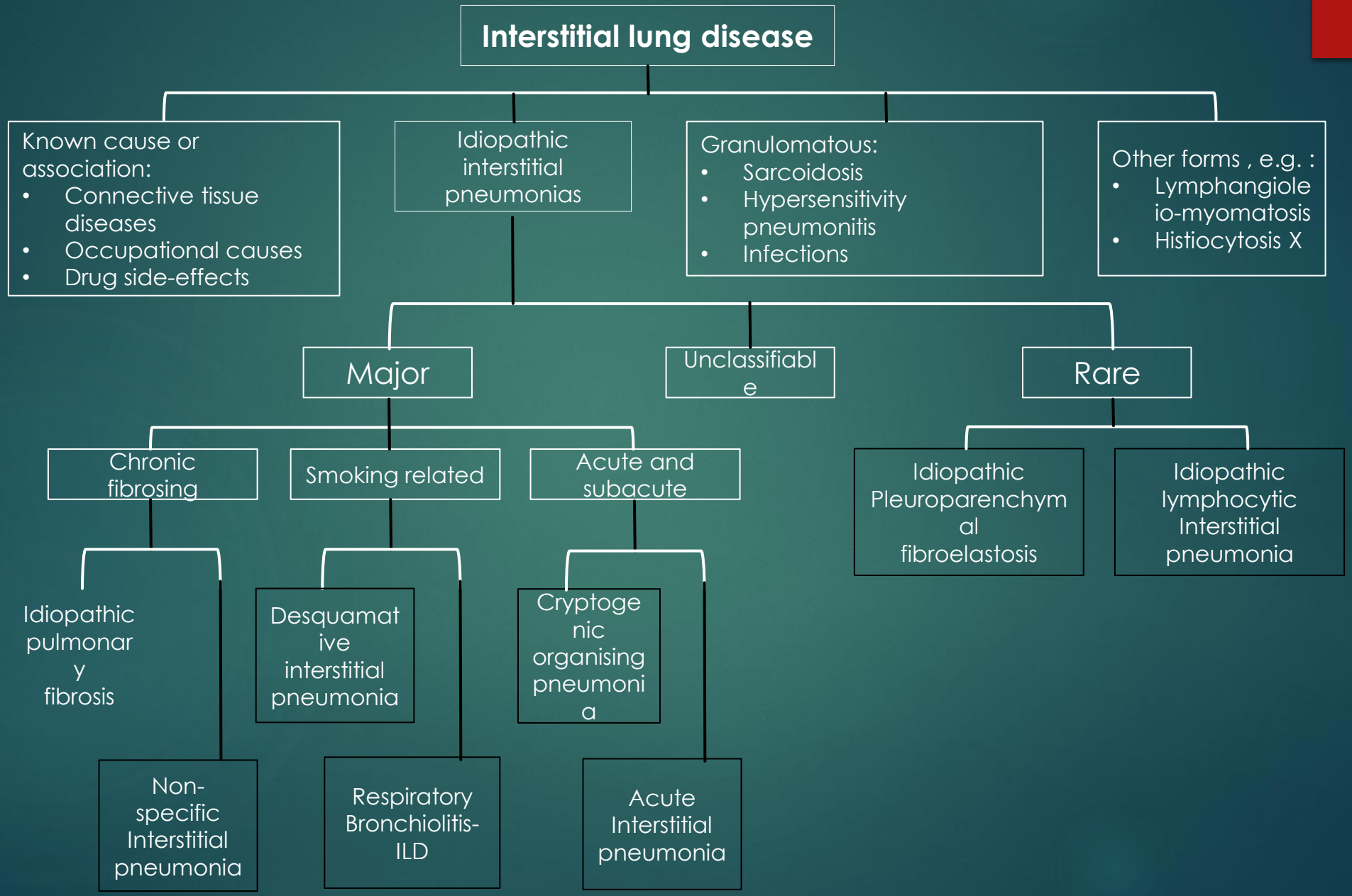
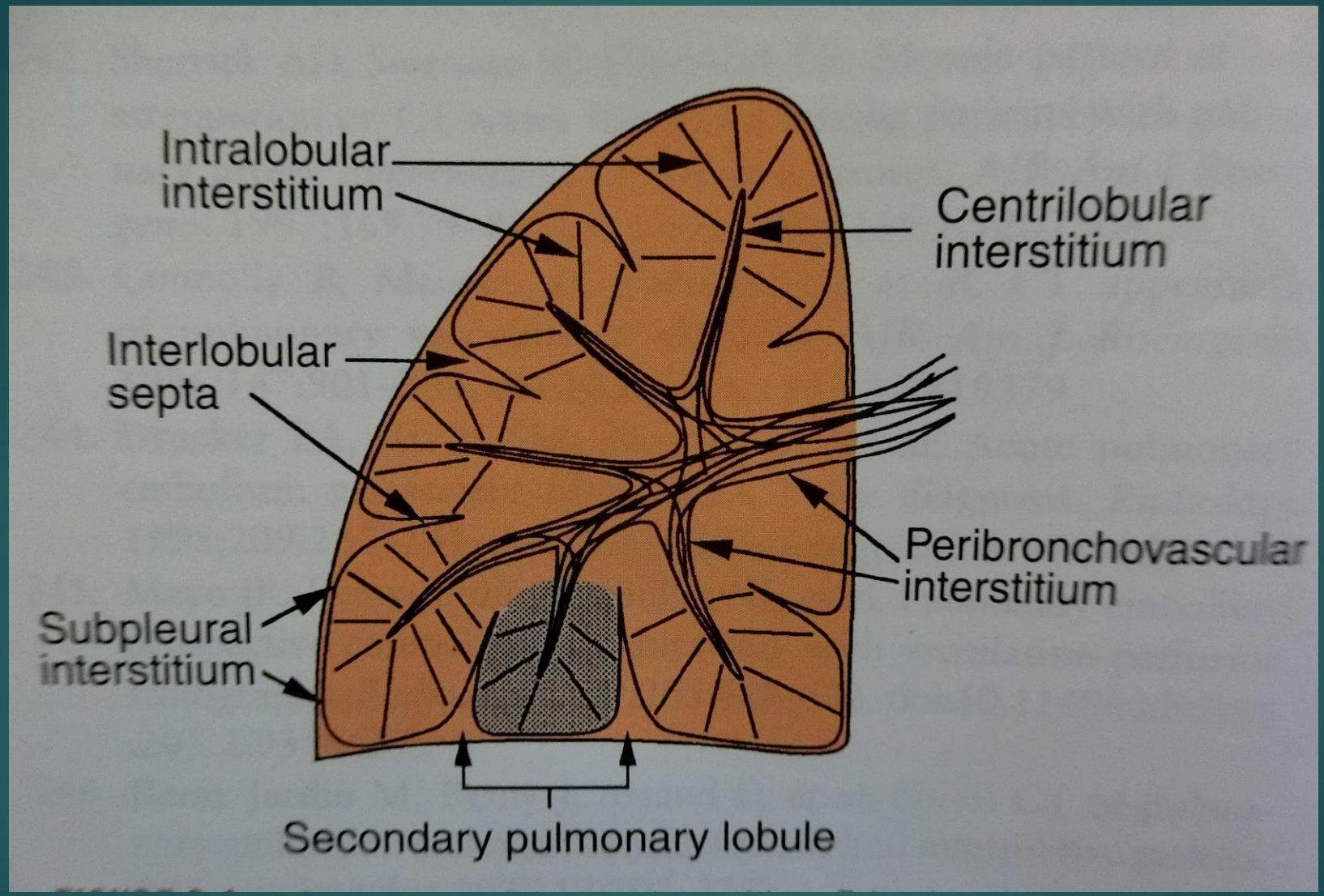
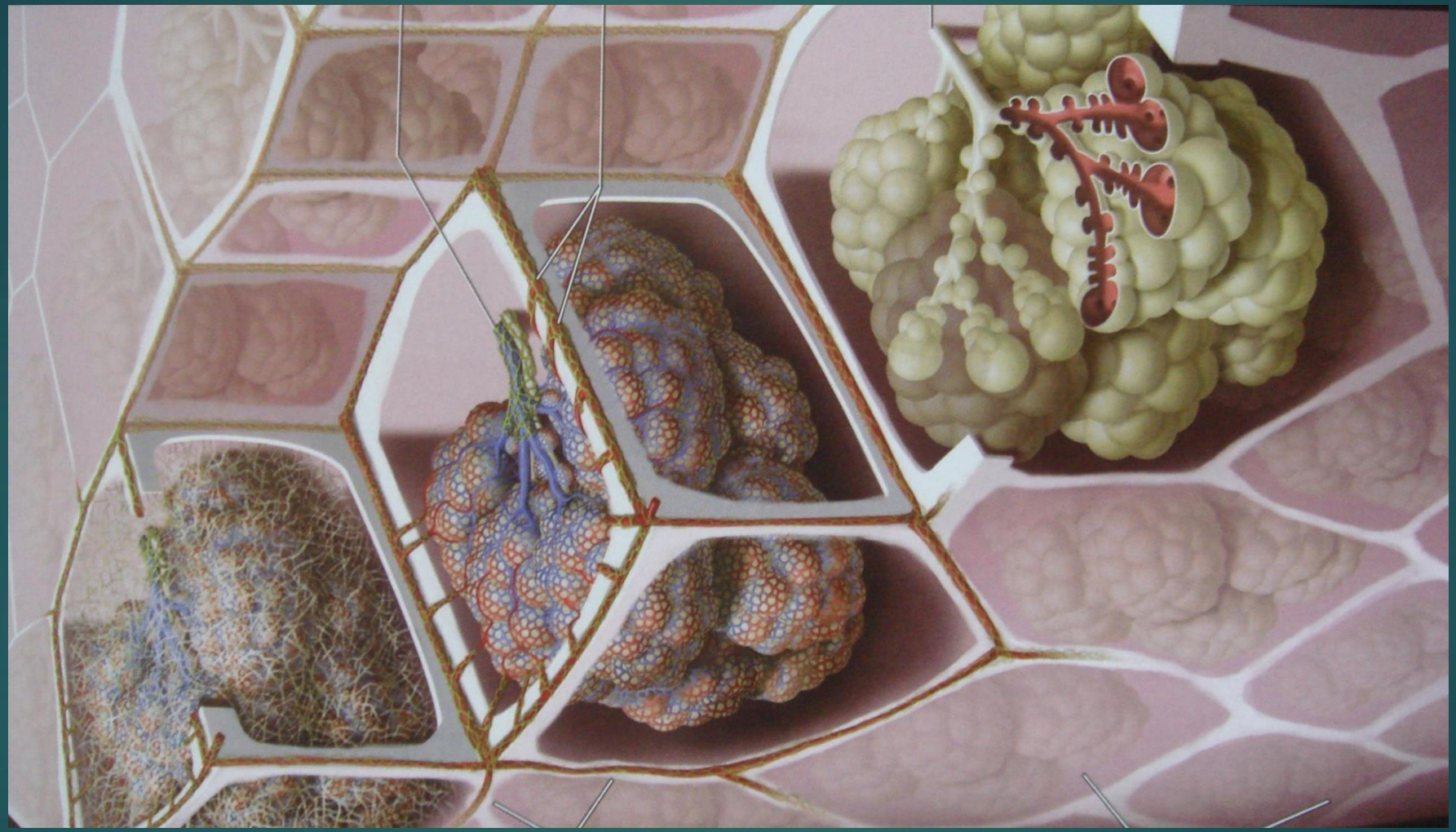
HRCT PATTERNS OF ILD

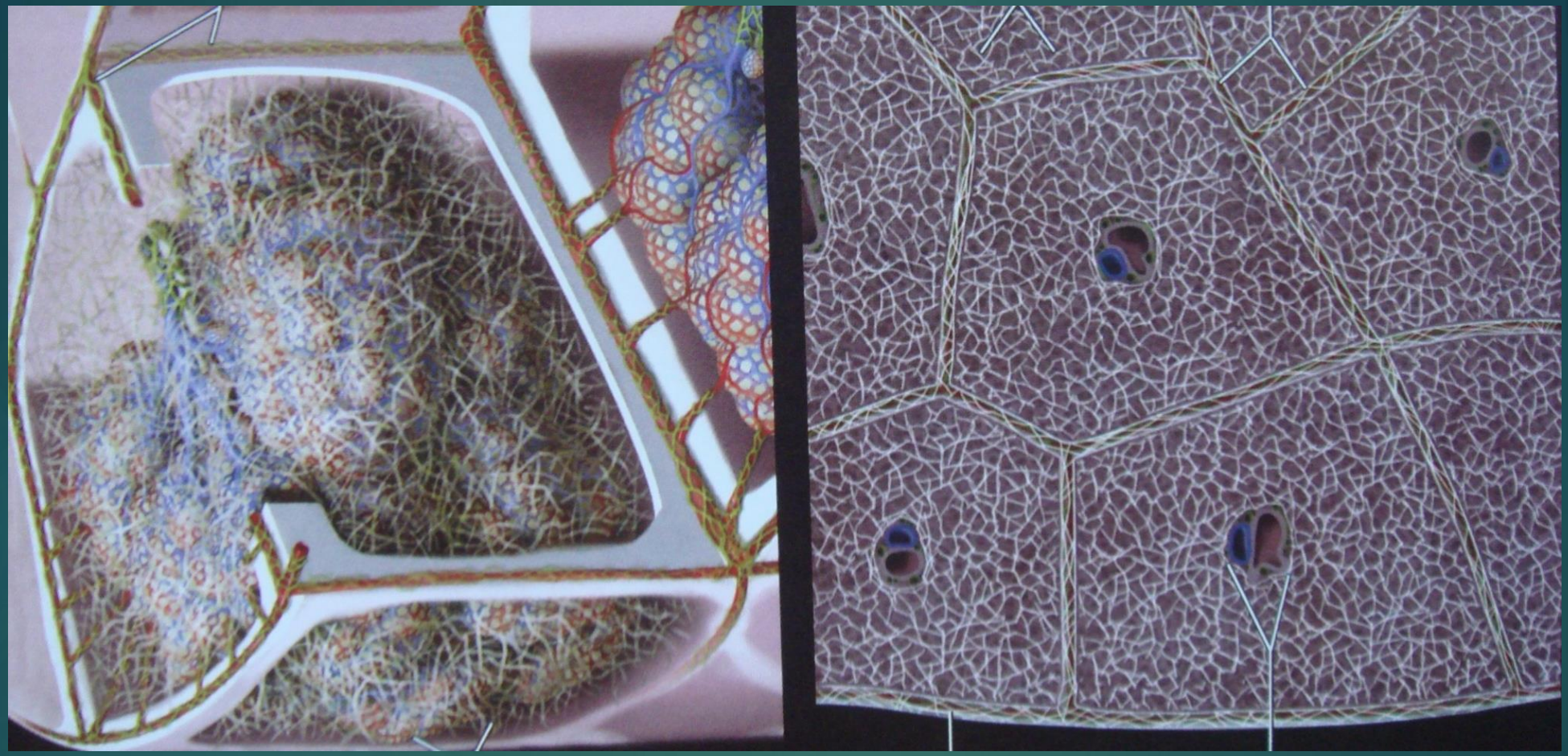
江自得

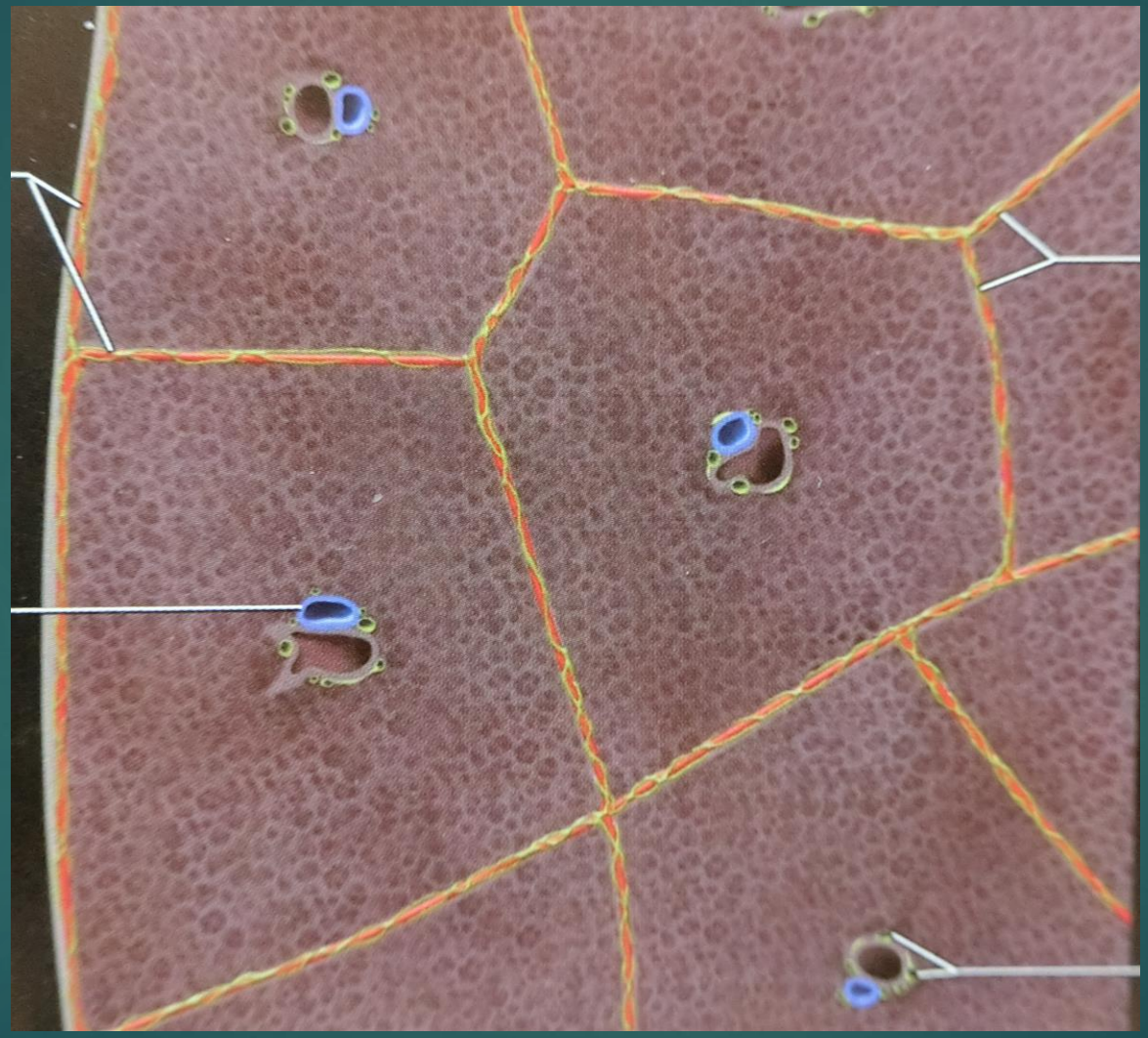
2013 ATS-ERS Classification of IIP




Intralobular interstitium
Centrilobular interstitium
Interlobular septa
Peribronchovascular interstitium
Subpleural interstitium
Secondary pulmonary lobule

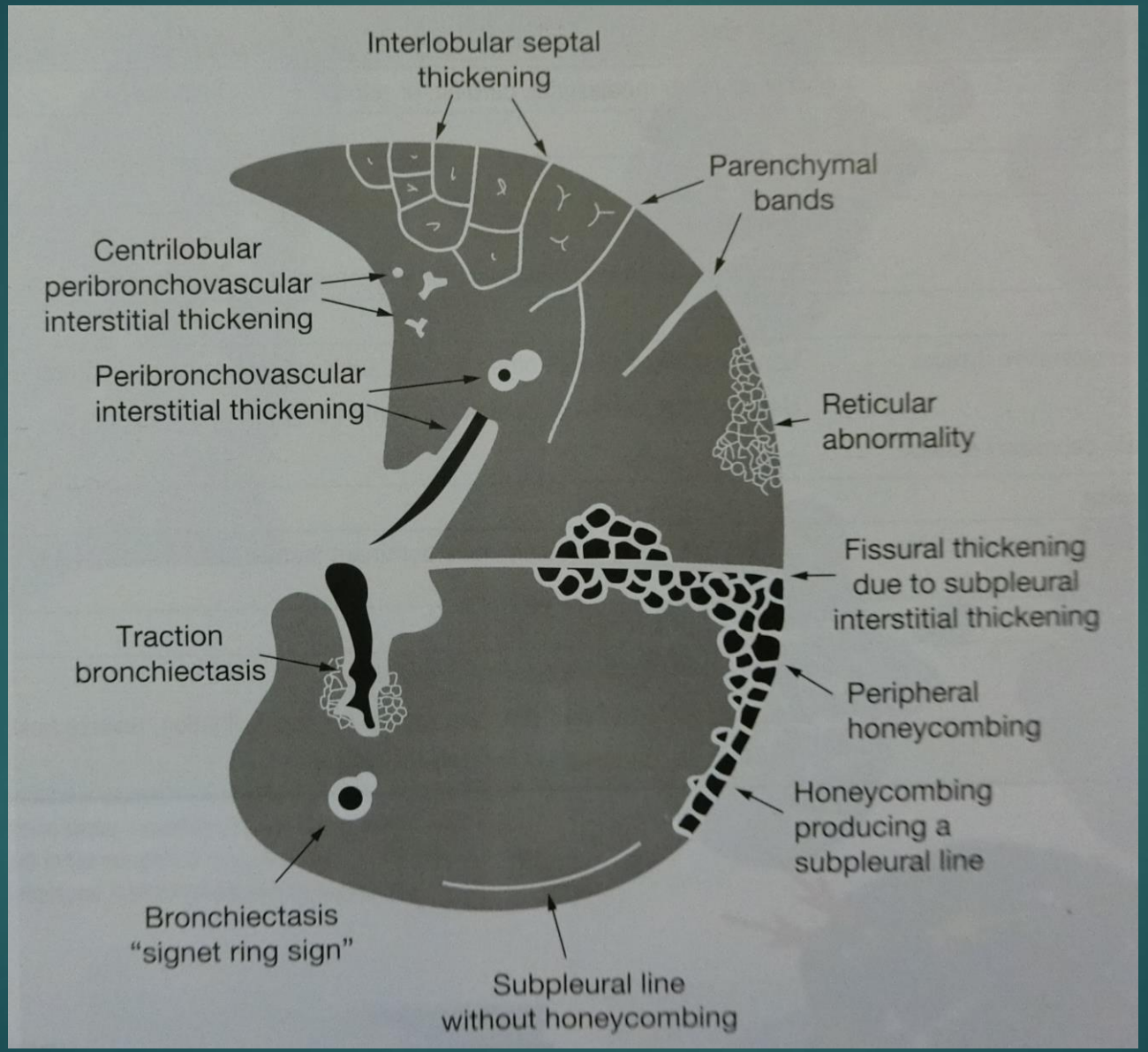


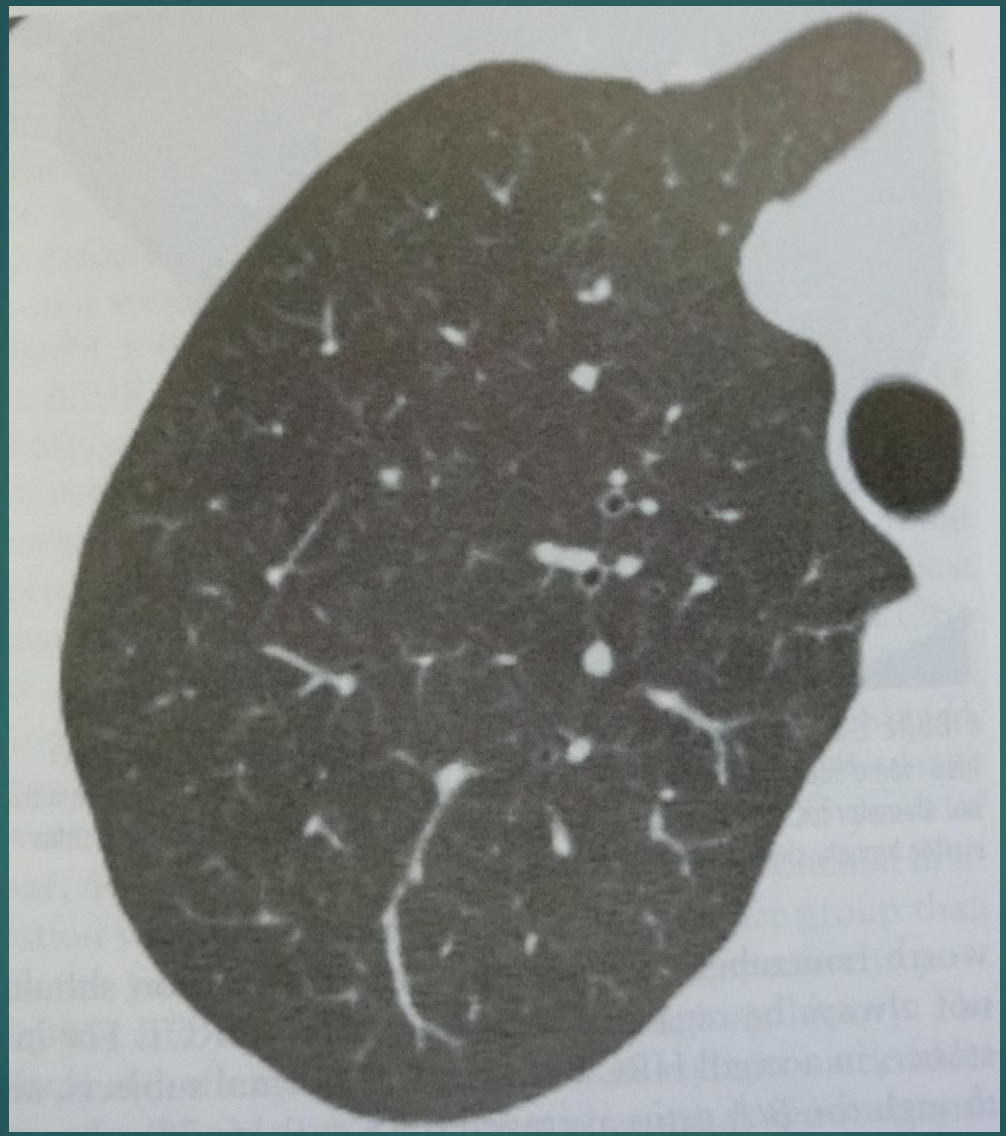


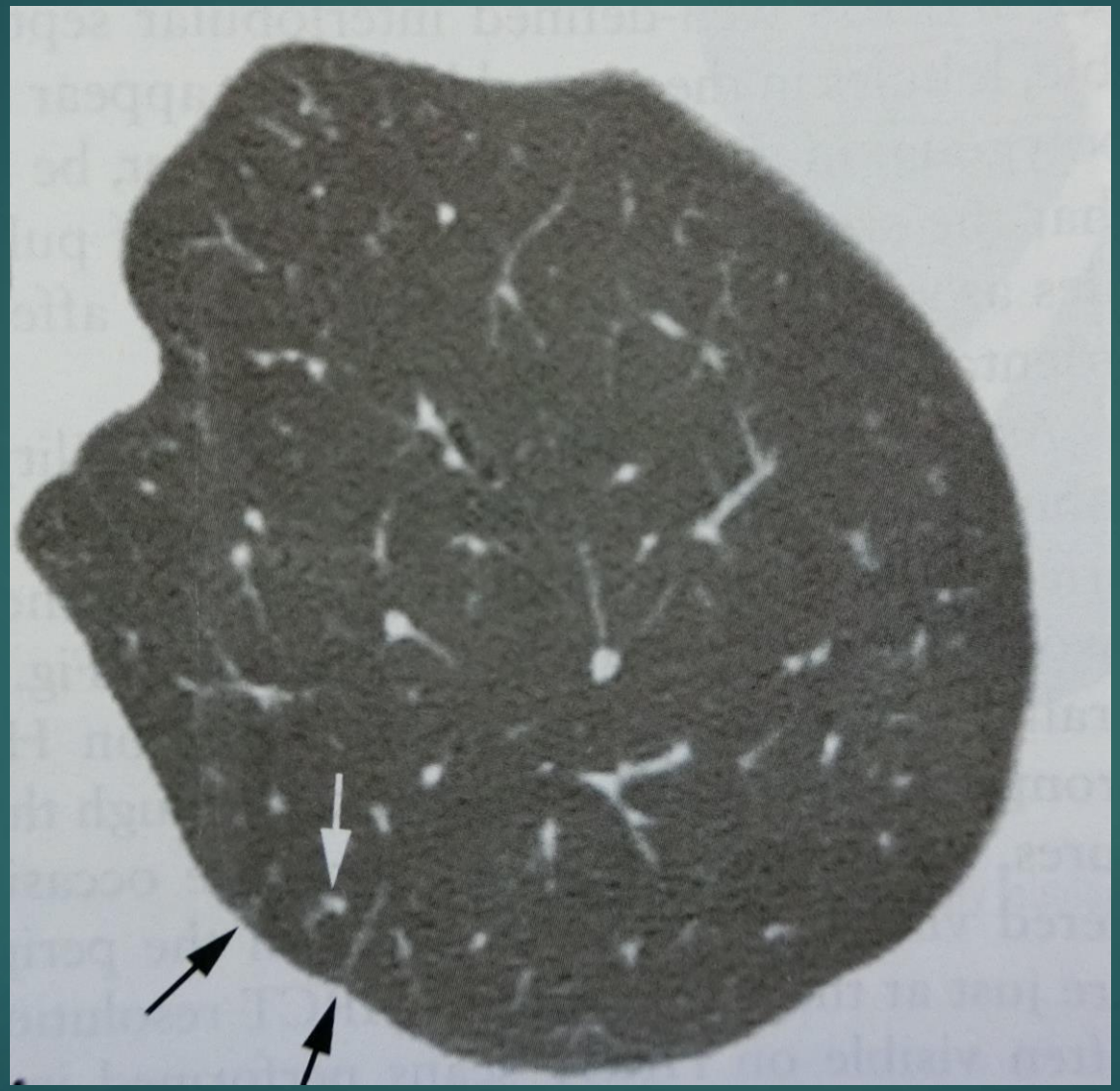


HRCT PATTERNS

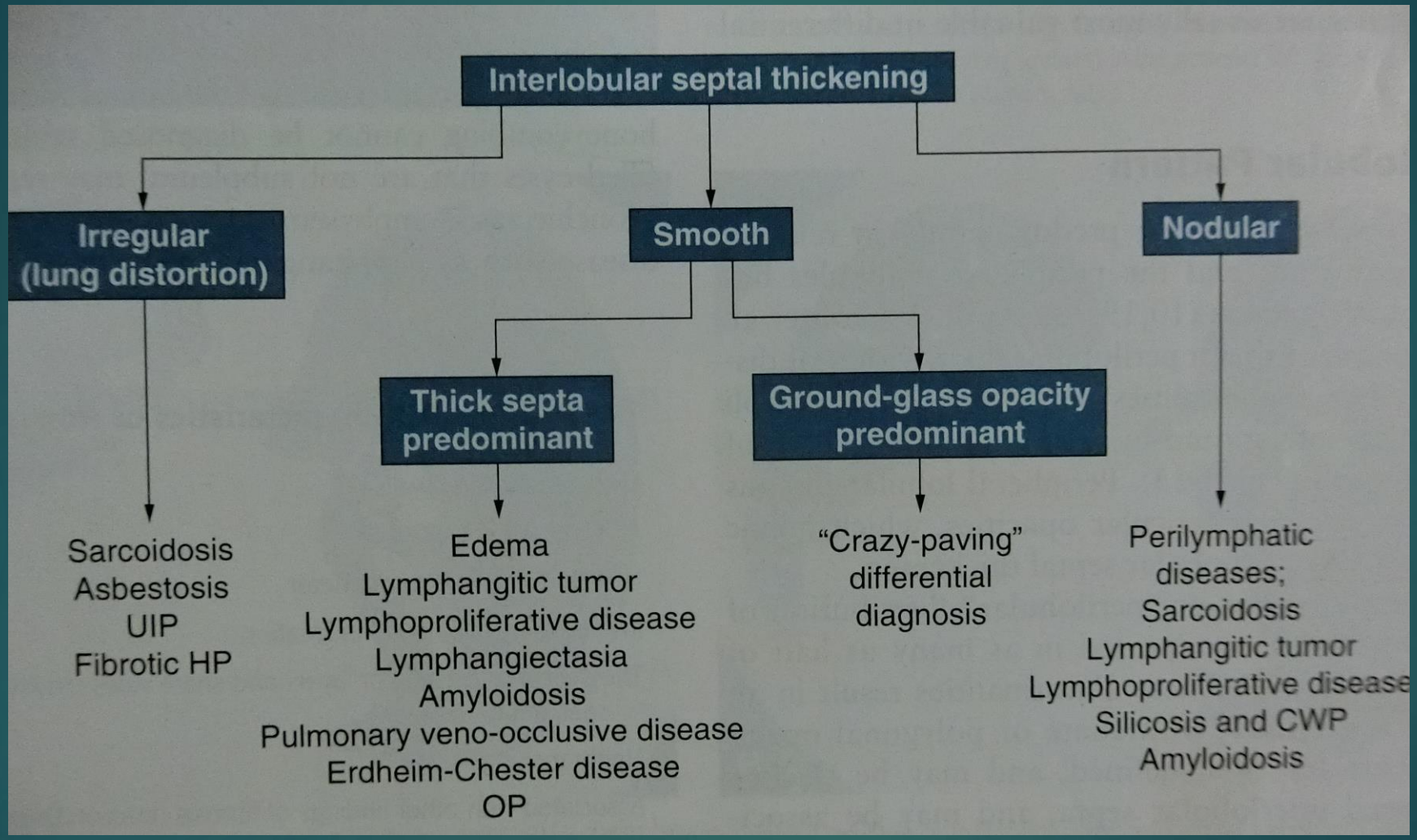
- Linear, Reticular
- Multiple Nodules
- Increased Lung Attenuation :
  GGO, Consolidation
- Decreased Lung Attenuation :
  Cyst, Mosaic Perfusion, Emphysema


Interlobular septal thickening
Parenchymal bands
Centrilobular peribronchovascular interstitial thickening
Peribronchovascular interstitial thickening
Reticular abnormality
Fissural thickening due to subpleural interstitial thickening
Traction bronchiectasis
Peripheral honeycombing
Honeycombing producing a subpleural line
Bronchiectasis "signet ring sign"
Subpleural line without honeycombing

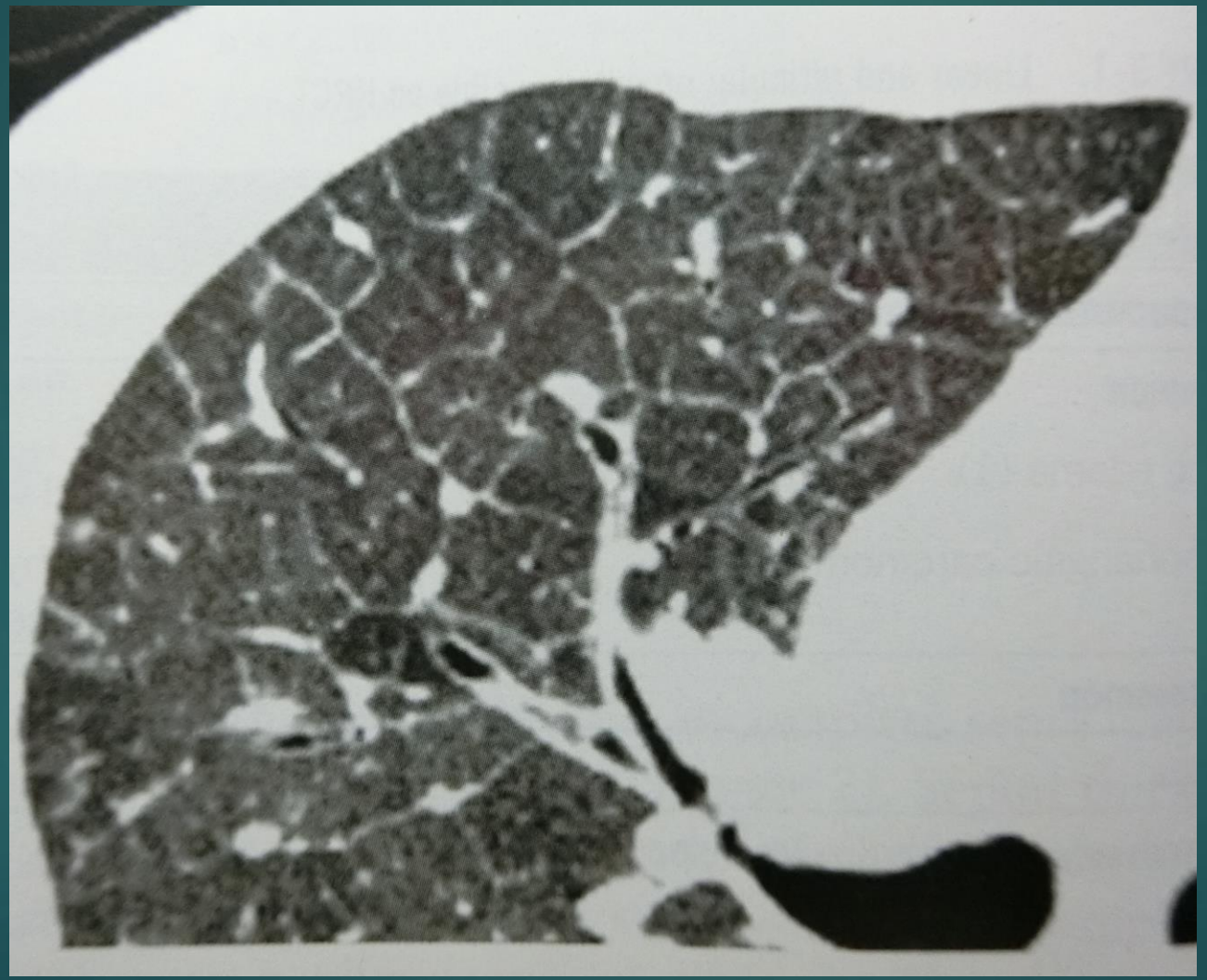




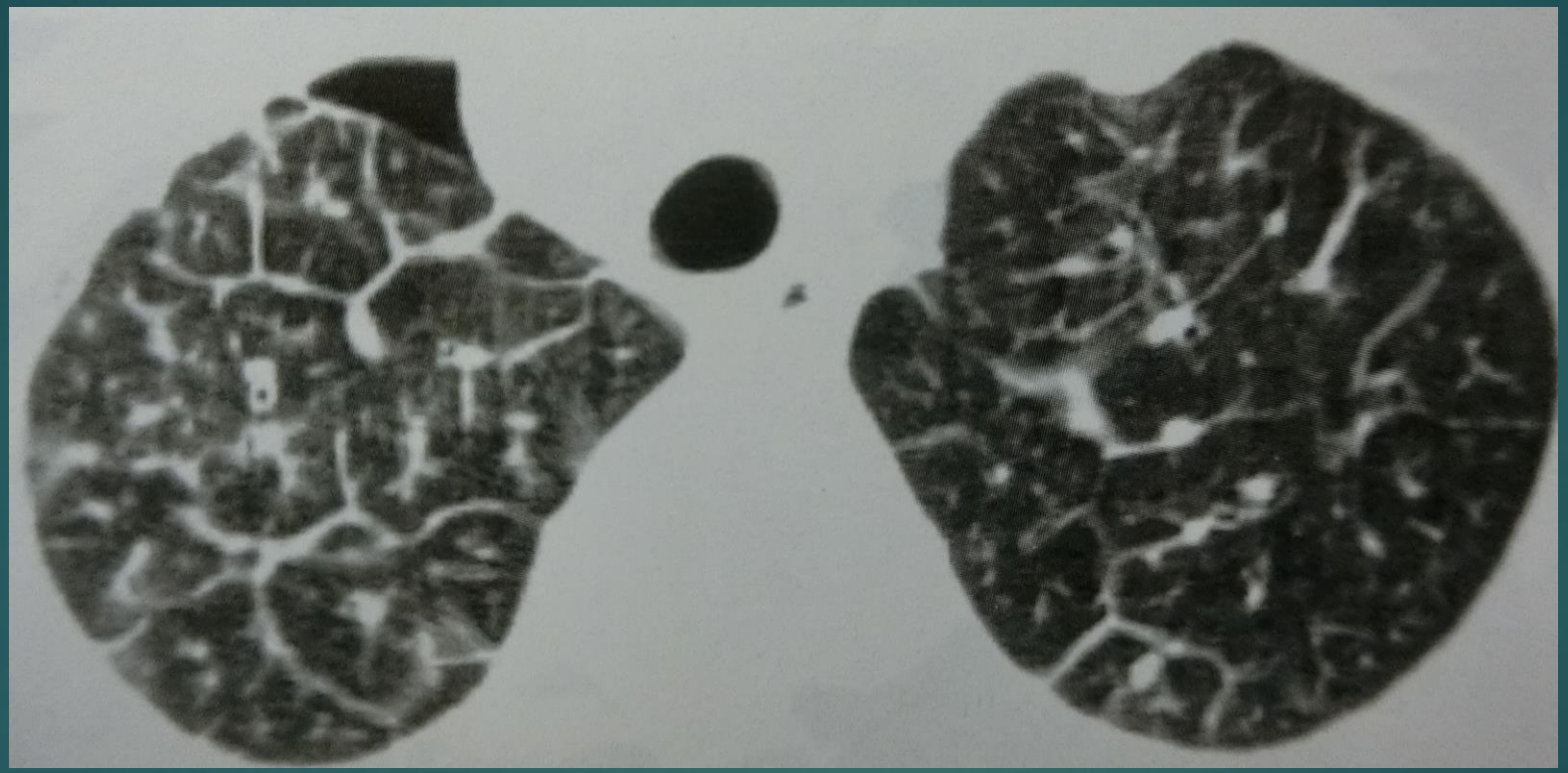
Interlobular Septal Thickening


Interlobular septal thickening
Irregular (lung distortion)
Smooth
Nodular
Thick septa predominant
Ground-glass opacity predominant
Sarcoidosis
Asbestosis
UIP
Fibrotic HP
Edema
Lymphangitic tumor
Lymphoproliferative disease
Lymphangiectasia
Amyloidosis
Pulmonary veno-occlusive disease
Erdheim-Chester disease
OP
"Crazy-paving" differential diagnosis
Perilymphatic diseases;
Sarcoidosis
Lymphangitic tumor
Lymphoproliferative disease
Silicosis and CWP
Amyloidosis

