HOW TO READ PLAIN X-RAY CHEST



2

Dr Marwan Matar

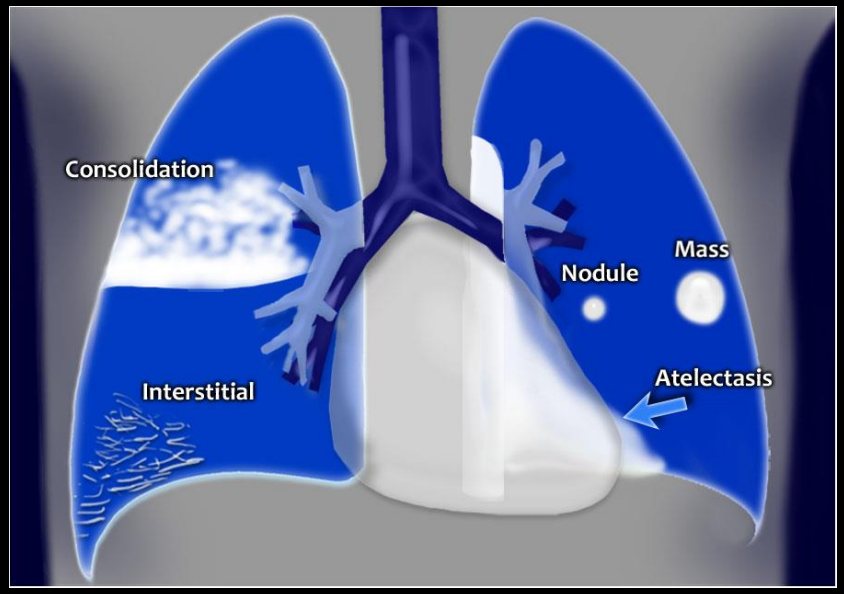
Consultant Radiologist

European Gaza Hospital

PATTERN APPROACH

4 PATTERN

1. Consolidation
2. Atelectasis
3. Interstitial
4. Nodules and masses



1

Consolidation

- **Definition** - any pathologic process that fills the alveoli with fluid, pus, blood, cells or other substances resulting in lobar, diffuse or multifocal ill-defined opacities

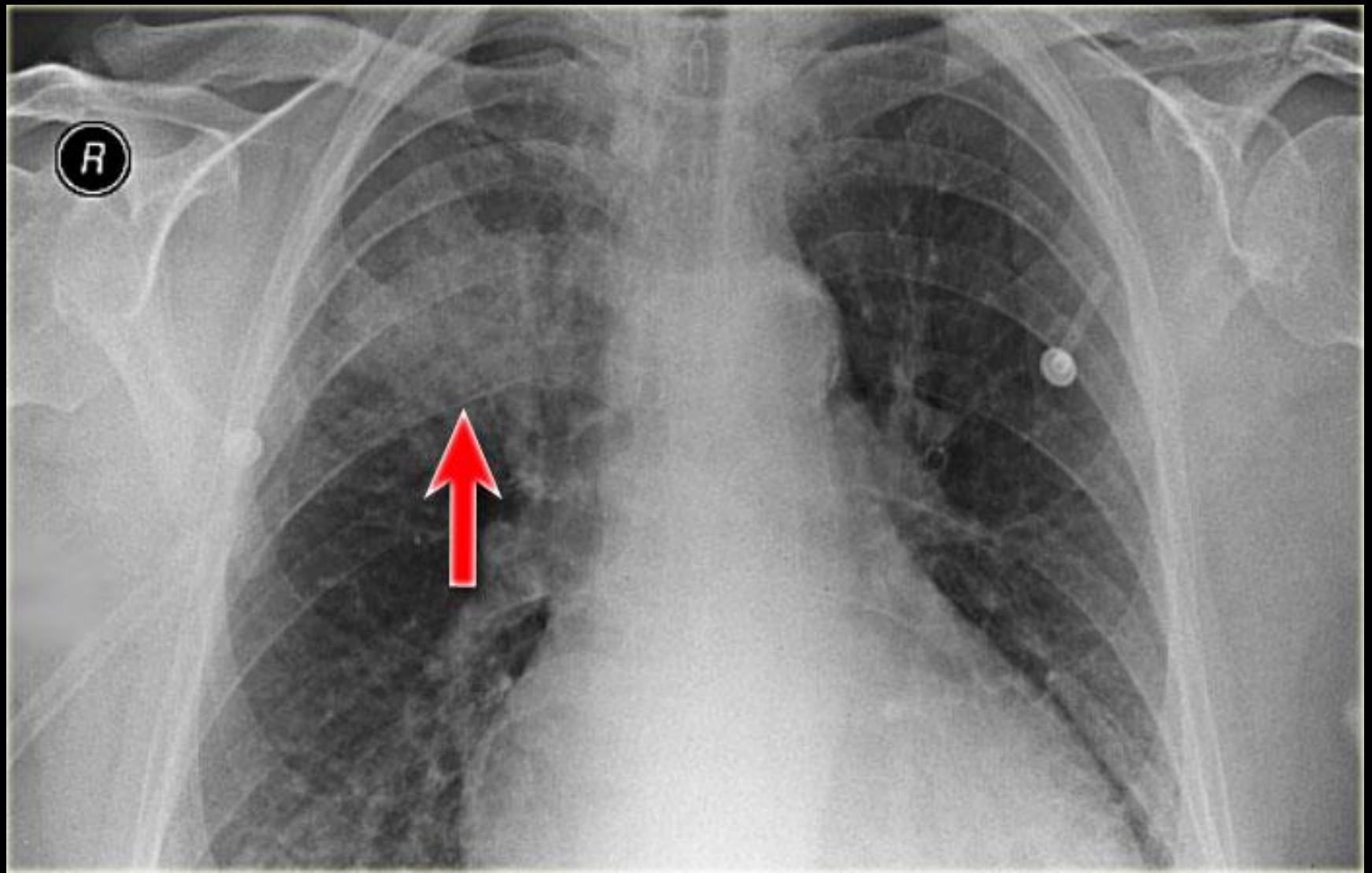
- When it reaches a fissure the spread stops there

- Pneumonia is by far the most common cause of consolidation .

The key-findings on the X-ray are:

- ill-defined homogeneous opacity obscuring vessels
- Silhouette sign: loss of lung/soft tissue interface
- Air-bronchogram
- Extention to the pleura or fissure, but not crossing it
- No volume loss

Ill defined opacity with air bronchogram



- Silhouette sign: loss of lung/soft tissue interface









Left lower lobe





Right upper lobe pneumonia





Content

Water	Pus	Blood	Cells
Heart failure ARDS Low albumin Renal failure	Pneumonia	Trauma Goodpasture Henoch Schonlein SLE	BAC Organizing pneum Chron eosin pneum Sarcoid

Pattern

Lobar

Lobar pneumonia
- Streptococ pneum.
- Klebsiella
- TB - viral - fungal
- Aspiration

Neoplasm
- Lungca with obstructive pneumonia
- BAC
- Lymphoma

Hemorrhage
- Contusion
- Infarction

Others
- Organizing pneumonia
- Eosinophilic pneum
- Sarcoidosis
- Sequestration
- Mitral regurgitation with RUL edema

Diffuse

Edema
- Heart failure
- Volume overload
- ARDS
- Low albumin
- Renal failure
- Transfusion reaction

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

Neoplasm
- BAC
- Lymphoma

Hemorrhage
- SLE
- Henoch-Schönlein
- Wegener
- Goodpasture

Others
- Organizing pneumonia
- Eosinophilic pneum
- Hypersensitivity pneum
- Alveolar proteinosis

Multi-focal

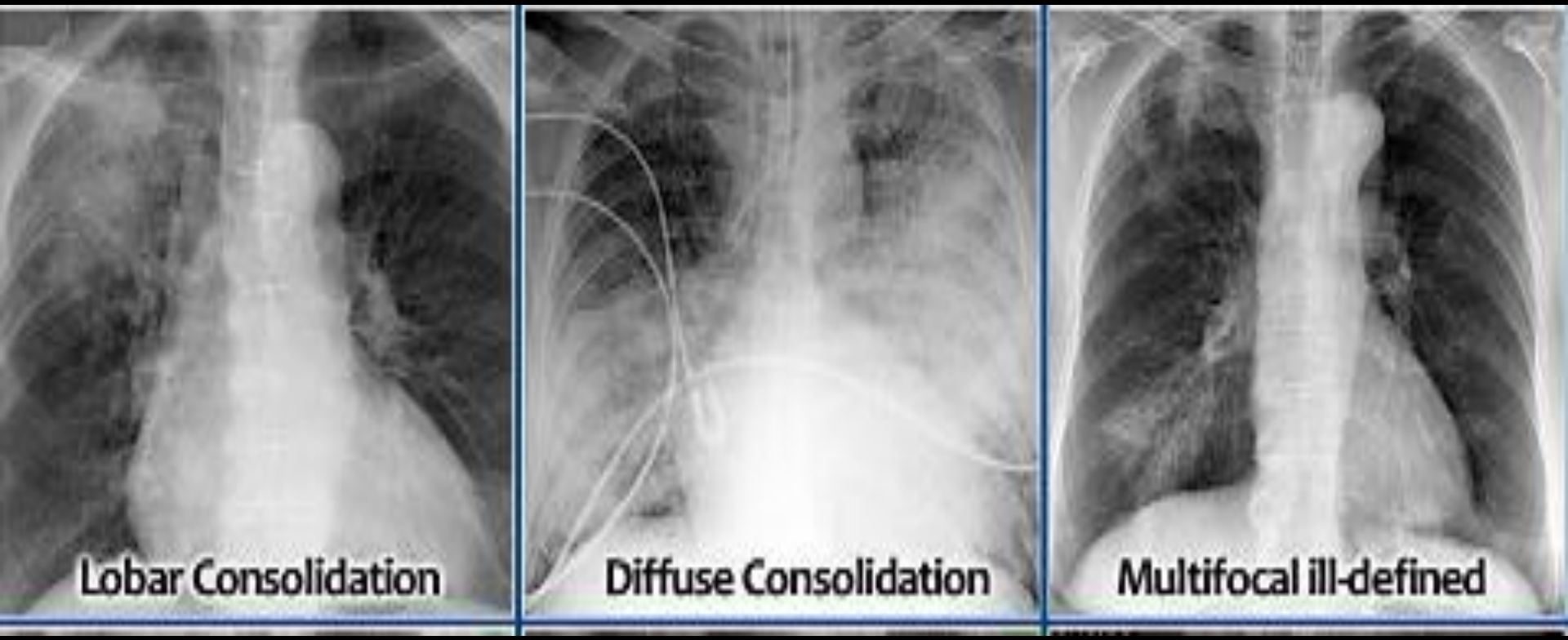
Bronchopneumonia
- Staph Aureus
- Legionella
- Gram negative
- Streptococcus pneum
- Kliebsiella
- Pseudomonas
- Anaerobe
- PCP
- TB
- Aspiration

