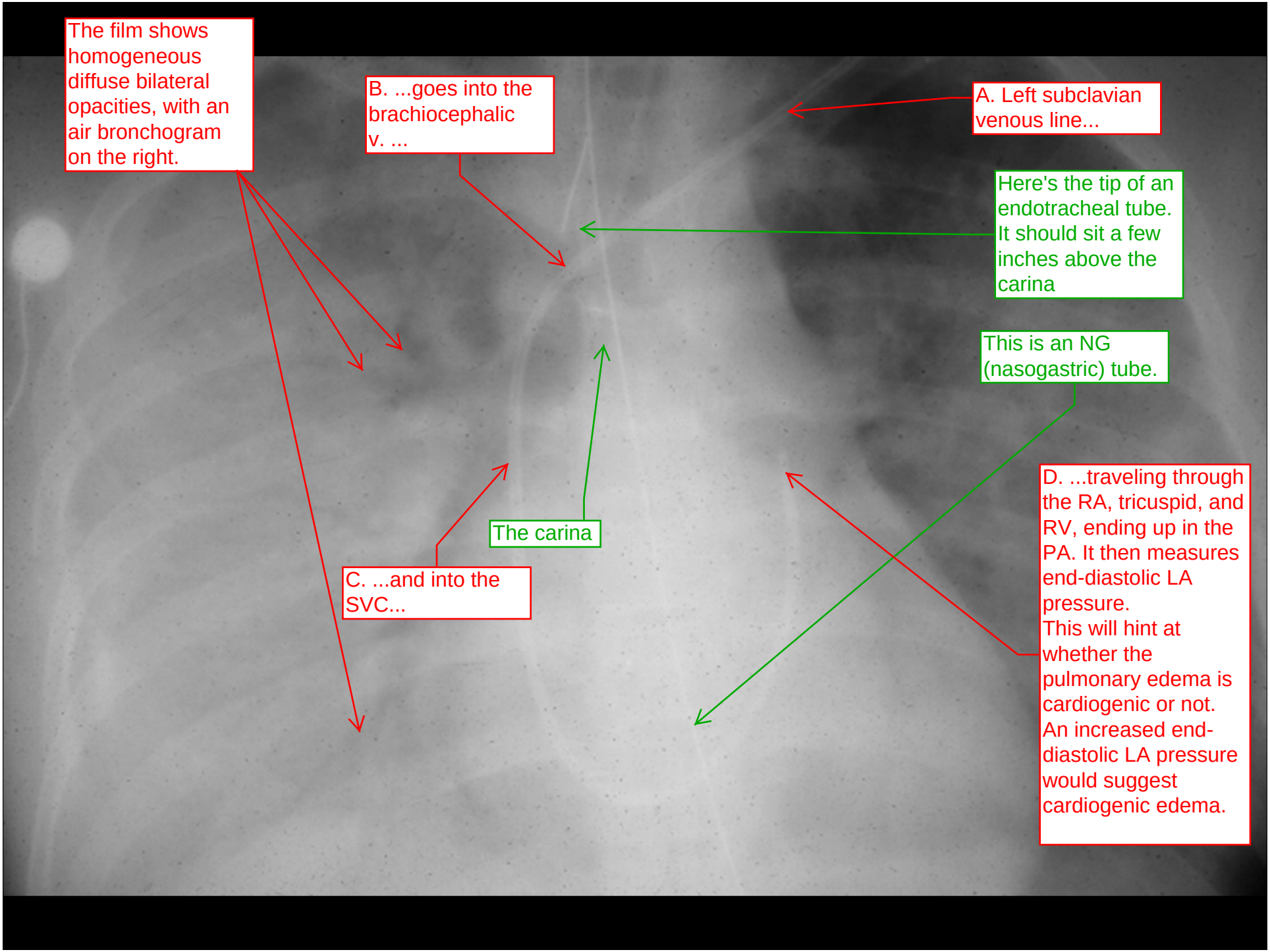

This is a pleural effusion in a patient who was in the left decubitus position when this CXR was taken. Due to gravity, the fluid has shifted to the left side.

From here on out, Dr. Goodman went over cases. For each case, he presented a CXR, followed by a slide that listed key symptoms/findings.