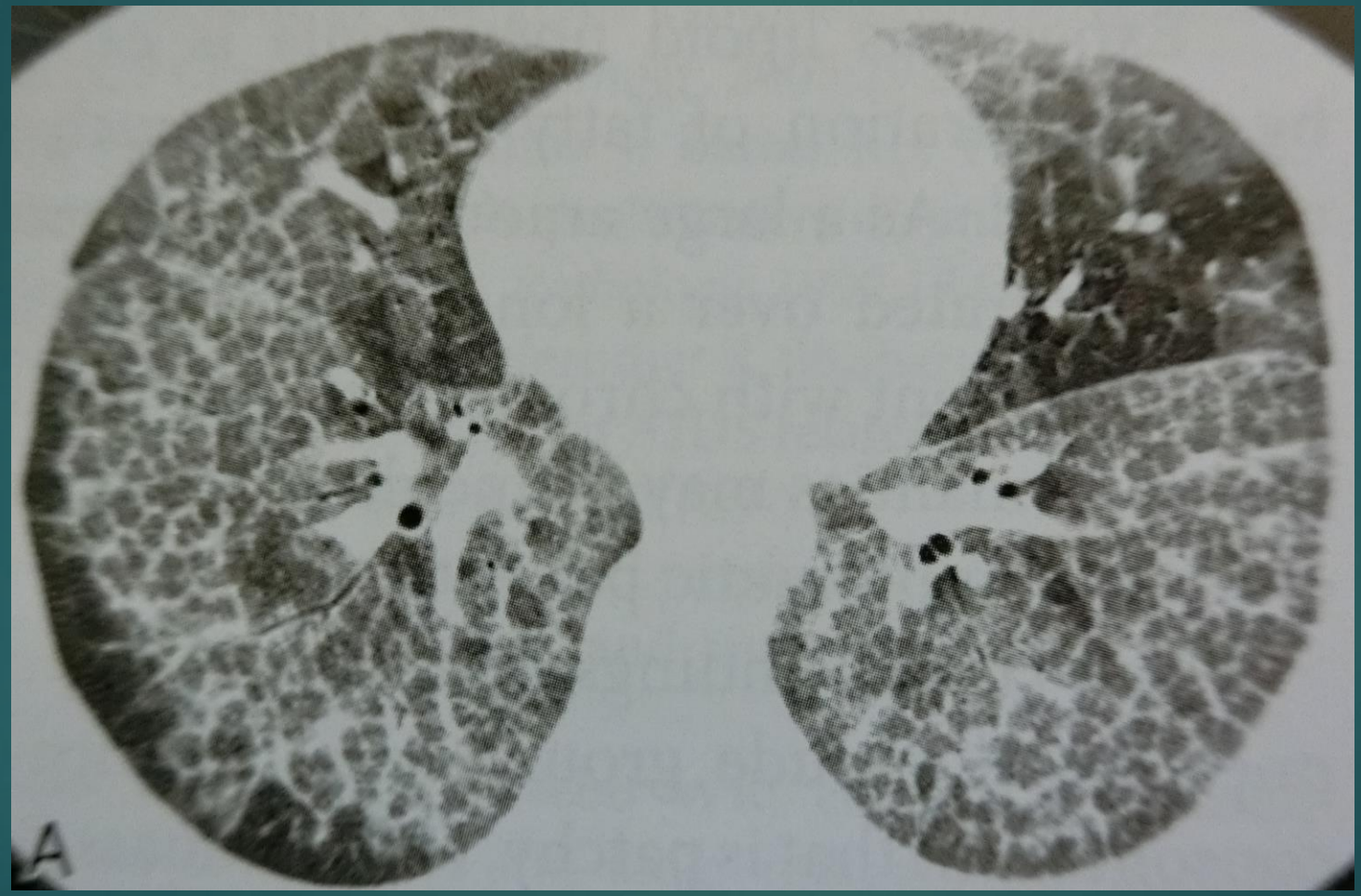
Pul. Edema



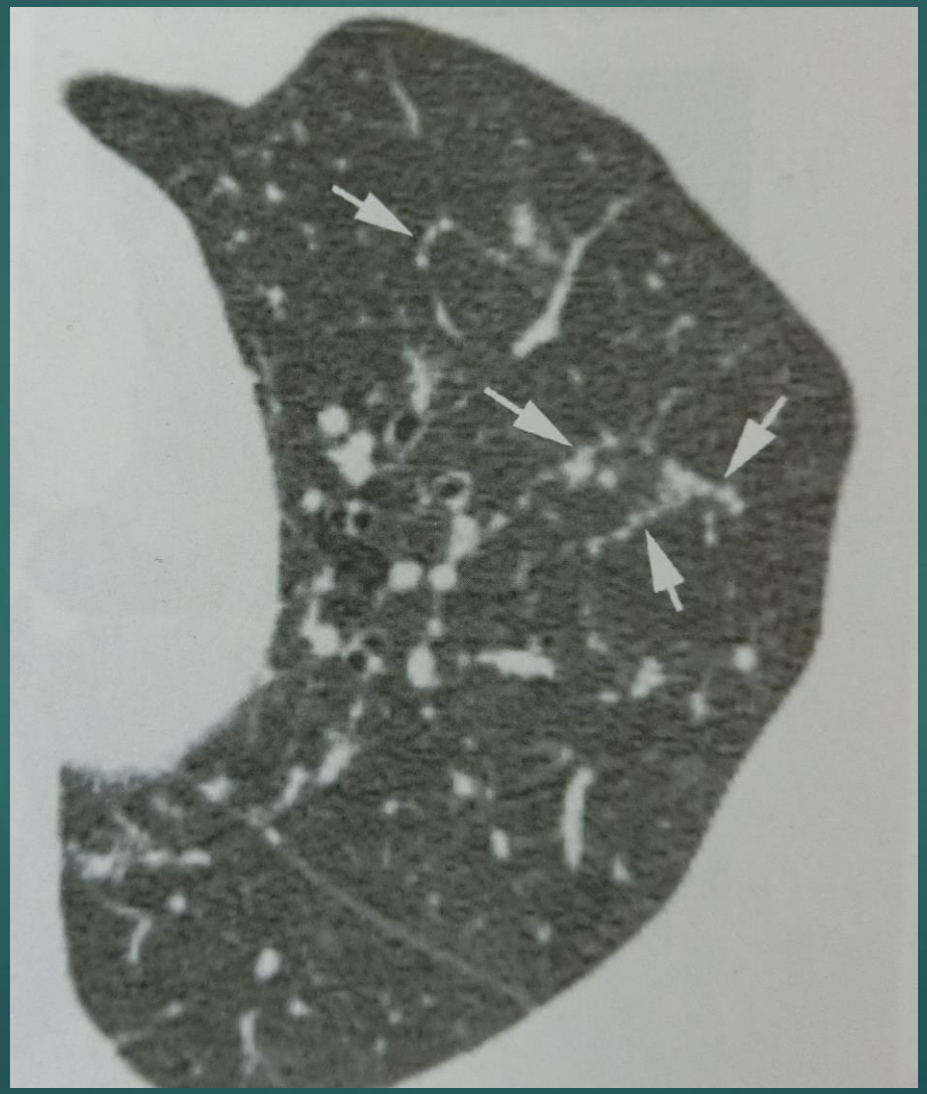
Lymphangitis Carcinomatosa



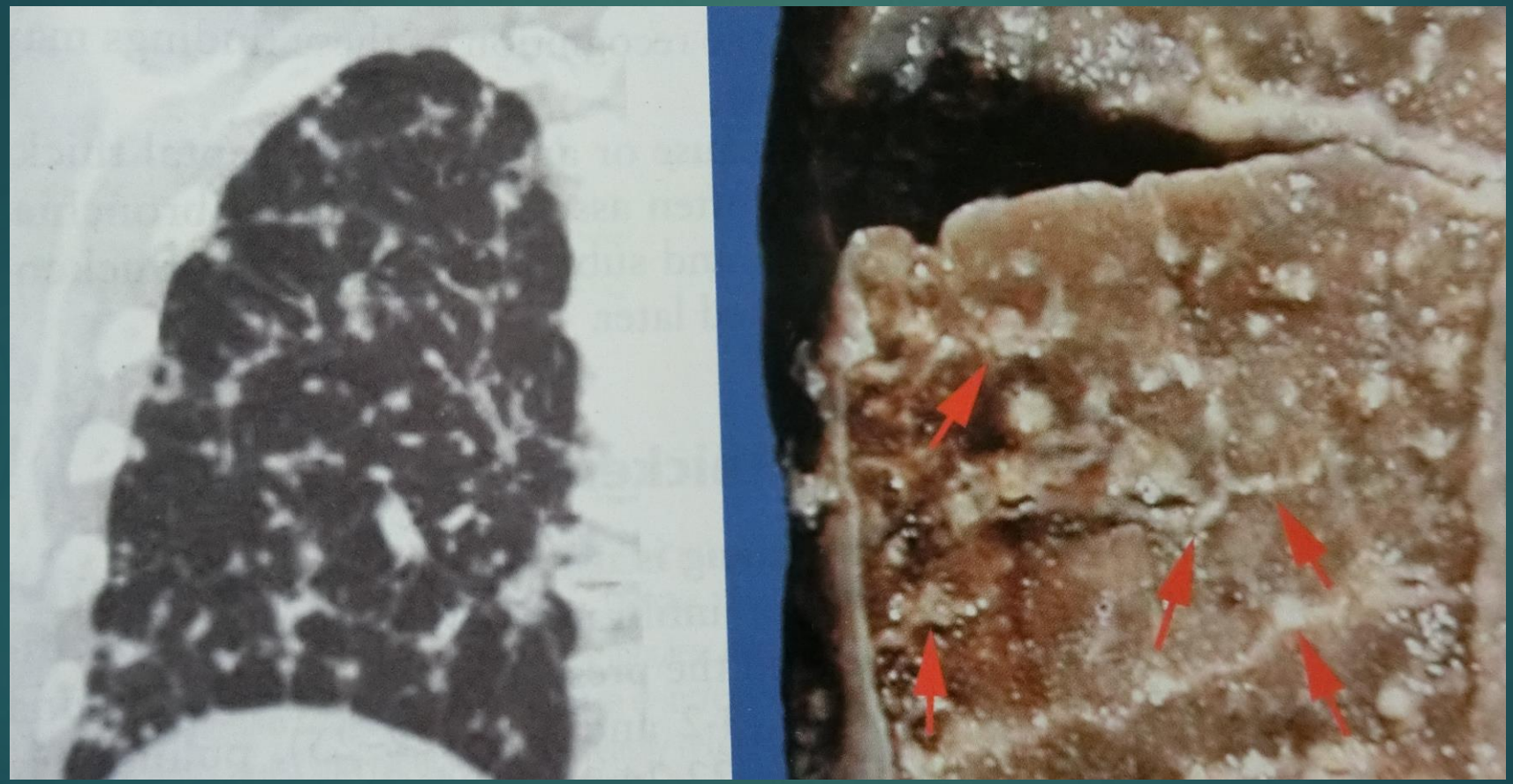
PAP



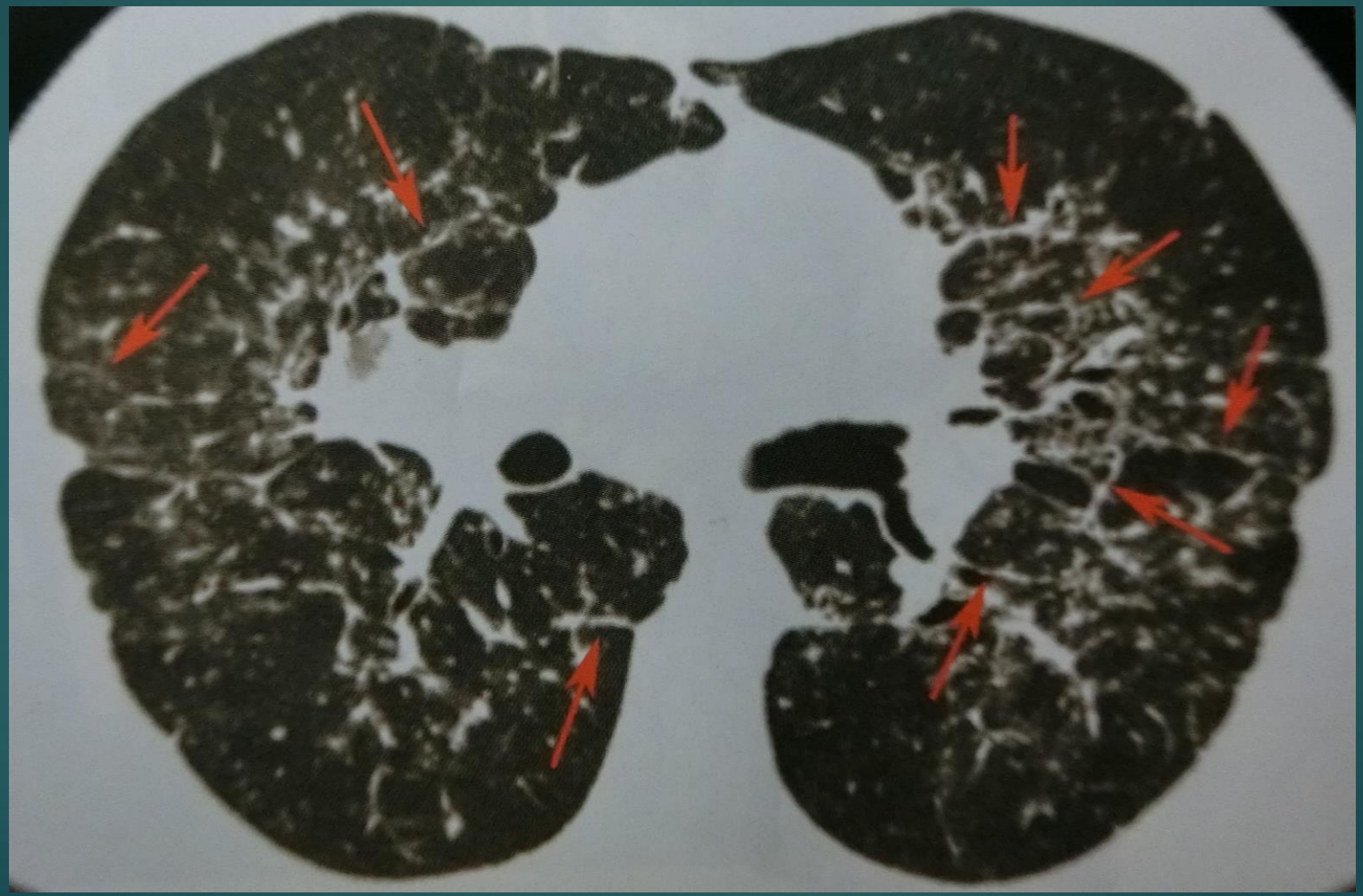
Sarcoidosis



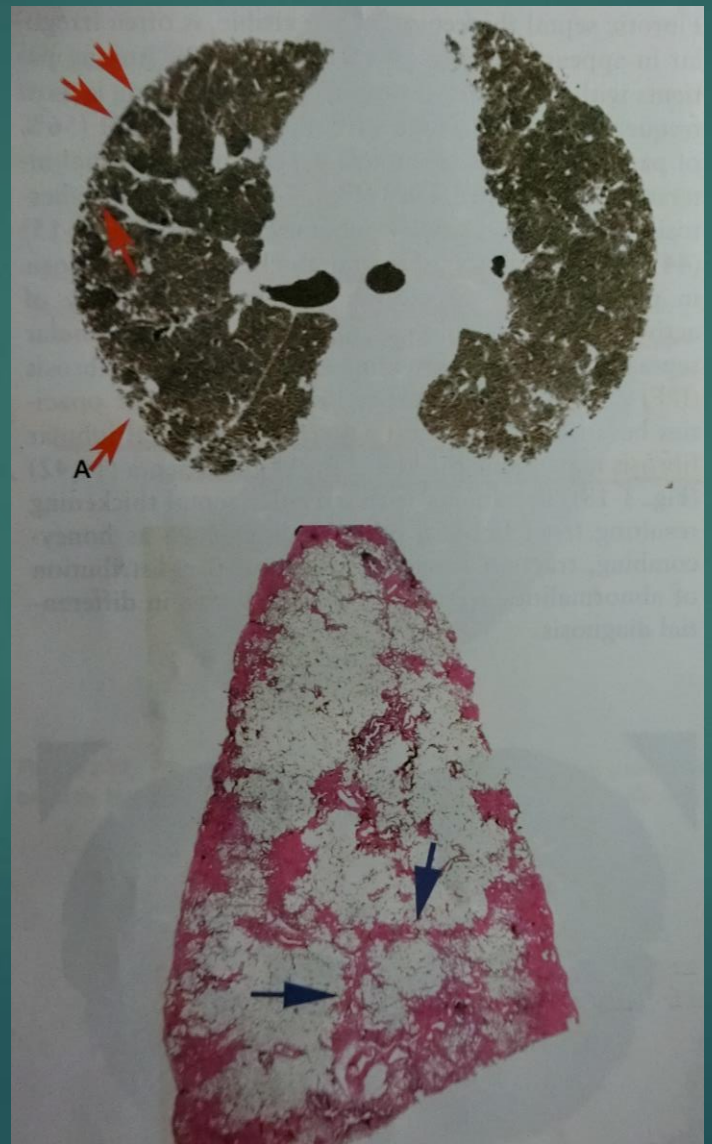
Lymphangitis Carcinomatosa



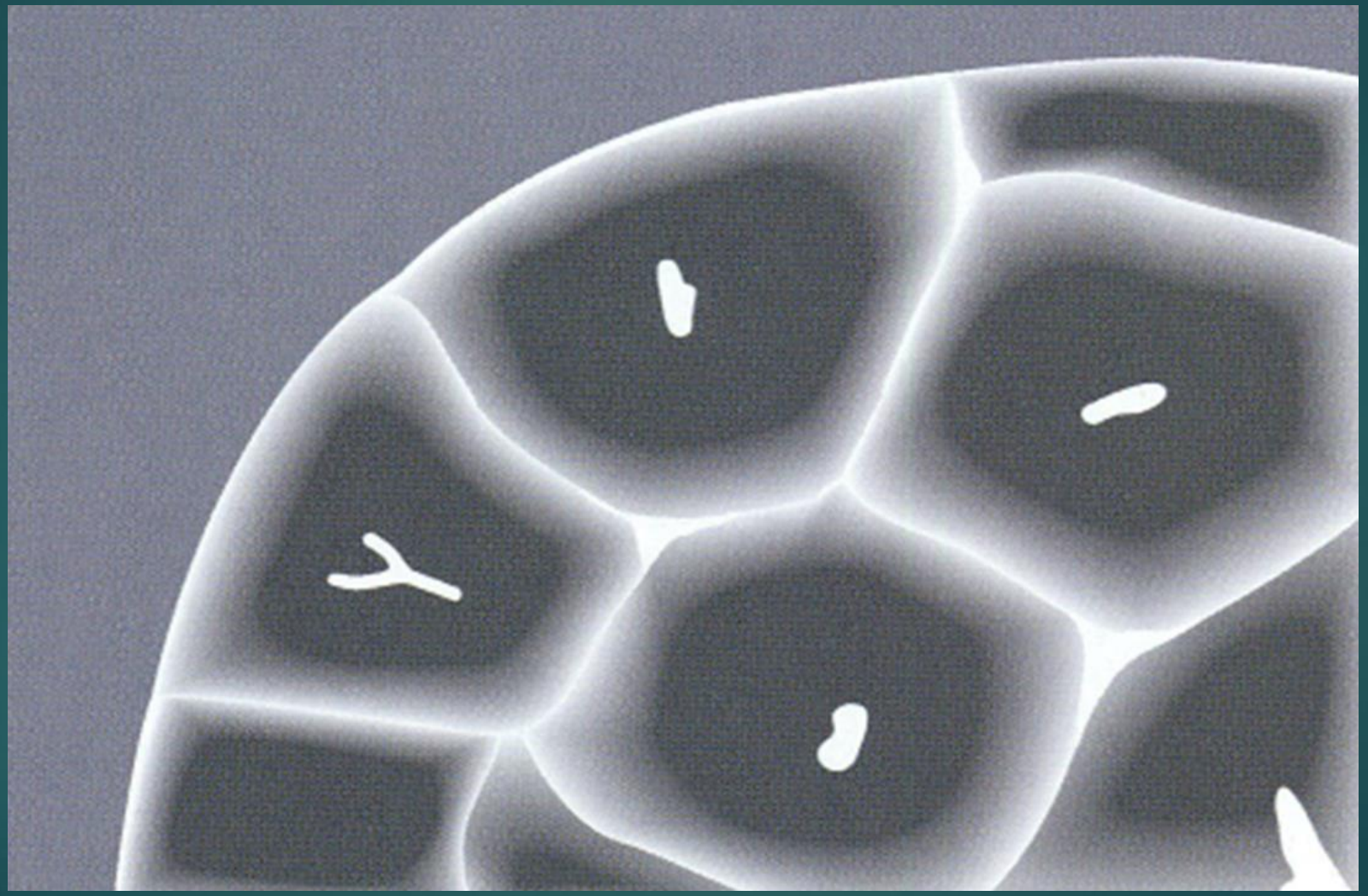
Sarcoidosis



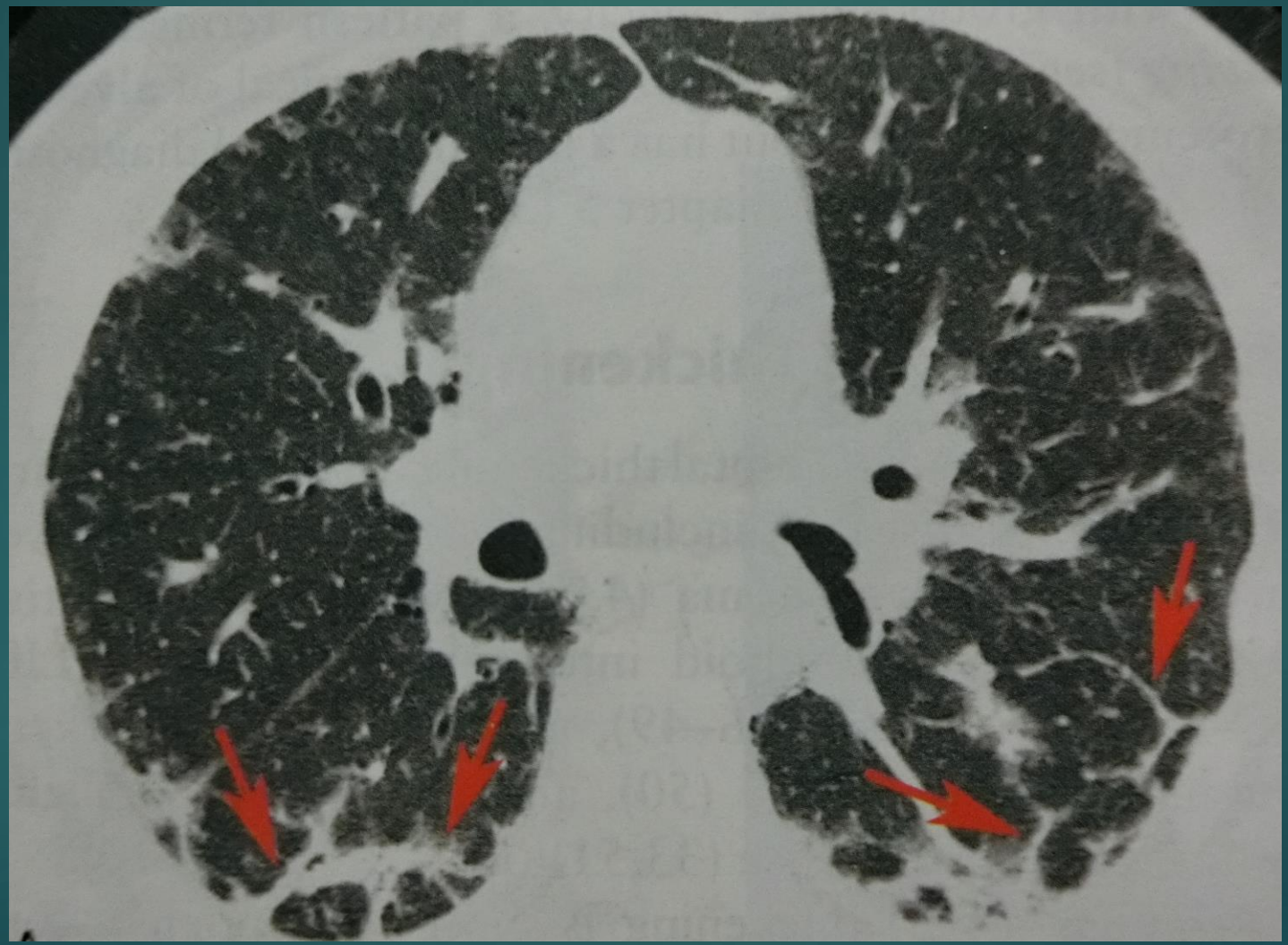
UIP



Perilobular Pattern

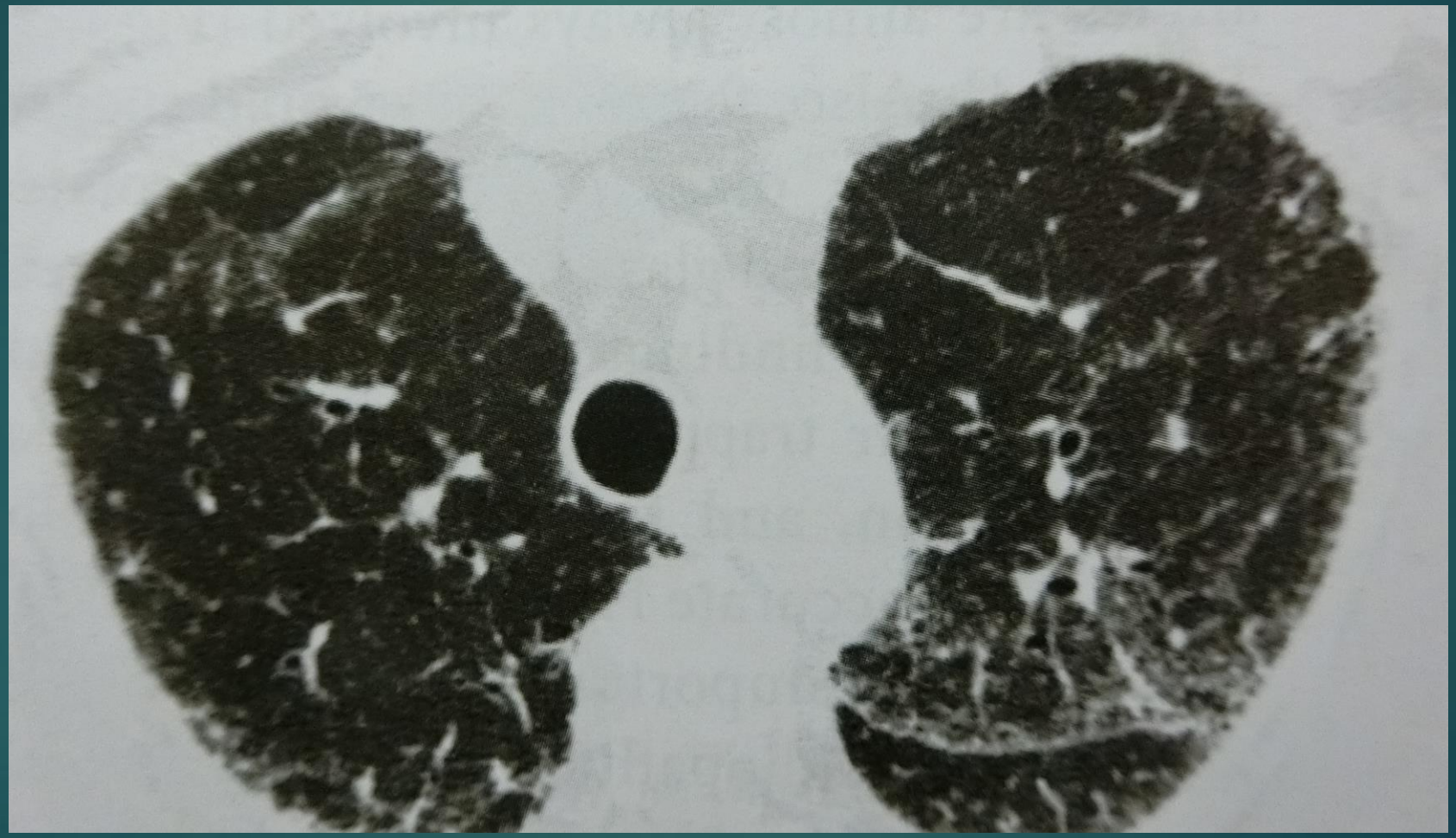


OP

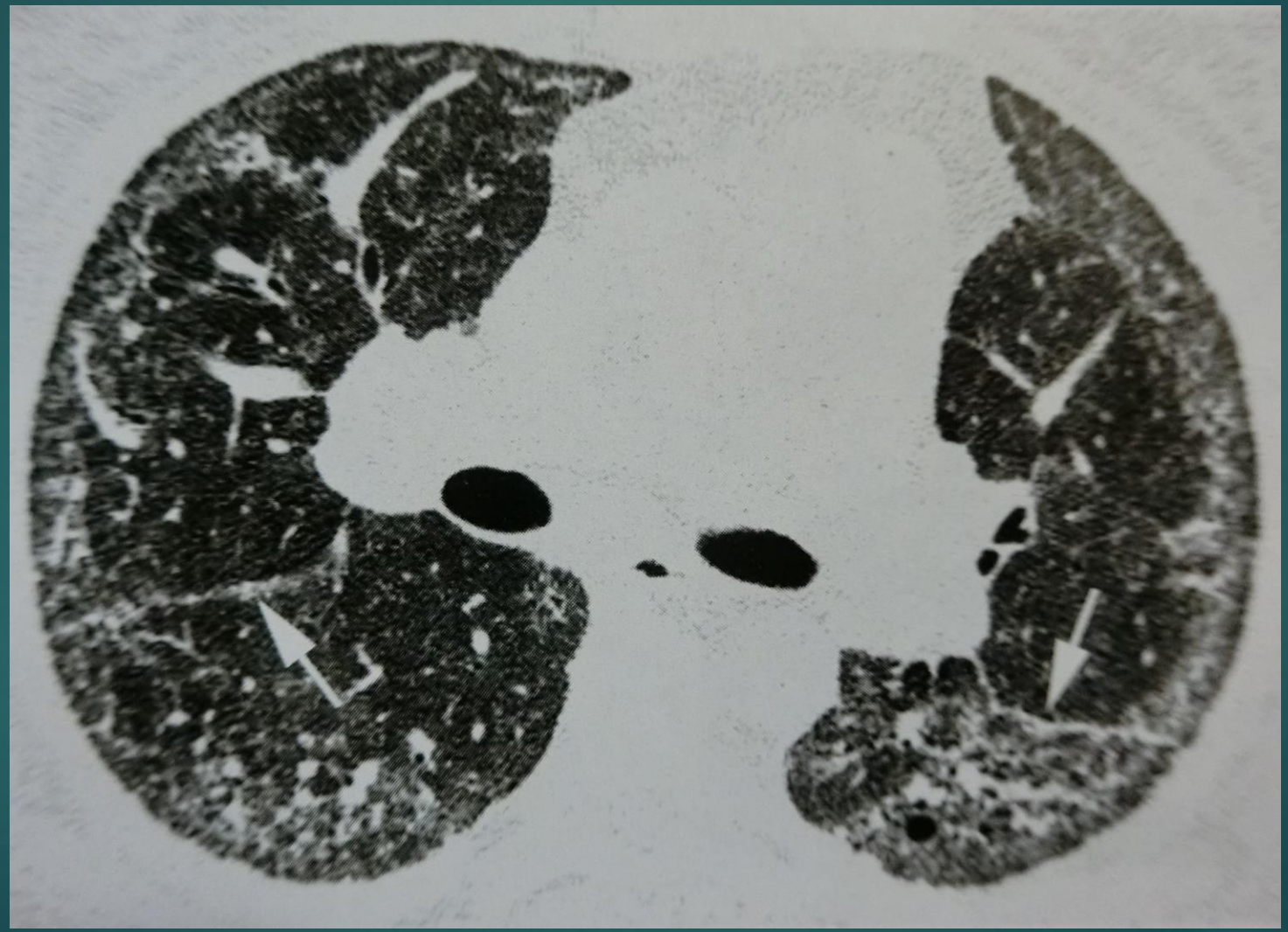


Subpleural Interstitial Thickening

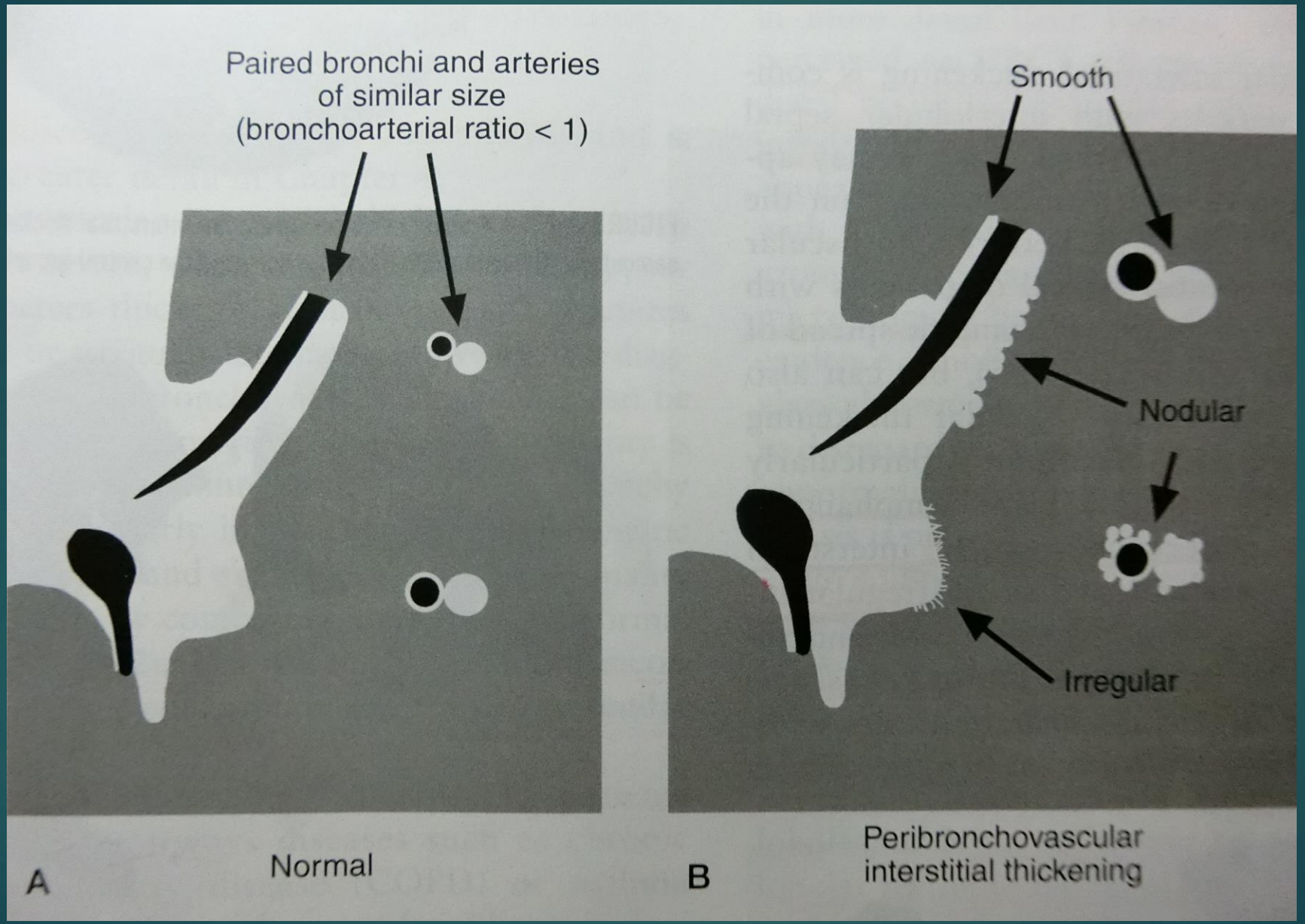
Early IPF



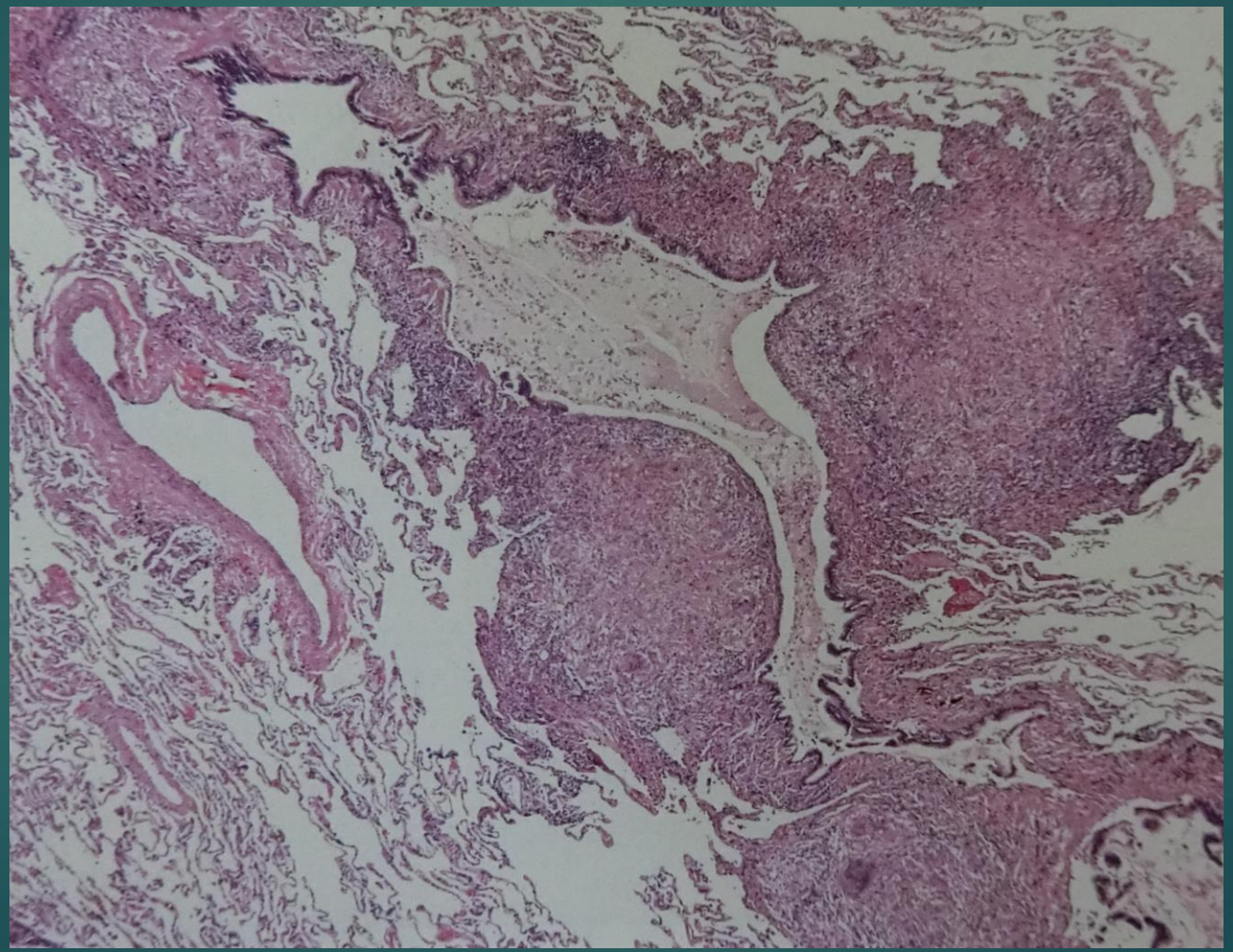
Fibrotic NSIP



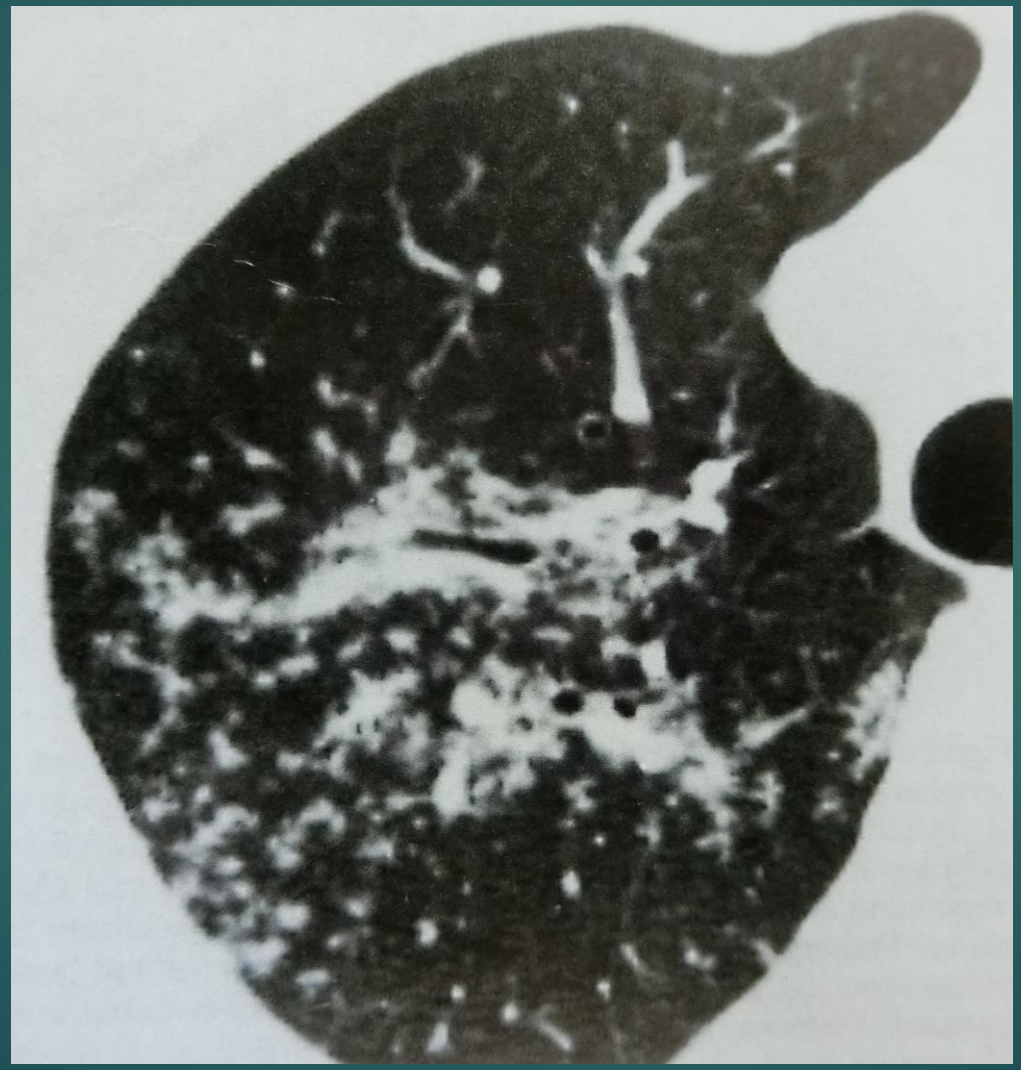
Peribronchovascular Interstitial Thickening


Paired bronchi and arteries
of similar size
(bronchoarterial ratio < 1)
A
Normal
Smooth
Nodular
Irregular
B
Peribronchovascular
interstitial thickening

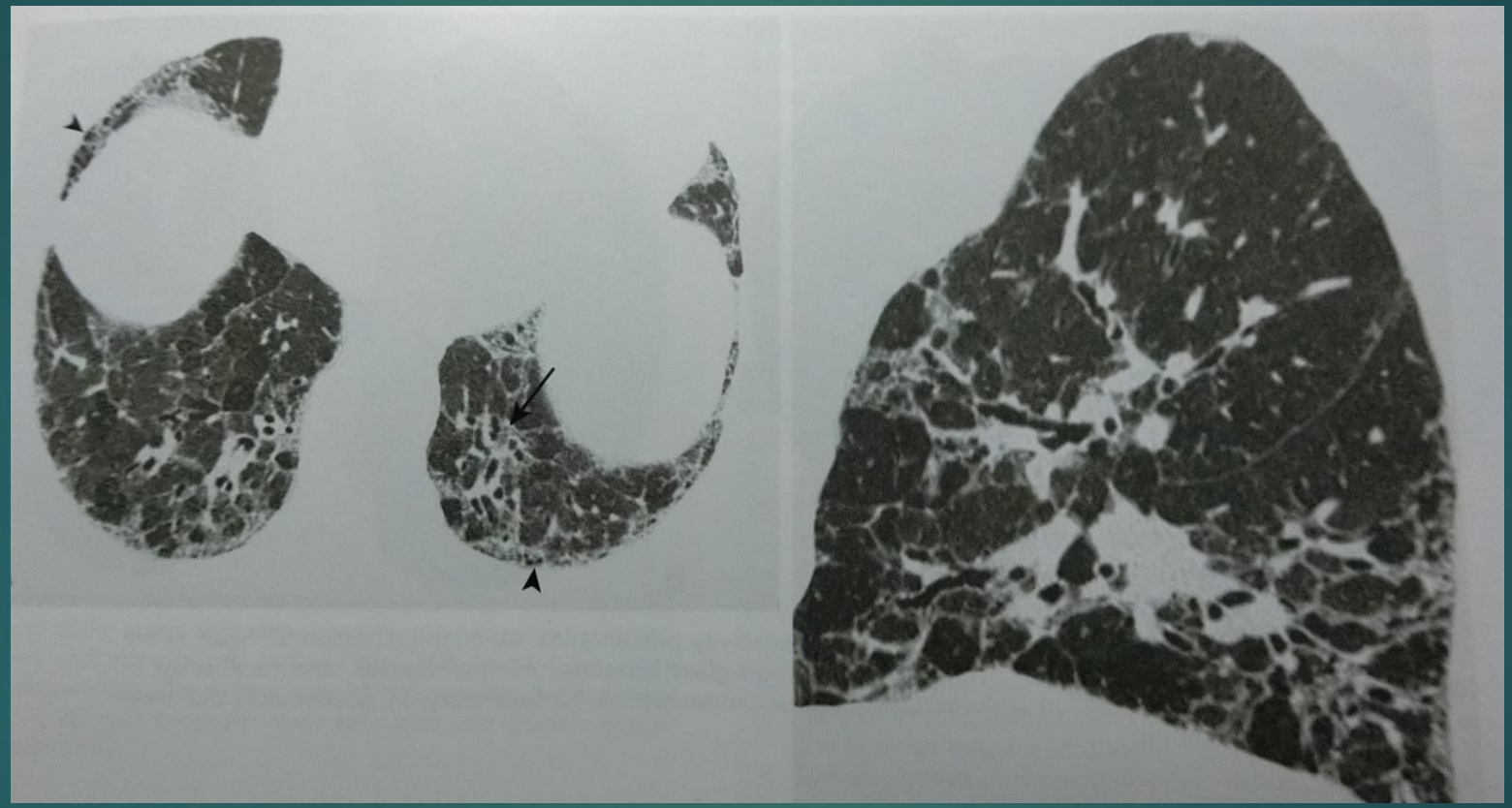
Sarcoidosis



Sarcoidosis



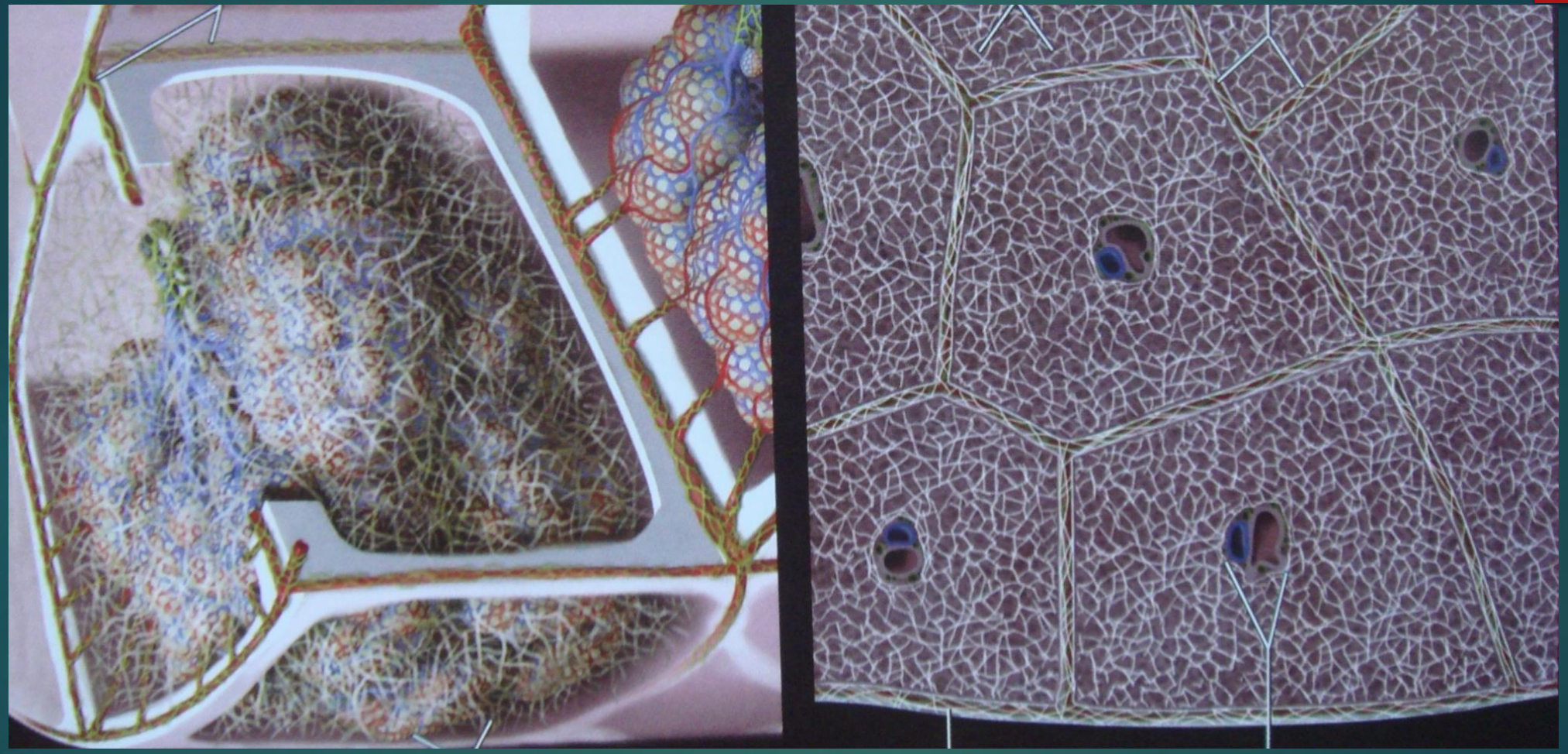
CHP

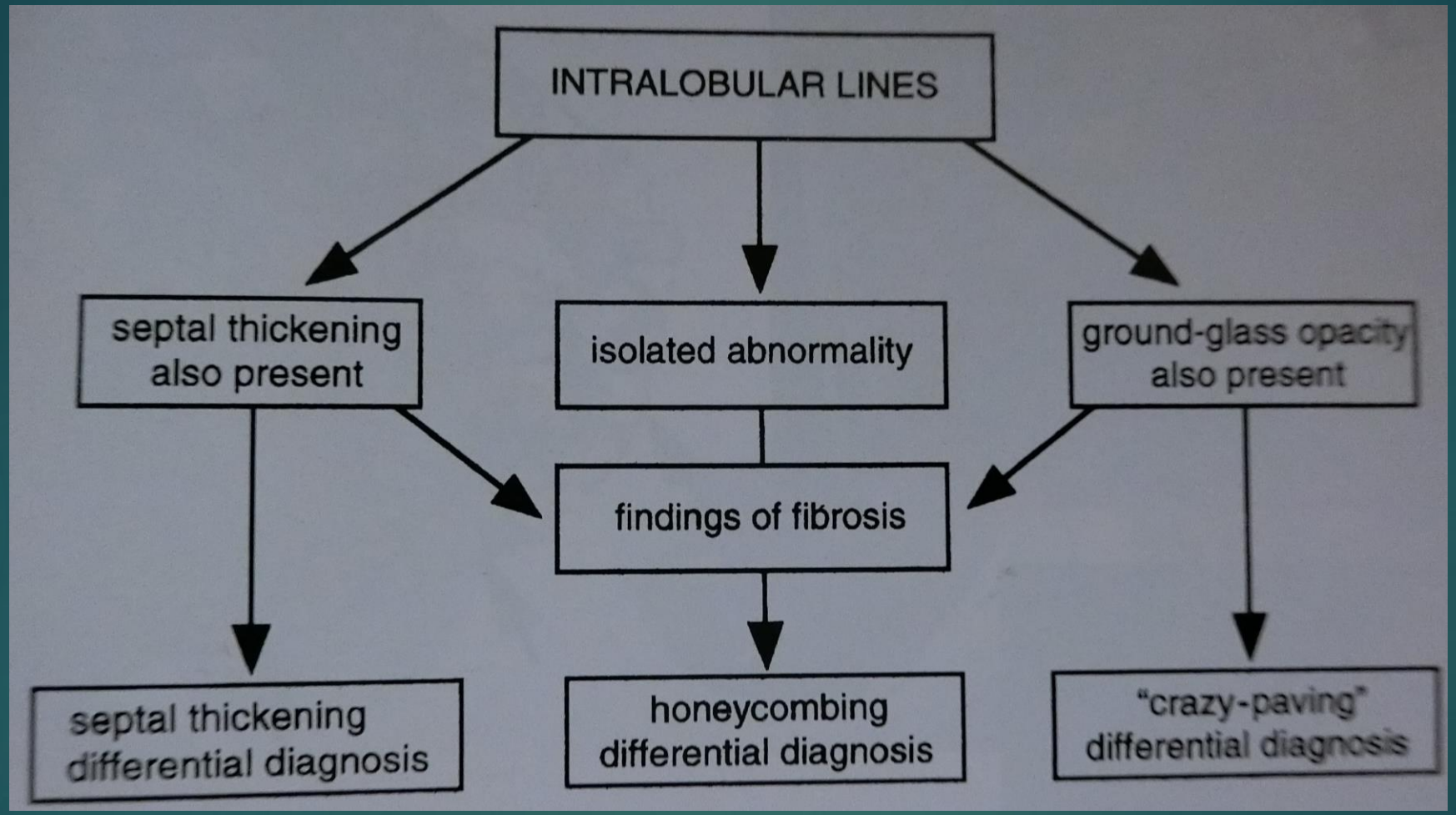


D.D of Peribronchovascular Interstital Thickening

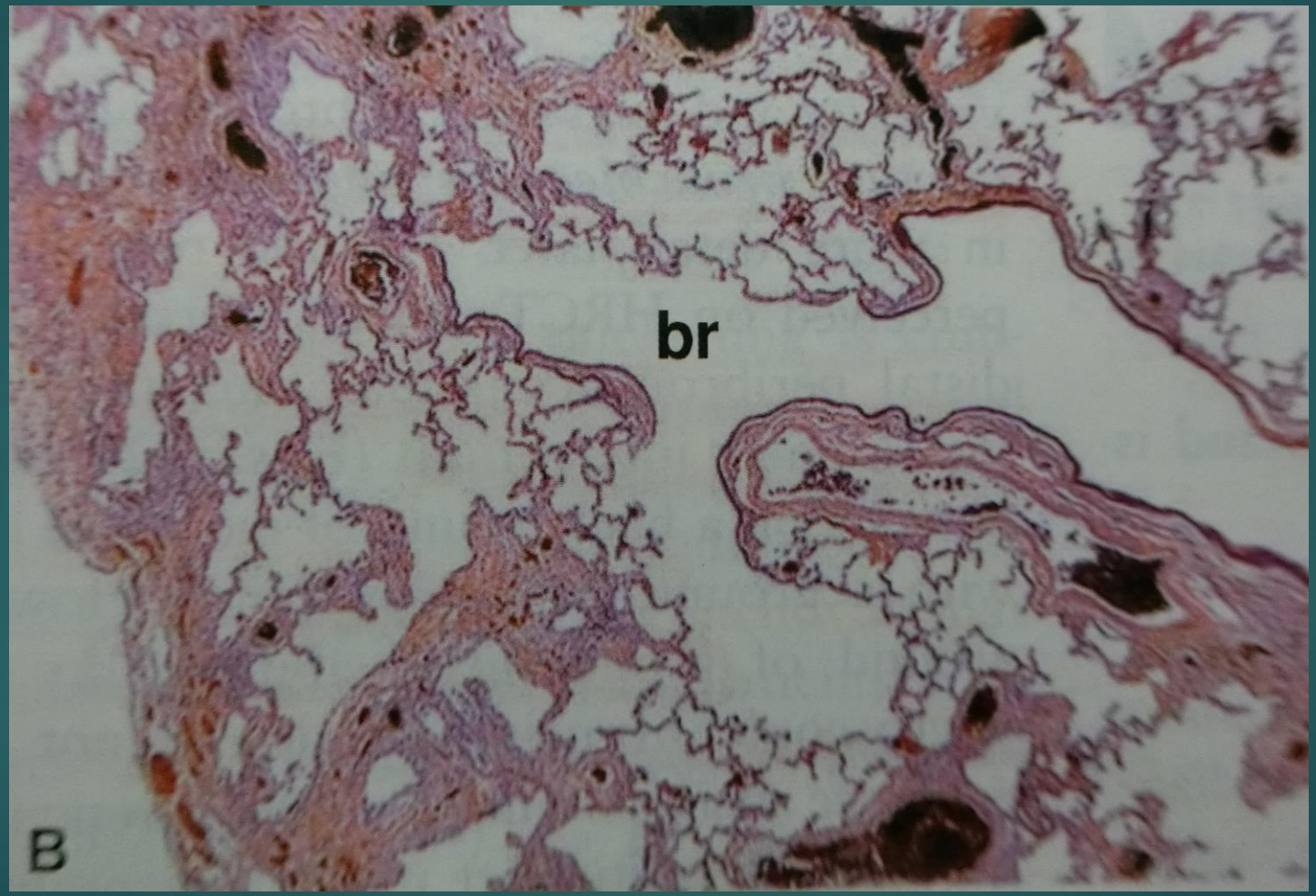
Diagnosis	Comments
Sarcoidosis	nodular or irregular
NSIP	with peribronchovascular reticulation,traction bronchiectasis
CHP	Irregular; with traction bronchiectasis
Pulmonary edema	smooth
Lymphangitic carcimomatosis	smooth or nodular

Intralobular Interstitial Thickening (Intralobular Line)

