



SUMPh "N. Testemitanu"
Radiology and Medical imaging department

MEDICAL IMAGING IN PNEUMOLOGY



Homework

1. Name the indications of the imaging methods used in pneumology.
2. Explain the radiological signs (12).
3. Explain the radiological syndromes (4).

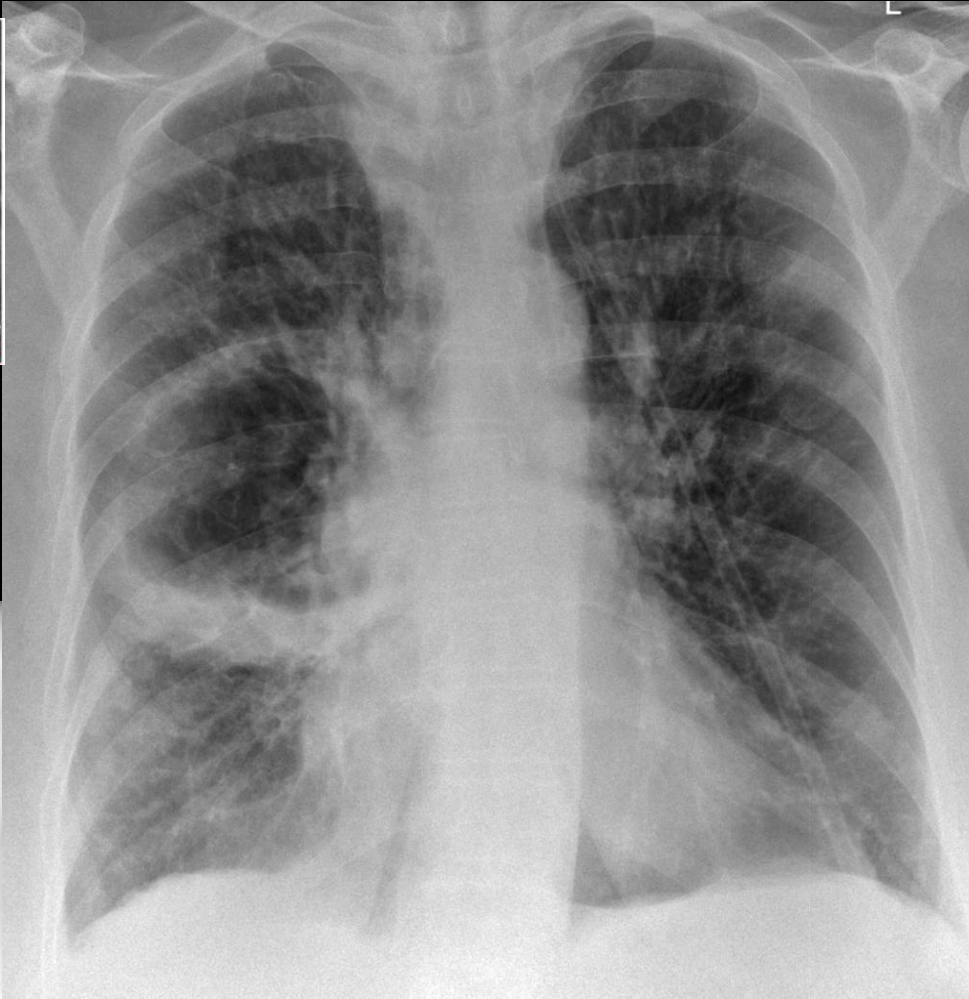
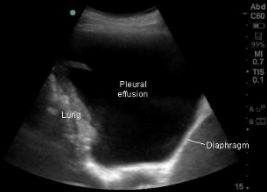


GOALS AND OBJECTIVES

- to be aware of the **role of modern diagnostic imaging modalities**
- to be familiar with **main radiological signs and syndromes**
- **tips and tricks in chest imaging**



IMAGING MODALITIES





IMAGING MODALITIES

- Conventional Radiography
- Computed Tomography
- Magnetic Resonance Imaging
- Ultrasonography
- Angiography
- Scintigraphy, Positron Emission Tomography, SPECT/CT



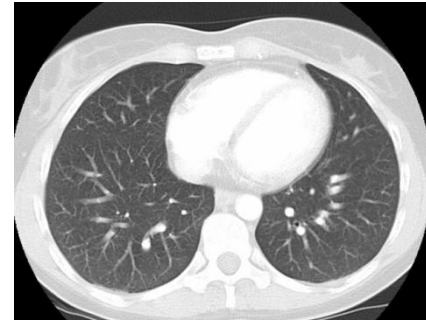
PLAIN CHEST X-RAY FILM



- Is the most frequently requested examination
- Visualization of the lungs is excellent because of inherent contrast of the tissues
- Lateral films shouldn't be undertaken routinely
- Comparison of the current film with old films is valuable
- Is mandatory before proceeding to more complex investigations



CT SCANNING MAIN INDICATIONS

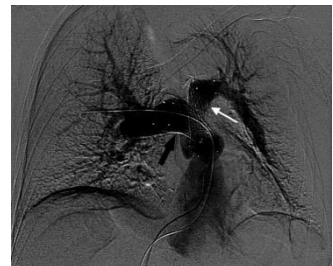
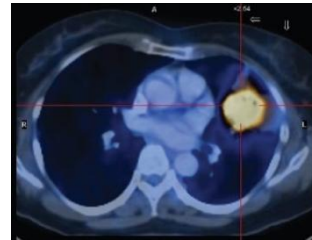
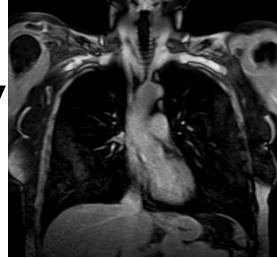


- Staging malignancy
- Detecting pulmonary metastases
- Far superior in assessing chest wall and pleural lesions, lung mass, the hilum and mediastinum
- High value in the diagnosis of diffuse lung disease
- Evaluation of bronchiectasis (surgery is undertaken without preoperative bronchography)



OTHER MODALITIES

- **MRI** – helpful in the diagnosis of hilar masses, lymphadenopathy and mediastinal lesions
- **Ultrasonography** – investigation of the chest wall and pleural lesions
- **Radionuclide scanning** – useful in staging malignancy
- **Pulmonary angiography** – gold standard for the diagnosis of pulmonary embolism





RADIOLOGICAL SIGNS

- Air bronchogram
- Air crescent
- Air trapping
- Beaded septum sign
- Signet ring sign
- Tree-in-bud pattern
- Ground-glass opacity
- Halo sign
- Honeycombing
- Milliary pattern
- Silhouette sign
- Reticular pattern



AIR BRONCHOGRAM

- An air bronchogram is a pattern of air-filled (low-attenuation) bronchi on a background of opaque (high-attenuation) airless lung
- The sign implies patency of proximal airways and evacuation of alveolar air by means of absorption (atelectasis) or replacement (eg, pneumonia) or a combination of these processes.



