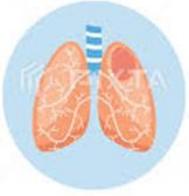


Respiratory System

RS

Dr. Ola Abu Al Karsaneh



Definition of Pneumonia :

□ Pathological :

- Any infection of the lung parenchyma distal to the terminal bronchioles.

□ Clinical:

- A constellation of symptoms & signs with at least one opacity on chest x-ray.

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THE FACTS ABOUT PNEUMONIA

Pneumonia is the largest infectious cause of death in children around the world, being responsible for over 920,000 deaths in children under the age of 5 in 2015.

What is Pneumonia?
It is an infection of the lungs that inflames air sacs, which may fill with fluid. This can happen in one or both lungs.

Is Pneumonia fatal?
Yes, especially for children in developing countries where proper care is not available. It is always a threat despite age.

Visit your doctor if you notice the following symptoms:

- Fever** (Illustration of a child with a fever)
- No appetite** (Illustration of a child not eating)
- Coughing up bloody or yellow phlegm** (Illustration of a child coughing)

- ❑ Normally, the lung parenchyma remains sterile because of the highly effective immune and nonimmune defense mechanisms.
-

Impairment of defense mechanisms leading to pulmonary infections :

- 1-Loss or suppression of cough reflex: coma, anesthesia, drugs
- 2-Injury to mucociliary apparatus: smoke, viral
- 3-Decrease in macrophage function: alcohol, smoking
- 4- Impaired immune system: chronic diseases, immune deficiency diseases, aging.
- 5-Existing pulmonary disease: atelectasis, COPD.
- 6- Unusually virulent infecting organism

Pneumonia is classified according to the specific etiologic agent or, if no pathogen can be isolated, by the clinical setting in which the infection occurs.



Classification according to clinical setting will considerably narrow the list of suspected pathogens for administering empirical antimicrobial therapy.

Classification of pneumonia (pneumonias syndromes)

1. Community-Acquired Acute (typical) Pn.
2. Community- Acquired Atypical Pn.
3. Nosocomial Pneumonia
4. Aspiration Pneumonia
5. Lung Abscess
6. Chronic Pneumonia
7. Pneumonia in the Immunocompromised host

1. Community-Acquired Acute Typical Pneumonia

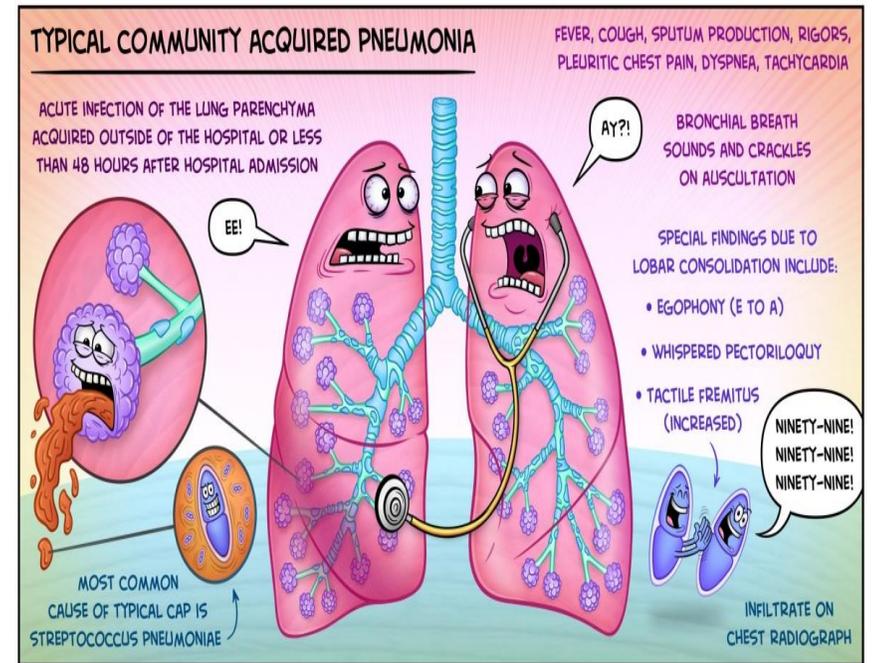
□ Aetiology:

- Bacteria, fungi, viruses, parasites.

Streptococcus pneumoniae

- The most common cause of community-acquired acute pneumonia

- The presence of numerous neutrophils in sputum containing the gram-positive, lancet-shaped diplococci supports the diagnosis.



□ Other common causes:

-Haemophilus influenzae and Moraxella catarrhalis:

- Both are associated with acute exacerbations of COPD.

-Staphylococcus aureus:

- Usually secondary to viral respiratory infections.
- High incidence of lung abscess and empyema.
- Associated with intravenous drug abuse.

-Klebsiella pneumoniae

- Observed in patients who are chronic alcoholics.
- Thick and gelatinous sputum is characteristic.

-Pseudomonas aeruginosa

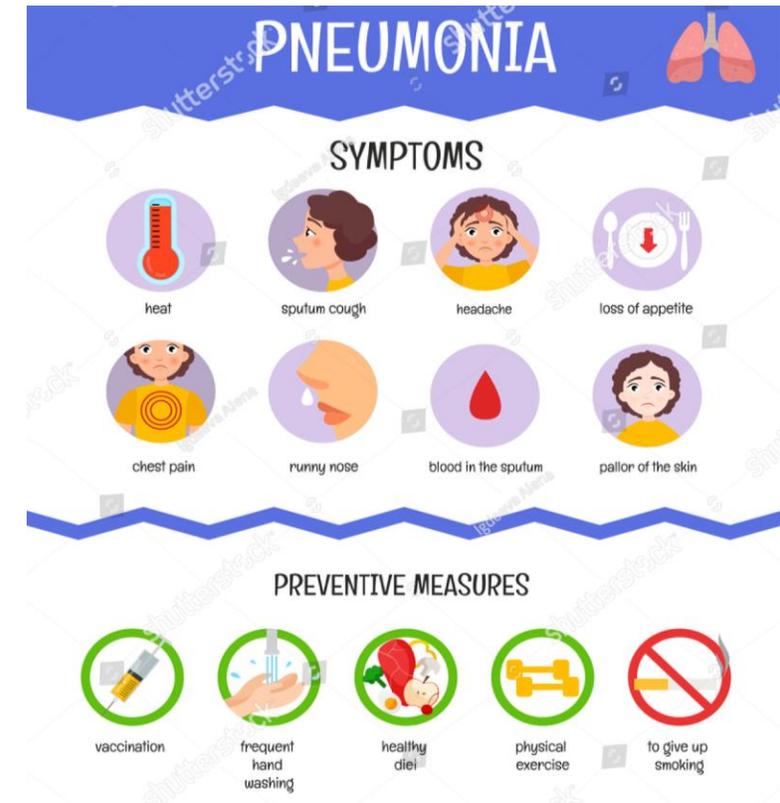
- **Most commonly seen in nosocomial settings.**
- Seen in persons with cystic fibrosis, in burn victims, and patients with neutropenia.
- Has a propensity to **invade blood vessels** at the site of infection, with consequent extrapulmonary spread.