Vascular
- Septic emboli
- Wegener's

Neoplasm
- BAC
- Lymphoma
- Metastases

Others
- Organizing pneumonia
- Eosinophilic pneum
- Lipoid pneumonia

Different pattern of consolidation



It is very important to differentiate between acute consolidation and chronic consolidation, because it will limit the differential diagnosis

Acute Consolidation	Chronic Consolidation
Pulmonary edema Pneumonia Aspiration Hemorrhage / Contusion Infarction	Neoplasm • post-obstruction • Bronch-alveolar ca • Lymphoma Sarcoidosis Organizing Pneumonia Eosinophilic pneumonia Alveolar proteinosis

the most common consolidation is lobar or segmental

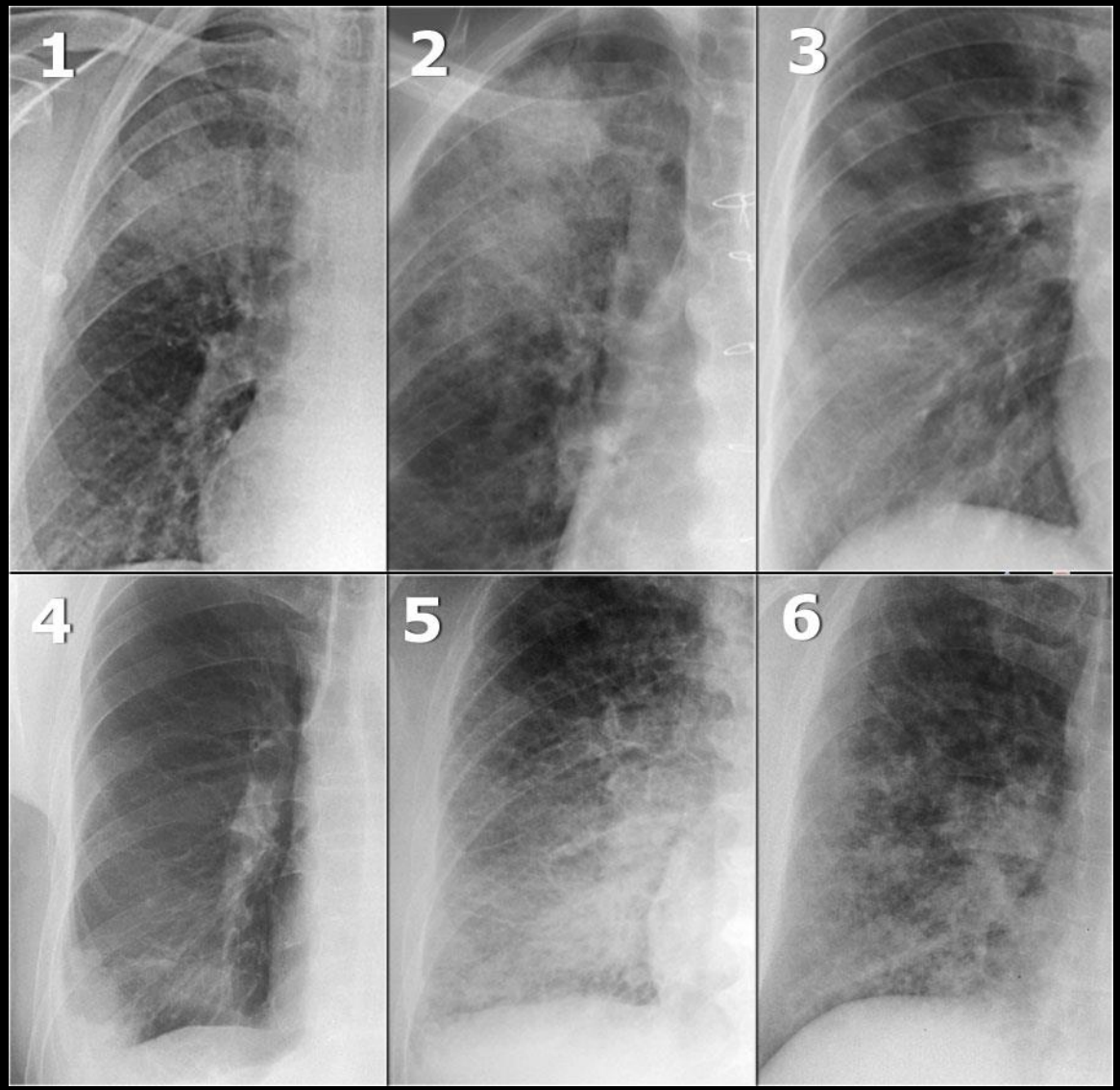
Lobar consolidation

Lobar pneumonia
- Streptococ pneum.
- Klebsiella
- TB
- Aspiration

Neoplasm
- Lungca with obstructive pneumonia
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- Lymphoma

Hemorrhage
- Contusion
- Infarction

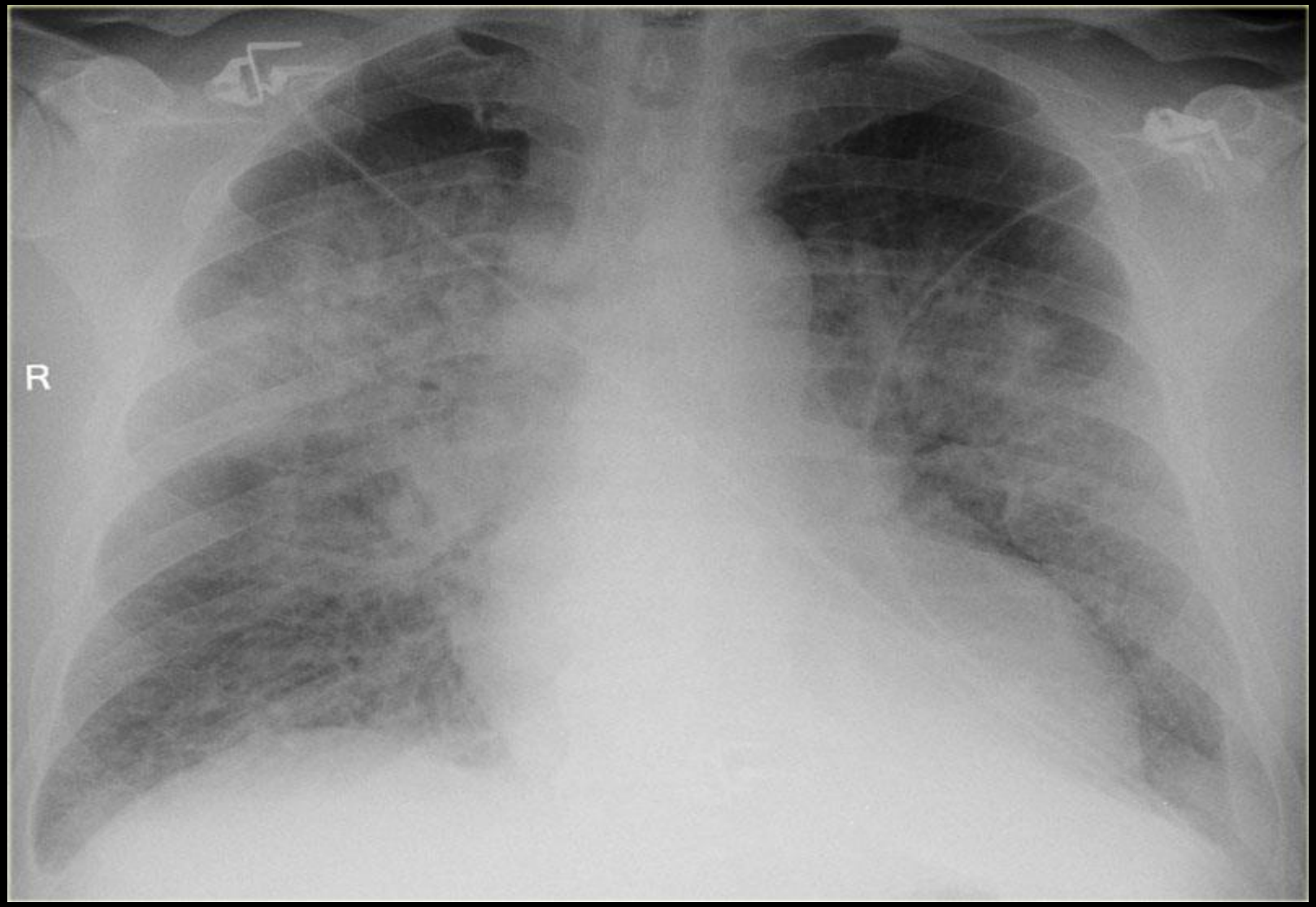
Others
- Organizing pneumonia
- Eosinophilic pneum.
- Sarcoidosis
- Sequestration
- Mitral regurgitation with RUL edema



