空洞性與囊泡狀病變

衛生福利部台中醫院

胸腔內科

黃丞正醫師

2021.7.31~8.1

Definition of cyst and cavity

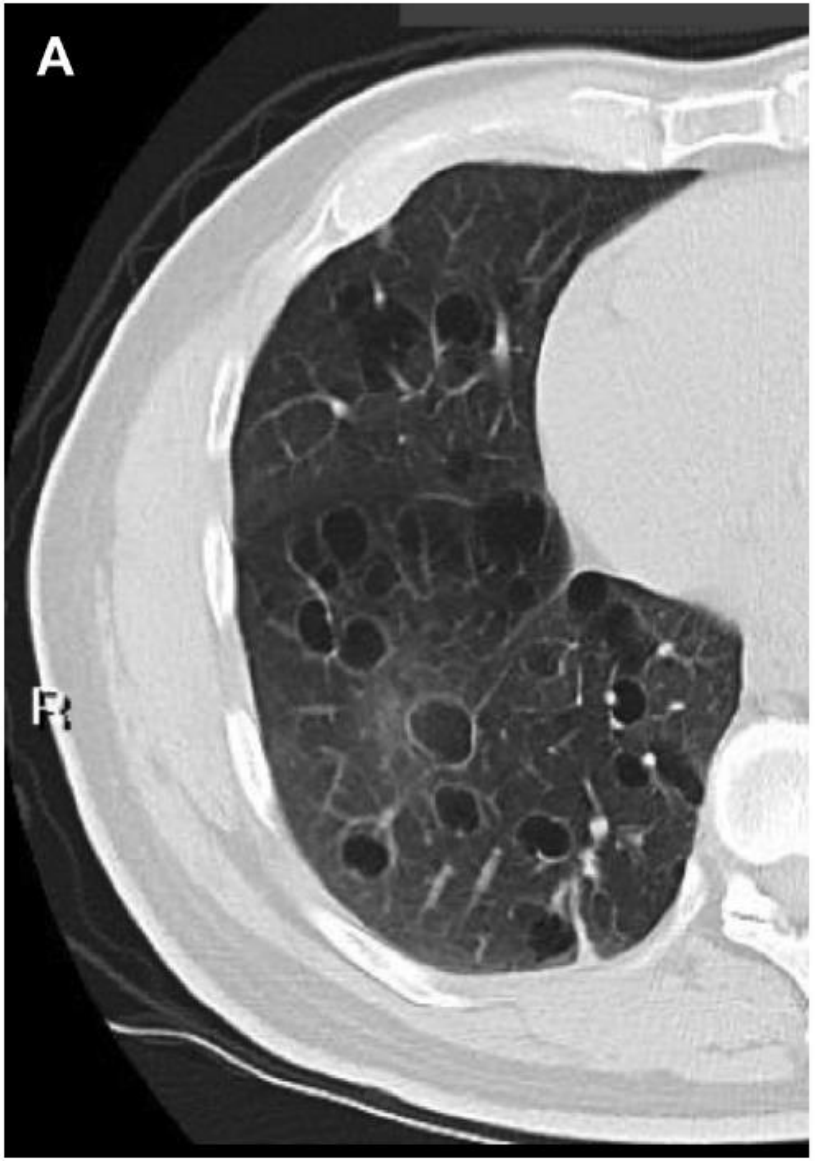
- Cyst： any low-attenuating circumscribed space, containing gas or liquid that is enclosed by an epithelial or fibrous wall and has a well-defined interface with the normal lung tissue； usually less than 4mm in wall thickness

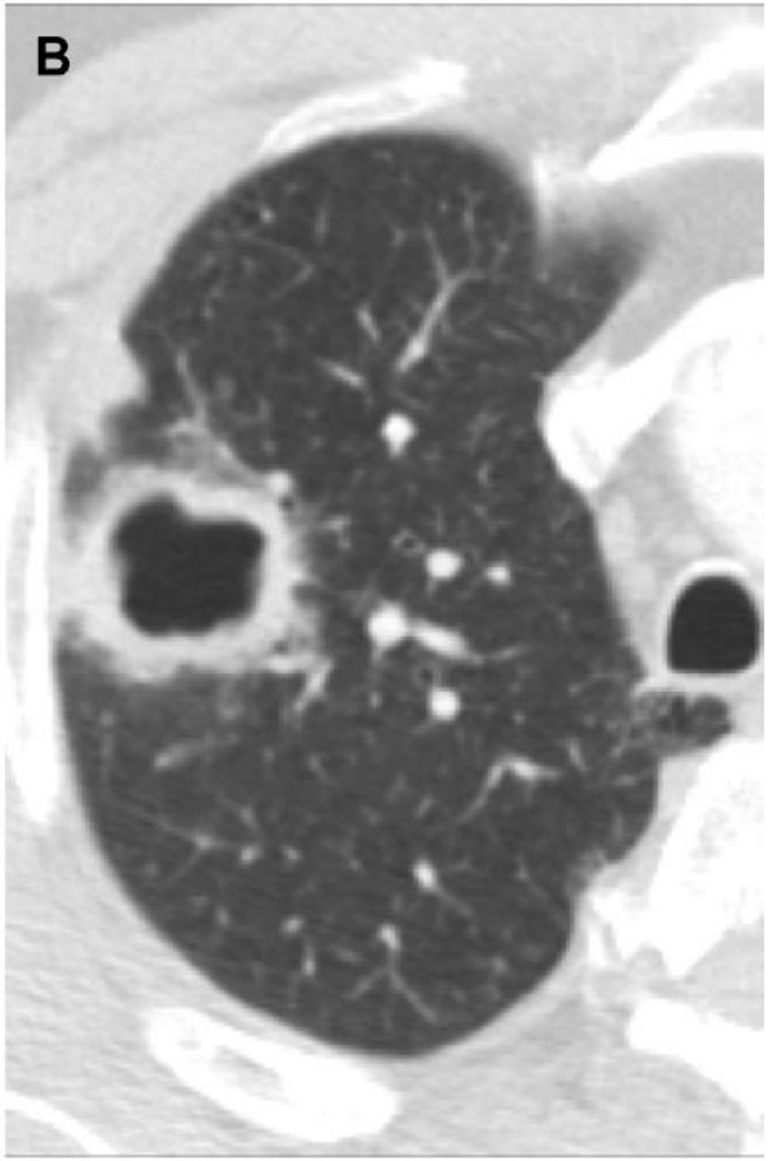
- Cavity: a discrete air and/or fluid-containing space within a pulmonary consolidation or mass that is characterized by markedly thicker walls；walls greater than 4mm in thickness.

American Journal of Roentgenology, vol. 143, no.3, pp. 509–517, 1984.
Thorax, vol. 62, no. 9, pp. 820–829, 2007.

True cysts

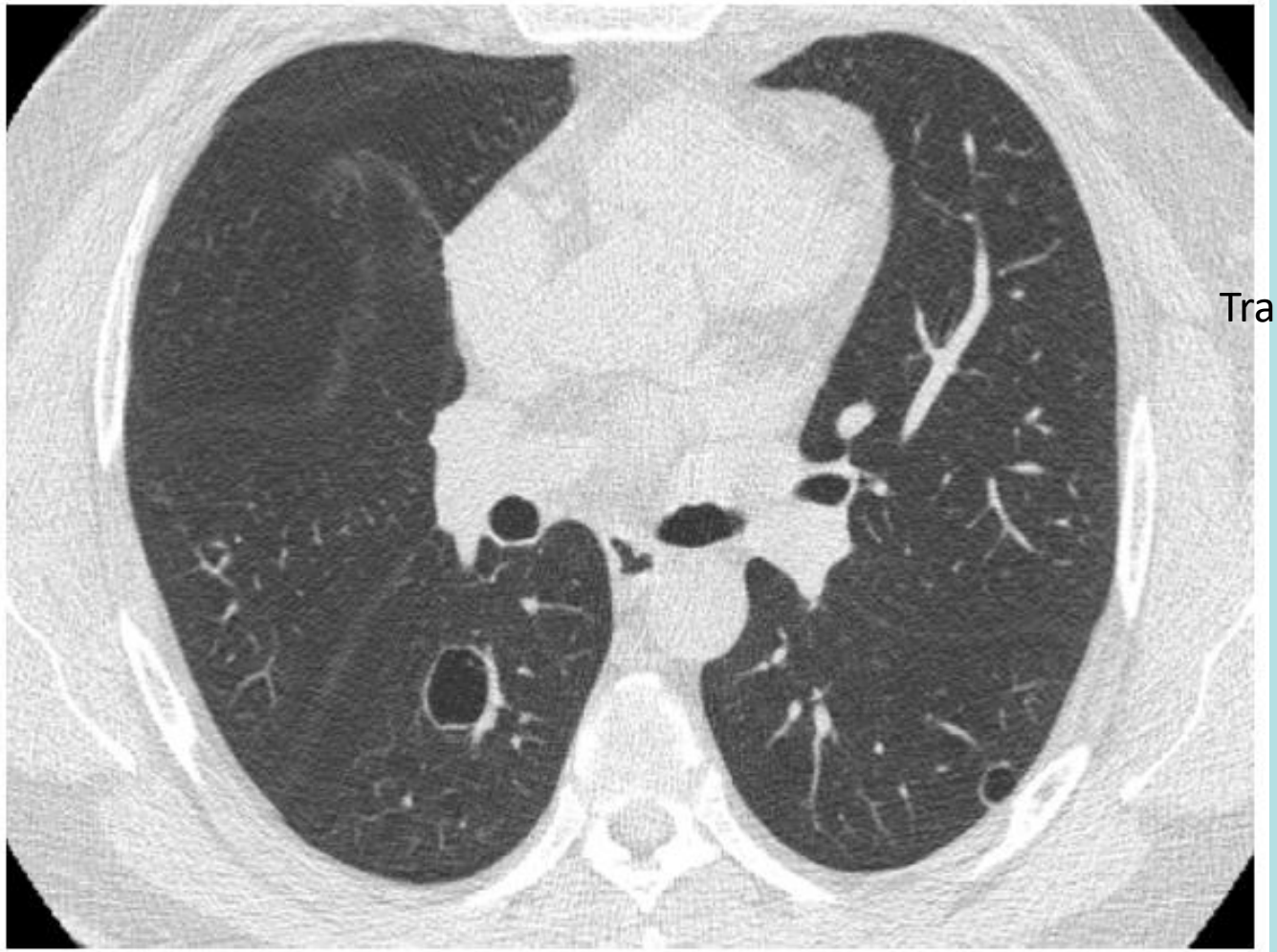
Cavity





CHEST 2016; 150(4):945-965

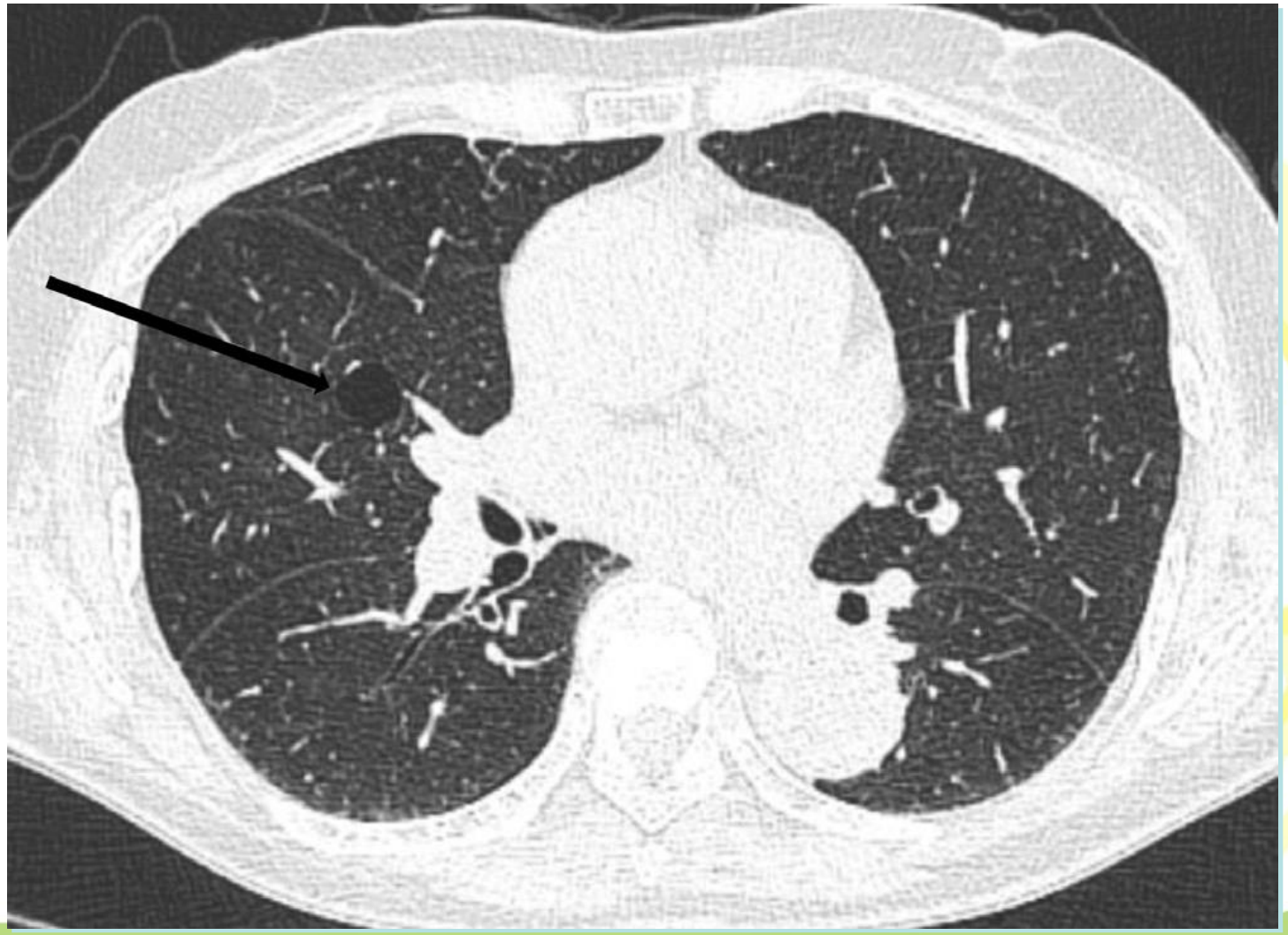
Cysts deceptively thicker due to compression of the adjacent lung parenchyma



Tracheobronchial papillomatosis

CHEST 2016; 150(4):945-965

Incidental cyst in 73-year-old woman

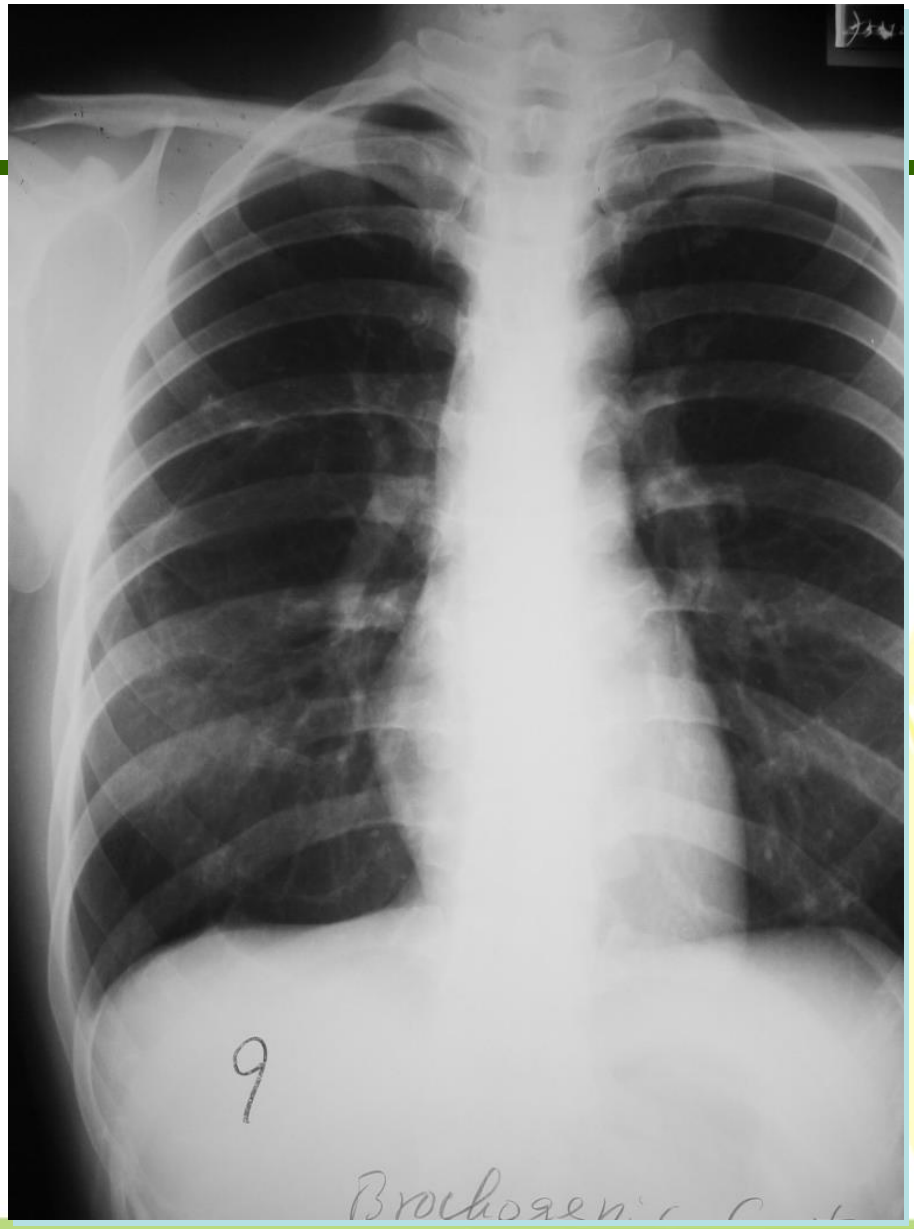


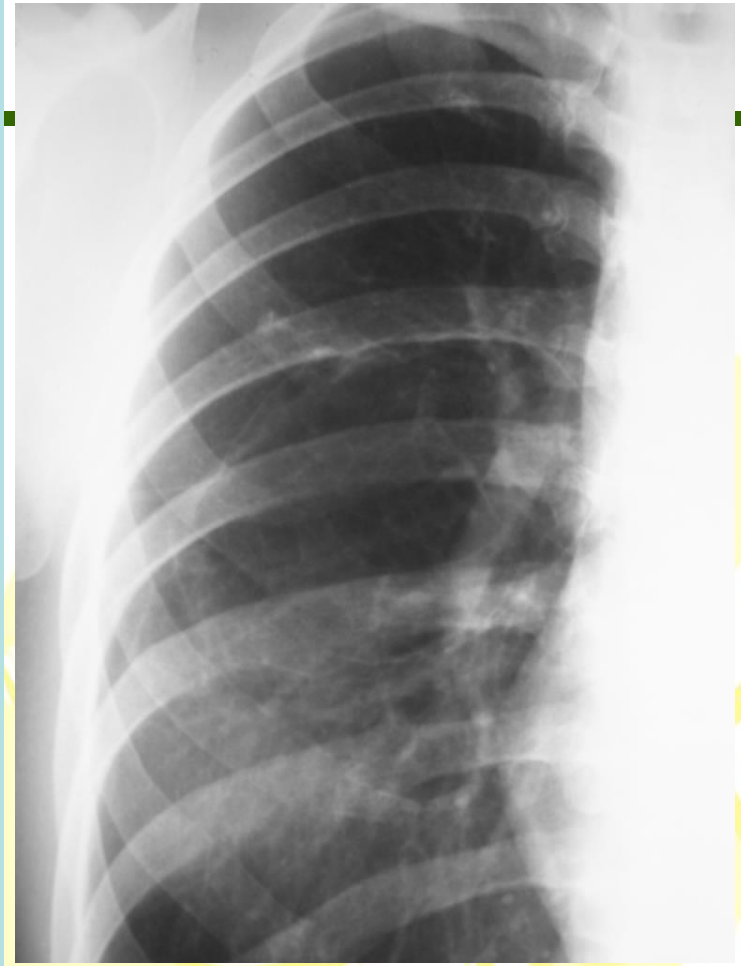
Congenital cysts

1. Bronchogenic cyst

2. Pulmonary sequestration(intra-, extra-)

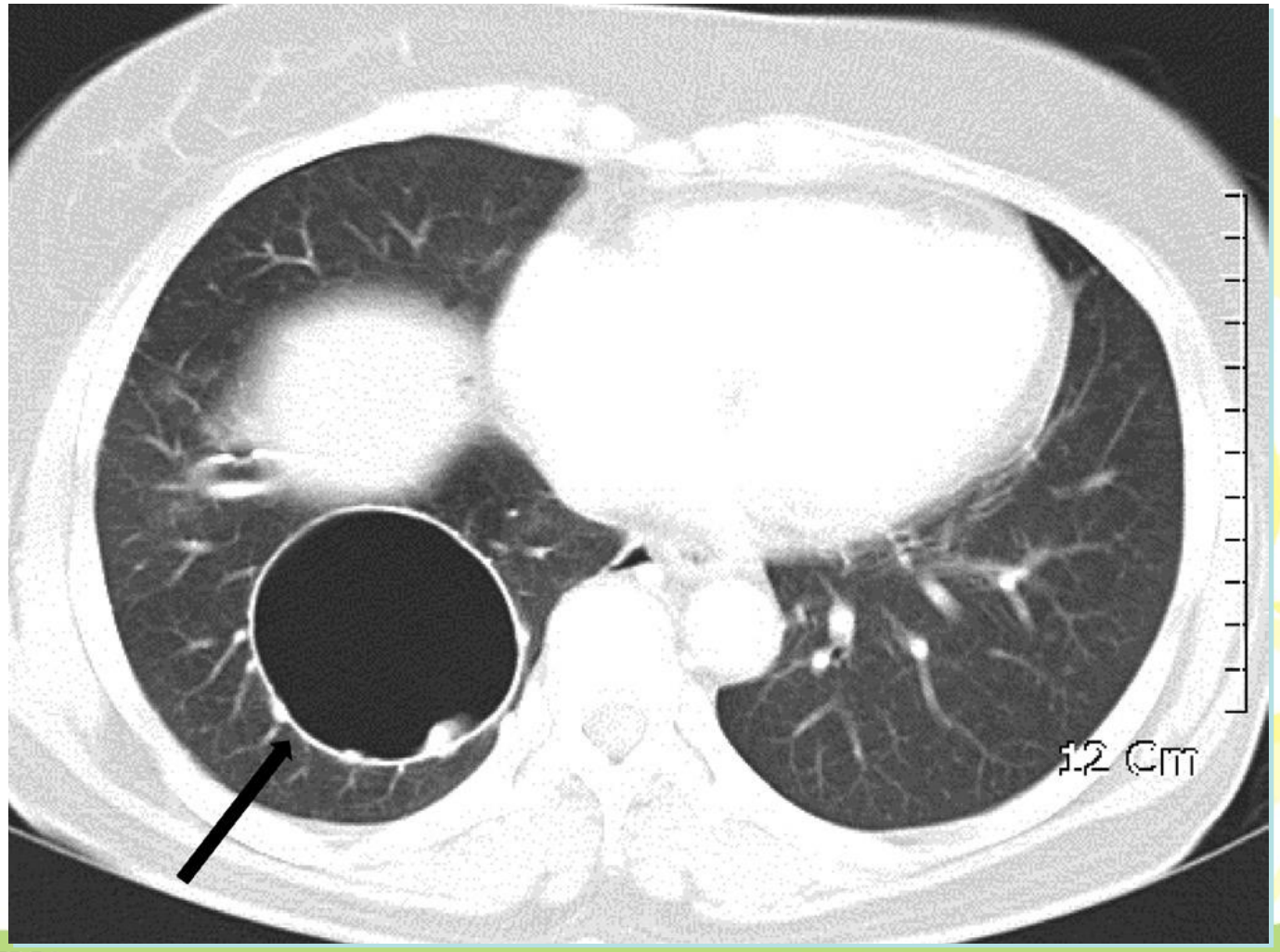
3. Congenital pulmonary airway malformation (CPAM), formly as congenital cystic adenoid malformation, (CCAM)



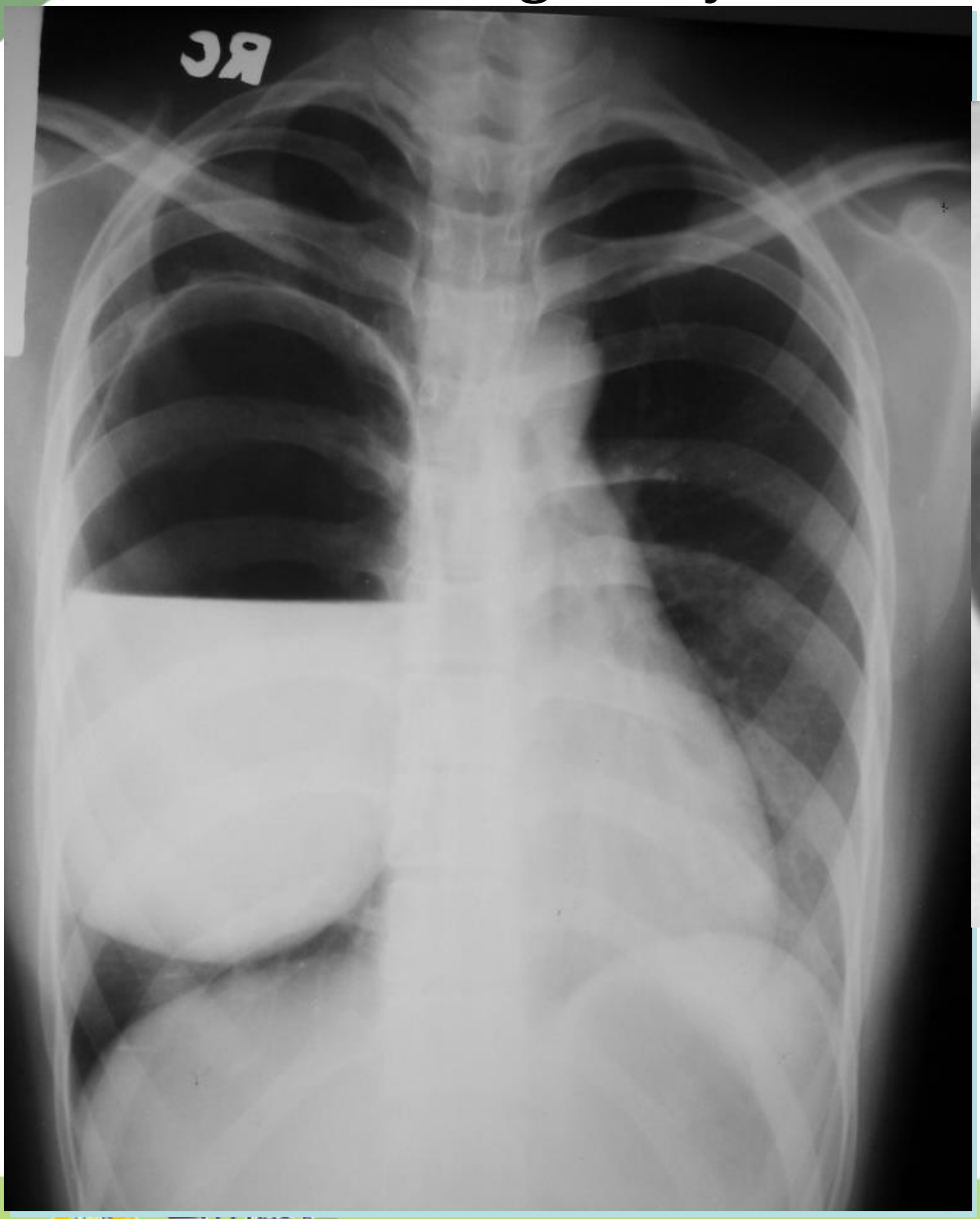


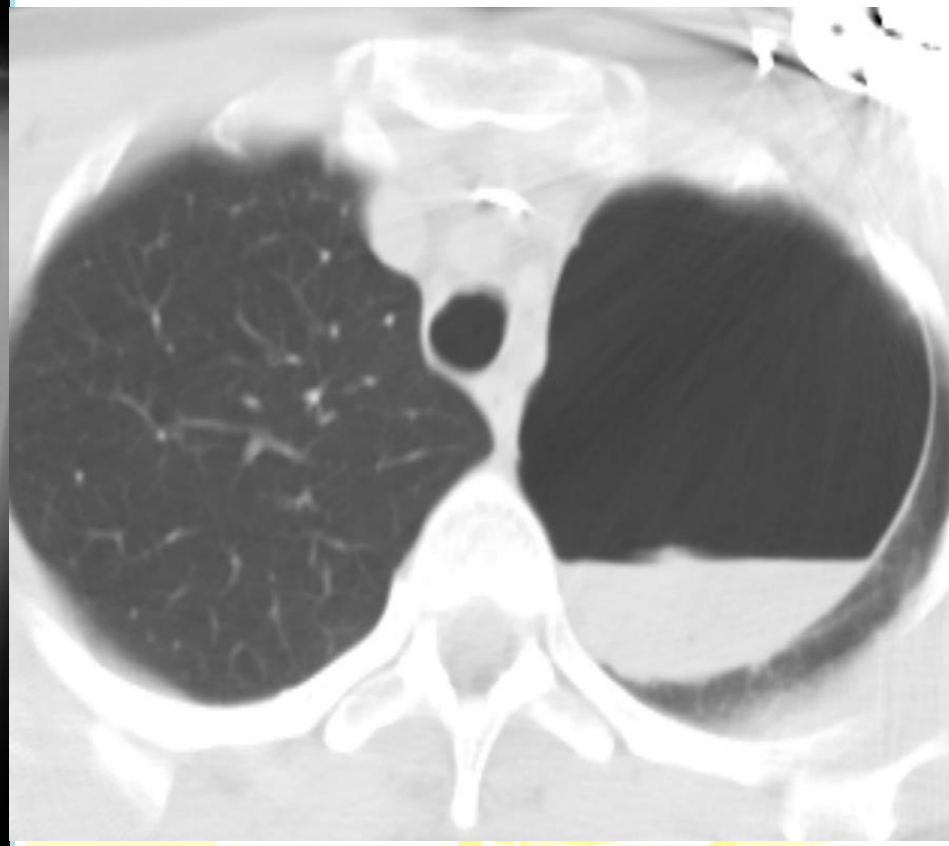
Bronchogenic cyst

Bronchogenic cyst



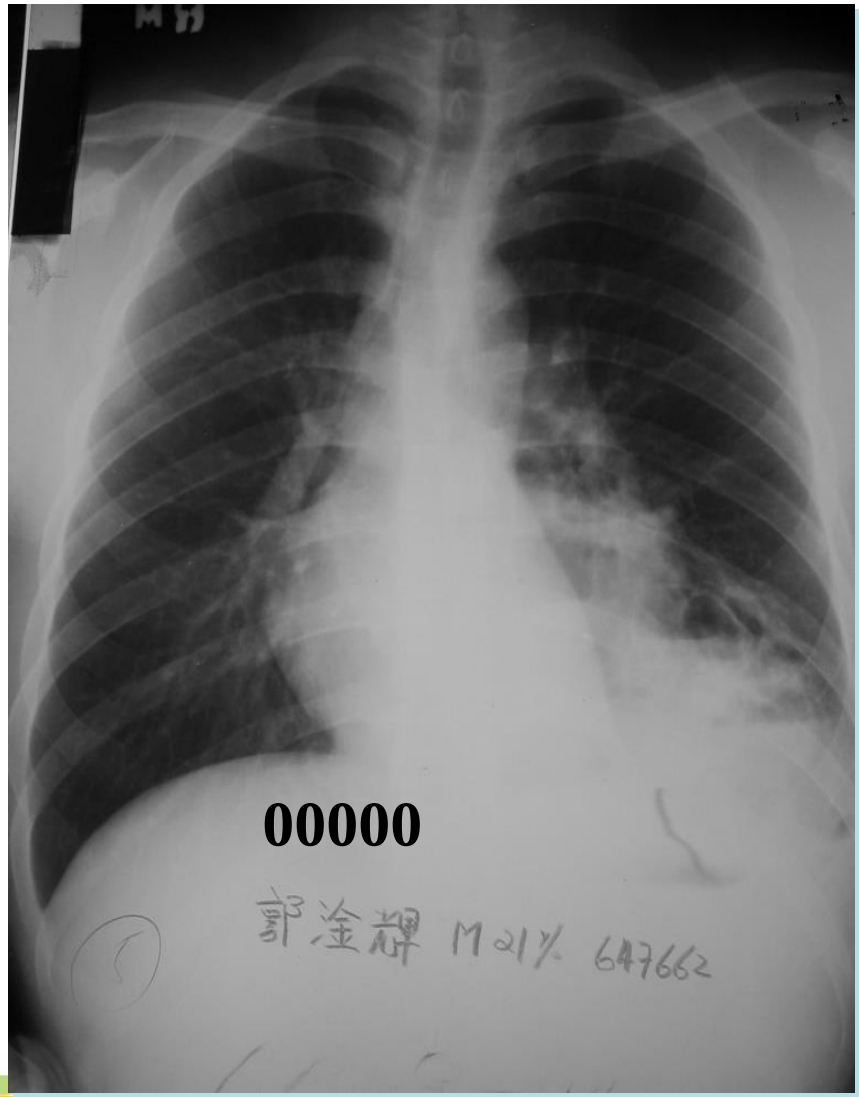
Bronchogenic cyst with air-fluid level

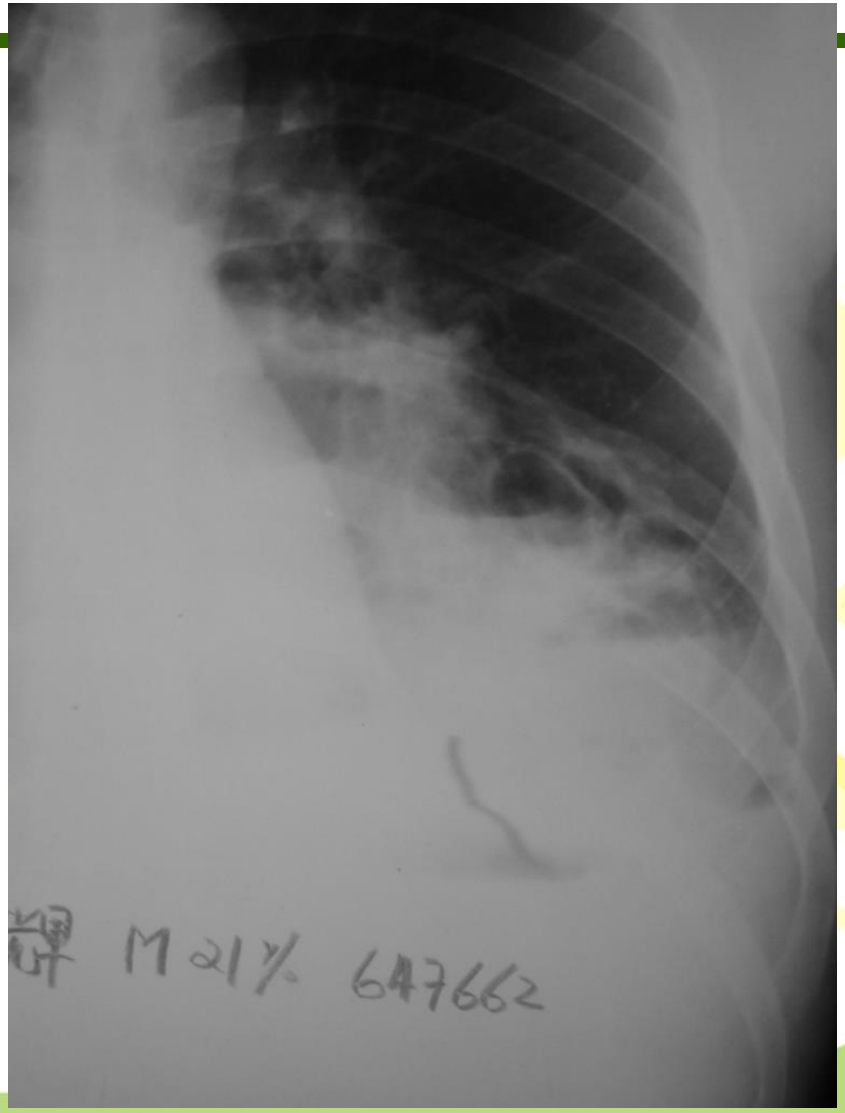




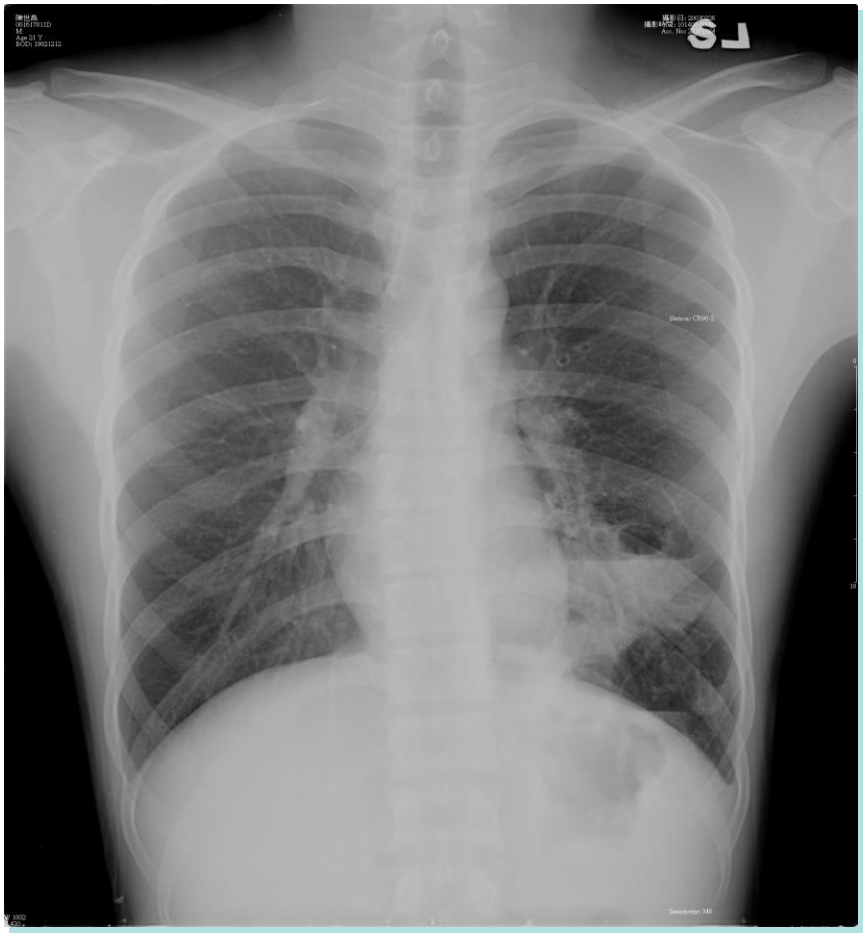
abnormal budding of the tracheobronchial tree