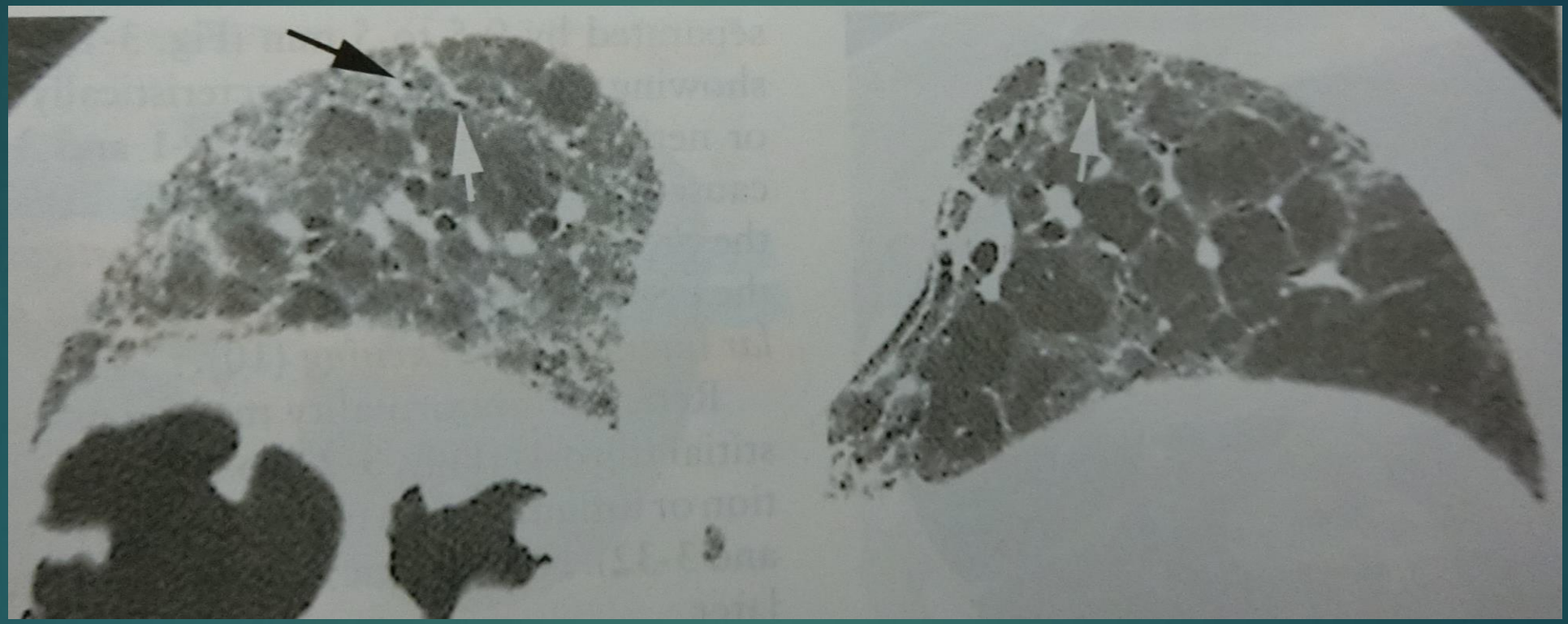



INTRALOBULAR LINES
septal thickening also present
isolated abnormality
ground-glass opacity also present
findings of fibrosis
septal thickening differential diagnosis
honeycombing differential diagnosis
"crazy-paving" differential diagnosis

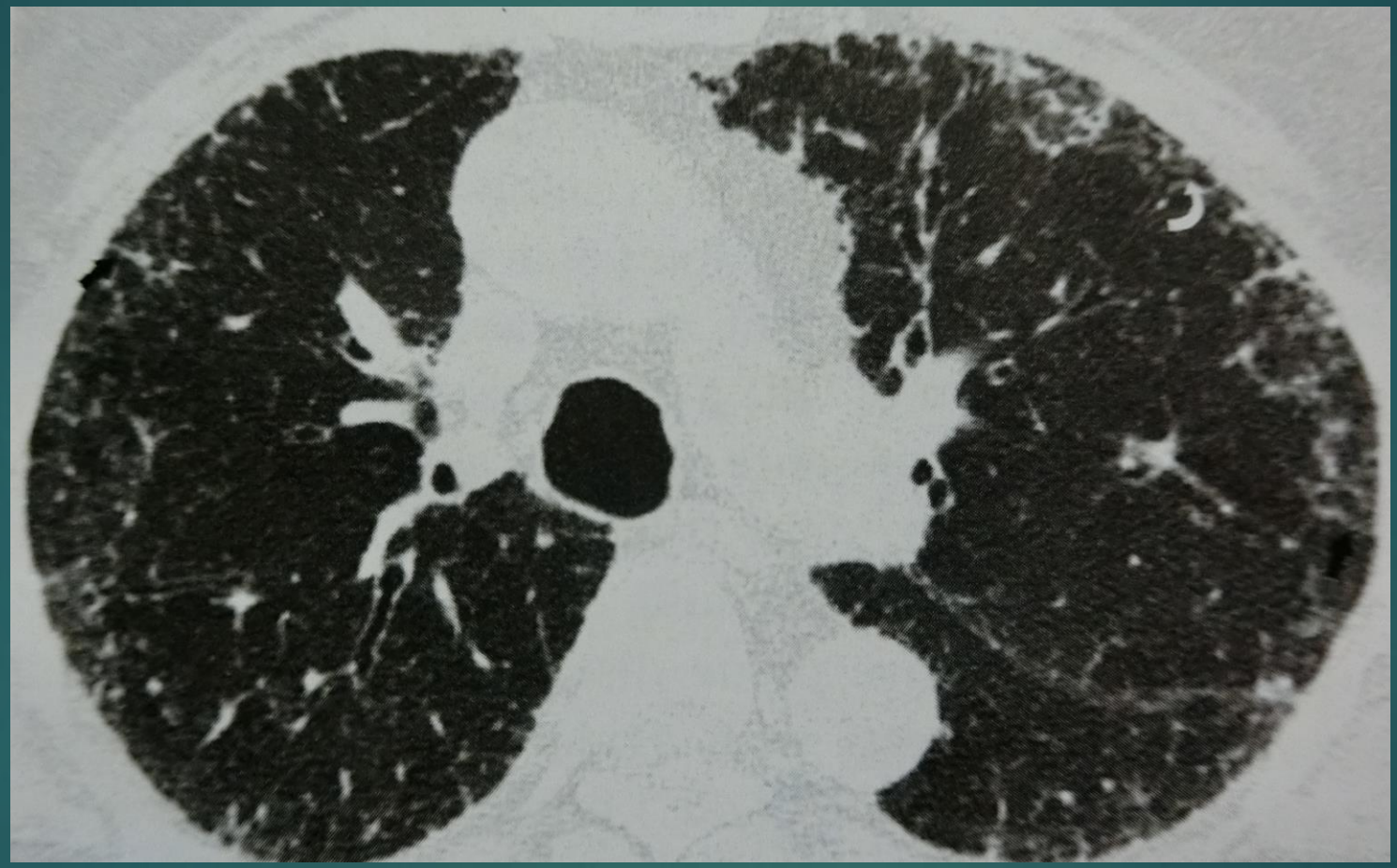
IPF



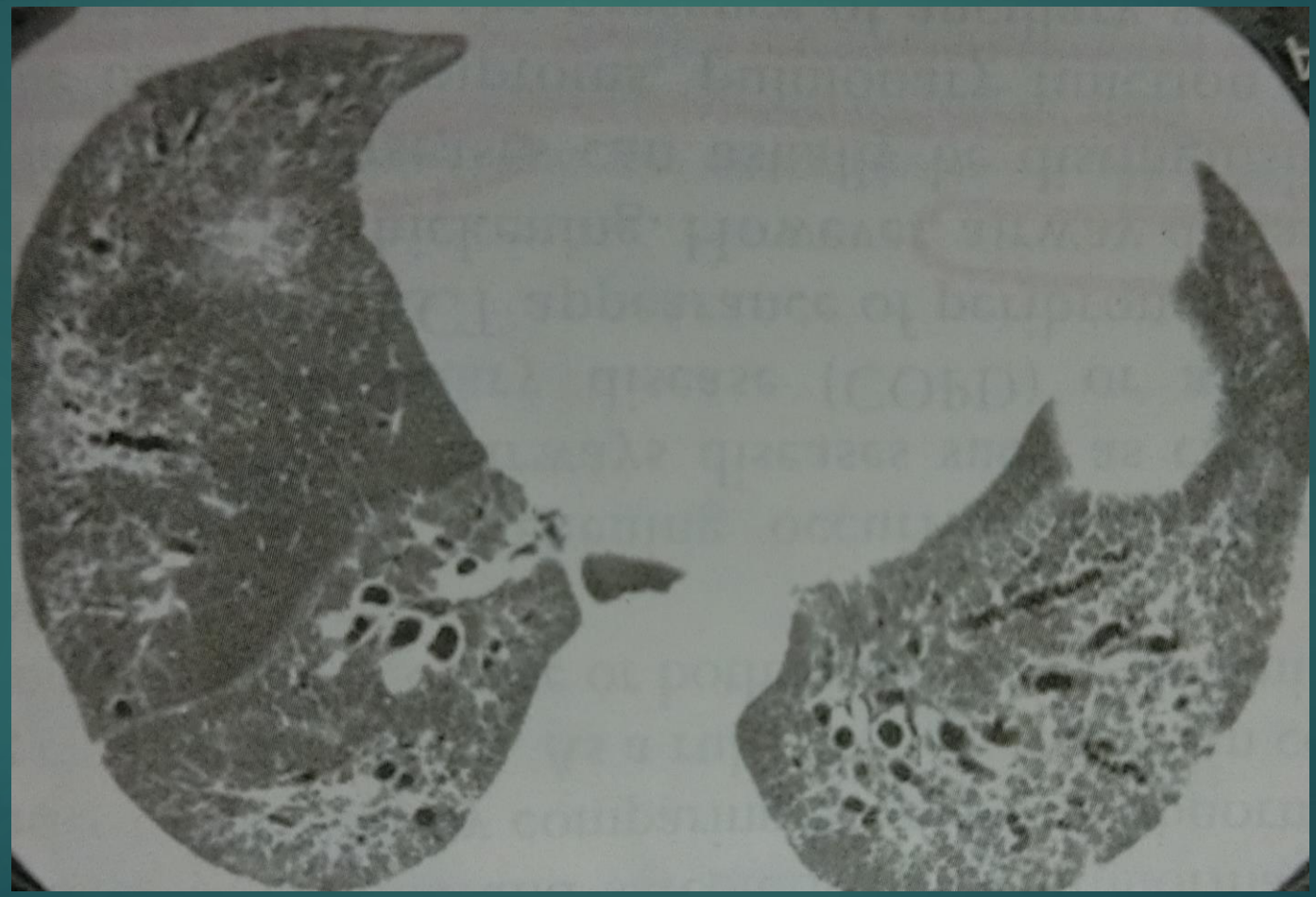
IPF



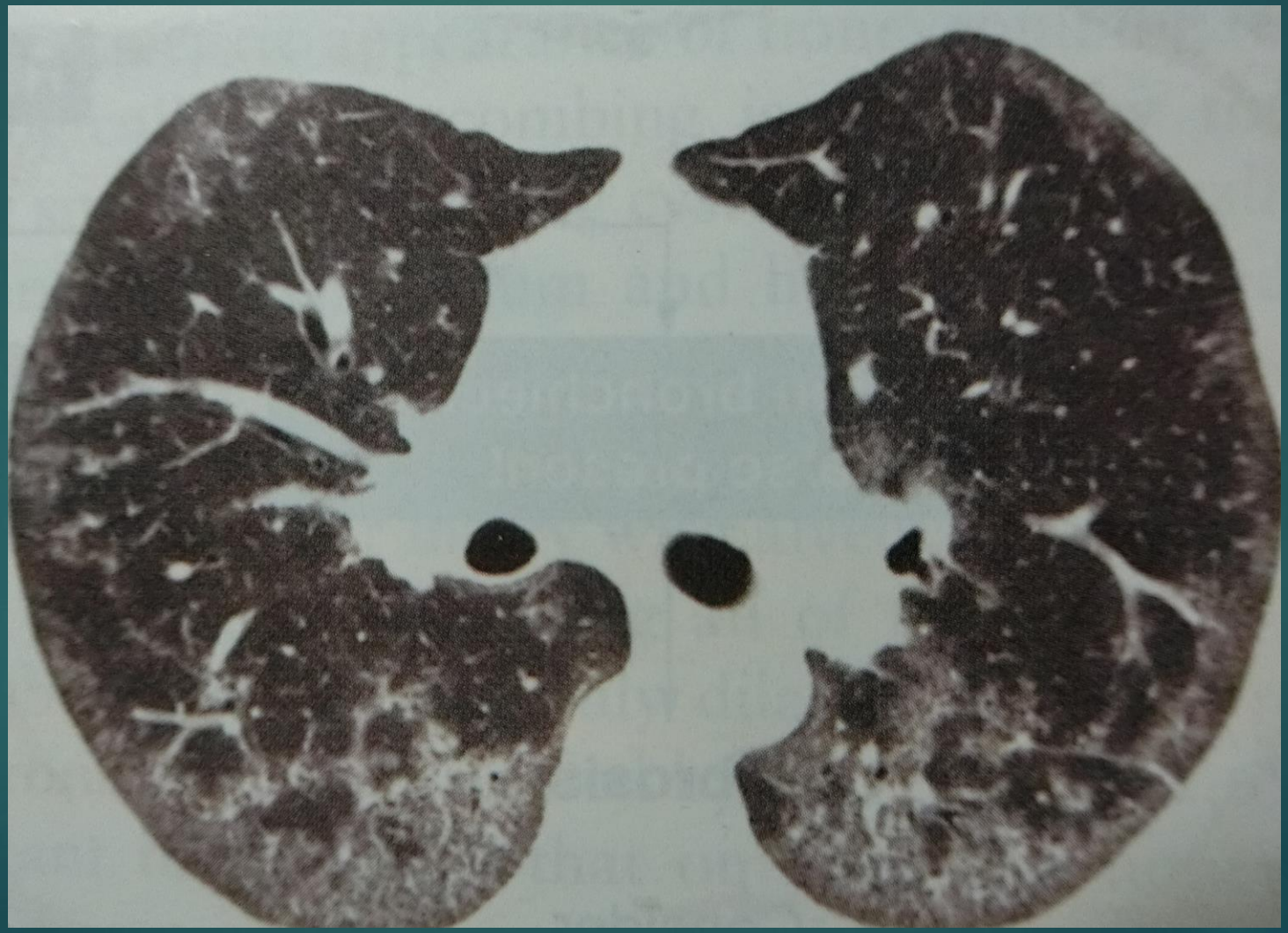
IPF



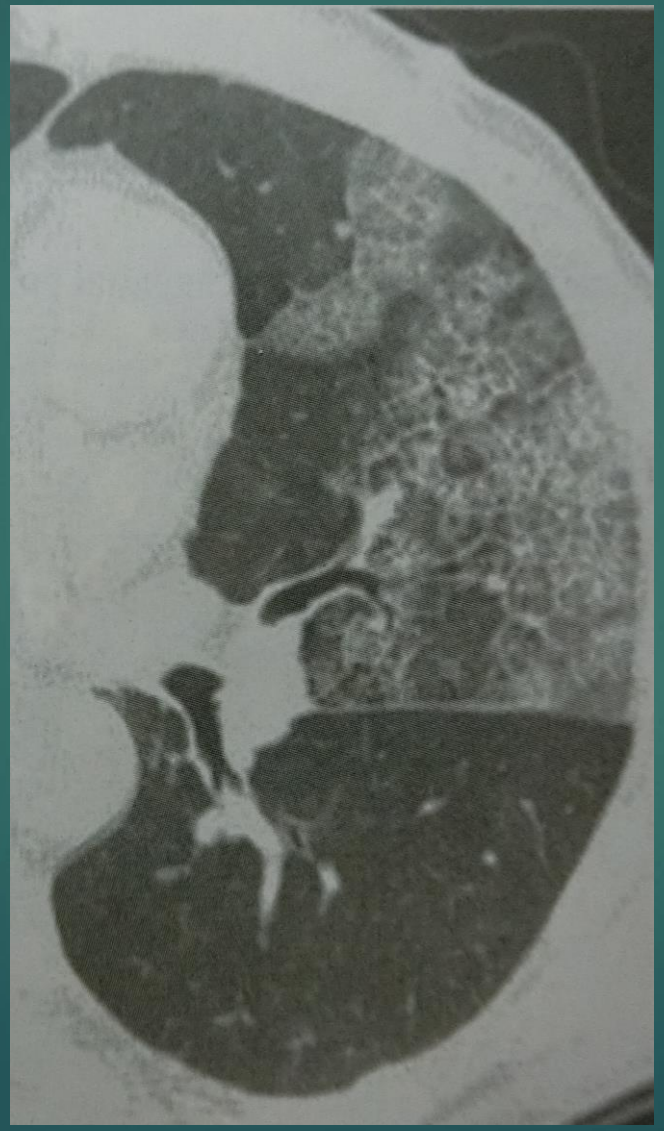
Fibrotic NSIP



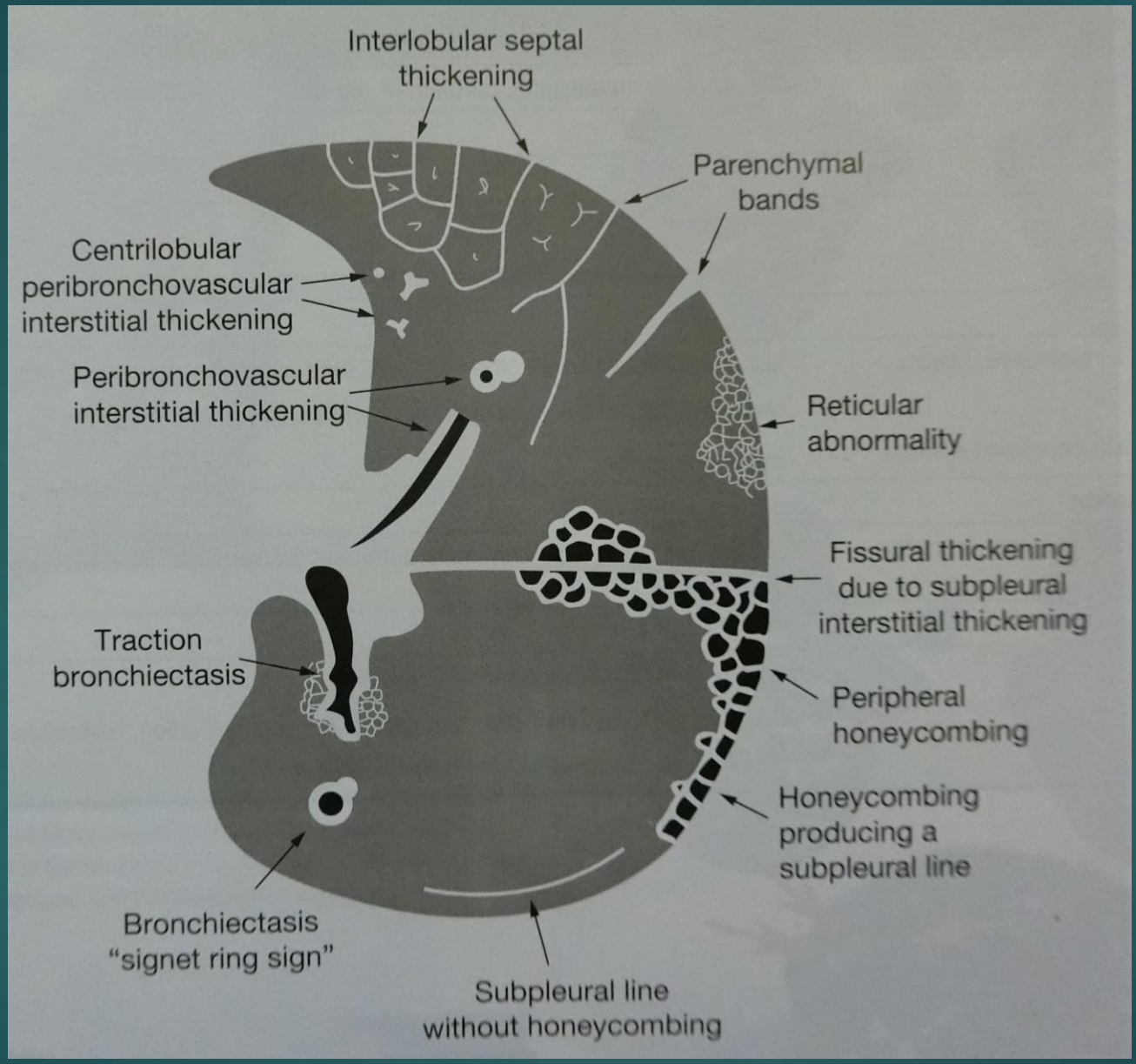
Cellular NSIP



Pul. Hemorrhage



Honeycombing


Interlobular septal thickening
Parenchymal bands
Centrilobular peribronchovascular interstitial thickening
Peribronchovascular interstitial thickening
Reticular abnormality
Fissural thickening due to subpleural interstitial thickening
Traction bronchiectasis
Peripheral honeycombing
Honeycombing producing a subpleural line
Bronchiectasis "signet ring sign"
Subpleural line without honeycombing

Current Hypothesis of Microscopic Honeycombing Formation

recurrent episodes of alveolar injury

↓

alveolar collapse

↓

Fibroproliferation

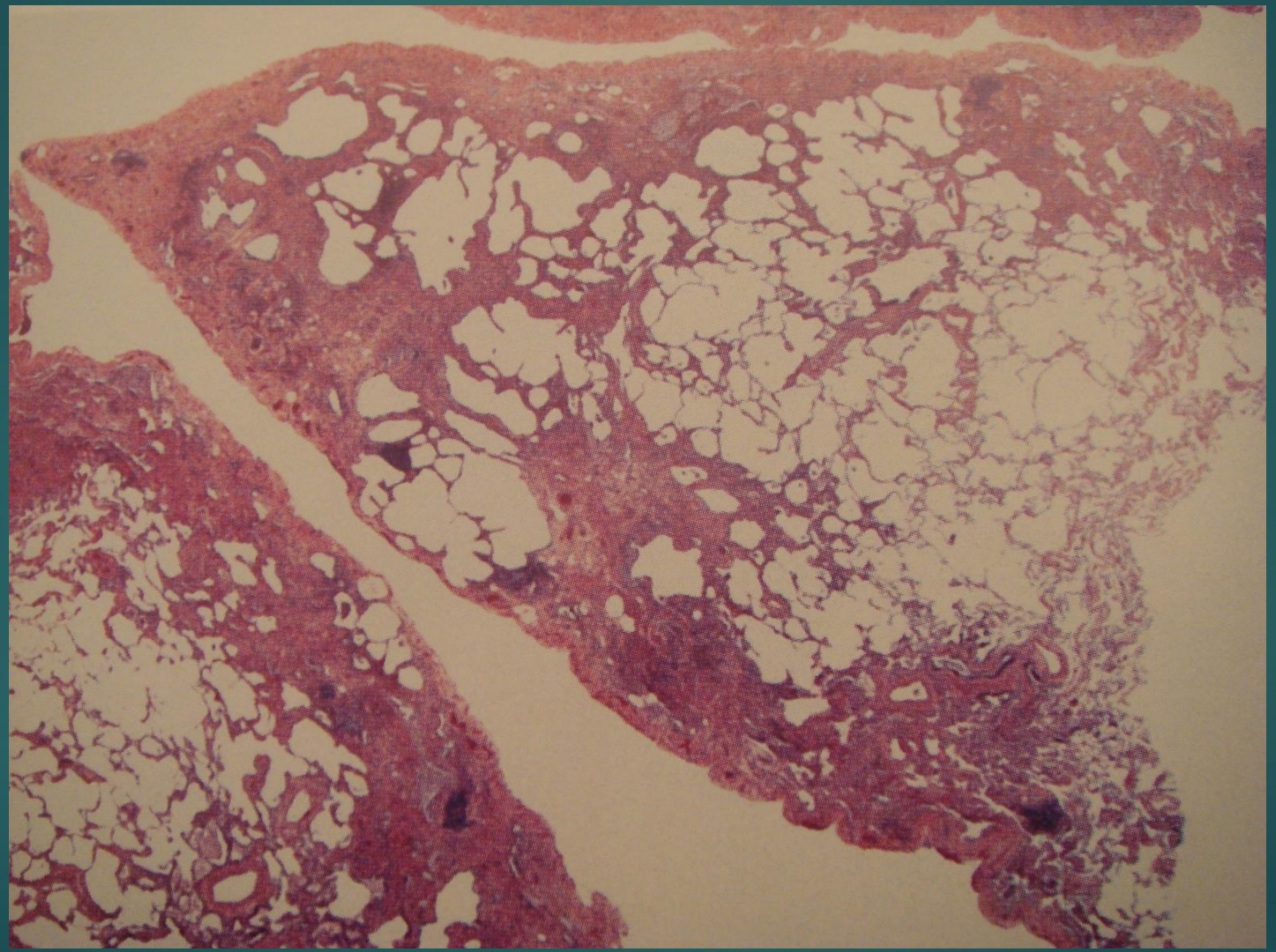
↓

Destroying alveolar spaces in a lobule

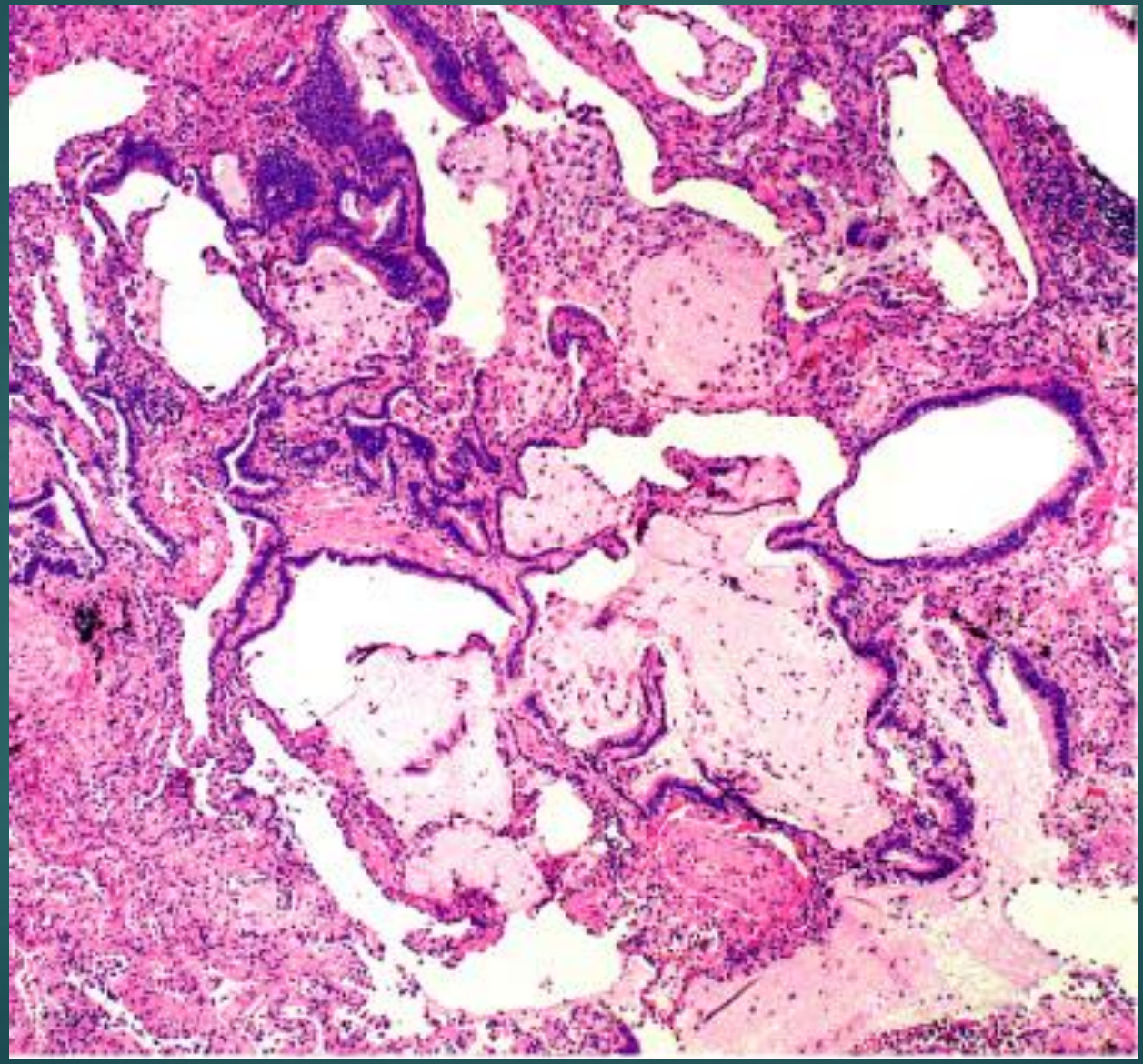
↓

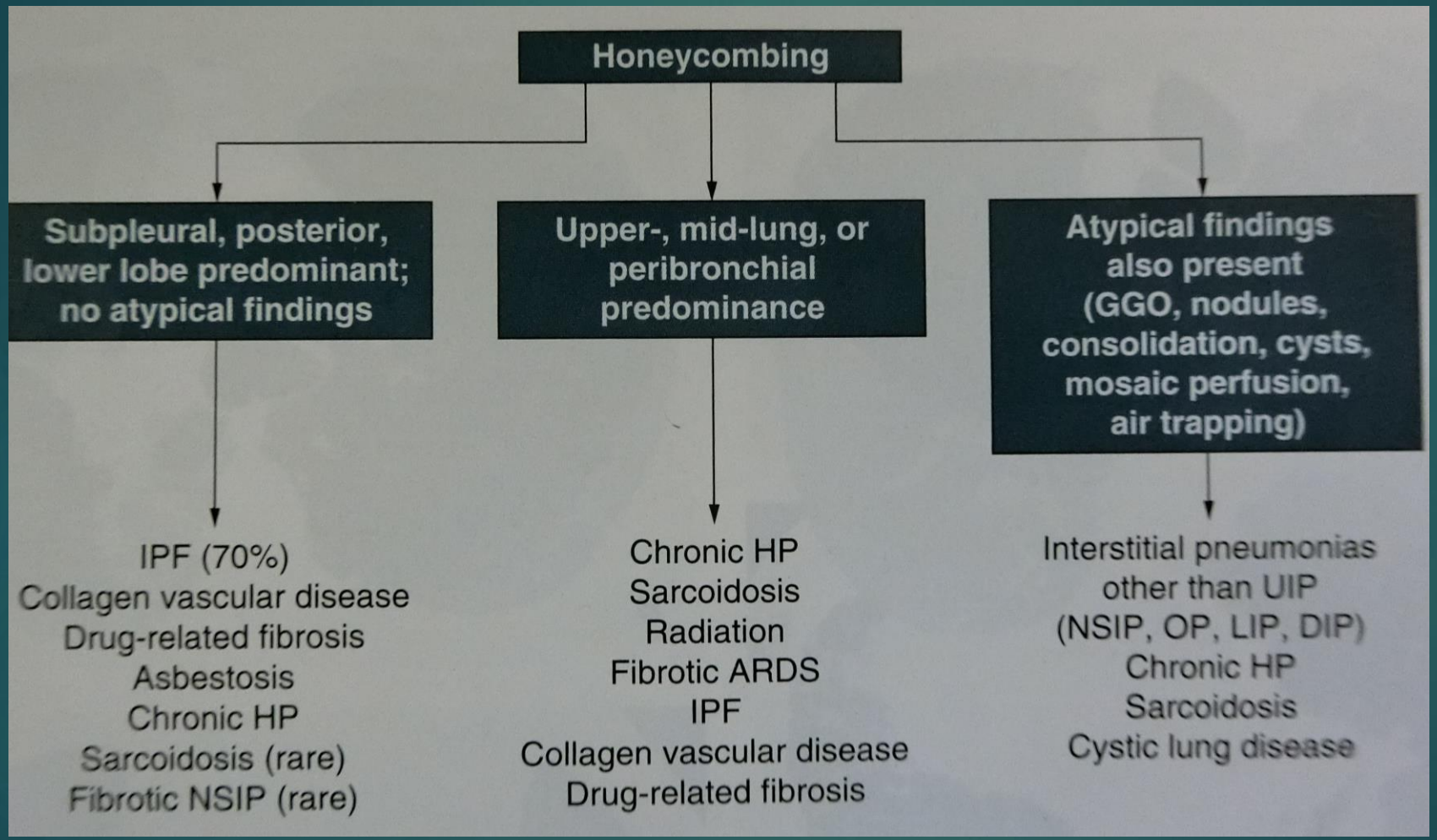
Leaving dilated, distorted respiratory bronchioles surrounded by scar tissue

UIP

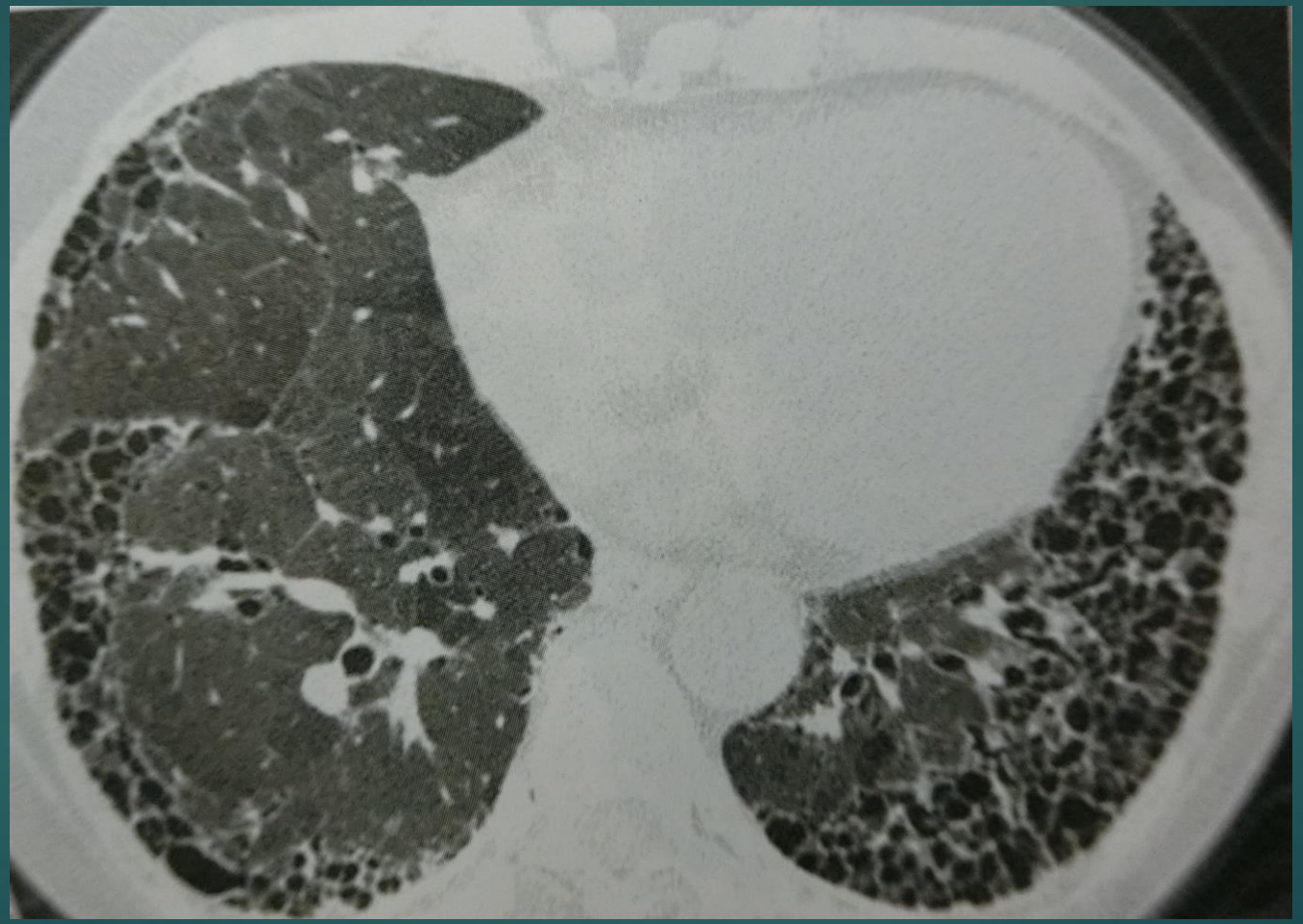


UIP

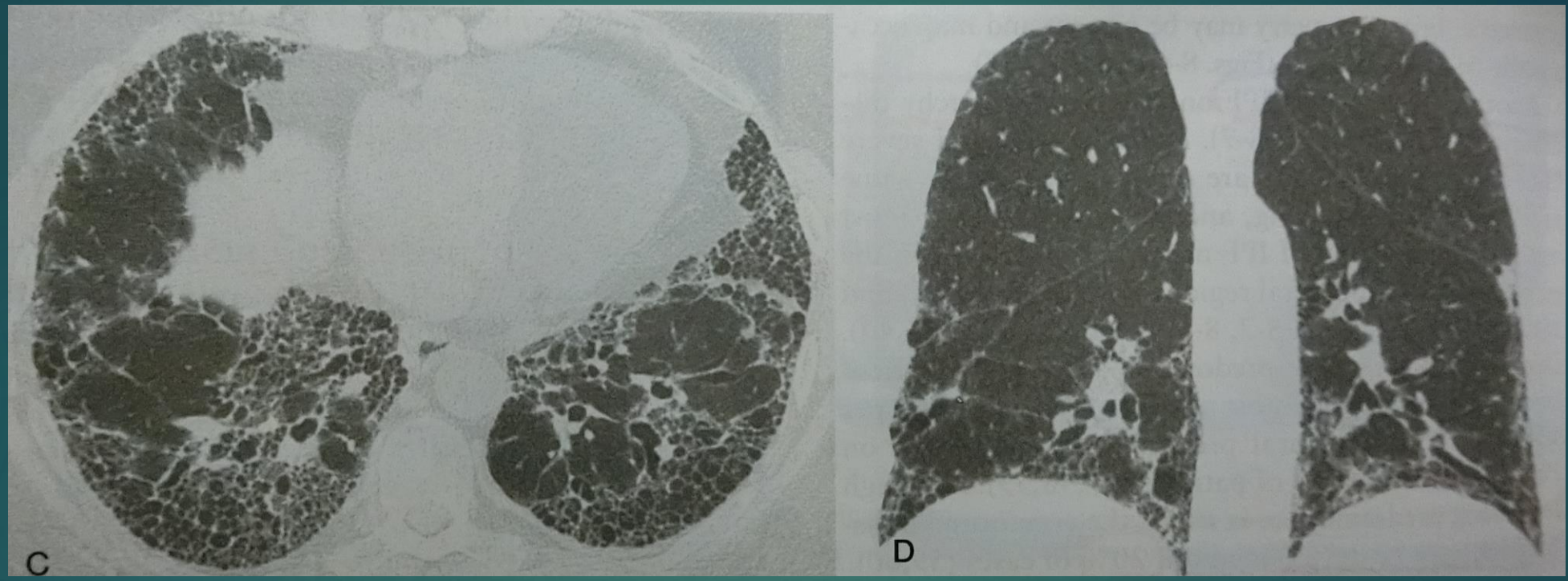



Honeycombing
Subpleural, posterior, lower lobe predominant; no atypical findings
Upper-, mid-lung, or peribronchial predominance
Atypical findings also present (GGO, nodules, consolidation, cysts, mosaic perfusion, air trapping)
IPF (70%)
Collagen vascular disease
Drug-related fibrosis
Asbestosis
Chronic HP
Sarcoidosis (rare)
Fibrotic NSIP (rare)
Chronic HP
Sarcoidosis
Radiation
Fibrotic ARDS
IPF
Collagen vascular disease
Drug-related fibrosis
Interstitial pneumonias other than UIP (NSIP, OP, LIP, DIP)
Chronic HP
Sarcoidosis
Cystic lung disease

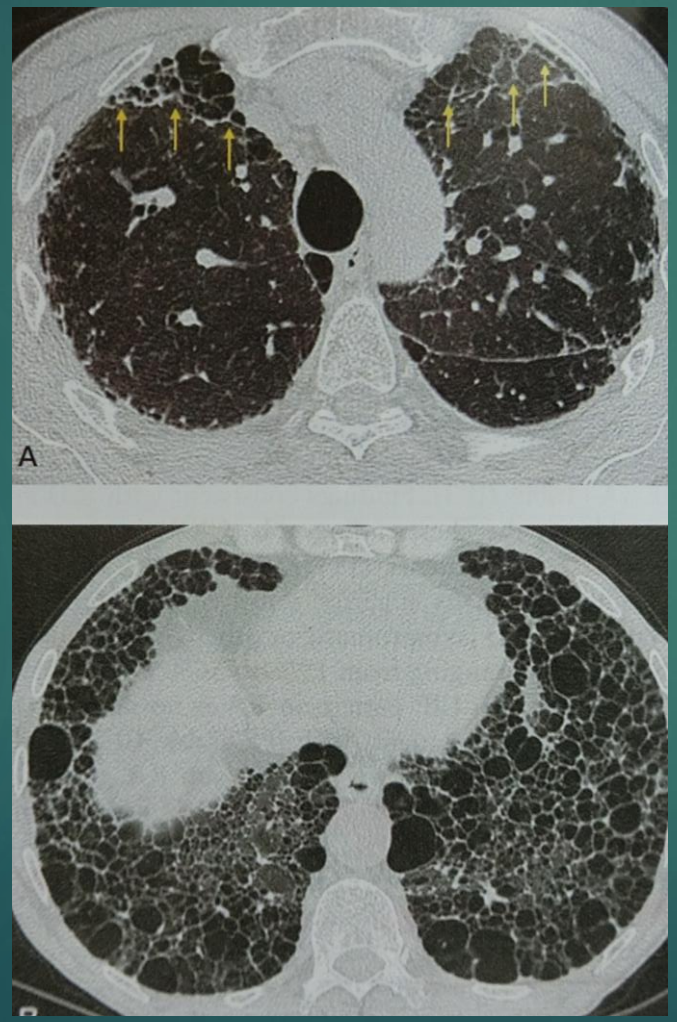
IPF



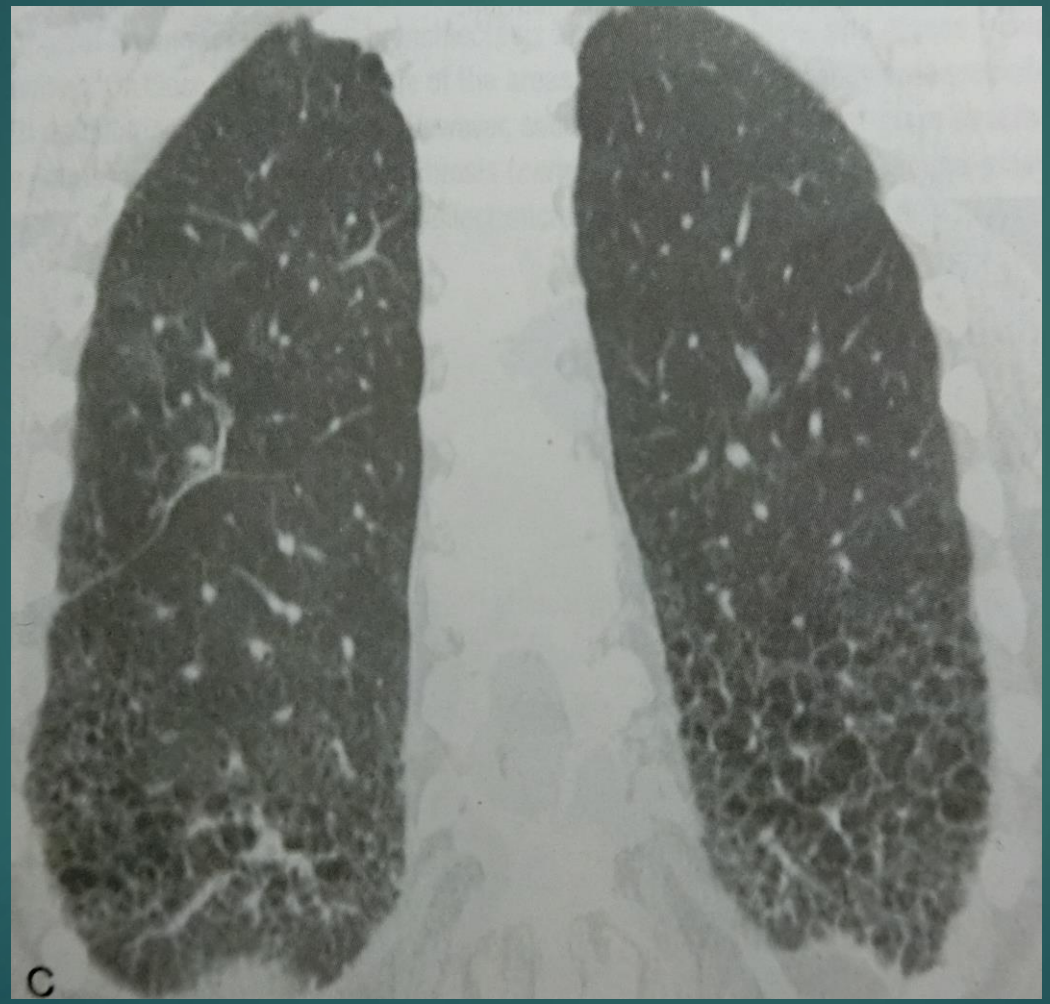
IPF



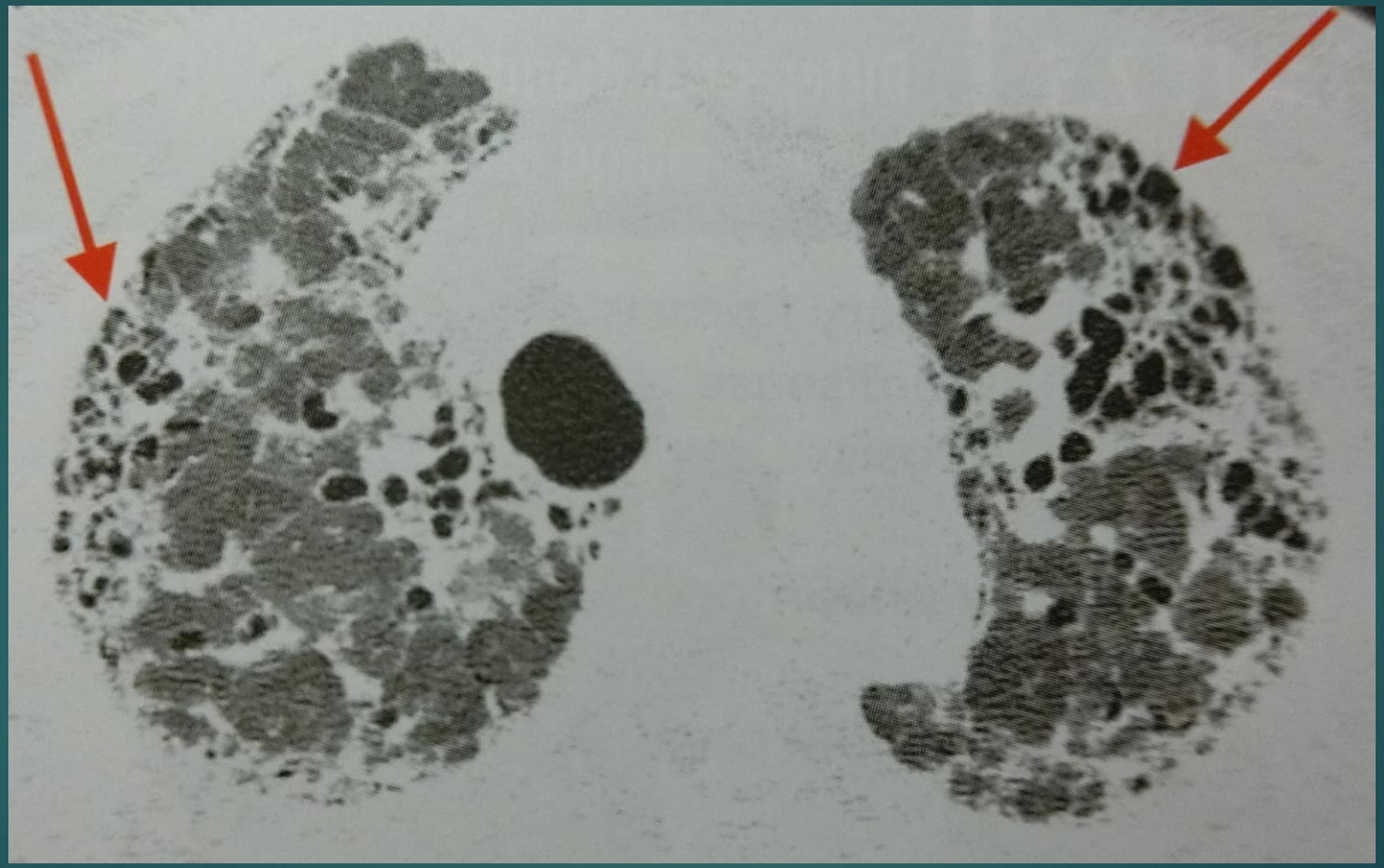
RA-UIP
A: anterior upper lobe sign
B: exuberant honeycombing sign



