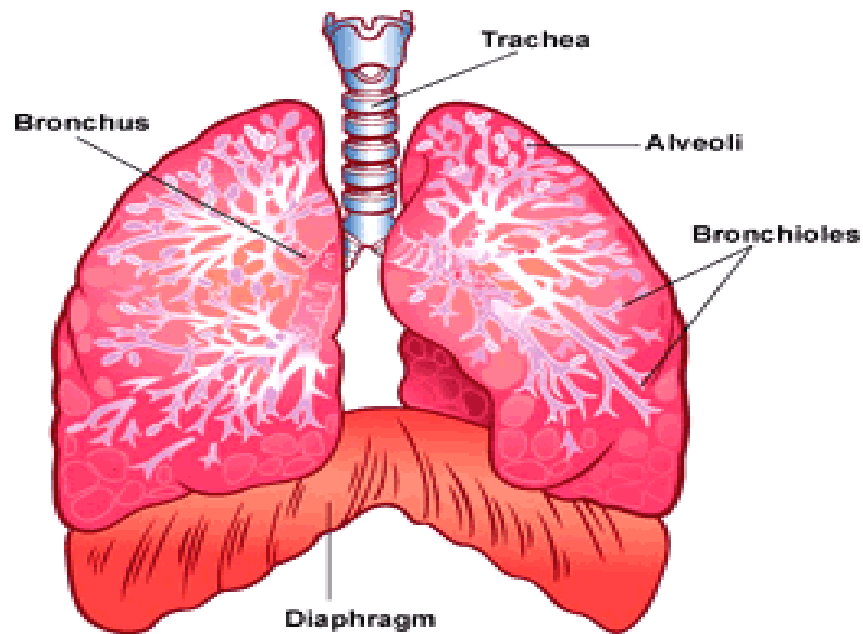


Lab 6

Respiratory System



Pulmonary Infection

- **It includes :**
 - 1. Upper respiratory tract infection (URTI)**
 - a. Common cold**
 - b. Flu**
 - c. Sinusitis**
 - d. Laryngitis**
 - 2. Lower respiratory tract infection (LRTI)**
 - a. Infection of airways from trachea and below**
 - b. Infection of lung parenchyma (pneumonia)**

Lower respiratory tract infections

- **Acute lung infections:**
 - **Pneumonias**
 - **Lung abscess**
 - **Fungal infections**
- **Chronic lung infection:**
 - **Pulmonary tuberculosis**

Pneumonia

It is the term acute infection is used to refer to microbe living inside a host for a limited period of time or Pneumonia is defined as any infection of lung parenchyma, typically less than six months.

PATHOGENESIS The microorganisms gain entry into the lungs by one of the following four routes:

1. Inhalation of the microbes present in the air.
2. Aspiration of organisms from the nasopharynx or oropharynx.
3. Haematogenous spread from a distant focus of infection.
4. Direct spread from an adjoining site of infection.

Aspiration- a condition in which food , liquids , saliva or vomit is breathed into the airways.

Classification of Pneumonia:

Bacterial pneumonia.

Typical organisms include *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Hemophilus influenzae*, *Klebsiella pneumoniae*.

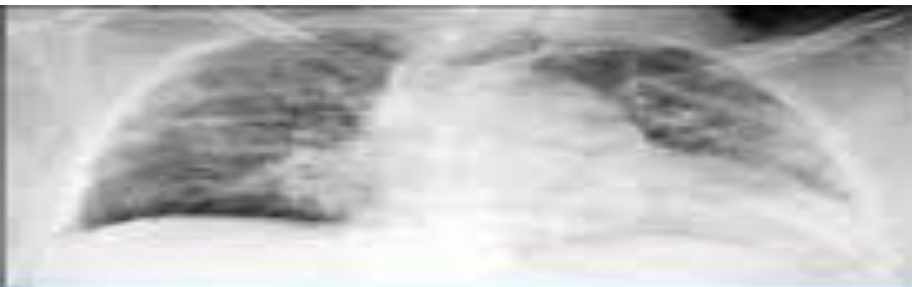
Viral and atypical pneumonia.

The major features for the gross and radiological examination of pneumonia is **Consolidation (solidification)**.

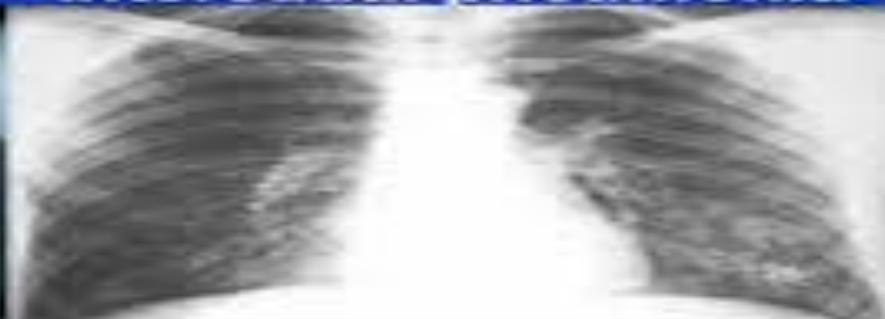
-This radiograph demonstrates patchy infiltrates consistent with a bronchopneumonia from a bacterial infection.



Lobar pneumonia



Bronchopneumonia
Interstitial pneumonia



Consolidation

- Occurs in the first 24 hours**
- Cellular exudates containing neutrophils, lymphocytes and fibrin replaces the alveolar air**
- Capillaries in the surrounding alveolar walls become congested**
- Pleurisy occurs inflammation of the pleurae, which impairs their lubricating function and causes pain when breathing. Marked by coughing and deep breathing**
- The mesothelial cells of the pleural membrane create pleural fluid, which serves as both a lubricant (to reduce friction during breathing) and as an adhesive to adhere the lungs to the thoracic wall (to facilitate movement of the lungs during ventilation).**

Bacterial pneumonia

I. Lobar pneumonia (community acquired)

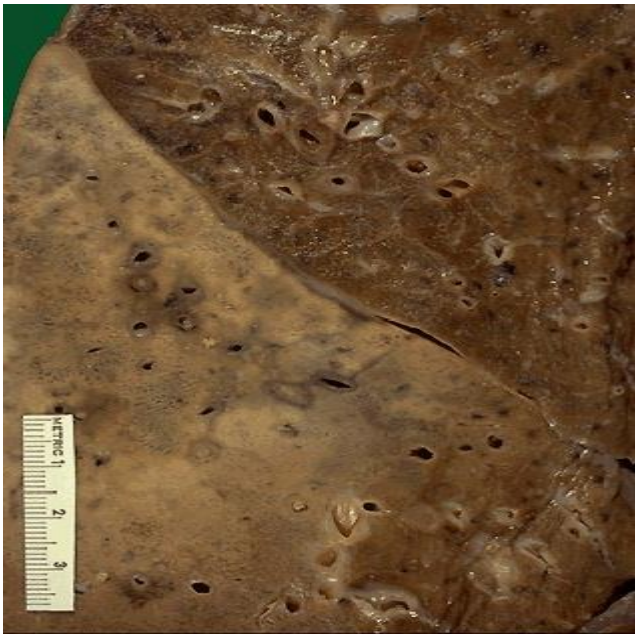
II. II. Bronchopneumonia (lobular pneumonia)

Lobar pneumonia (community acquired).

