PATHOLOGY TEAM 436

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MEDICINE
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سهلاً شئت إن الحزن تجعل وأنت سهلاً جعلته ما إلا سهلًا لا اللهم

Pneumonia

Objectives:

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

Doctor notes: green
Important : red
Extra explanation grey

Pneumonia: Is an inflammation of lung parenchyma which is caused by an infectious agent

(e.g. of infectious agent: it could be bacteria, virus, parasite, fungus, mycoplasma and chlamydia)

We classify the pneumonia according to:

1. Anatomy of the lung which is affected (Pathology)
2. Clinical presentation (or description).
3. Etiology (we mention the causal agent e.g. Streptococcal pneumonia, klebsiella pneumonia, aspergillus pneumonia).

Classification of pneumonia (pathologically):

- Interstitial (Atypical pneumonia).
- Lobar pneumonia.
- Bronchopneumonia.

Classification of pneumonia (clinically):

1. Community acquired pneumonia: most are bacterial in origin
   The most common cause:(*pneumococcal pneumonia*, and sometimes:: Haemophilus influenzae, Moraxella catarrhalis, Staphylococcus aureus, Legionella pneumophila, Klebsiella pneumoniae and Pseudomonas aeruginosa spp)
   Community acquired pneumonia means: pneumonia seen in some population in a certain area, e.g. an outbreak of pneumonia in nursery- حضانة- of king Khalid university hospital 10 children out of 25 get pneumonia) أو مثل جمعية البر في الرياض فاتحة مأوى لدار العجزة حصل بينهم انتشار للنومونيا
2. Hospital acquired pneumonia (*Nosocomial pneumonia*): Mostly caused by **Gram Negative Bacilli** (it loves hospital, especially **pseudomonas aeruginosa**) - it's resistant to antibiotics - (MRSA).
   (if there is someone told you about hospital infection in the surgical ward, you should thing about gram Negative Bacilli –بيقولك هذا الشخص الله أكبر كيف عرفت ياأخي لاسويت زراعة ولاسويت شيء)

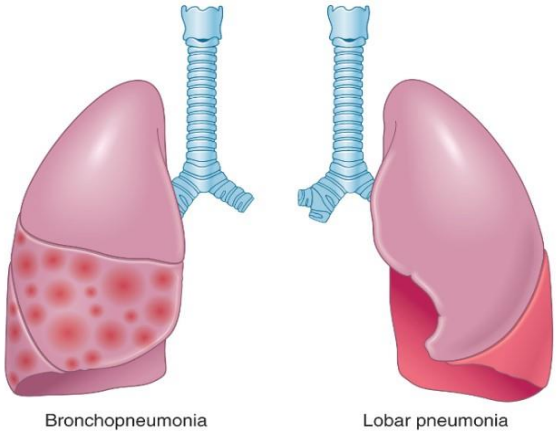
Clinical Case: 60 years old man has hernia. He was admitted to the hospital to have an operation. After the surgery he showed several symptoms: (productive cough, dyspnea, fever, chest pain, chills). **Diagnosis:** Hospital acquired pneumonia (Nosocomial pneumonia) ------> Gram Negative Bacilli.

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. Lobar pneumonia.

