

Chest 1

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- The chest radiograph (also known as the chest x-ray or CXR) is anecdotally thought to be the most frequently-performed radiological investigation globally although no published data is known to corroborate this.
- UK government statistical data from the NHS in England and Wales shows that the chest radiograph remains consistently the most frequently requested imaging test by GPs

General principles

1. Have a systemic approach
2. Interpret the CXR in conjunction with The clinical findings
3. Always compare with the previous CXR if available to assess the changes

by write the date of chest X-ray in Film.

Before we start

- The Images Seen on chest radiograph results from the differences in the materials in the body
- The hierarchy of the densities from the lower density (dark) to the higher density (light)
 - 1. Gas (Air in the lung) more lucence
 - 2. Fat (Fat layer in soft tissue)
 - 3. Water (Same density as heart and blood vessels)
 - 4. Bone (The most dense of the tissue)
 - 5. Metal (foreign body) more opacity
↓ Bright appearance

Resulting gray-scale image on x-ray order



Air



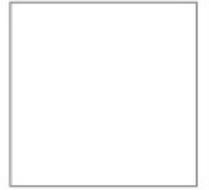
Fat



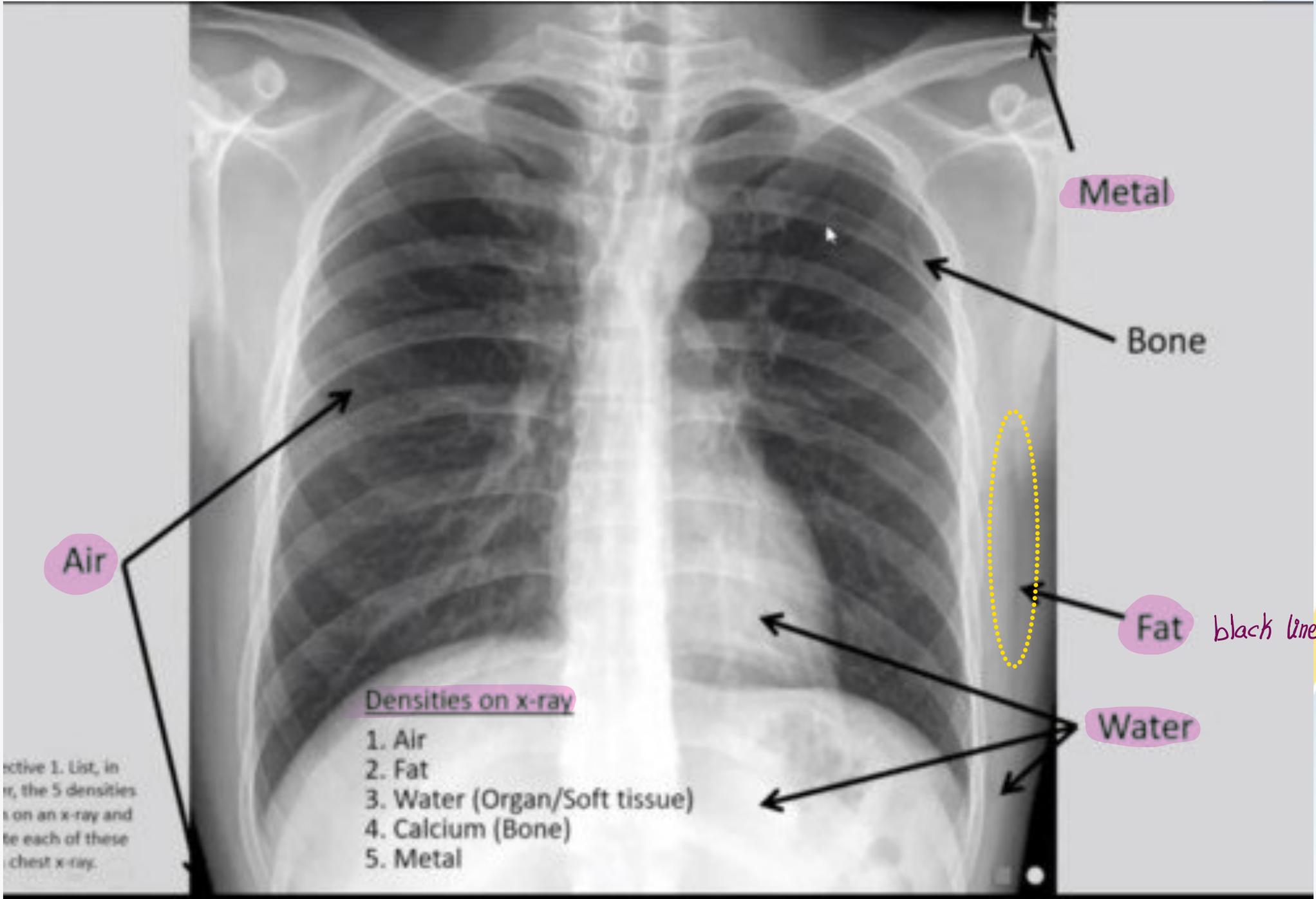
**Soft
Tissue**



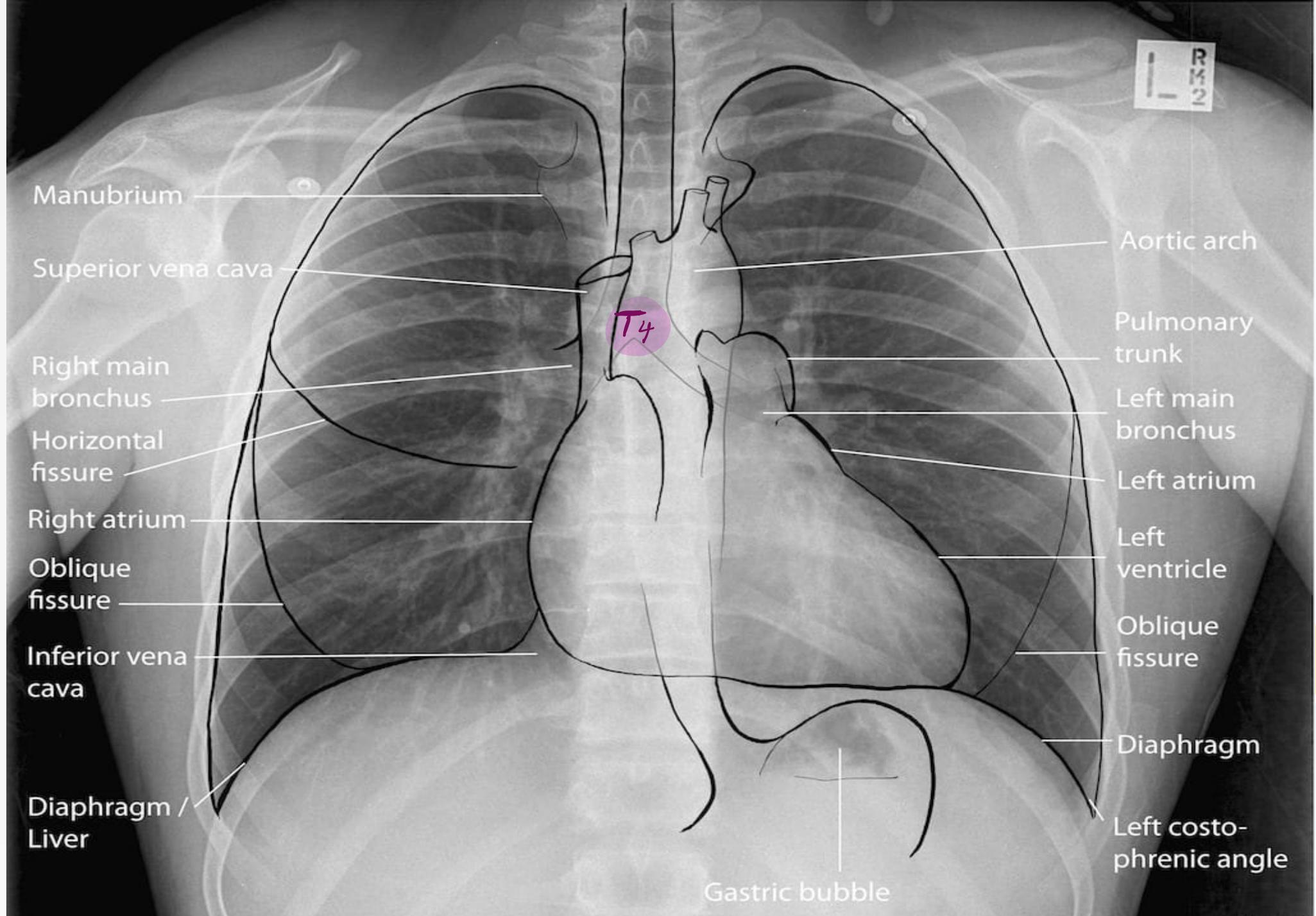
Bone

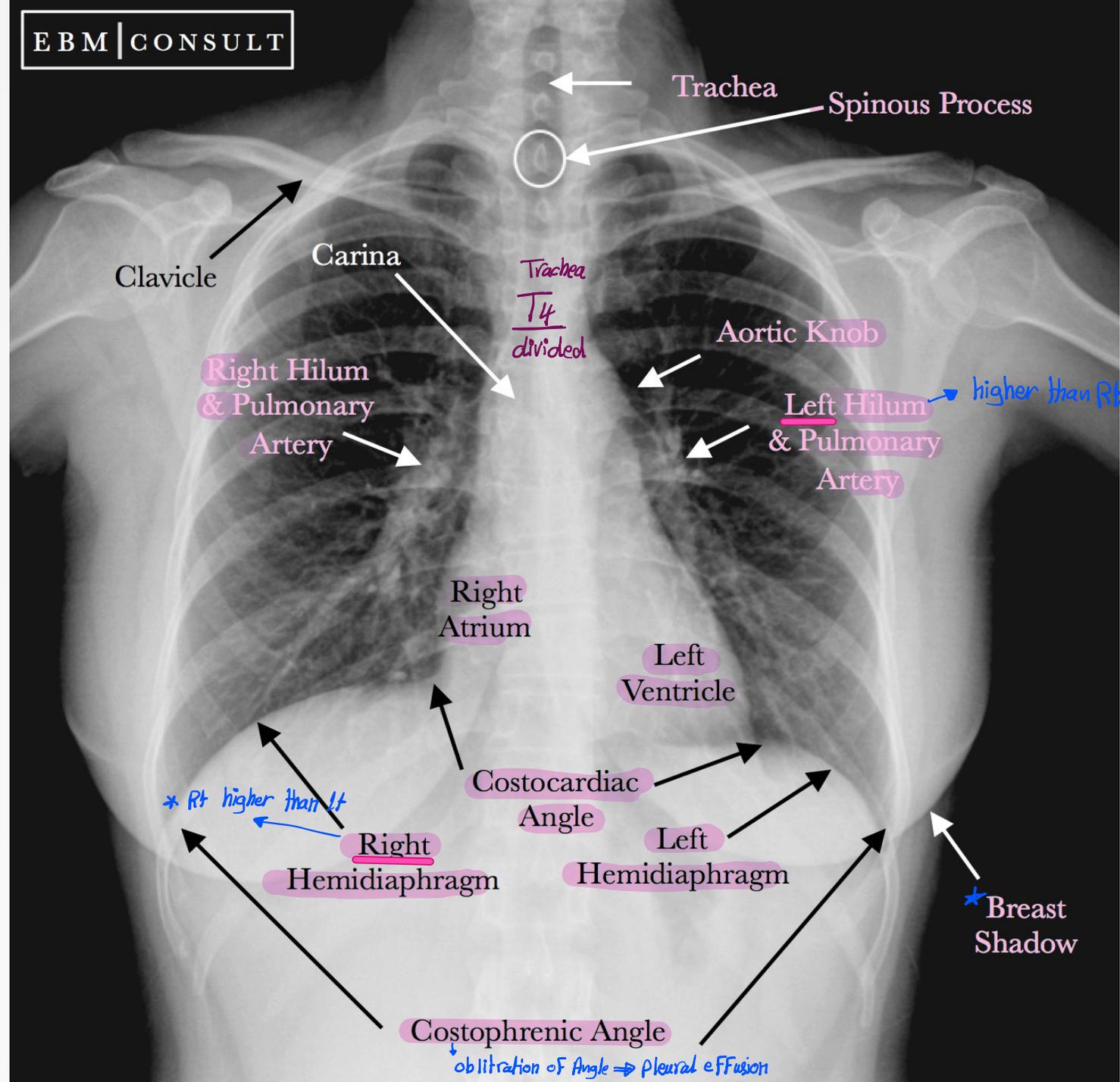


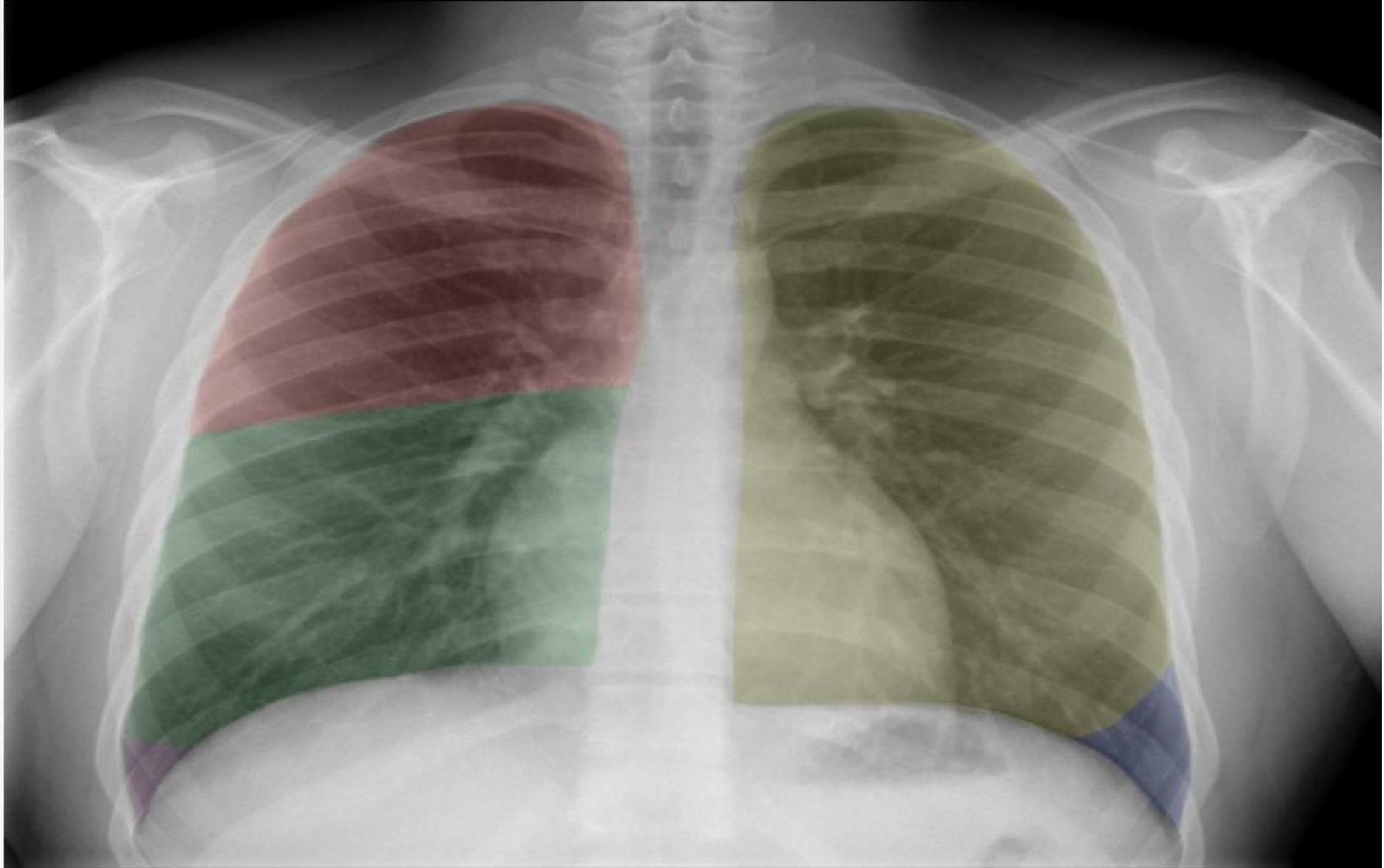
Metal



ective 1. List, in
r, the 5 densities
s on an x-ray and
te each of these
chest x-ray.







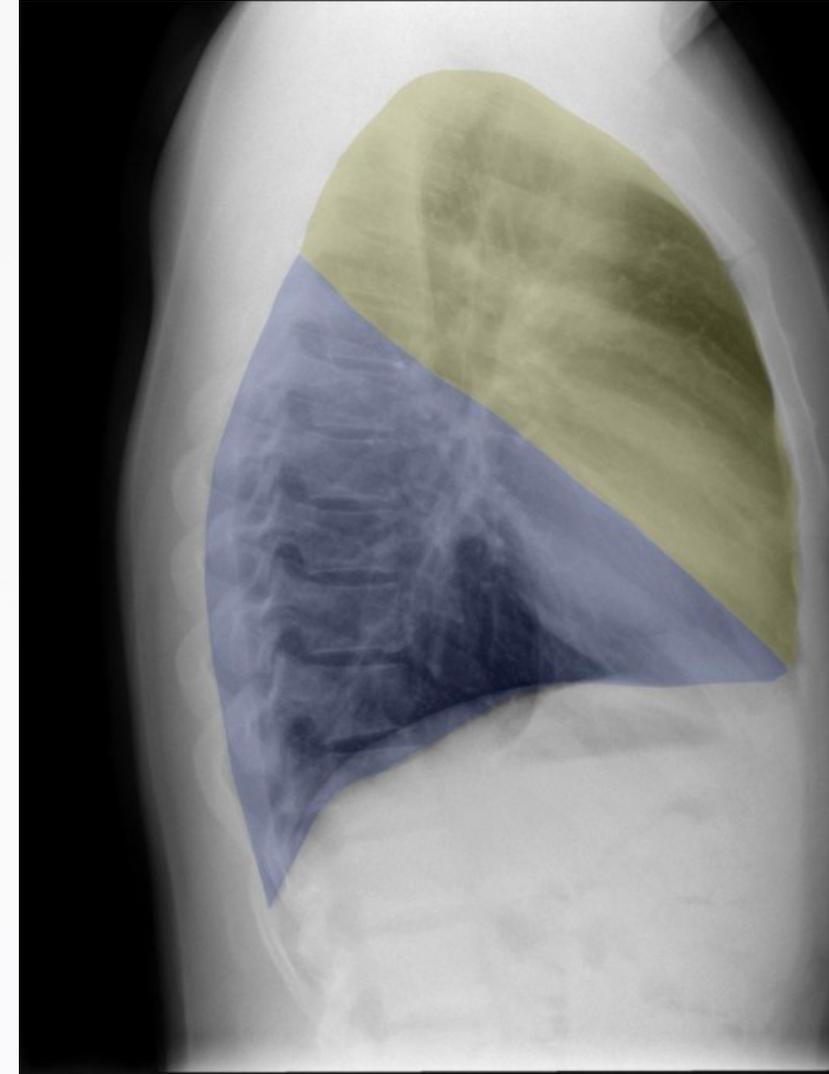
Right Lung

- **Right Lung**
The right lung has 3 lobes
and two fissures
- **Lobes:**
 - Right Upper Lobe (RUL)
 - Right Middle Lobe (RML)
 - Right Lower Lobe (RLL)
- **Fissures**
 - Major Fissure
 - minor fissure



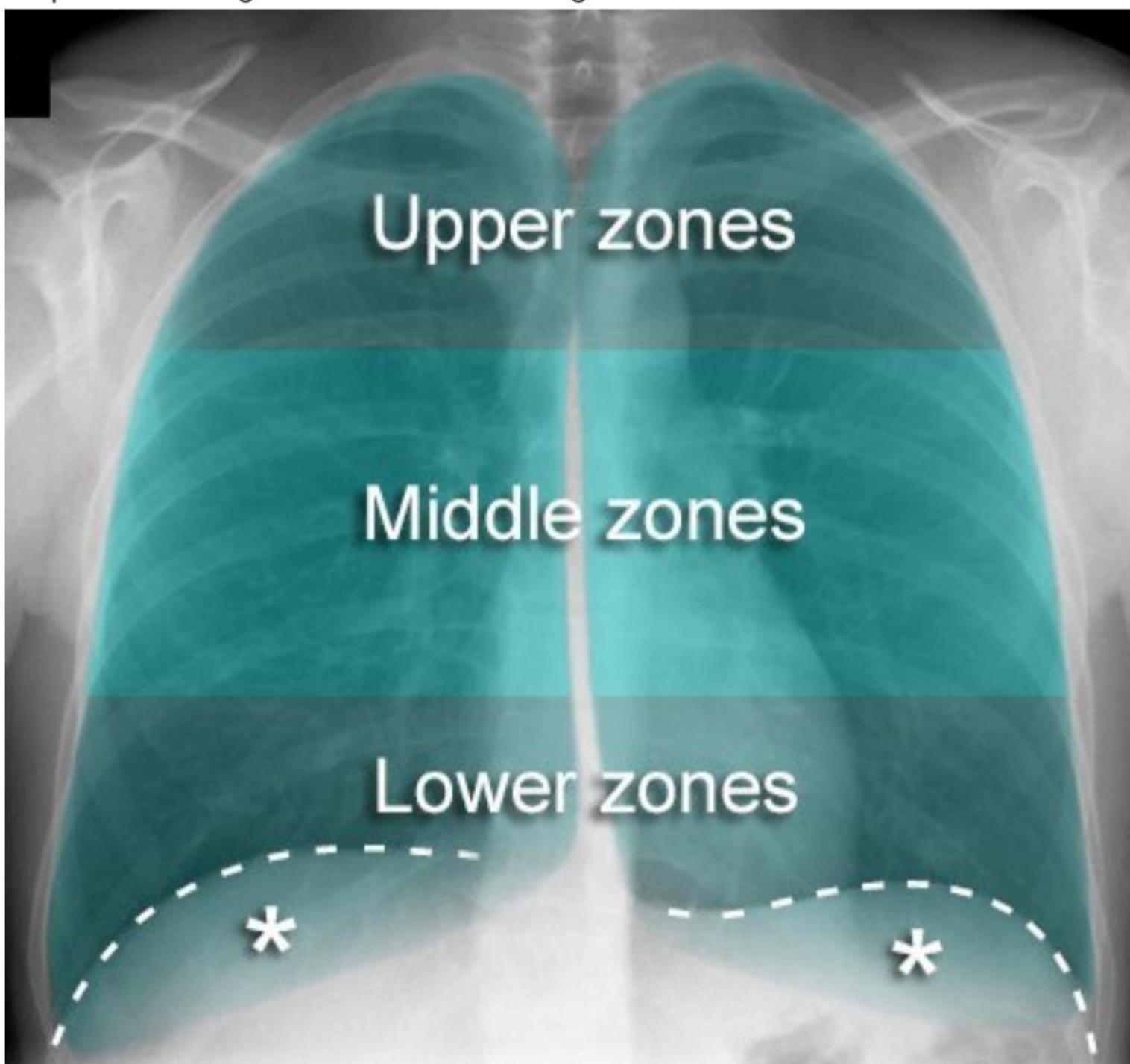
Left lung

- The left Lung is Comprised of two lobes which are divided by one fissure
- Lobes:
 - Left Upper Lobe (LUL)
 - Left Lower Lobe (LLL)
- Fissures:
 - Major Fissure



Lung zones

- For the purpose of description the lungs are divided into zones: upper, middle and lower. Each of these zones occupies approximately one third of the height of the lungs.
- The lung zones do not equate to the lung lobes. For example, the lower zone on the right comprises the middle and lower lobes.



Upper zones

Middle zones

Lower zones

*

*



Chest x ray

- There are many approaches to CXR interpretation, each trying to ensure that key abnormalities are identified and no area is overlooked.
- Many people would be familiar with the ABC method to interpreting CXRs.
- Now DRSABCDE can be used as a simple, yet comprehensive, approach to CXR interpretation.

