

PNEUMONIA

- **Pneumonia** is defined as inflammation of the substance of the lungs. It is usually caused by bacteria but can also be caused by viruses and fungi. Clinically, it usually presents as an acute illness with cough, purulent sputum, breathlessness and fever together with physical signs or radiological changes compatible with consolidation of the lung
- Most pneumonia occurs when a breakdown in your body's natural defenses allows germs to invade and multiply within your lungs. To destroy the attacking organisms, white blood cells rapidly accumulate. Along with bacteria and fungi, they fill the air sacs within your lungs (alveoli).

# • Stages of pneumonia

## **-Stage 1 (congestion)**

occurs within 24 hours of infection. Many bacteria are present in the lungs but few white blood cells are available to fight the infection. The lungs may look red from increased blood flow and swelling of the lung tissue.

## **-Stage 2 (red hepatization)**

occurs after 48 to 72 hours and lasts for about 2 to 4 days. The affected lung becomes more dry, granular and airless and resembles the consistency of liver. Red cells, white cells, bacteria and cellular debris can clog the lung airways.

## **-Stage 3 (grey hepatization)**

occurs on day 4 to 6 and continues for 4 to 8 days. The lung looks grey or yellow in color but still has the consistency of liver. Fibrin, hemosiderin and red blood cells break down and lead to a more fluid-like exudate. Macrophages, a type of large white blood cell, start to form.

## -Stage 4 (resolution)

is the final recovery stage and occurs during days 8 to 10. Fluids and breakdown products from cell destruction are reabsorbed. Macrophages (large white blood cells) are present and help to clear white blood cells (neutrophils) and leftover debris. You may cough up this debris. The airways and air sacs (alveoli) return to normal lung function. Any remaining lung swelling may lead to chronic lung disease (such as airway narrowing or pleural adhesions)

- Factors which increase the risk of developing pneumonia :

- Age: <16 or >65 years
- Co-morbidities: HIV infection, diabetes mellitus, chronic kidney disease, malnutrition, recent viral respiratory infection
- Other respiratory conditions: cystic fibrosis, bronchiectasis, COPD, obstructing lesion (endoluminal cancer, inhaled foreign body)
- Lifestyle: cigarette smoking, excess alcohol, intravenous drug use
- Iatrogenic: immunosuppressant therapy (including prolonged corticosteroids)

# Classification of pneumonia

A- Anatomical classification

B- Etiological classification

C-Clinical classification

# Anatomy of lung

- **The Right lung has three lobes :**

- upper lobe

- middle lobe

- lower lobe

- **The left lung has two lobes :**

- upper lobe

- lower lobe

## • Segments of the right lung :

### upper lobe segments :

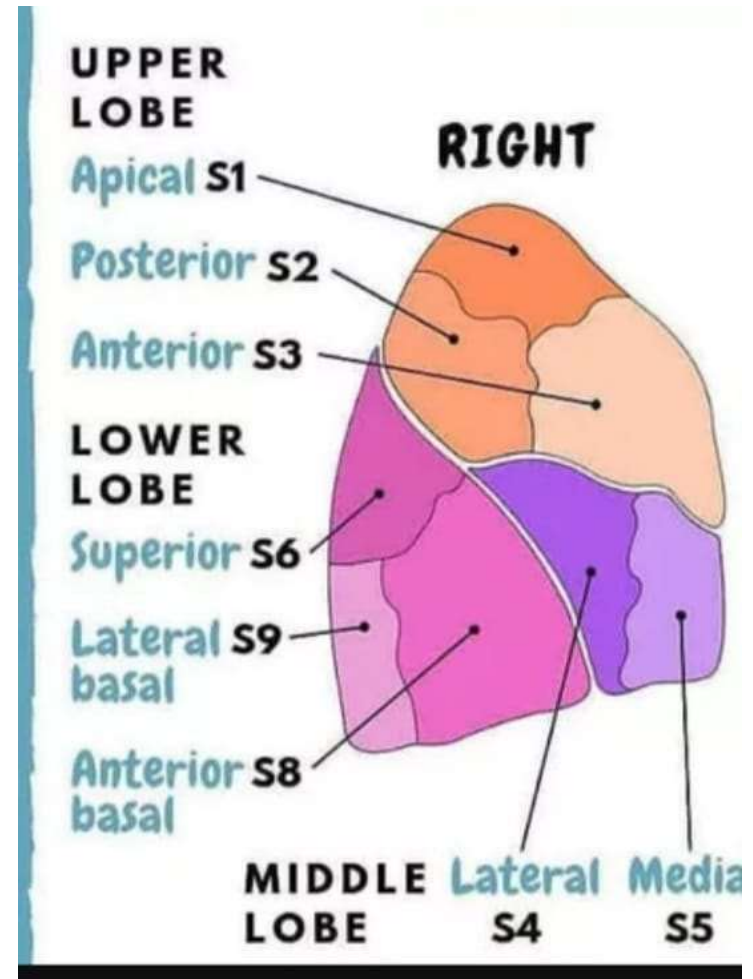
- Apical segment
- anterior segment
- posterior segment

