肺實質化病變與肺塌陷

2019/8/11 10:30

三軍總醫院 胸腔內科

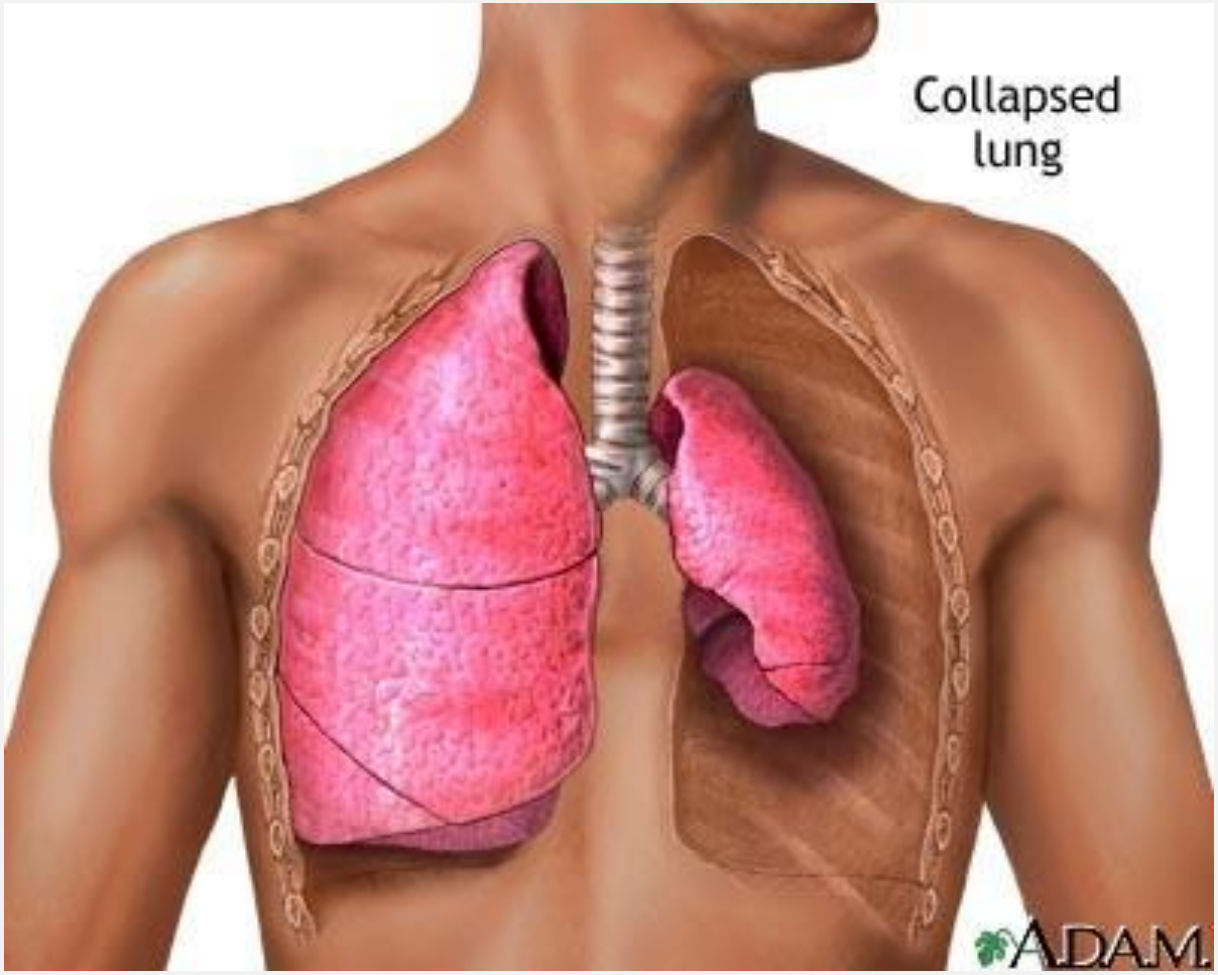
吳世偉

Contents

- Atelectasis / Collapse of lung
  - Types
  - Patterns

- Consolidation

Definition of atelectasis



希臘字源
Incomplete expansion

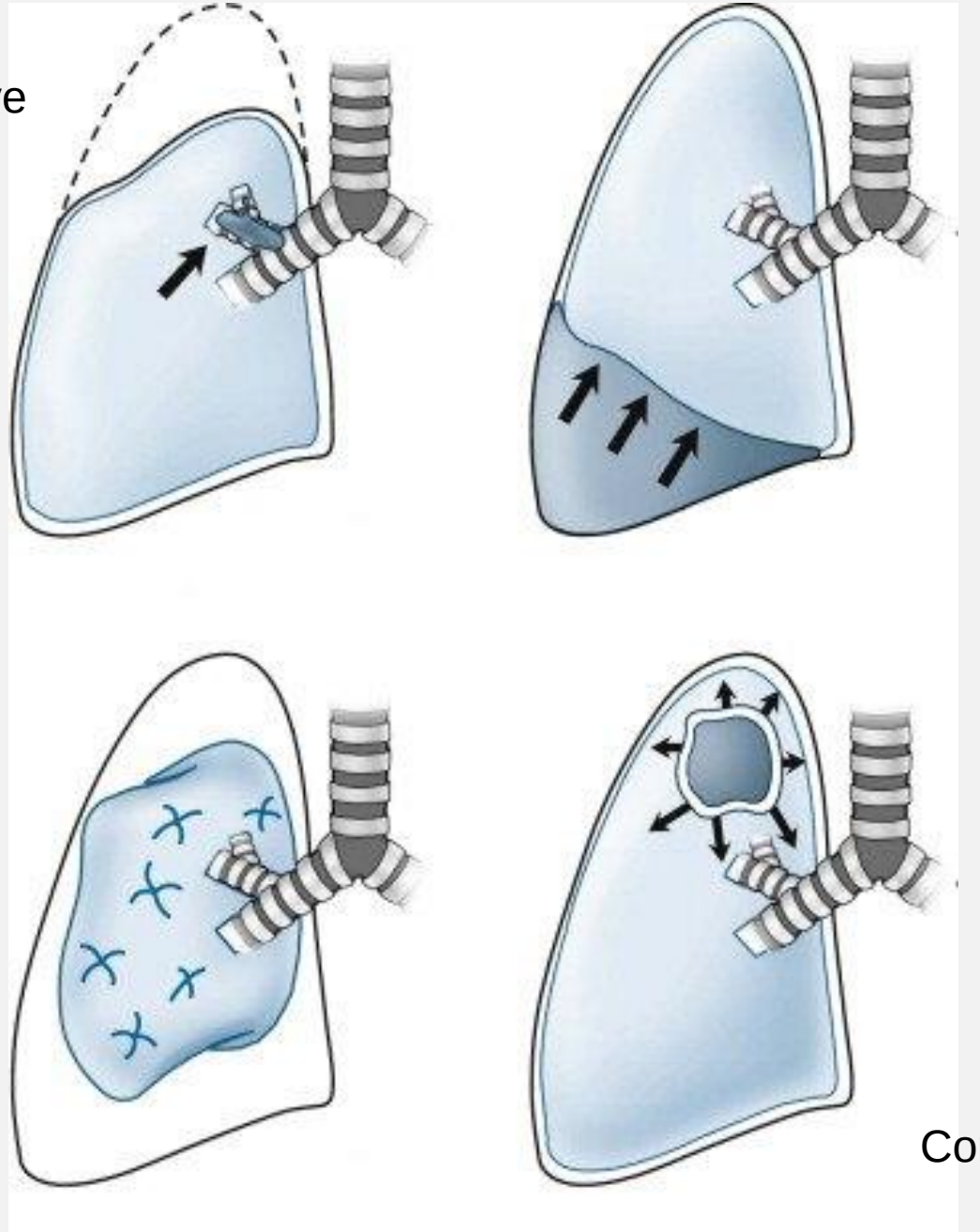
Loss of lung volume

Types of atelectasis

Type	Mechanism	Examples
Obstructive (resorptive)	Resorption of alveolar air by circulating blood	Endobronchial lesions
Passive (extrapulmonary)	Loss of negative pleural pressure	Pneumothorax, pleural effusion
Compressive (intrapulmonary)	Direct compression	Space occupying lesion, huge bullae
Cicatricial	Parenchymal scarring	Old TB, radiation pneumonitis
Adhesive	Loss of surfactant	Infant RDS, ARDS, acute RP
Acceleration	Gravity effect	-

Obstructive

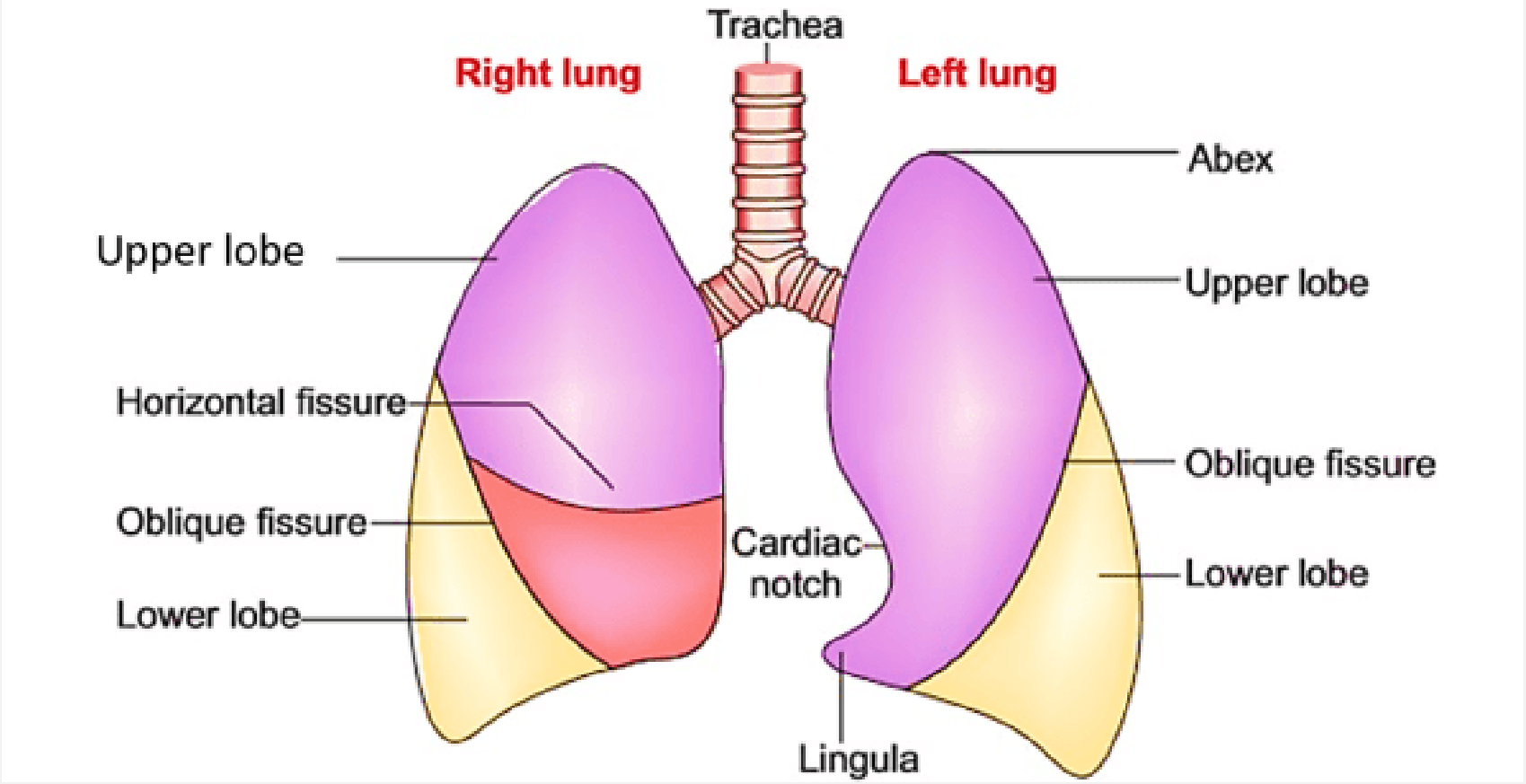
Passive



Cicatricial

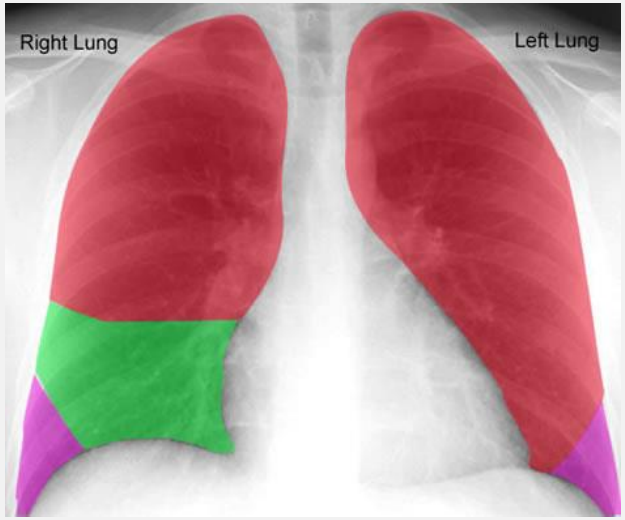
Compressive

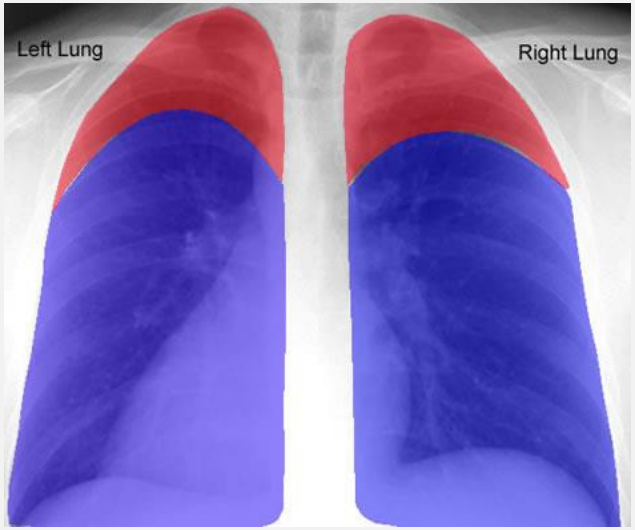
Anatomy


Trachea
Right lung
Left lung
Abex
Upper lobe
Upper lobe
Horizontal fissure
Oblique fissure
Oblique fissure
Cardiac notch
Lower lobe
Lower lobe
Lingula

Lobes

A

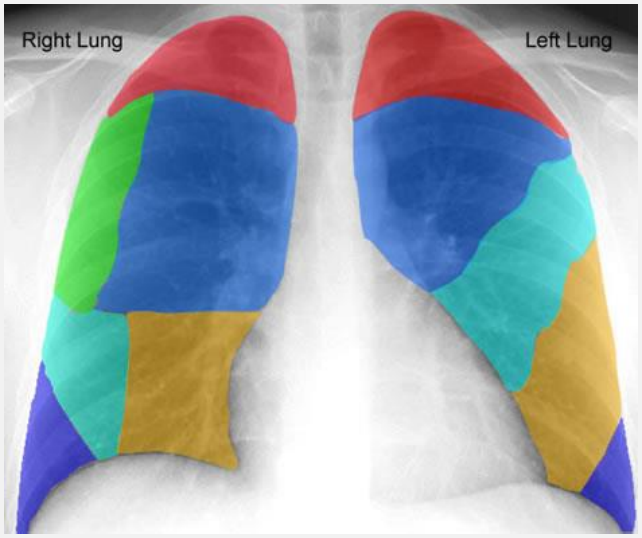


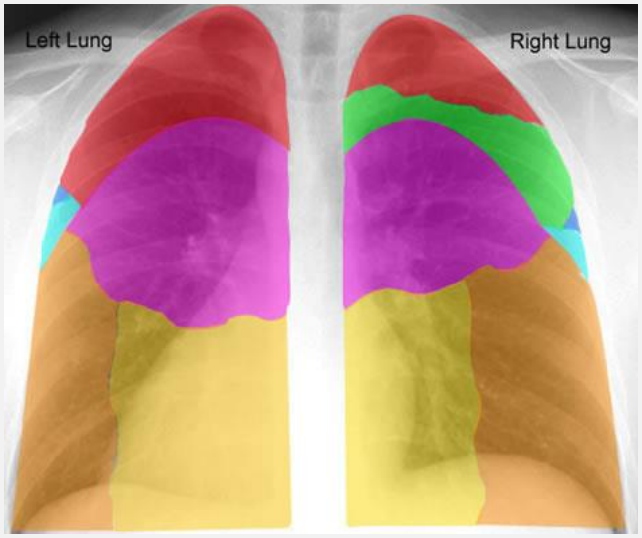


P

Segments

A

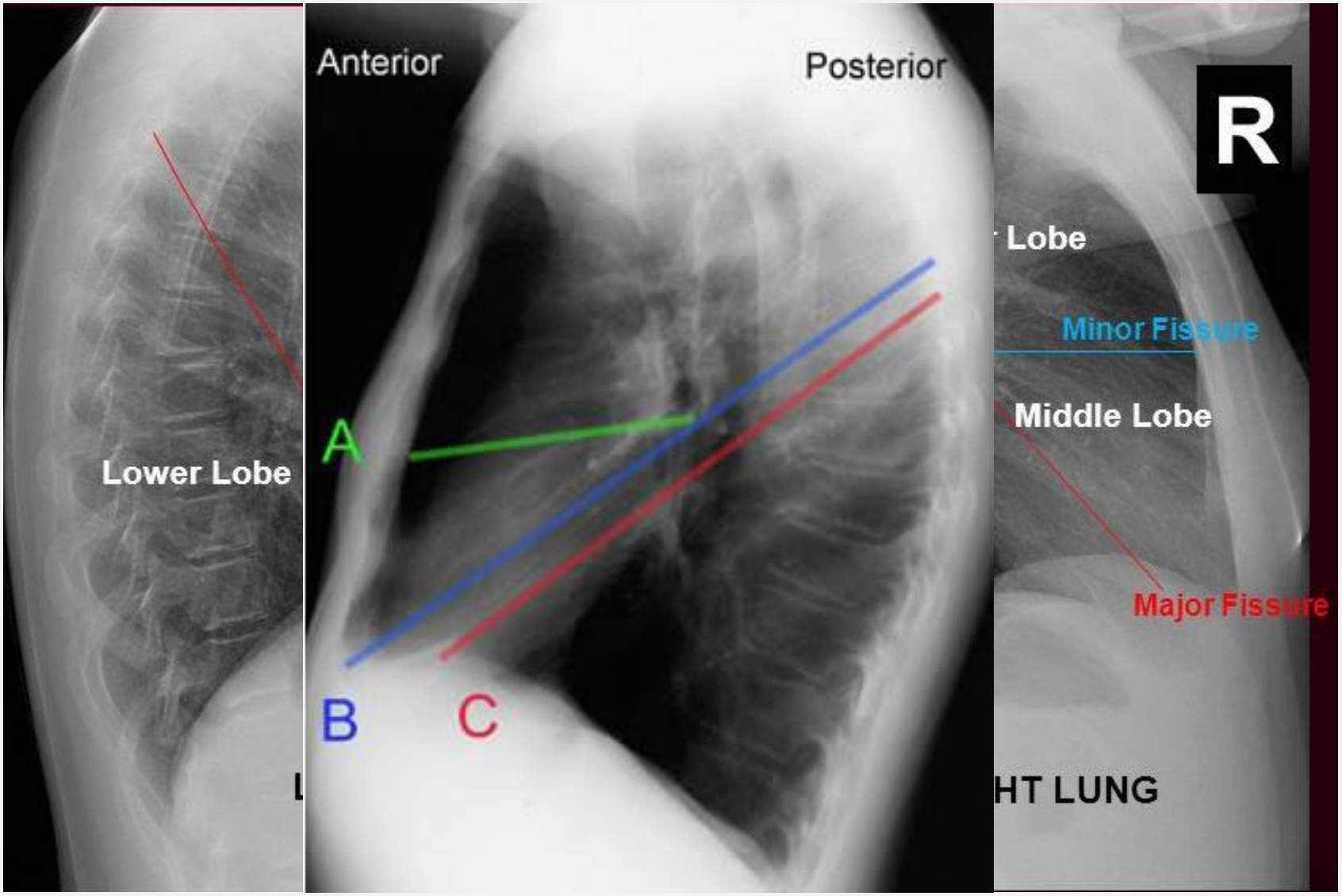




P

- **Right Lung containing:**
  - Upper Lobe: Apical Segment
  - Upper Lobe: Posterior Segment
  - Upper Lobe: Anterior Segment
  - Middle Lobe: Lateral Segment
  - Middle Lobe: Medial Segment
  - Lower Lobe: Anterior Basal Segment
- **Left Lung containing:**
  - Upper Lobe: Apical Posterior Segment
  - Upper Lobe : Anterior Segment
  - Upper Lobe: Lingula Superior Segment
  - Upper Lobe: Lingula Inferior Segment
  - Lower Lobe: Anteromedial Segment

CXR anatomy


Anterior
Posterior
R
Lower Lobe
A
B
C
Lobe
Minor Fissure
Middle Lobe
Major Fissure
HT LUNG

Direct signs of lung collapse

- Displacement of interlobar fissure.
- Crowding of the broncho-vascular markings.
- Increased lung opacity.

Indirect signs of lung collapse

- Hilar displacement.
- Mediastinal shift.
- Diaphragmatic elevation.
- Rib approximation.
- Compensatory hyperinflation.

Special signs

- Luftsichel sign.
- Juxtaphrenic peak.
- Superior triangle sign.

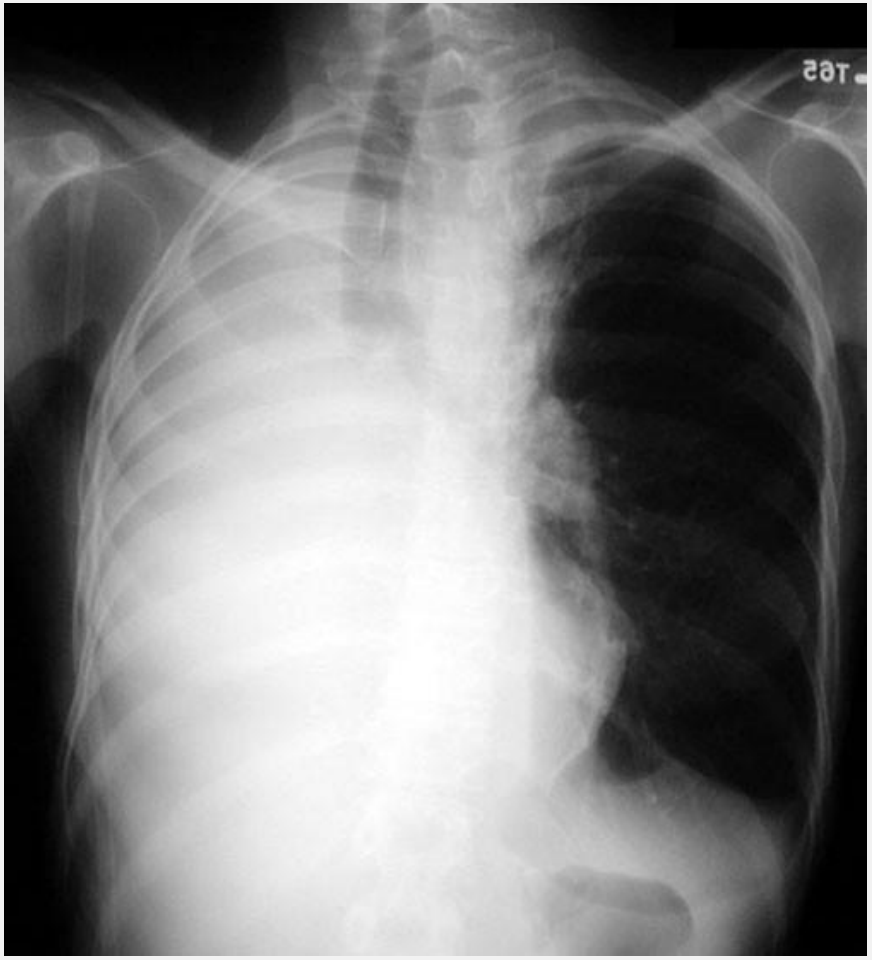
Patterns of lung collapse

- Entire lung collapse
- Lobar collapse
- Segmental collapse
- Other patterns
  - Sub-segmental atelectasis
  - Round atelectasis

Complete lung collapse - DDx

- Main bronchus obstruction
- Massive pleural effusion
- Massive pneumothorax

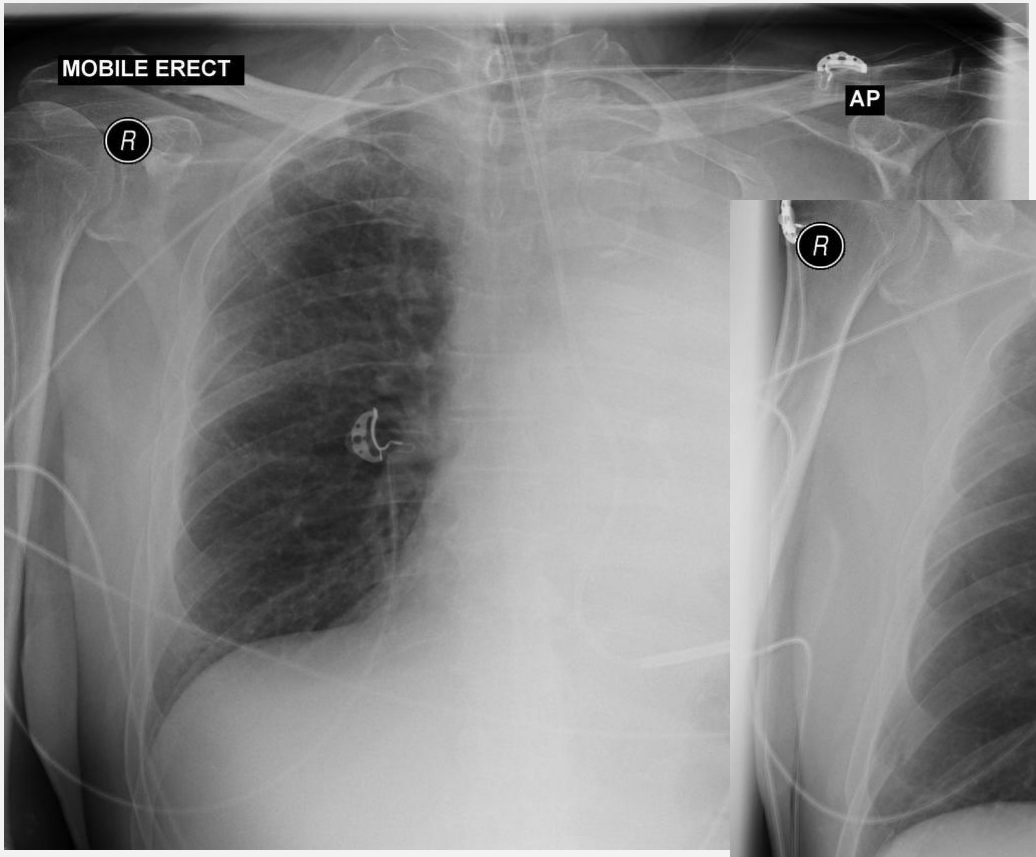
Main bronchus obstruction

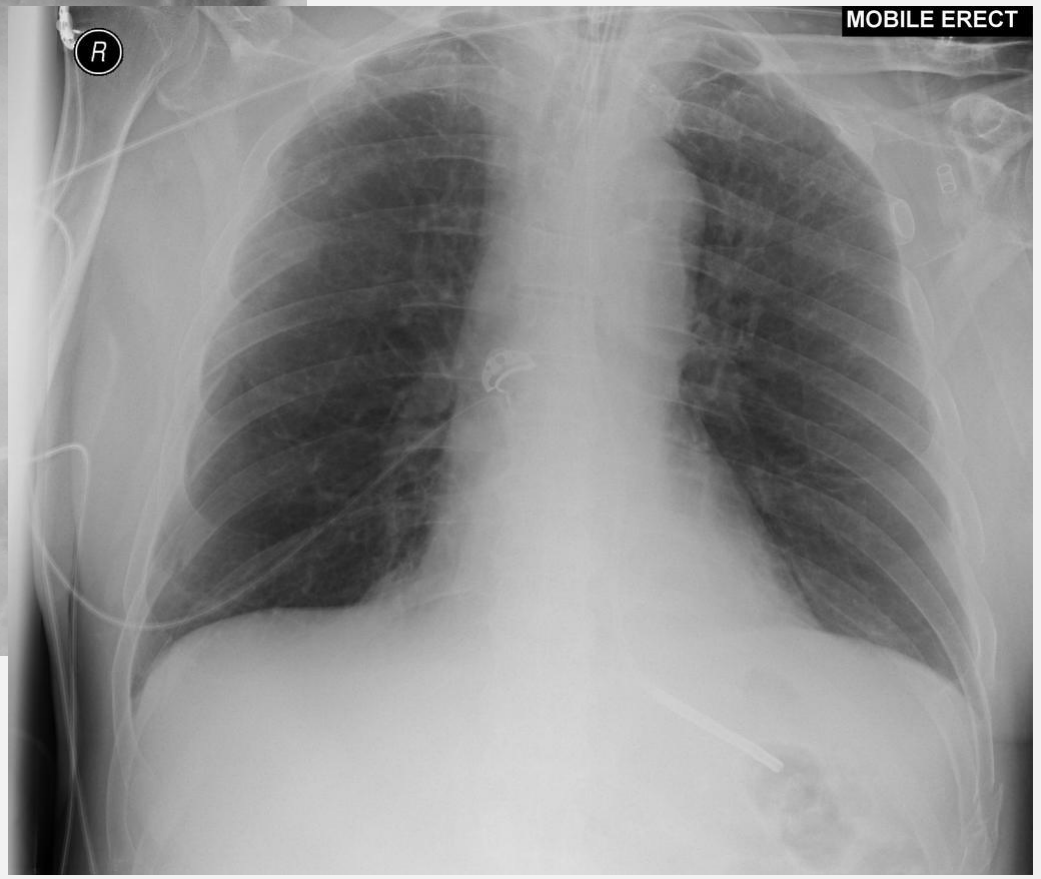


- Crowding of the broncho-vascular markings.
- Increased lung density with absence of airbronchogram.

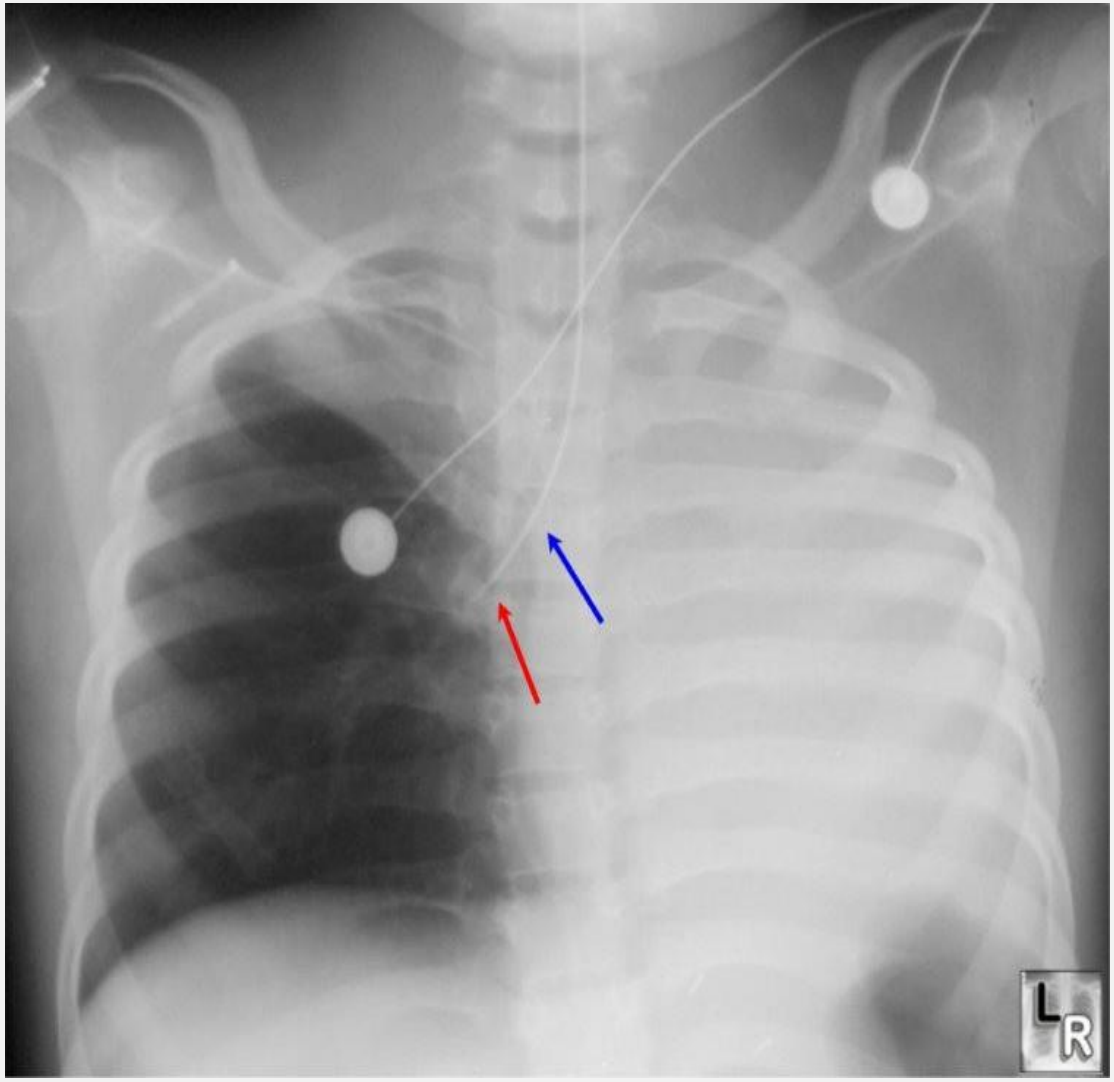
- Diaphragm elevation.
- Mediastinal shift.
- Rib approximation.
- Compensatory hyperinflation.
- Bronchial cutoff.

Sputum impaction

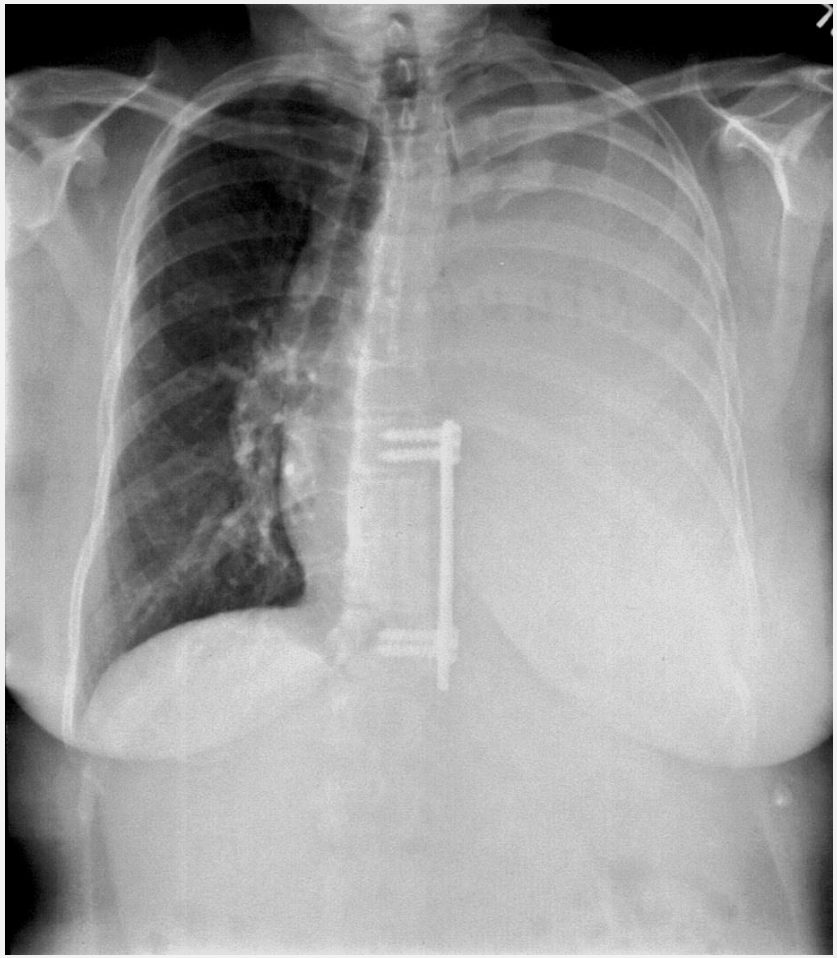




One lung intubation

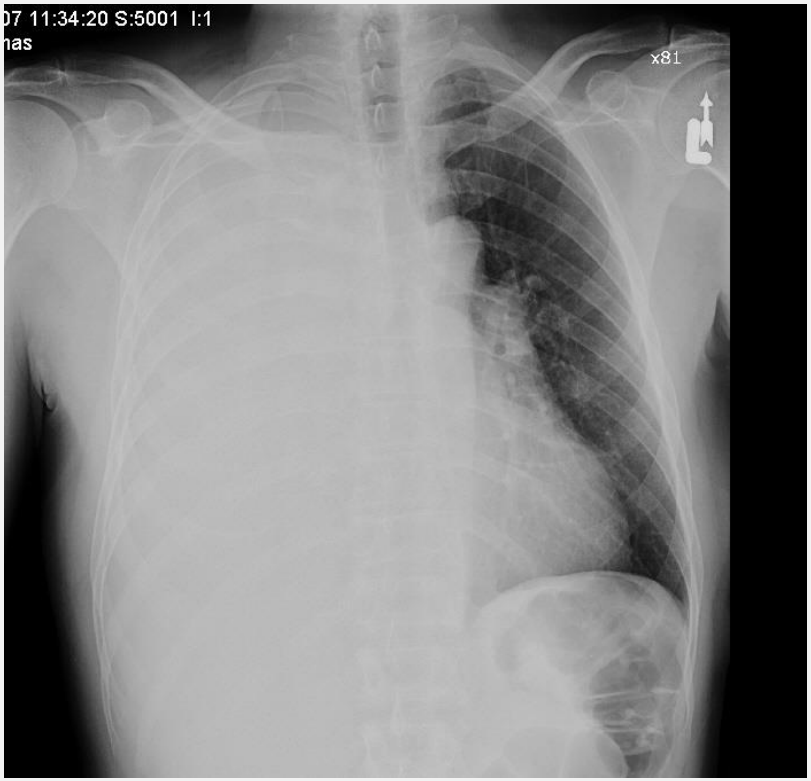


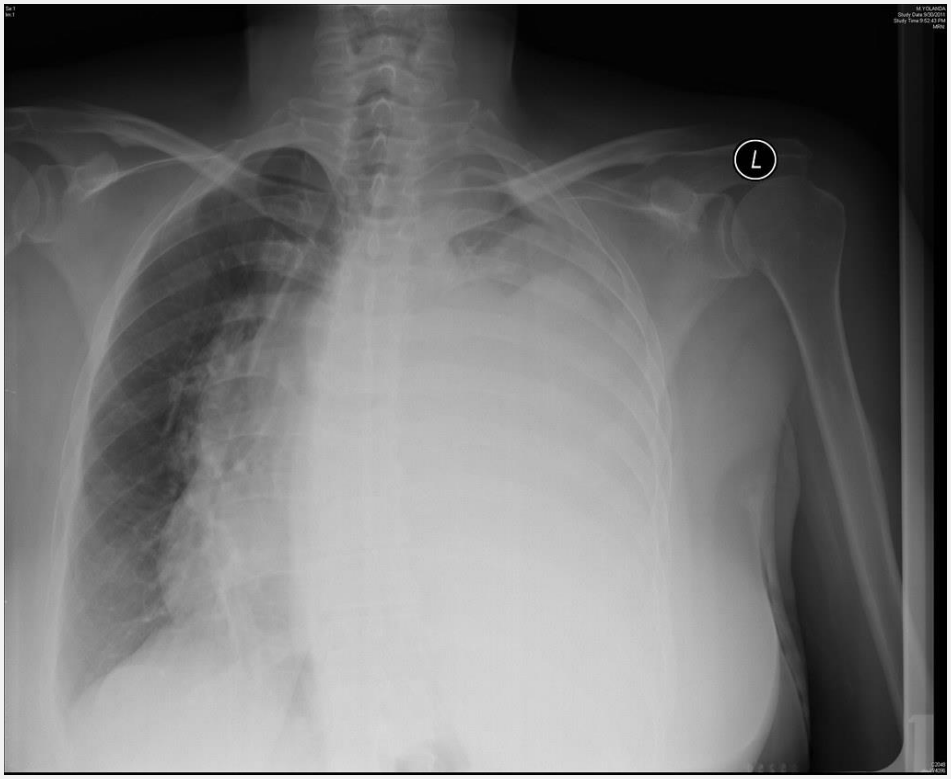
Massive pleural effusion



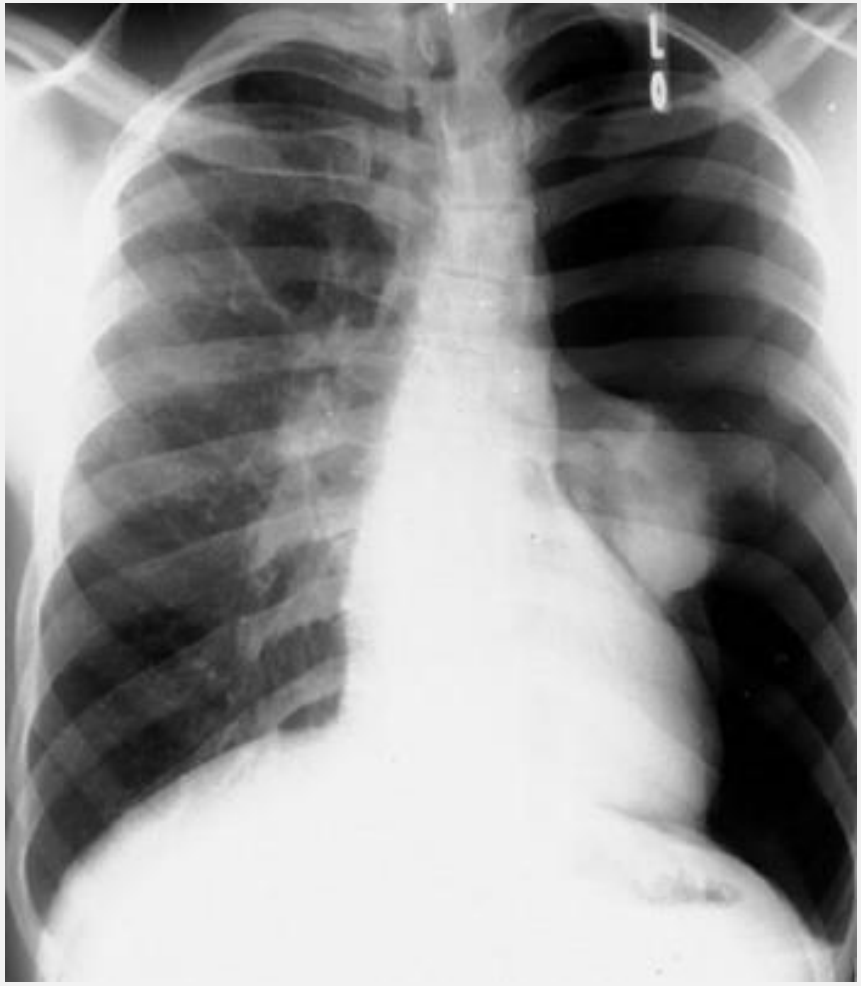
- Complete opacification of the ipsilateral hemithorax.
- Mediastinal shift to the opposite side.