1. Lobar pneumonia
2. Pulmonary Hemorrhage .
3. Organizing pneumonia

   (chronic consolidation) .
4. Infarction .
5. Cardiogenic edema
6. Sarcoidosis .

the most common diffuse consolidation is pulmonary edema



Batwing

Pulmonary edema
Bronchopneumonia
PCP
Viral pneumonia

Reversed Batwing

Bronchoalveolar carcinoma
Sarcoidosis
Organizing Pneumonia
Eosinophilic pneumonia

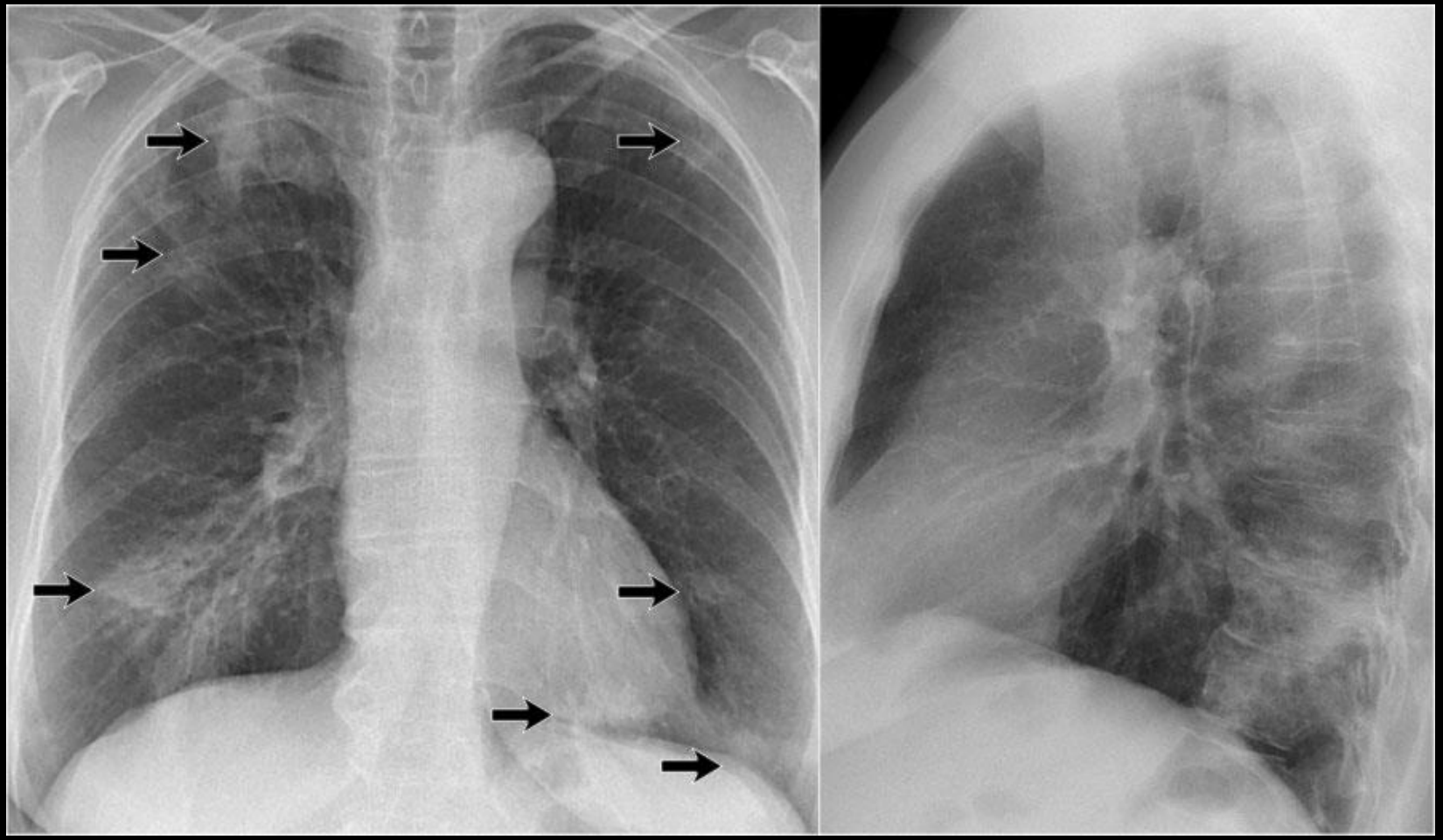
Multiple ill-defined

Bronchopneumonia
- Staph Aureus
- Legionella
- Gram negative
- Streptococcus pneumonia
- Klebsiella
- Pseudomonas
- Anaerobe
- PCP
- TB

Vascular
- Septic emboli
- Wegener's

Neoplasm
- BAC
- Lymphoma
- Metastases

Sarcoidosis



2

Atelectasis

- **Definition** - (lung collapse) is a result of loss of air in a lung with subsequent volume loss due to airway obstruction or external compression by pleural fluid or gas.

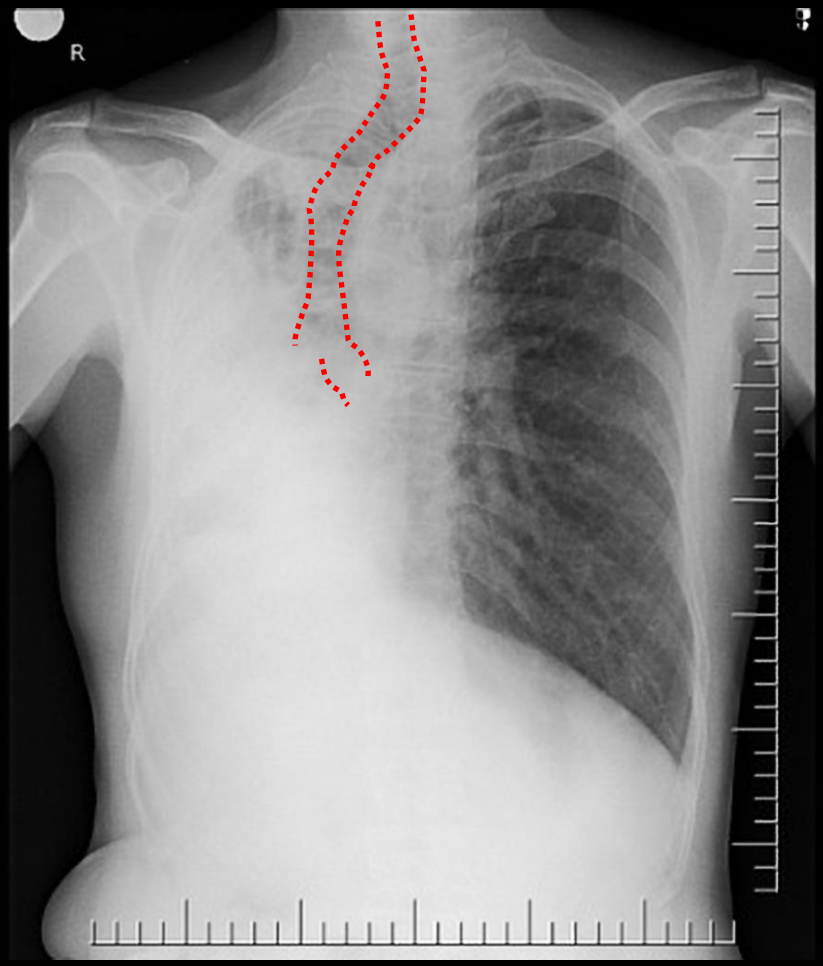
- In many cases atelectasis is the first sign of a lung cancer.