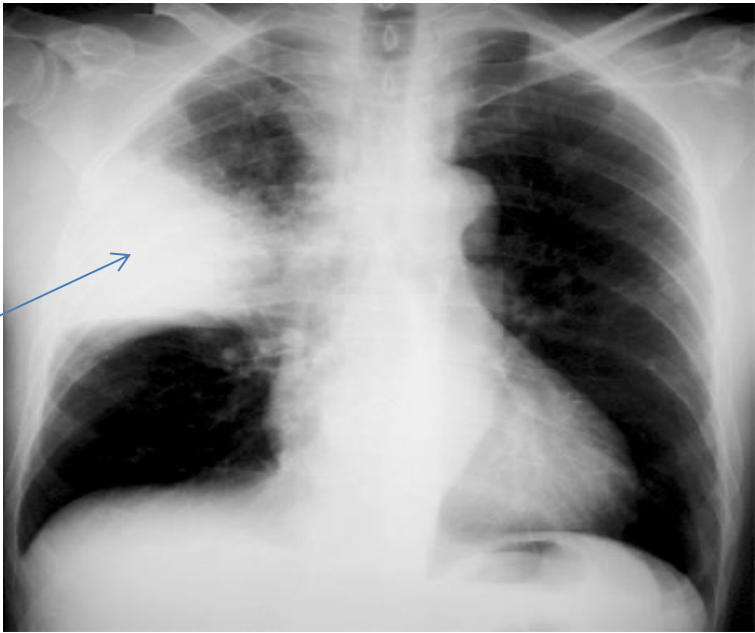
- **Consolidation involves a part of the lobe or the whole lobe .**
- **Etiology: a. Pneumococcal pneumonia**

Staphylococcal pneumonia (Staphylococcus aureus), Streptococcal pneumonia (β -haemolytic streptococci), Pneumonia by gram-negative aerobic bacteria ex: Haemophilus influenzae.

A closer view of the lobar pneumonia demonstrates the distinct difference between the upper lobe and the consolidated lower lobe. Radiographically, areas of consolidation appear as infiltrates.



consolidation



Morphology:

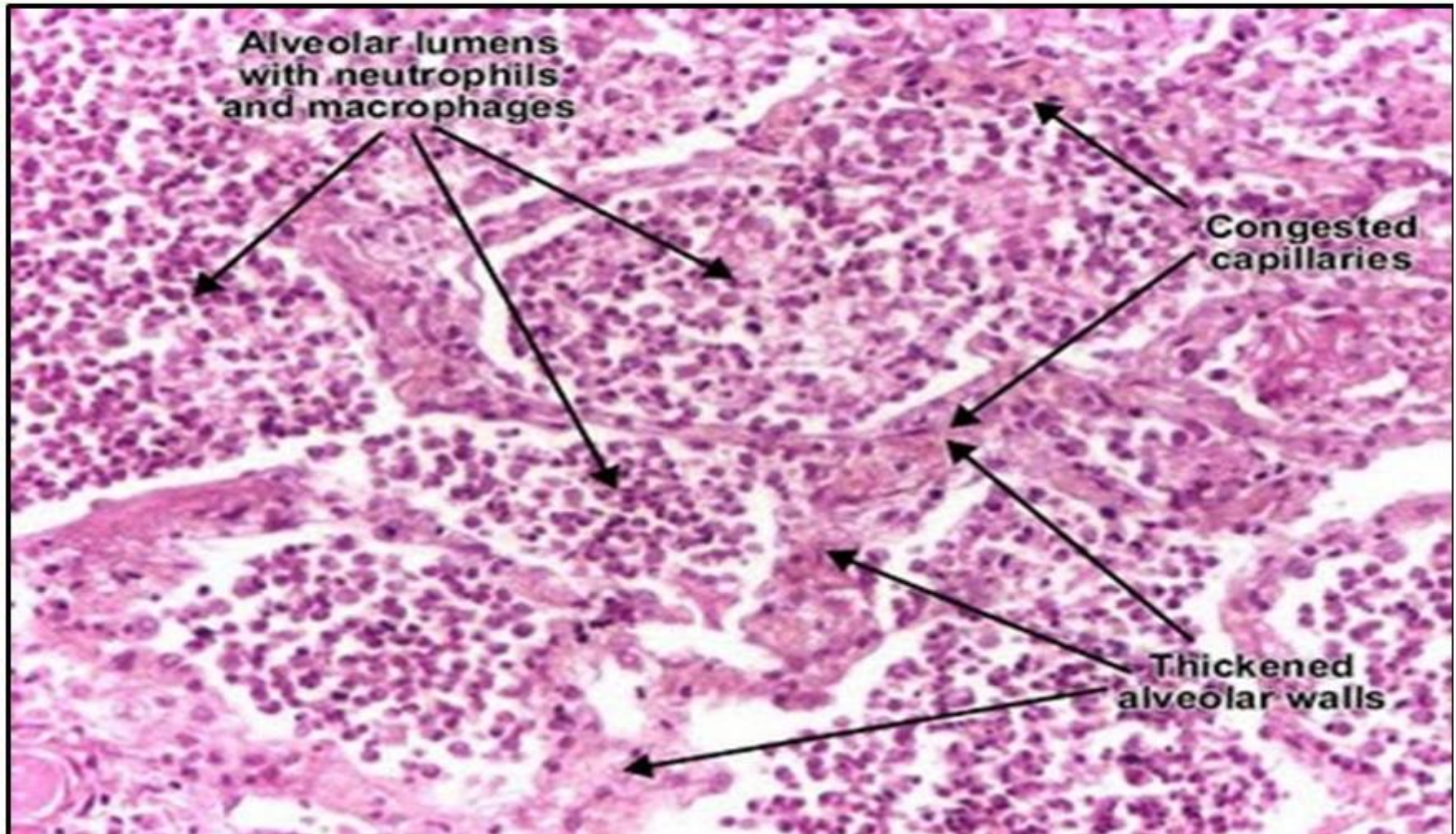
- i. Stage of congestion**
- ii. Stage of red hepatization**
- iii. Stage of grey hepatization**
- iv. Stage of resolution**

- **STAGE OF CONGESTION: INITIAL PHASE** The initial phase represents the early acute inflammatory response to bacterial infection that lasts for 1 to 2 days. Grossly, the affected lobe is enlarged, heavy, dark red and congested.

Gross: the lung is heavy and red

Microscopic: Alveolar vascular congestion & Intra-alveolar fluid with neutrophil + bacteria.

