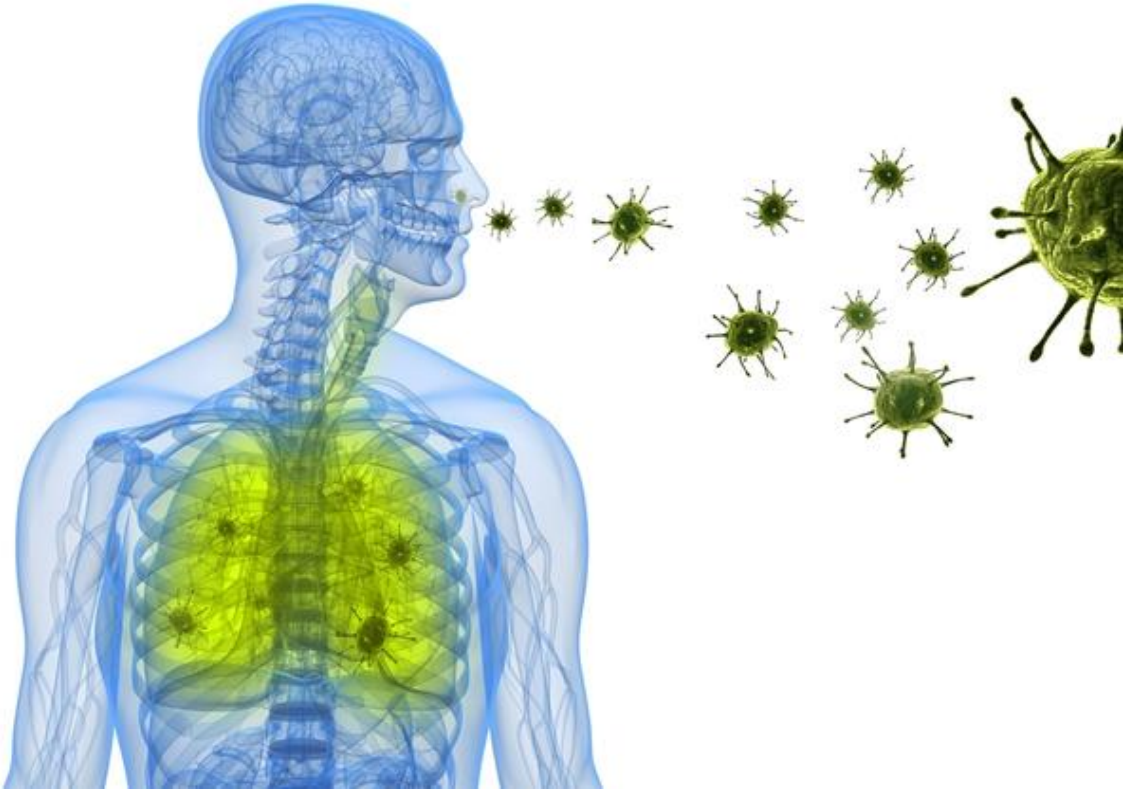
# Pneumonia



@pathology434

**OBJECTIVES:**

- Understand that pneumonia is an inflammatory condition of the lung characterized by consolidation (solidification) of the pulmonary tissue.
- Is aware of the pathogenesis of pneumonia and its classification which principally include bronchopneumonia, lobar pneumonia and atypical pneumonia.
- Is able to appreciate the aetiology and pathogenesis of lung abscess.

**Important note:** During the previous blocks, we noticed some mistakes just before the exam and we didn't have the time to edit the files. To make sure that all students are aware of any changes, please check out this link before viewing the file to know if there are any additions or changes. The same link will be used for all of our work: **Pathology Edit**

**Pneumonia:** Is an inflammation of lung parenchyma associated with consolidation (زياده الكثافه) in parts of the lung.

**Why is there consolidation?**
Because there is exudate (inflammatory infiltrate), fibrin and fluid.

**Consolidation is appreciated by two ways:**
1. Radiology → Chest X-ray or CT scan (computed tomography).
2. Gross examination → When we examine the lung which is infected by pneumonia we'll find its surface firm (normal is spongy) or we call it - solid beefy - and this is because of the edema.