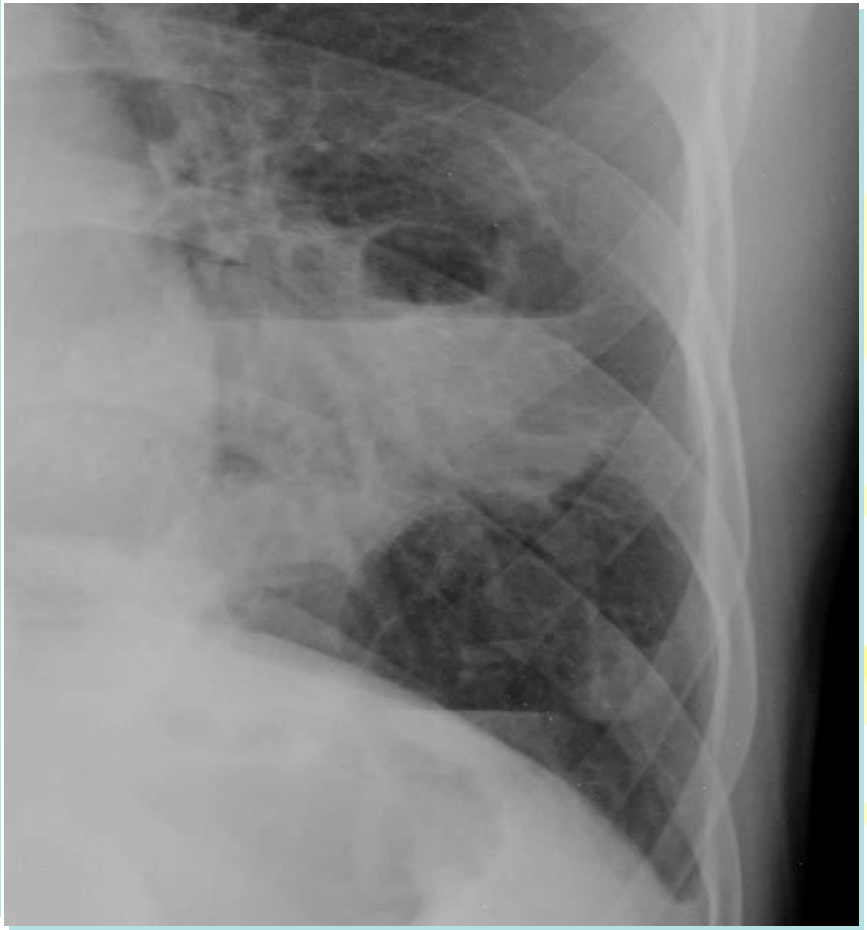
Pulmonary sequestration



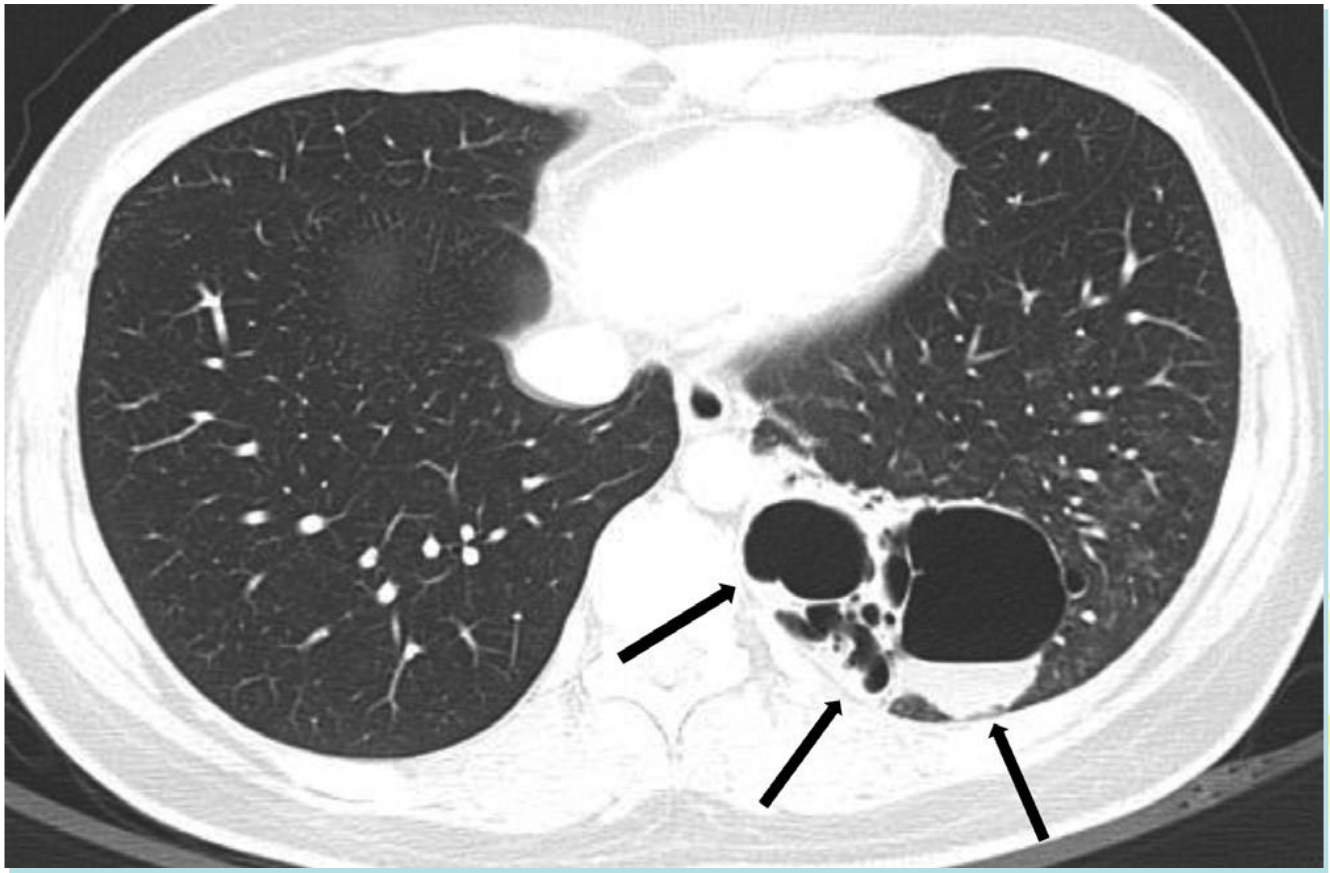


Congenital pulmonary airway malformation (CPAM)





Congenital pulmonary airway malformation (CPAM)



Cystic lung disease (Cysts mimicking)

- Bleb/Bullae: sharply demarcated areas of emphysema with a wall thickness of less than 1 millimeter. Bleb<1 cm/Bullae >1 cm

(Bullae can grow to larger volumes and occupy up to an entire lobe)

- Pneumatoceles: thin-walled, gas-filled spaces occurring in association with acute infections and after trauma.

(tend to resolve with the improvement of the underlying infection)

- Honeycombing : a patterning of irregular, thick-walled air spaces, a sign of end stage pulmonary fibrosis.
- Cystic bronchiectasis: bronchial dilation adjacent to the accompanying pulmonary artery (“signet-ring sign”), absence of tapering of bronchi, and within 1 cm of the pleural surfaces

Radiologic Distinctions for Air-Filled Lung Lesions

Air-Filled Lung Lesions	Air-Filled Lung Lesion Characteristics	Helpful Radiologic Findings
Cyst	Round Well-defined thin wall (< 2 mm)	Interfaced with normal lung
Cavity	Irregular Thick wall	Within consolidation, mass, or nodule
Bulla	More than 1 cm in size Imperceptible thin wall	Accompanied centrilobular and paraseptal emphysema
Pneumatocele	Round Thin-wall	Transient Adjacent consolidation or ground-glass opacity
Centrilobular emphysema	Usually without visible walls Central dot	Upper lung predominance
Honeycombing	Clustered 3–10 mm cystic lesions Well-defined 1–3 mm thickness walls One or more layers	Lower subpleural lungs Accompanied reticular pattern or traction bronchiectasis
Cystic bronchiectasis	Tubular rather than spherical	Branching pattern Associated bronchial wall thickening, centrilobular densities, air-trapping

Korean J Radiol 2019;20(9):1368-1380

Mechanism of Cysts

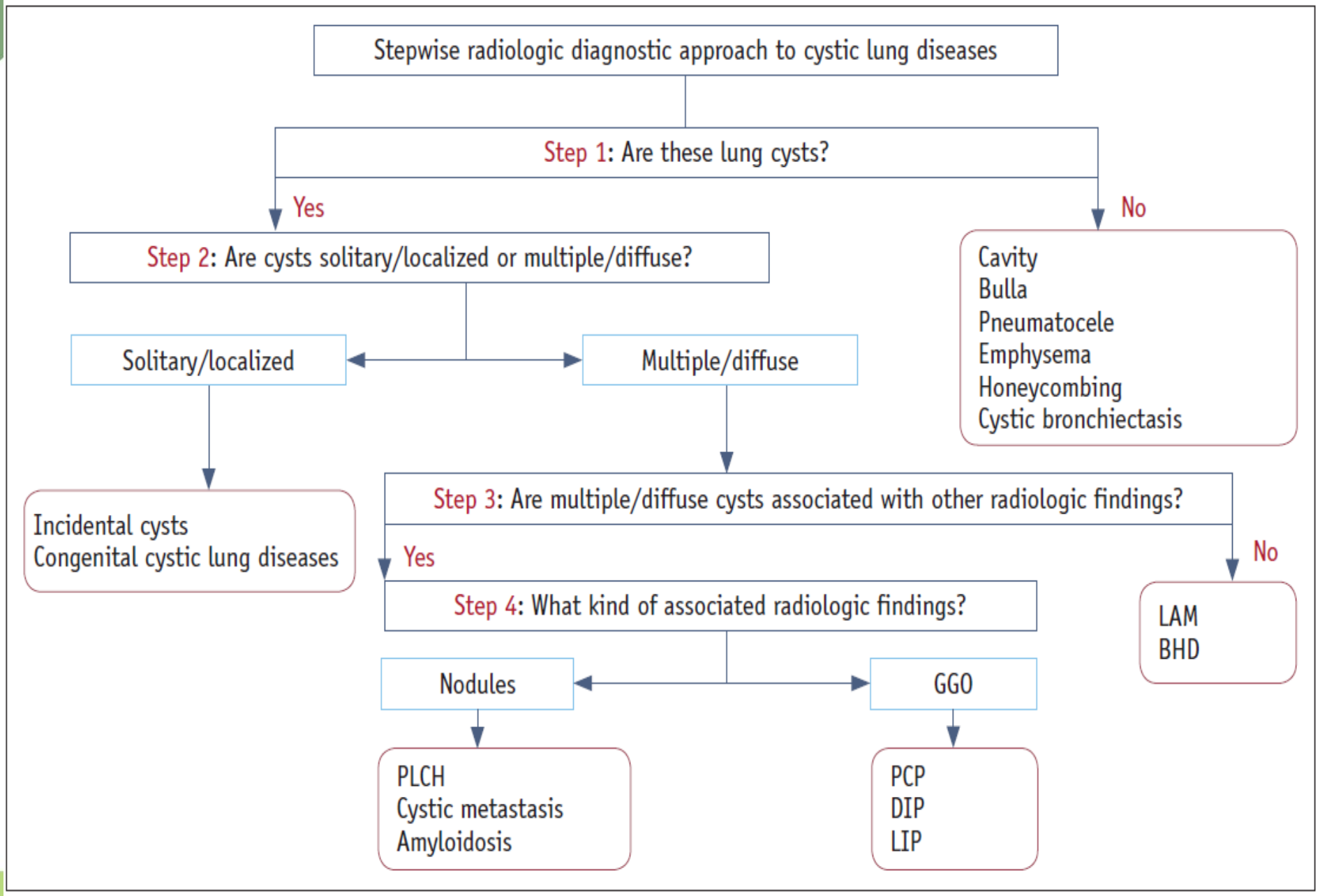
1. Check valve airway obstruction with distal airspace
2. Dilatation ischemia and necrosis of the airway walls
3. Lung parenchymal destruction by proteases

Eur Respir Mon 2011;54:46–83.

Lung cysts categories

- Location: subpleural, intraparenchyma
- Number : solitary, multiple
- Distribution: diffuse, upper or lower lung
- Associated CT findings: nodules or GGO

CHEST 2016; 150(4):945-965



Korean J Radiol 2019;20(9):1368-1380

A five-step approach to managing cystic lung disease

1. Are we dealing with true cysts? *Step 1*
2. Are the cysts subpleural? *Step 2*
3. Are parenchymal cysts without associated HRCT findings: *Step 3*
   - Solitary
   - Multifocal/diffuse
4. Are the parenchymal cysts associated with nodules? *Step 4*
5. Are the parenchymal cysts associated with ground glass nodules? *Step 5*

CHEST 2016; 150(4):945-965

Lung cysts categories

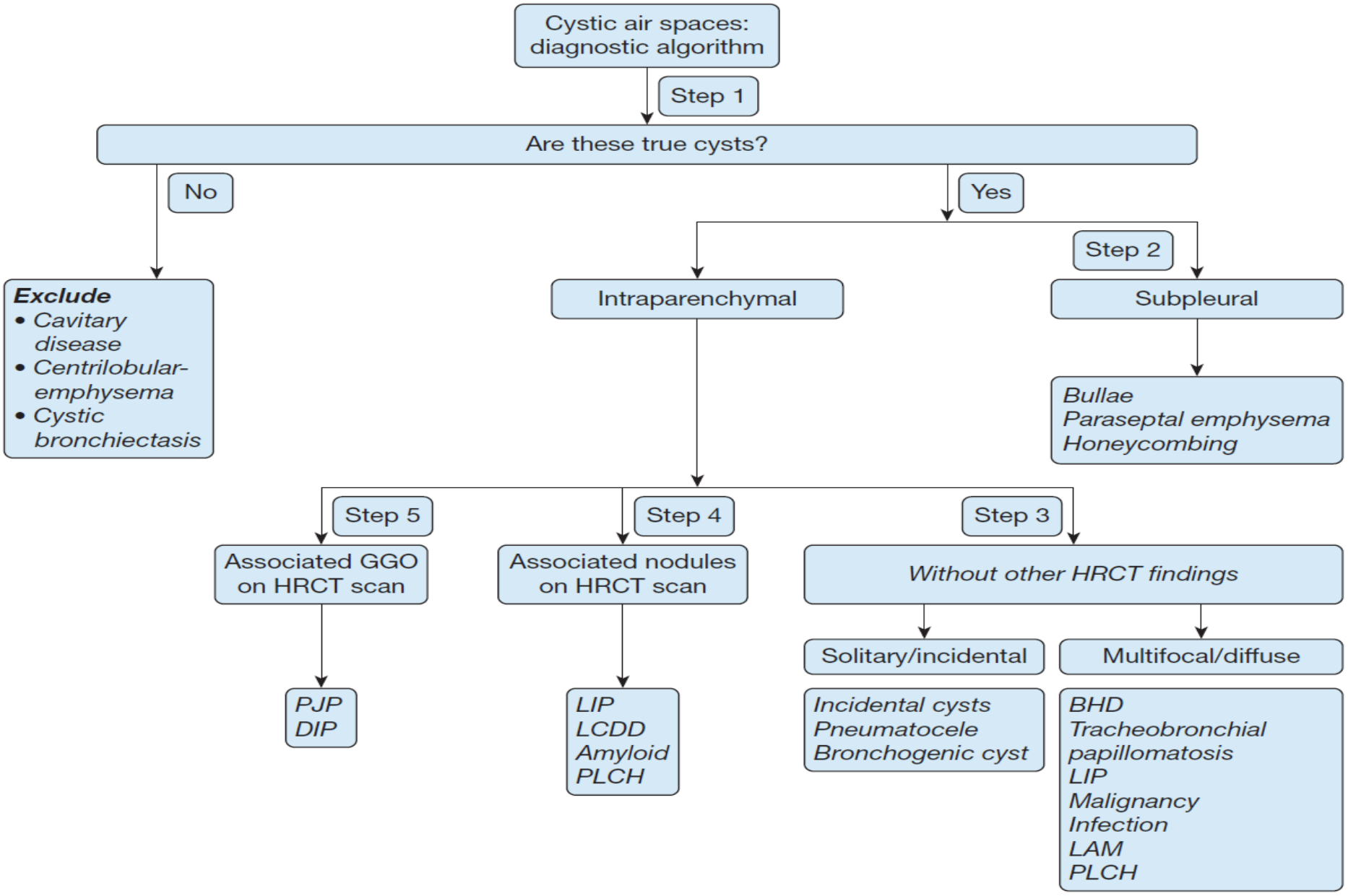
- Subpleural cysts: bullae, paraseptal emphysema or honeycomb changes.
- Parenchymal cysts

(1)solitary : incidental cyst , pneumatocele, and bronchogenic cyst

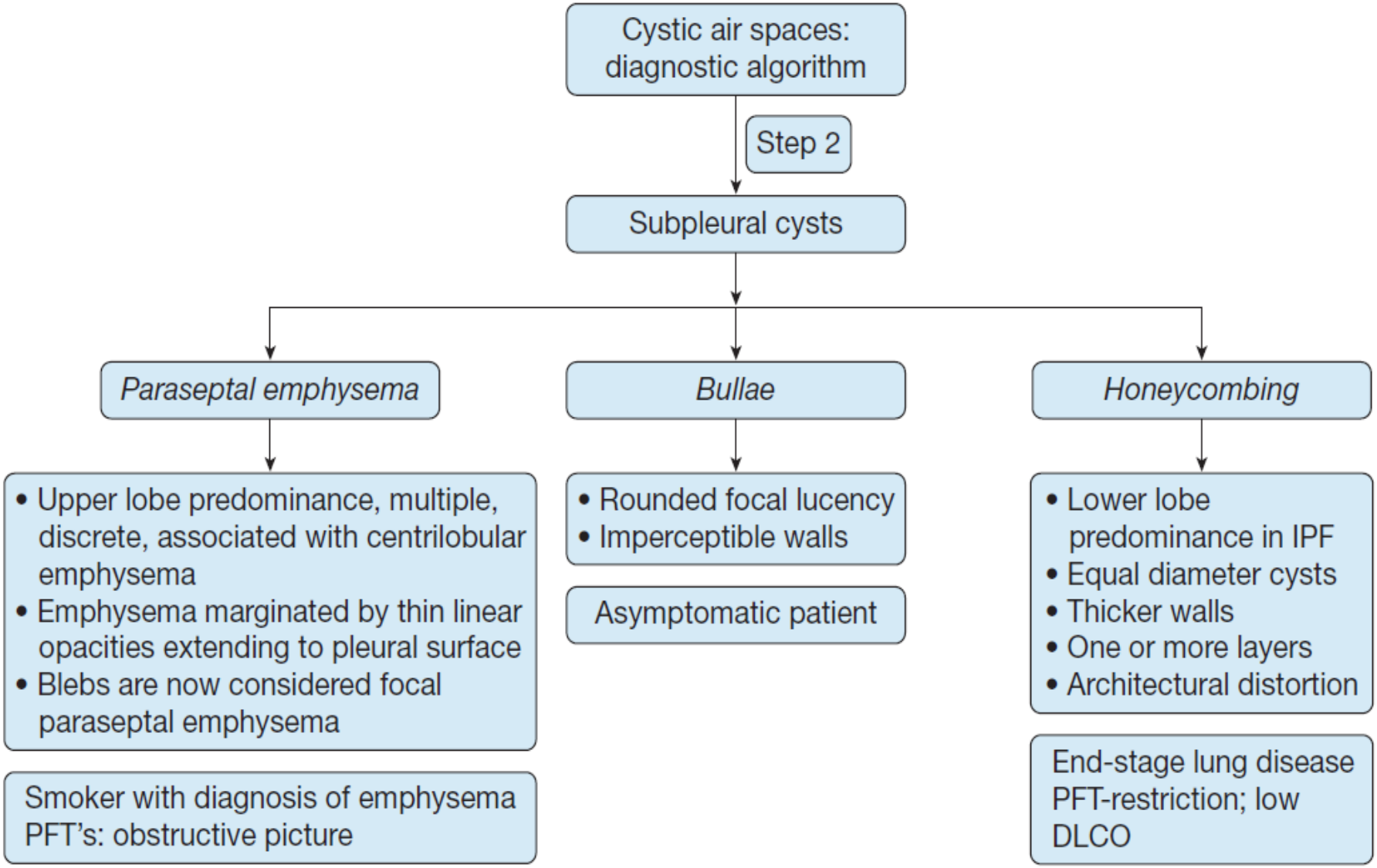
(2)multifocal : lymphangioleiomyomatosis (LAM)/tuberous sclerosis (TS) and Birt Hogg Dubé (BHD) syndrome.

- Associated with discrete lung nodules:
  - lymphoid interstitial pneumonia (LIP)
  - Amyloidosis
  - light-chain deposition disease (LCDD) (less frequently)
  - pulmonary Langerhans cell histiocytosis (PLCH).
- Association with diffuse ground-glass attenuation: various infections (Pneumocystis jirovecii pneumonia [PJP]) and desquamative interstitial pneumonia (DIP).