Lobar Pneumonia - Histopathology

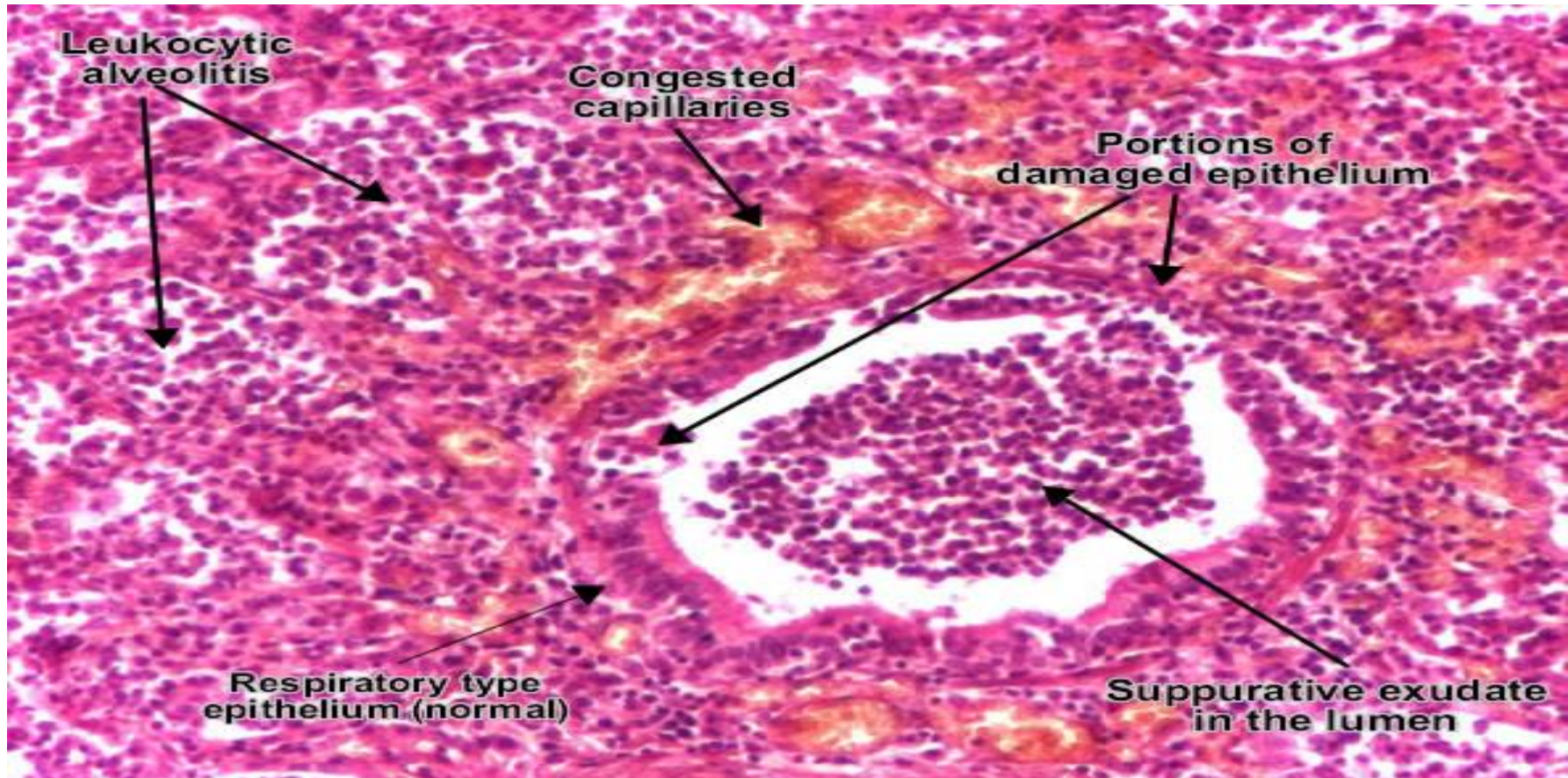


* Microscopic Picture:

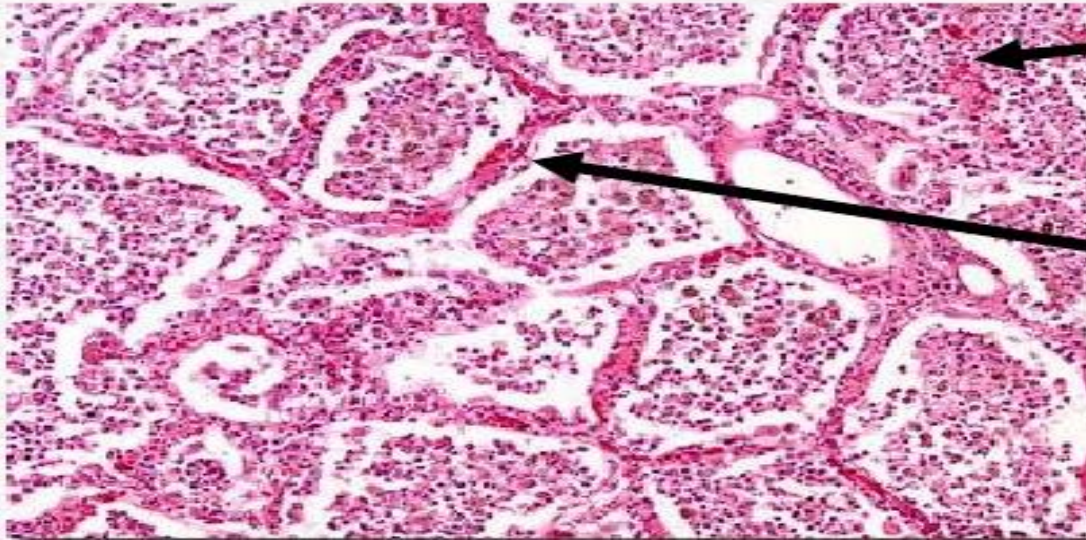
I. The bronchioles show:

- Their lumen shows: necrotic epithelial cells, polymorphs & pus cells.
- Their lining: ulceration.
- Their walls: congested capillaries, neutrophils and pus cells & exudate.

II. The adjacent alveoli show: 3 successive zones: zone of alveolitis then zone of alveolar collapse and a zone of alveolar dilatation (compensatory emphysema).



Lobar Pneumonia: Red hepatization.



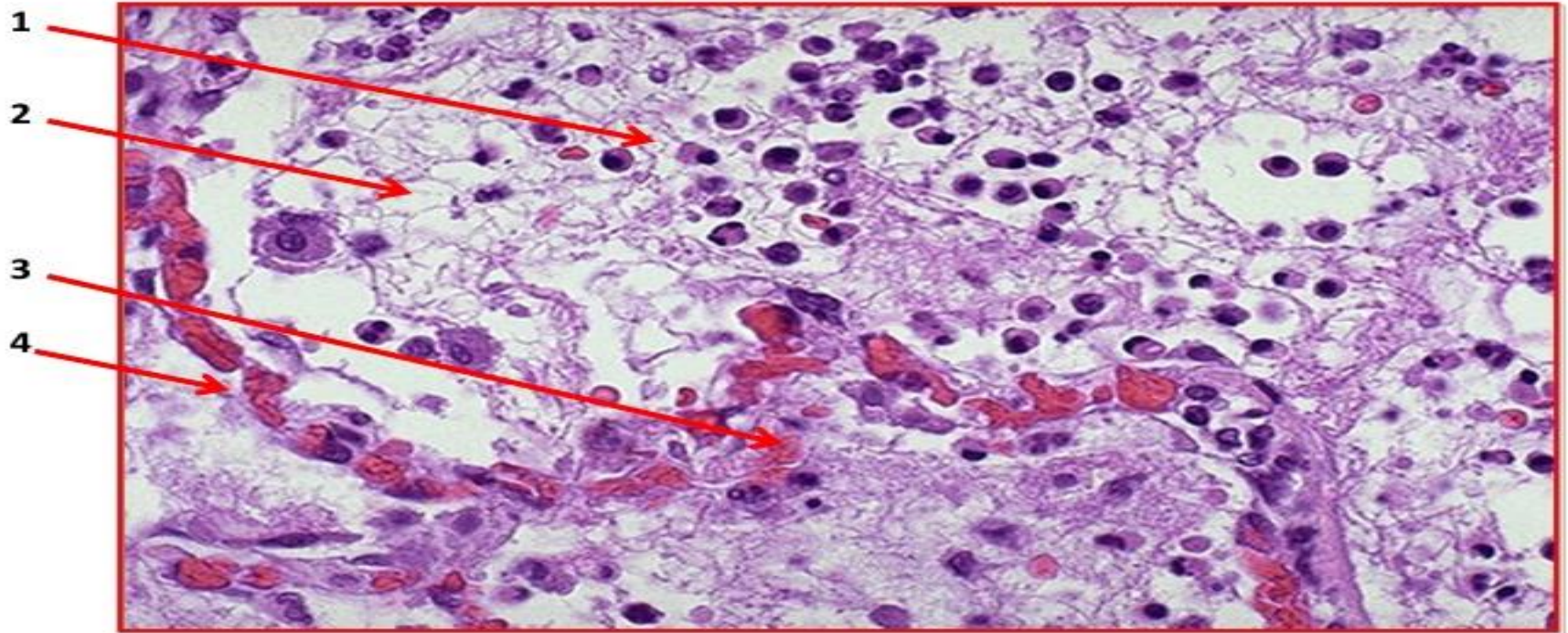
Acute inflammatory cells & RBC Filling alveolar spaces Uniformly.