**We classify the diseases according to:**
1. Clinical presentation.
2. Pathology.
3. Etiology (we mention the causal agent e.g. Streptococcal pneumonia, Staphylococcal pneumonia, E. coli pneumonia).

**Classification of pneumonia (clinically):**
1. Community acquired pneumonia.
2. Hospital acquired pneumonia (*Nosocomial pneumonia*): Mostly caused by **Gram Negative Bacilli** - it's resistant to antibiotics - (MRSA).

**Clinical Case:** 60 years old man has hernia. He was admitted to the hospital to have an operation. After the surgery he showed several symptoms: (productive cough, dyspnea, fever, chest pain, chills).
**Diagnosis:** Hospital acquired pneumonia (Nosocomial pneumonia).

**Classification of pneumonia (pathologically):**
- Interstitial (Atypical pneumonia).
- Lobar pneumonia.
- Bronchopneumonia.

**Effusion:** Accumulation of fluid within body cavity (pleural, peritoneal (**ascites**), synovial).

**Complications of pneumonia:** Lung abscess (localized infection) -especially in bacterial pneumonia-, acute inflammation turn to be chronic.

**Abscess:** A cavity lined by inflammatory vascular granulation tissue & contains puss. It can open up to the circulation and reach the brain.

# 1. Interstitial (Atypical) pneumonia.

Type of interstitial lung diseases which can be caused by multiple organisms (Mycoplasma pneumoniae, Chlamydia pneumoniae), but the most common cause in children are viruses (Adenovirus, Respiratory syncytial virus, Rhinovirus, Influenza virus) and they can cause **interstitial infiltrate**[1].

- The major inflammatory cell is **lymphocyte**, so when we find neutrophils it means there's a secondary infection.

Other common cause of atypical pneumonia is **Mycoplasma pneumoniae** which causes **Mycoplasma pneumonia** and it's a community acquired disease.
**Mycoplasma pneumoniae:** Is an organism which is between bacteria and fungi.

**Signs & Symptoms:** Dyspnea, cough, interstitial infiltrate.

**How do we diagnose it?** By **Cold Agglutinin**[2] **Test**. It's called *cold* because we do the test under a low temperature. The mycoplasma will lead to the formation of some IgM in the circulation. We take a blood sample from the patient and add RBC's form a sheep (lamb) to it. The RBC's of the lamb will *agglutinate* because of the IgM.

## Ornithosis (Psittacosis) pneumonia.

Caused by intracellular organism (Not virus nether bacteria) which is called ***Chlamydia psittaci***. This organism can infect also the eyes and the genital areas.

**Who are the people who get ornithosis (Psittacosis) pneumonia?**
People who raise birds, especially parrots[3]. Why? Because the feces - dropping - of the bird contains Chlamydia.

**Symptoms:** Low grade fever, malaise, mild dyspnea, productive cough.

**How to differentiate it from other lung diseases (e.g. asthma) ?** You do a chest X-ray & you'll find a sort of interstitial pneumonitis, then you should ask him if he raise birds or not.

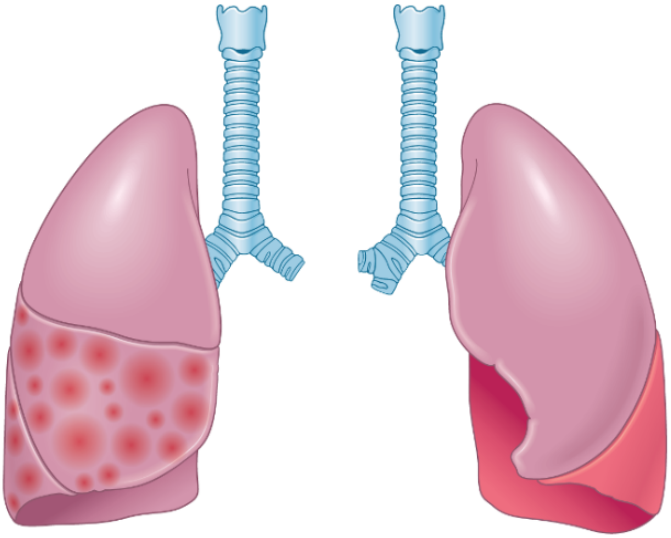
- Please notice that it's different from **bird fancier disease** (*pigeon-breeder's lung)*, which is a type of hypersensitivity pneumonitis that causes very small granuloma in the lungs. It is NOT pneumonia.