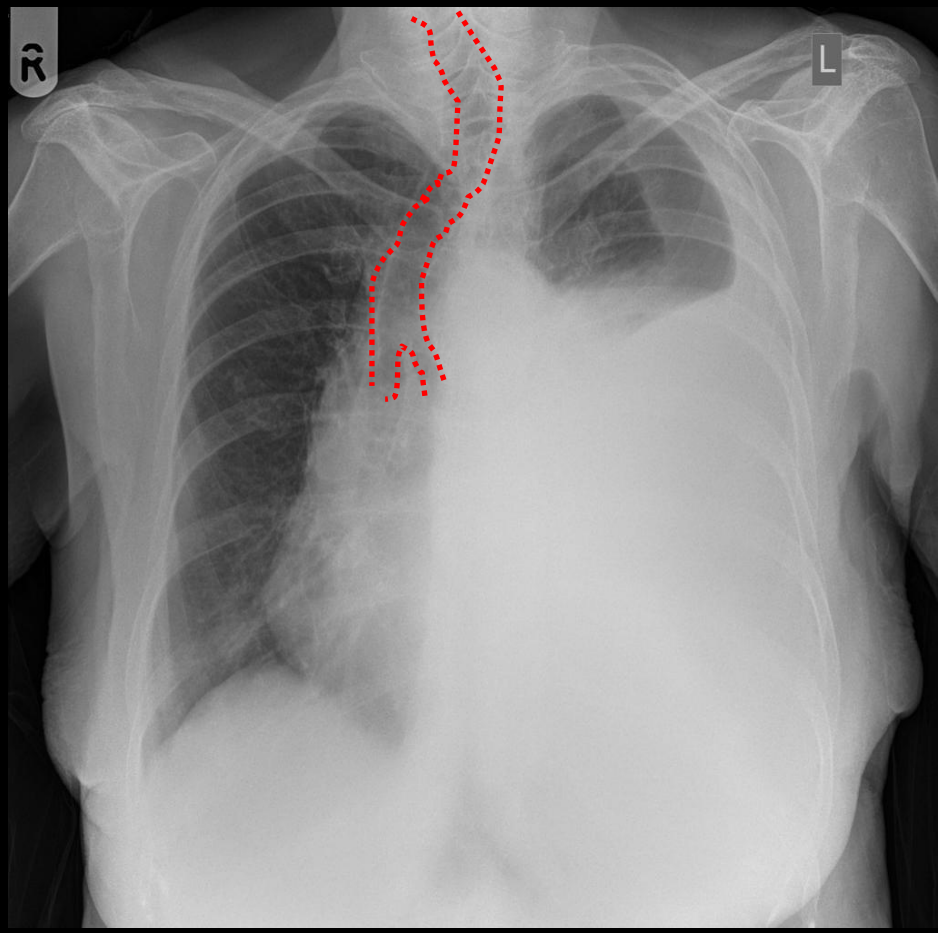
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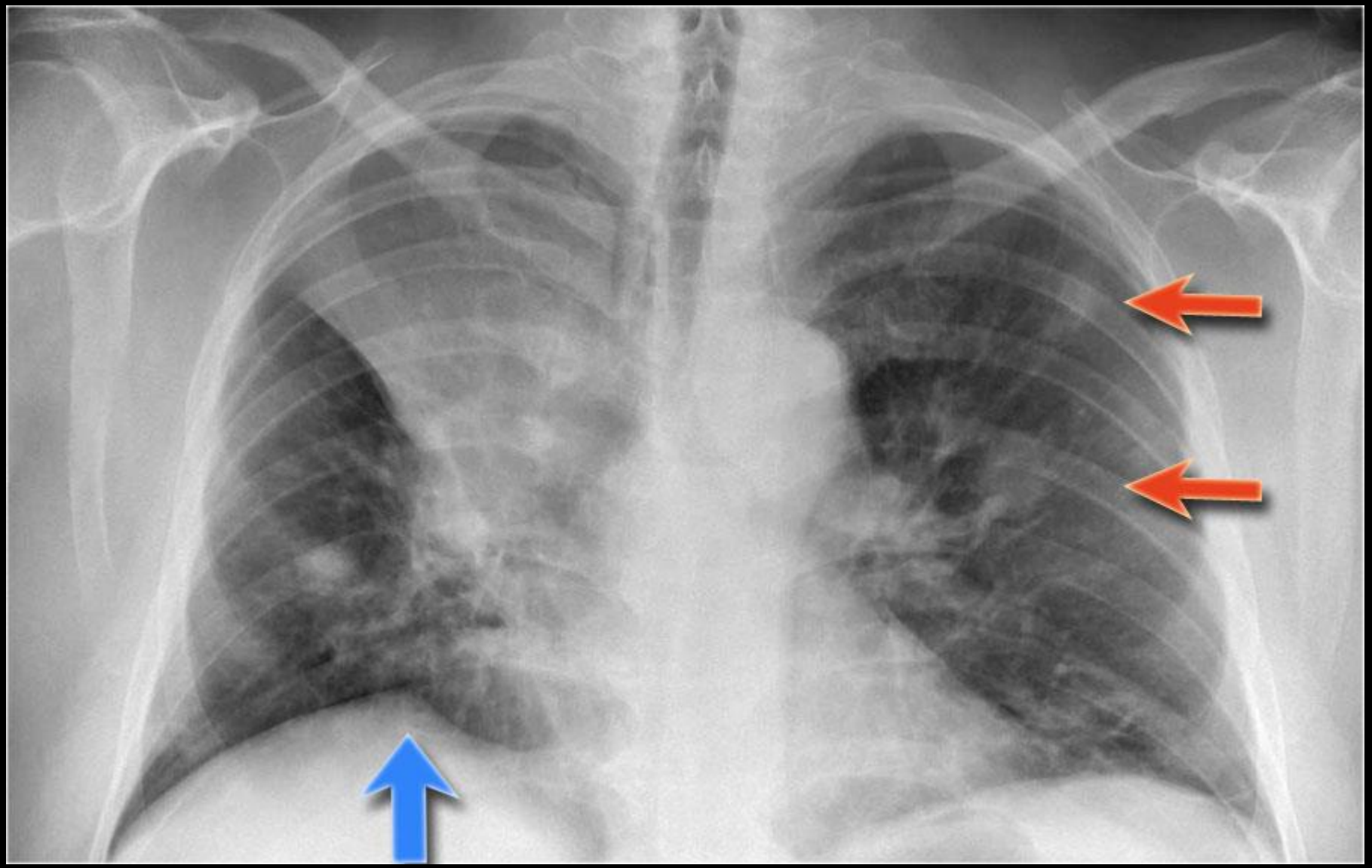
- Sharply- defined opacity obscuring vessels without air bronchogram .
- Volume loss resulting in displacement of diaphragm , fissure , hili or mediastinum

