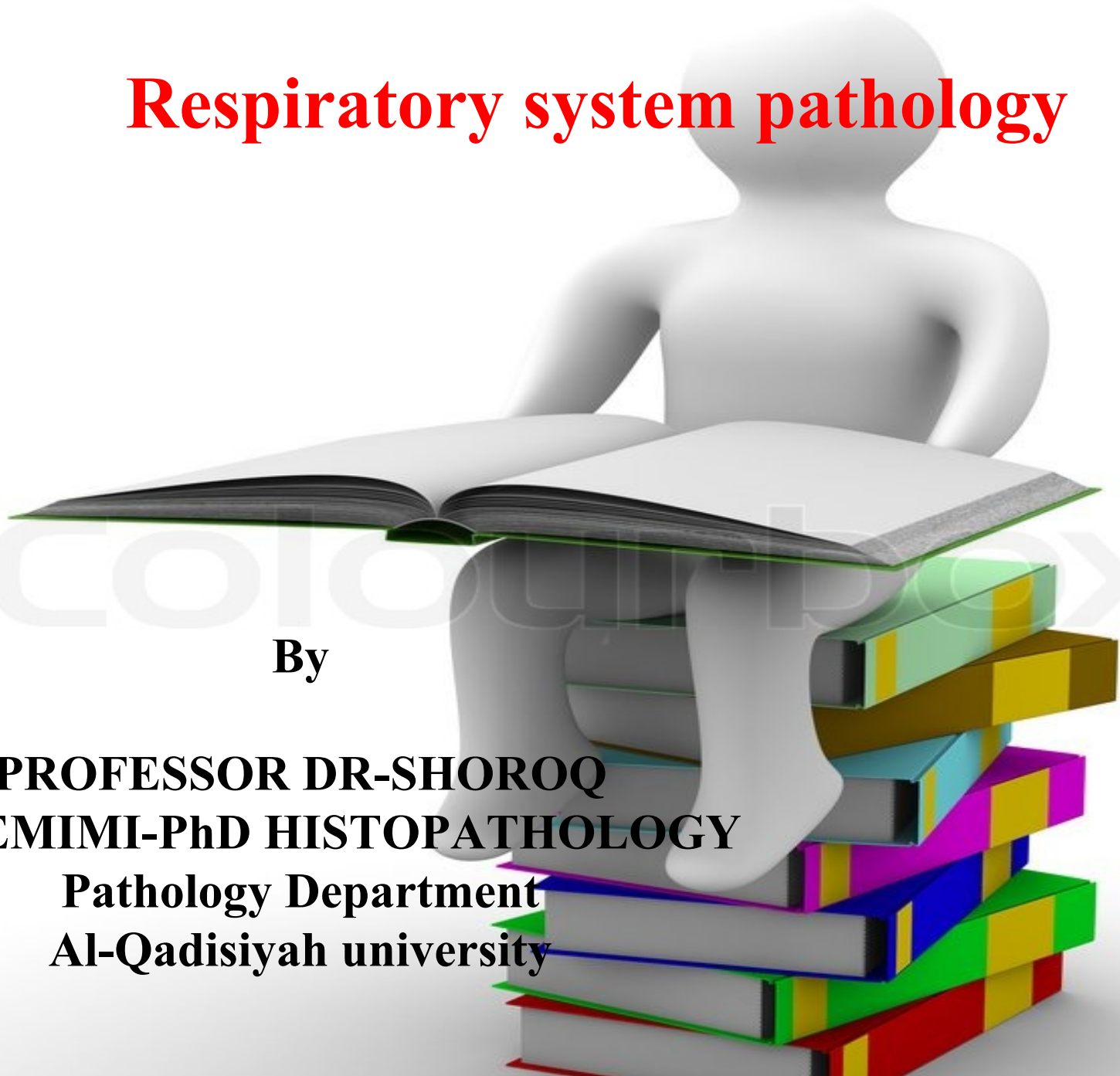


Respiratory system pathology

By

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Case 1

A 70 –year old man had undergone hip replacement and stayed in the hospital for 15 days . Before departure he suddenly complained of fever , cough ,purulent sputum and pleuritic chest pain . CXR revealed RT lower lobe consolidation .

Pulmonary Infection

Respiratory tract infections are more frequent than infections of any other organ .

Pneumonia can be very broadly defined as any infection of the lung parenchyma.

Pneumonia can result whenever these **local defense mechanisms are **impaired** or the systemic resistance of the host is lowered.**

The local defense mechanisms of the lung can be interfered by many factors , such as the following:

1- Loss or suppression of the cough reflex, as a result of coma, anesthesia, neuromuscular disorders, drugs, or chest pain (may lead to aspiration of gastric contents) .

2-Injury to the mucociliary apparatus, by either impairment of ciliary function or destruction of ciliated epithelium, due to cigarette smoke, inhalation of hot or corrosive gases, viral diseases, or genetic defects of ciliary function (e.g., the immotile cilia syndrome).

3- Accumulation of secretions in conditions such as cystic fibrosis and bronchial obstruction .

4- Interference with the phagocytic or bactericidal action of alveolar macrophages by alcohol, tobacco smoke, anoxia, or oxygen intoxication .

5- Pulmonary congestion and edema(congestive heart failure) .

6-Defects in innate immunity (including neutrophil and complement defects) and humoral immunodeficiency typically lead to an increased incidence of infections with pyogenic bacteria.

cell-mediated immune defects lead to increased infections with intracellular microbes such as mycobacteria and herpes viruses

PNEUMONIA

-Infection of lung parenchyma

-It can be classified as:

1. On the basis of Aetiological agent involved:

(i) Bacterial: Streptococcus Pneumoniae ; Staph Aureus; etc

(ii) Viral: Influenza ; Measles

(iii) Fungal: Cryptococcus; Candida; Aspergillus.

(iv) Others: Pneumocystis carinii; Mycoplasma ; _

2. On the basis of anatomical pattern: (Most widely used classification)

(i) Bronchopneumonia

(ii) Lobar pneumonia

(iii) Interstitial pneumonia

3. On the basis of clinical circumstances:

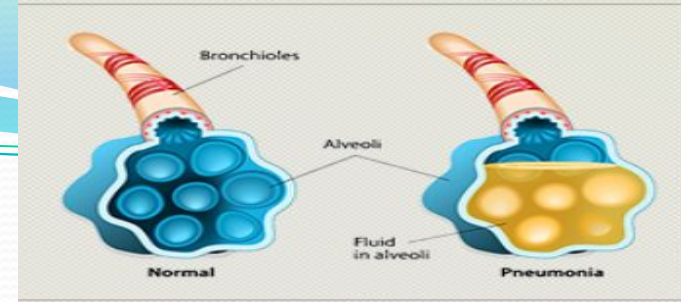
(i) Primary (in an otherwise healthy person)

(ii) Secondary (With local or systemic defects in defence)

4- On the basis of onset of the disease

A-Acute pneumonia.

B-Chronic pneumonia.



Bacterial pneumonias (usually secondary pneumonia) occur in three settings:-

- Community-acquired pneumonia arises outside the hospital**
- Opportunistic pneumonia affects persons whose immune status is defective.**

❑ **Nosocomial pneumonia is infection that develops in hospital environments and tends to affect immuno-compromised patients. *Staph. aureus* and *Pseudomonas aeruginosa* are the most common cause of nosocomial pneumonia** . This is due to a combination of antibiotic resistance, invasive procedures, equipment contamination, and a greater chance for exposure.



❑ ***Staph. aureus* are the most common secondary pneumonia (bacterial pneumonia superimposed on a viral upper respiratory tract infection).**

Community-Acquired Acute Pneumonias (CAP)

- Community-acquired acute pneumonia arises outside the hospital .
- Mostly caused by **bacterial** (more common) or **viral** origin
- Pneumonia occur with increased frequency in those with underlying chronic diseases (CHF, COPD, or diabetes) and humoral immunodeficiencies (i.e., pneumonias is **secondary type**).