[1] Is mainly localized in the alveolar wall and interstitium of the lungs, NOT inside the alveoli or the lumen of the bronchi.

[2] تراصّ

[3] ببغاء.. لهذا السبب اسم البكتيريا المسببة له (المتدثرة الببغائية).

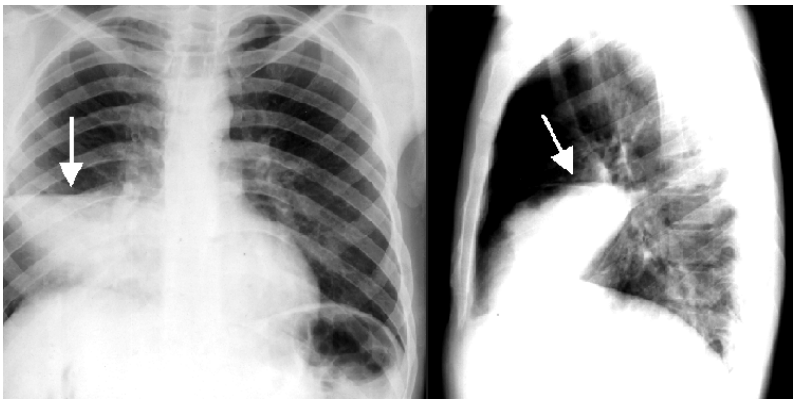
## 2. Lobar pneumonia.

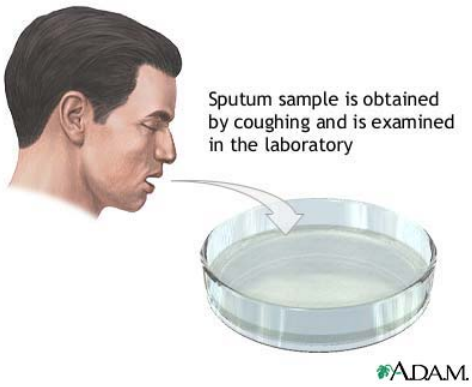



It happens to one lobe in the lung or sometimes two lobes. It is usually community acquired & it's rare nowadays. It's usually caused by **Staphylococcus Pneumoniae (Pneumococci)**. There is vaccine that is given to people who are susceptible to acquire this type of pneumonia: Old weak people, Advanced DM, Debilitating illnesses[4], Immunocompromised). It can cause pleural effusion.

**Symptoms & Signs:** Productive rusty brownish cough, chills, high fever, chest pain, dyspnea, hypoxia.

**How to diagnose?**






- **White Blood Cells Count:** You will find it high + (Band form - shift to the lift - cells)[5].
- Blood culture won't be always positive so it's better to do sputum culture.
- **X-ray:** You'll find consolidation.

[4] Diseases that causes weakness.
[5] Immature WBC which are produced by bone marrow and released to the peripheral blood because of the increase demand of them.

**If not treated, what will happen?**

- **Congestion:** You will find congestion in the alveolar wall with little exudate and increased vascular permeability.
- **Red hepatization:** A lot of fibrin and neutrophils within the alveoli.
- **Gray hepatization:** RBC's, macrophages, little amount of neutrophils.
- **Resolution:** Very little fibrin, more macrophages, less neutrophils and the infection will subside[6]

**Why it's called hepatization?** Because of the consolidation it won't be spongy anymore, it will be firm and looks like the liver (Hepatic).