1

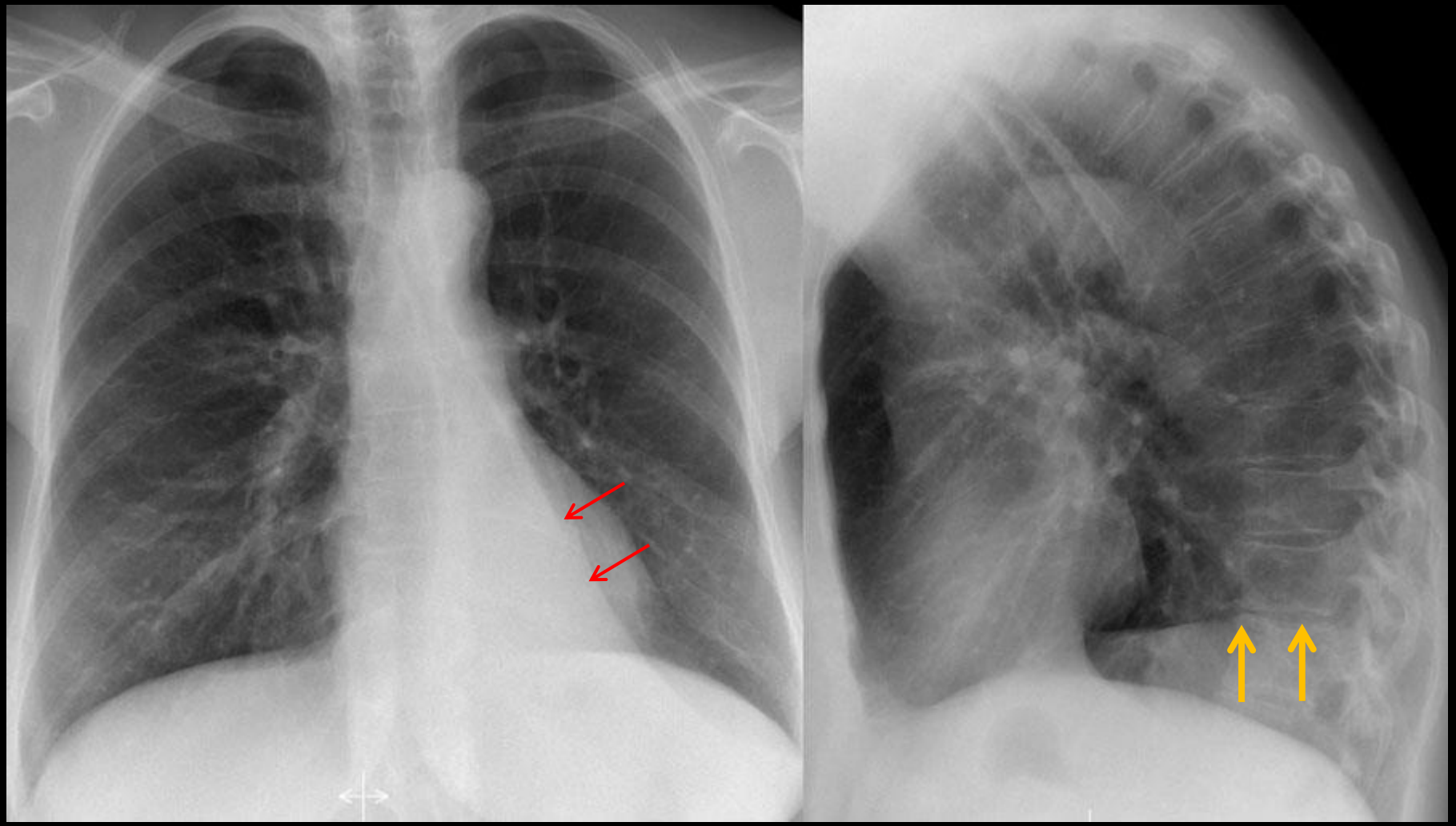


2





Left lower lobe atelectasis

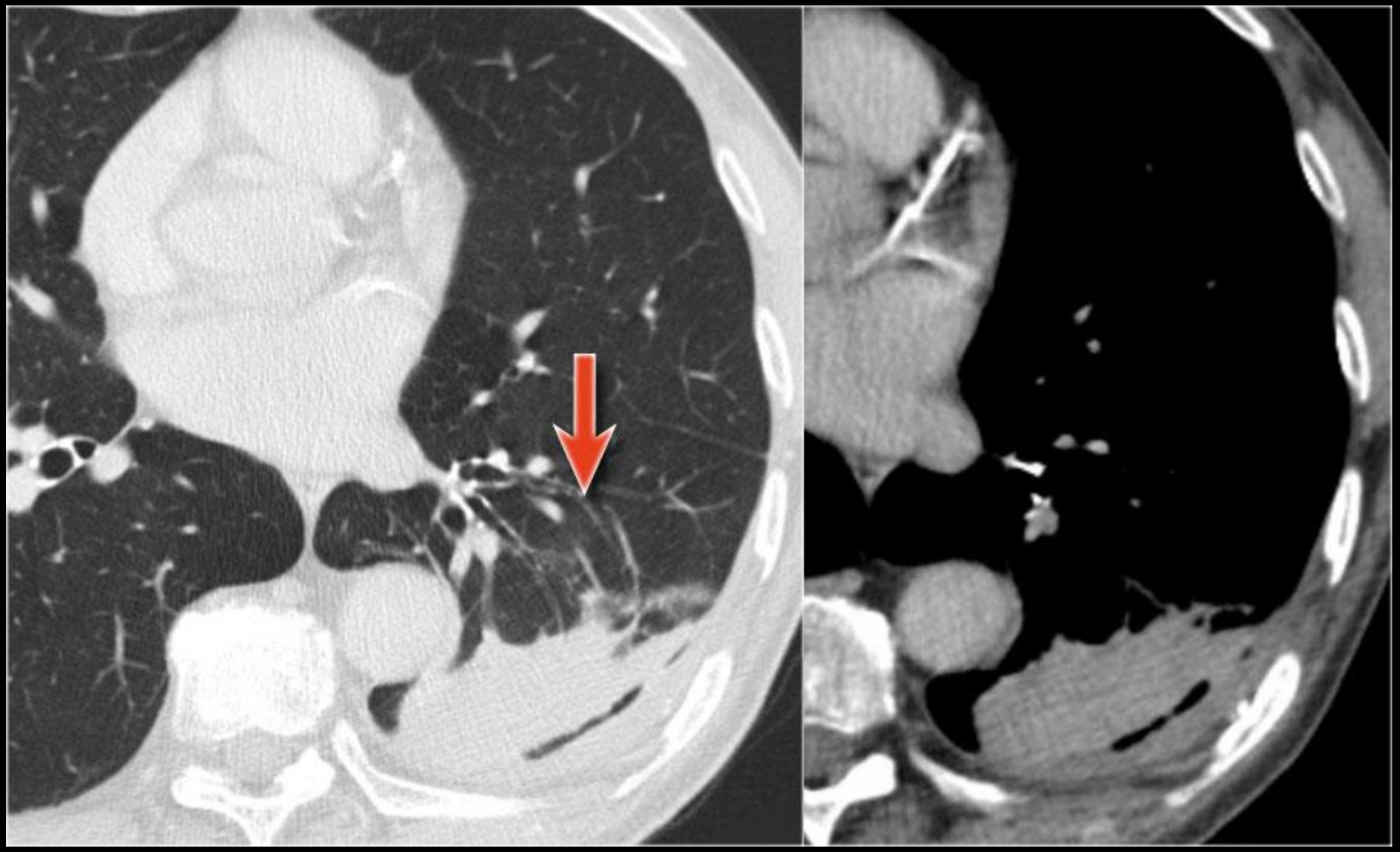


Rounded Atelectasis

CT findings

1. Pleural thickening
2. Round, oval or triangular shaped mass adjacent to the pleura
3. Comet tail sign - vessels converge into the mass in a curvilinear fashion





3

Nodules and Masses

- **Definition** -

➢ Nodule : defined as well-marginated, rounded opacity less than 3cm in diameter .

1. Solitary Pulmonary Nodule (SPN)
2. Multiple Pulmonary Nodules

➢ Mass : defined as well-marginated, rounded opacity more than 3cm in diameter .