RA-UIP with straight edge sign



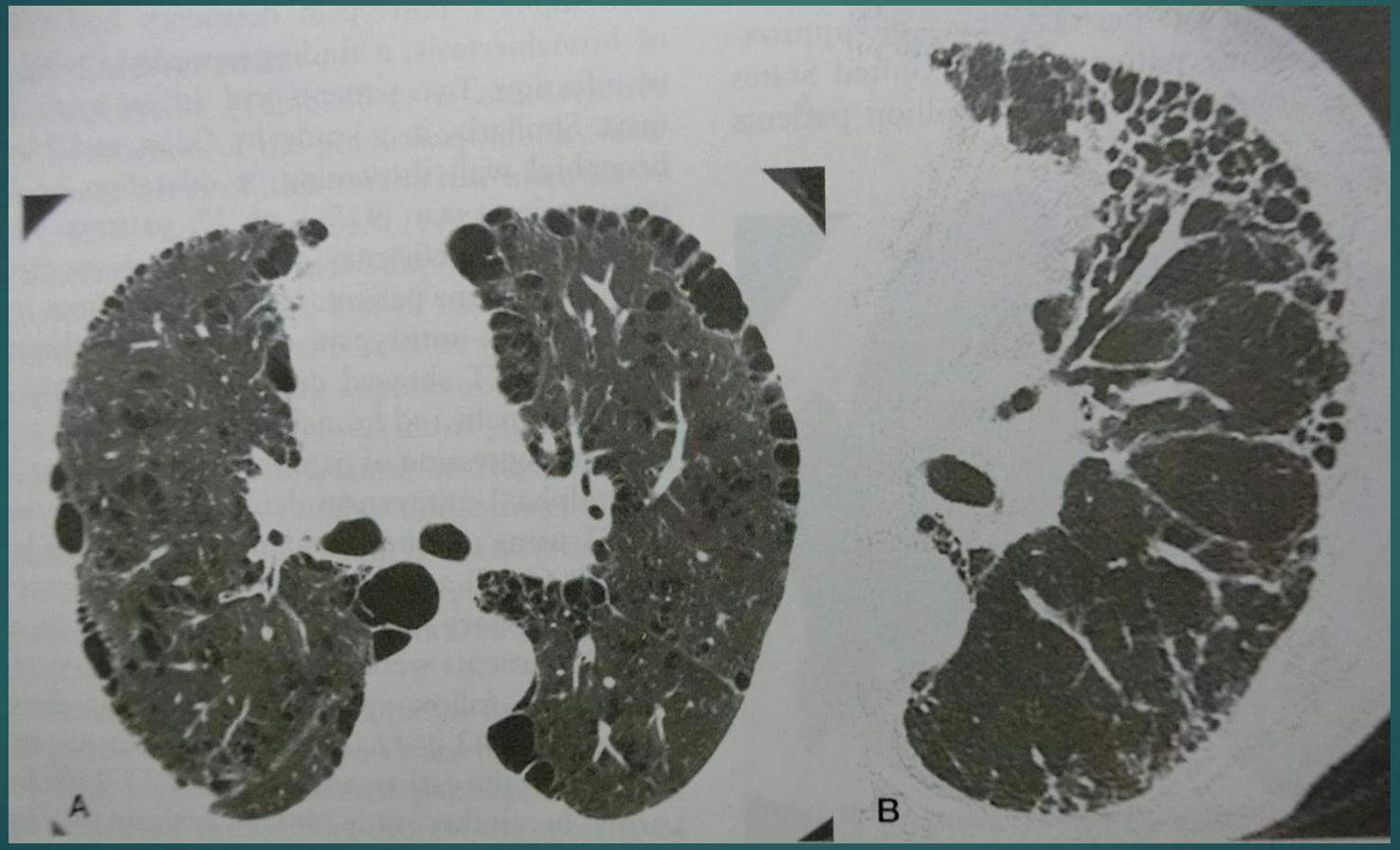
CHP



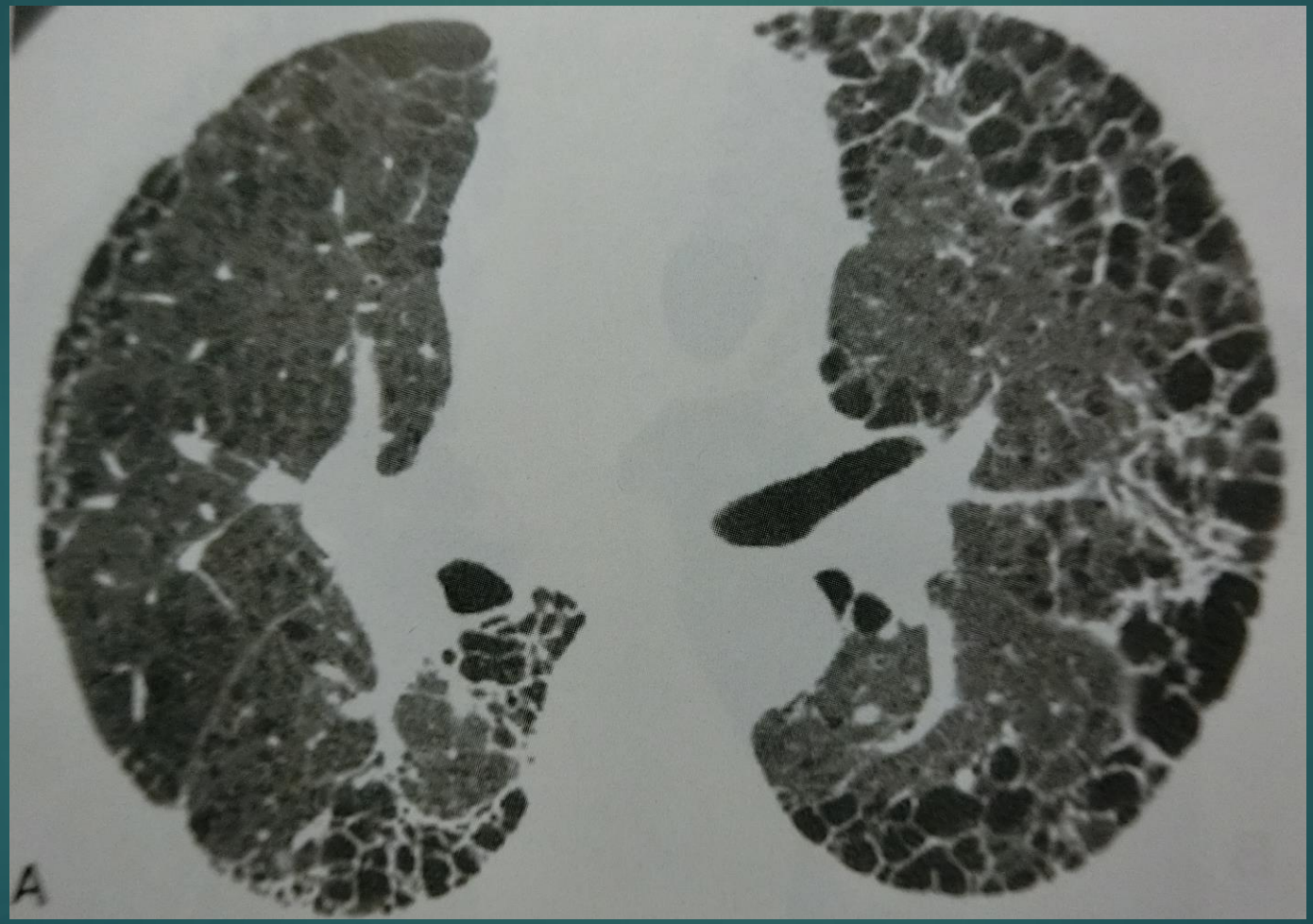
Honeycombing
vs
Paraseptal Emphysema

	Paraseptal emphysema	Honeycombing
Layers	One layer	One or more layers
Associated findings	Centrilobular emphysema, bullae in some	Traction bronchiectasis, reticulation
Distribution	Upper lobe predominant	Often lower lung predominant
Size	Often >1 cm	Usually <1 cm
Overall lung volume	Increased	Decreased

A: paraseptal emphysema
B: honeycoming

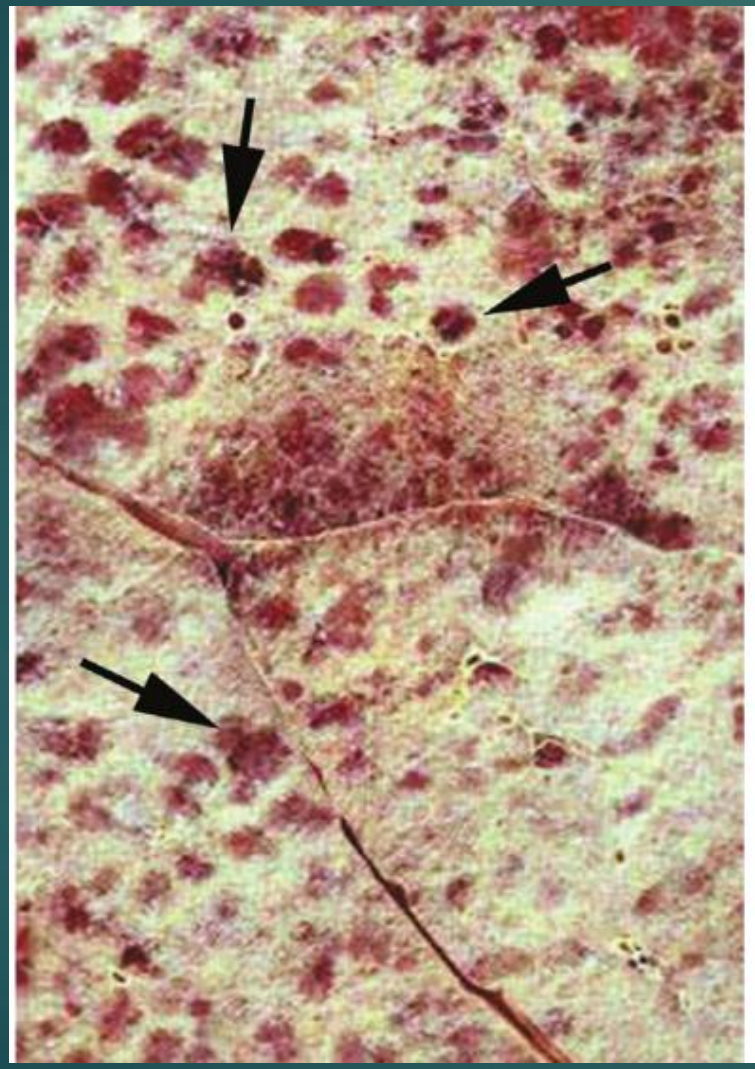


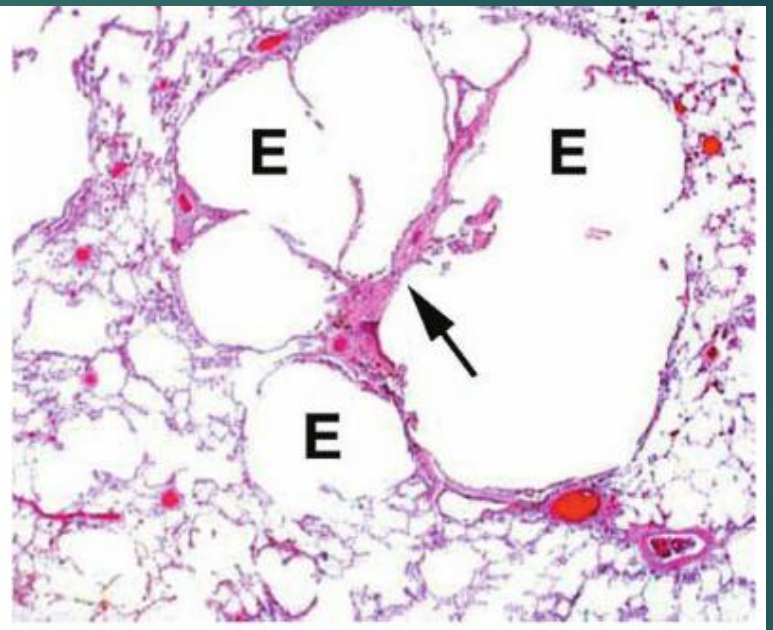
Emphysema + UIP



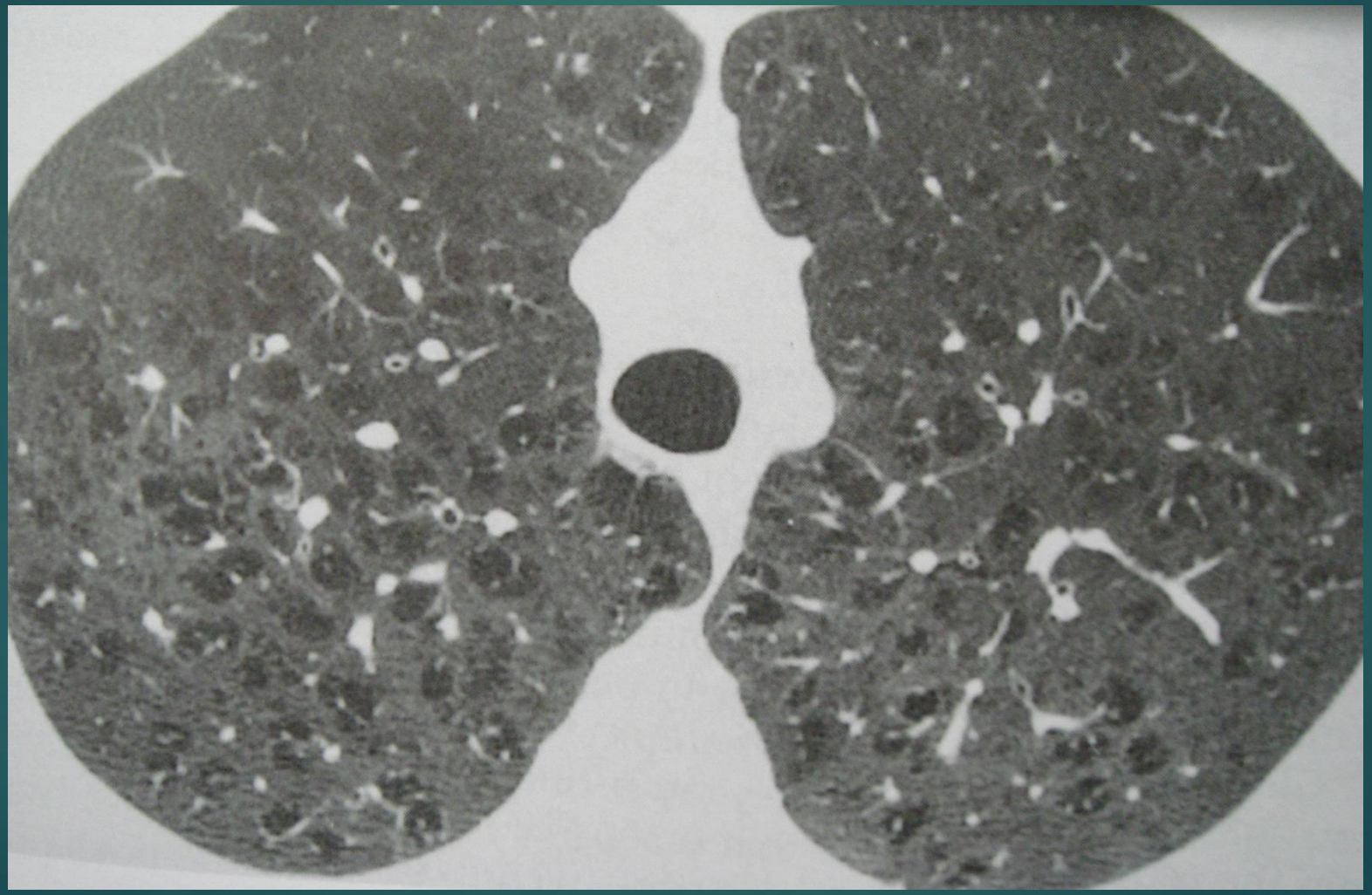
Honeycombing
vs
Centrilobular Emphysema

Centrilobular Emphysema

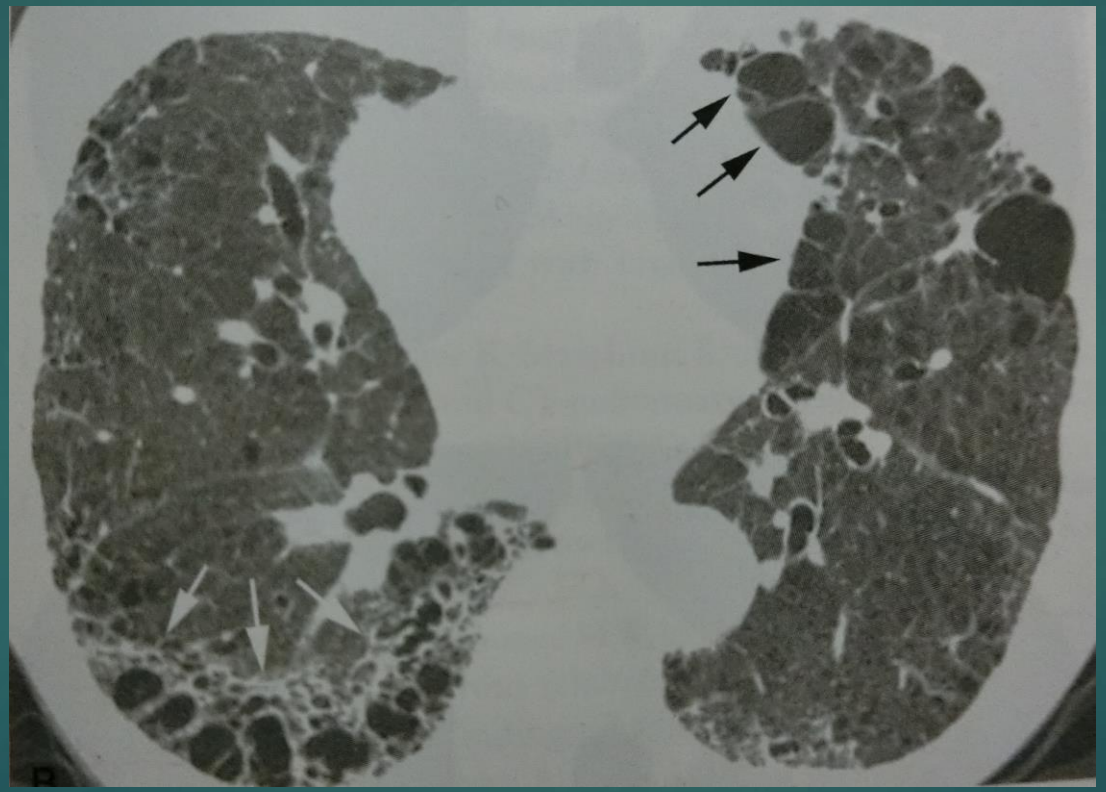




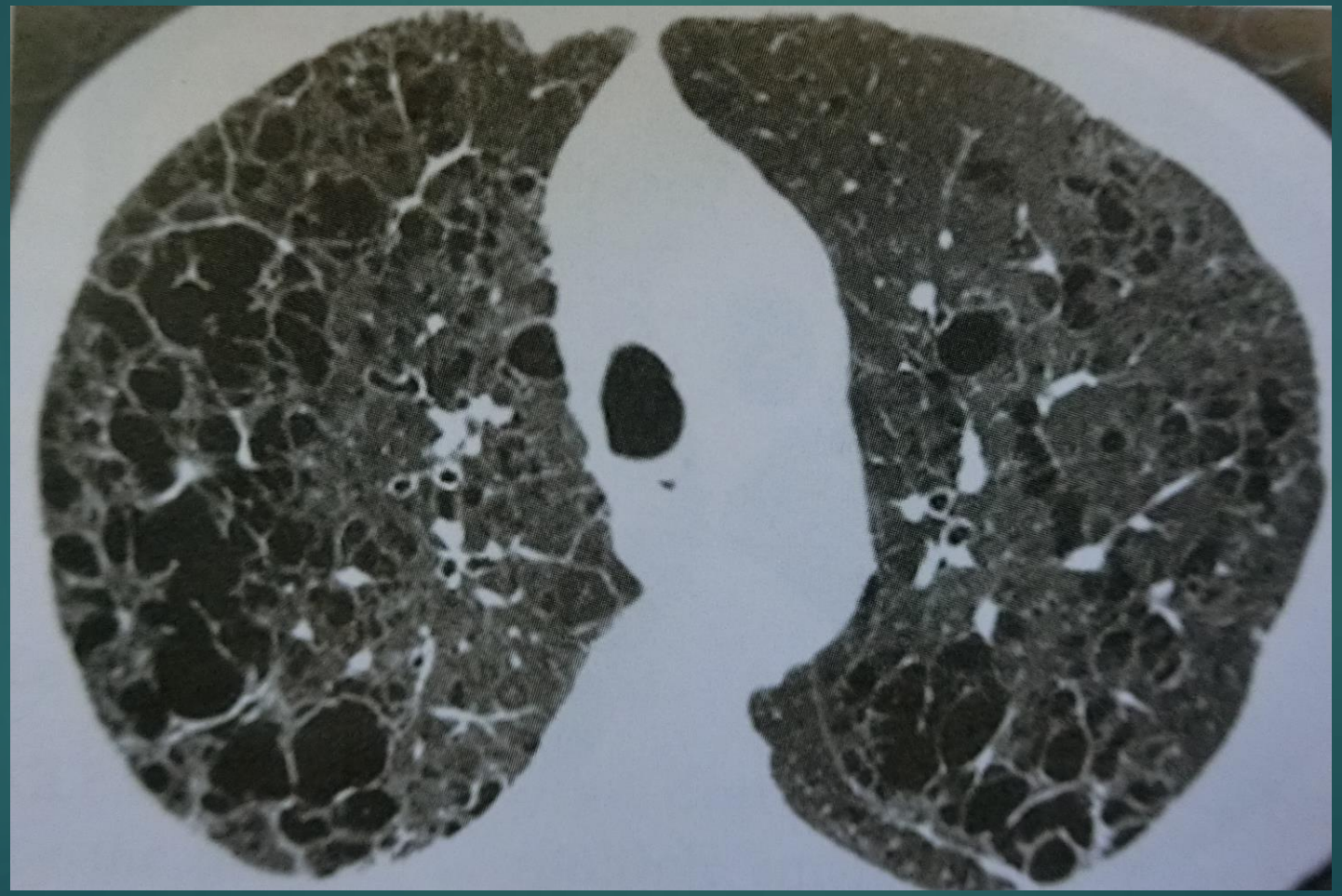
Centrilobular Emphysema



Paraseptal Emphysema + Honeycombing + CLE

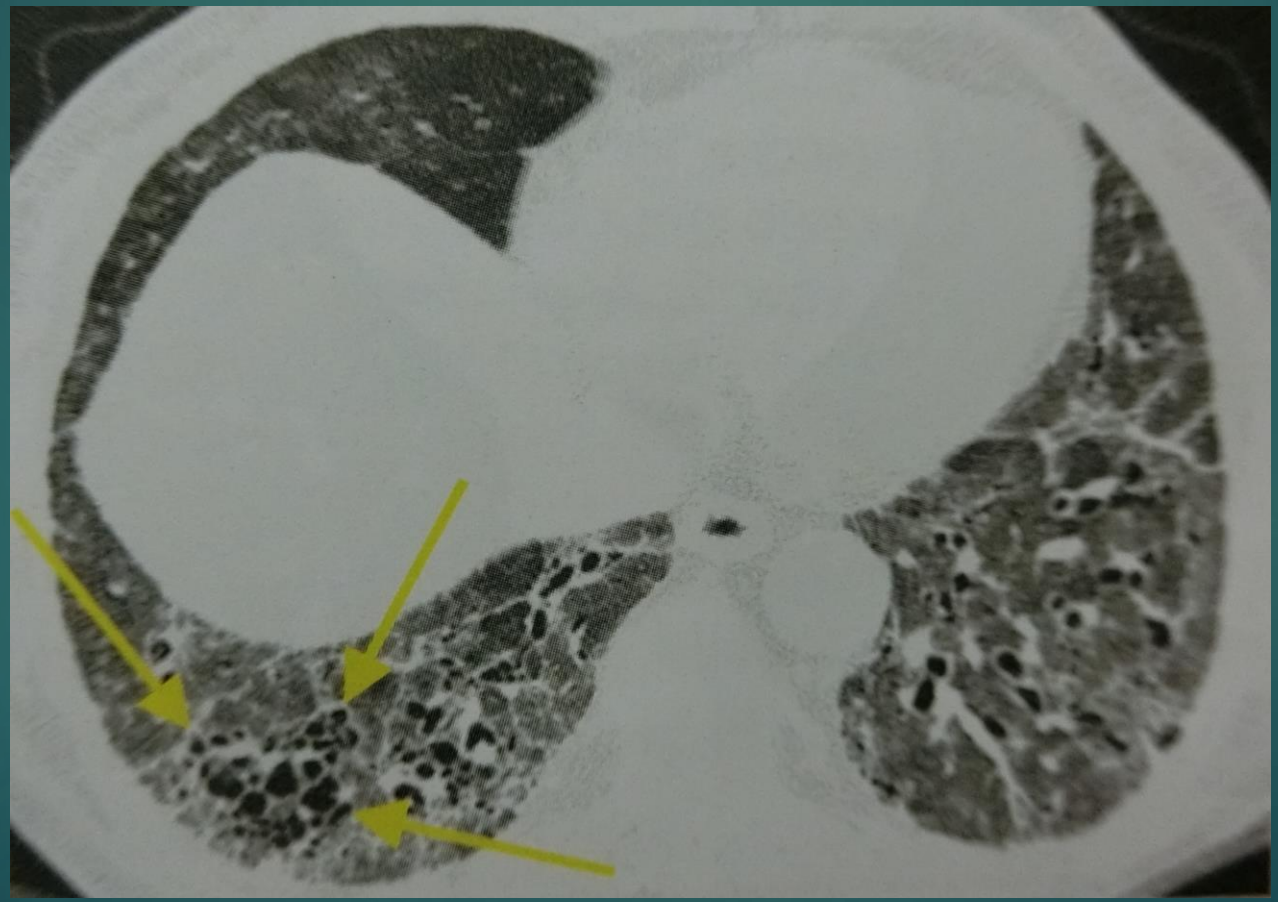


SRIF (AEF)

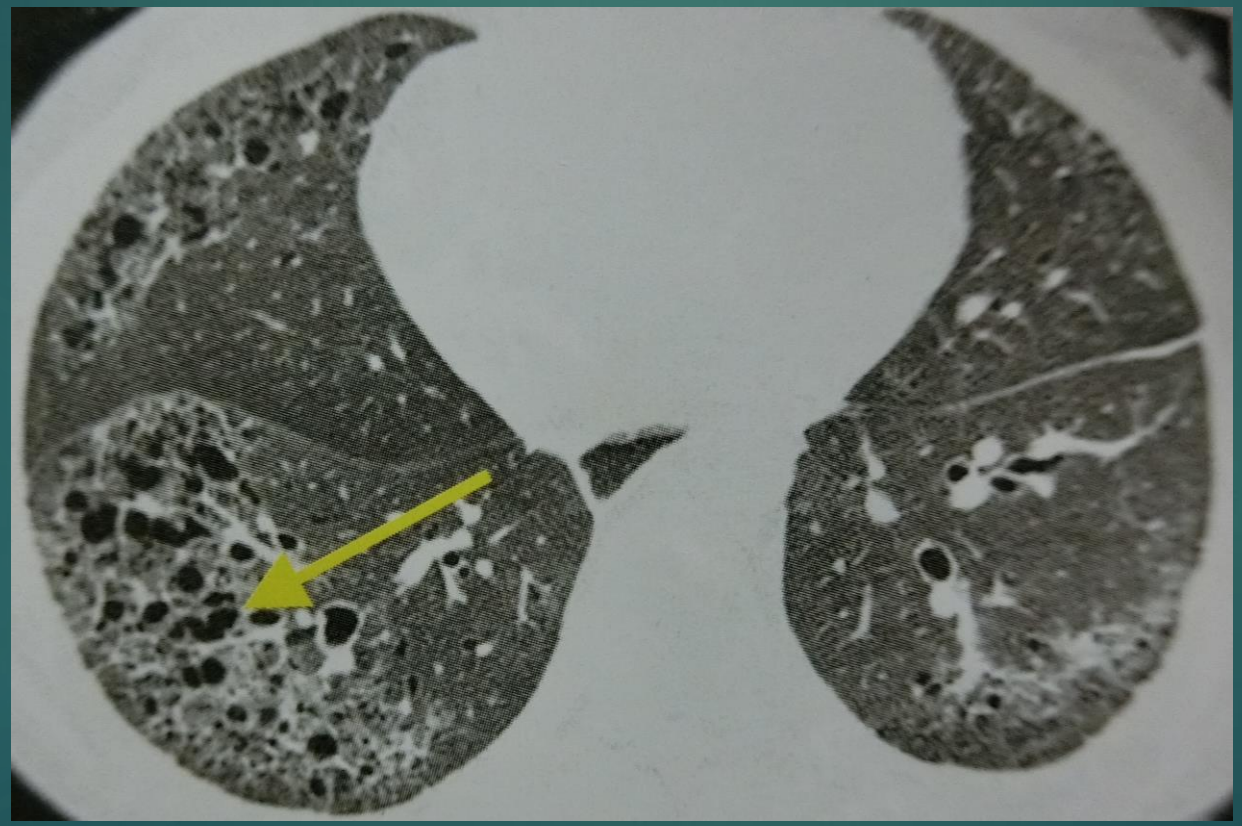


Honeycombing
vs
Traction Bronchiectasis

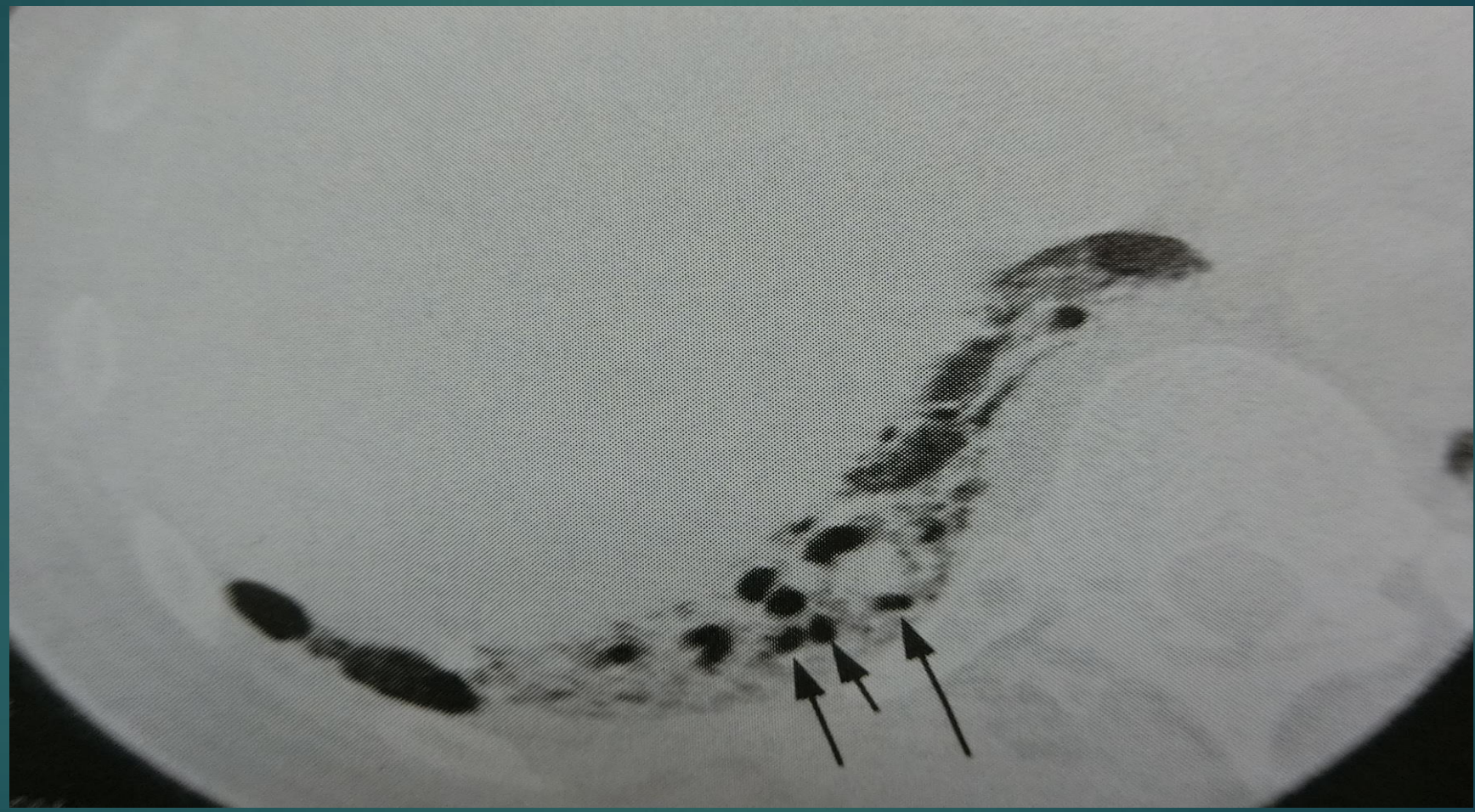
Fibrotic NSIP with Traction Bronchiectasis



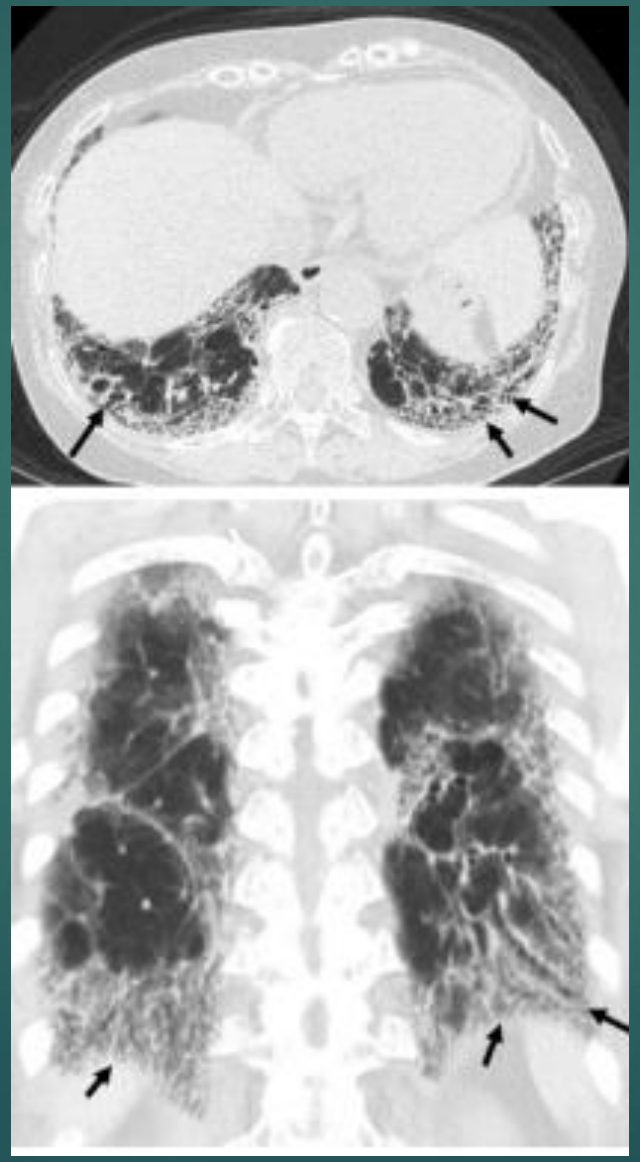
Fibrotic NSIP with Traction Bronchiectasis



Traction Bronchiectasis



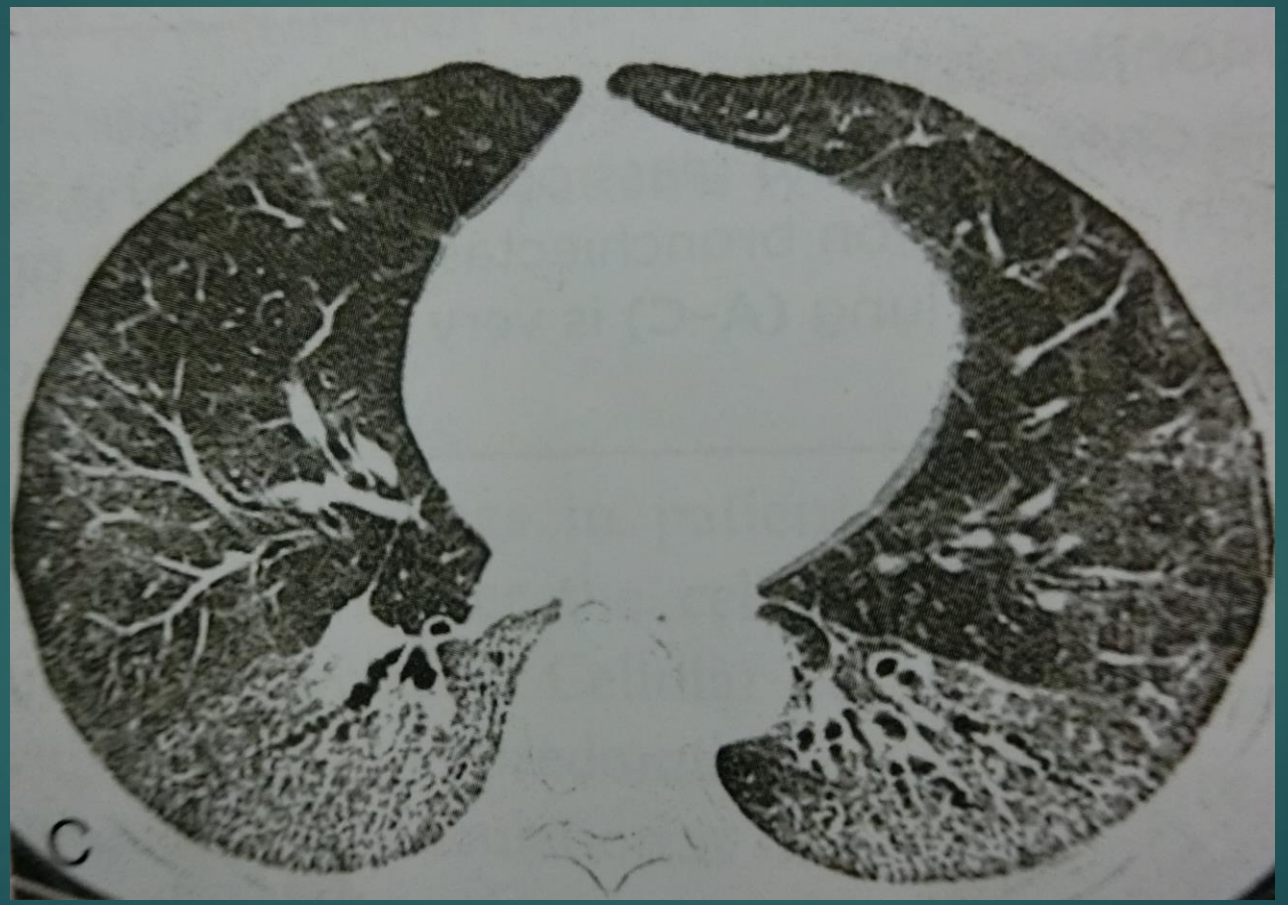
SS with fibrotic NSIP



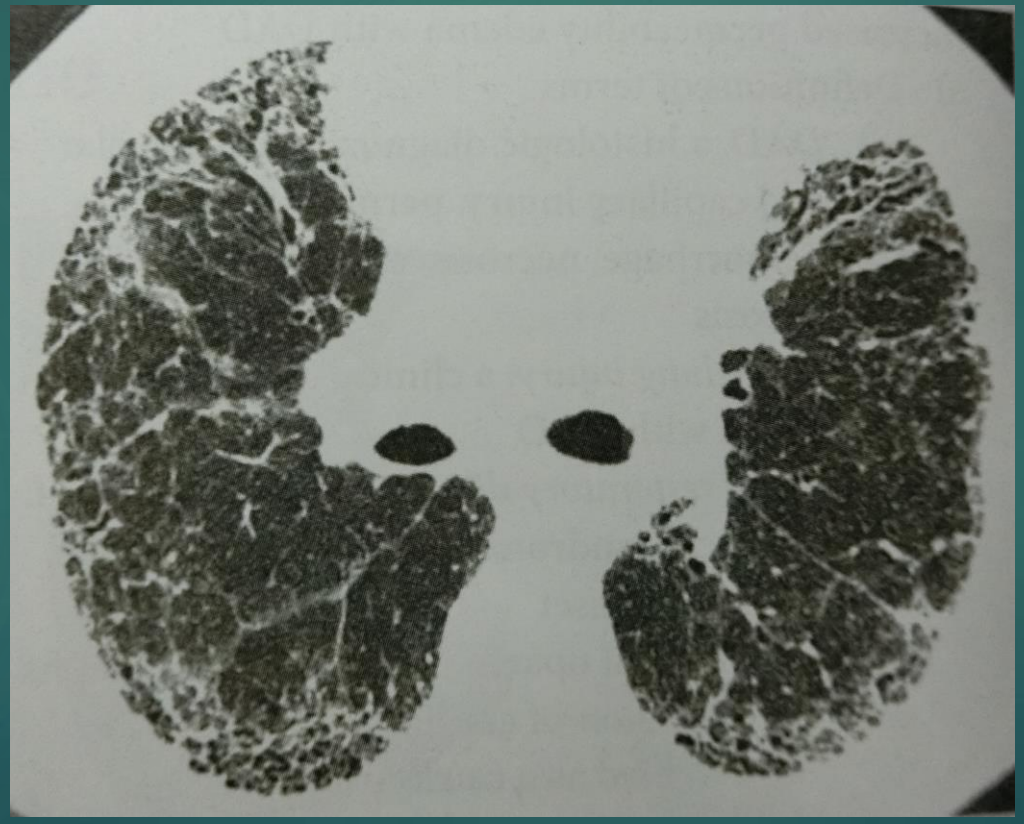
Signs of Fibrosis

- Honeycombing
- Traction bronchiectasis / bronchiolectasis
- Reticulation
- Architectural distortion
- Volume loss
- Subpleural or peribronchovascular irregularity

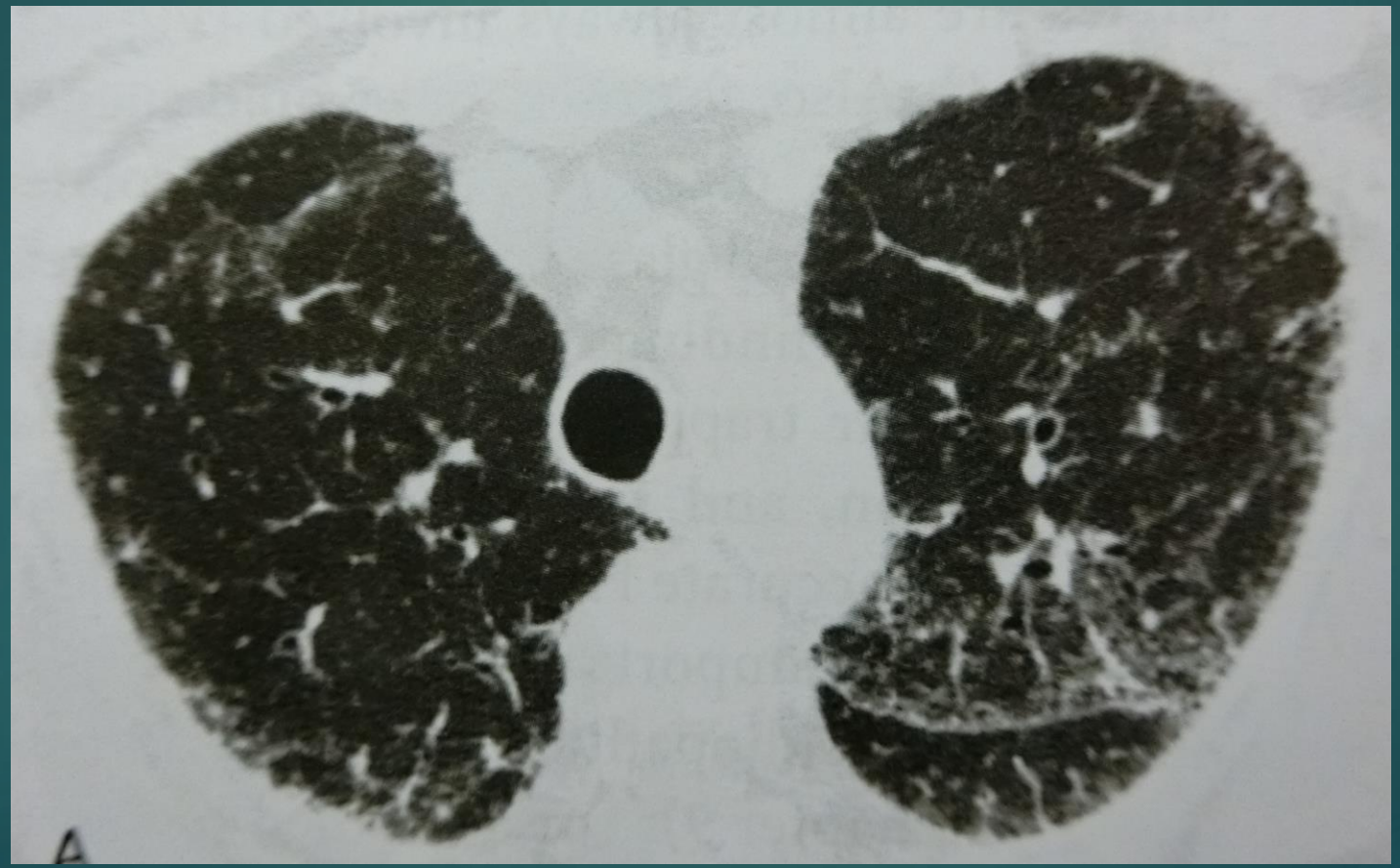
Fibrotic NSIP with volume loss



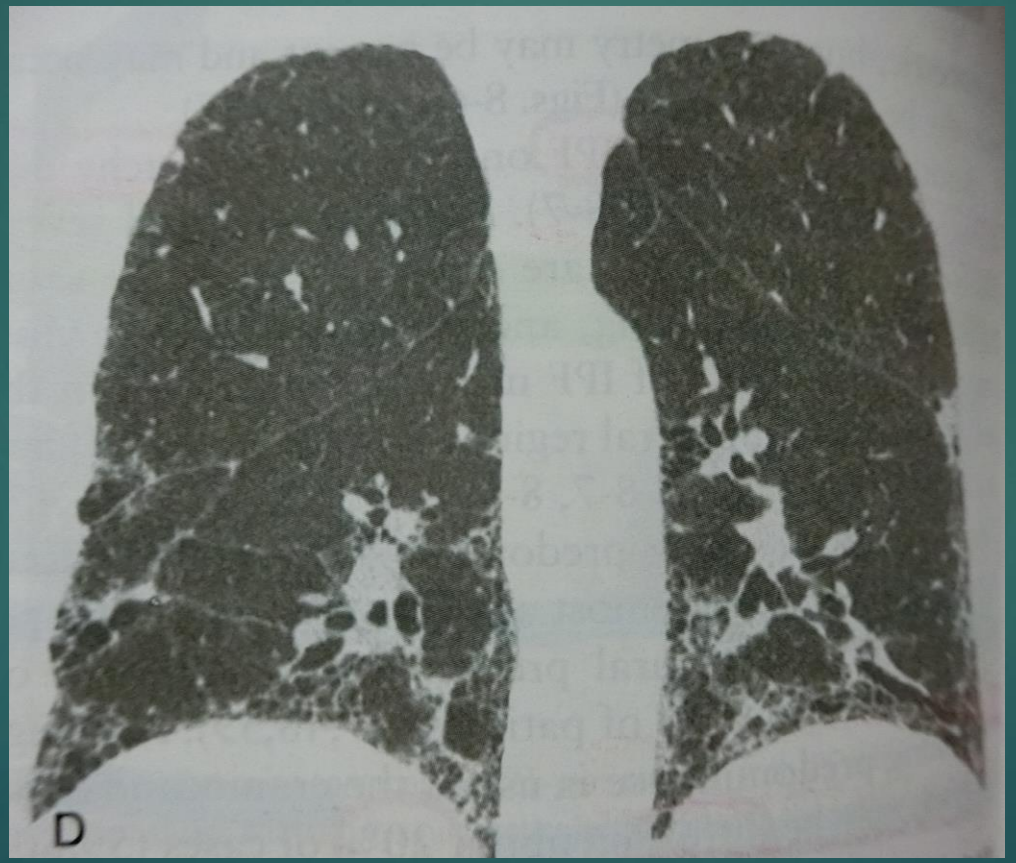
UIP with volume loss, architectural distortion