-Legionella pneumophila

- Seen particularly in organ transplant recipients.

Clinical Features

- An abrupt onset of:
 - Fever, Chills, rigors
 - SOB
 - Cough
 - Expectoration of sputum
 - Occasional patients have hemoptysis
 - Pleuritic chest pain (with pleuritis).



Morphology:

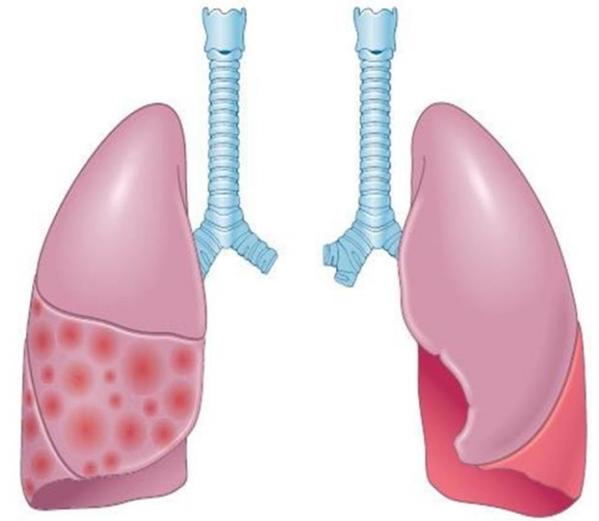
Acute bacterial pneumonia has two patterns of anatomic distribution:

1. Lobular bronchopneumonia.
2. Lobar pneumonia.

- The term “**consolidation**” refers to the “solidification” of the lung due to the replacement of the air by an exudate in the alveoli.

Lobular Bronchopneumonia: **Patchy** consolidation of the lung and generally involves **more than one lobe**.

Lobar pneumonia: Consolidation of **a large portion of a lobe** or of an **entire lobe**



Bronchopneumonia Lobar pneumonia
Figure 12-31 The anatomic distribution of bronchopneumonia and lobar pneumonia.

There are 4 stages of inflammatory evolution in **Lobar pneumonia**

1- Congestion:

- Heavy red lungs
- Severe vascular congestion
- Intra alveolar exudate with few neutrophils
- **Bacteria +++**
- Watery sputum

2- Red hepatization

- Firm, airless, red liver-like lung
- Fibrinopurulent pleuritis
- Intra alveolar exudate: organisms ++, cells:
Red cells
Neutrophils
Fibrin

3- Grey hepatization :

- Dry grey-brown cut surface
- ↑ intra alveolar fibrin & macrophages
- Disintegrating neutrophils & ↓ RBC's

4- Resolution:

- Exudate within the alveolar spaces is broken down by enzymatic digestion to produce granular, semifluid debris that is resorbed, ingested by **macrophages**, expectorated, or organized by fibroblasts growing into it.