• Congested capillaries in the alveolar septa

Gross: red, firm, airless, look like a liver

Microscopic: The inflammatory exudate composed of RBC+ neutrophil+ fibrin
Alveolar capillaries are engorged with blood. Fibrinous exudates fill the alveoli.
This stage is "characterized by the presence of many erythrocytes, neutrophils, desquamated epithelial cells, and fibrin within the alveoli

Lobar Pneumonia, Grey Hepatization



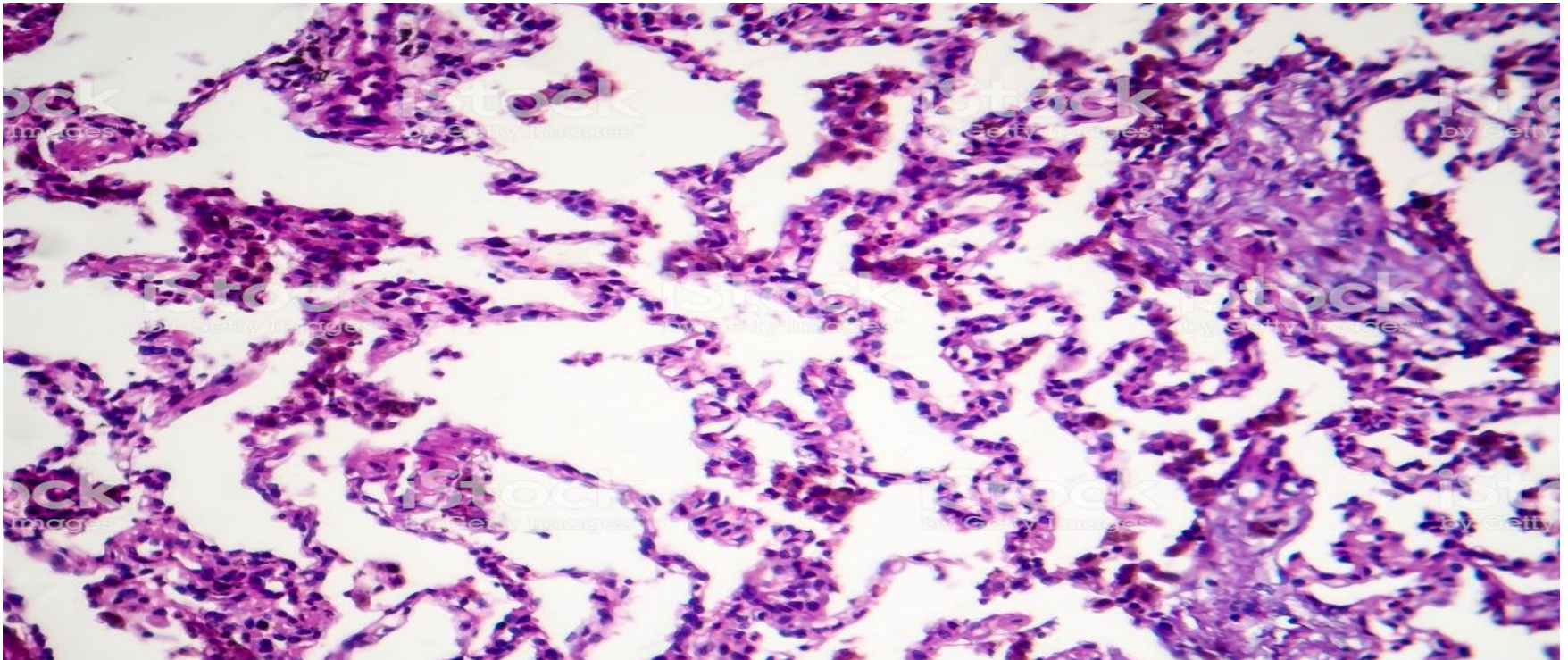
- 1) Inflammatory cells
- 2) Clumps of fibrin and edema
- 3) Fragmented RBCs
- 4) Congested alveolar capillaries

Gross: grey –brownish, dry surface

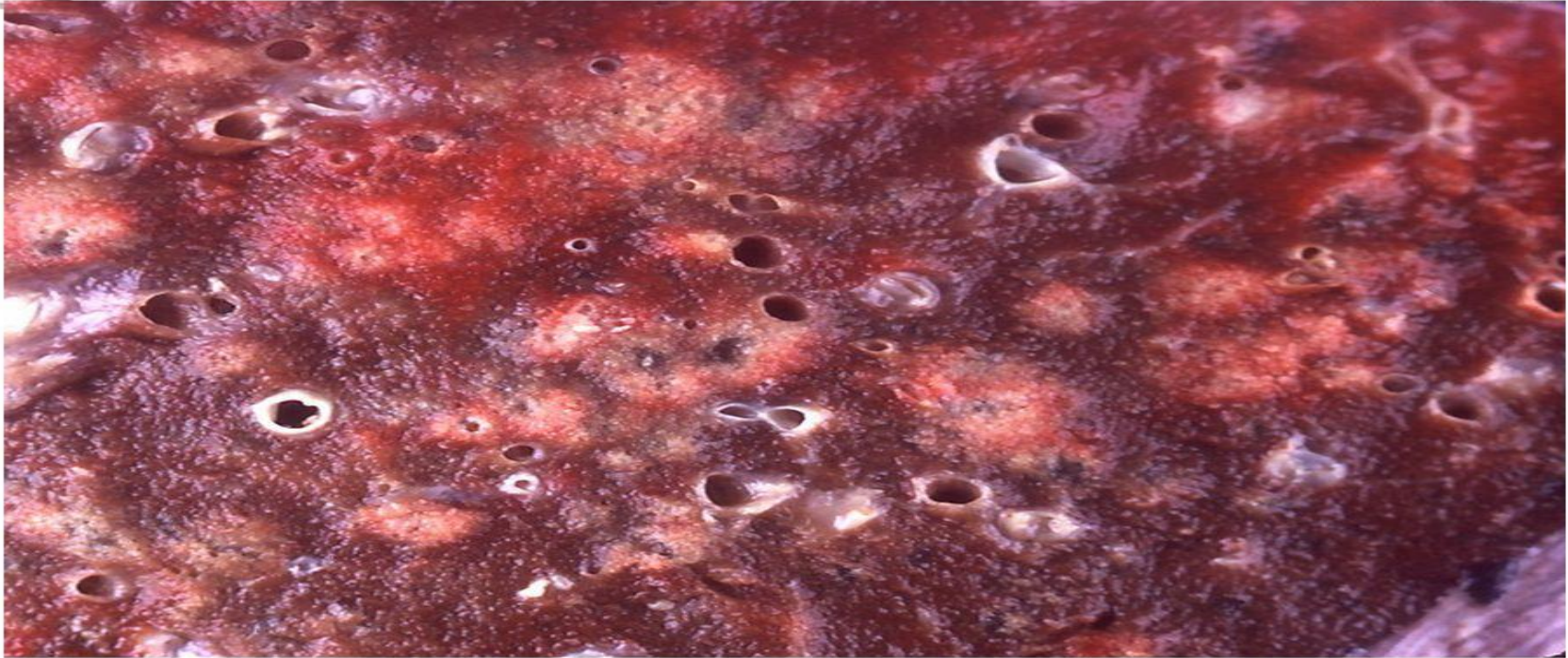
Microscopic: The exudate is composed of fibrin+ WBC which is called (fibrino-suppurative) exudate.