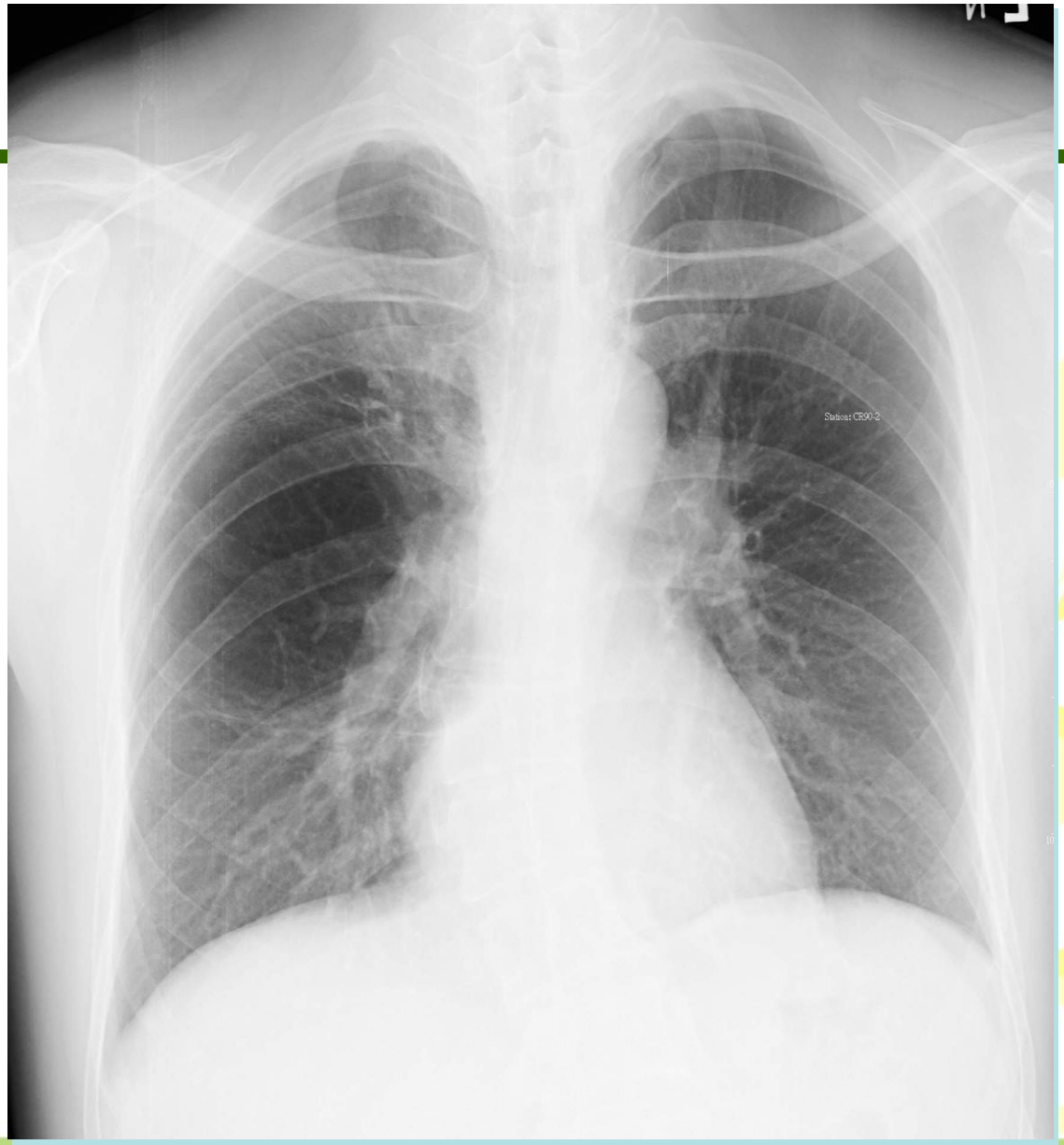
CHEST 2016; 150(4):945-965



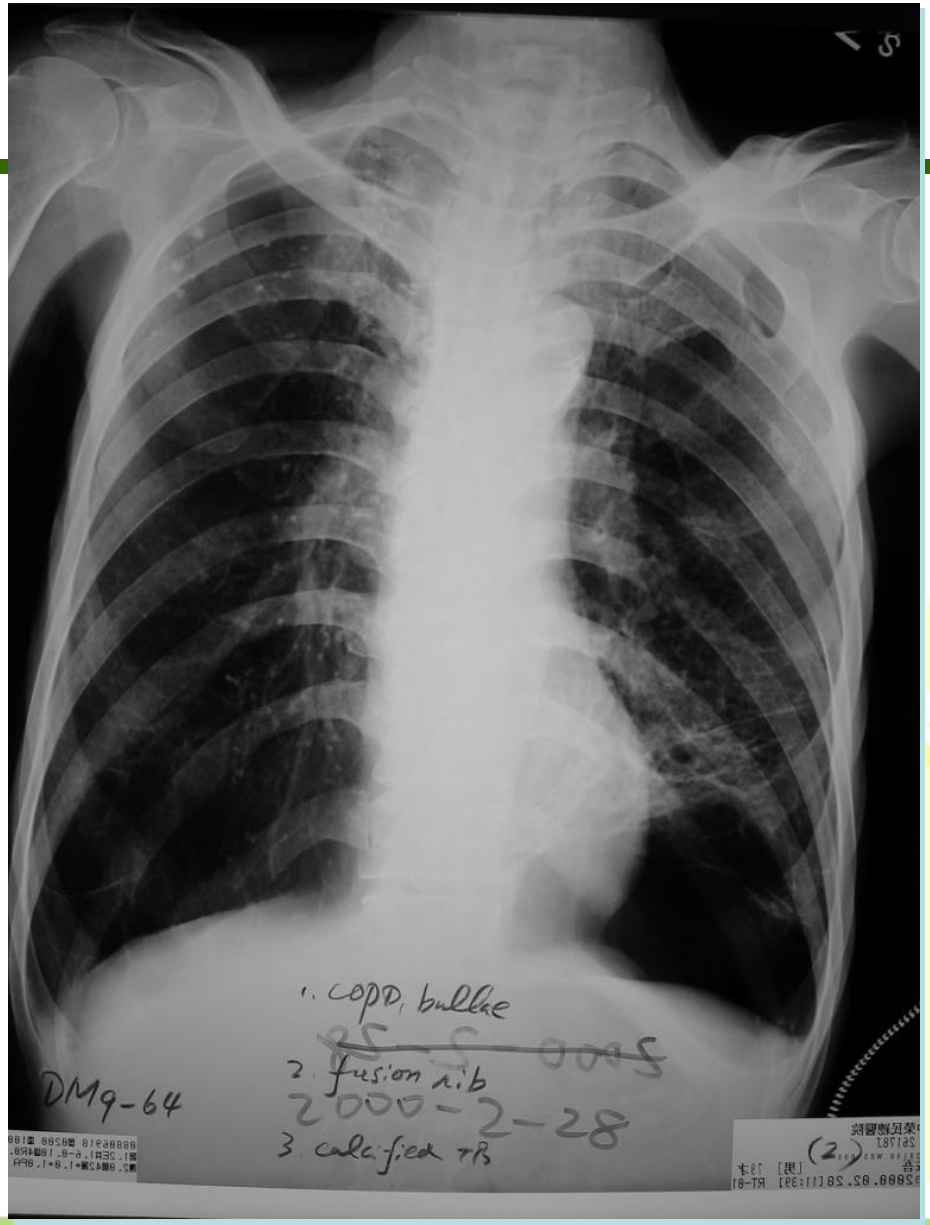
CHEST 2016; 150(4):945-965



CHEST 2016; 150(4):945-965

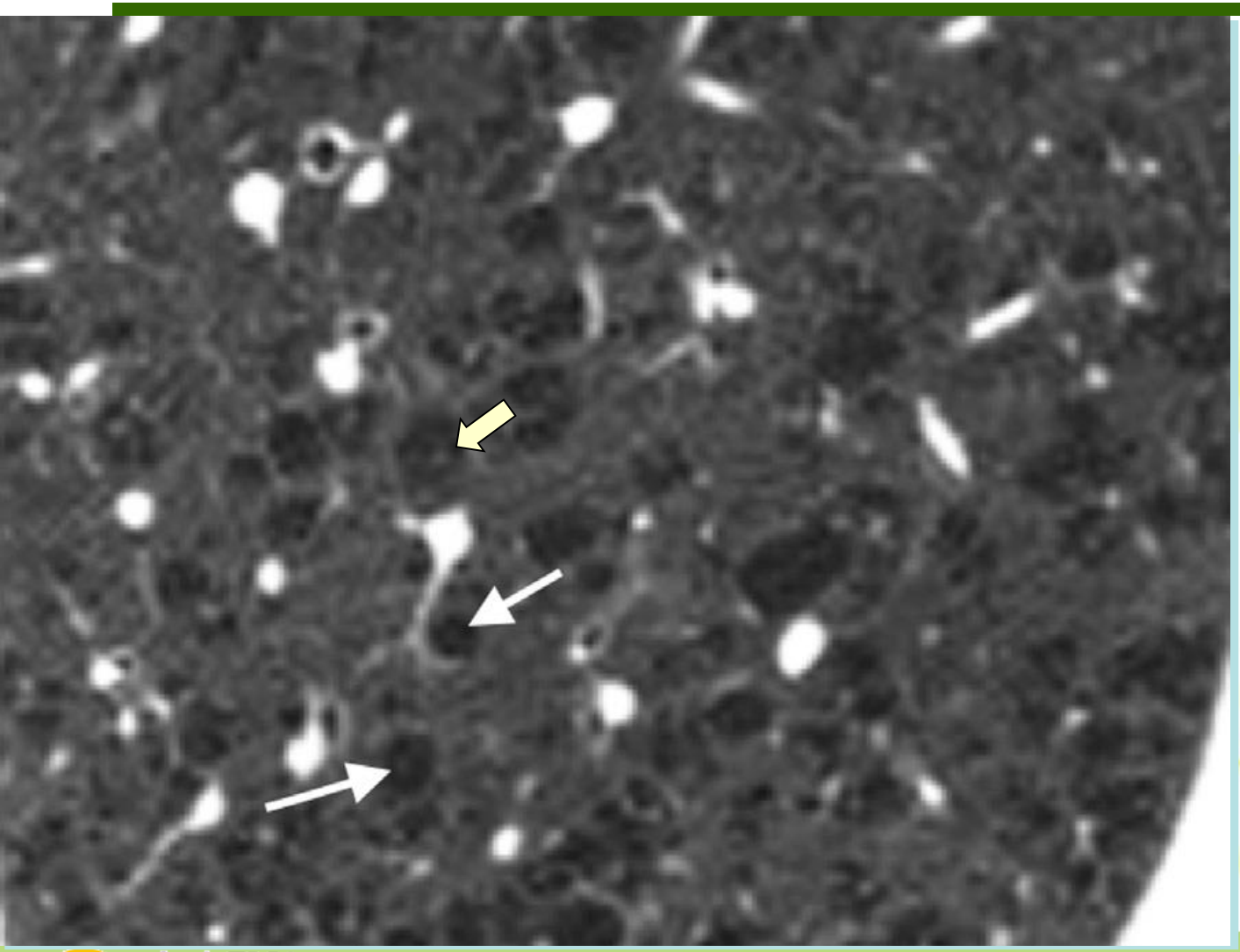


Bullae



COPD bullae

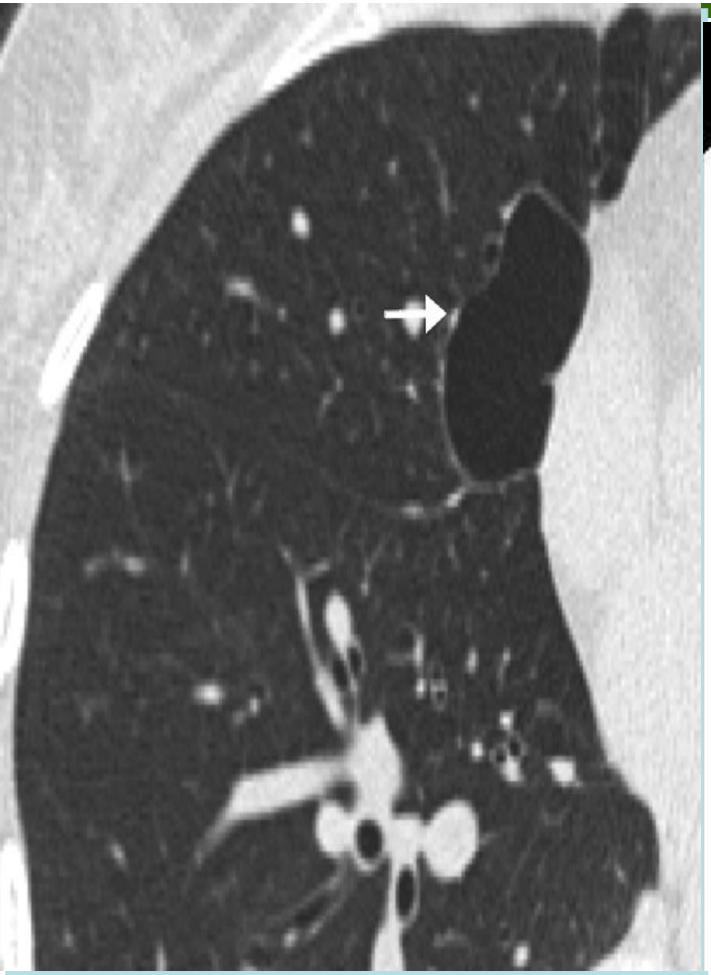
Centrilobular emphysema

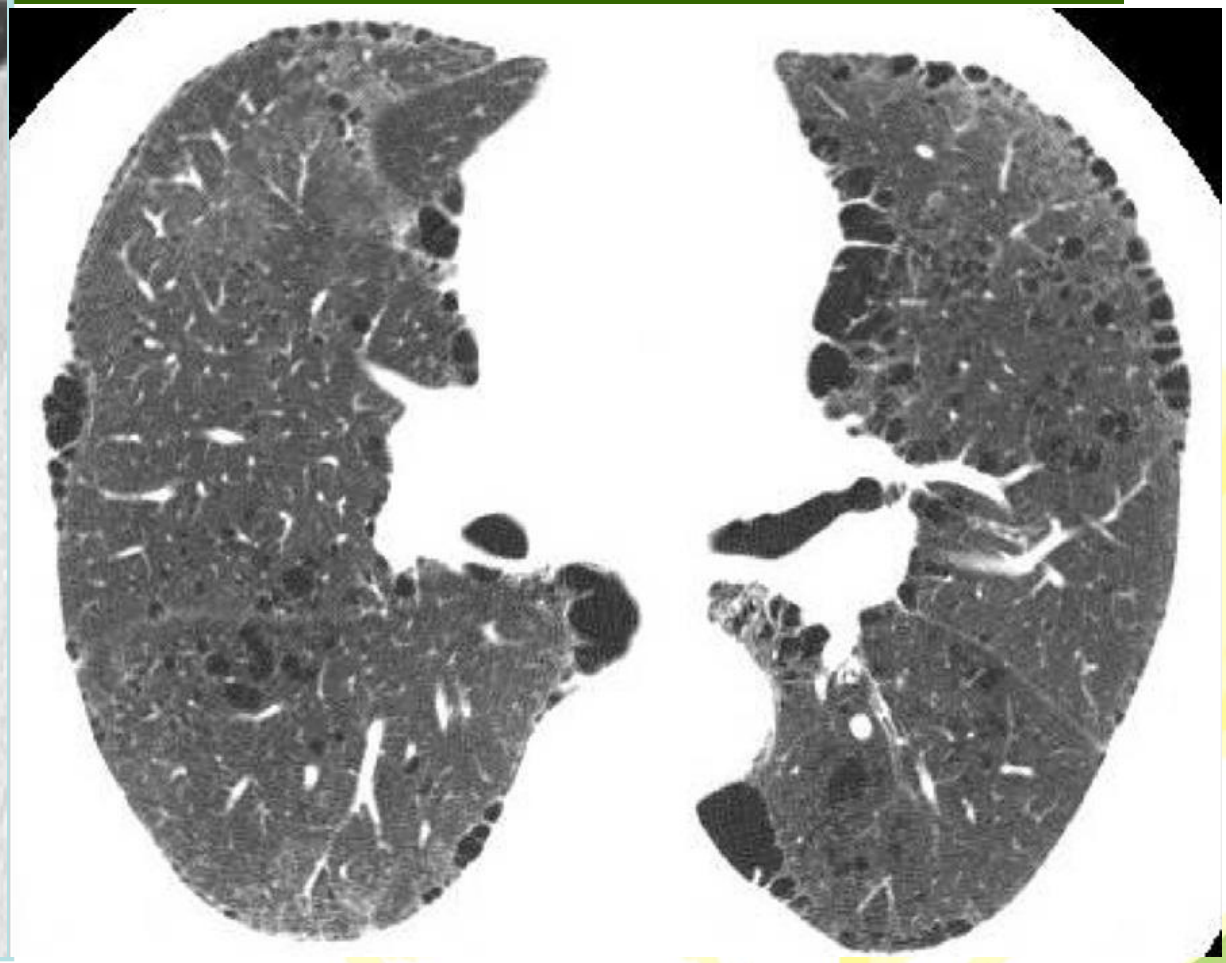


upper lung zones

a dot in the center, representing a branch of pulmonary artery

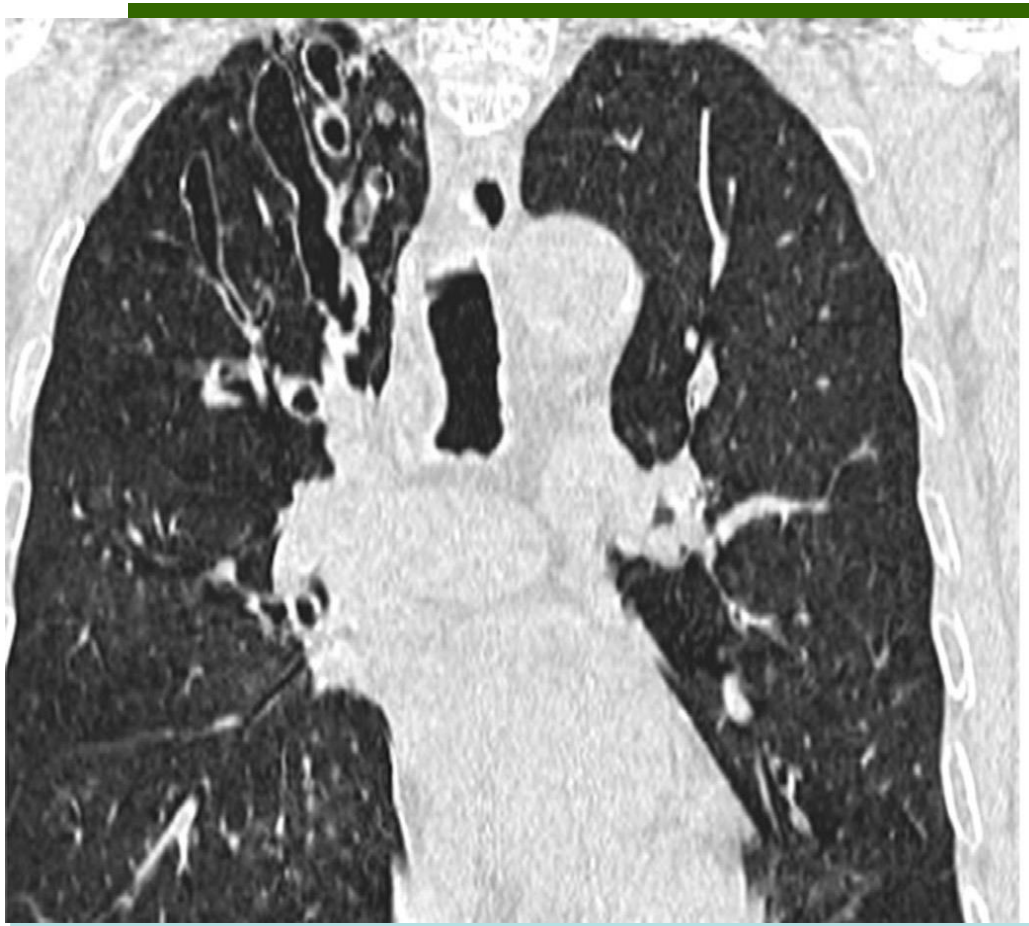
Paraseptal emphysema, very thin walls (< 1 mm)

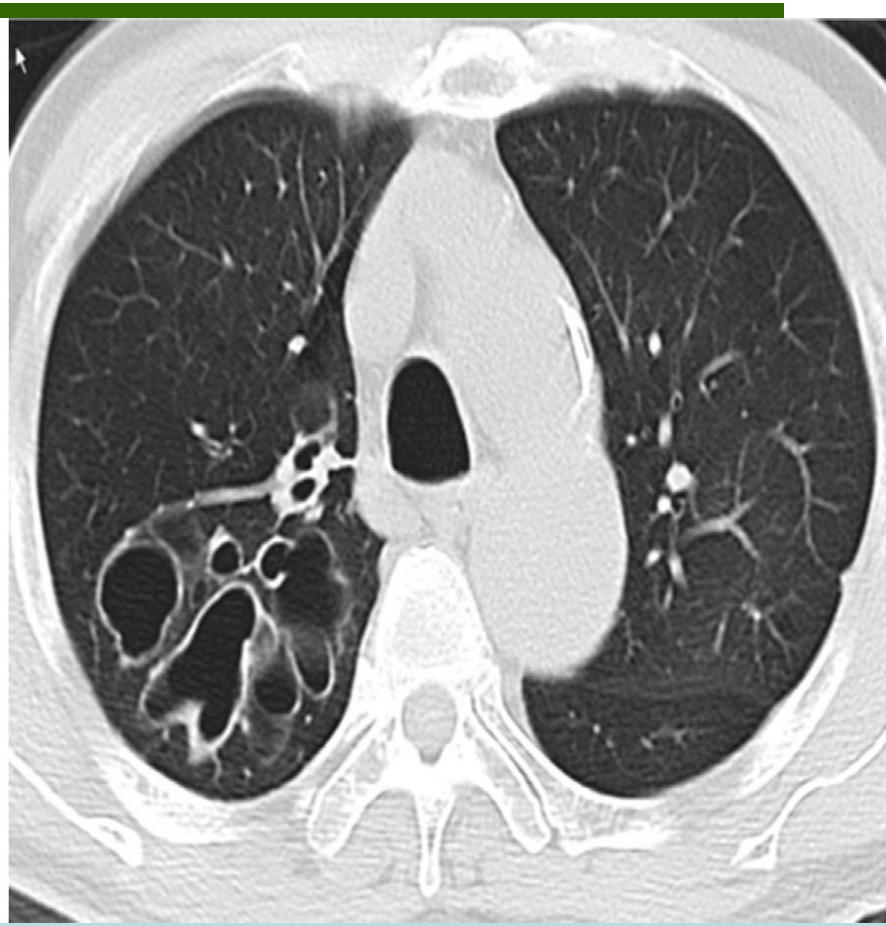




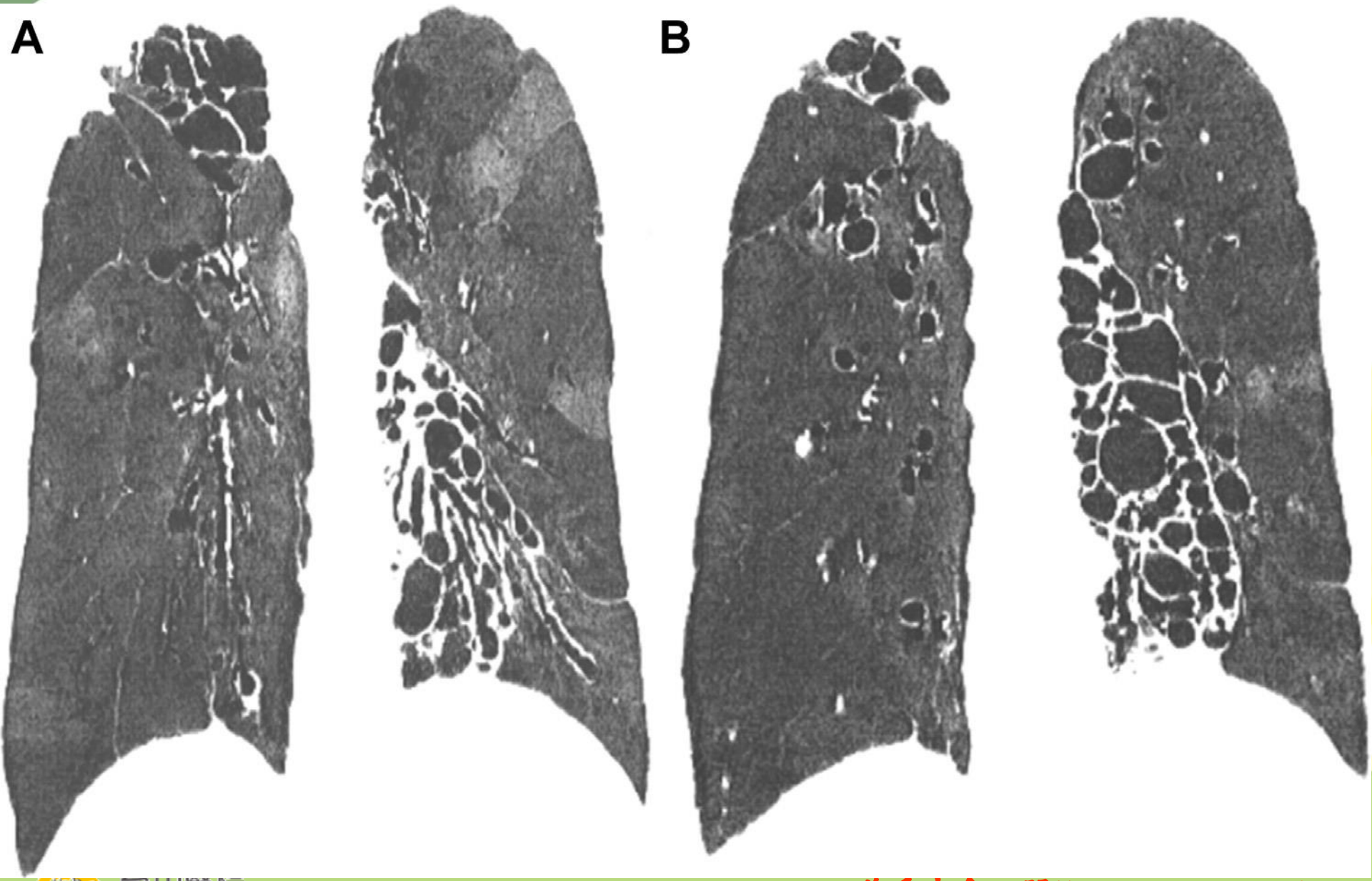
subpleural lucencies, upper lobe predominance mixed with centrilobular emphysema

Cystic bronchiectasis

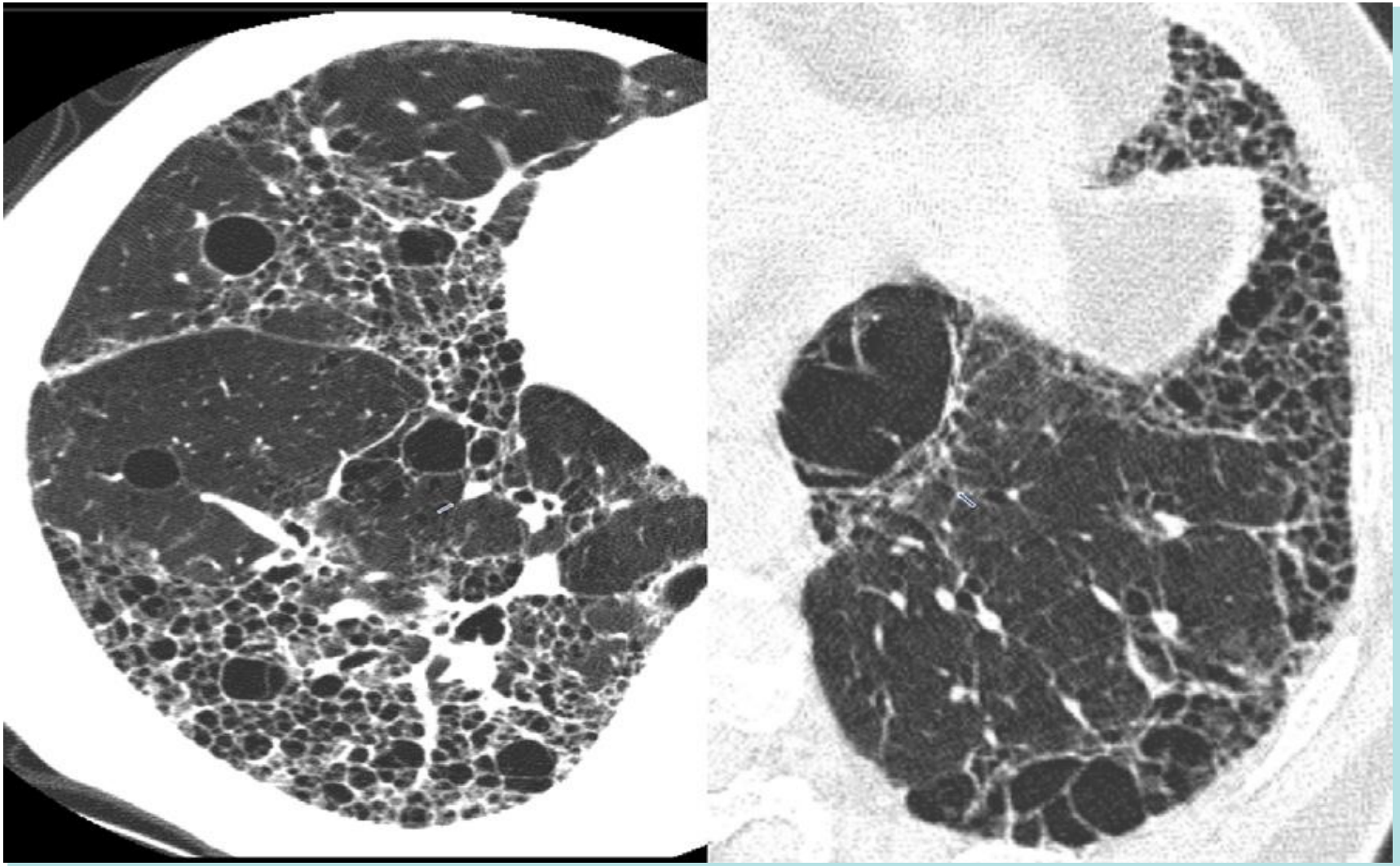




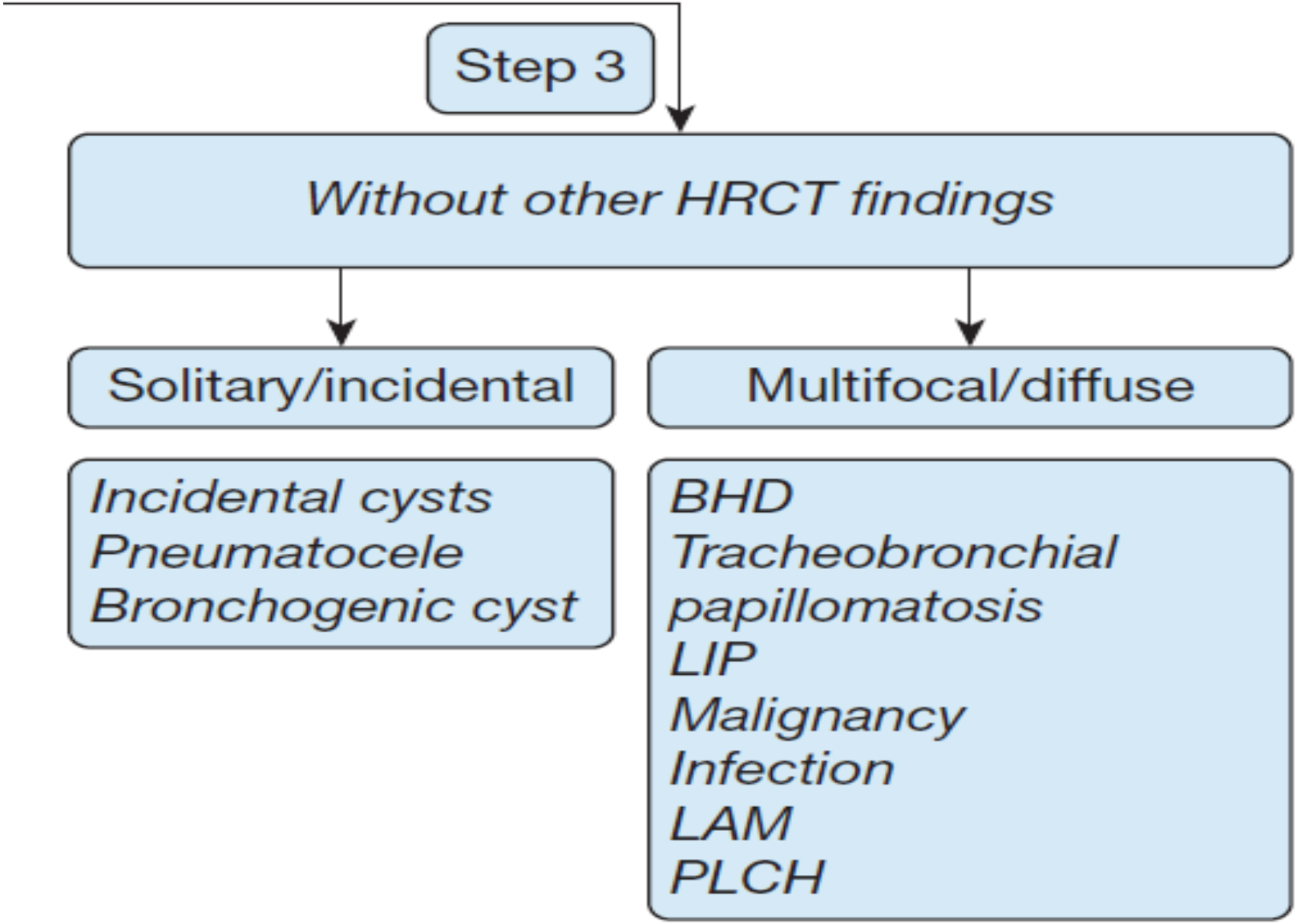
course peripherally to within 1 cm of pleural surface