### Middle lobe segments:

- lateral segment
- medial segment

### Lower lobe segments :

- superior segment
- medial basal
- anterior basal
- lateral basal
- posterior basal





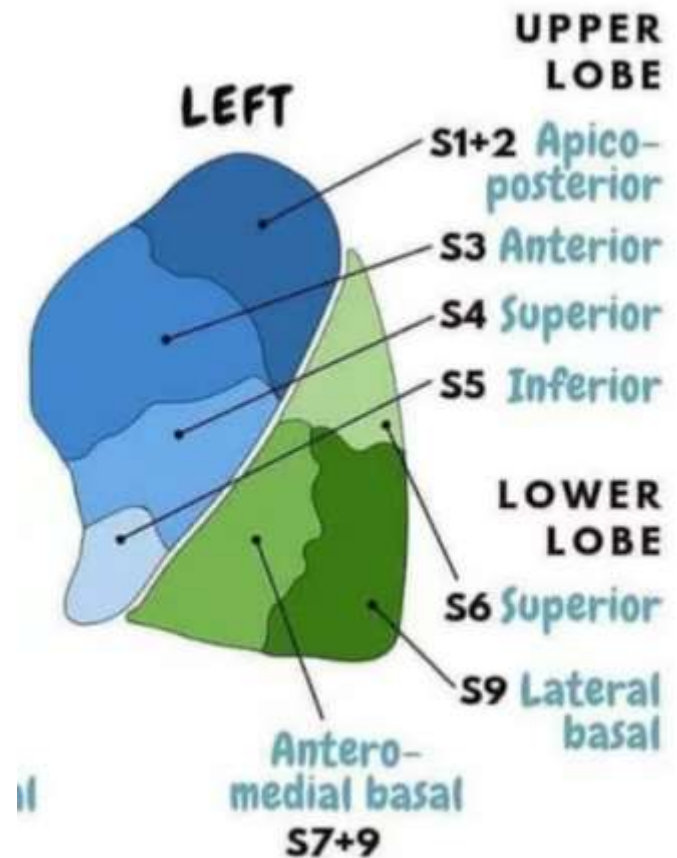
## • Segments of the Left lung :

### upper lobe segments:

- apical posterior segment
- anterior segment
- superior lingular segment
- inferior lingular segment

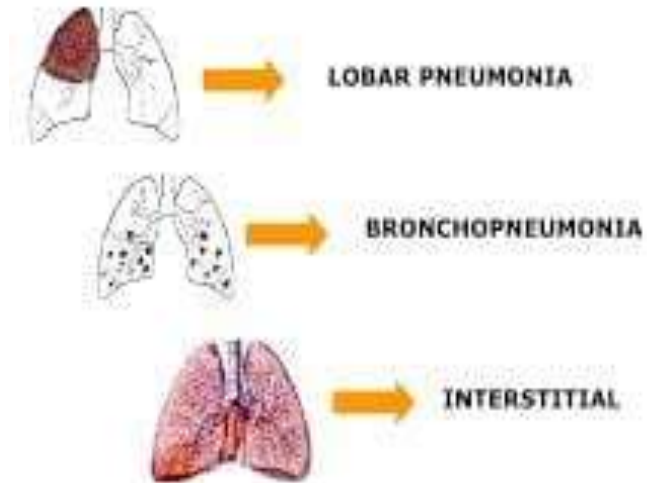
### Lower lobe segments :

- superior segment
- medial basal
- anterior basal
- lateral basal
- posterior basal



# Anatomical classification of pneumonia

- 1- lobar pneumonia
- 2- Bronchopneumonia
- 3- interstitial pneumonia



# Lobar pneumonia

- **Definition :**

is a form of pneumonia characterized by inflammatory exudate within the intra-alveolar space resulting in consolidation that affects large and continuous area of the lobe of a lung.

- **Causes of lobar pneumonia :**

-The most common organisms are *Streptococcus pneumoniae*, also called pneumococcus, *Haemophilus influenzae* and *Moraxella catarrhalis*.