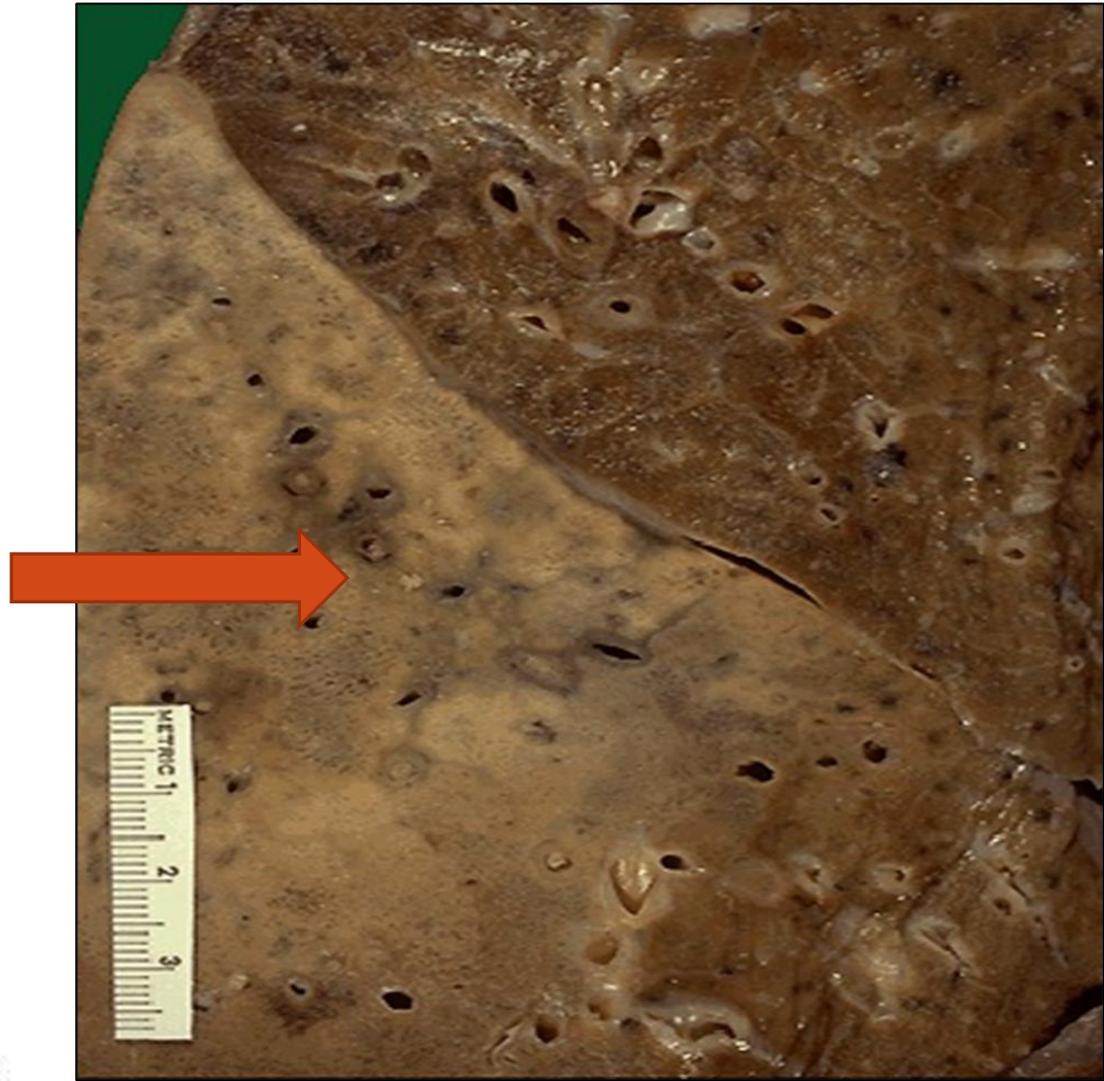
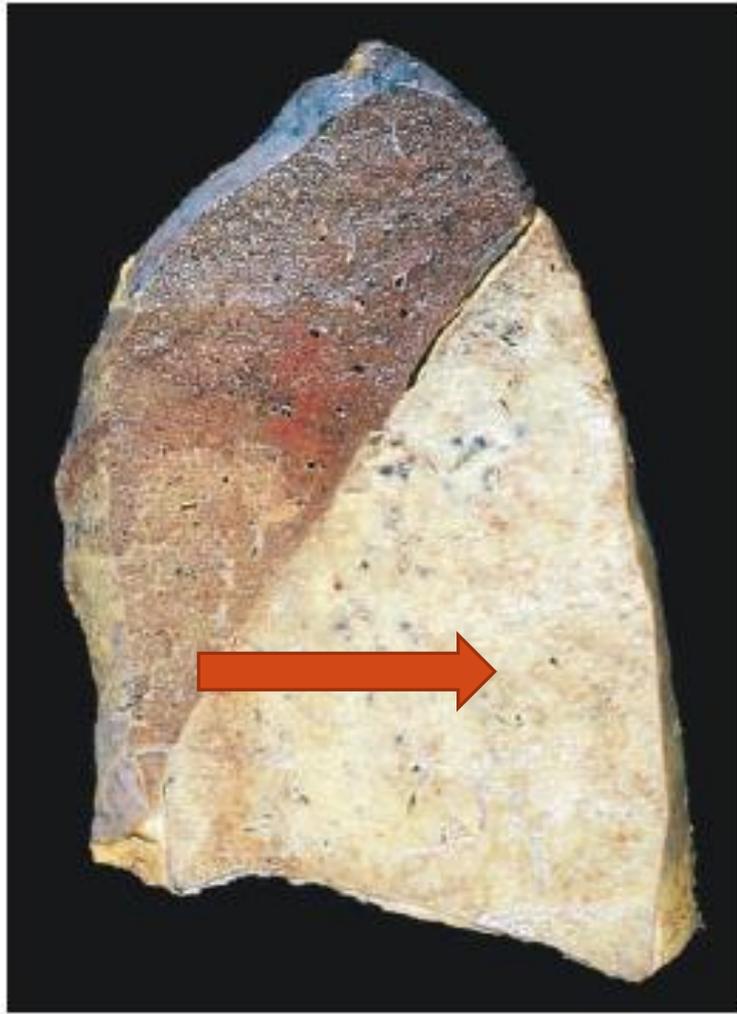
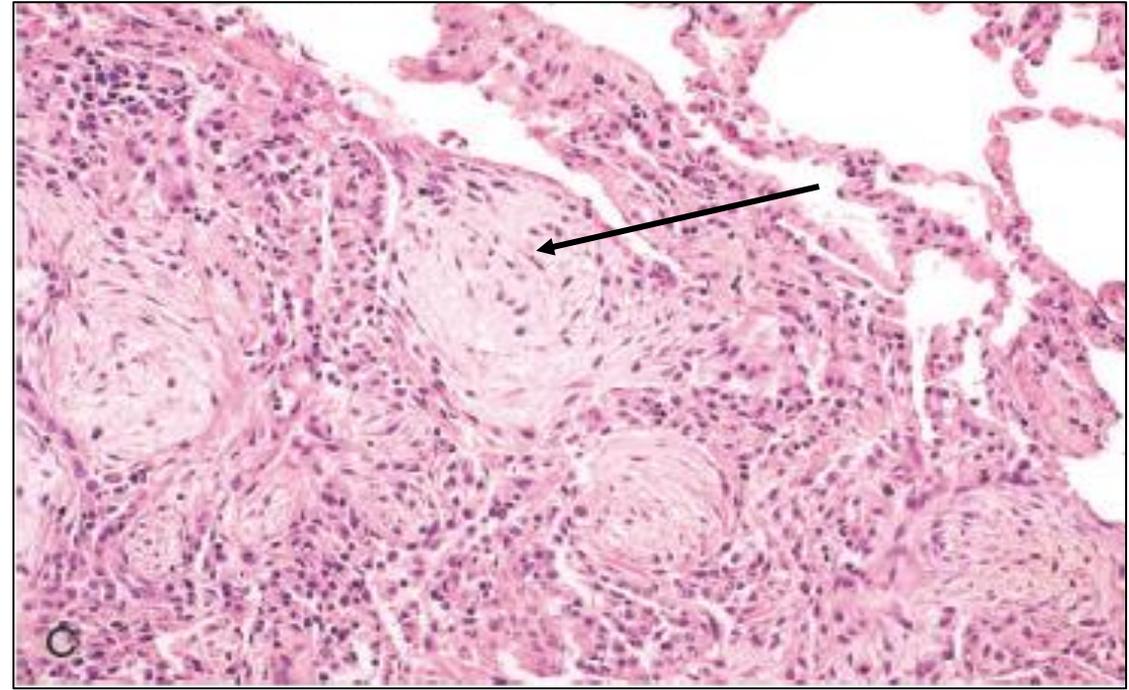
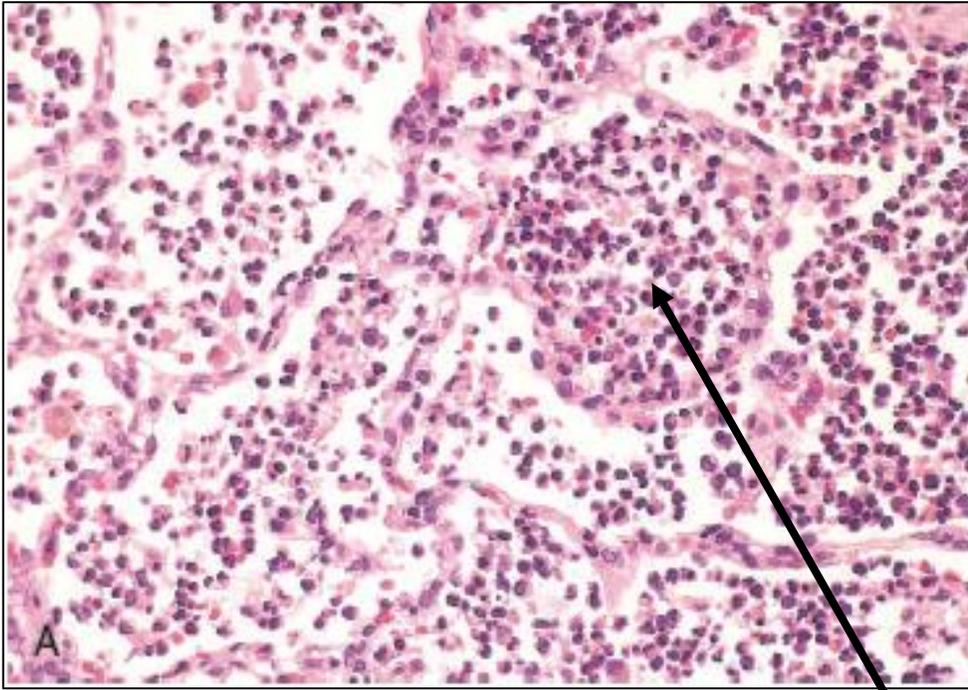


Fig. 13.30 Lobar pneumonia with gray hepatization. The lower lobe is uniformly consolidated.



(A) Acute pneumonia. Extensive neutrophil exudation into alveoli corresponds to early red hepatization.

