

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Pulmonary Embolism Imaging

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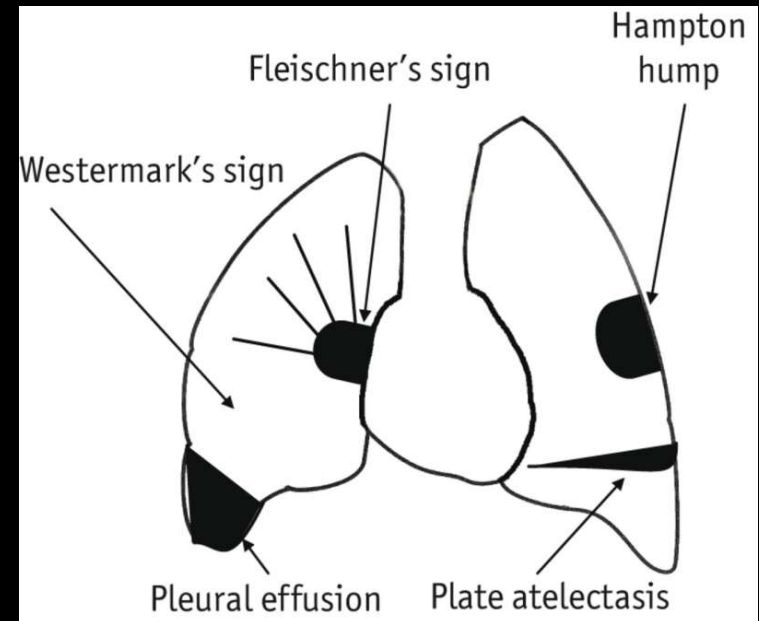
Sohag University

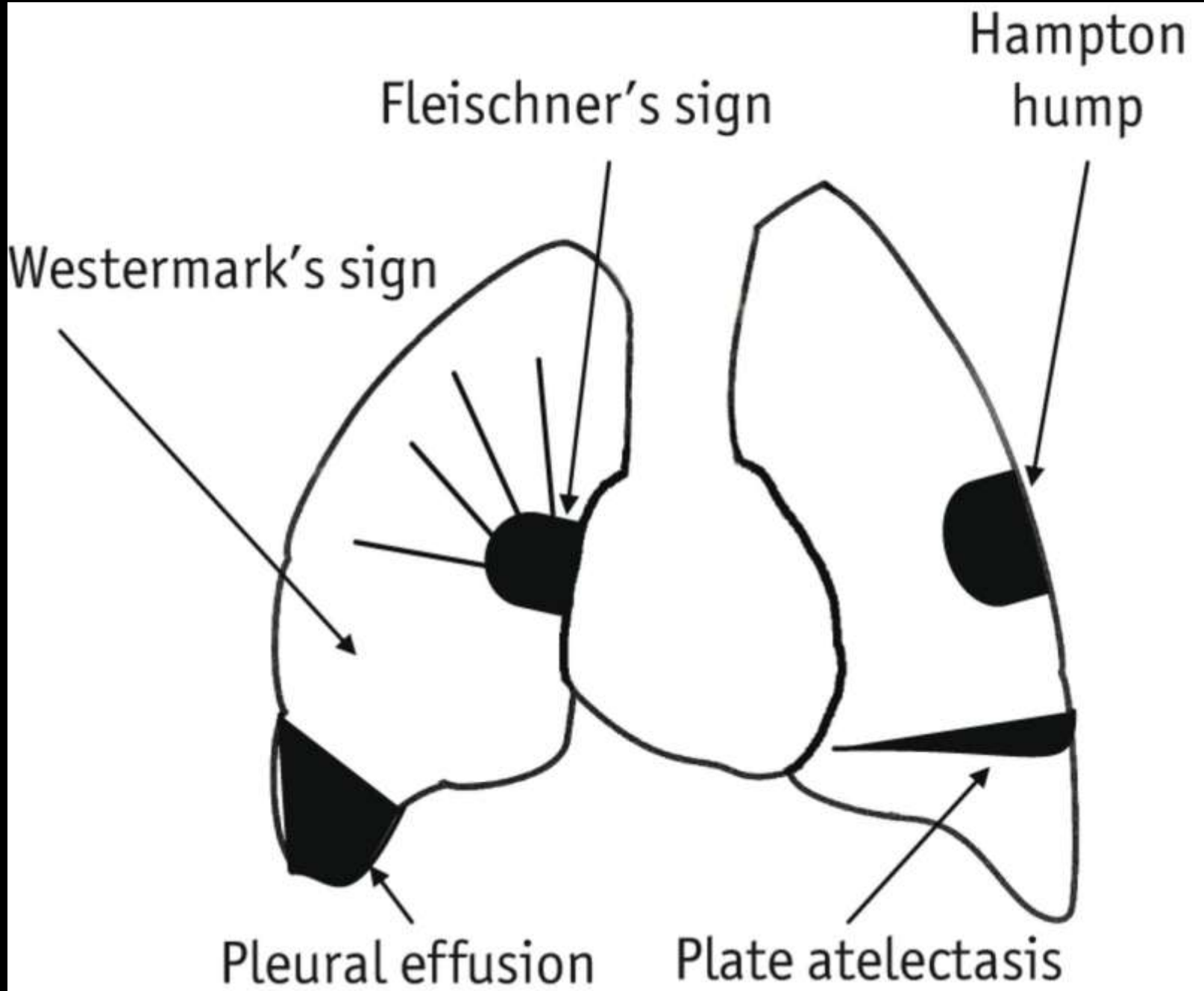
Chest X-Ray

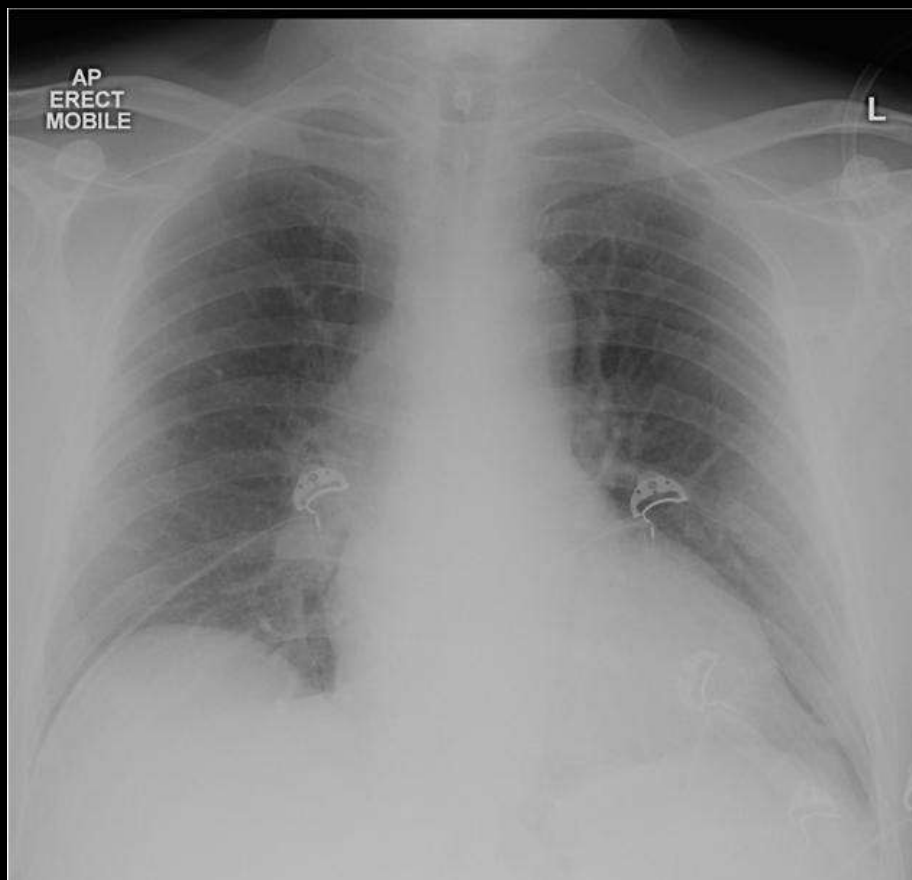
- Chest x-ray is neither sensitive nor specific for pulmonary embolism.

X-Ray signs

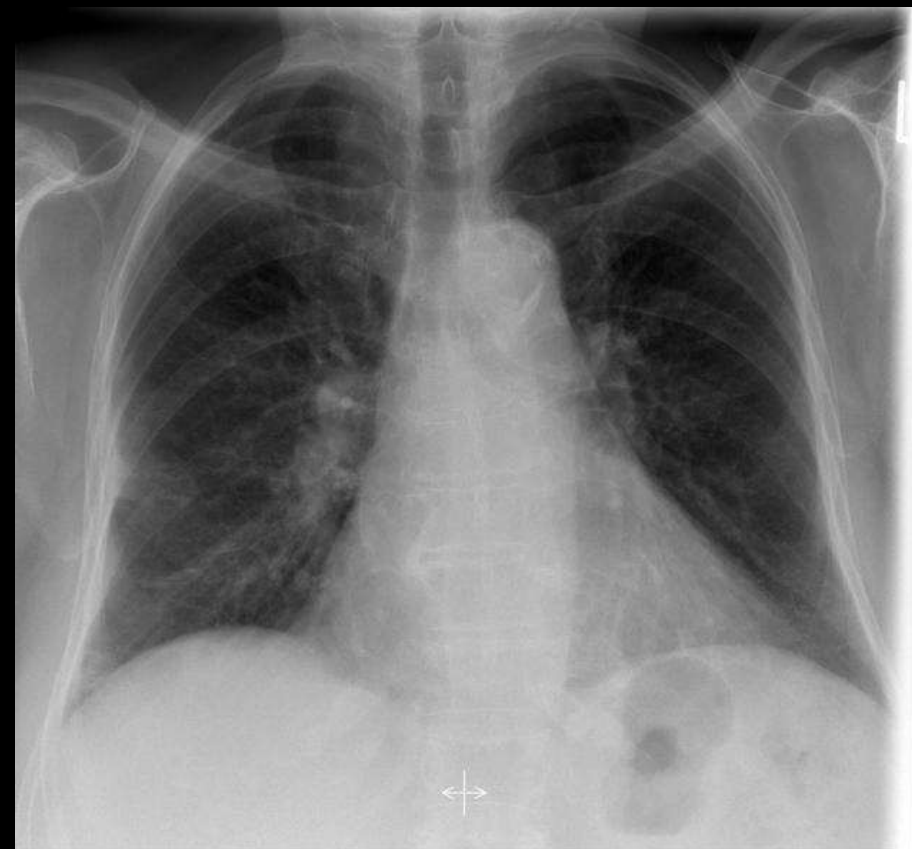
- Fleischner sign: enlarged PA
- Hampton hump: peripheral wedge of airspace opacity (infarction)
- Westermark sign: regional oligoemia
- Pleural effusion





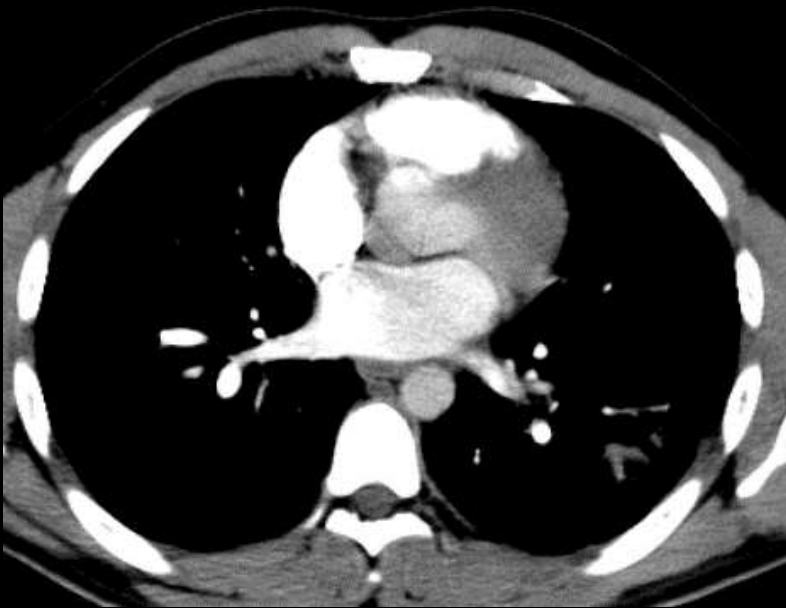
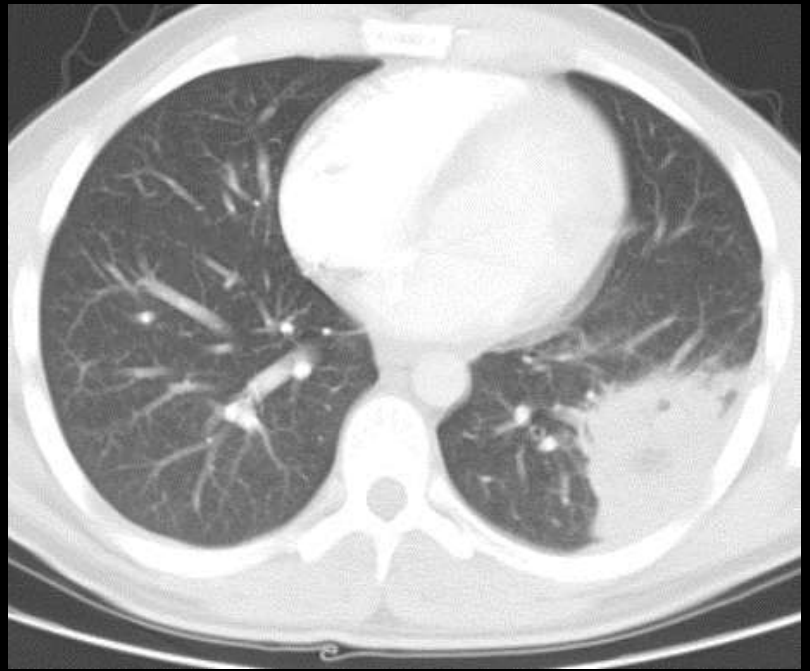
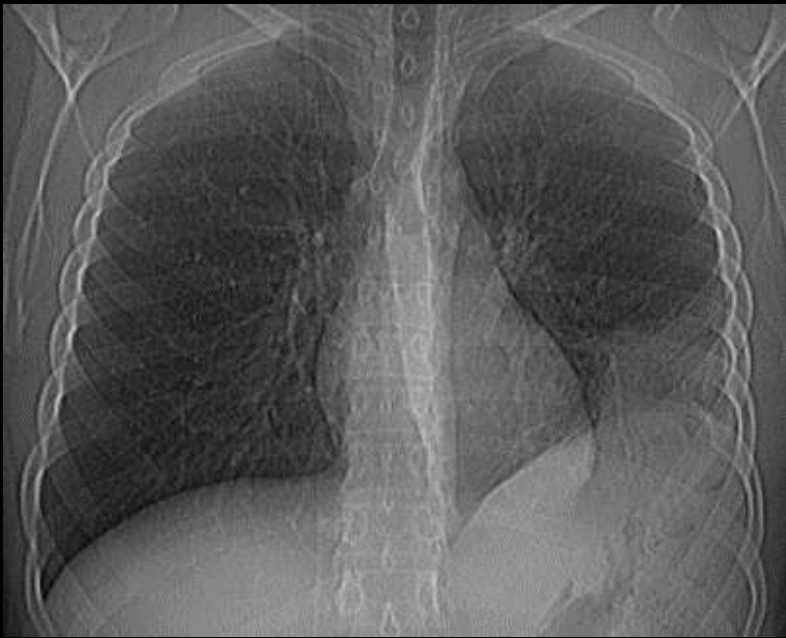


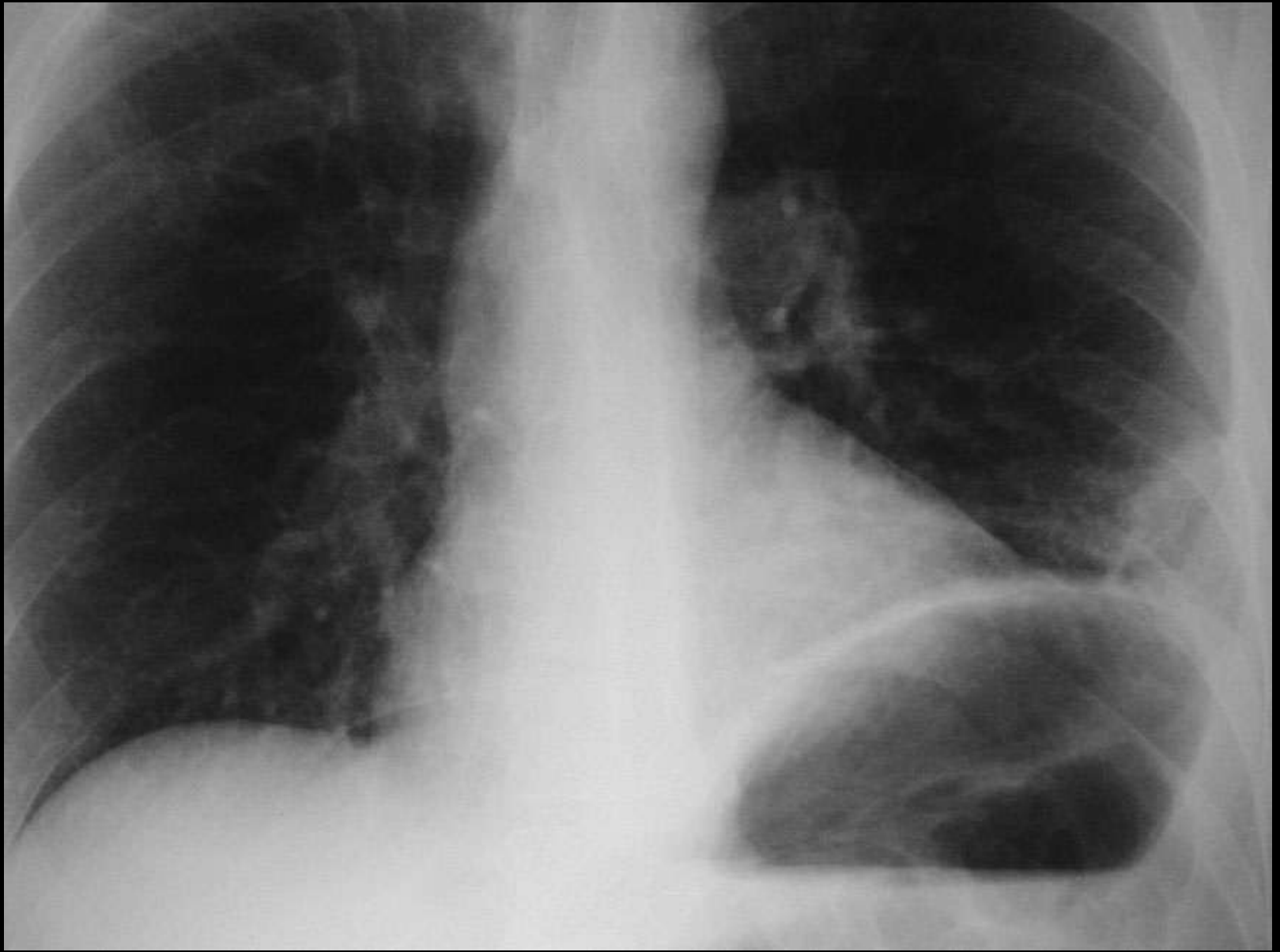
Fleischner sign
Prominent central PA

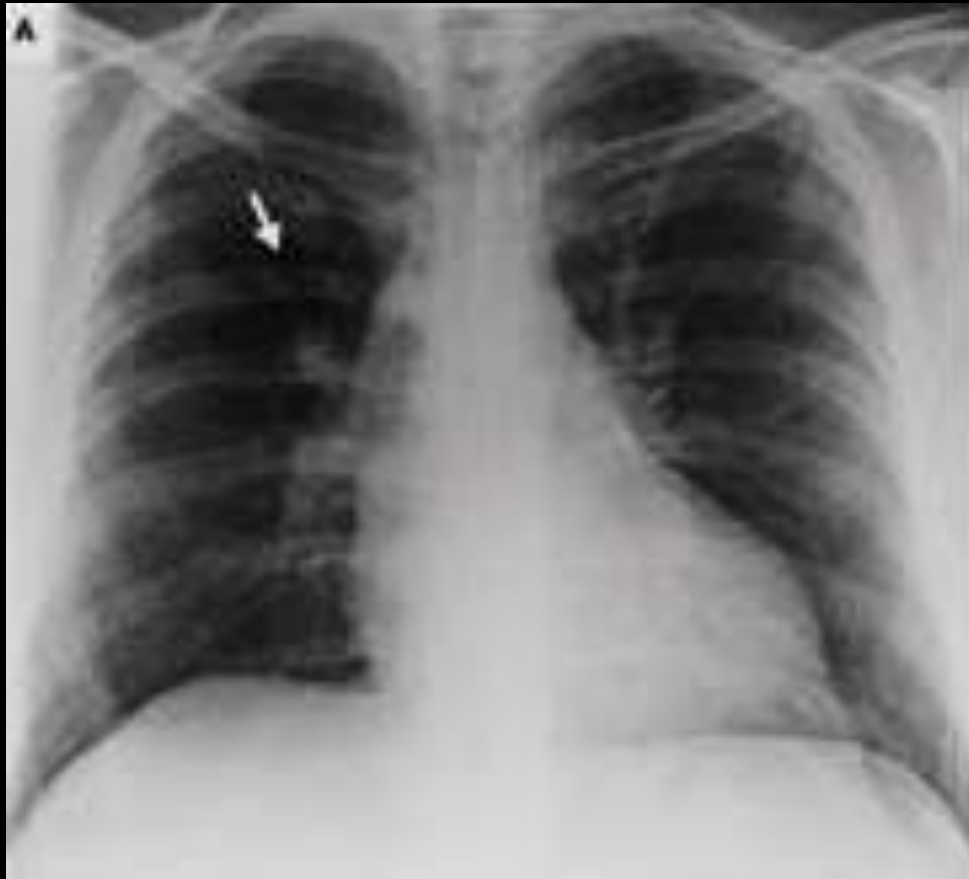


Hampton hump

Dome-shaped, pleural-based opacity.