AIR BRONCHOGRAM



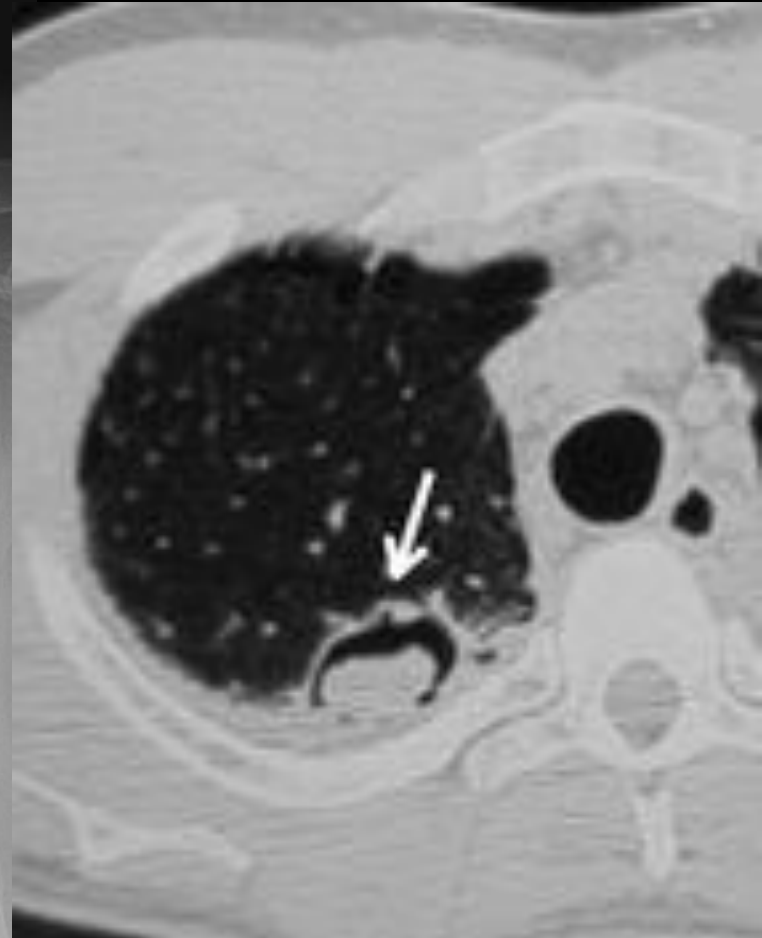
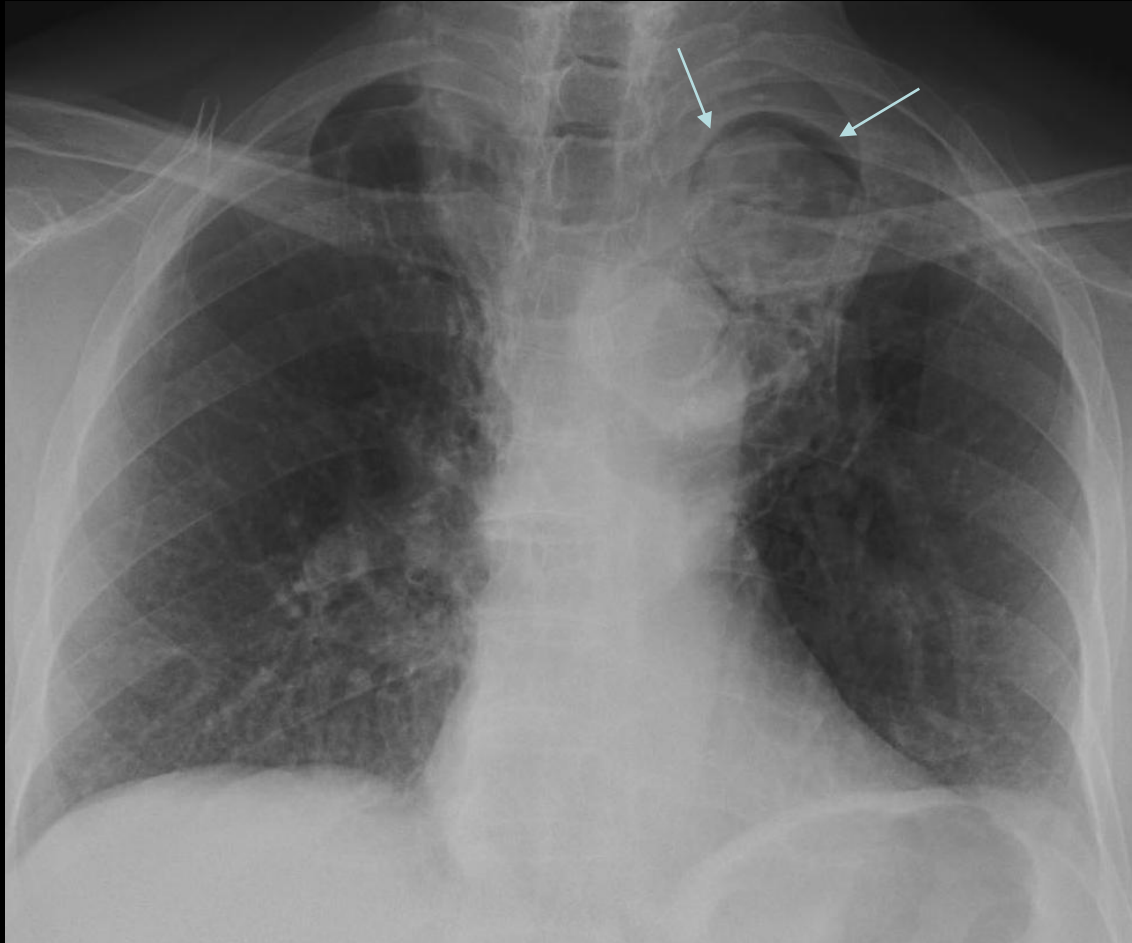


AIR CRESCENT

- is a collection of air in a crescentic shape that separates the wall of a cavity from an inner mass
- is characteristic of either Aspergillus colonization of pre-existing cavities or retraction of infarcted lung in angio-invasive aspergillosis



AIR CRESCENT SIGN



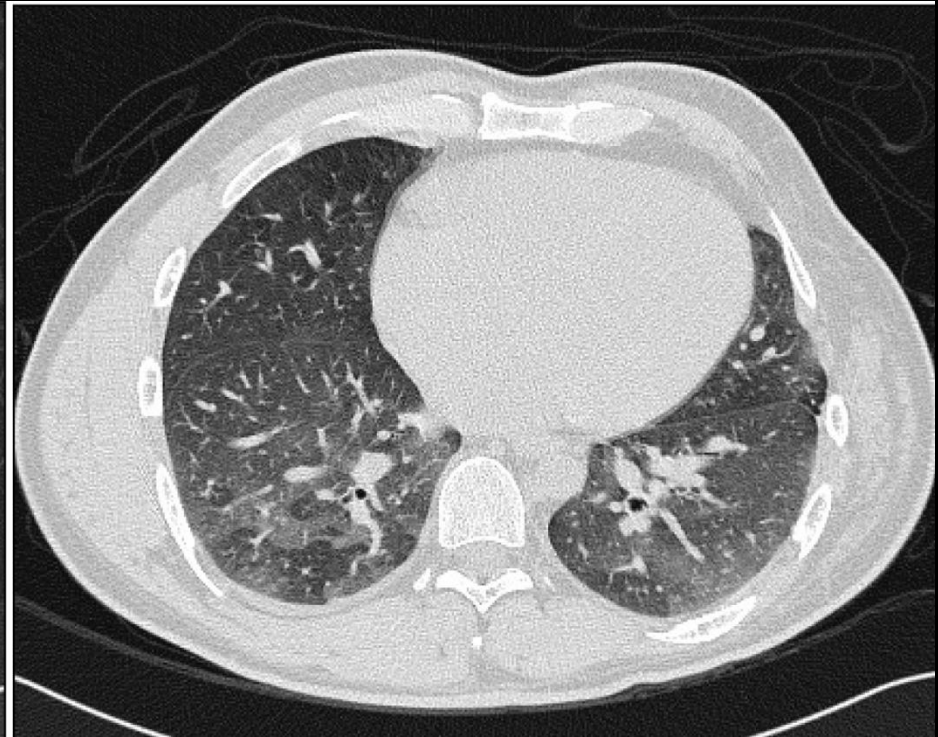
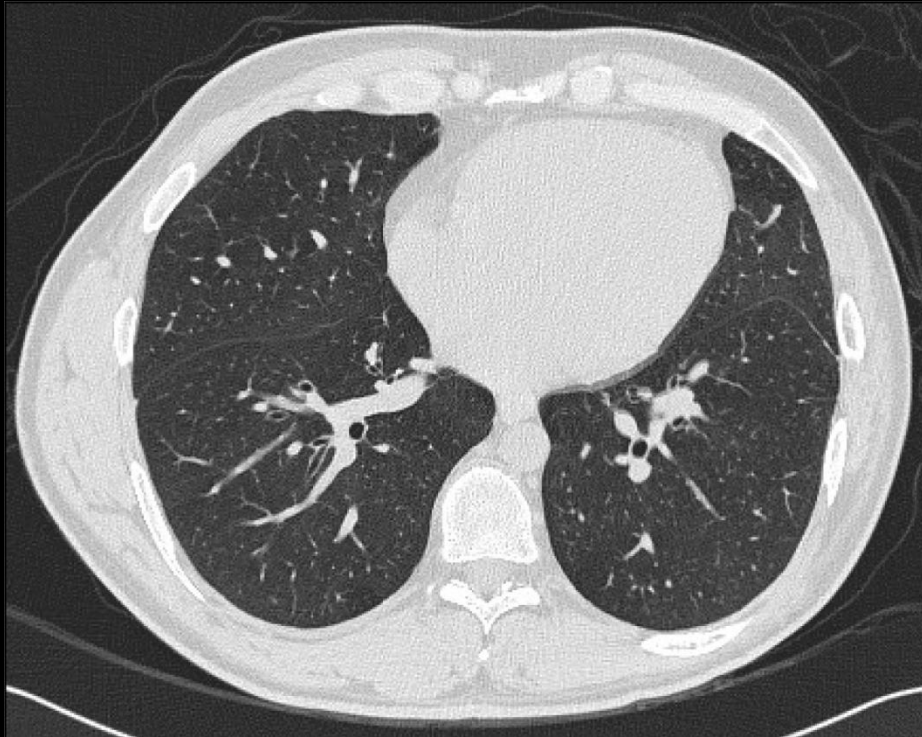


AIR TRAPPING

- Air trapping is retention of air in the lung distal to an obstruction
- is seen on end-expiration CT scans as parenchymal areas with less than normal increase in attenuation and lack of volume reduction
- Common conditions that lead to air trapping include asthma and bronchiolitis obliterans.