Massive pleural effusion



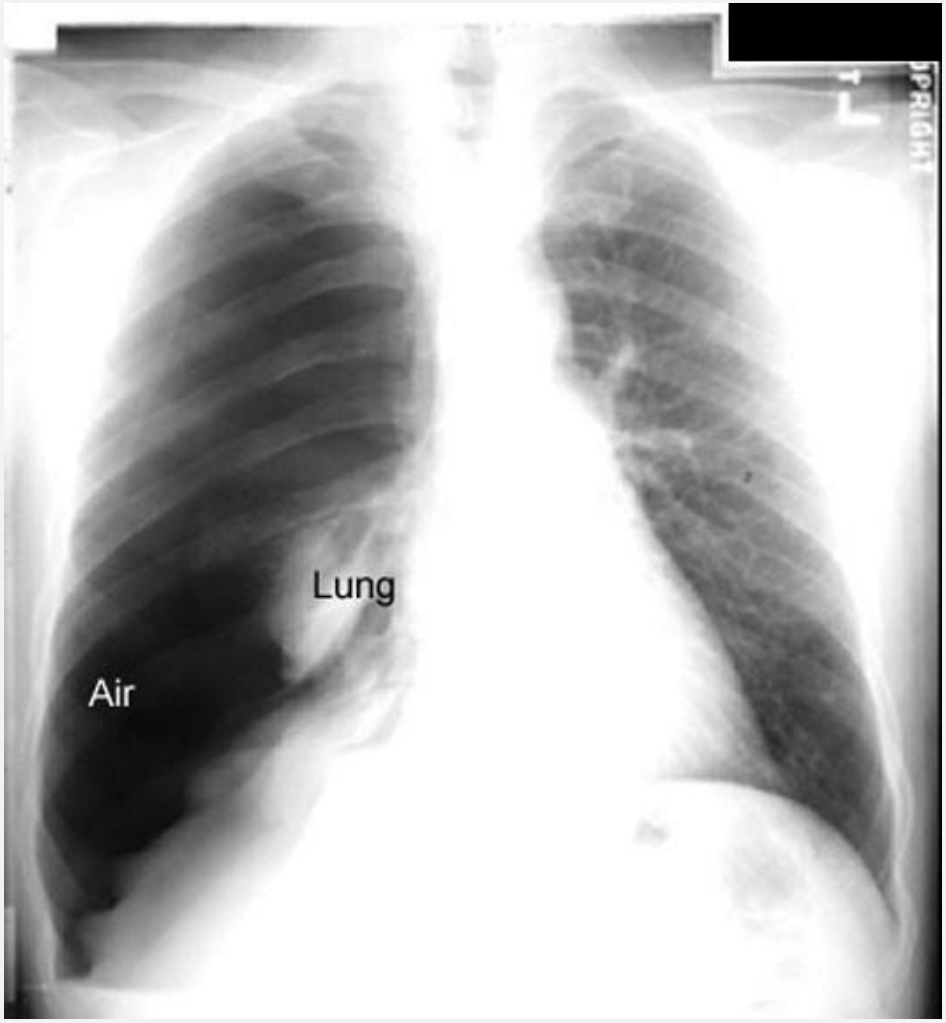


Massive pneumothorax

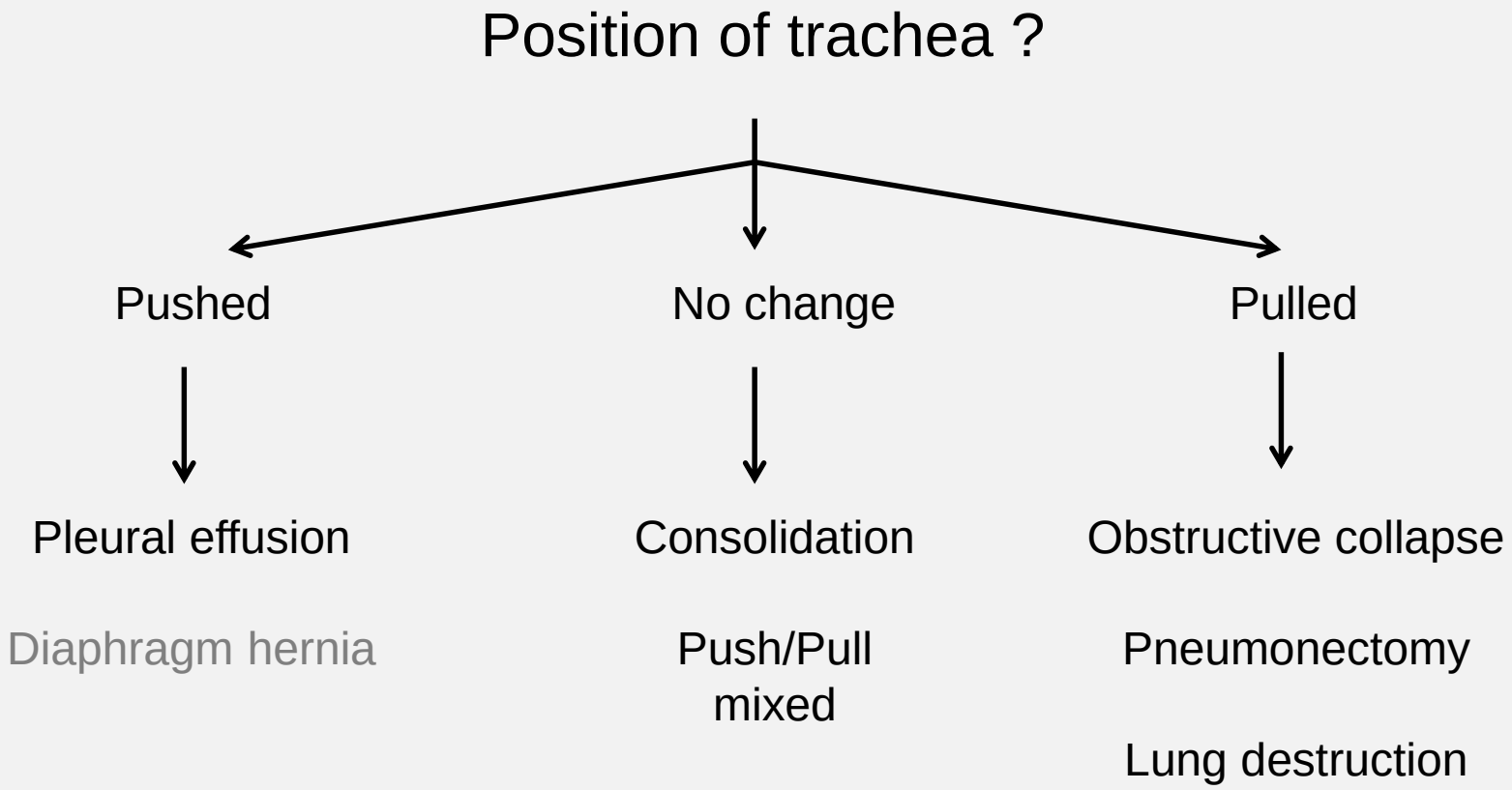


- Presence of pneumothorax.
- The lung is tethered to the hilum.

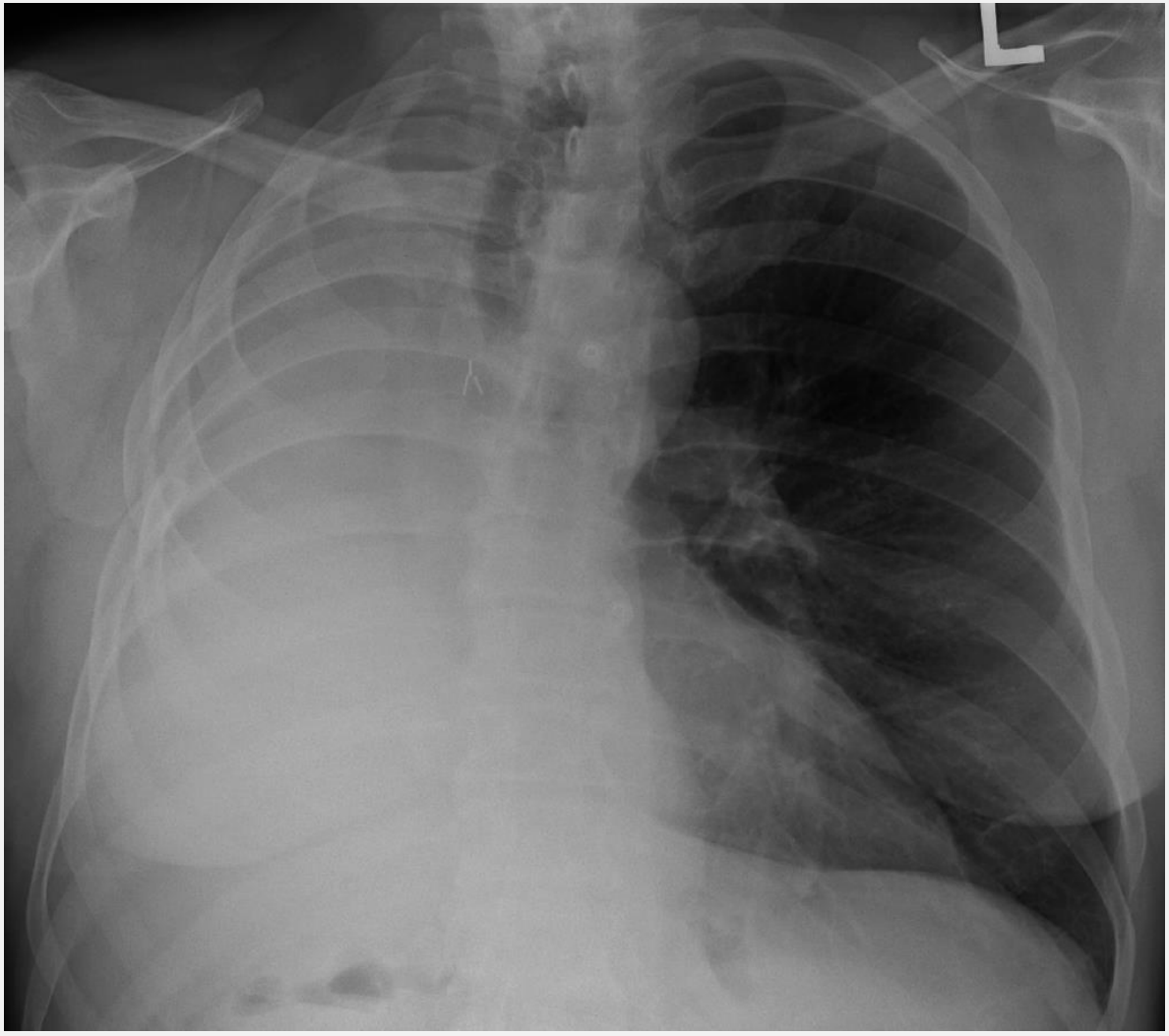
Massive pneumothorax

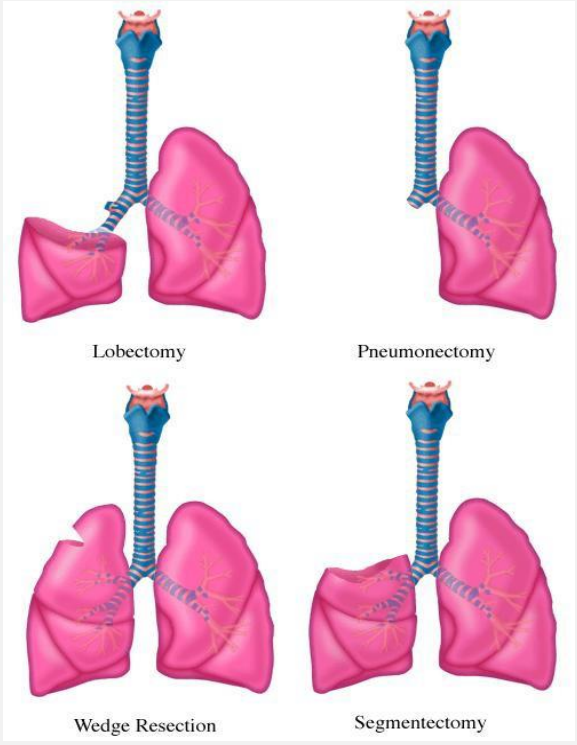


DDx of complete opacification

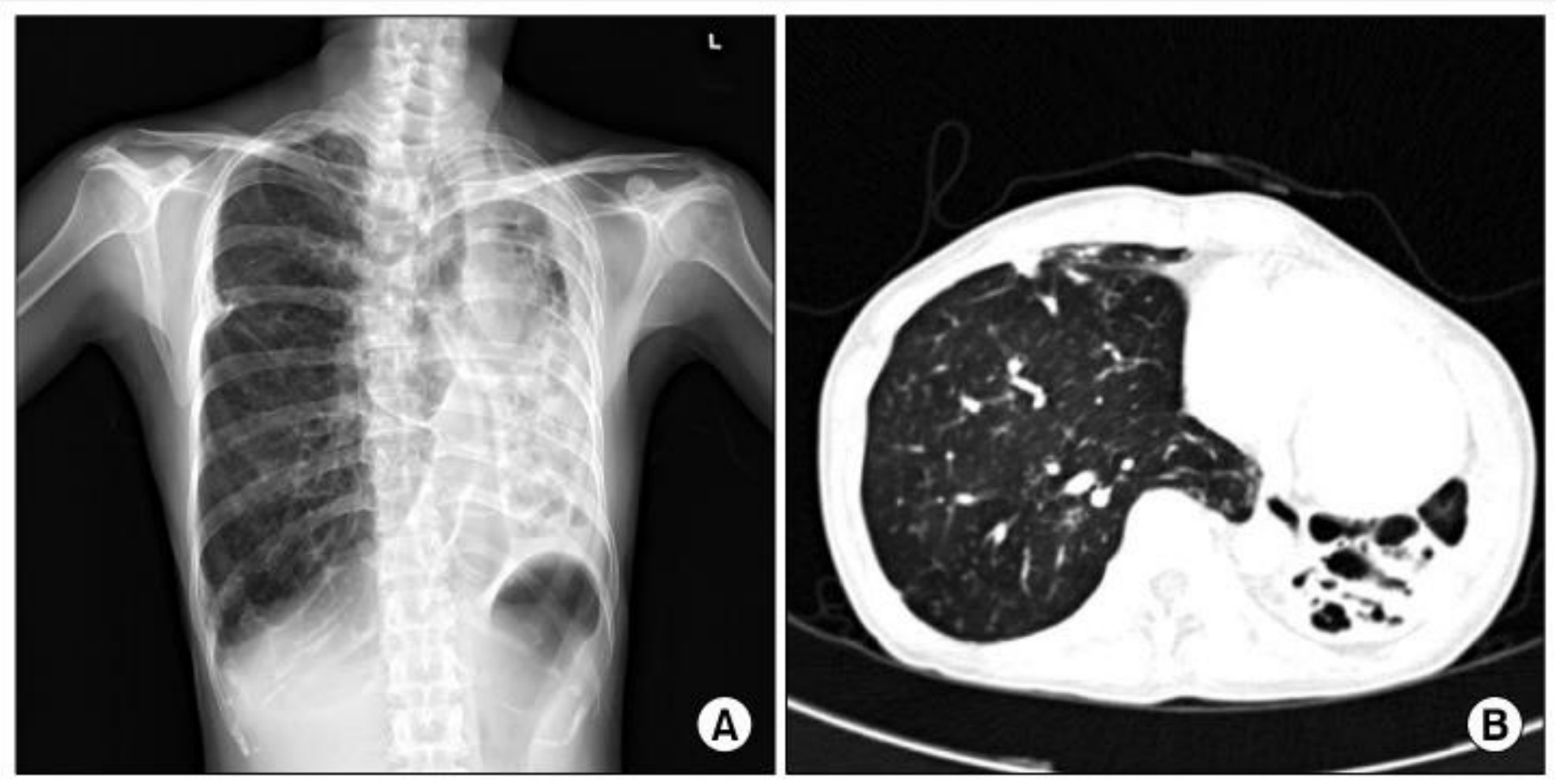


Example of pneumonectomy

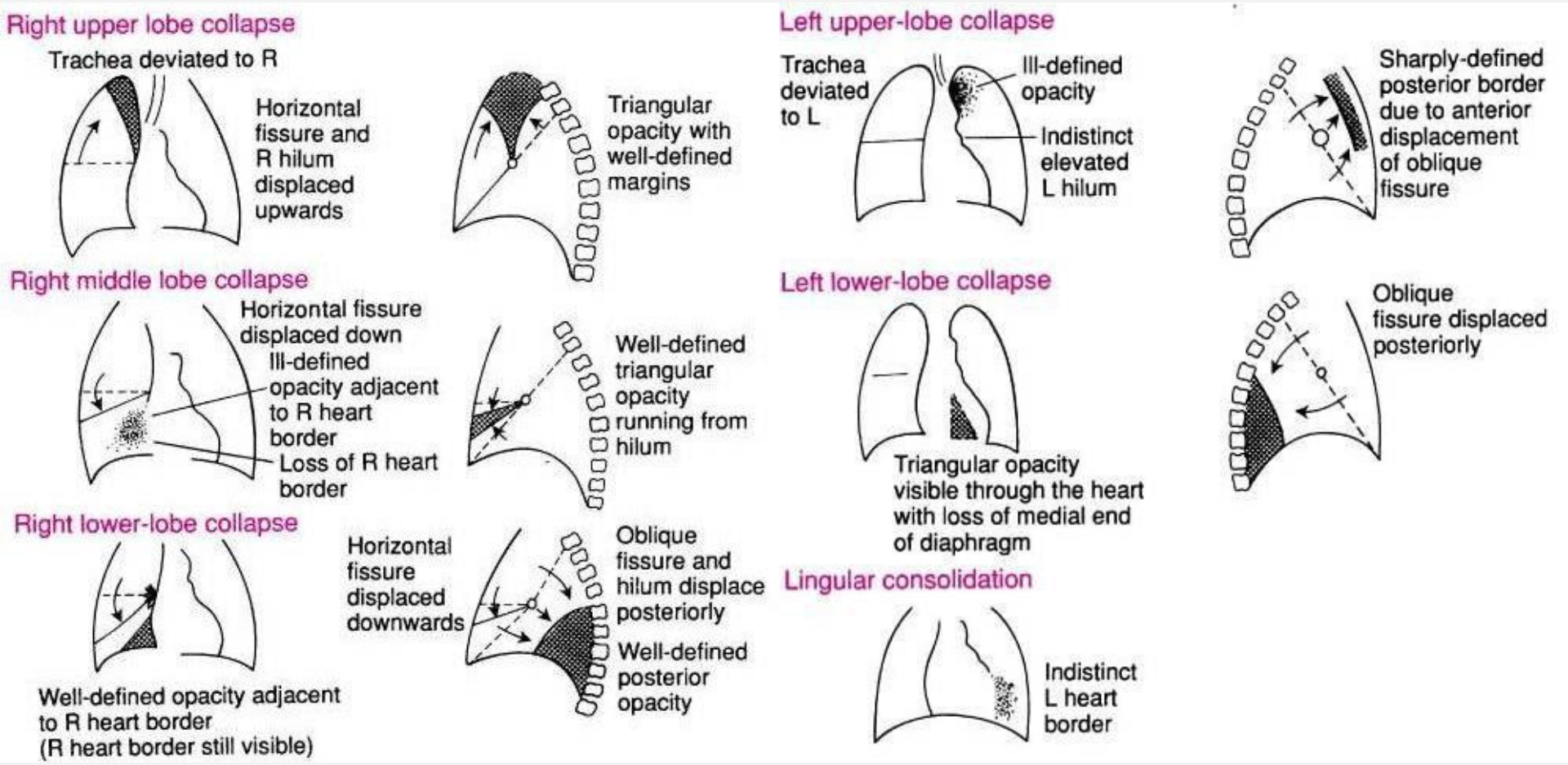




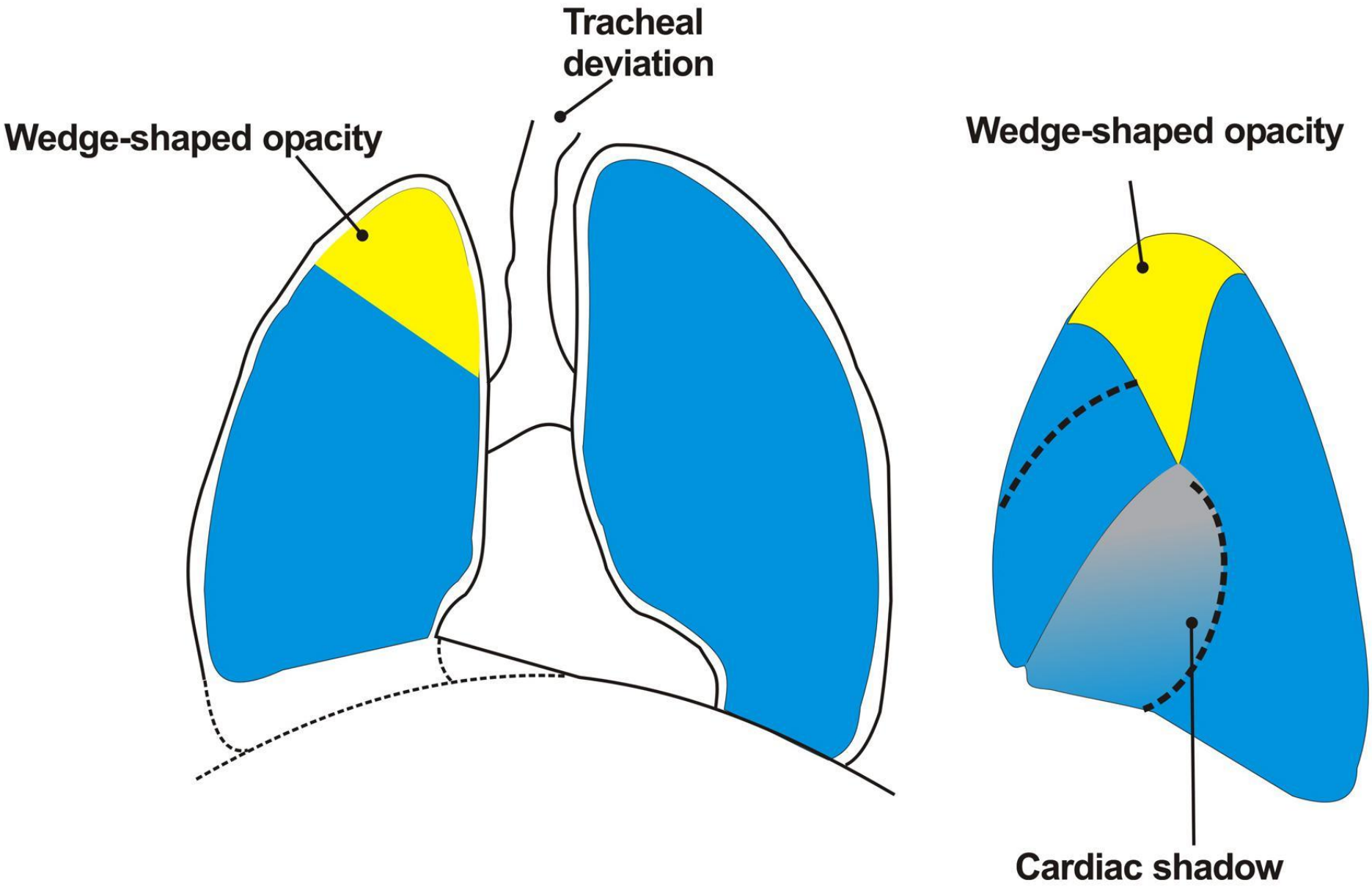
Old TB with lung destruction



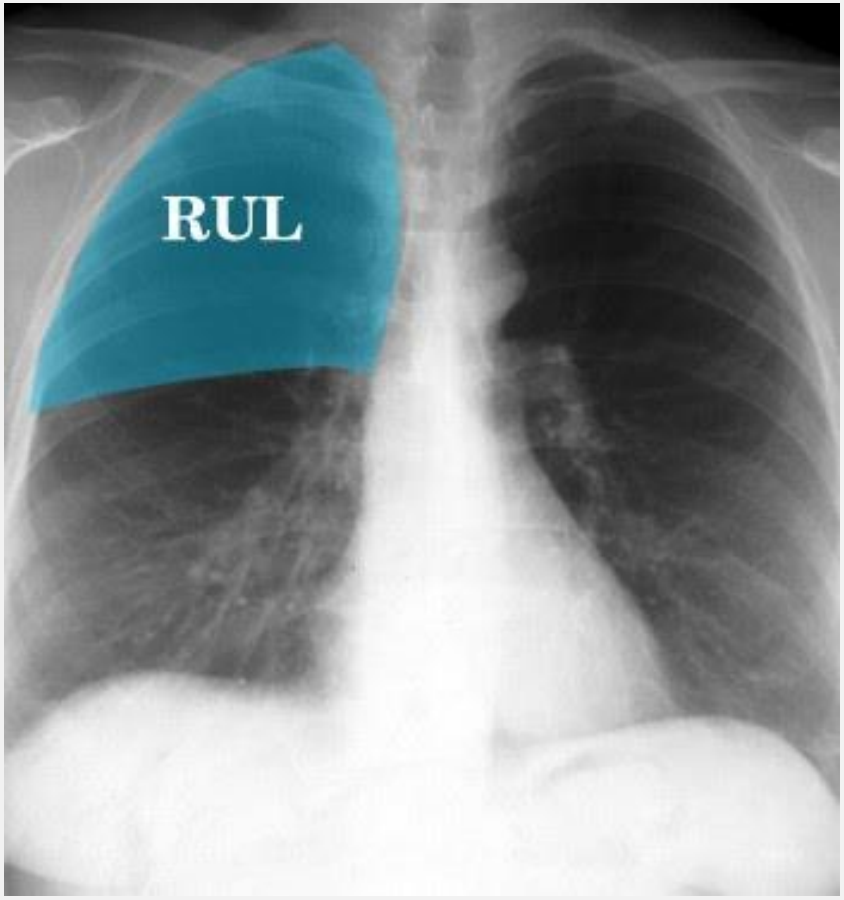
Lobar collapse

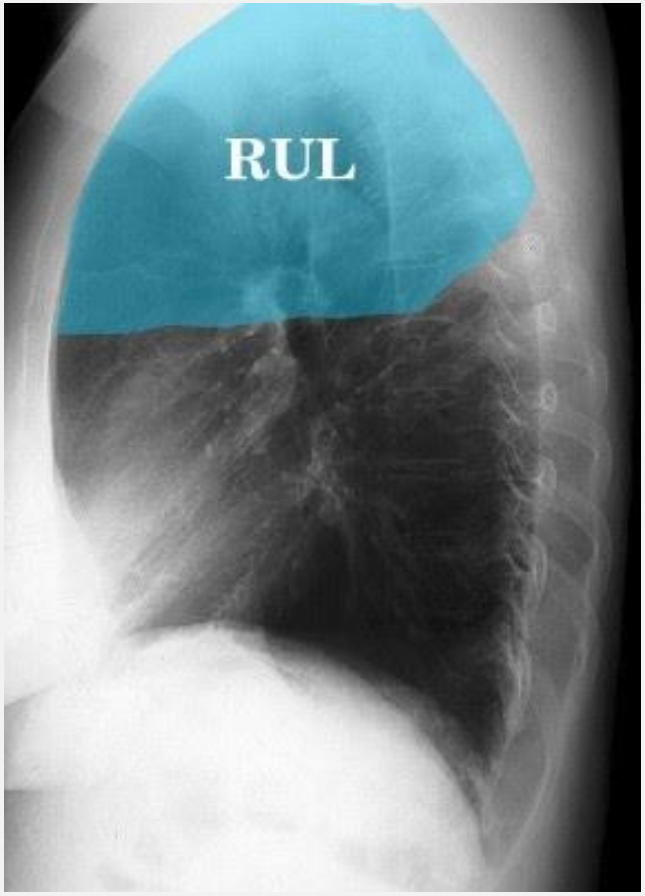


Right upper lobe collapse

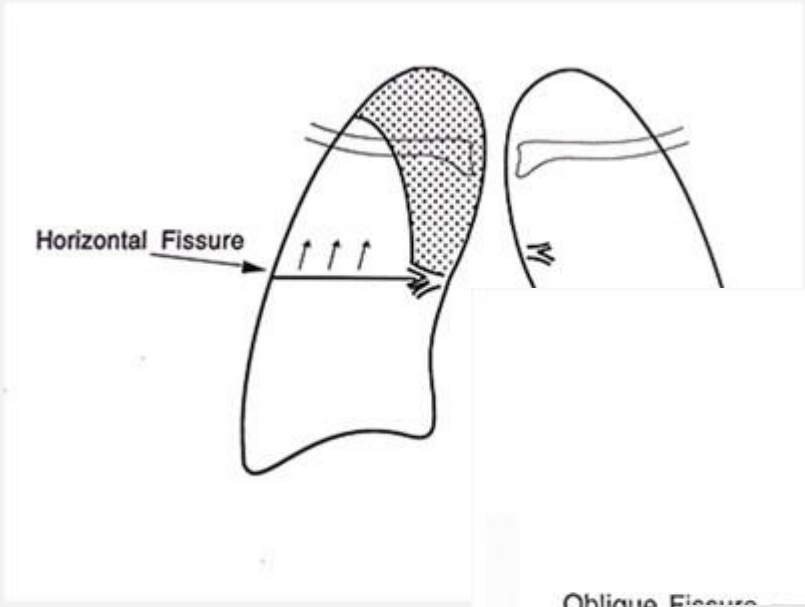


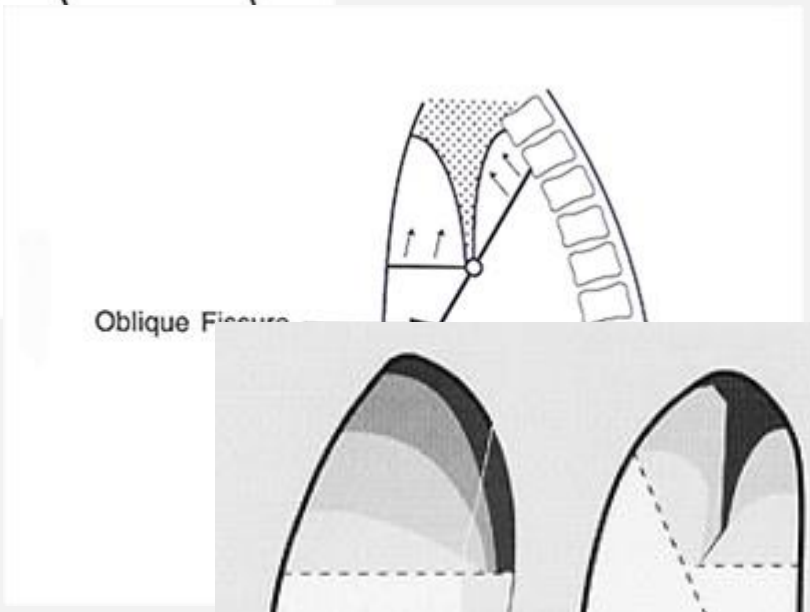
Normal RUL range

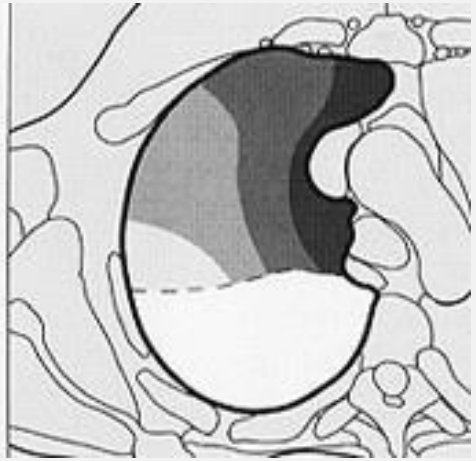




Progression of RUL collapse

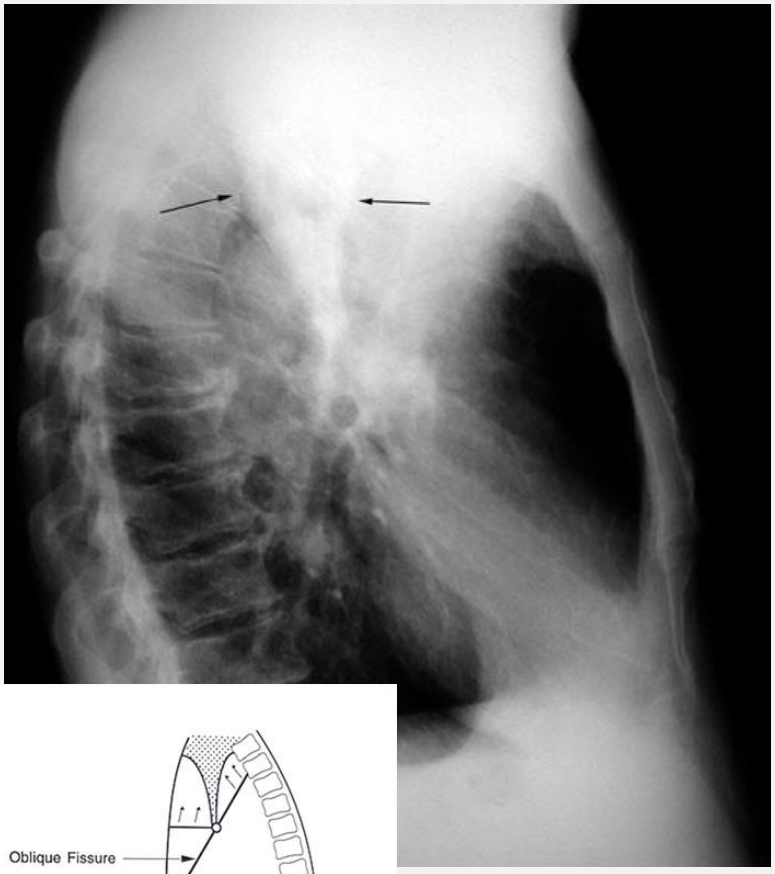






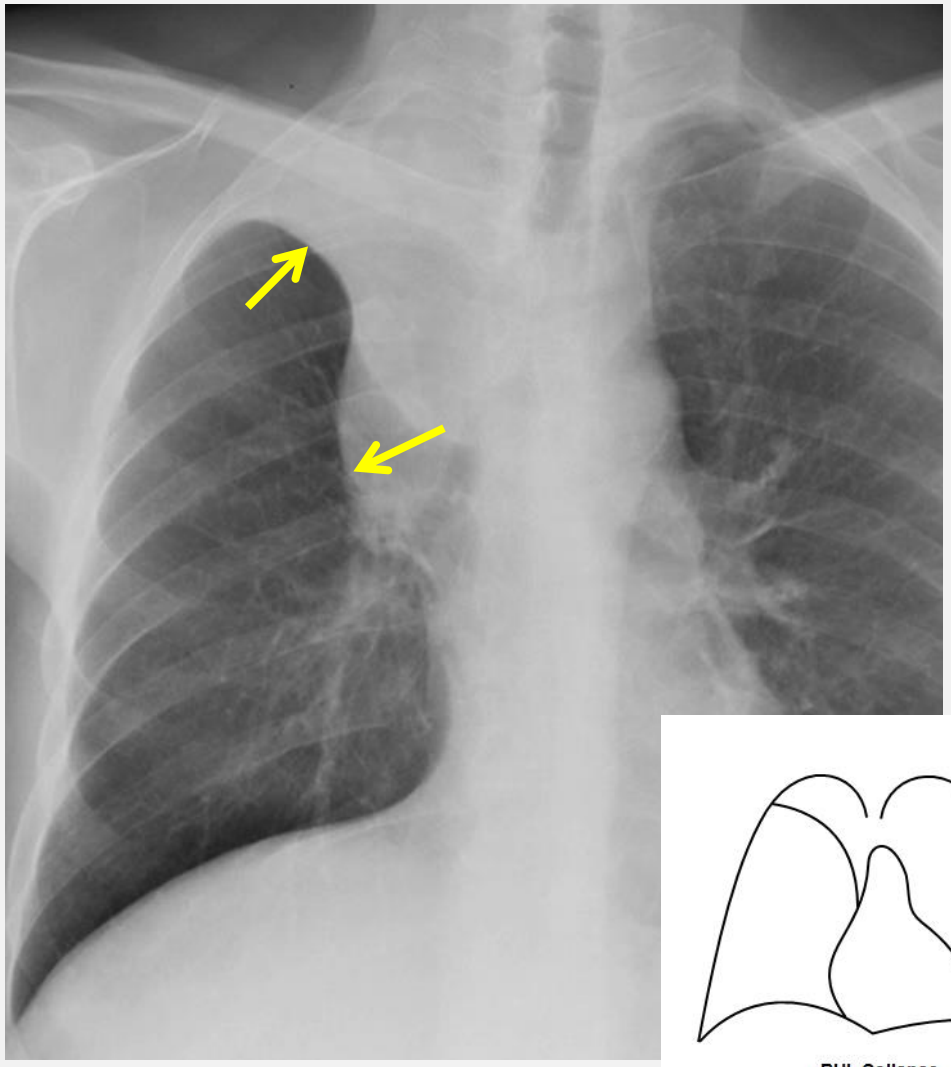
Features of RUL collapse

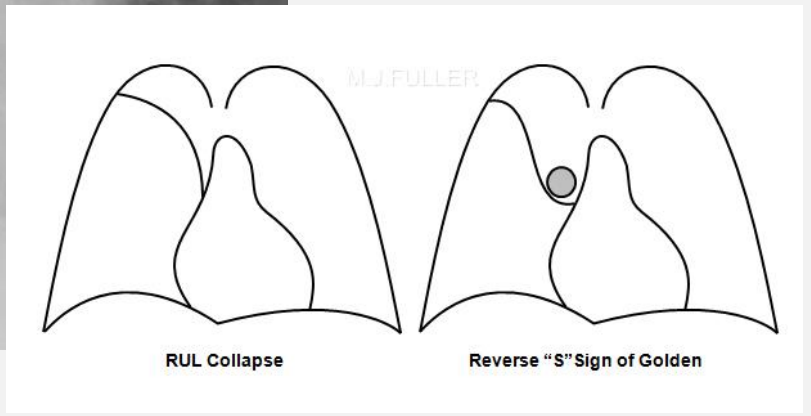
- Major and minor fissures move upward
- The minor fissure shows concave figure
- RUL packs against the mediastinum and lung apex
- Causes silhouette sign with the SVC shadow
- Juxtaphrenic peak



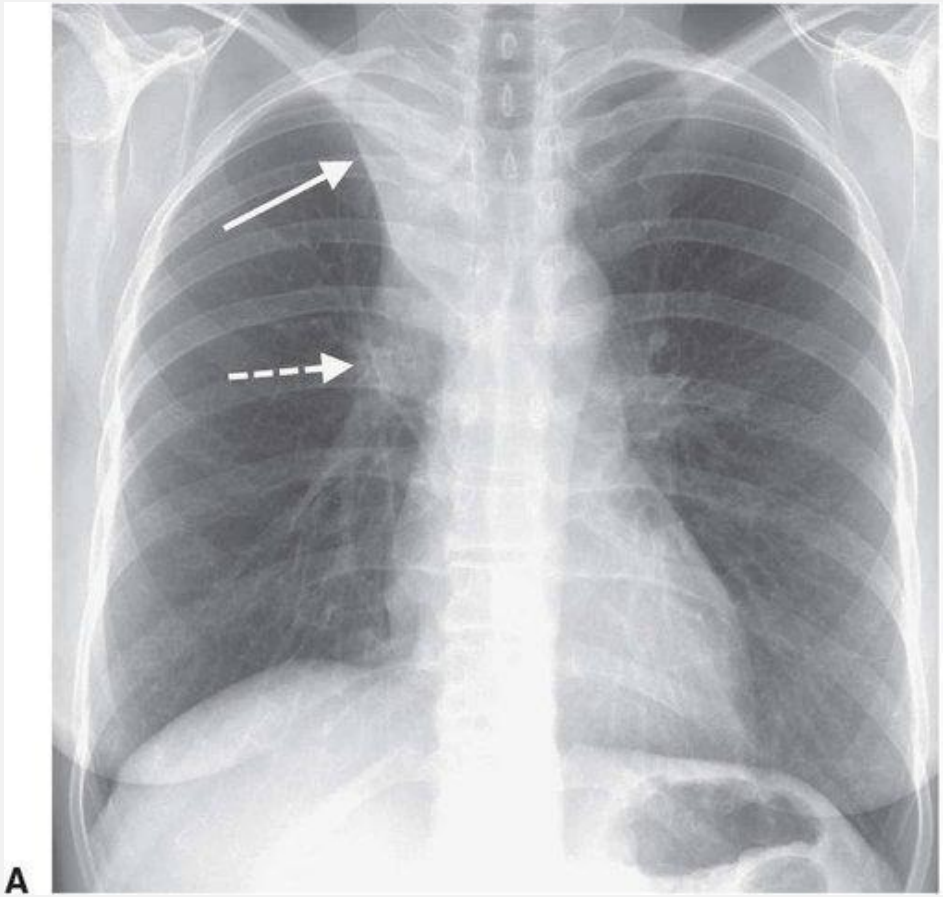
Elevated hilum

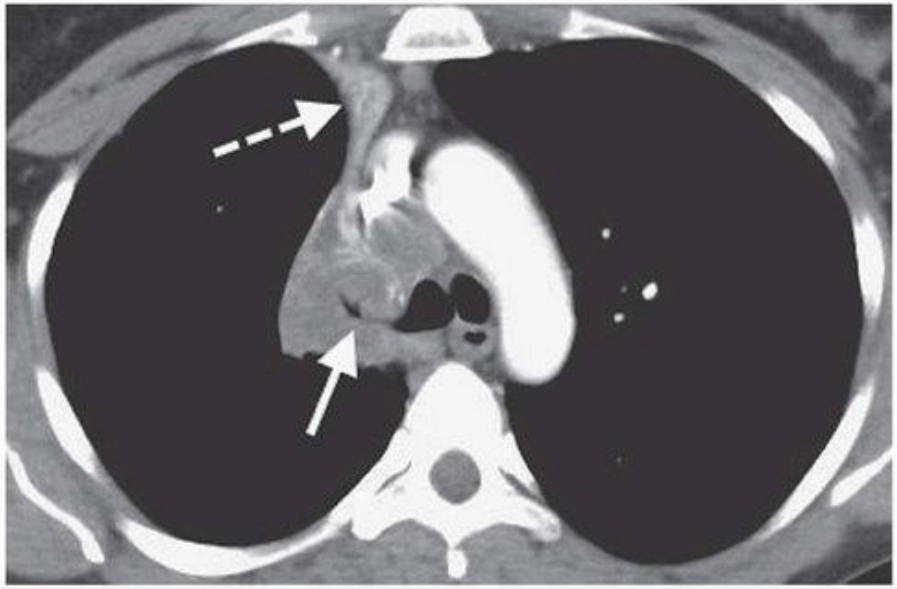
Golden S sign (+/-)