Details

- Before you even begin interpreting a CXR you should have the correct details. This includes;
- Patient name, age / DOB, sex
- Type of film – PA or AP, erect or supine, correct L/R marker, inspiratory/expiratory series
 - avoidable as make Cardiomegaly*
 - mainly in*
 - pediatric*
 - ICU patient*
 - why? to detect dextrocardia.*
- Date and time of study → *to compare with previous x-ray.*

PA view

- The PA view is frequently used to aid in diagnosing a range of acute and chronic conditions involving all organs of the thoracic cavity.
- Additionally, it serves as the most sensitive plain radiograph for the detection of free intraperitoneal gas or pneumoperitoneum in patients with acute abdominal
- Posterior – anterior refers to the direction of the X-Ray beam travel.; i e. X-Ray beams hit the posterior part of the chest before the anterior part.

gas in peritoneum

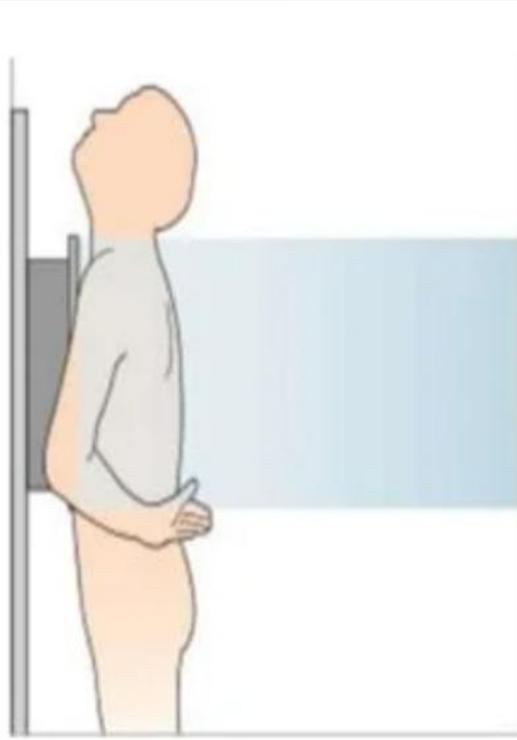


Image technical evaluation

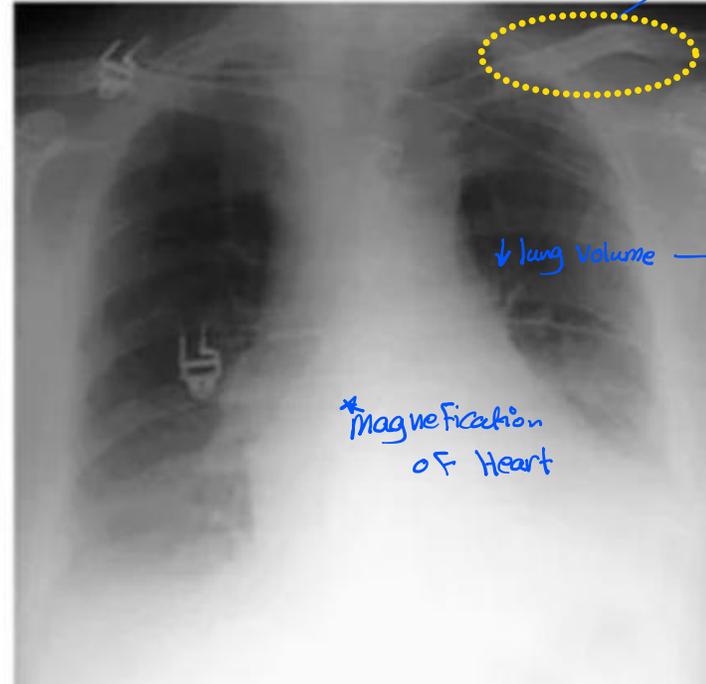
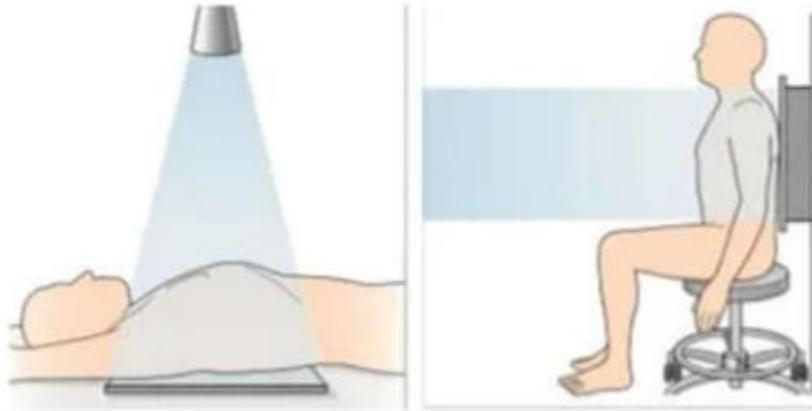
- The entire lung fields should be visible from the apices down to the lateral costophrenic angles.
- The chin should not be superimposing any structures
- *raised* arms are not superimposed over lateral chest wall (this can mimic pleural thickening)
- minimal to no superimposition of the scapulae borders on the lung fields

Imp

1. Sternoclavicular joints are equidistant from the spinous process → to detect Tracheal deviation
من طرف متى بيسر وعلى أي جهة
Collapse
massive pleural effusion
⋮
2. the clavicle is in the same horizontal plane
3. a maximum of ten posterior ribs are visualized above the diaphragm
4. The 5th-7th anterior ribs should intersect the diaphragm at midclavicular line
5. the ribs and thoracic cage are seen only faintly over the heart
6. clear vascular markings of the lungs should be visible

AP VIEW

- Anteroposterior chest view is an alternative to the PA view when the patient is too unwell to tolerate standing or leaving the bed
- The AP view examines the lungs, bony thoracic cavity, mediastinum, and great vessels. This particular projection is often used frequently to aid diagnosis of acute and chronic conditions in intensive care units and wards.
- It is important to note that the AP projection will produce a magnified mediastinal shadow due to the increased distance of the heart from the image receptor and beam divergence



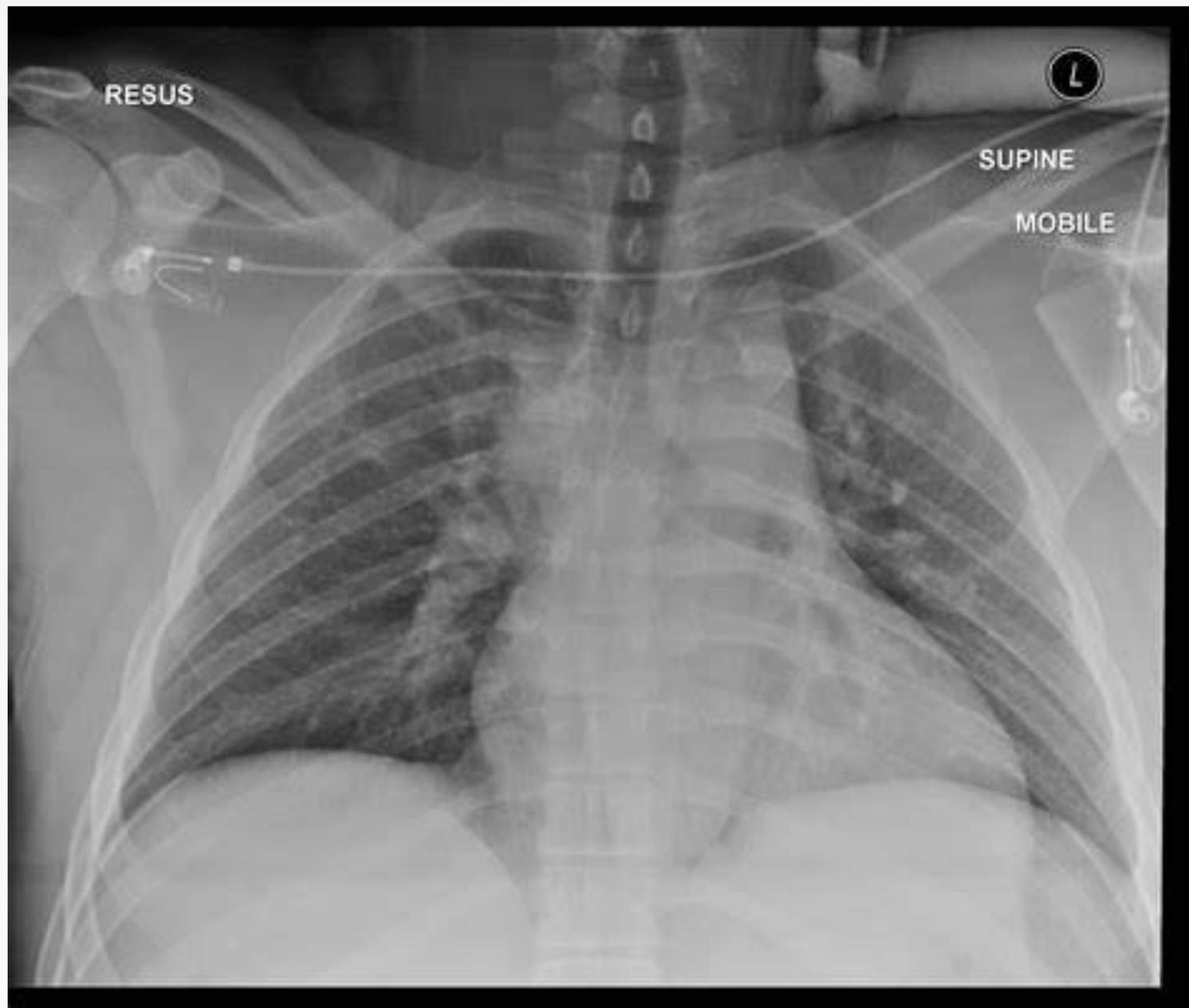
* clavicle above

↓ lung volume → raised diaphragm

* Magnification of Heart

Image technical evaluation

1. The entire lung fields should be visible from the apices down to the lateral costophrenic angles
2. Three posterior ribs should be seen above the superior aspect of the clavicle
3. the chin should not be superimposing any structures
4. sternoclavicular joints are equal distant apart ** IF not equal
tracheal deviation*
5. the clavicle is in the same horizontal plane
6. a minimum of eight posterior ribs are visualized above the diaphragm
7. the ribs and thoracic cage are seen only faintly over the heart
8. clear vascular markings of the lungs should be visible



Imp →

AP view vs PA view

* preferred

	PA view	AP view
Clavicle	<u>Over lung fields</u>	<u>Above lung apex</u>
Scapula	<u>Away from lung fields</u> بتكونه أذرع هون لنتوكل ما بقدرت مع Field بشوق اذرع	<u>Over the lung fields</u>
Ribs	Posterior ribs distinct	<u>Anterior ribs distinct</u> more oblique than post
Heart and cardiothoracic ratio	Normal size 1:2	Relatively <u>enlarged</u> Increased ratio
Diaphragm	Lower	Higher
Gastric air fluid level	Seen	Not seen
Lung volume	Normal	Decrease → raised diaphragm ⇒ smaller capacity of lungs

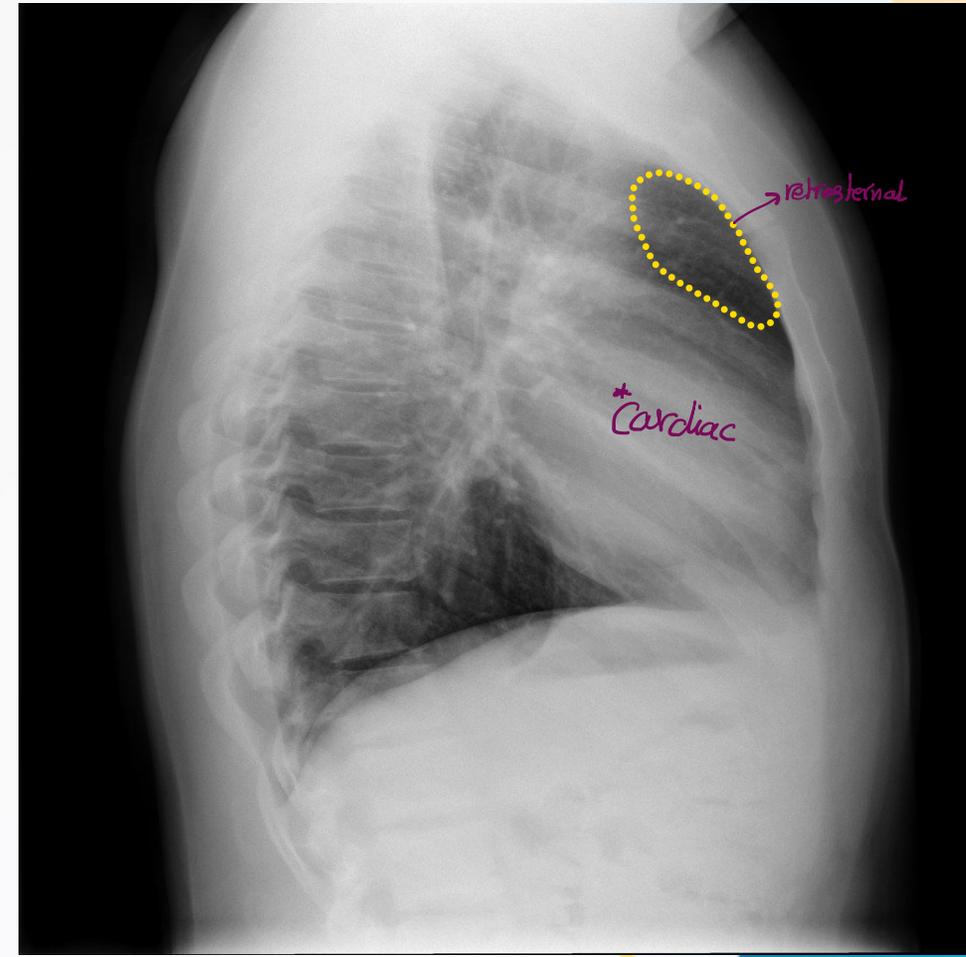
← لازم نفرق بينهم بالعدد والشكل.

Lateral view

- ✱ ● This orthogonal view to a frontal chest radiograph may be performed as an adjunct in cases where there is diagnostic uncertainty. The lateral chest view can be particularly useful in assessing the retrosternal and retrocardiac airspaces

ant
-med
Post

lateral
View



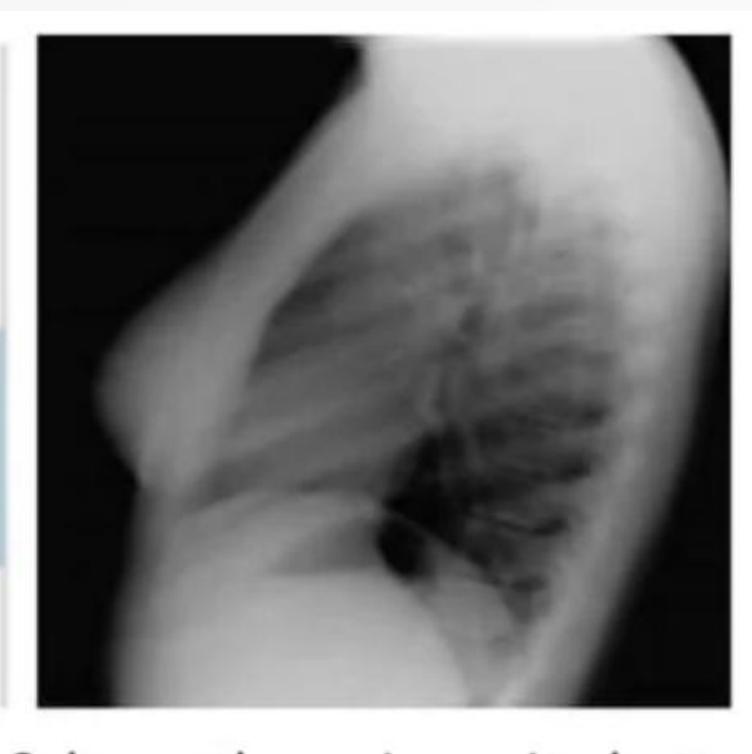
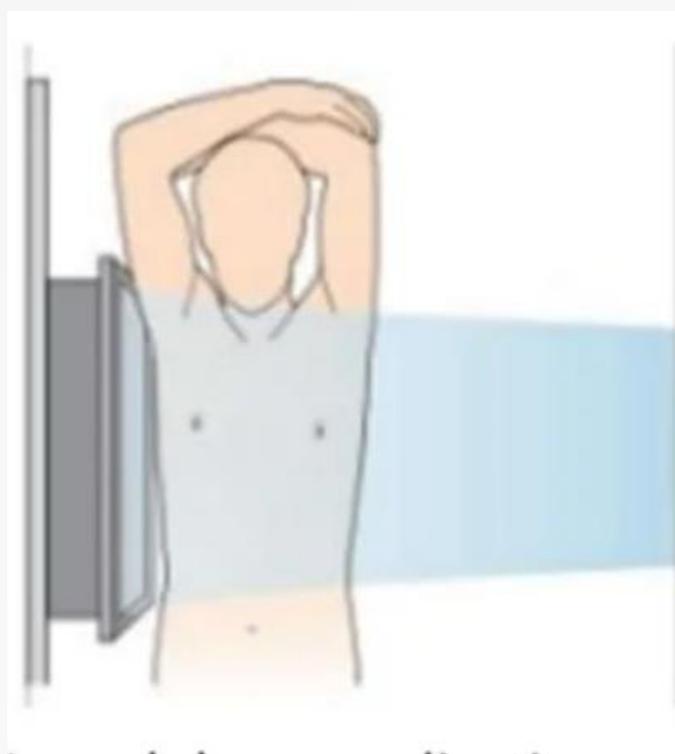


Image technical evaluation

1. The entire lung fields should be visible superior from the apices inferior to the posterior costophrenic angle
2. the chin should not be superimposing any structures
3. there is superimposition of the anterior ribs
4. the sternum is seen in profile
5. superimposition of the posterior costophrenic recess
6. a minimum of ten posterior ribs are visualized above the diaphragm
7. the ribs and thoracic cage are seen only faintly over the heart
8. clear vascular markings of the lungs should be visible

Imp
★

Lateral decubitus

- Undertaken to demonstrate small pleural effusions, or for the investigation of pneumothorax and air trapping due to inhaled foreign bodies.
- patient is lying either left lateral or right lateral on a trolley on top of a radiolucent sponge

● note: when investigating **pneumothorax** the side of interest should be up; when investigating **pleural effusions** the side of interest should be down

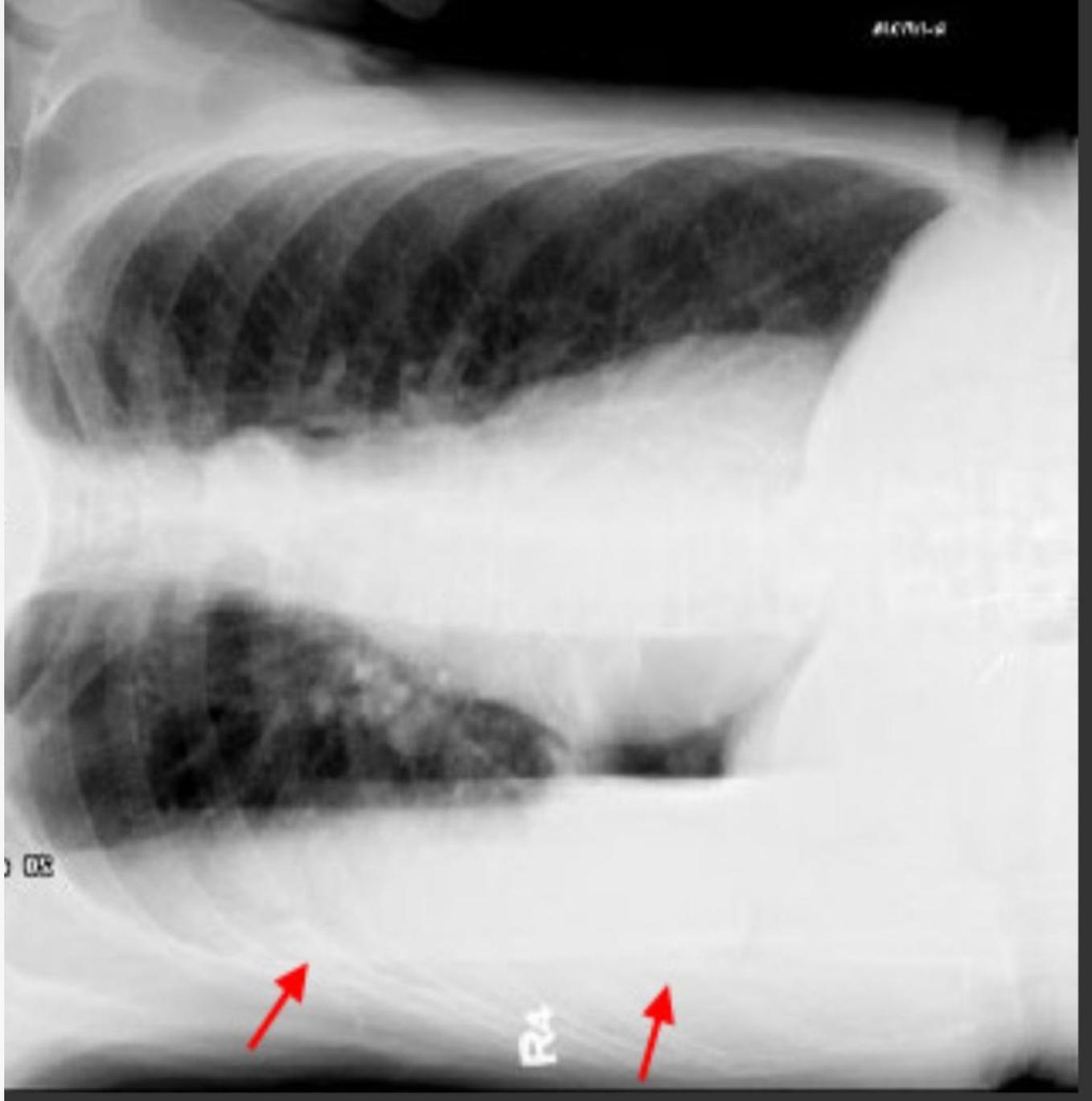
bet visceral & parietal pleura → lucency →

عكس الوجه، النائم عليها ←

opacity →

نفس الوجه، النائم عليها →

Tracheal deviation ← التنفس لازم أعطفه على



RT lateral side

* pleural effusion

↳ No Costophrenic Angle ✓
+ opacity

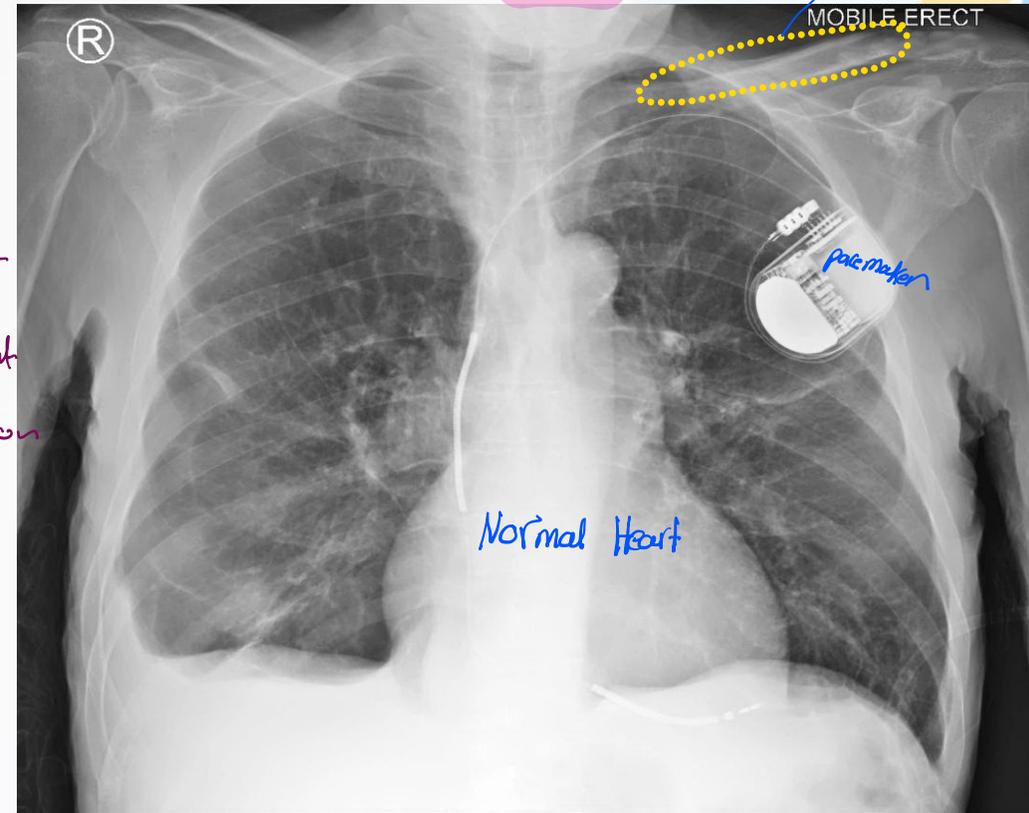
Pressure on vasculer
Tracheal deviation → Tension pneumothorax ← * بناف

• Erect Film

- The erect film is the standard film, and is performed with the patient standing. This type of film makes it easier to identify pleural effusions and pneumothoraces.
- X-rays performed in an x-ray department are usually erect. Mobile x-rays may be erect, though keep in mind that mobile erect x-rays are often performed in a semi-recumbent position rather than fully erect.

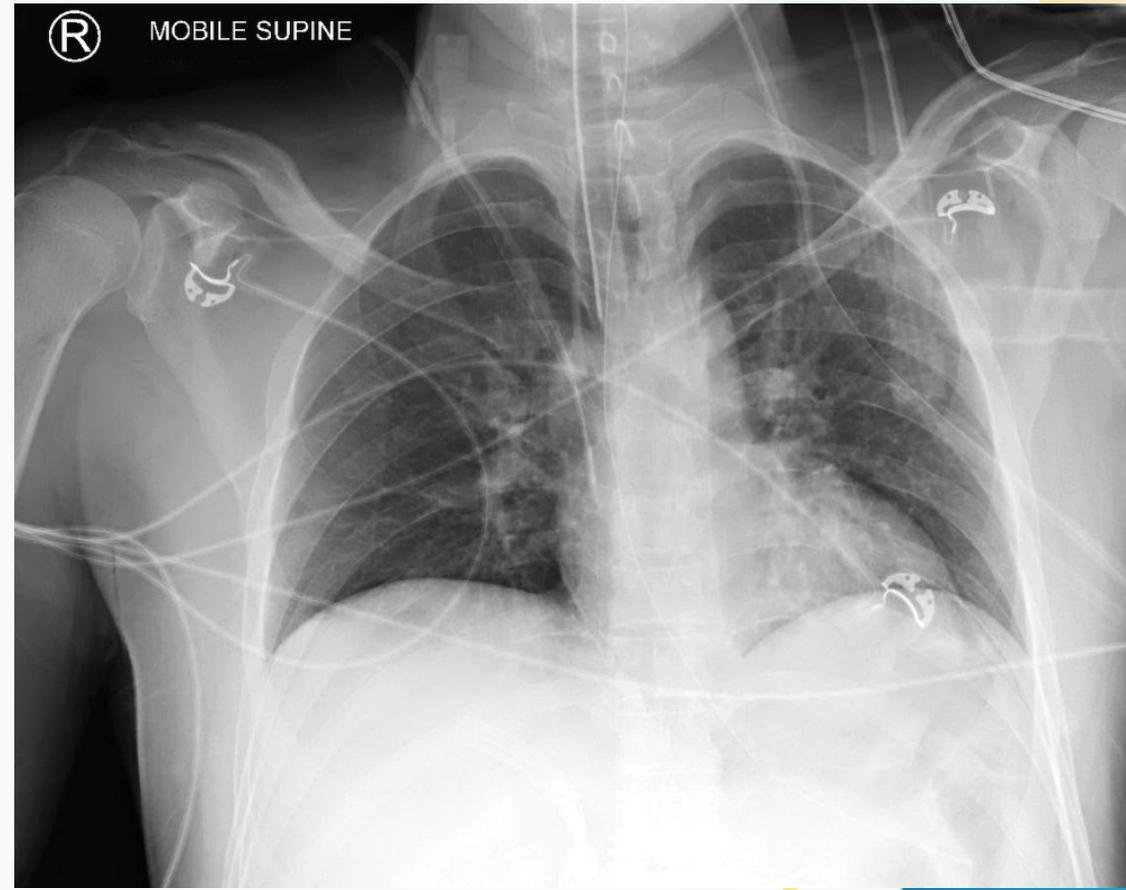
→ Rt side ←
Minimum amount
* pleural effusion
* No shifting of Trachea

PA



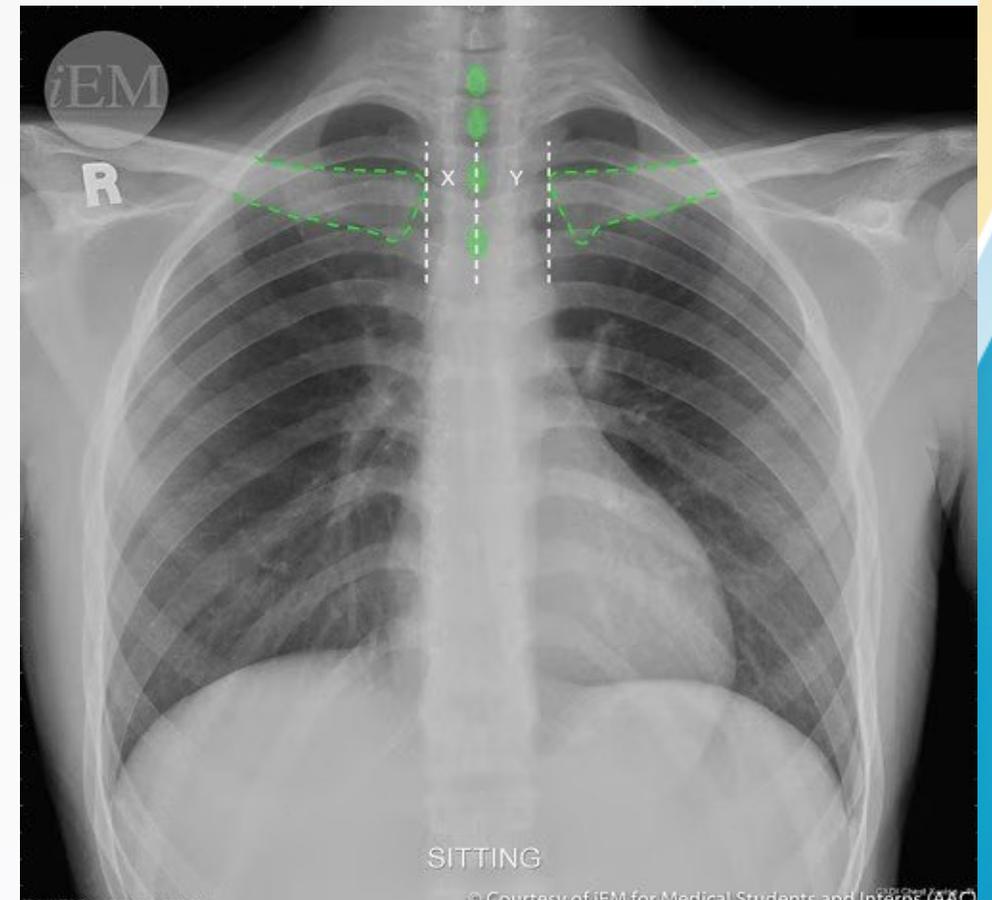
- **Supine Film**

A supine film is performed with the patient lying down. This will result in a wider mediastinum and smaller lung fields. Detection of pleural effusion and pneumothorax will be more difficult with supine films.