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

Lobular Bronchopneumonia

- The consolidation may be confined to one lobe but is more often **multilobar** and frequently **bilateral**.
- The lesions are slightly elevated, dry, granular, gray-red to yellow
- The lung substance surrounding the areas of consolidation may be hyperemic, edematous or normal
- Pleural involvement is less common than in lobar pneumonia.
- **Histologically**, a neutrophil-rich exudate fills the **bronchi, bronchioles, and adjacent alveolar spaces**.

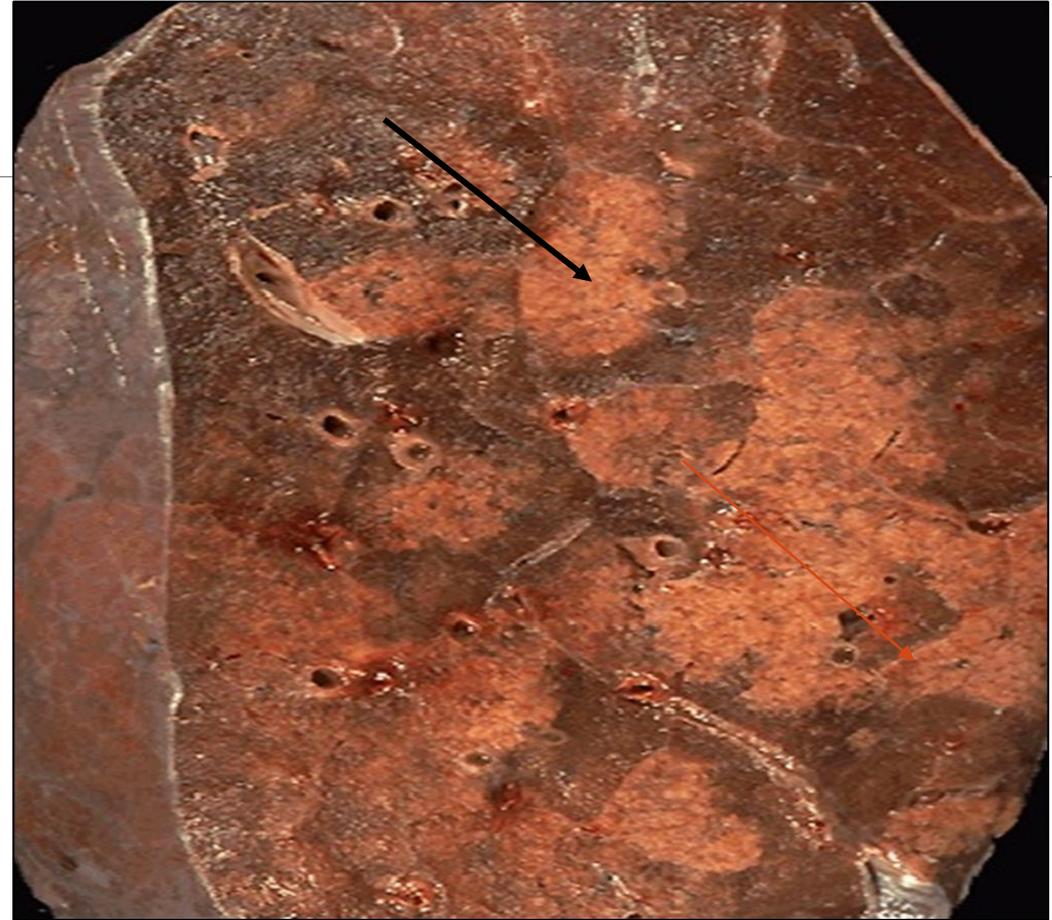
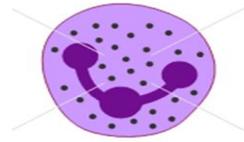
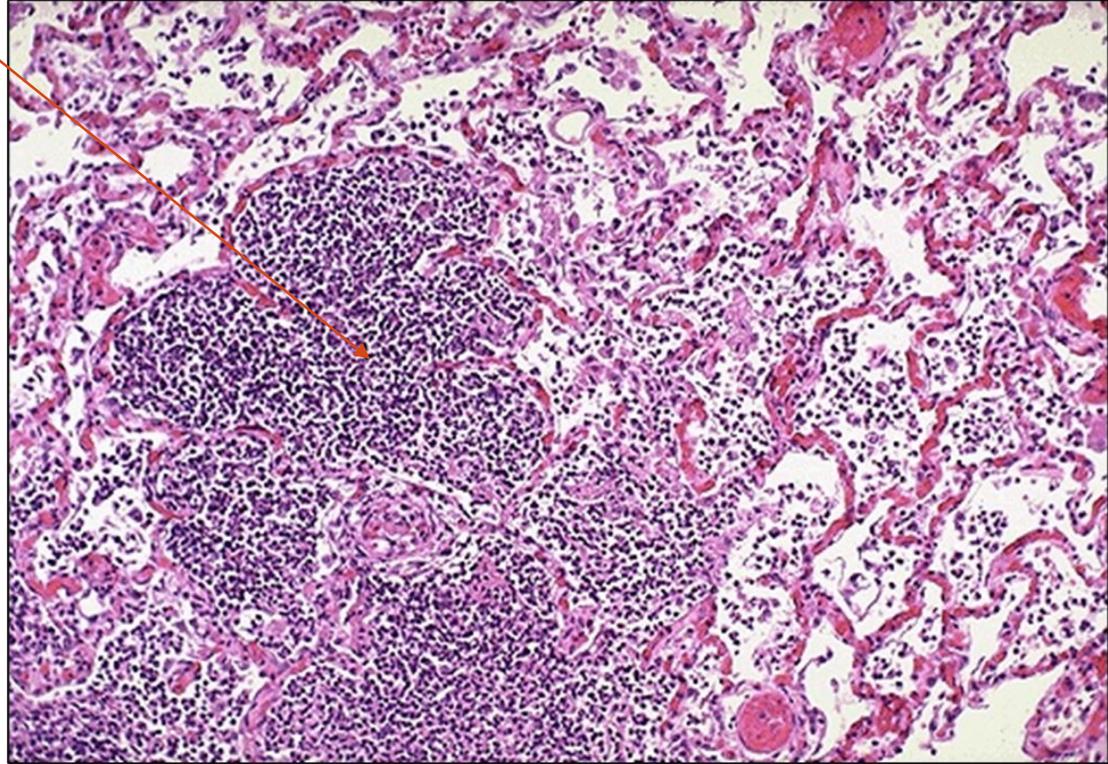
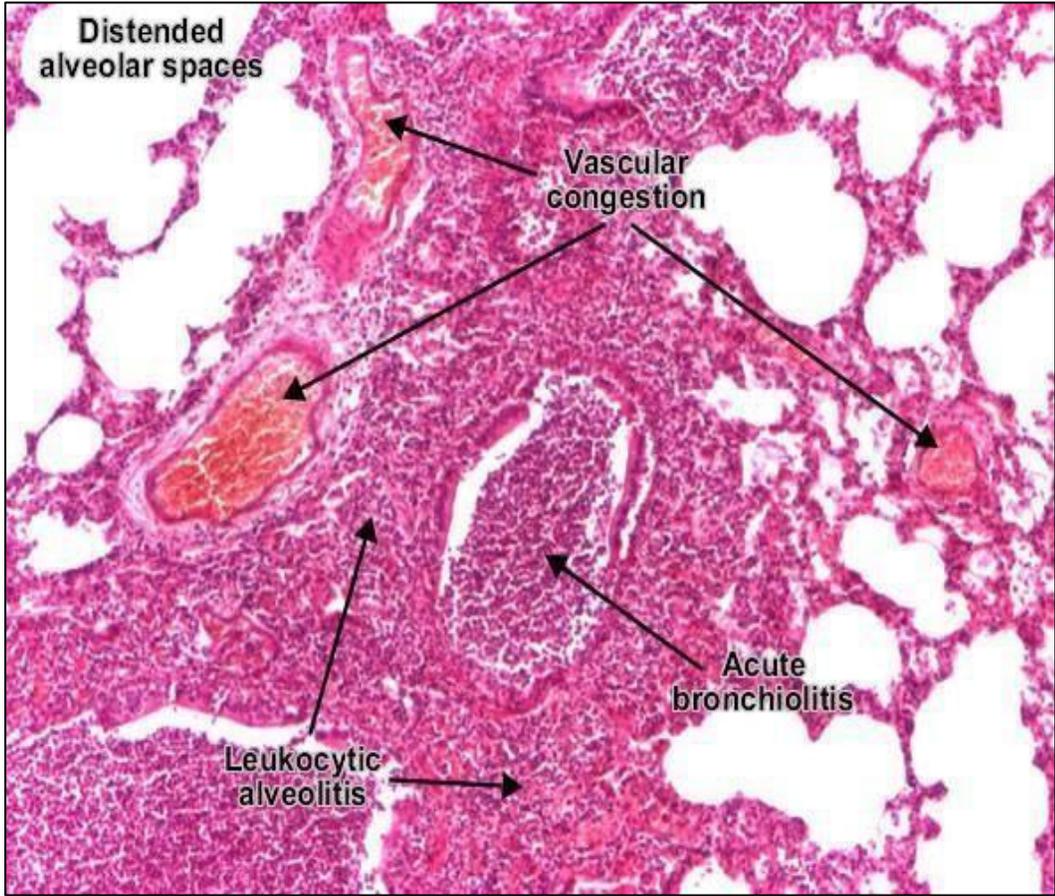