iv. Stage of resolution:

The exudate undergoes enzymatic digestion → formation of granular debris that is either resorbed & ingested by the macrophages or expectorated and coughed up.



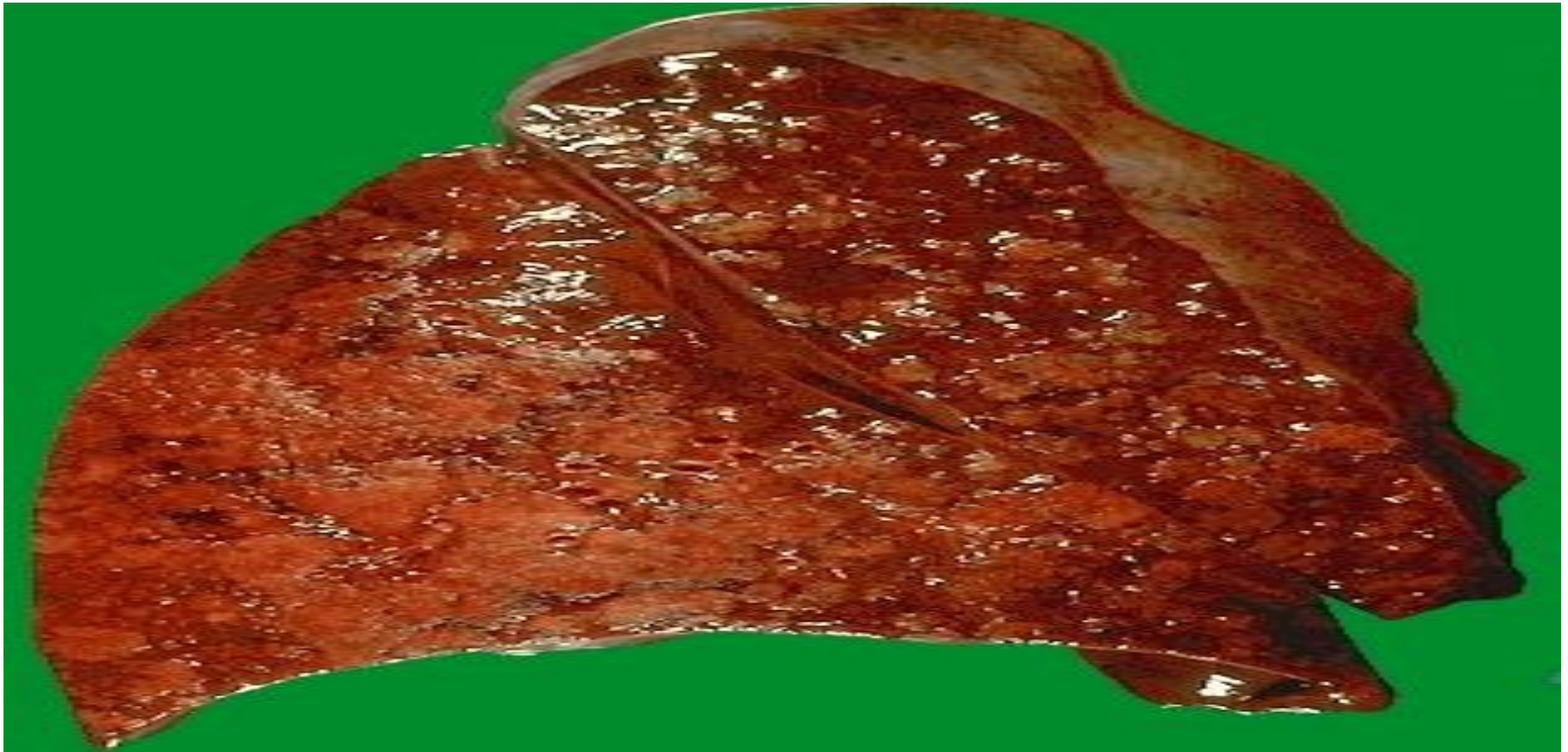
Bronchopneumonia



- Multiple consolidated yellowish patches exuding pus on pressure. Several patches may coalesce to produce confluent bronchopneumonia.

the pleura are double layered serous membrane that surround each lung, the parietal pleura forms the outer layer and the visceral pleura .