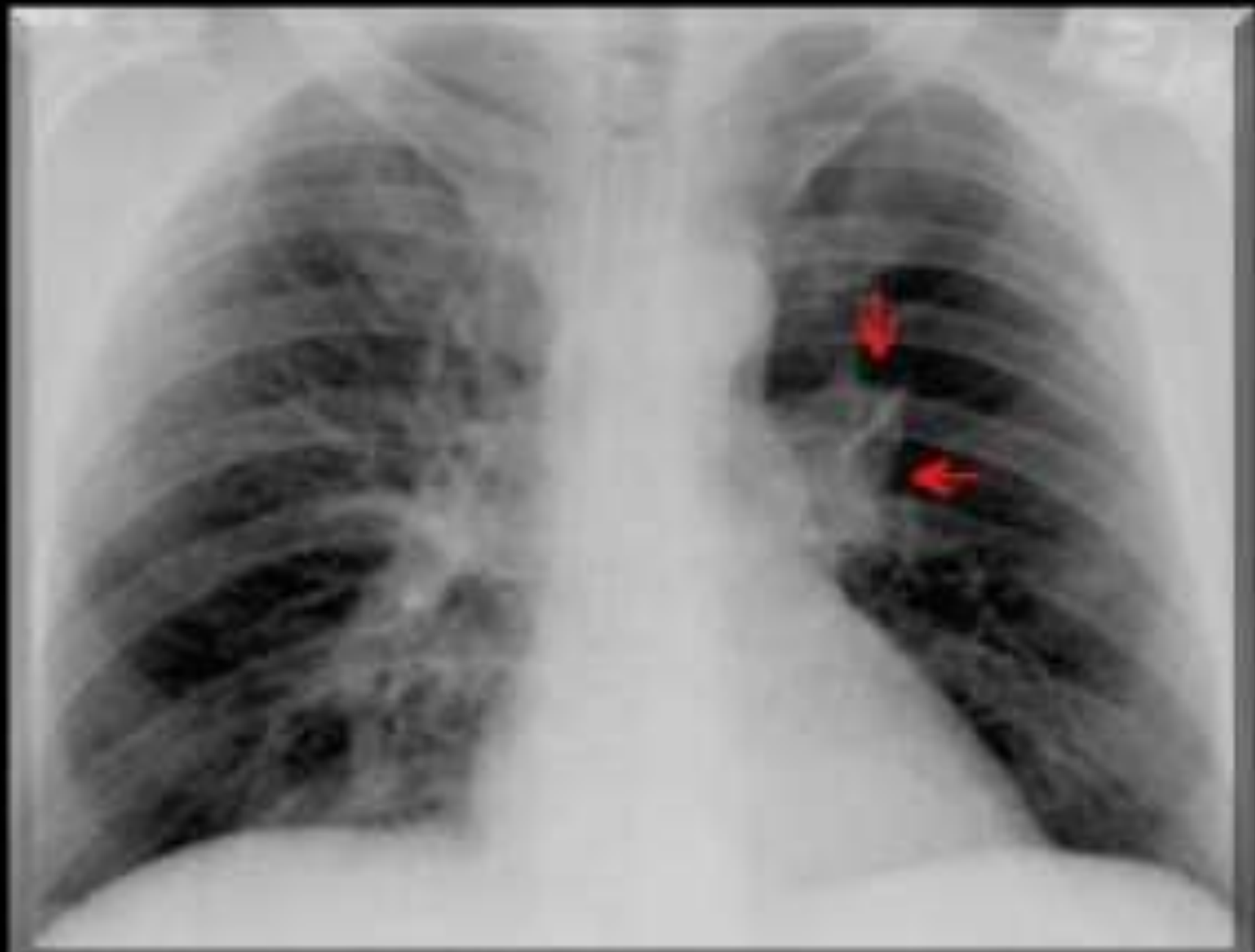






Westermark sign

Focal peripheral hyperlucency 2ry to oligoemia
Central pulmonary vessels may also be dilated



Pulmonary

CT Angiography

DFOV 26.2cm
STND/+

1024 X 1024

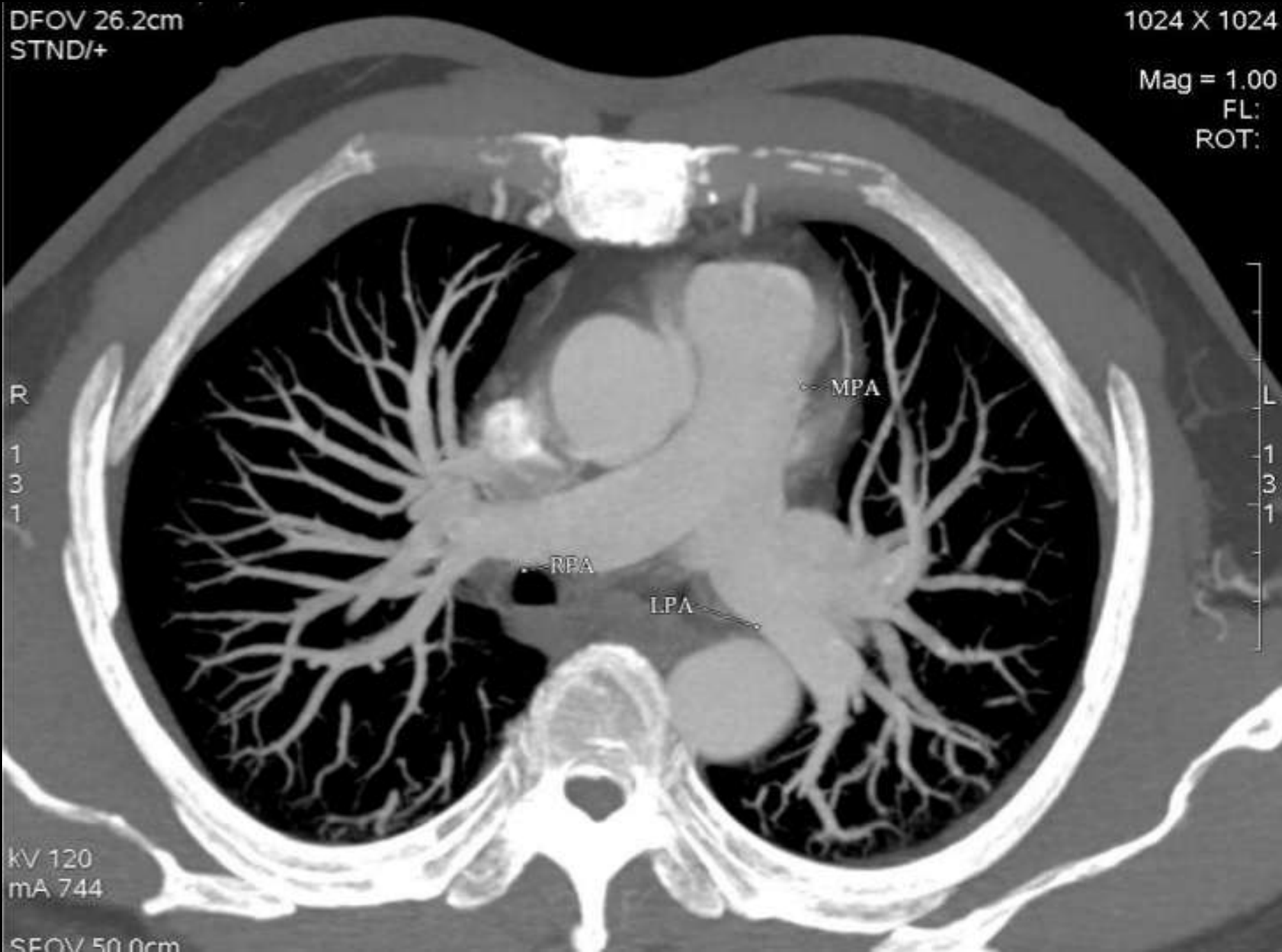
Mag = 1.00
FL:
ROT:

R
1
3
1

L
1
3
1

kV 120
mA 744

SFOV 50.0cm





Acute PE

CTA Signs

A- Vascular

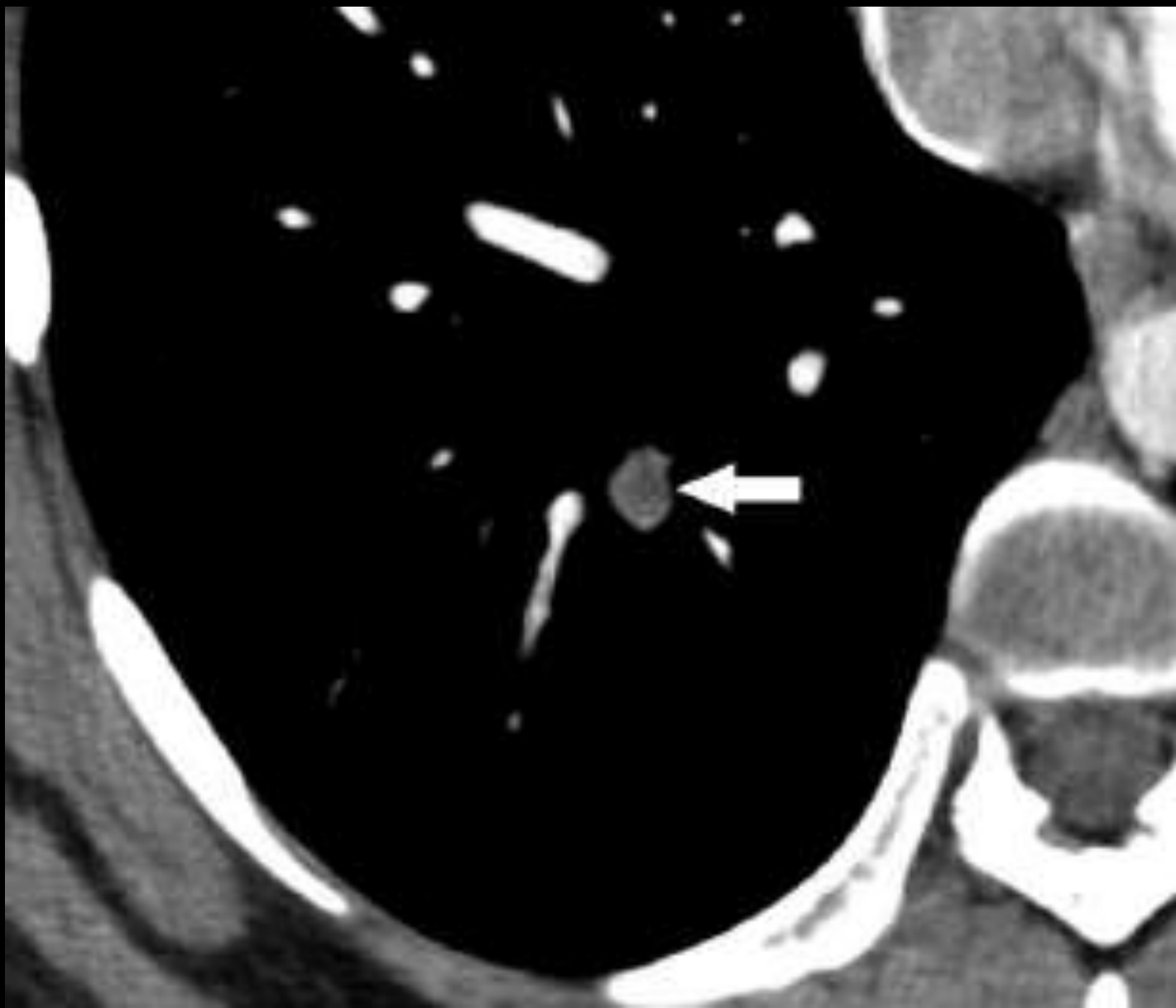
- 1-Enlarged A. + complete FD + no enhancement.
- 2-Partial FD + marginal luminal contrast filling "railway track sign".
- 3-Emboli may be non-occlusive "polo mint sign" (central FD surrounded by a thin rim of contrast).
- 4-Peripheral FD that forms acute angle with arterial wall.

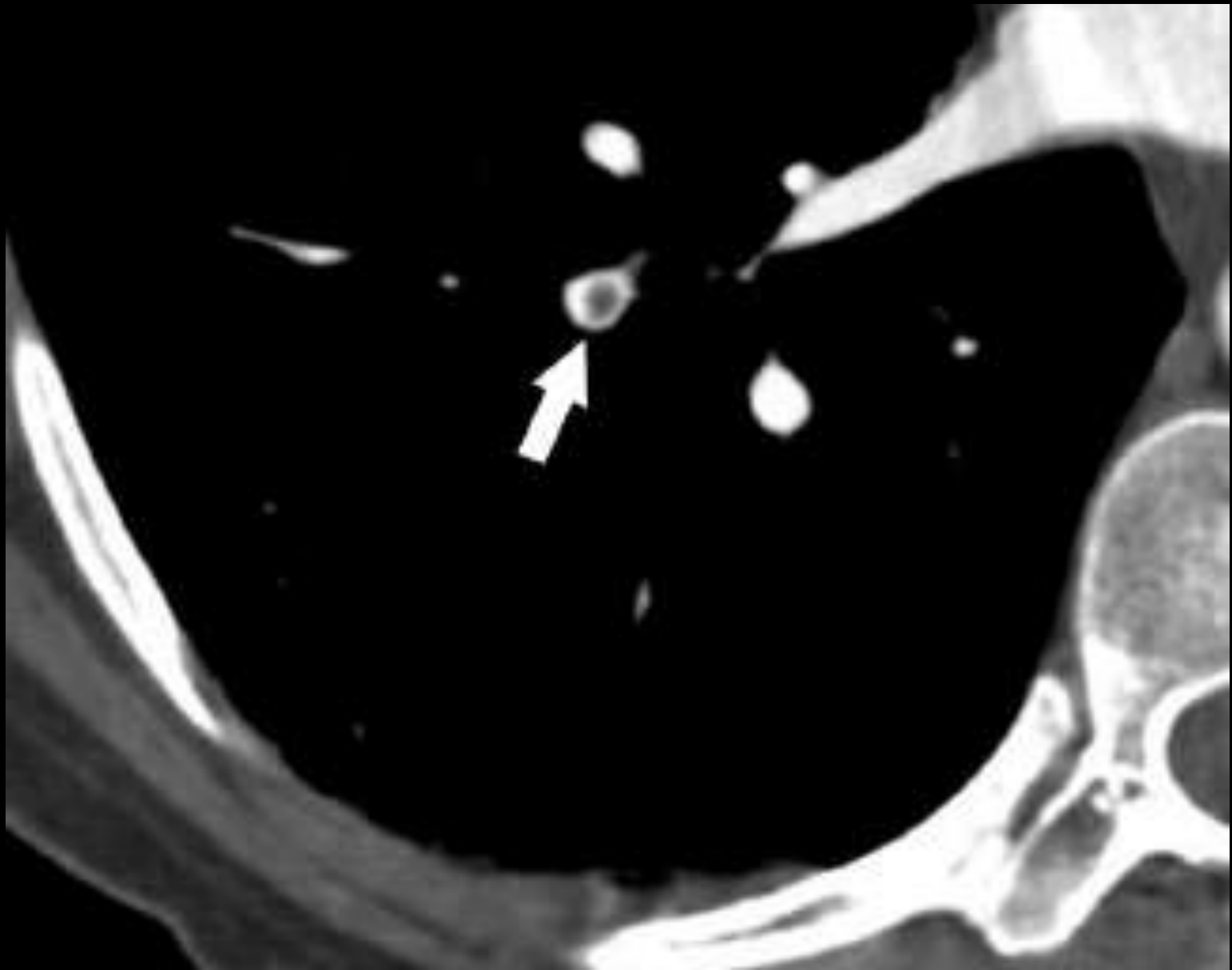
B-Parenchymal → peripheral wedge shaped infarction.

C-Cardiac → Rt. V. enlargement.



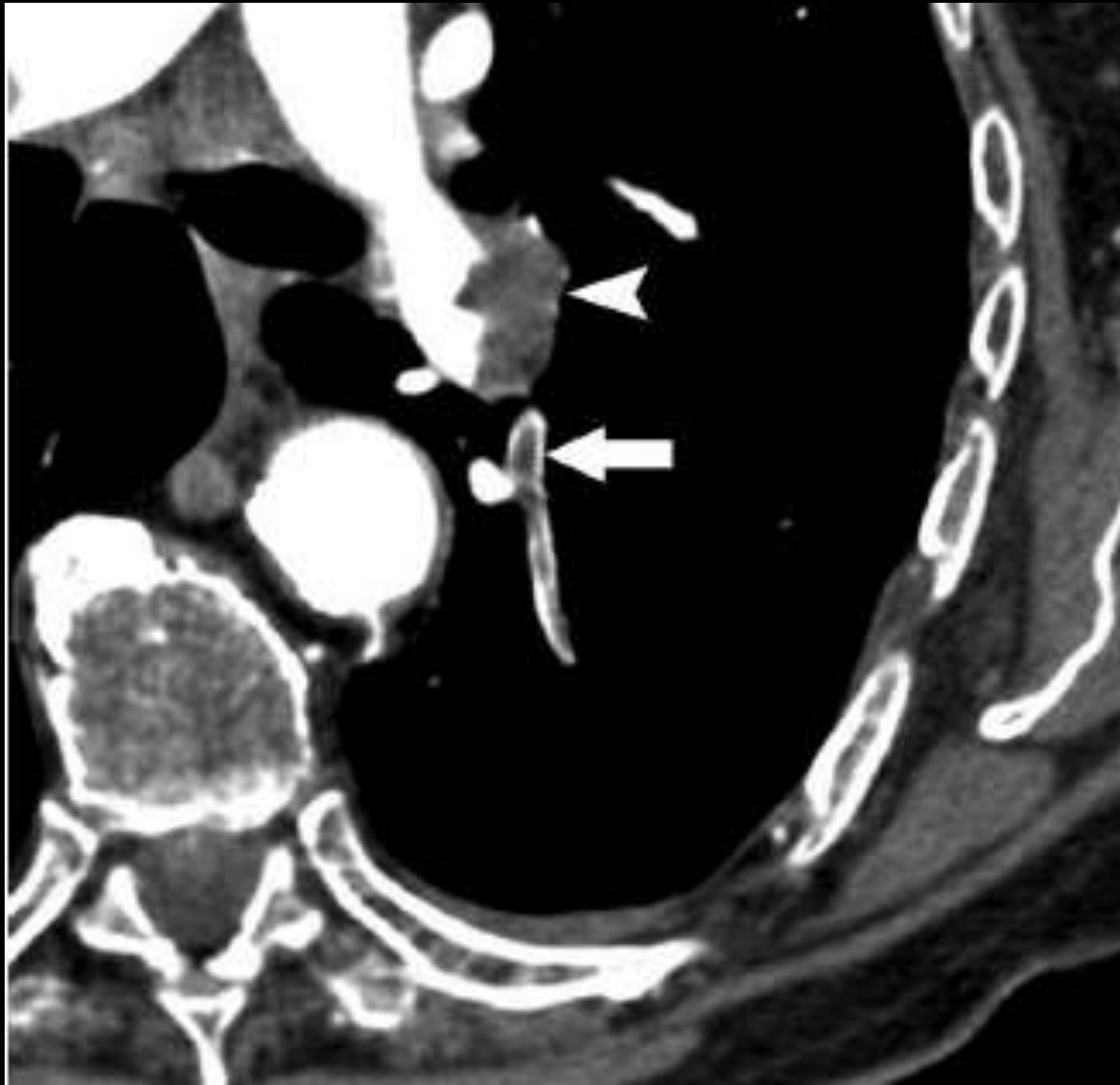
Enlarged totally thrombosed A.