AIR TRAPPING





BEADED SEPTUM SIGN

- consists of irregular and nodular thickening of interlobular septa reminiscent of a row of beads
- It is frequently seen in lymphangitic spread of cancer, sarcoidosis



BEADED SEPTUM SIGN



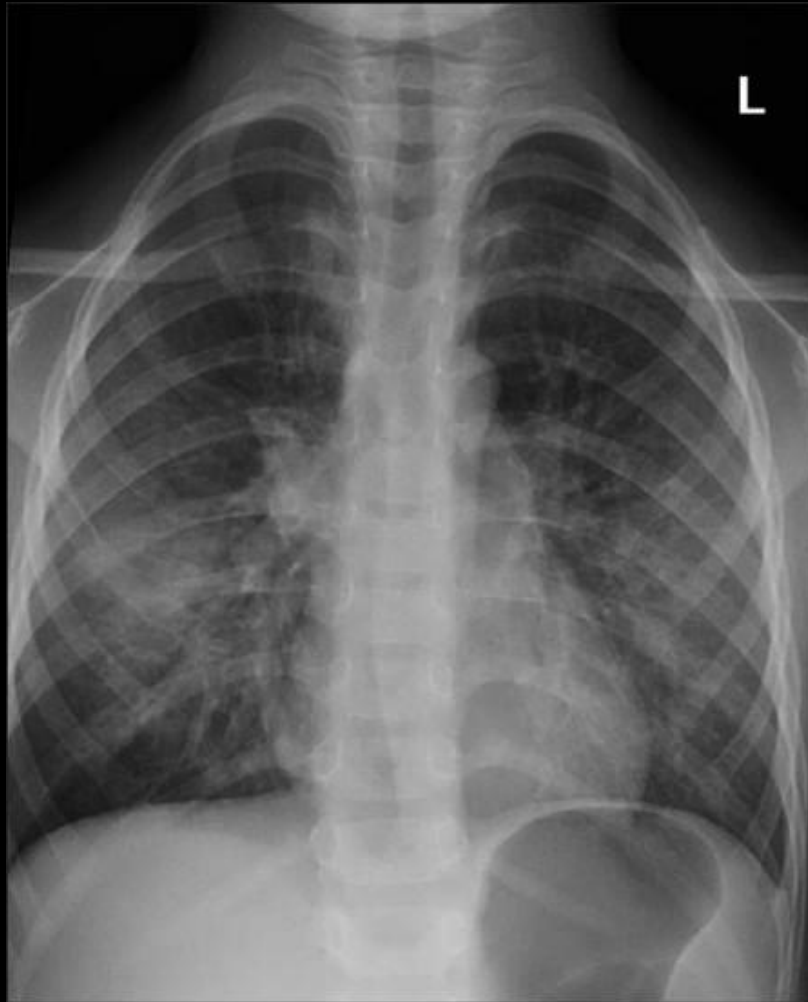


GROUND-GLASS OPACITY

- An area of hazy increased lung opacity, with preservation of bronchial and vascular margins
- Caused by partial filling of airspaces, interstitial thickening, partial collapse of alveoli, increased capillary blood volume, or a combination of these
- Less opaque than consolidation



GROUND-GLASS OPACITY



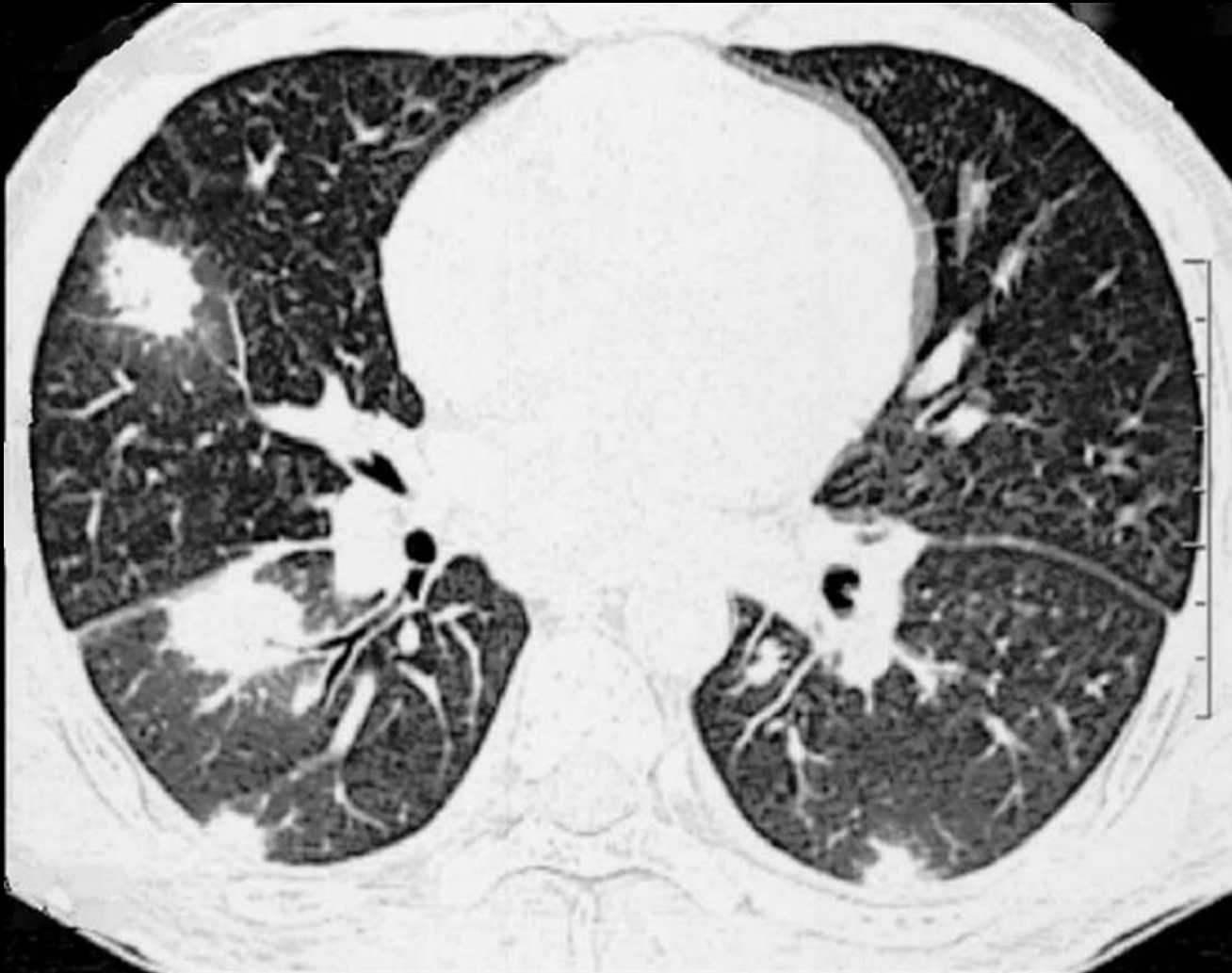


HALO SIGN

- The halo sign is a CT finding of ground-glass opacity surrounding a nodule or mass
- May be caused by haemorrhage around foci of invasive aspergillosis or other types of nodules, or by local pulmonary infiltration by neoplasm