## 3. Bronchopneumonia.

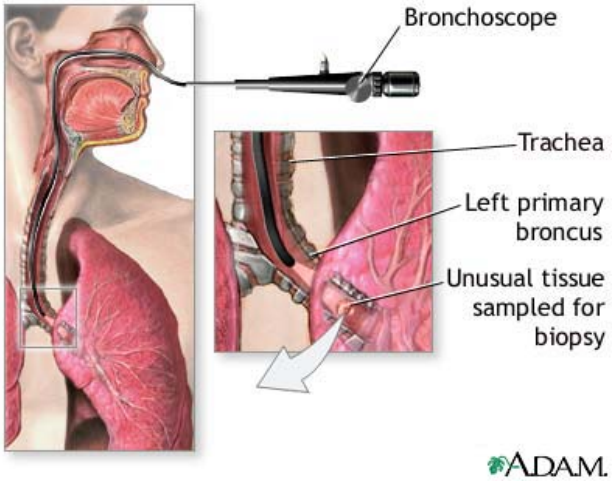
**Multifocal** and **patchy** inflammation of the bronchi, and surrounding the alveoli. It can affect more than one lobe in the same lung or both lungs. It can be caused by any organism. Usually there's a predisposing cause (DM, smoking, old age, COPD, morbidity).

- It can be secondary to TB.

**Immunocompromised:** Is someone who has weakened immunity because of (Malignancy, chemotherapy, autoimmune diseases which is treated by cytotoxic therapy & corticosteroids, AIDS). It's the opposite of ***Immunocompetent***.

AIDS patients can easily acquire pneumonia (e.g. fungal pneumonia is very hard to infect healthy people but it infects AIDS people easily)

**Clinical case:** 40 years old man travels a lot. He came to the hospital with severe dyspnea and cough for the last 3 weeks. You do an x-ray for him and he shows **reticulonodular shadowing** in both sides of the lungs. After that you perform a test called **BAL (Bronchoalveolar lavage).**




**How do we perform BAL?**

We use a bronchoscope to reach the lungs then we squirt a fluid and collect it for examination.

[6] Go away.

When you perform BAL test you find *soup bubble exudate* but you don't find any inflammatory cells in the lungs. **Why?** Because he is immunosuppressed. You do ***Silver Stain*** - for the bacteria - and you find an organism called ***pneumocystis jiroveci*** (Fungus). Pneumocystis jiroveci is the most common cause of pneumonia in HIV patients. You test his blood and you find a decrease in WBC's level. Then you take the serum & do a molecular testing for HIV virus. The test will be positive for sure.

- Other type of infection that can affect immunocompromised patients is *fungal infection* (It rarely - never affects healthy people). E.g Aspergillus.

## SUMMARY

### Acute Pneumonias

- *S. pneumoniae* (the pneumococcus) is the most common cause of community-acquired acute pneumonia, and the distribution of inflammation is usually lobar.
- Morphologically, lobar pneumonias evolve through four stages: congestion, red hepatization, gray hepatization, and resolution.
- Other common causes of acute pneumonias in the community include *H. influenzae* and *M. catarrhalis* (both associated with acute exacerbations of COPD), *S. aureus* (usually secondary to viral respiratory infections), *K. pneumoniae* (observed in patients who are chronic alcoholics), *P. aeruginosa* (seen in persons with cystic fibrosis, in burn victims, and in patients with neutropenia), and *L. pneumophila,* seen particularly in organ transplant recipients.
- In contrast with acute pneumonias, *atypical pneumonias* are characterized by respiratory distress out of proportion to the clinical and radiologic signs, and by inflammation that is predominantly confined to alveolar septa, with generally clear alveoli.
- The most common causes of atypical pneumonias include those caused by *M. pneumoniae,* viruses including influenza viruses types A and B, human metapneumovirus, *C. pneumoniae,* and *C. burnetii* (agent of Q fever).

# Direct Questions.

1. **When do we give antibiotic in viral pneumonia condition?**

We give if there is secondary infection from bacteria.

2. **Why bronchopneumonia usually distribute in lower lobe?**

Because it is affected by gravity.