Figure 15-33 Bronchopneumonia. Section of lung showing patches of consolidation (*arrows*).



Broncho-pneumonia, suppurative inflammation of the bronchiole with the extension of the inflammation to the surrounding alveoli



2. Community-Acquired Atypical Pneumonia:

- An acute febrile respiratory disease characterized by patchy inflammatory changes in the lungs, largely confined to the alveolar septa & pulmonary interstitium.
- The term **atypical** denotes:
 1. Cough with moderate amounts of sputum.
 2. The absence of a physical finding of consolidation.
 3. Lack of alveolar exudate.
 4. Moderate elevation of WBC count.

☐ Causes

- ✓ **Mycoplasma pneumonia** is the most common
- ✓ Other causes include viruses, such as influenza, SARS virus ...etc.
- ✓ Chlamydia – Psittacosis
- ✓ Rickettsiae

□ Clinically:

- It is variable and may simulate URT infection, called a chest cold.
- It may present as a fulminant life-threatening infection in immunocompromised individuals.
- The onset is that of acute illness with fever, headache & malaise, and later cough with minimal sputum, and alveolar-capillary block occurs due to edema causing respiratory distress.

□ Morphology:

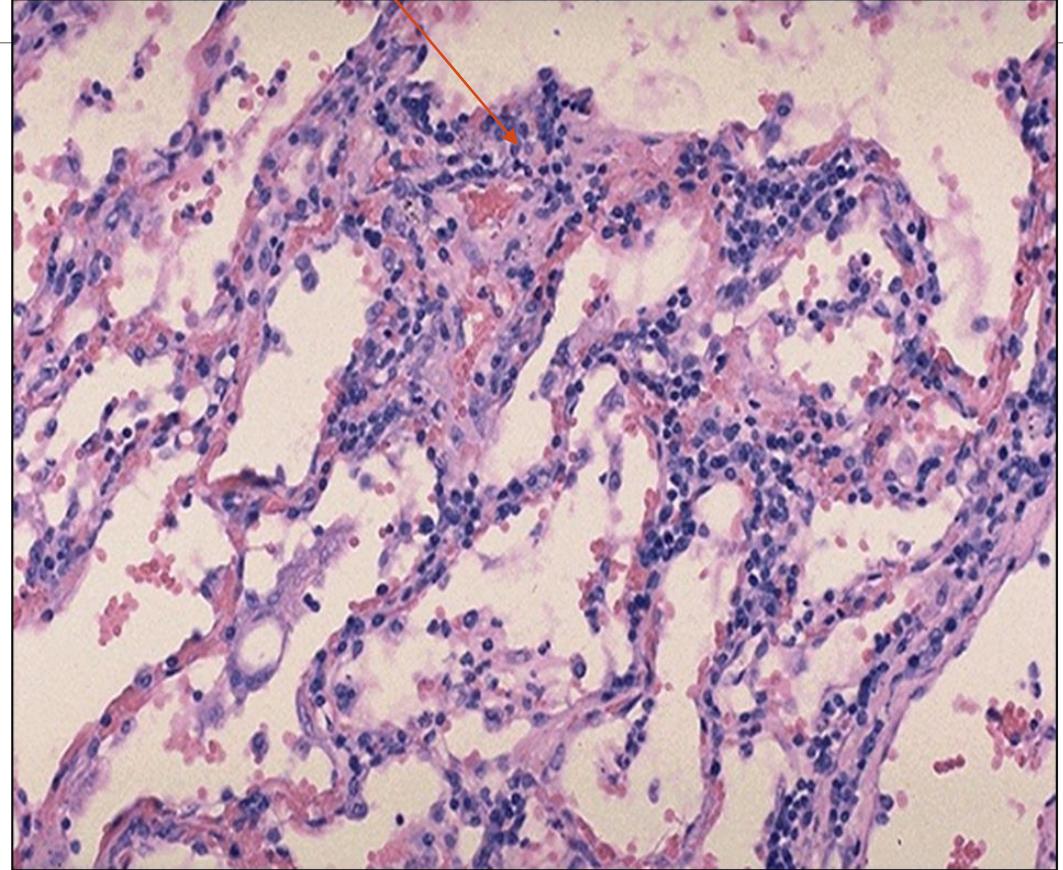
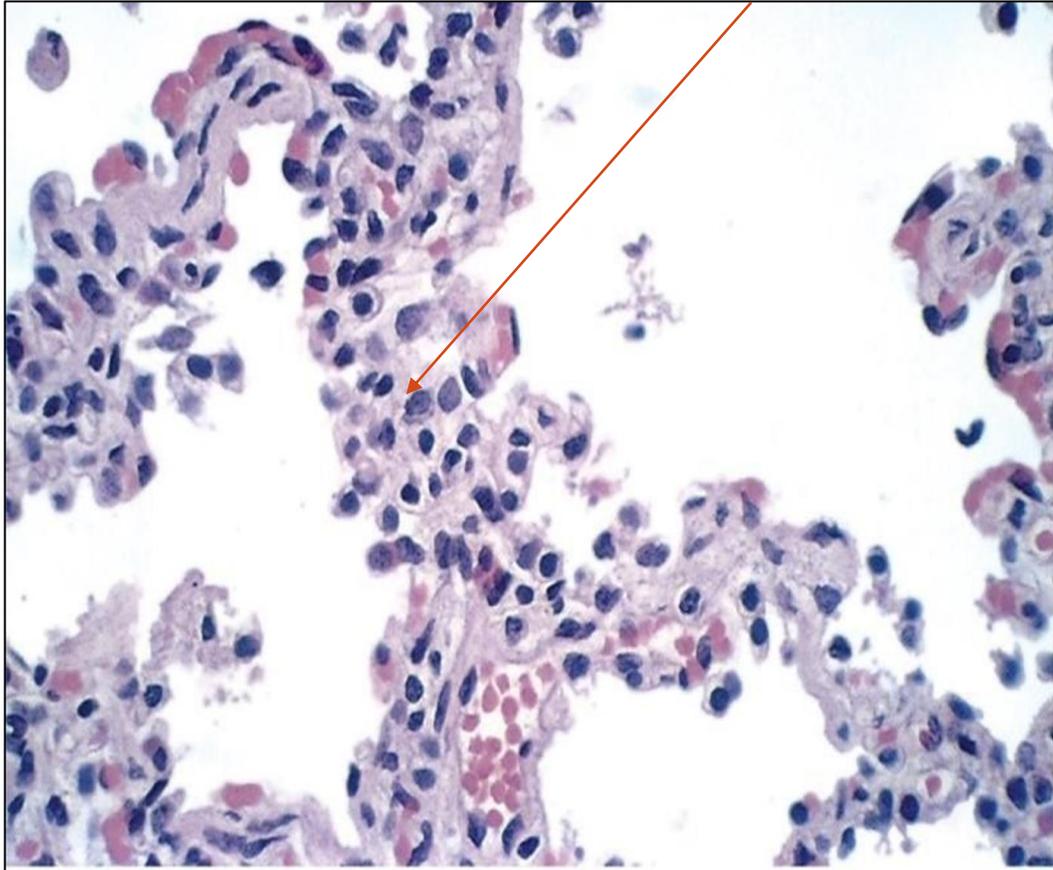
❖ Grossly :