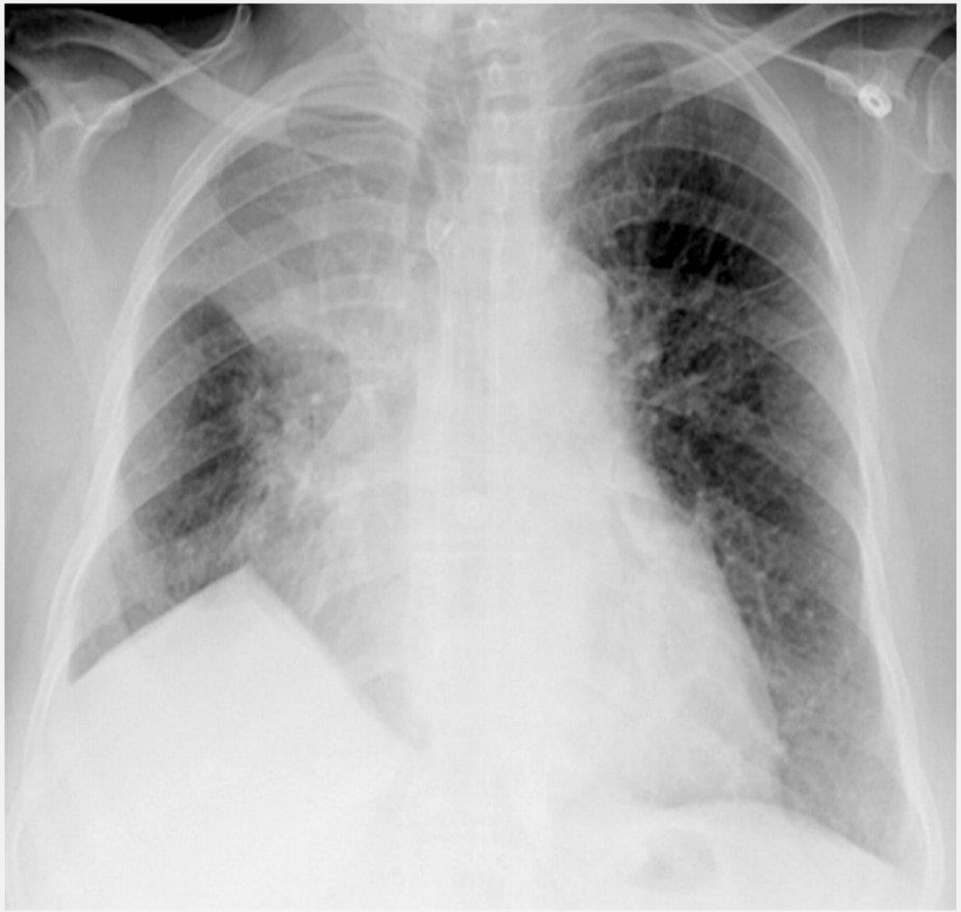


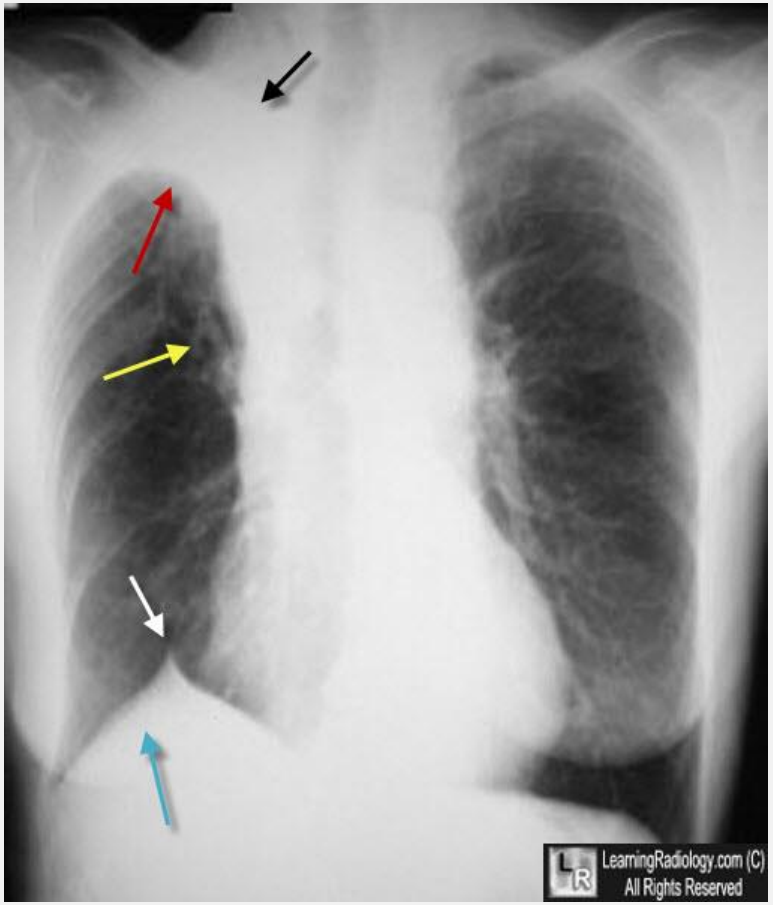
SCC of lung



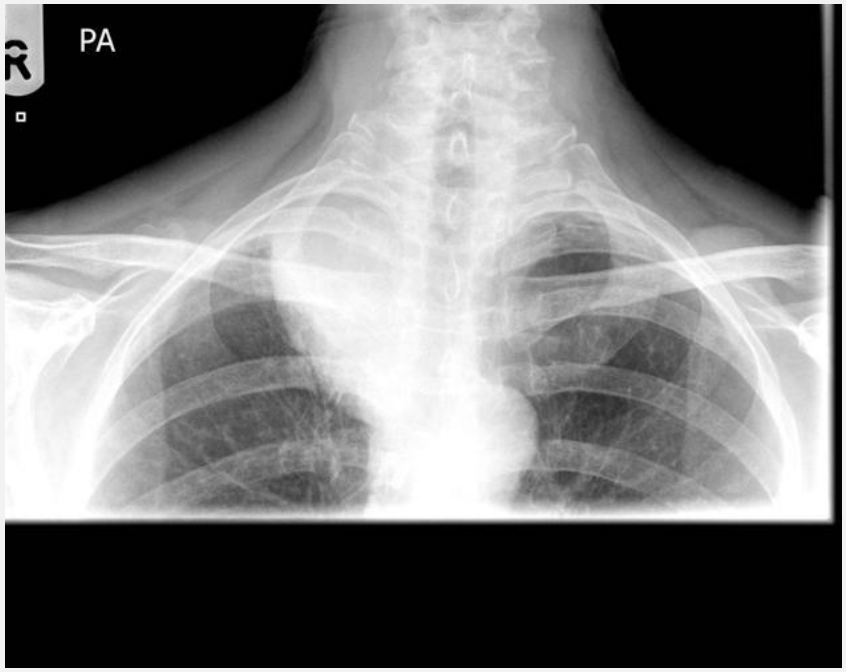


Juxtaphrenic peak (+/-)

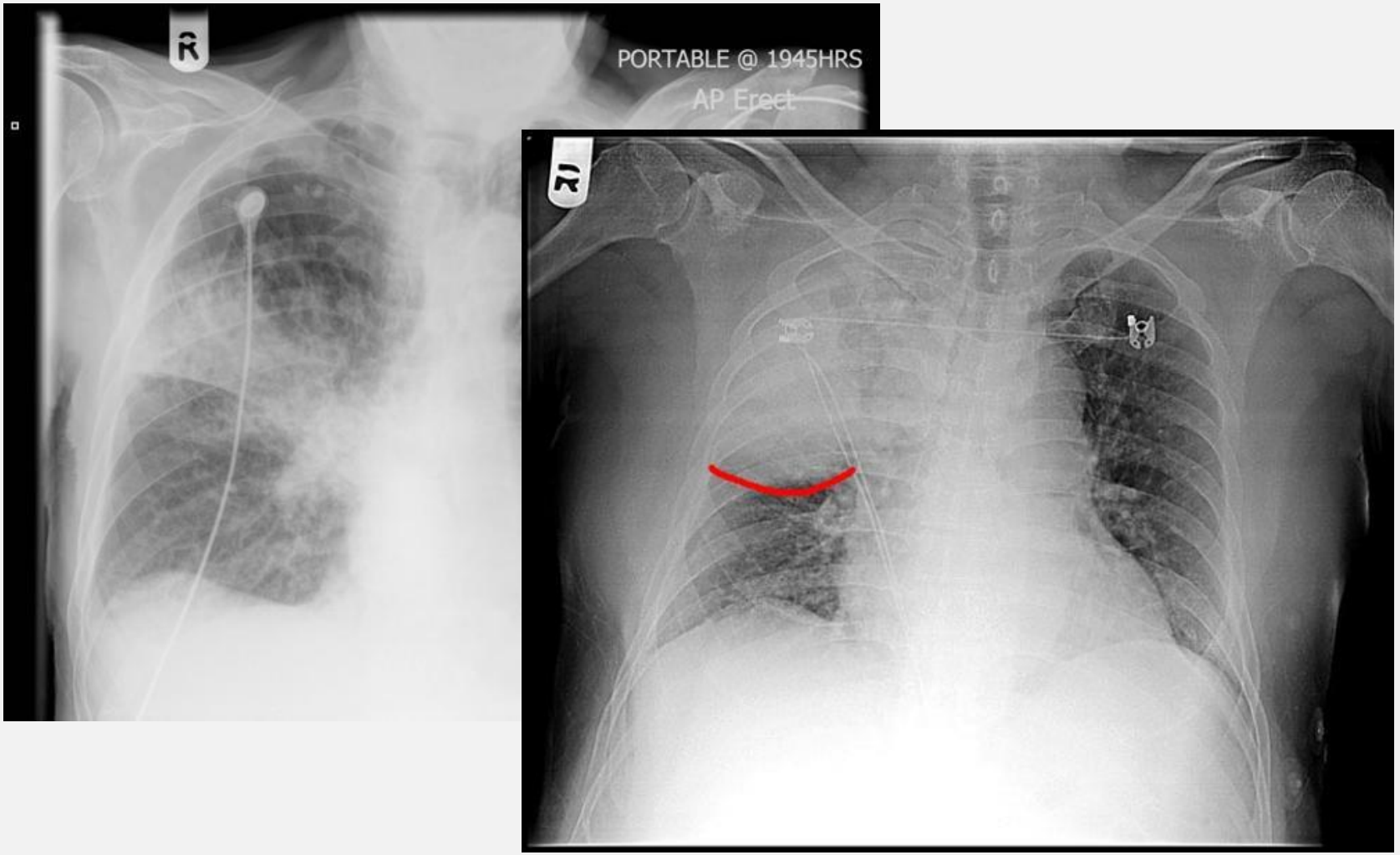




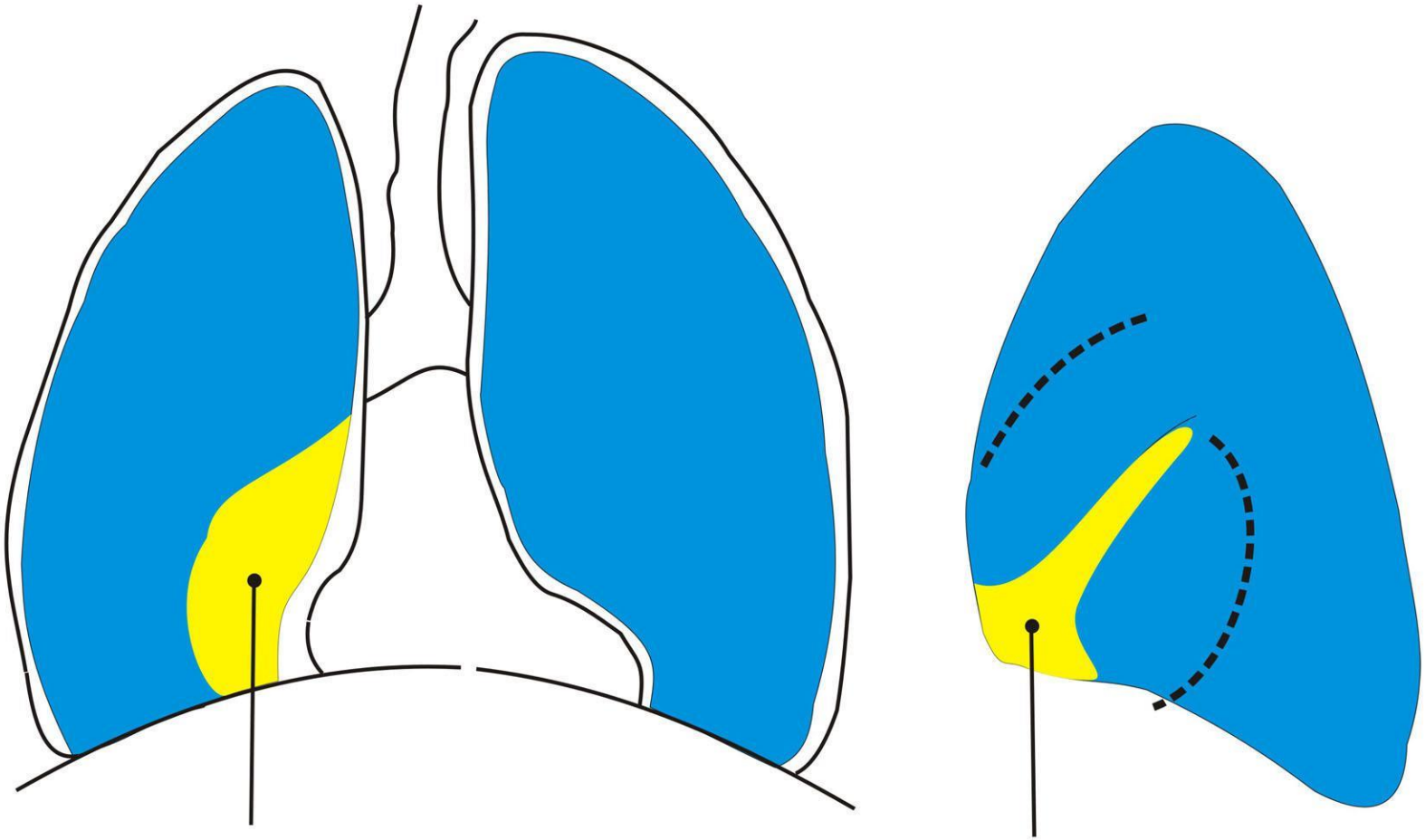
DDx - mass



DDx - consolidation



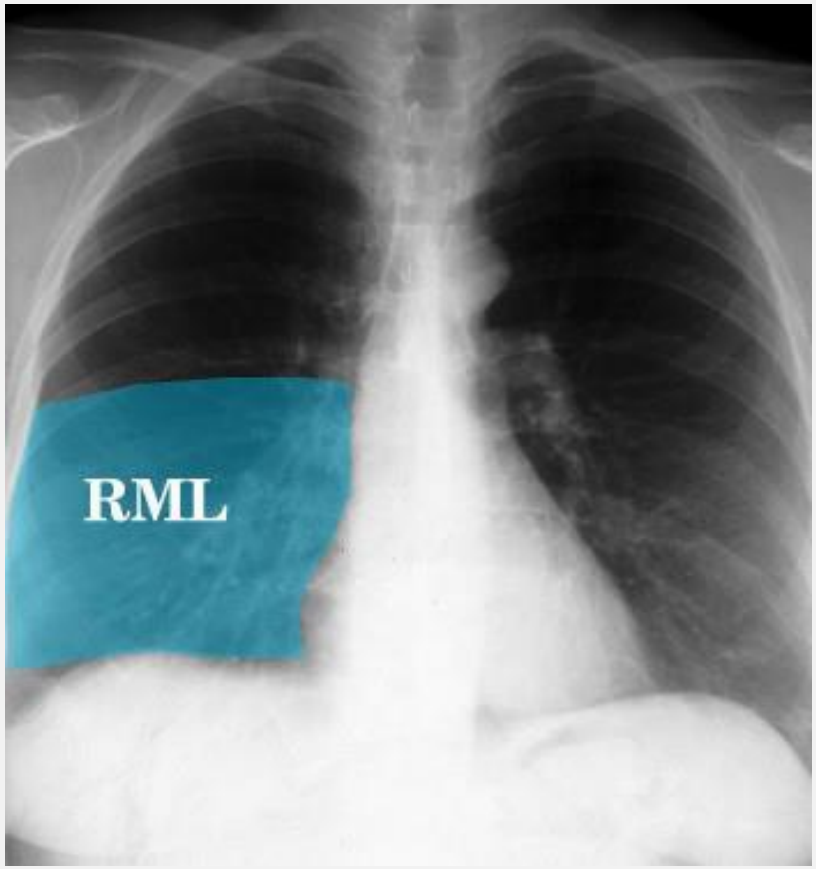
Middle lobe collapse

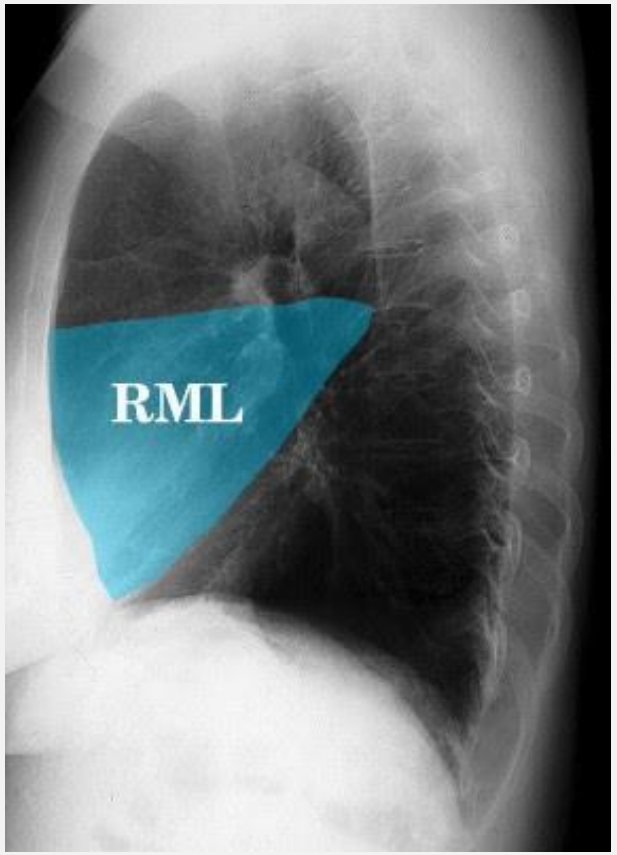


Hazy opacification with loss of right heart border

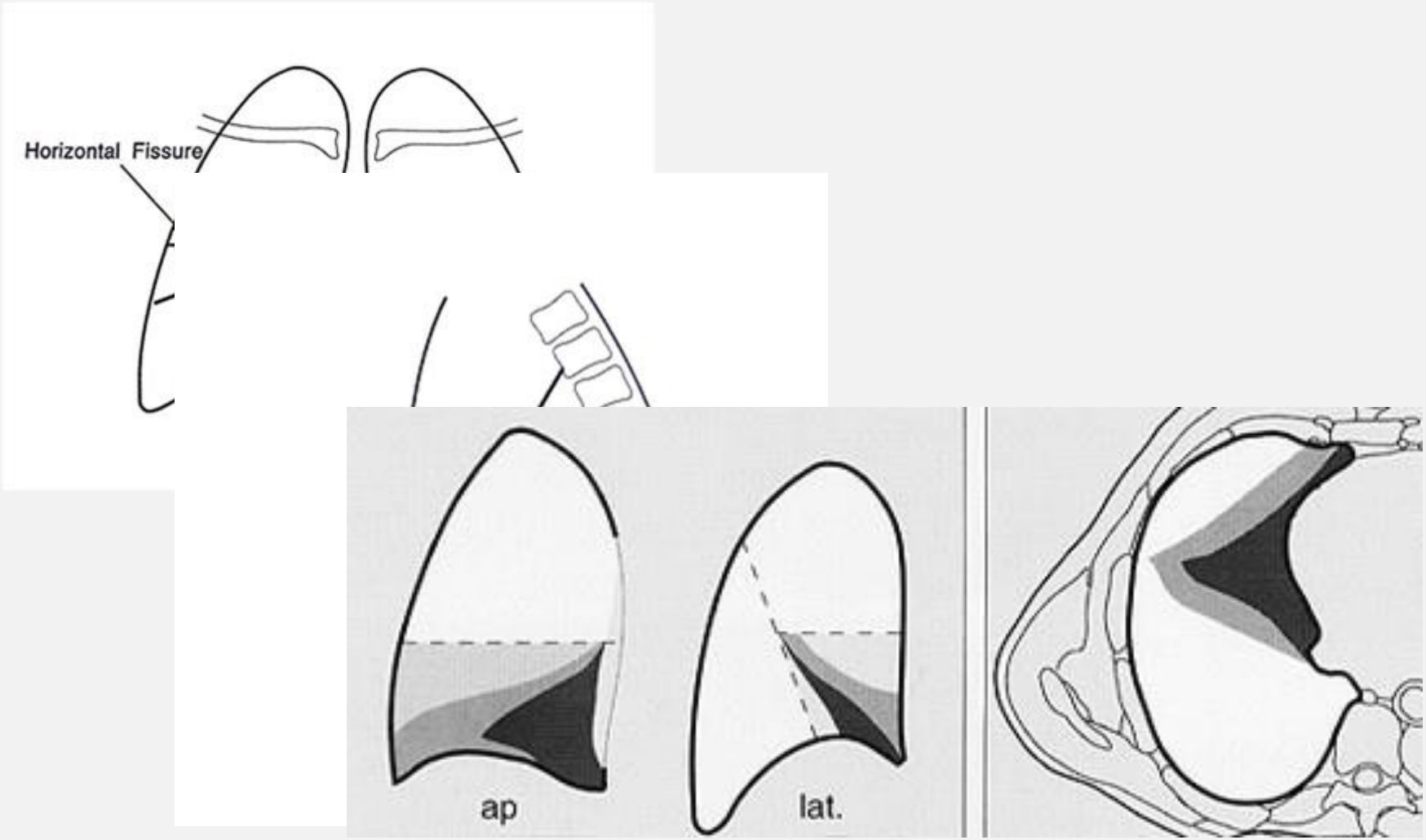
Dense wedge-shaping opacity

Normal RML range





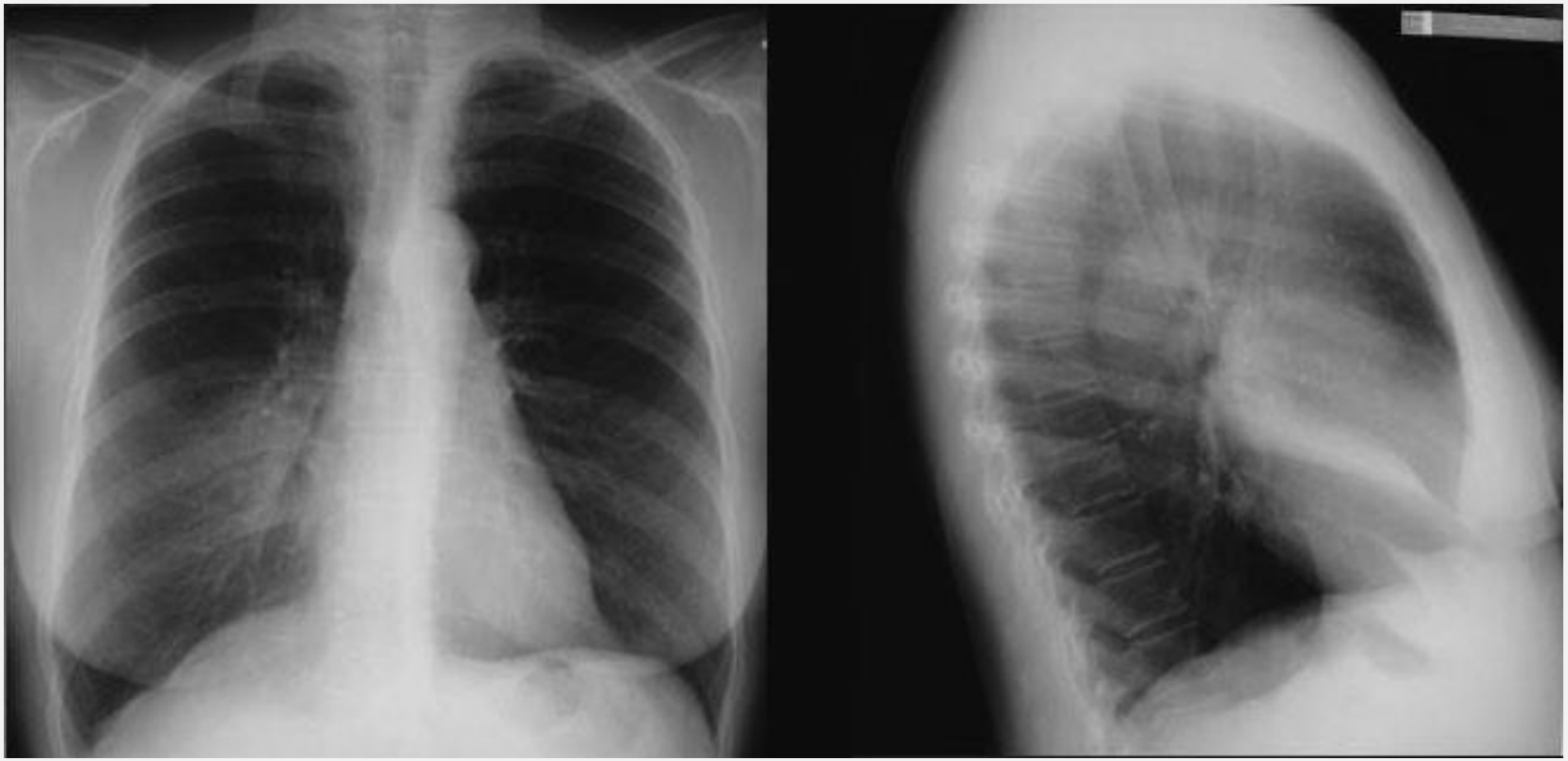
Progression of RML collapse



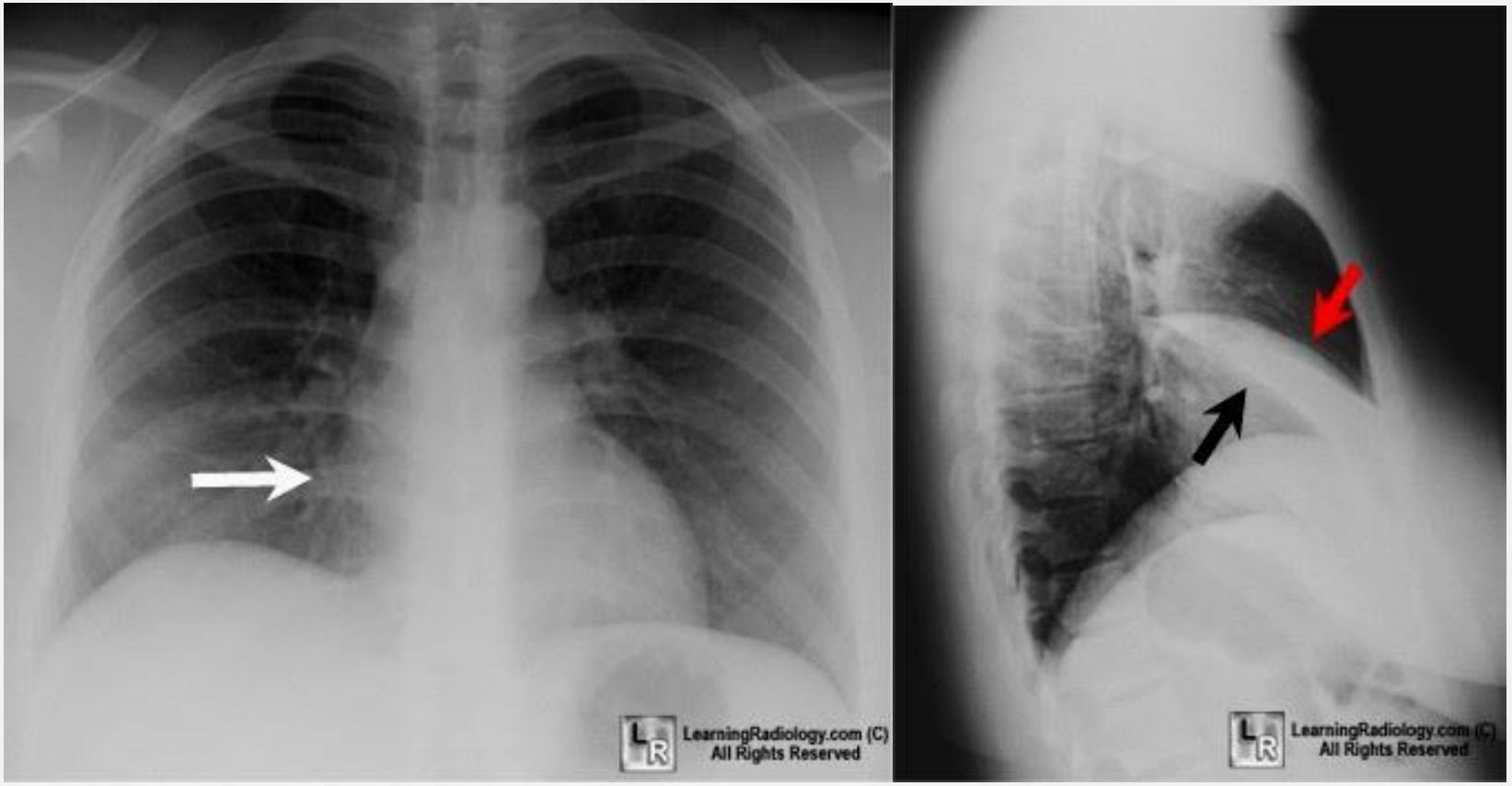
Features of RML collapse

- Horizontal fissure and oblique fissure move towards
- Obscuration of right heart border
- Volume of this lobe is small, so indirect signs occasionally present only

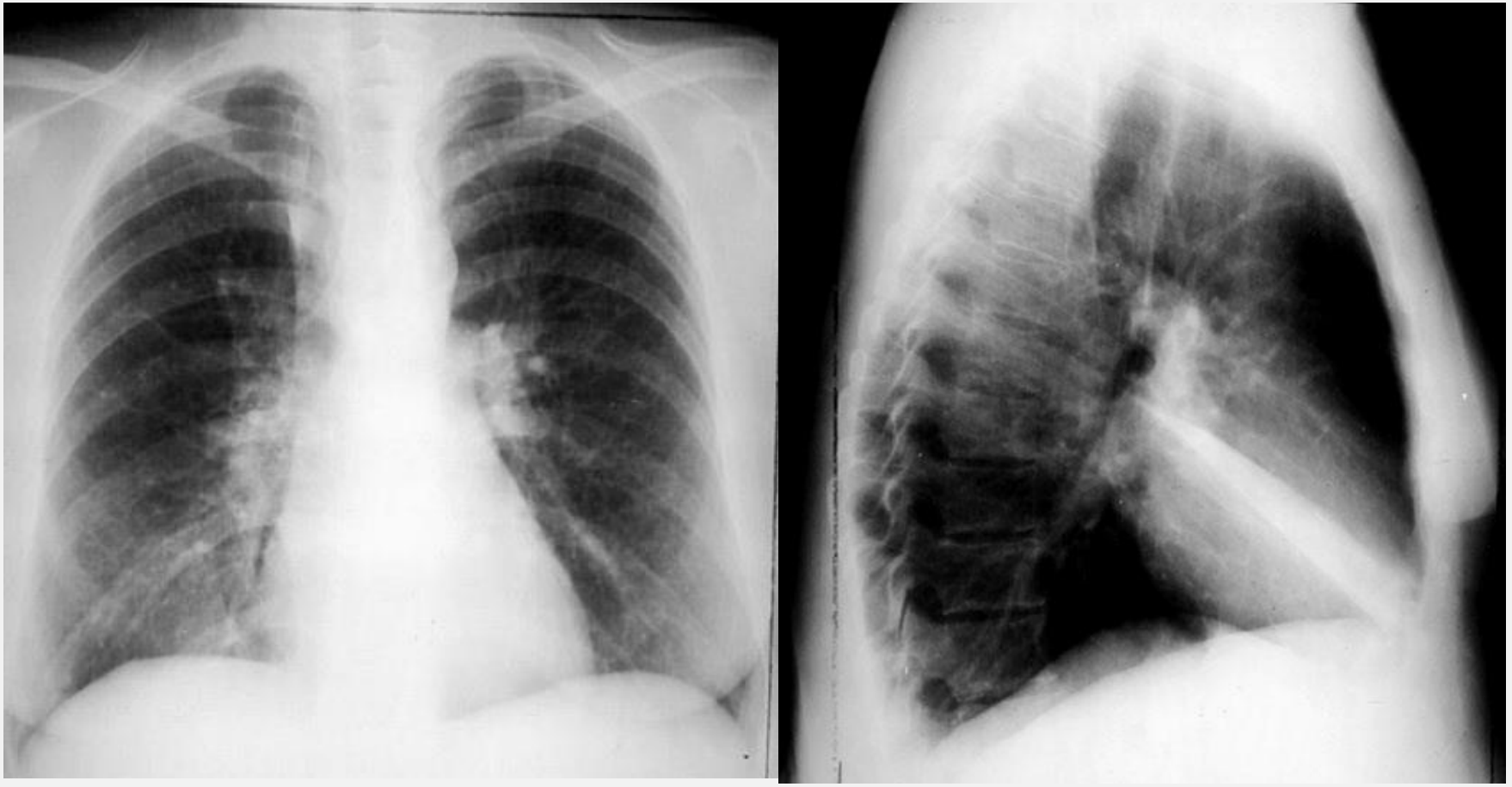
RML collapse



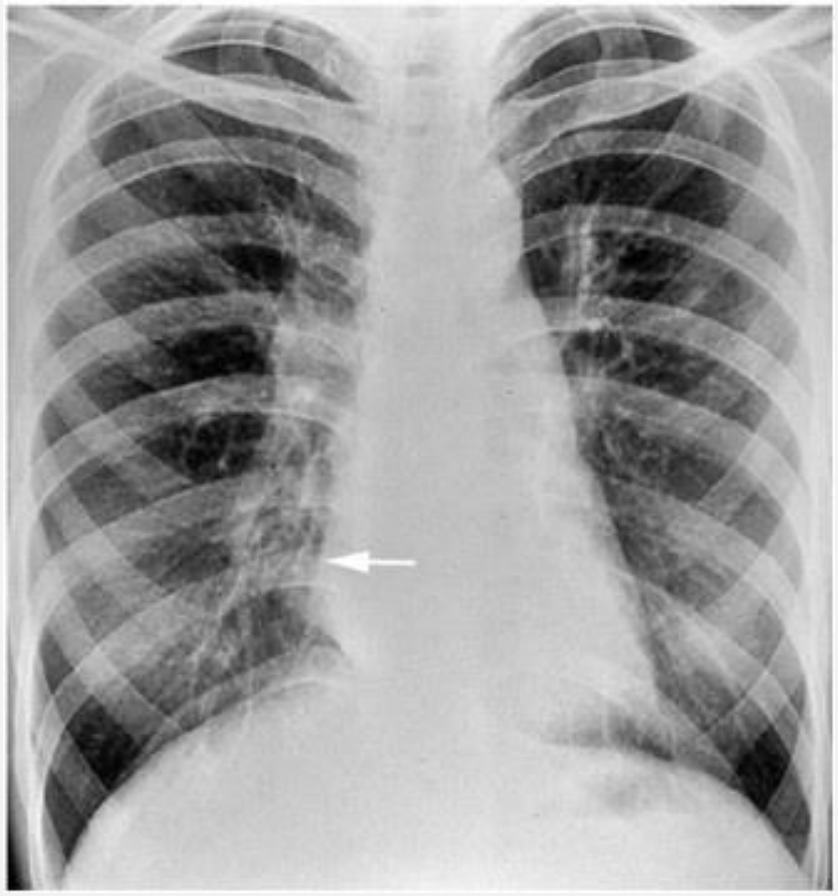
RML collapse

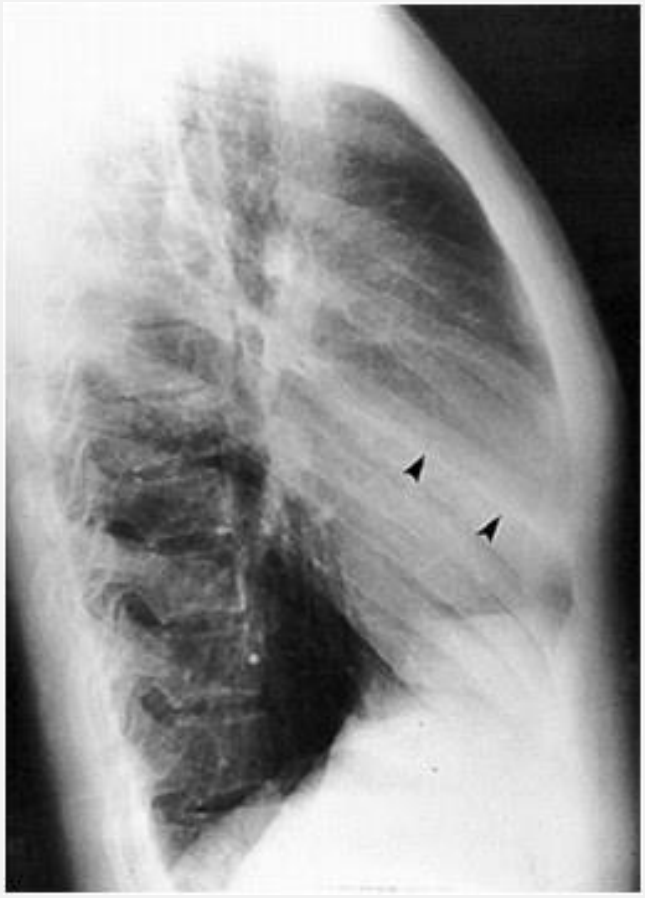


RML collapse

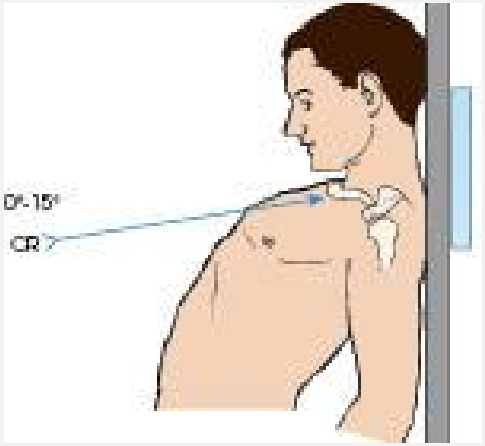


RML collapse

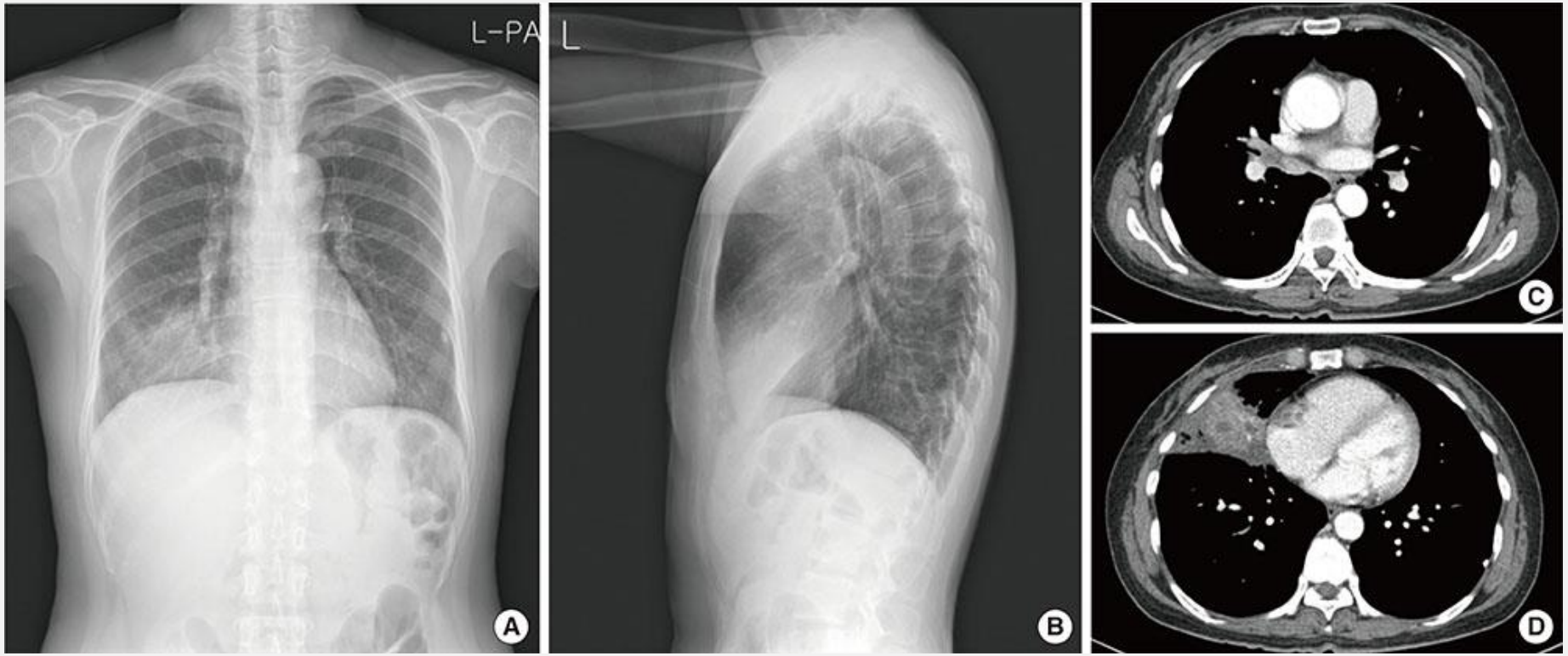




Lordotic view



RML syndrome

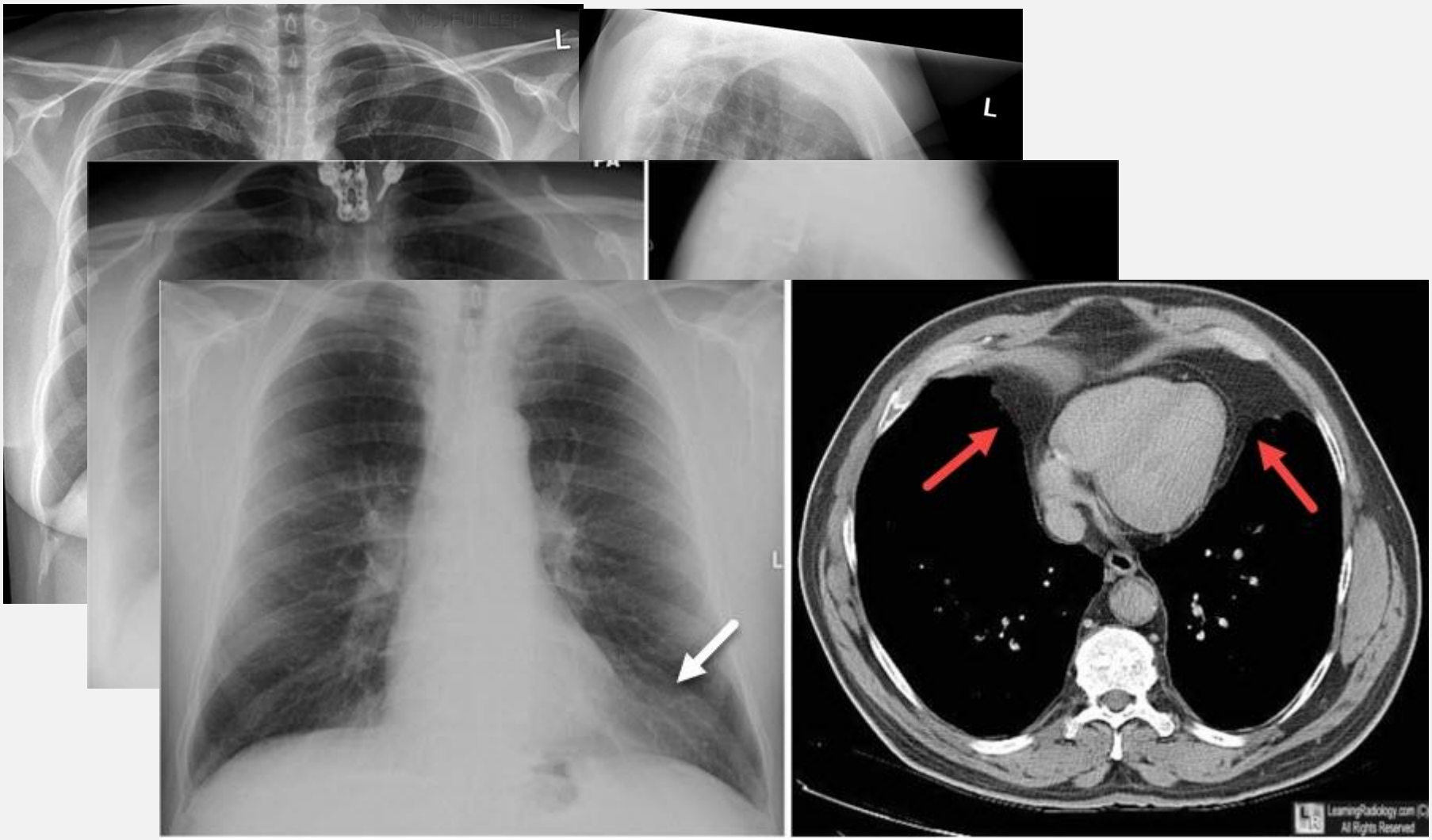


Chronic non obstructive collapse of right middle lung lobe and usually associated with bronchiectasis.