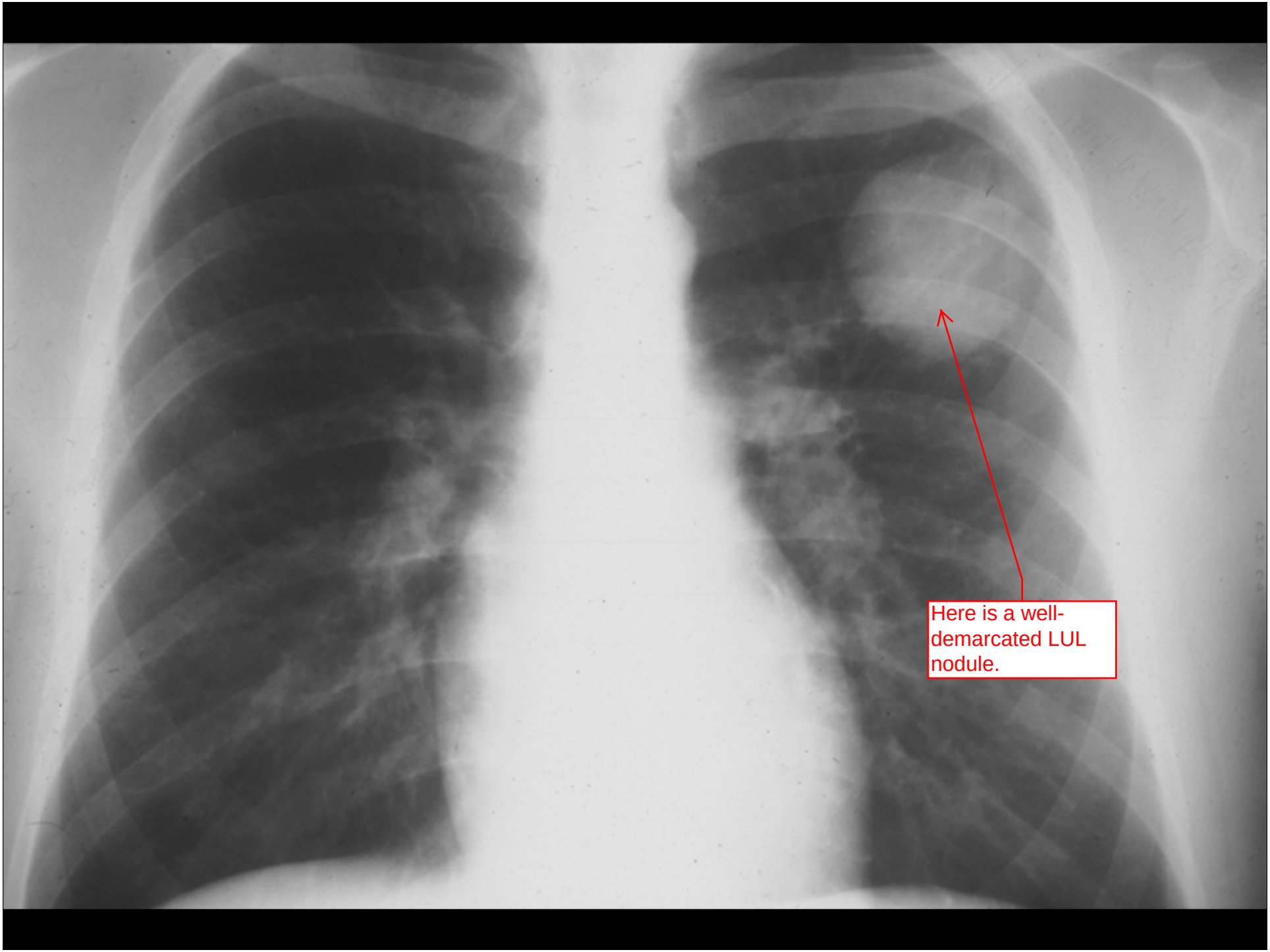
# Cough and Fever

Diagnosis:
**pneumococcal pneumonia**.


The film shows homogeneous diffuse bilateral opacities, with an air bronchogram on the right.
B. ...goes into the brachiocephalic v. ...
A. Left subclavian venous line...
Here's the tip of an endotracheal tube. It should sit a few inches above the carina
This is an NG (nasogastric) tube.
The carina
C. ...and into the SVC...
D. ...traveling through the RA, tricuspid, and RV, ending up in the PA. It then measures end-diastolic LA pressure.
This will hint at whether the pulmonary edema is cardiogenic or not.
An increased end-diastolic LA pressure would suggest cardiogenic edema.