3. **Why in Pneumocystis carinii pneumonia there is no immune response or little?**

Because it affects immunocompromised patient especially HIV patient.

# MCQ's.

1. **A 35-year-old woman has experienced multiple bouts of severe necrotizing pneumonia with *Haemophilus influenzae,Staphylococcus aureus, Pseudomonas aeruginosa,* and *Serratia marcescens* cultured from her sputum since childhood. She now has for weeks at a time a cough productive of large amounts of purulent sputum. On physical examination, there is dullness to percussion with decreased breath sounds over the right mid to lower lung fields. A chest radiograph shows areas of right lower lobe consolidation. A bronchogram shows marked dilation of right lower lobe bronchi. Which of the following mechanisms is the most likely cause of airspace dilation in this patient?**
   A. Congenital weakness of supporting structures of the bronchial wall
   B. Diffuse alveolar damage
   C. Destruction of bronchial walls by recurrent inflammation
   D. Damage to bronchial mucosa by major basic protein of eosinophils

**Ans: C, This patient has a typical history of bronchiectasis. In this condition, irreversible dilation of bronchi results from inflammation and destruction of bronchial walls after prolonged infections.**

2. **A homeless alcoholic presents to your emergency department complaining of cough, rigors, pleuritic chest pain, and difficulty breathing. Chest radiograph shows a right upper-lobe pneumonia. What organism must be considered?**
   A. Klebsiella pneumonia
   B. Pneumococcus
   C. coliform bacteria.
   D. Pseudomonas Aeroginosa

**Ans:B, Bronchopneumonia"involvement of the entire lobe". Klebsiella pneumonia rarely occurs.**

3. **A patient came to the ER with High fever, dyspnea and a rusty cough. Histological investigations showed high neutrophils count and left shift in neutrophil count. What is the most likely diagnosis?**
   A. Bronchopneumonia
   B. Aspergillus Pneumonia
   C. Mycoplasma Pneumonia
   D. Lobar Pneumonia

**Ans:D**

4. **A patient diagnosed with Viral Pneumonia. After period of time he developed Secondary bacterial infection. What is the most common etiological cause?**
   A. E.coli
   B. streptococcus
   C. Influenza A
   D. staphylococcus

**Anc:D**

5. **in-patient presented with pneumonia, what is the most commonly is the causing organism?**

A. E.coli
B. Gram negative bacteria
C. Pseudomonas aeruginosa
D. All are correct

**Anc:D**

6. **Which features best characterises Pneumocystis carinii pneumonia (PCP)?**
   A. It usually presents as lobar pneumonia
   B. Tuberculosis and atypical mycobacterium infection must be ruled out if PCP is suspected
   C. Diagnosed by Cold agglutinant test
   D. localized suppurative necrotic process within the pulmonary parenchyma

**Anc:B, It happens to immunocompromised patients**

7. **Atypical Pneumonia is also known as?**

A. Lobar Pneumonia
B. Bacterial Pneumonia
C. Interstitial Pneumonia
D. Community acquired Pneumonia

**Anc:C**

8. **A patient diagnosed with lobar Pneumonia. Sputum cytology showed fibrin and neutrophils. Which Pathological stage is the patient in?**

A. Gray hepatization
B. Red hepatization
C. Congestion
D. Resolution

**Anc:B**

9. **6- A patient diagnosed with lobar Pneumonia. Sputum cytology showed increase number of macrophages and decreased neutrophils. Which Pathological stage is the patient in?**

A. Red hepatization
B. Congestion
C. Gray hepatization
D. Resolution

**Anc:C**

10. **A patient has Pneumocystis carinii pneumonia. The Doctor ordered a bronchial lavage. What will in most likely show?**

A. Bubble gum transudate
B. Soap bubble exudate
C. Triple bubble Exudate
D. Double bubble transudate

**Anc:B**

11. **What is the old test used in case of Mycoplasma Pneumonia?**

A. Hot Agglutinin test
B. Worm Agglutinin test
C. Cold Agglutinin test
D. Polymerase chain reaction

**Anc:C**

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## Good Luck!

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