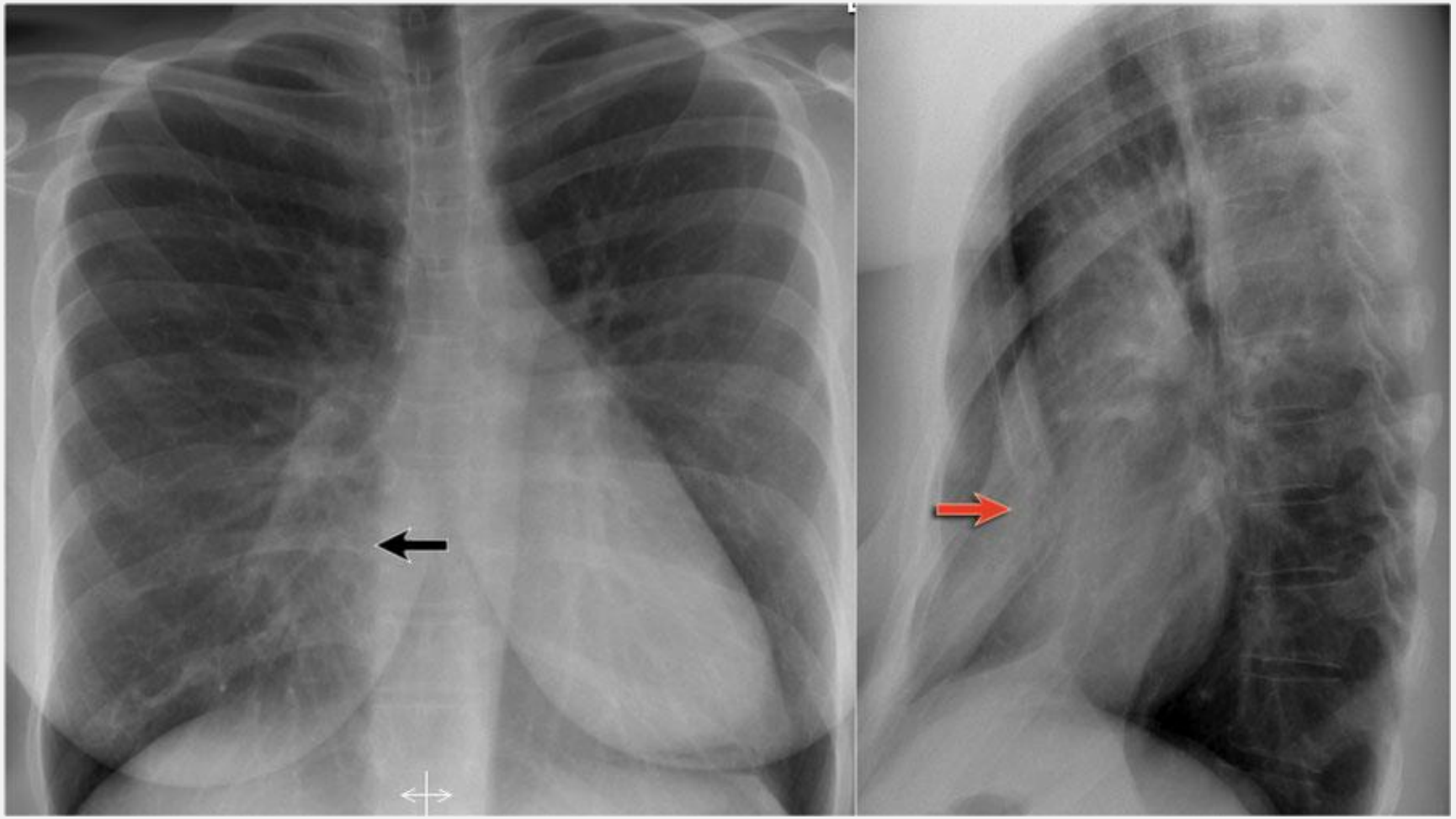
Most common in children with a history of asthma or atopy.

RML syndrome in a 6 y/o child.

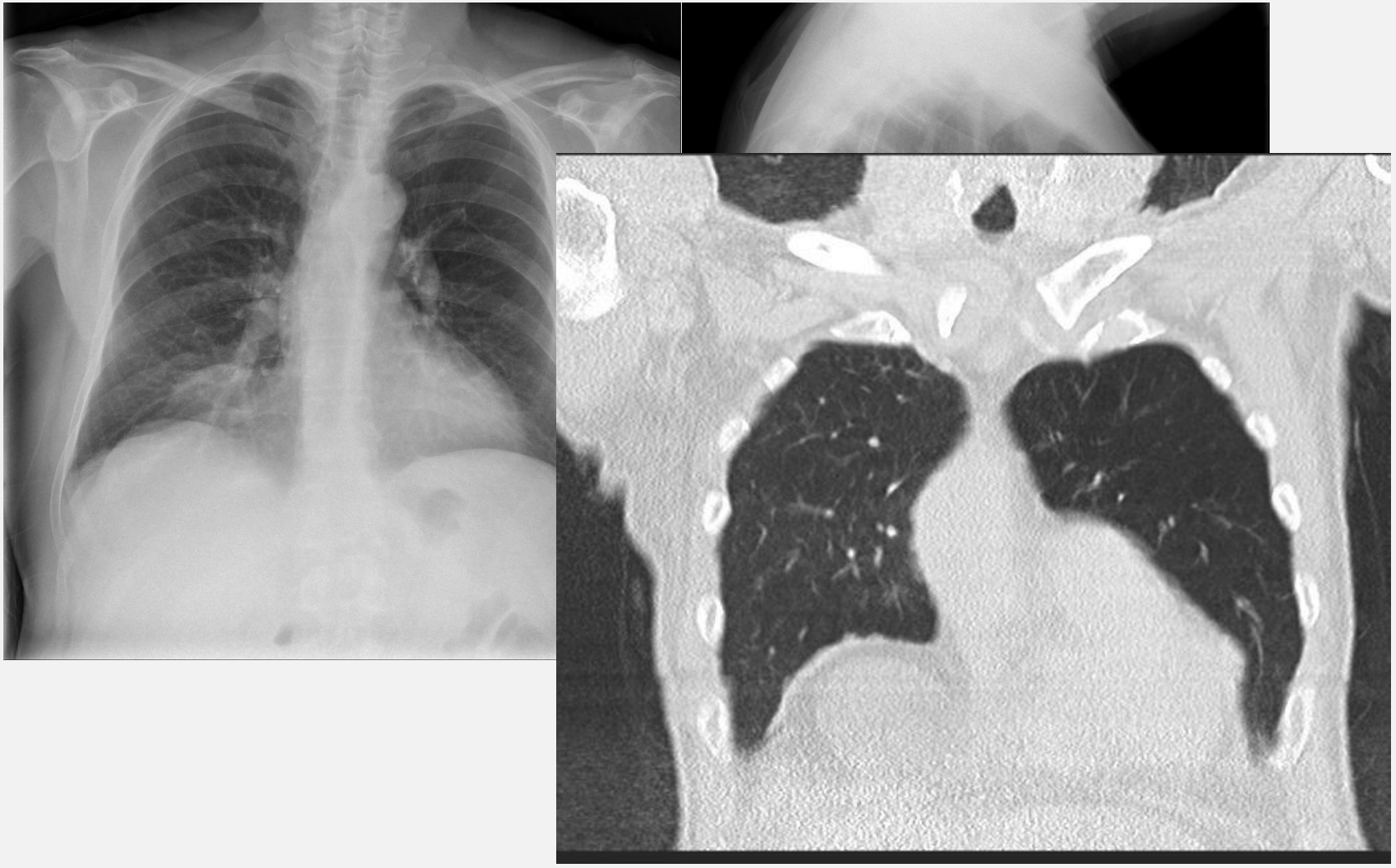
DDx – Pericardial fat



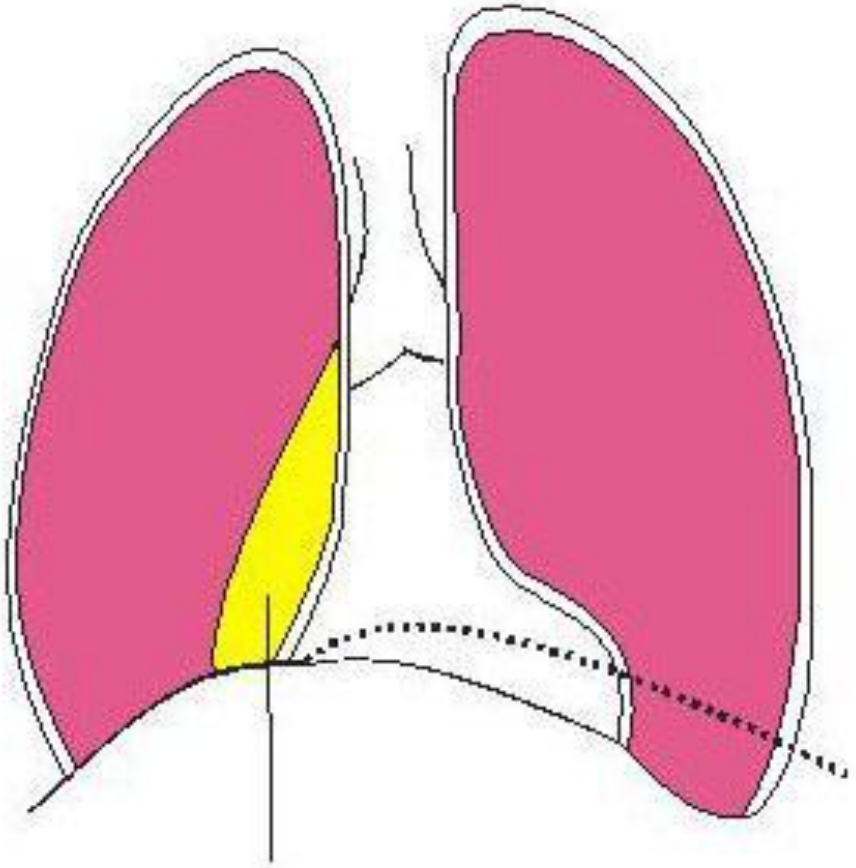
DDx - Pectus excavatum



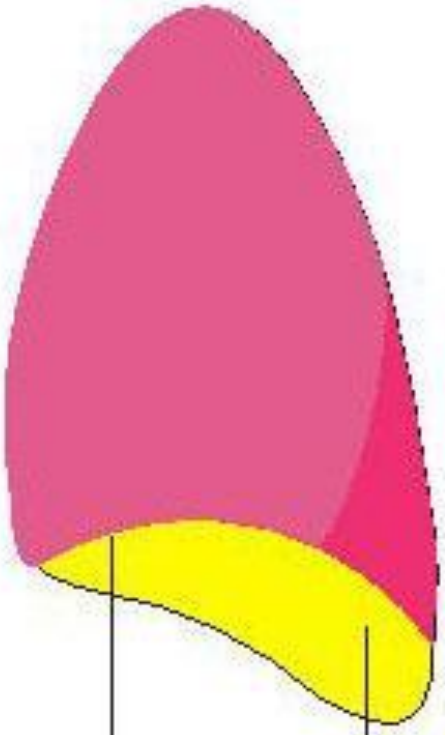
DDx - Morgagni hernia



Right lower lobe collapse



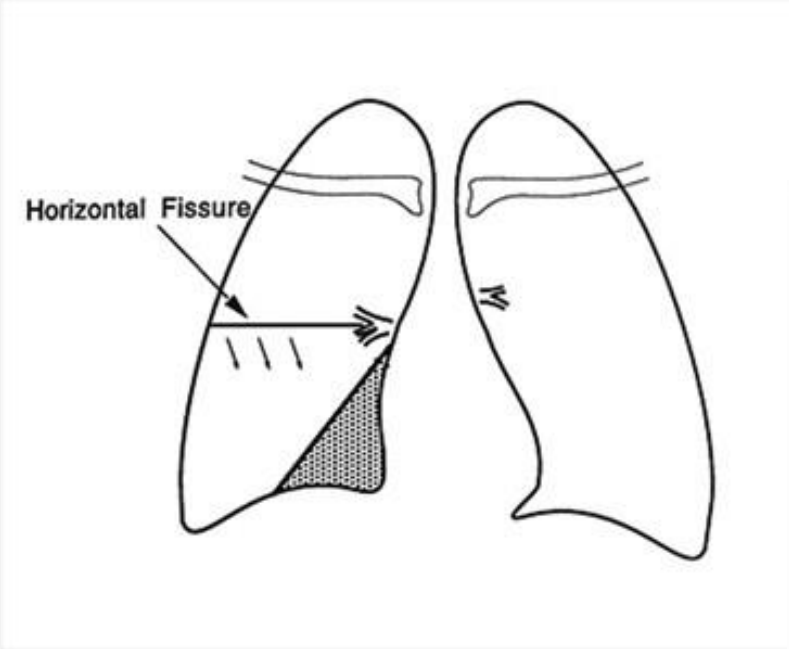
Heart border preserved and additional wedge-shaped density

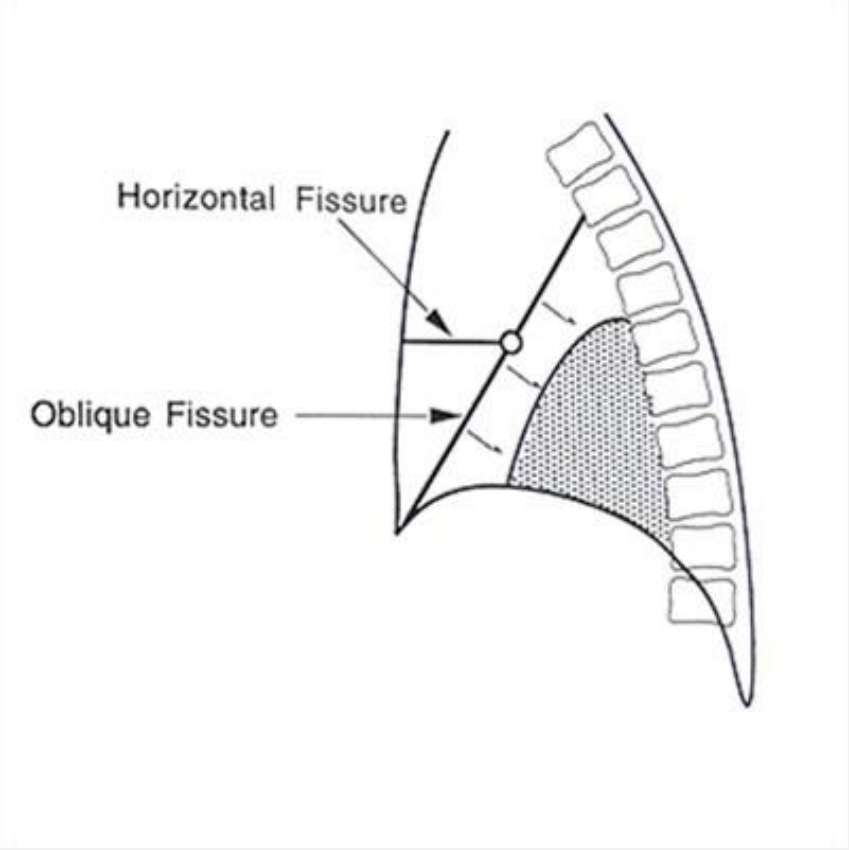


Elevated diaphragm

Wedge-shaped density

Progression of lower lobe collapse

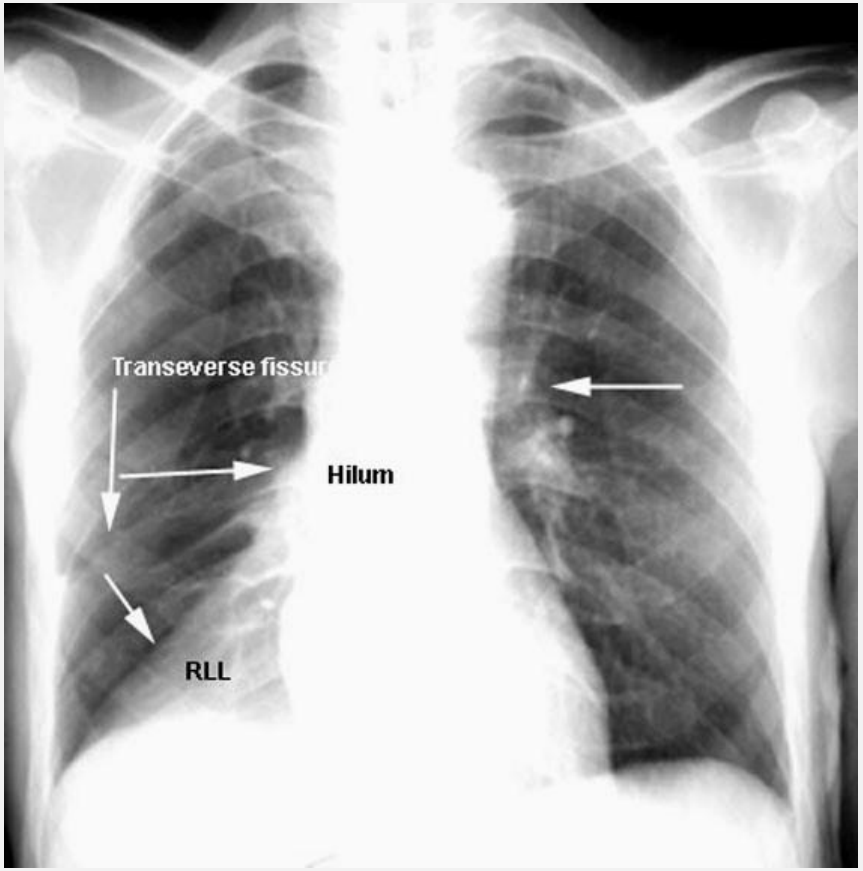


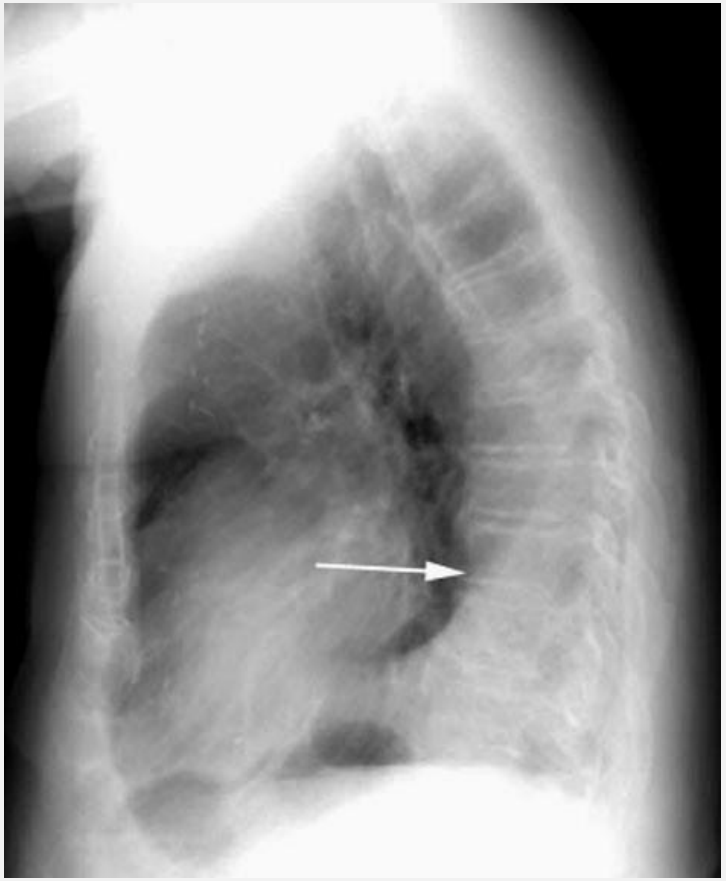


Features of RLL collapse

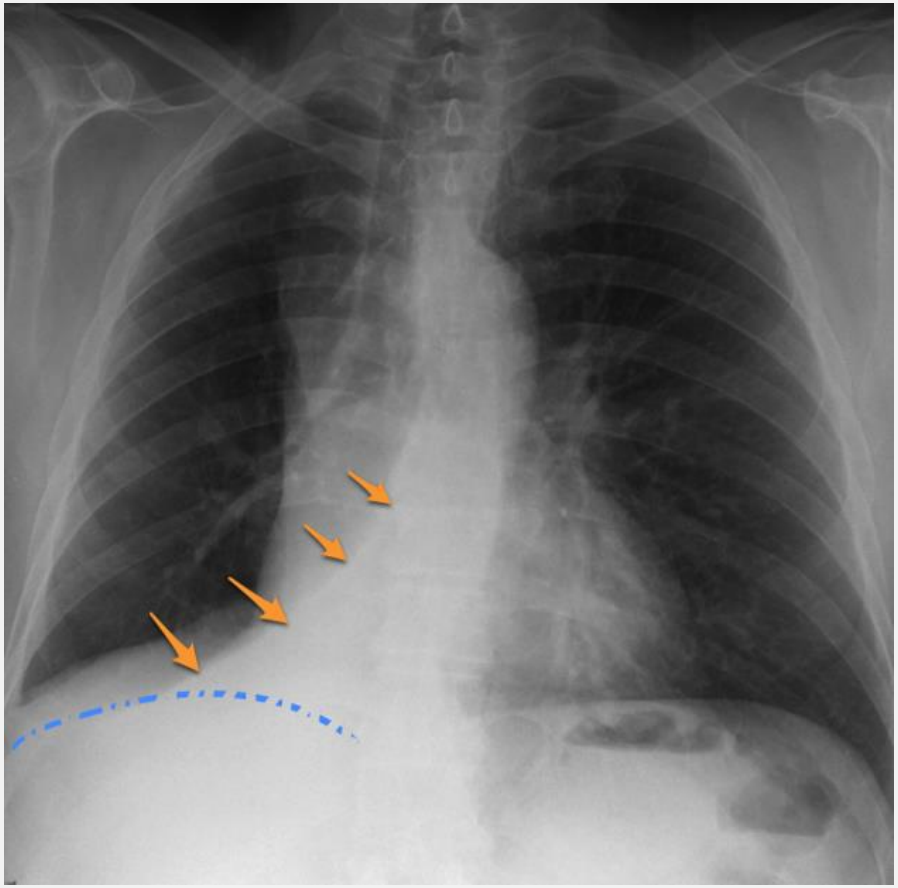
- Equivalent to the LLL collapse
- The major fissure rotates backward and medially
- Lesion is at the posteromedial of the thorax, triangular opacity lies on the right diaphragm and mediastinum
- Loss of the diaphragmatic border and the diaphragm is elevated
- Downward displacement of the right hilum
- No loss of the right cardiac border

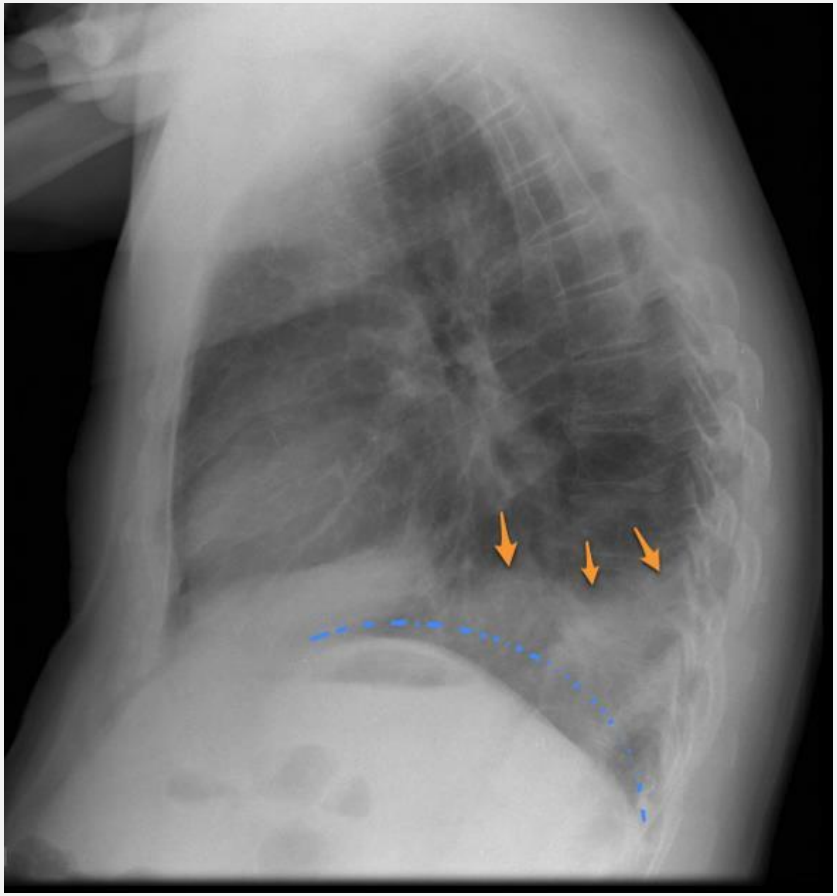
RLL collapse



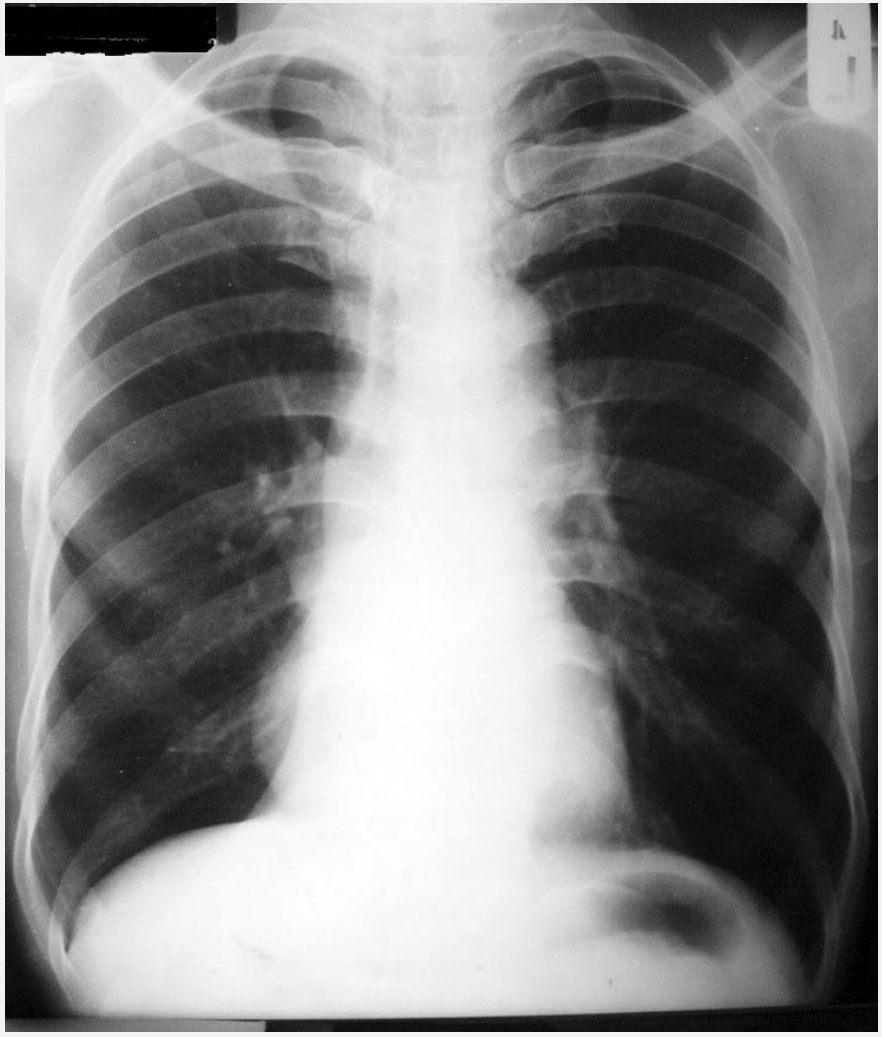


RLL collapse



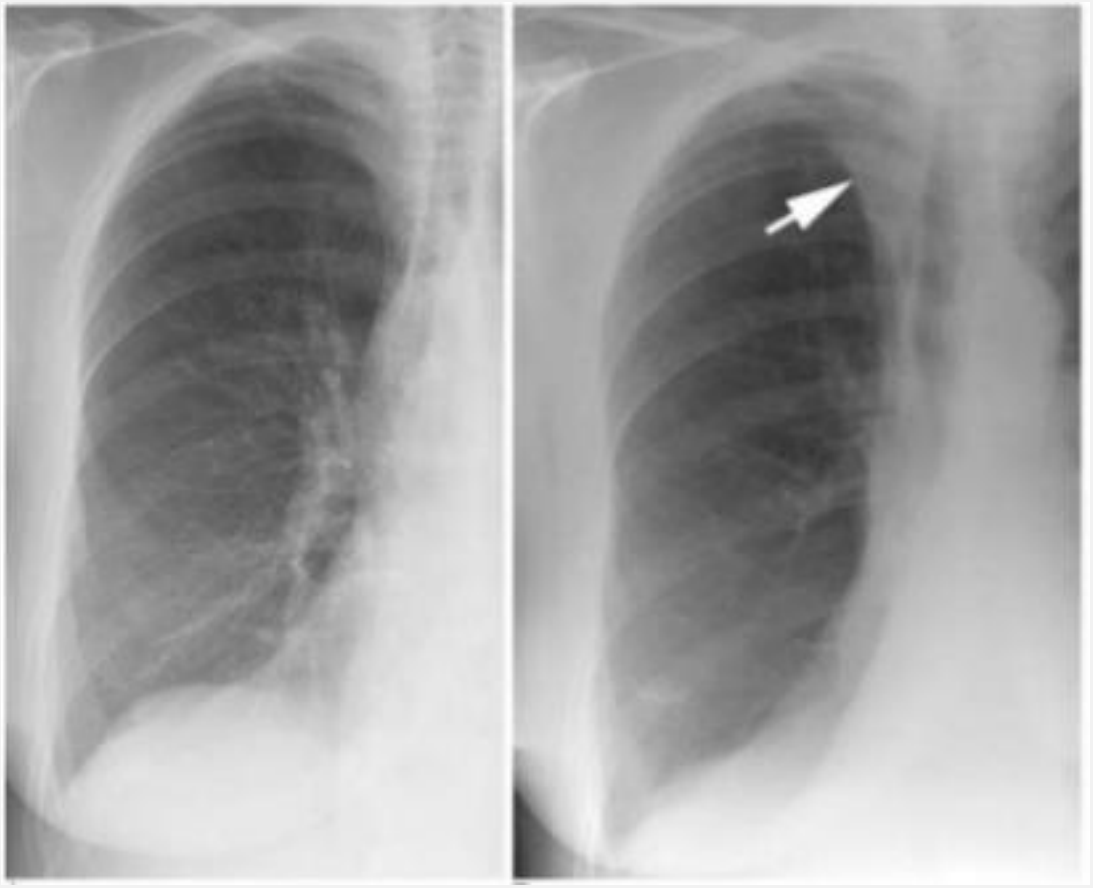


RLL collapse



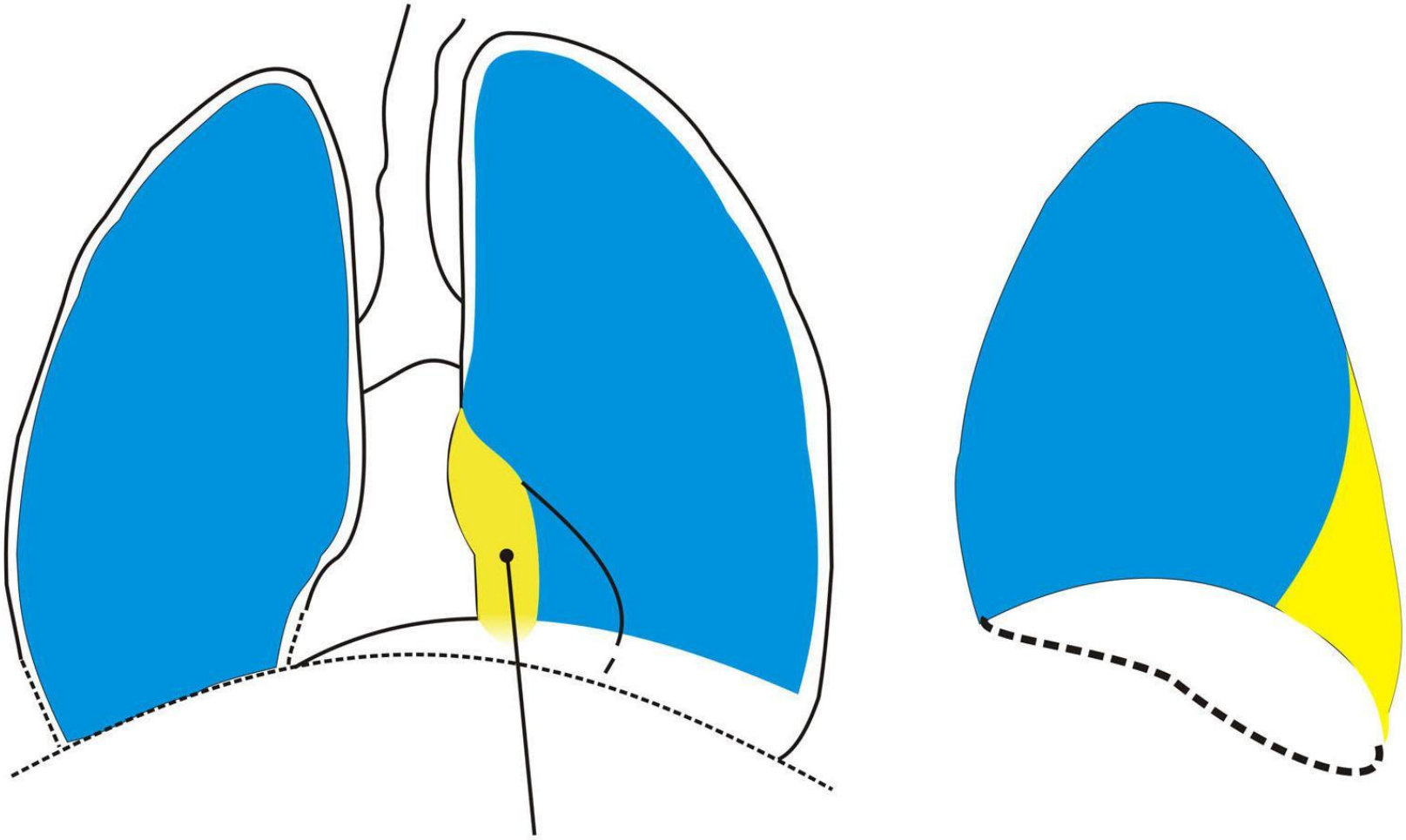
PA view shows triangular shape opacity overlying to the right cardiac silhouette and mildly downward shifting of the hilum.

Superior triangle sign



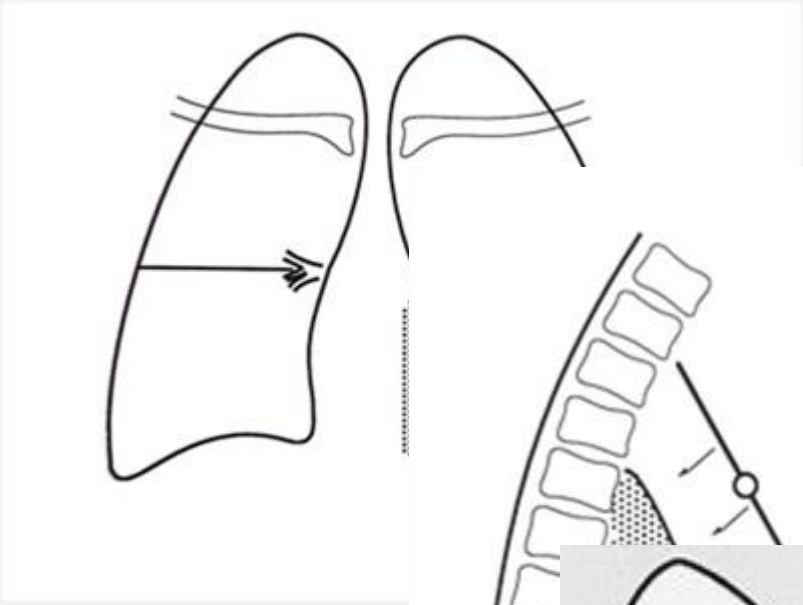
Widening of the superior mediastinum, usually on the right, associated with collapse of the lower lobe producing traction on the mediastinal pleura.