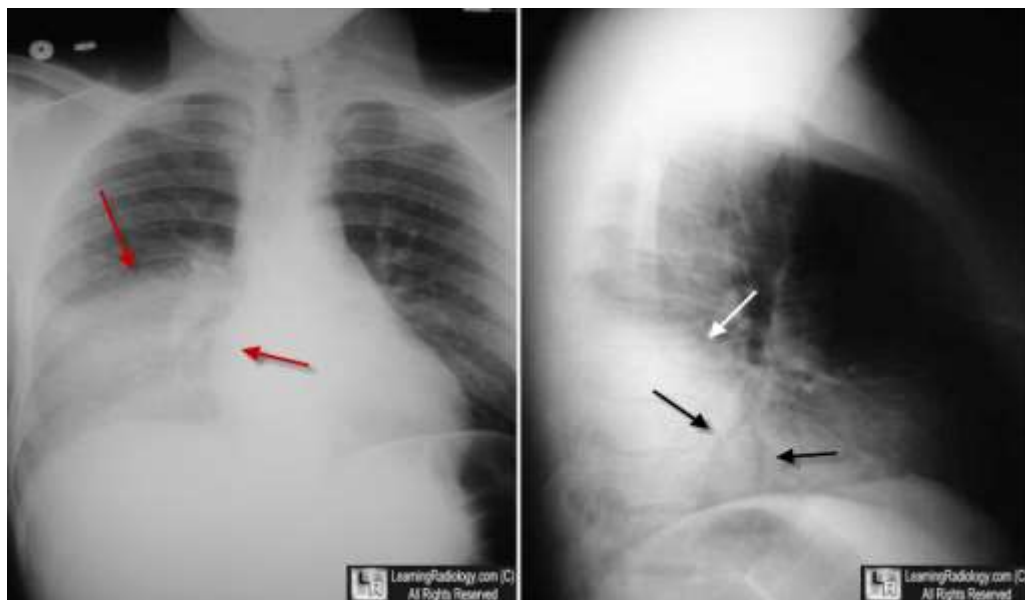
-*Mycobacterium tuberculosis*, the tubercle bacillus, may also cause lobar pneumonia if pulmonary tuberculosis is not treated promptly.

-Other organisms that cause lobar pneumonia are *Legionella pneumophila* and *Klebsiella pneumoniae*.

- Diagnosis :

## Chest x-ray :

On a posteroanterior and lateral [chest radiograph](#), an entire lobe will be radiopaque, which is indicative of lobar pneumonia



CXR PA and Lateral view showing infiltration (consolidation) of the right lower lobe typical for lobar pneumonia





CXR PA and Lateral view showing infiltration (consolidation) of the upper left lobe typical for lobar pneumonia

# Bronchopneumonia

- **Definition:**

It is the acute inflammation of the bronchi, accompanied by inflamed patches in the nearby lobules of the lungs

- **Causes:**

- Bronchopneumonia is usually a bacterial pneumonia rather than being caused by viral disease.

- It is more commonly a hospital-acquired pneumonia than a community-acquired pneumonia, in contrast to lobar pneumonia.

- Bronchopneumonia is less likely than lobar pneumonia to be associated with *Streptococcus pneumoniae*. Rather, the bronchopneumonia pattern has been associated mainly with the following: *Staphylococcus aureus*, *Klebsiella*, *E. coli* and *Pseudomonas*.



X-ray :Bilateral Bronchopneumonia  
-Centrilobular and peribronchiolar pneumonia  
-Multifocal patchy in distribution rather than localized to any one lung region

- **Nonspecific interstitial pneumonia (NSIP)**

**definition :**

is a rare disorder that affects the tissue that surrounds and separates the tiny air sacs of the lungs. These air sacs, called the alveoli, are where the exchange of oxygen and carbon dioxide takes place between the lungs and the bloodstream.