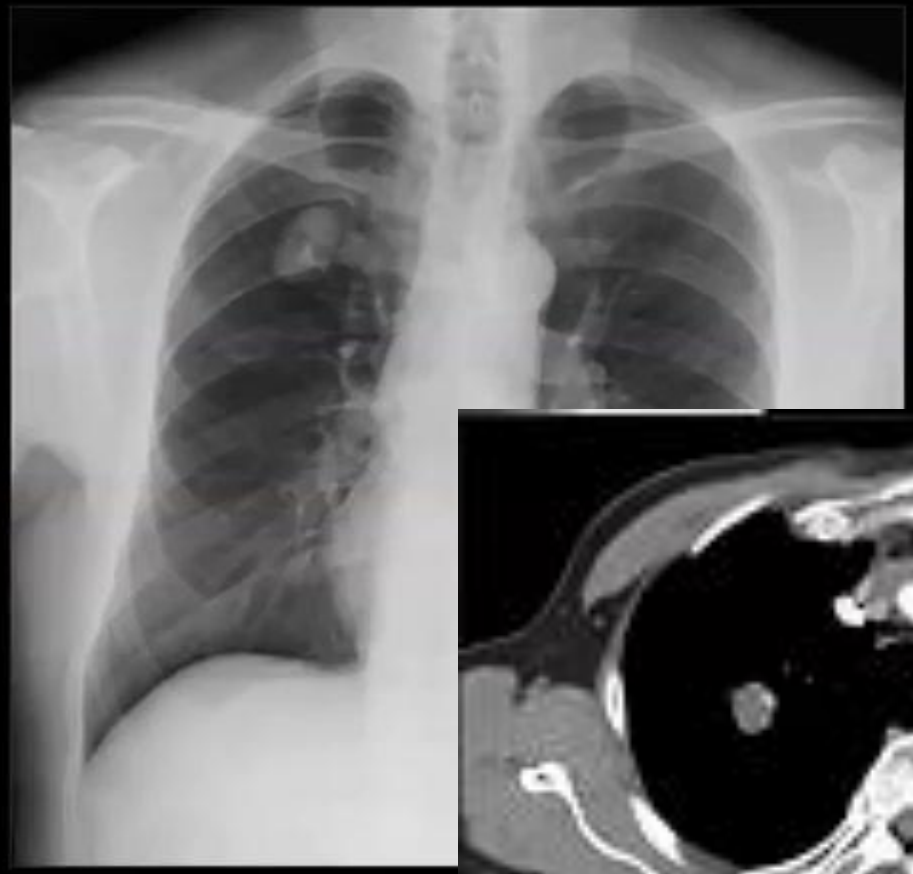
Nodules

1. Tuberculoma
2. Hamartoma
3. Bronchogenic carcinoma
4. Metastasis
5. AVM
6. Hydatid cyst

Characters of a benign lesion

Smooth edge with matrix calcification = benign lesion

- Tuberculoma
- Hamartoma
- Bronchogenic ca.
- Metastases
- AVM
- Hydatid cyst

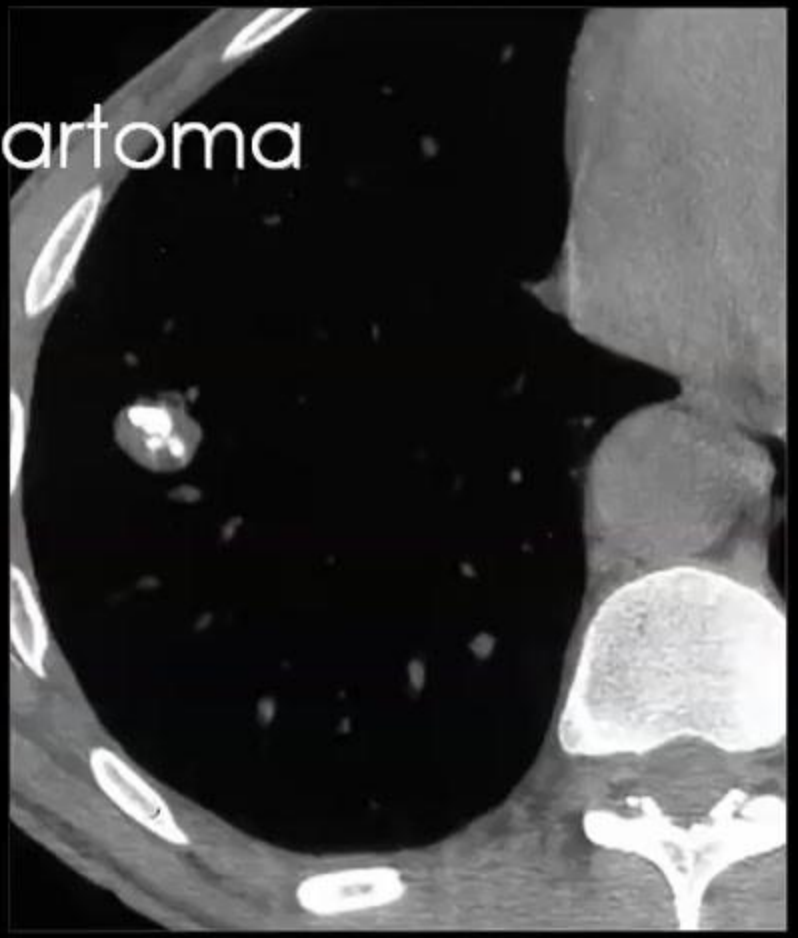


- Number
- Edge
- Calcium
- Density
- Vascular pedicle



Hamartoma

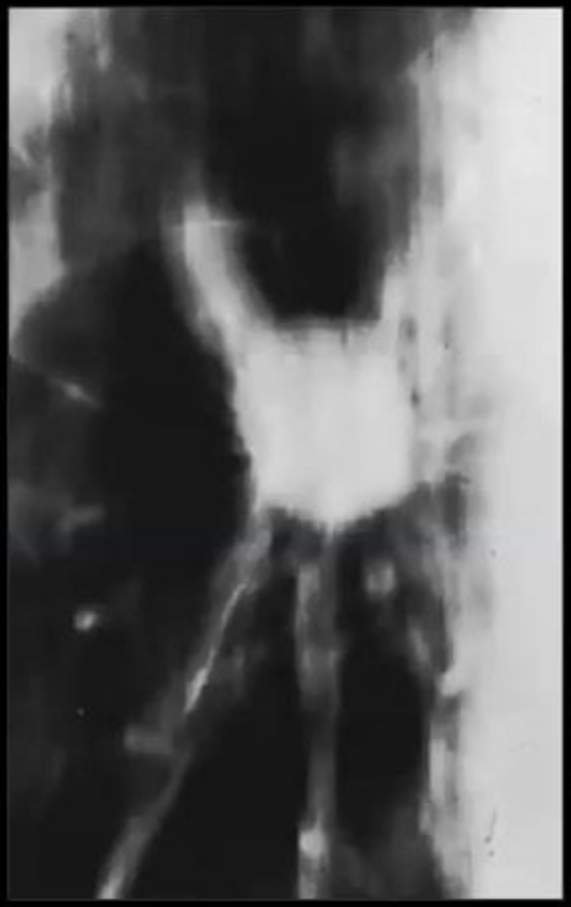


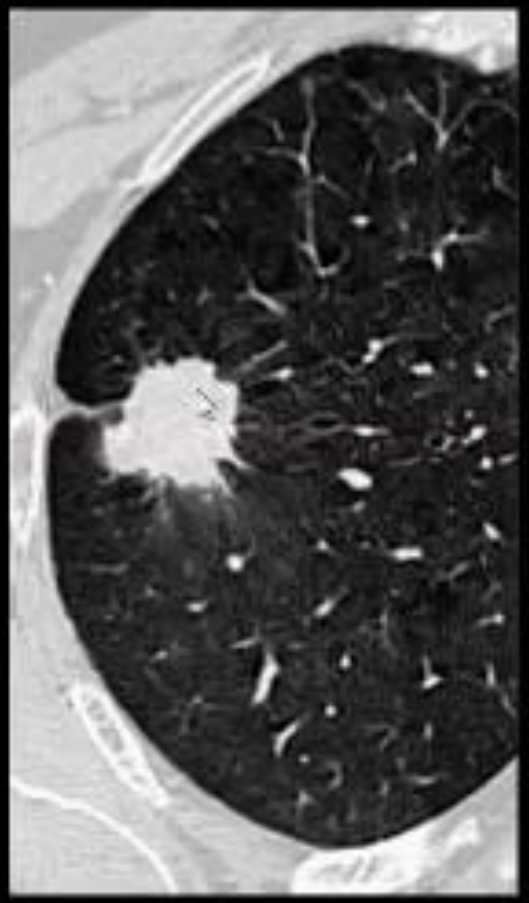


Usually single, smooth edge, less than 3cm , popcorn calcification in **15%**

Speculated margin = malignant lesion

- Tuberculoma
- Hamartoma
- Bronchogenic carcinoma
- Metastases
- AVM
- Hydatid cyst





Vascular pedicle

two lines connecting the lesion to the hilum = AVM

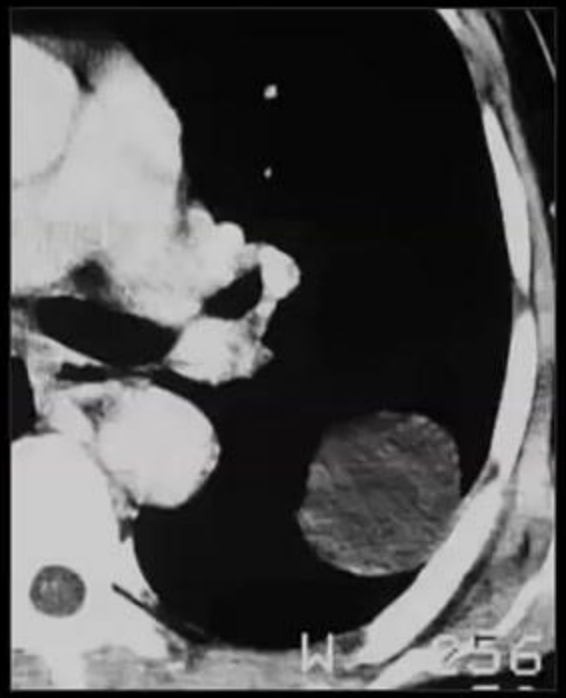
- Tuberculoma
- Hamartoma
- Bronchogenic ca.
- Metastases
- Arteriovenous malformation
- Hydatid cyst



- Number
- Edge
- Calcium
- Density
- Vascular pedicle

Single or multiple Lesions with water density = hydatid cyst (s)

- Tuberculoma
- Hamartoma
- Bronchogenic ca.
- Metastases
- AVM
- Hydatid cyst



Thin non enhanced margin
Fluid , No air



Thick enhanced margin
Fluid + Air

Masses

Well defined lesion measuring more than 3cm



- **Bronchogenic Carcinoma**
- **Hydatid cyst**
- **Metastatic deposit**

CT is needed to show if the lesion is cystic or solid ?!!

Bronchogenic Carcinoma





4

Interstitial disease

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

- X-Ray is limited (pattern ??) just reticular

- HRCT (High Resolution CT) .

Reticular pattern

- **Edema**
  heart failure - fluid overload
- **Interstitial pneumonia**
  Viral - PCP - Mycoplasma
- **Lymphangitis ca**
- **UIP** - *honeycombing*
  IPF - RA - Systemic sclerosis
  Dermatomyositis
- **Drugs**
  Nitrofurantoine - Methotrexate - Amiodarone
  Busulfan - Bleomycin - Cytoxan

Cystic disease

- Langerhans cell histiocytosis
- Lymphangioleiomyomatosis
- Pneumatoceles
- Lymphocytic Interstitial Pneumonia

Fine nodular

- Sarcoidosis
- Metastases
- TB

Cystic Versus Reticular







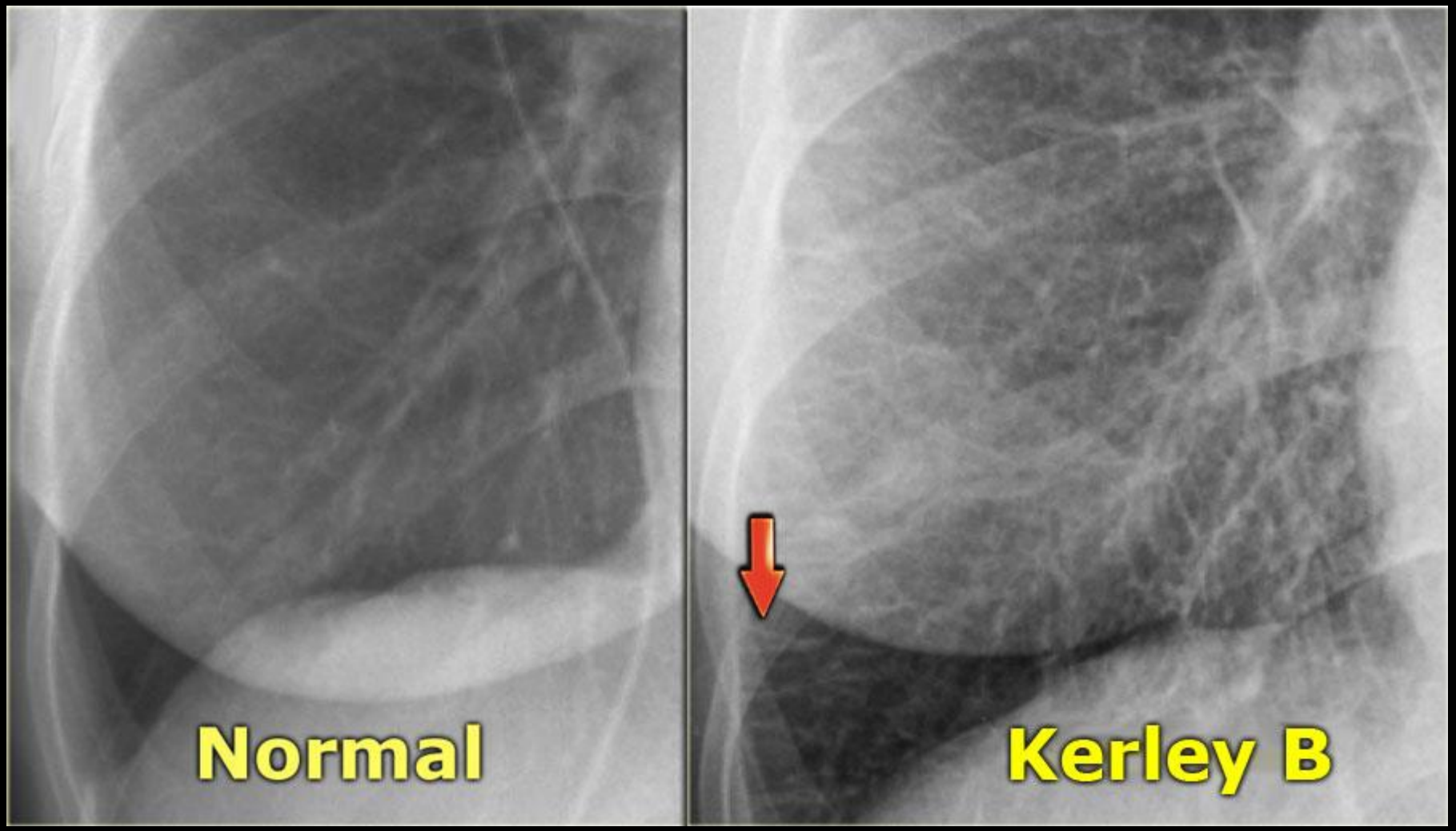


؟ Abnormal ?