Community-Acquired (Acute) Pneumonias either :-

1-Community-Acquired typical Pneumonias

2-Community-Acquired A typical Pneumonias

Community-Acquired typical Pneumonias

Bacterial infection lead to typical form of community-acquired (acute) pneumonias .

Clinical features :-

High fever, pleuritic chest pain, and a productive mucopurulent cough and occasionally hemoptysis .

On Serum exam , WBC is usually elevated .

In acute bacterial pneumonia presence a fibrino-purulent exudate in the alveoli , so called **consolidation .**

Bacterial causes include:-

Streptococcus pneumoniae

Haemophilus influenzae

Moraxella catarrhalis

Staphylococcus aureus

Legionella pneumophila

Klebsiella pneumoniae and Pseudomonas spp.



***Streptococcus pneumonia (or pneumococcus) is the most common bacterial cause of community-acquired typical (acute) pneumonia . usually seen in middle aged adults and elderly**

In general the acute bacterial pneumonia can present according to anatomical distribution as one of two patterns:

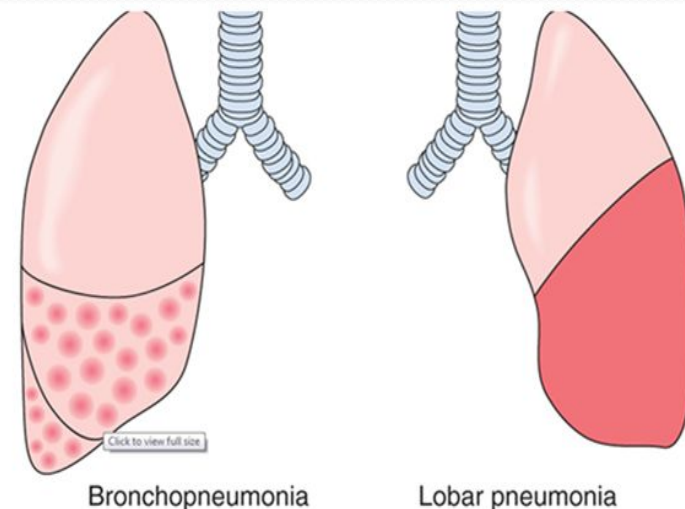
1-Bronchopneumonia:

Is characterized by scattered by patchy consolidation centered on bronchioles that generally involves more than one lobe.

The initial infection is of the bronchi and bronchioles with extension into the adjacent alveoli.

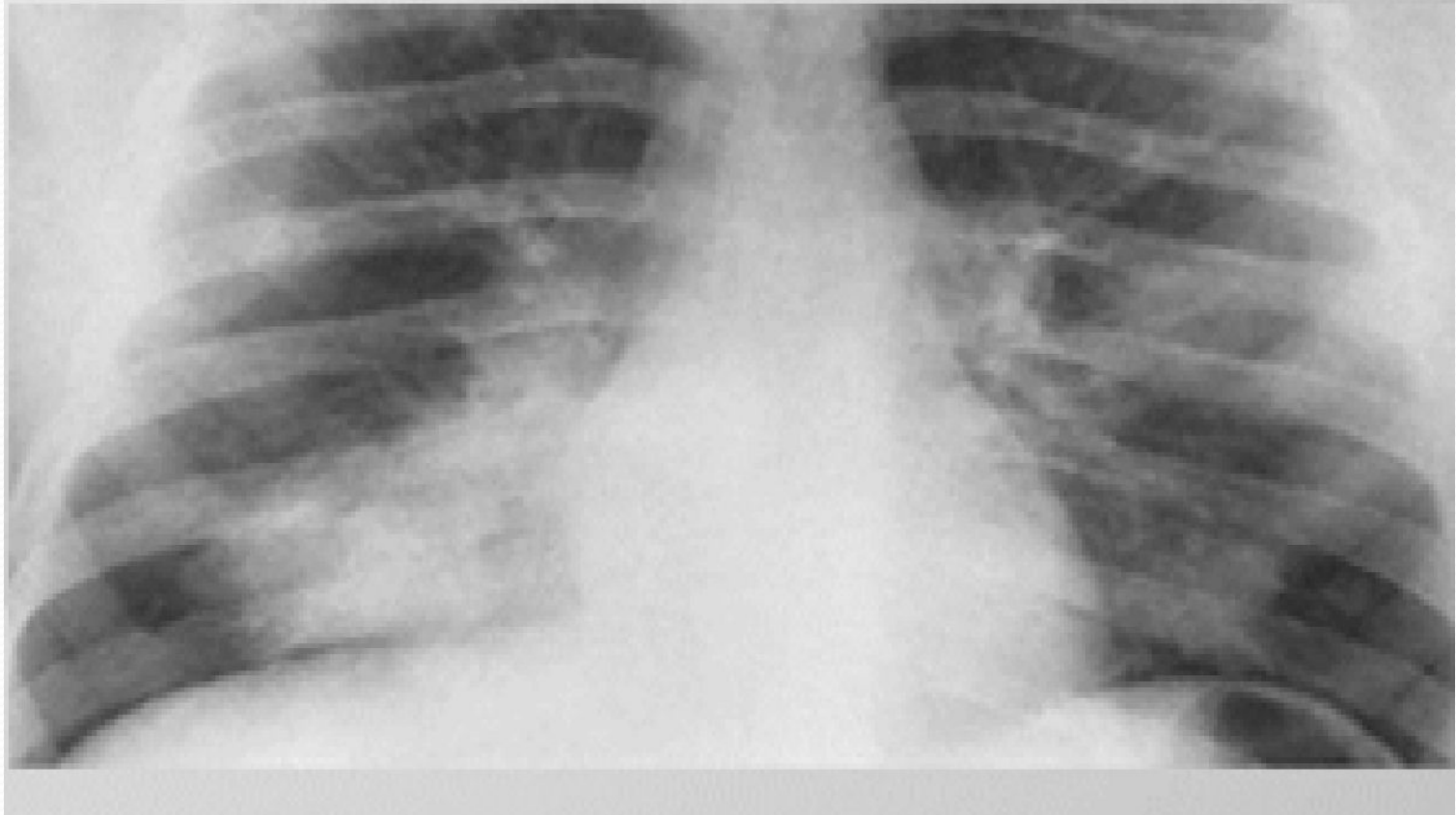
2. Lobar pneumonia:

Is characterized by consolidation of An entire lobe .



Chest x-ray for lobar pneumonia typically shows lobar or segmental consolidation (opacification)





CXR-for bronchopneumonia typically shows patchy consolidation (opacification) .

Before antibiotics usage pneumonia (lobar pneumonia and bronchopneumonia) evolved through **four stages:**

1-Congestion.

2-Red hepatization.

3-Gray hepatization.

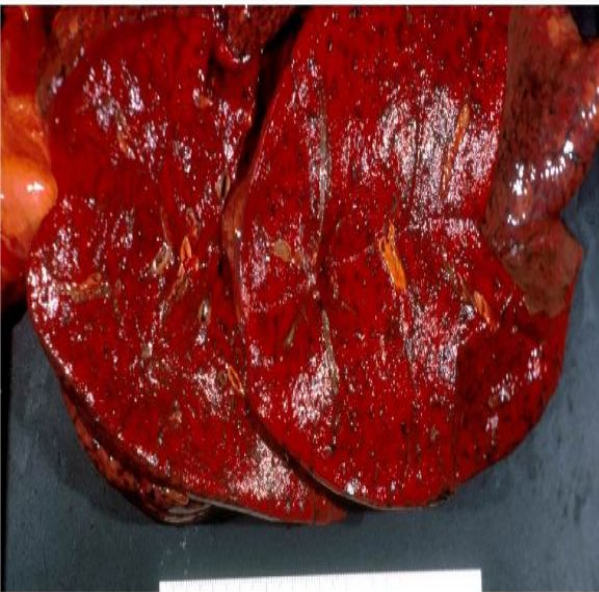
4-Resolution .