A
B

Honeycombing- end-stage lung disease

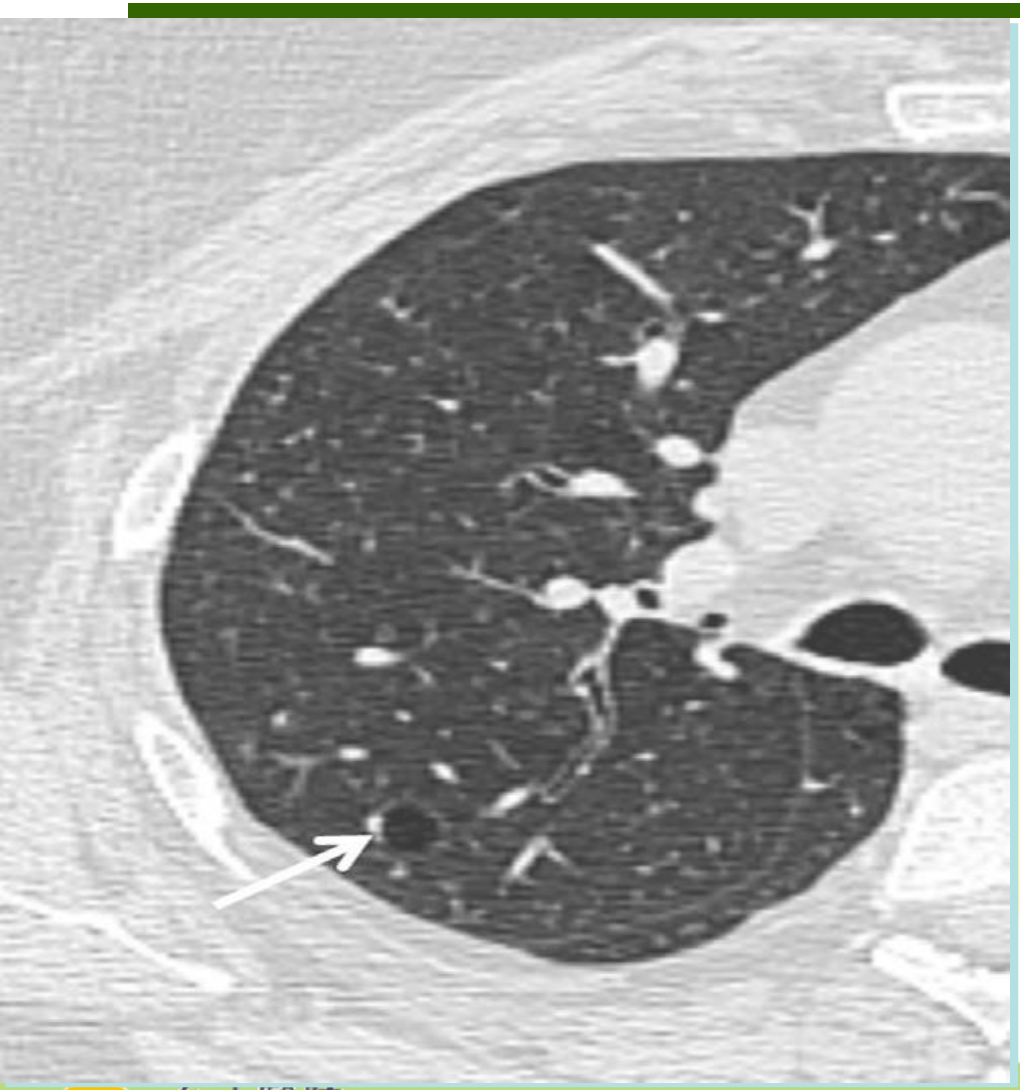


Lower lobe predominance, subpleural area thicker walls



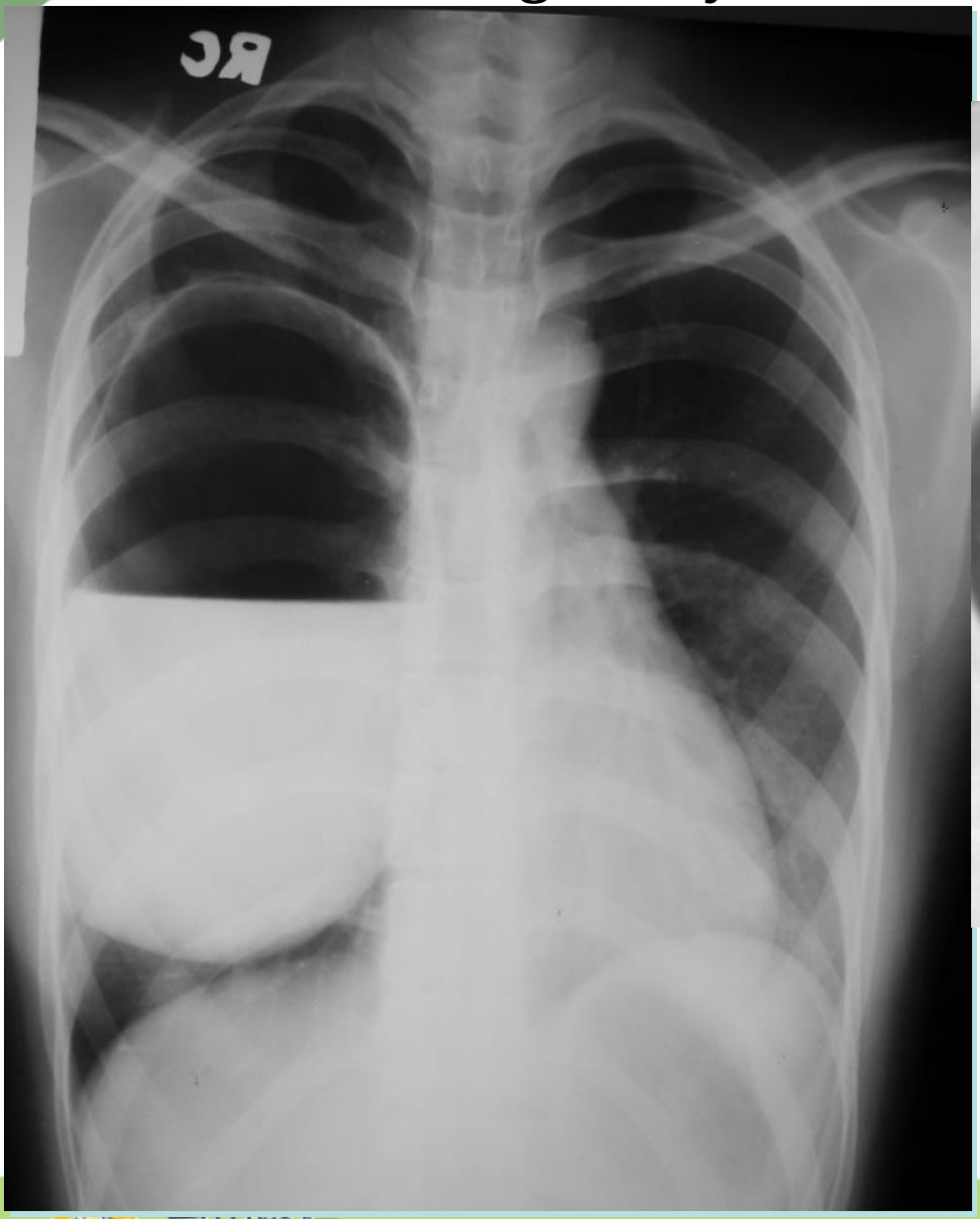
CHEST 2016; 150(4):945-965

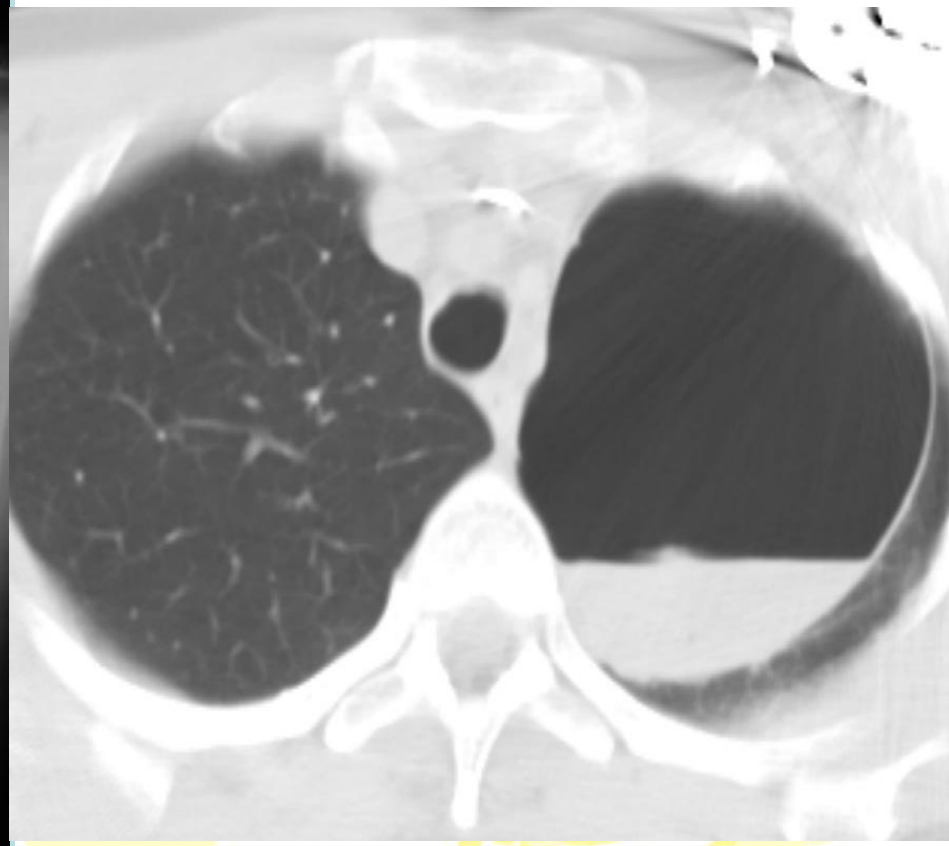
Incidental cyst



normal aging process or persist as a remnant of previous infection or trauma

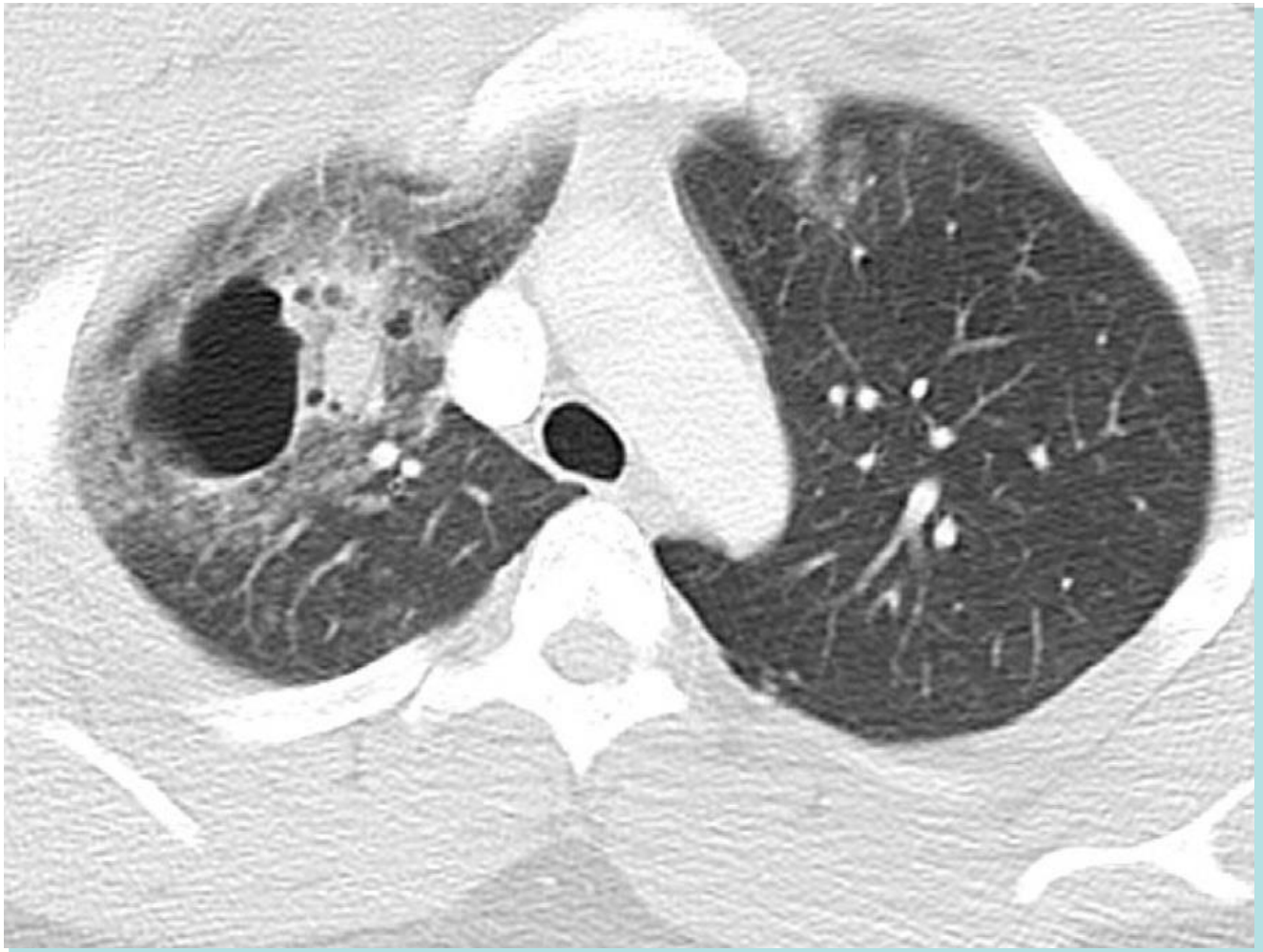
Bronchogenic cyst infected



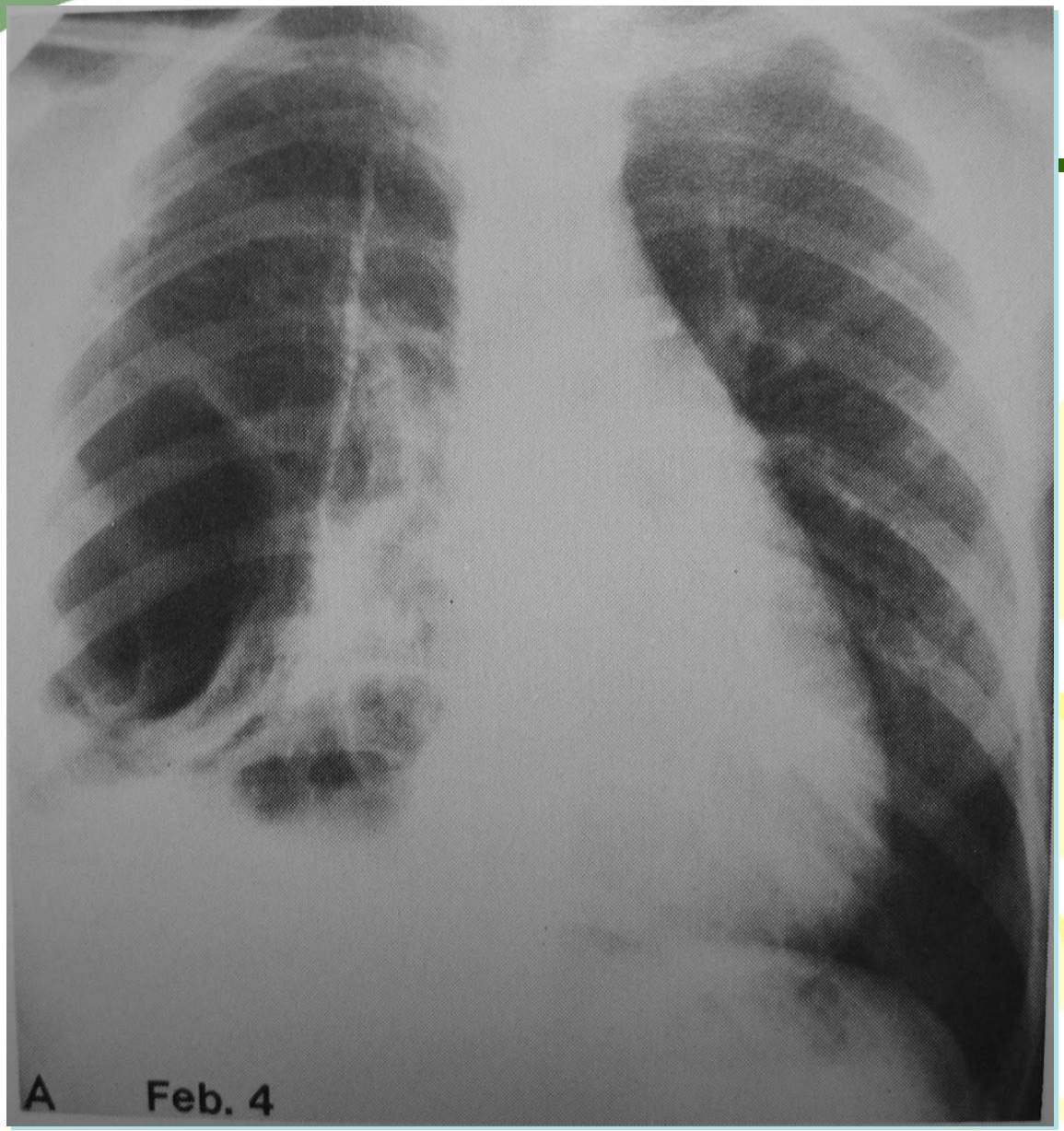


abnormal budding of the tracheobronchial tree

Traumatic pneumatocele



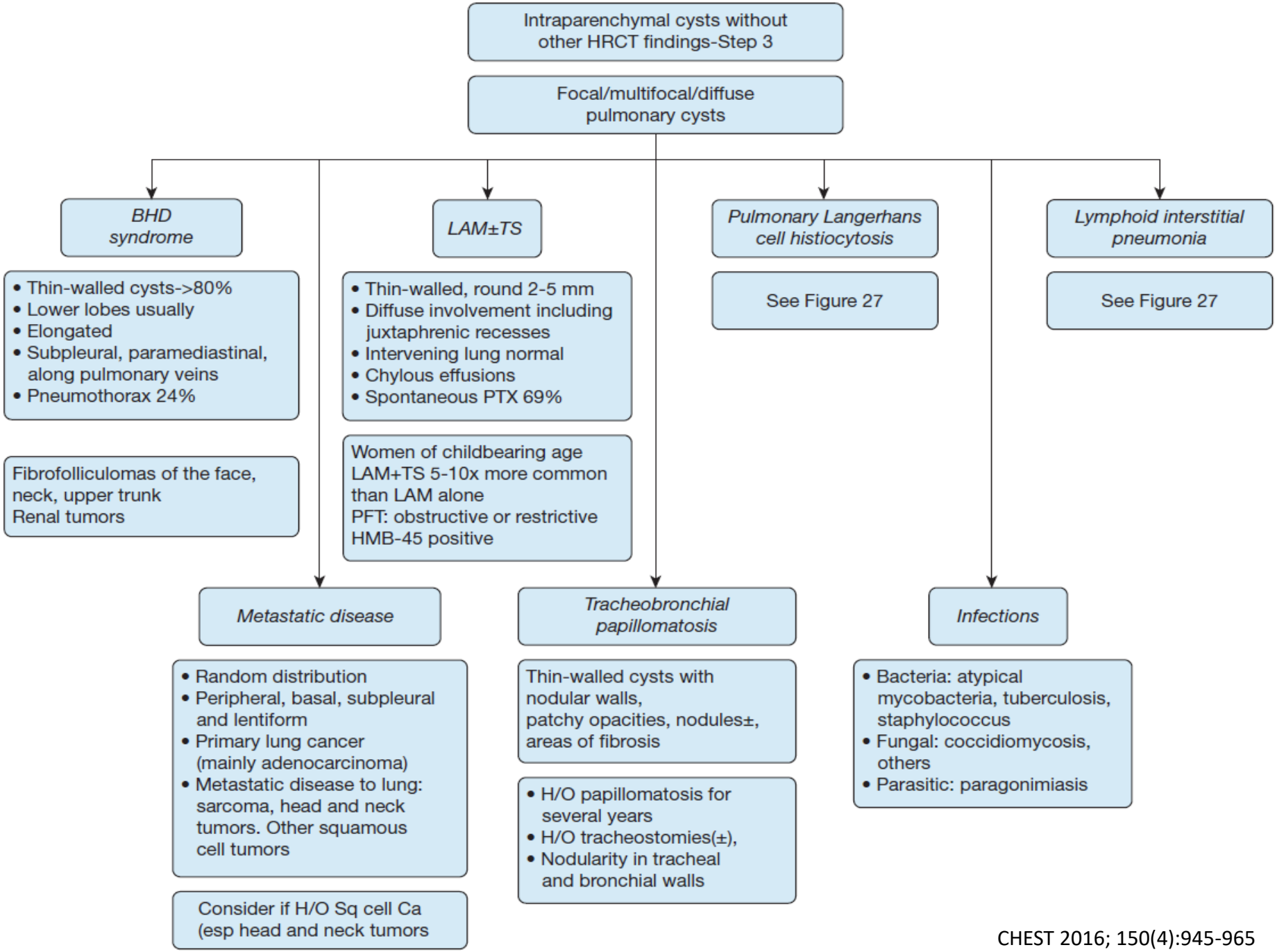
CHEST 2016; 150(4):945-965



Pneumatocele, Staphylococcal pneumonia

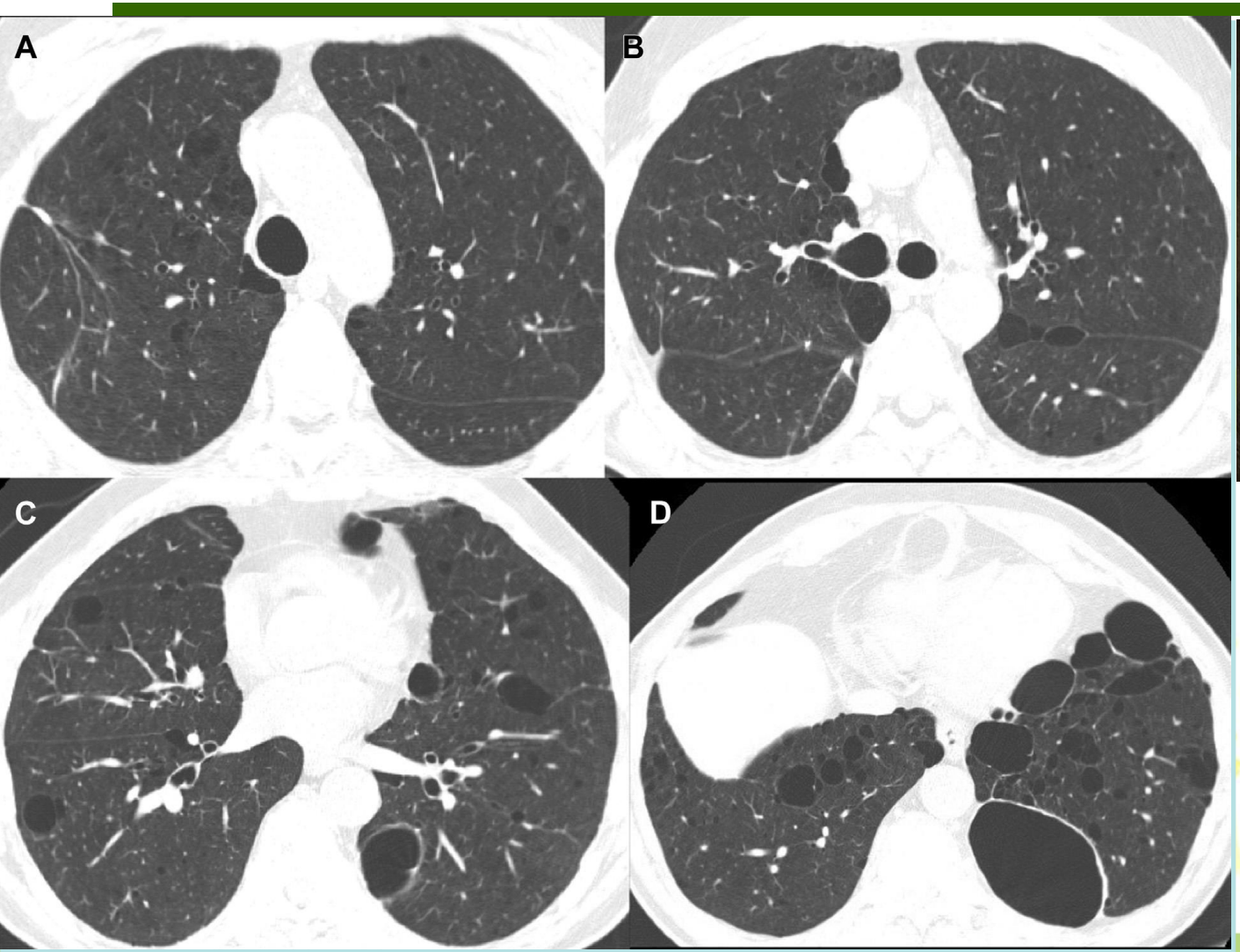
Fraser et al,

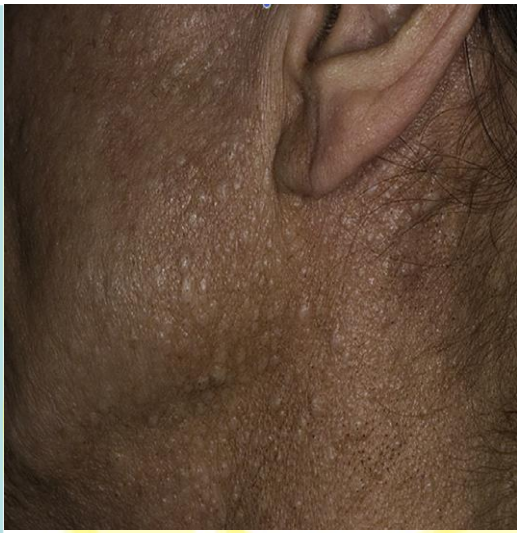
Synopsis of disease of the chest, 2nd ed



CHEST 2016; 150(4):945-965

Birt-Hogg-Dubé (BHD) syndrome



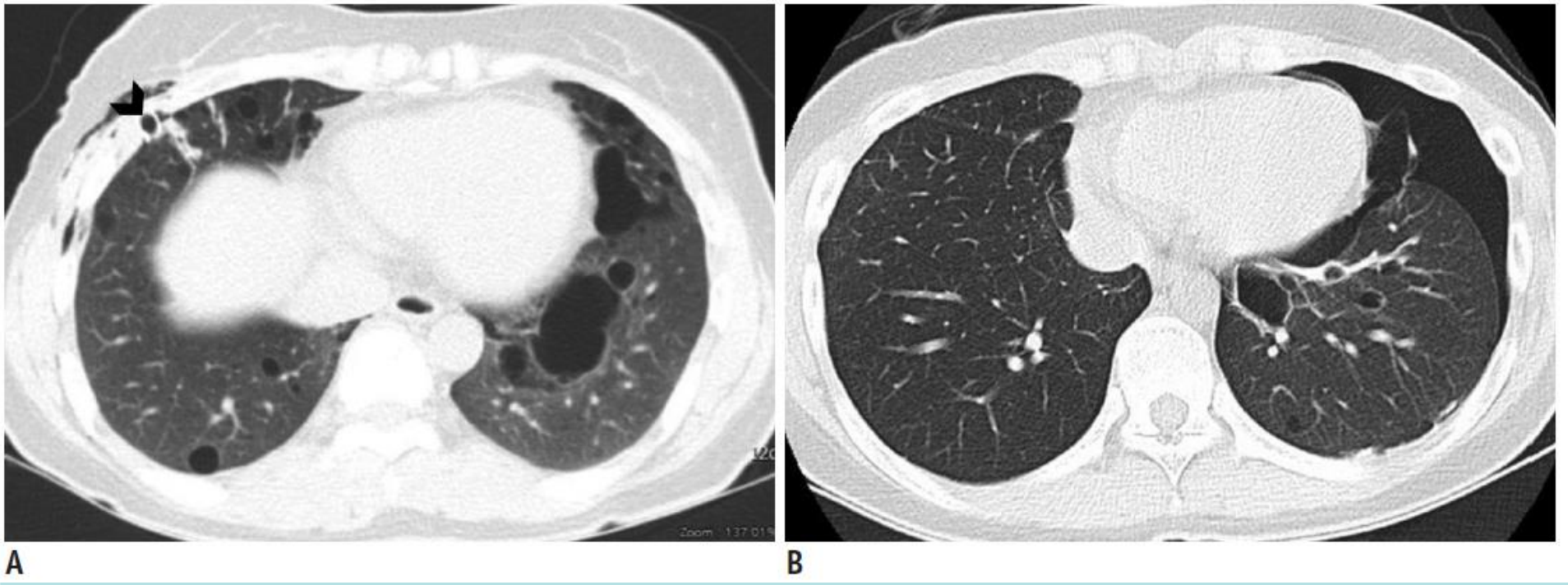


Fibrofolliculomas

AD, FLCN gene mutations

peripheral lung zones, at lung bases, and along the mediastinum

Birt-Hogg-Dubé (BHD) syndrome



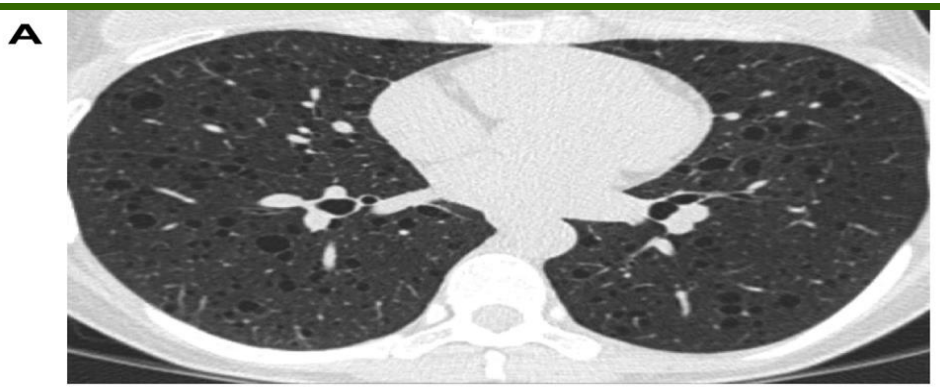
recurrent pneumothorax in 47-year-old woman (A) and 22-year-old woman (B) who were mother and daughter
Autosomal dominant disease

Lymphangioleiomyomatosis (LAM)

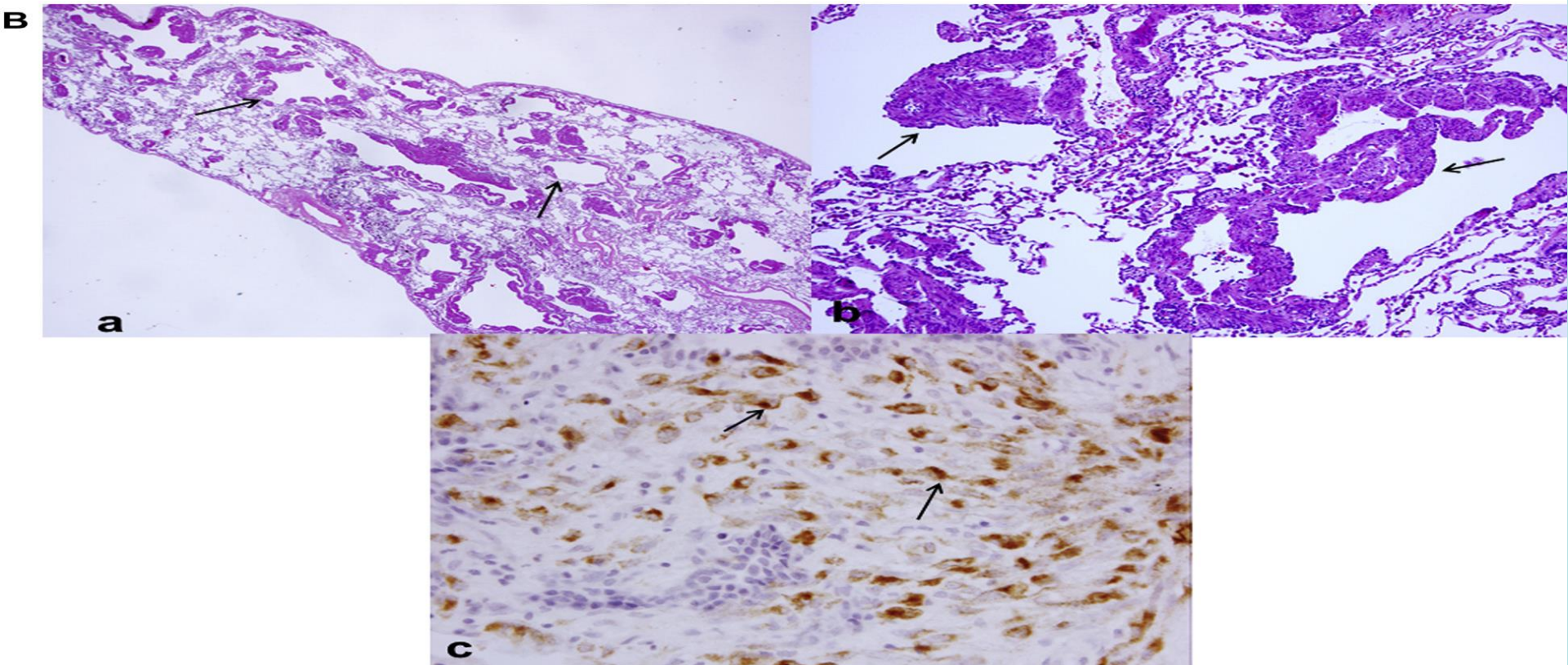
Characteristic	TS-LAM	Sporadic LAM
Radiology	HRCT may show diffuse nodular lesions along with thin-walled cysts, especially when MMPH coexists[45]	Thin-walled cysts surrounded by normal parenchyma[49]
Severity (clinical signs/symptoms)	Less severe	More severe
Genetic predisposition	Familial	Occurs sporadically
Associated findings	CNS (hamartomas, developmental delays, seizure disorder) Skin (hypomelanotic macules, ash-leaf spots, shagreen patches on the lower back or nape of neck, subungual fibromas, skin tags, and café au lait spots) Eye (retinal phakomas) Hepatic and renal angiomyolipomas	Renal angiomyolipomas[46,47]

CHEST 2016; 150(4):945-965

Lymphangioleiomyomatosis (LAM)

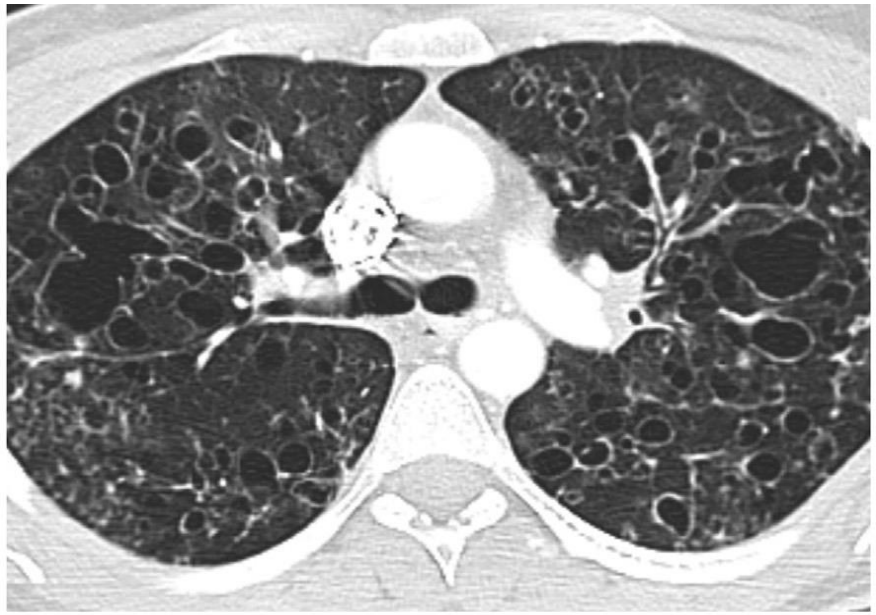


Thin-walled round (2-5 mm) cysts usually involve juxtaphrenic recesses and spare the extreme apices.

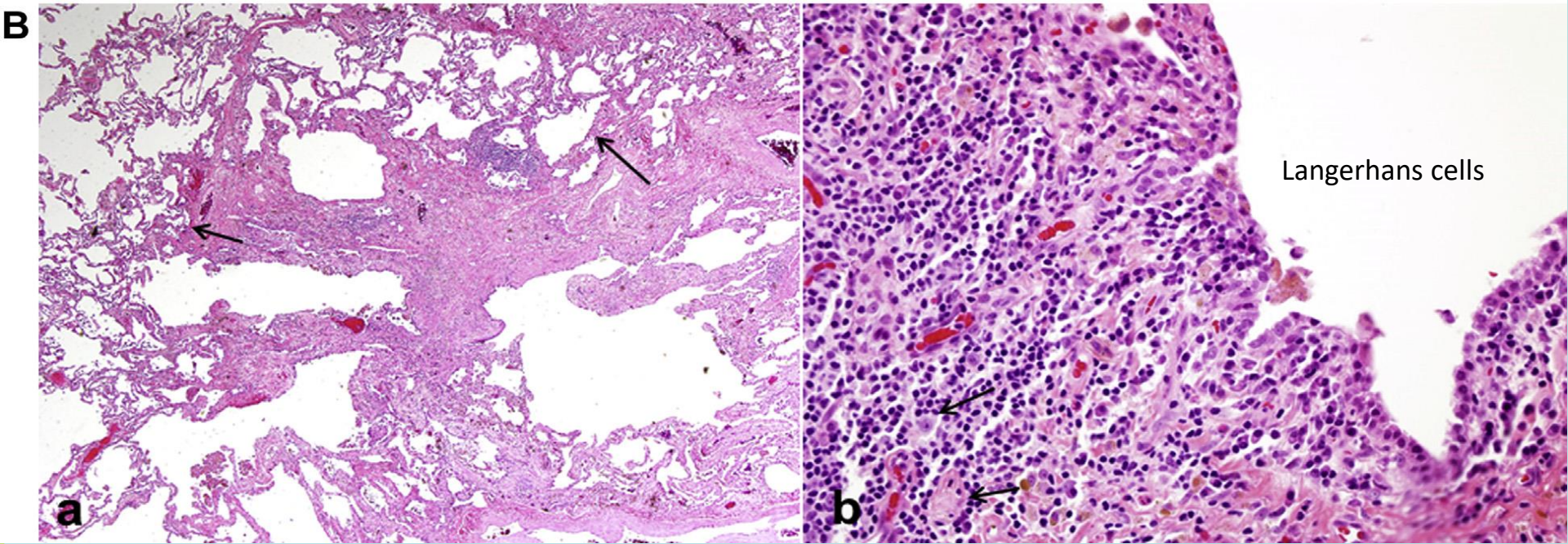


Pulmonary Langerhans Cell Histiocytosis

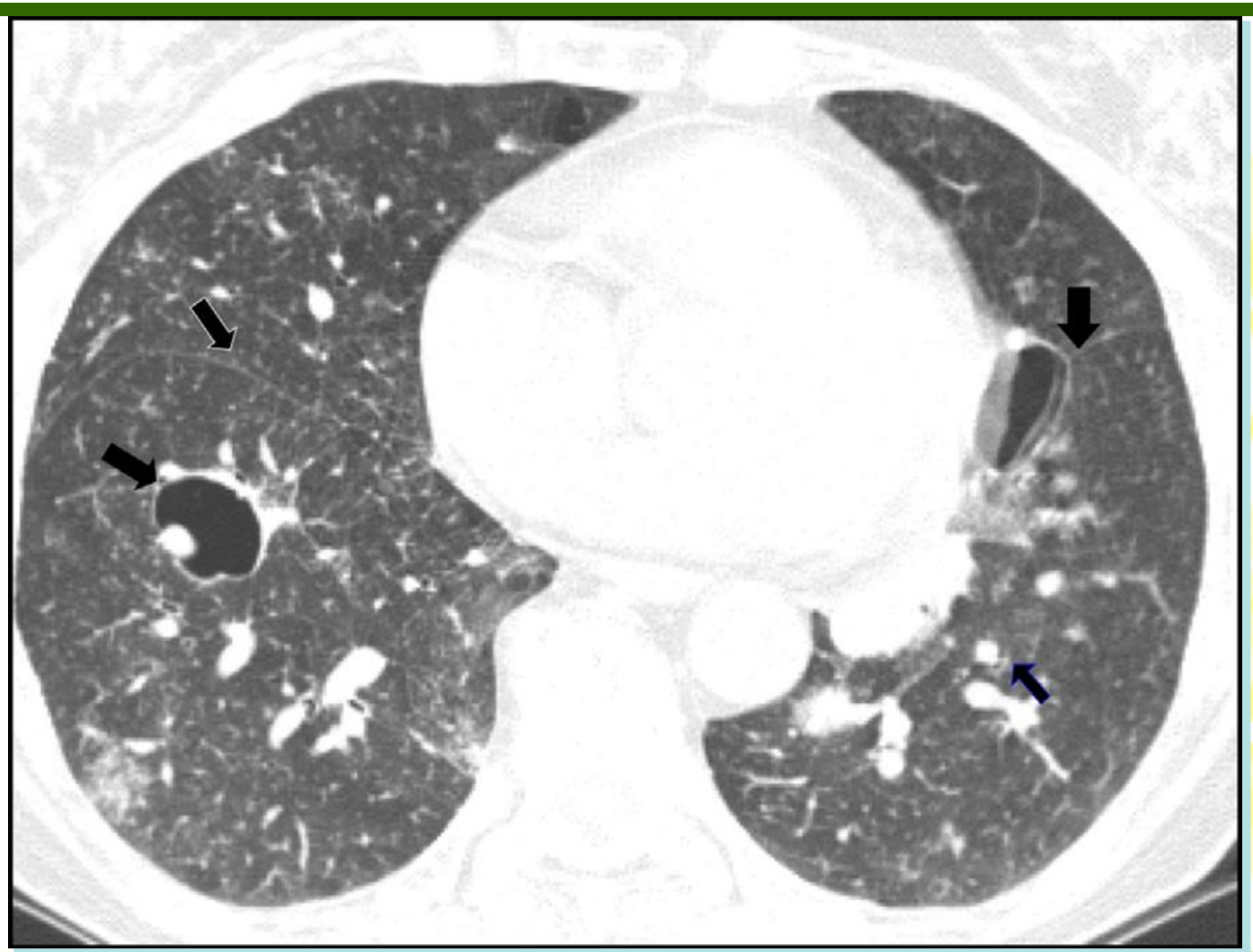
Cysts predominantly in upper and middle lobes, are variable in size, thick- or thin-walled, and have bizarre shapes.