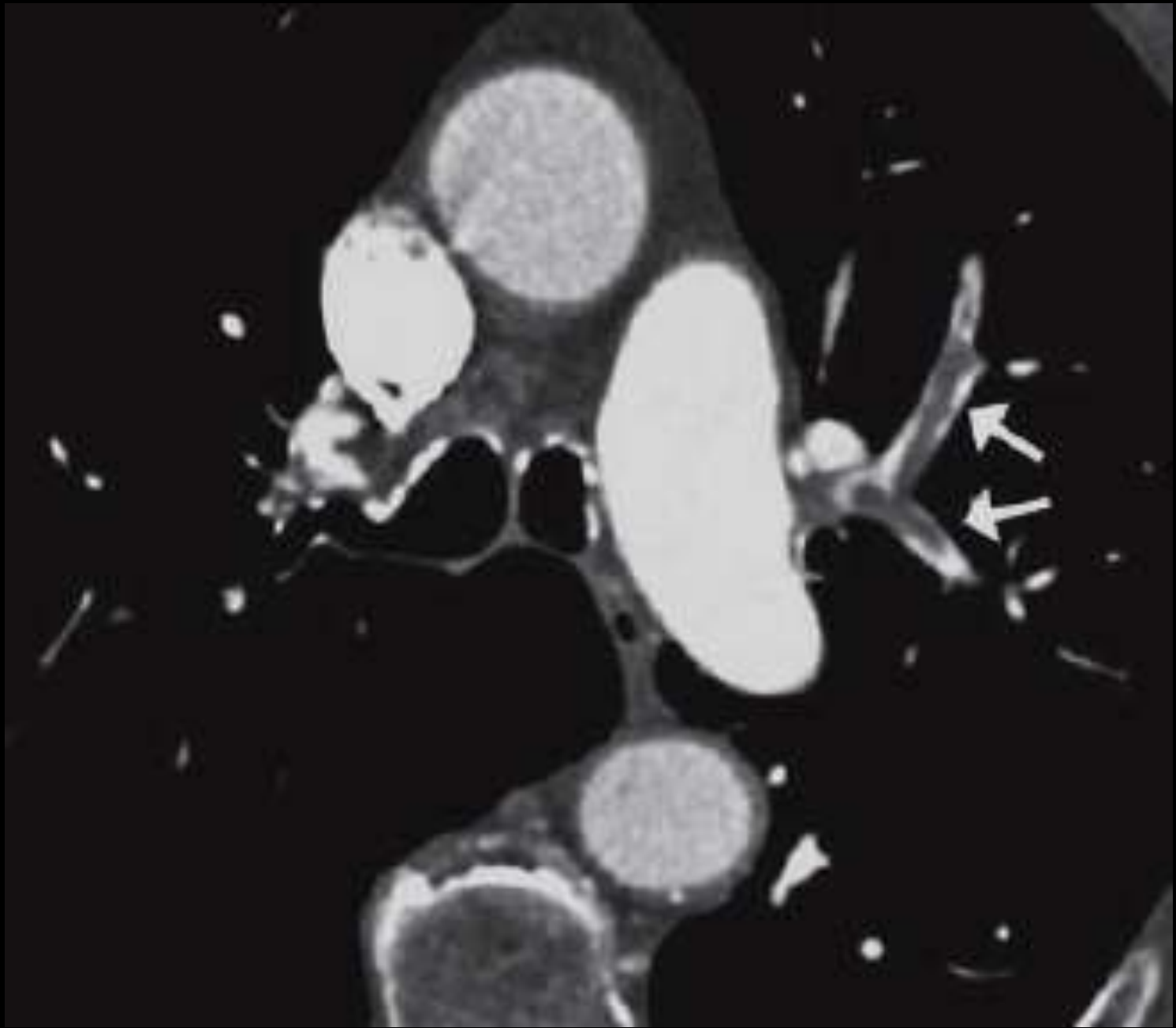
Polo mint sign

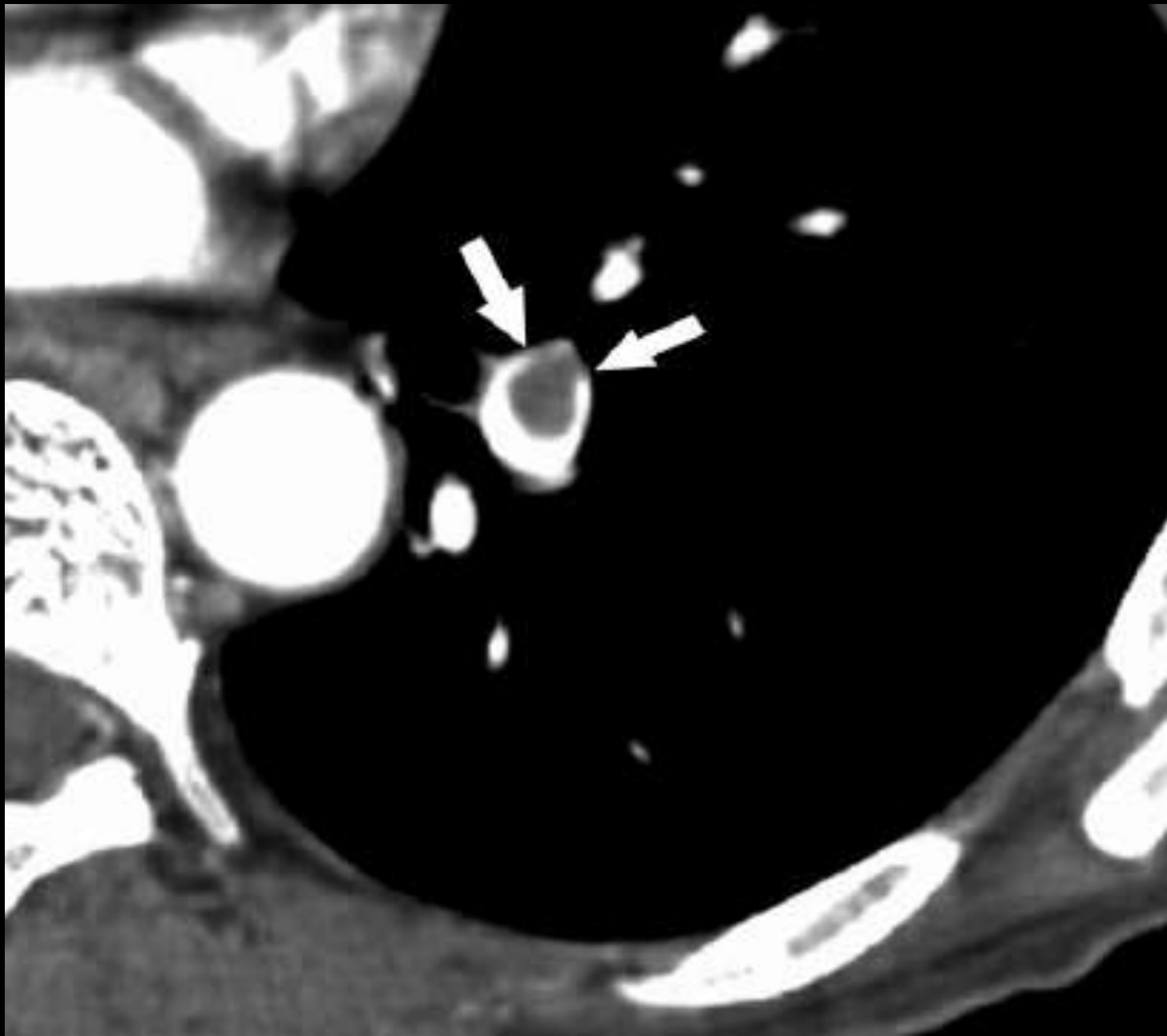
Central embolus surrounded by contrast



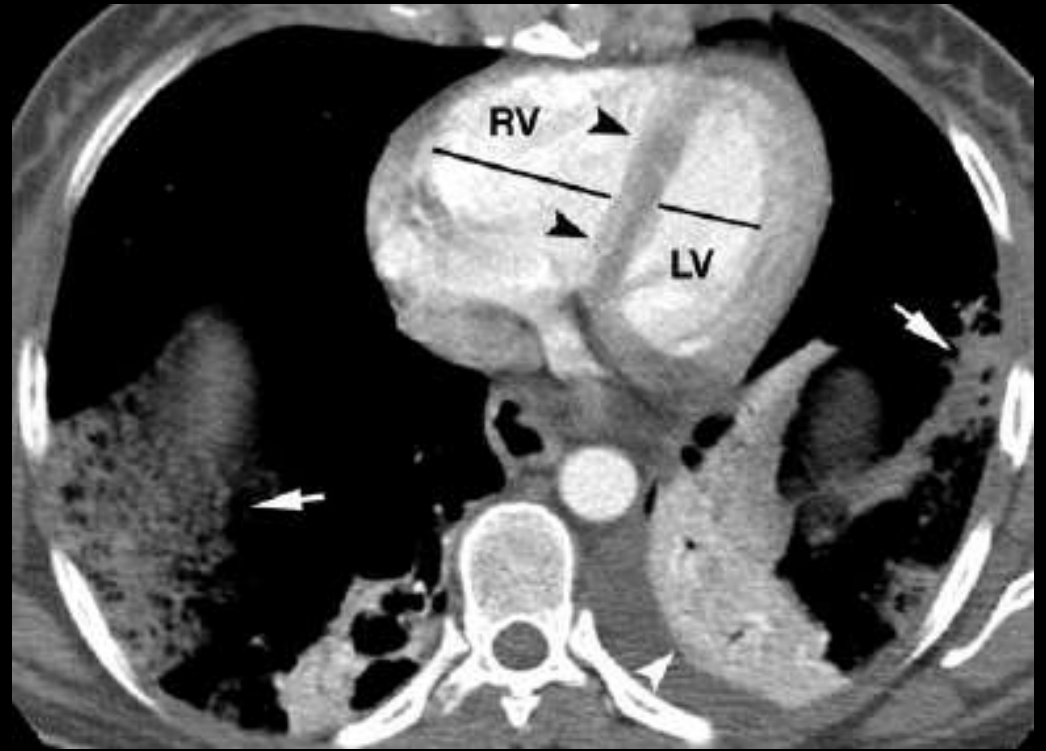
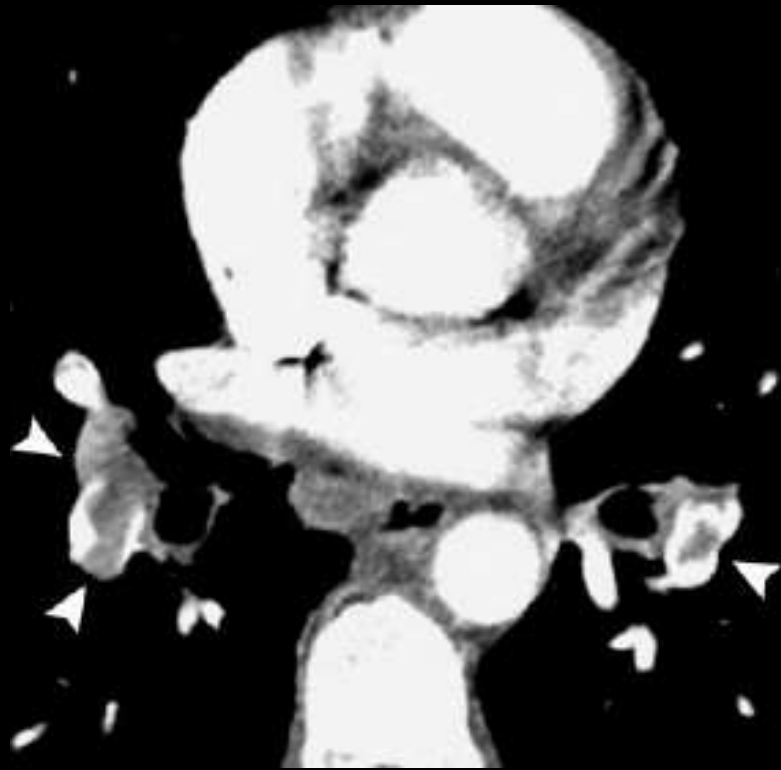
Railway track sign

Partial FD surrounded by contrast. Acute pulmonary embolus in Lt main PA

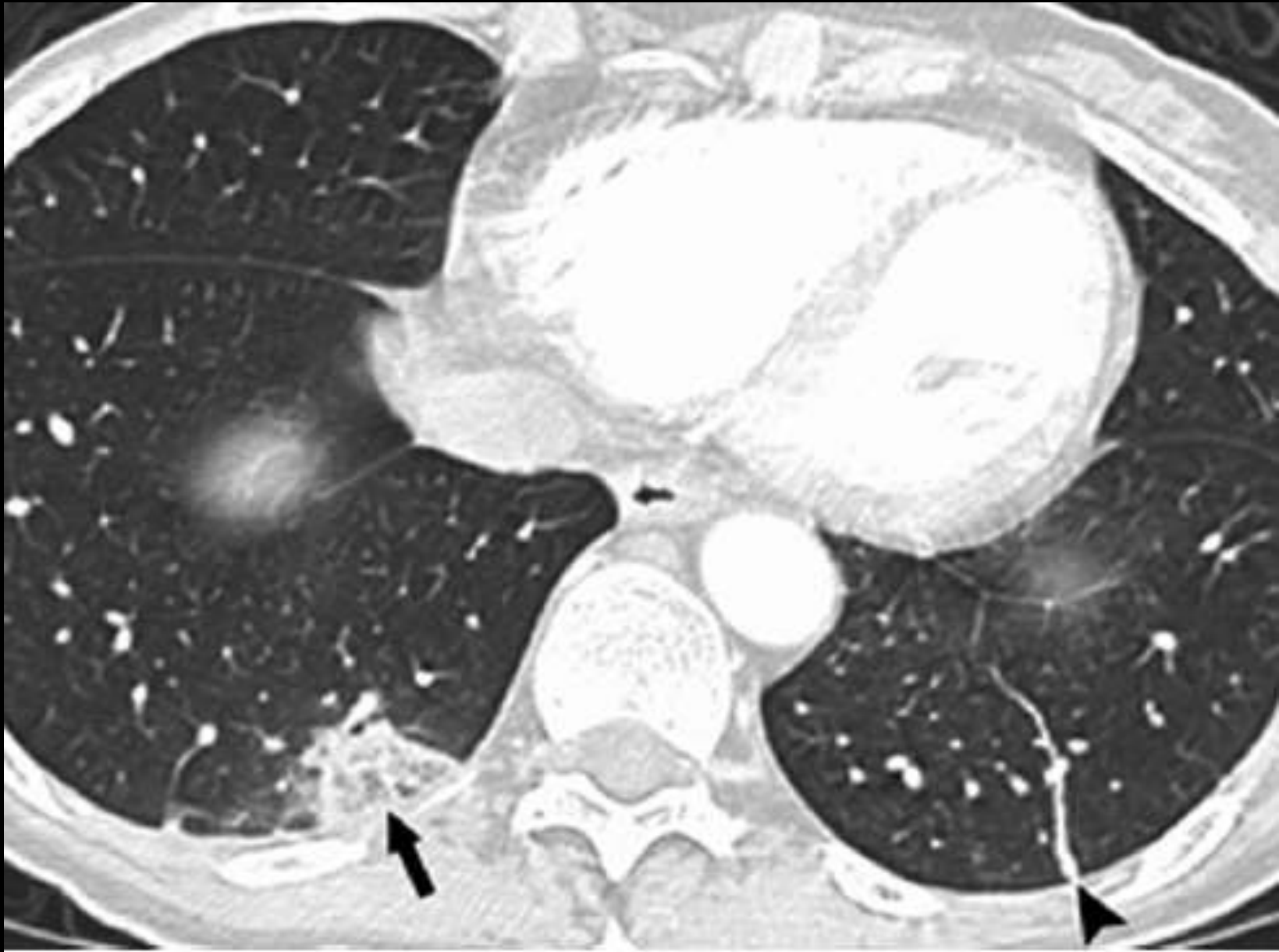


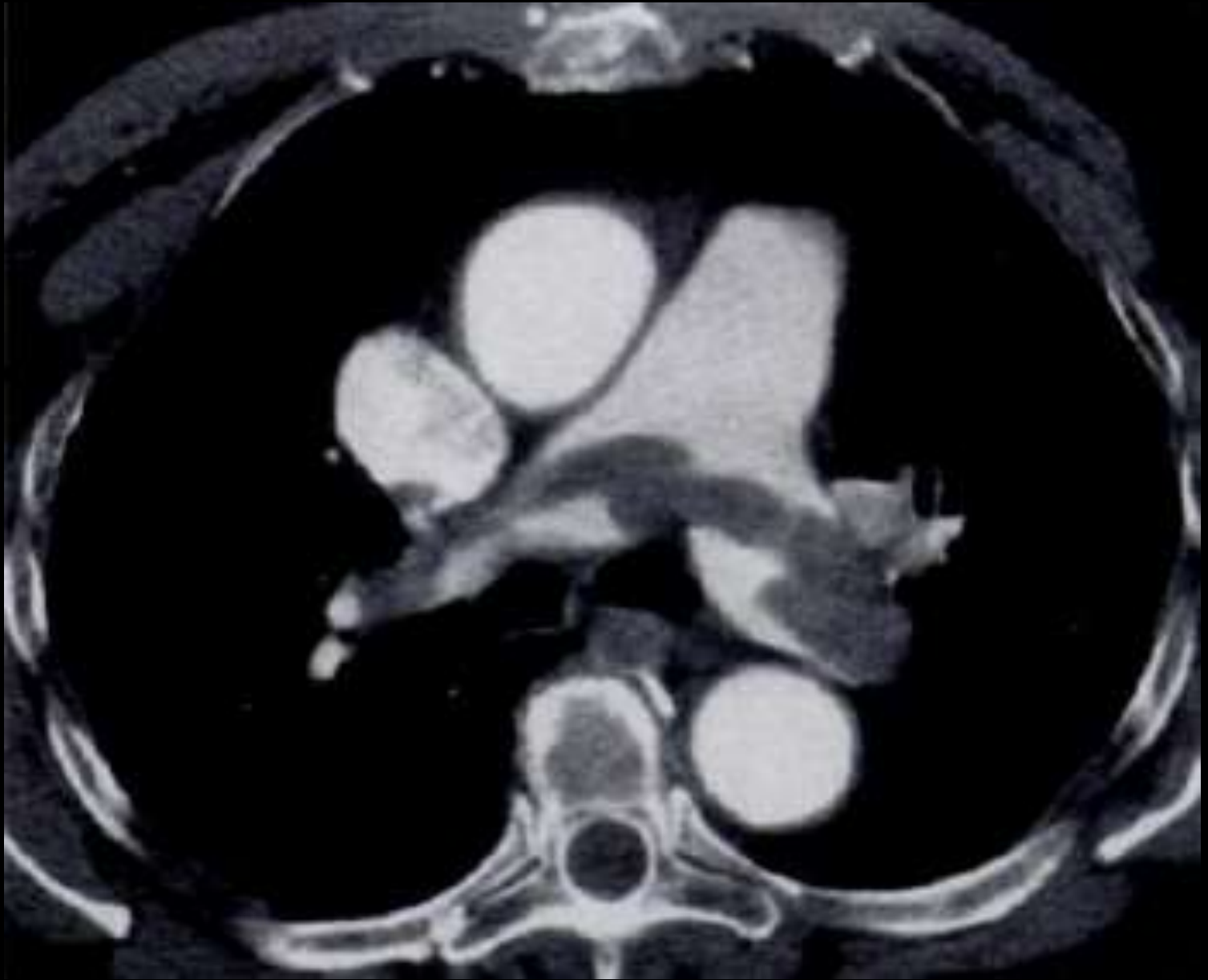


Eccentric embolus with acute angles



Railway track" sign, infarction & Rt V strain.



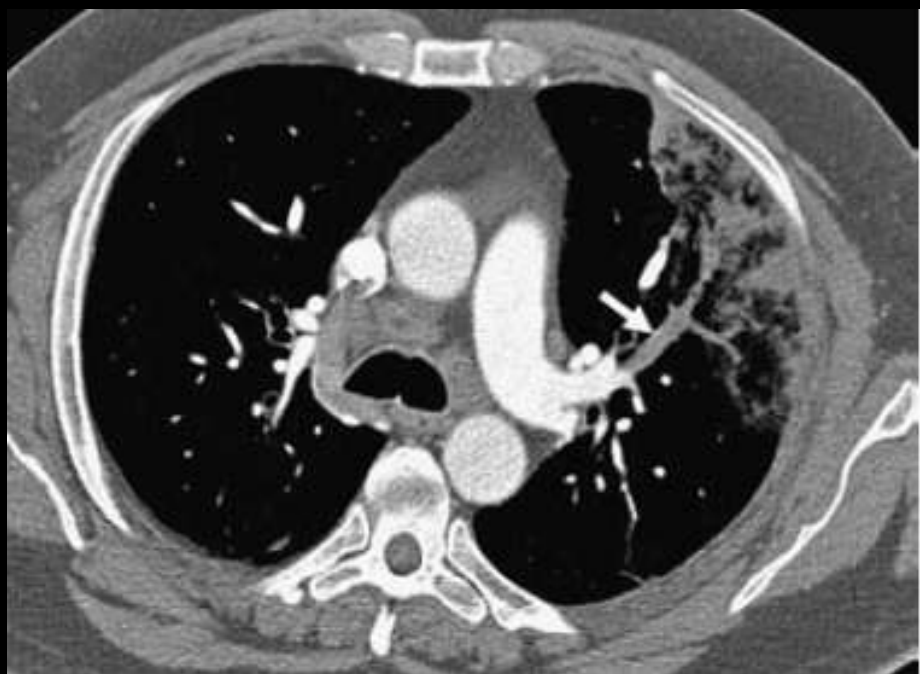


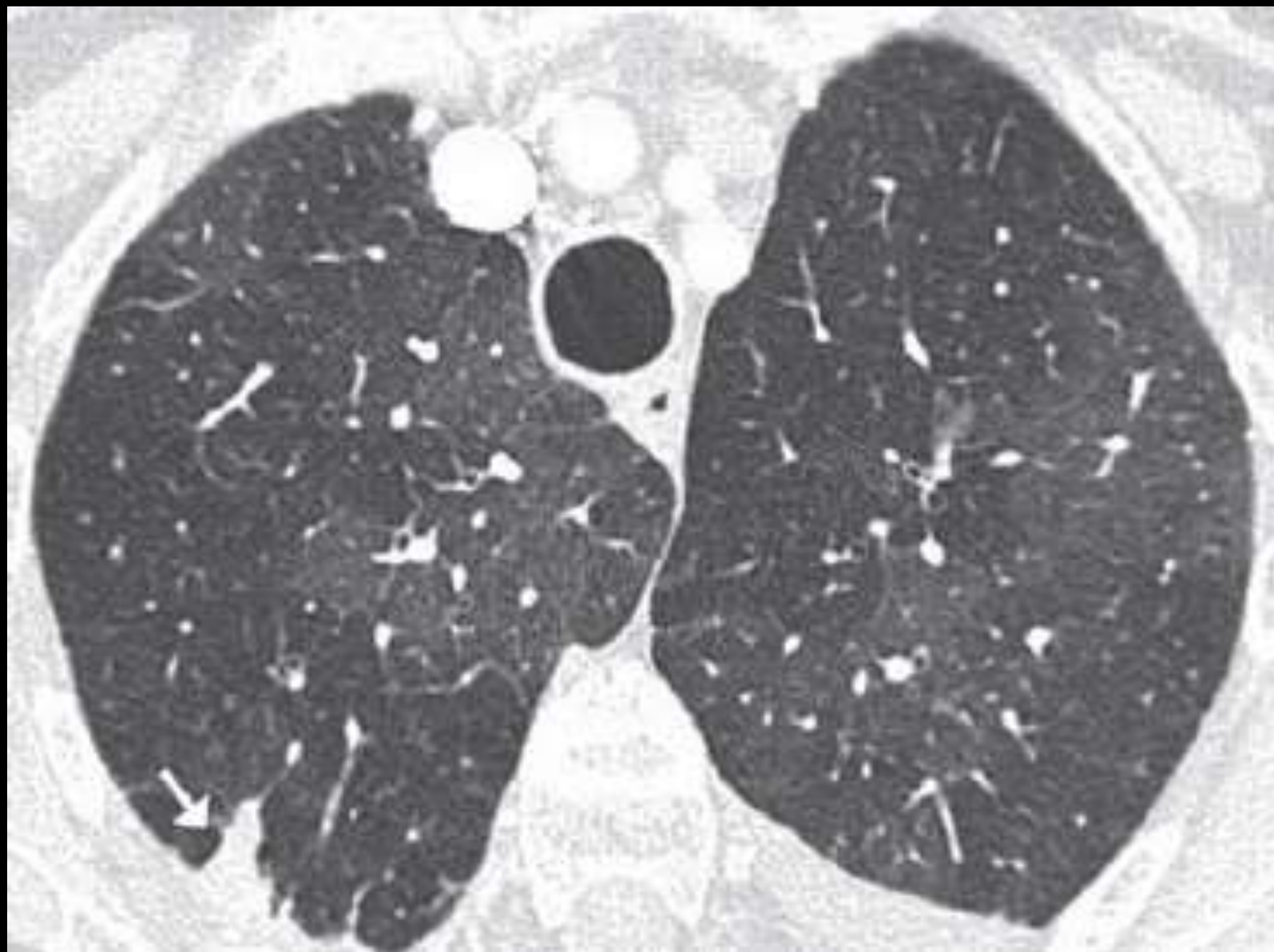
Saddle thrombus











Chronic PE

CTA signs

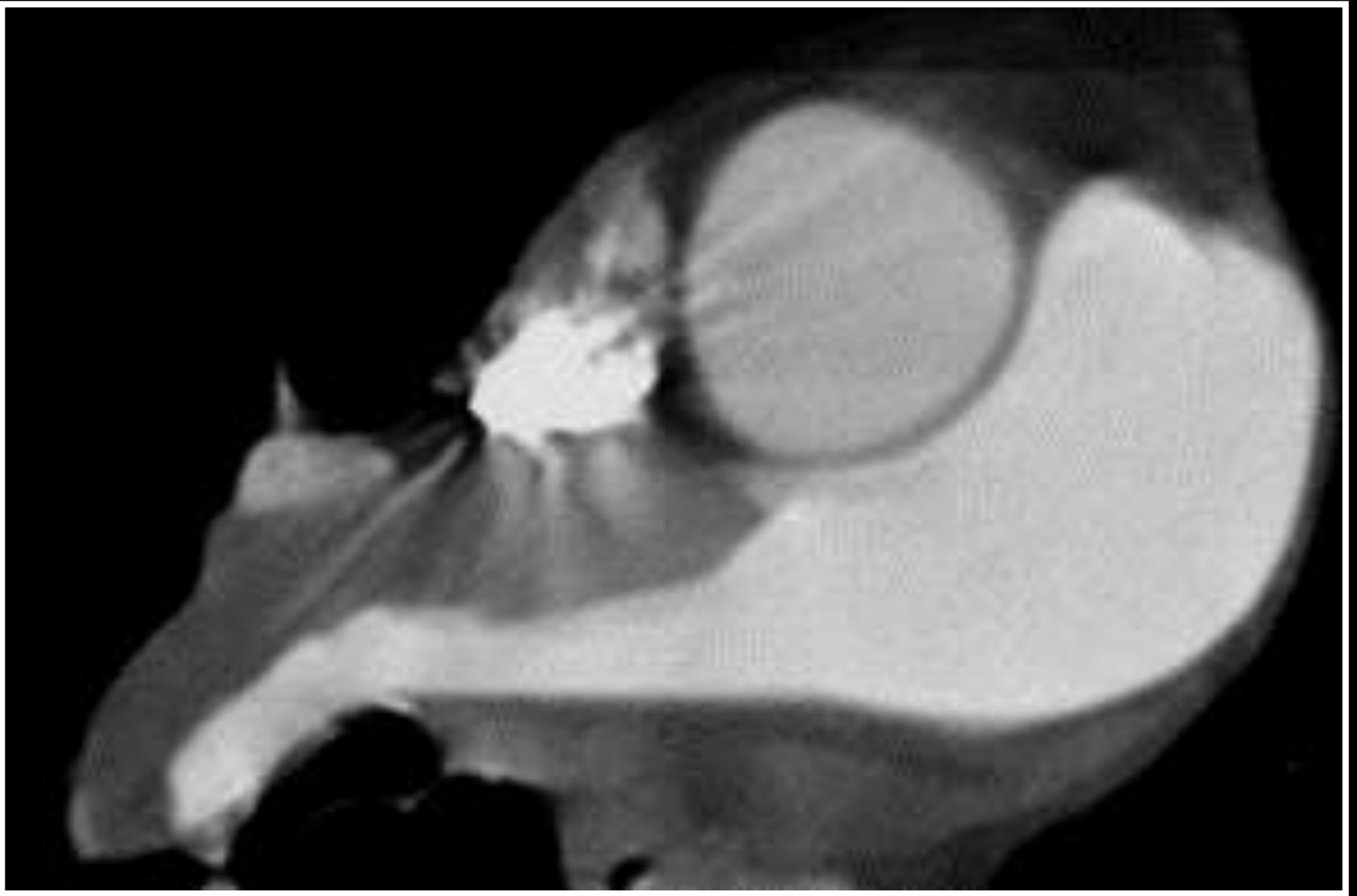
- (A) Direct PA signs
 - Complete / partial obstruction
 - Eccentric thrombus (obtuse angle with A. wall)
 - Calcified / Recanalized thrombus
 - Abrupt narrowing
 - Post stenotic dilatation

- (B) Pulmonary hypertension signs
 - Enlargement of main PAs
 - Narrow peripheral PAs in affected segments
 - Pulmonary arterial calcification
 - RV enlargement/hypertrophy

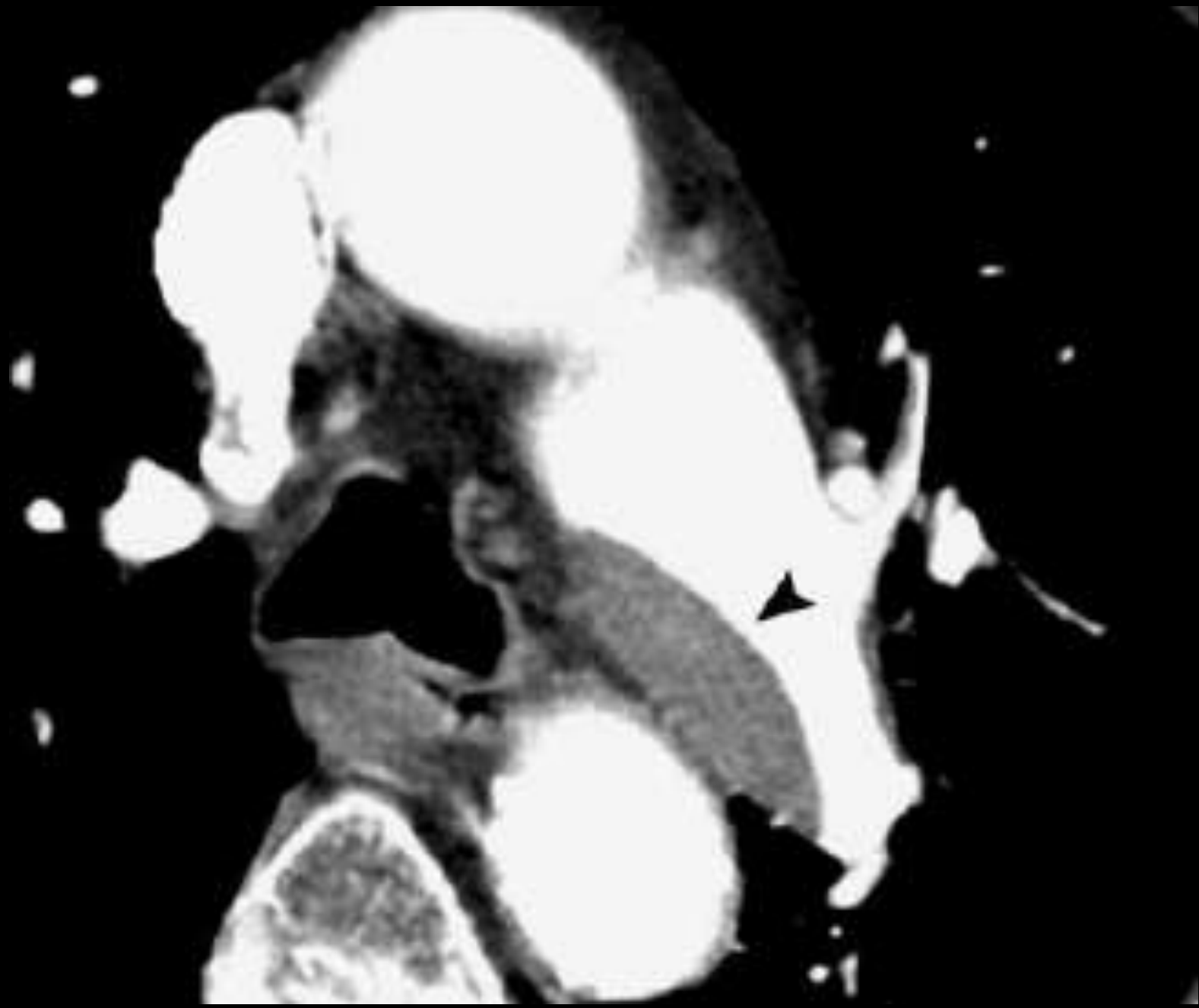
- **(C) Systemic collaterlas sign**
 - Enlargement of bronchial artery branches