HALO SIGN



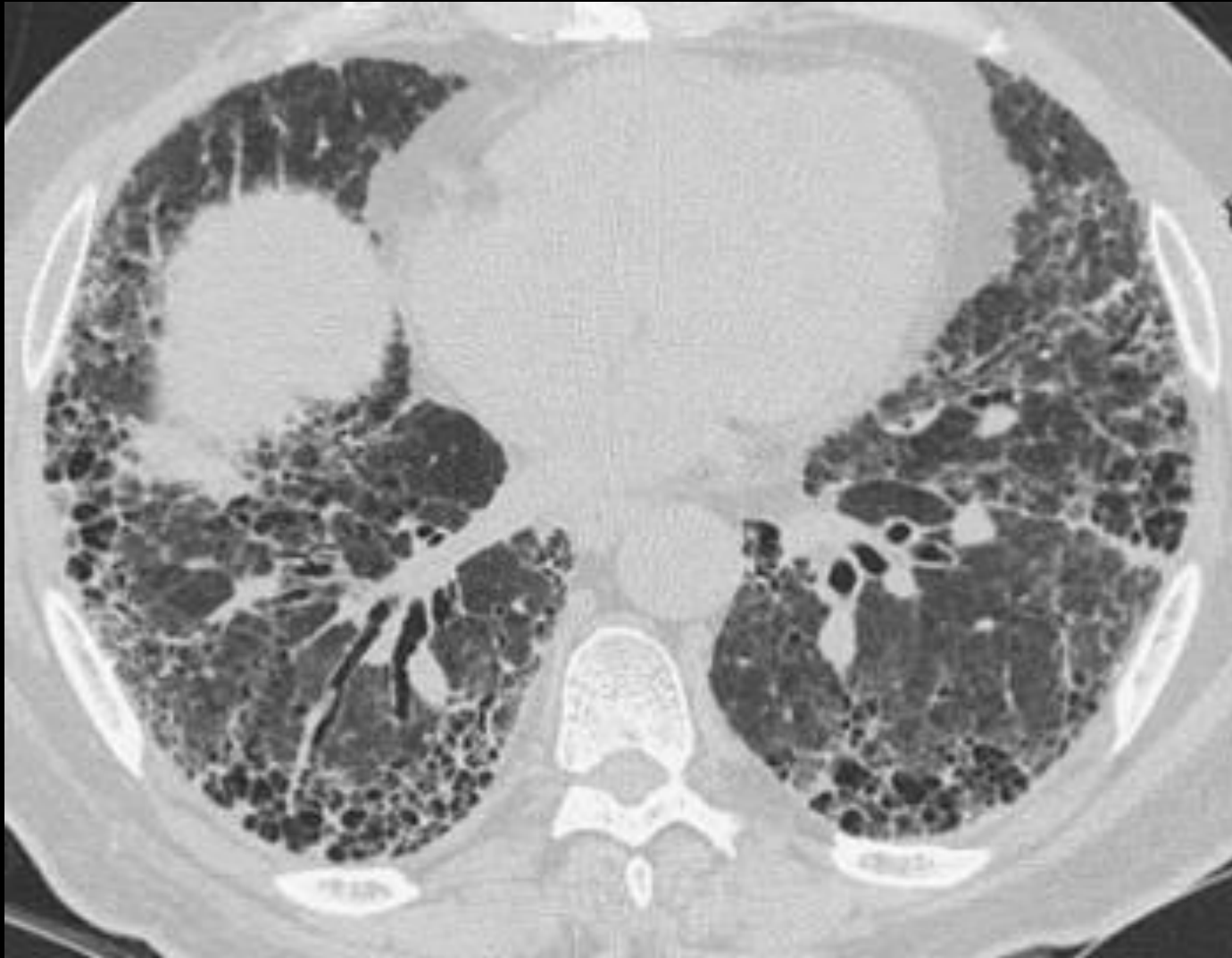


HONEYCOMBING

- The appearance is of clustered cystic air spaces, typically of comparable diameters on the order of 3–10 mm but occasionally as large as 2.5 cm
- Is considered specific for pulmonary fibrosis and is an important criterion in the diagnosis of usual interstitial pneumonia



HONEYCOMBING





MILIARY PATTERN

- On chest radiographs, the milliary pattern consists of profuse tiny, discrete, rounded pulmonary opacities (<3 mm in diameter) that are generally uniform in size and diffusely distributed throughout the lungs
- CT scans show widespread, randomly distributed micronodules
- This pattern is a manifestation of hematogenous spread of tuberculosis and metastatic disease.



MILIARY PATTERN





SIGNET RING SIGN

- This finding is composed of a ring-shaped opacity representing a dilated bronchus in cross section and a smaller adjacent opacity representing its pulmonary artery, with the combination resembling a signet (or pearl) ring
- Basic CT sign of bronchiectasis, asthma



SIGNET RING SIGN





SILHOUETTE SIGN

- The silhouette sign is the absence of depiction of an anatomic soft-tissue border.
- It is caused by consolidation and/or atelectasis of the adjacent lung, by a large mass, or by contiguous pleural fluid. The silhouette sign results from the juxtaposition of structures of similar radiographic attenuation



SILHOUETTE SIGN



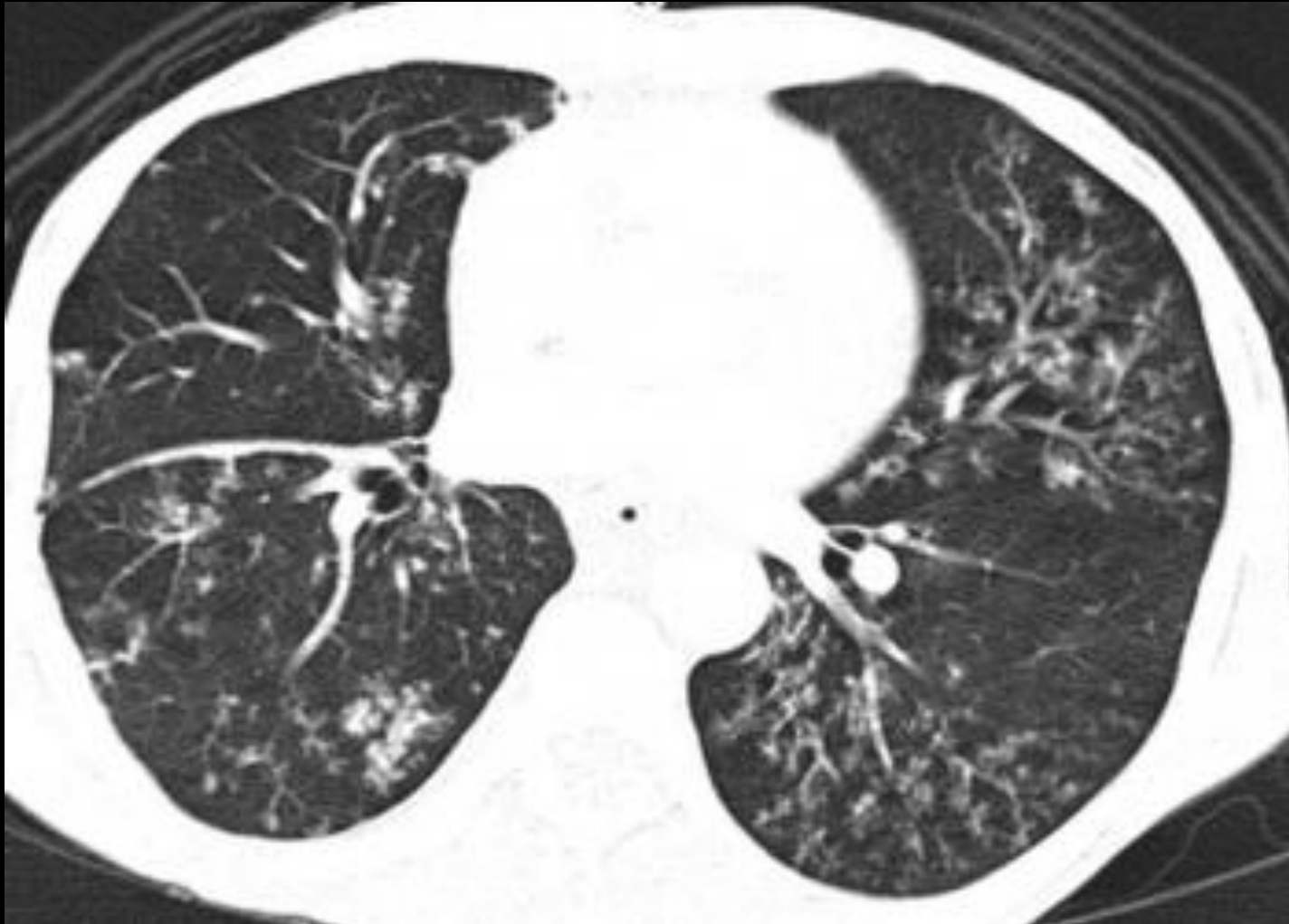


TREE-IN-BUD PATTERN

- Represents centrilobular branching structures that resemble a budding tree. The pattern reflects a spectrum of endo- and peribronchiolar disorders, including mucoid impaction, inflammation, and/or fibrosis
- It is particularly common in diffuse panbronchiolitis, endobronchial spread of mycobacterial infection, and cystic fibrosis