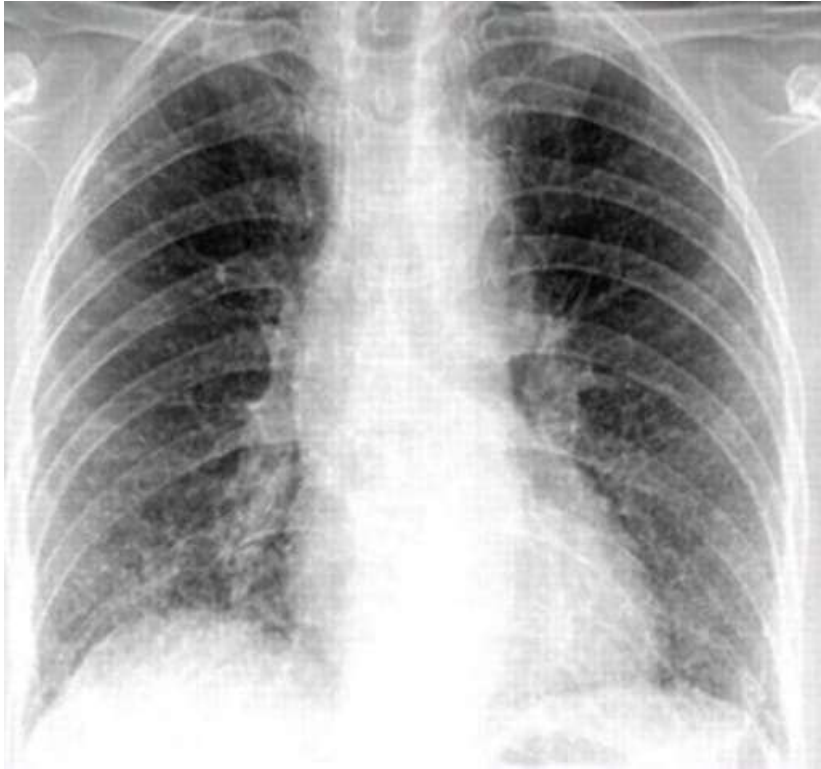
**Causes :**

-Many researchers believe that it is an autoimmune disease, because of the similarities between NSIP and certain connective tissue diseases, such as systemic sclerosis.

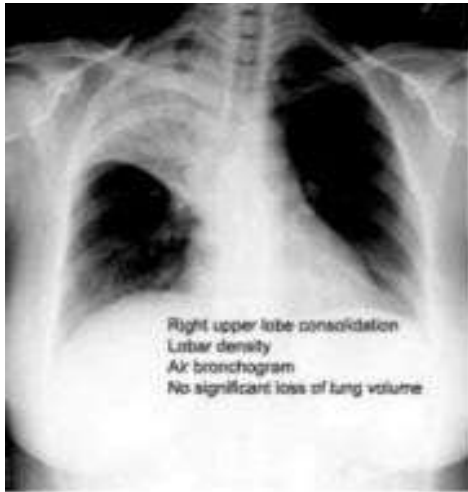
-Some researchers suggest that genes are involved, with heredity playing a role in its development.

-Inhaling chemicals or dust, use of certain chemotherapy drugs, or radiation treatment could result in the lung damage associated with NSIP.





X-ray :interstitial pneumonia  
Peribronchovascular infiltration



## Lobar Pneumonia

- Involves single lobe
- Unilateral



## Interstitial Pneumonia

- Involves interstitial space
- Ground glass appearance
- Bilateral, symmetrical



## Bronchopneumonia

- Central bronchi involved
- Patchy bilateral disease
- Asymmetrical

## Clinical classification of pneumonia:

- Community- acquired (primary) pneumonia : typical or atypical pneumonia.
- Hospital – acquired (nosocomial) pneumonia
- Aspiration pneumonia
- Pneumonia in the immunocompromised host including AIDS

- **COMMUNITY-ACQUIRED PNEUMONIA:**

- *occurs in previously healthy individual. Normal pulmonary defense mechanisms prevent the development of lower respiratory tract infection .*
- *Occurs when there is a defect in normal host defense mechanism*
- *There is a large infectious inoculum*
- *Highly virulent pathogen defeats immunity .*

## *Typical pneumonia*

- Common agents :
- 1- *S pneumoniae* (60%)
- 2- *Haemophilus influenzae* (15%)
- 3- Aerobic gram-negative rods (6% to 10%)-  
*Klebsiella* (and other *Enterobacteriaceae*)
- 4- *S-aureus* (2% to 10%)

# Clinical features:

- 1- SYMPTOMS:

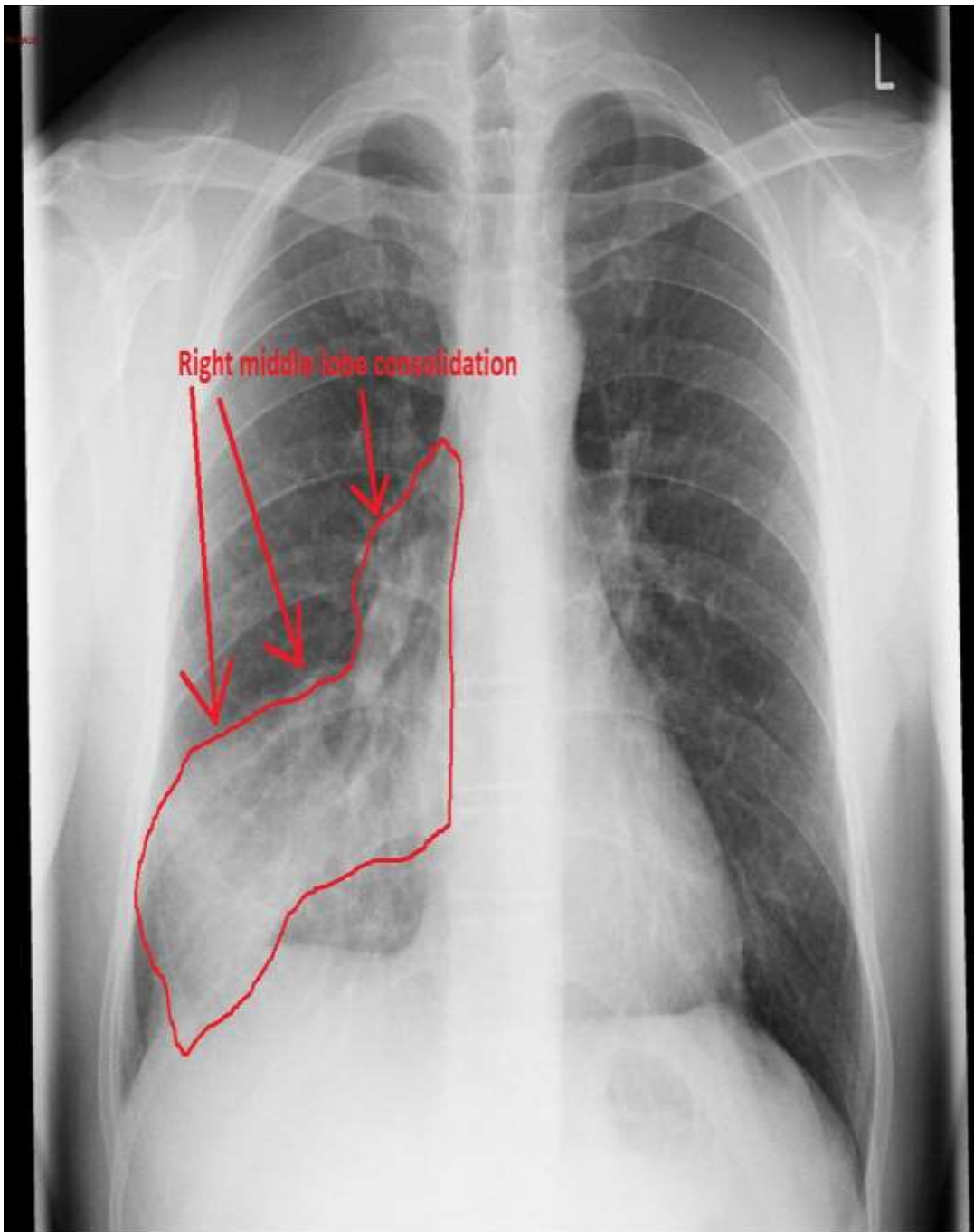
- \*Acute onset of fever and shaking chills
- \*Cough productive of thick, purulent sputum
- \*Pleuritic chest pain ( suggests pleural effusion
- \*Dyspnea

- 2- SIGNS:

- \*Tachycardia, tachypnea
- \*Late inspiratory crackles, bronchial breath sounds, increased tactile and vocal fremitus, dullness on percussion
- \*Pleural friction rub (associated with pleural effusion)

- 3- Chest x-ray (CXR):

- \*Lobar consolidation
- \*Multilobar consolidation indicates very serious illness



# A TYPICAL PNEUMONIA

- 1- COMMON AGENTS :

- Mycoplasma pneumoniae (most common)
- Chlamydia pneumoniae
- Chlamydia psittaci
- Coxiella burnetii (Q fever)
- Legionella spp
- Viruses: influenza virus (A&B), adenoviruses, parainfluenza virus, RSV

- 2- CLINICAL FEATURES:

A- Symptoms :

- Insidious onset – headache, sore throat, fatigue, myalgias
- Dry cough ( No sputum production)
- Fever ( chills are uncommon )



- B- Signs :
- Pulse-temperature dissociation – normal pulse in the setting of high fever is suggestive of atypical CAP
- Wheezing, crackles, rhonchi
- C- CXR:
- Diffuse reticulonodular infiltrates
- Absent or minimal consolidation

hint

Most cases of CAP result from aspiration of oropharyngeal secretions because the majority of organisms that cause CAP are **normal inhabitants of the pharynx**