Lobar pneumonia

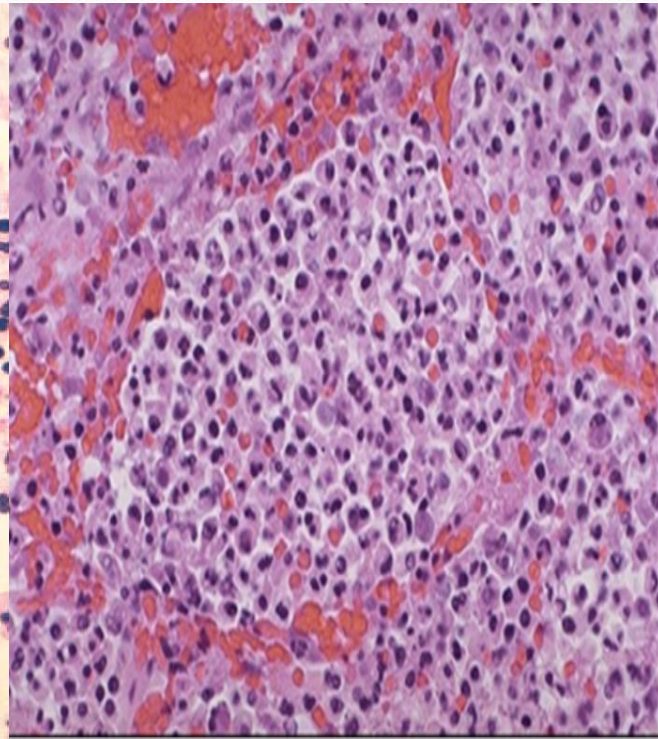
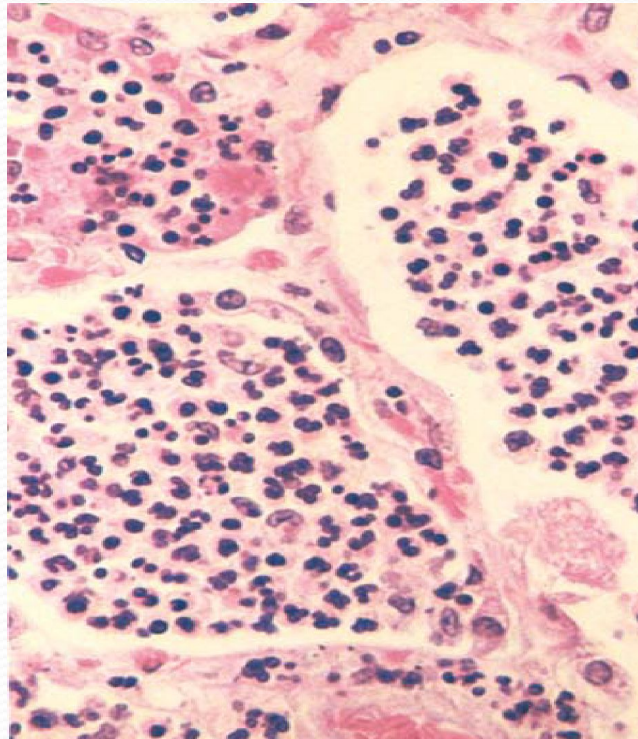
Congestion stage:-

Is the first stage, the affected lobe is **heavy, red, and wet.**

Histologically:- vascular congestion can be seen in the alveolar wall, with proteinaceous fluid, scattered neutrophils, and many bacteria in the alveoli.

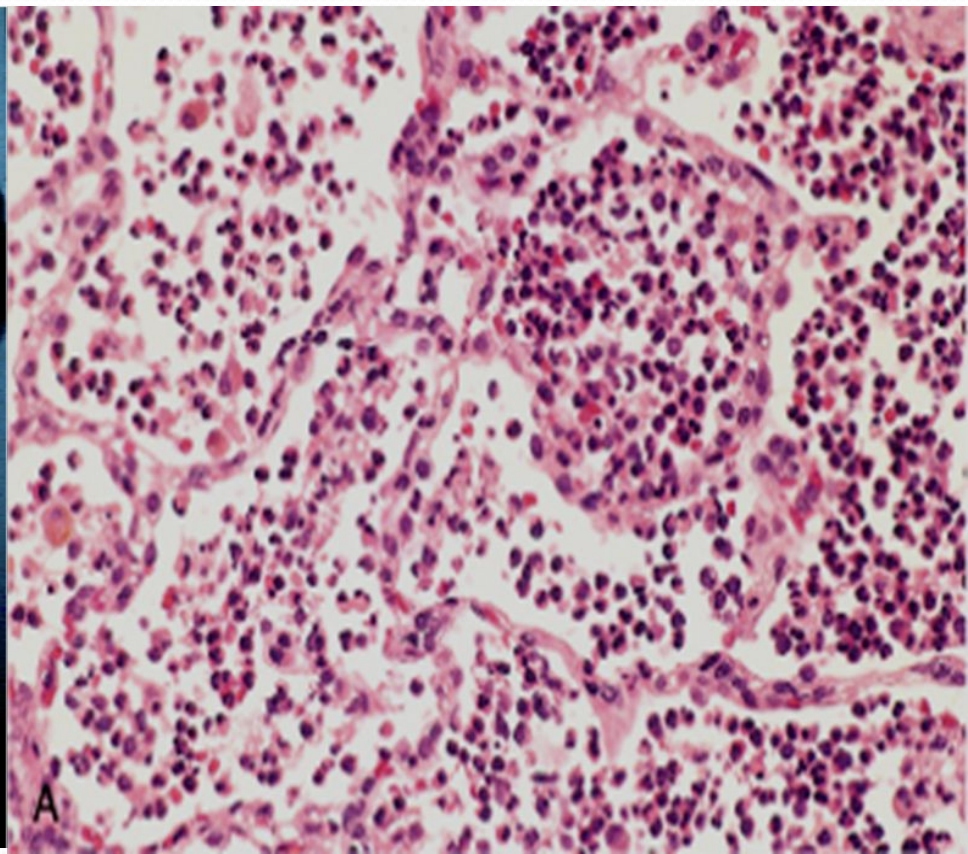
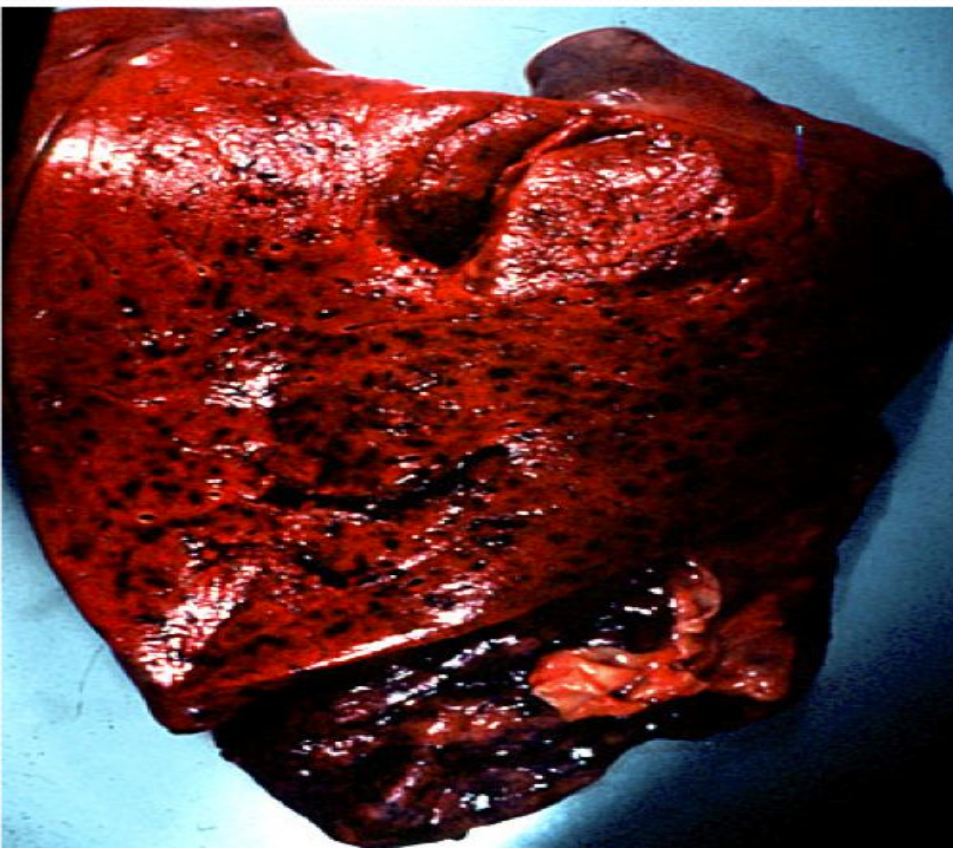