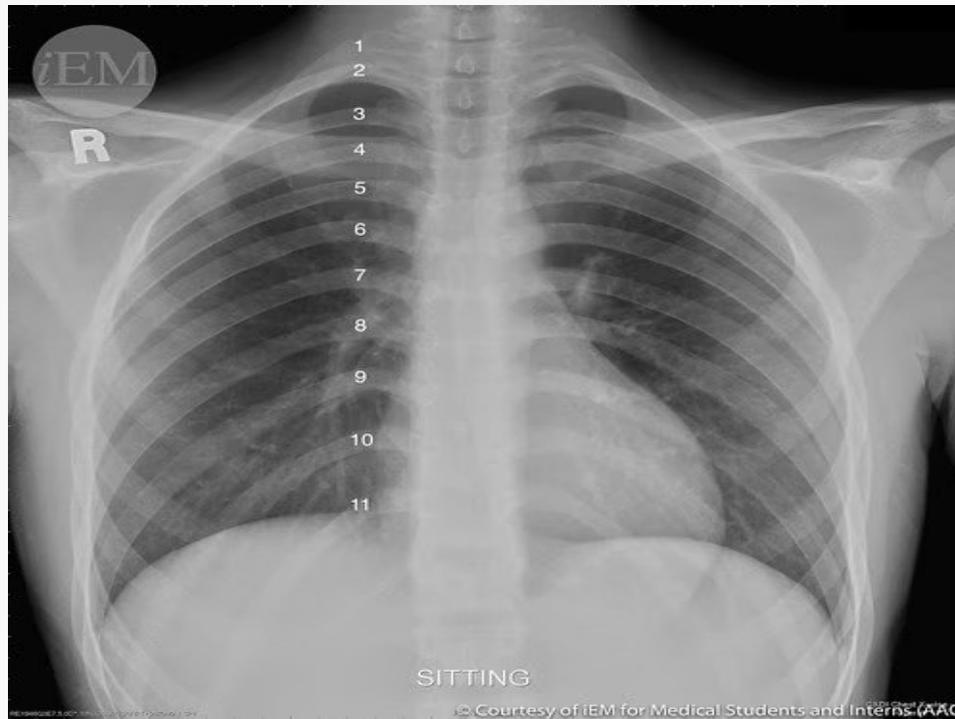


RIPE (assessing the image quality)

- Assessing The Image Quality, “RIPE” mnemonic is used; Rotation, Inspiration, Position, Exposure(Penetration).
Rotation: The clavicles should appear symmetrical and be seen as equal length. The distance between the thoracic spinal process and clavicular heads should be equal . If there is a rotation, mediastinum may look abnormal.



- to more distinct image.
- **Inspiration:** On good inspiration, the diaphragm should be seen at the level of the 8th – 10th posterior rib or 5th – ~~6th~~ anterior rib.





Expiratory

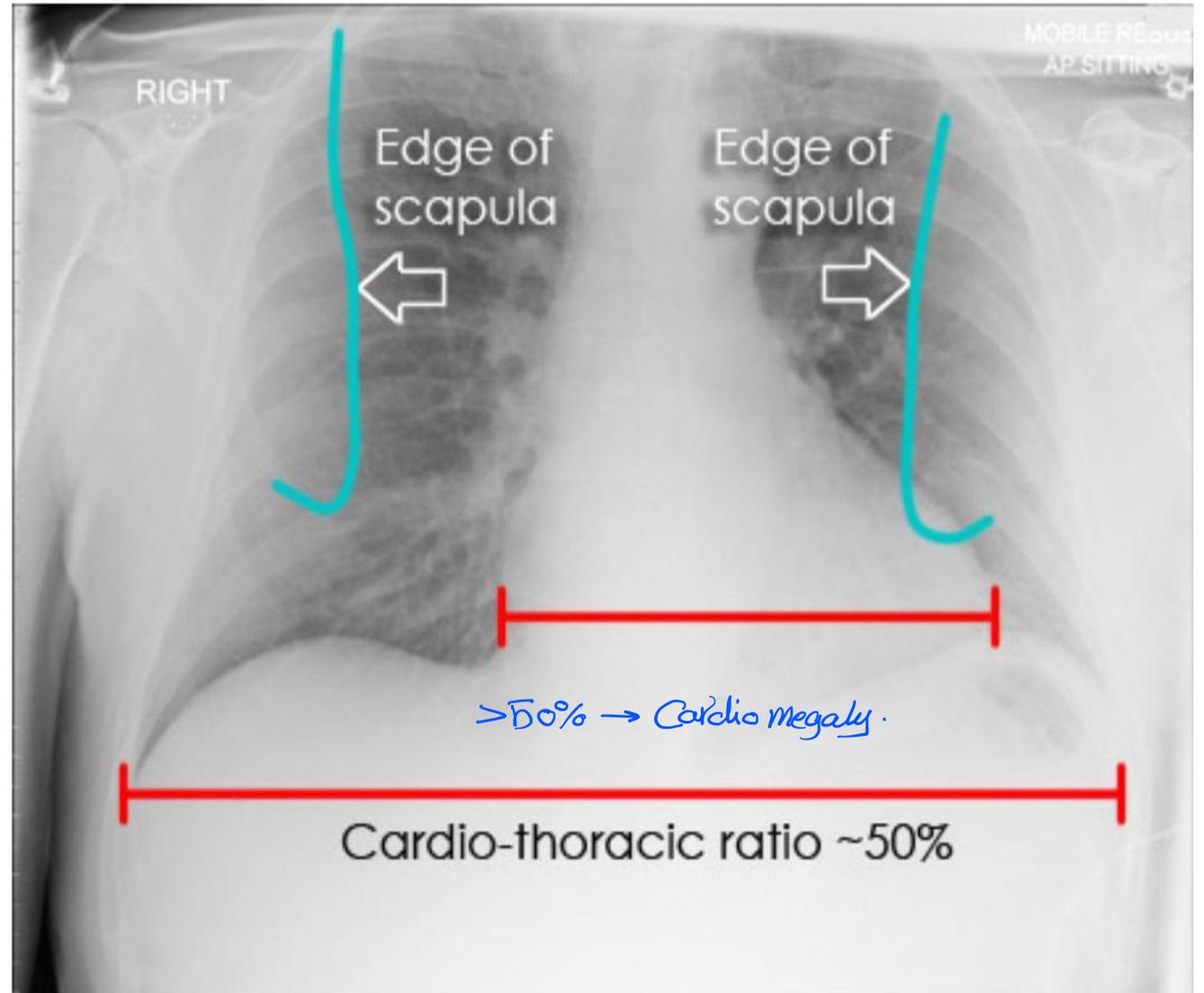


Inspiratory ✓ اذخ

Projections

Radiographers will often label a chest X-ray as either PA or AP.

If the image is not labelled, it is usually fair to assume it is a standard PA view. If you are not sure then look at the medial edges of each scapula.

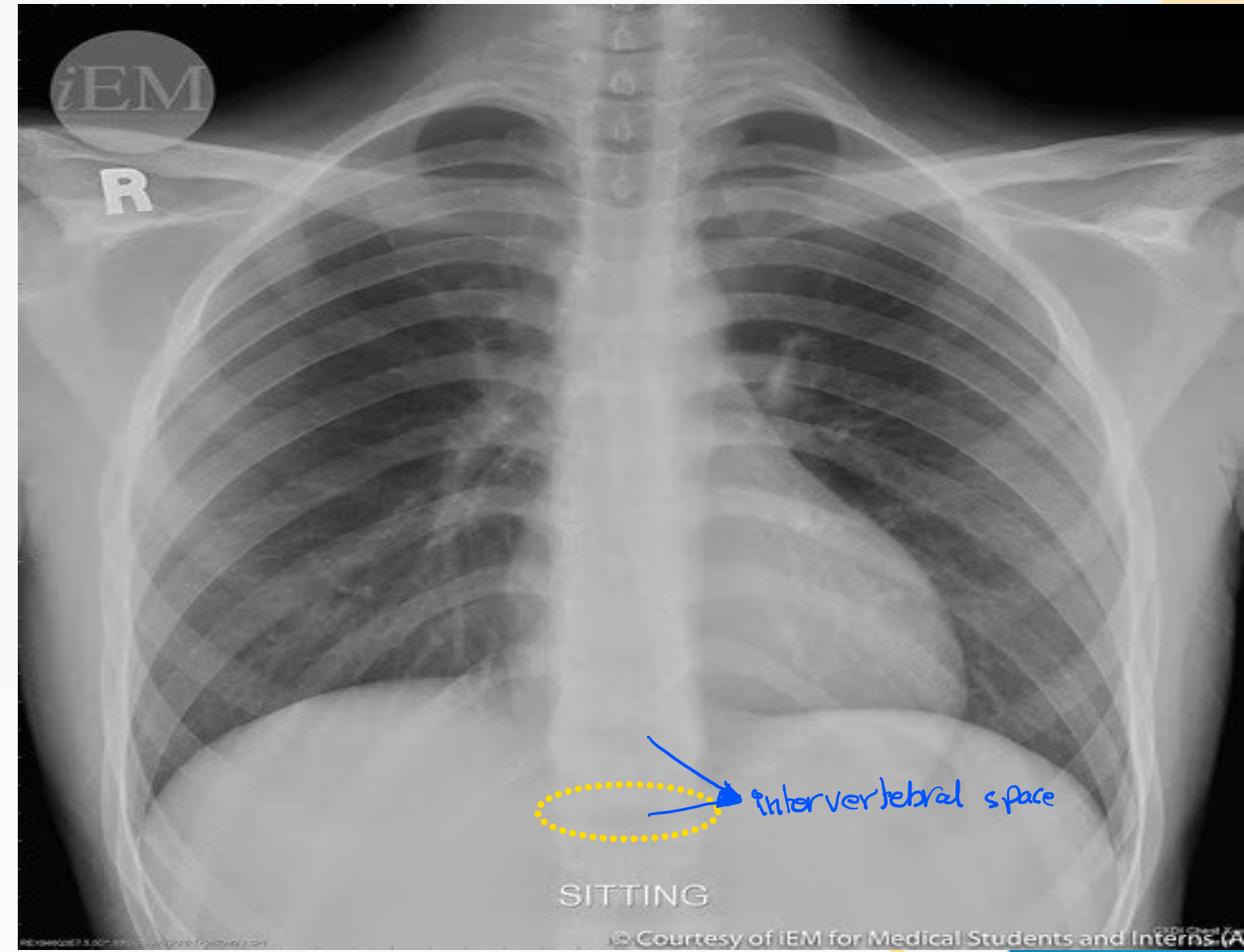


- **Exposure / Penetration:**

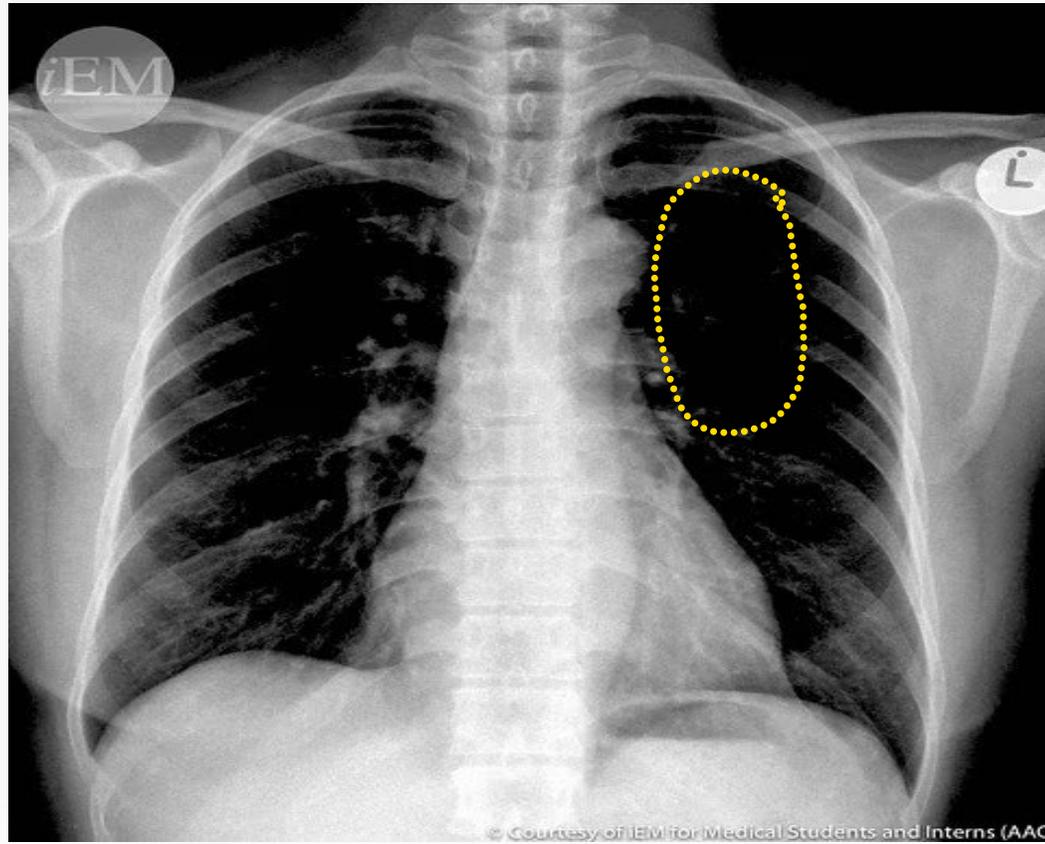
- Ideally, you should be able to see the heart, the blood vessels, and the intervertebral spaces. Exposure should be adequate if you are able to see approximately T4 vertebra and spinal process.

over → black image
less → white image
So must be middle.

exposure → over → above T4
 ↓
 less → Not seen T4

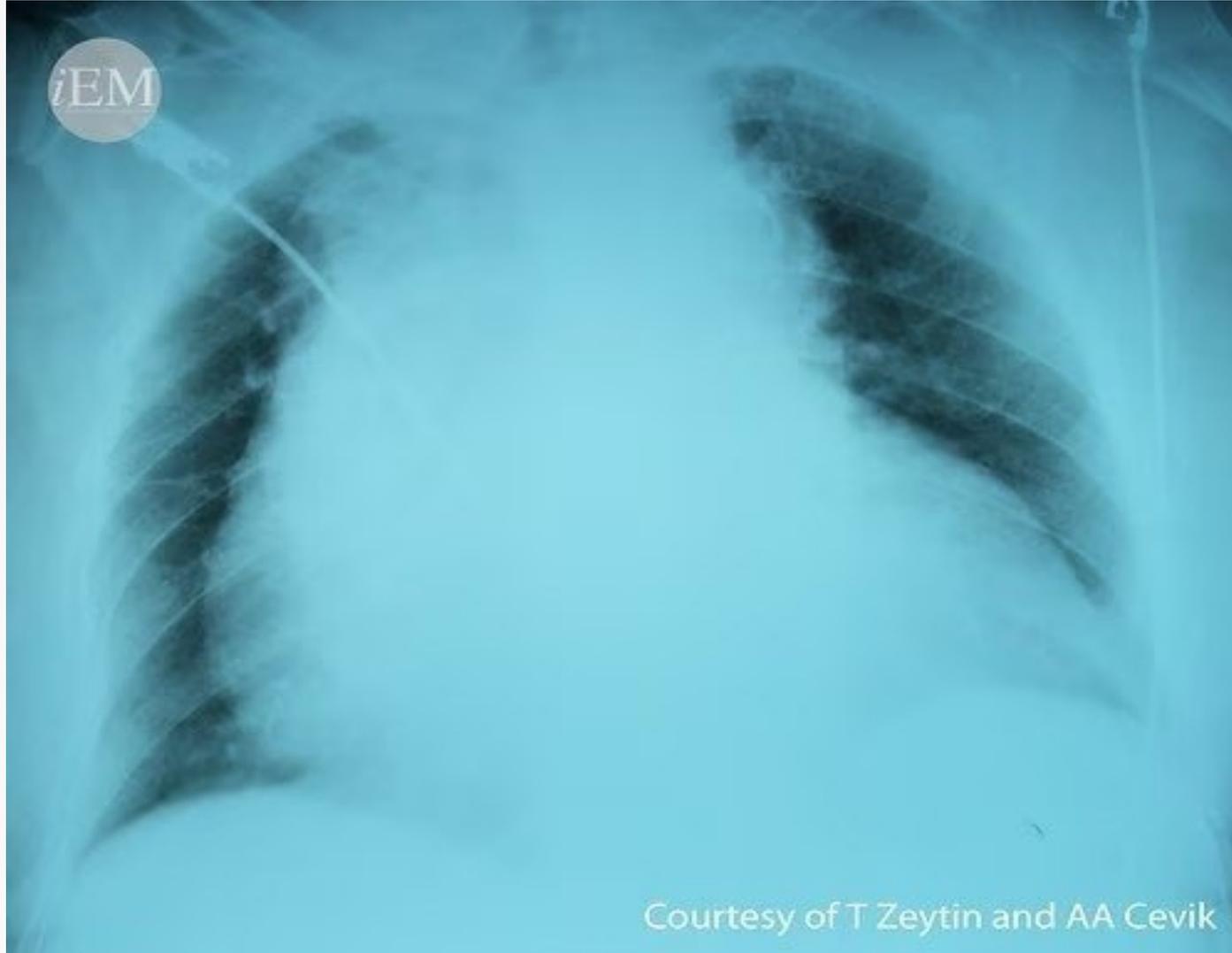


- Overexposed PA X-Ray film. You are able to see all vertebral bodies with obvious intervertebral spaces.



- more black ✓
- above T4 ✓
- obvious IV space.

- Underexposed PA X-Ray film. You can not appreciate thoracic vertebra



lungs and pleural spaces

- On a chest x-ray lung abnormalities will either present as areas of increased density or as areas of decreased density
Lung abnormalities with an increased density – also called opacities – are the most common.

A practical approach is to divide these into four patterns:

1. Consolidation

Interstitial

Nodules or masses

Atelectasis

- * differentiation bet :- ^{منه!} ^{التفريق} *
- Collapse → defect in bronchus
 - Consolidation → defect in alveoli

Consolidation

- result of replacement of air in the **alveoli by transudate, pus, blood, cells** or other substances.

Pneumonia is by far the most common cause of consolidation.

The disease usually starts within the alveoli and spreads from one alveolus to another.

When it reaches a **fissure** the **spread stops** there. [الفتس باء Collapse]*

The **key-findings** on the X-ray are:

1. **ill-defined homogeneous opacity obscuring vessels**

2. **Silhouette sign: loss of lung/soft tissue interface** →

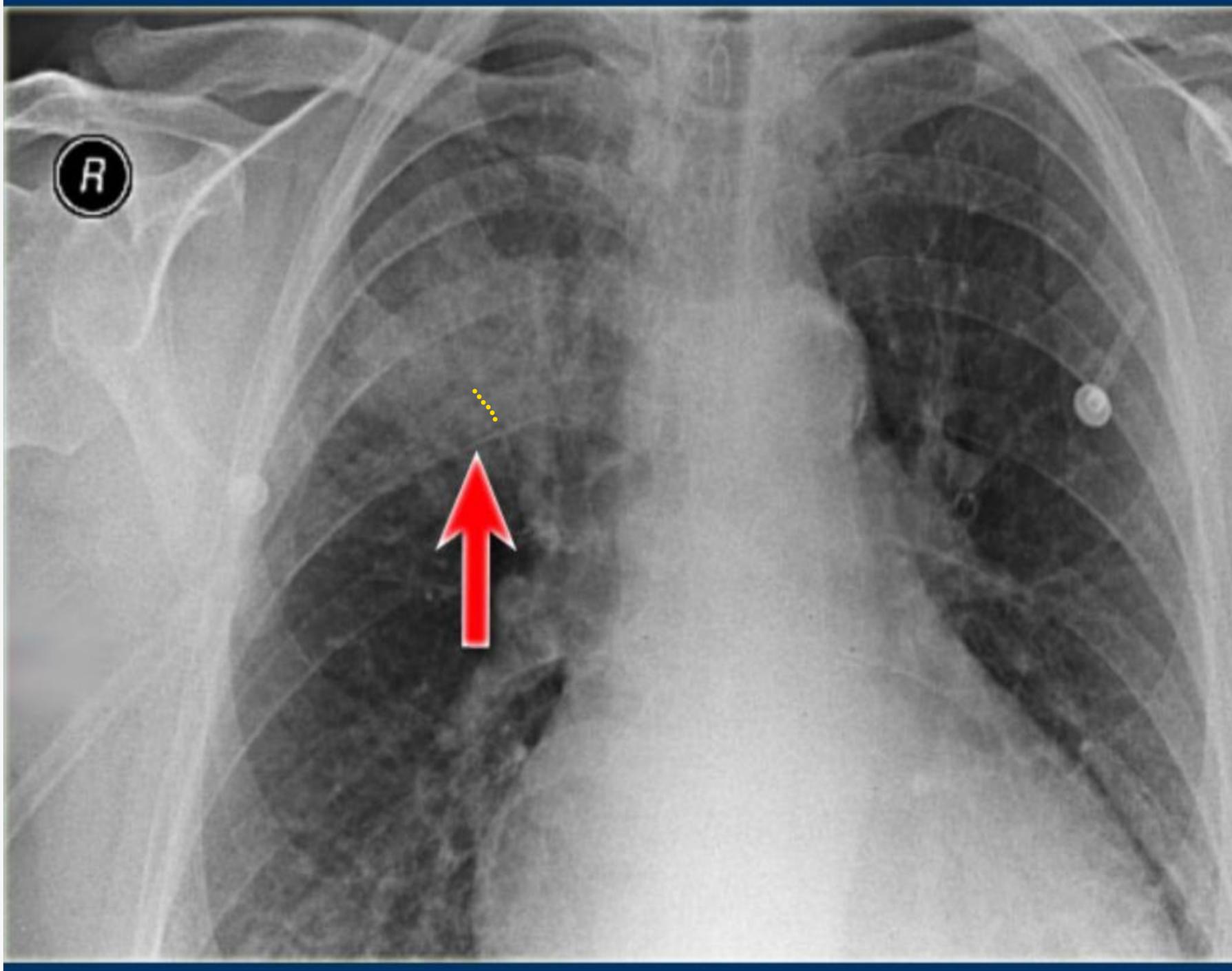
3. **Air-bronchogram** → black lines as displacement of air with → Transudate, pus.....

4. Extention to the pleura or fissure, **but not crossing it**

5. **No volume loss** [الفتس باء Collapse]*

المحدد بين
lung & soft tissue →
مفتى وافتى
Heart
ديشون اذا بقدر
Sharp line

بقارنه
بالنسبة
ال



* Reporting :-

- ill defined opacity
with Air bronchograms
in Rt upper lung lobe.

0
0
0

=: Normal (سليمة) :- *
* 5 points Imp

① lung field [clear Lt lung]

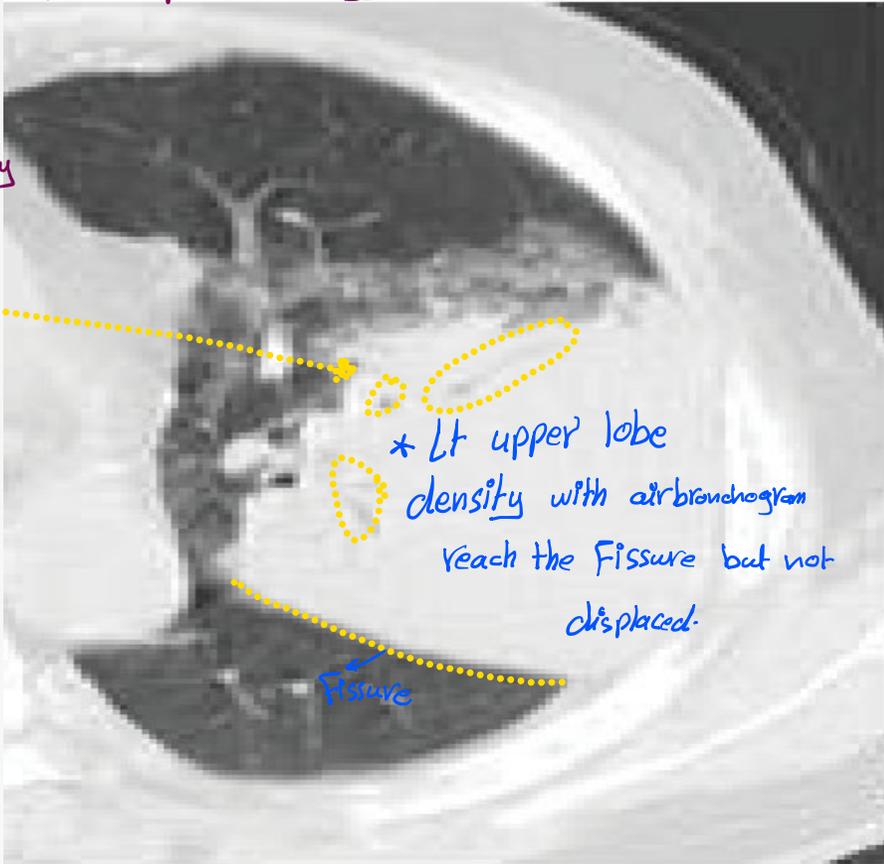
② No or Unremarkable
Tracheal deviation
Normal hila
+ mediastinum

③ No cardiomegaly

④ Costophrenic Angle

⑤ Thoracic Bone Cage

* The picture suggestive of Lt side Consolidation.