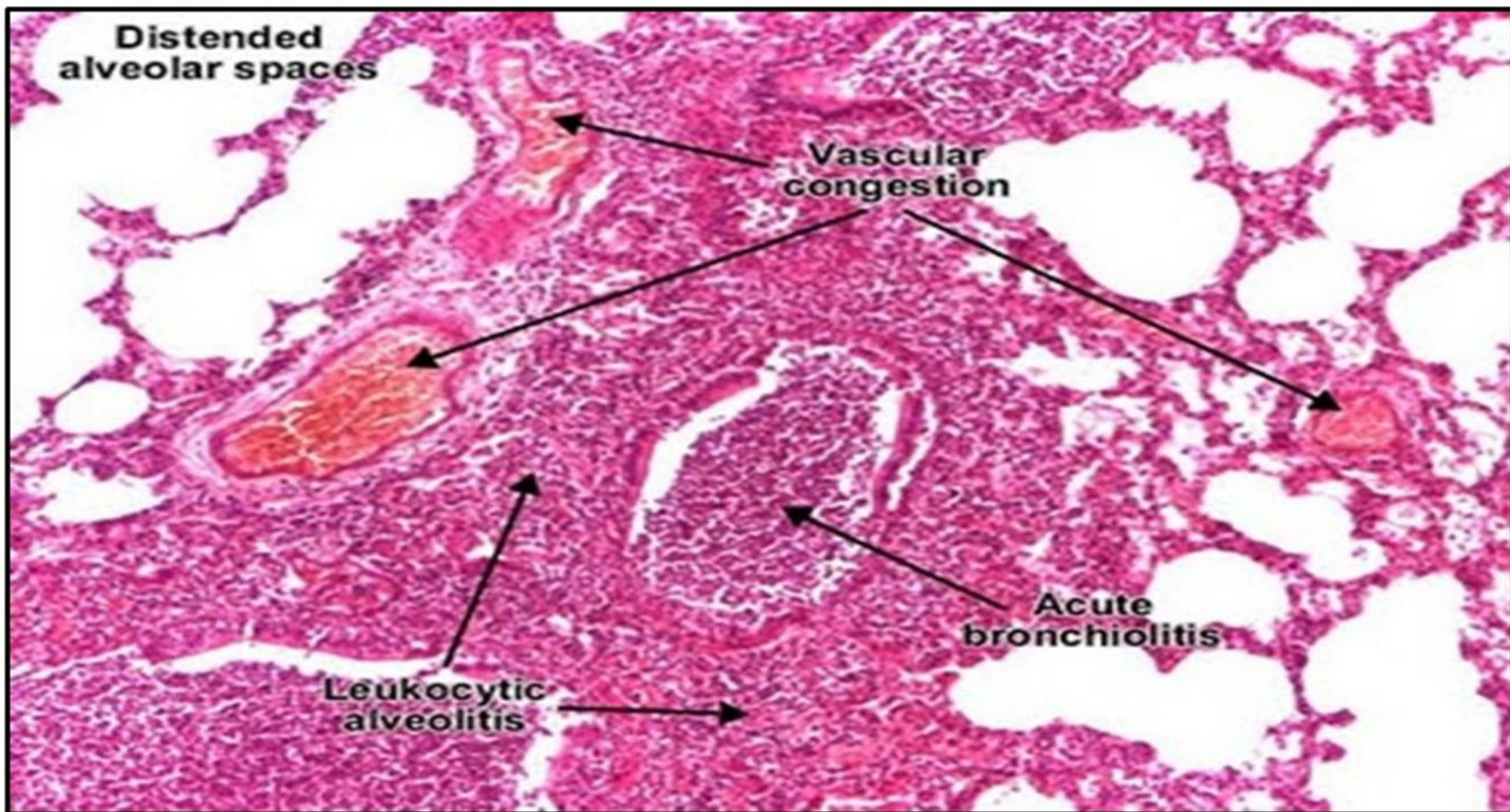
The cut surface of this lung demonstrates the typical appearance of a bronchopneumonia with areas of tan-yellow consolidation.

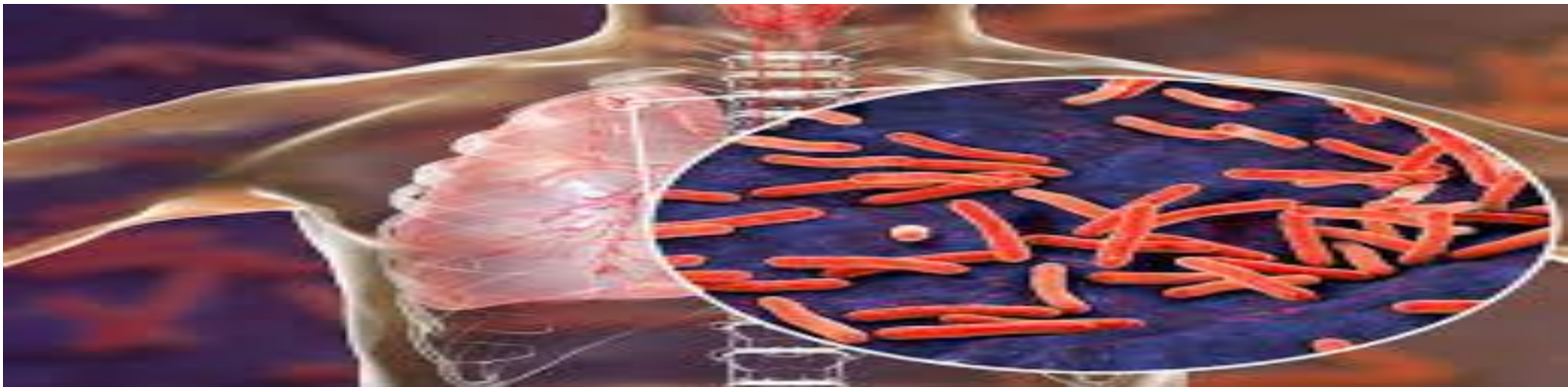


Morphology of bronchopneumonia:

Bronchopneumonia affects one or more lobes. Macroscopically, one can identify multiple foci of condensation (1 - 3 cm diameter), white-yellowish, imprecisely circumscribed, centered by bronchiole, separated by normal lung parenchyma.

Foci of inflammatory condensation centered by a bronchiole with acute bronchiolitis (suppurative exudate rich in neutrophils in the lumen, foci of ulceration of the epithelium wall. The alveolar lumens surrounding the bronchia are filled with neutrophils ("leukocytic alveolitis"). Capillaries in the alveolar walls show congestion. Inflammatory foci are separated by normal, aerated parenchyma.





Tuberculosis

- Tuberculosis is chronic infectious disease caused by *Mycobacterium tuberculosis*, a rod-shaped aerobic bacteria.

Types of TB:

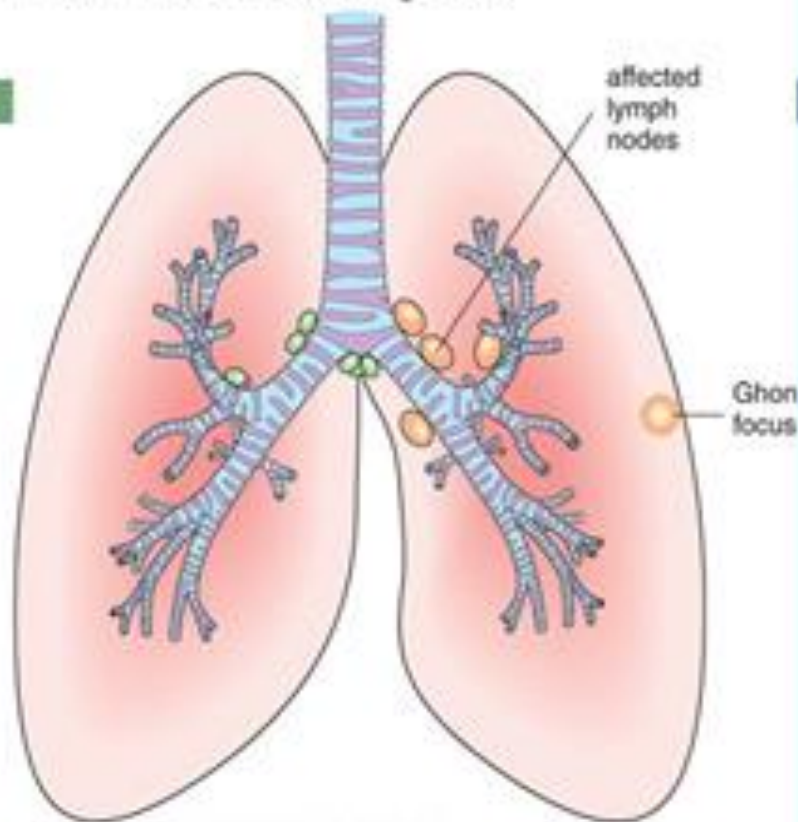
1. Primary TB:

- It occurs in a person infected with tubercle bacilli for the first time
- It affects the lower lobes