Heavy lungs
Firm and rusty or brown due to accumulation of hemosiderin



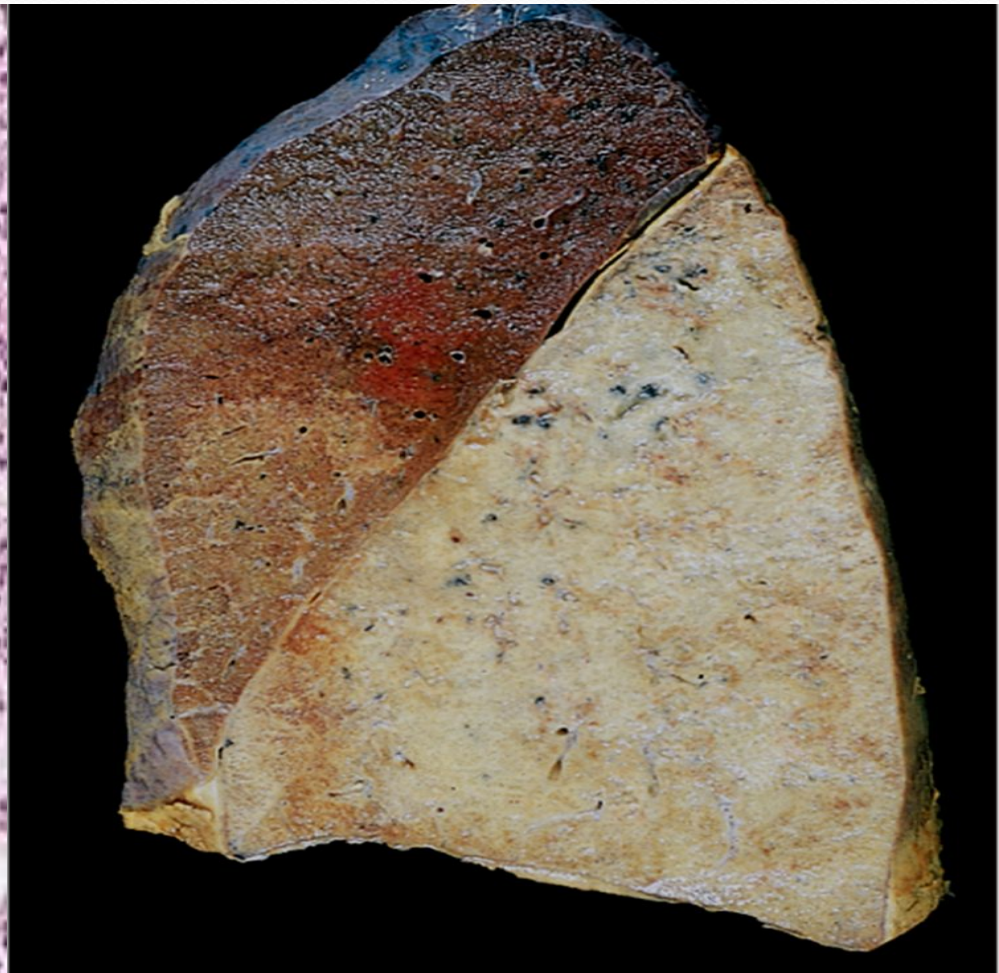
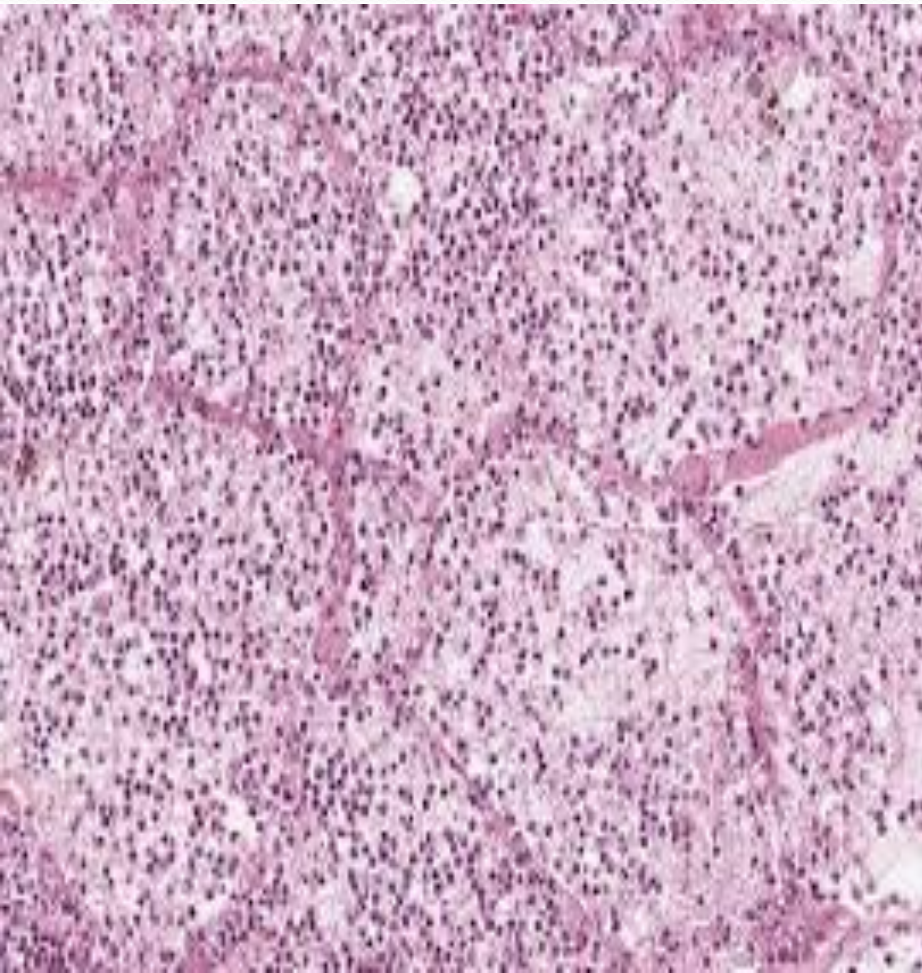
Red hepatization stage:-

Within a few days, the stage of **red hepatization** follows, in which the lung lobe has a **liver-like** consistency, the alveolar spaces are packed with **neutrophils, red cells, and fibrin**.