* In CT opacity → density

* upper lobe كفي عرفه انه

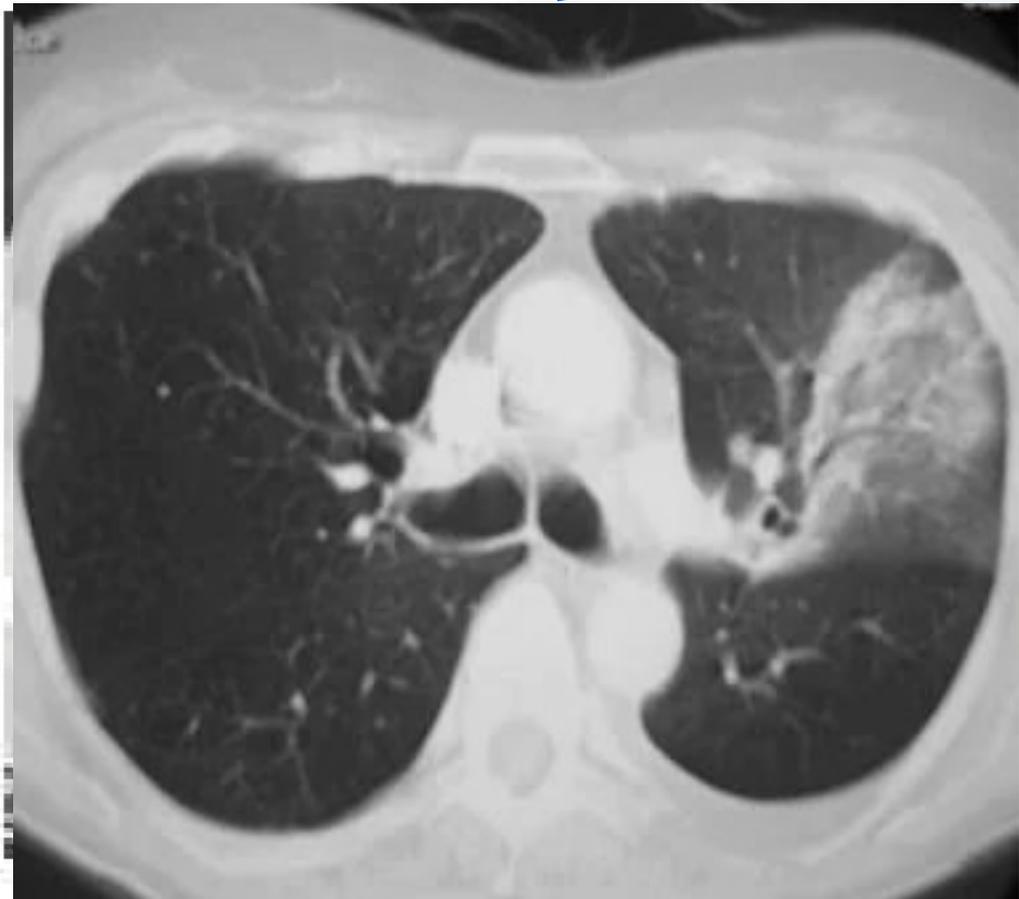
↳ Air bronchogram.

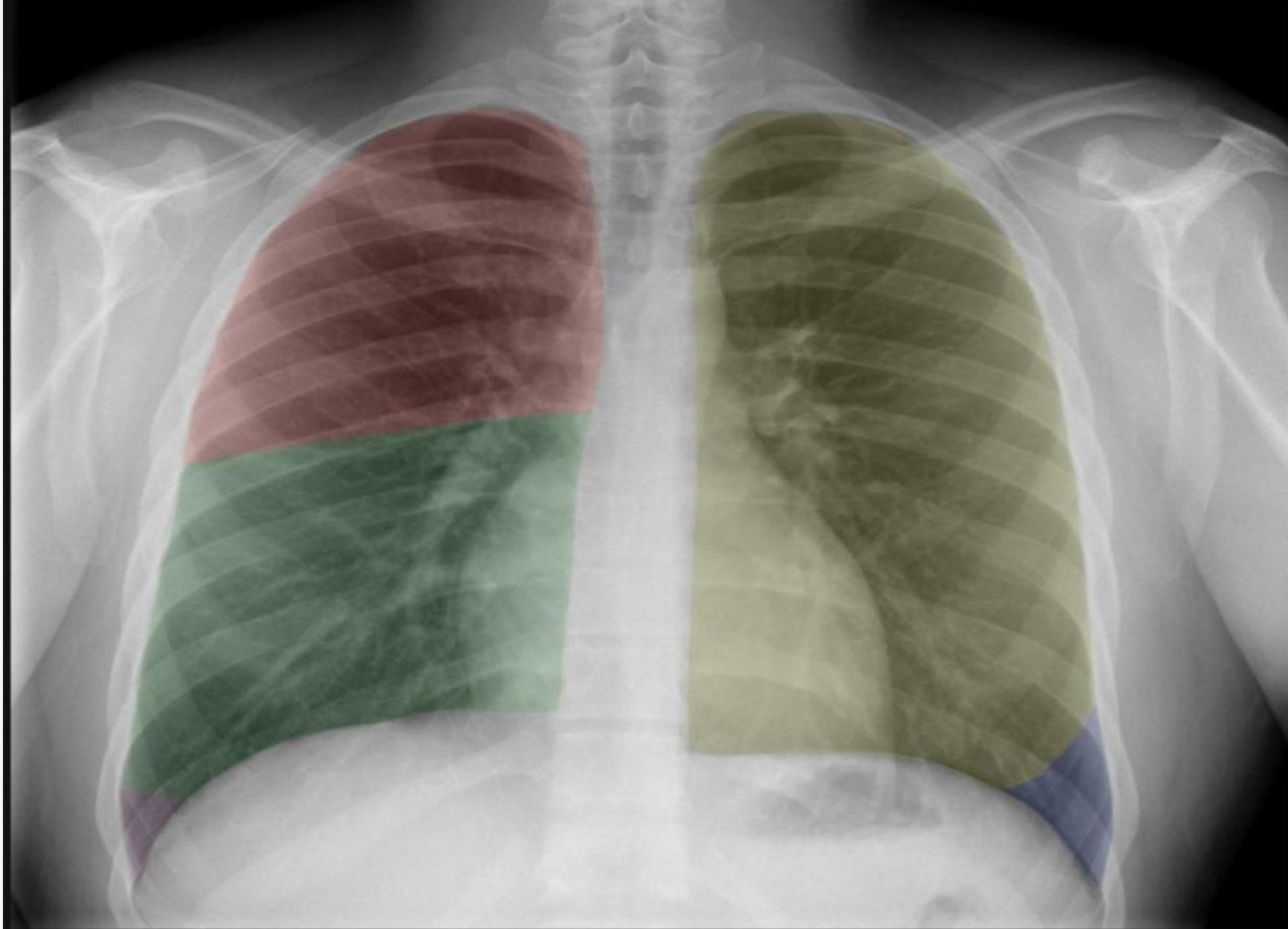
+ حدود ال Fissure واضحة

* Lt upper lobe density with air bronchogram reach the Fissure but not displaced.

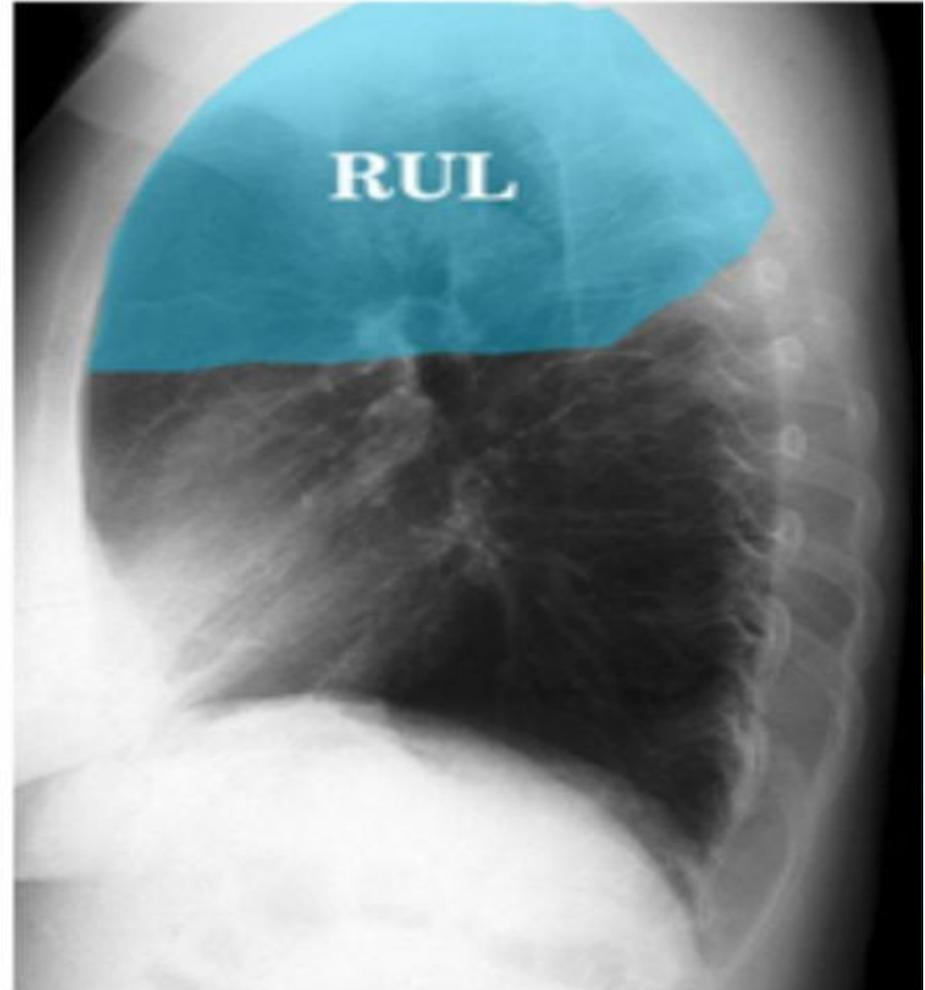
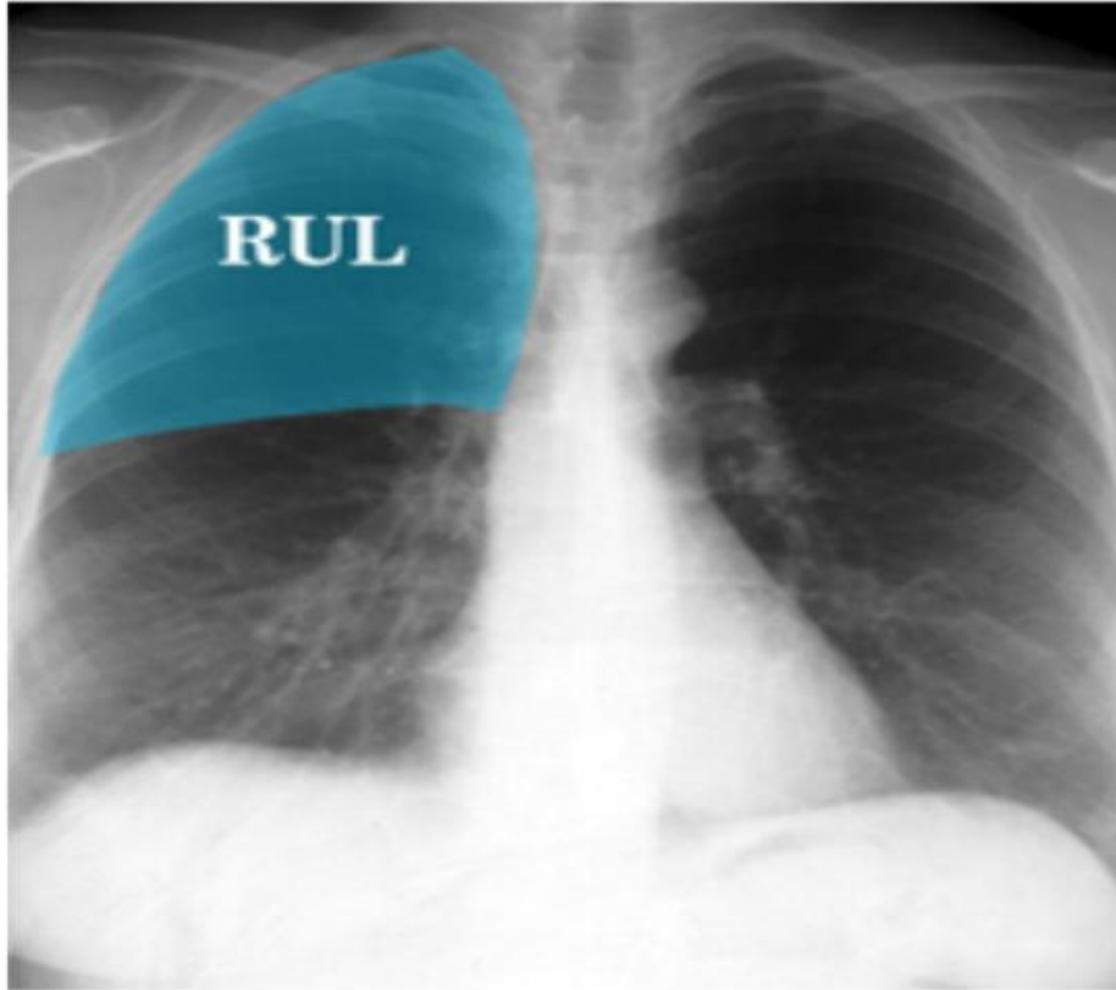
Fissure

* Axial selective section of chest CT scan lung window





Upper lobe of right lung



upper
lower ← lobes middle lobe
* اذّة نثقت الـ Heart borders مستحيل يكون الـ

diaphragm ← lower
mediastinal // ← upper

Features of right upper lobe consolidation on CXR include:

1. opacification of the right upper zone and/or apex, that may abut and outline the superior margin of the horizontal fissure

2. Normal (clear and distinct) right heart border (cf. Middle lobe consolidation)

* انه صحت مش رح يبينه الـ

↓
Confer with

3. normal (clear and distinct) right hemidiaphragm contour (cf. Right lower lobe consolidation)

diaphragm. ← برينه لو انه lower مش رح يبينه الـ

4. air bronchograms → Imp آتت على

5. on lateral CXR: triangular opacification superior and anterior to the right oblique fissure posteriorly and the horizontal fissure anteriorly

Reporting الـ *
بجود مكان الـ Consolidation: الزبط

Minimum Tracheal deviation

• Normal key findings +
• ما نرى ما نقصه

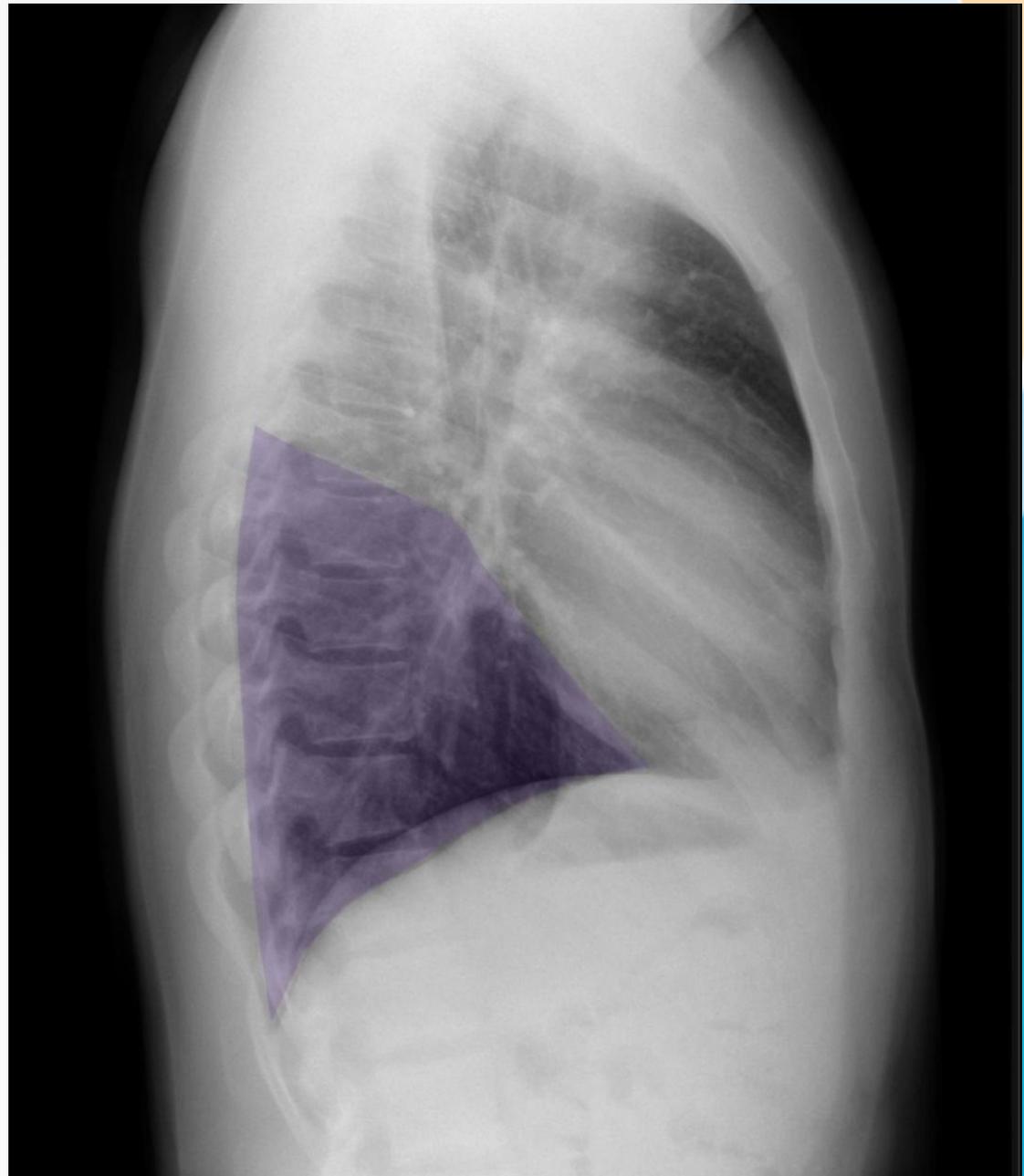
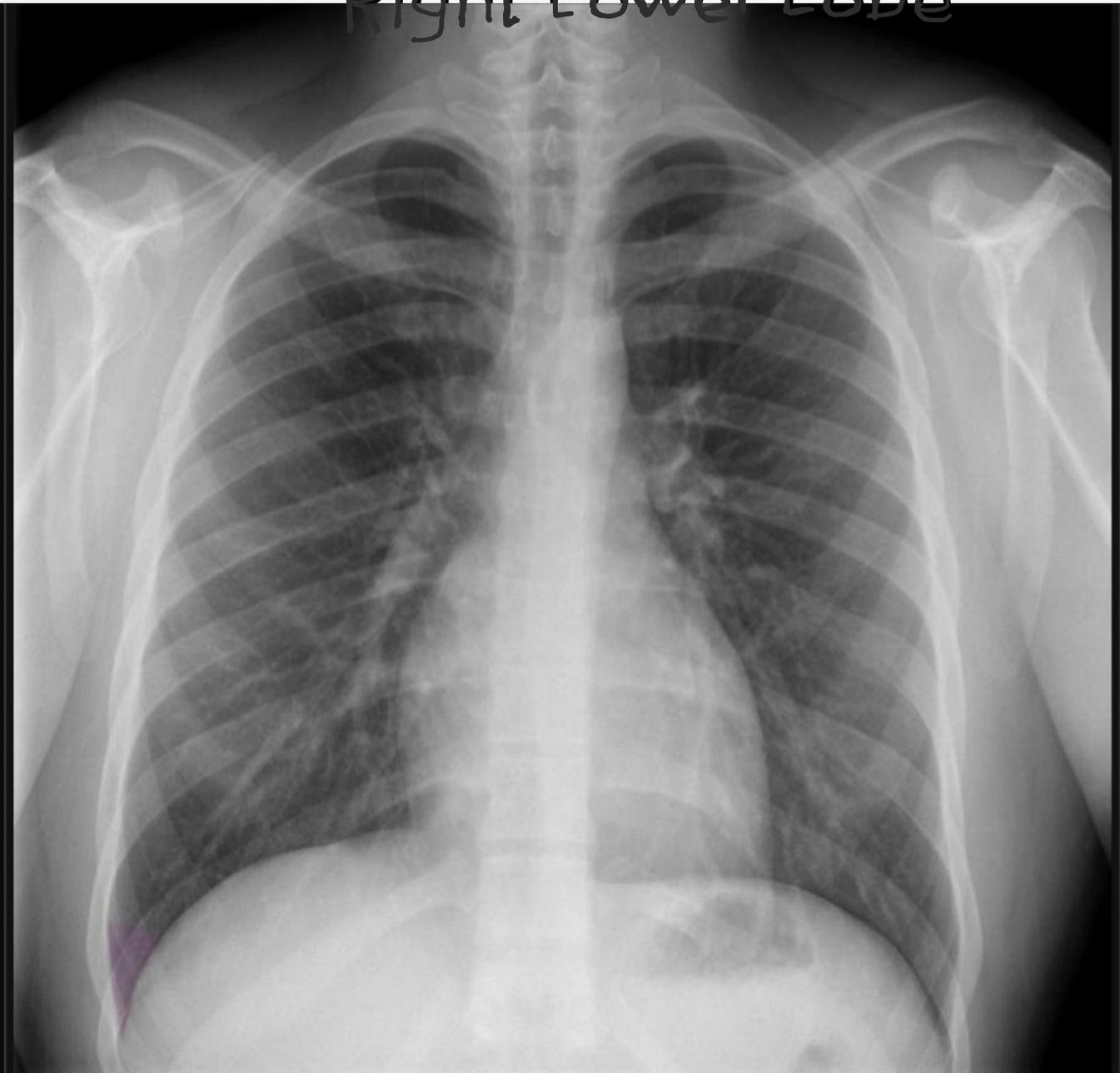
* PA

apex

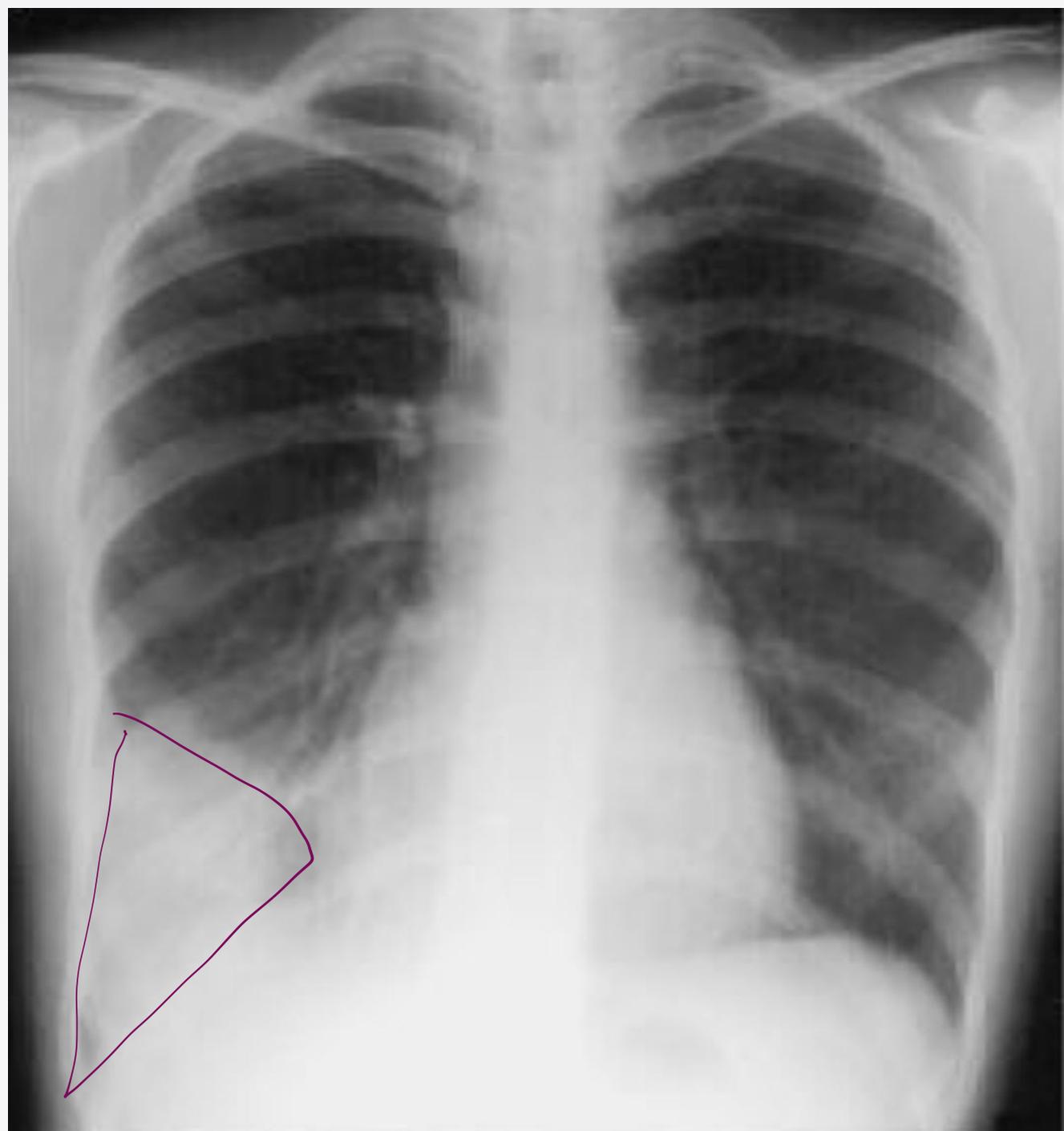
* upper lobe consolidation



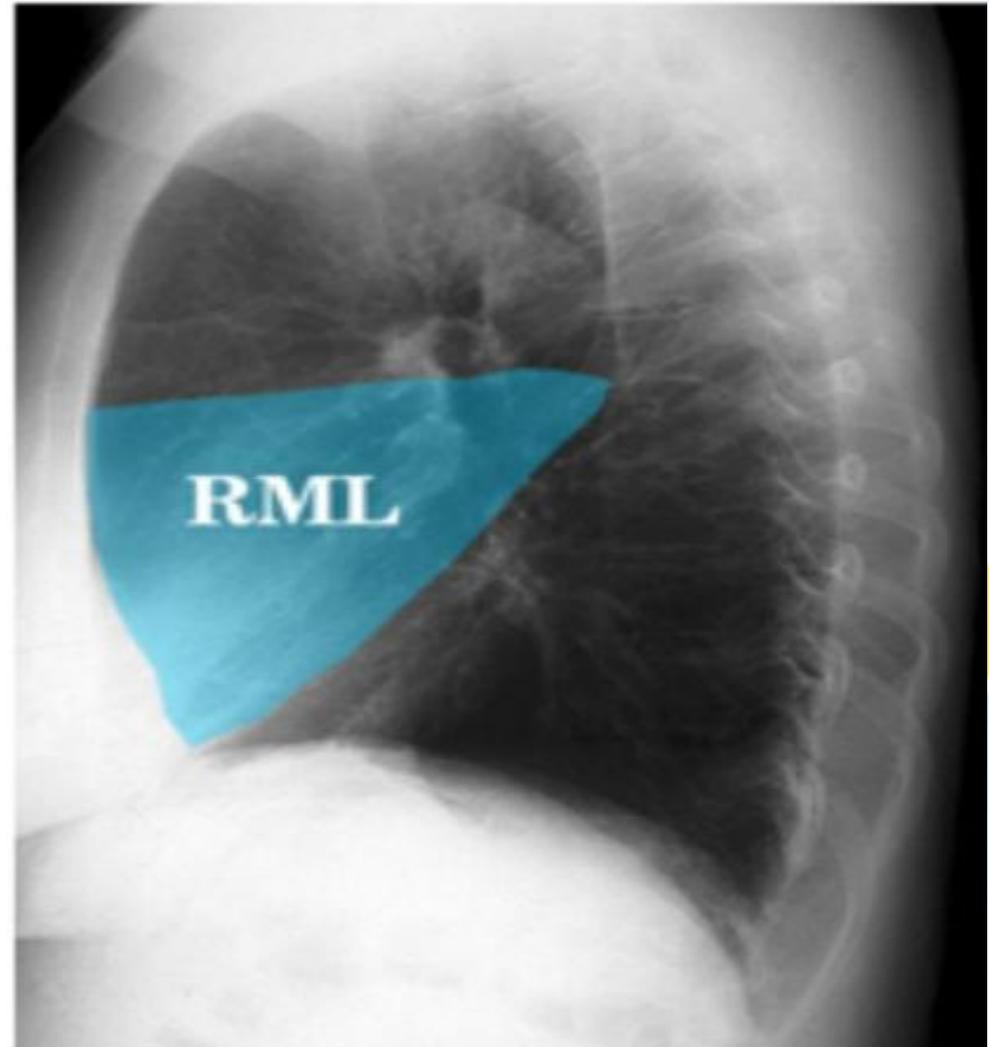
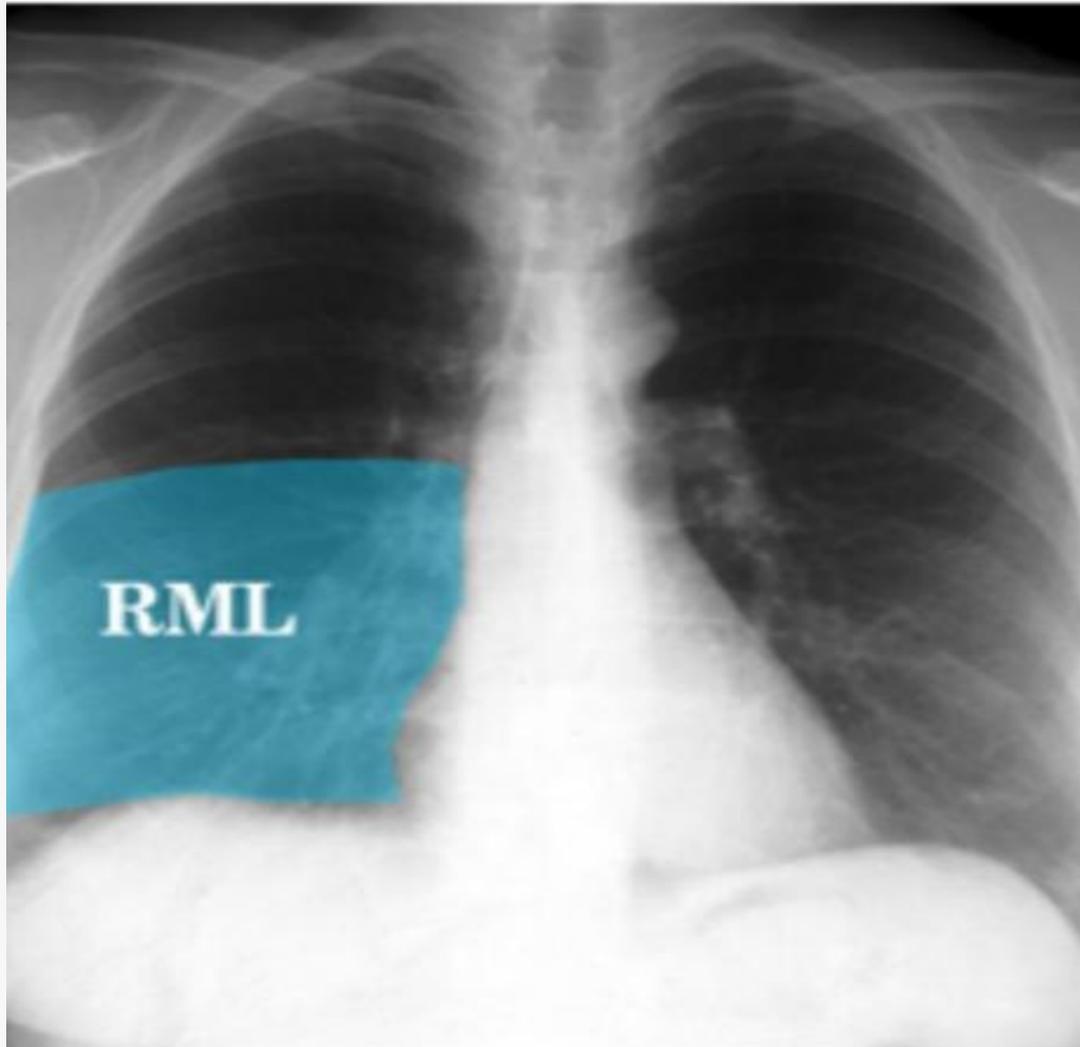
Right Lower Lobe