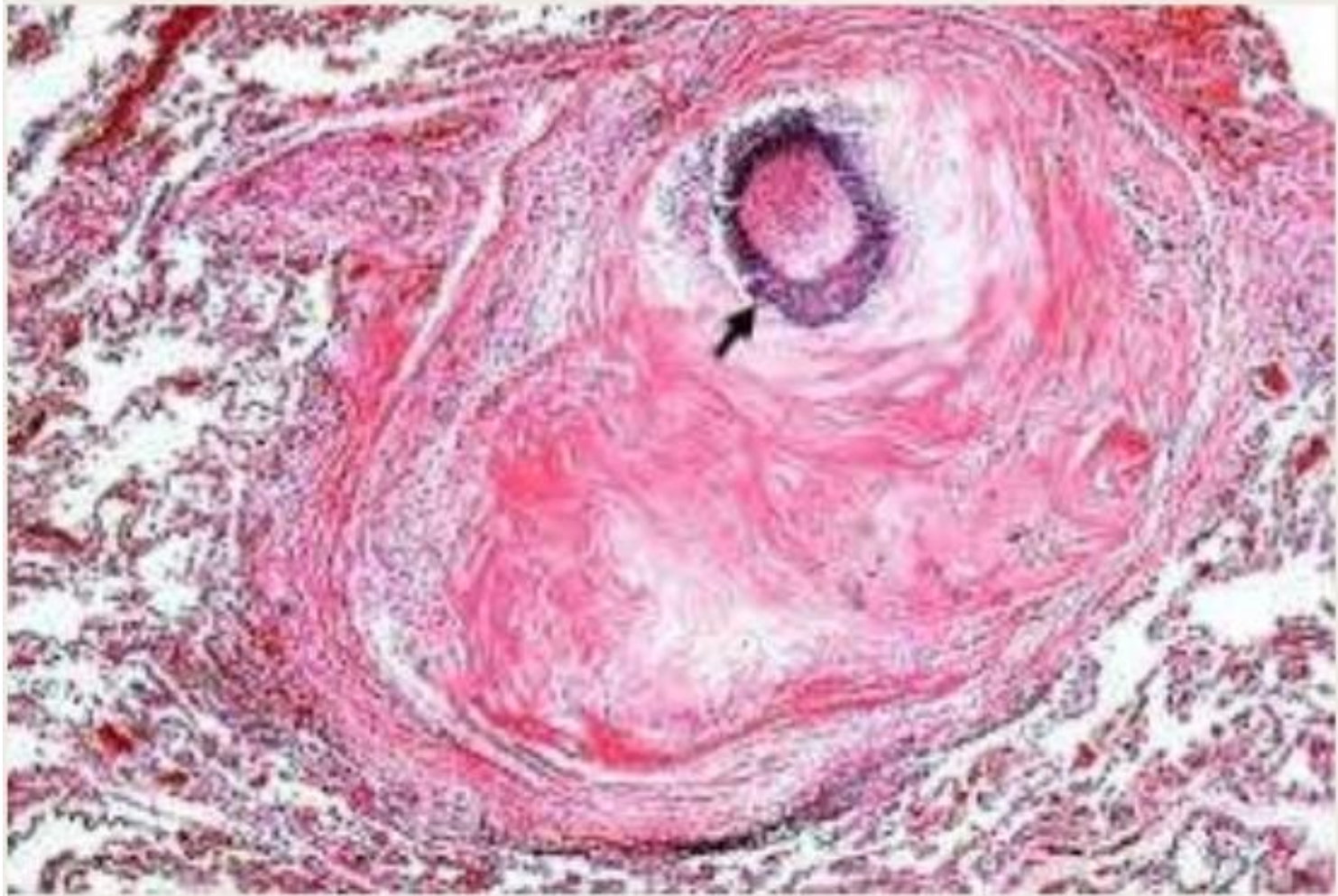
What is Ghon's focus?

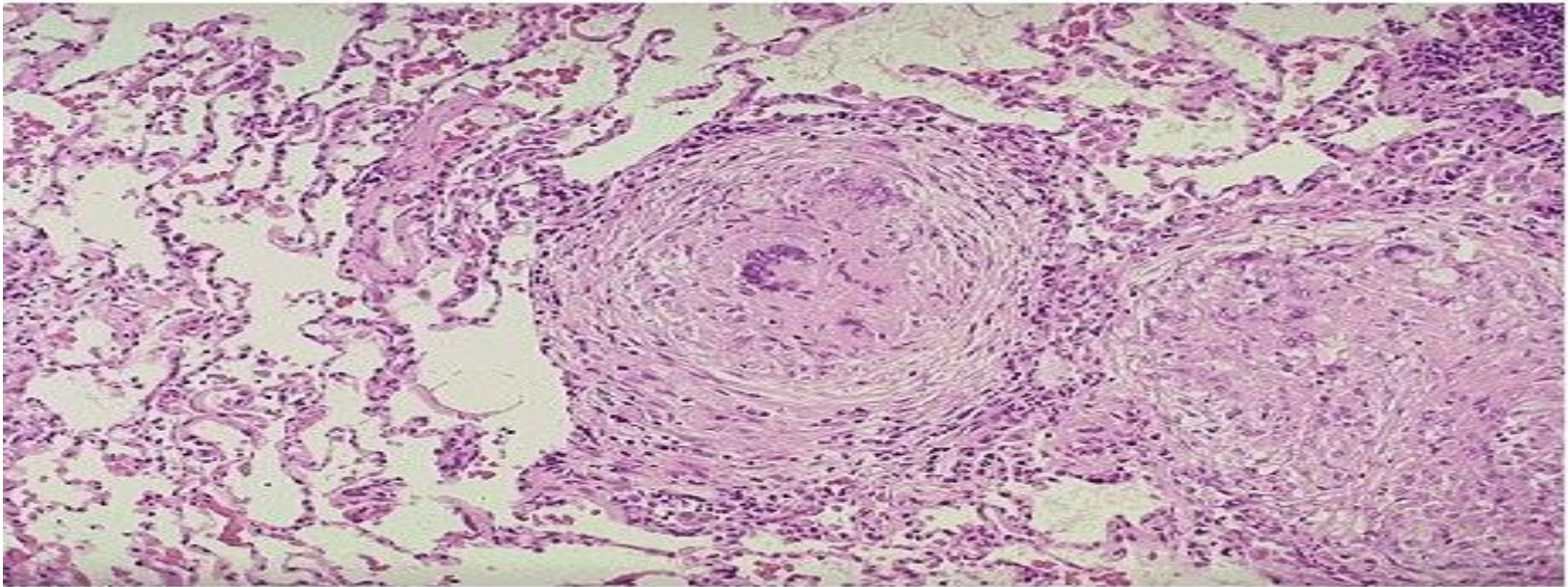
- It is a grey-white circumscribed granuloma that is composed of tubercle bacilli engulfed by macrophages (epithelioid and multinucleated giant cells) in addition to other immune cells.
- The combination of the primary lung lesion and lymph node granulomas is called *Ghon's complex* .