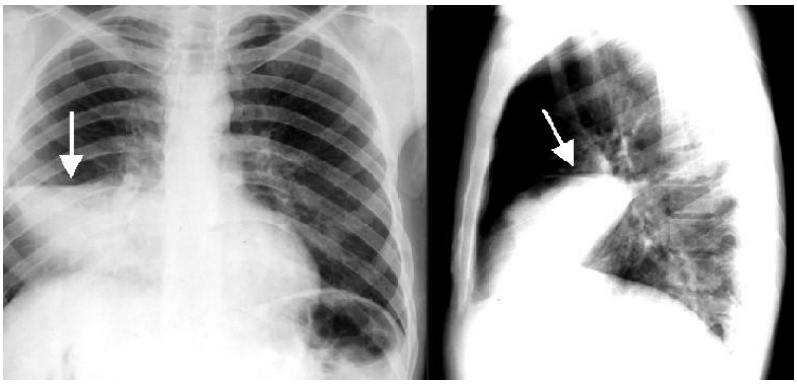


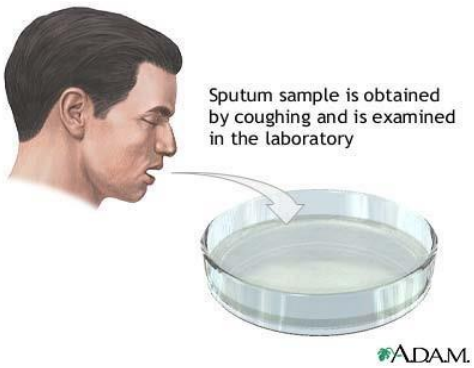
It happens to one lobe in the lung or sometimes two lobes. It is usually community acquired & it's rare nowadays (because of the advances in antibiotics, prophylactics and improvement of personal hygiene-النظافة الشخصية). It's usually caused by **Streptococcus pneumoniae (Pneumococci)**-responsible for more than of 90% lobar pneumonia. **There is vaccine that is given to people who are susceptible to acquire this type of pneumonia**: [Old weak people (vulnerable people: who has multiple diseases-عنده أشكال ألوان من الأمراض), Advanced DM, Debilitating illnesses[1],alcoholic, Immunocompromised]. It can cause pleural effusion.

Symptoms & Signs: Productive purulent sputum (rusty brownish sputum), chills, malaise, very high fever, pleuritic chest pain, dyspnea (Not severe like the other diseases), hypoxia.

Why is there rusty sputum?
Because it contains small amount of blood and hemosiderin.

How to diagnose?





- You found that one or two lobes (never patchy or never foci) **usually entire lobe** (maybe in one lung or two)
- **White Blood Cells Count:** You will find it high + (Band form - shift to the lift - cells)[2].
- Blood culture won't be always positive so it's better to do sputum culture.
- **X-ray:** You'll find increase density (because this type of pneumonia **causes consolidation of lung**).

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

Why is there consolidation?
Because there is exudate (inflammatory infiltrate), fibrin, colonies of bacteria and fluid. It is filling bronchiole, branches of the bronchi and the alveoli so it becomes very solid so you will see it in the X-ray white area.

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.

Lobar pneumonia goes into four pathological stages? (these usually happens following the treatment)

- **Stage I: Congestion:** You will find congestion in the alveolar wall with little exudate and increased vascular permeability.
- **Stage II: Red hepatization:** A lot of fibrin, bacteria, exudative fluid and neutrophils (acute inflammatory cells) within the alveoli.
- **Stage III: Gray hepatization:** The neutrophils become much less in number and they are replaced by more macrophages (so we will find phagocytosis of the debris, removal of fibrin).
- **Stage IV: Resolution:** Very little fibrin, more macrophages, less neutrophils and the infection will subside[3]

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).

During these period people who have Lobar pneumonia may develop complication:
- pleuritis (inflammation of the pleura)
- empyema (accumulation of pus in the pleural cavity) ----> (usually caused by extension of the acute inflammation to the pleura)
- an abscess with fluid level -----> you will see it in the X-ray as a cavity with fluid level (as a result of Resolution from the inflammation but sometimes the inflammation will go away without forming any abscess)
- septicemia

2. Bronchopneumonia.

Multifocal and **patchy** inflammation and infection of the bronchi, bronchiole and surrounding parenchyma. Usually it involves lower lobes (basal),It can affect more than one lobe in the same lung or both lungs. It can be caused by any organism (one of the important organism is **Staphylococcus aureus** always cause Bronchopneumonia as secondary to flu or to other virus illnesses or upper respiratory tract infection). Usually there's a predisposing cause (DM, smoking, old age, COPD, morbidity, (sometimes patient with severe burns usually because of pseudomonas aeruginosa and sometimes with alcoholic people usually because of klebsiella pneumonia).

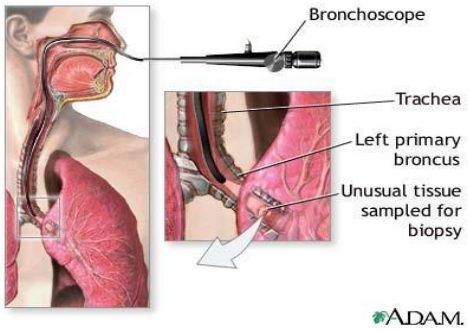
- It can be secondary to TB.

Immunocompromised: In 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)

[3] Go away.