- Features of right lower lobe consolidation on CXR include:
 1. Opacification of the right lower zone, that may abut the oblique fissure
 2. obscuration of the right hemidiaphragm (silhouette sign)
 3. normal (clear and distinct) right heart border (cf. Middle lobe consolidation)
 4. normal (clear and distinct) right superior mediastinal contour (cf. Right upper lobe consolidation)
 5. air bronchograms
 6. on lateral CXR: triangular opacification posterior and inferior to right oblique fissure with obscuration of the dome and posterior aspect of the right hemidiaphragm

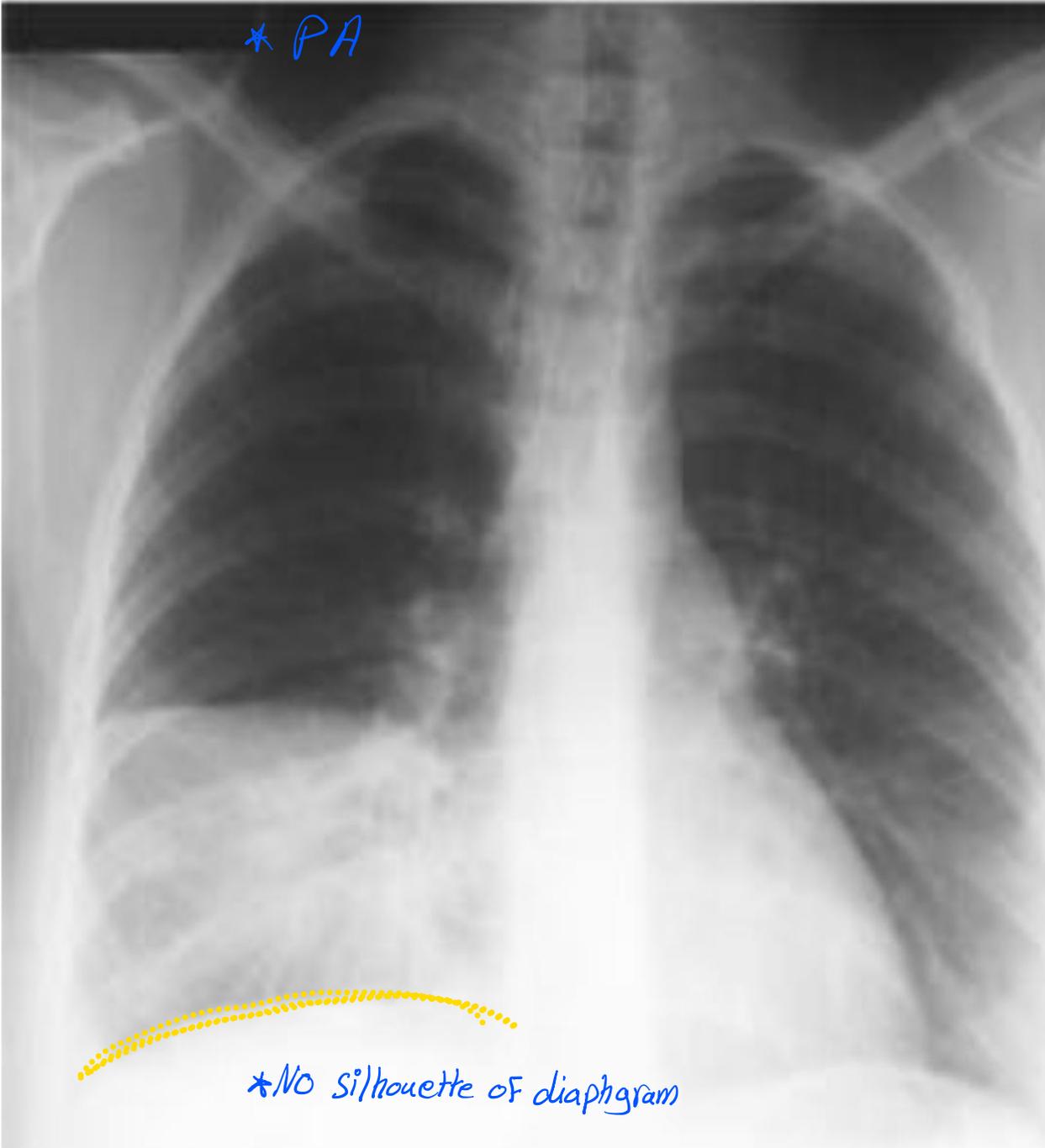


Middle lobe of right lung



1. opacification of the **right lower zone** that may abut and outline the inferior margin of the horizontal fissure indistinct appearance or **obscuration** of the **right heart border** (silhouette sign)
2. normal (clear and distinct) right superior mediastinal contour
3. normal (clear and distinct) right hemidiaphragm contour
4. air bronchograms
5. on lateral CXR: triangular opacification between the horizontal (superiorly) and right oblique fissures (posteriorly)

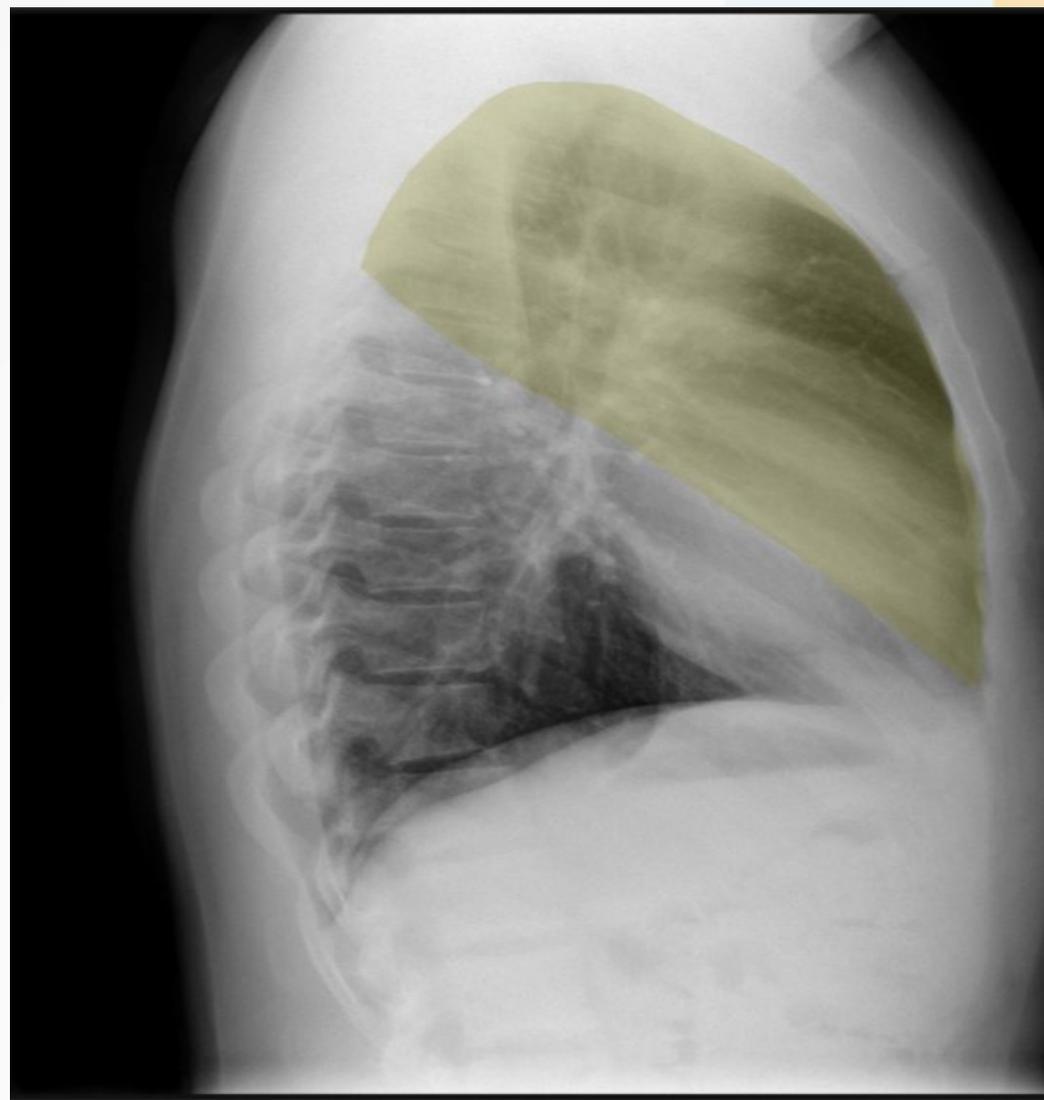
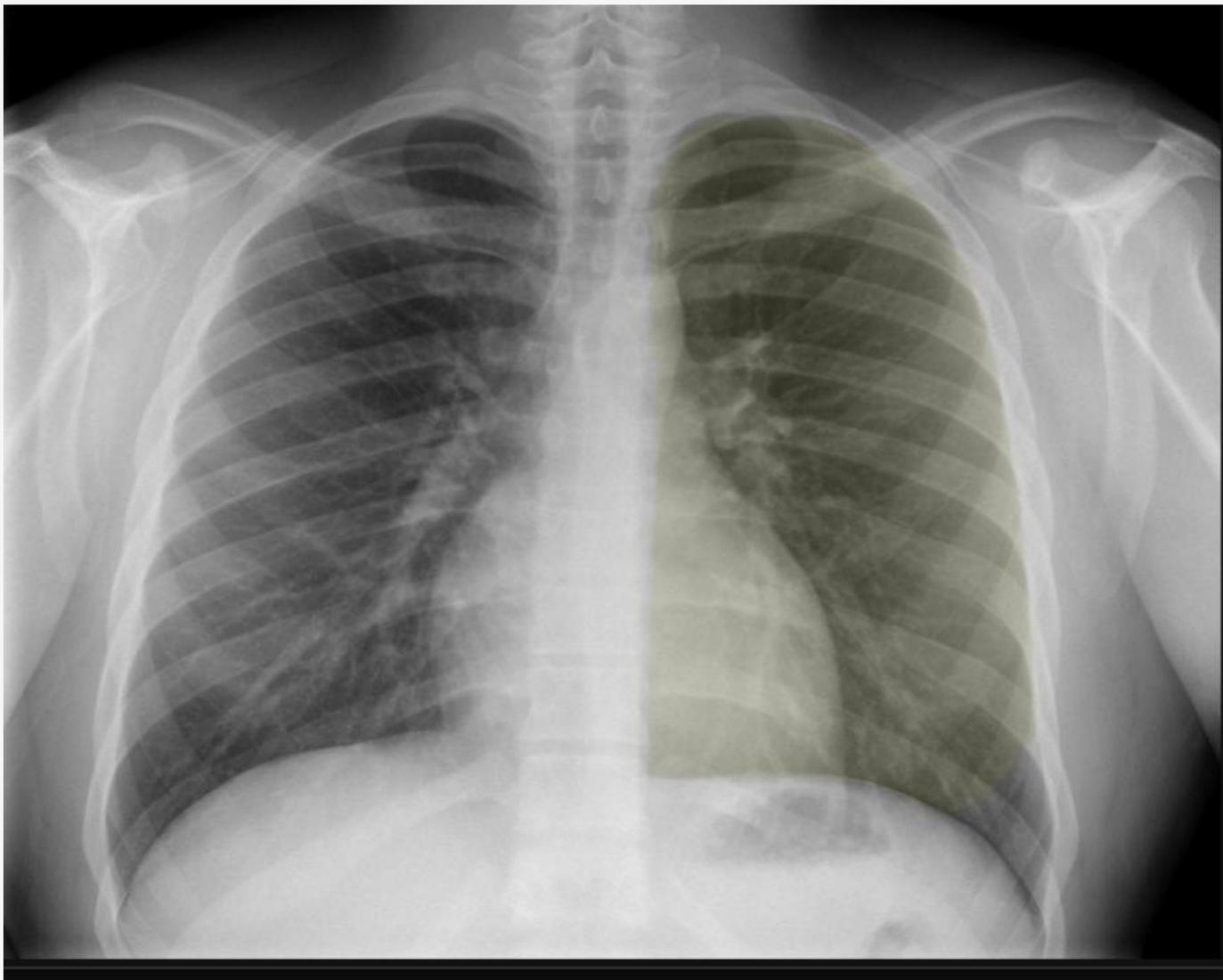
* PA



* No silhouette of diaphragm

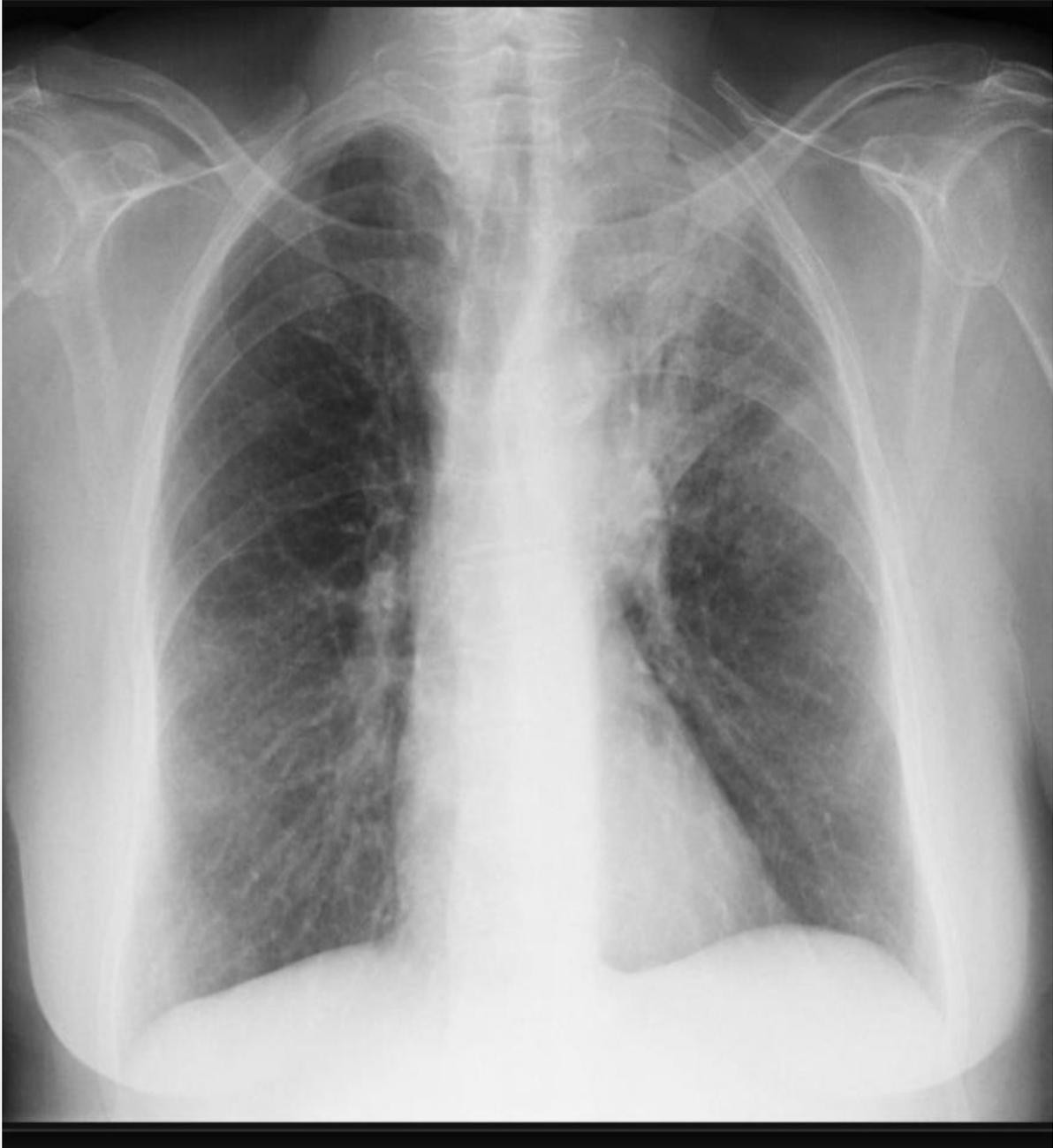


Left lung upper lobe

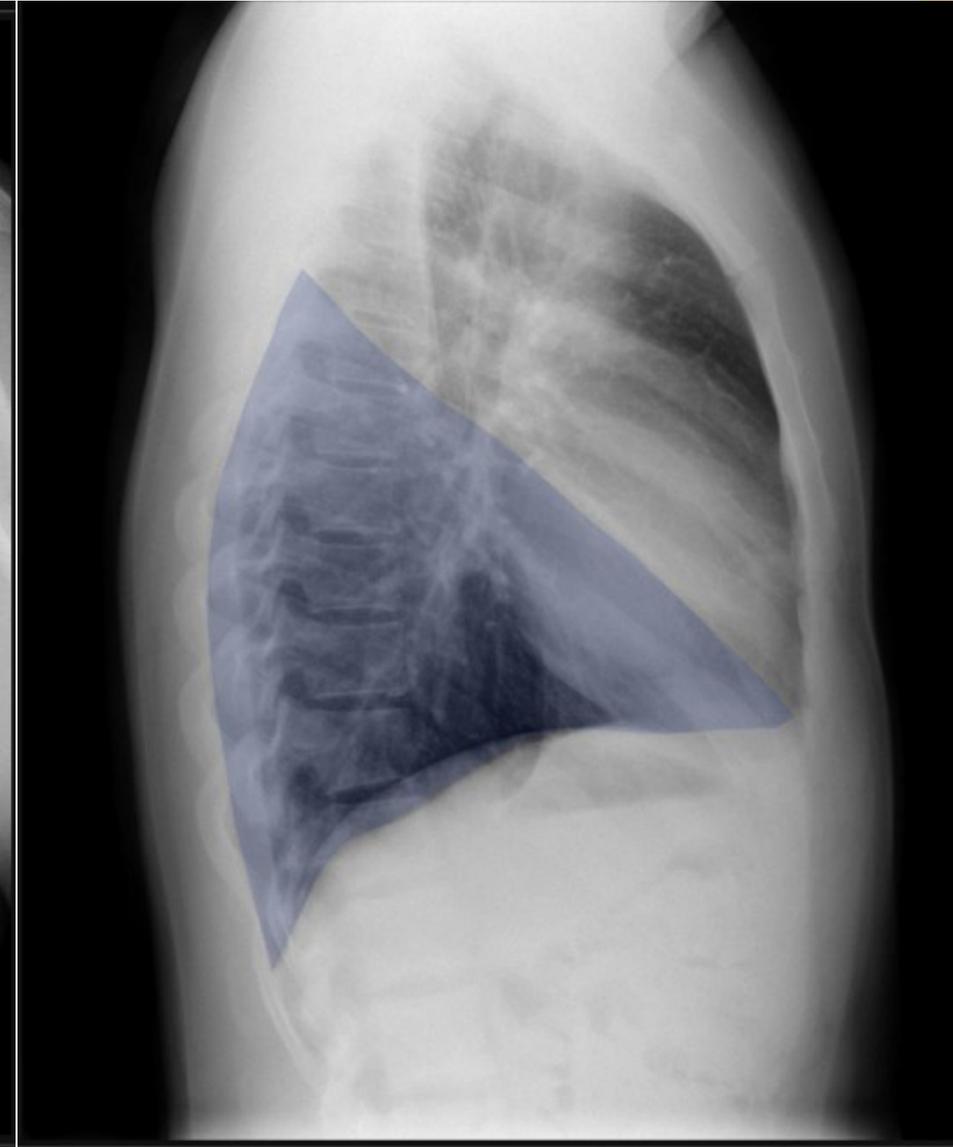


● Features of **left upper lobe** consolidation on CXR include:

1. Opacification of the left upper zone and/or apex
2. obscuration of the left superior mediastinal contour (silhouette sign), such as the aortic arch and left paratracheal stripe
3. obscuration of the left hilum, particularly the superior hilum
4. obscuration of the left heart border due to lingular consolidation
normal (clear and distinct) left hemidiaphragm contour
5. air bronchograms
6. on lateral CXR: triangular opacification superior and anterior to the left oblique fissure and normal (clear and distinct) left hemidiaphragm contour

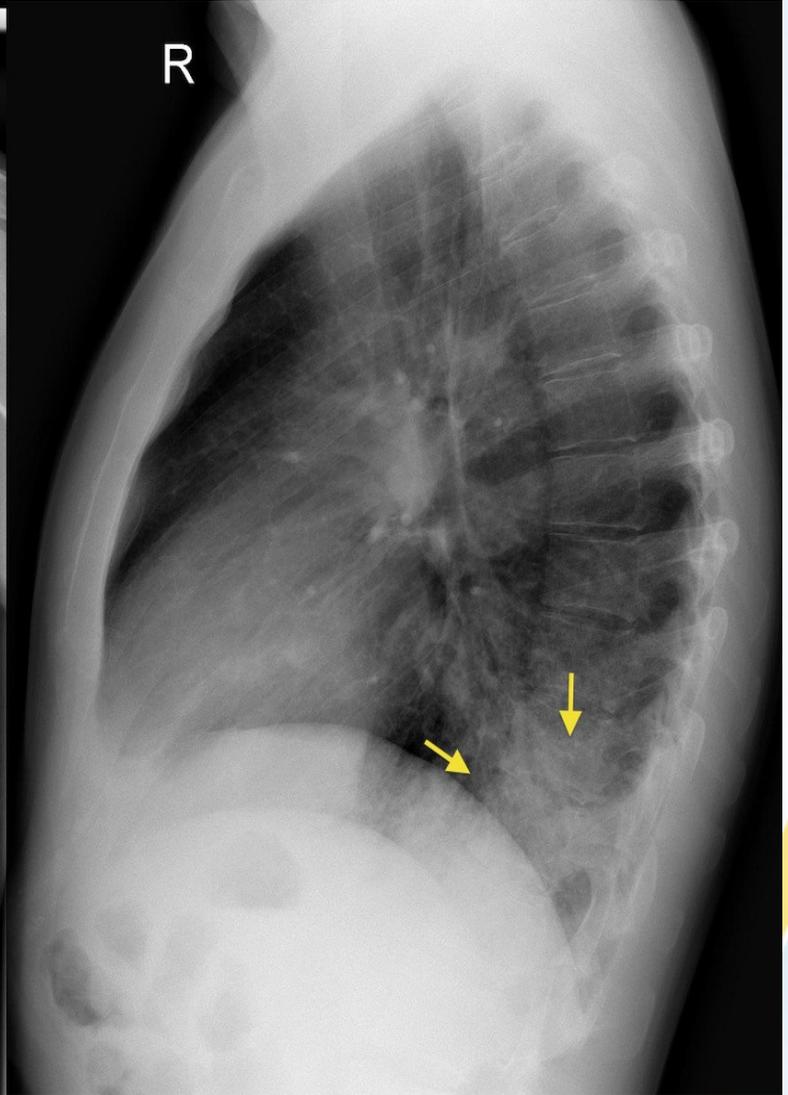
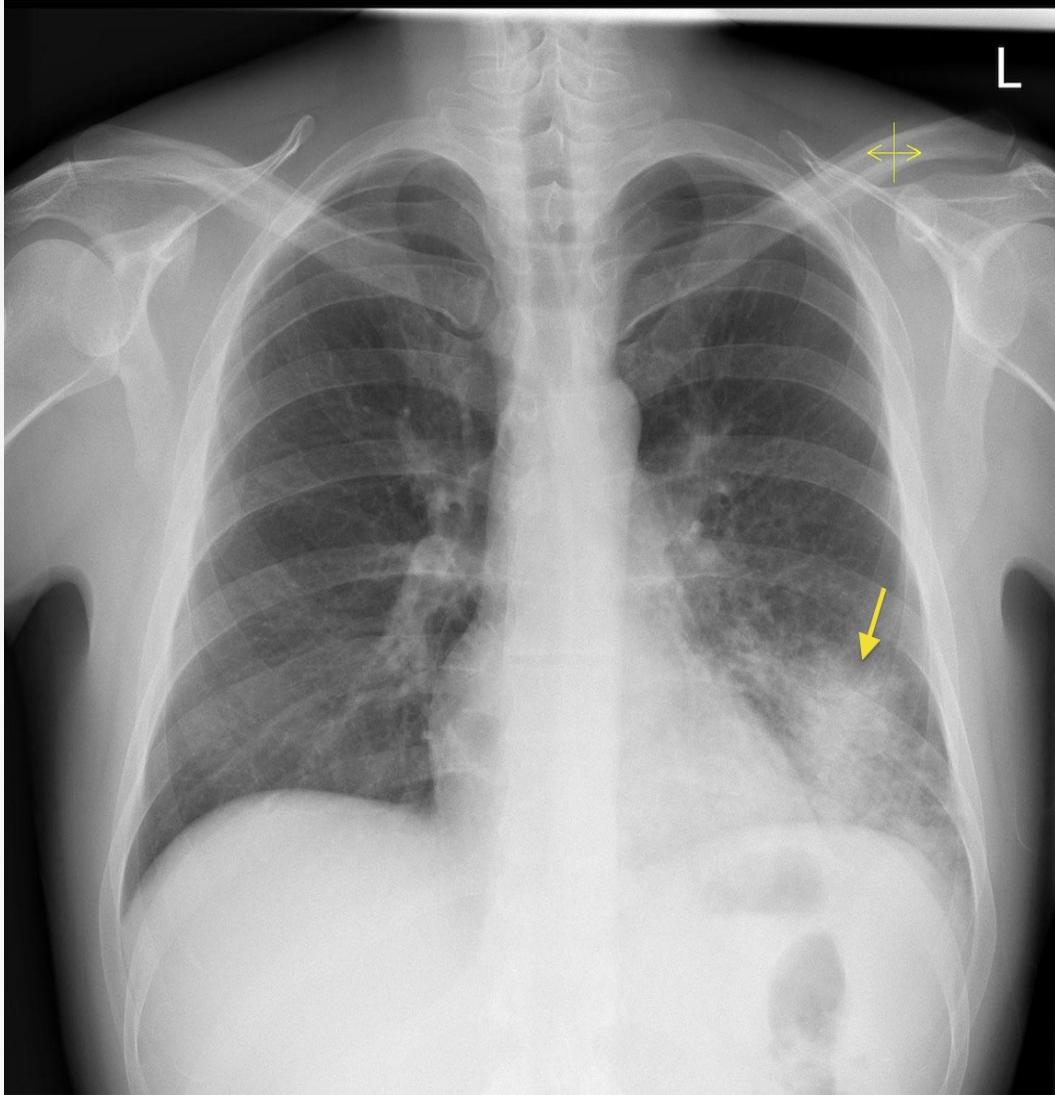