BRAF mutation, young smokers (most commonly between 20 and 40 years of age

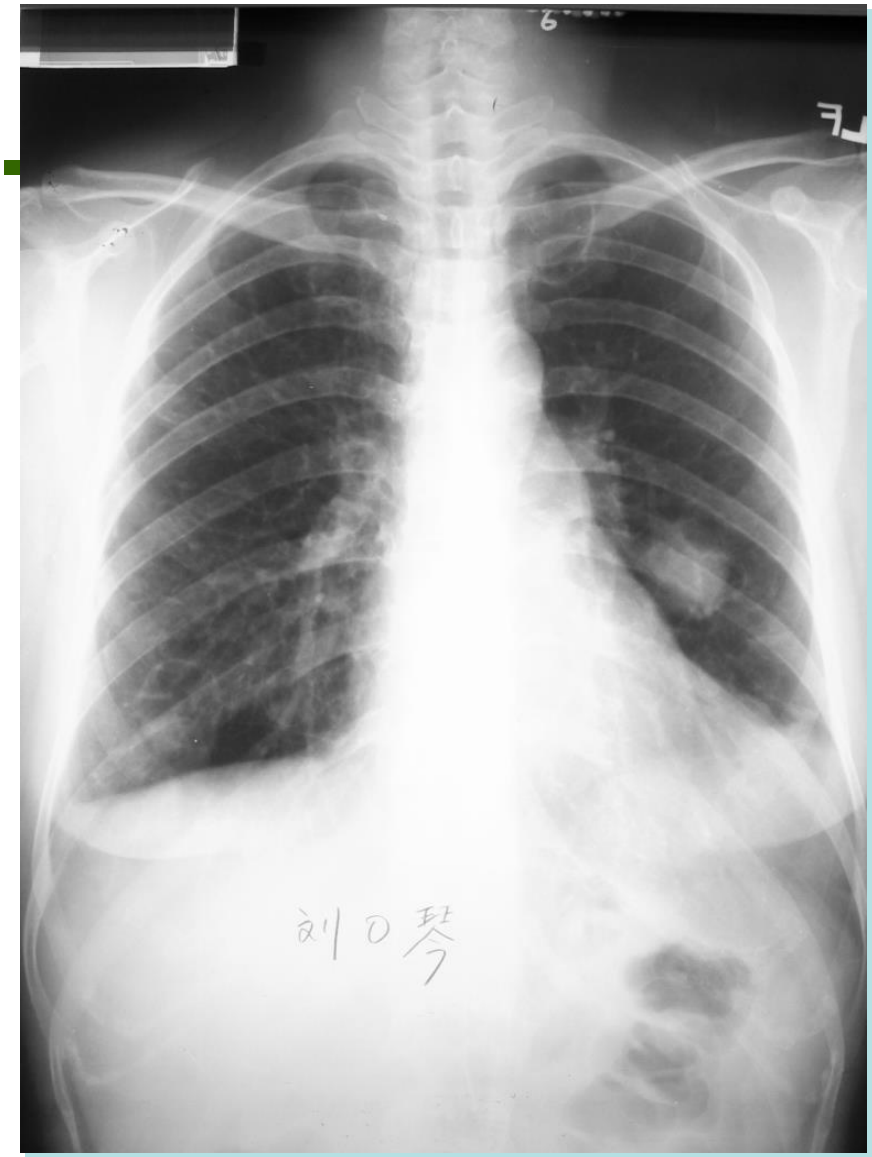


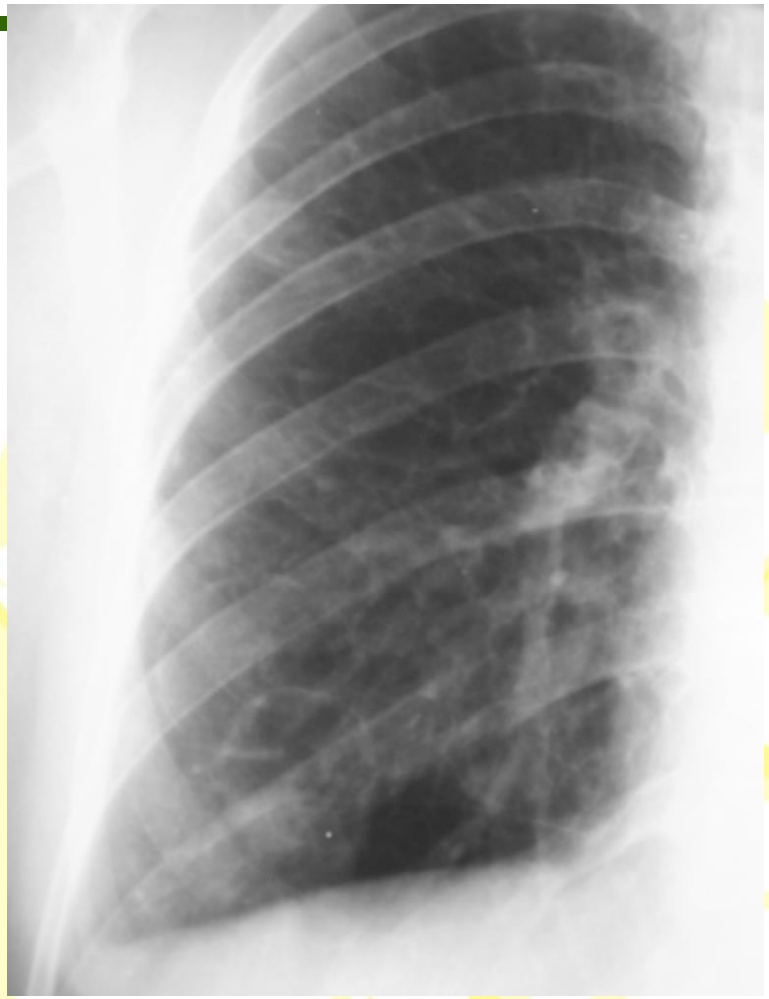
Lymphoid interstitial pneumonia



random in distribution, with multiple small nodules

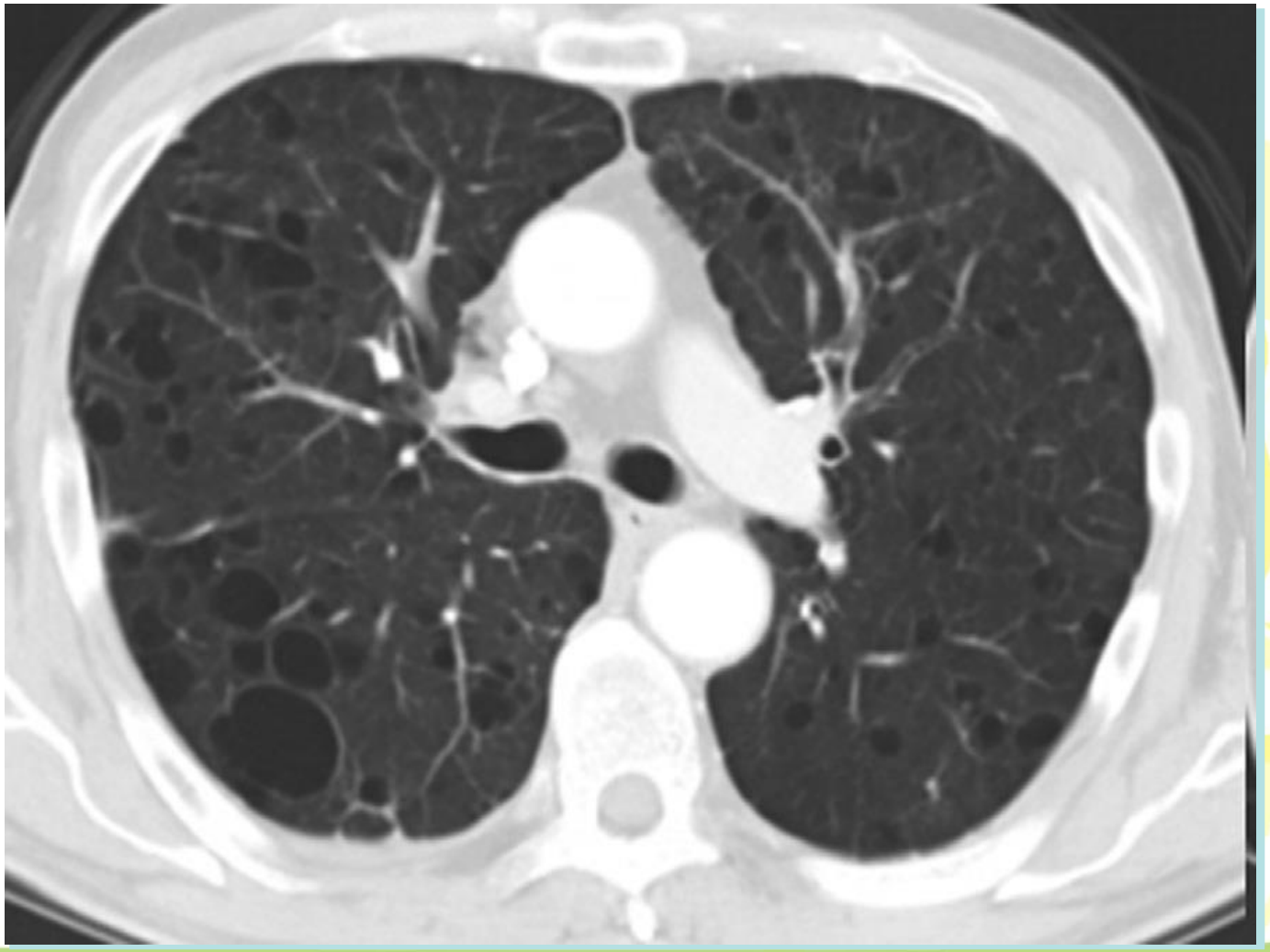
Hemangiopericytoma





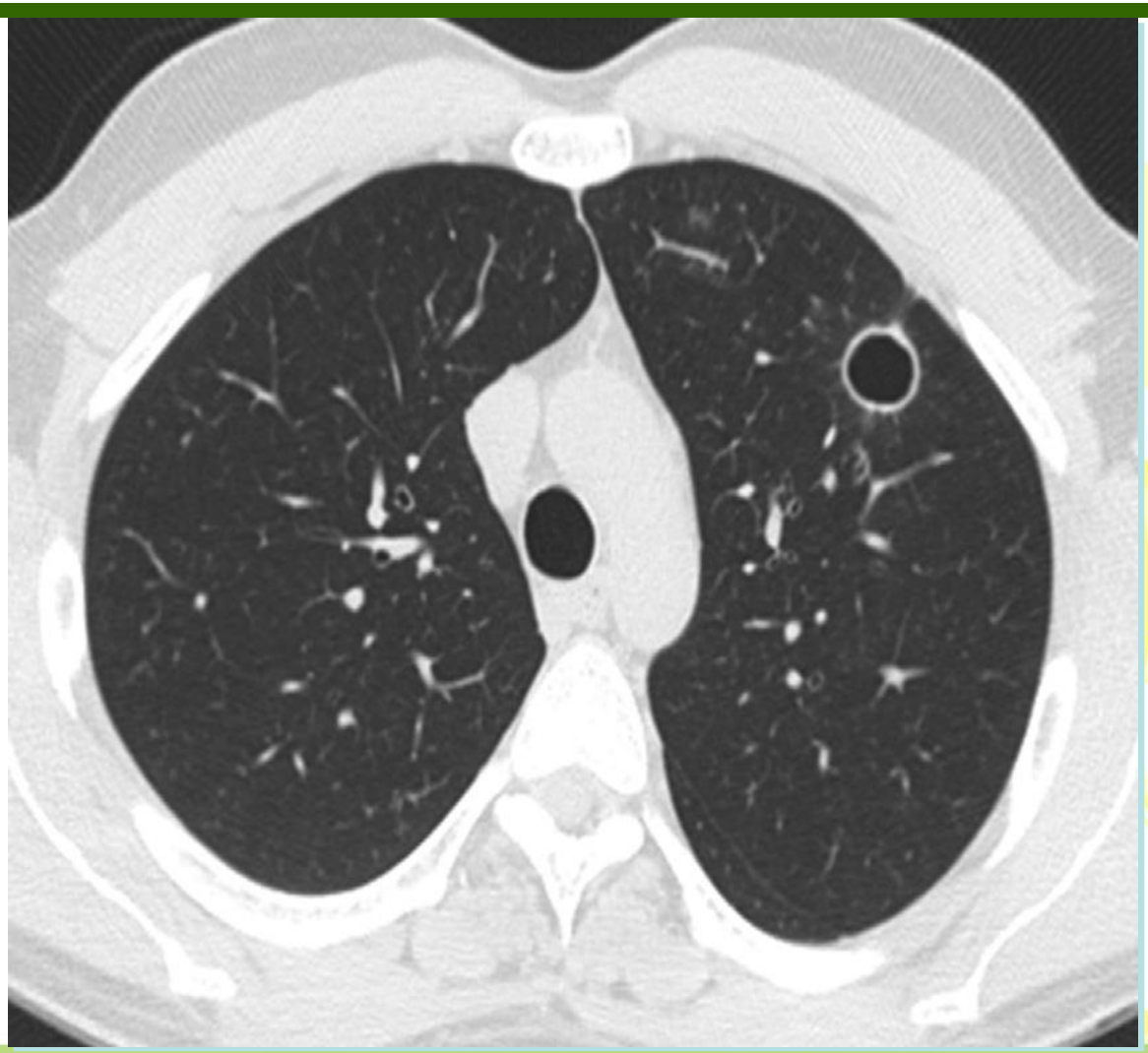
check-valve obstruction with distal overinflation

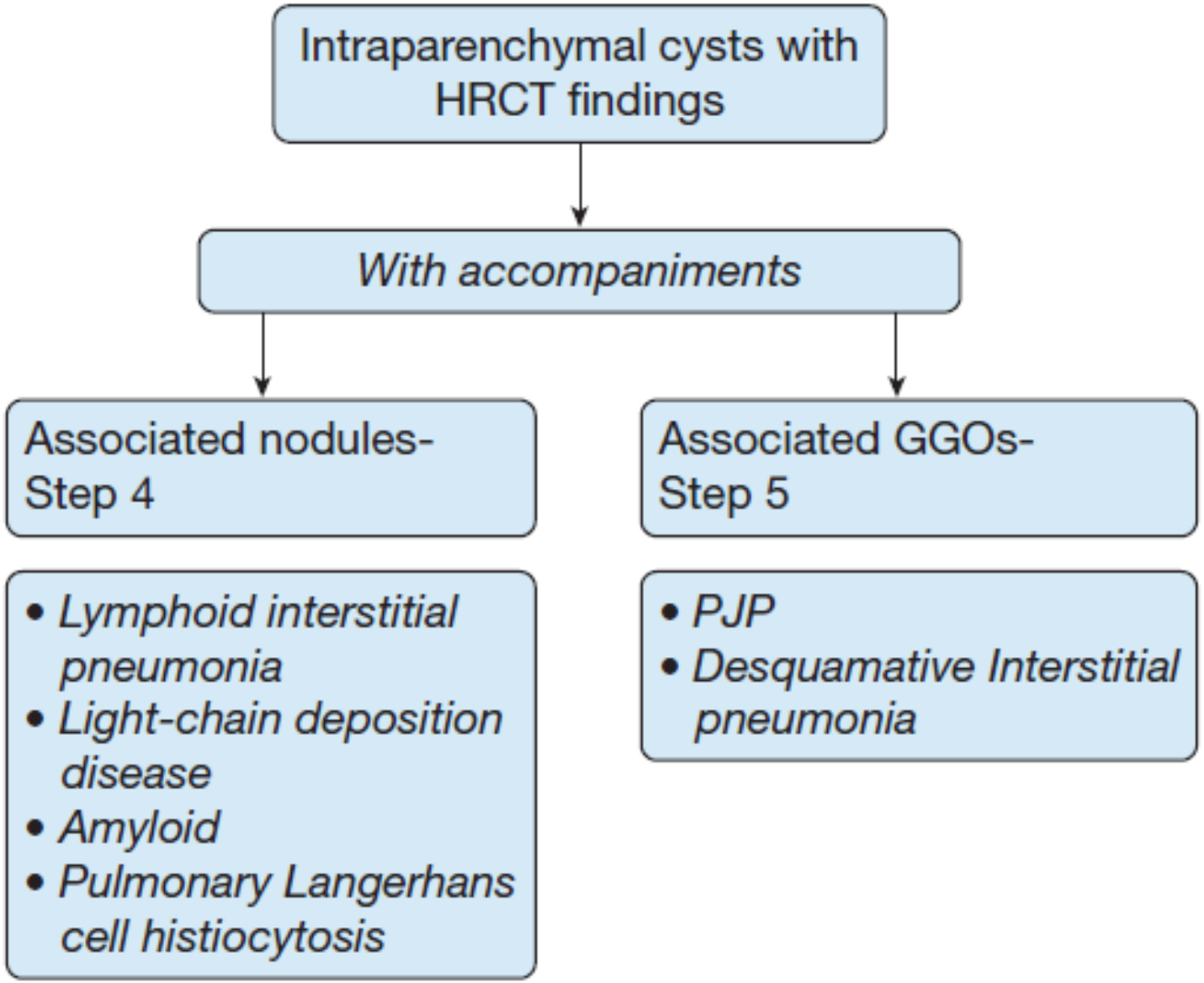
Colon cancer with lung metastasis

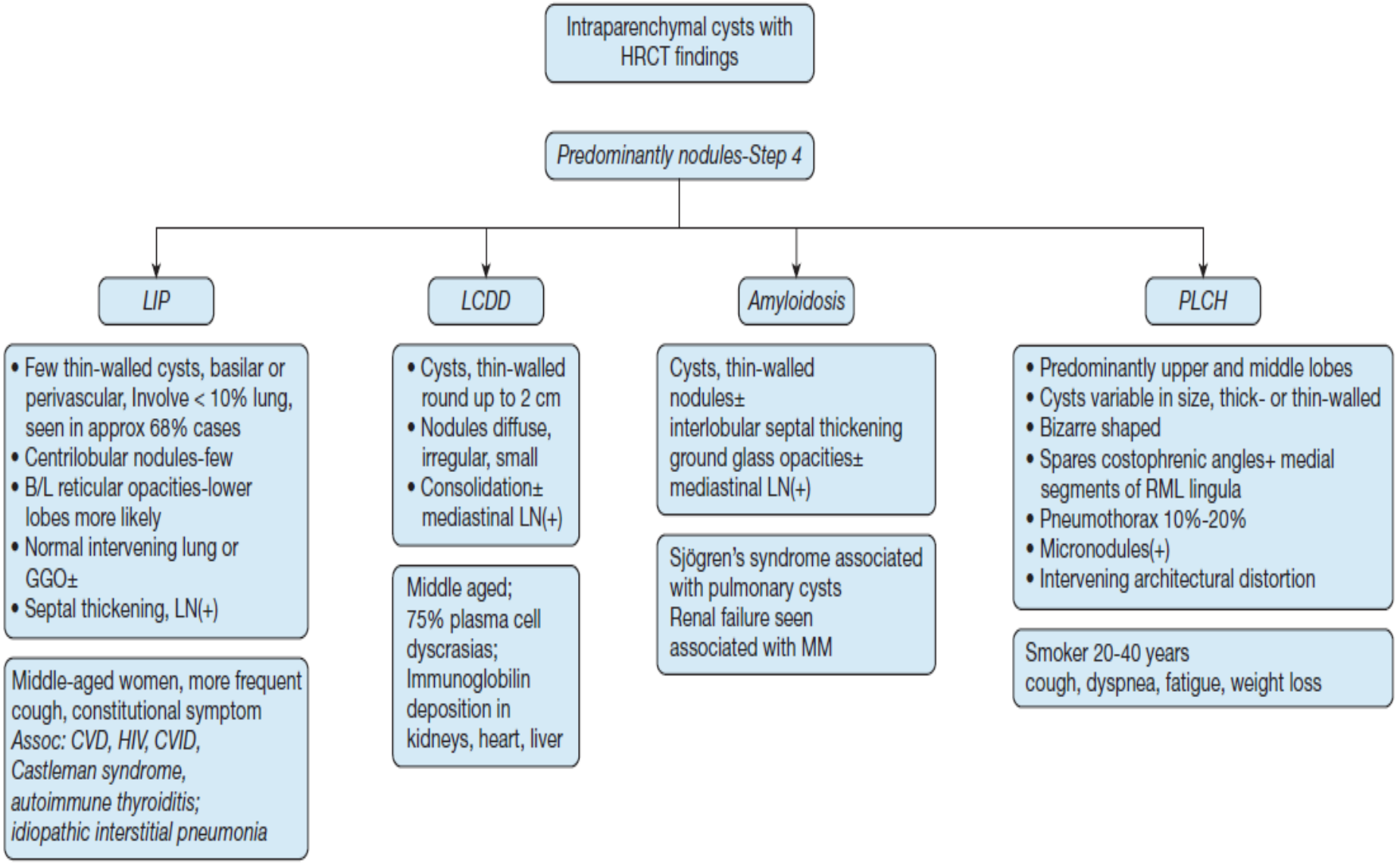


check-valve obstruction with distal overinflation

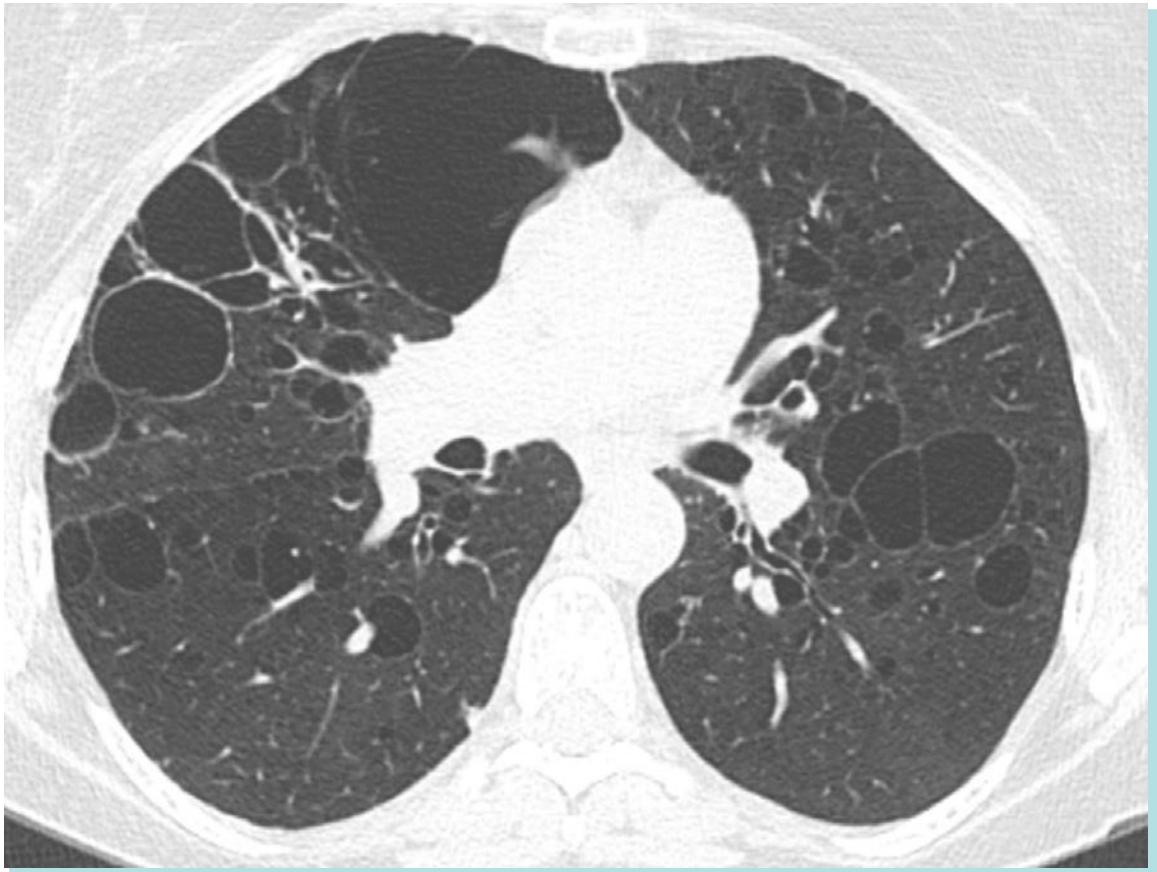
Coccidioidomycosis




Intraparenchymal cysts with HRCT findings
With accompaniments
Associated nodules- Step 4
Associated GGOs- Step 5
• Lymphoid interstitial pneumonia
• Light-chain deposition disease
• Amyloid
• Pulmonary Langerhans cell histiocytosis
• PJP
• Desquamative Interstitial pneumonia


Intraparenchymal cysts with HRCT findings
Predominantly nodules-Step 4
LIP
• Few thin-walled cysts, basilar or perivascular, Involve < 10% lung, seen in approx 68% cases
• Centrilobular nodules-few
• B/L reticular opacities-lower lobes more likely
• Normal intervening lung or GGO±
• Septal thickening, LN(+)
Middle-aged women, more frequent cough, constitutional symptom
Assoc: CVD, HIV, CVID, Castleman syndrome, autoimmune thyroiditis; idiopathic interstitial pneumonia
LCDD
• Cysts, thin-walled round up to 2 cm
• Nodules diffuse, irregular, small
• Consolidation± mediastinal LN(+)
Middle aged; 75% plasma cell dyscrasias; Immunoglobilin deposition in kidneys, heart, liver
Amyloidosis
Cysts, thin-walled nodules± interlobular septal thickening ground glass opacities± mediastinal LN(+)
Sjögren's syndrome associated with pulmonary cysts Renal failure seen associated with MM
PLCH
• Predominantly upper and middle lobes
• Cysts variable in size, thick- or thin-walled
• Bizarre shaped
• Spares costophrenic angles+ medial segments of RML lingula
• Pneumothorax 10%-20%
• Micronodules(+)
• Intervening architectural distortion
Smoker 20-40 years
cough, dyspnea, fatigue, weight loss

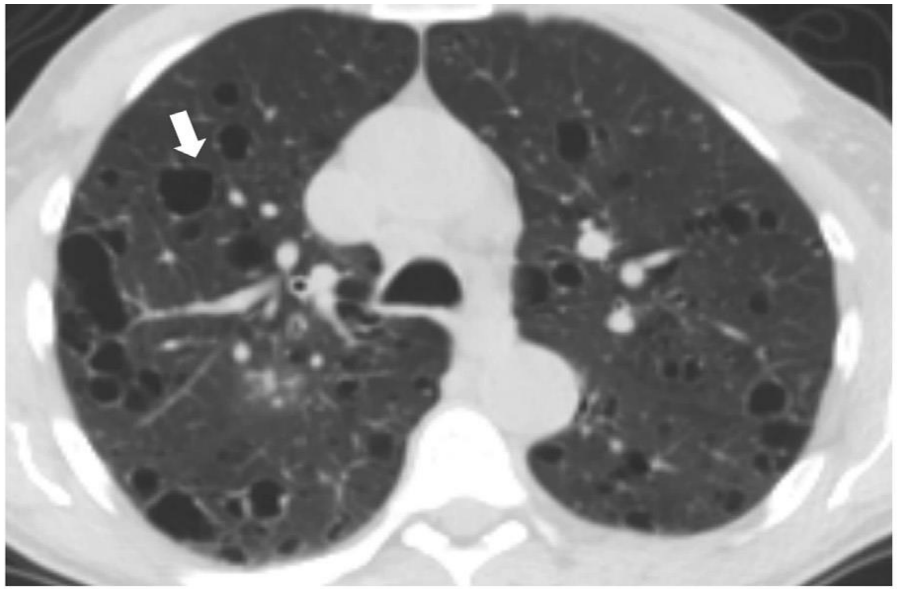
Amyloidosis



thin-walled cysts with or without nodules, Interlobular septal thickening , along with associated mediastinal lymphadenopathy

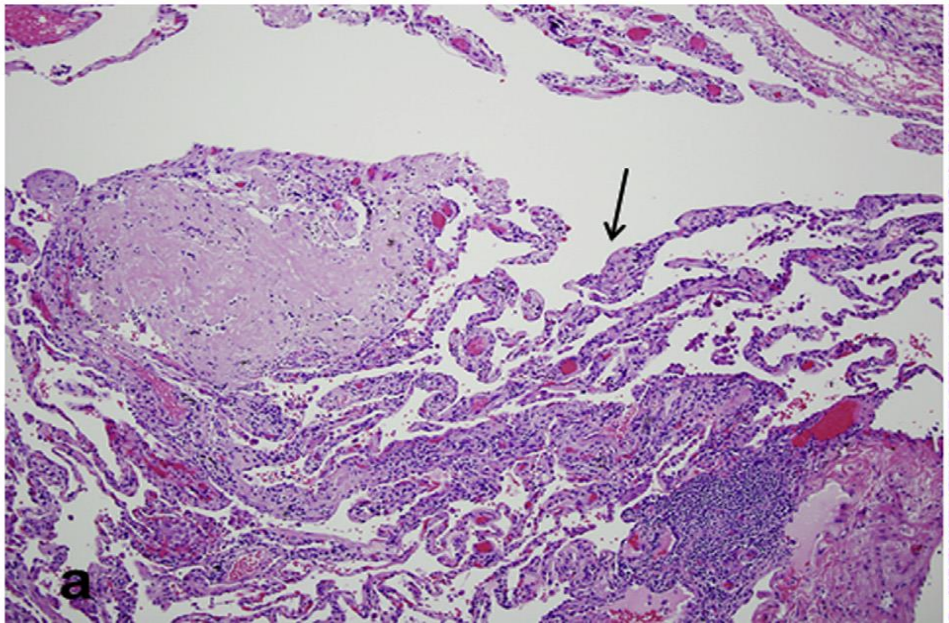
Light-chain deposition disease (LCDD)