- **(D) Parenchymal signs (often non-specific)**
 - Scars
 - Mosaic perfusion pattern
 - Focal ground-glass opacities

- **(E) Pleural effusion**



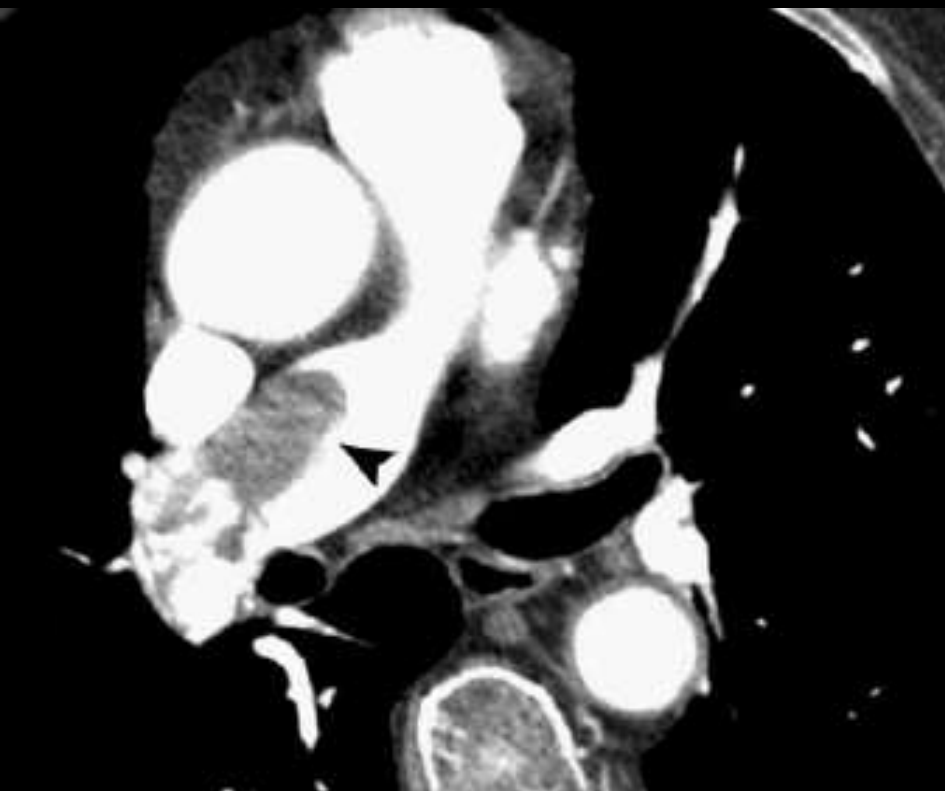
Eccentric thrombus with obtuse angle



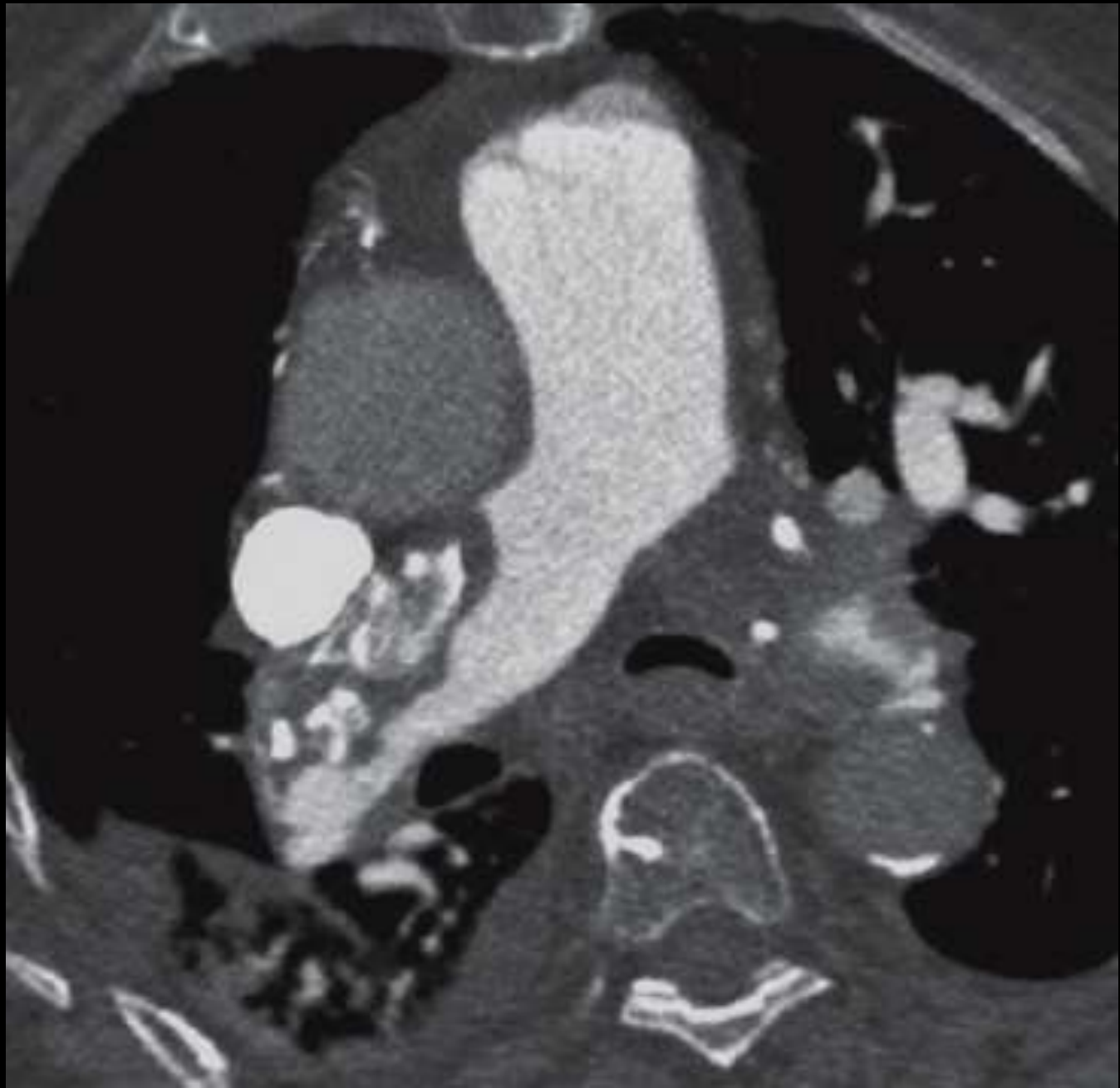


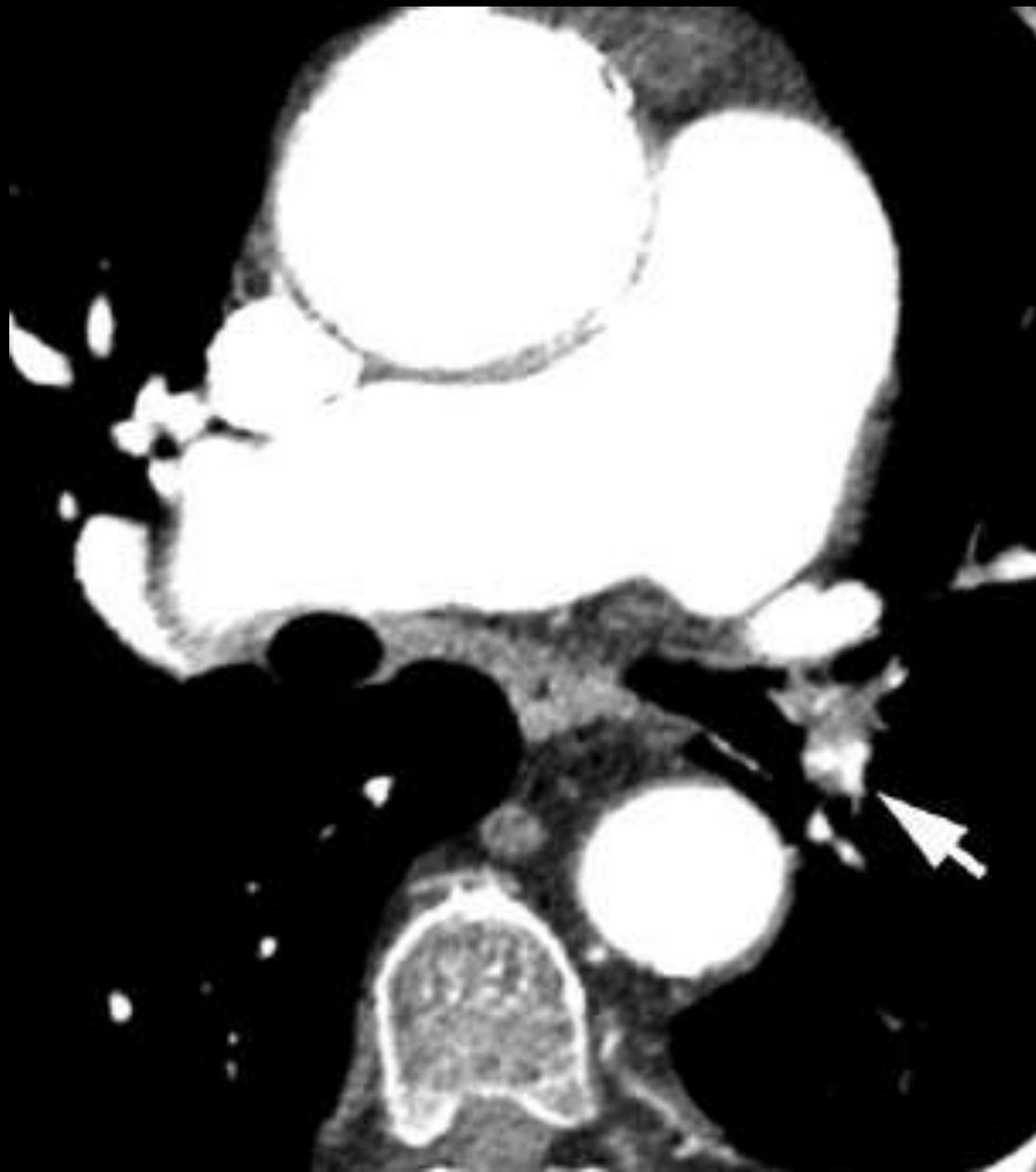


Complete occlusion and reduction in size of the artery

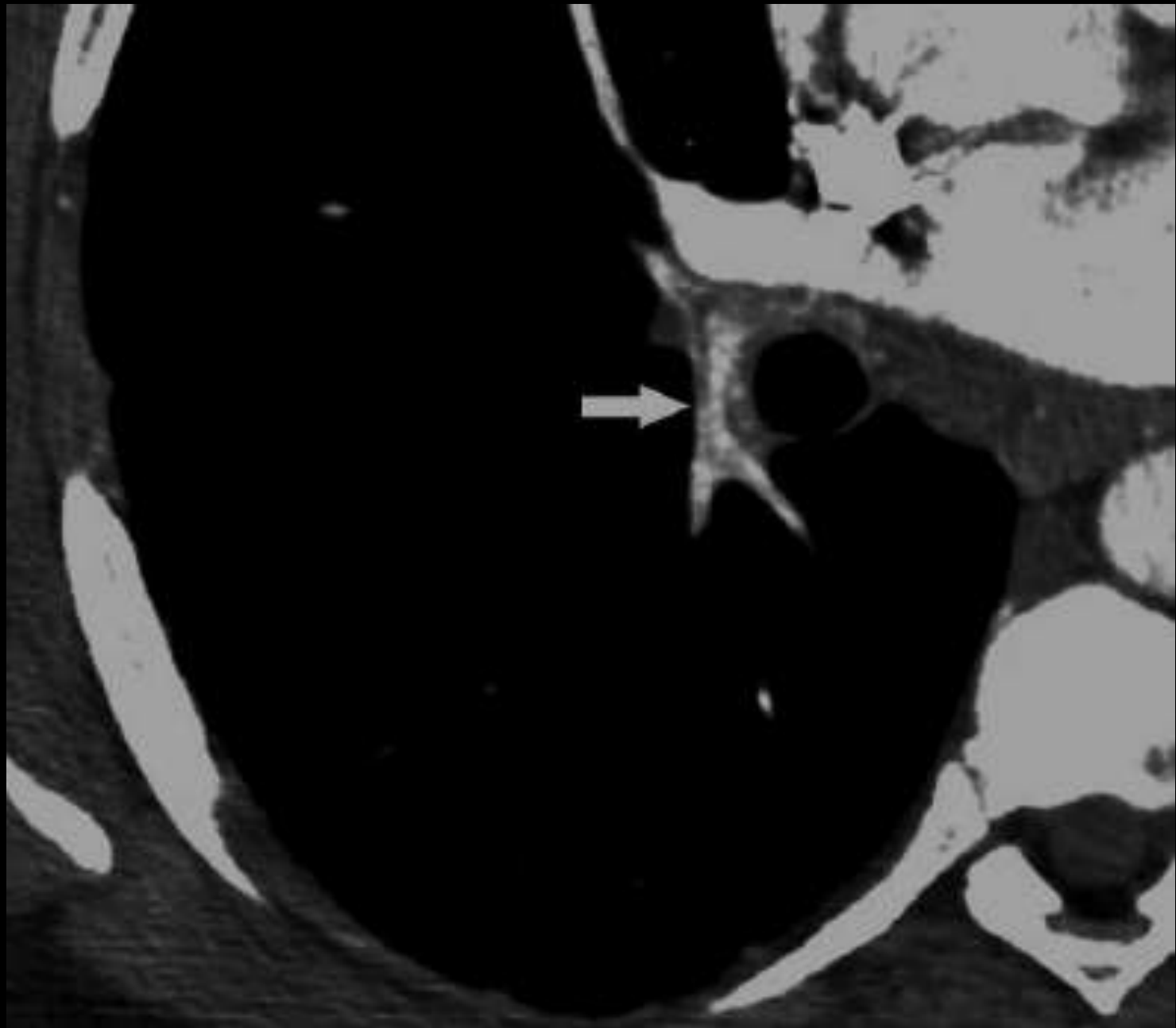


Calcified thrombus





Recanalized thrombus

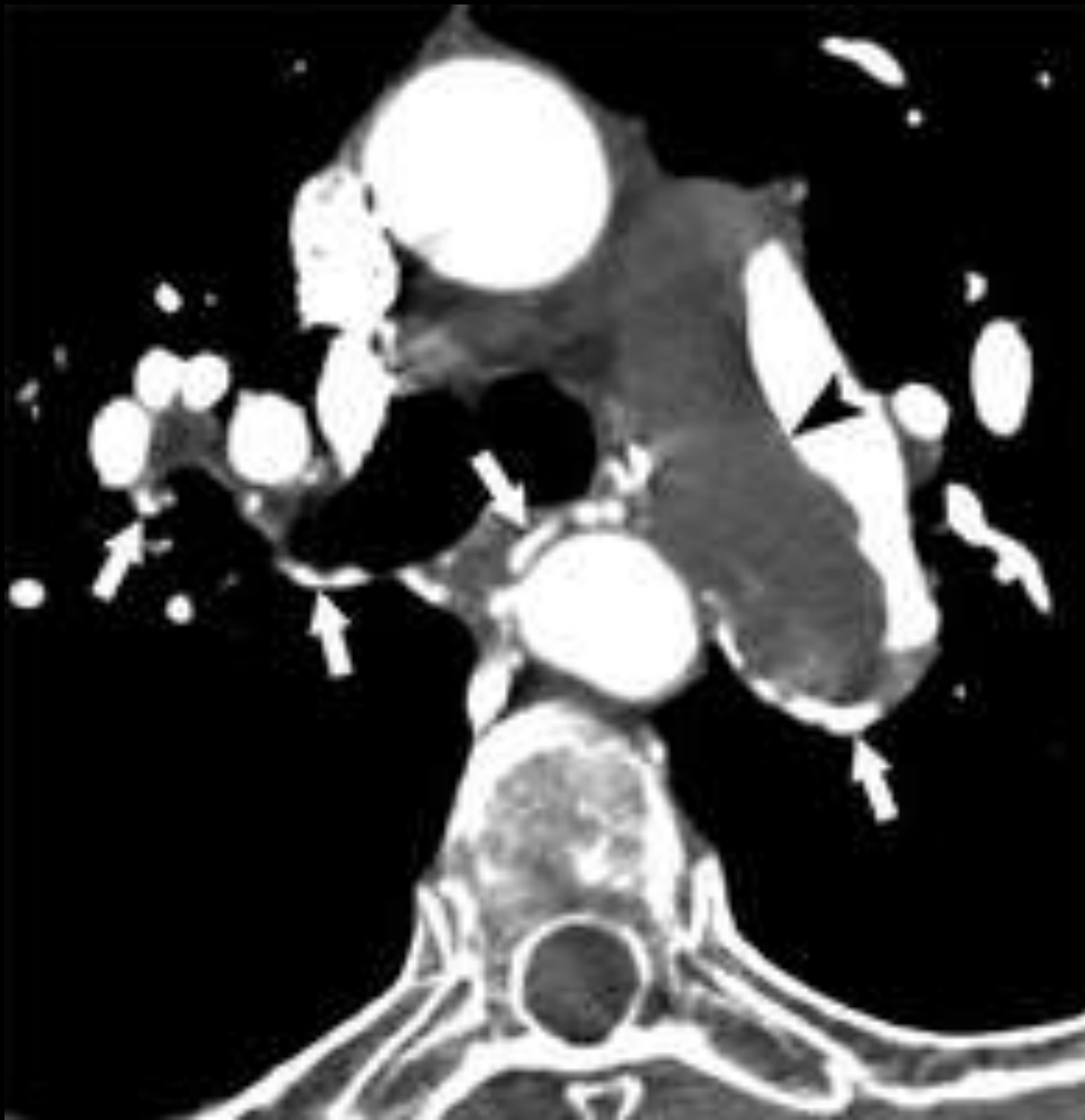




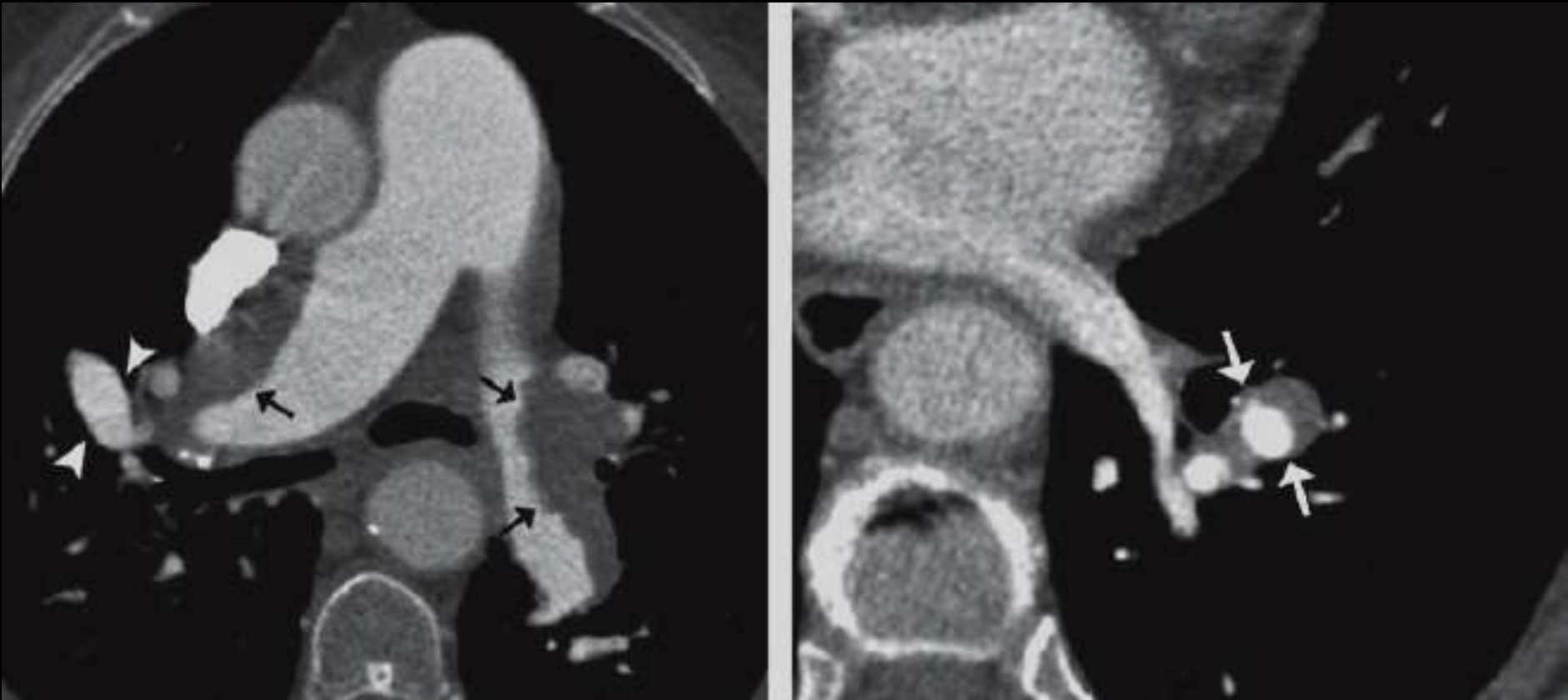
Eccentric thrombus in Rt PA (black arrows)

Abrupt stenosis and recanalization of the Rt interlobar artery (arrowheads).

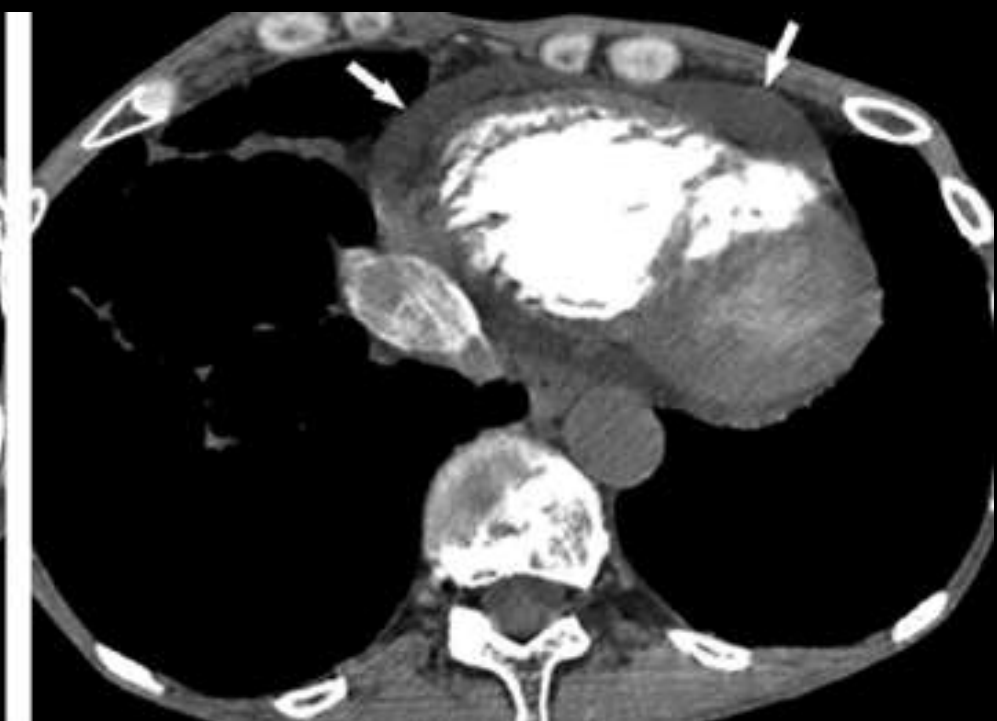
Dilated bronchial arteries in the mediastinum and around the stenosed vessels (white arrows).