- Reticular pattern at the base of lung .
- Some Kerley B lines
- Increase heart size
- Pleural fluid at the left side
- Prominent pulmonary vessels compared to old study .

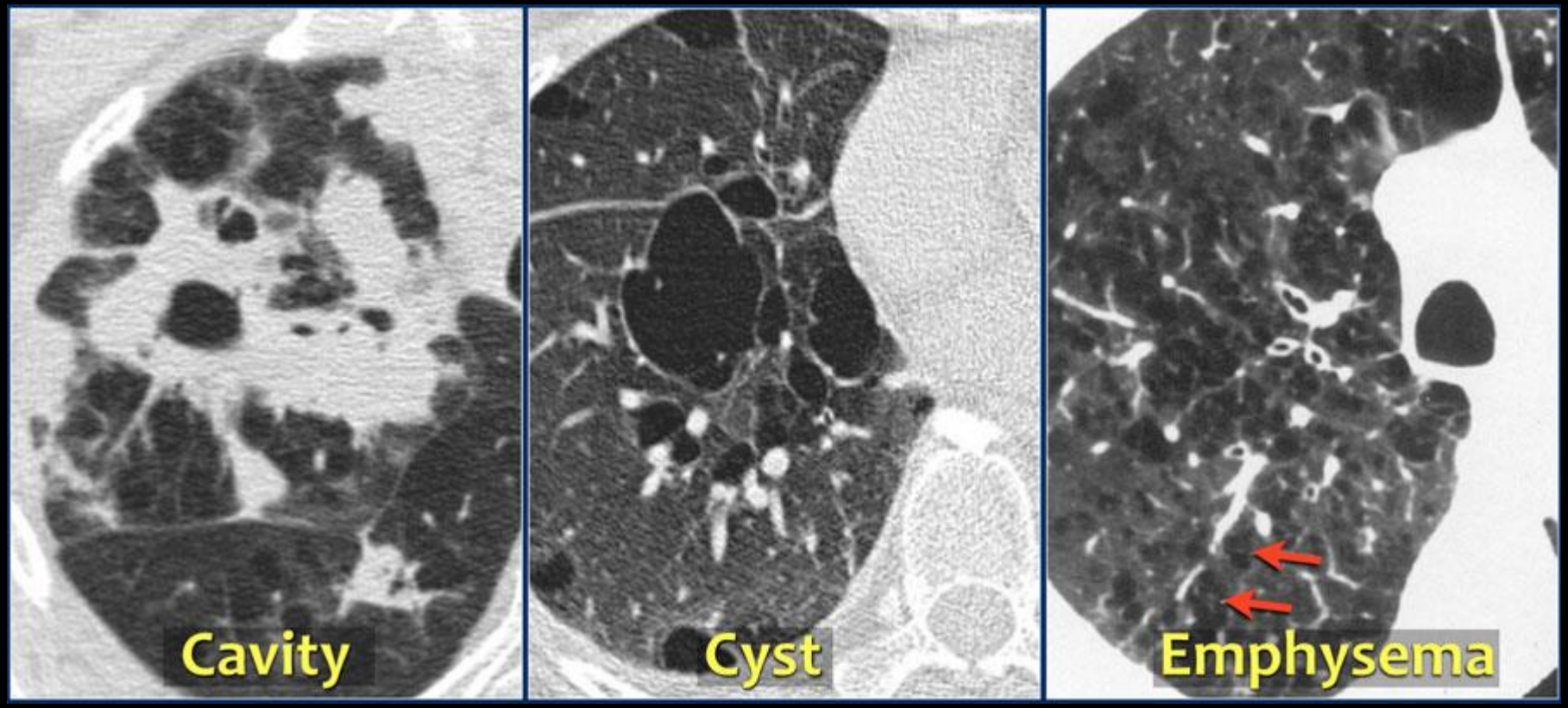
We can conclude that we are dealing with congestive heart failure



Interstitial edema in Heart failure
lymphangitis carcinomatosa

Decrease density or lucency
low attenuation

- Cavity - focal lucency with a thick wall
- Cyst – focal lucency with a thin wall
- Emphysema - lucency without a visible wall



1 Consolidation

Content of the alveoli

Water	Blood	Pus	Cells
Heart failure ARDS Low Albumen Volume overload Renal failure	Trauma Goodpasture dis Henoch Schonelin SLE	Pneumonia	BAC Organizing Pneum Chronic eosinophi Sarcoid

Pattern

Diffuse

Edema
- Heart failure
- Volume overload
- Low albumen
- Renal failure
- ARDS

Bronchopneumo
- Staph aurus
- Gram (-)
- Viral – fungal

Hemorrhage

Goodpasture
- Henoch Sch
- SLE

BAC
Lymphoma
Organizing Pneu
Eosinophilic pne
Hypersensitive Pn

Lobar

Lobar pneumonia
- Streptococcus
- Klebsiella
- Aspiration

Hemorrhage
- Contusion
- Infarction

Others

BAC
Lymphoma
Organizing Pneu
Eosinophilic pne

Multiple ill def

Broncho-pneum
- Streptococcus
- Legionella
- Klebsiella
- Pseudomonas
- Gram (-)
- Anearobic
- TB

Vascular
- Septic emboli
- Wegener

Neoplasm

Acute

Pneumonia
Aspiration
Infarction
Edema

Chronic

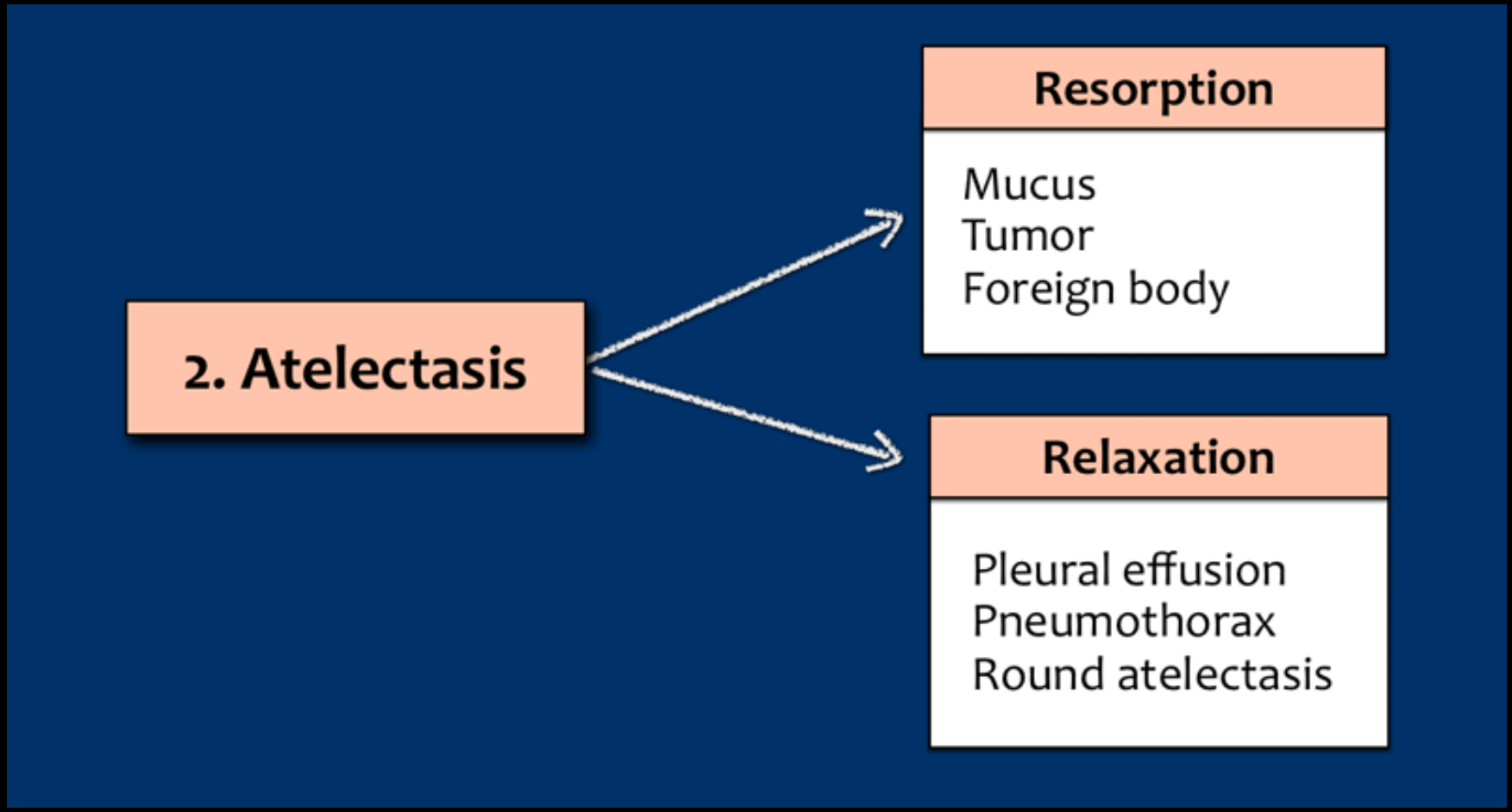
BAC
Lymphoma
Organizing Pneu
Eosinophilic pne
Alveolar Protino
Sarcoidosis