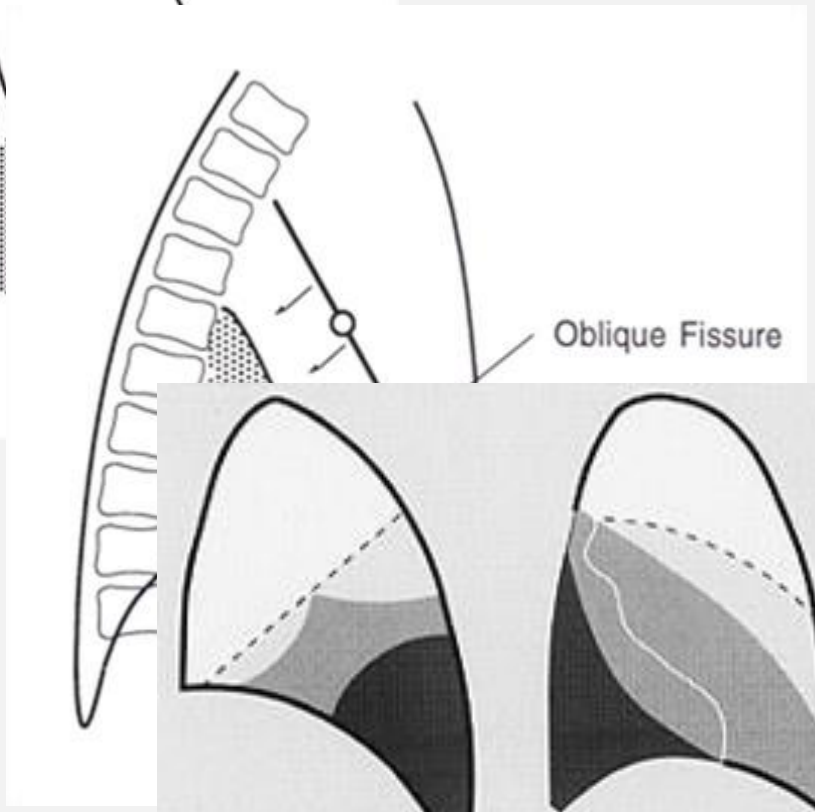
Left lower lobe collapse

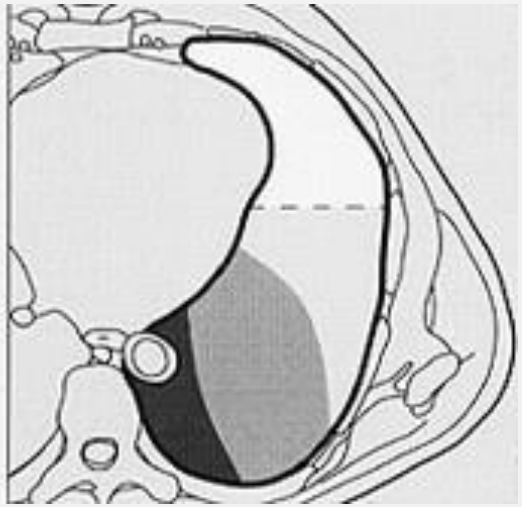


Wedge-shaped density behind heart, obscuring medial diaphragm, which is elevated

Progression of LLL collapse







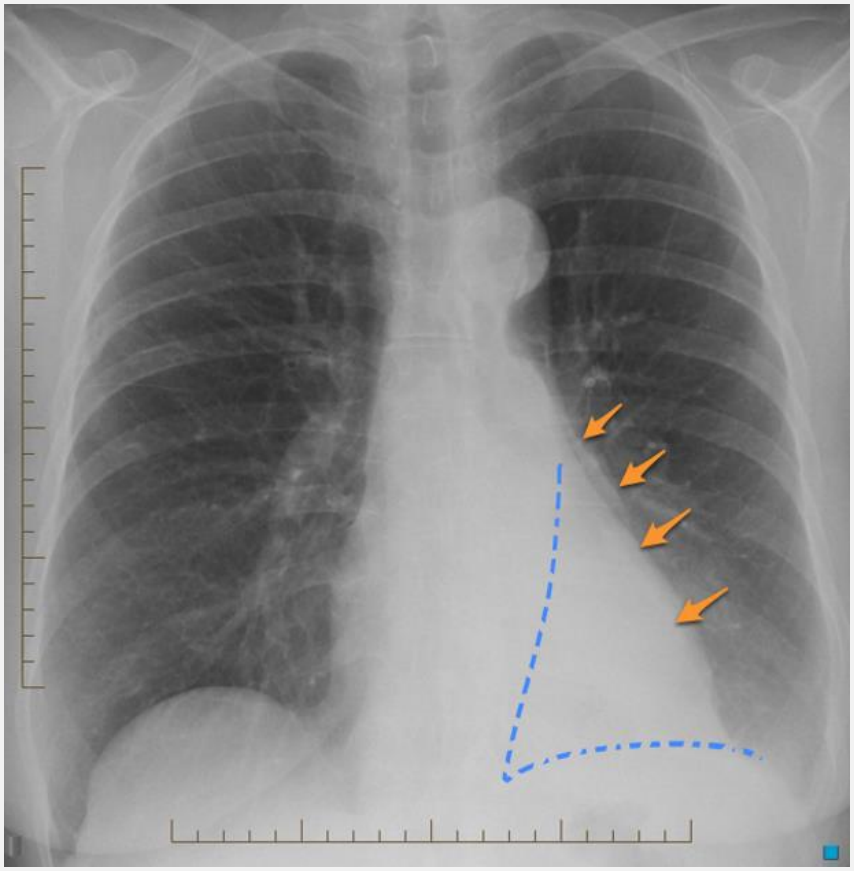
Features of LLL collapse

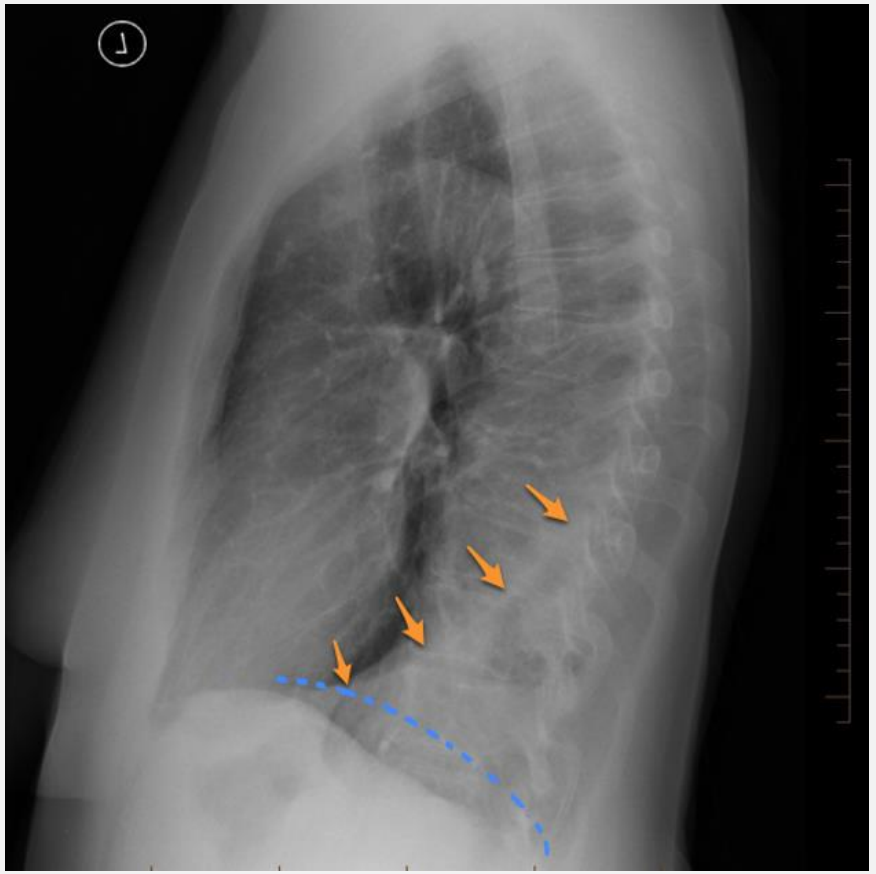
- Equivalent to the RLL collapse
- Triangular opacity in the posteromedial aspect of the left lung
- Edge of collapsed lung may create a "double cardiac contour"
- Increased density of the heart
- Loss of the normal left hemi-diaphragmatic outline
- Loss of the outline of the descending aorta
- Downward displacement of the left hilum
- No loss of the left cardiac border

LLL collapse

Triangular opacity in the posteromedial aspect of the left lung
A "double cardiac contour"
Loss of the outline of the descending aorta
Downward displacement of the left hilum
No loss of the left cardiac border

LLL collapse

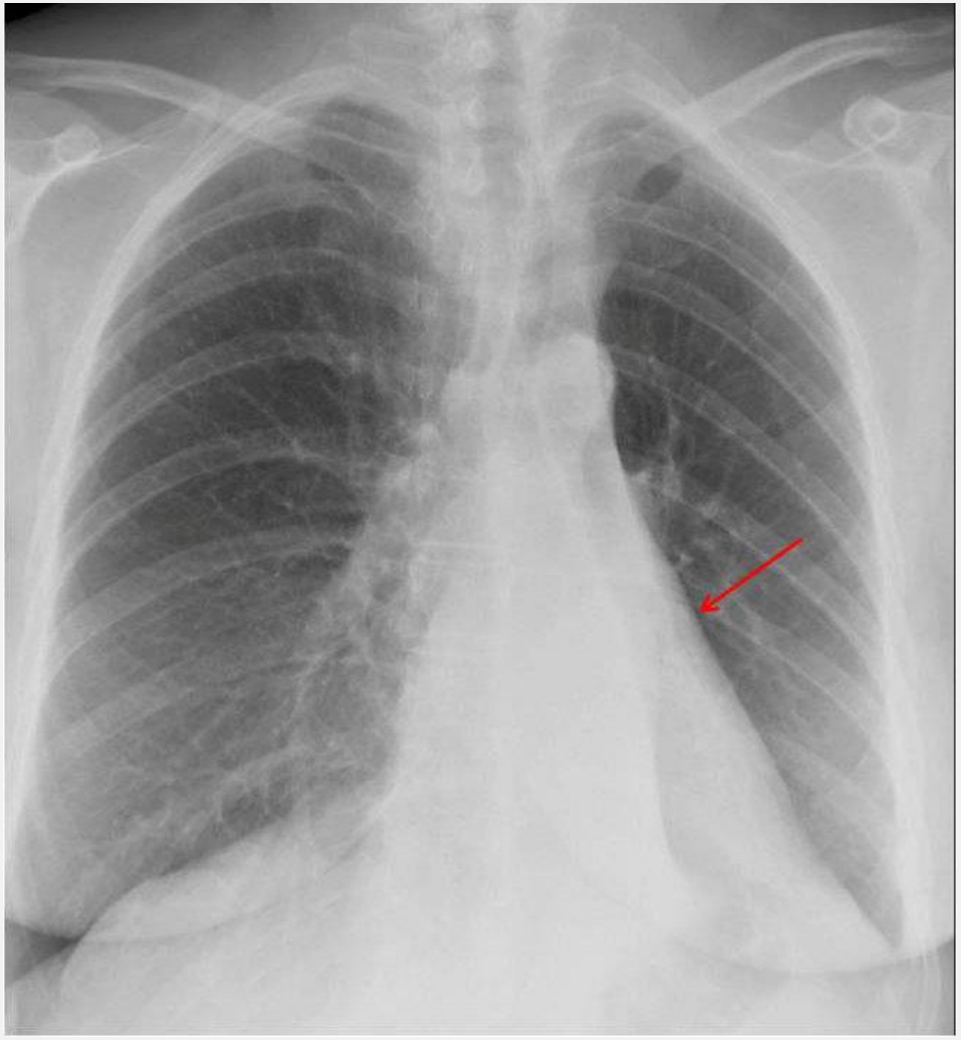


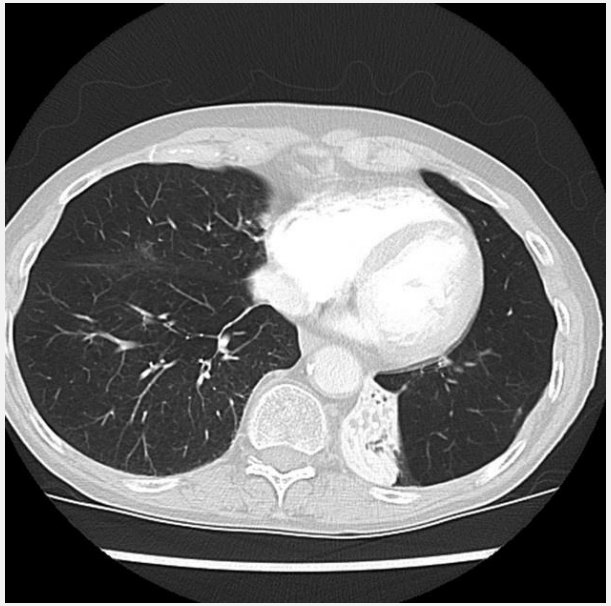


LLL collapse

LLL collapse

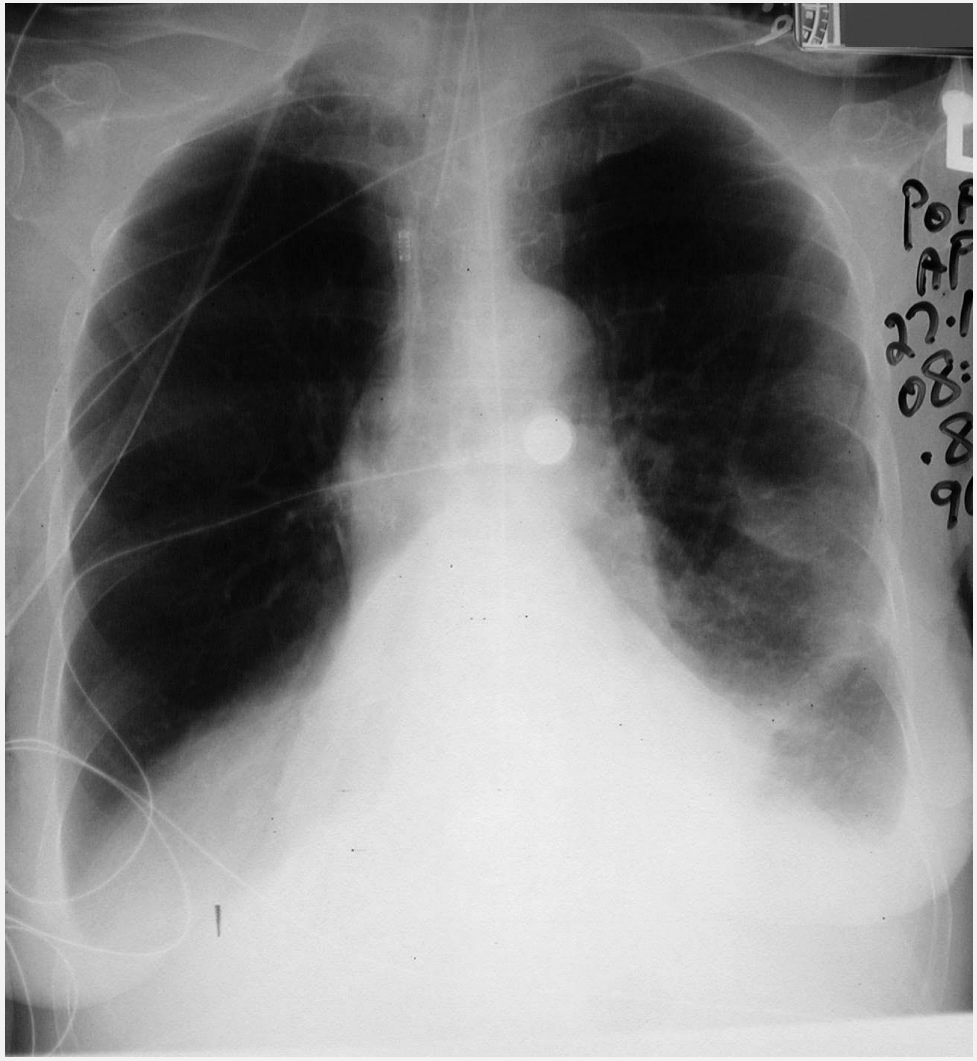
Flat waist sign



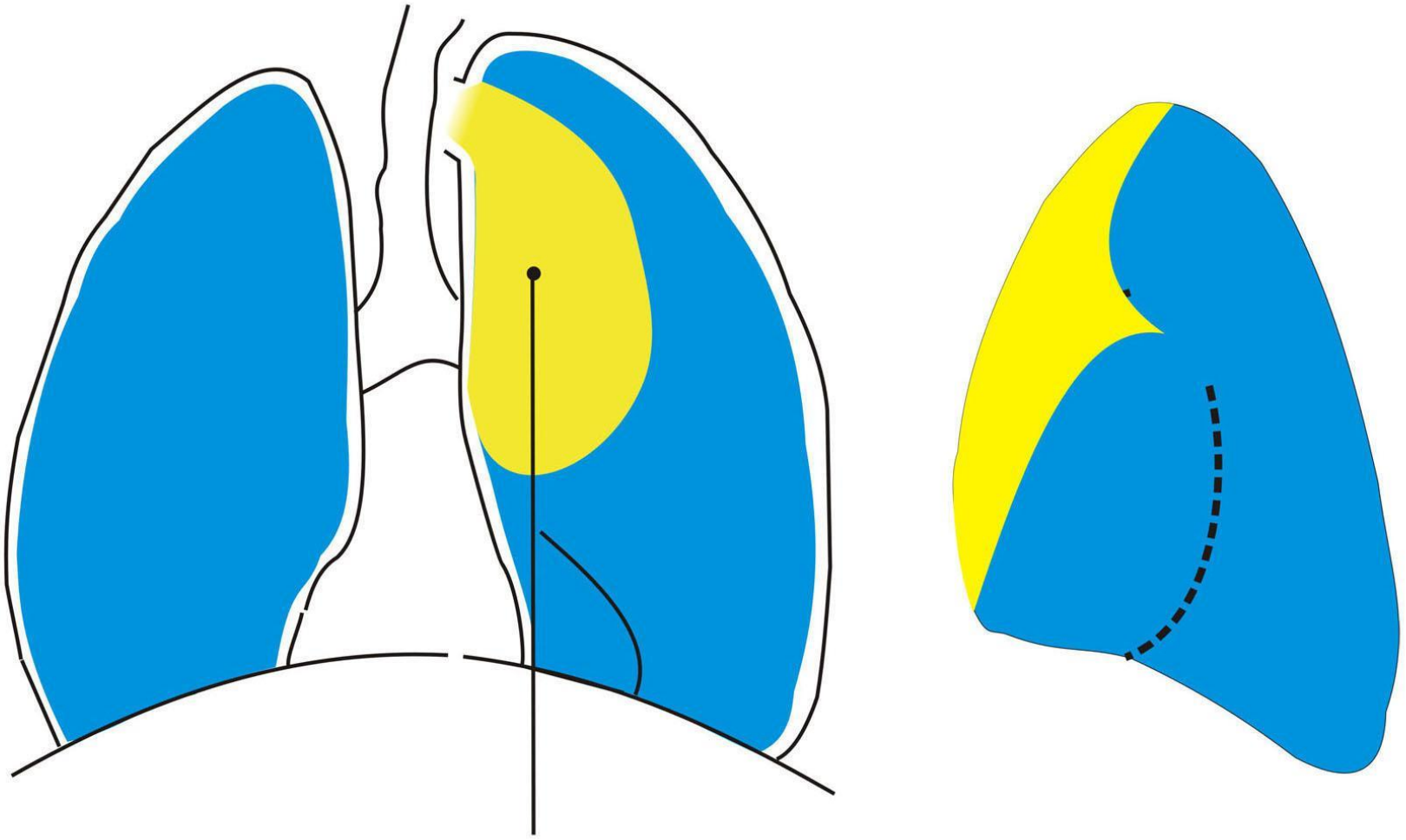


Flattening of the left cardiac border in left lower lobe collapse due to leftward displacement and rotation of the heart.

BLL collapse

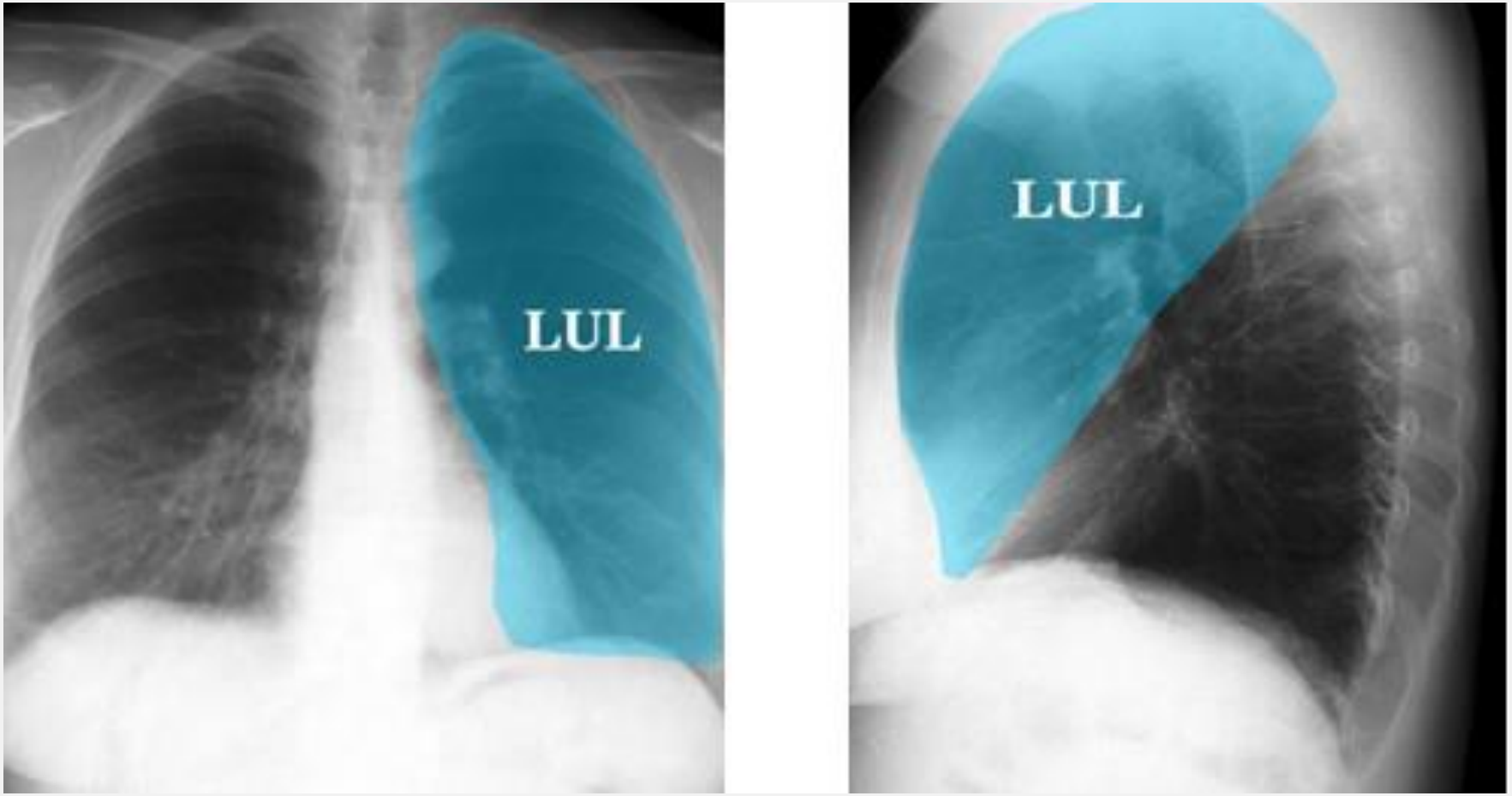


Left upper lobe collapse

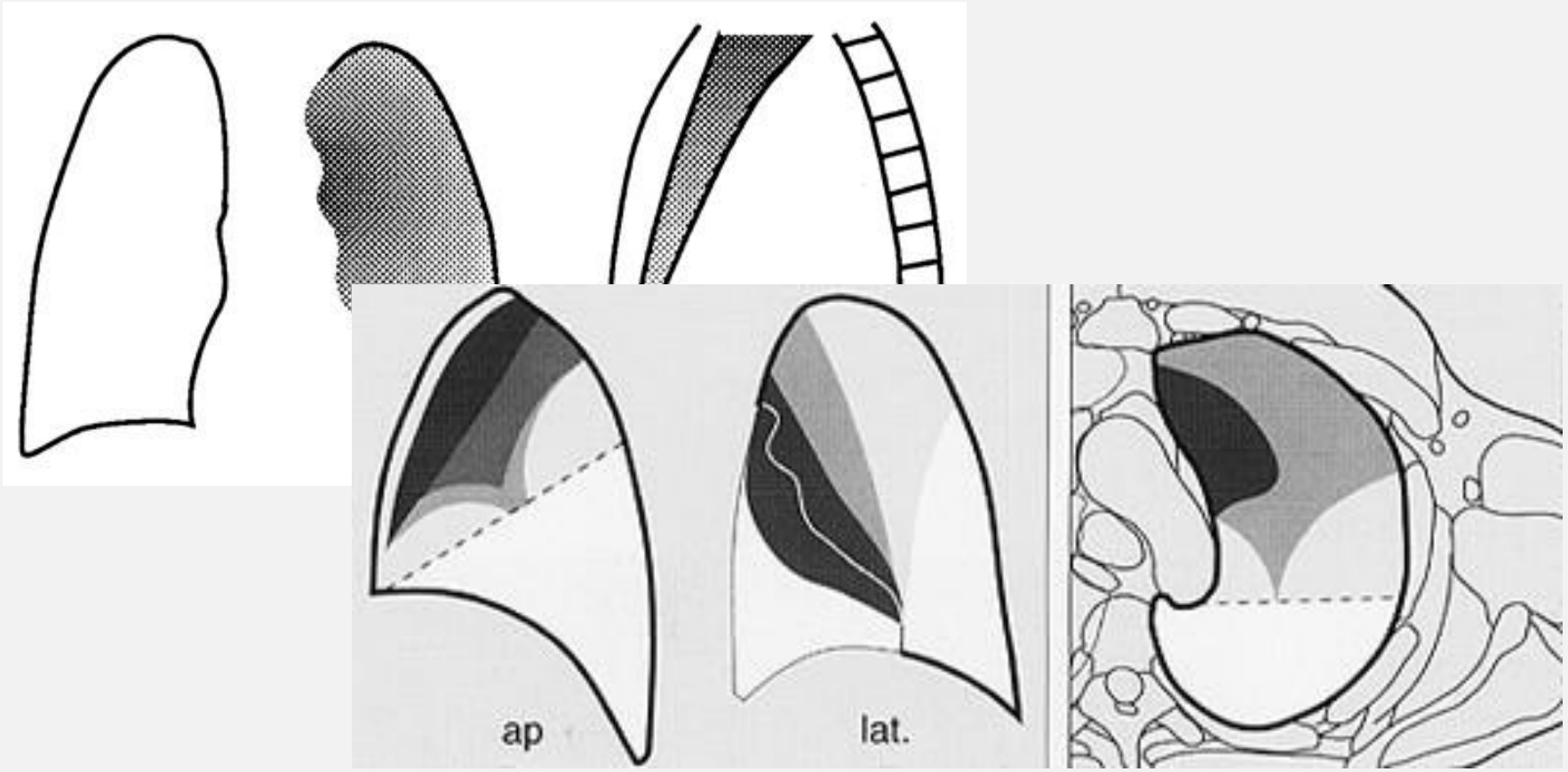


Hazy opacity obscuring heart border but with obvious aortic knuckle and descending aorta

Normal LUL range



Progression of LUL collapse



Features of LUL collapse

- Different from RUL atelectasis because there is no minor fissure on the left
- Hazy density extending from the left hilum
- Elevation of the left hilum and diaphragm
- Outward angulation of the LLL artery and left main bronchus
- On lateral film, an elongated opacity extending from apex and almost reaching diaphragm

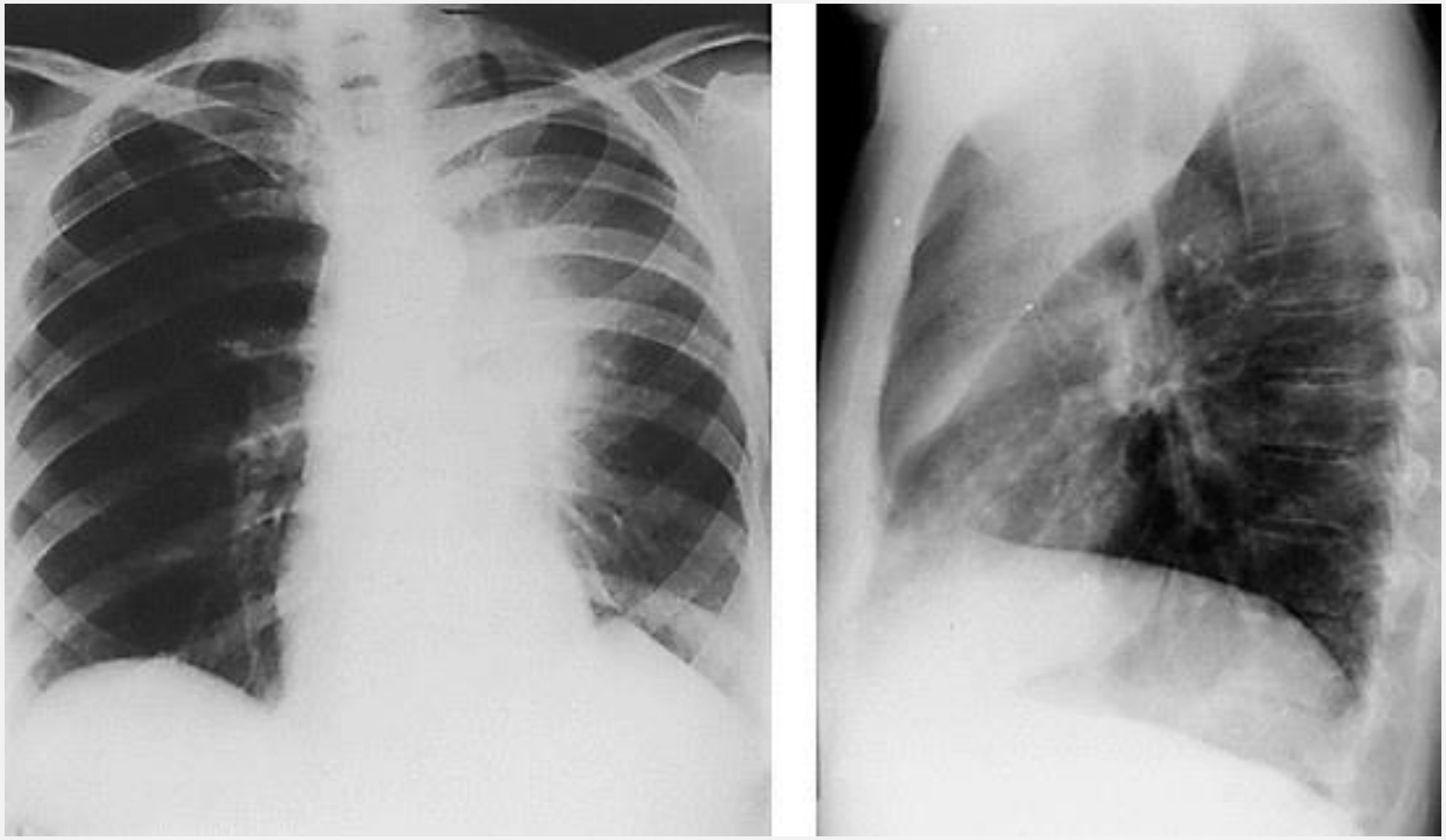
LUL collapse

Ill defined haziness at the left upper and middle lung filed
Elevation of the left hilum and diaphragm

LUL collapse

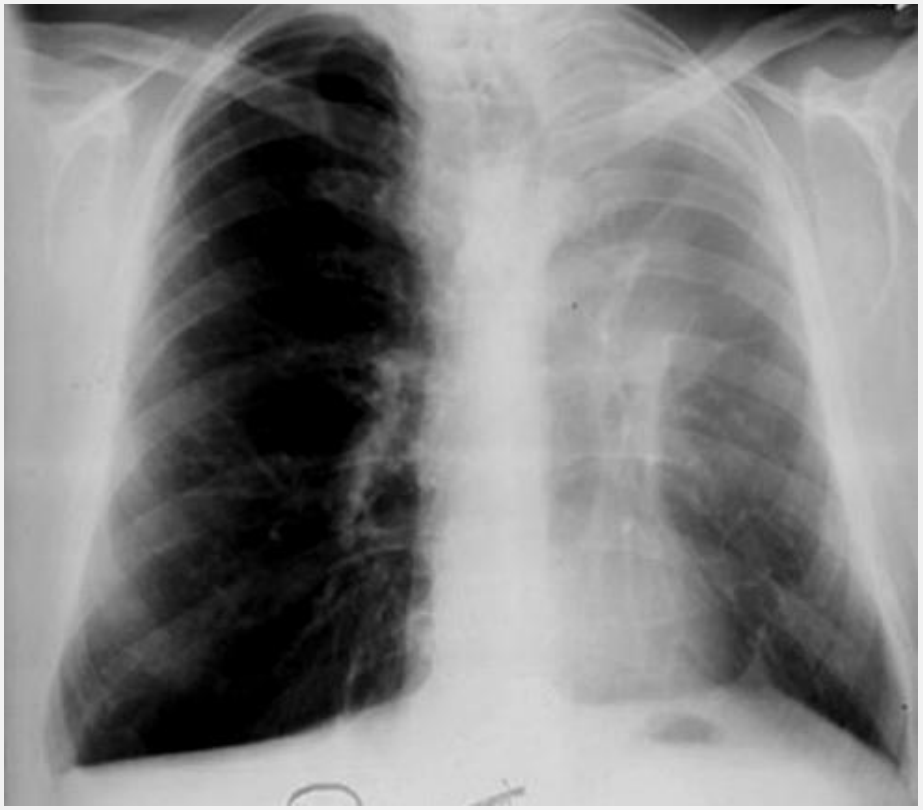
Anterior displacement of major fissure
Opacity at the retrosternal space parallel the anterior chest wall

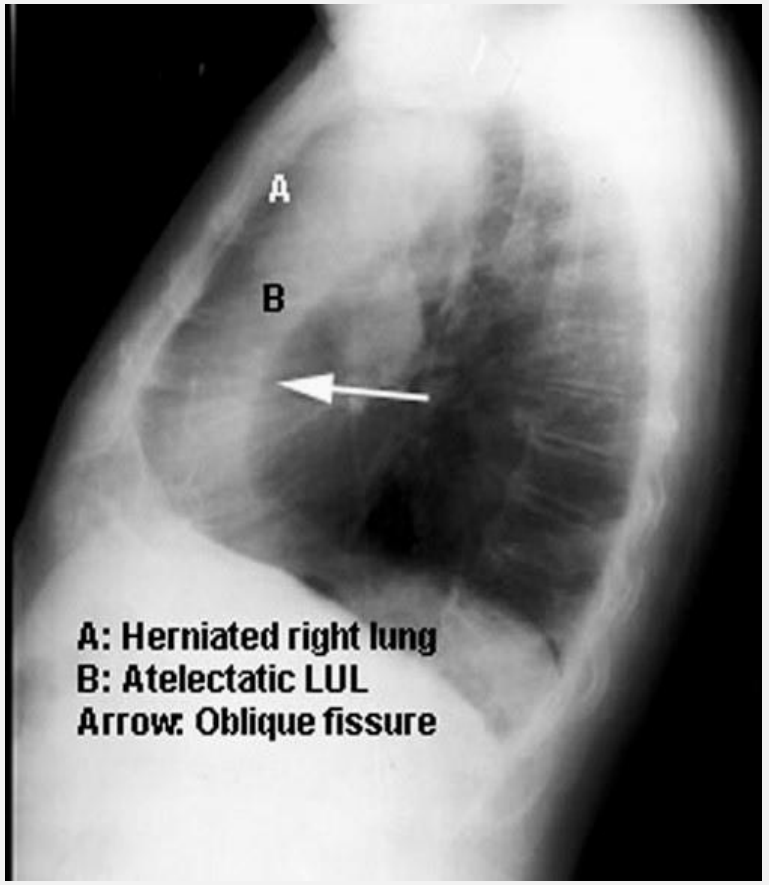
LUL collapse



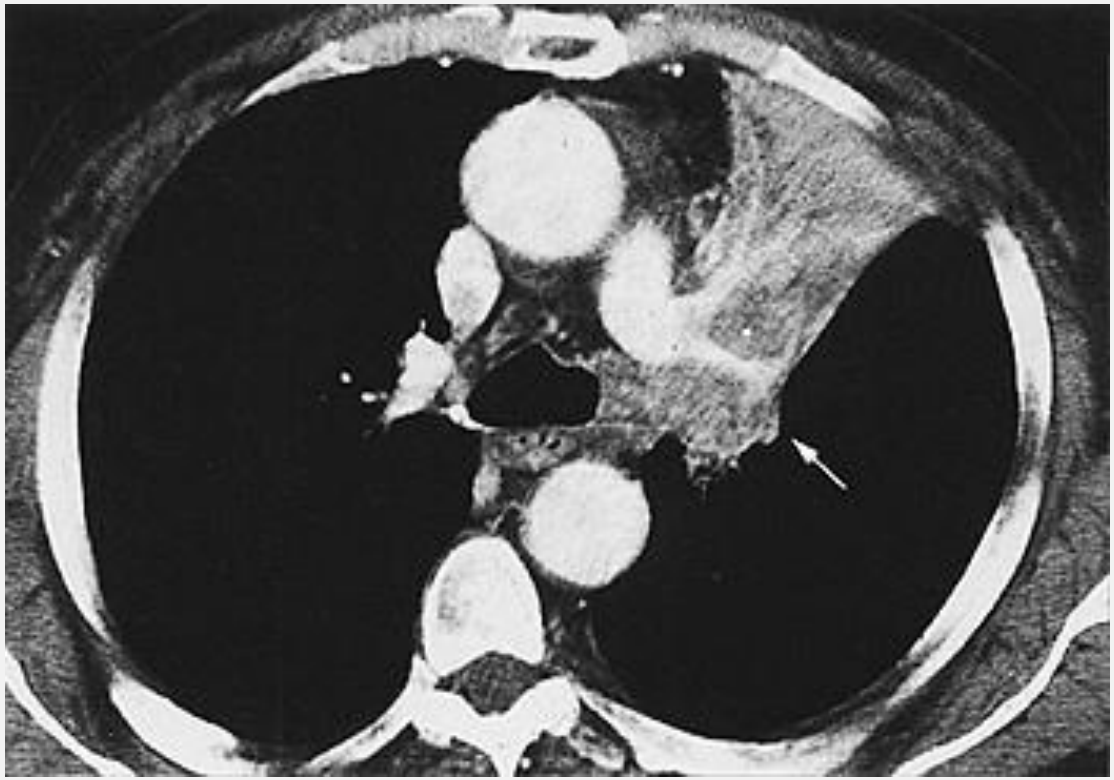
LUL collapse

LUL collapse

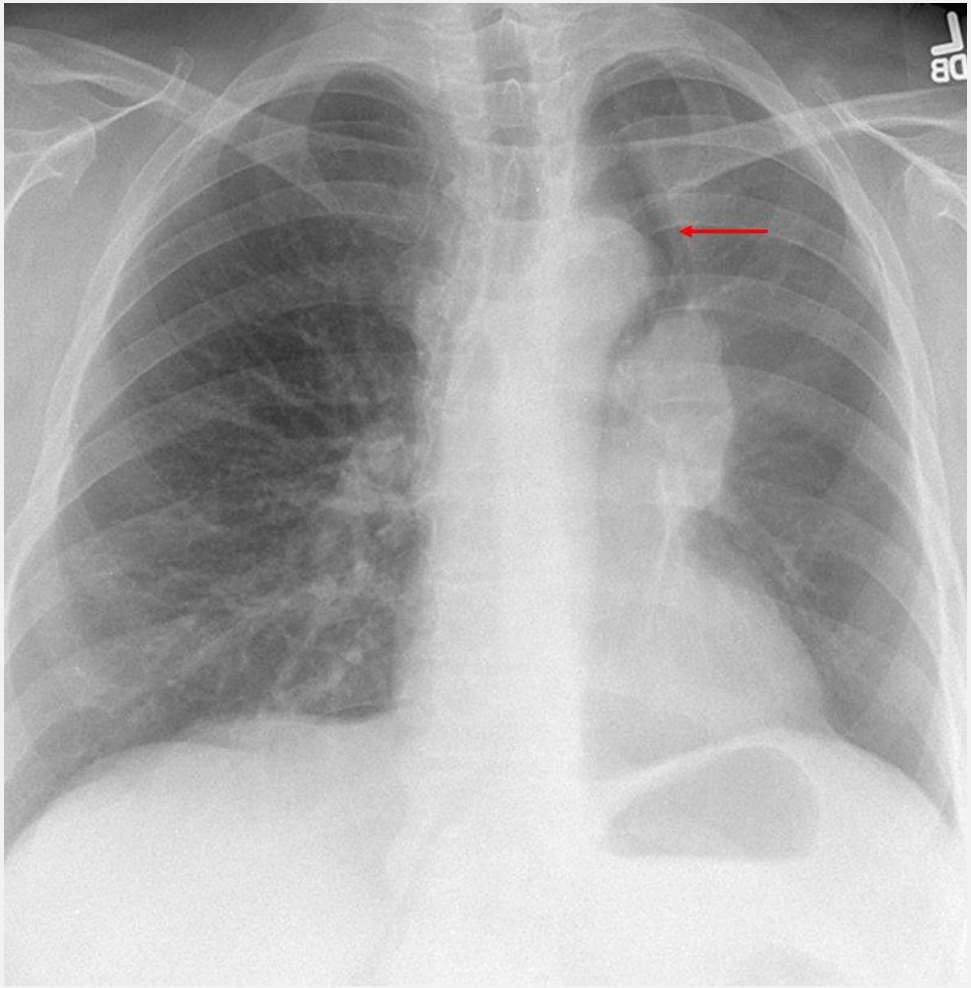




LUL collapse

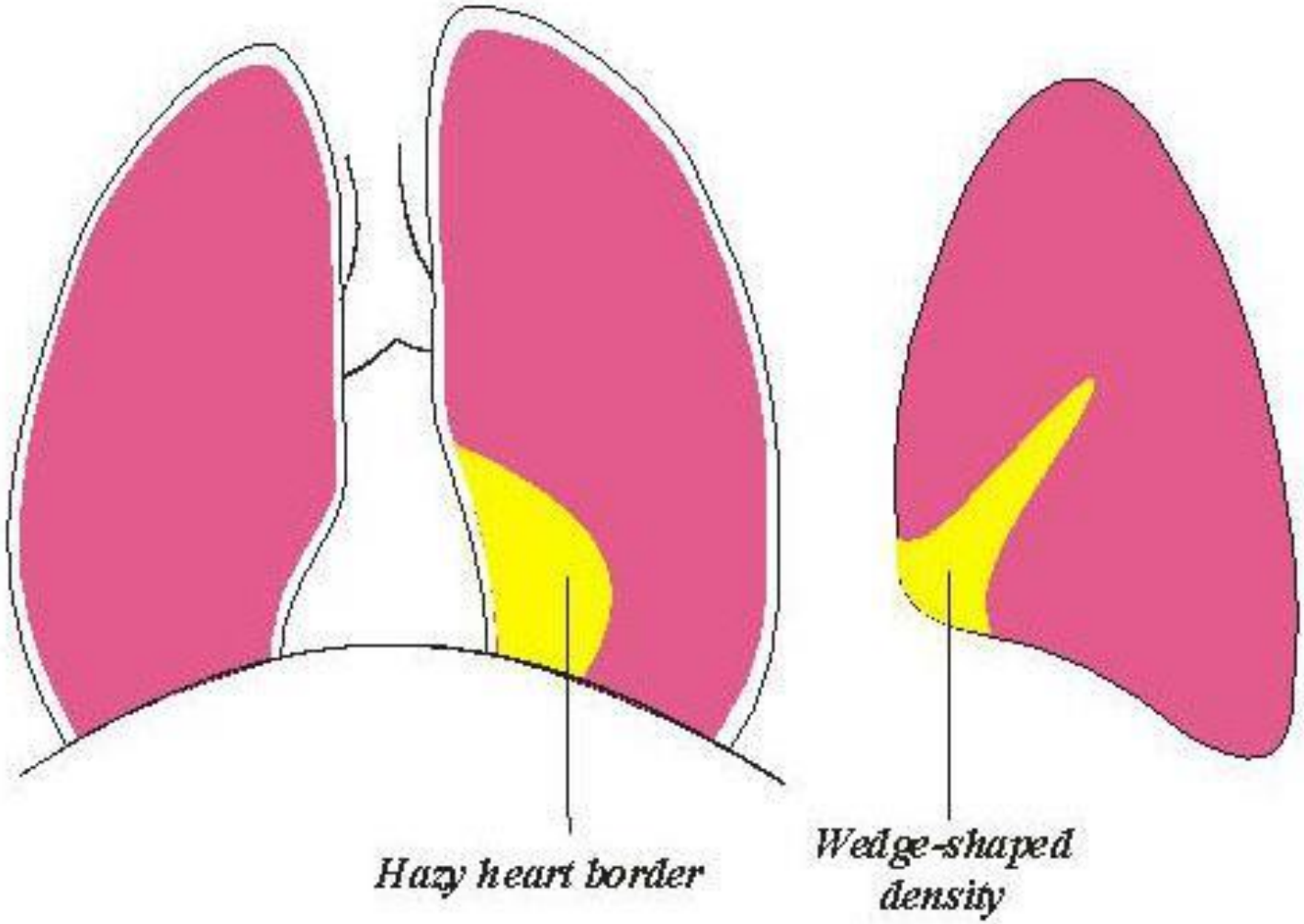


Luftsichel sign



Herniation of the superior segment of the hyperinflated left lower lobe between the mediastinum and the collapsed left upper lobe.