Lower Lobe of left Lung



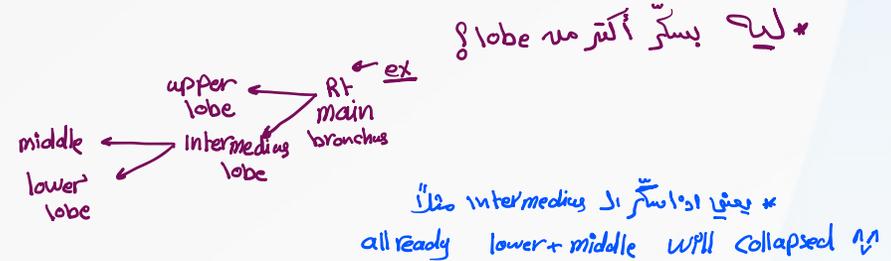
Features of **left lower lobe** consolidation on CXR include:

1. Opacification of the mid and/or lower zones, and occasionally even upper zone
2. obscuration of the left hilum, particularly the inferior hilum in apical segment consolidation
3. obscuration of the descending aortic contour (cf. Left upper lobe consolidation)
4. normal (clear and distinct) left heart border (cf. Left upper lobe consolidation)
5. obscuration of the left hemidiaphragm contour (cf. Left upper lobe consolidation)
6. air bronchograms
7. on lateral CXR: triangular opacification inferior and posterior to the left oblique fissure and obscuration of the left hemidiaphragm contour



Collapse

- Lobar collapse refers to the collapse of an entire lobe of the lung
- Most often collapse of most or all of a lobe is secondary to bronchial obstruction
- Etiology :



mural

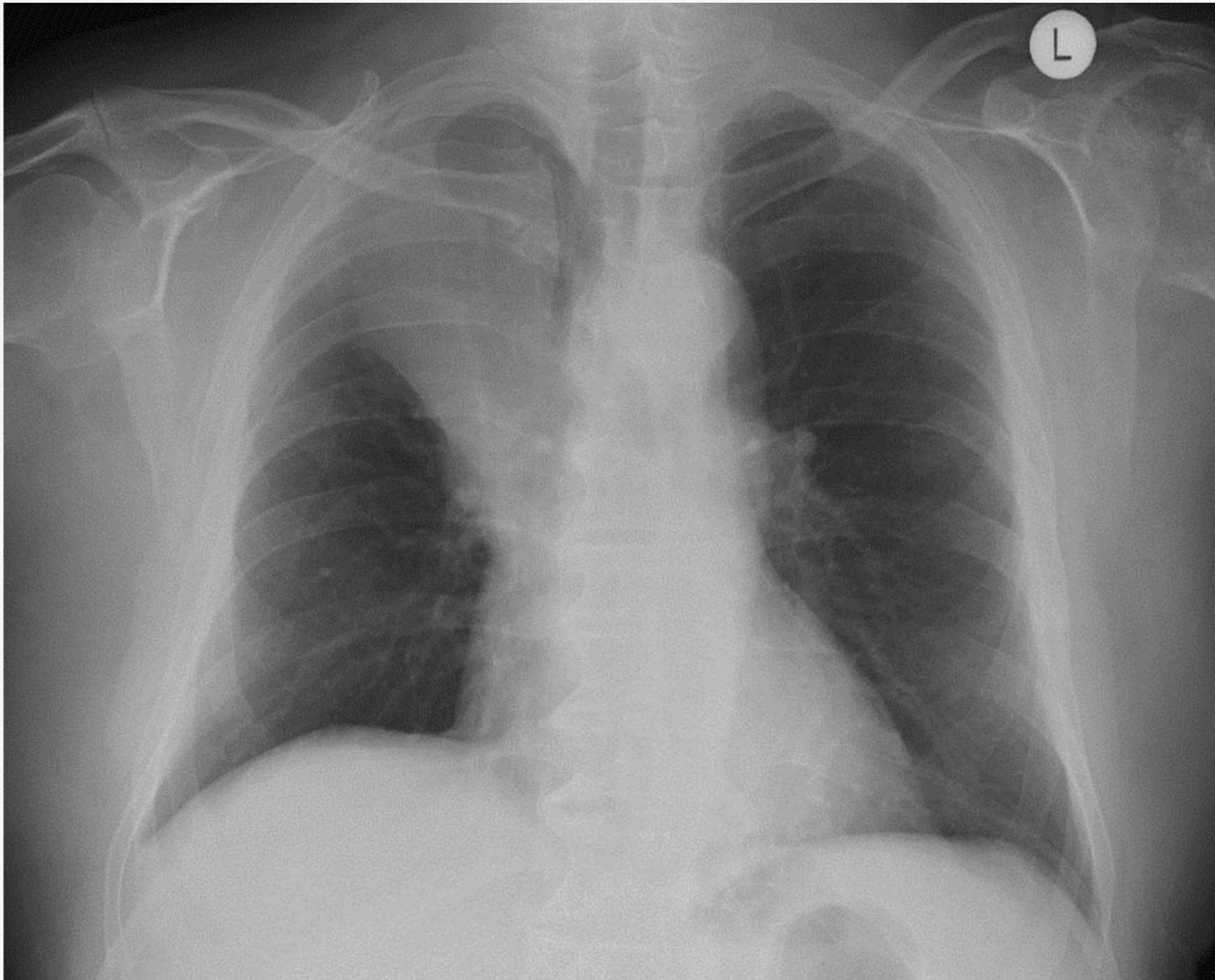
- lung cancer

extrinsic

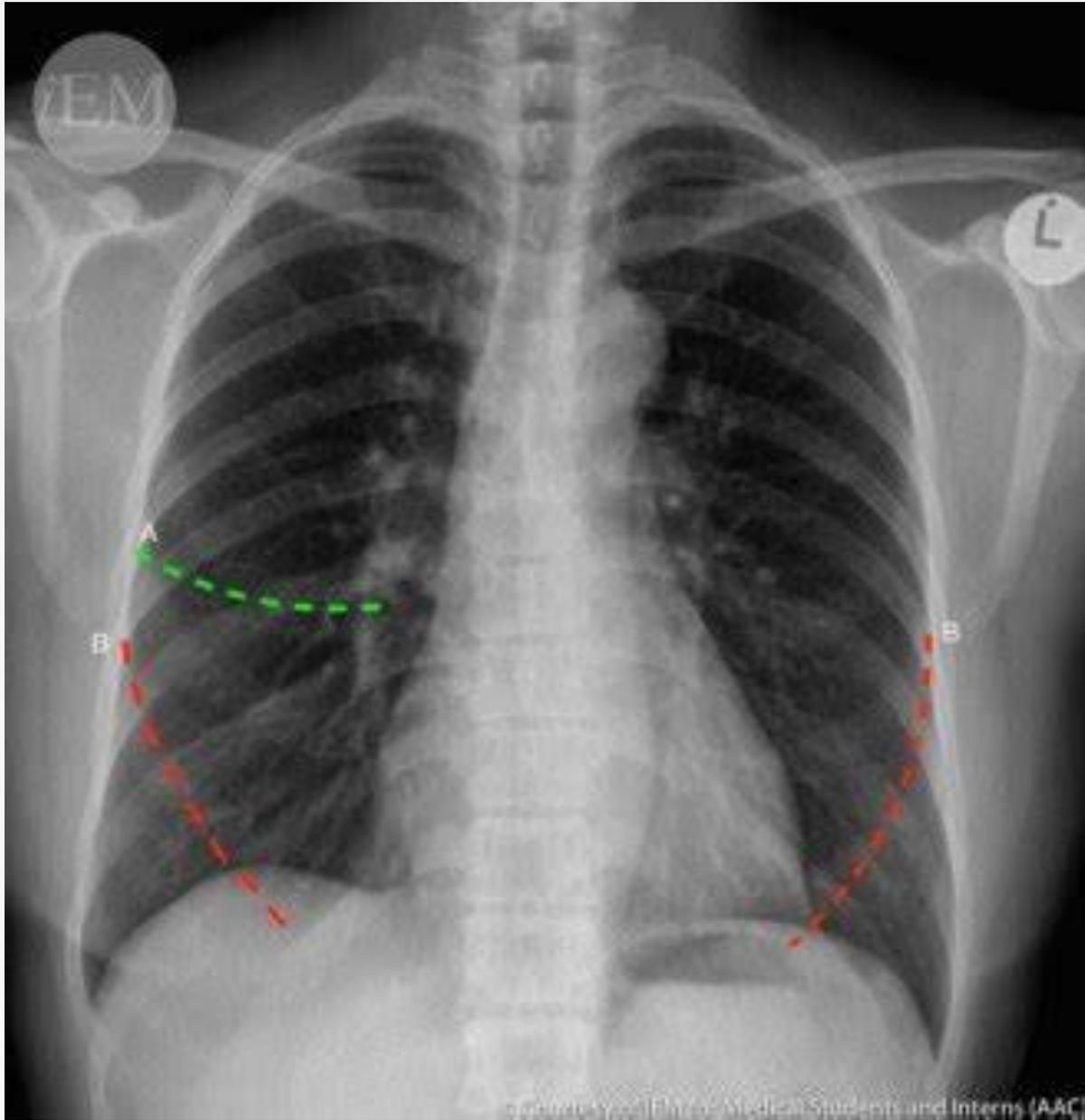
- compression by adjacent mass ruction

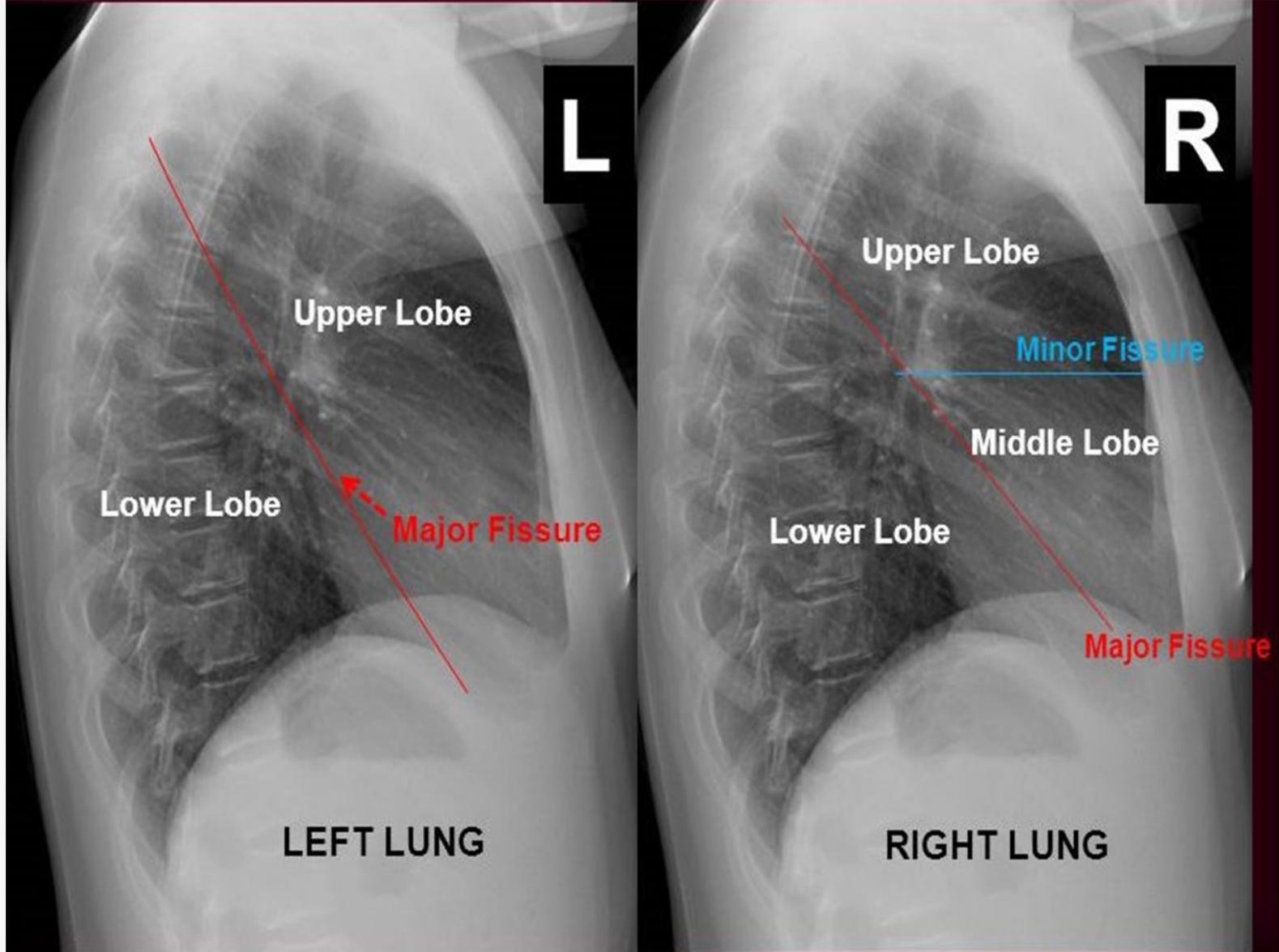
luminal

- aspirated foreign material
- mucus plugging
- endobronchial mass
- misplaced endotracheal tube

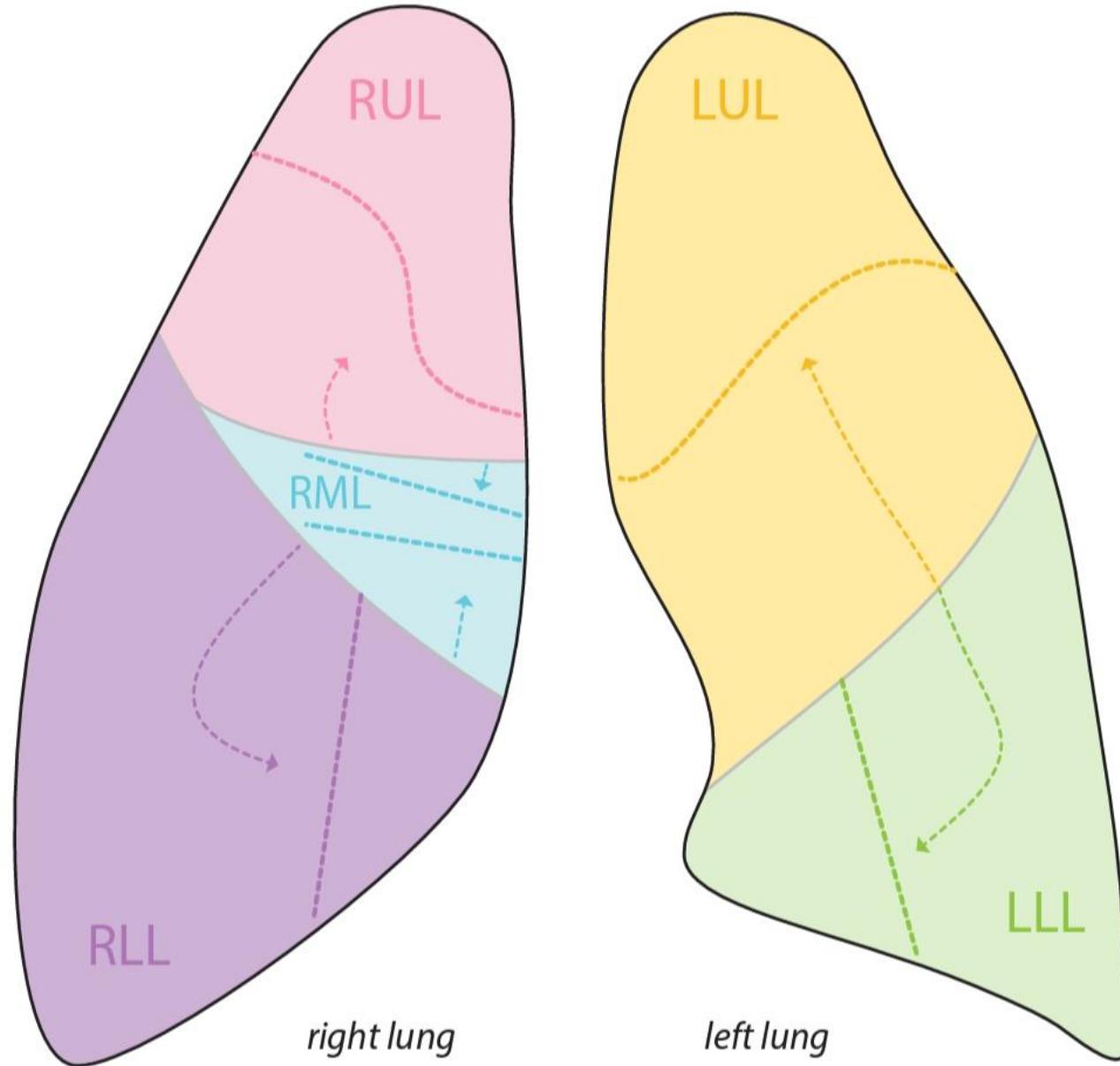




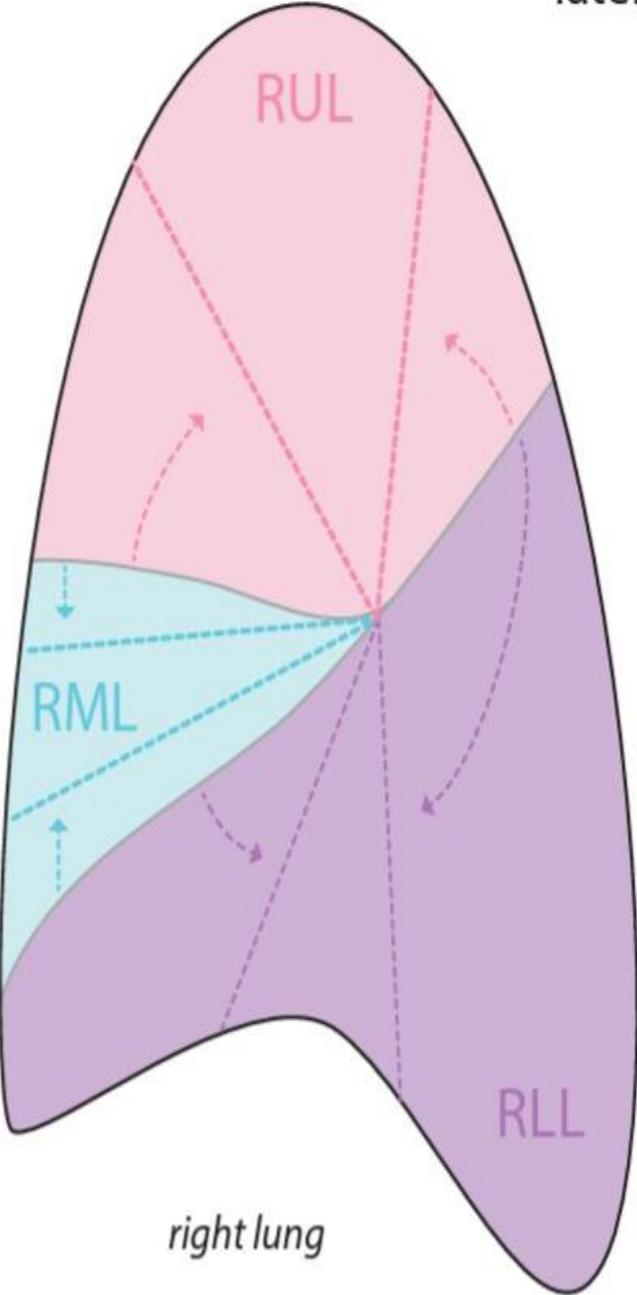




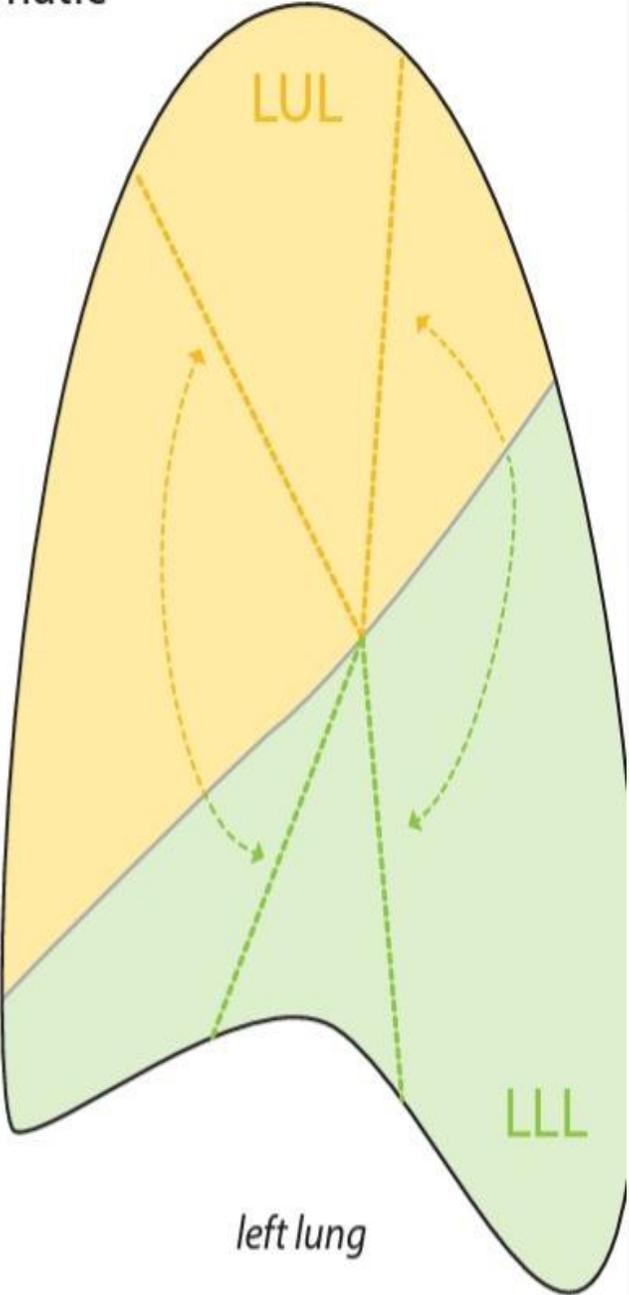
frontal schematic



lateral schematic



right lung



left lung

Reporting → Decrease volume loss with shifting of trachea or mediastinal toward side of collapse.

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

* Displacement of the fissures.

* 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.

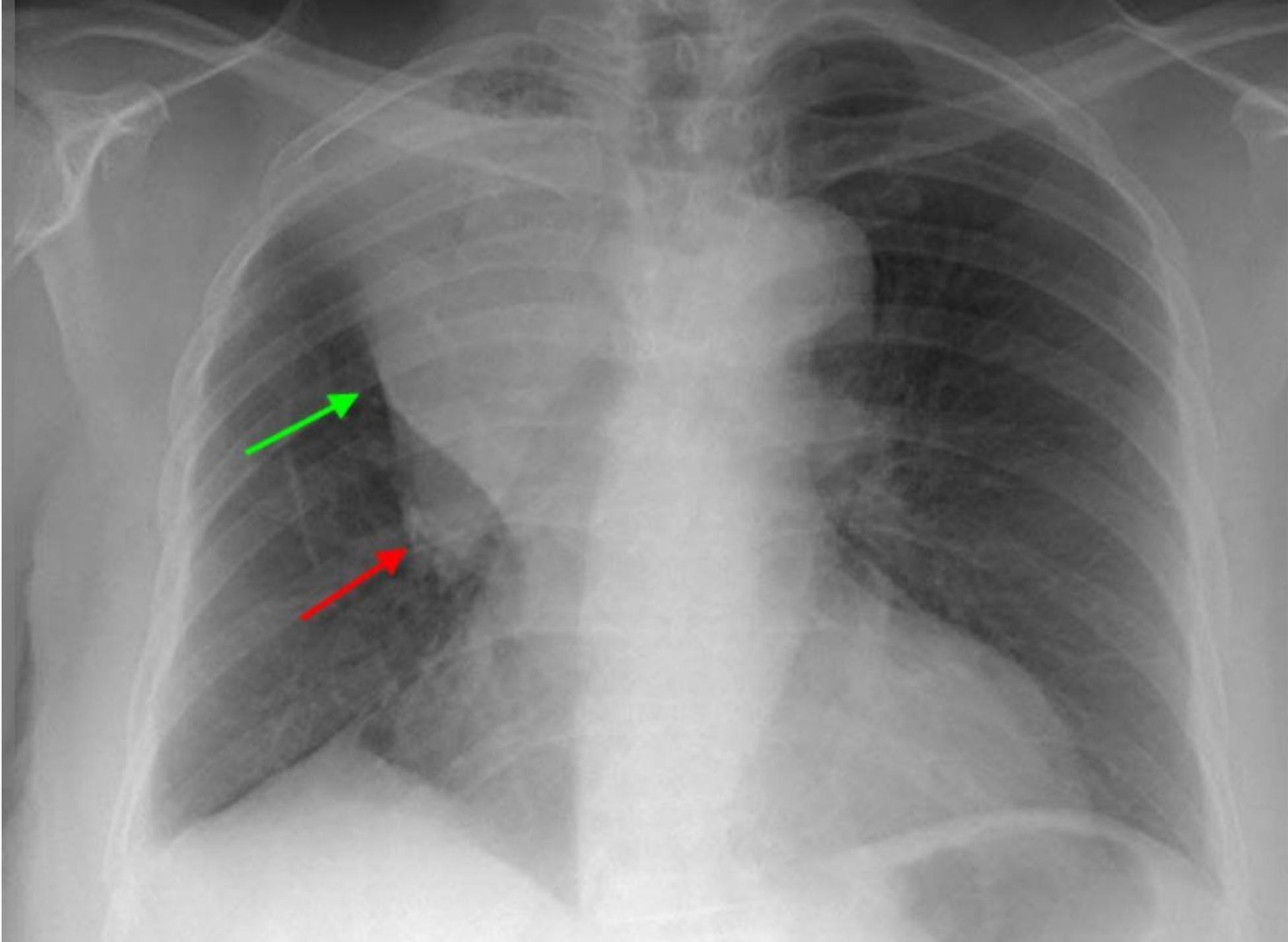
Mediastinal shift to the side with volume loss.