UIP with subpleural irregularity



UIP with peribronchovascular irregularity

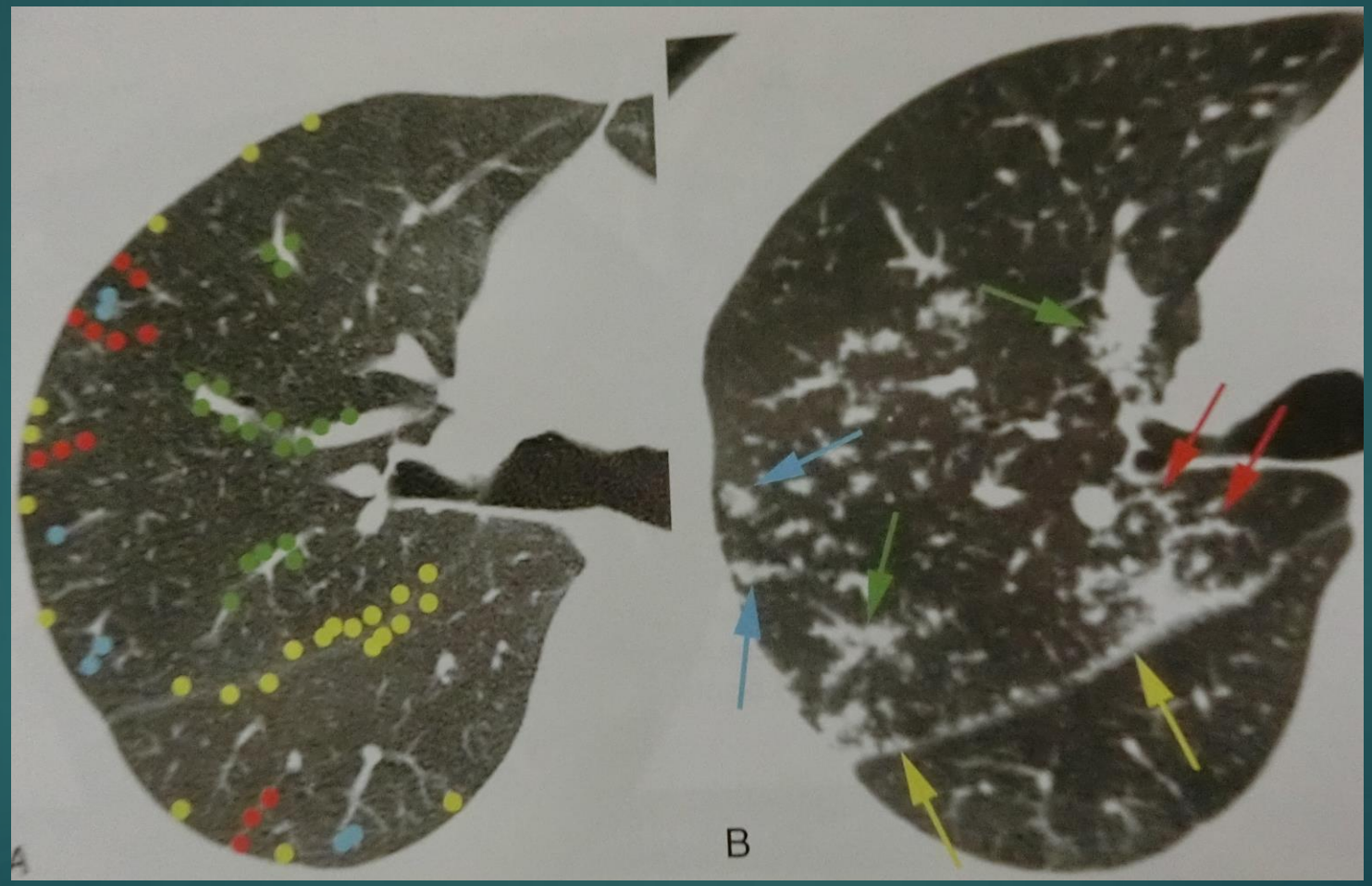


Multiple Nodules

Distribution of Multiple Nodules

- Perilymphatic
- Random
- Centrilobular

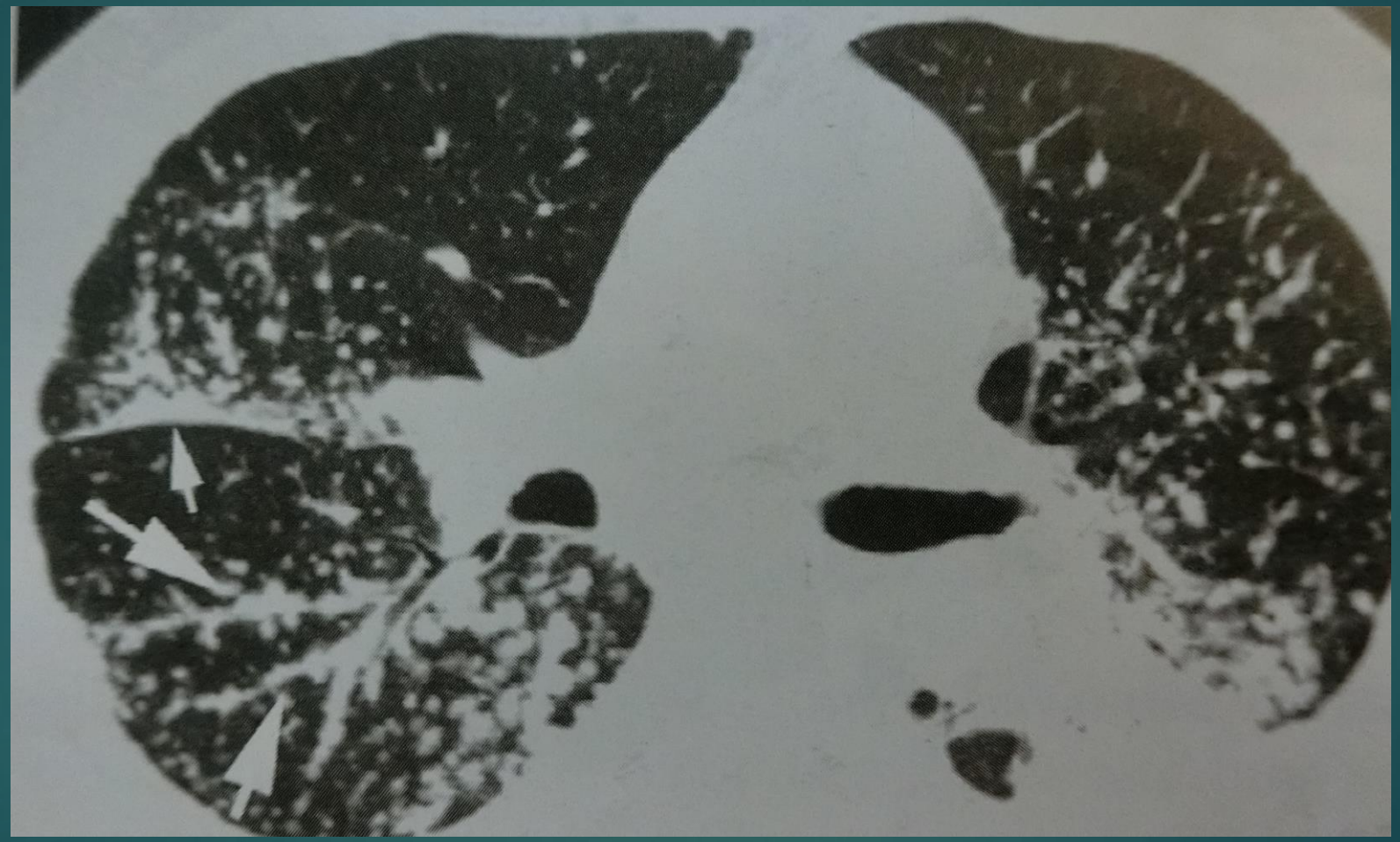
Perilymphatic Nodules



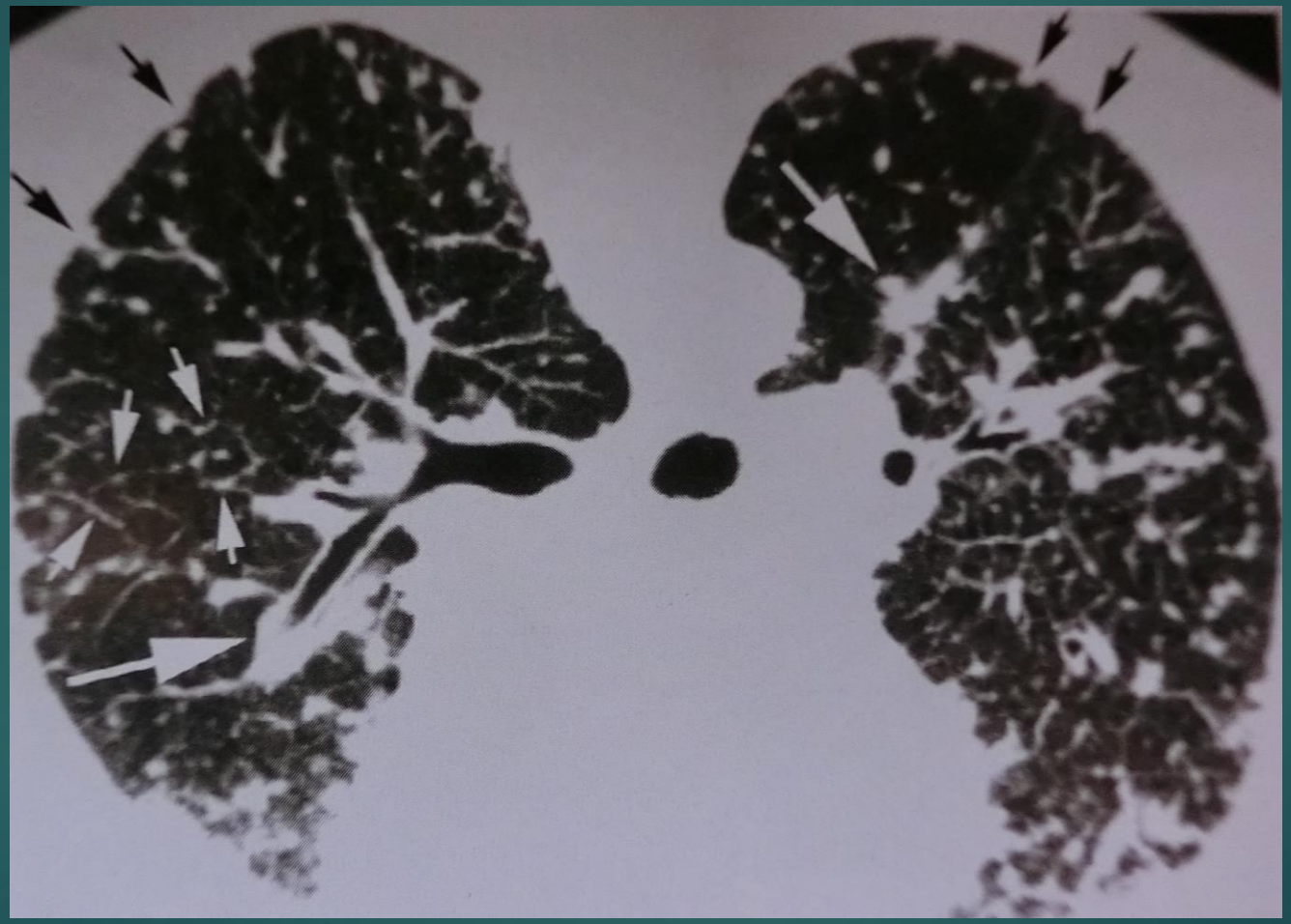
D.D of Perilymphatic Nodules

- Sarcoidosis (common)
- Lymphangitic carcinomatosis or lymphoma/ leukemia
- Some pneumoconiosis (silicosis, CWP)
- LIP (rare)
- Amyloidosis (rare)
- MM with light chain protein deposition (rare)

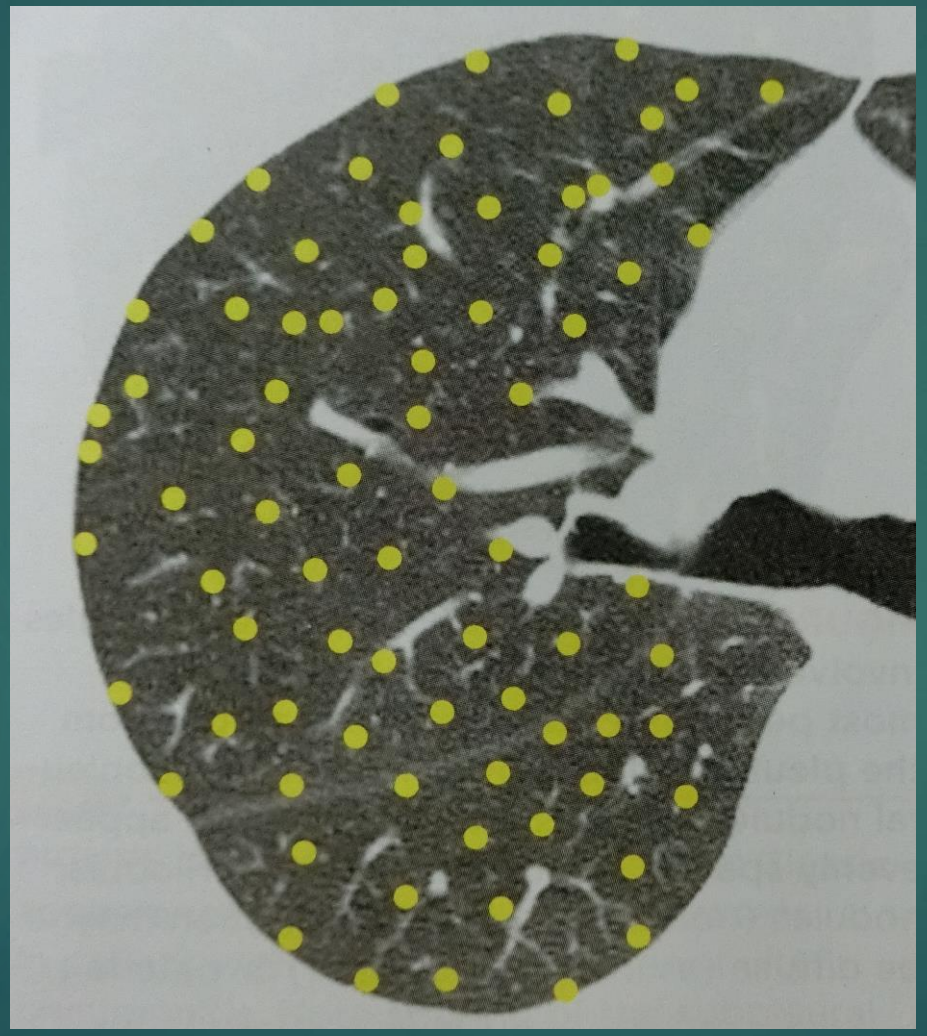
Sarcoidosis



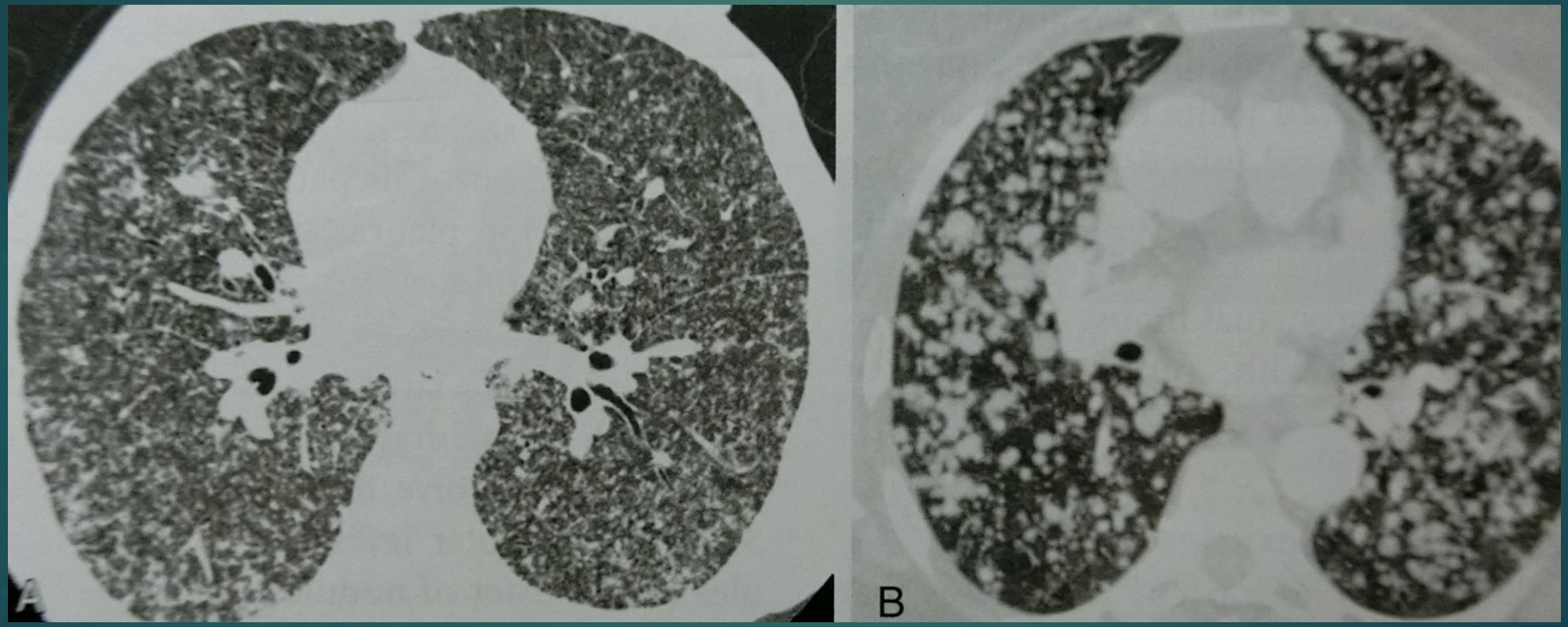
Lymphangitis Carcinomatosa



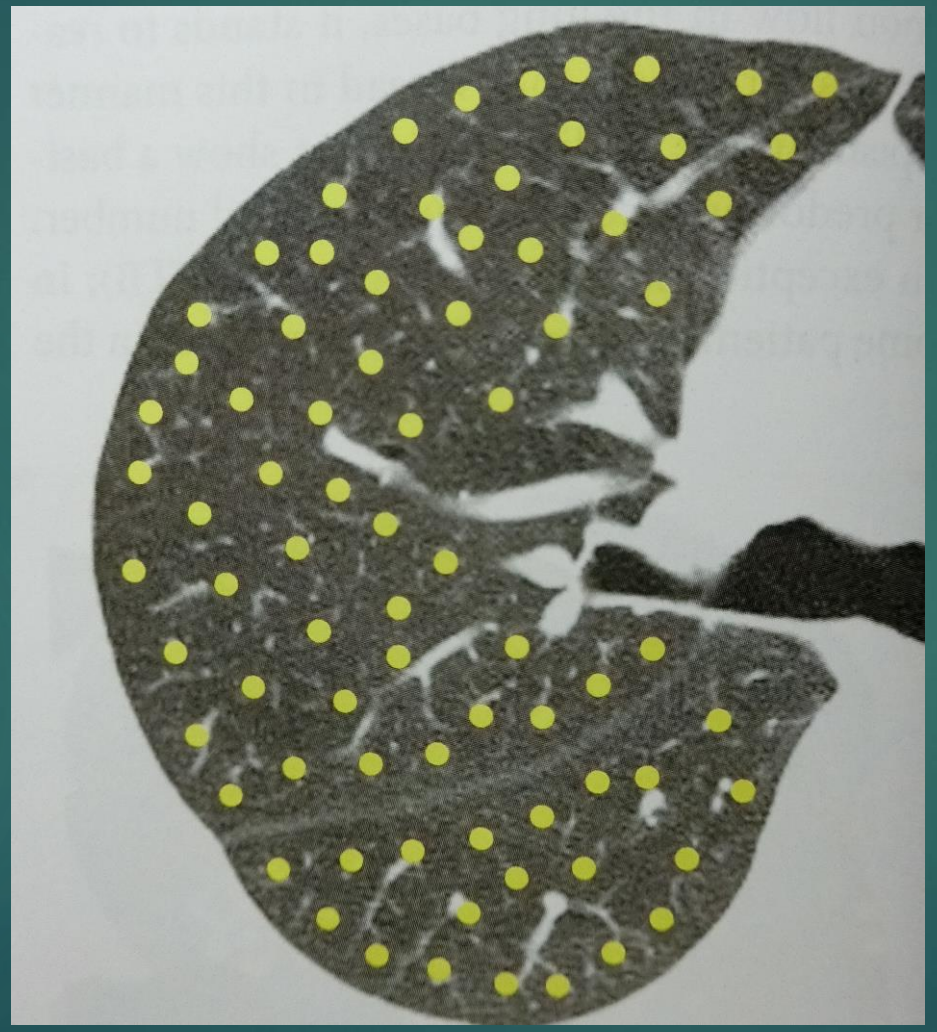
Random Nodules

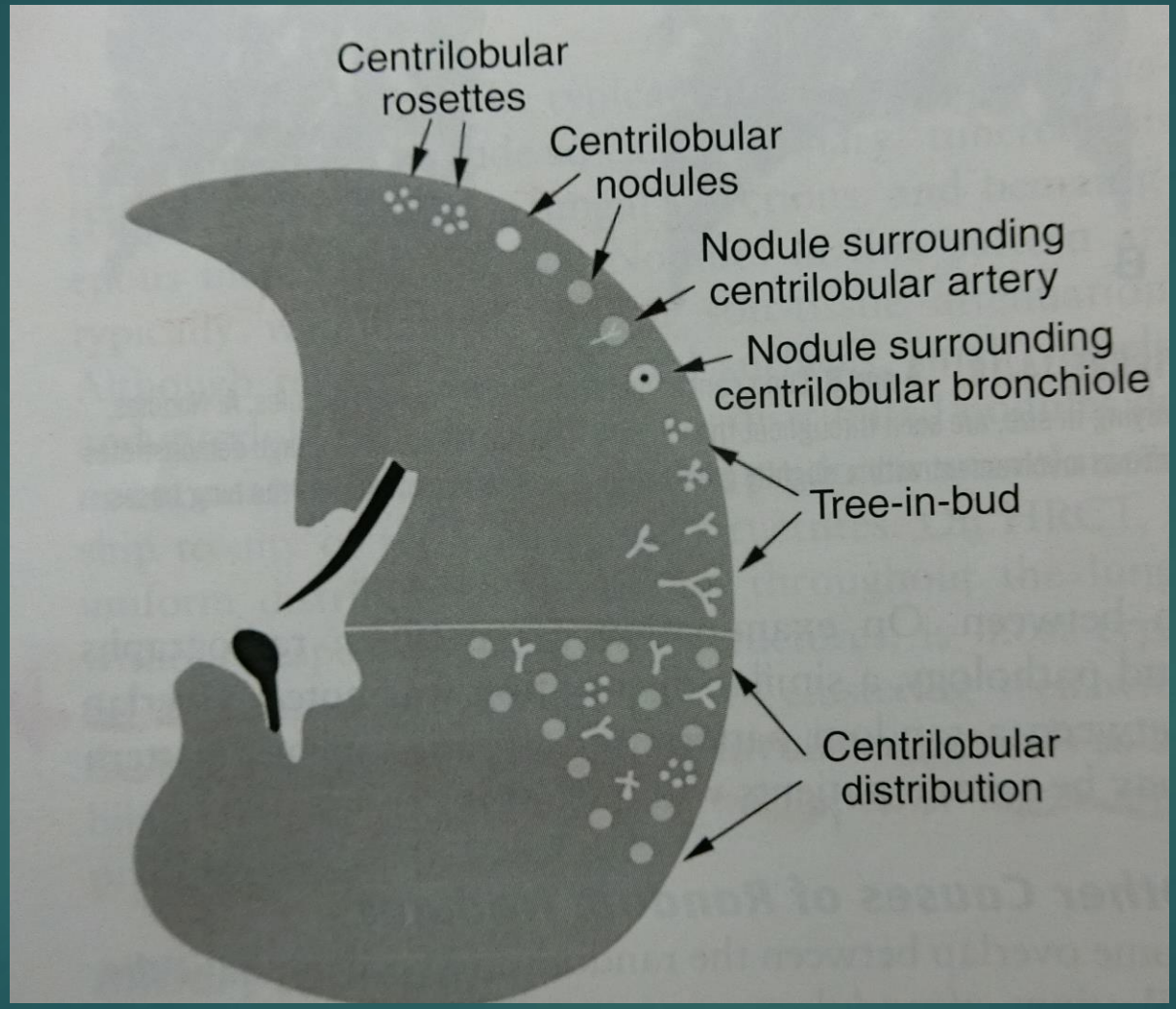


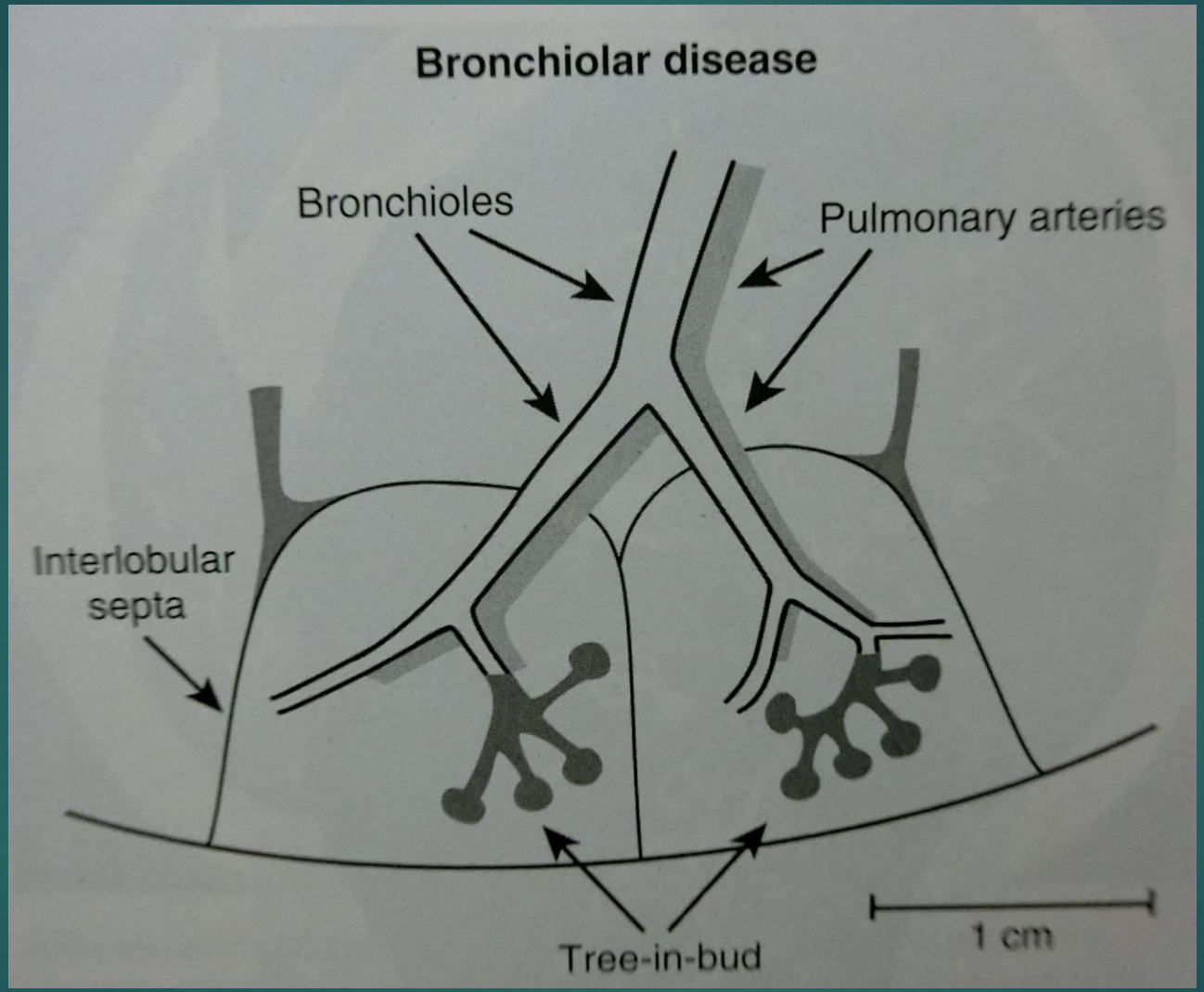
A : Miliary TB
B : Hematogenous Spread of Metastasis



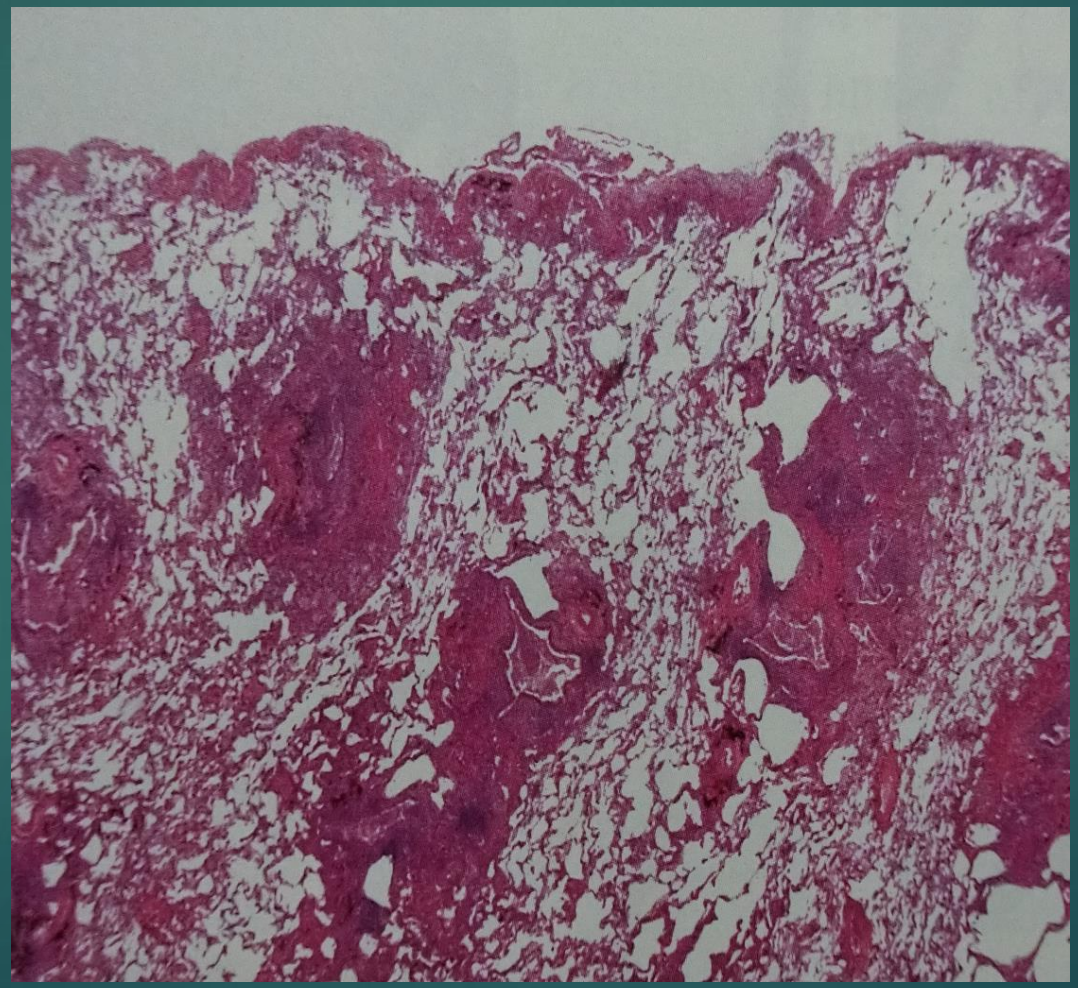
Centrilobular Nodules



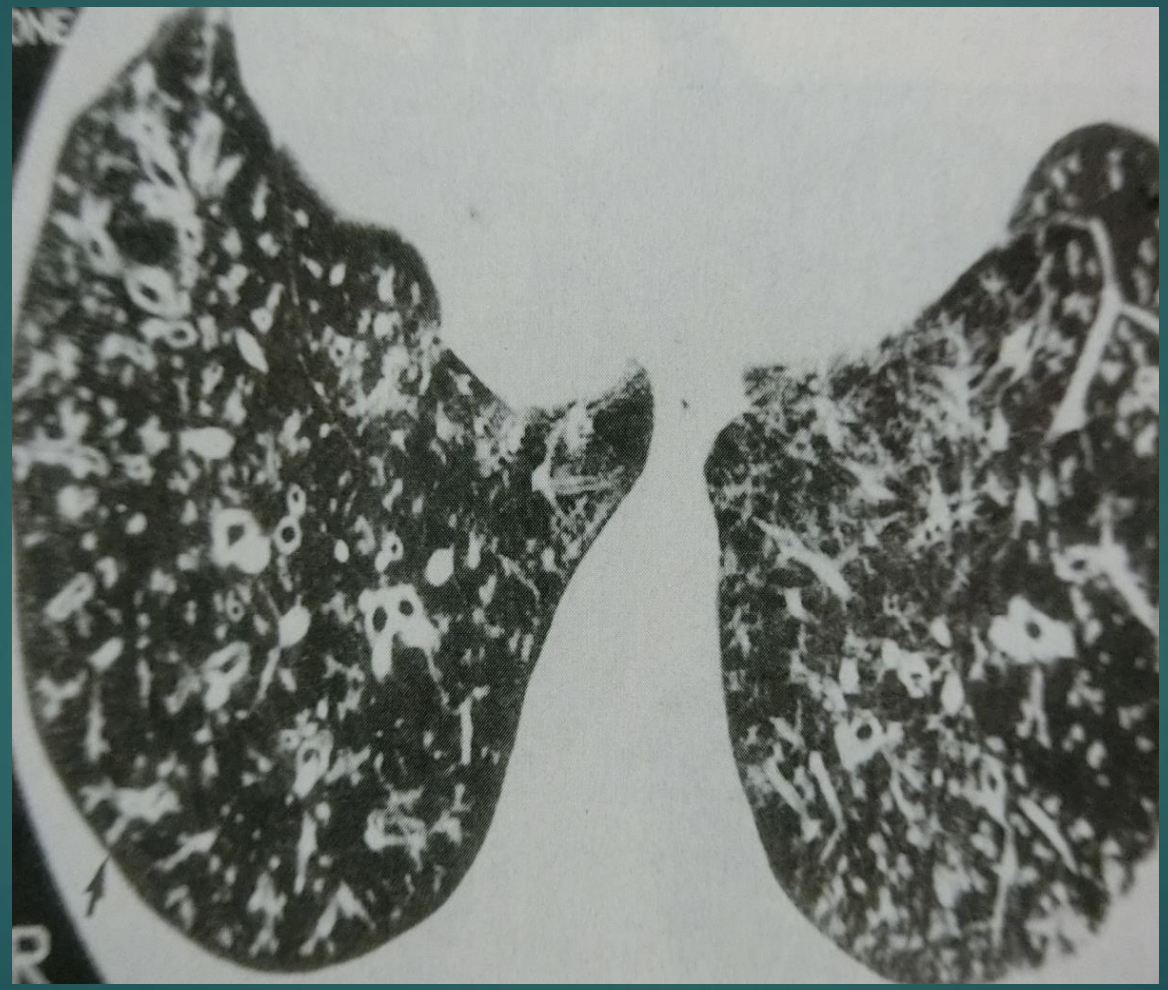

Centrilobular rosettes
Centrilobular nodules
Nodule surrounding centrilobular artery
Nodule surrounding centrilobular bronchiole
Tree-in-bud
Centrilobular distribution


Bronchiolar disease
Bronchioles
Pulmonary arteries
Interlobular septa
Tree-in-bud
1 cm

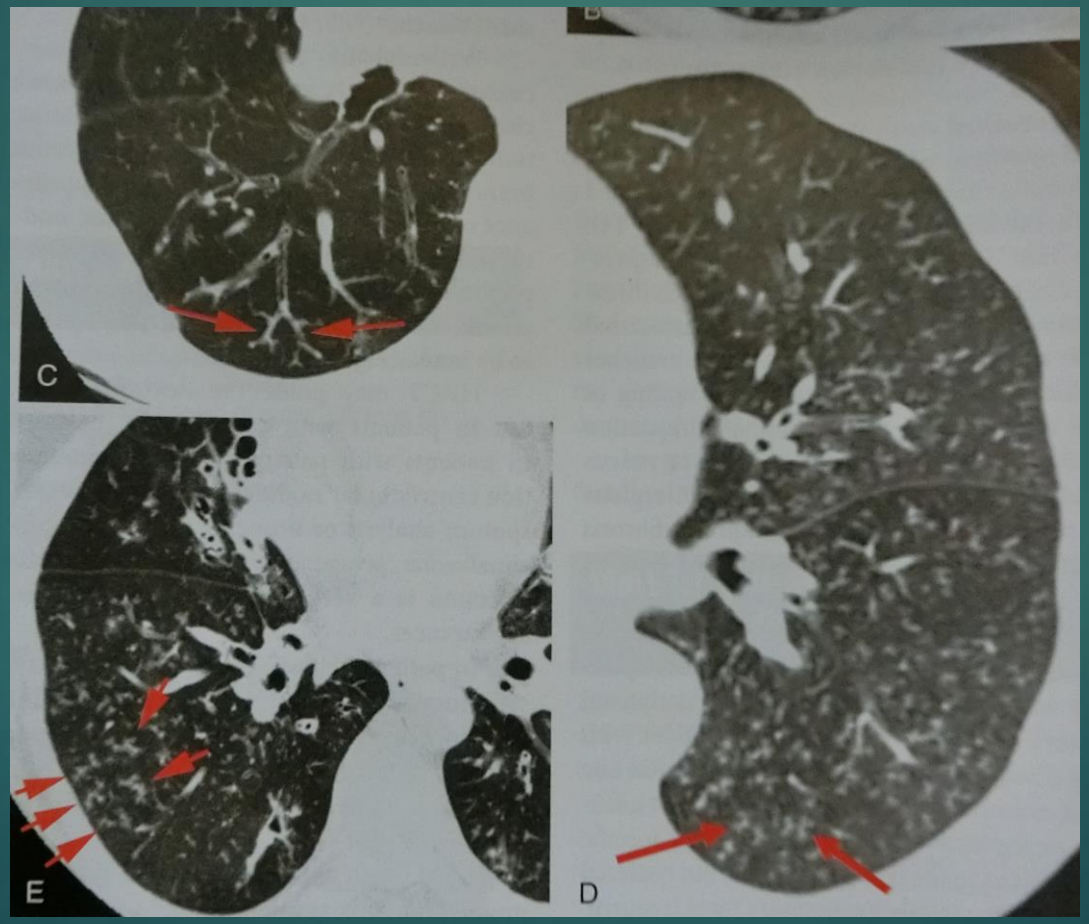
DPB



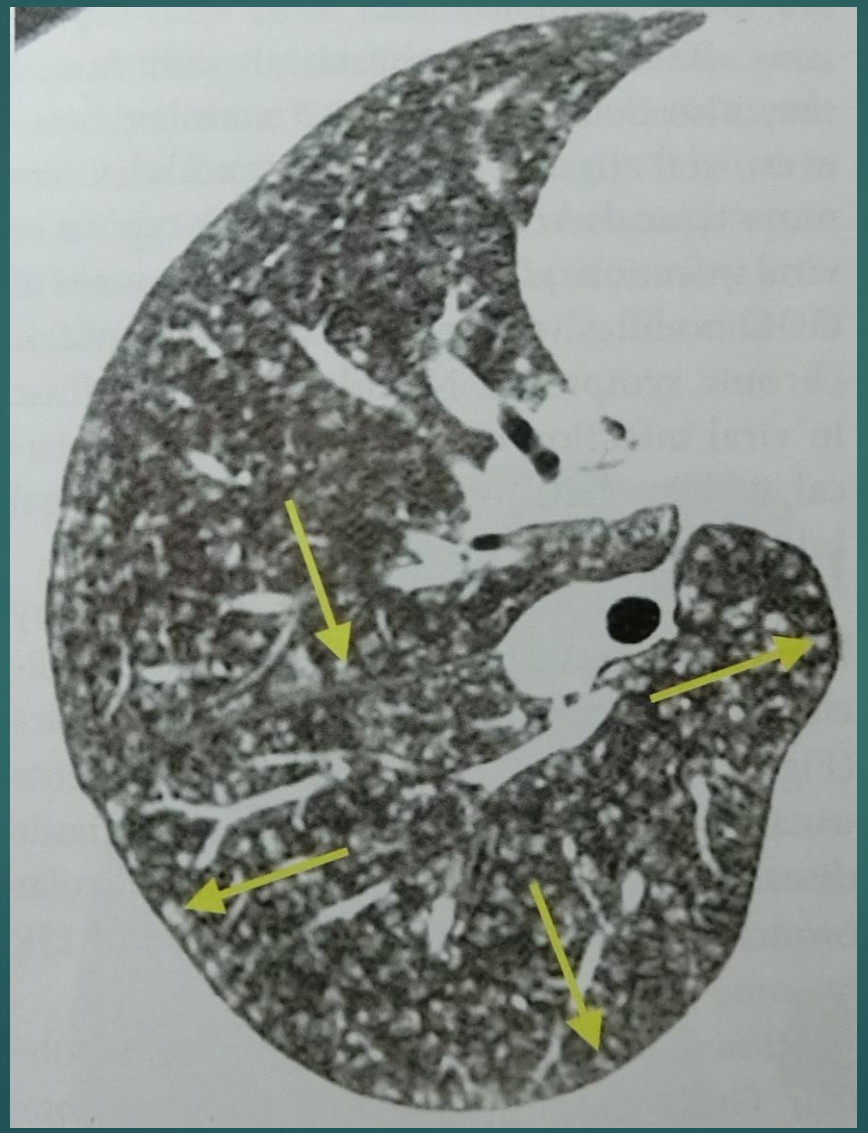
DPB



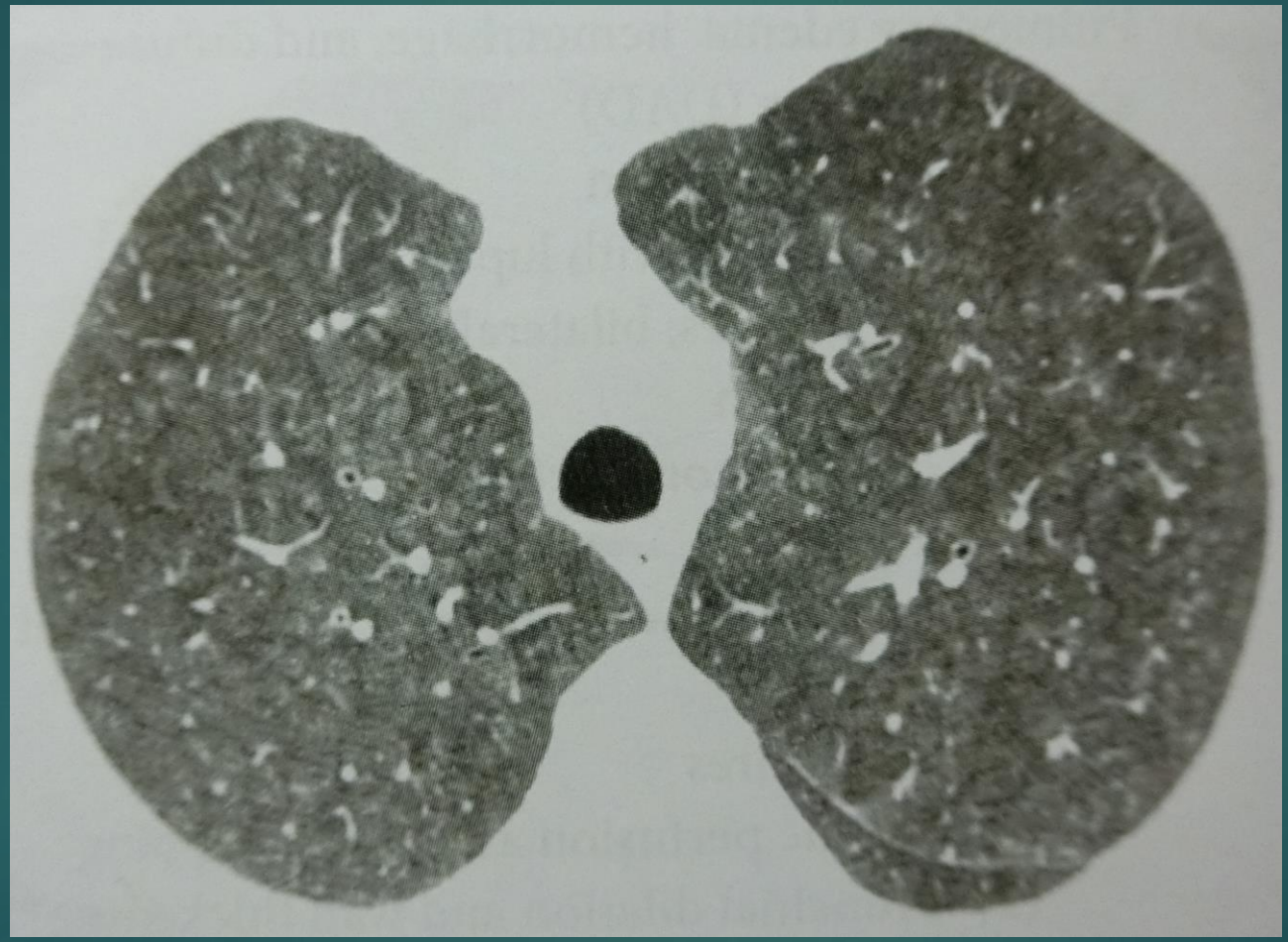
C : TIB in Chronic Airway Infection
D : TIB in Aspiration
E : TIB in Bronchiectasis