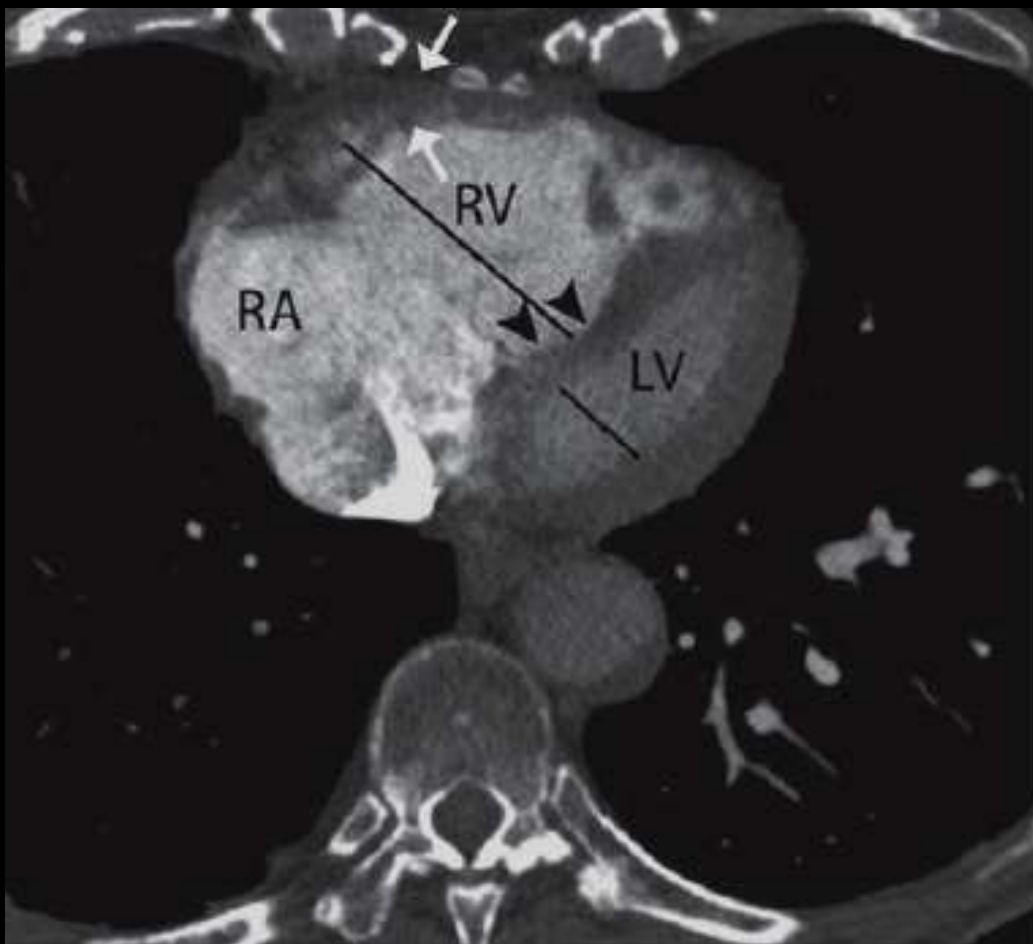
Eccentric thrombus & bronchial A. collaterals



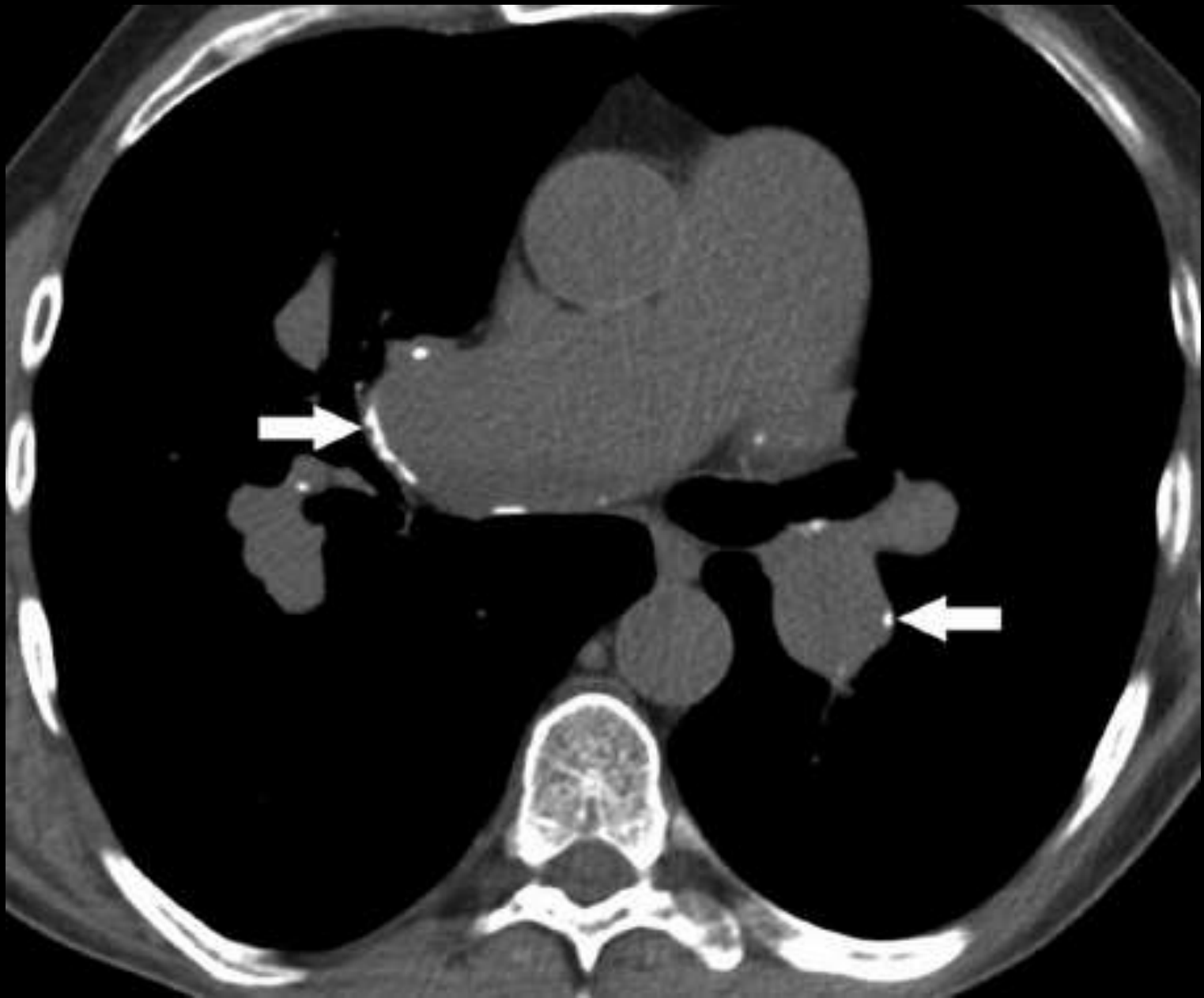
Bilateral **eccentric** ch thrombi with **obtuse** angles.
Post stenotic dilatation (arrowheads) in the posterior segmental A. of the Rt UL



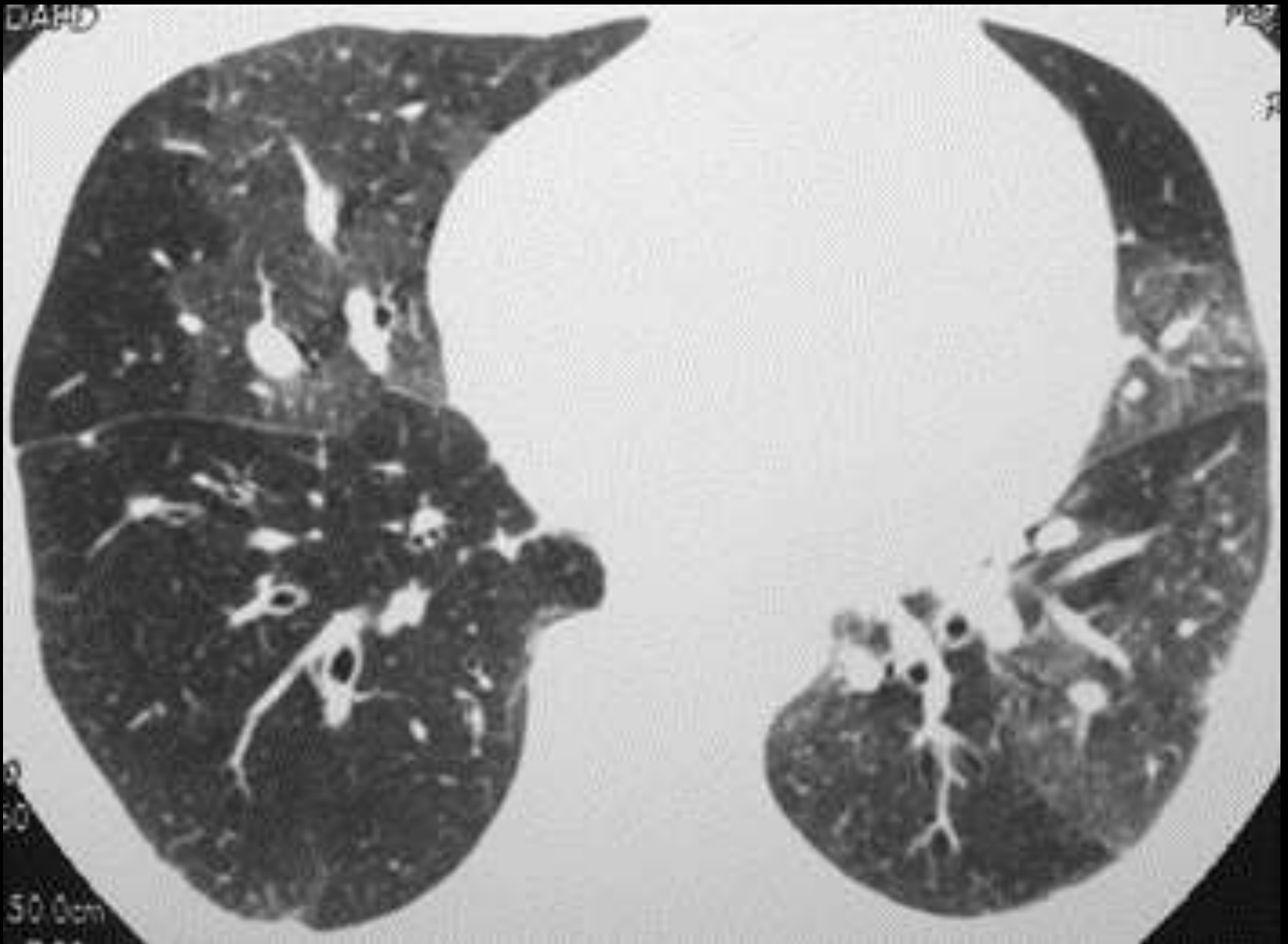
Pulmonary arterial hypertension with pericardial effusion



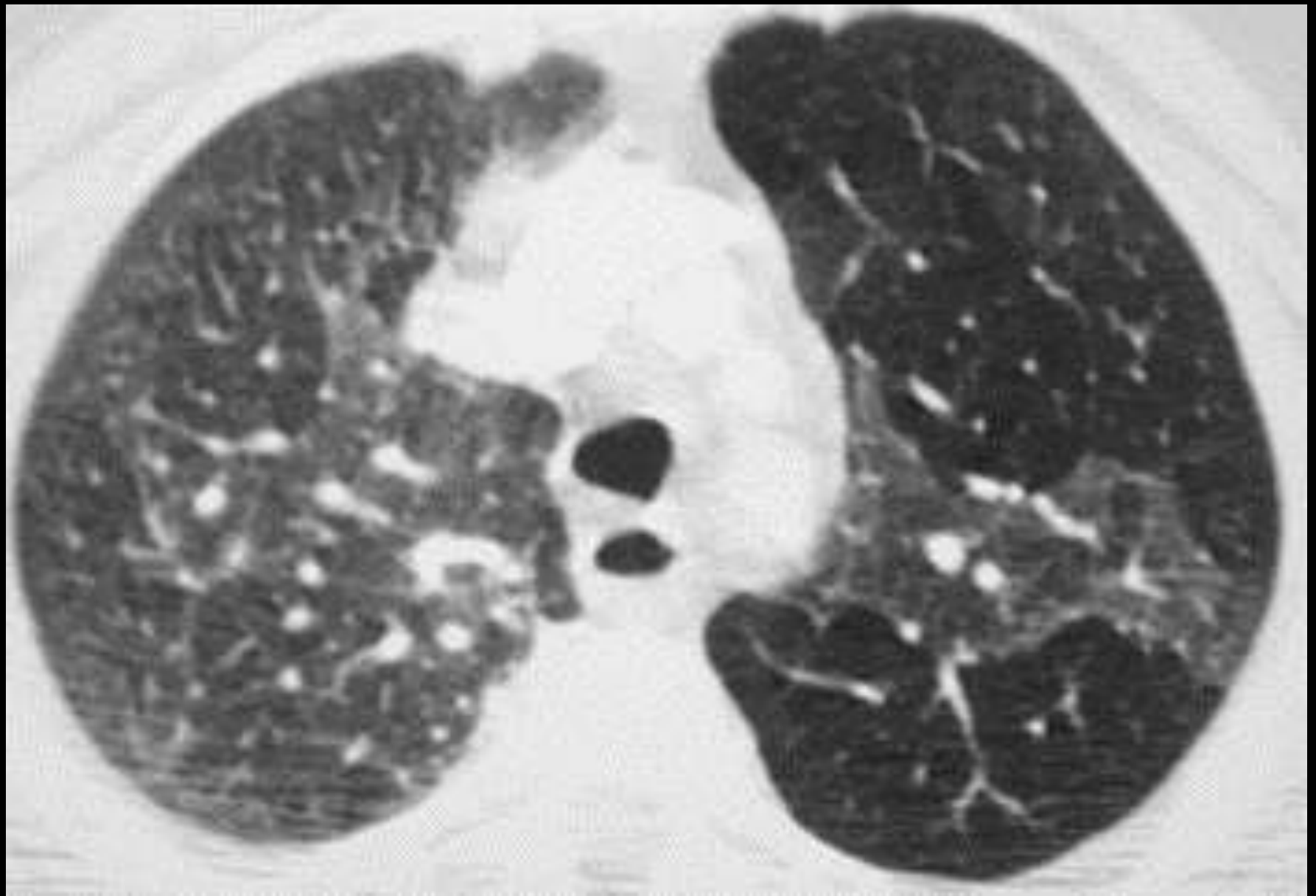
Rt V strain with passive hepatic congestion