- May be patchy or involve whole lobes bilaterally or unilaterally.
- The areas are red-blue, congested & the pleura is smooth un-inflamed

❖ Microscopically :

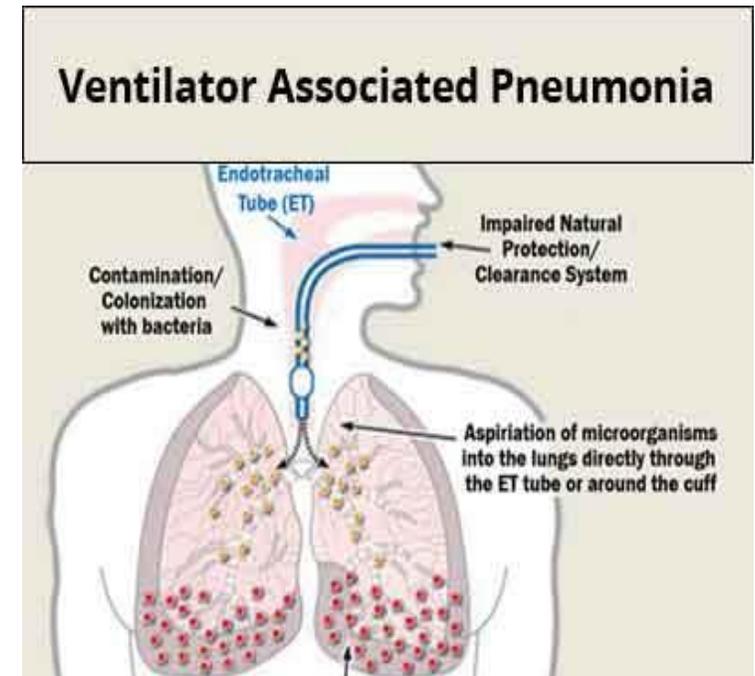
- **The inflammatory reaction is largely confined to the wall of the alveoli (interstitial).**
- The septa are widened & edematous; they usually contain **mononuclear inflammatory cells**, including lymphocytes, histiocytes & occasionally plasma cells.
- **The alveolar spaces are FREE of cellular exudate in classic cases.**

Atypical pneumonia, showing widened thickened alveolar septa infiltrated by lymphocytes with proliferating pneumocytes type II & congested capillaries.