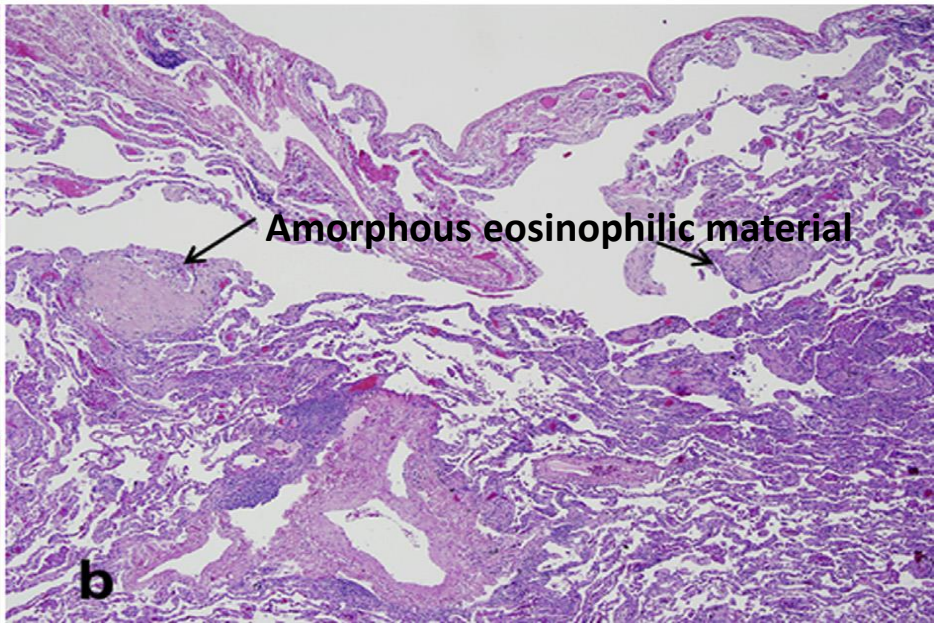
A

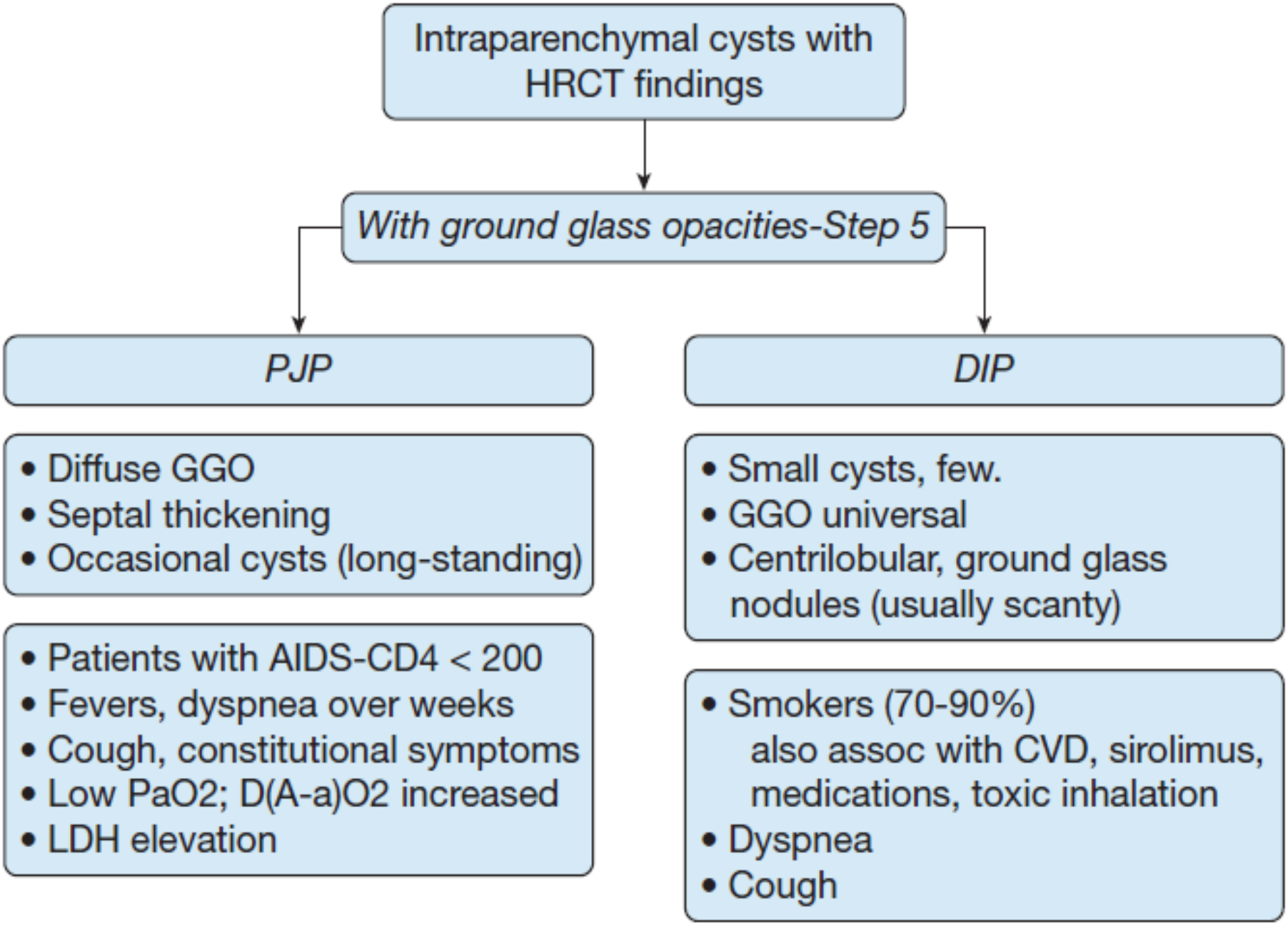


nodules are diffuse, irregular, and small, Lung consolidation, mediastinal lymphadenopathy

B



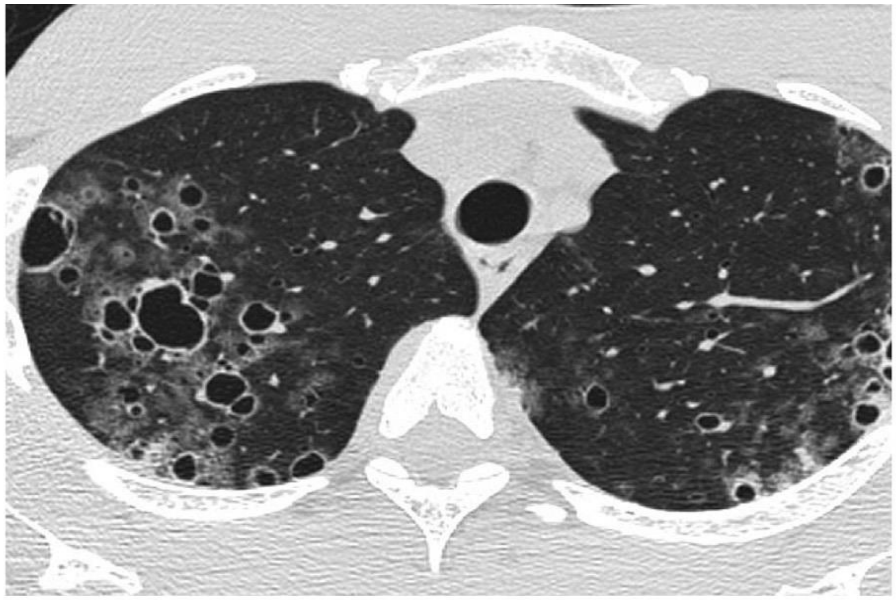



Intraparenchymal cysts with HRCT findings
With ground glass opacities-Step 5
PJP
DIP
• Diffuse GGO
• Septal thickening
• Occasional cysts (long-standing)
• Patients with AIDS-CD4 < 200
• Fevers, dyspnea over weeks
• Cough, constitutional symptoms
• Low PaO2; D(A-a)O2 increased
• LDH elevation
• Small cysts, few.
• GGO universal
• Centrilobular, ground glass nodules (usually scanty)
• Smokers (70-90%) also assoc with CVD, sirolimus, medications, toxic inhalation
• Dyspnea
• Cough

Pneumocystis jirovecii pneumonia

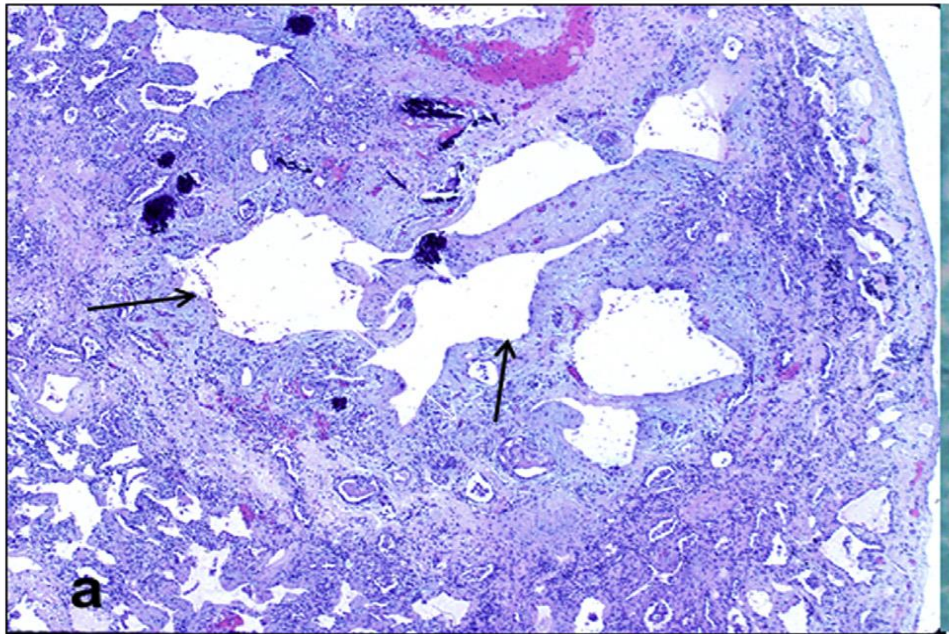
Cysts are multiple, with upper lobe predominance, variations in size, shape, and wall thickness

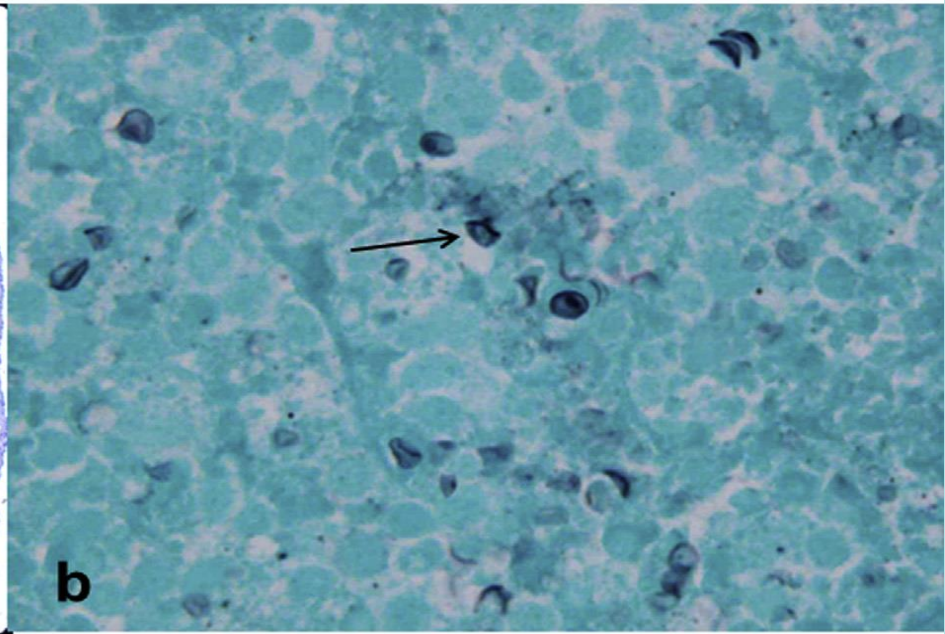
A



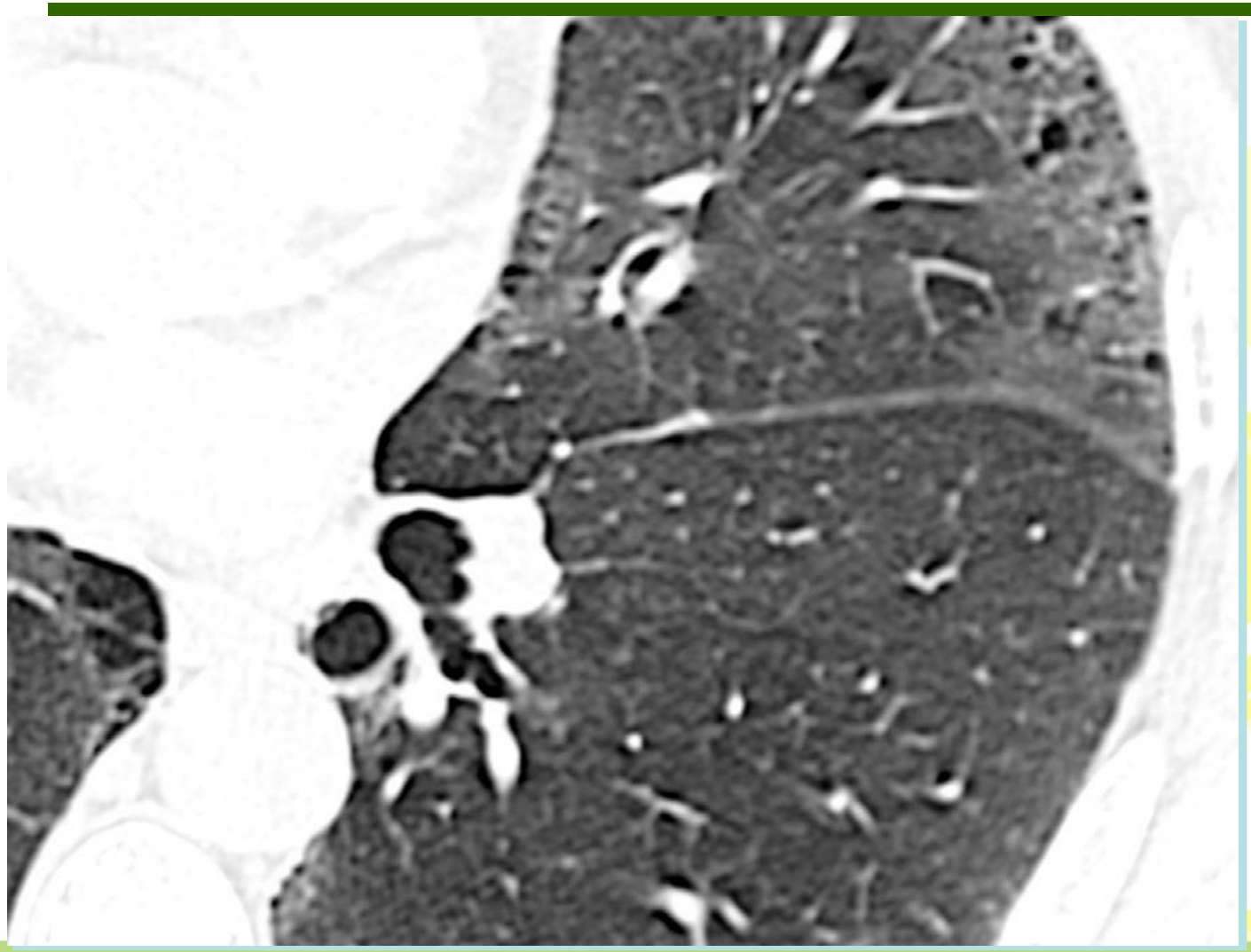
Diffuse ground glass opacities with septal thickening and occasional cysts

B





Desquamative interstitial pneumonia (DIP)



40 ~ 60 years of age male smokers, GGO prominently in lower lung zones and subpleural regions

Radiologic and Pathologic Characteristics of Cysts Seen in Selected DCLD

	LAM	PLCH	BHD	LIP/FB	Amyloid/LCDD
Distribution	Diffuse, random	Upper & middle lung zones; sparing costophrenic angles	Basilar/peripheral/ subpleural and near vessels	Diffuse, random, often near vessels	Diffuse, random
Size	2 mm to 2 cm	Variable, 2 mm to >2 cm	75% <1 cm	Average size 3 mm to 1 cm	4 to 45 mm, majority larger than 1 cm
Shape	Round, uniform	Bizarre, irregular	Elliptical, lentiform	Round, variable	Round, variable
Pathological examination diagnostic	Yes	Yes	No	Yes	Yes
Pathologic findings	Infiltration by HMB-45–positive LAM cells with smooth muscle phenotype	S100- and CD1a-positive Langerhans cells with intracellular Birbeck granules by electron microscopy; stellate fibrotic scars in late stages	Intraparenchymal and subpleural cysts abutting interlobular septae and lacking abnormal cell proliferations or significant fibroinflammatory component	LIP: diffuse interstitial polyclonal lymphocytic infiltrate FB: peribronchiolar polyclonal follicular lymphoid hyperplasia with germinal centers	Amyloid: amorphous protein deposits with fibrillar ultrastructure and apple-green birefringence by Congo red stain viewed under polarized light LCDD: typically monotypic kappa light chain deposition with finely granular ultrastructure lacking apple-green birefringence by Congo red stain and polarized light
Other associated findings on HRCT	Pleural effusions	Micro and macro nodules with or without cavitation, thick-walled cysts, cavities and reticulation	Cysts frequently abut pleura and proximal vessels	Ground-glass attenuation, poorly defined centrilobular nodules, interlobular septal thickening, cysts may contain internal structure	Multiple nodules of varying attenuation and random distribution; nodules abut cyst walls

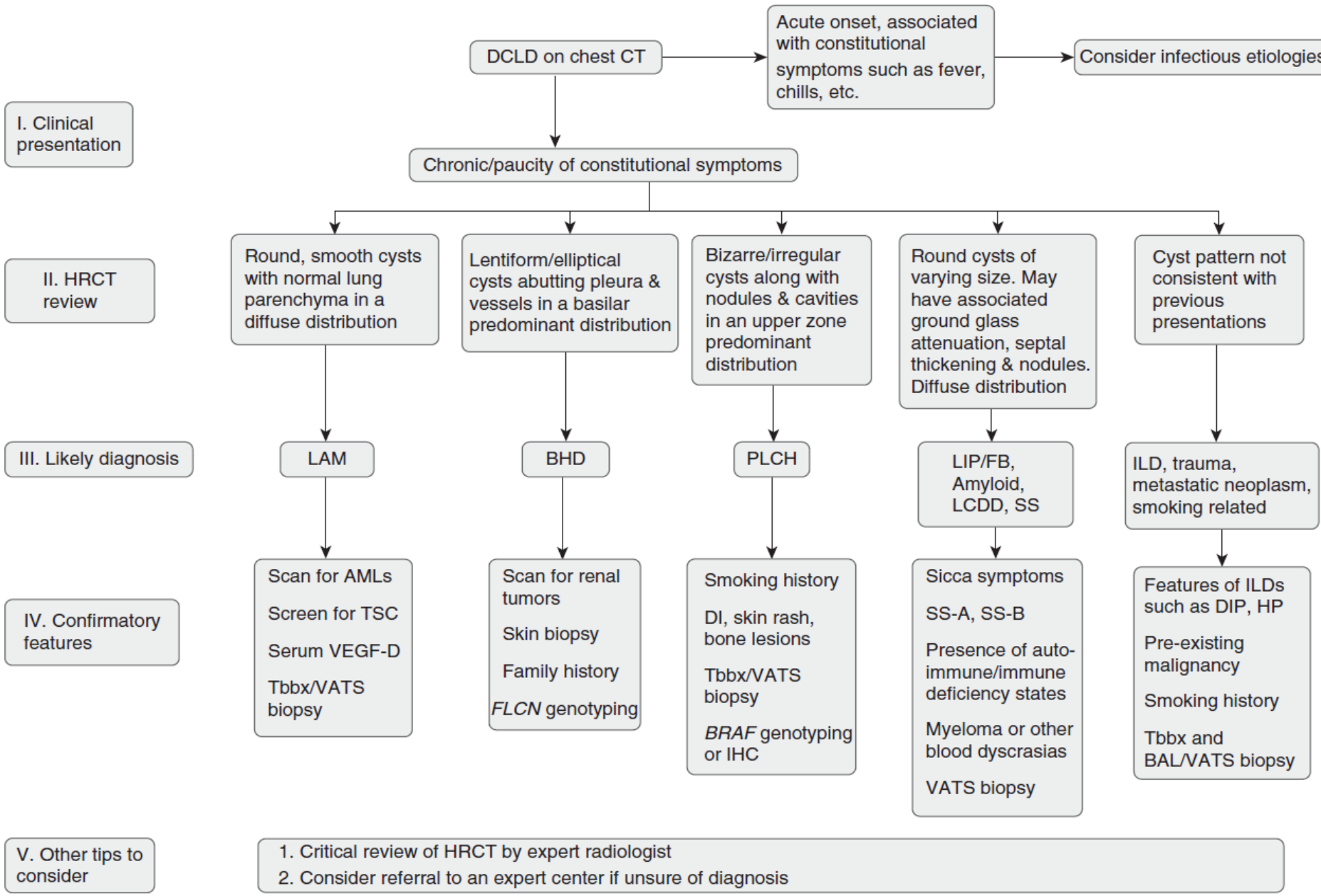
Am J Respir Crit Care Med Vol 192, Iss 1, pp 17–29, Jul 1, 2015

Demographic Features of Selected Diffuse Cystic Lung Diseases

	LAM	PLCH	BHD	LIP/FB	Amyloid/LCDD
Inheritance pattern	Autosomal dominant or sporadic	Not heritable	Autosomal dominant	Not heritable	Not heritable
Genetic mutation implicated	*TSC*	*BRAF*, *MAP2K1*	*FLCN*	N/A	N/A
Nature of mutation	Somatic in S-LAM and germline in TSC-LAM	Somatic	Germline	N/A	N/A
Prevalence of pneumothorax, %	70	10–20	24	Unknown	Unknown
Average age at first pneumothorax	35	27	38	Unknown	Unknown
Rate of recurrent pneumothorax, %	73	63	75	Unknown; likely rare	Unknown; likely rare
Exacerbation by pregnancy	Yes	No	No	No	Unknown
Smoking related	No	Yes	No	No	No
Sex	Women ≫ men	Women = men	Women = men	Women > men	Women = men

Am J Respir Crit Care Med Vol 192, Iss 1, pp 17–29, Jul 1, 2015

Algorithm to guide approach to the diagnosis of diffuse cystic lung diseases



AJRCCM Vol 192, Iss 1, pp 17–29, Jul 1, 2015

Cavity: malignant or benign?

- A wall thickness of less than 7 mm was highly specific for benign disease.
- Wall thickness of greater than 24 mm was highly specific for malignant disease.
- Perilesional consolidation was common around benign cavitary nodules whereas lacking in malignancy.
- The degree of contrast enhancement in the content of nodules (< 10 HU) indicate benign lesions and may be used to distinguish aspergillomas from lung cancer.
- Rim enhancement of the walls on contrast-enhanced CT is common in abscesses.

Asia Pac J Clin Oncol. 2016; 12: 105–112
Clin Radiol. 2007 and 2016.
Radiology. 2000; 214: 73–80
AJR Am J Roentgenol. 2014; 202: 479–492

Associated CT findings in patients with solitary lung cavities.

Associated findings	
Perilesional centrilobular nodules[a]	*n*=27
Malignant	0 (0)
Non-malignant	27 (100)
Perilesional consolidation[a]	*n*=42
Malignant	11 (26)
Non-malignant	31 (74)

Data are presented as *n* (%).

[a] $p<0.05$ (malignant versus non-malignant).

Clinical Radiology 71 (2016) 1132e1136

空洞性病灶

1.外緣

- Corona radiata, lobulation, spiculation, tail sign, triangular shadow sign .....malignant
- Smooth, well-defined .....benign

2.壁厚度

- 整圈厚度皆>10mm.....malignant
- 若後薄不一，但最厚處 > 15mm.....malignant

3.內緣

- 平滑，規則.....benign
- 不規則或呈鋸齒狀..... malignant

4.衛星病灶.....benign

Solitary or Multiple cavity Lesions

A. Infection (bacterial, fungal, mycobacterial and parasites)

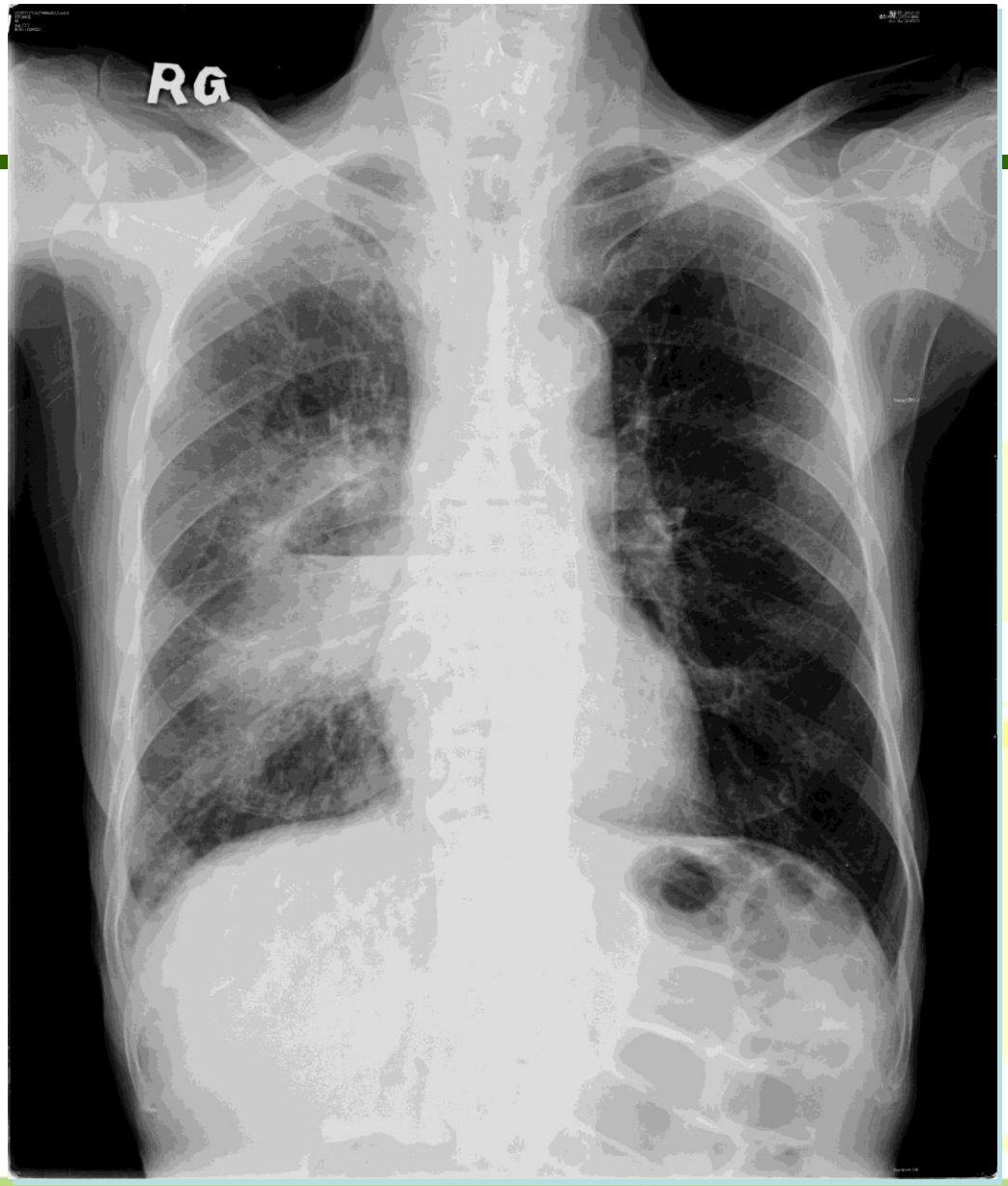
B. Neoplasm (primary or metastasis): 10–15 %

C. Vascular (Commonly multiple)

1. Wegener's granulomatosis
2. Rheumatoid cavitary nodules
3. Infarction (thromboemboli or septic emboli)

D. Inhalation

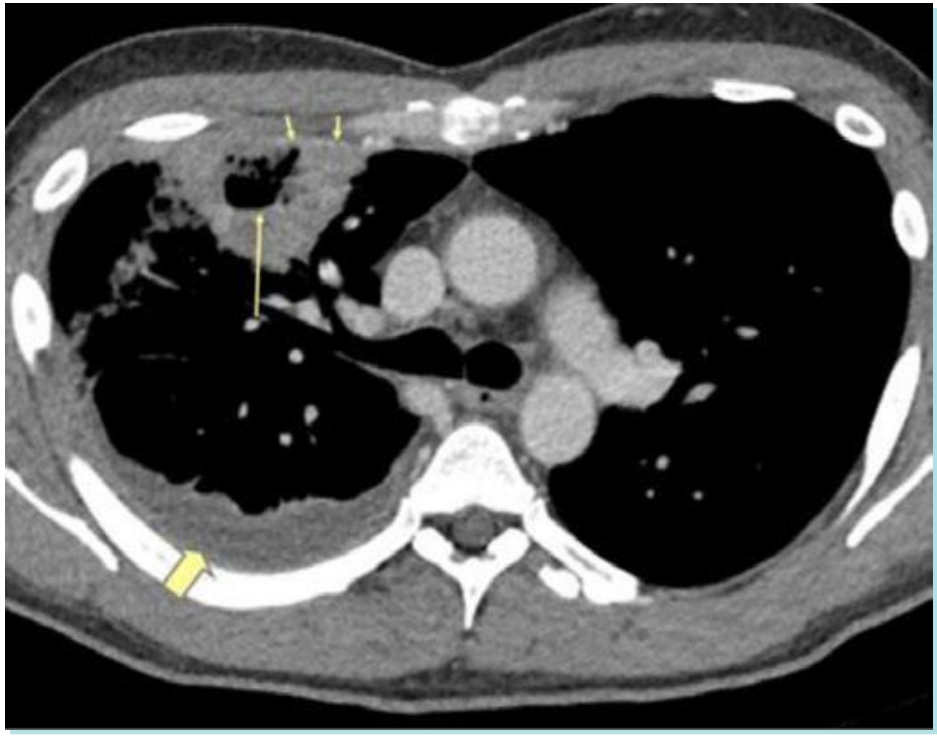
Silicosis and coal-worker's pneumoconiosis