PA wall calcification

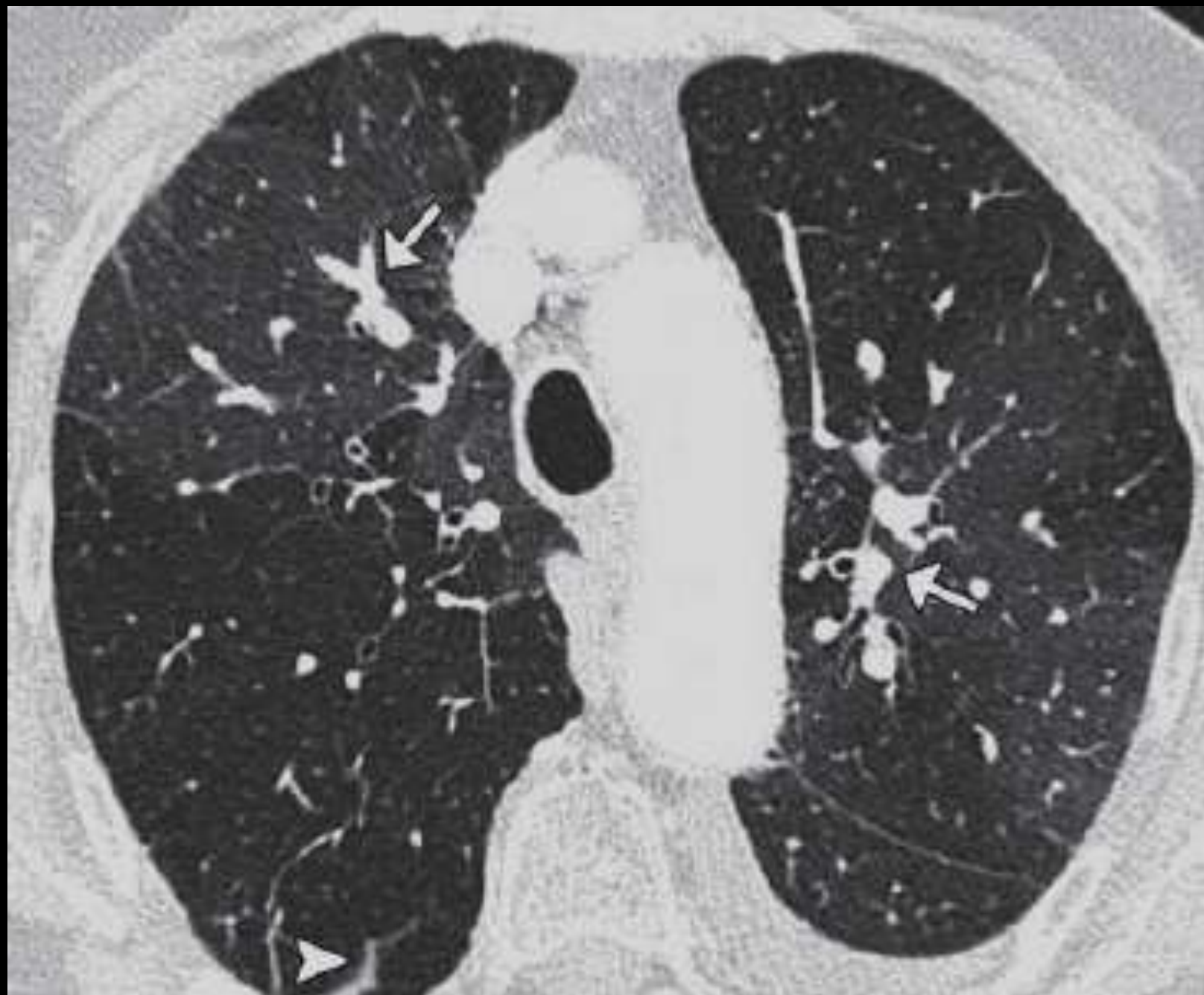


Mosaic pattern





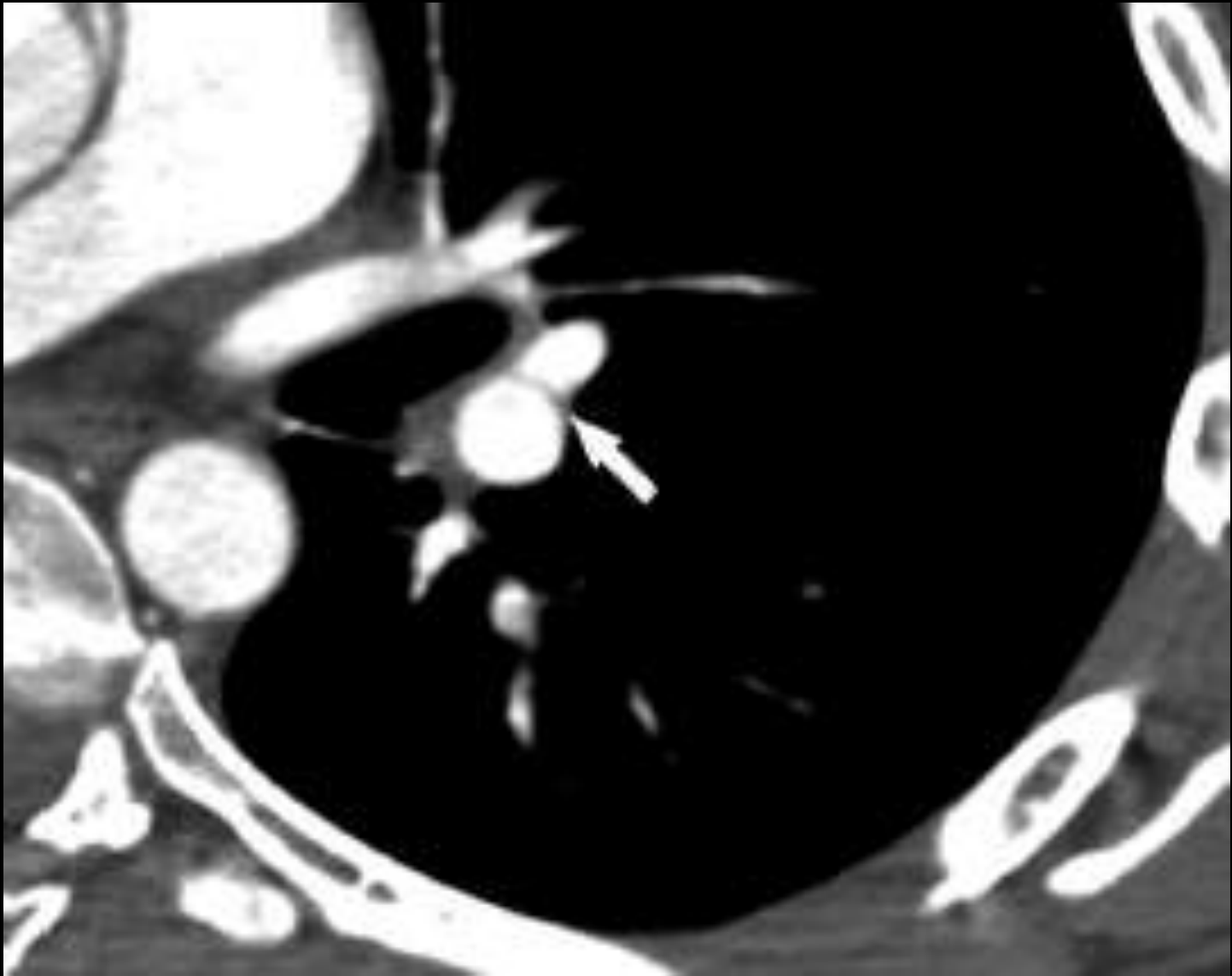
Mosaic perfusion pattern & scar



Pitfalls & Mimics



Arterial angulations



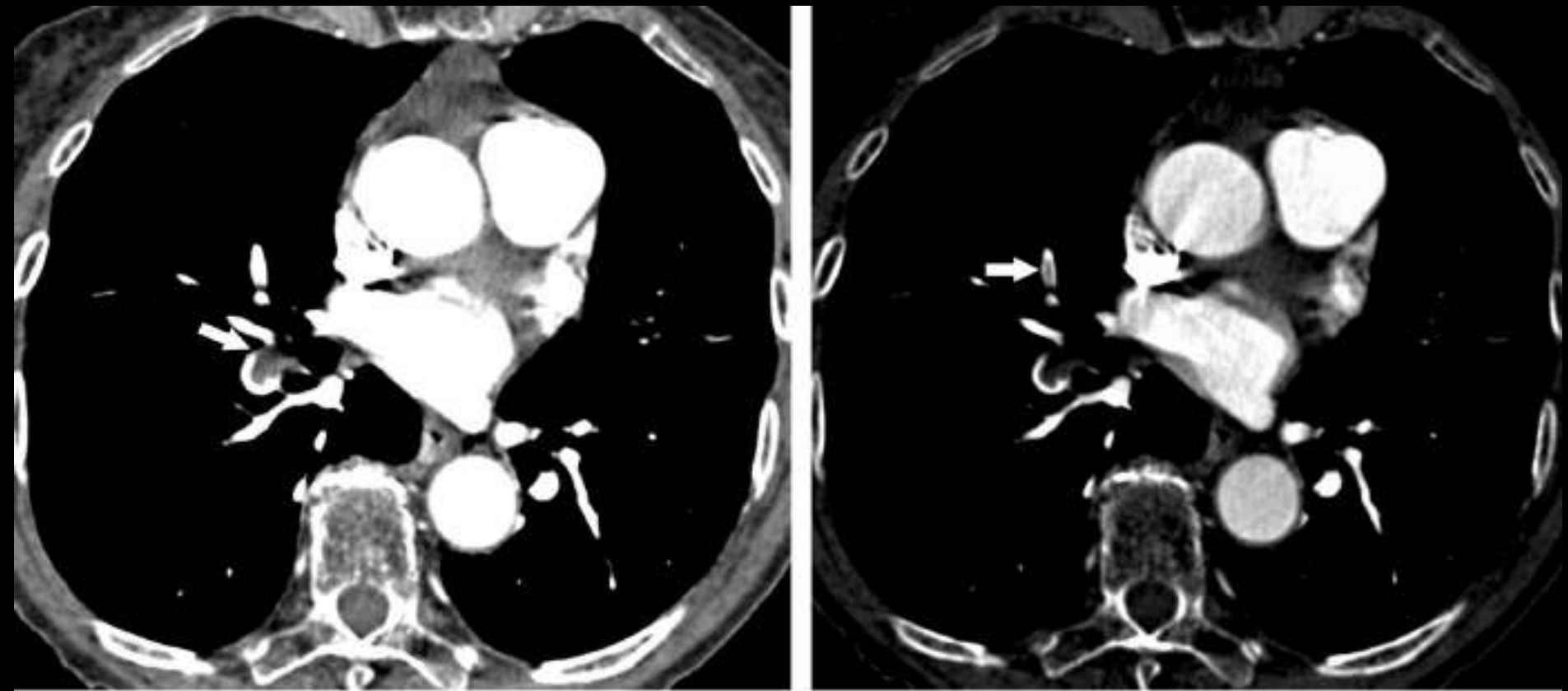
Vascular bifurcation



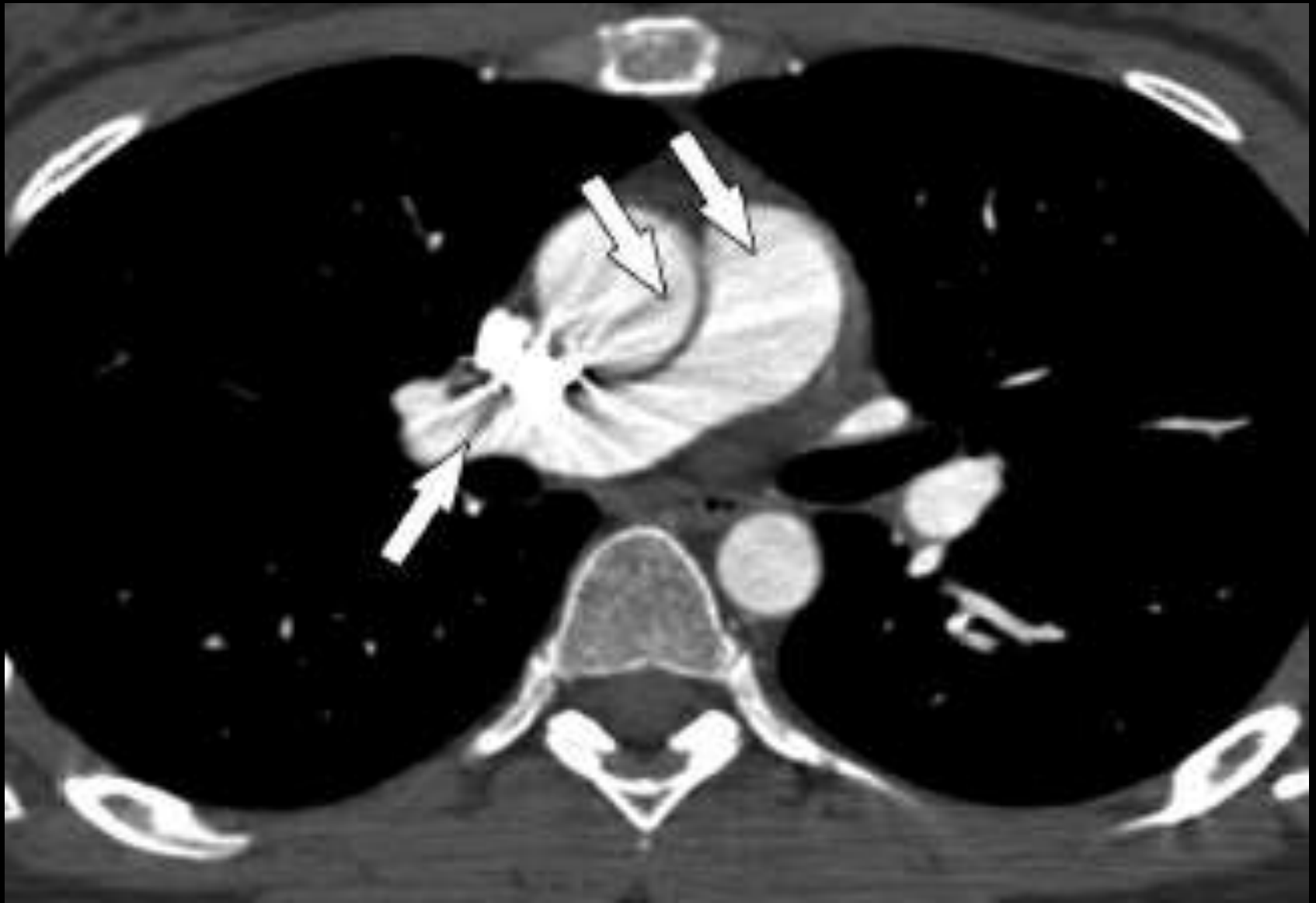
Image noise



Flow-related artifact



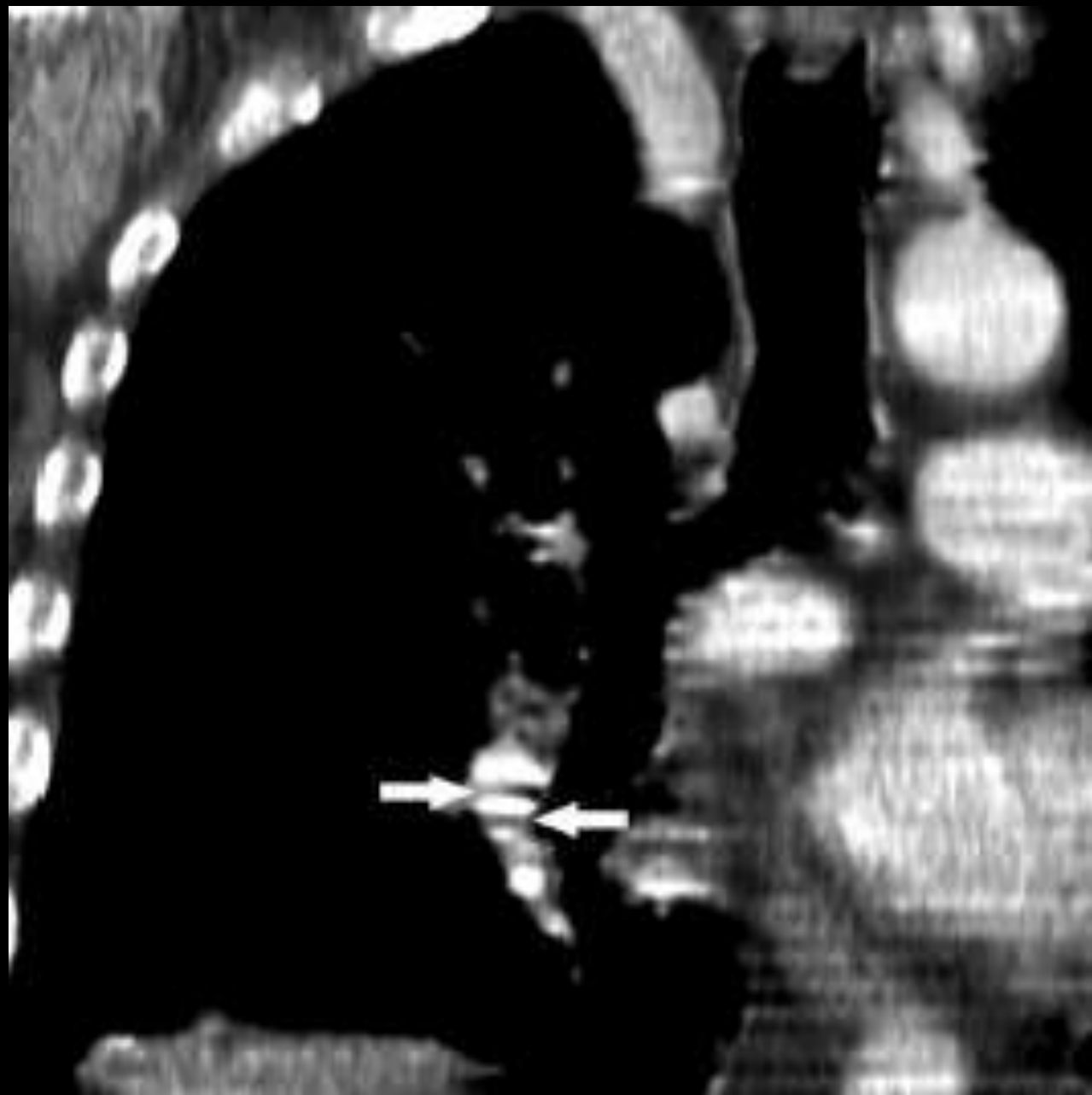
Window setting



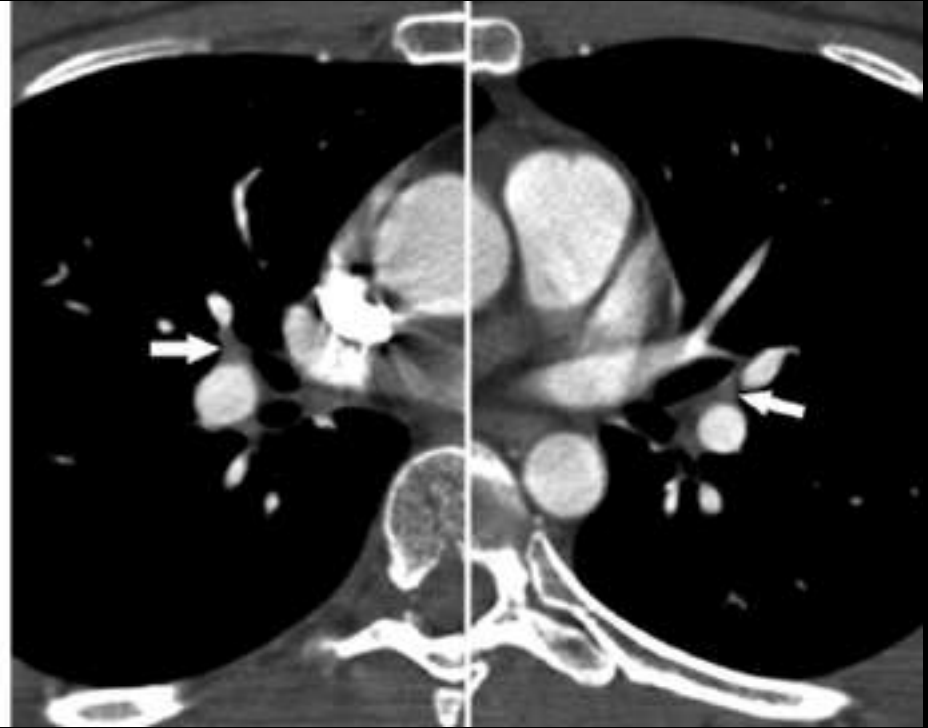
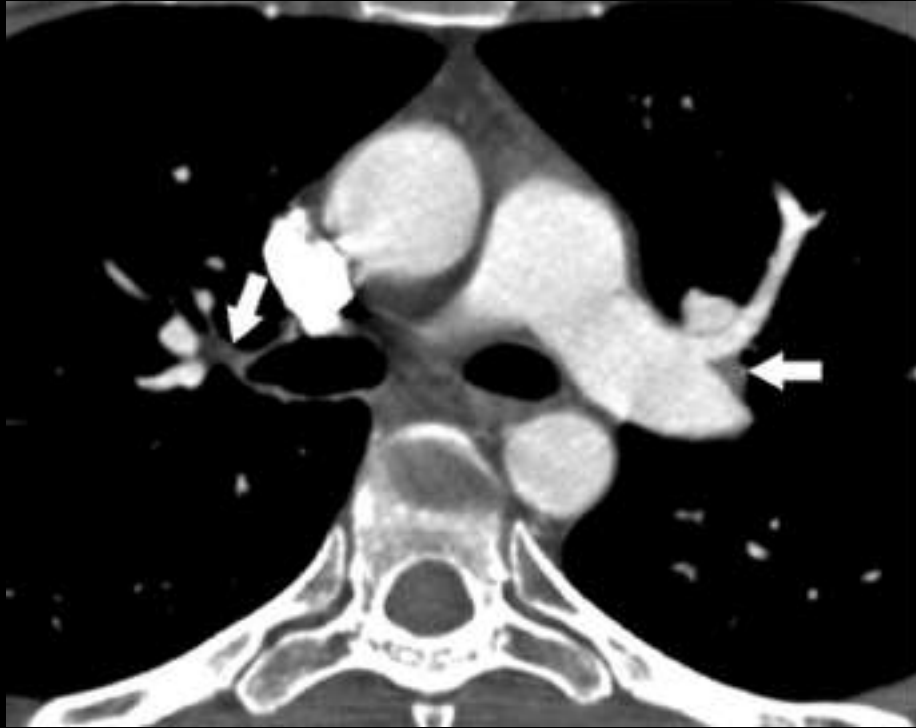
Streak artifact (from dense contrast in the SVC).



Partial volume artifact



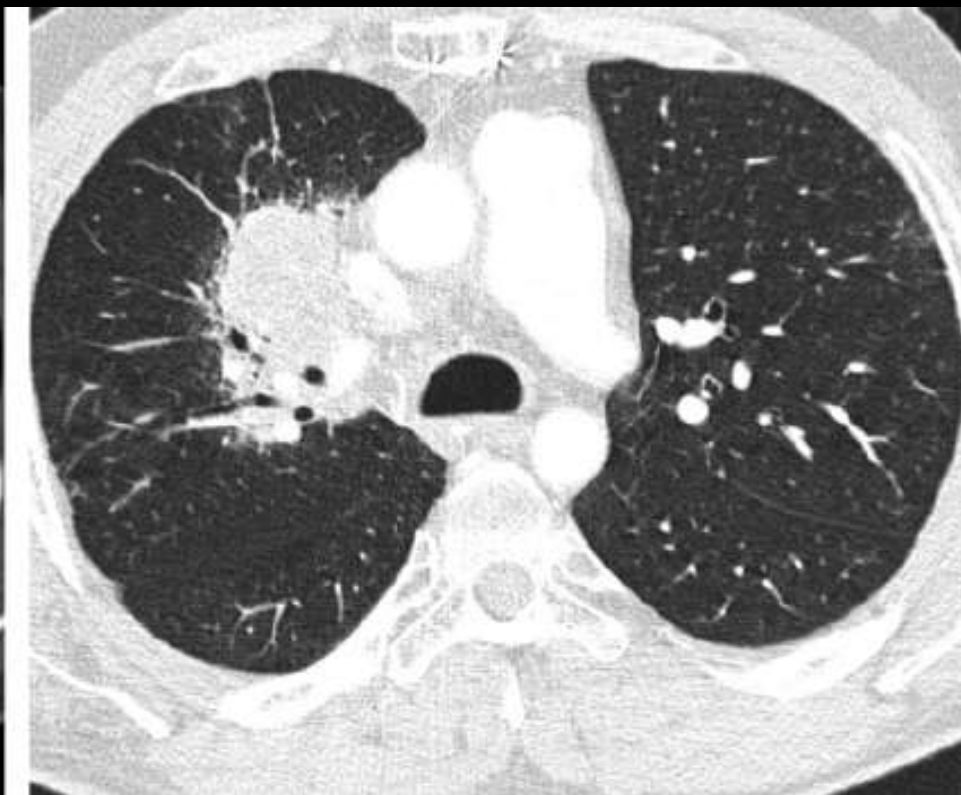
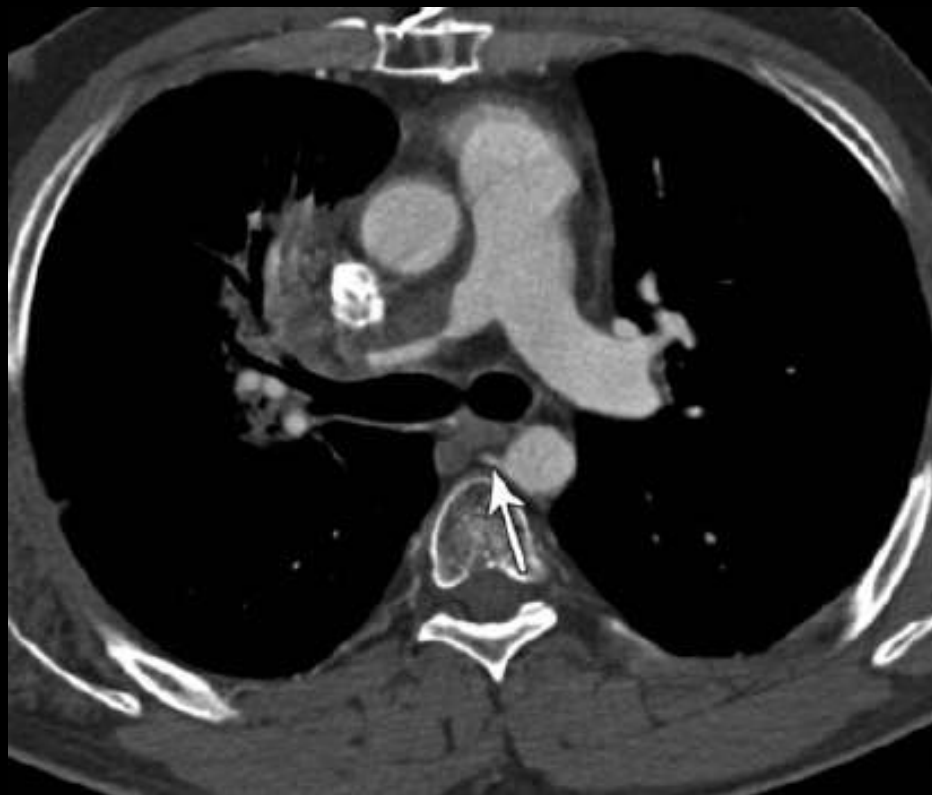
Stair step artifact



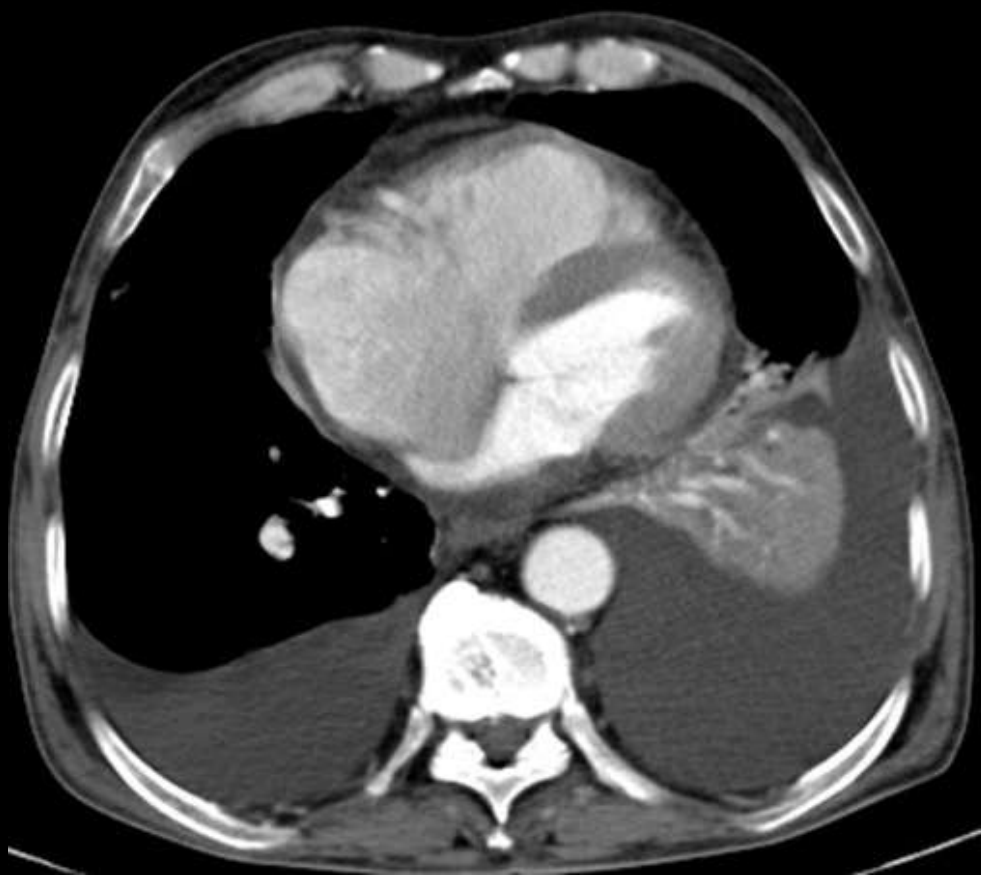
Hilar LNs



Mucus plugs



PA leiomyosarcoma



Collapse

Ventilation Perfusion Lung Scan

- It is a scintigraphic examination of the lung that evaluates pulmonary vasculature perfusion and segmental broncho-alveolar tree ventilation.

Technique

- The ventilation scan performed using radio-isotope labelled aerosols like technetium-99m DTPA delivered to the patient through a non-rebreathing mask, with the patient supine. The micro-aerosol particles are small enough to reach the distal tracheobronchial tree and reflect regional ventilation. The patient is then imaged in the upright position in three phases: initial breath, equilibrium and washout.
- The perfusion scan involves IV injection of Tc-99m MAA in supine position. The MAA particles are just small enough to get lodged in the pre-capillary arterioles. A high resolution, large field of view gamma camera is used to image the lungs.

Normal ventilation scan

Even distribution of radionuclide throughout the lung fields.

Pulmonary embolism

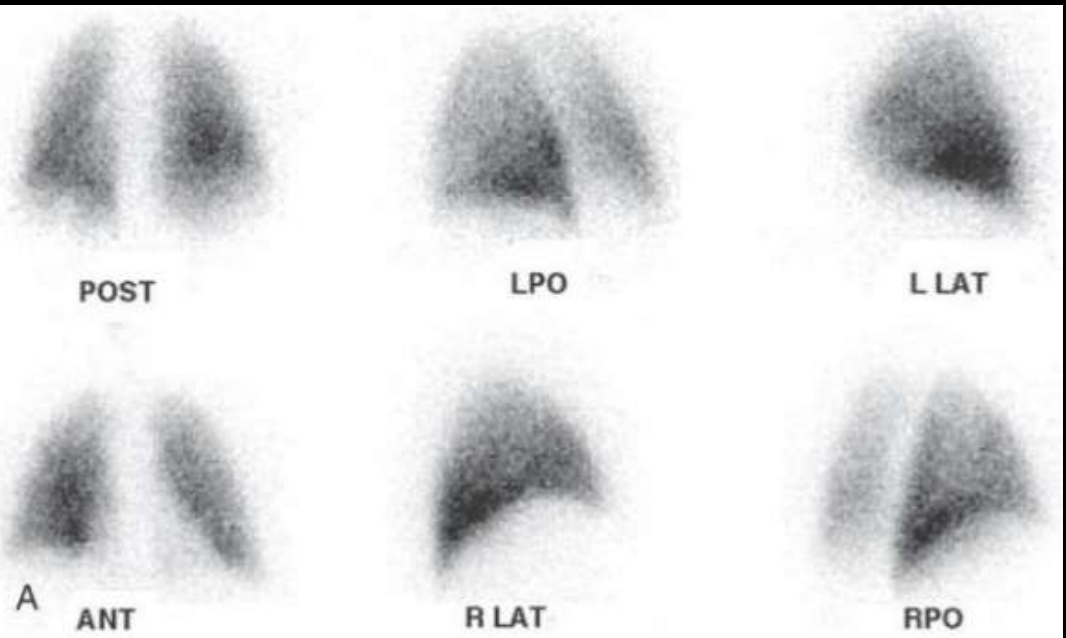
Multiple, bilateral perfusion defects.

A ventilation/perfusion (V/Q) scan will show ventilation-perfusion mismatches. A high probability scan is defined as showing two or more unmatched segmental perfusion defects.