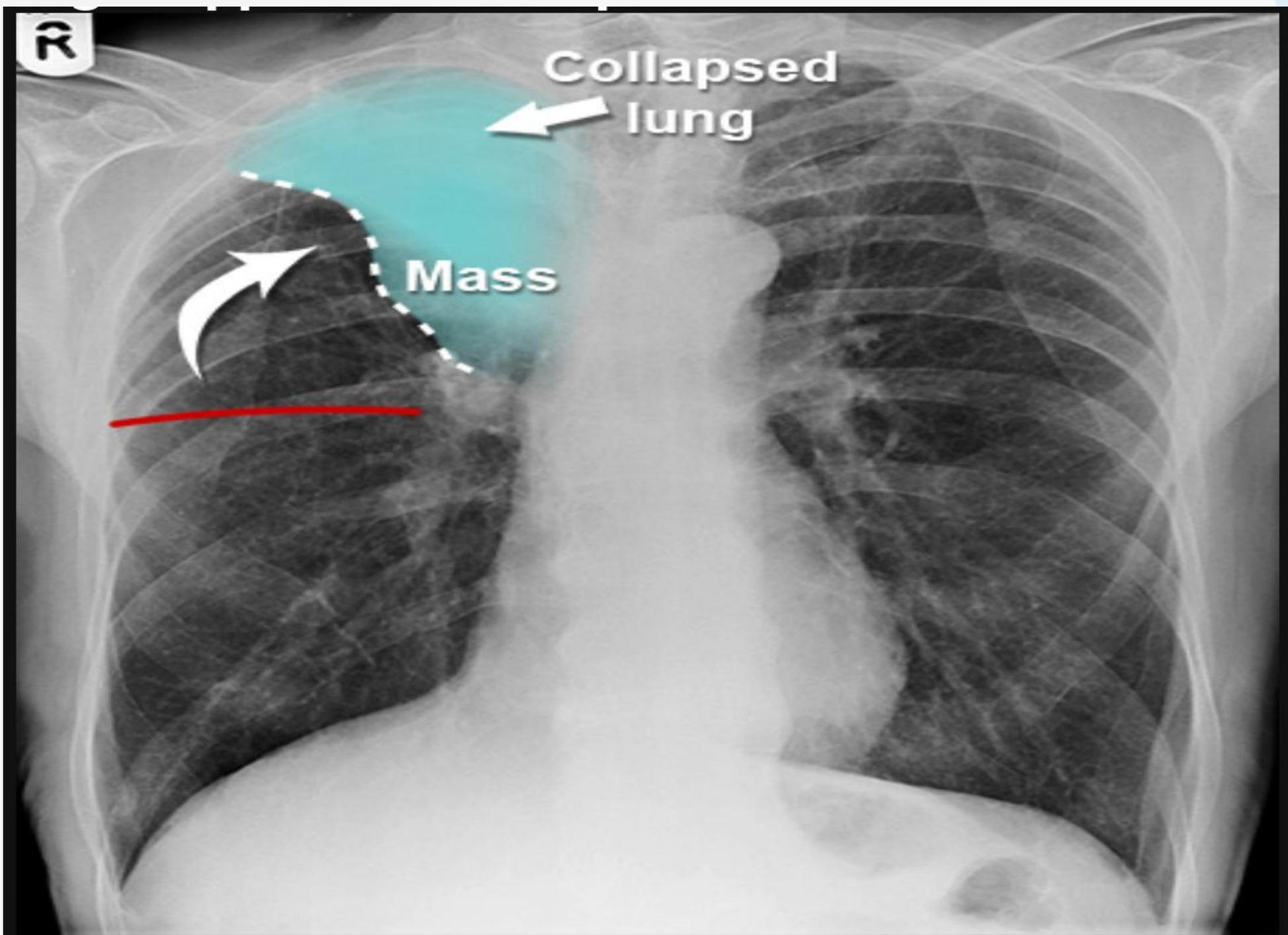
Overinflation of adjacent or contralateral lobes.

Hilar displacement.

Right Upper lobe collapse

- Right upper lobe collapse has distinctive features, and is usually easily identified on frontal chest radiographs; much more so than left upper lobe collapse.
- The reverse S sign of Golden is seen in right upper lobe collapse caused by an obstructing mass. The central convex margins of the mass form a reverse S. Although the sign describes a reverse S, it is also commonly known as **Golden's S sign**
- The **juxtaphrenic peak sign** is a peridiaphragmatic triangular opacity caused by diaphragmatic traction from an inferior accessory fissure or an inferior pulmonary ligament

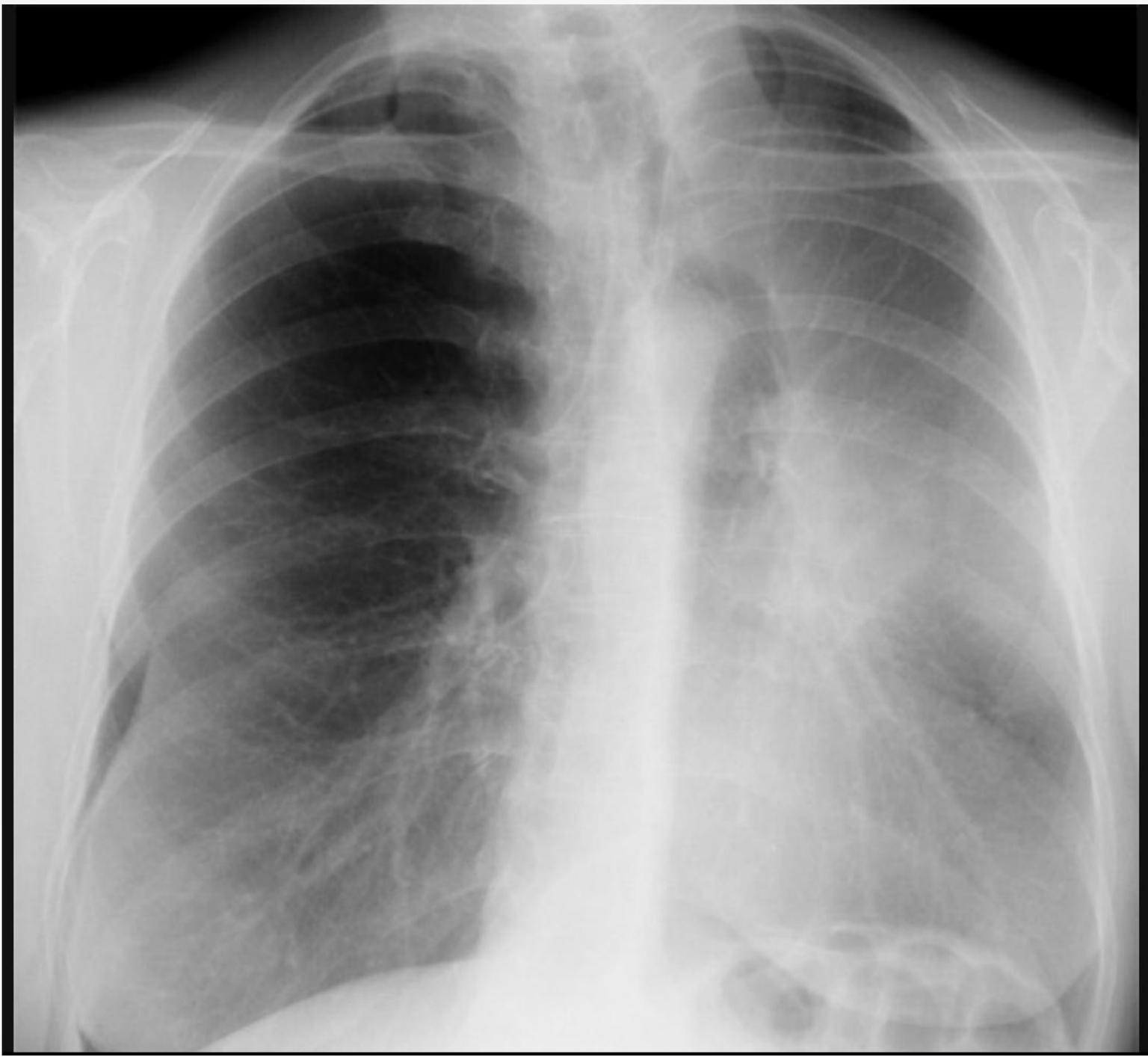


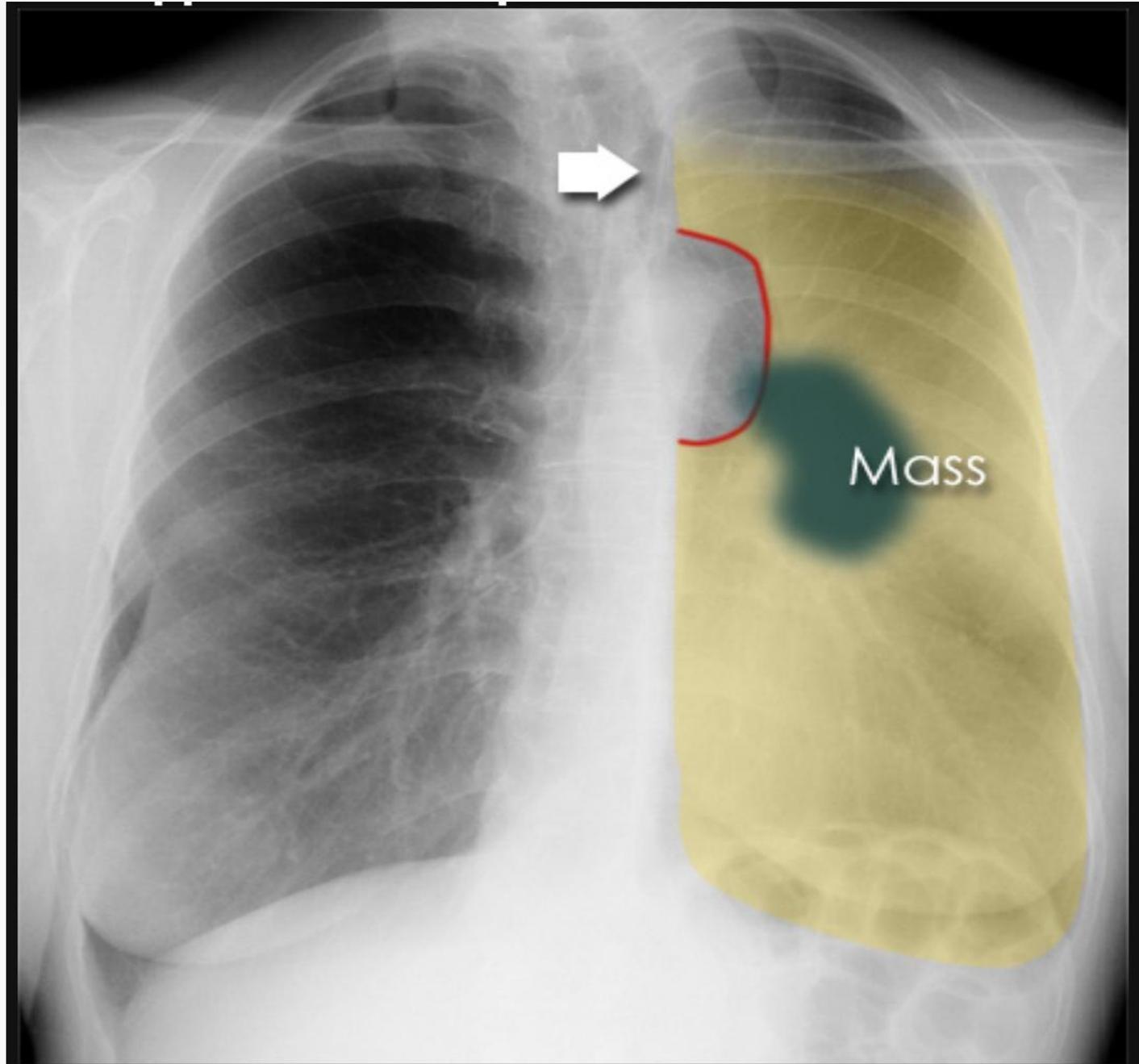




Left upper lobe collapse

- Volume loss of the left hemithorax
- 'Veil-like' opacification of the left hemithorax obscuring the left heart border - characteristic of left upper lobe collapse
- Hyperexpanded superior segment of the left lower lobe insinuates itself between the left upper lobe and the superior mediastinum, sharply silhouetting the aortic arch and resulting in a sickle-shaped lucency medially. This is known as the luftsichel sign
- peaked' or 'tented' hemidiaphragm: juxtaphrenic peak sign



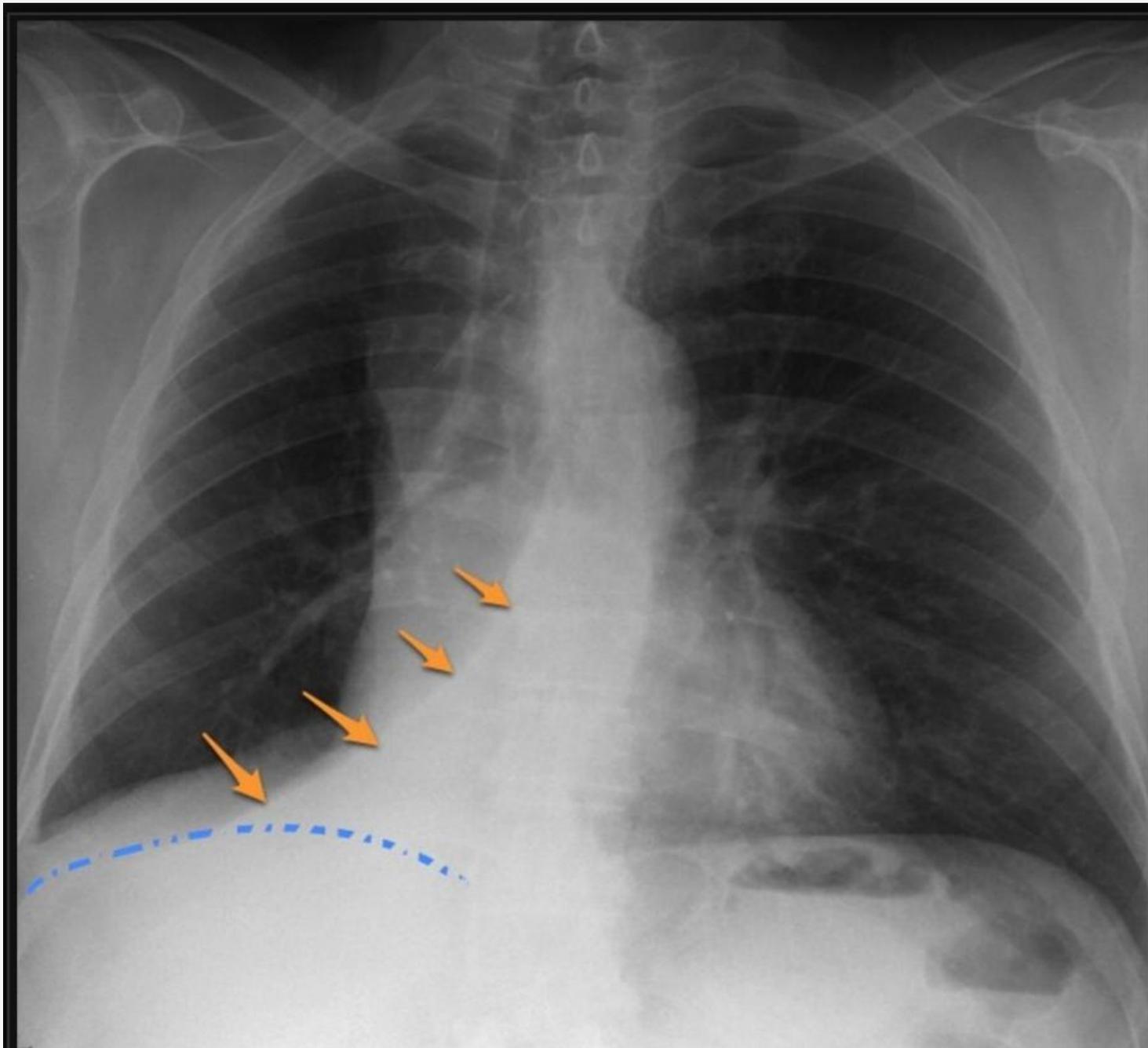


Mass



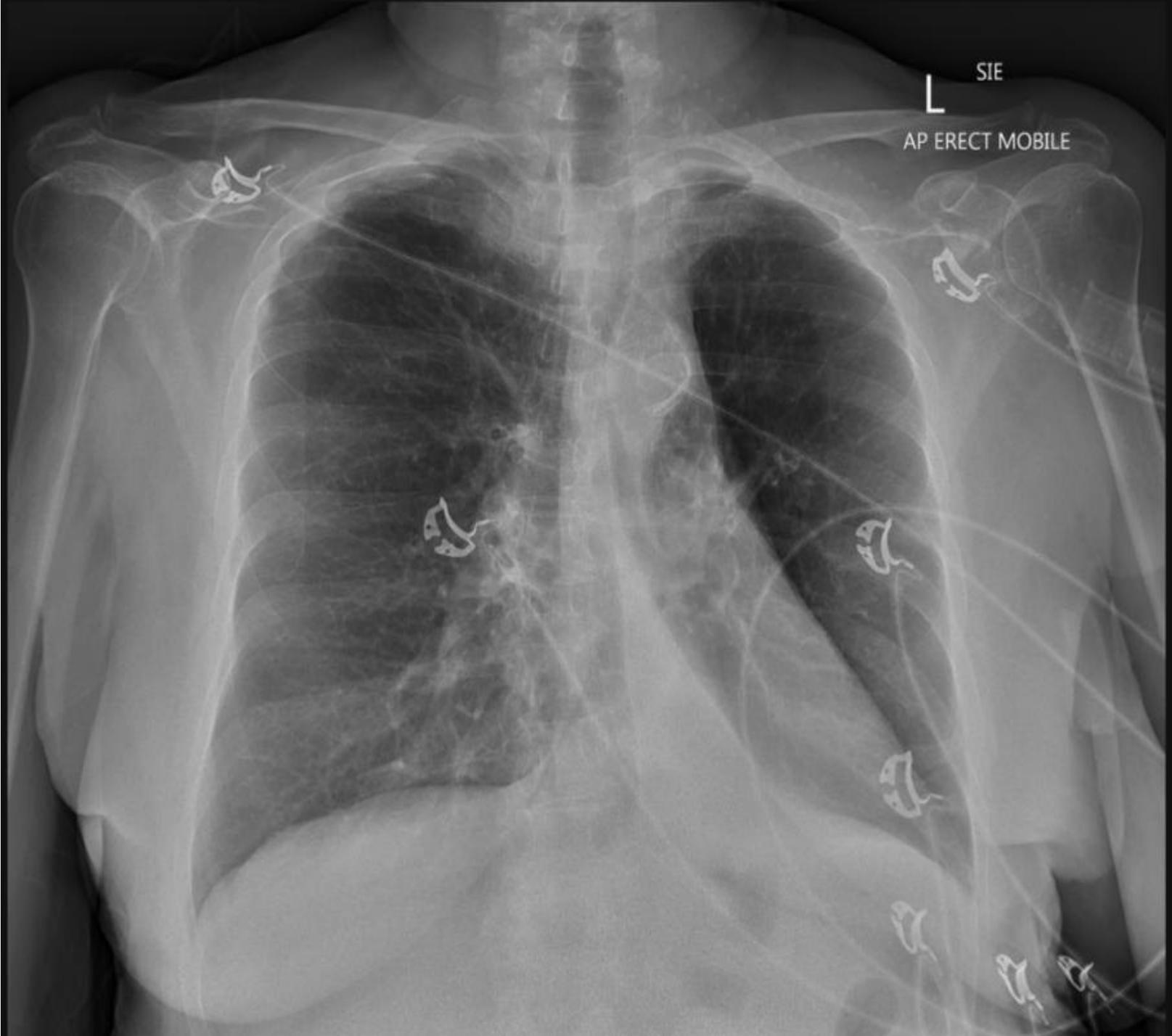
Right lower lobe Collapse

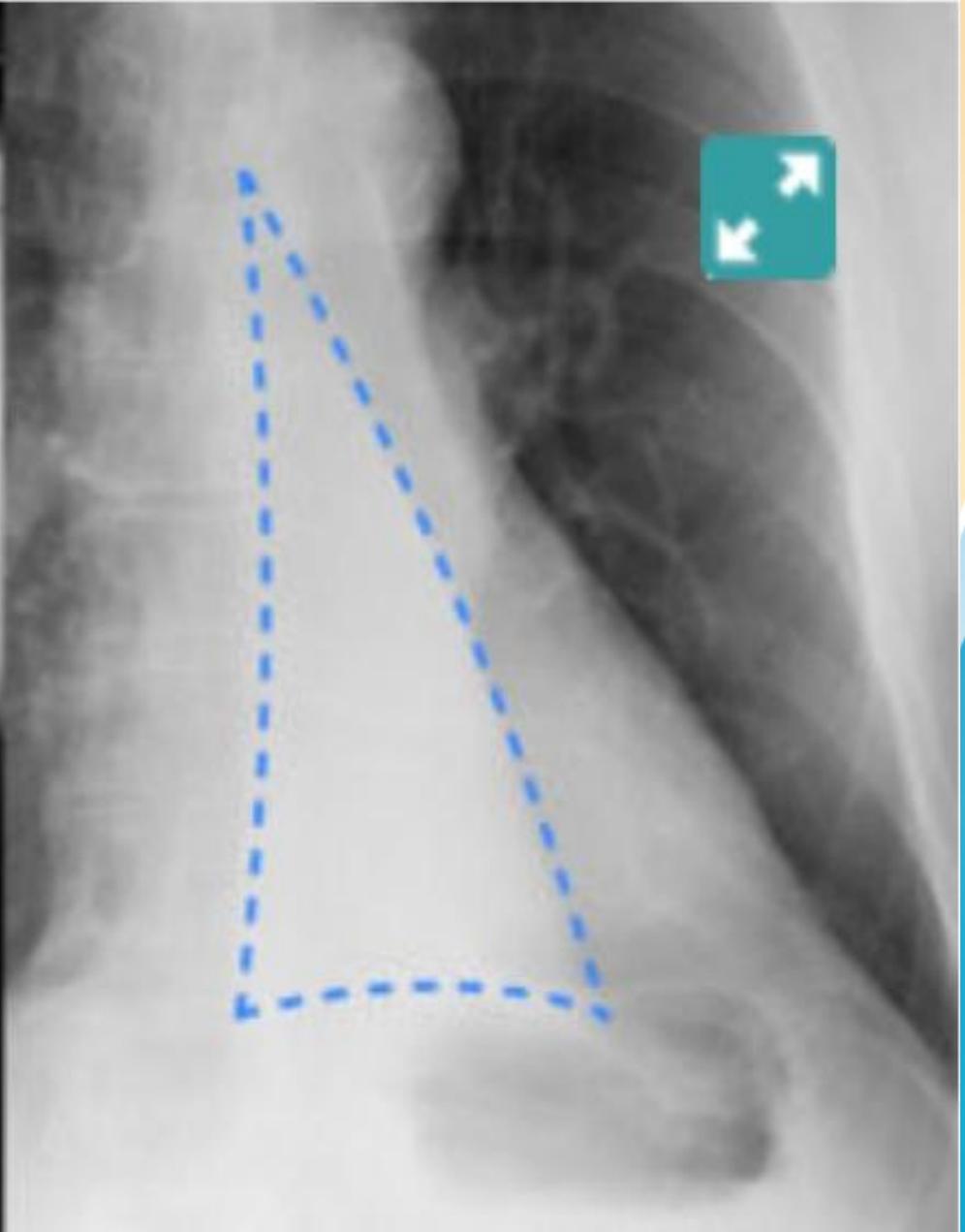
- Collapse of the right lower lobe is usually easily identified
- Signs
 1. Triangular opacity in the right lower zone (usually medially) with the apex pointing towards the right hilum
 2. obscured medial right hemidiaphragm
 3. inferior displacement of the right hilum
 4. obscured descending interlobar pulmonary artery
 5. distinct right heart border in contact with normal middle lobe
 6. inferior displacement of the horizontal fissure



Left lower lobe collapse

1. triangular opacity in the posteromedial aspect of the left lung (retrocardiac sail sign)
2. left lower zone opacification (usually medially) with the apex pointing towards the left hilum
3. edge of the collapsed lung may create a 'double cardiac contour'
4. inferior displacement of the left hilum
5. flat waist sign: flattening of the left heart border
6. obscuration of the left hemidiaphragm
7. obscuration of the descending aorta



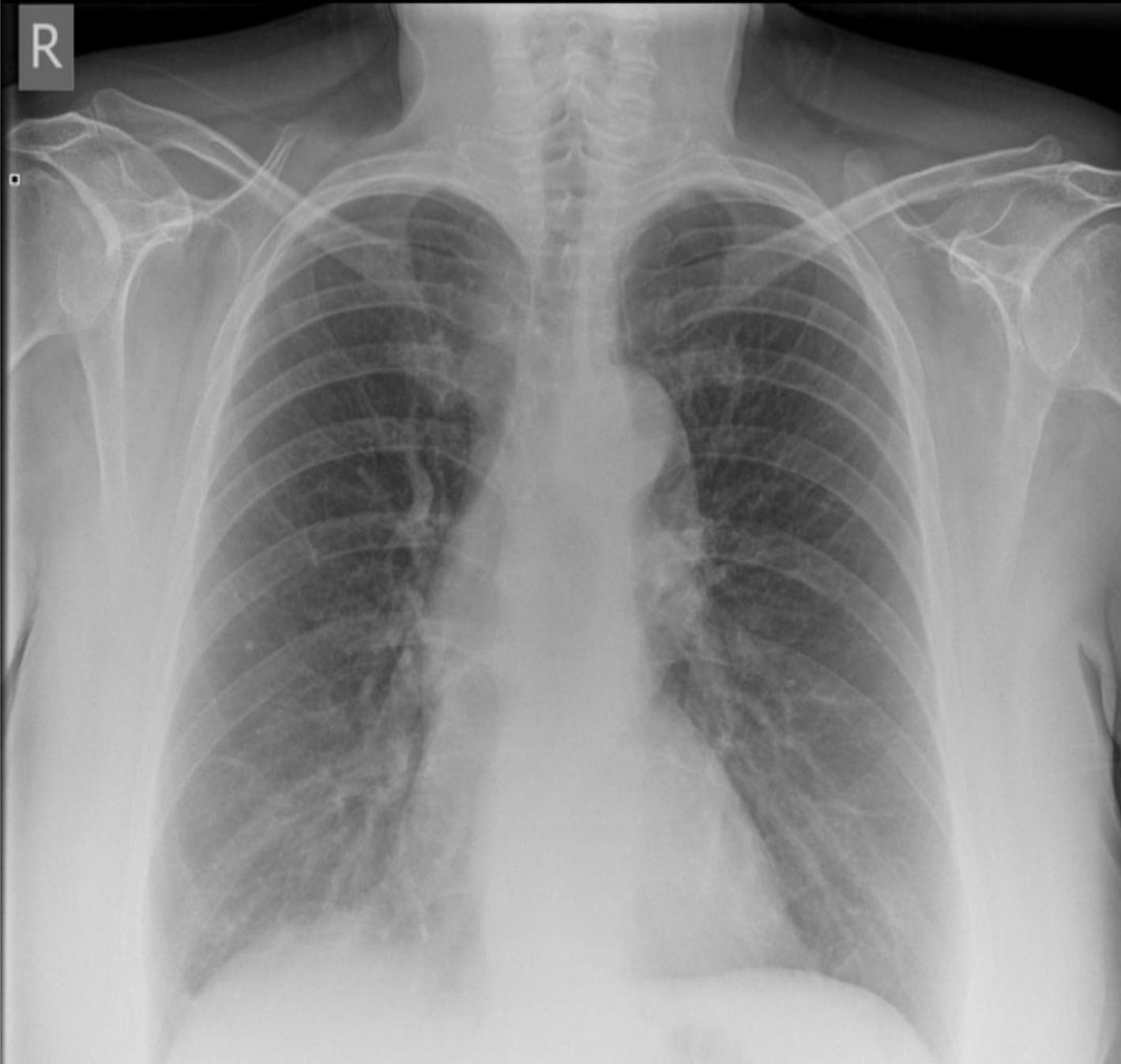


Right Middle lobe collapse

- Right middle lobe collapse (or simply termed middle lobe collapse) has distinctive features, but can be **subtle** on frontal chest radiographs. .
- It is important to note that of all the lobes, the right middle lobe is the most likely to be chronically collapsed.