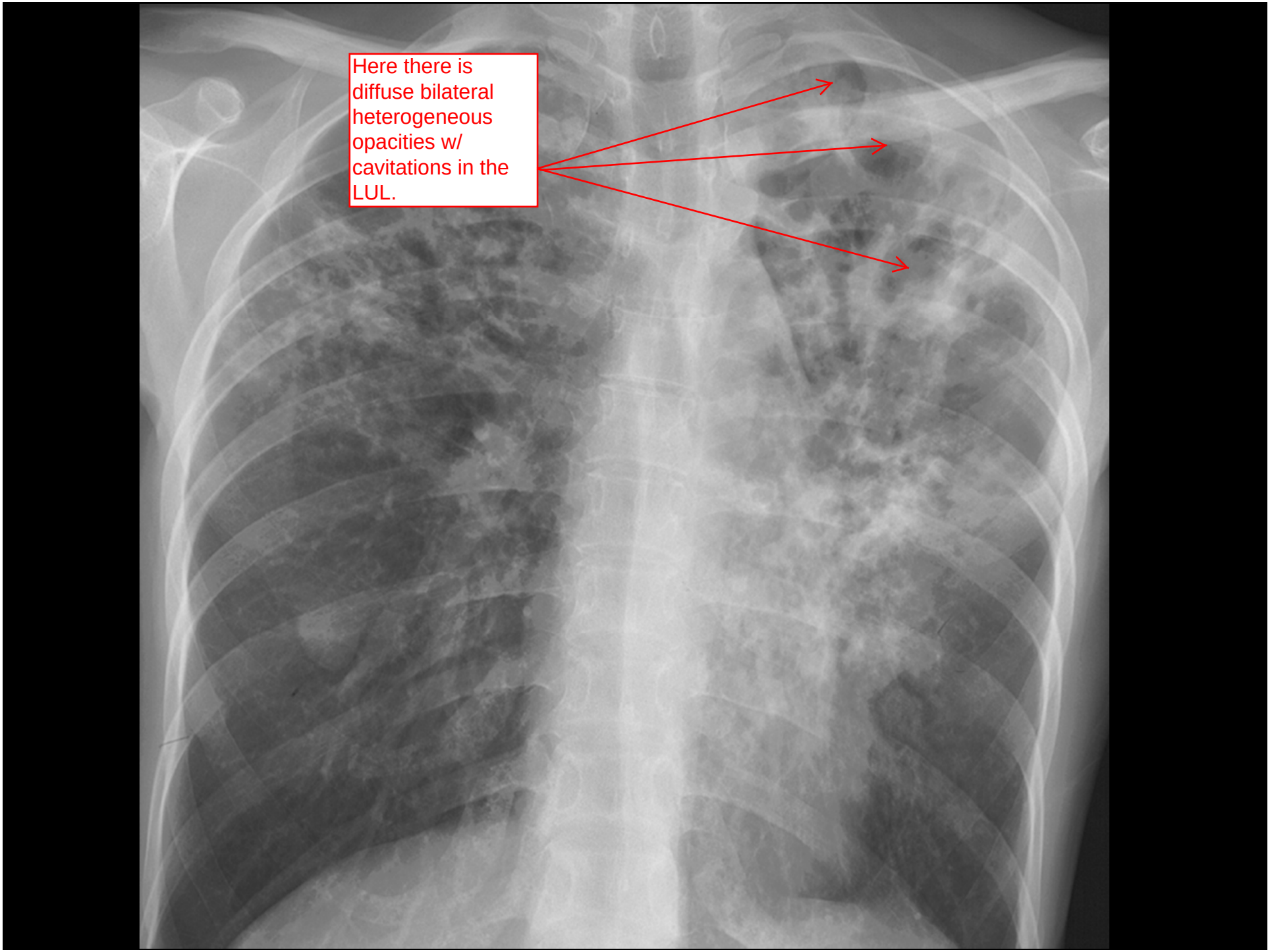
# Short of breath, septic

Diagnosis:
**pulmonary edema due to ARDS**


Here is a well-demarcated LUL nodule.