TREE-IN-BUD PATTERN



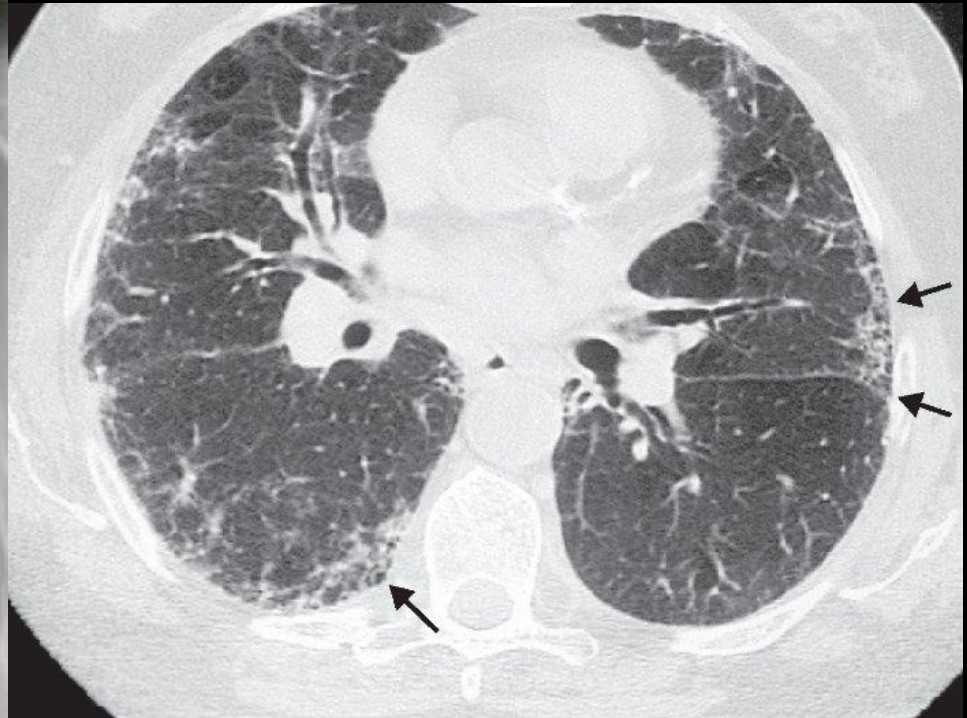


RETICULAR PATTERN

- Reticular pattern is a collection of innumerable small linear opacities that, by summation, produce an appearance resembling a net
- Represent interlobular septal thickening, intralobular lines;
- Represents interstitial lung disease, interstitial edema



RETICULAR PATTERN





RADIOLOGICAL SYNDROMES

- Consolidation
- Interstitial pattern
- Nodule or mass
- Atelectasis



CONSOLIDATION

NOTION

- Consolidation - any pathologic process that fills the alveoli with fluid, pus, blood, cells (including tumor cells) or other substances resulting in lobar, diffuse or multifocal ill-defined opacities



CONSOLIDATION

CLASSIFICATION

- Lobar consolidation
- Diffuse consolidation
- Multifocal ill-defined consolidations

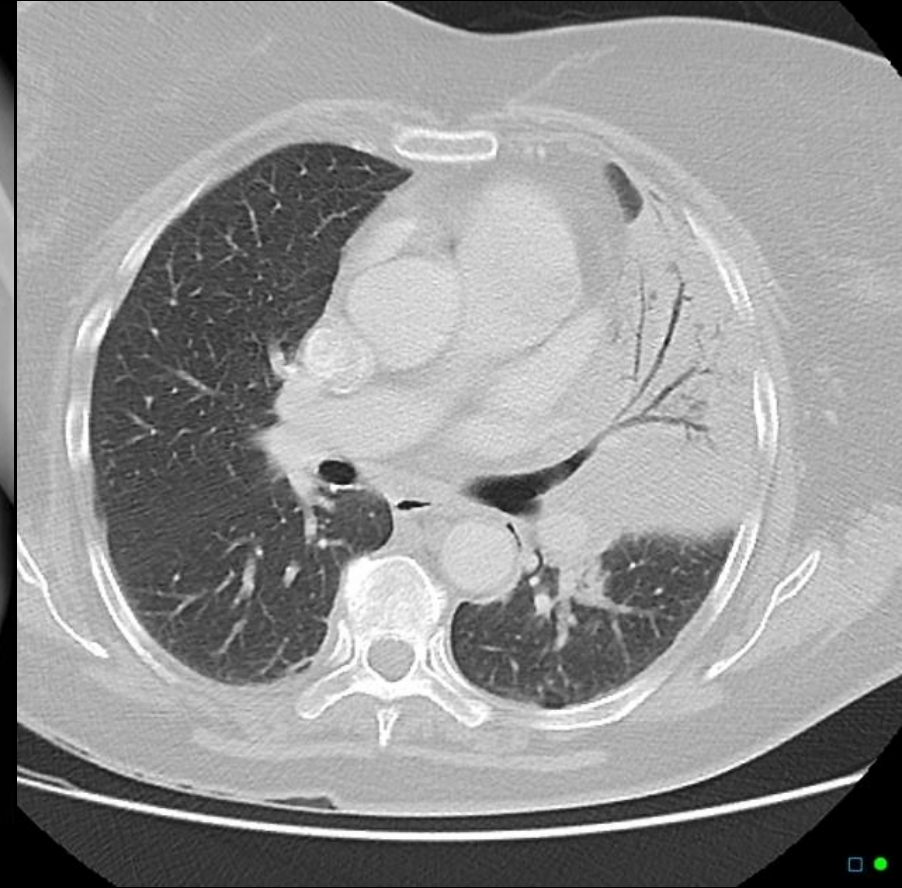


CONSOLIDATION

Lobar	Diffuse	Multi-focal
Lobar pneumonia <ul style="list-style-type: none"> - Streptococ pneum. - Klebsiella - TB - viral - fungal - Aspiration Neoplasm <ul style="list-style-type: none"> - Lungca with obstructive pneumonia - BAC - Lymphoma Hemorrhage <ul style="list-style-type: none"> - Contusion - Infarction Others <ul style="list-style-type: none"> - Organizing pneumonia - Eosinophilic pneum - Sarcoidosis - Sequestration - Mitral regurgitation with RUL edema 	Edema <ul style="list-style-type: none"> - Heart failure - Volume overload - ARDS - Low albumin - Renal failure - Transfusion reaction Bronchopneumonia <ul style="list-style-type: none"> - Staph Aureus - Gram negative - PCP - Viral - fungal Neoplasm <ul style="list-style-type: none"> - BAC - Lymphoma Hemorrhage <ul style="list-style-type: none"> - SLE - Henoch-Schönlein - Wegener - Goodpasture Others <ul style="list-style-type: none"> - Organizing pneumonia - Eosinophilic pneum - Hypersensitivity pneum - Alveolar proteinosis 	Bronchopneumonia <ul style="list-style-type: none"> - Staph Aureus - Legionella - Gram negative - Streptococcus pneum - Klebsiella - Pseudomonas - Anaerobe - PCP - TB - Aspiration Vascular <ul style="list-style-type: none"> - Septic emboli - Wegener's Neoplasm <ul style="list-style-type: none"> - BAC - Lymphoma - Metastases Others <ul style="list-style-type: none"> - Organizing pneumonia - Eosinophilic pneum - Lipoid pneumonia