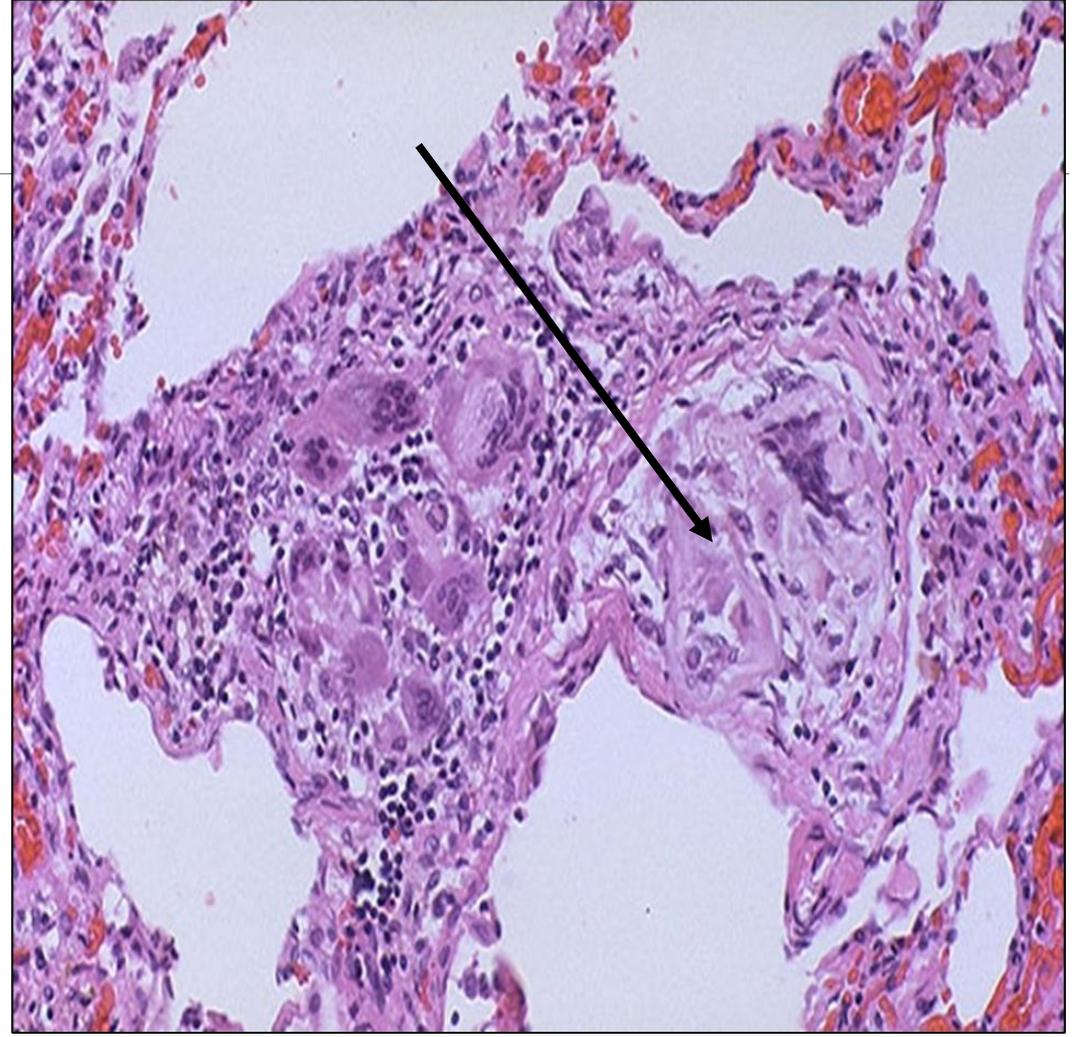
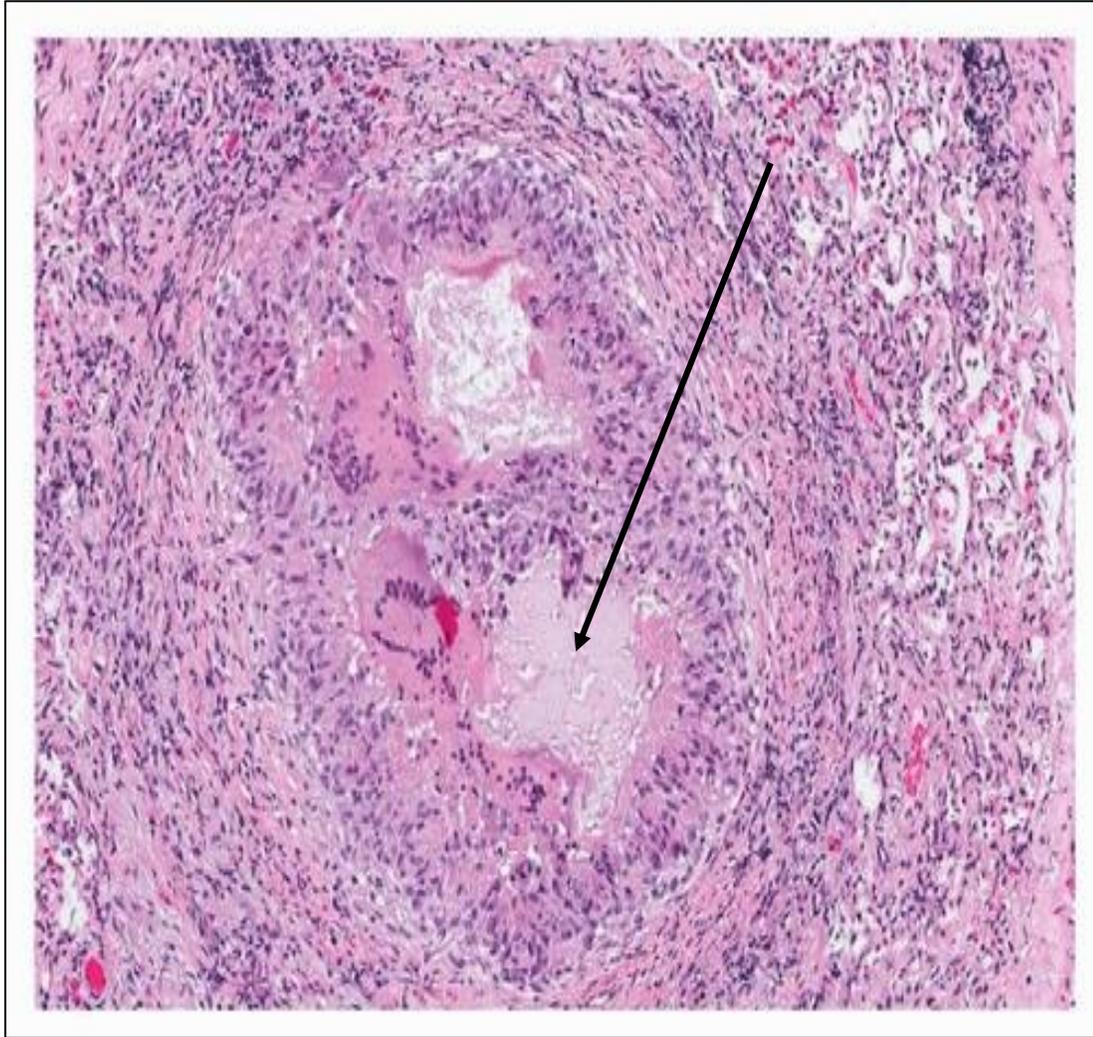
3- Nosocomial pneumonia (Hospital-acquired pneumonia):

- ❖ Is a pulmonary infection acquired during hospital stay (at least 48 hours after admission).
- ❖ It is common among hospitalized patients with severe underlying disease, immune suppression, or prolonged antibiotic therapy.
- ❖ Those on mechanical ventilation represent a high-risk group.
- ❖ Gram-negative rods like **enterobacteria & pseudomonas sp.** & Gram-positive **staph. Aureus** are the most common isolates.



4- Aspiration pneumonia:

- Caused by aspiration of gastric contents either while the patient is unconscious (e.g. stroke) or during repeated vomiting.
- The resultant pneumonia is partly chemical, resulting from the irritating effect of gastric acid, and partly bacterial.
- It is **necrotizing pneumonia** that may be fatal, especially in debilitating patients, but in those who survive, complications like **abscess formation & foreign-body giant cell granulomas are common**.
- Typically, more than one organism is recovered on culture, aerobes being more common than anaerobes



5- Lung abscess:

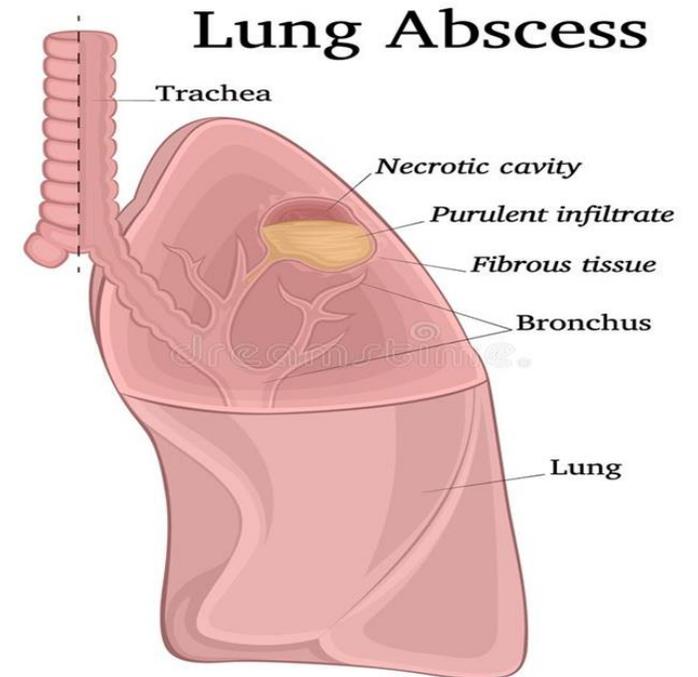
A localized area of suppurative necrosis within pulmonary parenchyma resulting in the formation of one or more large cavities.