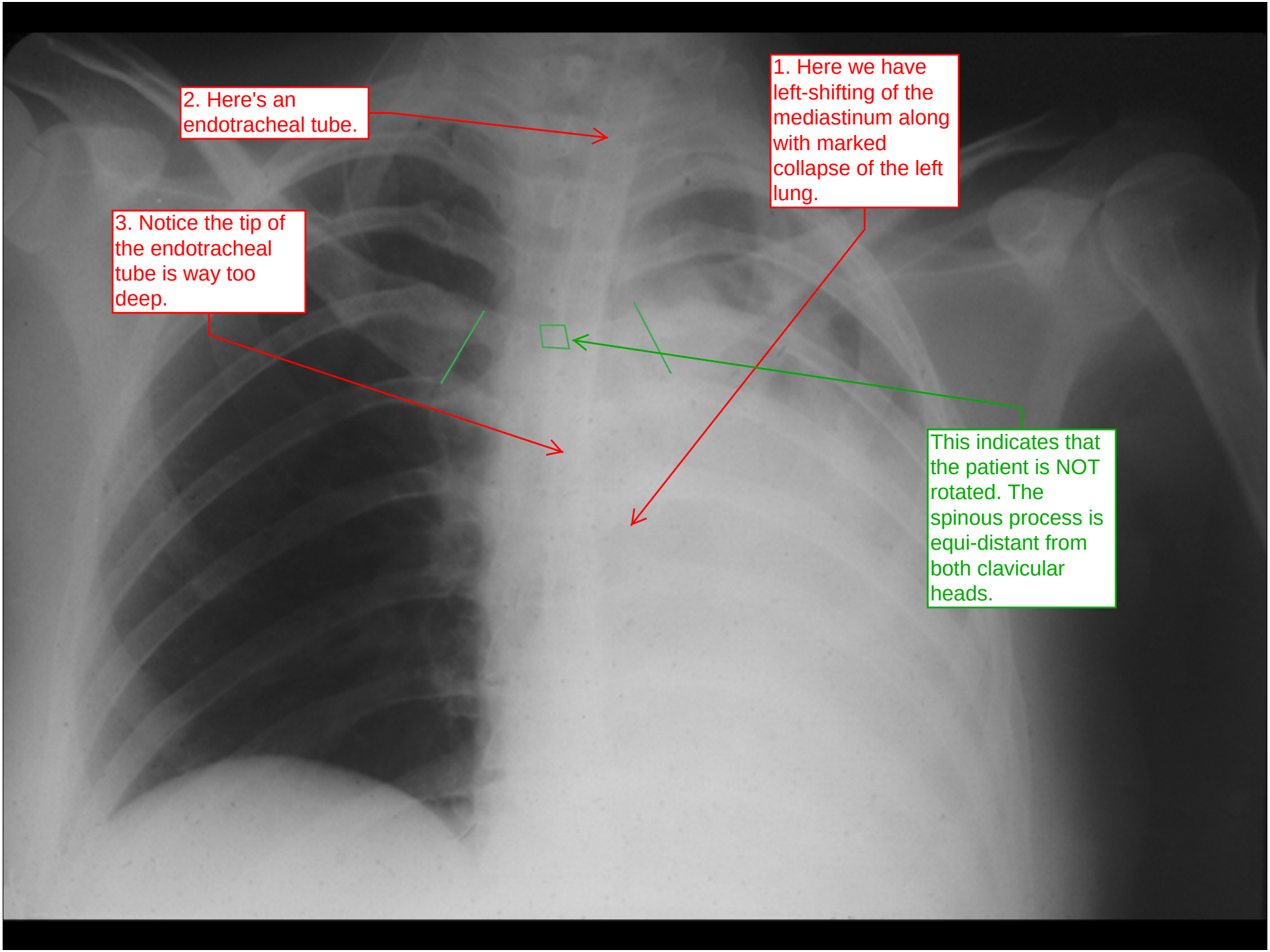
# Weight Loss and Hemoptysis

Diagnosis:
**lymphoma**


Here there is diffuse bilateral heterogeneous opacities w/ cavitations in the LUL.

# Hemoptysis, Weight Loss, Night Sweats

Diagnosis:
**TB**


1. Here we have left-shifting of the mediastinum along with marked collapse of the left lung.
2. Here's an endotracheal tube.
3. Notice the tip of the endotracheal tube is way too deep.
This indicates that the patient is NOT rotated. The spinous process is equi-distant from both clavicular heads.

# iatrogenesis

Diagnosis: **iatrogenic atelectasis**.
Some idiot placed the endotracheal tube down too far. As a result, only the right lung was perfused, and the left lung underwent reabsorption atelectasis due to complete left bronchus obstruction.