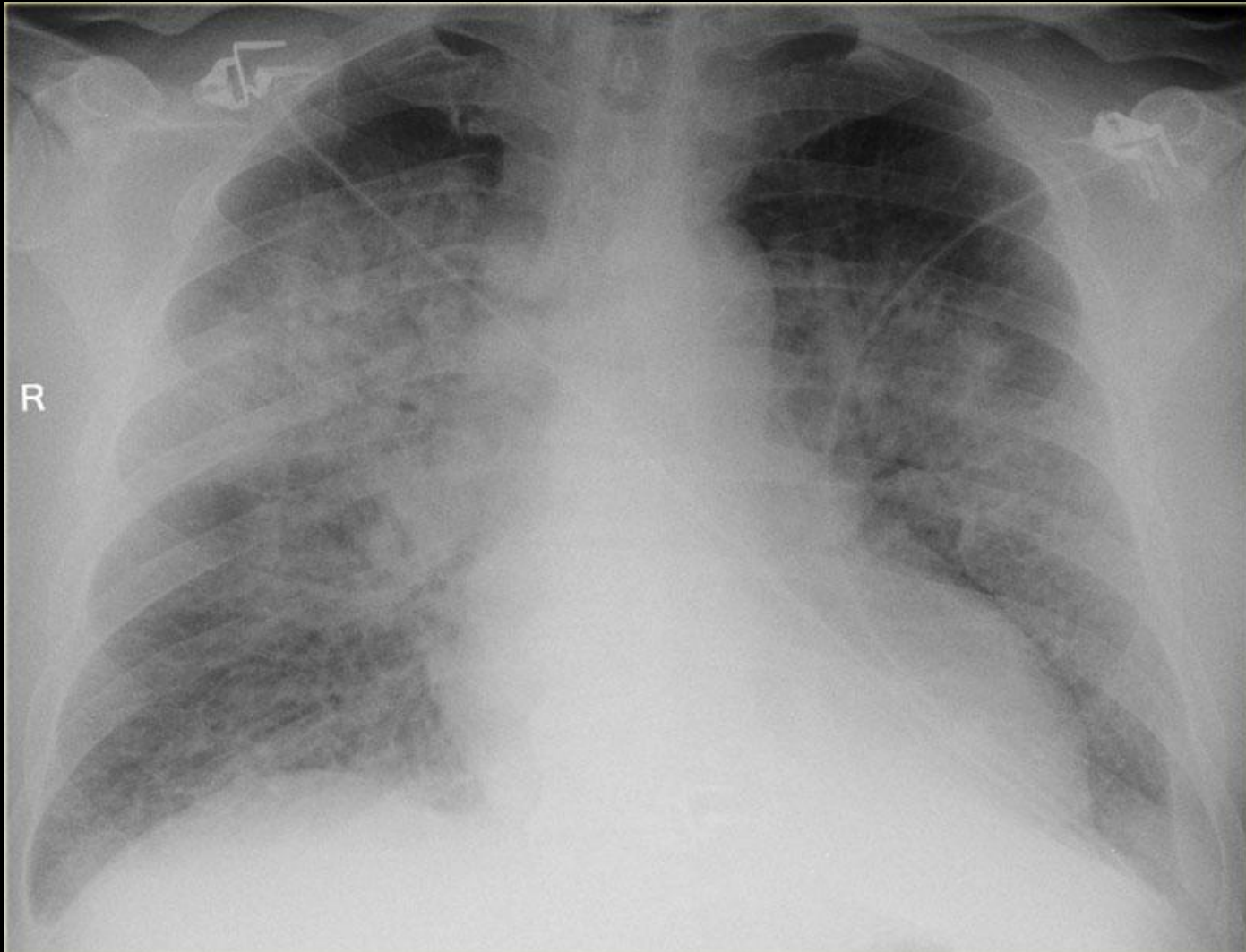
LOBAR CONSOLIDATION



Lobar pneumonia



DIFFUSE CONSOLIDATION



Pulmonary edema



MULTIFOCAL ILL-DEFINED CONSOLIDATIONS



Bronchopneumonia



INTERSTITIAL PATTERN

NOTION

- Interstitial pattern - involvement of the supporting tissue of the lung parenchyma resulting in fine or coarse reticular opacities or small nodules.