Mechanisms of the introduction of causative organisms :

- 1- Aspiration of infective material or gastric content.
- 2- As a complication of bacterial pneumonia & mycotic infections.
- 3- Bronchiectasis.
- 4- Following bronchial obstruction as in tumors.
- 5- Septic embolism from septic thrombophlebitis or infective endocarditis.
- 6- In bacteremia.

Clinically:

- Cough with foul-smelling sputum; hemoptysis may occur.
- Fever, malaise & clubbing of fingers.

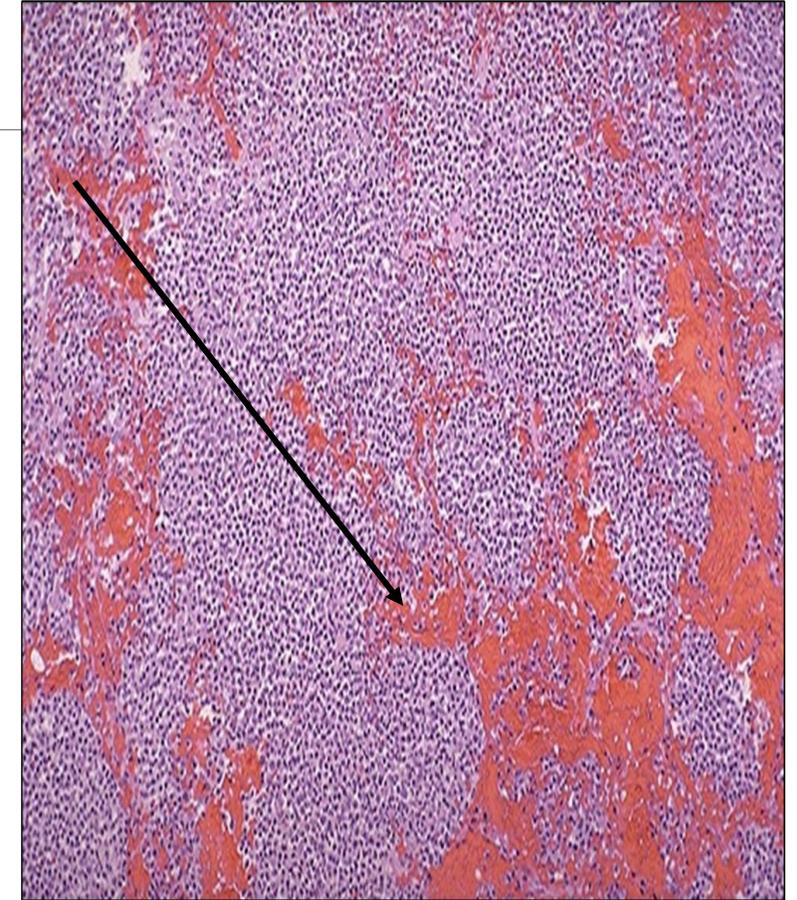
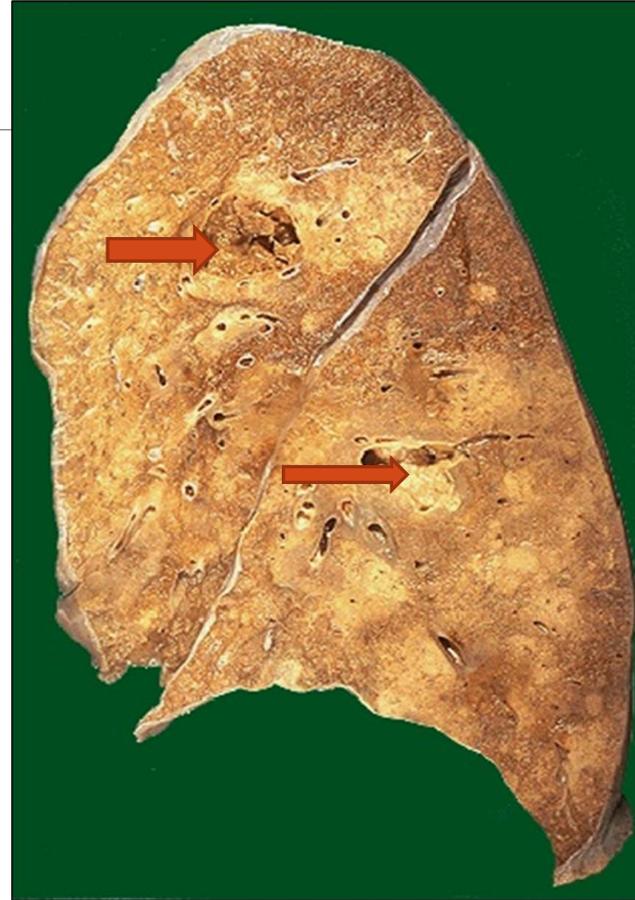


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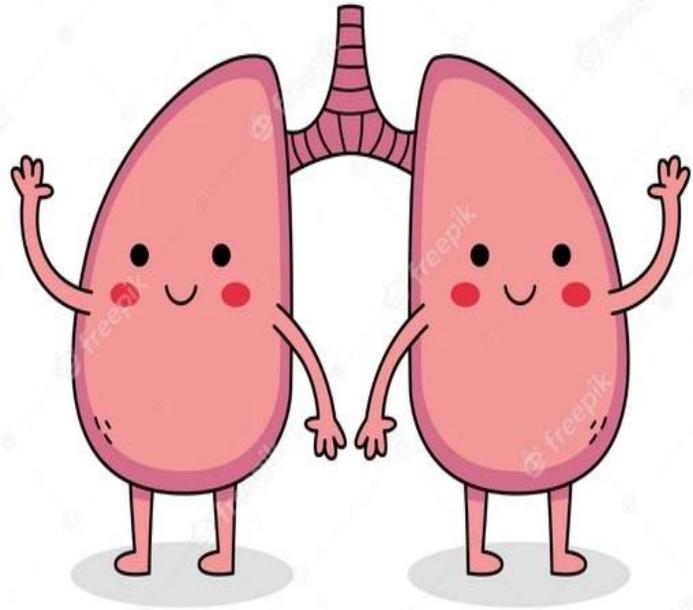
- Vary from a few mm to large **cavities**.

Microscopically:

There is suppurative neutrophilic inflammation surrounded by fibrous scarring & mononuclear cell infiltration, including lymphocytes, plasma cells & macrophages, depending on the chronicity of the lesion.



Irregular-shaped cavities within lung parenchyma



Thank you