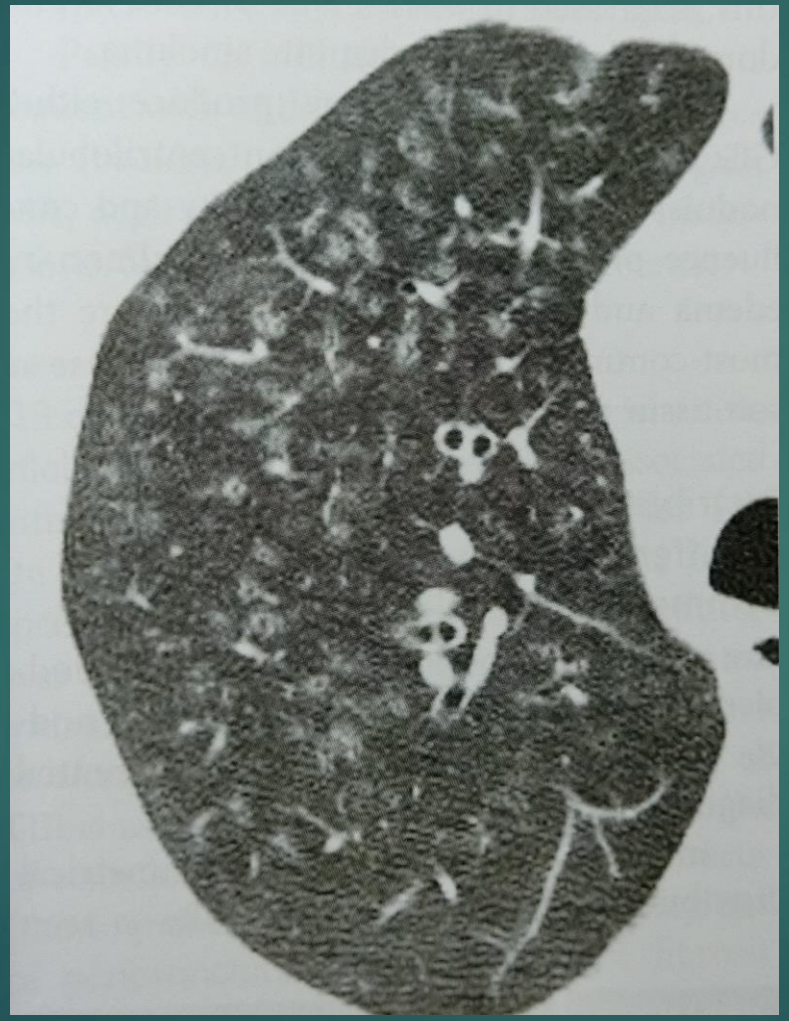
Subacute HP



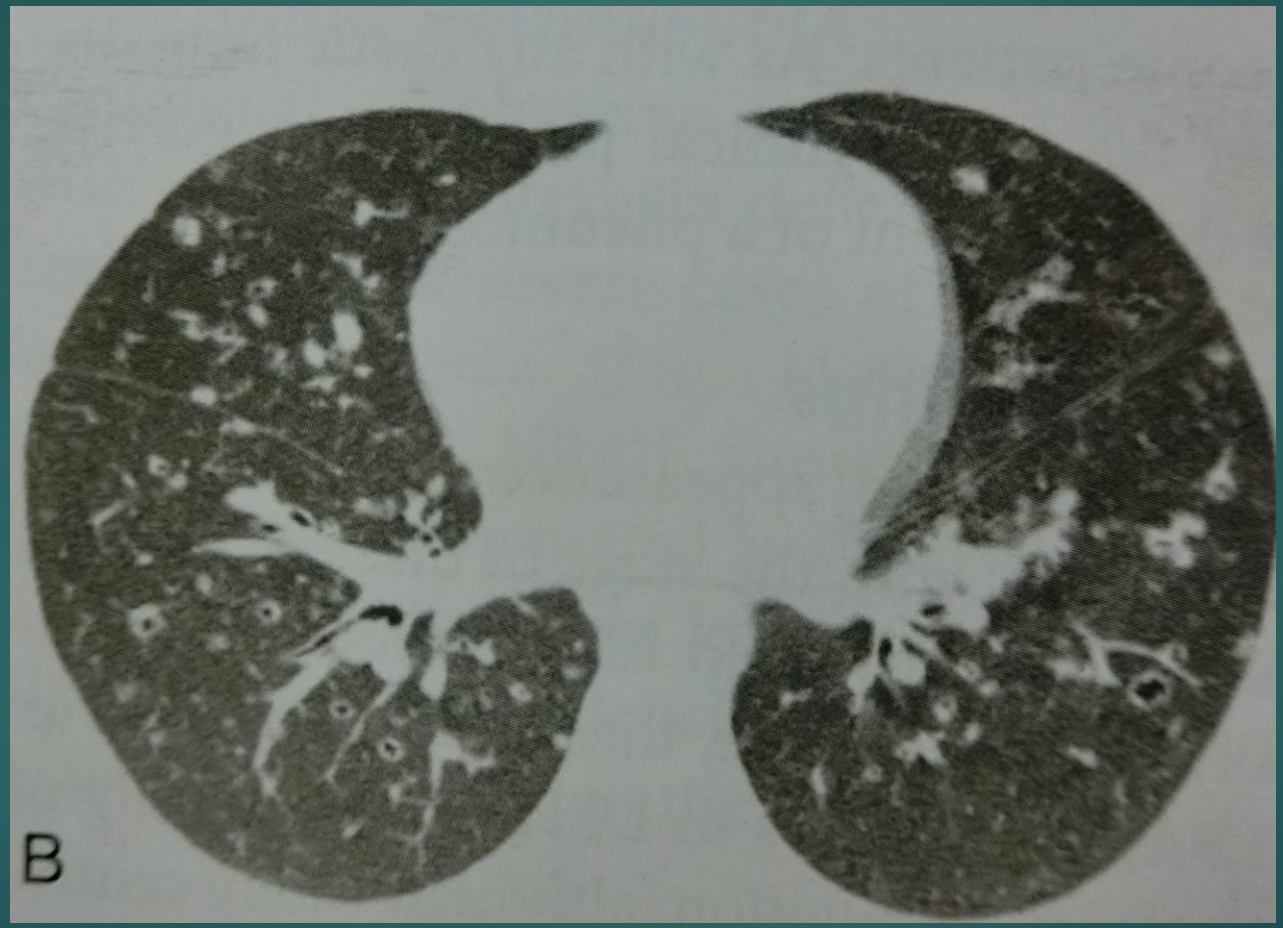
RB-ILD

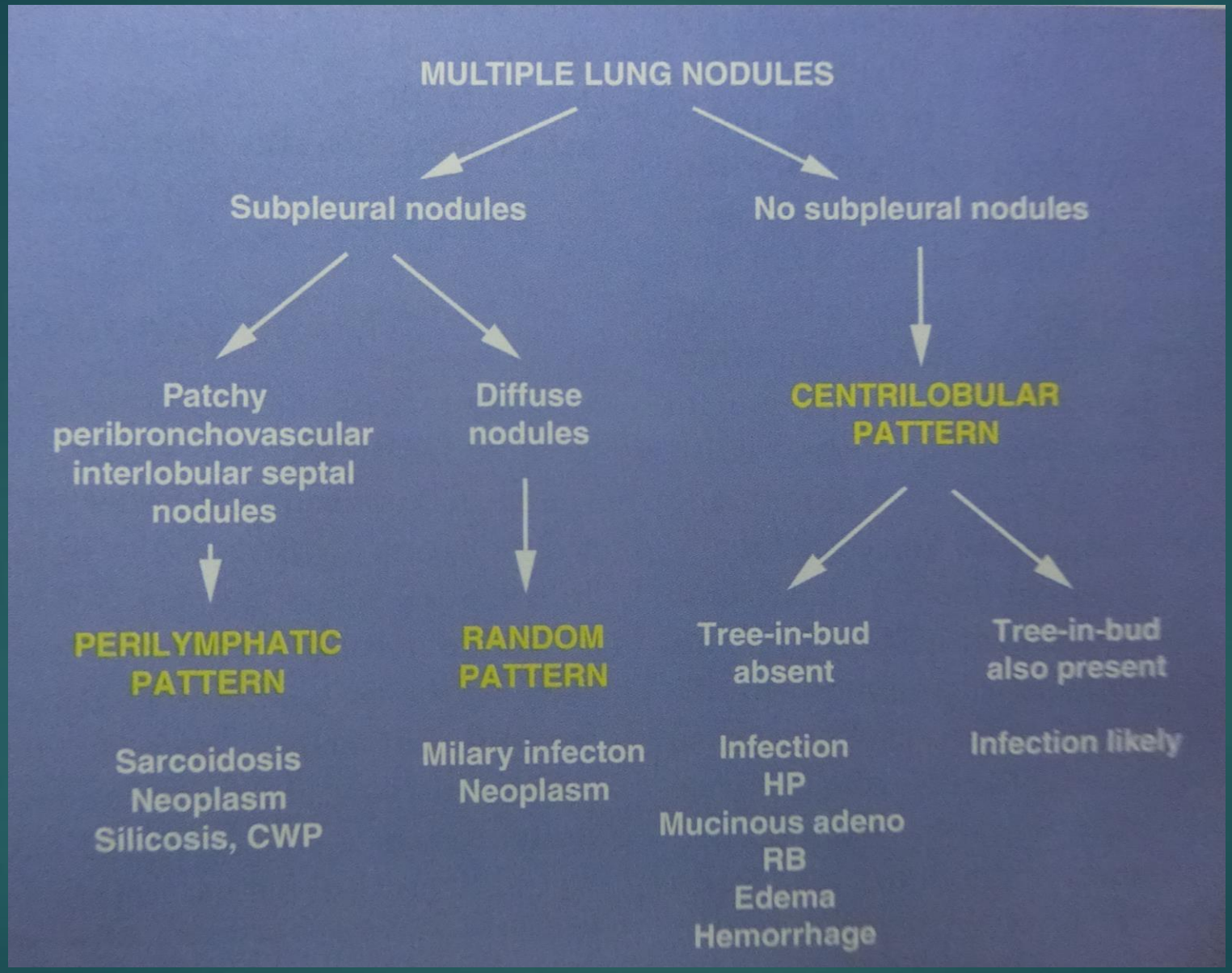


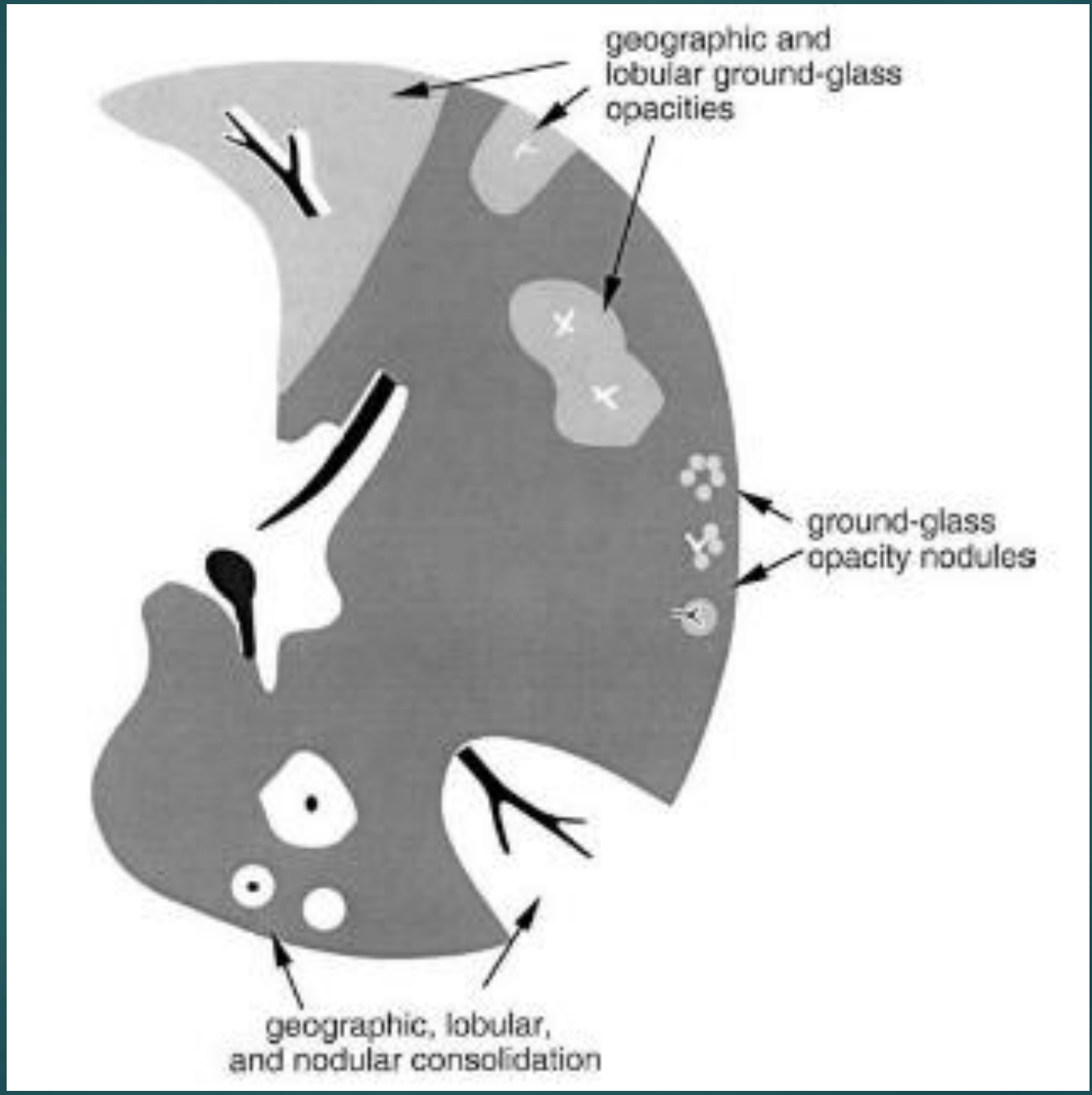
Follicular Bronchiolitis



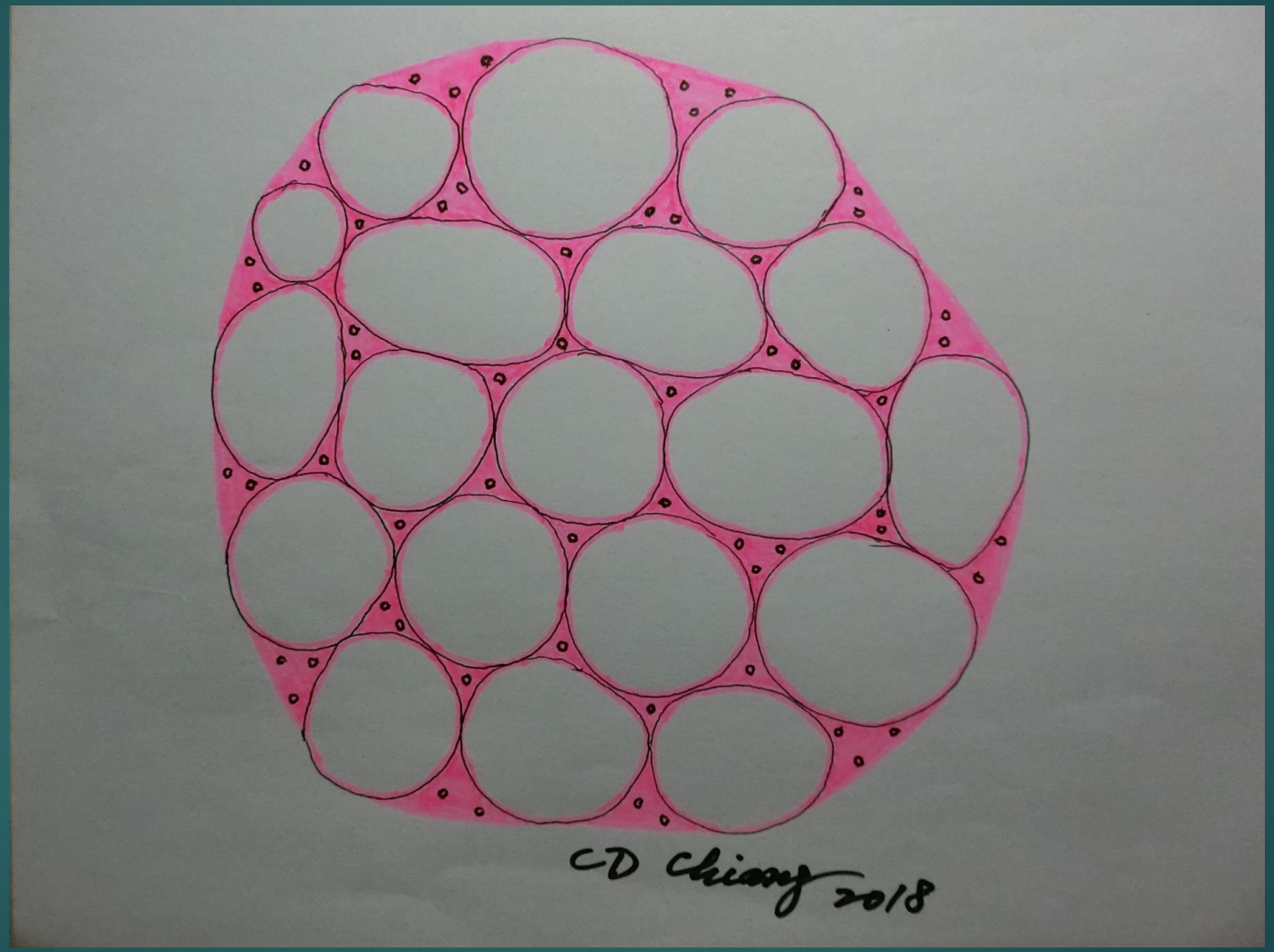
PLCH



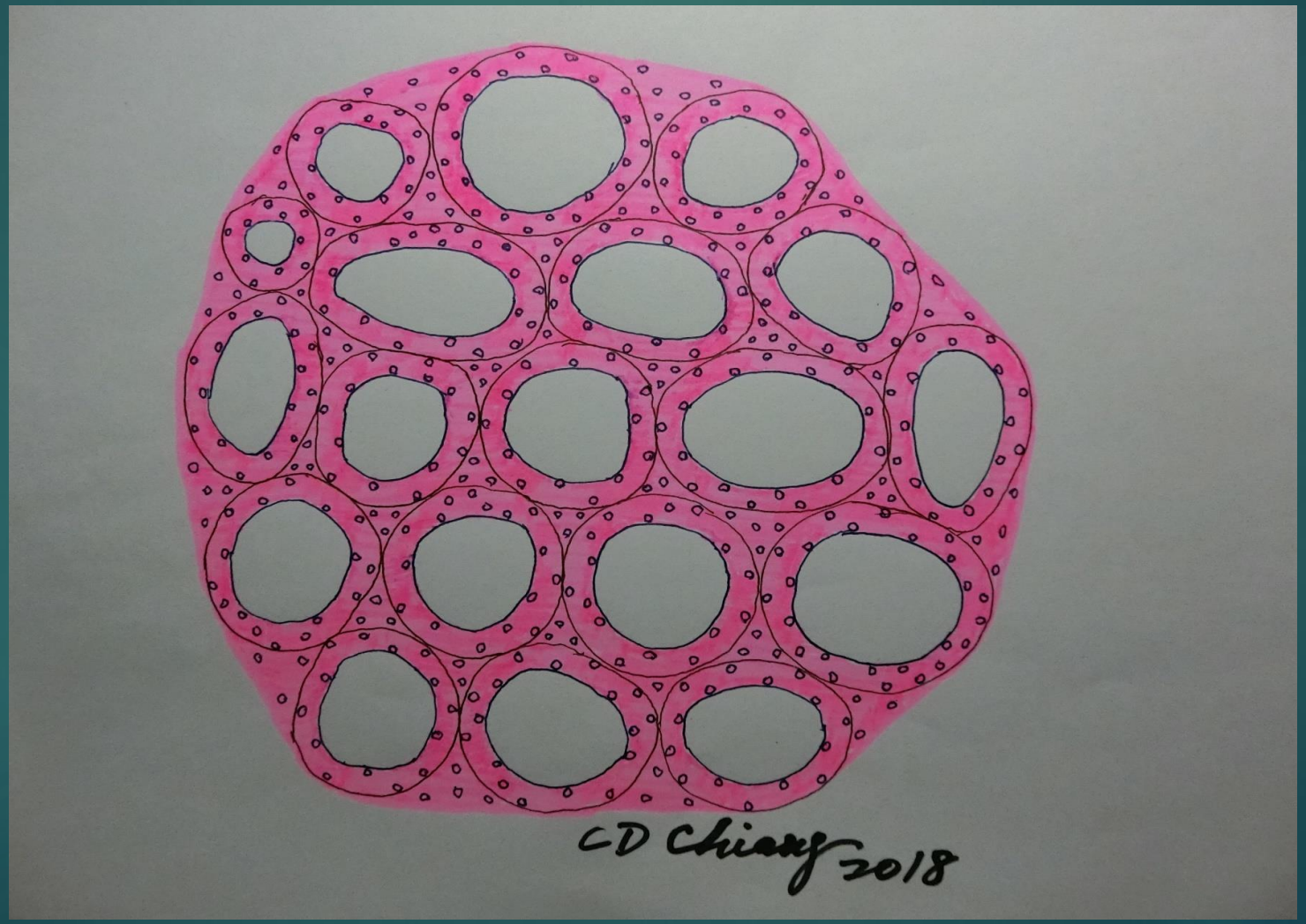

MULTIPLE LUNG NODULES
Subpleural nodules
No subpleural nodules
Patchy peribronchovascular interlobular septal nodules
Diffuse nodules
CENTRILOBULAR PATTERN
PERILYMPHATIC PATTERN
RANDOM PATTERN
Tree-in-bud absent
Tree-in-bud also present
Sarcoidosis
Neoplasm
Silicosis, CWP
Milary infecton
Neoplasm
Infection
HP
Mucinous adeno
RB
Edema
Hemorrhage
Infection likely


geographic and
lobular ground-glass
opacities
ground-glass
opacity nodules
geographic, lobular,
and nodular consolidation

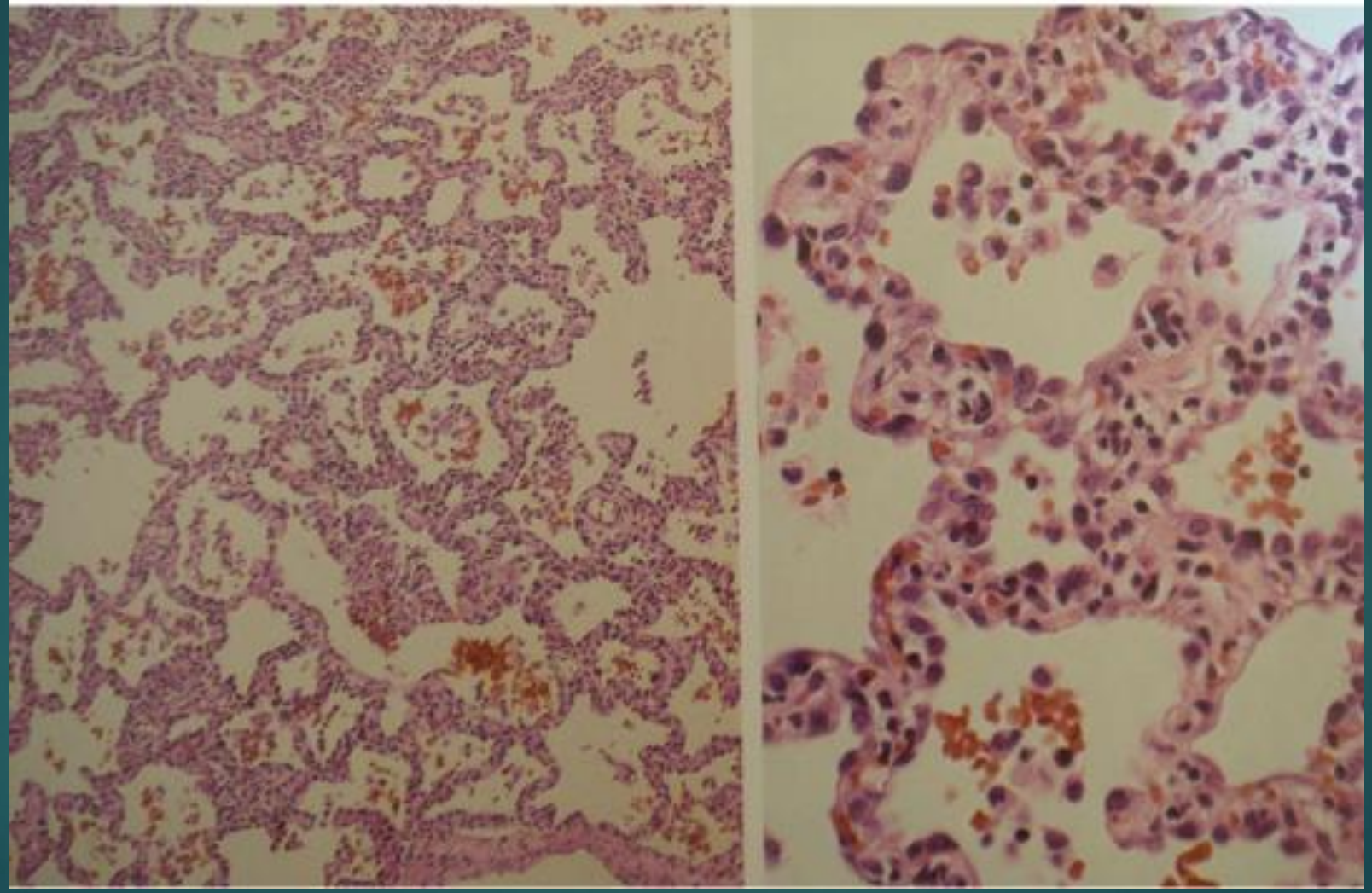
NORMAL



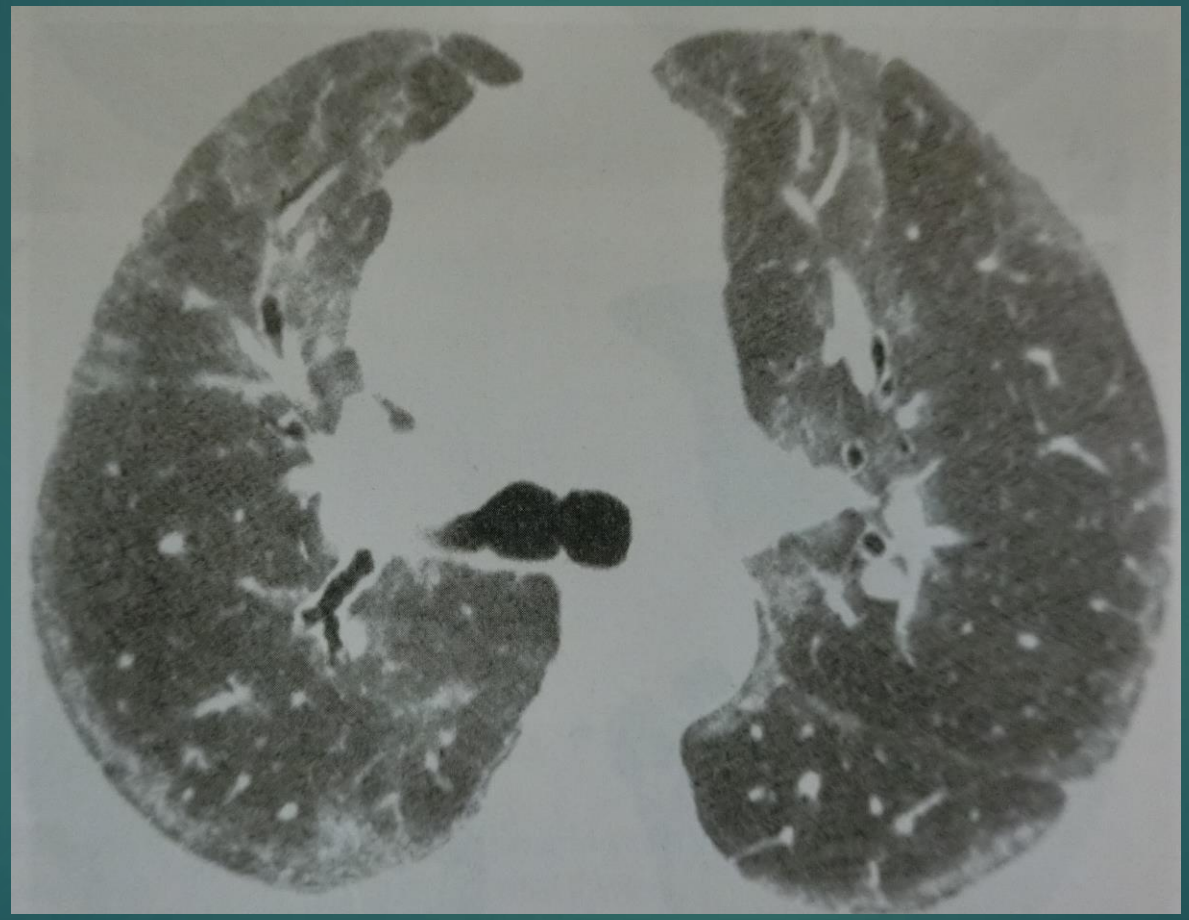
Diffuse Alveolar Septal Inflammation(even)



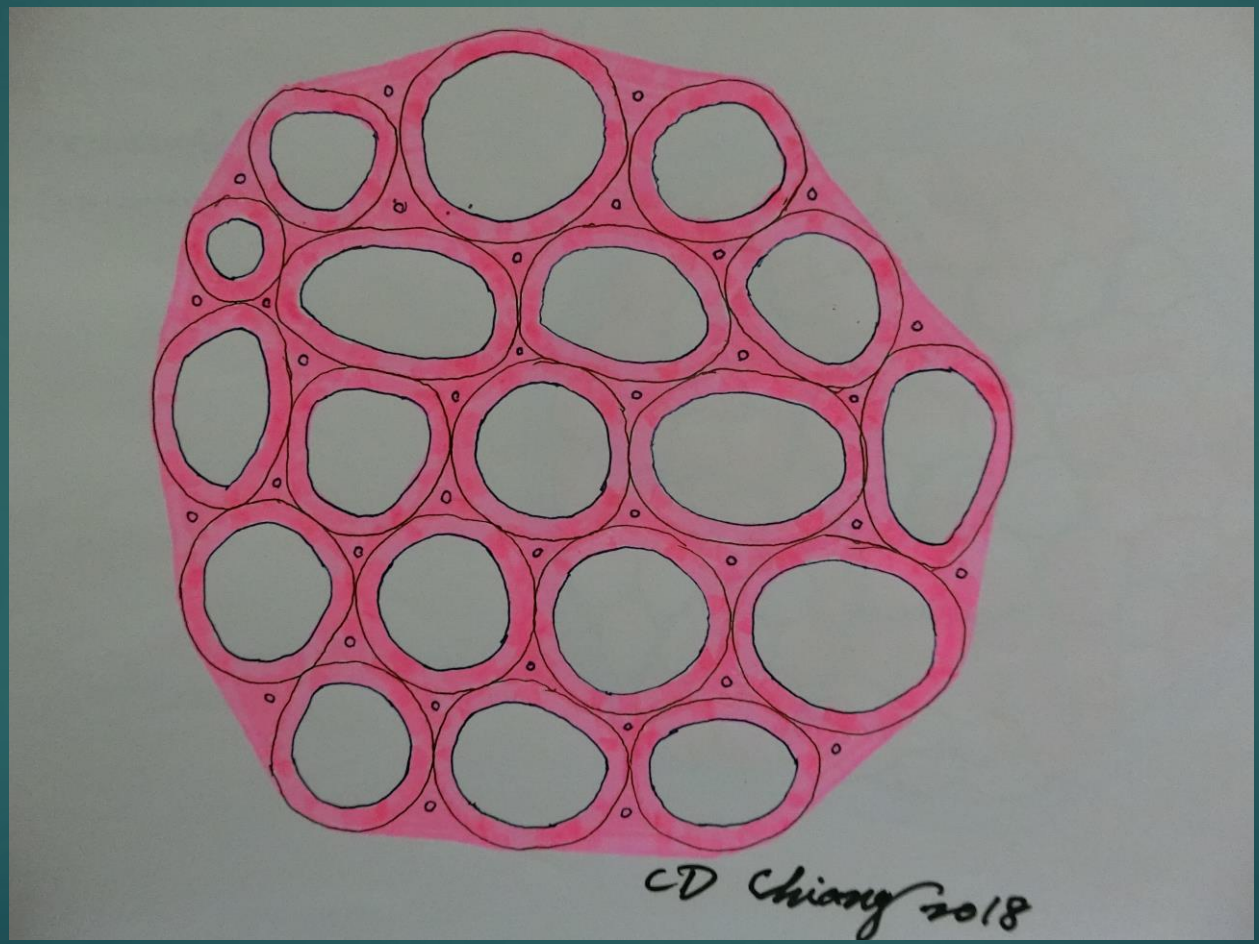
Cellular NSIP



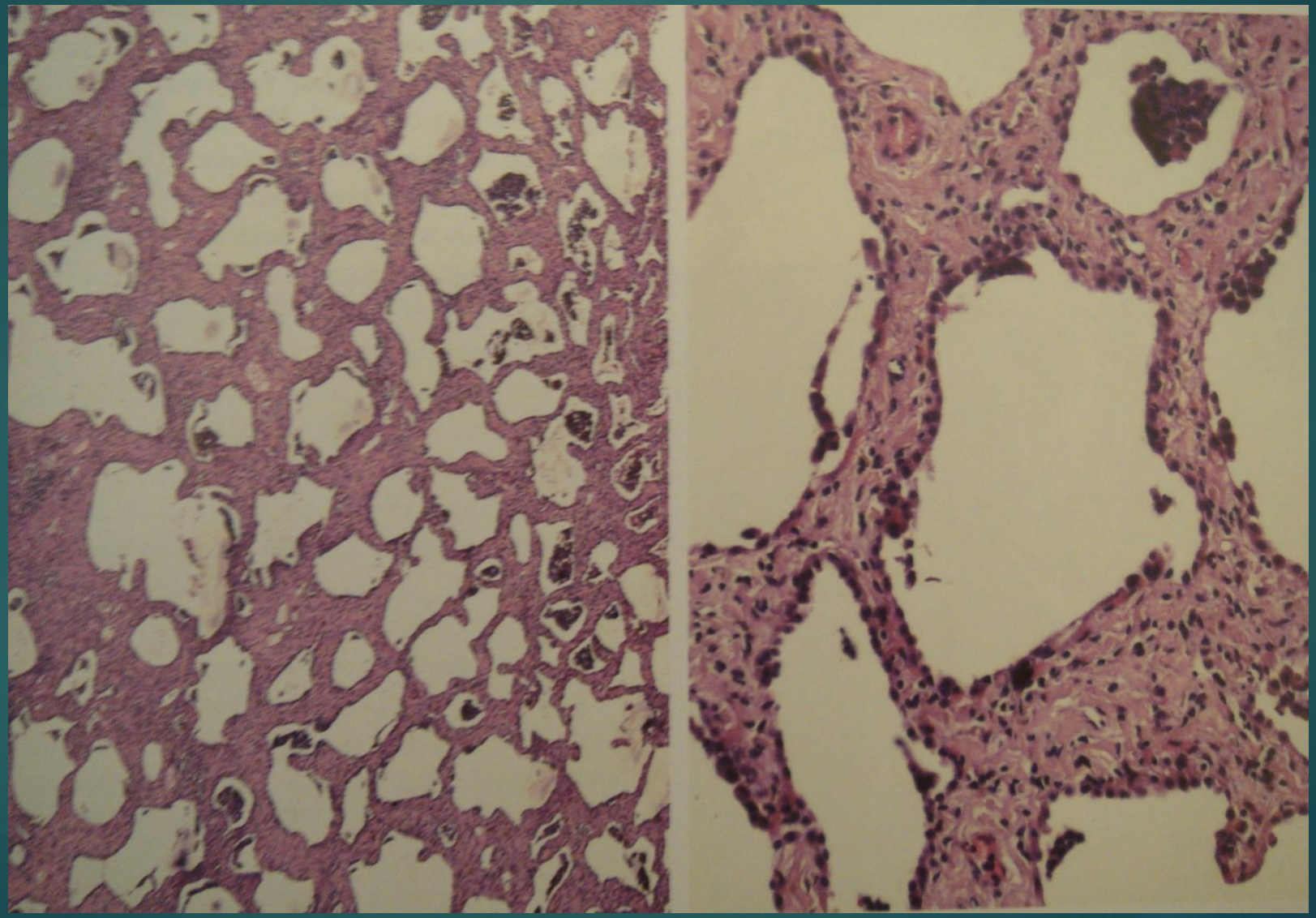
Cellular NSIP



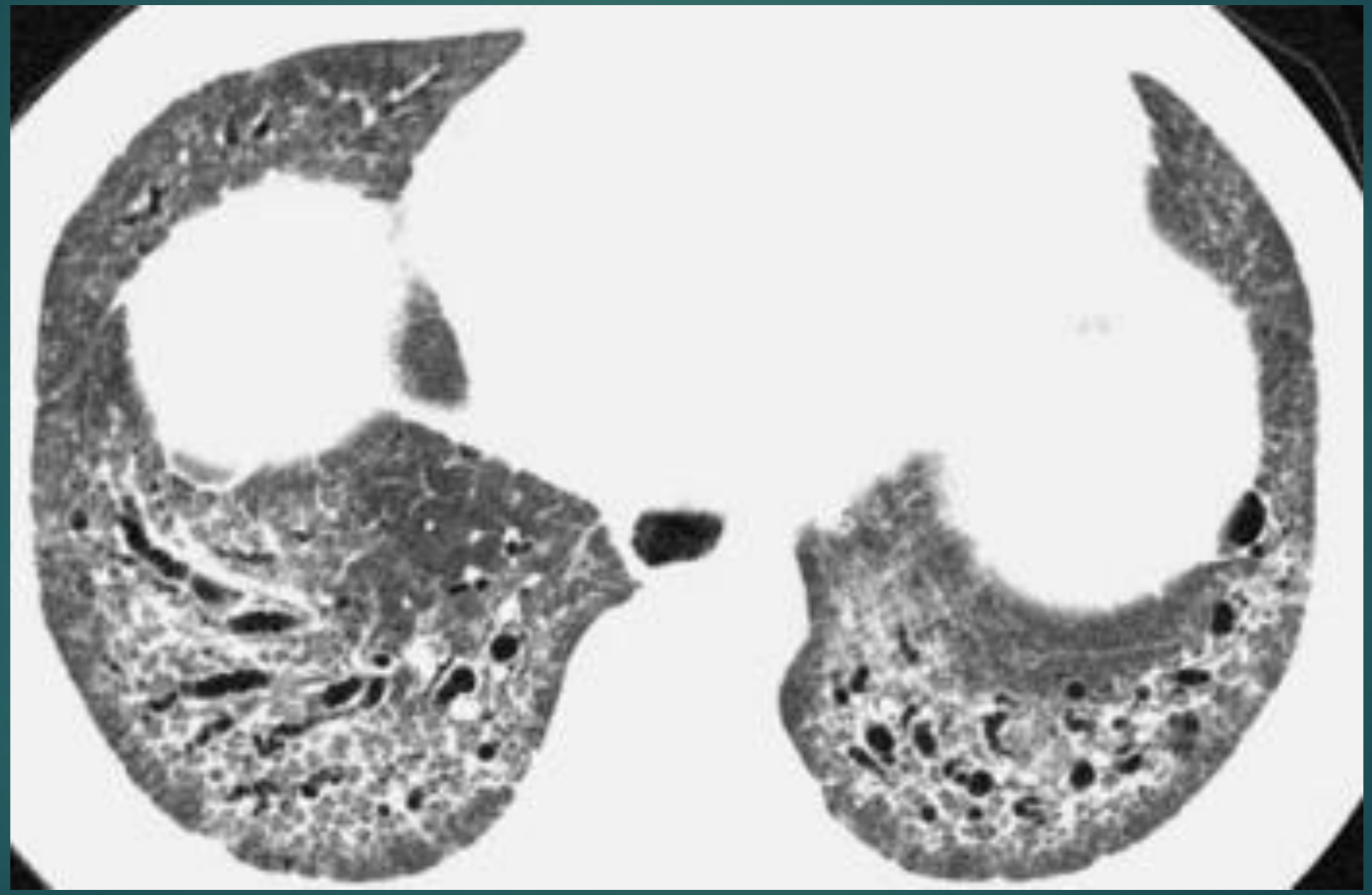
Diffuse Alveolar Septal Fibrosis (even)



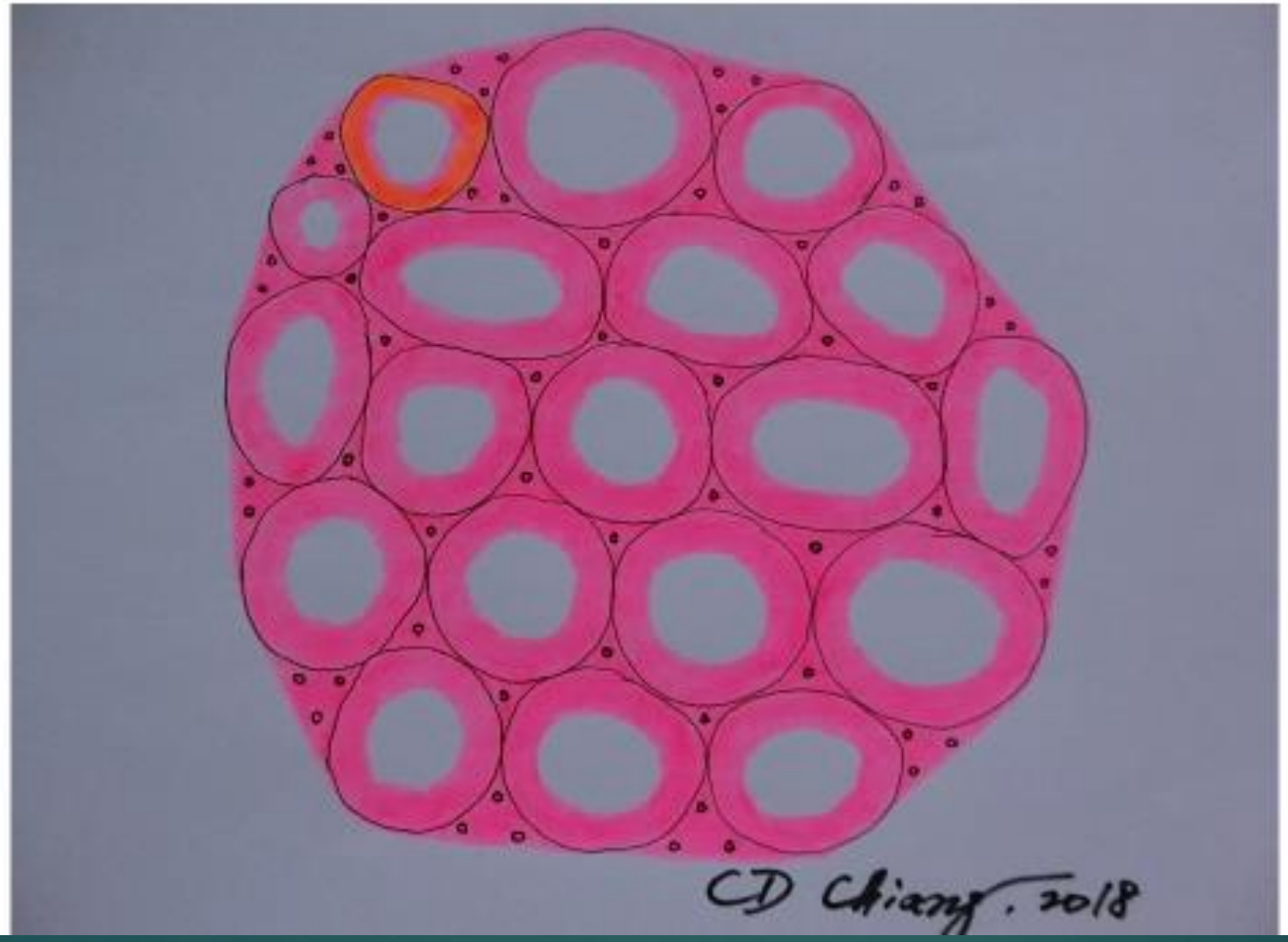
Fibrotic NSIP



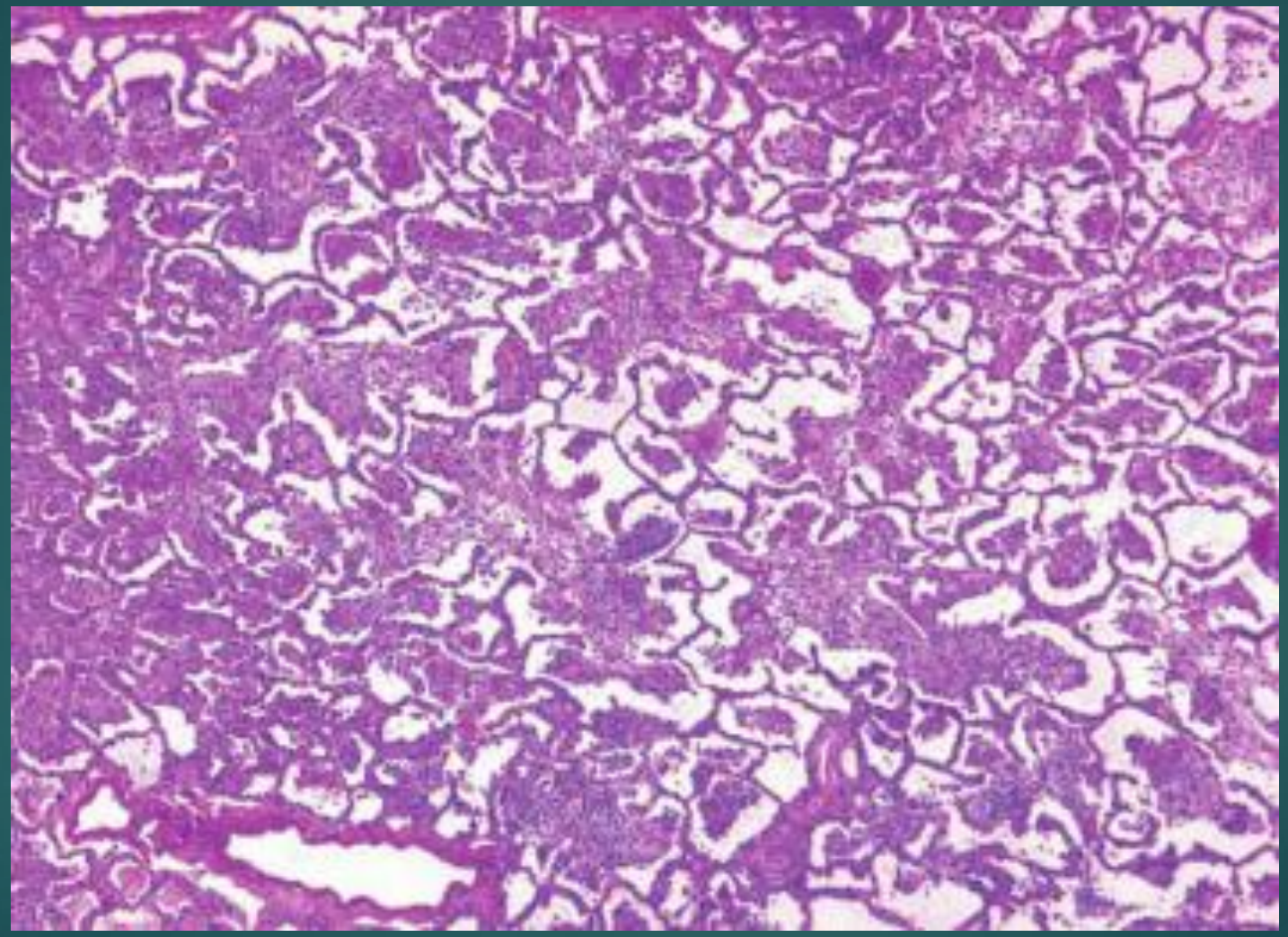
Fibrotic NSIP



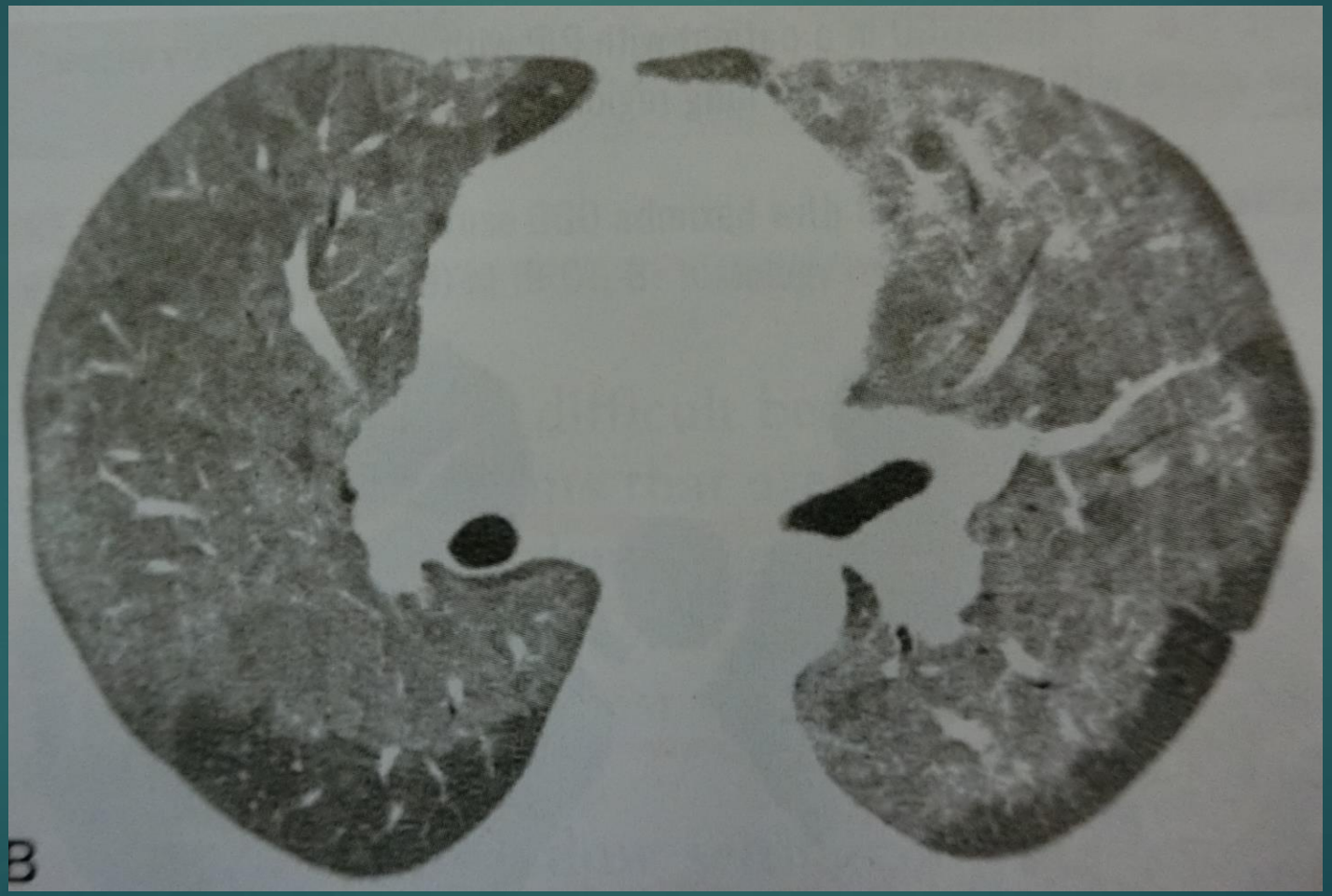
Partial Filling of the Alveolar Spaces



PJP



PJP



AIP

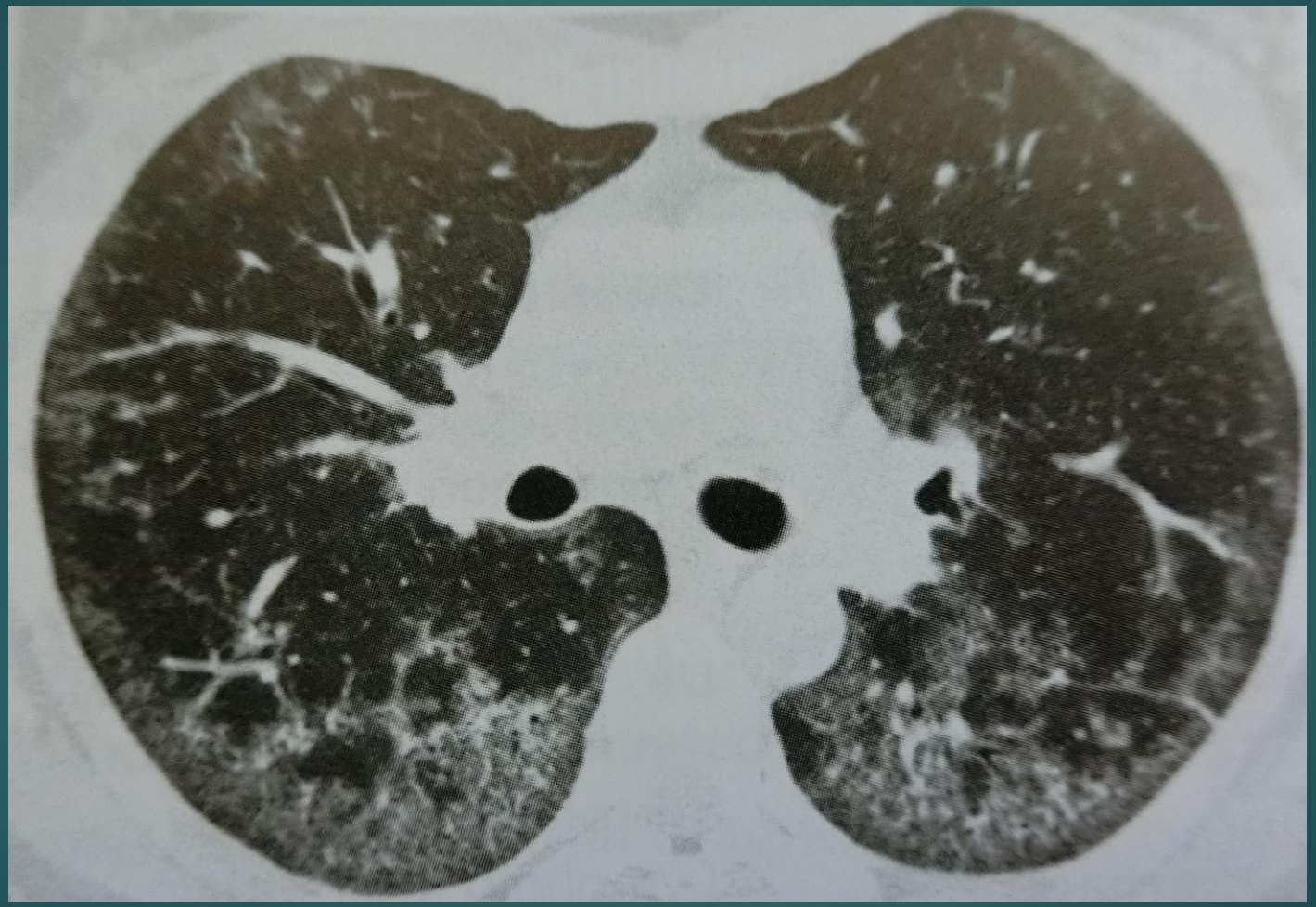
D.D of GGO (1)

Acute	Subacute / Chronic
DAD (AIP, ARDS)	NSIP
Acute HP	HP
AEP	DIP / RB-ILD
Aspiration	LIP
Edema	OP
Hemorrhage	EP
	Sarcoidosis
	PAP
	BAC

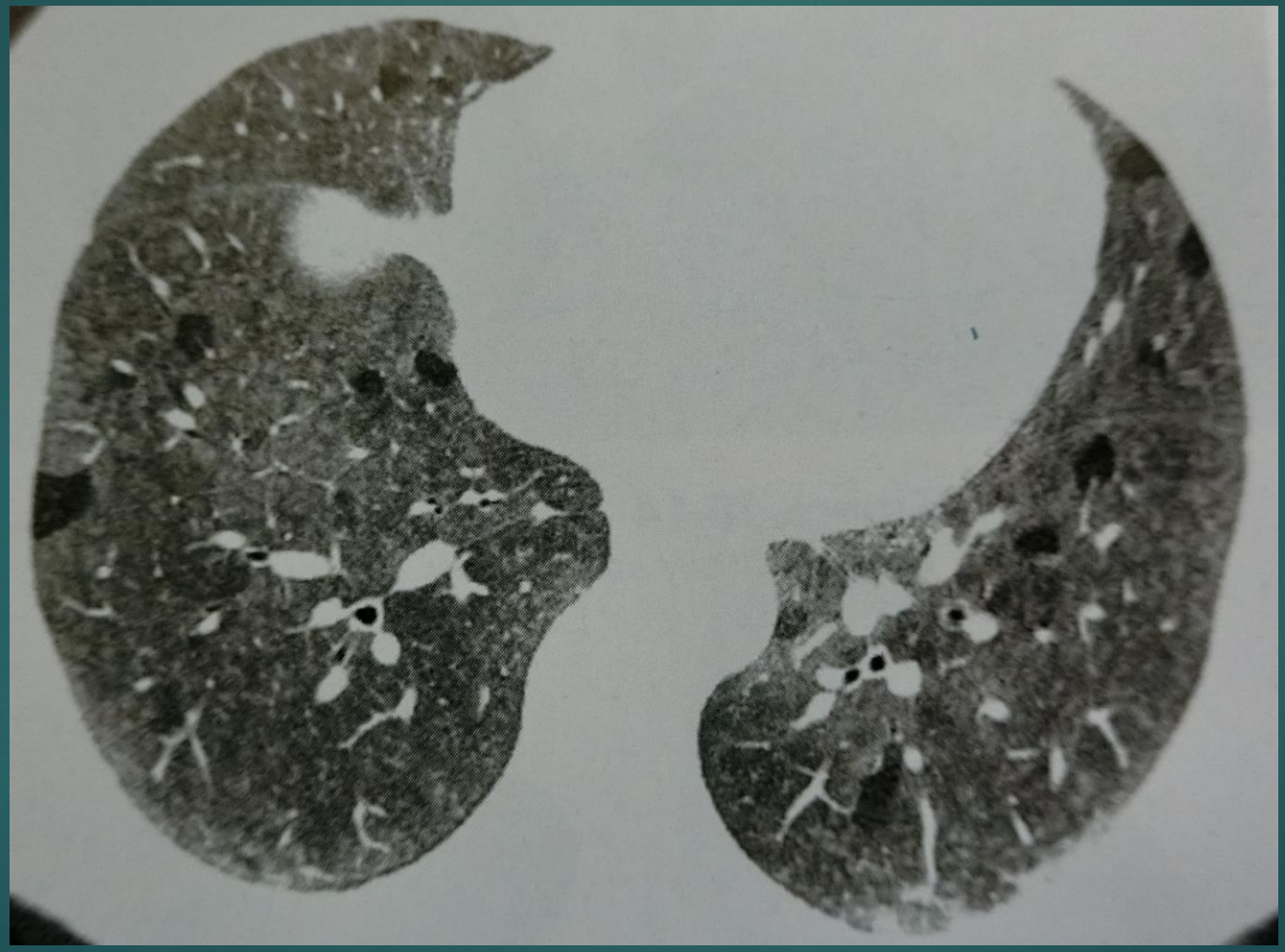
D.D of GGO (2) (subacute/chronic)

Associated HRCT finding	Likely Diagnosis
Fibrosis	NSIP, HP, UIP
Peripheral distribution	NSIP, DIP
Subpleural sparing	NSIP
Patchy / geographic distribution	HP, NSIP, OP
Mosaic perfusion and/or air trapping	HP
Centrilobular nodules	HP, RB-ILD, DIP
	FB, LIP, BAC
ILS thickening	PAP,BAC