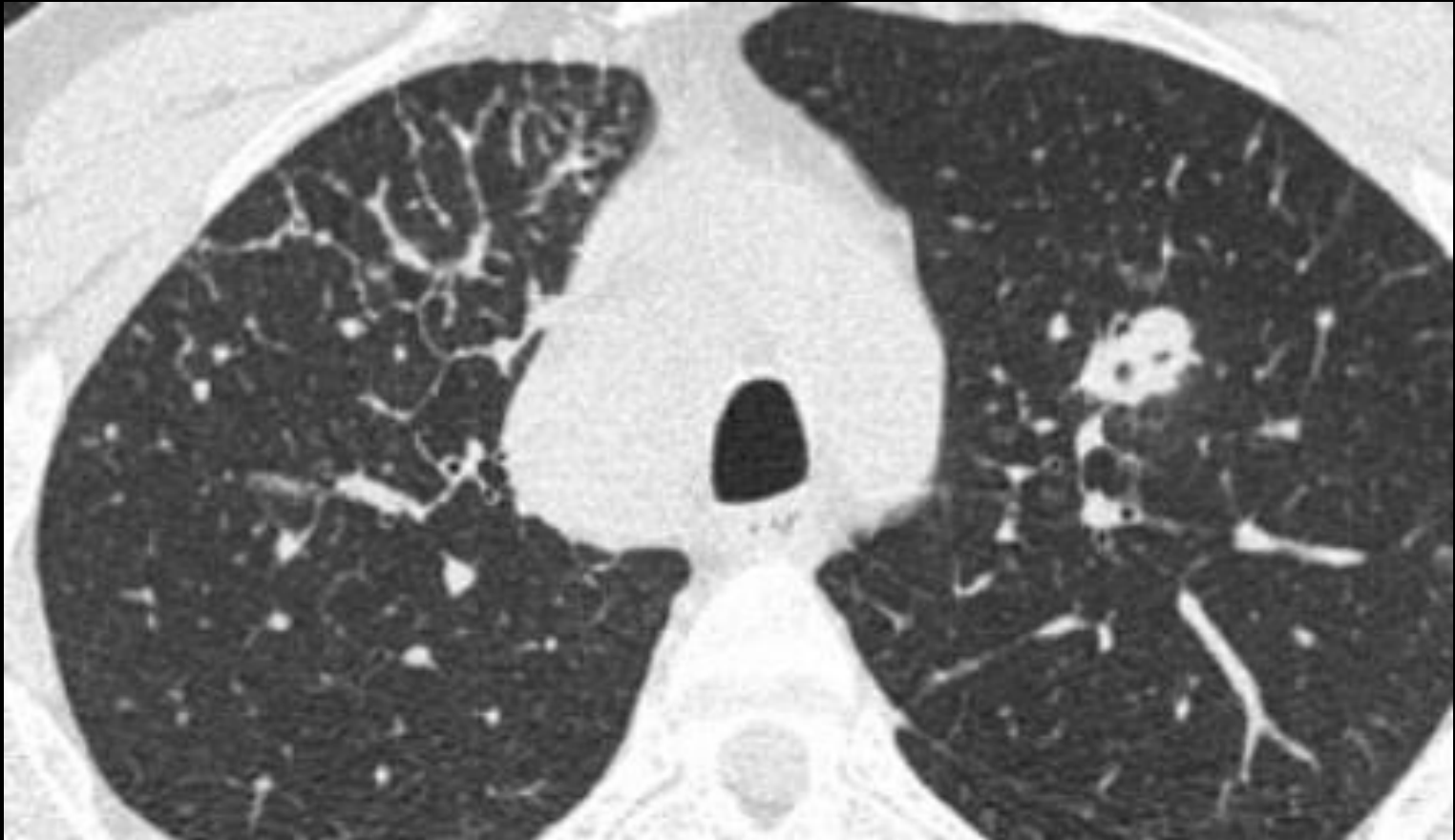
INTERSTITIAL PATTERN

CLASSIFICATION

- Reticular interstitial opacities
- Nodular interstitial opacities



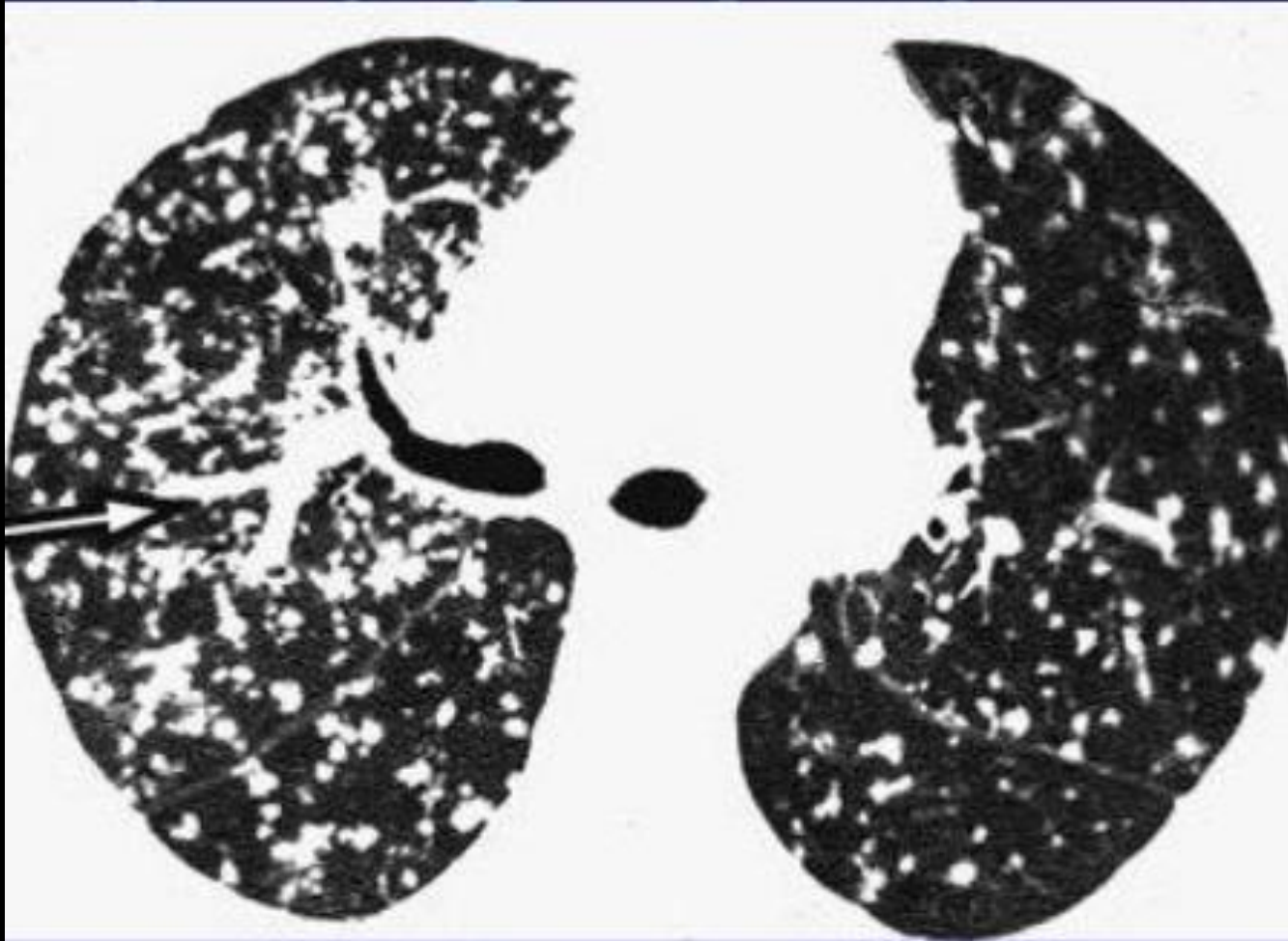
RETICULAR PATTERN



Lymphangitic carcinomatosis



NODULAR PATTERN



Sarcoidosis

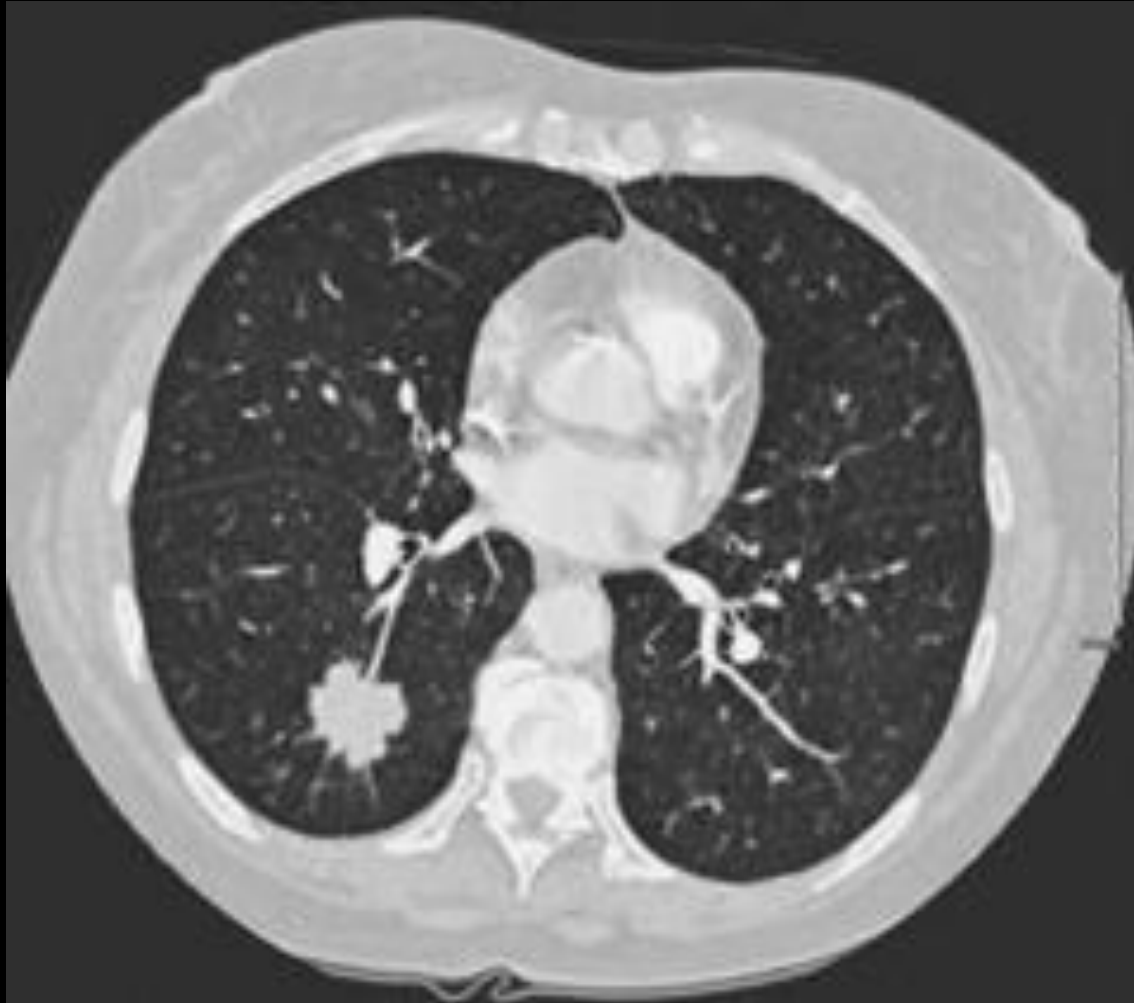


NODULE OR MASS

- Nodule or mass - any space occupying lesion either solitary or multiple.
- Solitary pulmonary nodule is defined as a discrete, well-marginated, rounded opacity less than or equal to 3 cm in diameter.