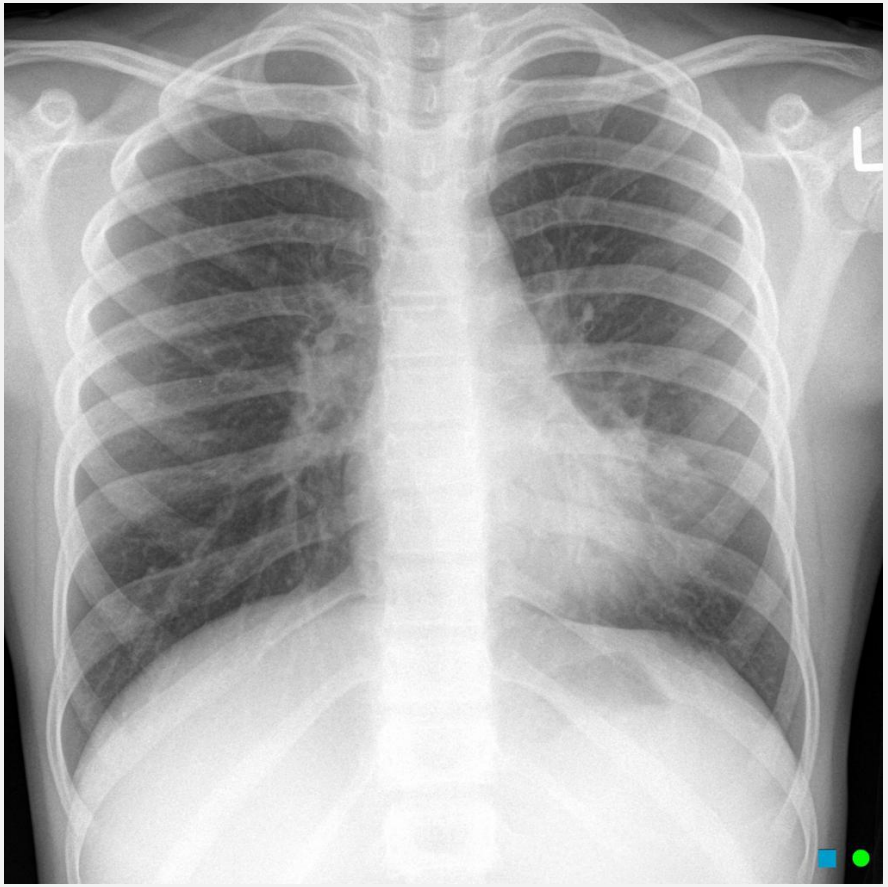
Lingular collapse



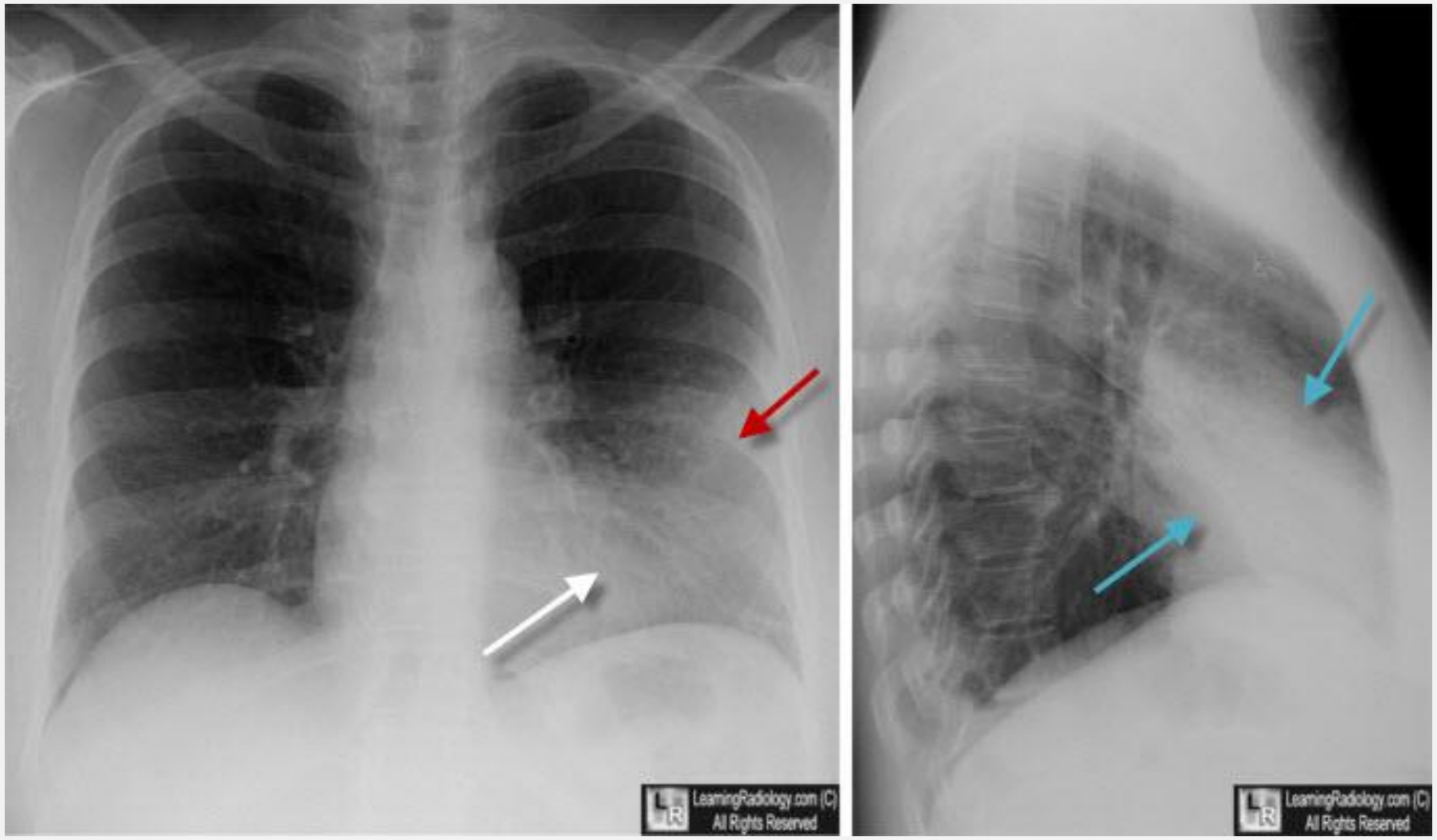
Features of lingula collapse

- Often involved with LUL collapse, but may collapse alone
- Anterior displacement of lower half of oblique fissure
- Increase opacity and obscuration of left heart border

Lingula collapse



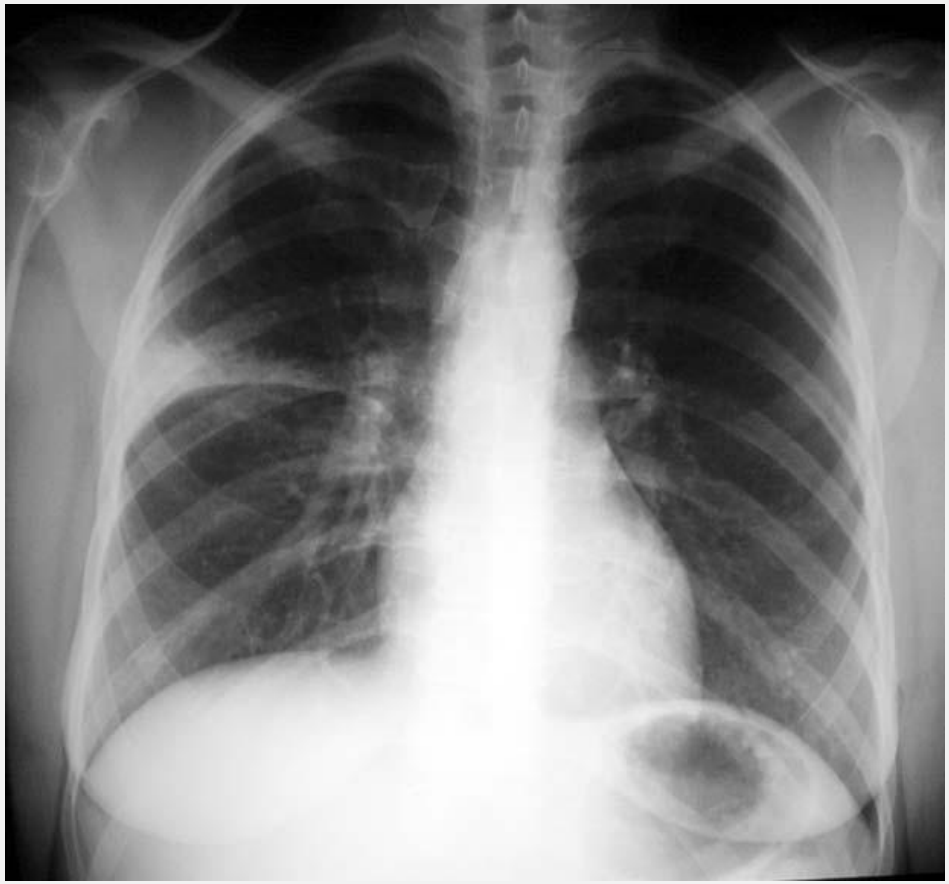
Lingular pneumonia



Segmental atelectasis

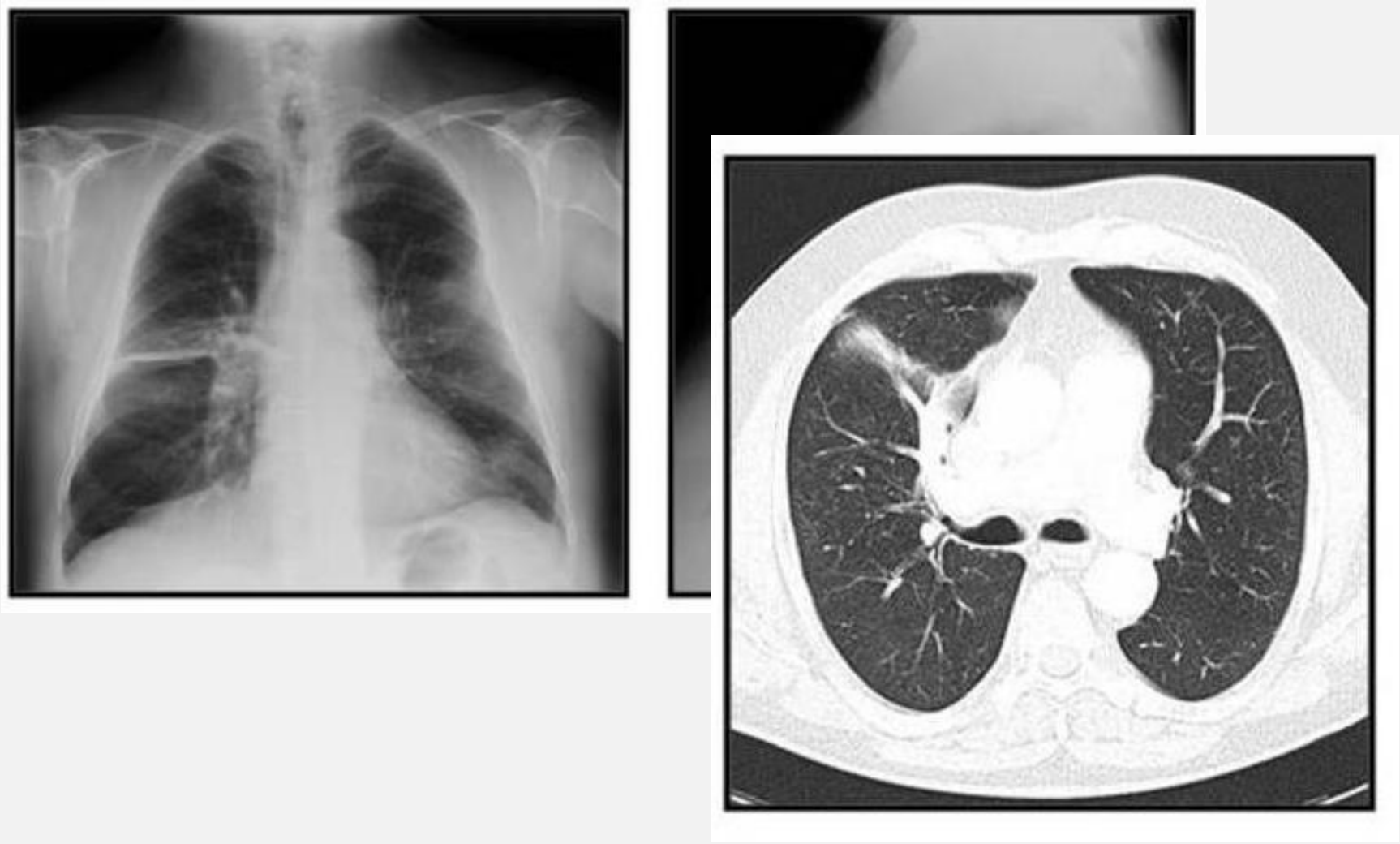
- Direct signs
  - Wedge shaped opacity with its apex at the hilum and its base in contact with the pleura.
  - Fissure displacement.
  - Silhouette sign.
- Indirect signs: usually absent

Segmental atelectasis (Ant. seg. of RUL)

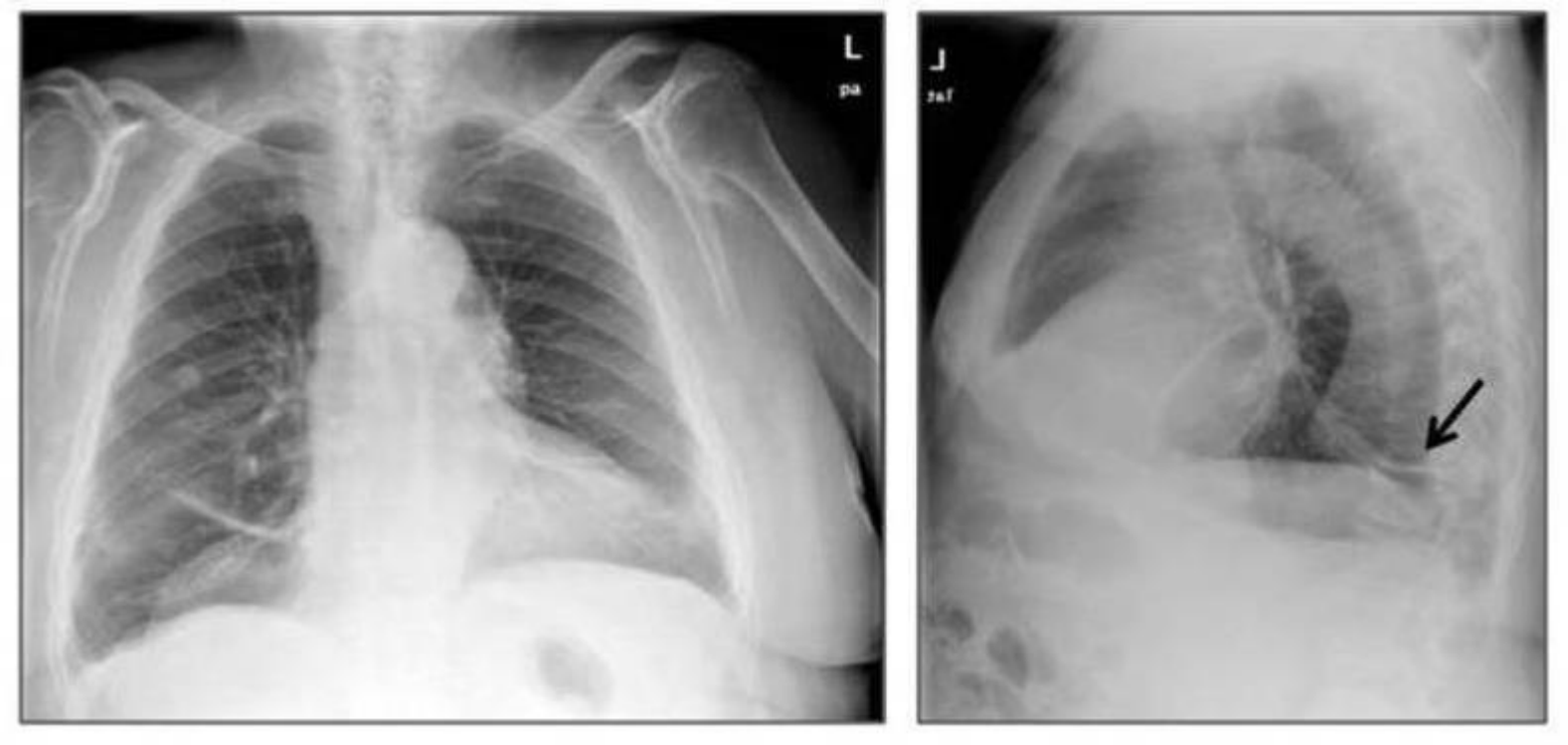


Segmental atelectasis (Ant. seg. of LUL)

Sub-segmental atelectasis (Ant. seg. of RUL)

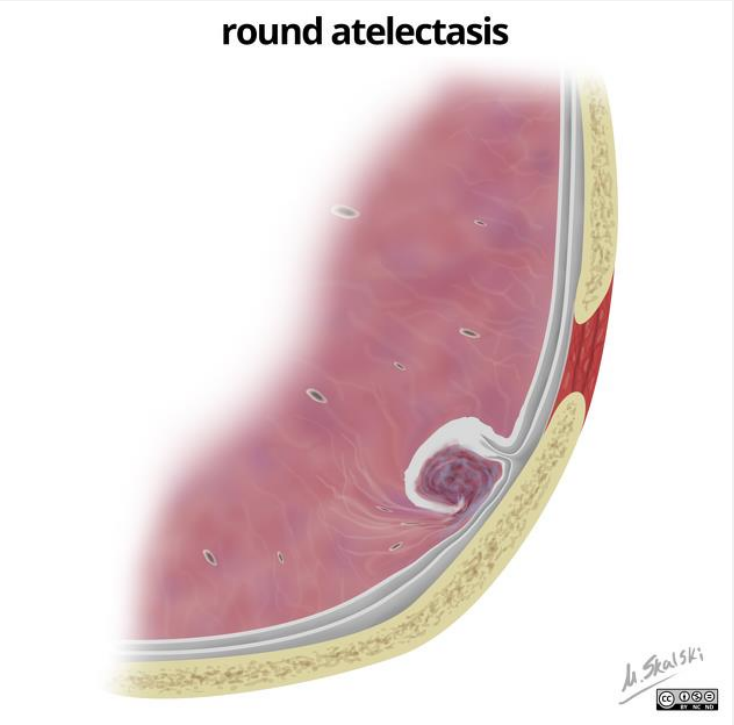


Sub-segmental atelectasis (Post. seg. of RLL)



Round atelectasis

- Also known as rounded atelectasis, folded lung or Blesovsky syndrome, an unusual type of lung atelectasis where there is infolding of a redundant pleura.

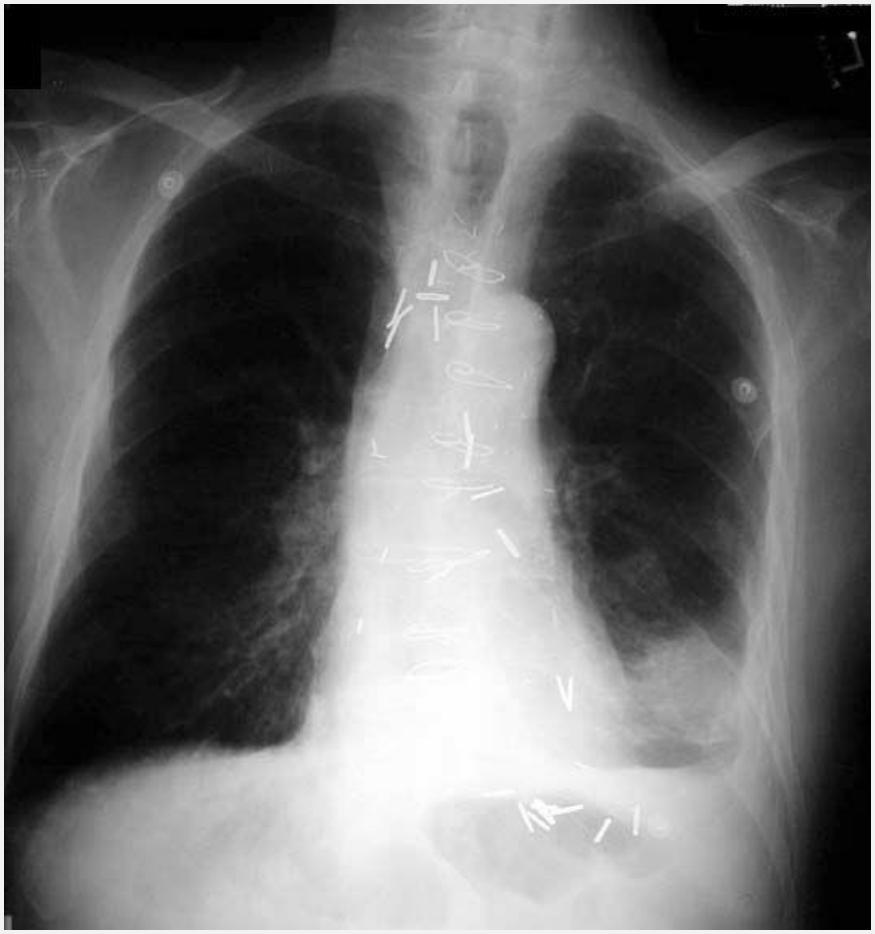


Round atelectasis

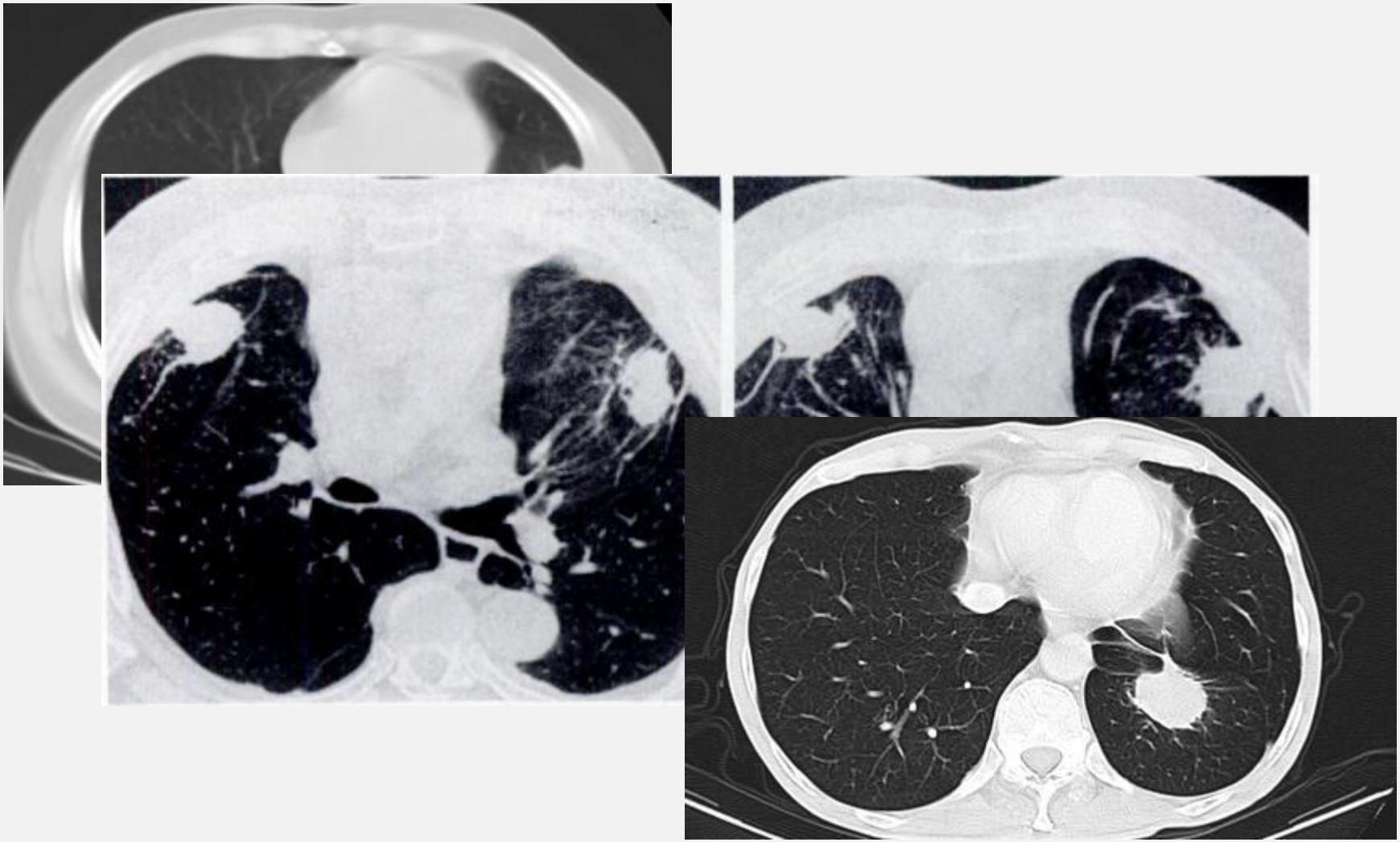
- Etiology:
  - Exposure to mineral dust: asbestosis, pneumoconiosis.
  - Exudative pleuritis: tuberculosis, hemothorax.

- Location:
  - Posterior basal segment of the lower lobe (for mechanical reasons).

Round atelectasis



Round atelectasis



Comet-tail sign: *pulling of bronchovascular bundles*

Contents

- Atelectasis / Collapse of lung

- Consolidation

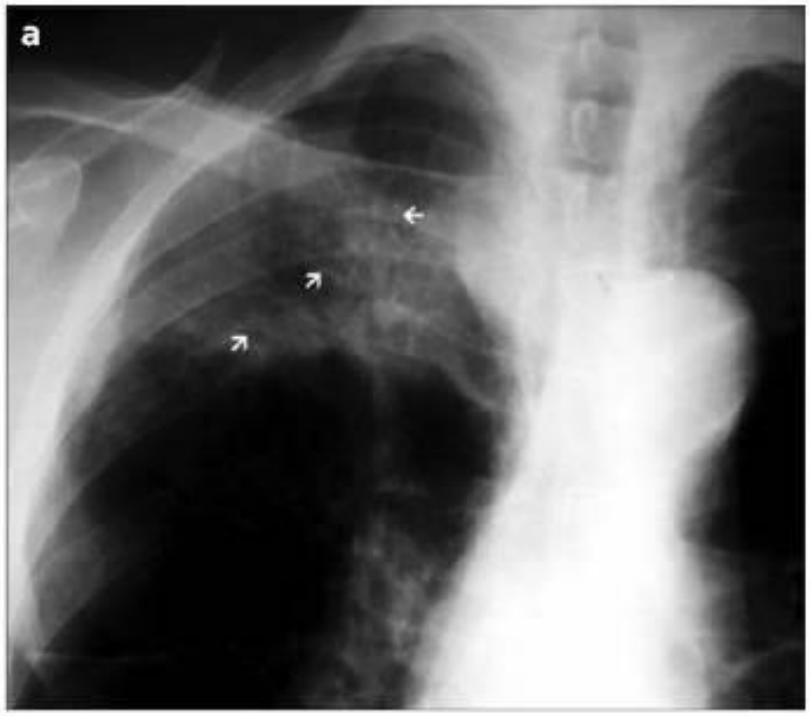
Definition of consolidation

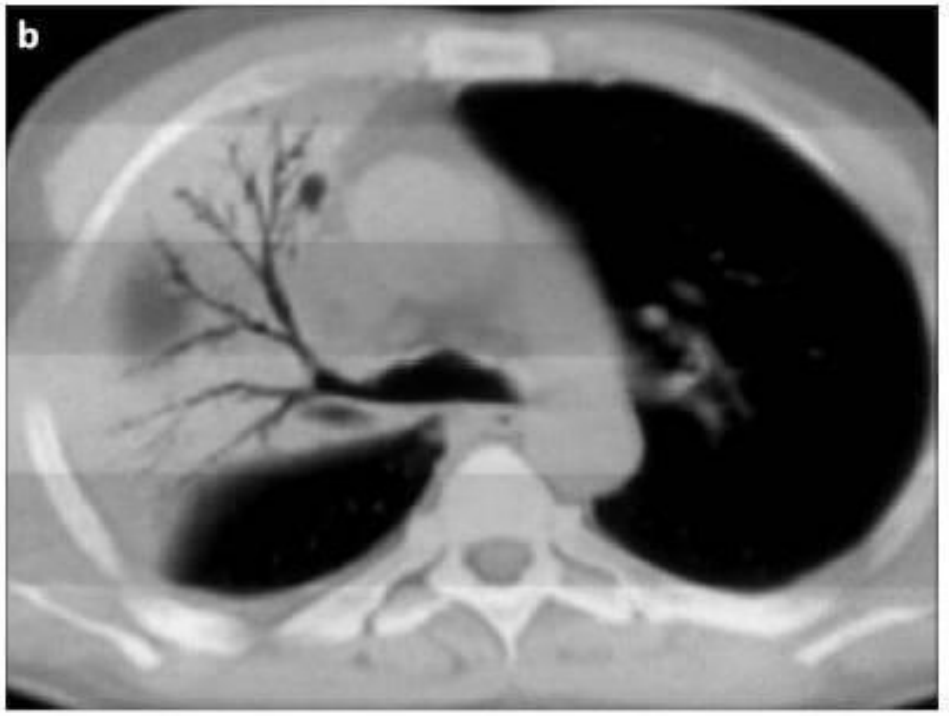
- Replacement of air in one or more acini by fluid or solid material
  - fluid
  - blood
  - pus
  - cells
  - other materials

Radiological signs of consolidation

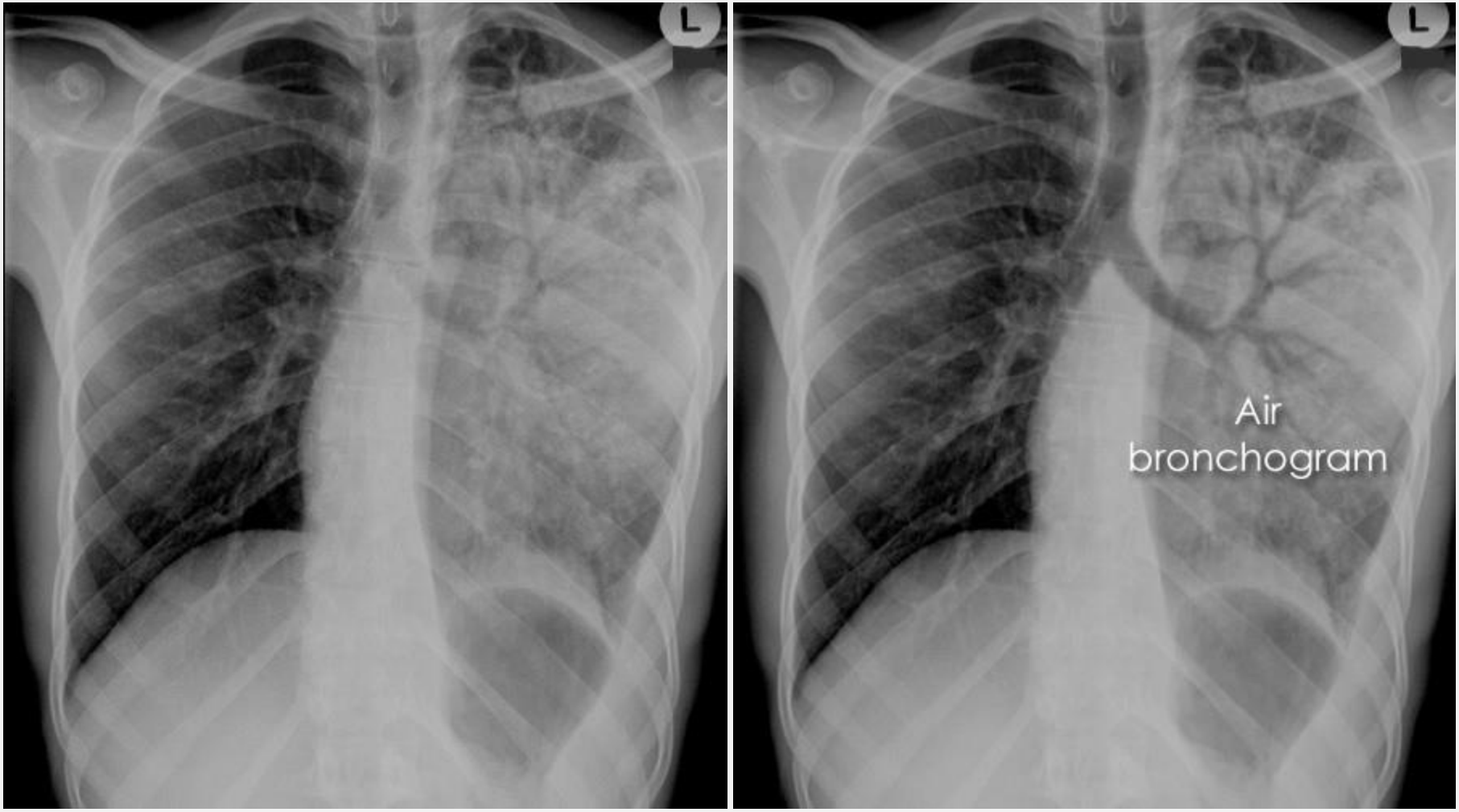
- Homogenous opacity with obscuration of vascular markings.
- Ill-defined opacities.
- Preserved lung volume.
- Silhouette sign.
- Air broncho-gram.
- CT angio-gram.

Air bronchogram

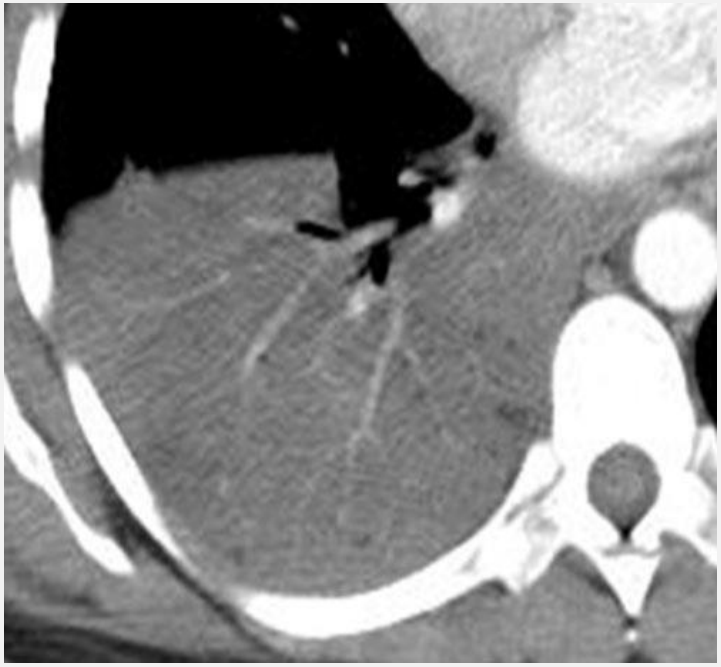


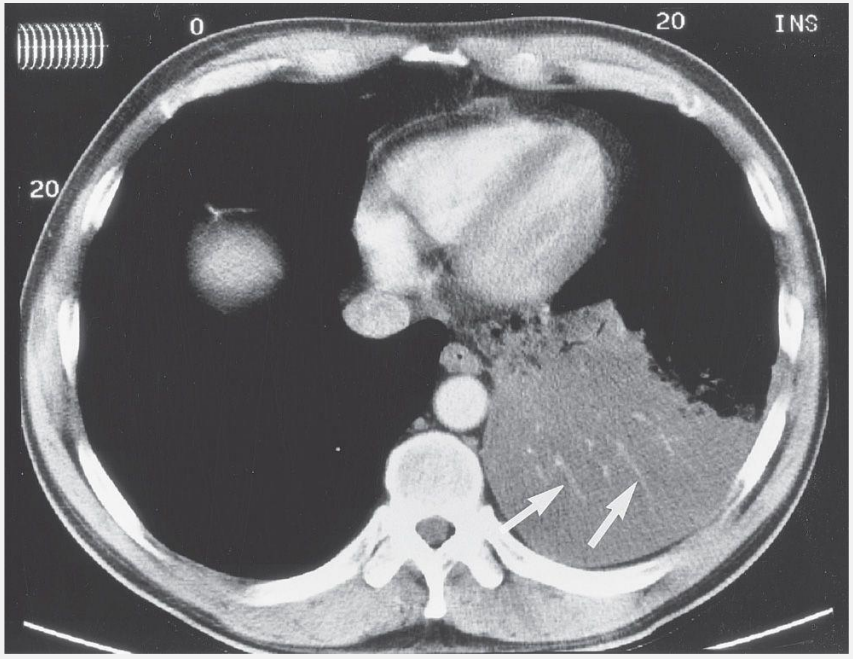


Air bronchogram



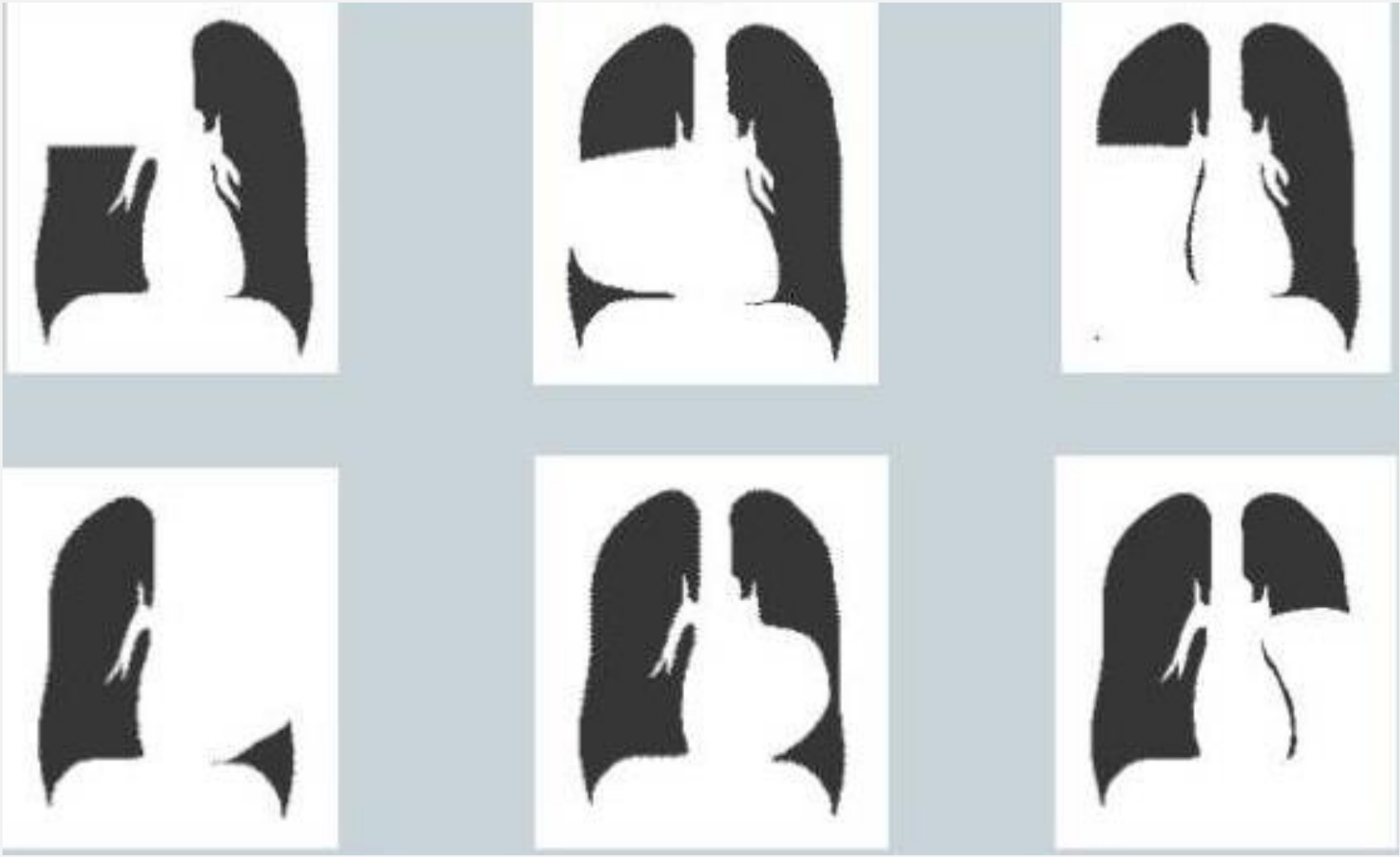
CT angiogram



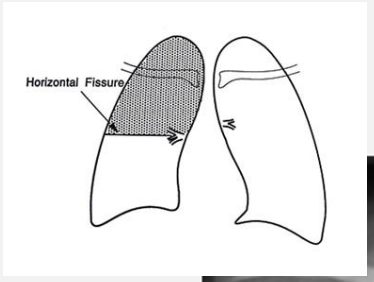


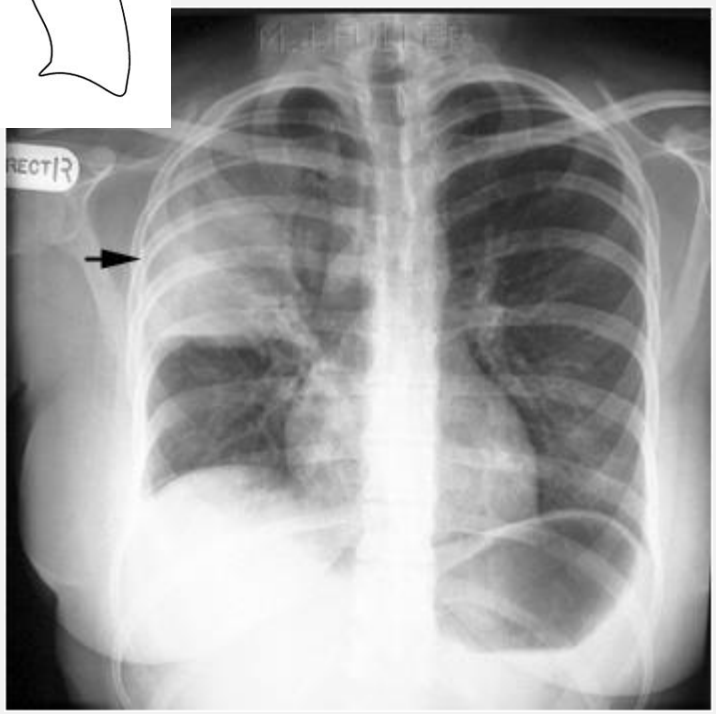
Non-specific

Location of consolidation

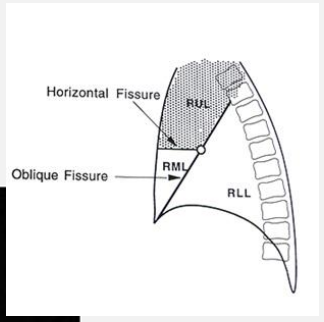


RUL consolidation



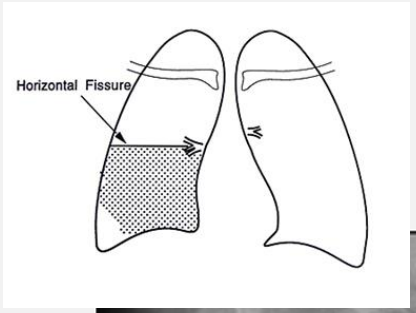


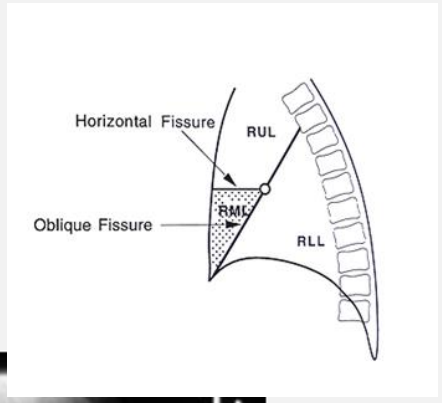
Dense opacity seen above the horizontal fissure.
Air-bronchogram line.