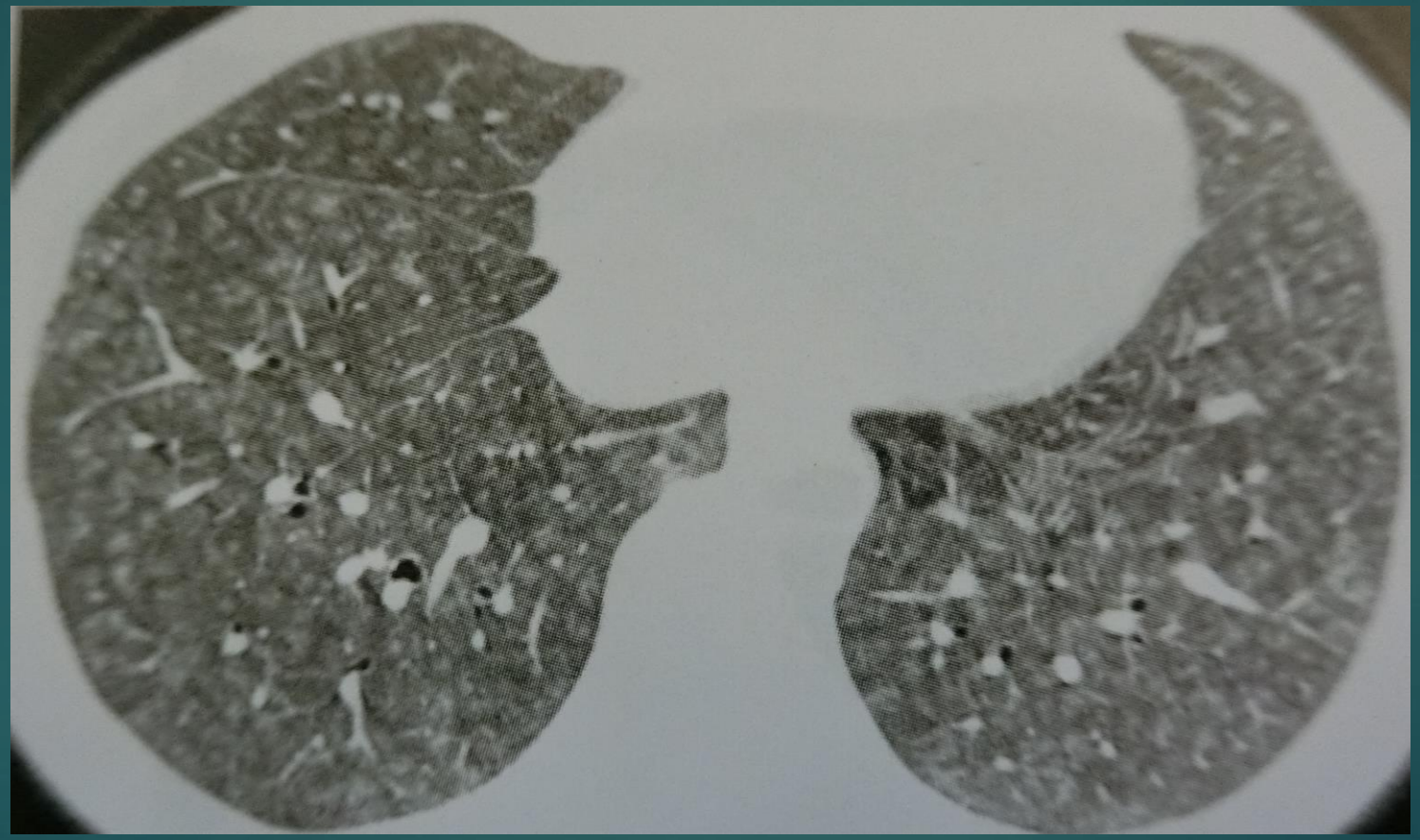
Cellular NSIP with Subpleural Sparing



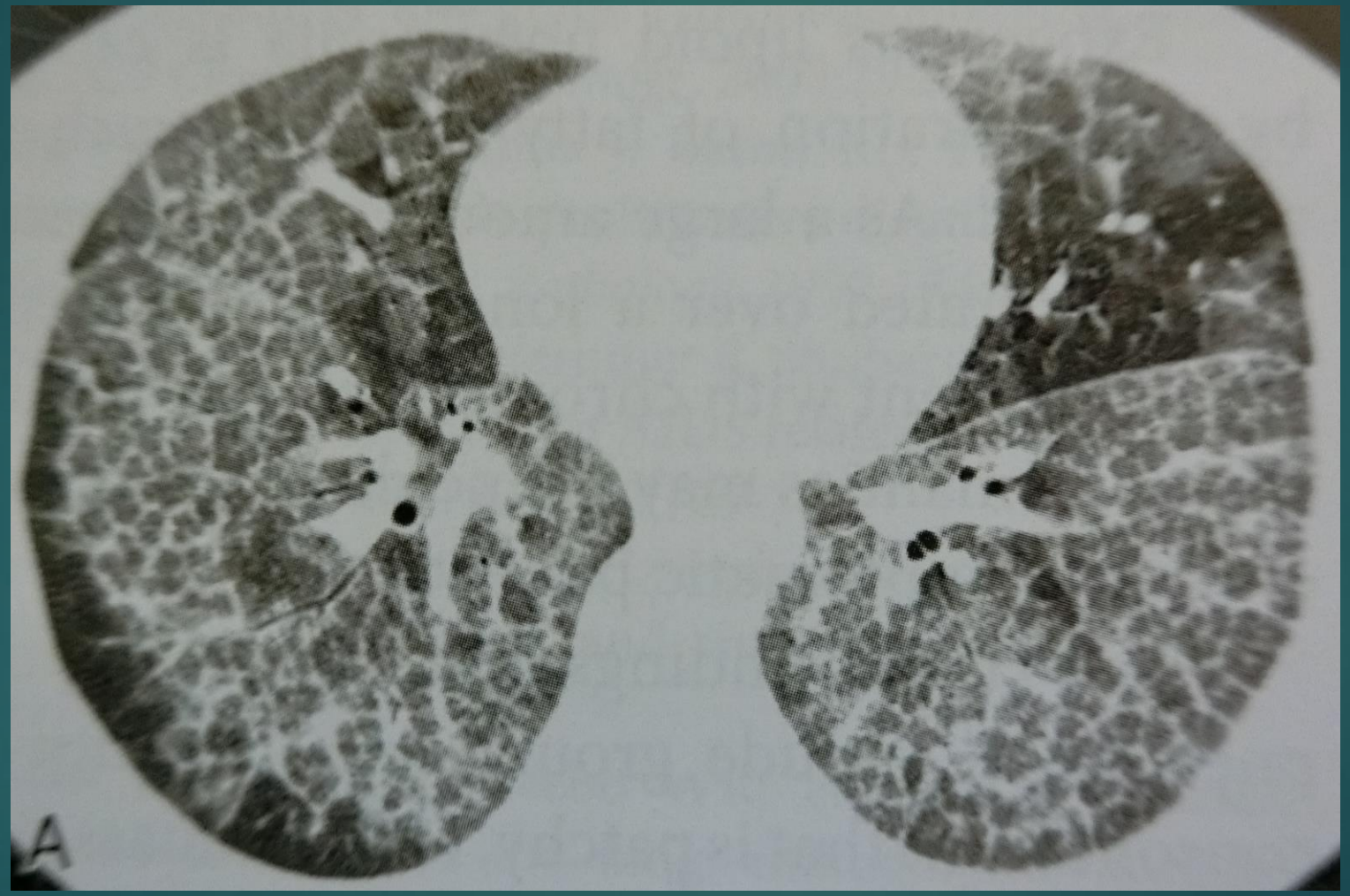
Subacute HP with Mosaic Perfusion



Subacute HP with Centrilobular Nodules



PAP



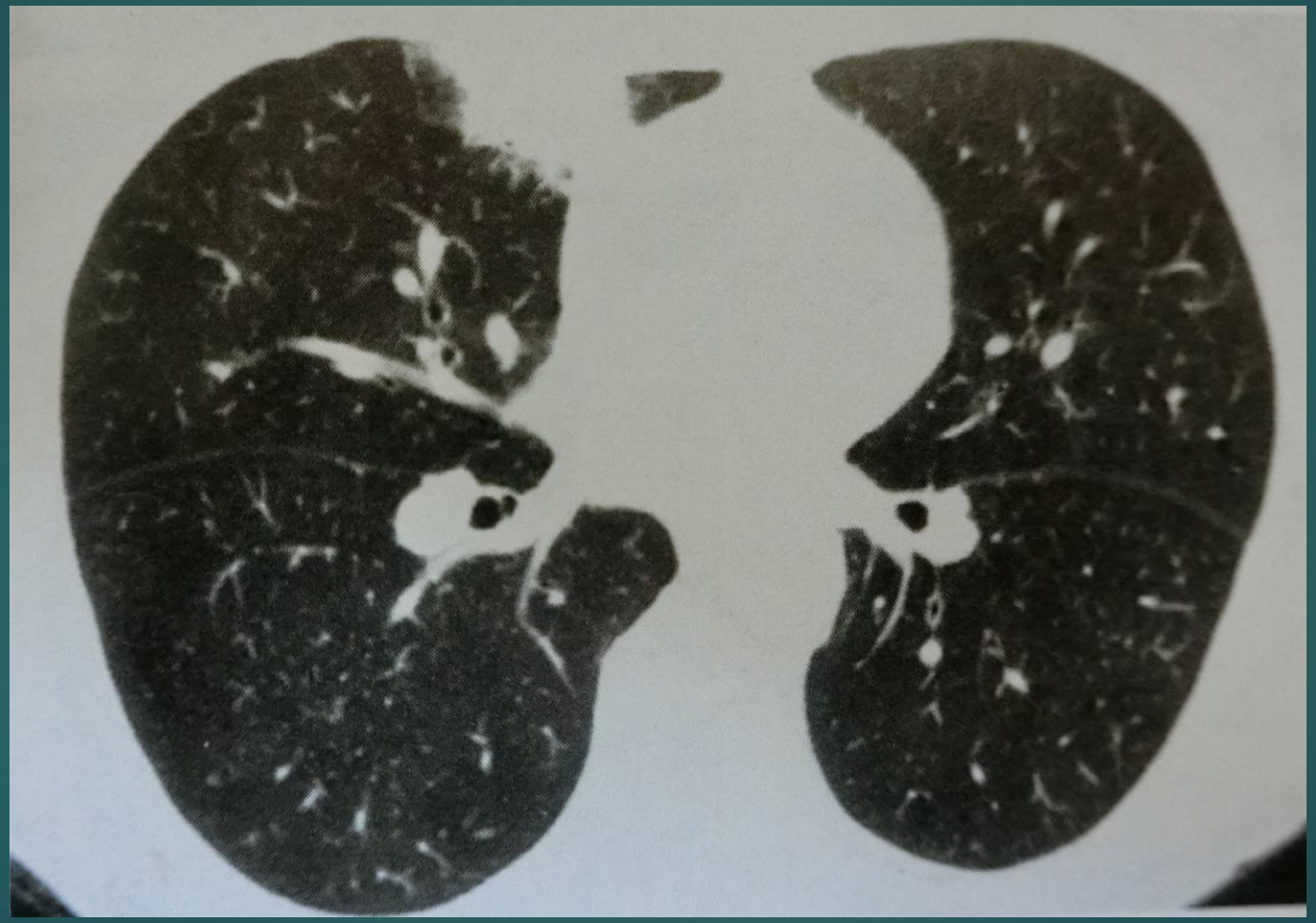
D.D of Consolidation (1)

Acute	Subacute / Chronic
AHP	HP
AEP	OP
DAD	EP
Aspiration	Sarcoidosis
Infection	Lymphoma
Edema	BAC
Hemorrhage	

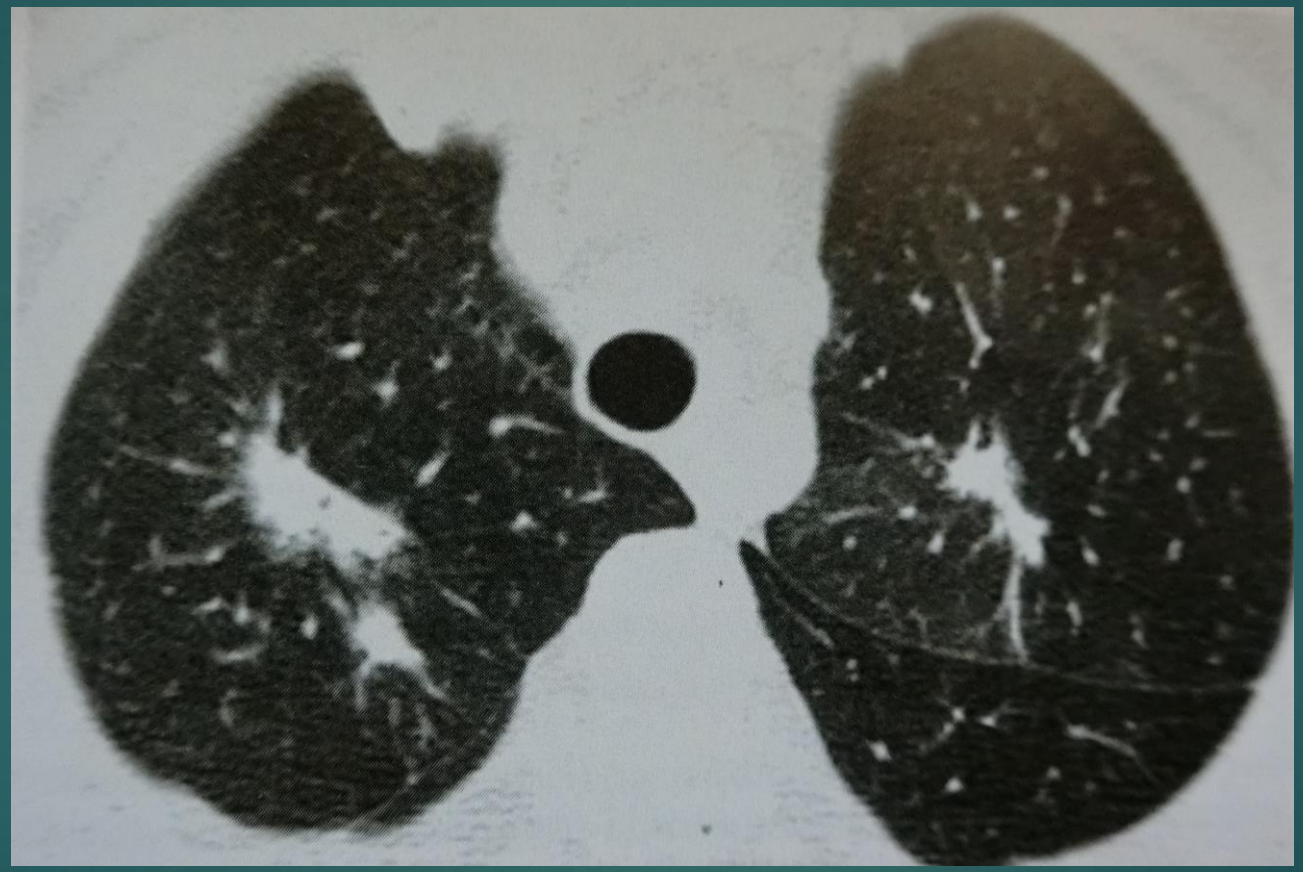
D.D of Consolidation (2) (subacute/chronic)

Distribution	Likely Diagnosis
Patchy	Any
Single, focal Nodules/Masses	BAC, Lymphoma, OP
Diffuse	OP, BAC
Peribronchovacular	OP, Sarcoid
Peripheral	OP, CEP
Reversed halo sign	OP, Sarcoid, BAC, TB, Fungi, GPA

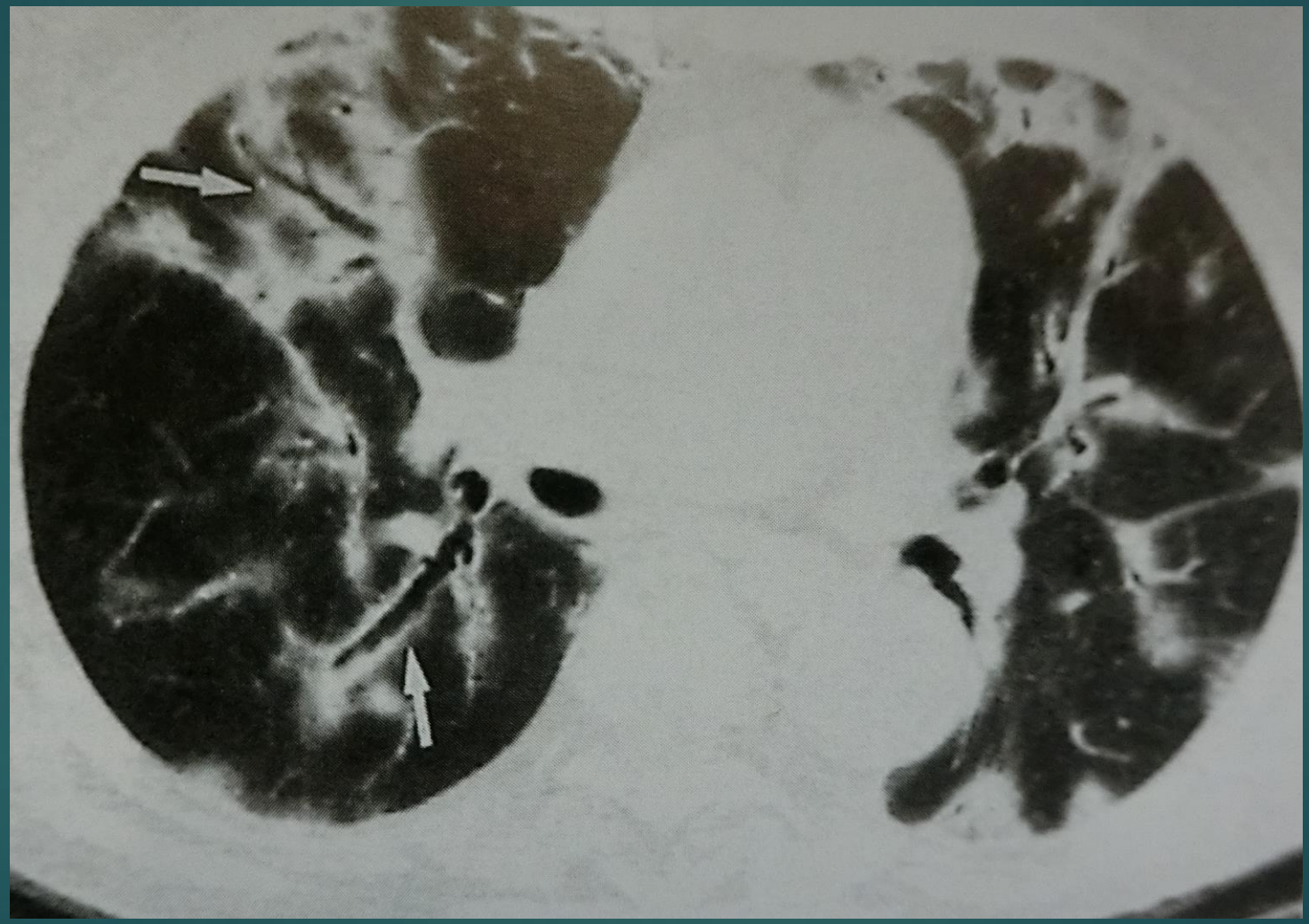
MALToma



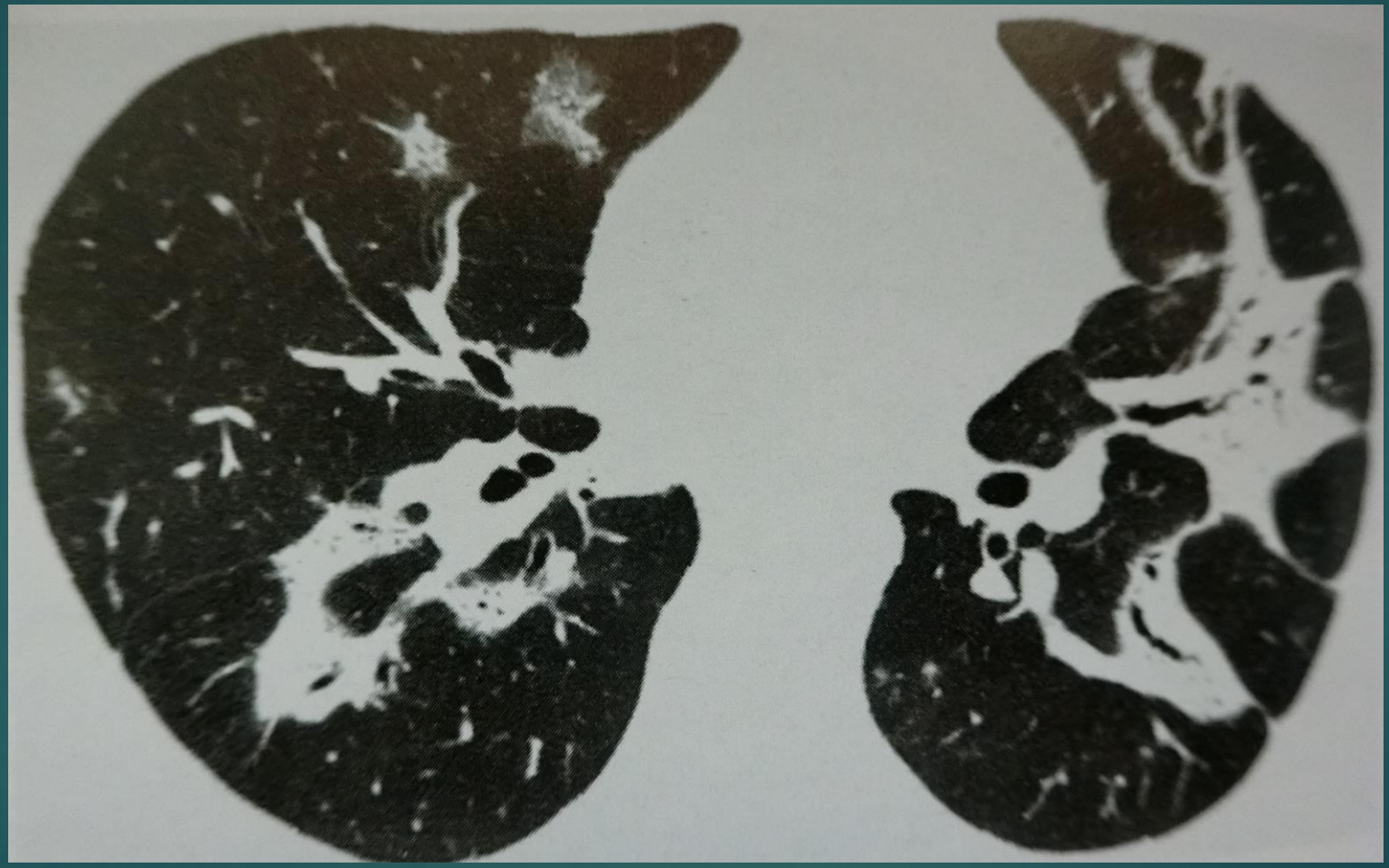
OP



COP



COP

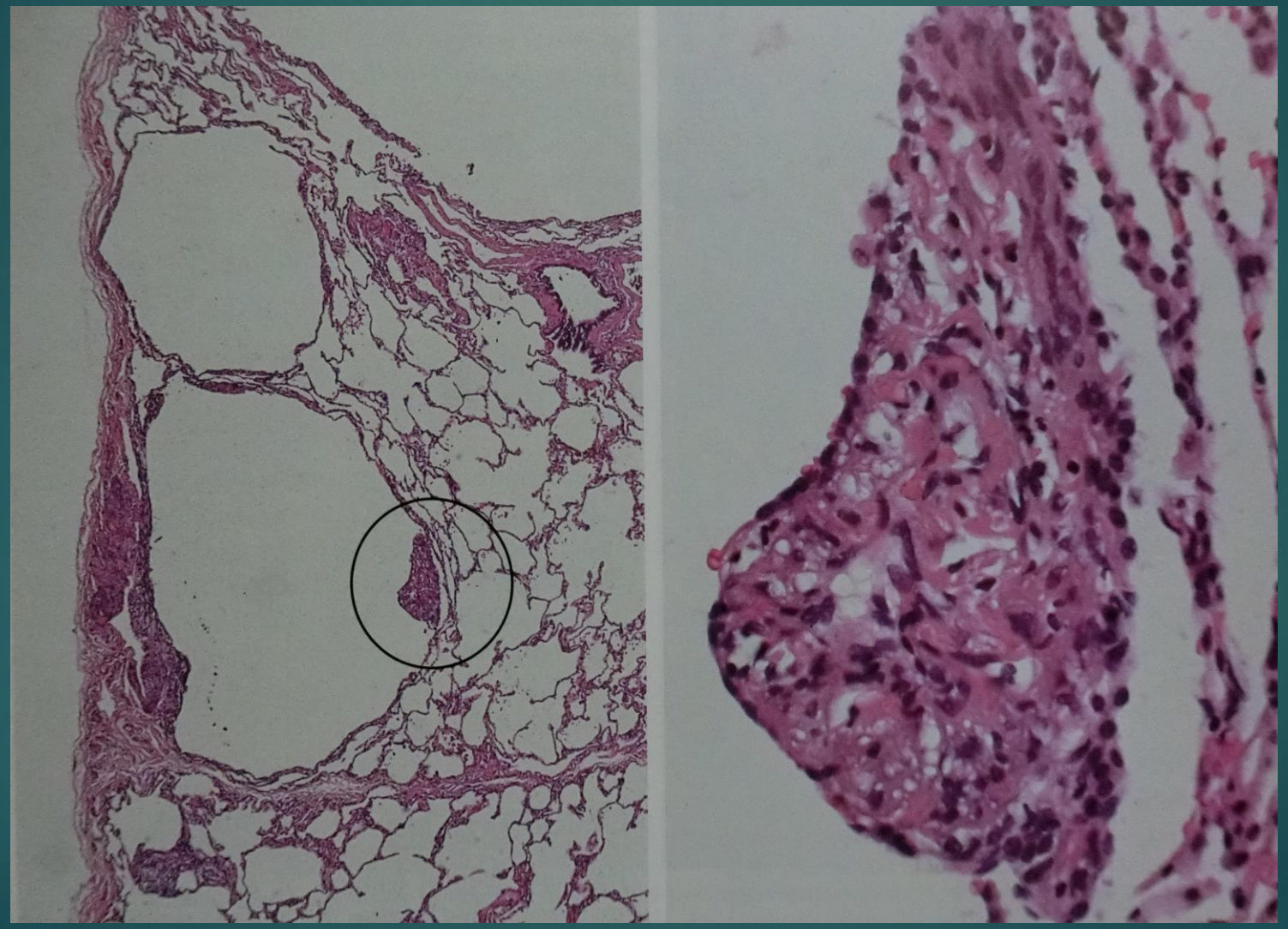


COP

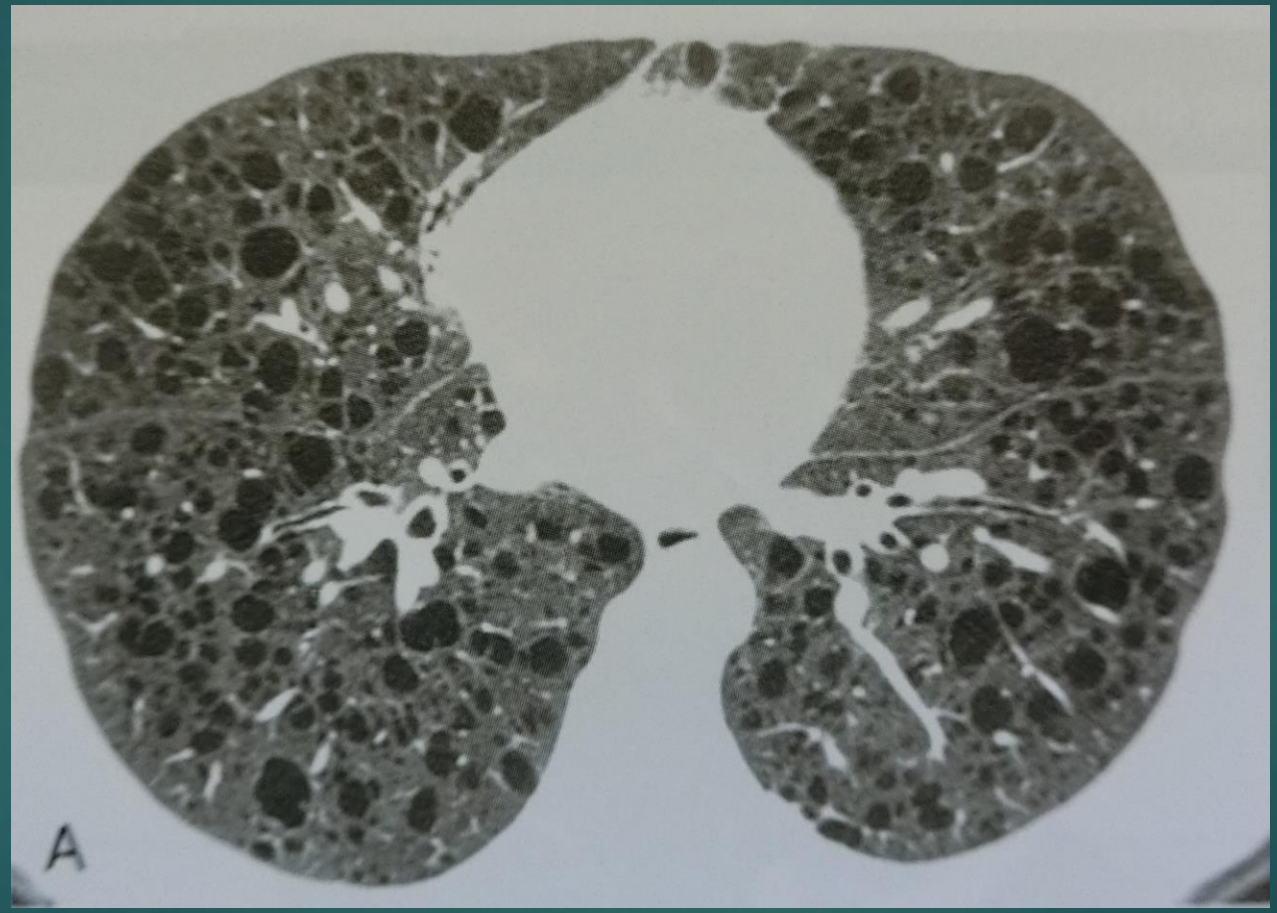
D.D of Multiple Cystic Lesions

- PLCH
- LIP
- LAM
- Amyloidosis / light-chain protein deposition
- Birt – Hogg – Dube syndrome
- Papillomatosis
- Pneumatocele
- Cystic metastasis
- Benign metastasizing leiomyoma