PRIMARY TUBERCULOSIS: Ghon Focus & Ghon complex

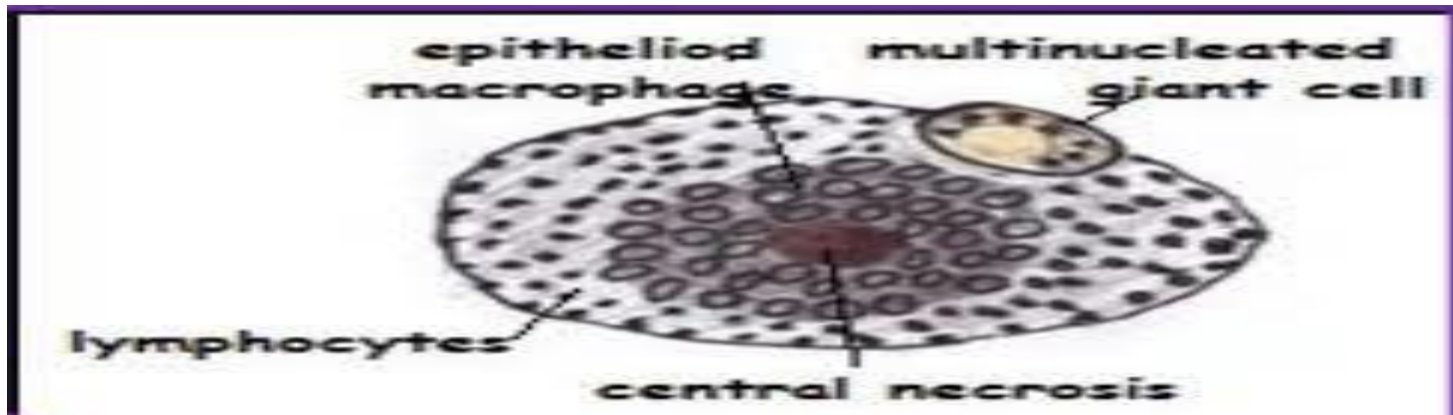


Microscopy- Ghon's focus



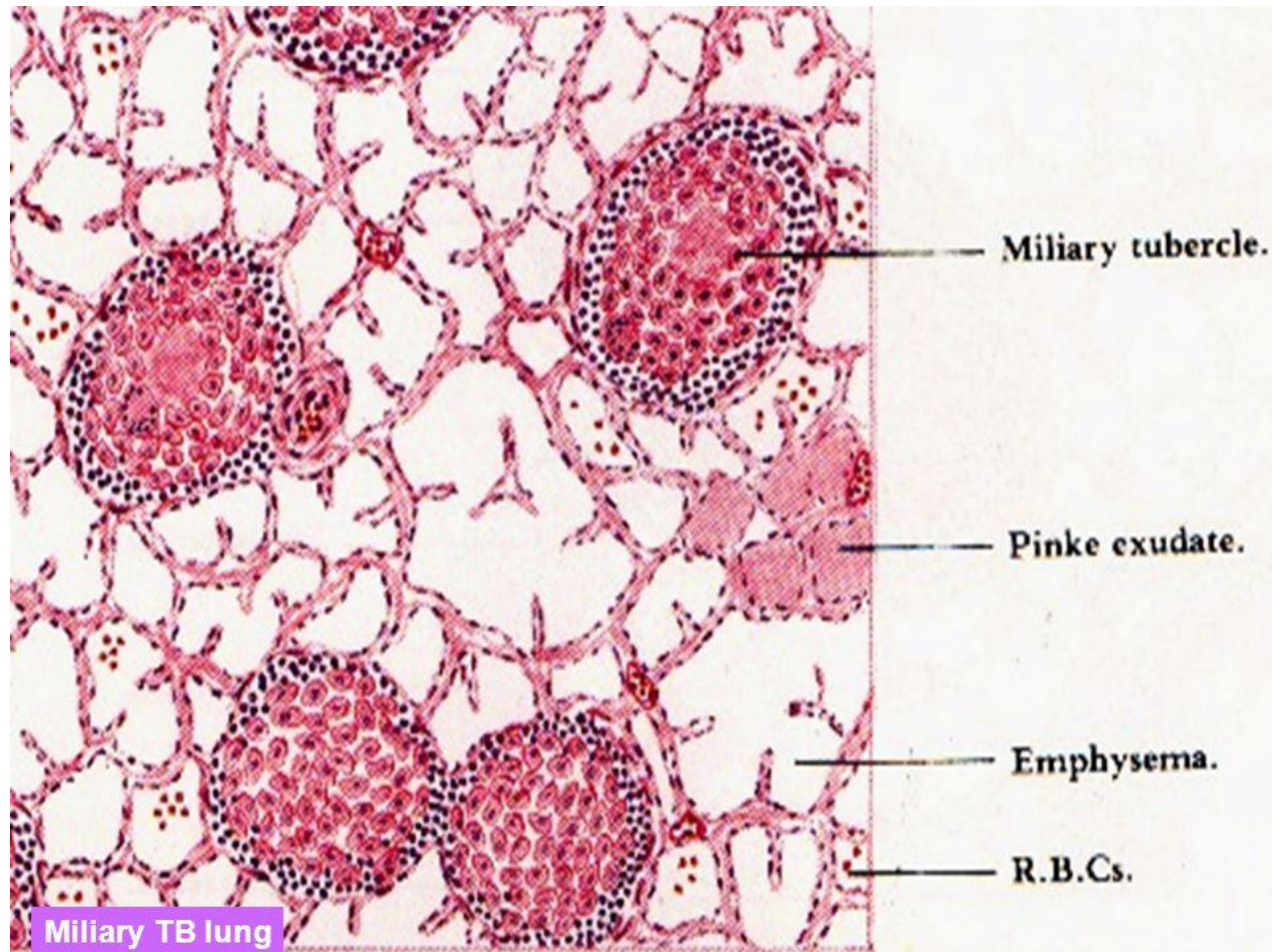


Well-defined non-caseating granulomas . Granulomas are composed of transformed macrophages called epithelioid cells along with lymphocytes, occasional PMN's, plasma cells, and fibroblasts.



Outcomes of primary TB:

- It is asymptomatic, with the only evidence of the disease being a positive tuberculin skin test result and calcified lesions seen on the chest radiograph.
- In immune compromised patients, primary tuberculosis may progress, causing more extensive destruction of lung tissue and spread within the lung or to the other body organs (miliary TB).



Miliary TB: millet seed-sized lesion (1 mm diameter)

2. Secondary TB:

- **It represents either re-infection from inhaled droplet as in endemic areas or reactivation of a previously healed primary lesion**
- **It is classically localized to the apex of one or both upper lobes.**
- **The regional Lymph nodes involvement is less than they are in primary TB**
- **Cavitation occurs which leads to erosion of airways**



Cavitation TB

Complications of secondary TB:

1. Progressive pulmonary TB:

The apical lesion enlarges with expansion of the caseation area

2. Miliary pulmonary disease:

Individual lesions which are microscopic or small (2 mm) named miliary means millet-seed like yellow-white foci

3. Endobronchial, endotracheal and laryngeal TB:

This occurs when infective material is spread through lymphatics or from expectorated infective material, the mucosal lining become studded with minute granulomatous lesions.

4. Systemic miliary TB:

This occurs when the infective foci in the lungs invade the pulmonary venous return to the heart. The most infected organs are liver, kidneys, spleen, bone marrow, meninges, adrenals, fallopian tubes and epididymis

5. Isolated-organ TB:

It may appear in anyone organ or tissue seeded hematogenously like in meninges (tuberculous meningitis), bone (tuberculous osteomyelitis), kidneys (renal tuberculosis)

6. Tuberculous lymphadenitis:

it is the most frequent form of extrapulmonary TB, occurs in the cervical region

7. Intestinal TB:

It comes from the ingestion of contaminated milk or swallowing of coughed-up infected material



Miliary TB of the liver

Caseous renal tuberculosis



Cervical lymphadenitis

THANK YOU