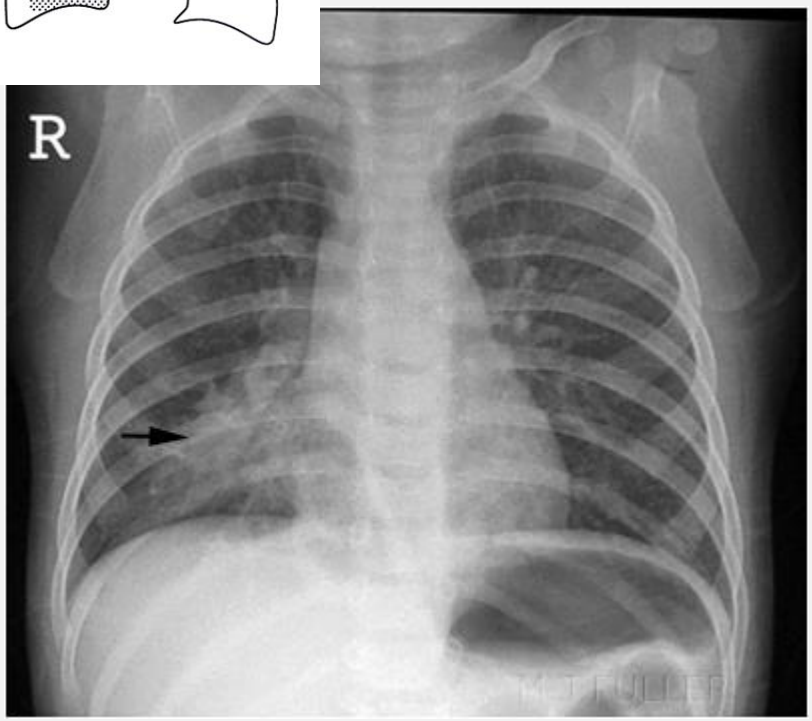


Dense opacity in the RUL sharply bordered by the horizontal and oblique fissures

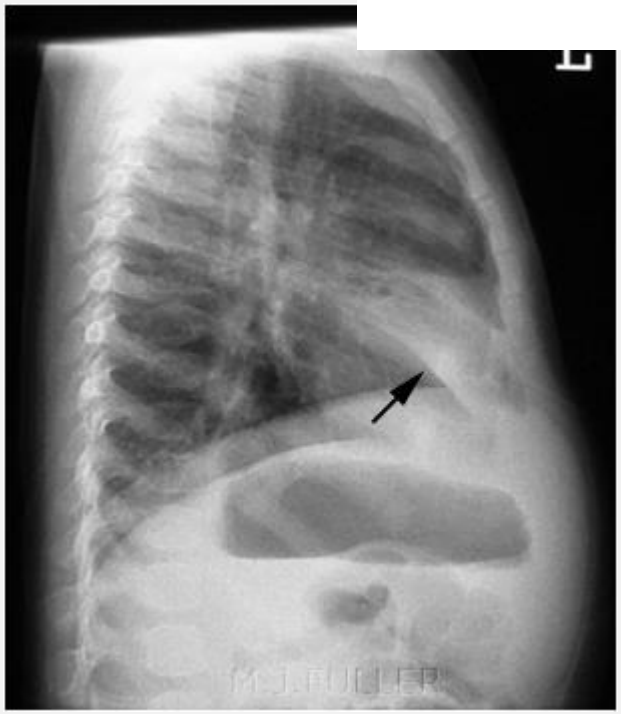
RML consolidation





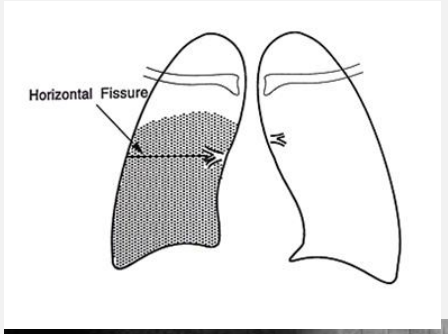


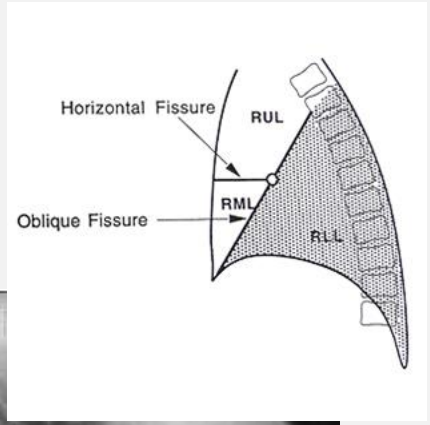
RML opacification
Loss of adjacent right heart border



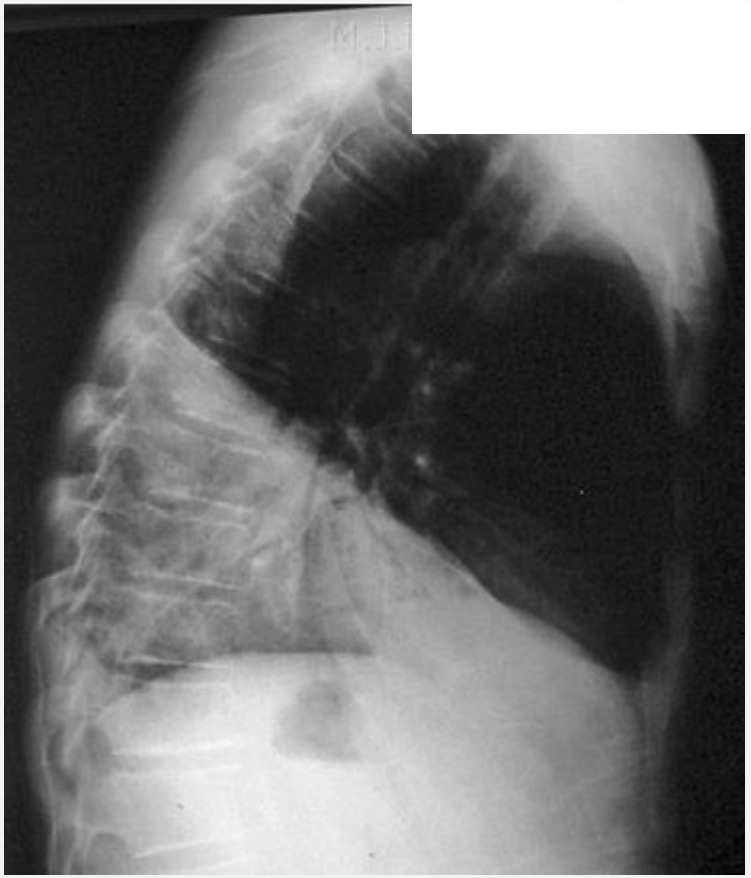
Wedge shaped opacity characteristic of RML consolidation(black arrow)
Lingula segment consolidation can have a similar appearance on the lateral view

RLL consolidation



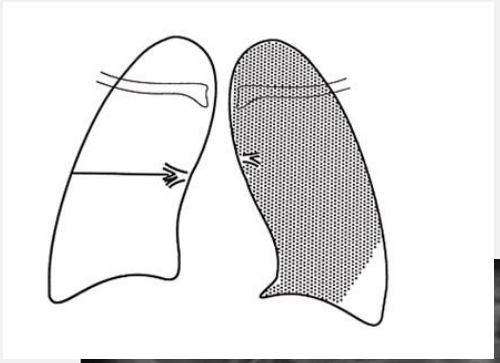


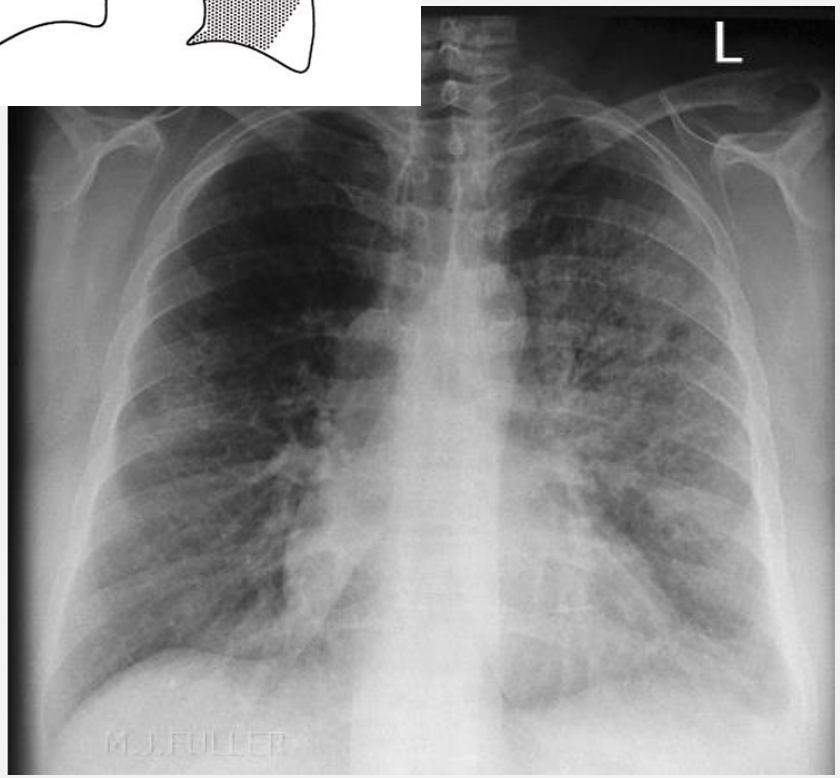
Loss of right hemi-diaphragm
Dense opacity in RLL
Some loss of right heart border



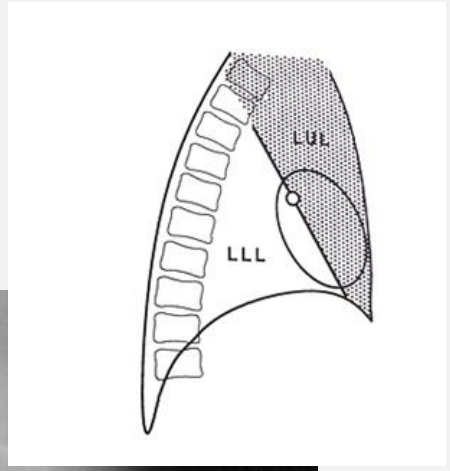
Triangular opacity
Loss of right hemi-diaphragm

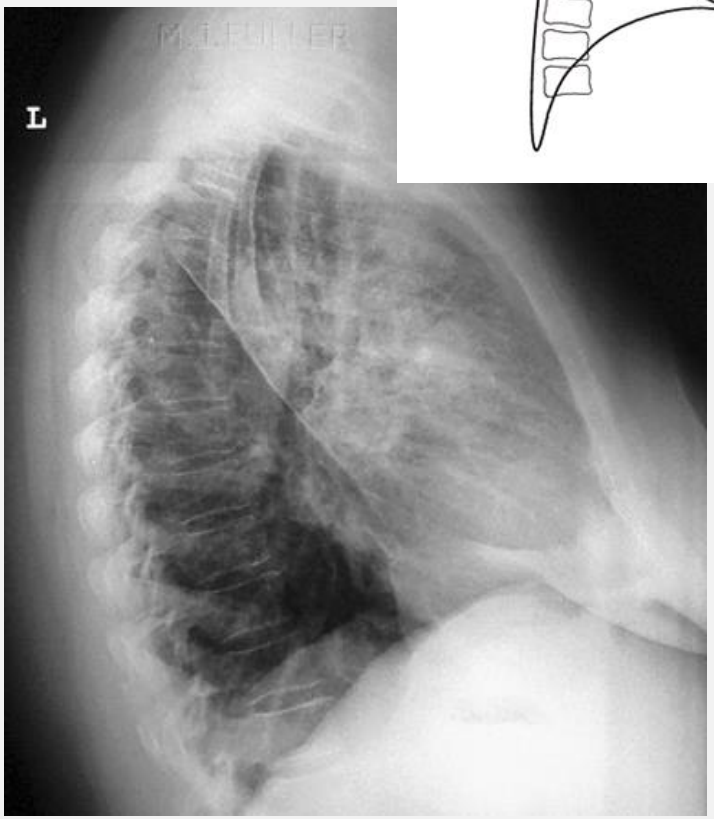
LUL consolidation





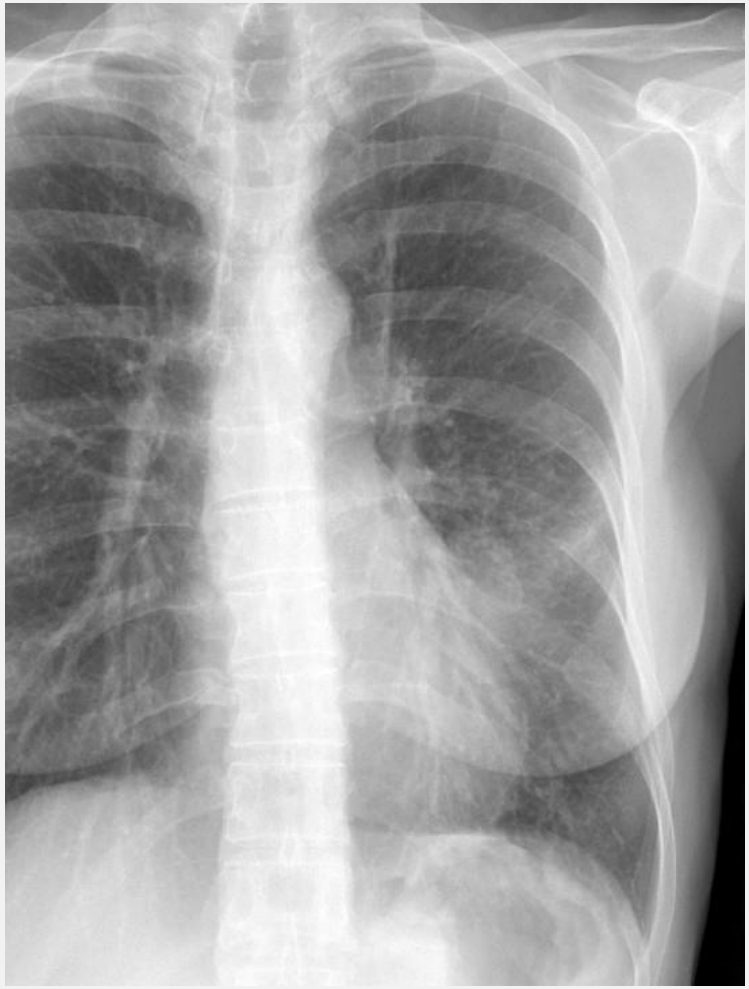
Opacity left hemi-thorax
Air-bronchogram lines
Some loss of left heart border



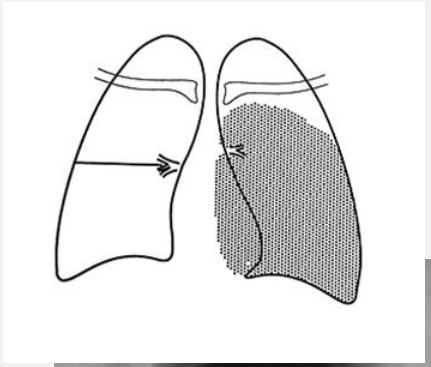


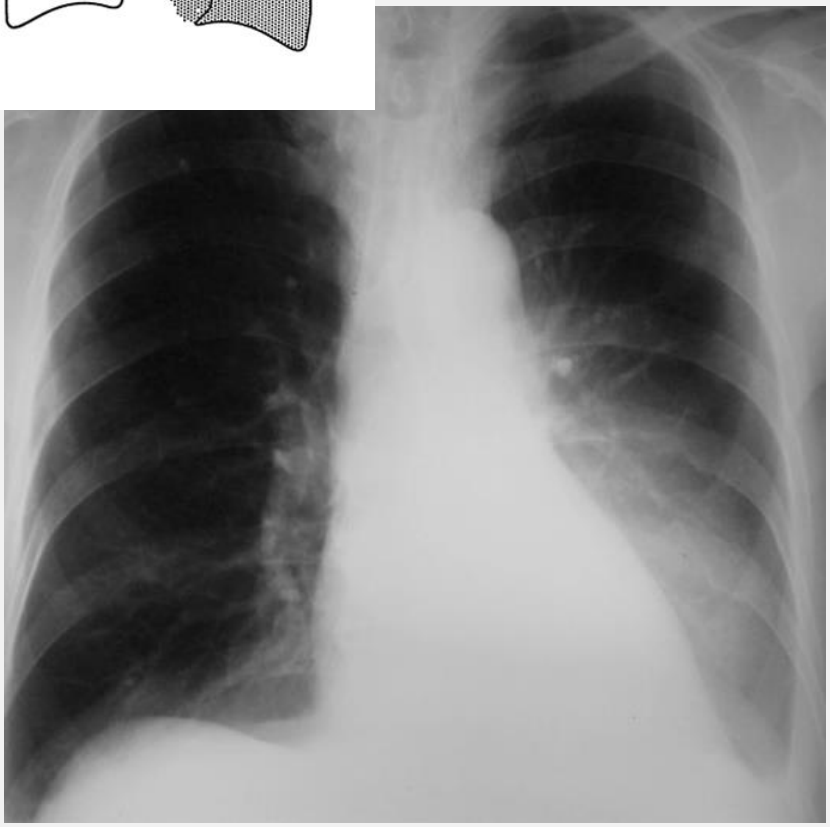
Opacity seen anterior to the oblique fissure

Lingula consolidation

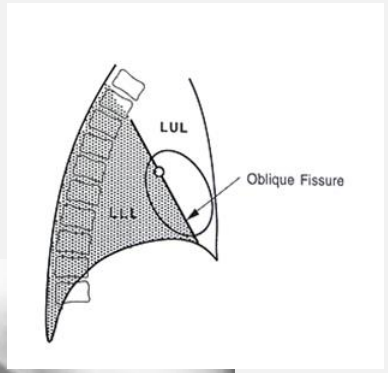


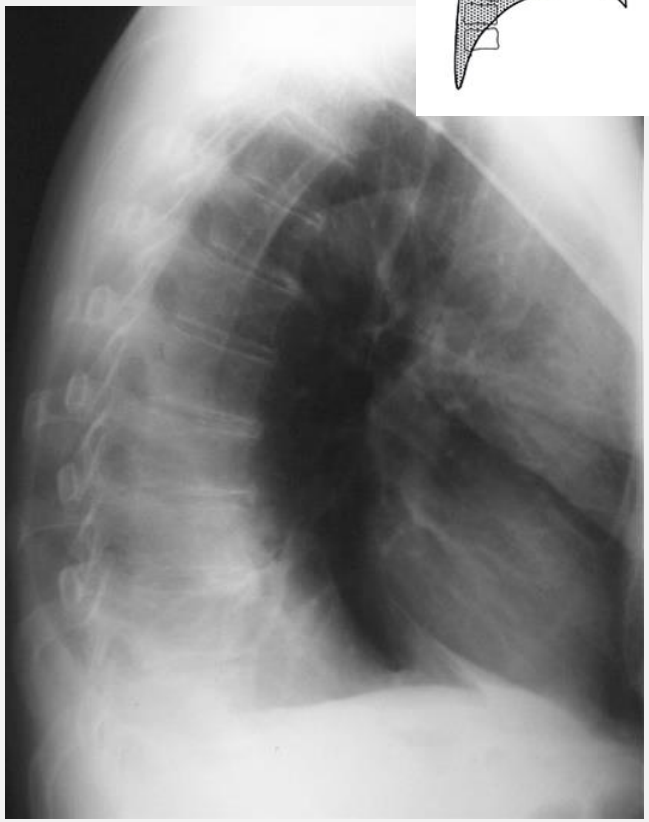
LLL consolidation





Appears as an area of increased opacity within the LLL
Some loss of the hemi-diaphragm medially is seen
Some pleural effusion





Increased opacity within the LLL
Loss of the normal darkening of the T spine
Some loss of the left hemi-diaphragm posteriorly

Causes of consolidation

Alveolar contents	Examples
Fluid	Pulmonary edema ARDS Hypoalbuminemia
Pus	Pneumonia
Blood	Alveolar hemorrhage Trauma
Cells	BAC Lymphoma
Others	PAP Lipoid pneumonia

Course of consolidation (or clinical s/sx)

- Acute
  - Pneumonia
  - Edema
  - Aspiration
  - Infarction
- Chronic
  - BAC
  - Lymphoma
  - Organizing pneumonia
  - Eosinophilic pneumonia
  - PAP
  - Sarcoidosis

Patterns of consolidation

Focal

Multi-focal

Diffuse

Identify the location and extent of the consolidation

Narrow down DDx by pattern

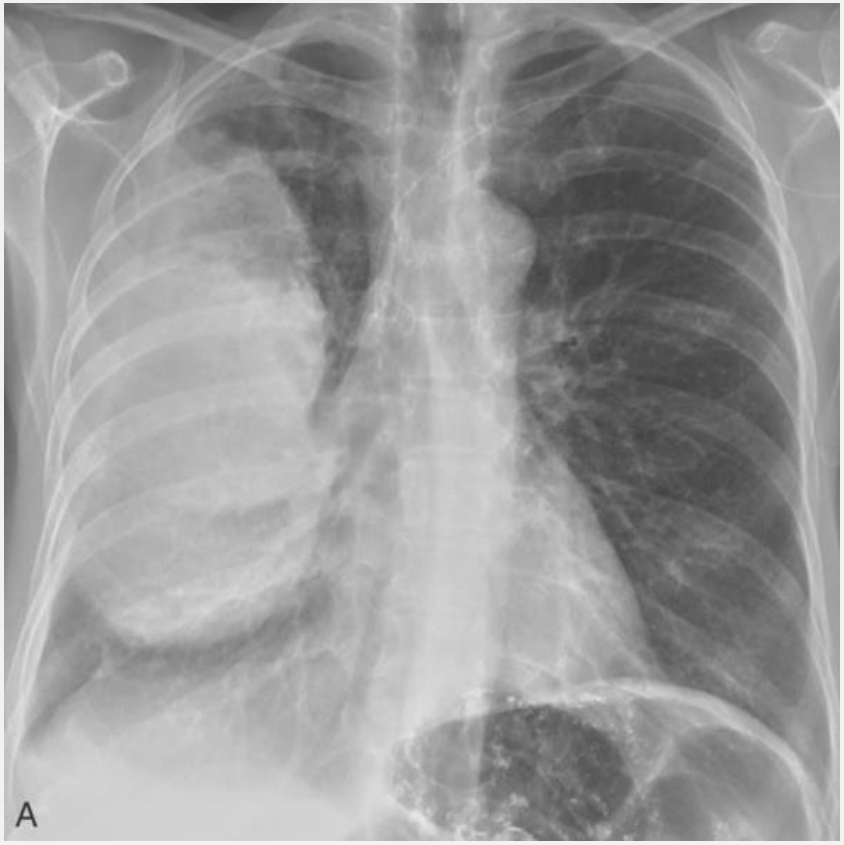
Further narrow down DDx by clinical correlation

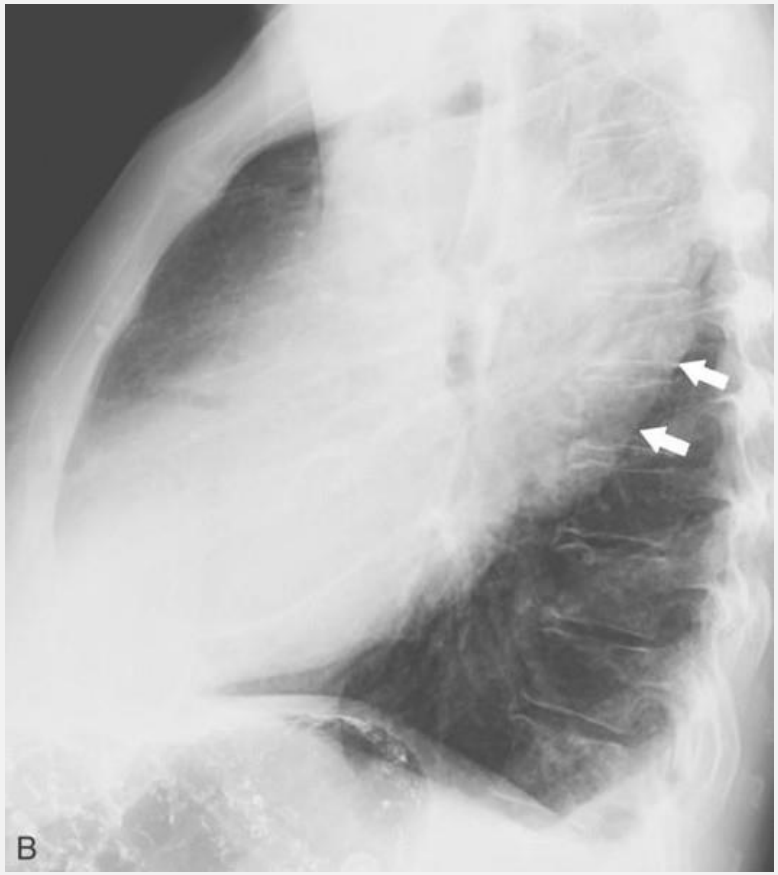
Further diagnostic procedures

Focal consolidation

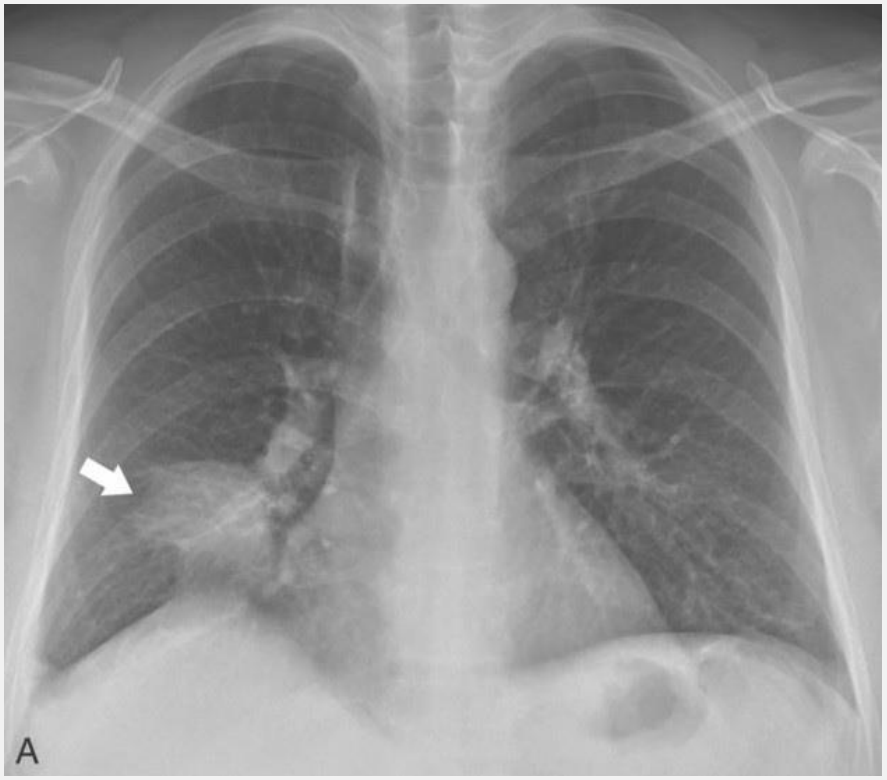
- Pneumonia
- Neoplasm
- Hemorrhage
- Others:
  - Organizing pneumonia
  - Sequestration
  - Sarcoidosis

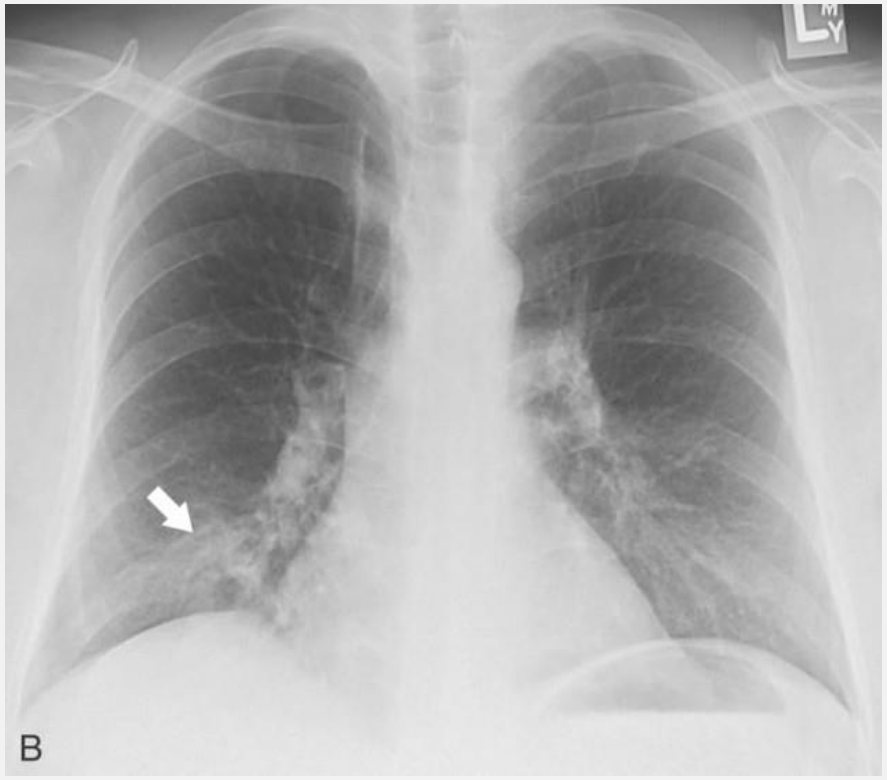
RUL & RML lobar pneumonia





Round pneumonia

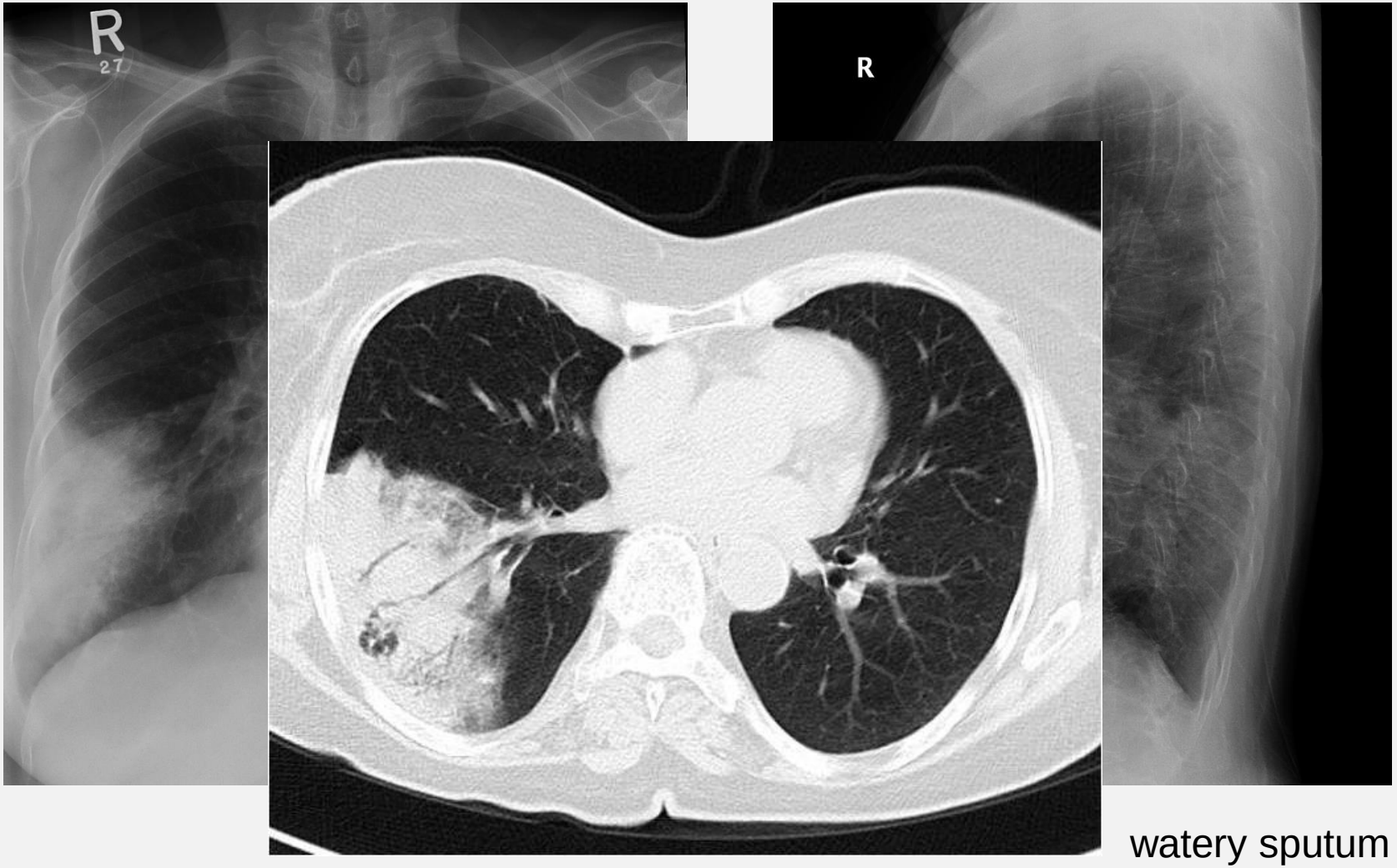




S/P ABx

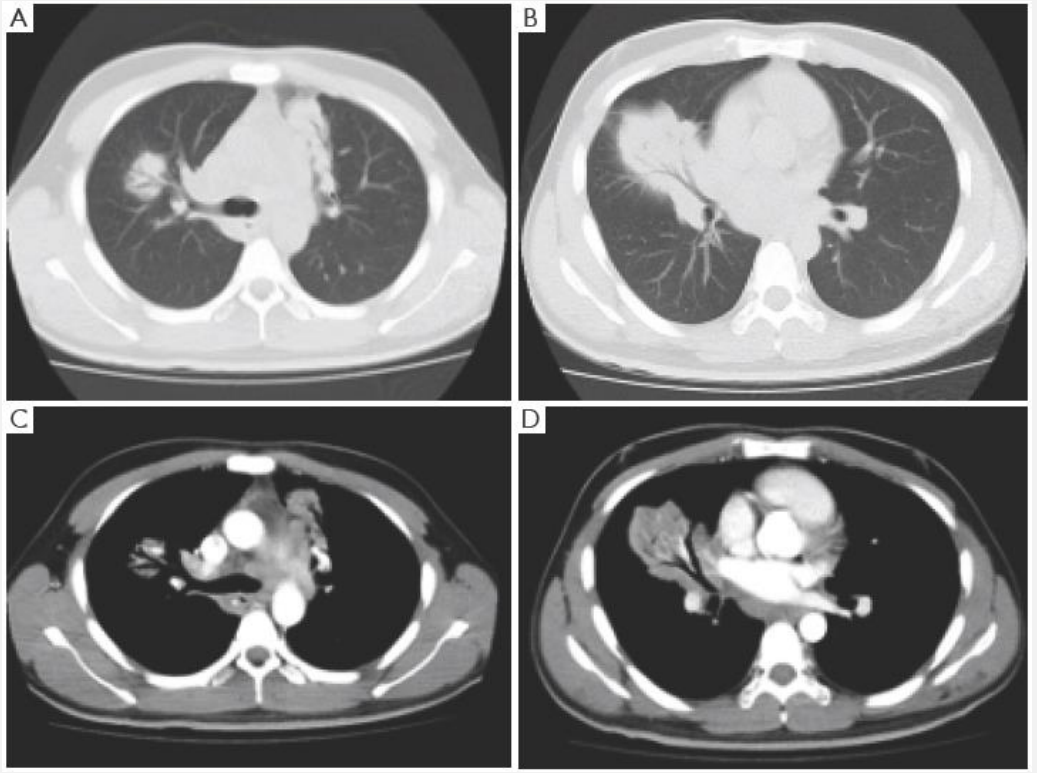
Children more common

BAC



watery sputum (+)