On frontal radiographs the findings are subtle compared to the lateral projection and include :

1. right mid to lower zone air space opacification (which can be subtle)
2. the normal horizontal fissure is no longer visible (as it rotates inferiorly rendering it non-tangential to the x-ray beam)
3. obscuration of the right heart border
4. On lateral view :
 - appearing as a triangular opacity in the anterior aspect of the chest overlying the cardiac shadow, with its apex at the right hilum





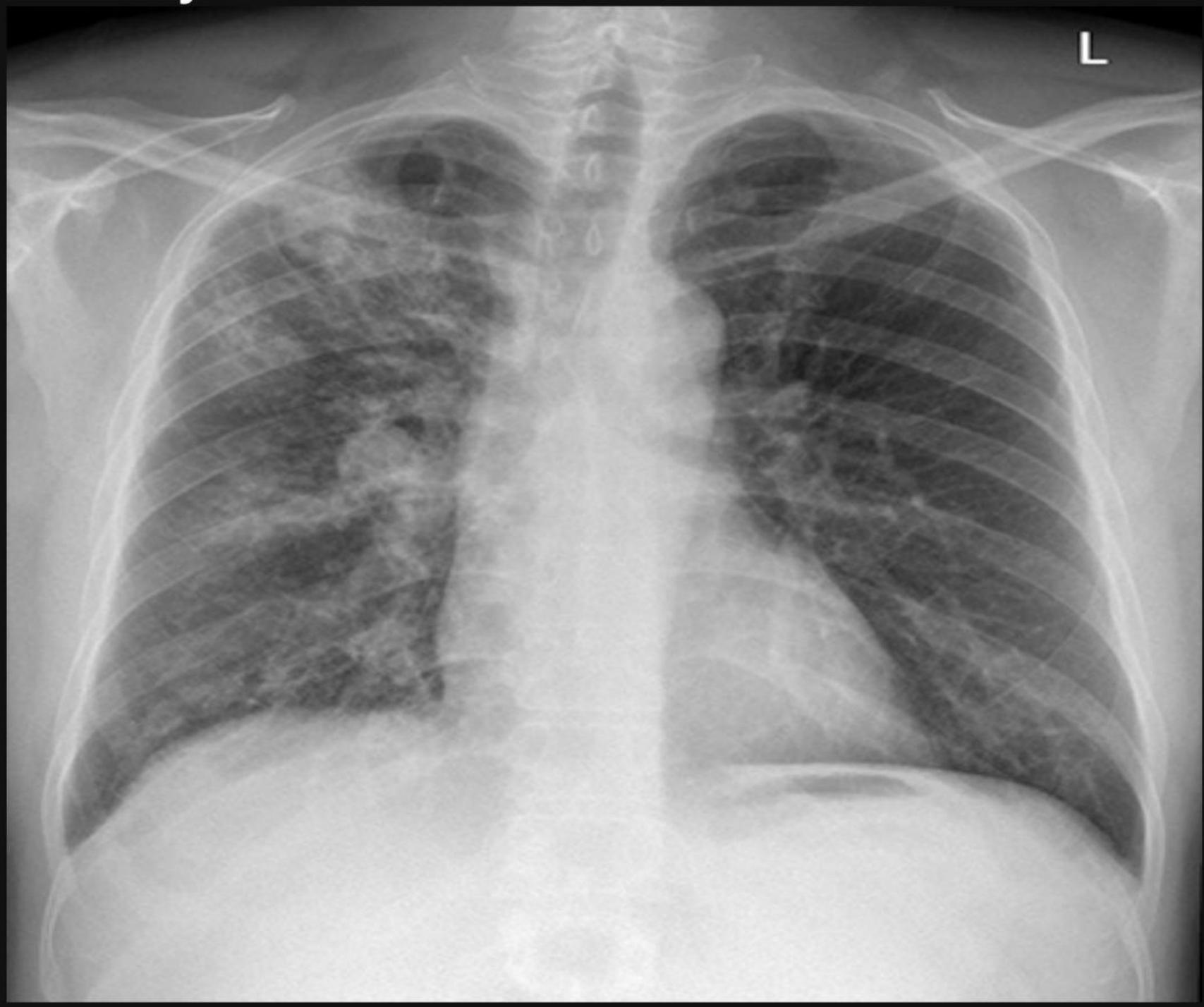
Tuberculosis

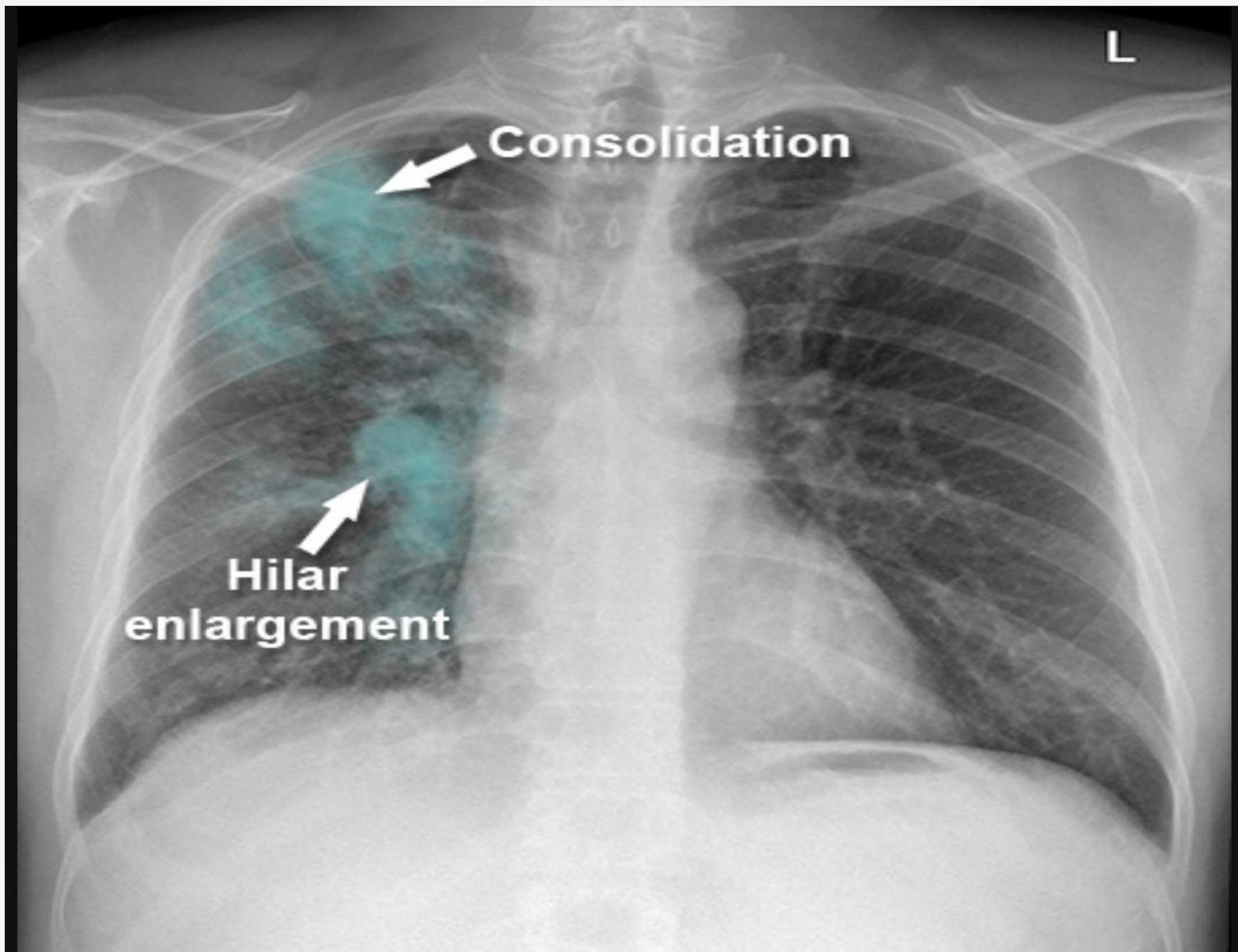
(commonly abbreviated to TB, short for tubercle bacillus) encompasses an enormously wide disease spectrum affecting multiple organs and body systems predominantly caused by the organism [Mycobacterium tuberculosis](#).

Pulmonary manifestations of tuberculosis are varied and depend in part whether the infection is primary or post-primary

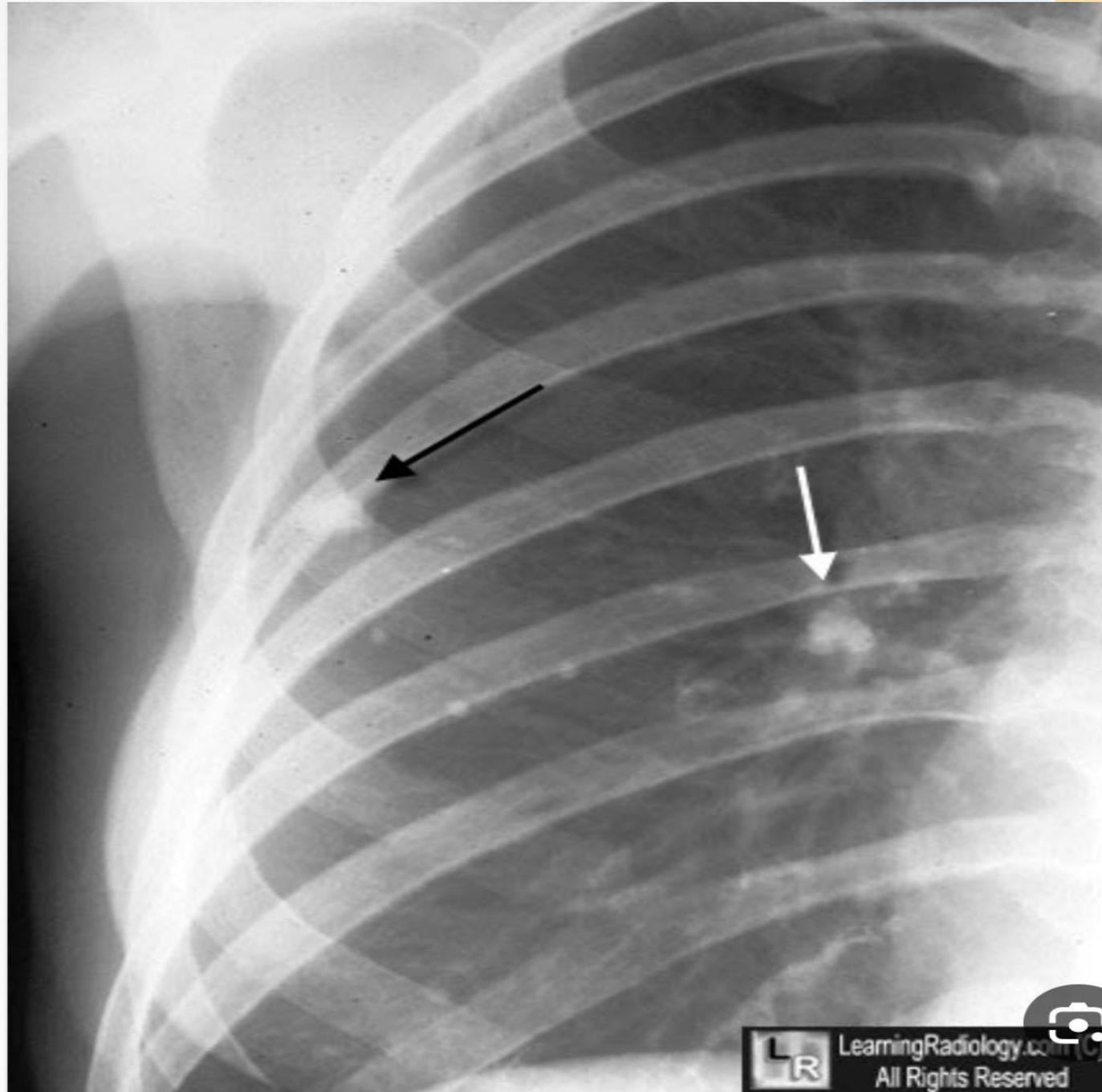
primary pulmonary tuberculosis

- the initial focus of infection can be located anywhere within the lung and has **non-specific appearances** ranging from too small to be detectable, to patchy areas of consolidation or even lobar consolidation.
1. **Cavitation** is uncommon in primary TB
 2. Most cases, the infection becomes localized and a caseating granuloma forms (tuberculoma) which usually eventually calcifies and is then known as a Ghon lesion
 3. ipsilateral hilar and contiguous mediastinal (paratracheal) lymphadenopathy, usually **right-sided**
 4. Pleural effusions are more frequent in adults,
 5. Calcification of nodes is seen in 35% of cases . When a calcified node and a Ghon lesion are present, the combination is known as a Ranke complex.





Ranke Complex



Reactivation (post-primary) tuberculosis

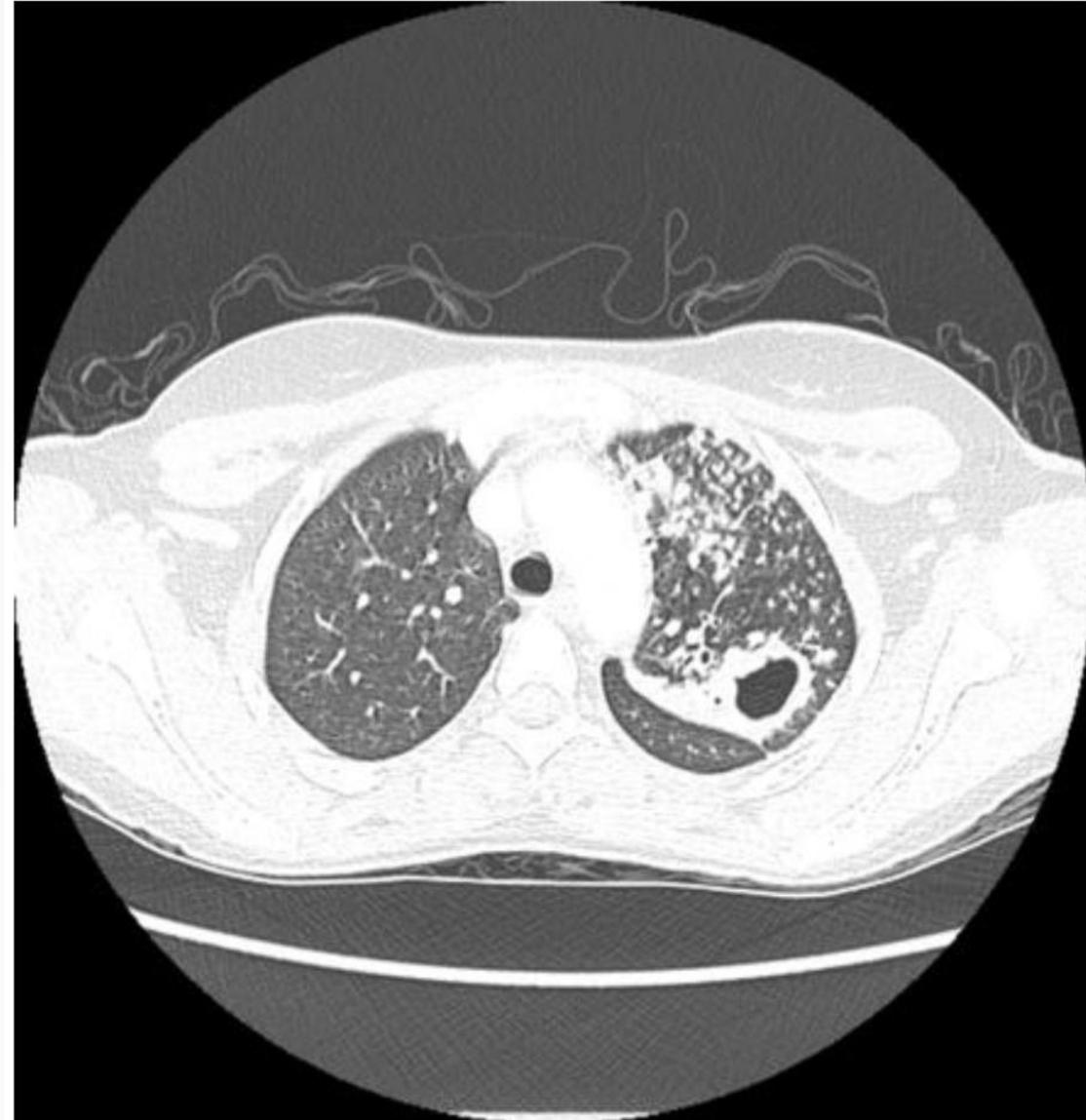
- Post-primary TB within the lungs develops in either :

posterior segments of the upper lobes

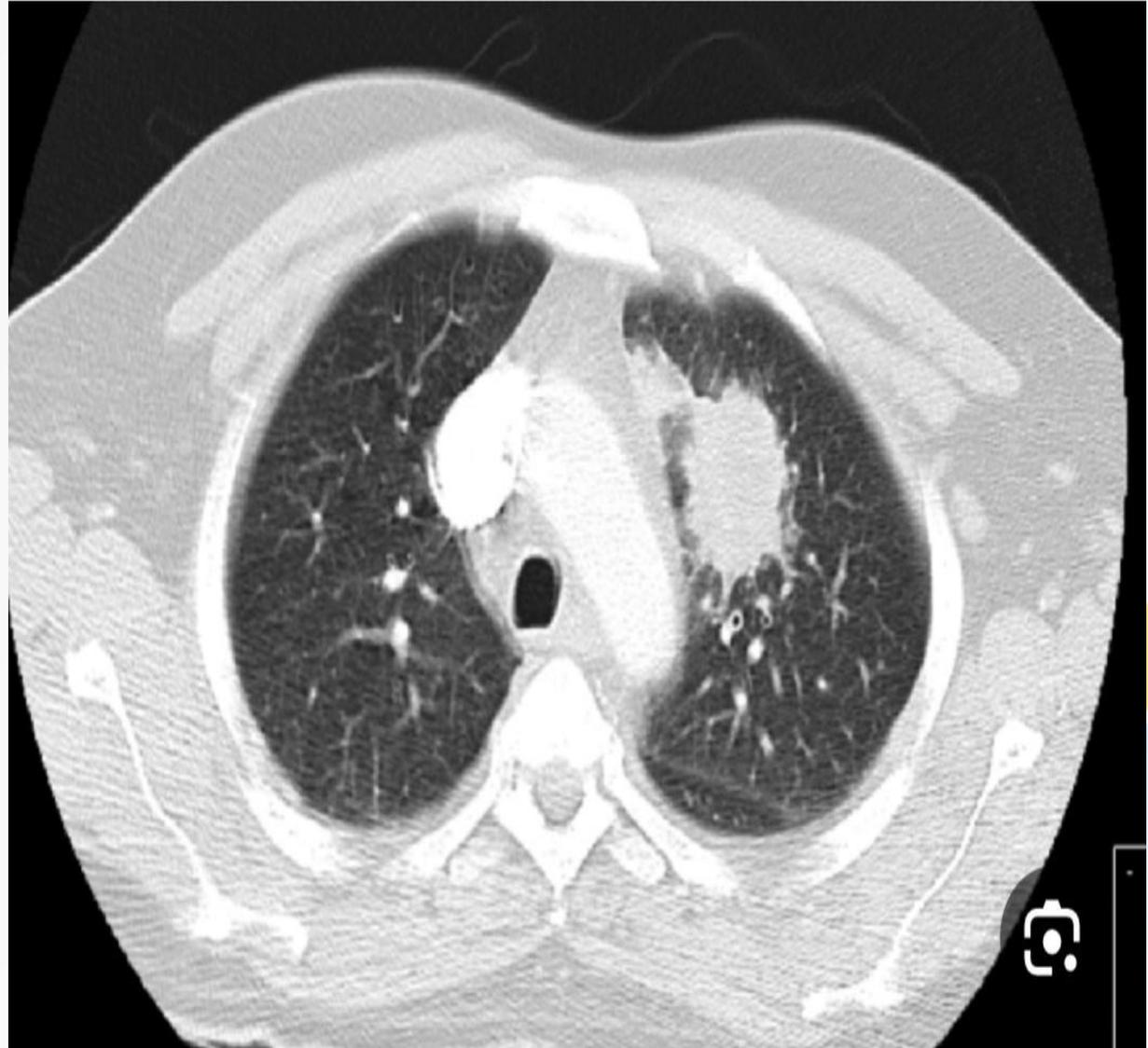
superior segments of the lower lobes

1. Post-primary infections are far more likely to **cavitate**
2. Lack of adenopathy in immunocompetent
3. Immunosuppressed patient (such as HIV), there is evidence of adenopathy
4. Tuberculoma is a well-defined rounded opacity usually in the upper lobes.

Cavitary lung lesion

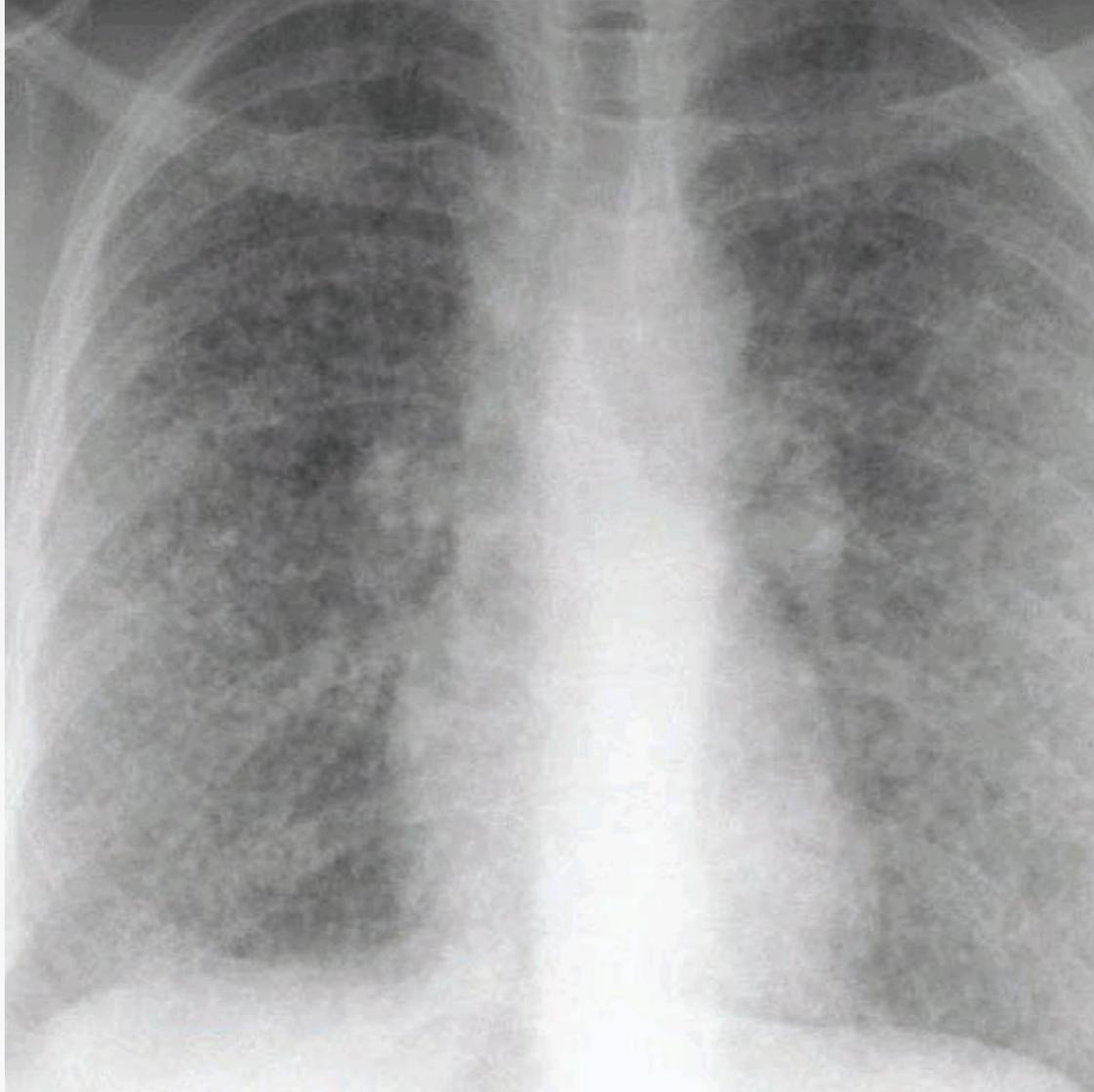


Tuberculoma



Miliary tuberculosis

- Miliary tuberculosis is a diffuse random distribution of tiny nodules seen in hematogenously disseminated TB. •
 - Miliary TB can occur in primary or reactivation TB.
- 



Healed tuberculosis

- Healed TB is evident on radiography as apical scarring, usually with upper lobe volume loss and superior hilar retraction.
 - Calcified granulomas may be present as well, which indicate containment of the initial infection by a delayed hypersensitivity response.
- 