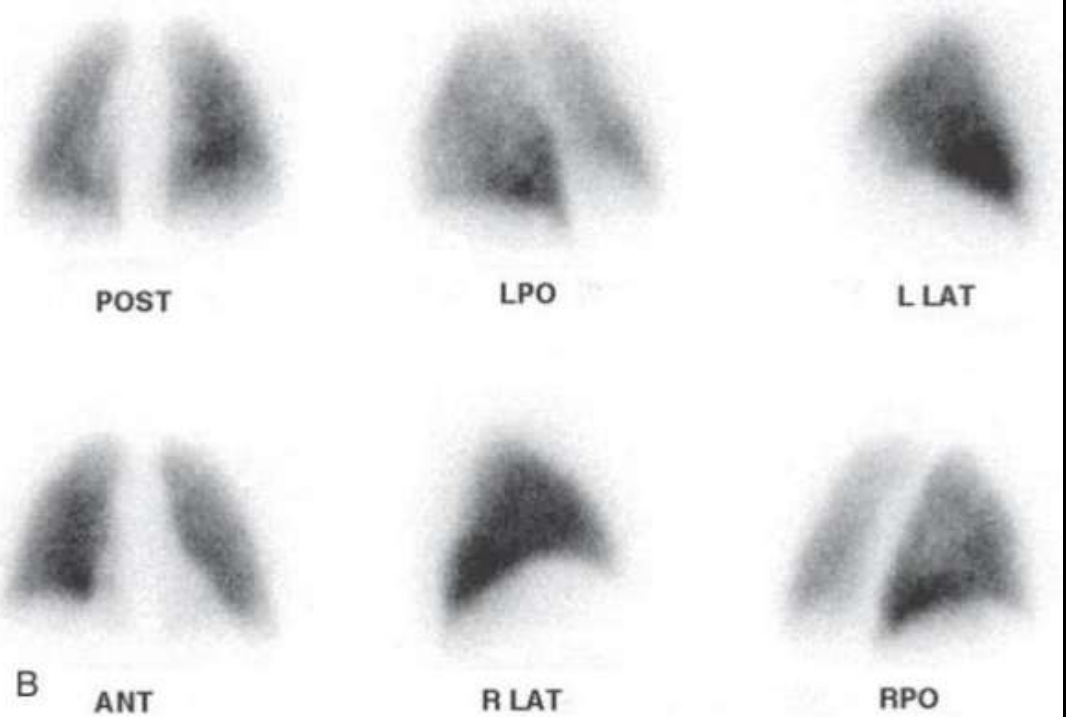
V/Q Scan Interpretation

Result	Interpretation	Significance
Low probability	Perfusion deficit with matched ventilation deficit	< 20% probability of PE
Intermediate probability	Perfusion deficit that corresponds to parenchymal abnormality on chest x-ray	20% - 80% probability of PE
Normal	No perfusion deficit	Excludes pulmonary thromboembolism
High probability	Multiple segmental perfusion deficits with normal ventilation	> 80% probability of PE

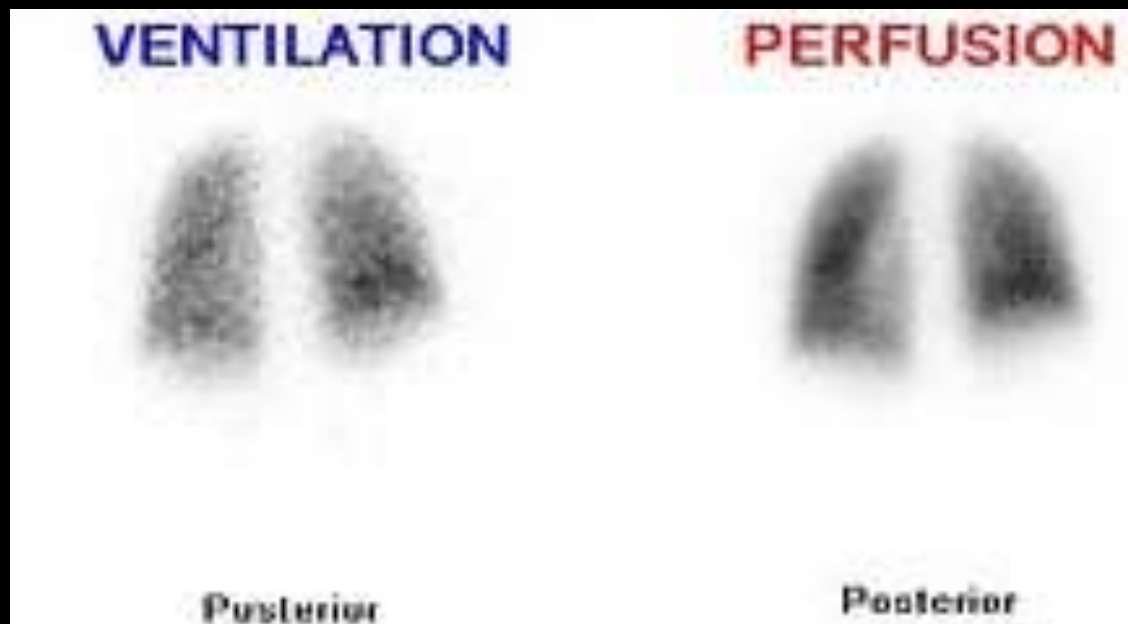
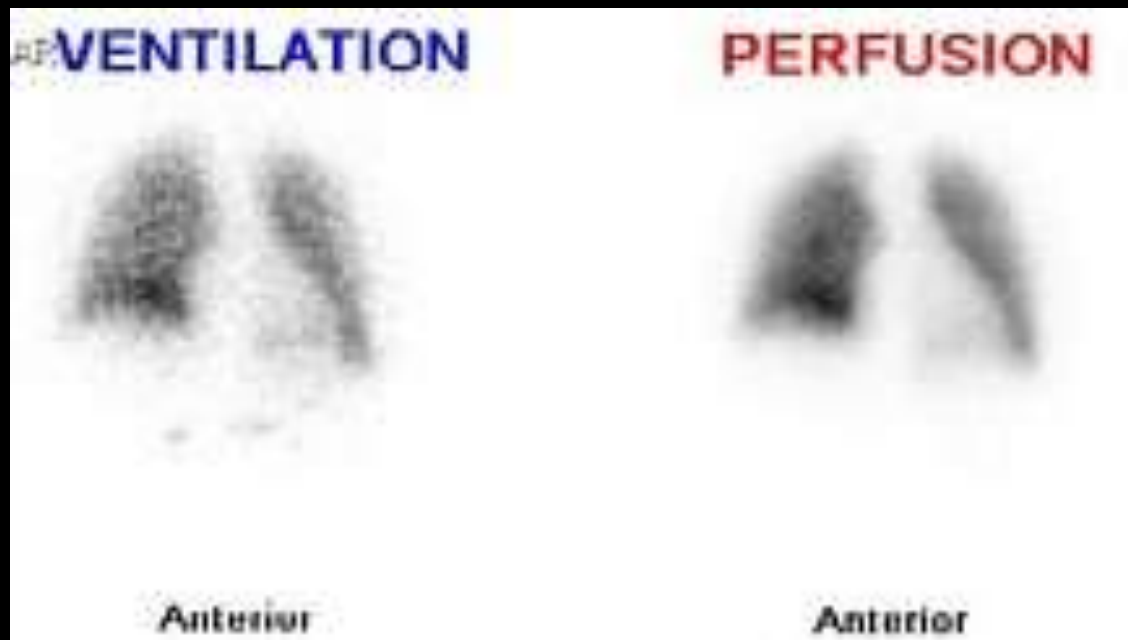
Ventilation