Lymphoma

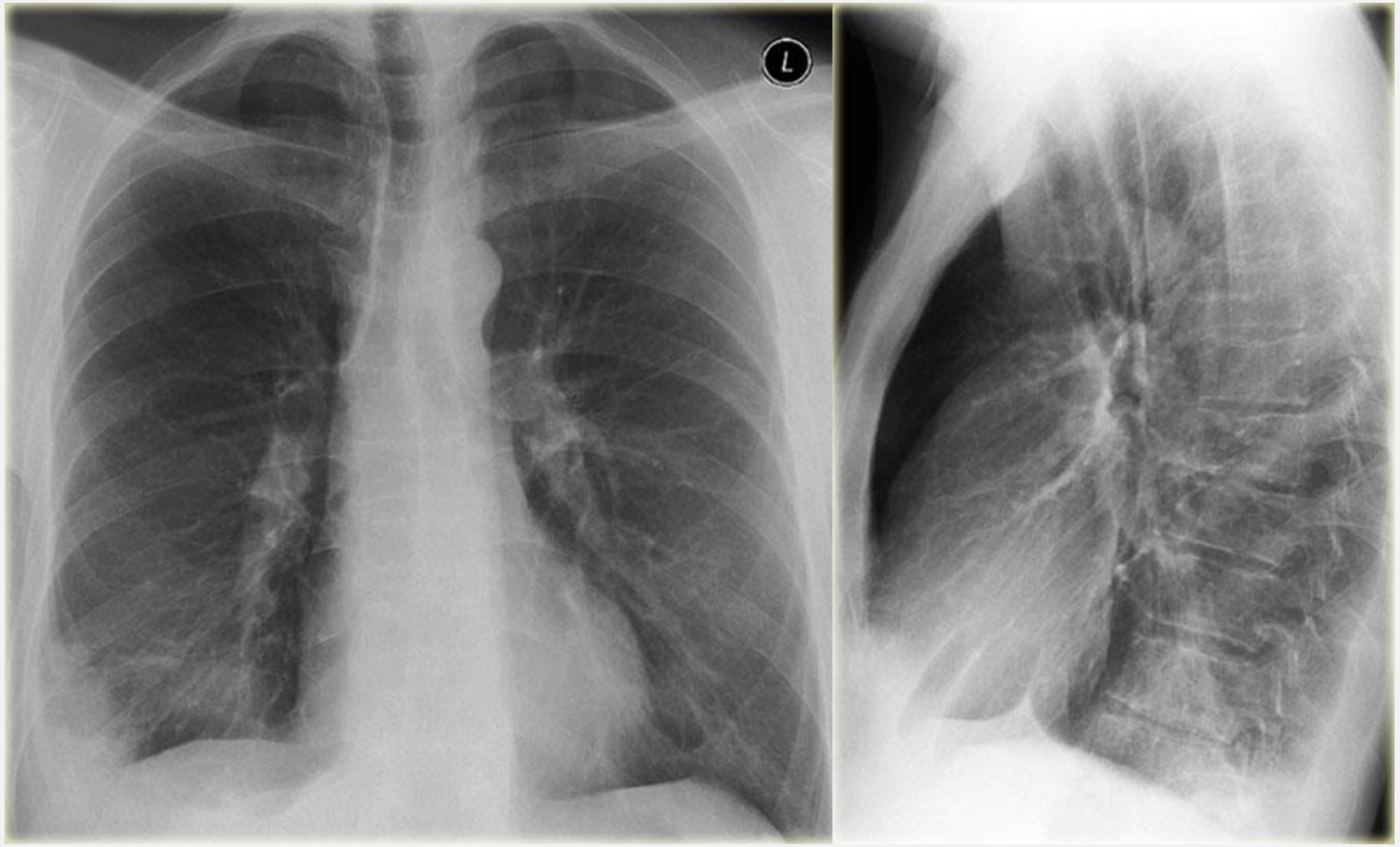


sweating, weight loss

Pulmonary hemorrhage

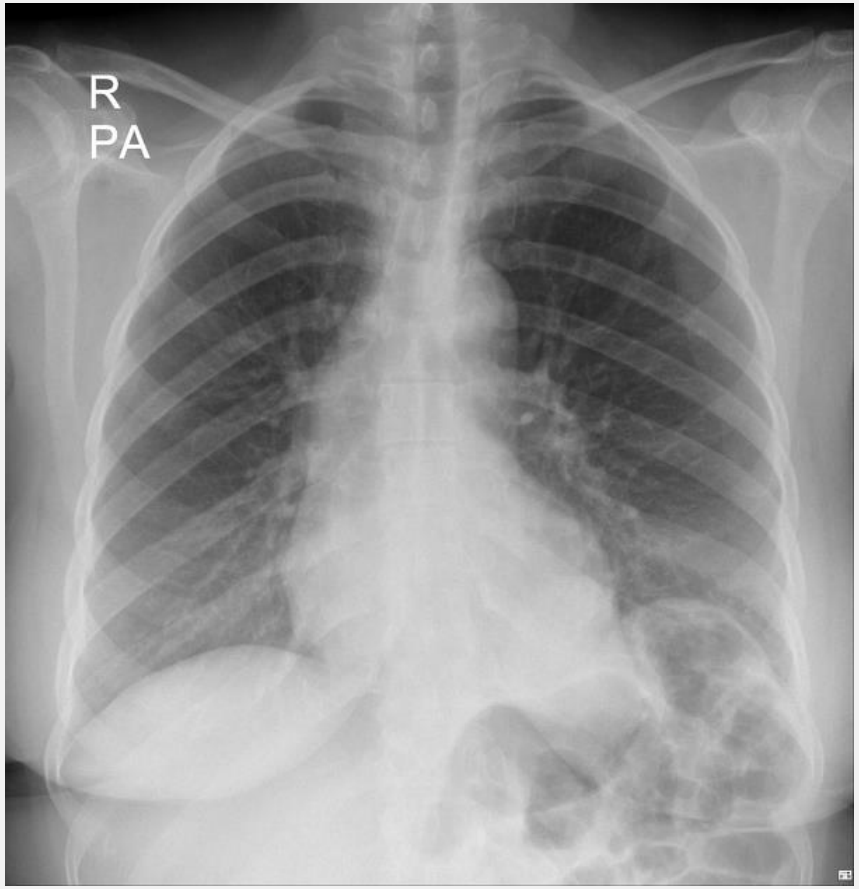
S/P biopsy

Lung infarction



chest pain

Sequestration

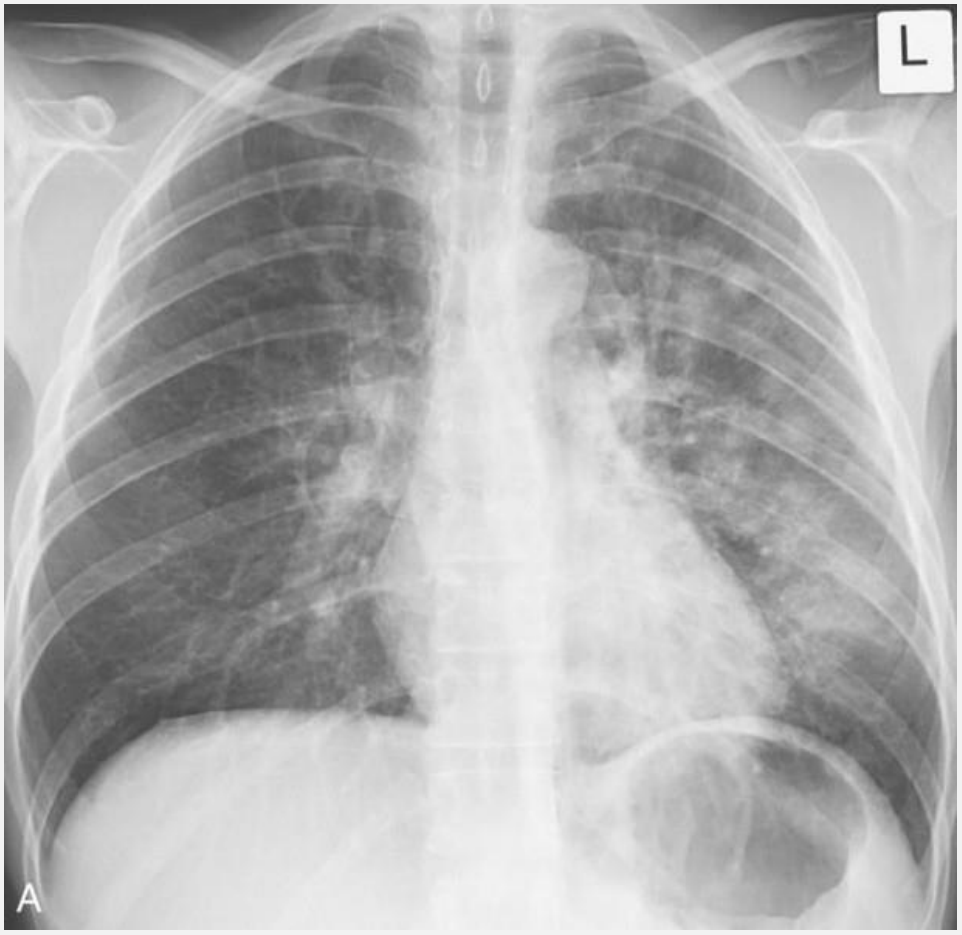


frequent LRTI

Multifocal consolidation

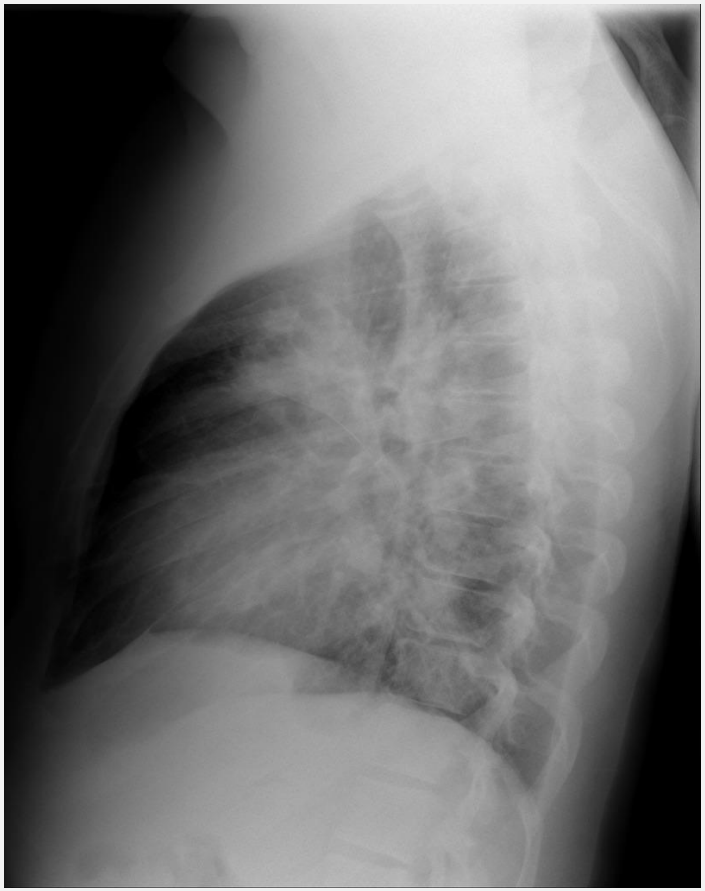
- Bronchopneumonia (lobular pneumonia)
- Vascular
  - Septic emboli
  - Wegener's granulomatosis
- Neoplasm
- Others

Bronchopneumonia



fever, cough

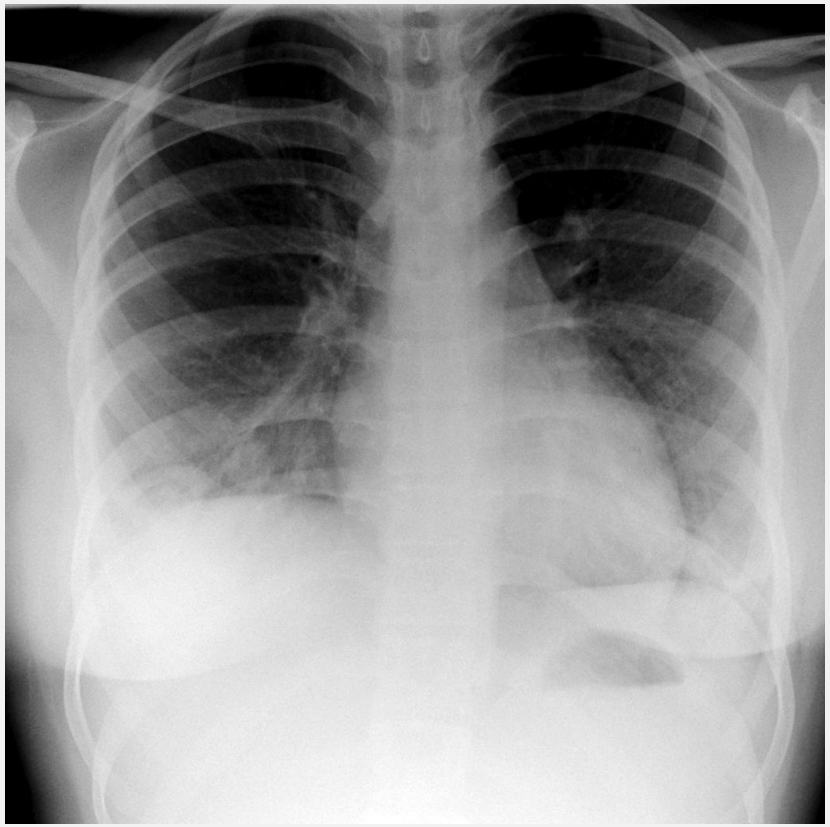
Bronchopneumonia due to Haemophilus influenzae



fever, cough

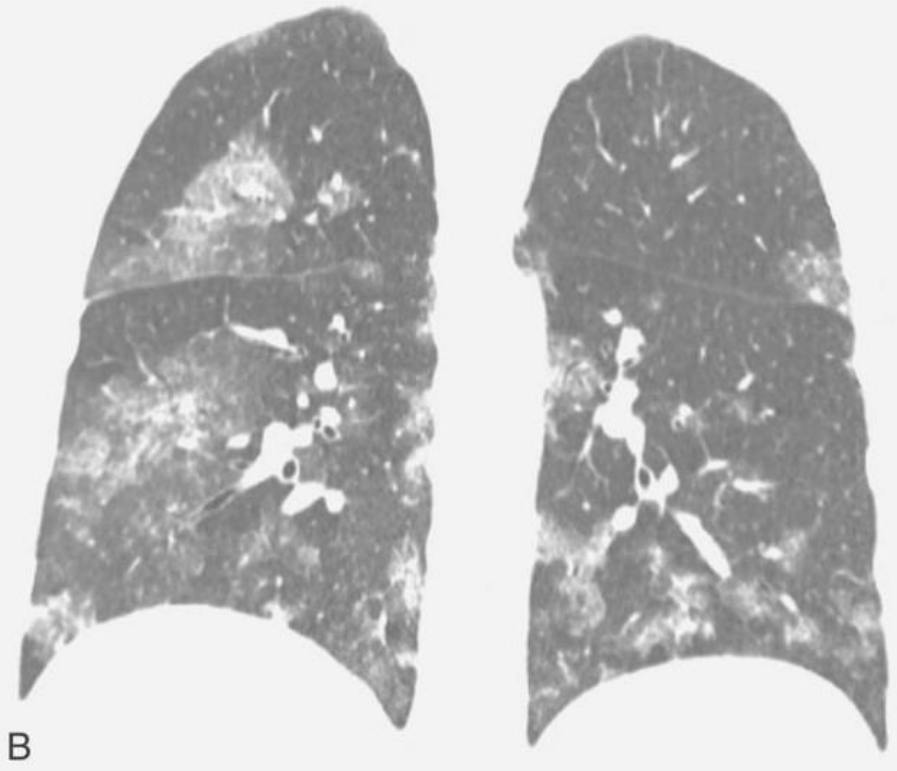
Septic emboli

Wegener's granulomatosis



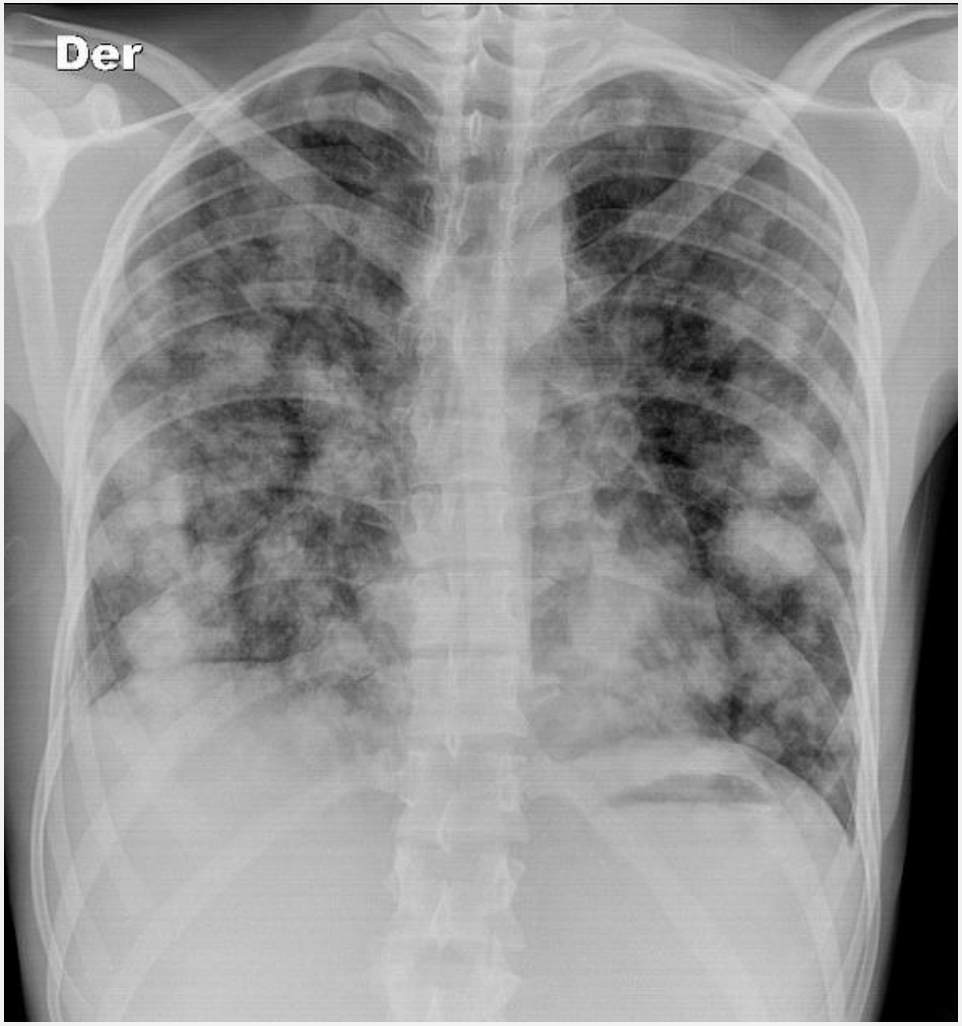
s/sx(-)

Wegener's granulomatosis



blood-tingled sputum

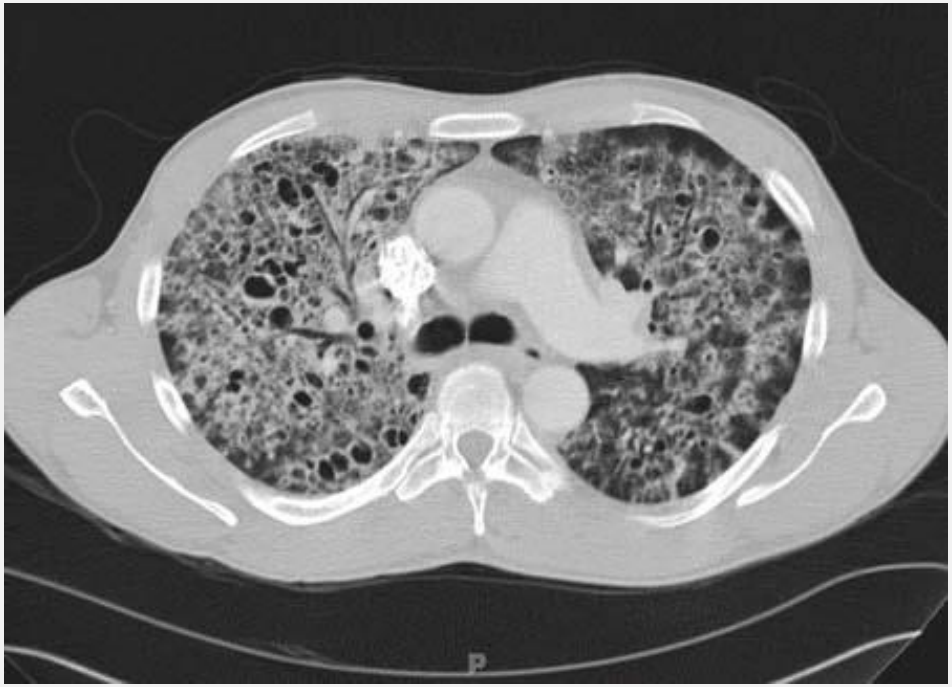
Pulmonary metastases



Diffuse consolidation

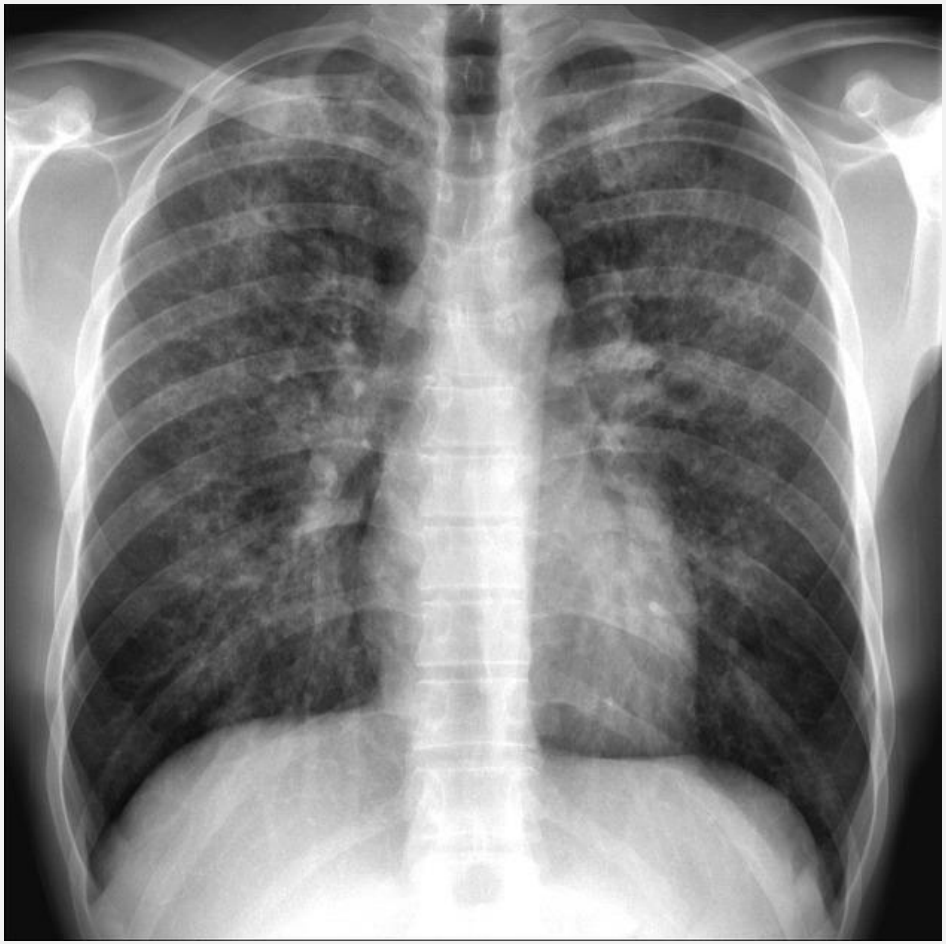
- Bronchopneumonia
- Edema
- Diffuse hemorrhage
- Others

PJP pneumonia



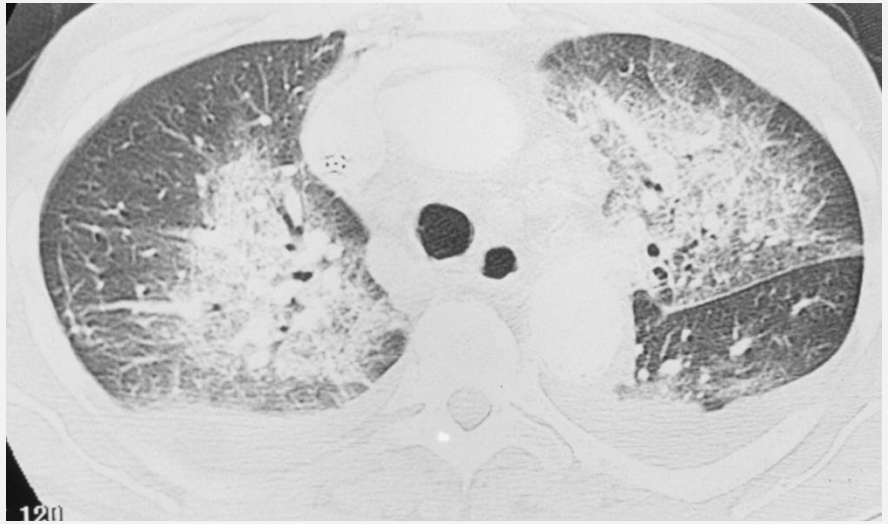
fever, SOB

PJP pneumonia

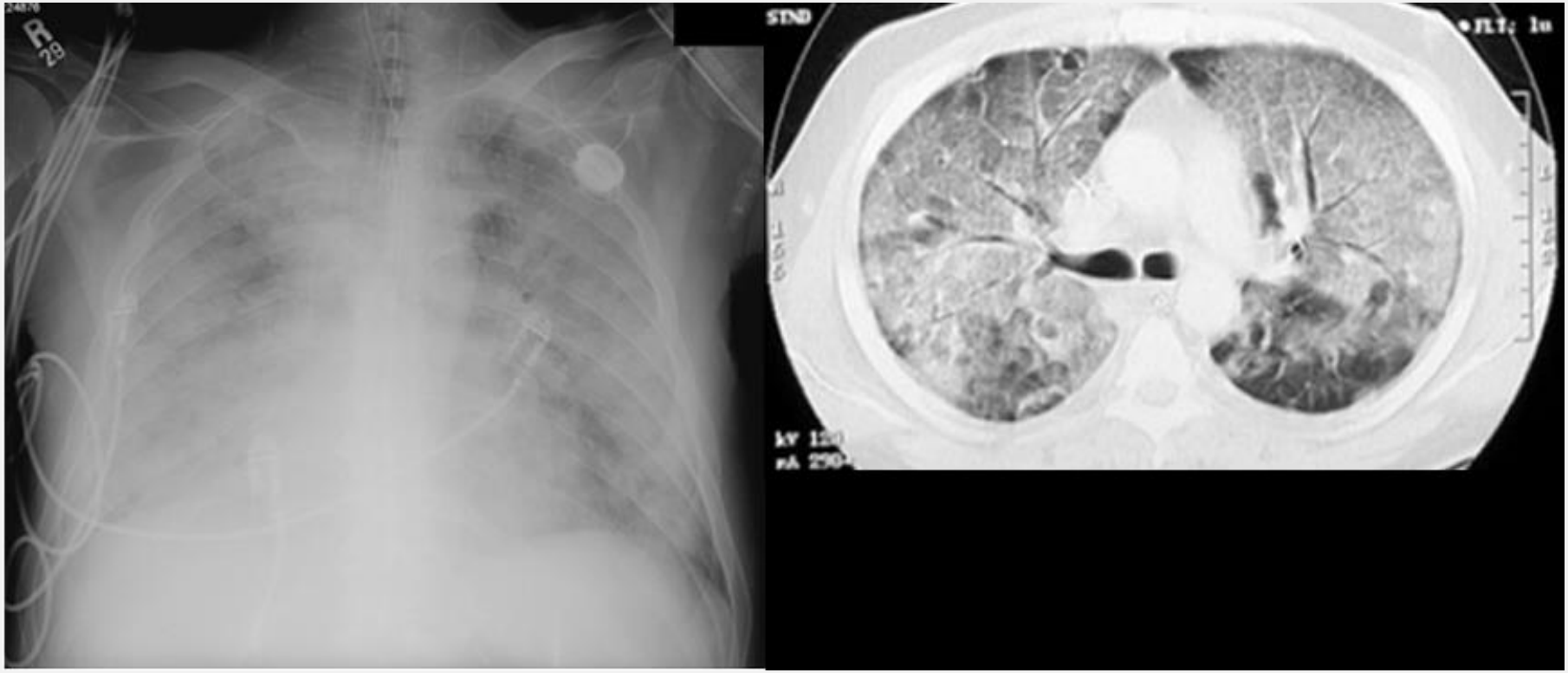


SOB

Pulmonary edema



ARDS

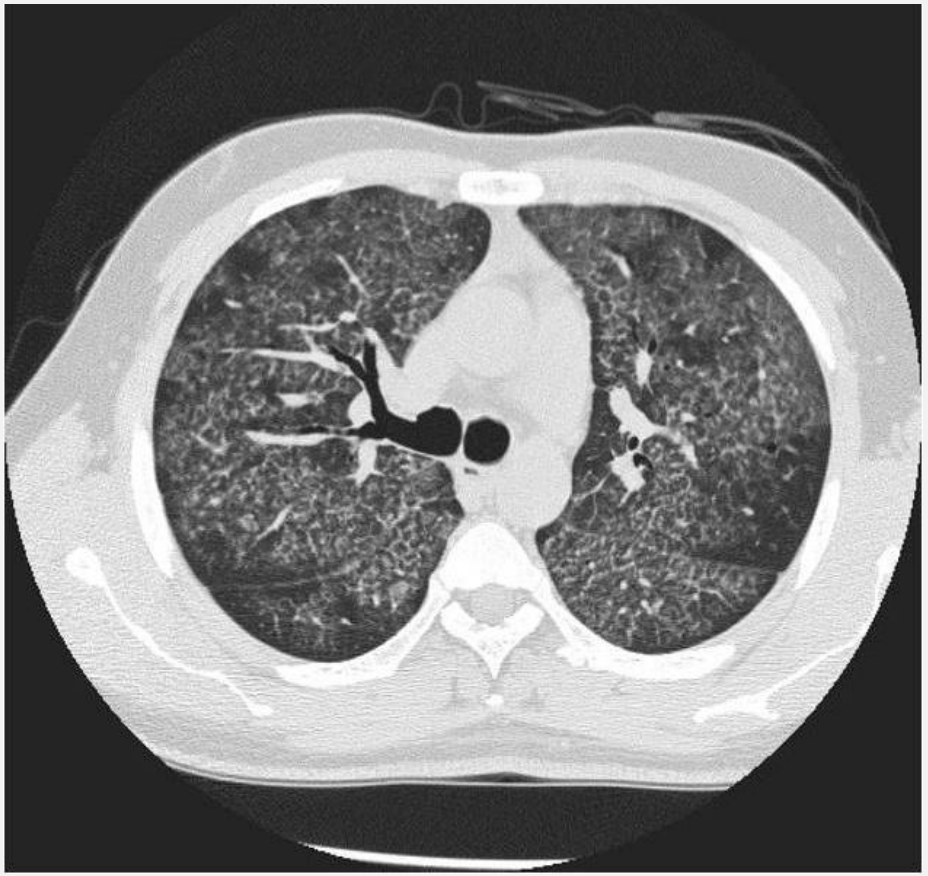


Severe hypoxemia

Goodpasture syndrome

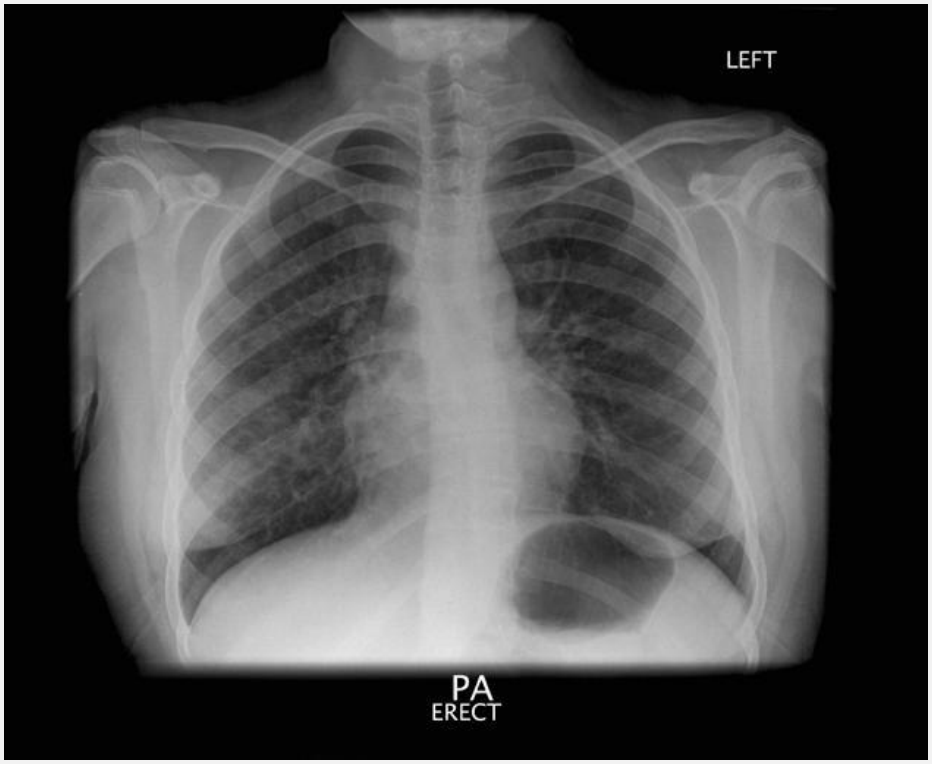
Massive hemoptysis(+)

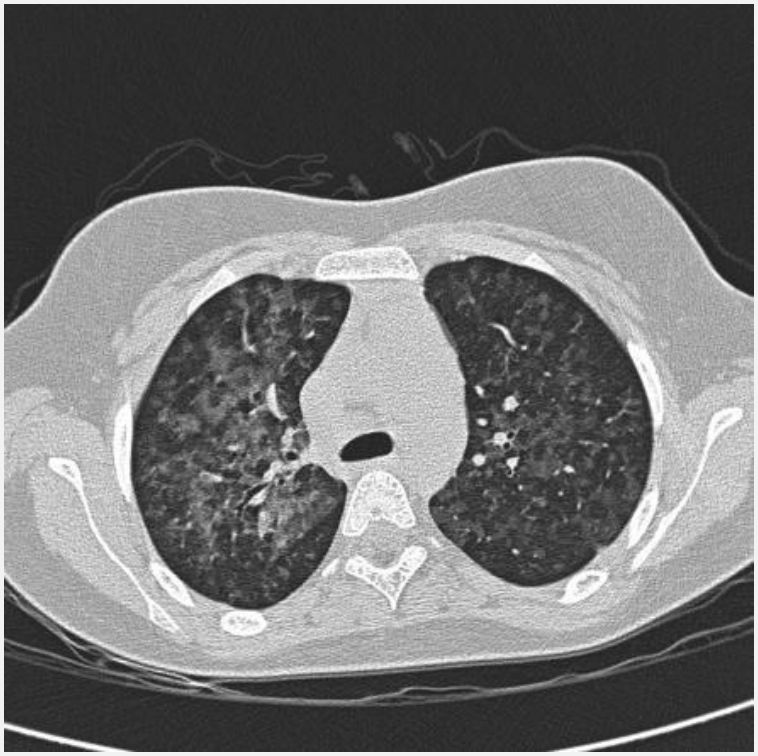
Pulmonary alveolar proteinosis



s/sx(-)

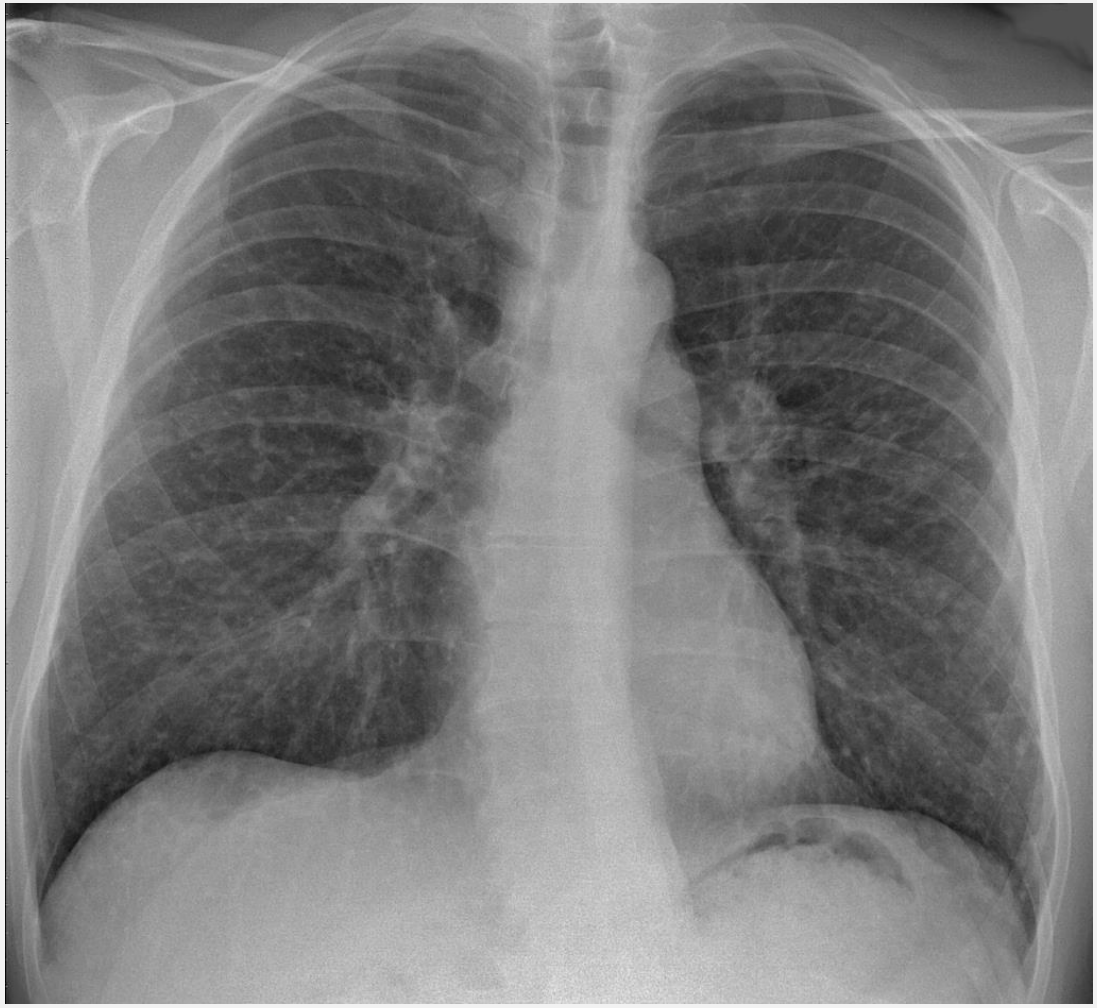
Hypersensitivity pneumonitis





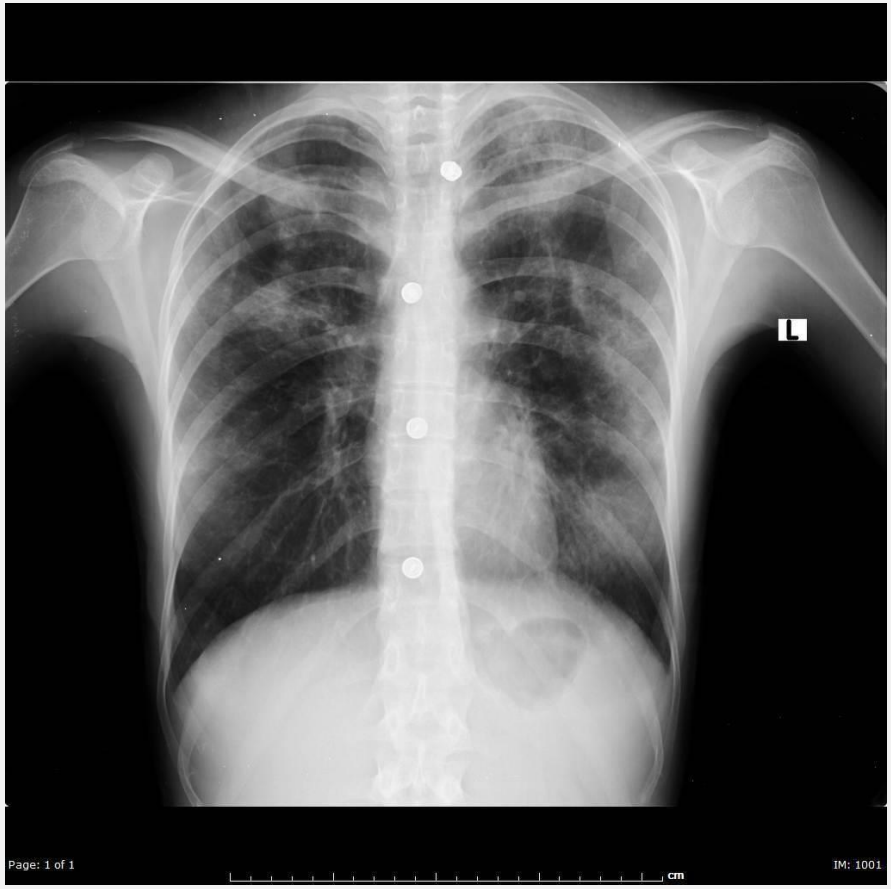
barn visit (+), fever

Sarcoidosis

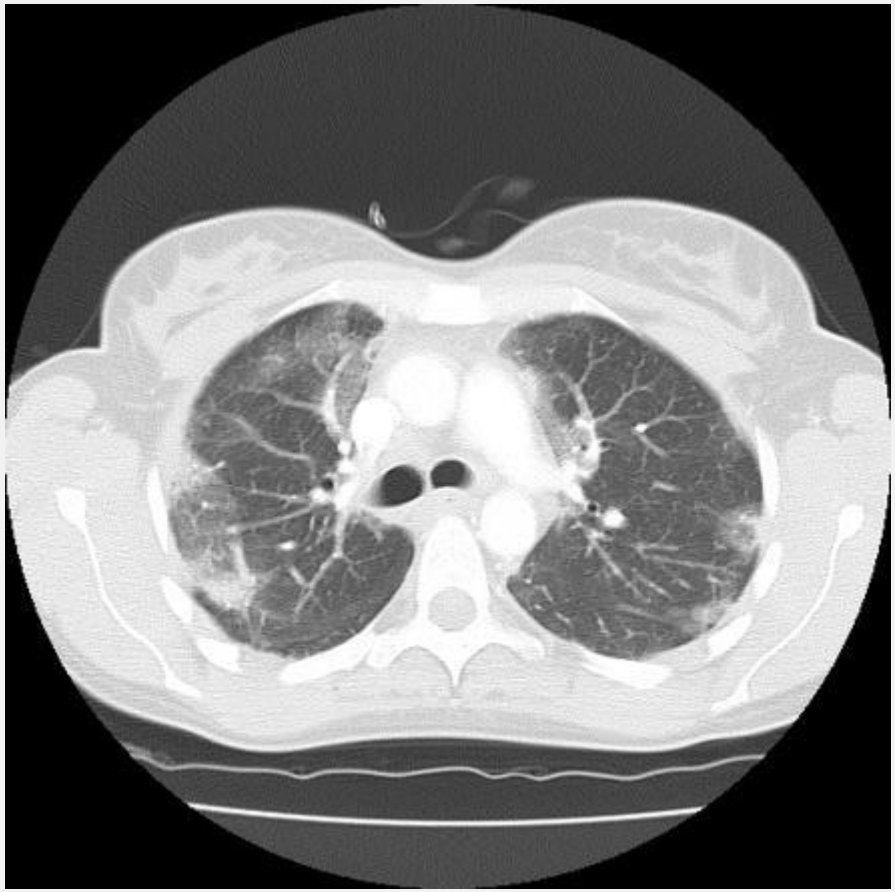


mild cough

Chronic eosinophilic pneumonia



COP



Atoll (reverse halo) sign

1. Consolidation

Content of the alveoli

Water	Pus	Blood	Cells
Heart failure ARDS low albumin volumeoverload renal failure	Pneumonia	Trauma Goodpasture Henoch Schönlein SLE	BAC Organizing pneum. Chron eosinophilic Sarcoid

Pattern

Diffuse

Edema
- Heart failure
- volume overload
- low albumin
- renal failure
- ARDS
- Transfusion reaction

Bronchopneumonia
- Staph Aureus
- Gram-negative
- PCP
- viral - fungal

Hemorrhage
- SLE
- Henoch-Schönlein
- Wegener
- Goodpasture

BAC
Lymphoma
Organizing pneum.
Eosinophilic pneum.
Hypersensitivity pneum

Lobar

Lobar pneumonia
- Streptococ. Pneum.
- Klebsiella
- Aspiration

Hemorrhage
- Contusion
- Infarction

Others
- BAC
- Lymphoma
- Organizing Pneum.
- Eosinophilic pneum.
- Sarcoidosis

Multiple ill-defined

Bronchopneumonia
- Staphylococcus
- Legionella
- Gram negative
- Streptoc. Pneum.
- Klebsiella
- Pseudomonas
- Anaerobe
- PCP
- TB

Vascular
- Septic emboli
- Wegener's

Neoplasm
- BAC
- Lymphoma
- Metastases

Acute

Pneumonia
Aspiration
Infarction
Edema

Chronic

BAC
Lymphoma
Organizing pneum.
Eosinoph. pneumonia
Alveolar proteinosis
Sarcoidosis

Batwing

Edema
Bact pneumonia
PCP
viral pneumonia

Reversed Batwing

Broncho-alv. carcinoma
Organizing Pneum (BOOP)
Eosinophilic pneumonia
Sarcoidosis
Radiation

Identify the location and extent of the consolidation

Narrow down DDx by pattern

Further narrow down DDx by clinical correlation

Further diagnostic procedures

Thank you.