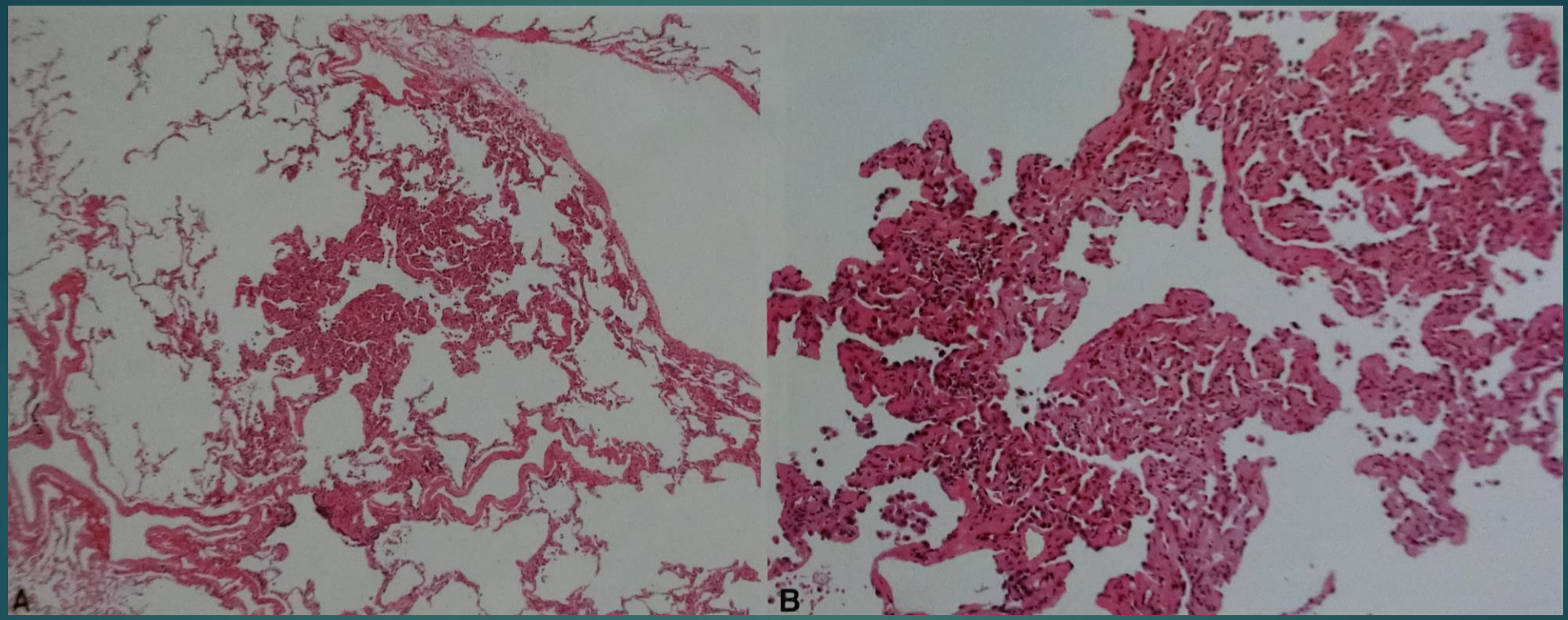
LAM



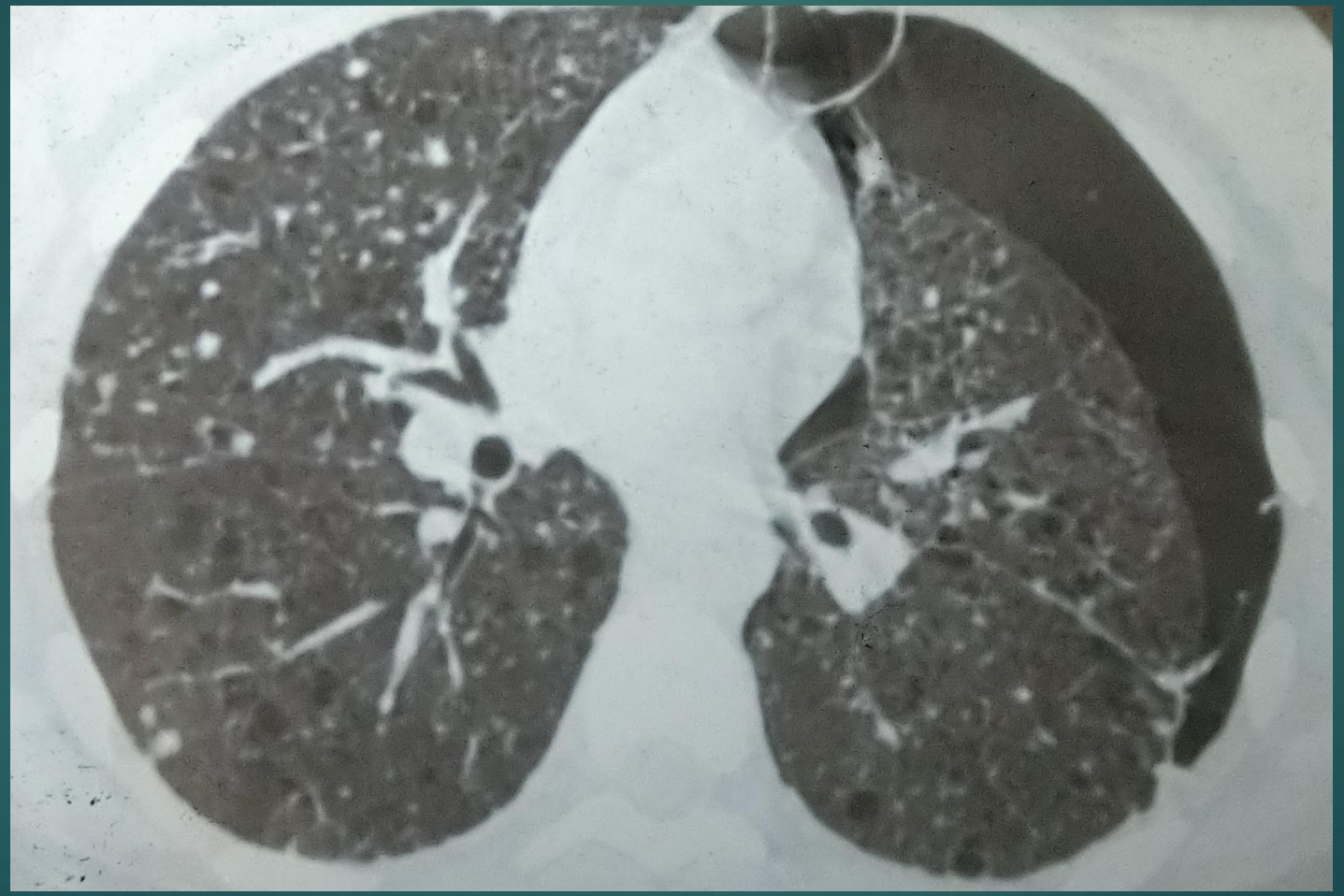
LAM



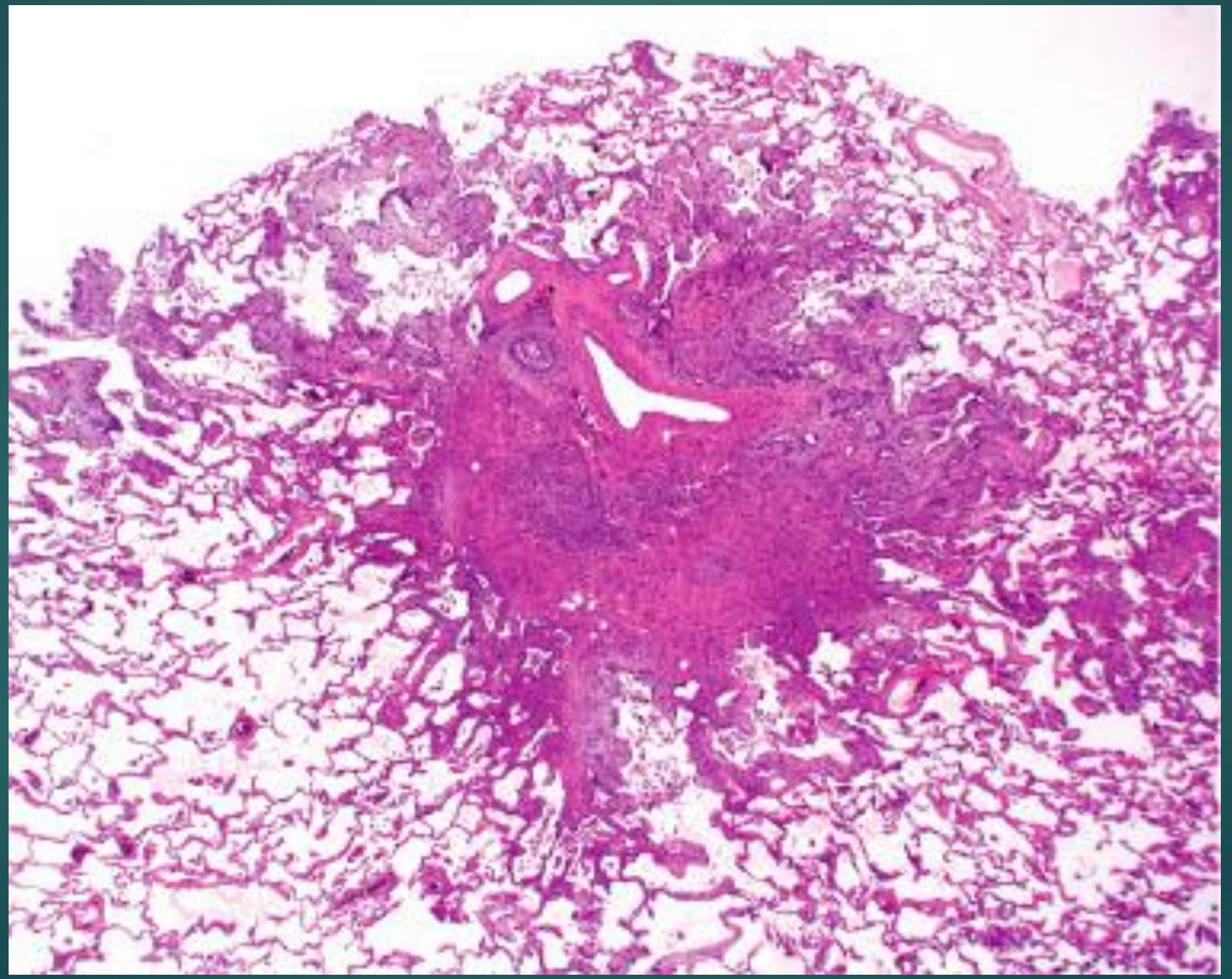
MMNPH



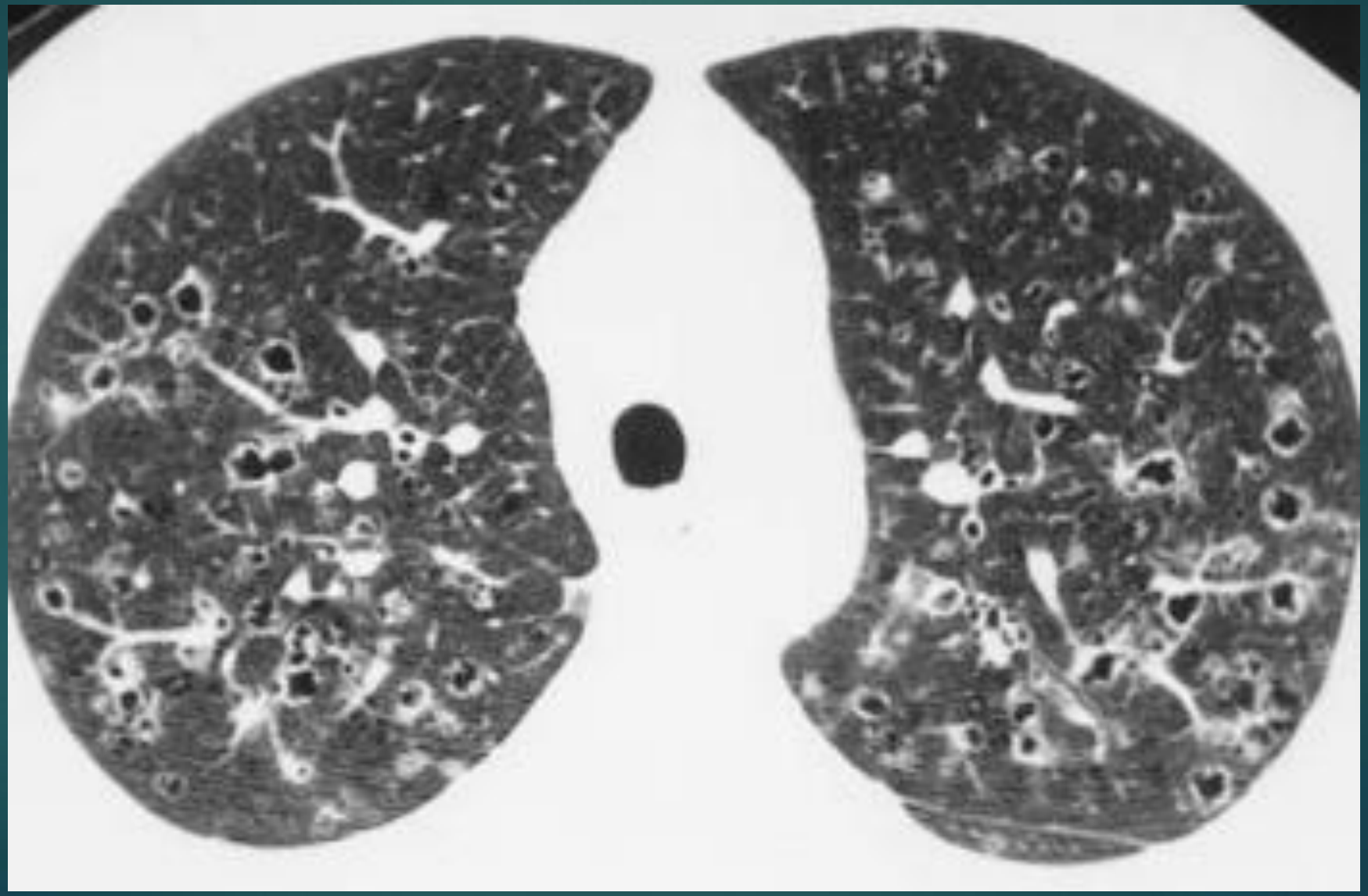
TSC-LAM with MMNPH



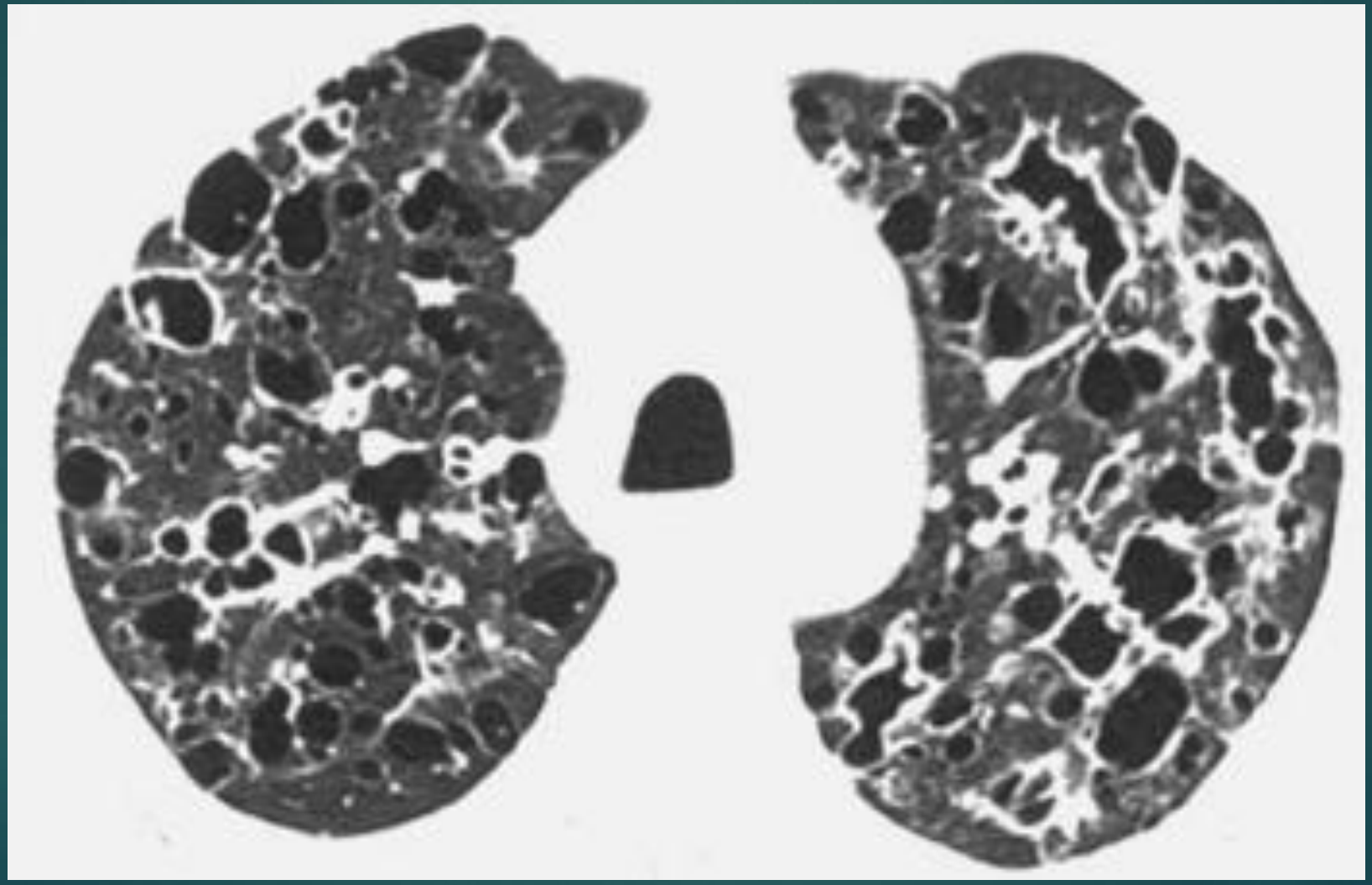
PLCH



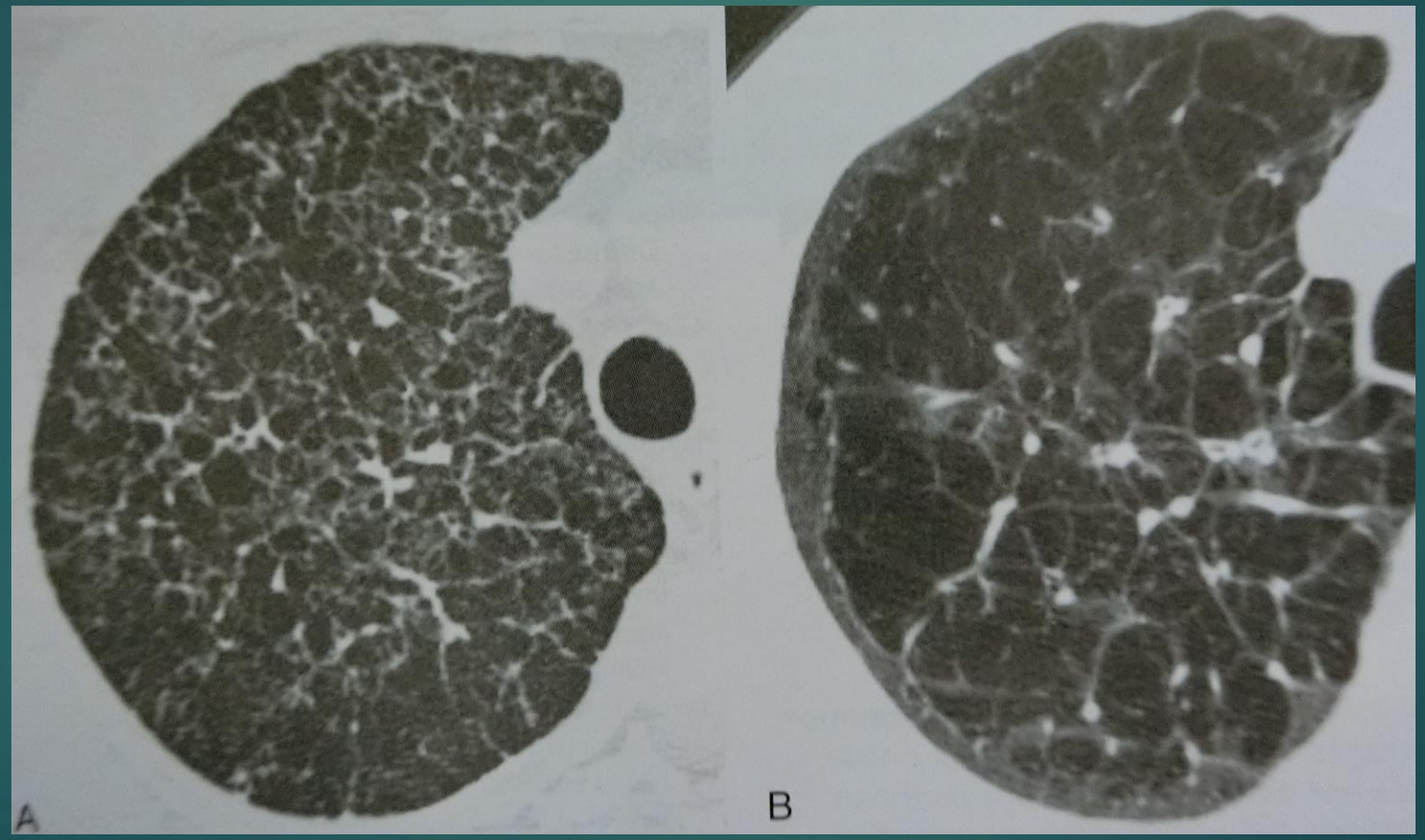
PLCH



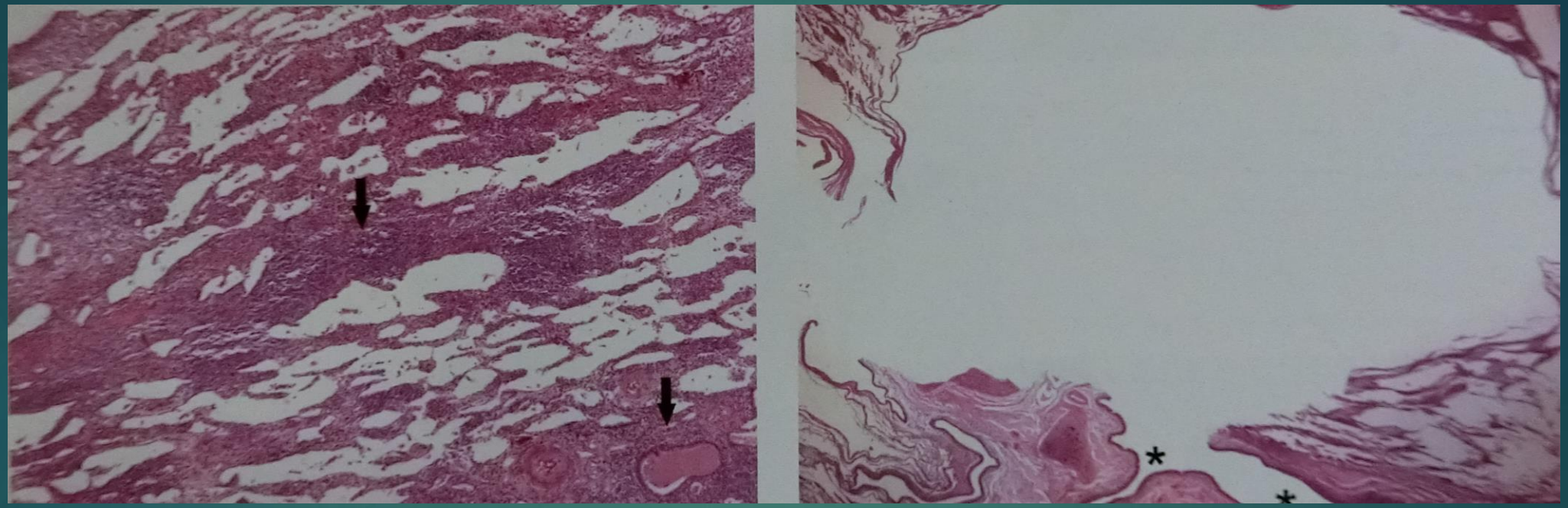
PLCH



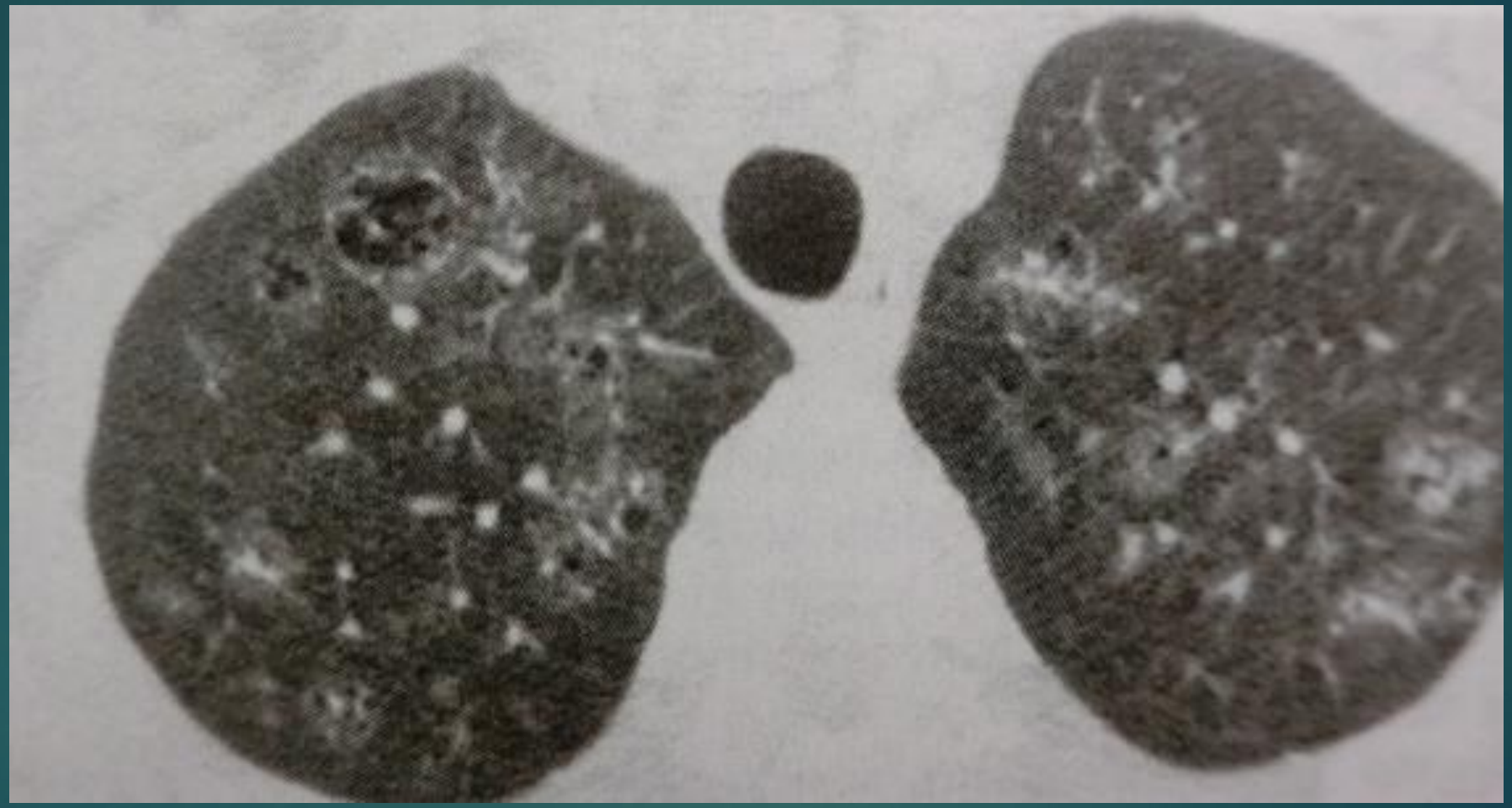
A : PLCH
B : CLE



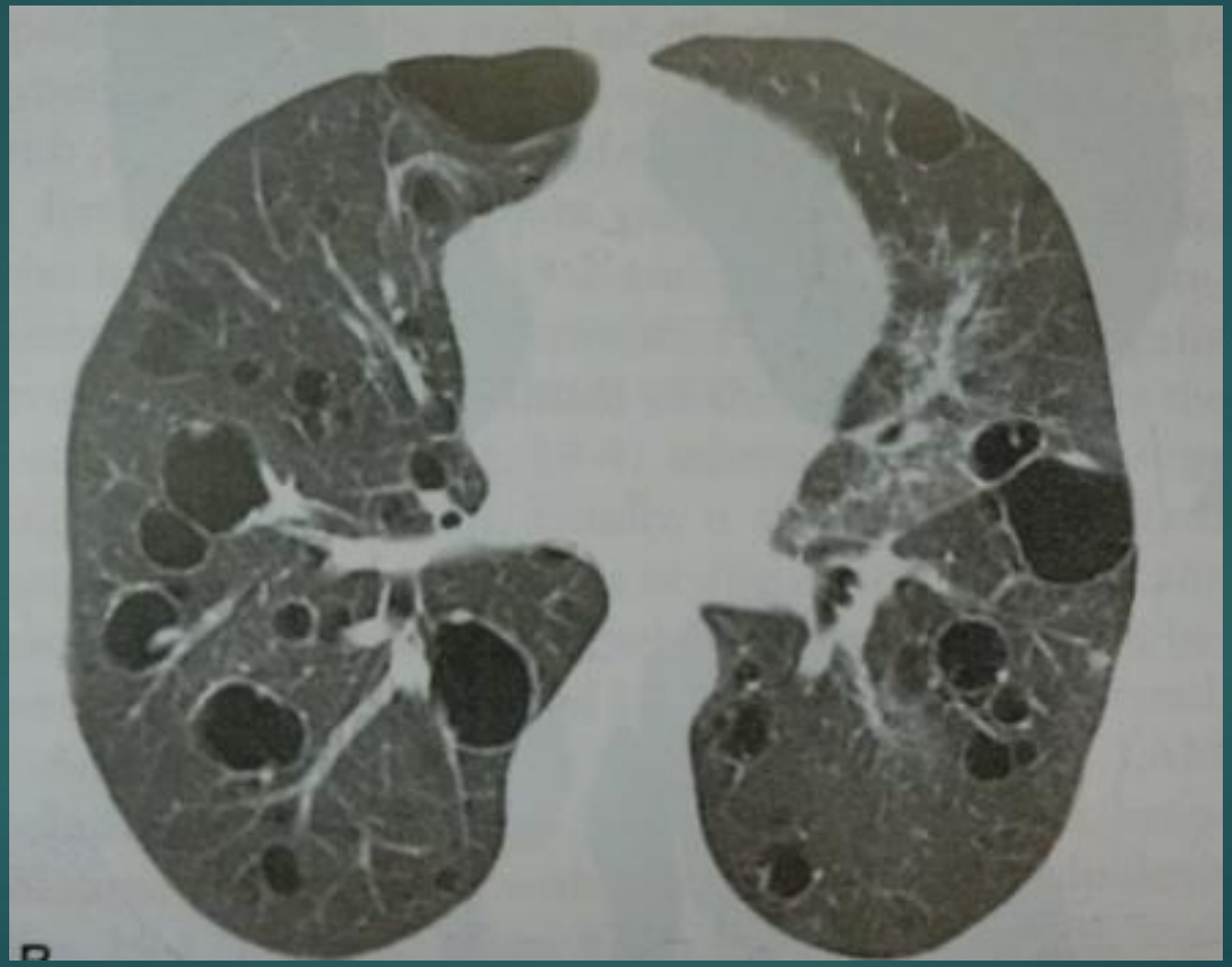
LIP



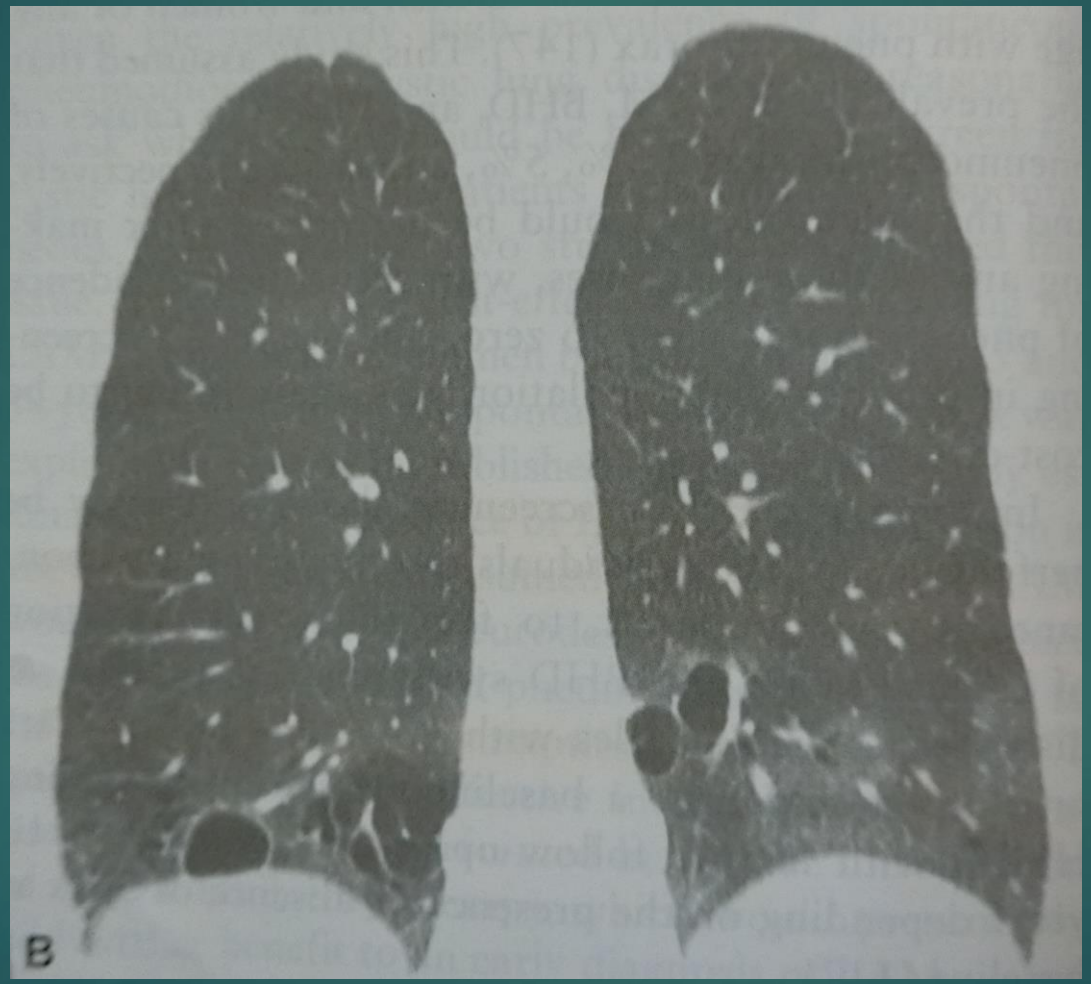
LIP



LIP



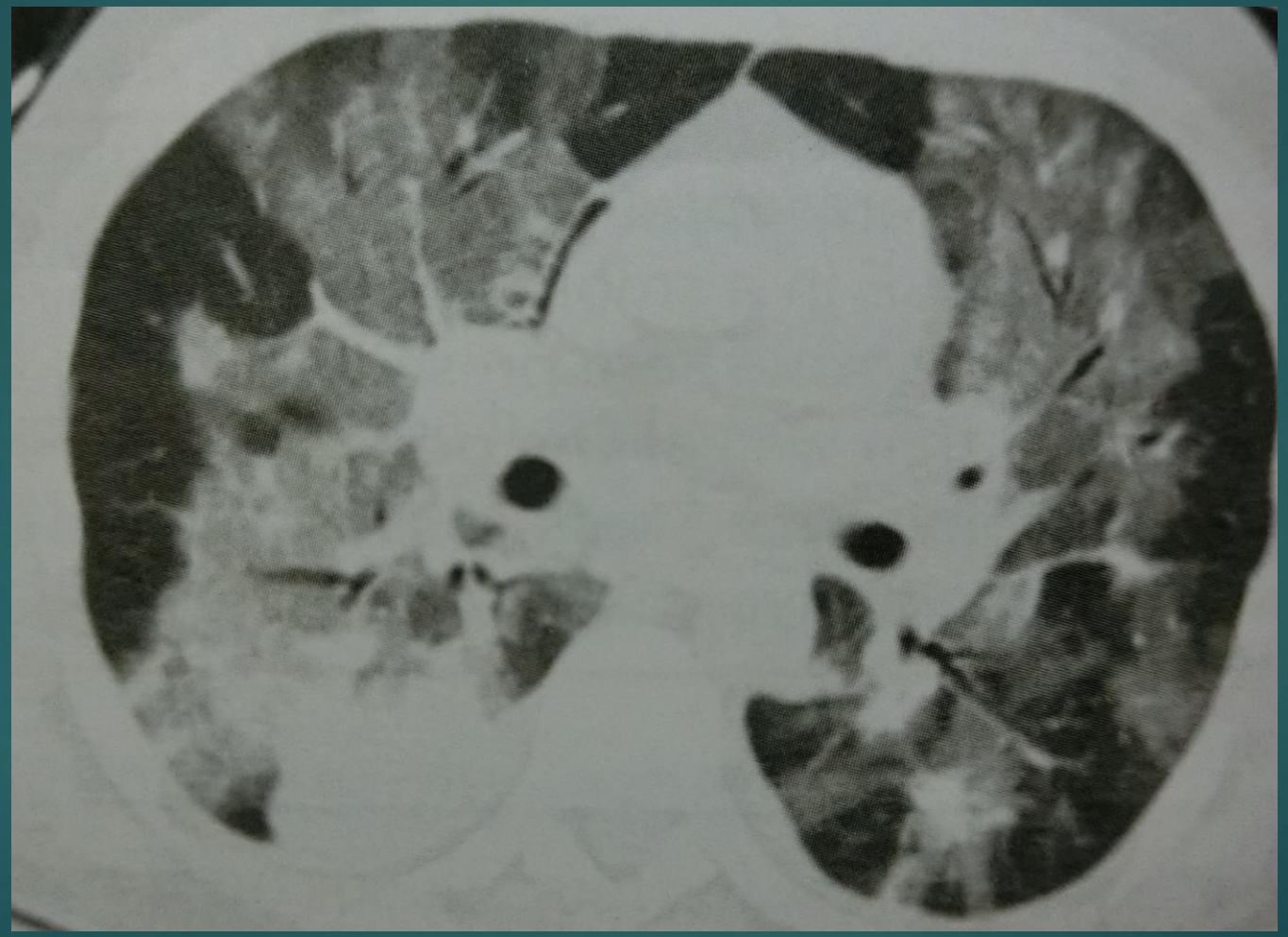
Amyloidosis



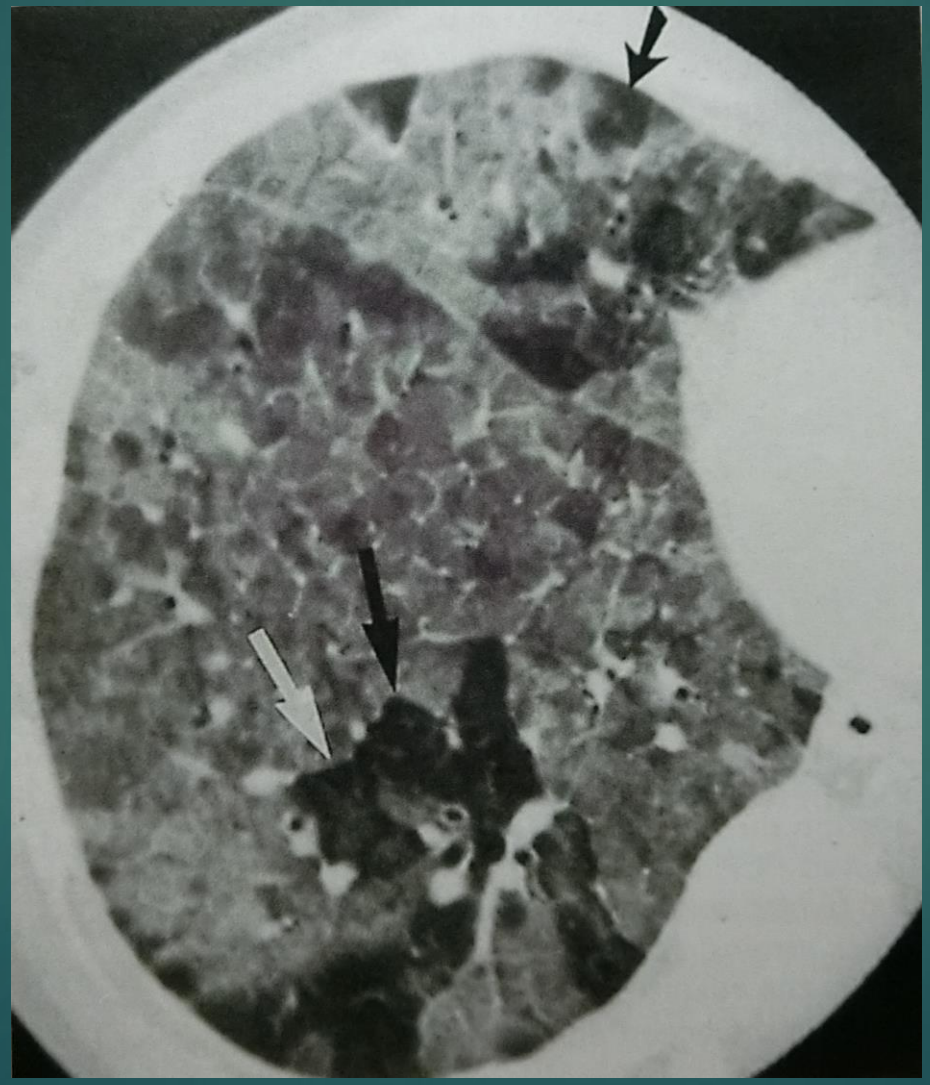
Causes of Inhomogeneous Lung Attenuation

- GGO
- AIRWAY OBSTRUCTION→MOSAIC PERFUSION
- VASCULAR OBSTRUCTION→MOSAIC PERFUSION
- COMBINATION OF THESE (I.E, MIXED DIS.)

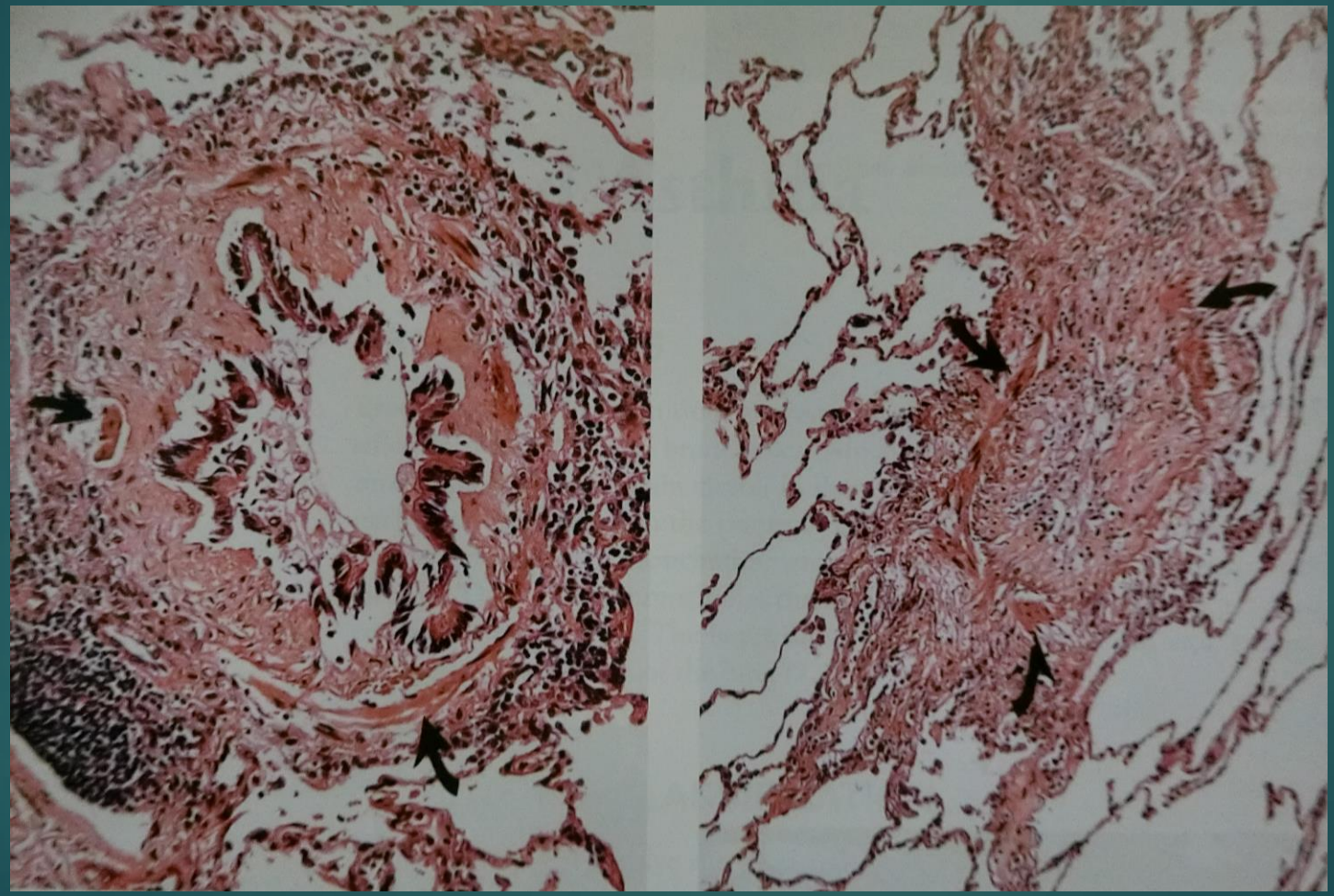
Viral Infection



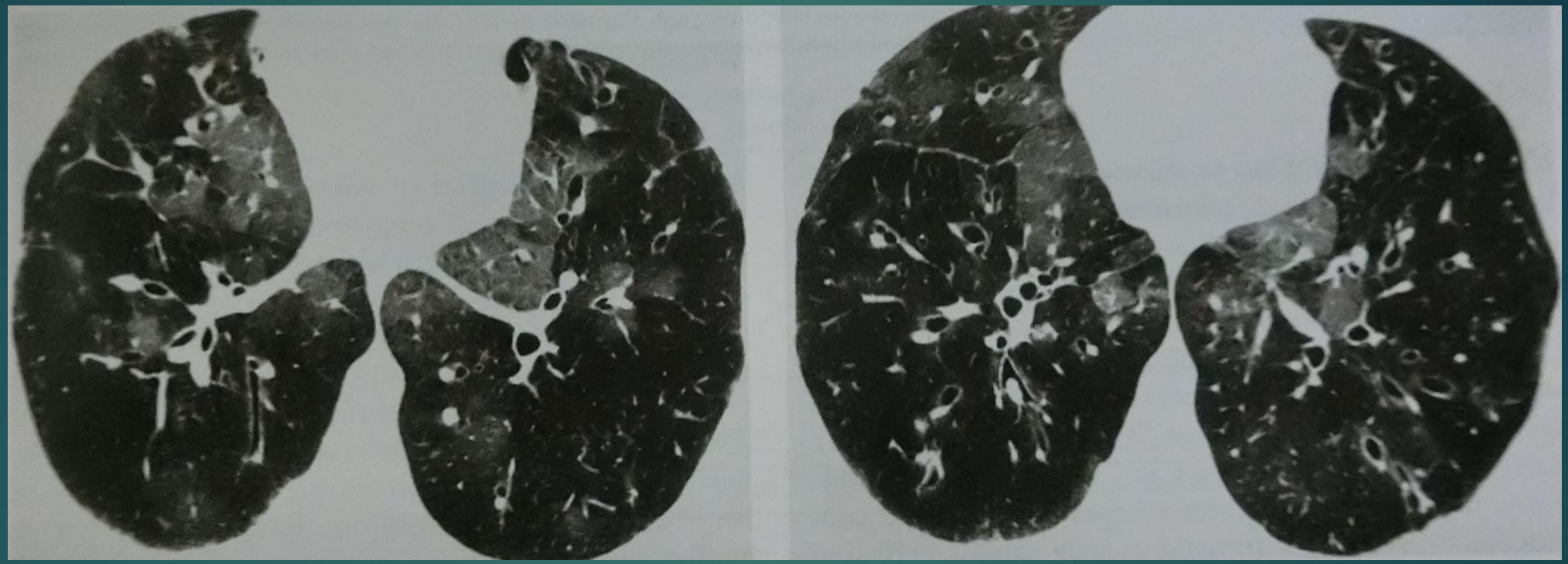
PJP



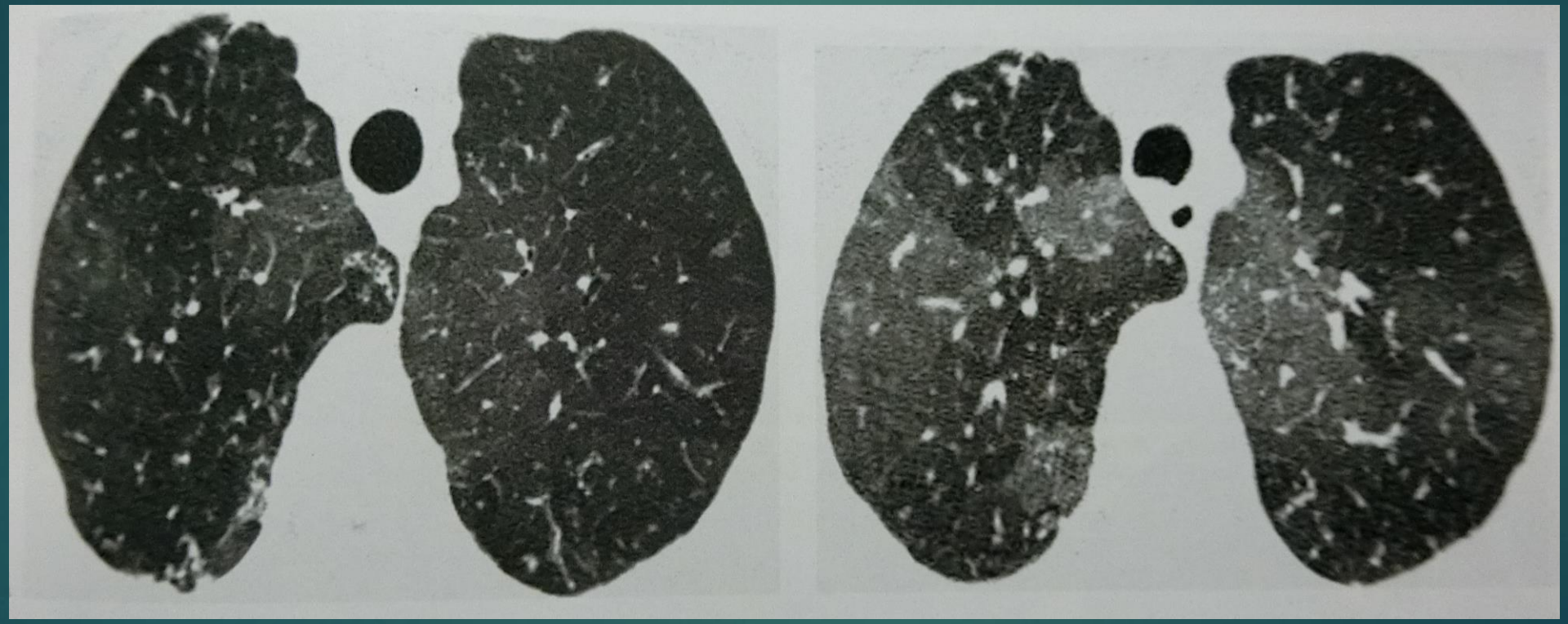
BO



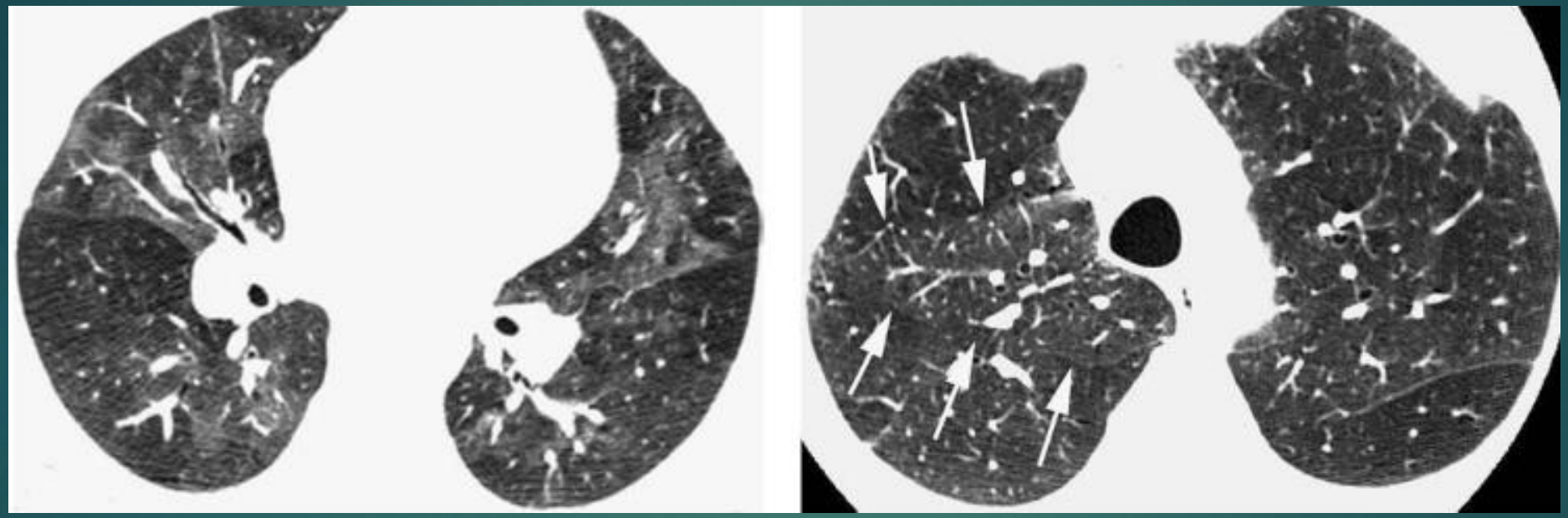
BO (BM Transplantation)



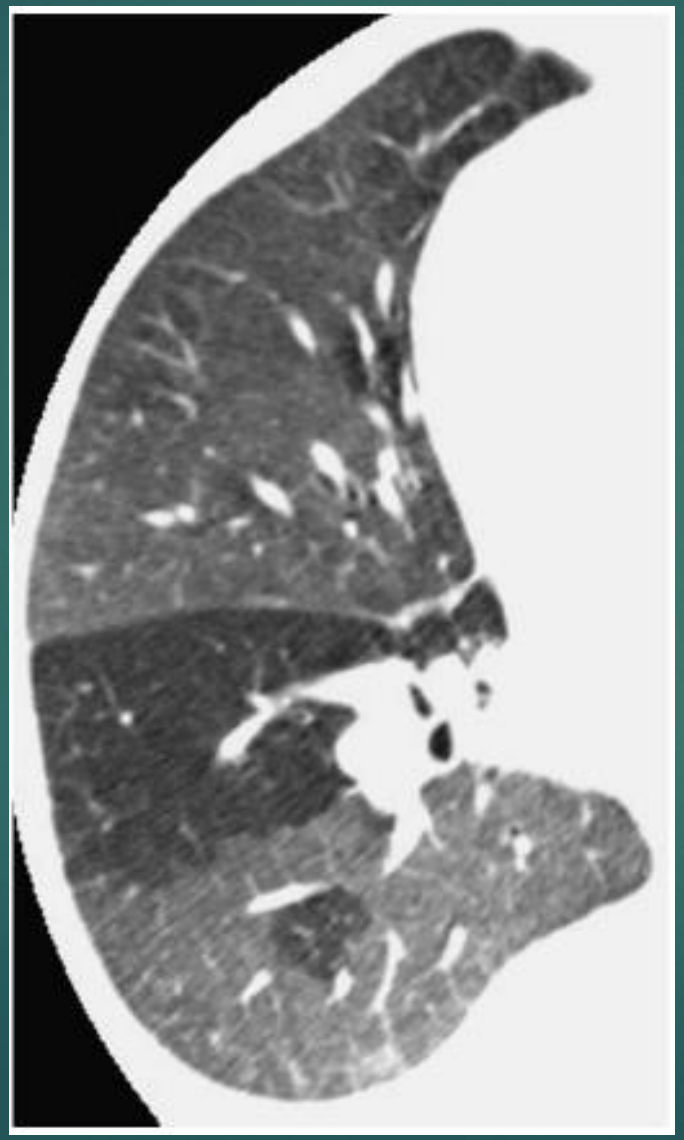
Chronic Airway Infection with Mosaic Perfusion Air Trapping



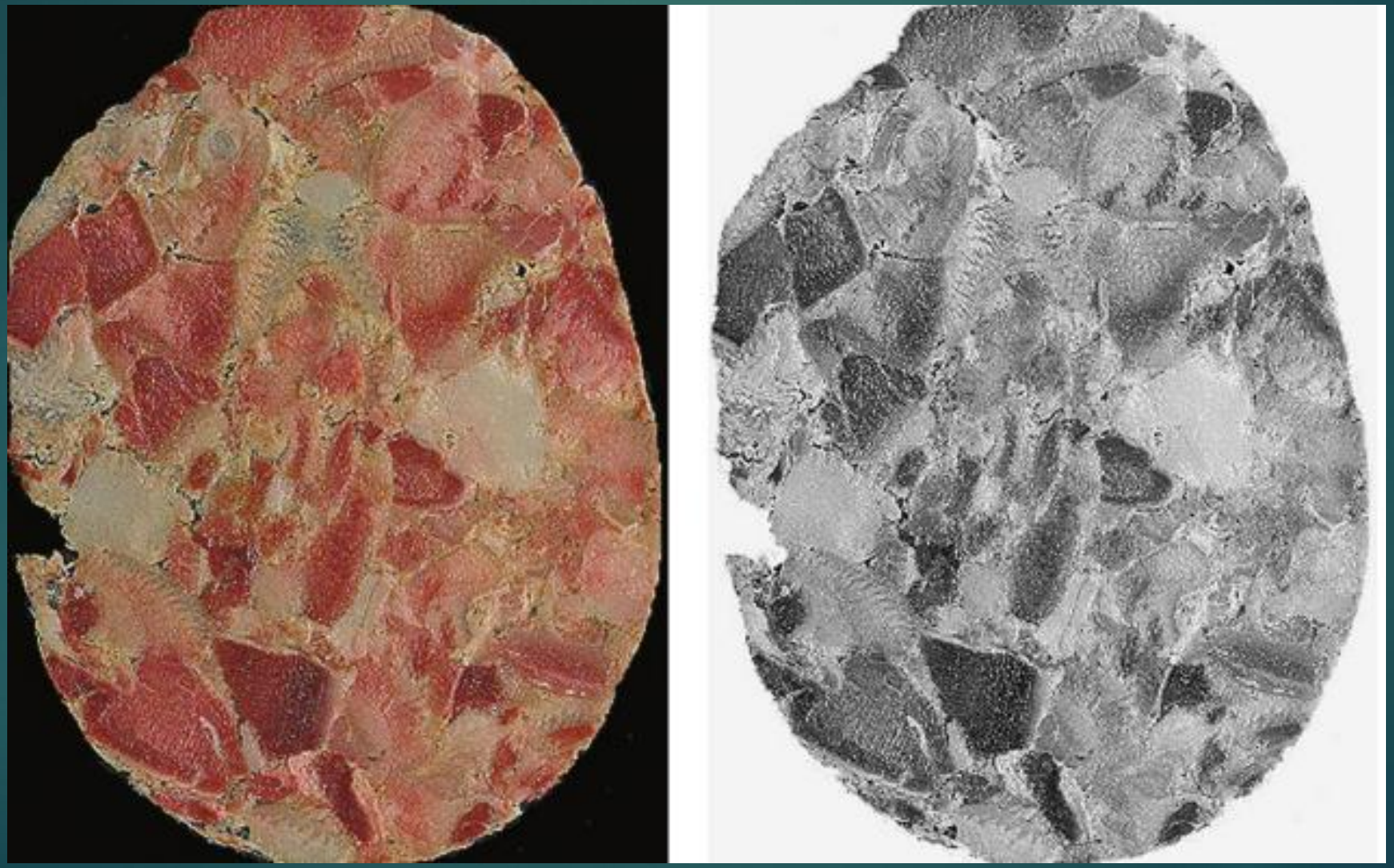
Acute pul. embolism



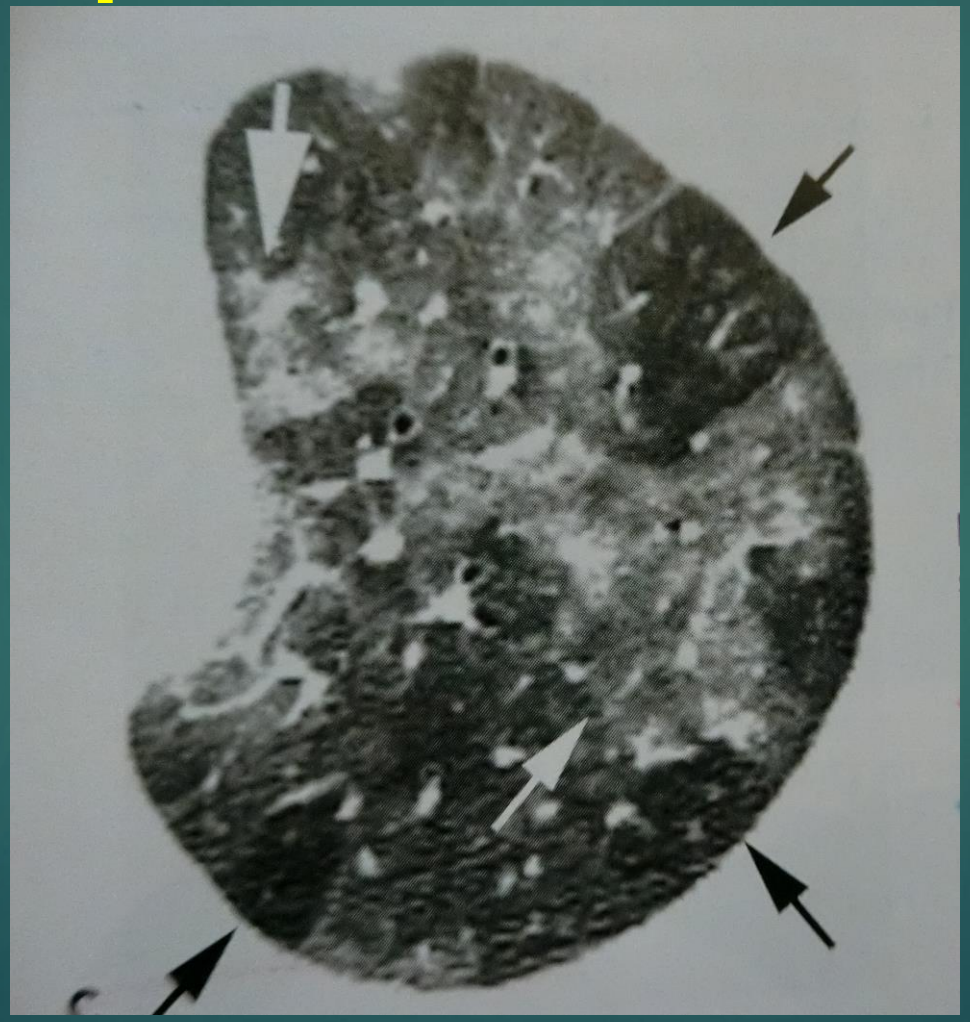
Chronic pul. thromboembolism



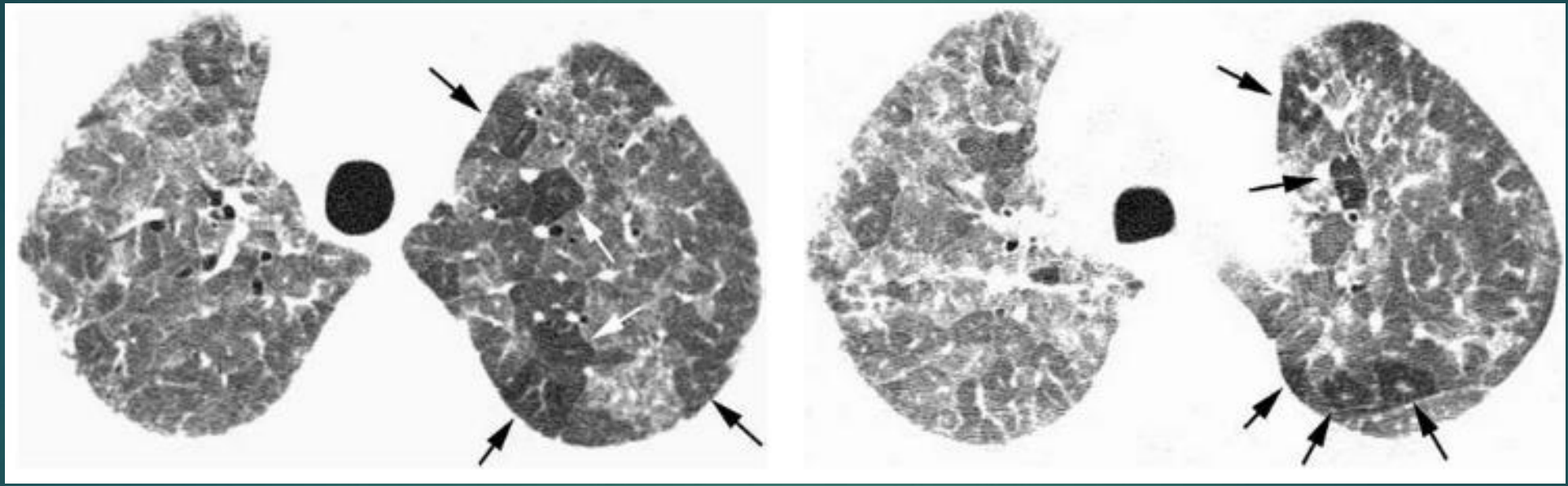
Headcheese

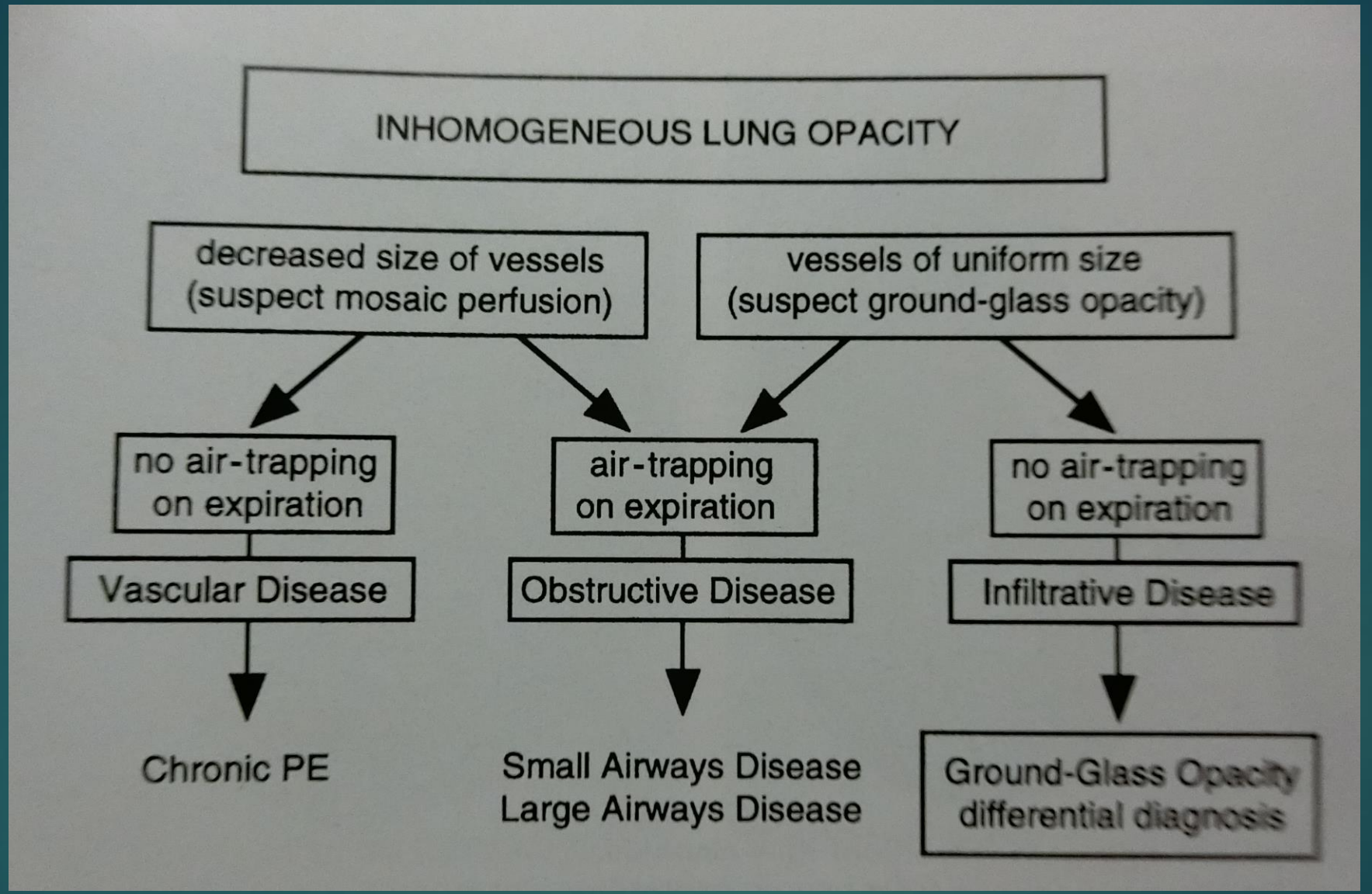


Headcheese Sign in Mycoplasma Pneumonia



Headcheese sign in HP




INHOMOGENEOUS LUNG OPACITY
decreased size of vessels (suspect mosaic perfusion)
vessels of uniform size (suspect ground-glass opacity)
no air-trapping on expiration
air-trapping on expiration
no air-trapping on expiration
Vascular Disease
Obstructive Disease
Infiltrative Disease
Chronic PE
Small Airways Disease
Large Airways Disease
Ground-Glass Opacity differential diagnosis