- \* CXR of atypical pneumonia



# Comparison between CXR of typical and atypical pneumonia :

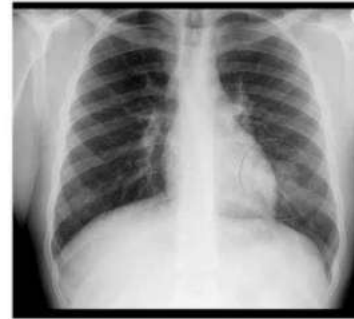


Source: Ron Boucher

## Typical pneumonia

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Staphylococcus aureus*

FA 2012: 196.2 • FA 2011: 176.2 • FA 2010: 177  
ME 3e: 291



Source: Nicholas Lange

## Atypical pneumonia

- *Mycoplasma pneumoniae*
- *Chlamydia pneumoniae*
- *Legionella pneumophila*

INFID2\_2-1

- **Hospital – acquired (nosocomial) pneumonia**

- ⦿ Pneumonia developing more than 48h after admission to the hospital
- ⦿ This time of 48h period to exclude any infection present at the time of admission
- ⦿ G-ve organisms are mainly responsible for nosocomial pneumonia

***Organisms:***

G-ve bacilli (60%) e.g:

E-coli , pseudomonas, Enterobacter , Klebsiella , Proteus,  
Streptococcus pneumoniae(10%), Staphylococcus aureus (10%)

**Clinical features :**

are similar to features of **community-acquired pneumonia**

- ***Aspiration pneumonia :***

- Aspiration of small amounts of orophageal secretions occur during sleep in normal individuals are rarely causes disease
- Aspiration of large amounts of material > 50 ml with a PH < 2.4 (such as gastric secretions ) produces classic aspiration pneumonia

- ***Predisposing factors:***

- seizures, coma
- Trachial intubation, general anesthesia
- NG tube
- Neurological disorders
- Diaphragmatic hernia with reflux

## *Pneumonia in the immunocompromised host including AIDS:*

- Pulmonary infection is common in immunocompromised pt
- The immunocompromised patient is defined as :
  - 1- pt with neutrophil count  $< 100 / \mu\text{l}$
  - 2- patient takes prednisolone in a dosage of over 5mg/dl
  - 3- patient with diseases causing defects of cellular or humoral immunity such as AIDS
- **ORGANISMS:**
  - G-VE bacilli e.g : pseudomonas
  - Opportunistic organism e.g: pneumocystis carinii (PCP), (CMV), viral and fungal infections

# Etiological classification

- Pneumonia can be caused by a wide variety of bacteria, viruses and fungi in the air we breathe. Identifying the cause of your pneumonia can be an important step in getting the proper treatment.

- **Bacteria:**

The most common type of bacterial pneumonia is called pneumococcal pneumonia. Pneumococcal pneumonia is caused by the *Streptococcus pneumoniae* germ that normally lives in the upper respiratory tract. pneumonia can occur on its own or develop after you've had a viral cold or the flu. Bacterial pneumonia often affects just one part, or lobe, of a lung. When this happens, the condition is called lobar pneumonia.

- Those at greatest risk for bacterial pneumonia include people recovering from surgery, people with respiratory disease or viral infection and people who have weakened immune systems.
- Some types of bacteria cause what is known as "atypical" pneumonia, including:

- [Mycoplasma pneumoniae](#)

a tiny wide-spread bacterium that usually infects people younger than 40 years old, especially those living and working in crowded conditions. The illness is often mild enough to go undetected and is sometimes referred to as walking pneumonia.

- [Chlamydia pneumoniae](#)

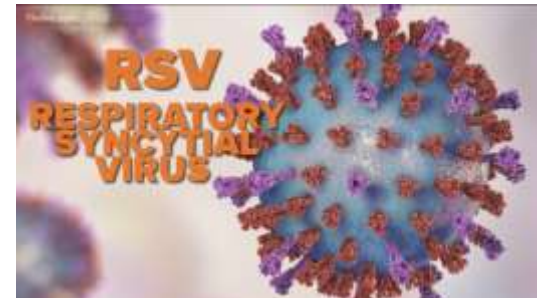
which commonly causes upper respiratory infections year-round, but can also result in a mild form of pneumonia.

- [Legionella pneumophila](#), which causes a dangerous form of pneumonia called Legionnaire's disease. Unlike other bacterial pneumonias, Legionella is not passed from person to person. Outbreaks of the disease have been linked to exposure to contaminated water from cooling towers and whirlpool spas



# • Viruses:

- Viruses that infect the upper respiratory tract may also cause pneumonia. The influenza virus is the most common cause of viral pneumonia in adults. Respiratory syncytial virus (RSV) is the most common cause of viral pneumonia in young children.
- Most viral pneumonias are not serious and last a shorter time than bacterial pneumonia. Viral pneumonia caused by the influenza virus may be severe and sometimes fatal. The virus invades the lungs and multiplies; however, there are almost no physical signs of lung tissue becoming filled with fluid. This pneumonia is most serious in people who have pre-existing heart or lung disease and pregnant women.