Batwing

Edema
Bacterial Pneum
PCP
Viral Pneum

Reversed Bat

Bronch-alveo-Ca
Orgonizing Pneu
Eosinophil Pneu
Sarcoidosis


2. Atelectasis
Resorption
Mucus
Tumor
Foreign body
Relaxation
Pleural effusion
Pneumothorax
Round atelectasis

3. Nodule - Mass

Nodule < 3cm

Granuloma
- *Fungal*
- *TB*

Lungca
Metastasis
Hamartoma

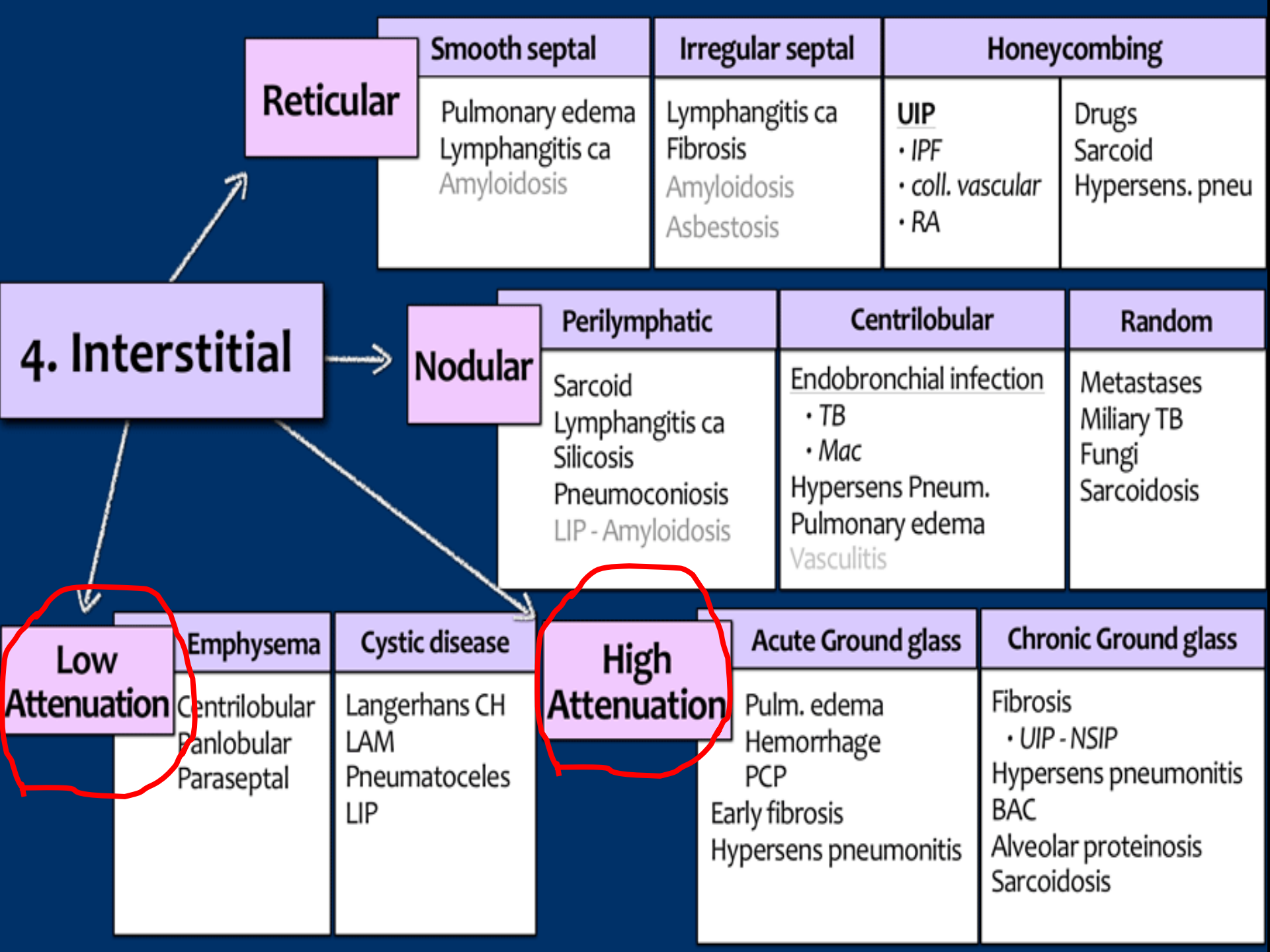
Mass > 3cm

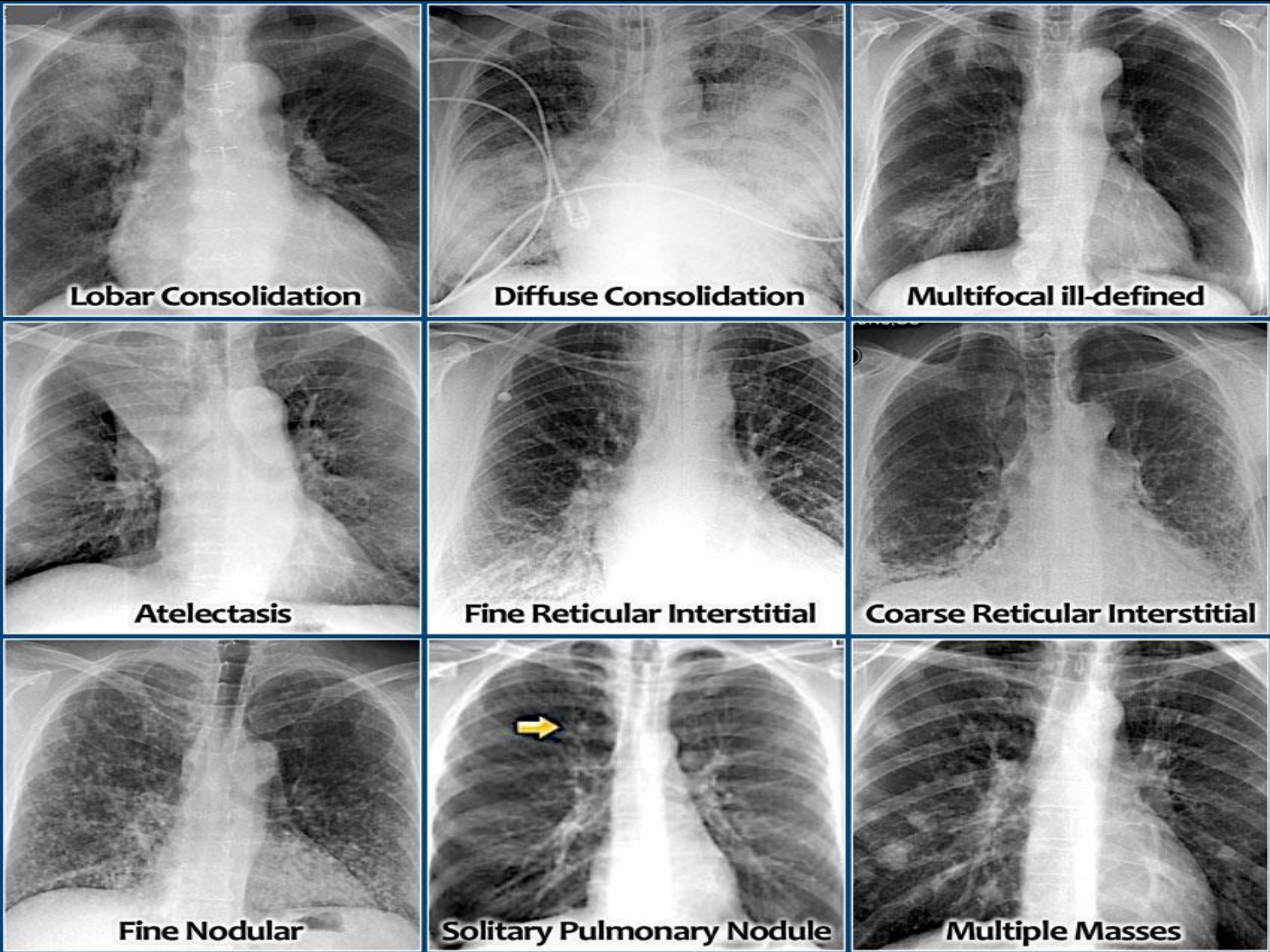
Lungca
Granuloma
Hamartoma

Multiple masses

Infection:
- TB
- Histoplasmosis
- Fungi
- Sept emboli

Metastases
BAC
Sarcoidosis
Wegener
RA
Rendu-Osler


4. Interstitial
Reticular
Smooth septal
Pulmonary edema
Lymphangitis ca
Amyloidosis
Irregular septal
Lymphangitis ca
Fibrosis
Amyloidosis
Asbestosis
Honeycombing
UIP
• IPF
• coll. vascular
• RA
Drugs
Sarcoid
Hypersens. pneu
Nodular
Perilymphatic
Sarcoid
Lymphangitis ca
Silicosis
Pneumoconiosis
LIP - Amyloidosis
Centrilobular
Endobronchial infection
• TB
• Mac
Hypersens Pneum.
Pulmonary edema
Vasculitis
Random
Metastases
Miliary TB
Fungi
Sarcoidosis
Low Attenuation
Emphysema
Centrilobular
Panlobular
Paraseptal
Cystic disease
Langerhans CH
LAM
Pneumatoceles
LIP
High Attenuation
Acute Ground glass
Pulm. edema
Hemorrhage
PCP
Early fibrosis
Hypersens pneumonitis
Chronic Ground glass
Fibrosis
• UIP - NSIP
Hypersens pneumonitis
BAC
Alveolar proteinosis
Sarcoidosis


Lobar Consolidation
Diffuse Consolidation
Multifocal ill-defined
Atelectasis
Fine Reticular Interstitial
Coarse Reticular Interstitial
Fine Nodular
Solitary Pulmonary Nodule
Multiple Masses

RADIOLOGY THE EYE OF MEDICINE

THANK YOU