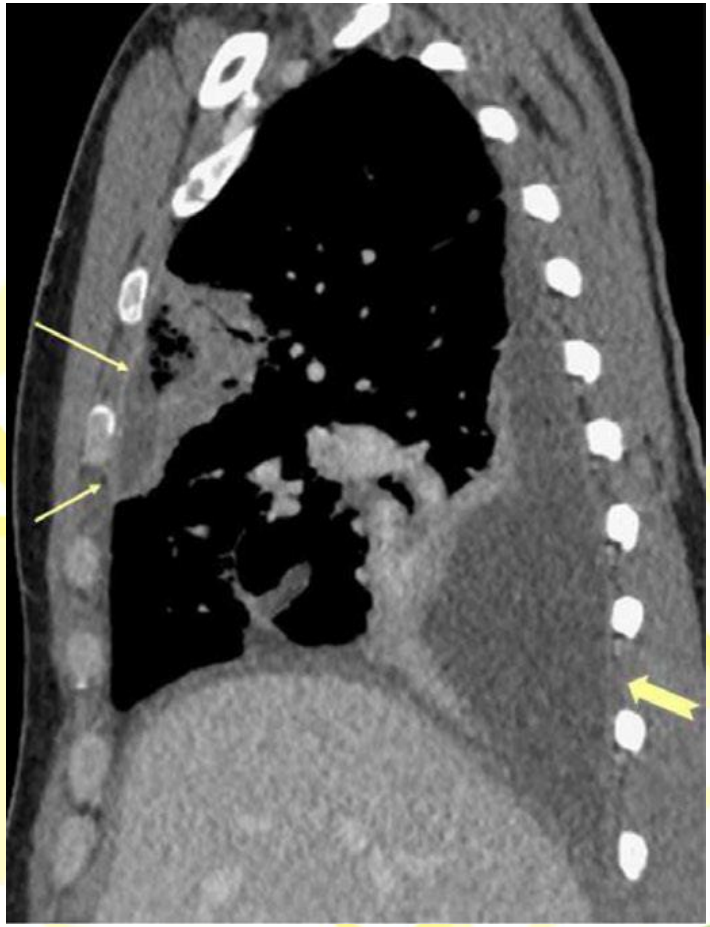


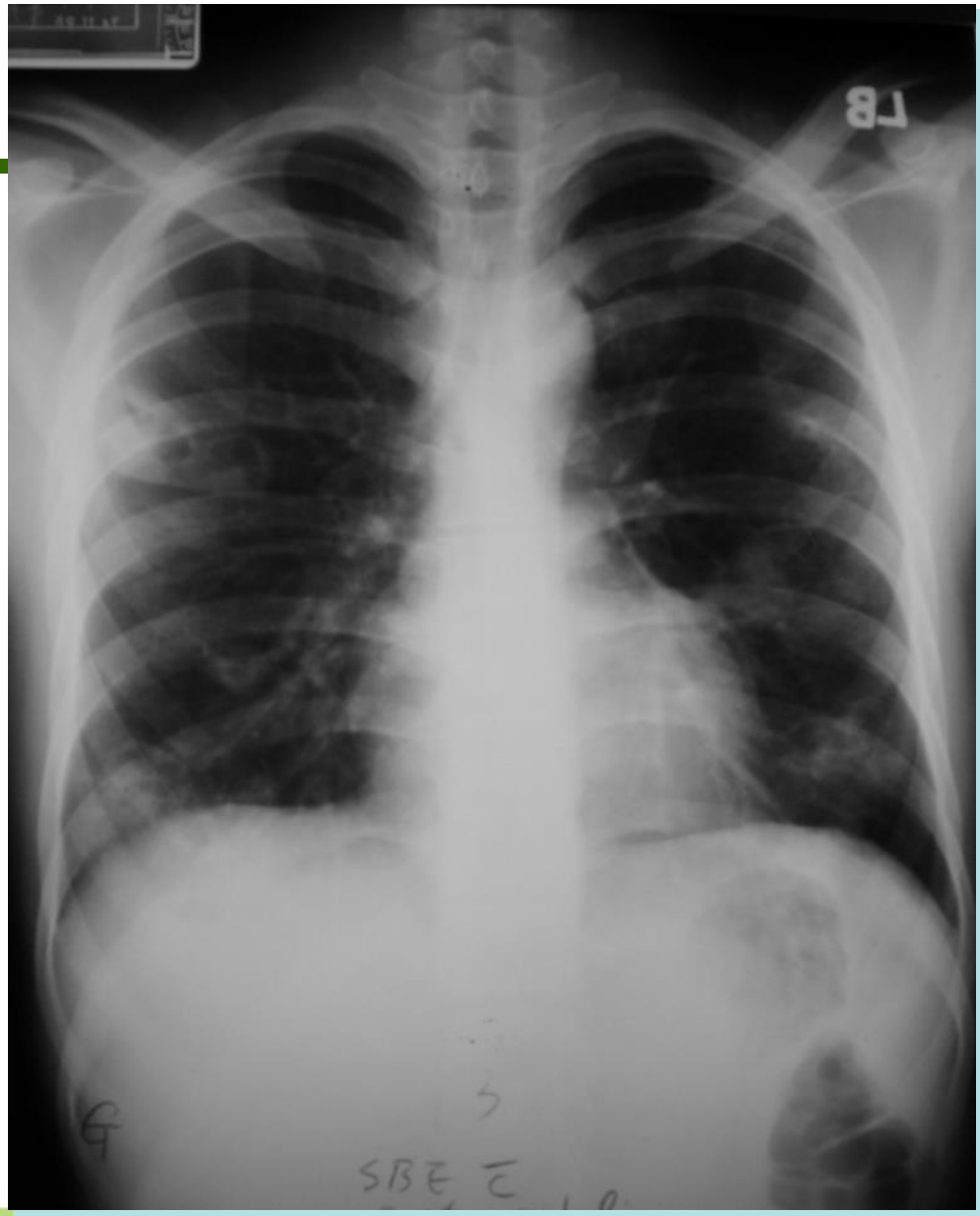
Lung abscess,

Klebsiella pneumoniae

Lung abscess



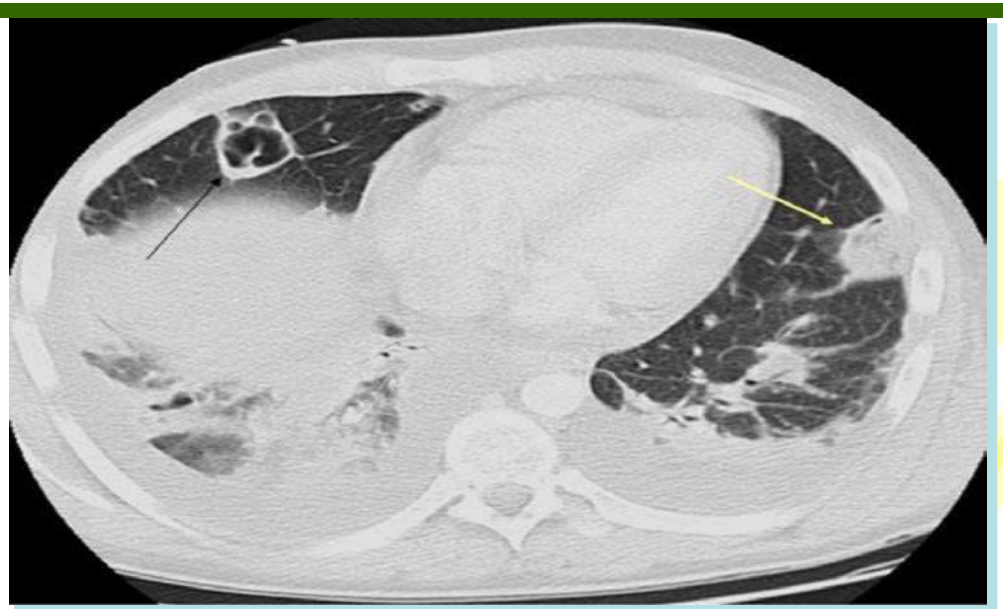


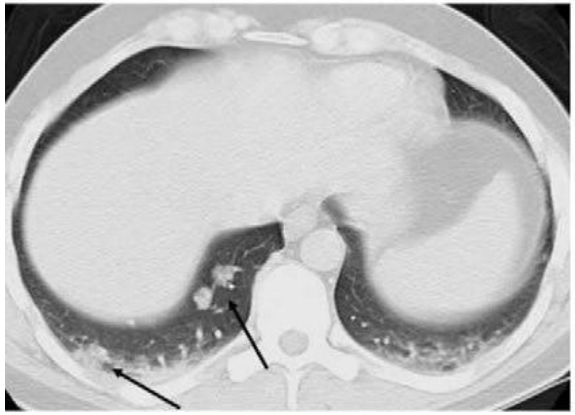


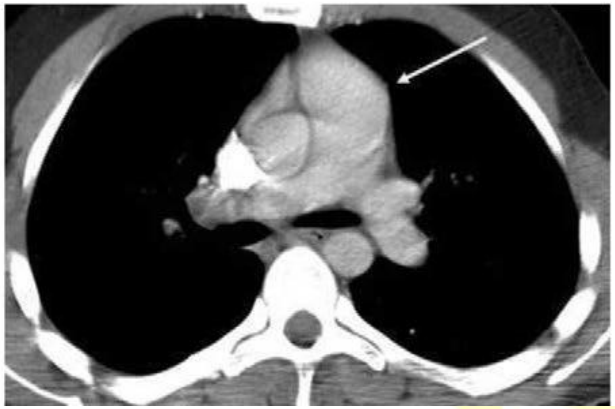
Septic emboli, cavity

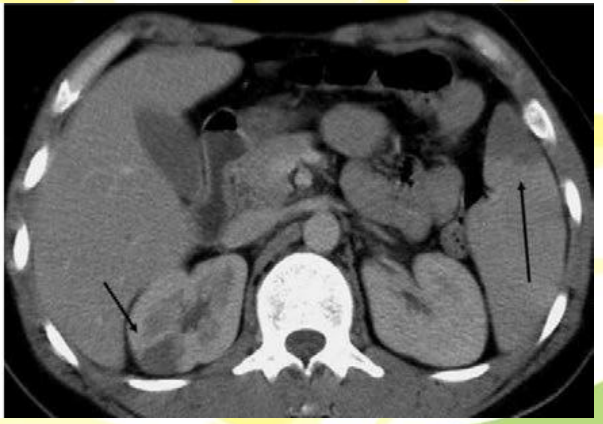
Staphylococcus aureus

Septic emboli in the lungs and parenchymal organs

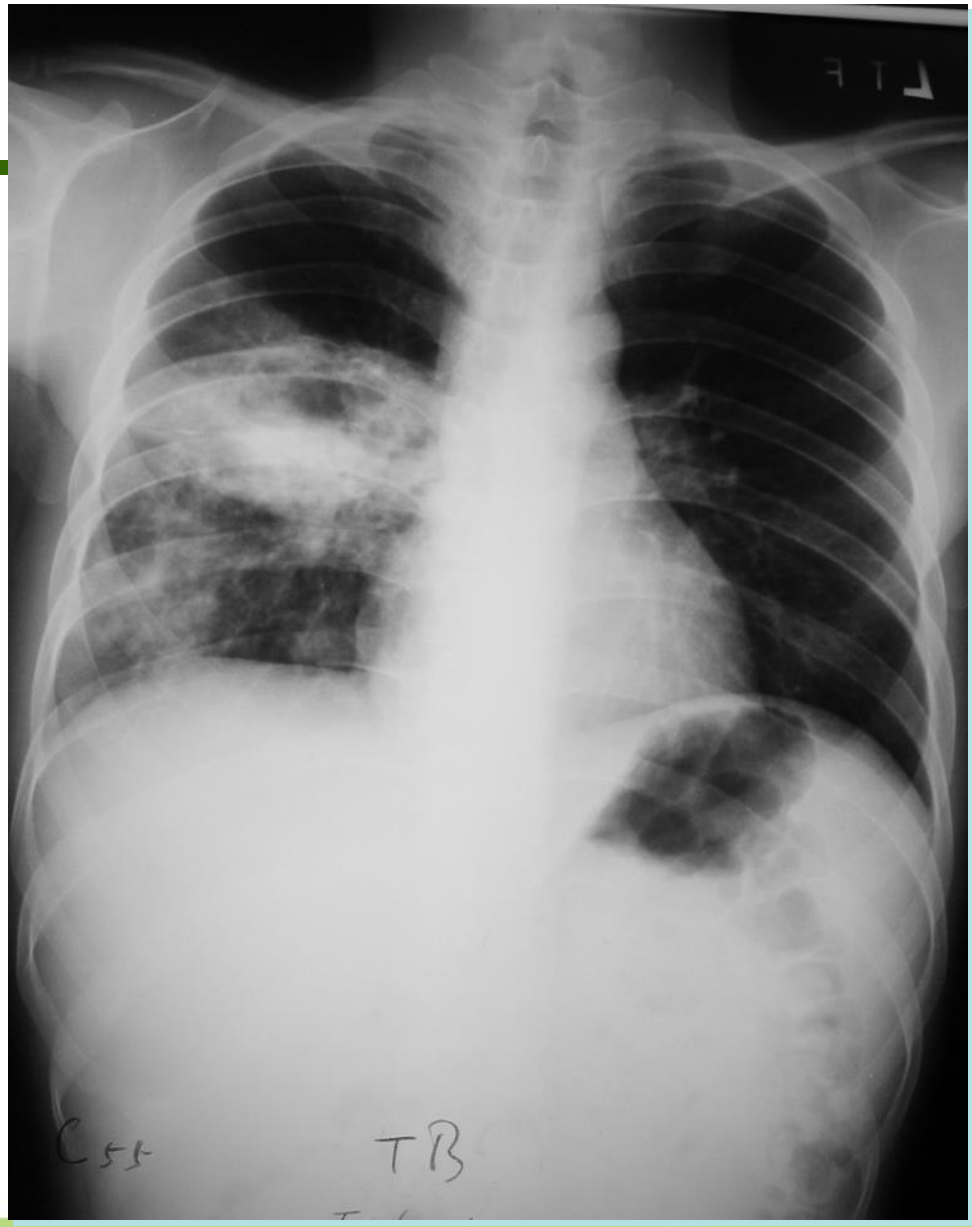


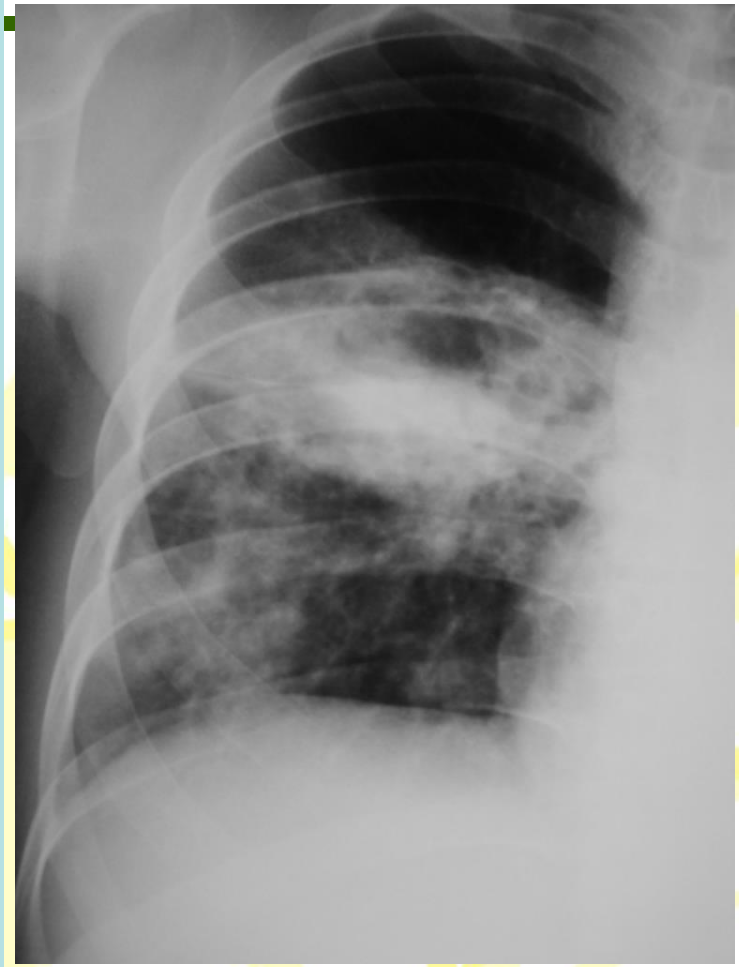


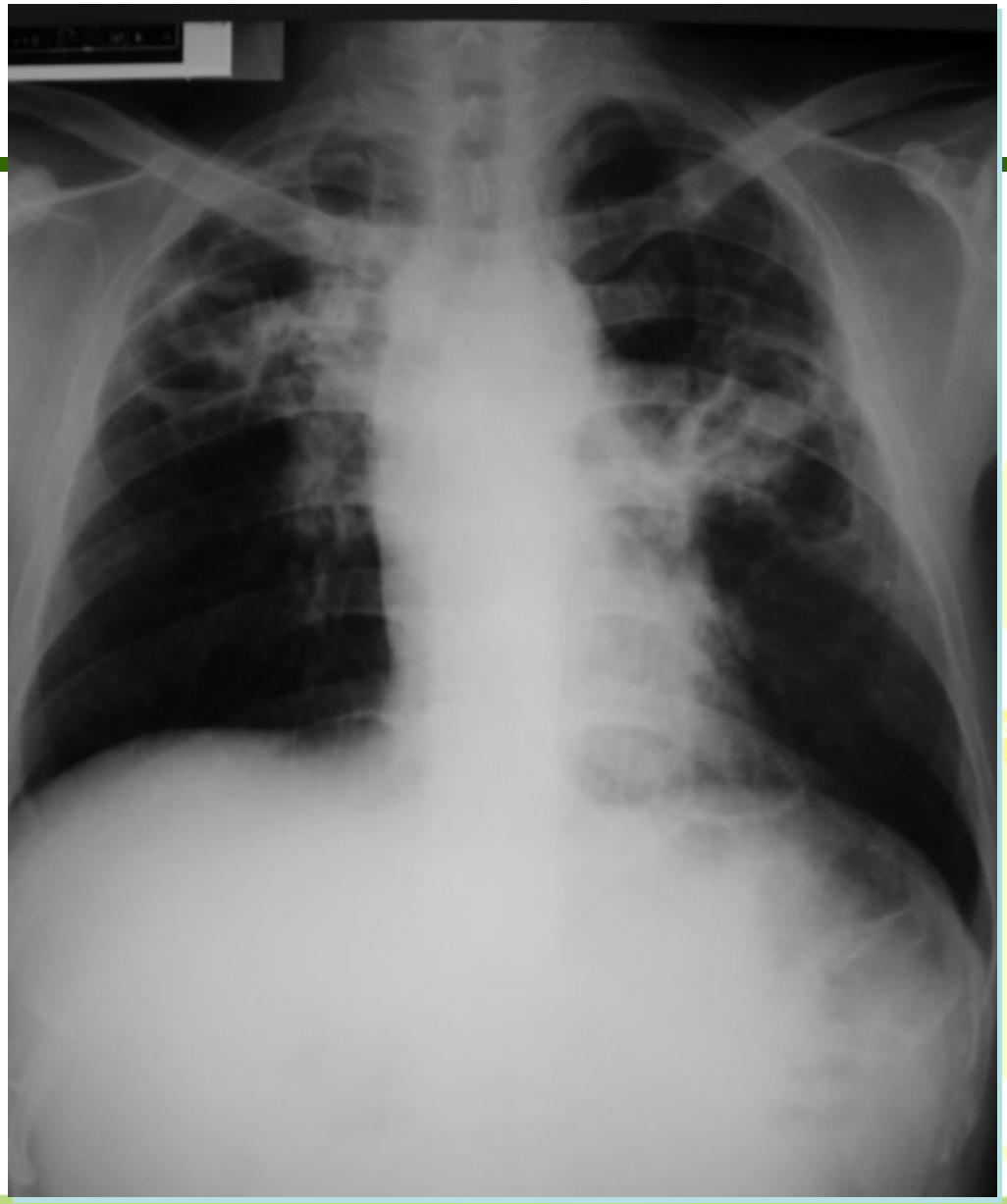




Tuberculosis

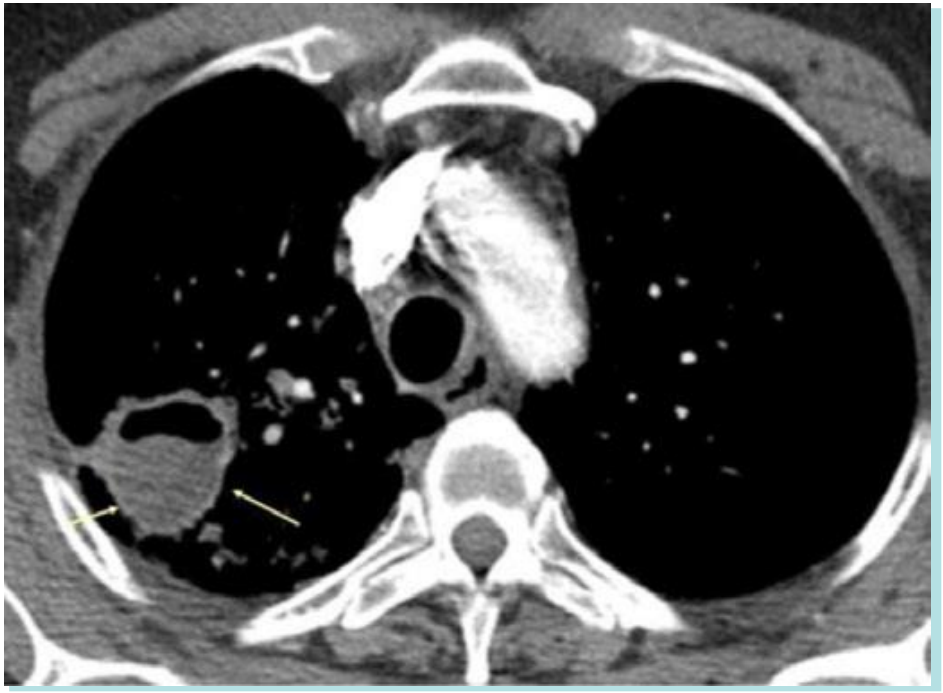


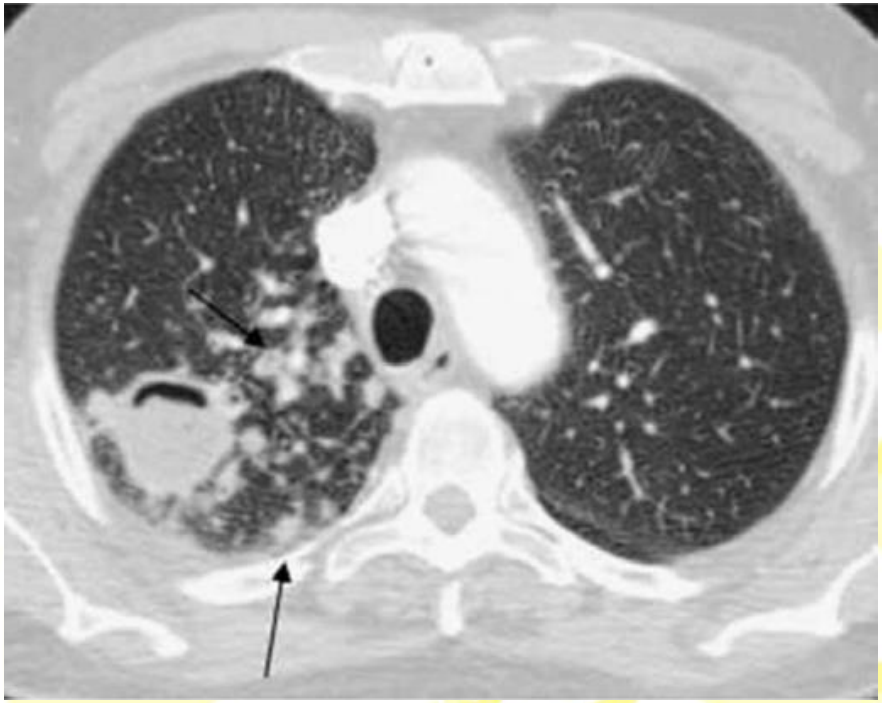




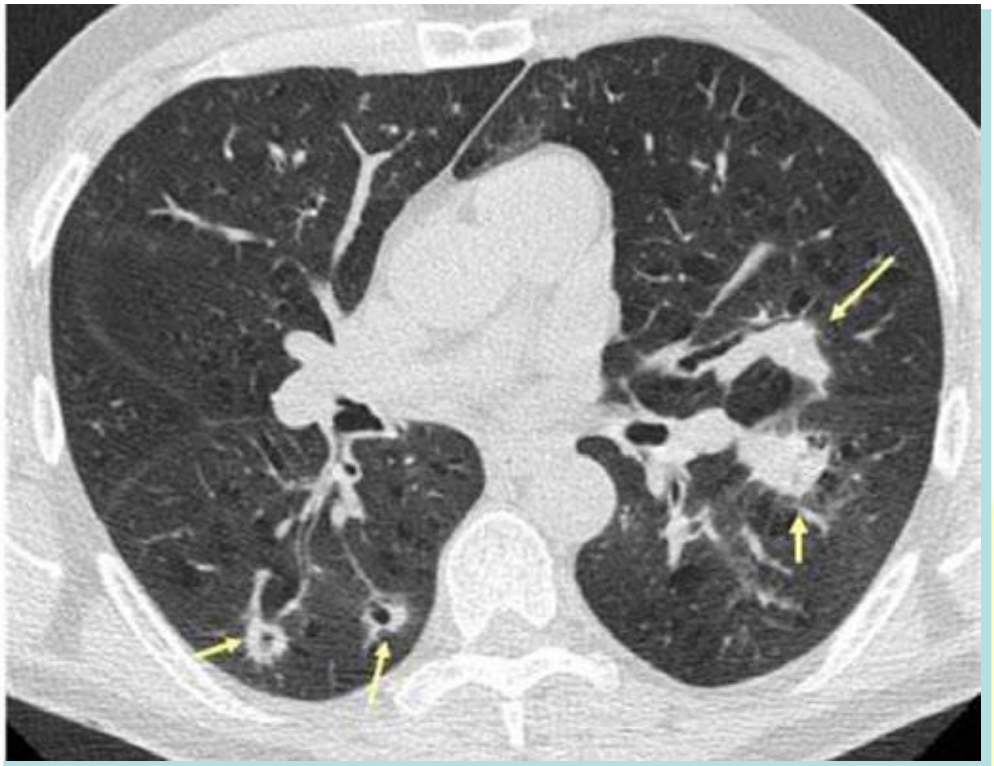
Tuberculosis

Tuberculosis

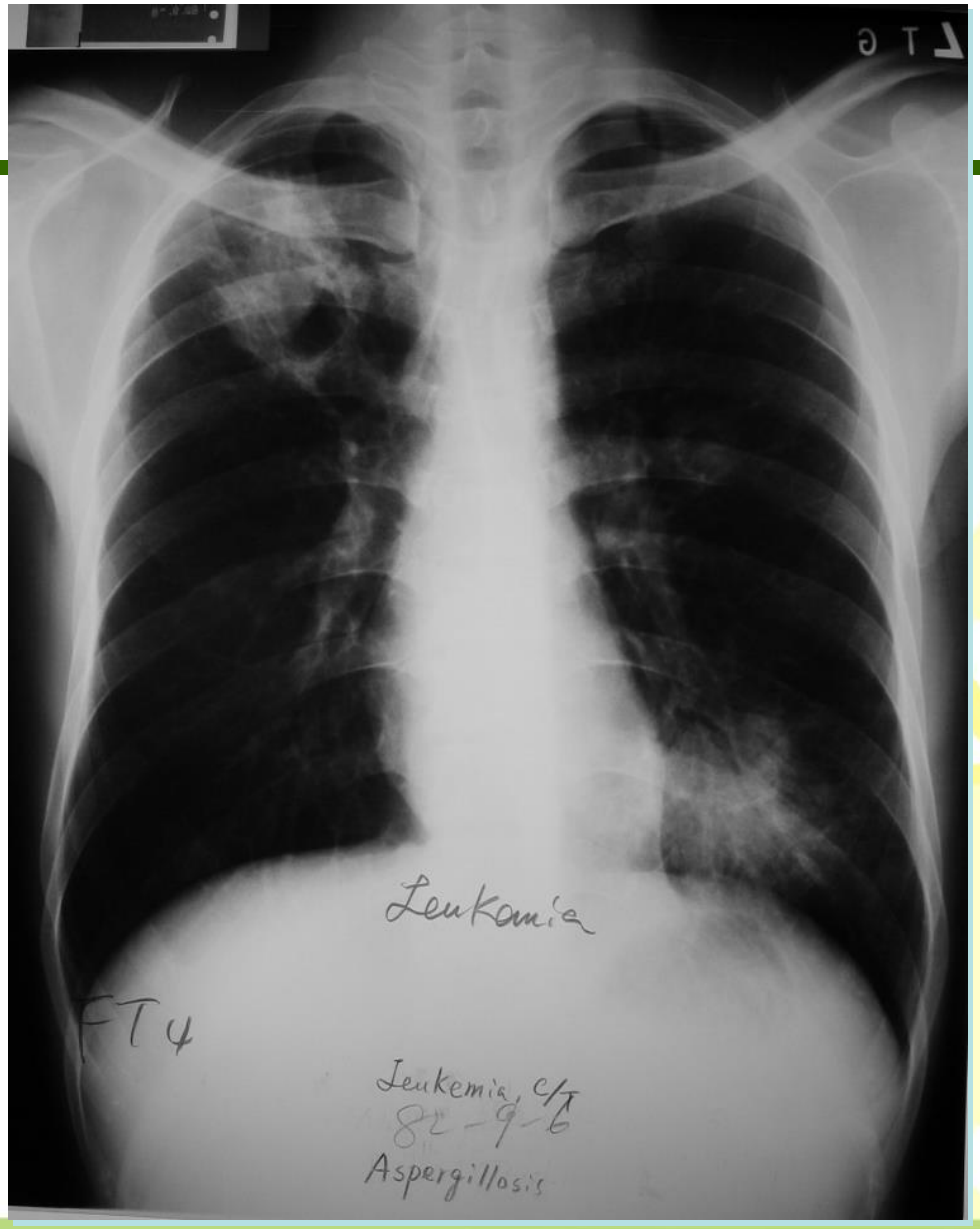




multiple perilesional nodules



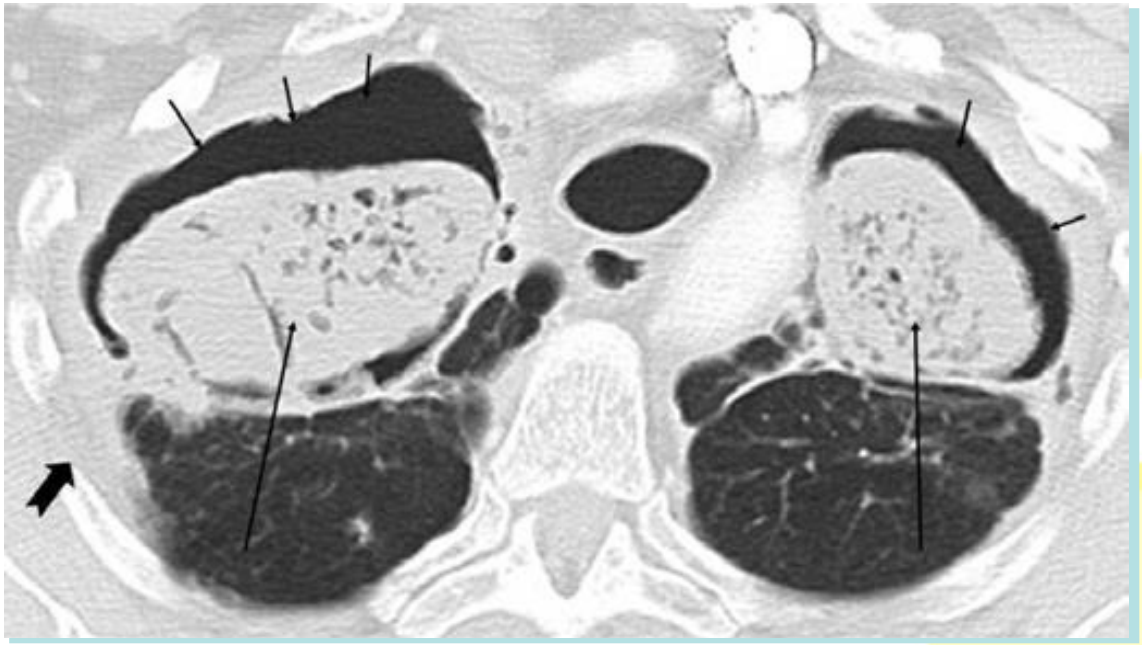
mycobacterium avium intracellulare



1.Aspergillosis

2.Leukemia

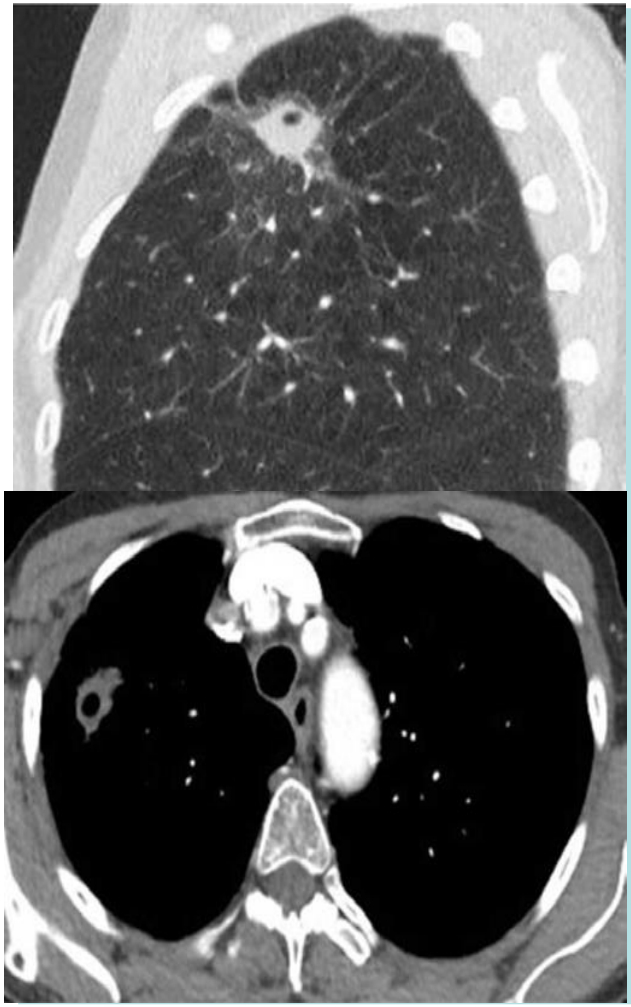
Aspergilloma

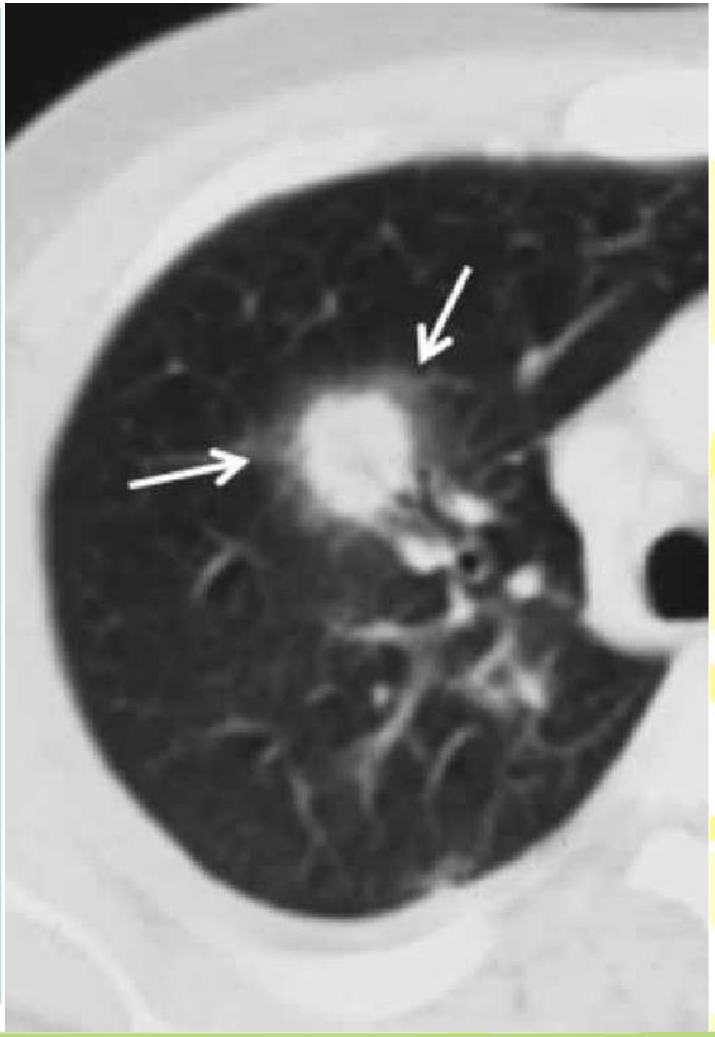


local pleural thickening (thick arrow)

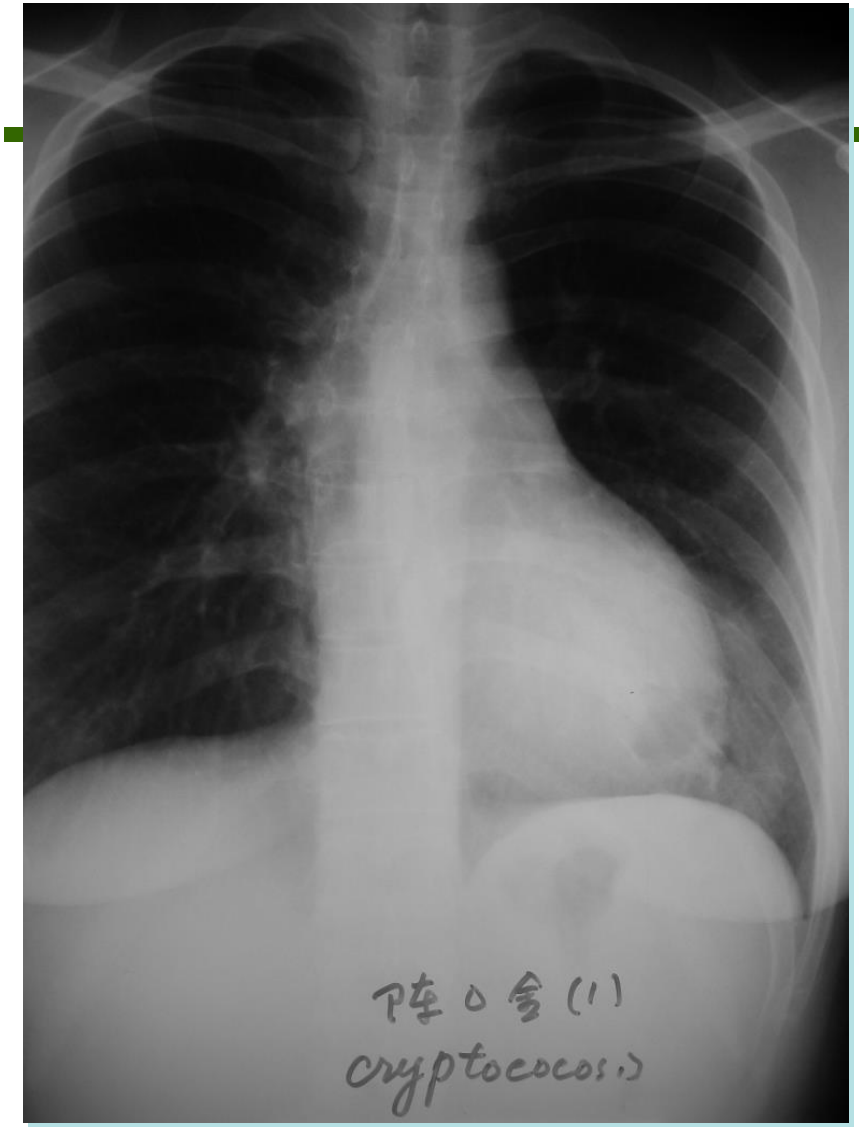
crescent-shaped air (short arrows) anteriorly due to large formed fungus balls (long arrows).