- Fungi:

- Fungal pneumonia is most common in people with chronic health problems or weakened immune systems, and in people who are exposed to large doses of certain fungi from contaminated soil or bird droppings. Pneumocystis pneumonia is a serious fungal infection caused by *Pneumocystis jirovecii*. It occurs in people who have weak immune systems due to HIV/AIDS or the long-term use of medicines that suppress their immune systems, such as those used to treat cancer or manage organ transplants.

- The following are three fungi that occur in the soil in some parts of the United States and can cause some people to get pneumonia:

1-Coccidioidomycosis

2-Histoplasmosis.

3-Cryptococcus

# Diagnostic Testing for Pneumonia:

## 1. Conventional Microbiological Diagnosis Blood and pleural

**cultures:** Performing blood cultures in patients before a previous antimicrobial treatment has a high specificity but a low positivity (less than 20% of the cases) Pneumococcus is the main causative agent in blood cultures of patients with CAP

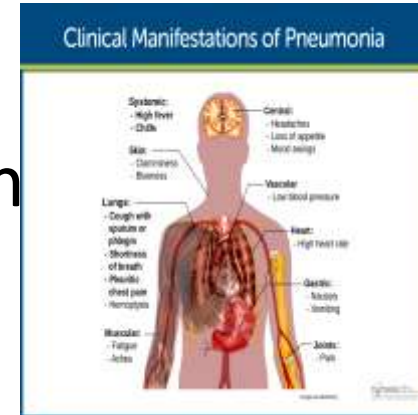
**2. Sputum stain and culture:** Sputum sample collection is performed before patients initiate antimicrobial therapy. For an increase of microbiological diagnostic accuracy an adequate collection and transport of the sample is recommended; a good quality sample is considered when the sputum sample contains less than 10 epithelial cells and more than 25 lymphocyte cells.

**3. Urinary Antigen Detection: Urinary Antigen Test:** antigens from Legionella serotype 1 and pneumococcus are renally excreted and can be detected. This detection is not affected by the use of previous antimicrobial therapy.

**4. Molecular tests** help us identify a specific pathogen or help distinguish between bacterial and viral infection and provide information about antibiotic susceptibility patterns, monitor the response to antibiotic therapy, assess prognosis, aid antimicrobial stewardship, and give information for disease surveillance.

## *Clinical presentation of pneumonia:*

- Pneumonia usually present as an acute illness with respiratory and systemic features.



- Age is a determinant in the clinical manifestation of pneumonia.

## ***Cont.***

- The presence of cough, particularly cough productive of sputum is the most consistent presenting symptom.

### ***Systemic:***

- High fever
- Chills

### ***vascular:***

- low blood pressure

### ***Skin:***

- clamminess
- blueness

### ***heart:***

- high heart rate

### **Central:**

- headaches
- loss of appetite
- mood swings

### **Muscular:**

- fatigue
- aches

### **joints:**

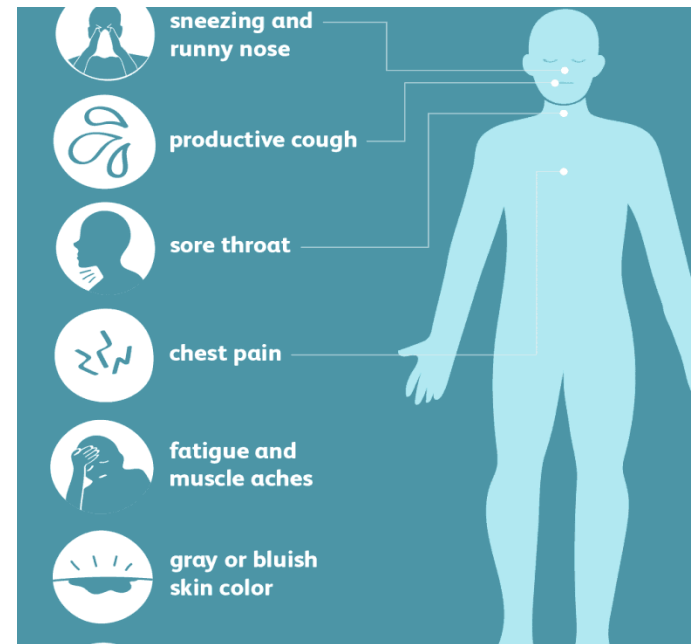
- pain

### **lungs:**

- cough with sputum or phlegm
- shortness of breath
- pleuritic chest pain
- hemoptysis

### **Gastric:**

- nausea
- vomiting



## **Note:**

Pulmonary symptoms include breathlessness and cough.

Initially the cough is characteristically short, painful and dry, but later accompanied by the expectoration of mucopurulent sputum.