Gray hepatization stage:-

In the next stage,, the lung is **dry, firm, gray** and like **liver** , because the red cells are lysed, while the fibrin and **mononuclear cells, (fibrin purulent exudate)** persists within the alveoli.

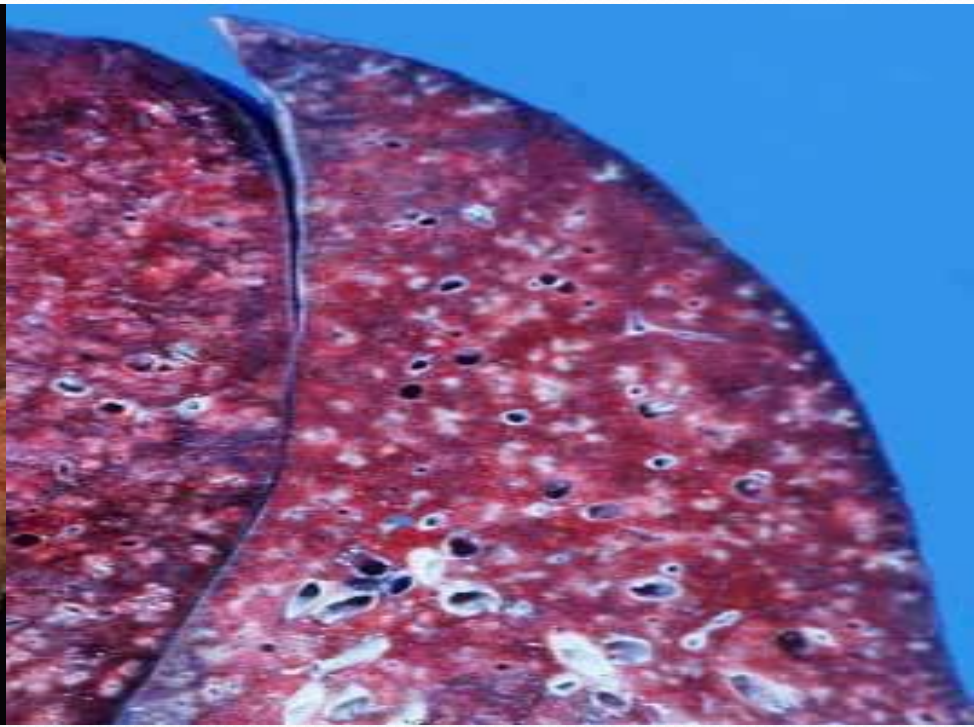
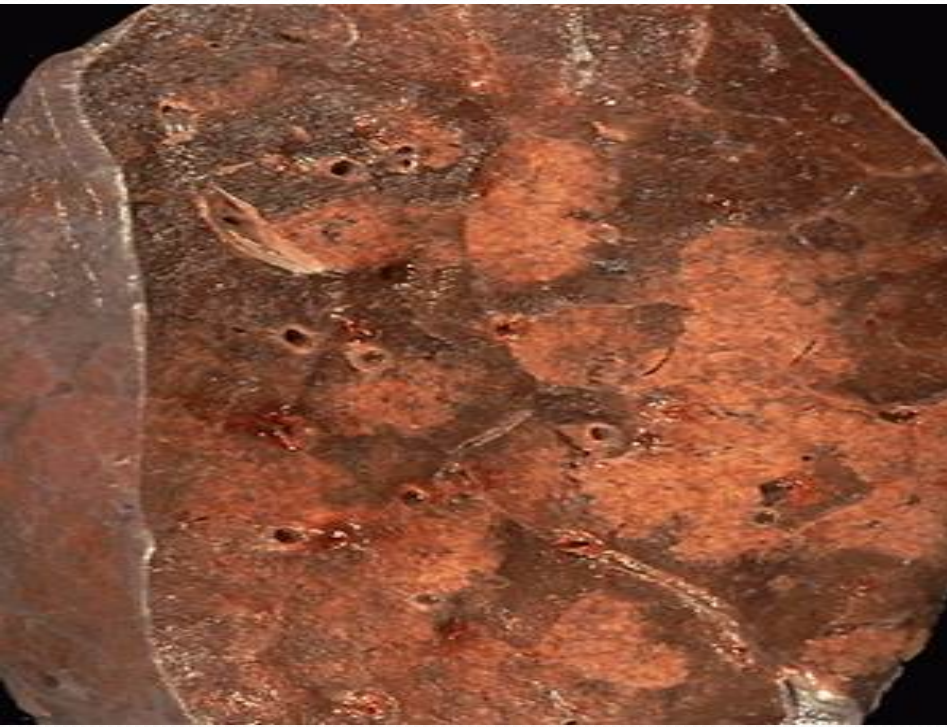


Resolution stage:-

With appropriate therapy, complete resolution of the inflammation; the exudates within the alveoli are enzymatically digested to produce semifluid debris that is resorbed, ingested by macrophages and coughed up. Exudate resolution usually restores normal lung structure and function .