Perfusion



Normal V/Q Scan



Normal V/Q scan



LPO



Post



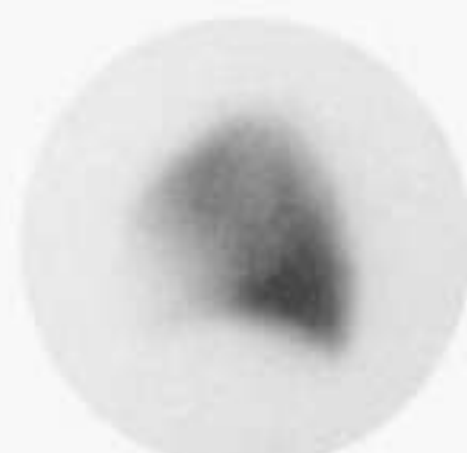
RPO



RLat



Ant

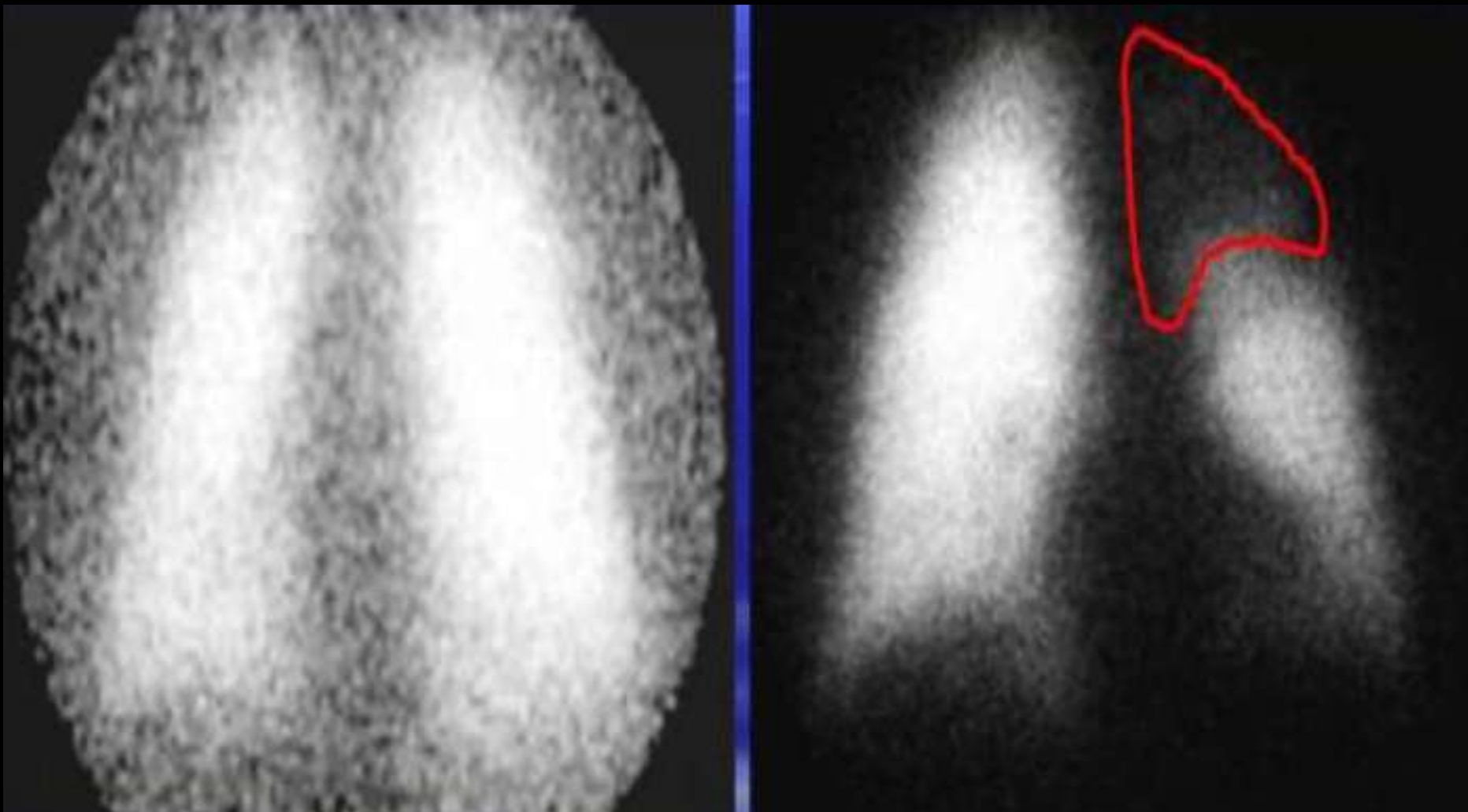


LLat

Normal perfusion

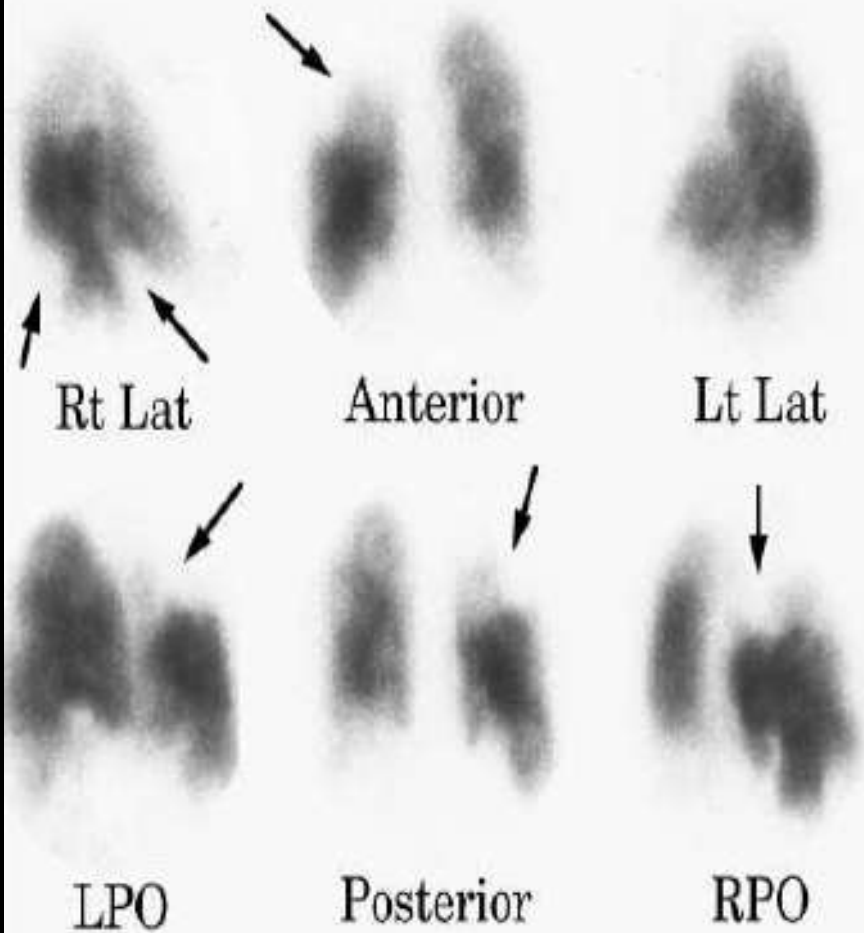
Ventilation

Perfusion

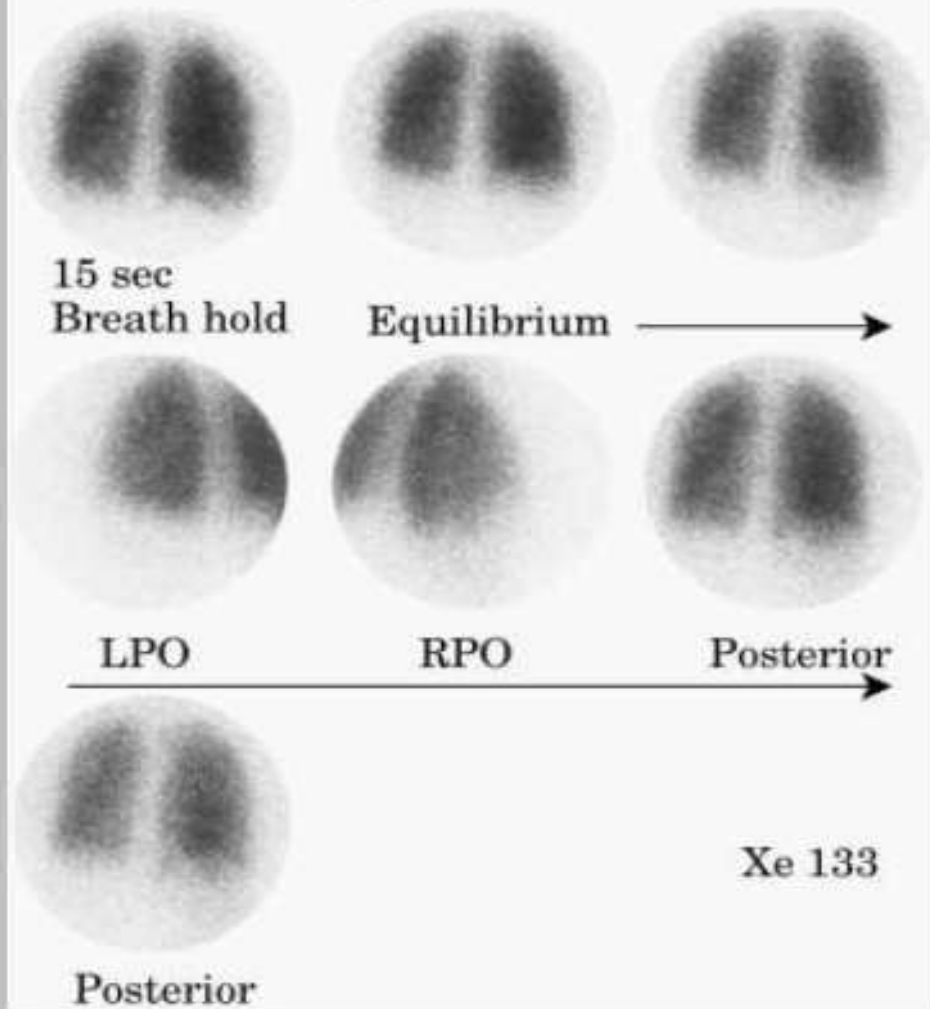


Perfusion deficit with Lt UL infarction

Lung Perfusion

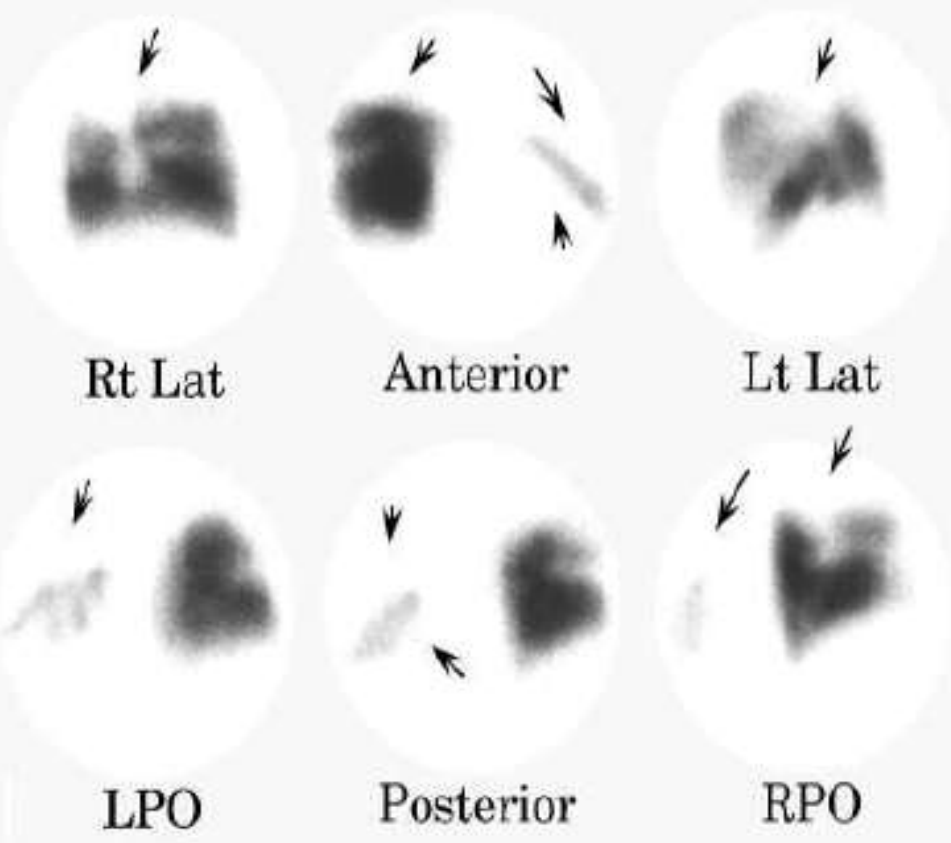


Lung Ventilation

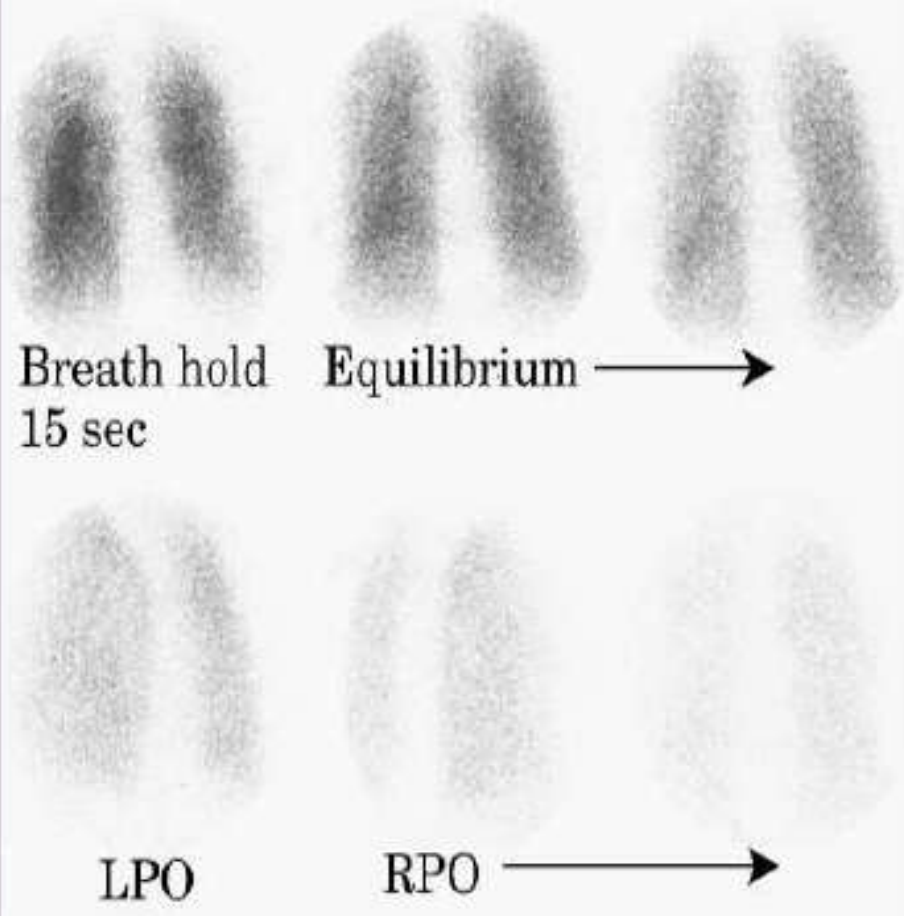


Rt sided multiple V/Q mismatch deficits

Lung Perfusion



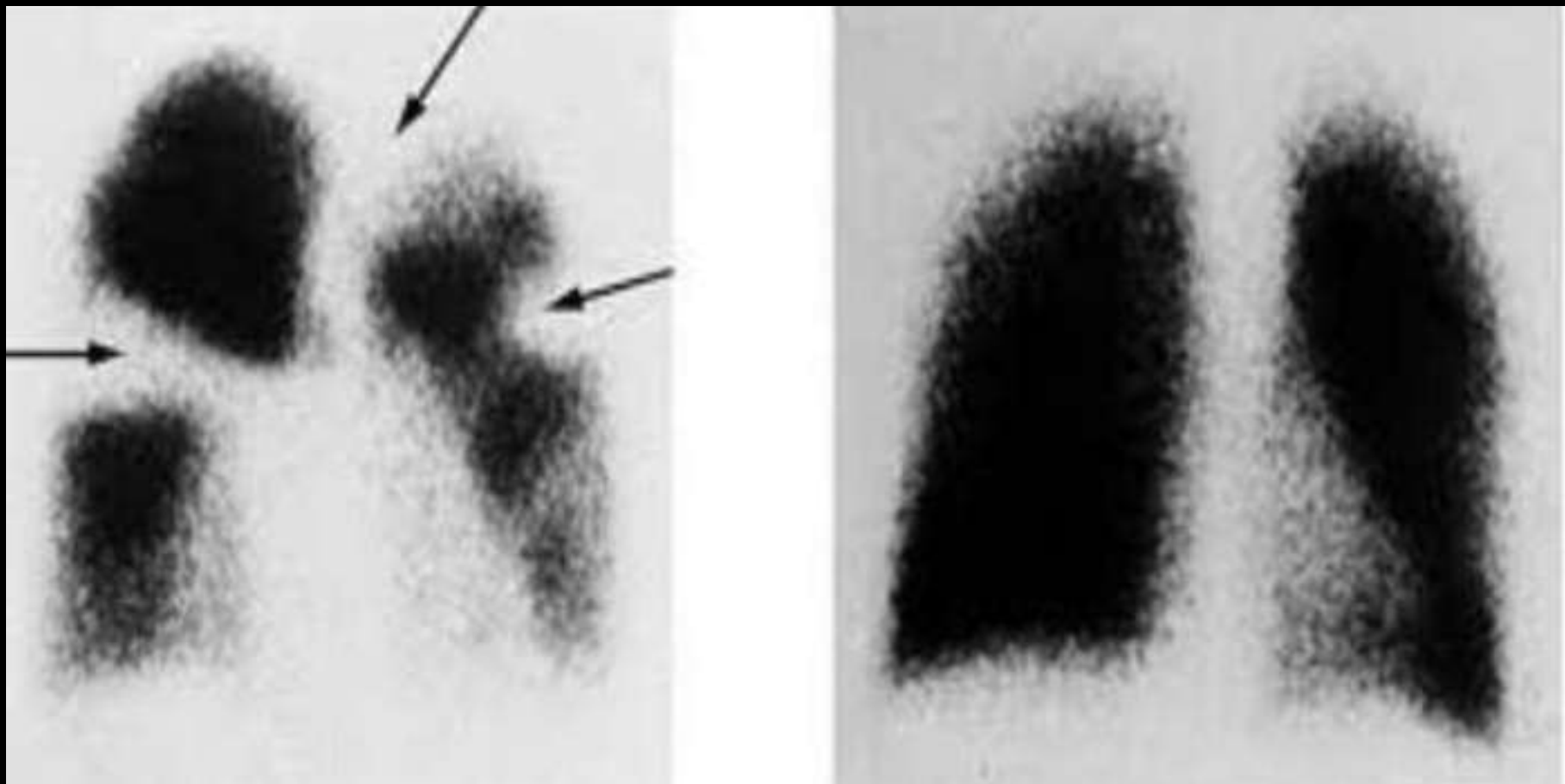
Lung Ventilation



Bilateral V/Q mismatch deficits

Perfusion

Ventilation



Bilateral V/Q mismatch deficits



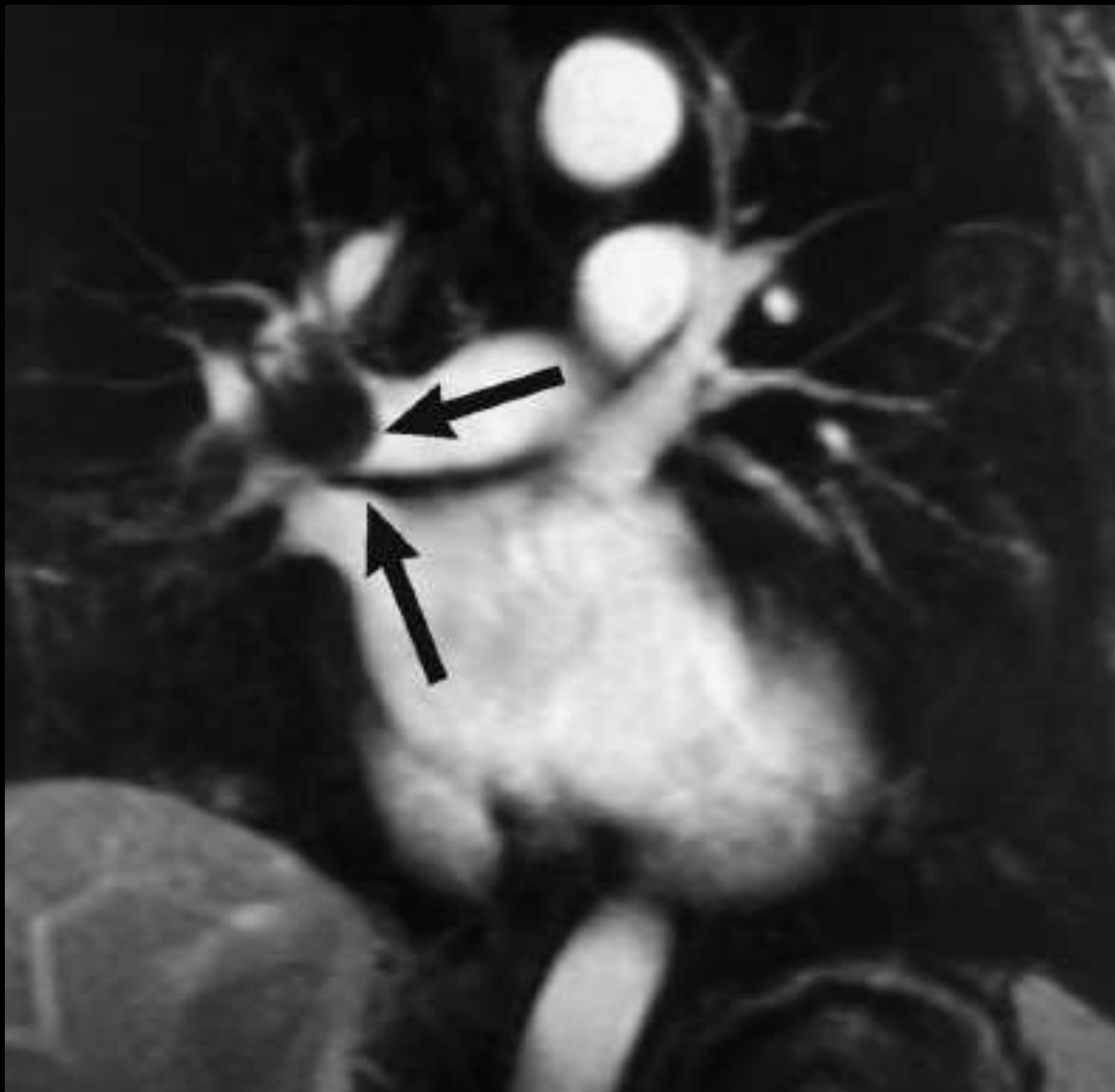
Lt sided mismatch defect consistent with high probability PE

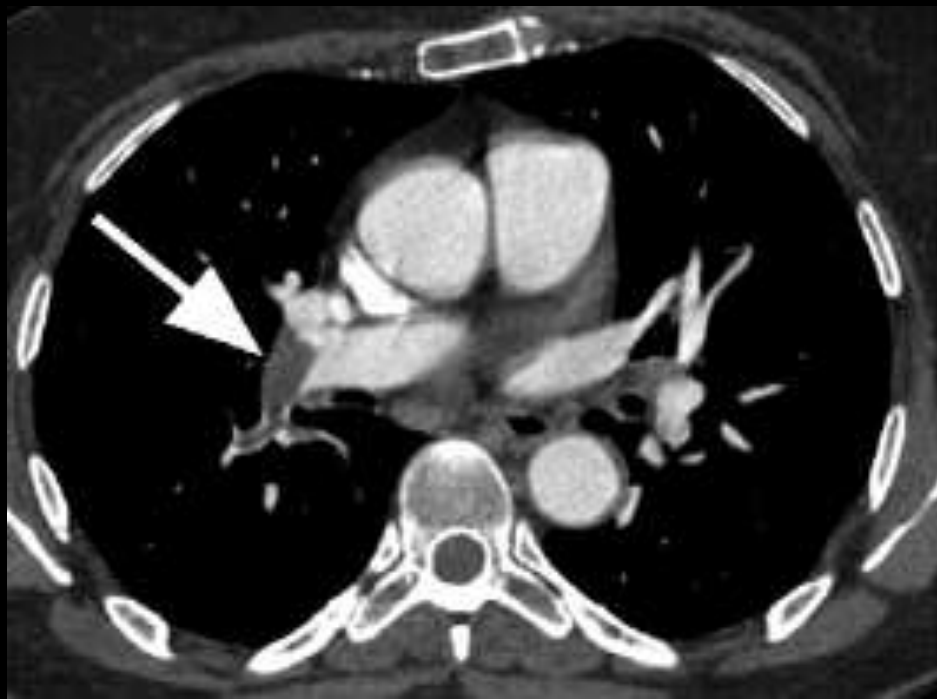
MRI

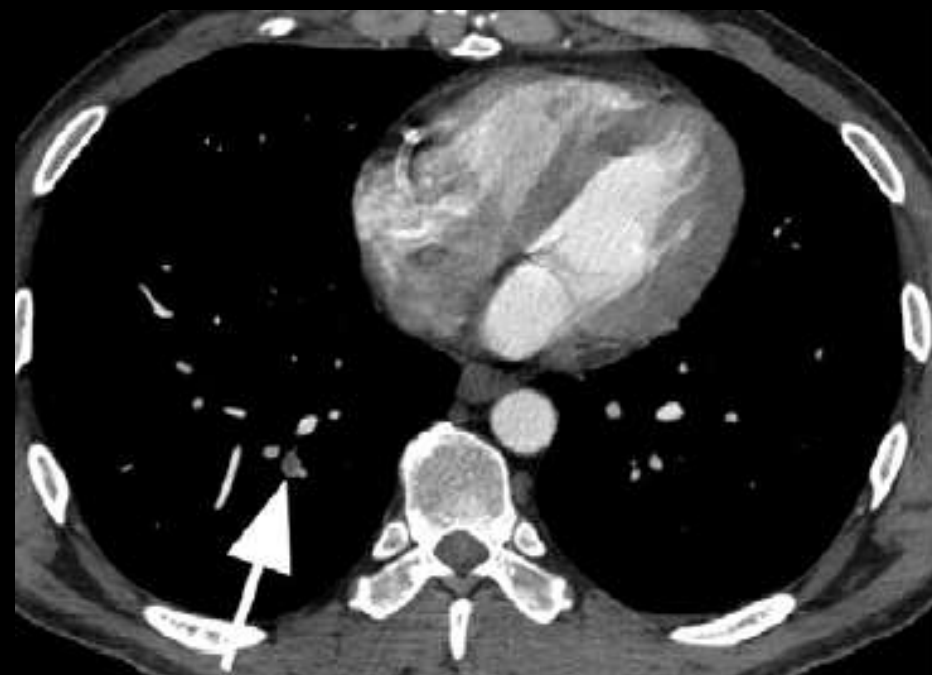


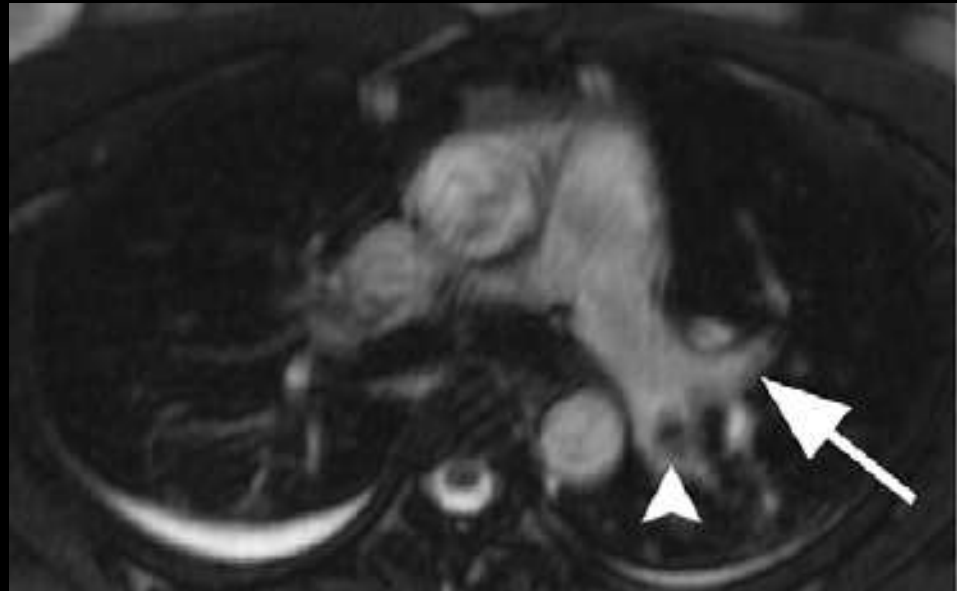
Normal unenhanced GE MRI

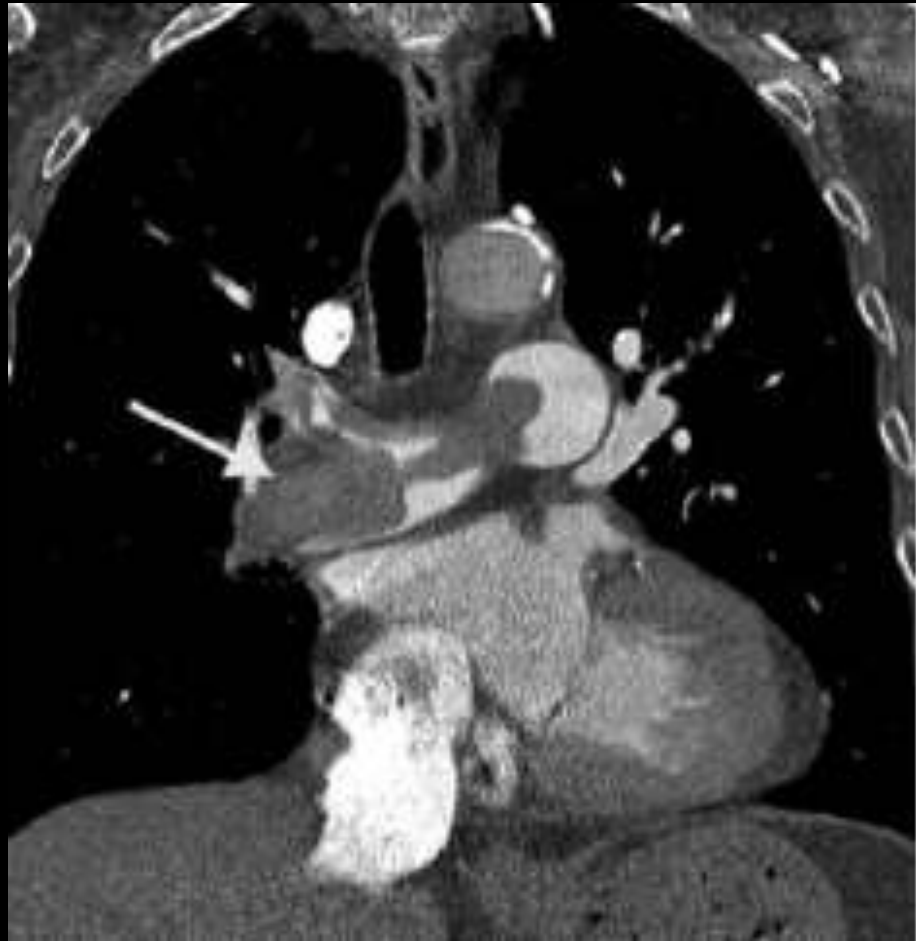


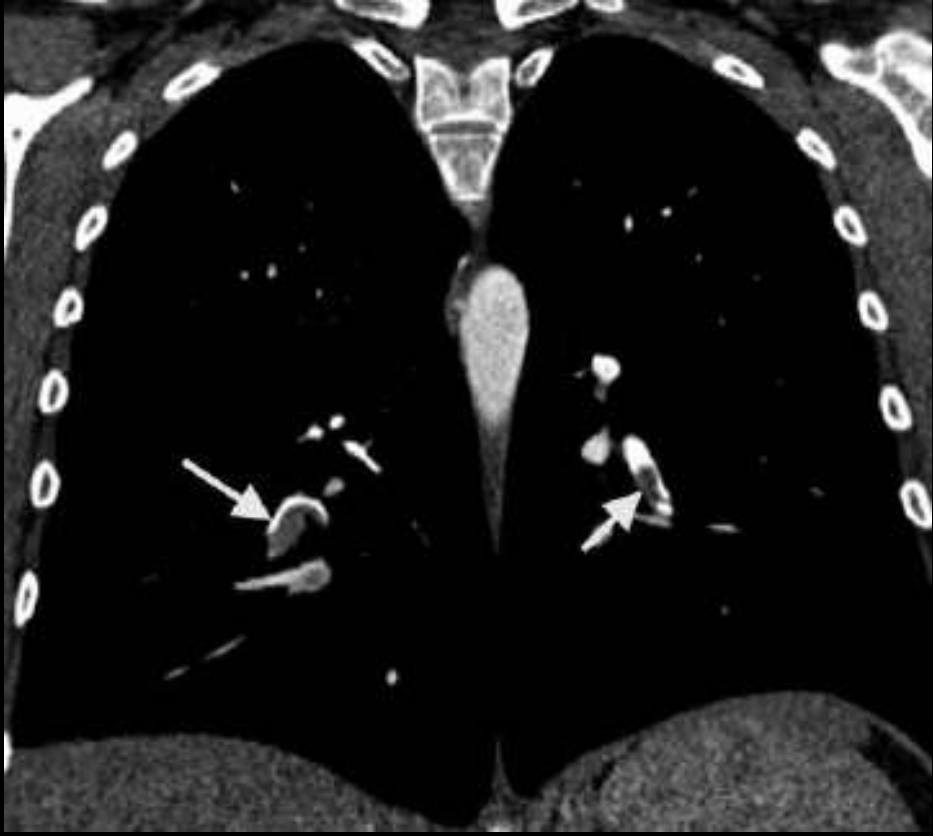










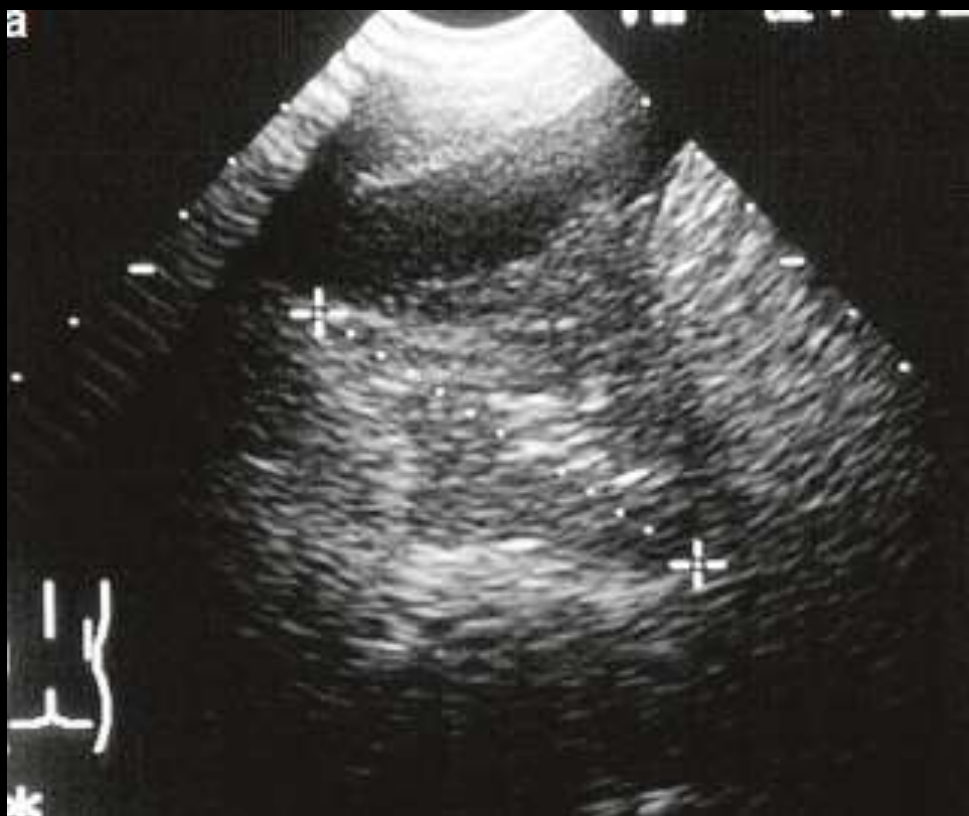


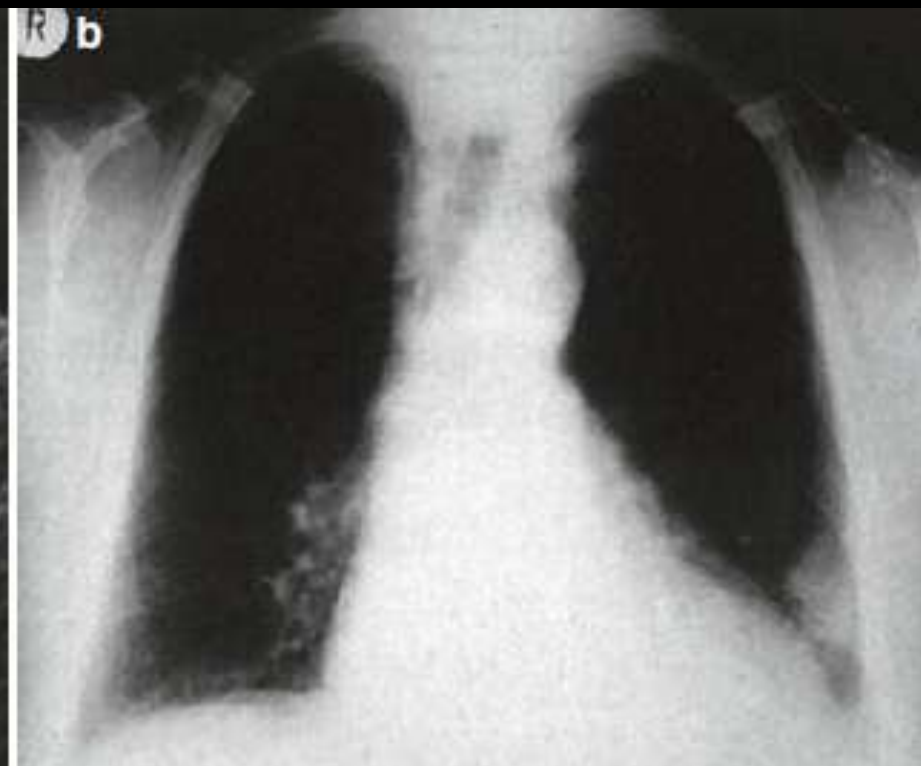
US & Doppler

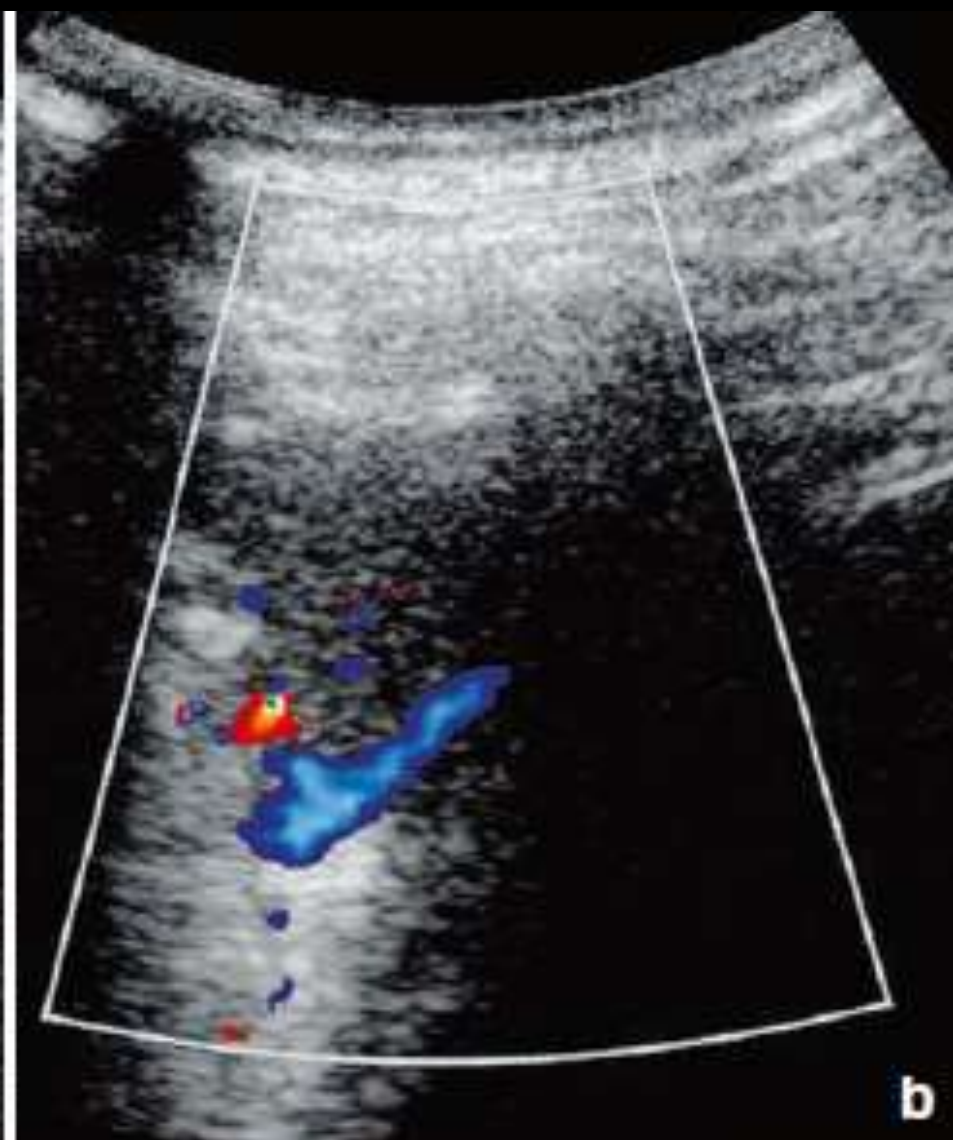
















Thank You