Rust-coloured sputum may be seen in patients with strep.pneumonia infection, and some patients may report hemoptysis.

Pleuritic chest pain may be a presenting feature and on occasion may be referred to the shoulder or anterior abdominal wall.



# Pneumonia in paediatrics...clinical manifestation:

- Neonates may have fever only with subtle or no physical findings of pneumonia.
- The typical clinical patterns of viral or bacterial pneumonias usually differ between older infants and children.

Symptoms	Signs
Fever	Tachypnea
Fast and difficult breathing	Chest retraction
Cough	Grunting and stridor
Chest pain	Nasal flaring
Abdominal pain	Cyanosis
Poor feeding	Dullness on percussion
Irritability	Diminished breath sounds, wheeze, crackles on auscultation.

# Treatment

CURB65 criteria for hospitalization

- Confusion (new onset)
- Blood Urea nitrogen greater than 19 mg/dL
- Respiratory rate of 30 or greater
- Systolic Blood pressure < 90 mmHg systolic Or Diastric blood pressure < 60 mmHg
- Age 65 or older

# CURB-65

Confusion

1

bUn 20+

1

RR 30+

1

BP <90/60

1

Age > 65

1

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5

0-1	Outpatient
2	Inpatient
3+	ICU

# Treatment of cap

- For outpatient, treatment with

Macrolides or doxycycline in people younger than 60 years of age

A fluoroquinolone is the first-line agent (levofloxacin, moxifloxacin) in older adult and patient with comorbidities

**\*\*For outpatients**, treatment is continued for 5 days. Do not stop treatment until patient has been afebrile for 48 hours.

**For hospitalized patients**, Treatment with

a fluoroquinolone alone or a third-generation cephalosporin plus a macrolide (i.e., ceftriaxone plus azithromycin) is appropriate.

## • Treatment of hospital-acquired pneumonia

1. Treatment is tailored toward gram-negative rods (any of the following three are appropriate):
  - a. Cephalosporins with pseudomonal coverage: ceftazidime or cefepime
  - b. Carbapenems: imipenem
  - c. Piperacillin/tazobactam
2. Macrolides are not used (as they are in CAP)

- **TREATMENT OF FUNGAL PNEUMONIA**

fluconazole (Diflucan), itraconazole (Sporanox), flucytosine (Ancobon), and ketoconazole (Nizoral)

## **TREATMENT OF viral pneumonia**

There are no treatments for most viral causes of pneumonia. However, if the flu virus is thought to be the cause, antiviral drugs might be prescribed, such as oseltamivir

# complications of pneumonia:

## 1. Pleural Effusion & Respiratory Failure

For seniors with chronic underlying lung diseases like COPD, breathing can become increasingly difficult with a pneumonia infection. This is particularly true if fluid accumulates around the lungs, building up in the layers of surrounding tissue and the chest cavity—a complication called pleural effusion. In severe scenarios, this serious complication could put you at risk of acute respiratory distress (ARDS), respiratory failure, and hospitalization.

## 2. Lung Abscess

When pus forms in a lung cavity, an abscess can occur. This is a common and serious pneumonia complication that can significantly impact older adults if not treated. A lung abscess can also lead to the rarer pneumonia complication of lung necrosis (necrotizing pneumonia), which is a consequence of severe lung inflammation that results in critical lung tissue damage

### 3. Kidney, Liver & Heart Damage

Your body needs oxygen to function. For older adults, more commonly those with underlying chronic health conditions, pneumonia can cause severe shortness of breath and other respiratory complications that restrict oxygen to the lungs. This complication can cause organ damage to the kidneys, liver, and heart, which is why it's so important for seniors to get properly diagnosed and treated for pneumonia as soon as possible.

### 4. Urinary Tract Infections (UTIs)

A UTI typically occurs when harmful bacteria invade the kidneys, ureter, bladder, or urethra. Since our immune systems weaken with age, most older adults are already at increased risk for urinary tract infections. A UTI can also be a pneumonia complication, since some types of bacteria that induce the lung infection can spread to other areas of the body, like the urinary tract.



## 5. Sepsis

Sepsis is a particularly dangerous pneumonia complication. A life-threatening condition, it can lead to tissue damage, organ failure, and death if left untreated. Those with chronic health problems or compromised immune systems are at higher risk of developing sepsis from an infection like pneumonia. Adults over 65, however, are 13 times more likely to be hospitalized with sepsis than any other group.

# •Thank you

- Raghad alramahe
- Leena alowisat
- Tamara khawaldeh
- Roaa alhamaydeh
- Raghad tlilan
- Rou'eyh qasaimeh
- Haneen Tayseer