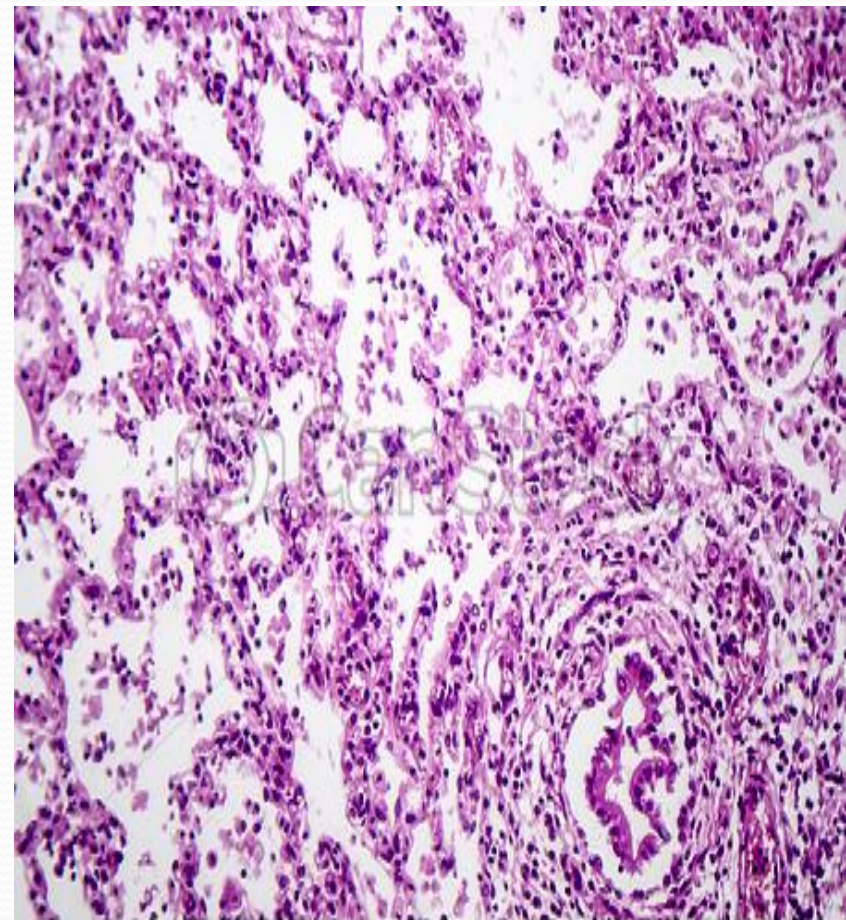
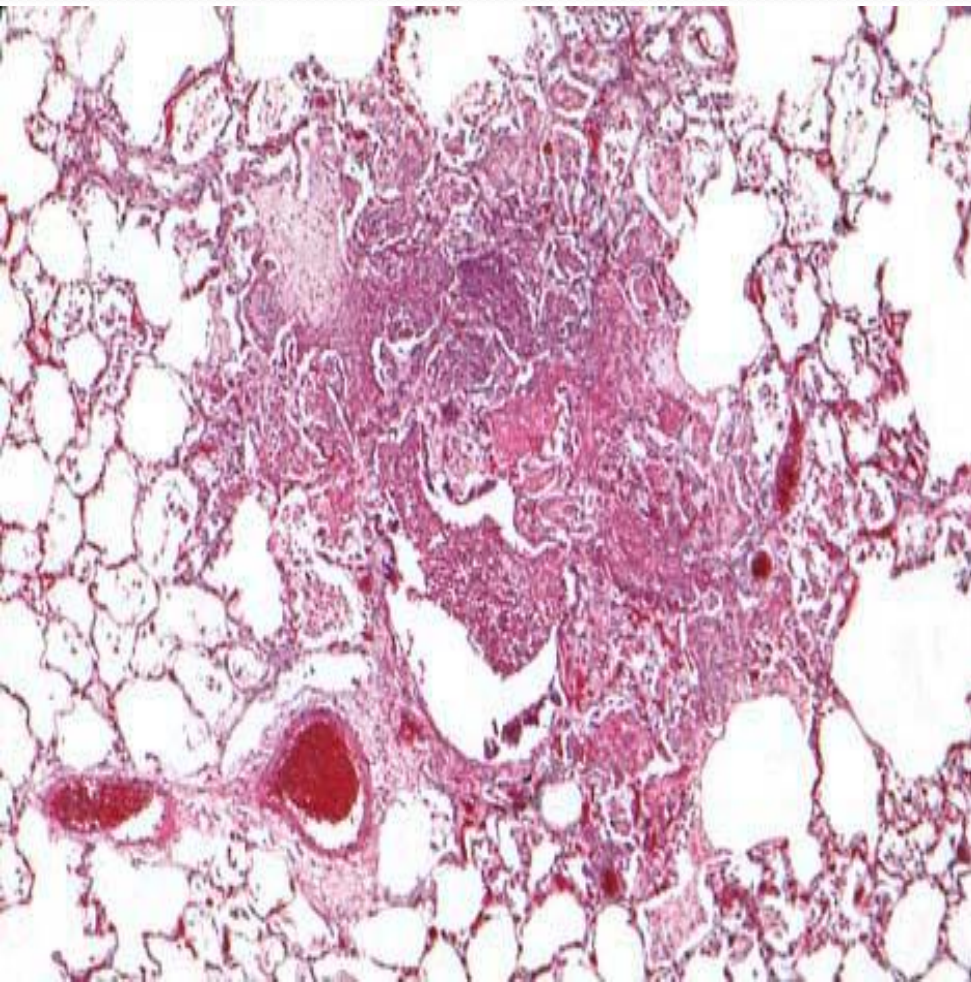
- ❖ The pleural also involve by infection . So, the pleural reaction called (fibrinous or fibrinopurulent pleuritis) and this reaction may similarly resolve completely to normal if appropriate therapy.**

In the bronchopneumonia : (evolved through four stages)
gray-red to yellow patches of consolidation, up to 4 cm in diameter with large intervening areas are generally normal and distributed throughout one or several lobes, most frequently bilateral and basal.
Confluence of these foci may occur in severe cases, producing the appearance of a lobar consolidation.



Microscopical features of bronchopneumonia :

the reaction consists of focal suppurative exudate that fills the bronchi, bronchioles, and adjacent alveolar spaces. The alveoli intervening areas are generally normal .



***With appropriate therapy, complete resolution of the inflammation is the rule for bronchopneumonia also .**

***In contrast , if patient with acute pneumonia(lobar or bronchopulmonary) and inappropriate therapy this lead to complication .**

Complications of acute pneumonia

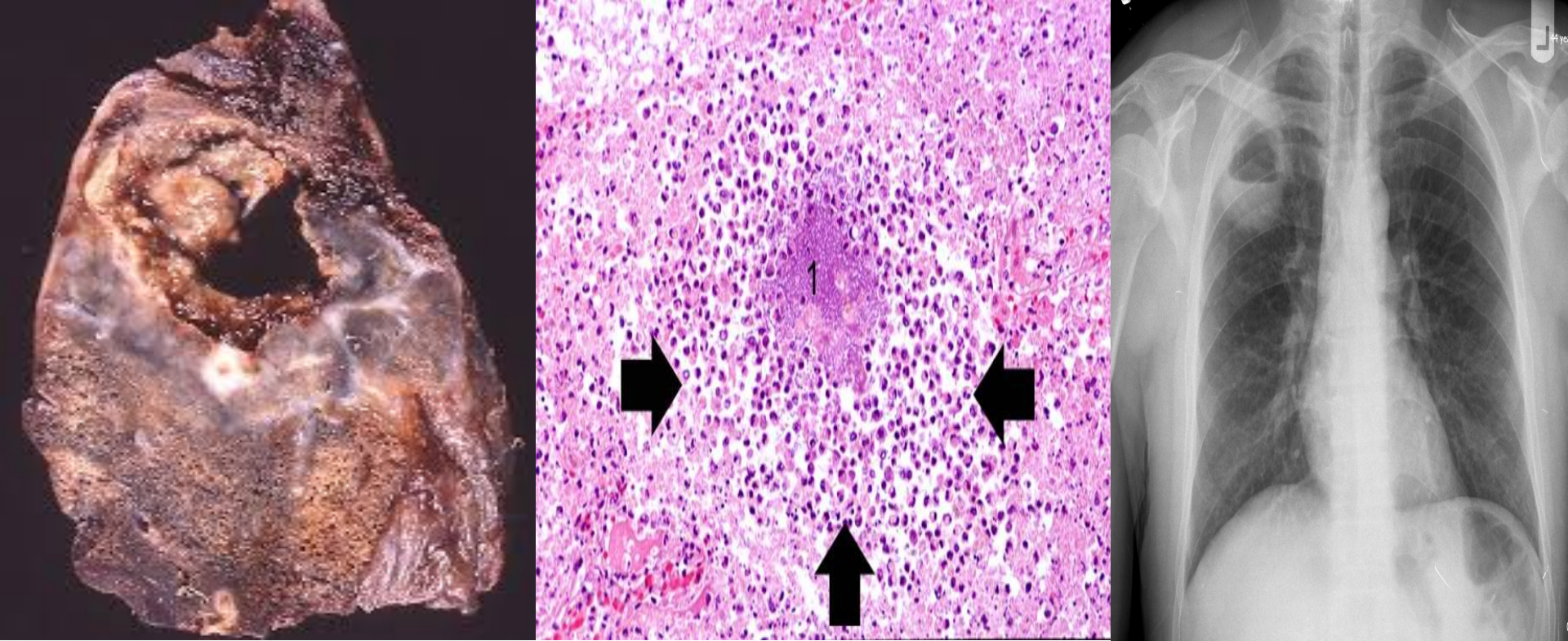
1-Lung abscess (necrosis of the pulmonary tissue and formation of cavities containing necrotic debris or fluid caused by microbial infection) .

2- Empyema(Present of pus in the pleural cavity ,it is not a primary disease ,it is secondary to other underlying diseases .