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.

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.

3. Interstitial (Atypical) pneumonia.

Type of interstitial lung diseases which can be caused by multiple organisms (Mycoplasma pneumoniae, Chlamydia pneumoniae)-Most commonly mycoplasma and viruses- but the most common cause in children are viruses (Adenovirus, Respiratory syncytial virus, Rhinovirus, Influenza virus) and they can cause **interstitial infiltrate**[4].

- The major inflammatory cell is **lymphocyte**, so when we find neutrophils it means there's a secondary infection. (If bacterial, it is most characteristically associated with neutrophilic leukocytosis with an increase in band neutrophils ("shift to the left")).

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

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 classified as bacteria but without cell wall (this is why it takes many forms and very difficult to culture).

Signs & Symptoms (the same for Atypical pneumonia): Dyspnea, fever, malaise, cough, interstitial infiltrate (it happened in few days' unlike restrictive lung disease which is chronic).

How do we diagnose it? By **Cold Agglutinin[5] 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 (some sort of a bacteria) which is called ***Chlamydia psittaci*** (likes to live inside the cell). This organism can infect also the eyes (It cause trachoma of the eye and we call it chlamydia trachomatis) and the genital areas -noble organs ☺ - (it cause nonspecific urethritis).

Who are the people who get ornithosis (Psittacosis) pneumonia?

People who raise birds, especially parrots[6]. Why? Because the feces - dropping - of the bird contains Chlamydia.

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

How do we diagnose it? By complement fixation test

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, also by complement fixation test 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(the person allergic to the proteins inside those droppings)that causes very small granuloma in the lungs. It is NOT pneumonia.

[5] تراصّ

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

read it quickly

Table 12–6 The Pneumonia Syndromes and Implicated Pathogens

Community-Acquired Acute Pneumonia
Streptococcus pneumoniae
Haemophilus influenzae
Moraxella catarrhalis
Staphylococcus aureus
Legionella pneumophila
Enterobacteriaceae (*Klebsiella pneumoniae*) and Pseudomonas spp.
Community-Acquired Atypical Pneumonia
Mycoplasma pneumoniae
Chlamydia spp.—Chlamydia pneumoniae, Chlamydia psittaci, Chlamydia trachomatis
Coxiella burnetii (Q fever)
Viruses: respiratory syncytial virus, human metapneumovirus, parainfluenza virus (children); influenza A and B (adults); adenovirus (military recruits)
Nosocomial Pneumonia
Gram-negative rods belonging to Enterobacteriaceae (*Klebsiella* spp., *Serratia marcescens*, *Escherichia coli*) and *Pseudomonas* spp.
S. aureus (usually methicillin-resistant)
Aspiration Pneumonia
Anaerobic oral flora (*Bacteroides*, *Prevotella*, *Fusobacterium*, *Peptostreptococcus*), admixed with aerobic bacteria (*S. pneumoniae*, *S. aureus*, *H. influenzae*, and *Pseudomonas aeruginosa*)
Chronic Pneumonia
Nocardia
Actinomyces
Granulomatous: *Mycobacterium tuberculosis* and atypical mycobacteria, *Histoplasma capsulatum*, *Coccidioides immitis*, *Blastomyces dermatitidis*
Necrotizing Pneumonia and Lung Abscess
Anaerobic bacteria (extremely common), with or without mixed aerobic infection
S. aureus, *K. pneumoniae*, *Streptococcus pyogenes*, and type 3 pneumococcus (uncommon)
Pneumonia in the Immunocompromised Host
Cytomegalovirus
Pneumocystis jiroveci
Mycobacterium avium complex (MAC)
Invasive aspergillosis
Invasive candidiasis
"Usual" bacterial, viral, and fungal organisms (listed above)

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

Ans: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

Ans: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

Ans: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

Thank you

حاجتي وقت إلي فرده حفظت وما قرأت ما استودعتك إني اللهم

Girls

Munirah aldofyan

Rawan Alwadee

Do’aa Abdulfattah

Fatima Alangari

Raneem Alghamdi

wejdan alzaid

Najd Altheeb

haneen alsubki

samar alqahtani

lama alfawzan

Boys

Faisal Algharbi

Talal AlEnezi

Essam AlShahrani

Abdulkarim alOtaibi

Moataz ltokhais

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