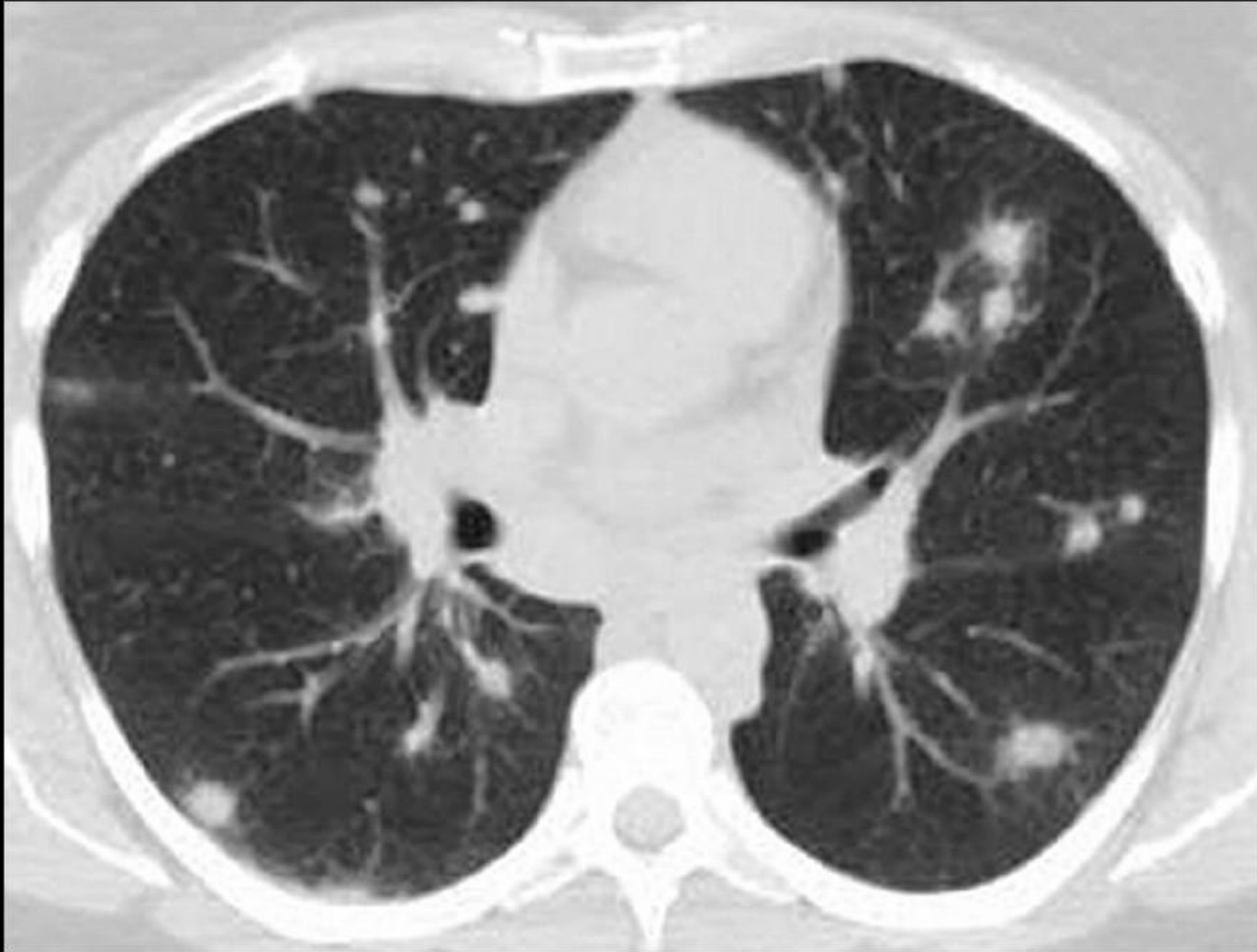
SOLITARY PULMONARY NODULE



Bronchial carcinoma



MULTIPLE PULMONARY MASSES



METASTASES



ATELECTASIS

NOTION

- Atelectasis or lung-collapse is the result of loss of air in a lung or part of the lung with subsequent volume loss due to airway obstruction or compression of the lung by pleural fluid or a pneumothorax.



ATELECTASIS

CLASSIFICATION

- linear atelectasis: a minimal degree of collapse as seen in patients with rib fracture
- lobar atelectasis: collapse of one or more lobes of a lung
- segmental atelectasis: collapse of one or more individual pulmonary segments
- subsegmental atelectasis
- round atelectasis: classically associated with asbestos exposure (comet tail sign).

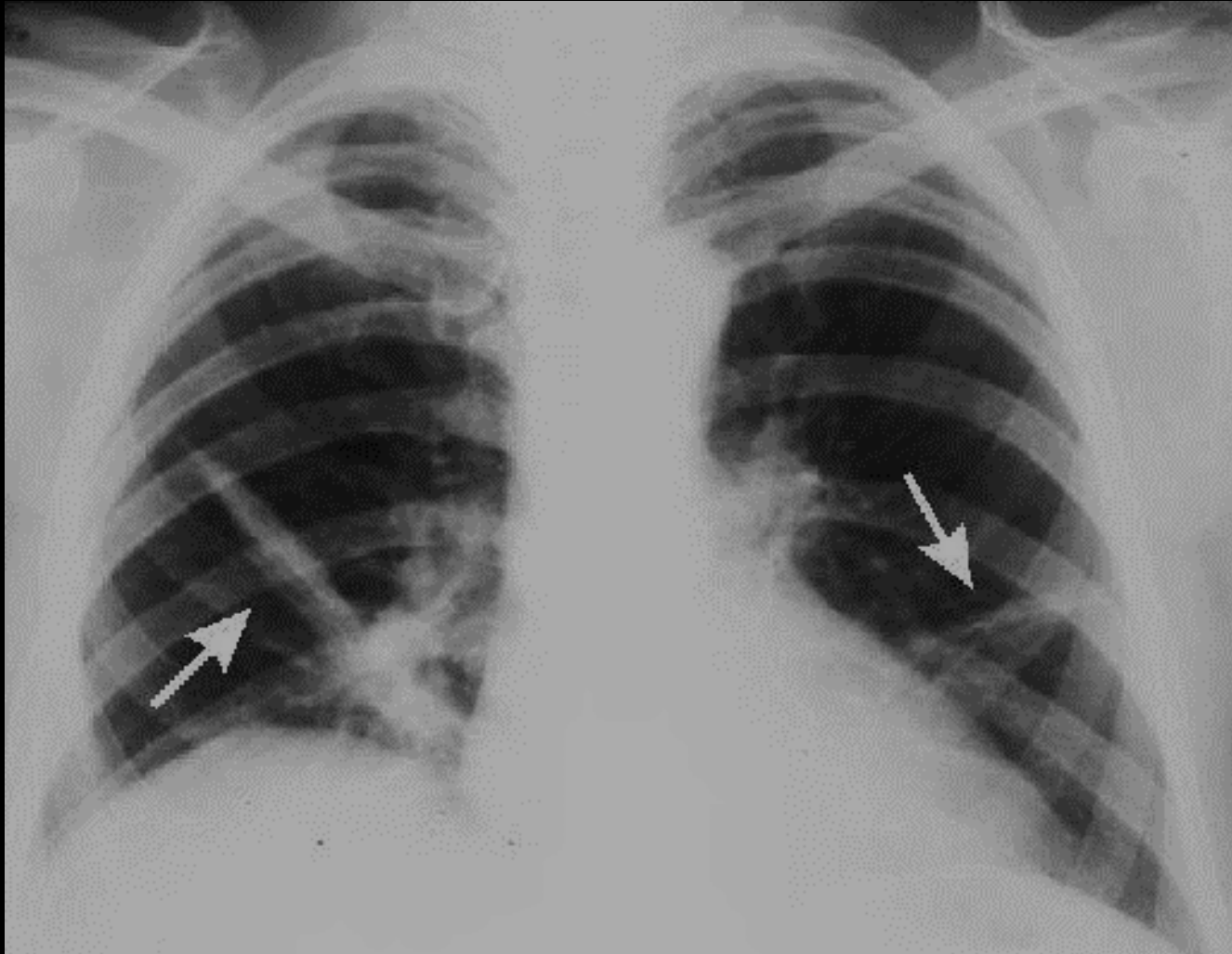


LOBAR ATELECTASIS





LINEAR ATELECTASIS





ROUND ATELECTASIS



Dankie Gracias
Спасибо شكريا
Merci Takk
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Ďakujeme Vielen Dank Paldies
Kiitos Tänname teid 谢谢
Thank You Tak
感謝您 Obrigado Teşekkür Ederiz
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