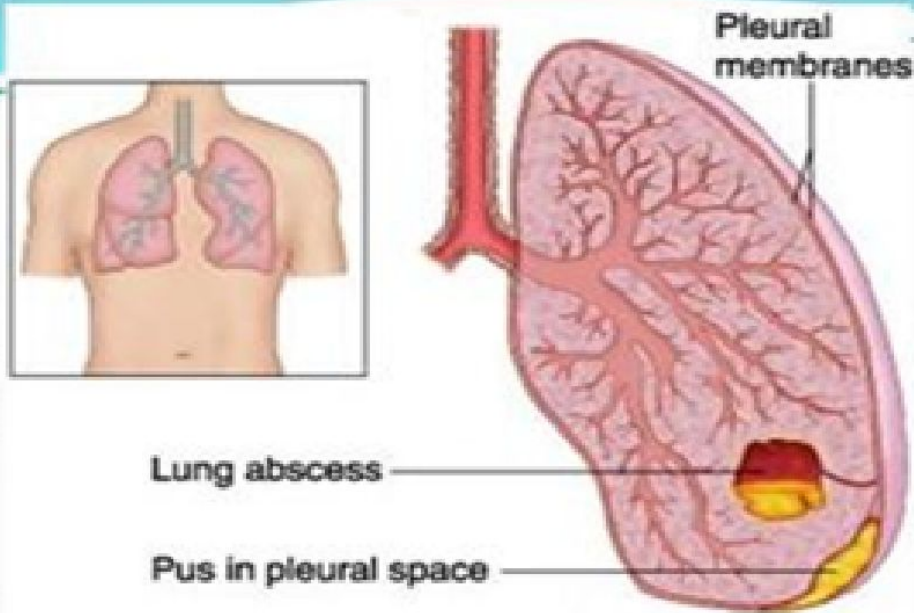
3- Fibrosis complicating organization (fibrous scarring) in lung or in pleura (organization in pleura, leaving fibrous thickening or permanent adhesions.

4- Bacteremia dissemination may lead to meningitis, arthritis, or infective endocarditis.



Lung abscess

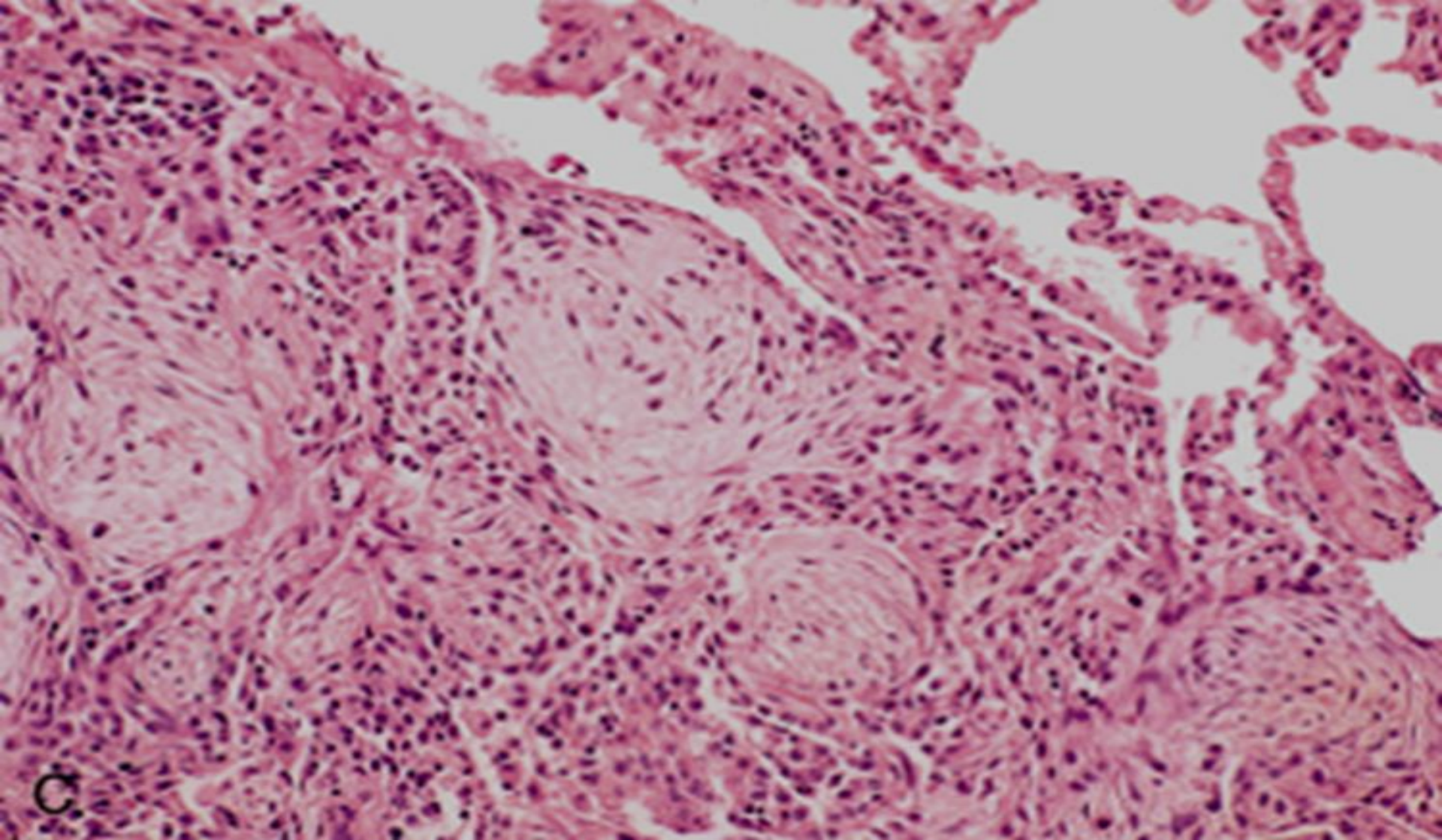
Necrosis of the pulmonary tissue and formation of cavities containing necrotic debris or fluid caused by microbial infection.



Empyema

CXR:-Empyema's form an obtuse angle with the chest wall .The biconvex shape is also suggestive of the diagnosis.





Advanced organizing pneumonia, featuring transformation of exudates to fibromyxoid masses richly infiltrated by macrophages and fibroblasts (fibrous scarring) .

Case 2

A 10-year-old boy presents with fever, malaise, headaches, and muscle pain (myalgia) . CXR reveals bilateral lung infiltrates with no sign of consolidation .

Community-Acquired Atypical pneumonias

It is **Interstitial pneumonitis** with absence of physical findings of consolidation (due to lack of alveolar exudates).

It is more common in children and young adults

Causes



1-Mycoplasma pneumonia : is the most common offender. It is common among children . They may occur sporadically or as local epidemics in closed communities (schools, military camps, and prisons).

2-Viruses (including influenza types A and B). It is common among young adults.