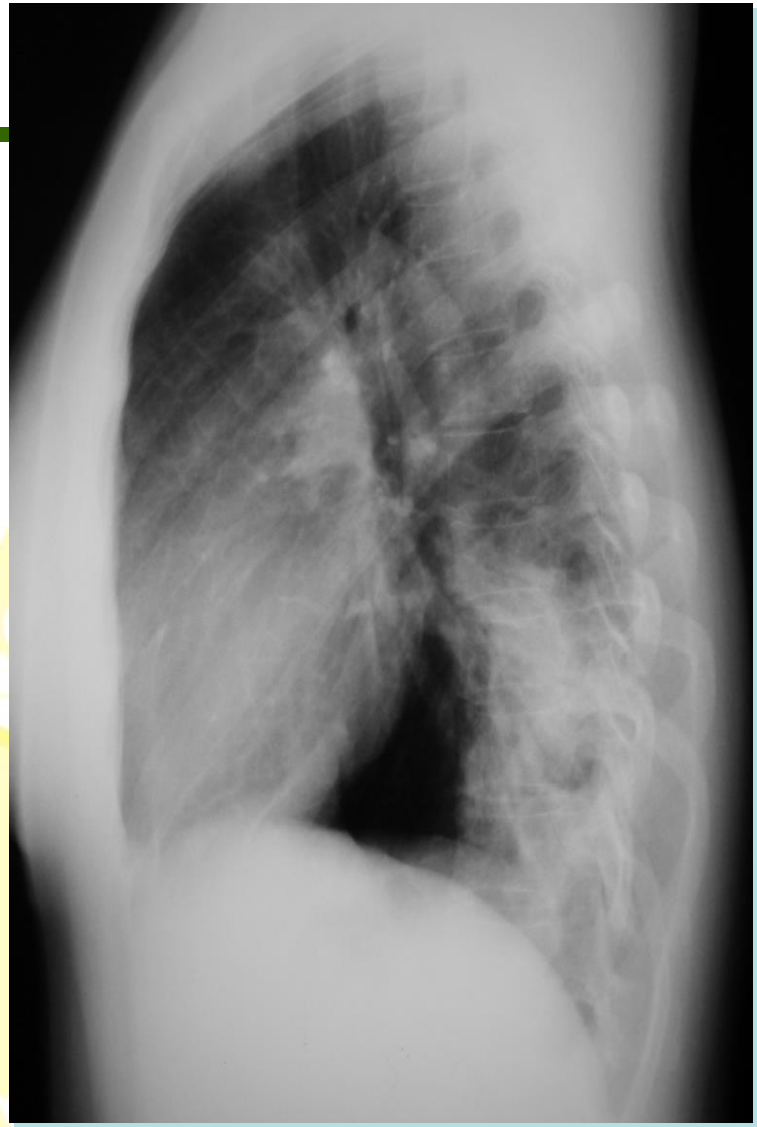
Aspergillosis



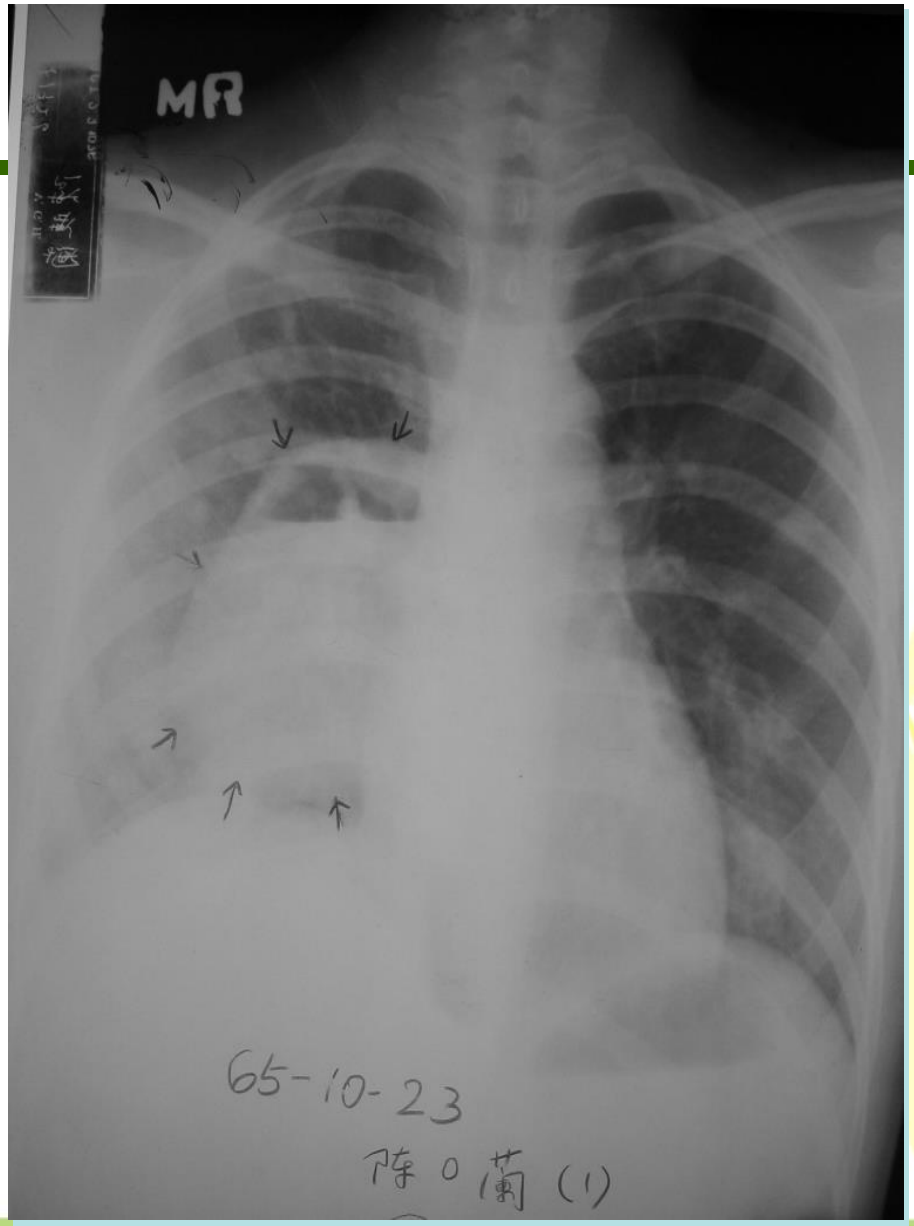


halo of ground glass surrounding it.

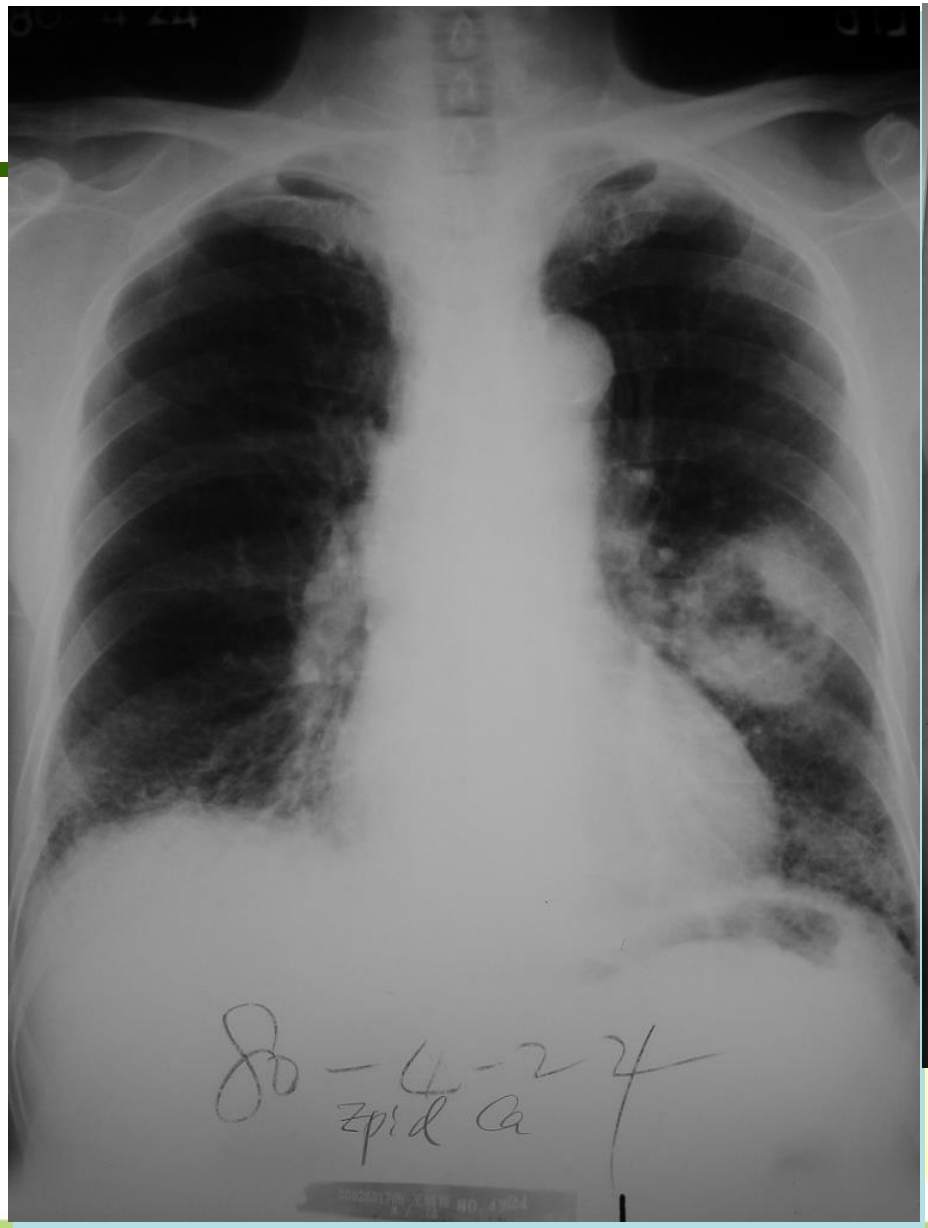


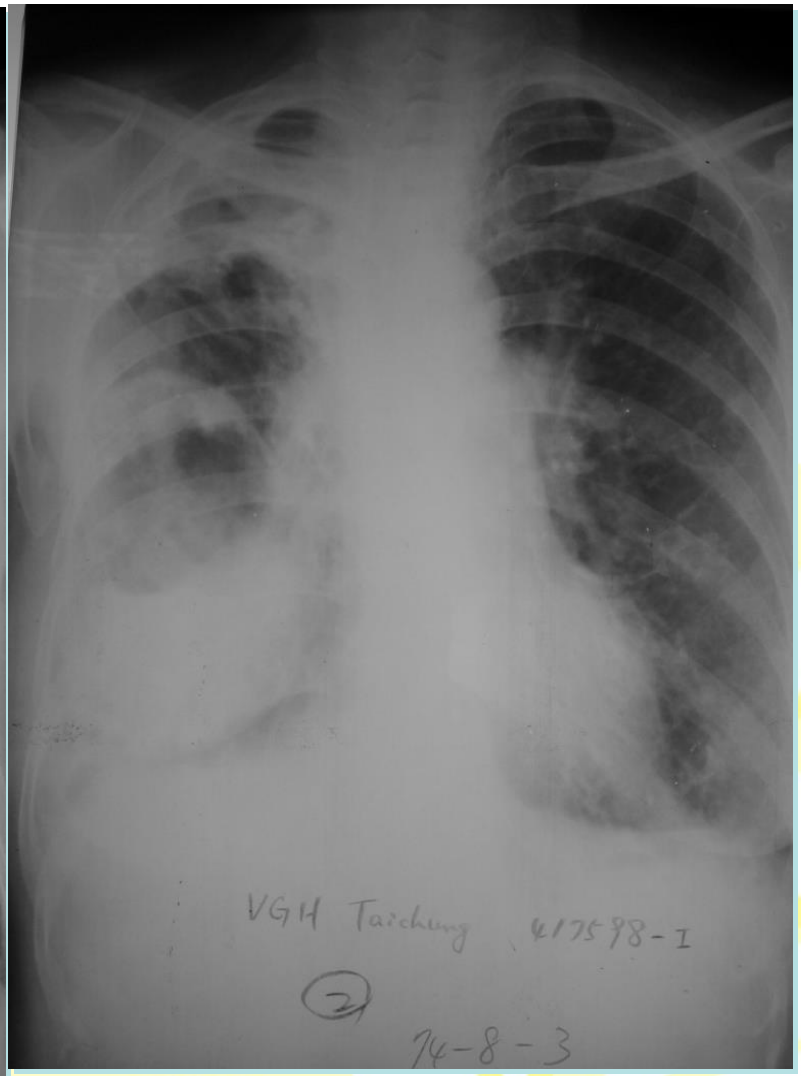


Cryptococcus



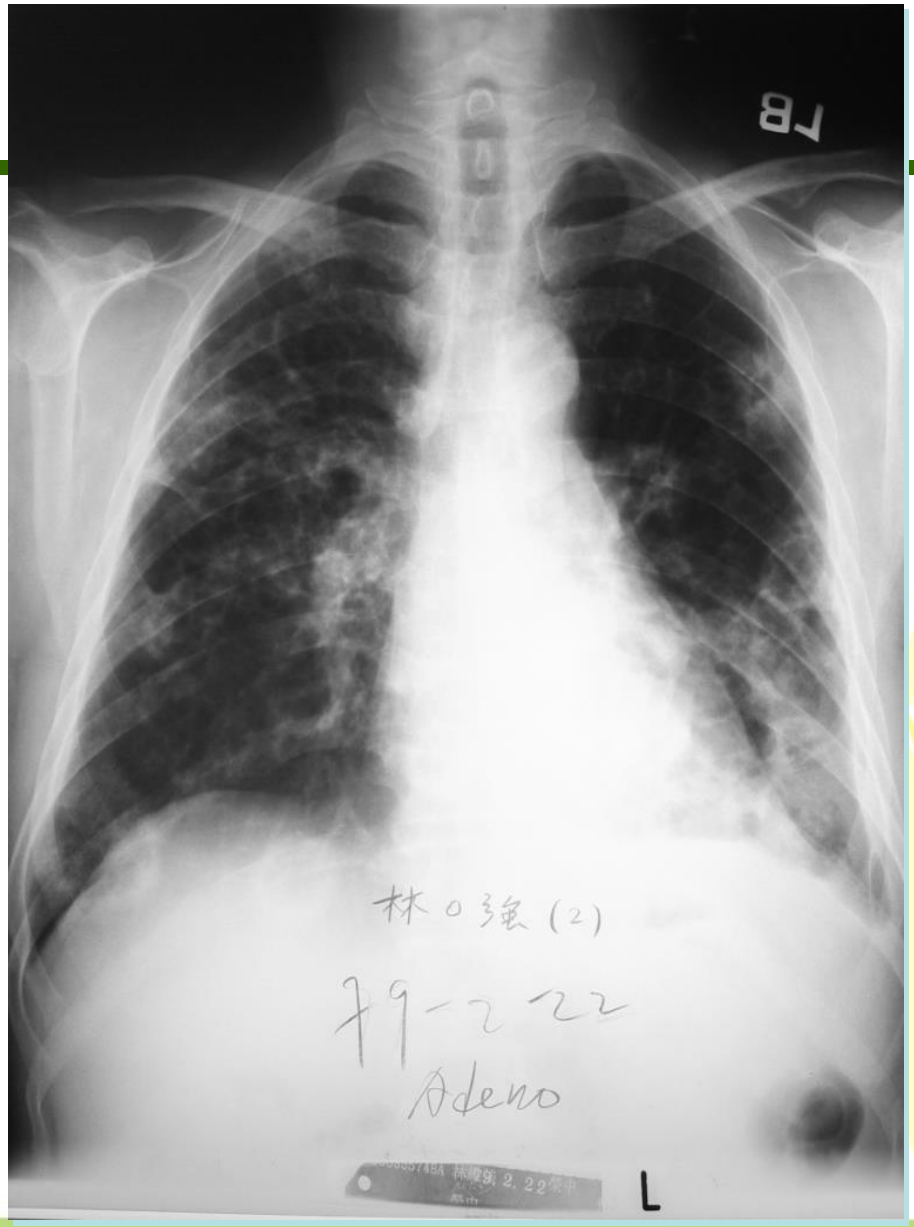
Nocardia





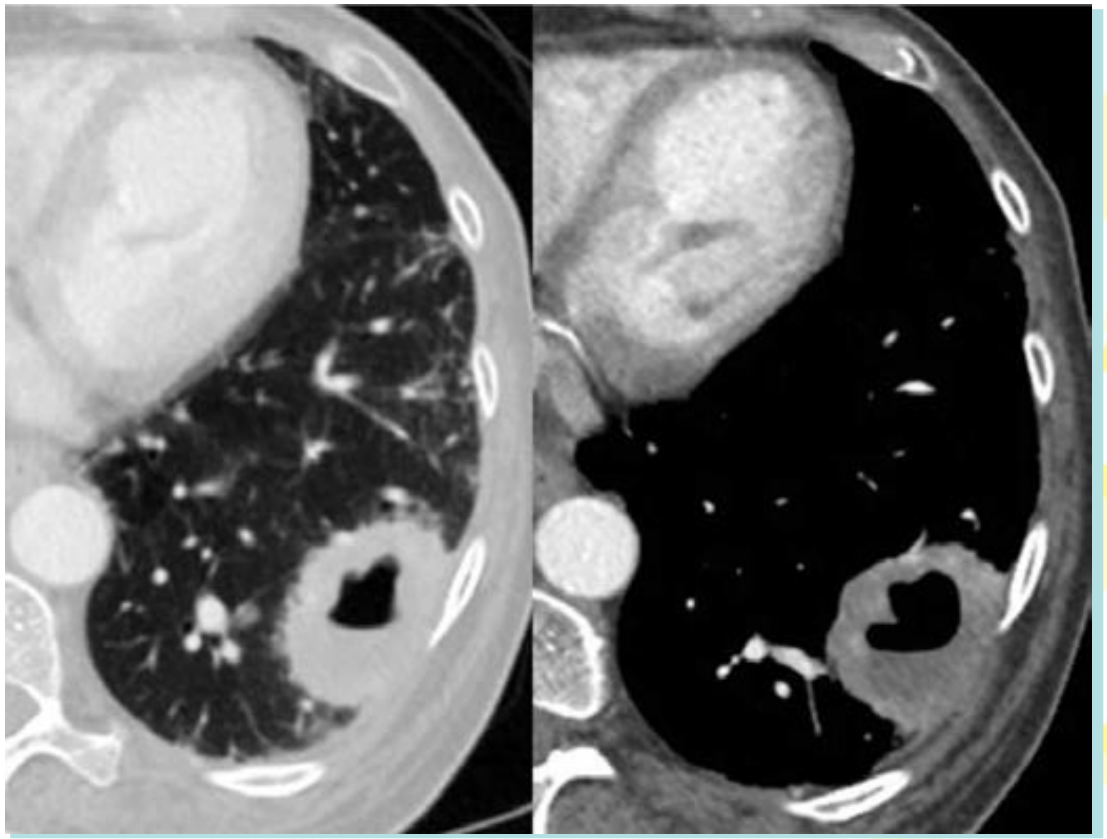
Lung cancer,

Squamous cell carcinoma

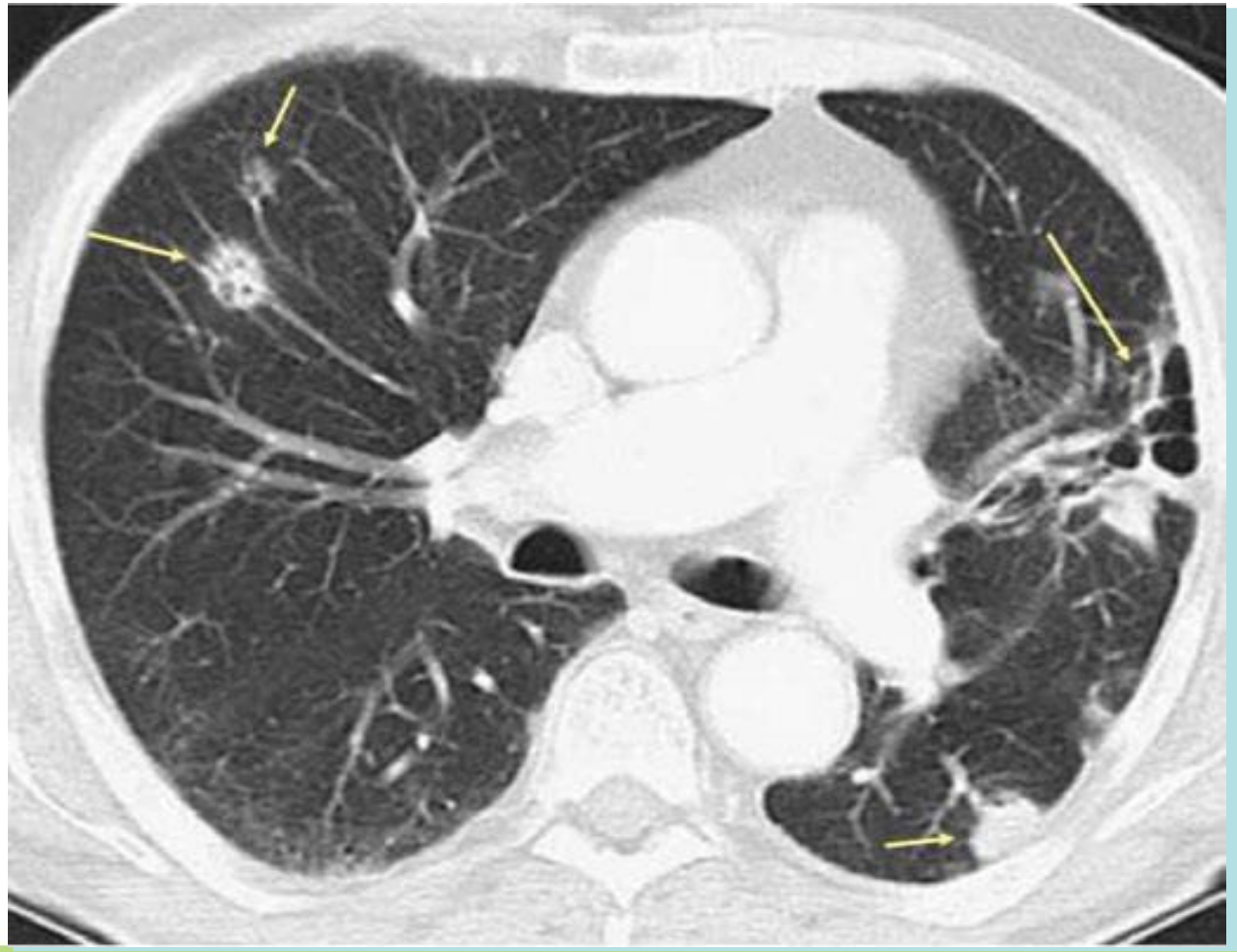


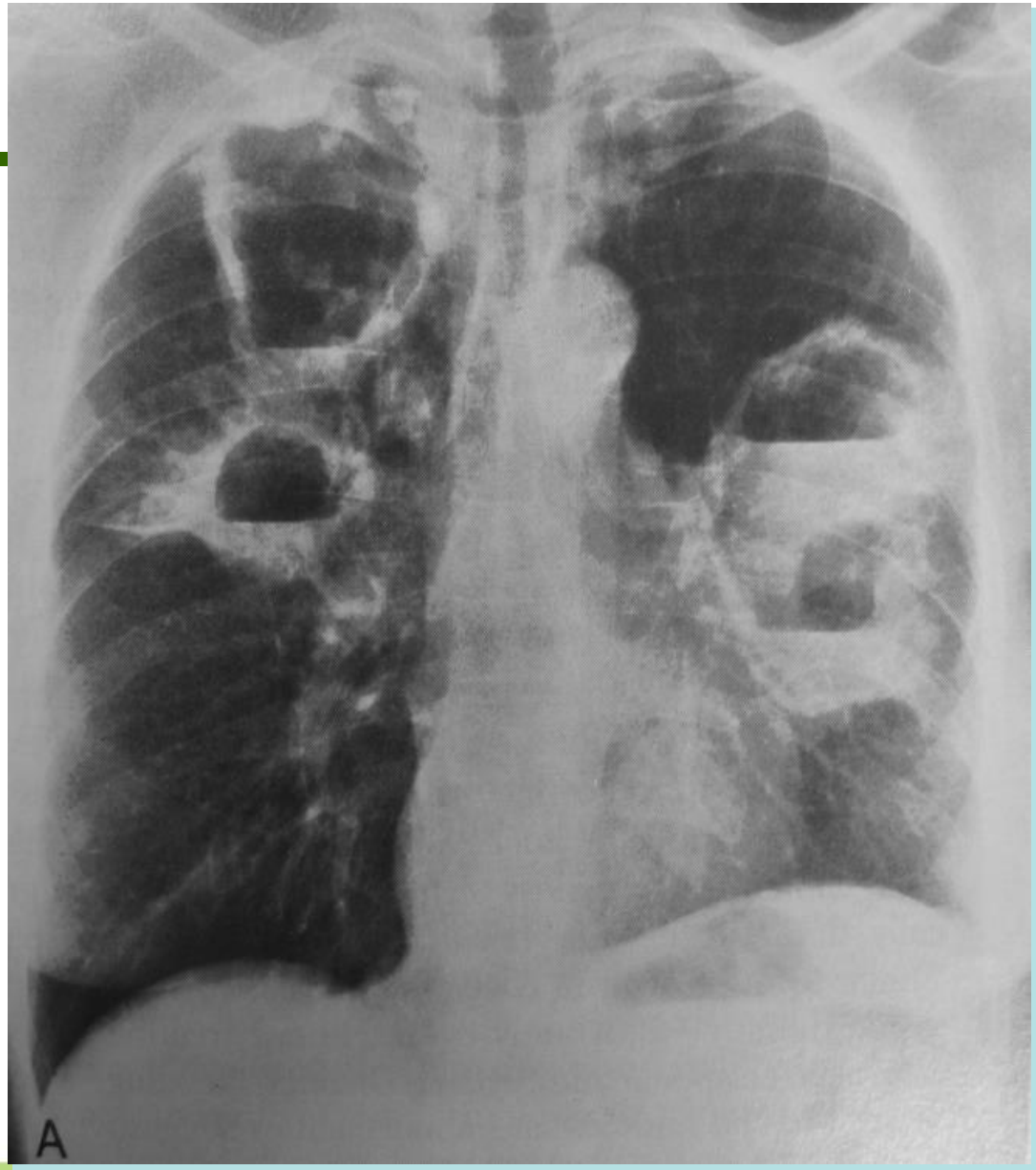
Lung cancer, adenocarcinoma

Lung cancer



Metastases from an pancreatic adenocarcinoma



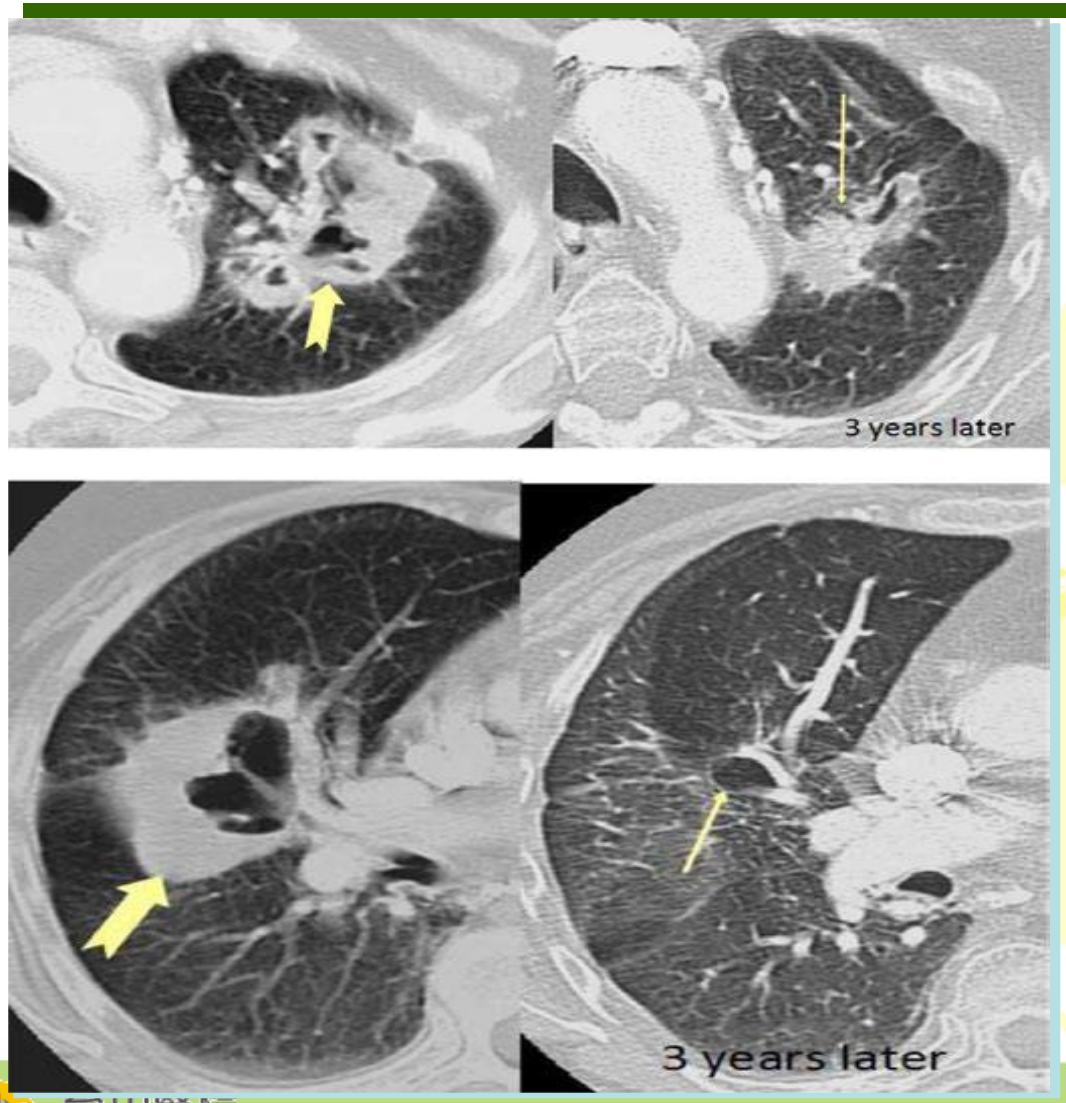


Wegner' granulomatosis,

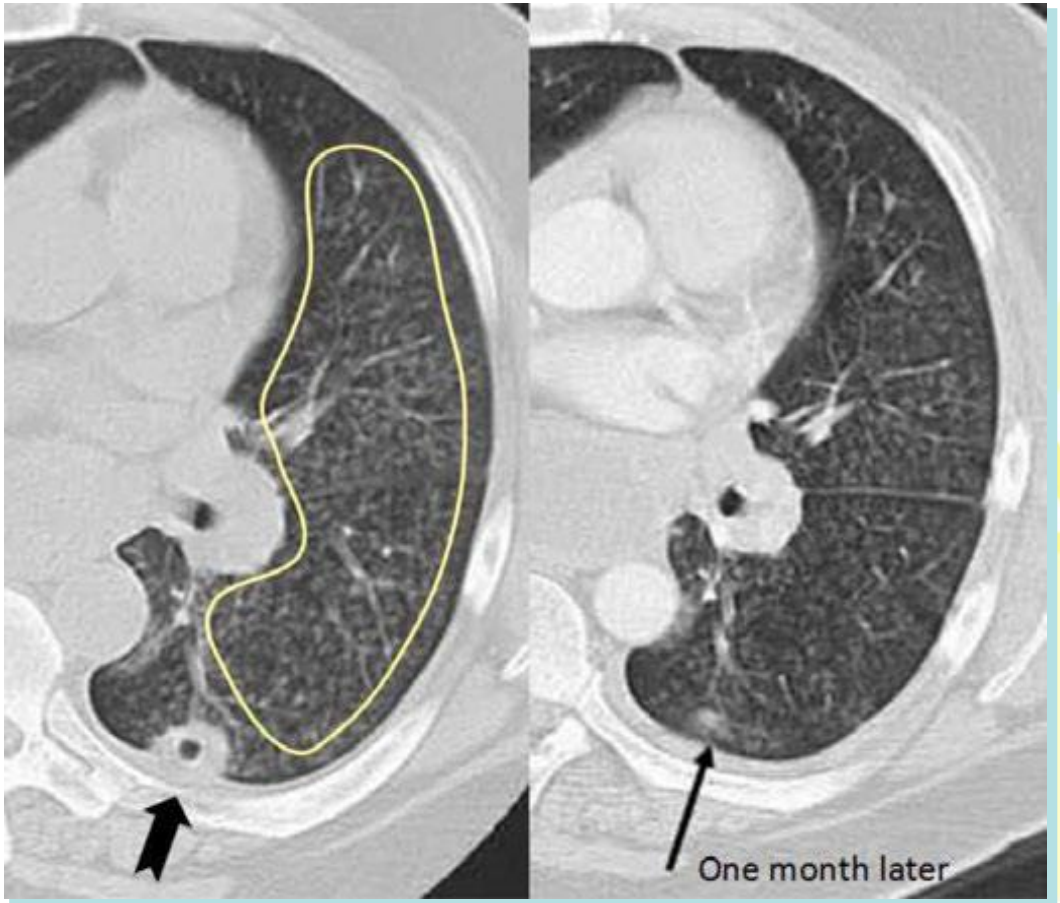
Fraser et al,

Synopsis of disease of the chest, 2nd ed.

Granulomatosis with polyangiitis



Rheumatic nodule



rheumatoid arthritis
under methotrexate
treatment

感謝聆聽
敬請指教