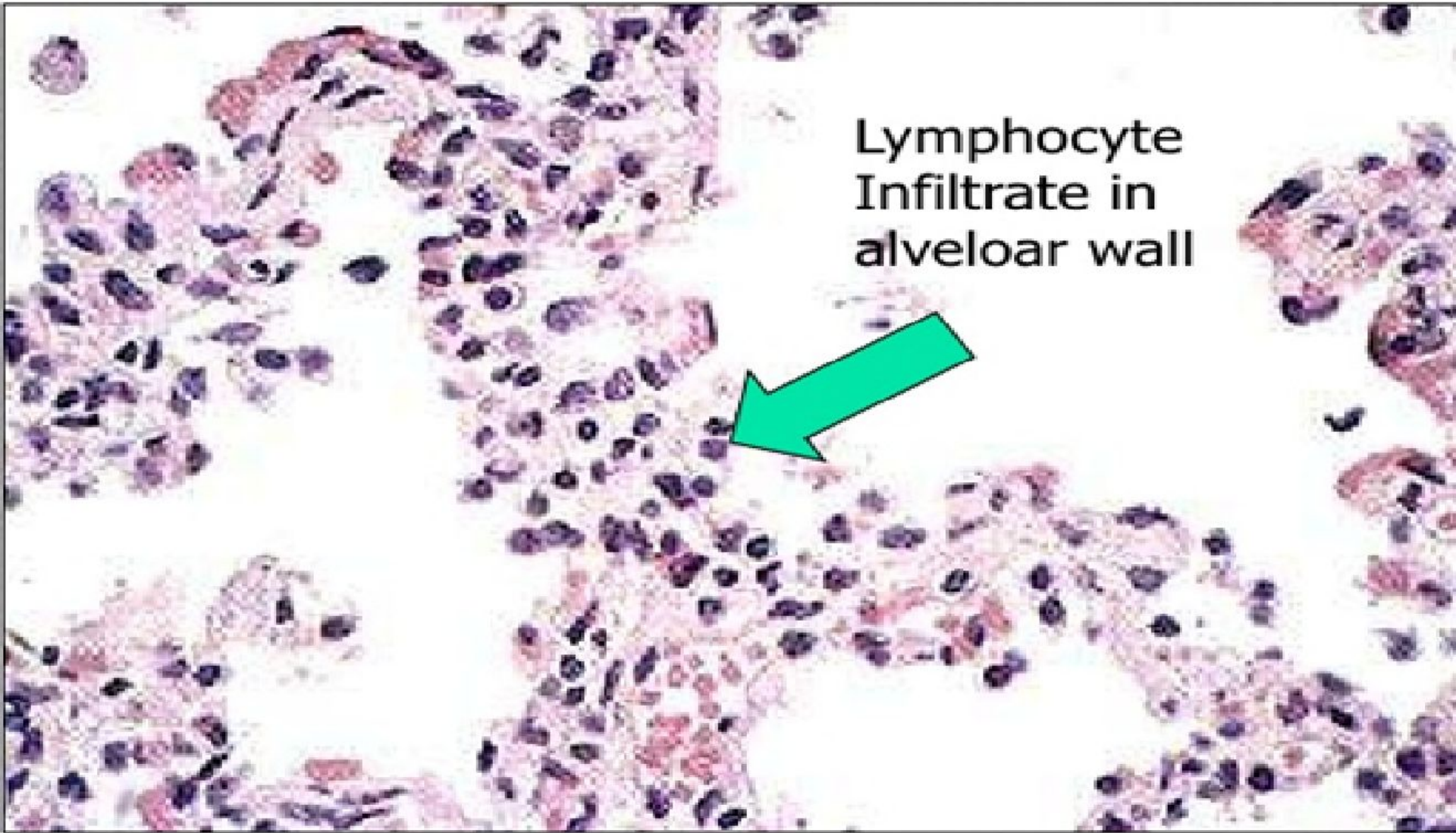
3-Chlamydia pneumonia .

4-Coxiella burnetii (Q fever)

Clinical features

Atypical pneumonia are commonly associated with milder forms of pneumonia . Where symptoms more systemic (headache, malaise and diarrhea ---all these symptom are due to mediators) than pulmonary (cough ,sputum and dyspnea) .

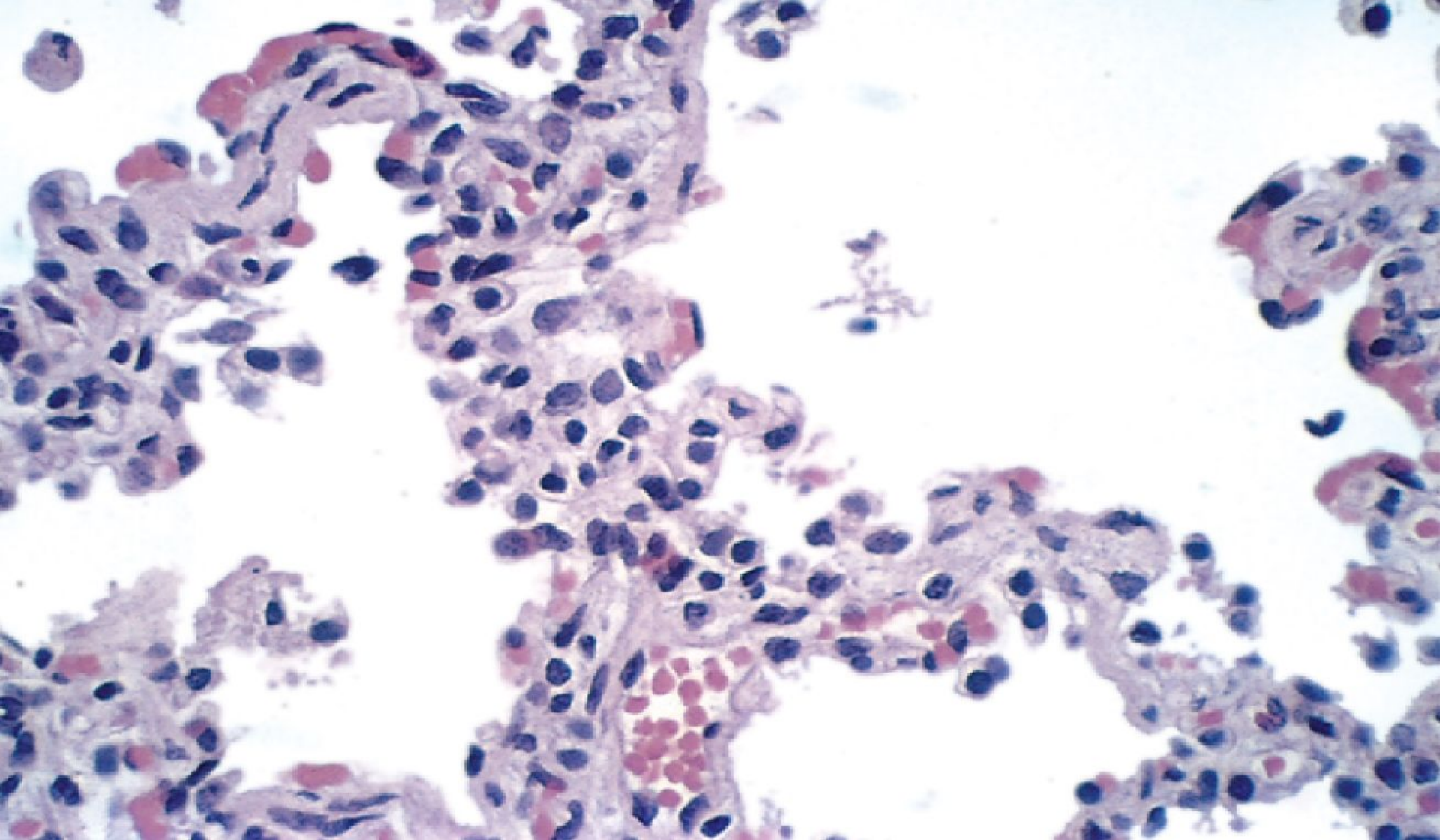
***later on Followed by a productive cough with radiographs showing consolidation (i.e atypical pn. later on change to typical type).**



Lymphocyte
Infiltrate in
alveolar wall

Atypical pneumonias

The inflammatory reaction is confined within the alveolar walls, which are widened by edema & mononuclear inflammatory infiltrate. Alveolar spaces are free from cellular exudates .



Thanks



**You learn some
thing every day if
you pay attention**

PBL-1

A 70 –year old man had undergone hip replacement and stayed in the hospital for 15 days . Before departure he suddenly complained of fever , cough ,purulent sputum and pleuritic chest pain .

CXR revealed RT lower lobe consolidation .

Q1/What is most likely diagnosis ?

Q2/What are most common M.O caused this disease ?

Q3 /List the possible complication.

Q4/Enumerate the stages of pulmonary infection?

PBL-2

A 10-year-old boy presents with fever, malaise, headaches, and muscle pain (myalgia) .

CXR reveals bilateral lung infiltrates with no sign of consolidation .

1-What is most appropriate diagnosis ?

2-What is most common M.O caused this disease ?

3-Microscopical finding?