

Pneumonia

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.

Editing File

Black: original content.

Red: Important.

Green: AlRikabi's Notes.

Grey: Explanation.

Blue: Only found in boys slides.

Pink: Only found in girls slides.



Introduction to Pneumonia

Definition

Pneumonia can be very broadly defined as **any infection** in the lung.

Predisposing factors

- Old age, diabetes and CVS
- Debilitated diseases (rheumatoid arthritis, COPD, renal failure).
- **Immunologic deficiencies**, treatment with immunosuppressive agents, leukopenia, autoimmune disease (SLE).
- Chemotherapy.
- Retention and accumulation of secretions: e.g. cystic fibrosis and bronchial obstruction.
- Pulmonary congestion and edema.
- Decreased function of **alveolar macrophages**: by alcohol, tobacco smoke, anoxia, or oxygen intoxication.
- Injury to the mucociliary apparatus: by either impairment of ciliary function or destruction of ciliated epithelium e.g. cigarette smoke, inhalation of hot or corrosive gases, viral diseases, chronic diseases or genetic disturbances.
- Loss or suppression of the **cough** reflex: coma, anesthesia, neuromuscular disorders, drugs, or chest pain.

Portal of entry for most pneumonias is:
Inhalation of air droplets
Aspiration of infected secretions or objects
Hematogenous spread from one organ to other organs can occur.

[Helpful Video!](#)

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

- The vulnerability of the lung to infection despite these defenses is not surprising because many microbes are airborne and readily inhaled into the lungs.
- nasopharyngeal flora are regularly aspirated during sleep, even by healthy individuals
- lung diseases often lower local immune defenses.

Investigations:

- X-ray (lobe consolidation)
- CBC¹

If High Neutrophils—>bacterial pneumonia (high neutrophils duo to shift to the left)²

If High Lymphocytes—>Viral pneumonia

- ESR (high)
- CRP
- CVS
- Sputum culture

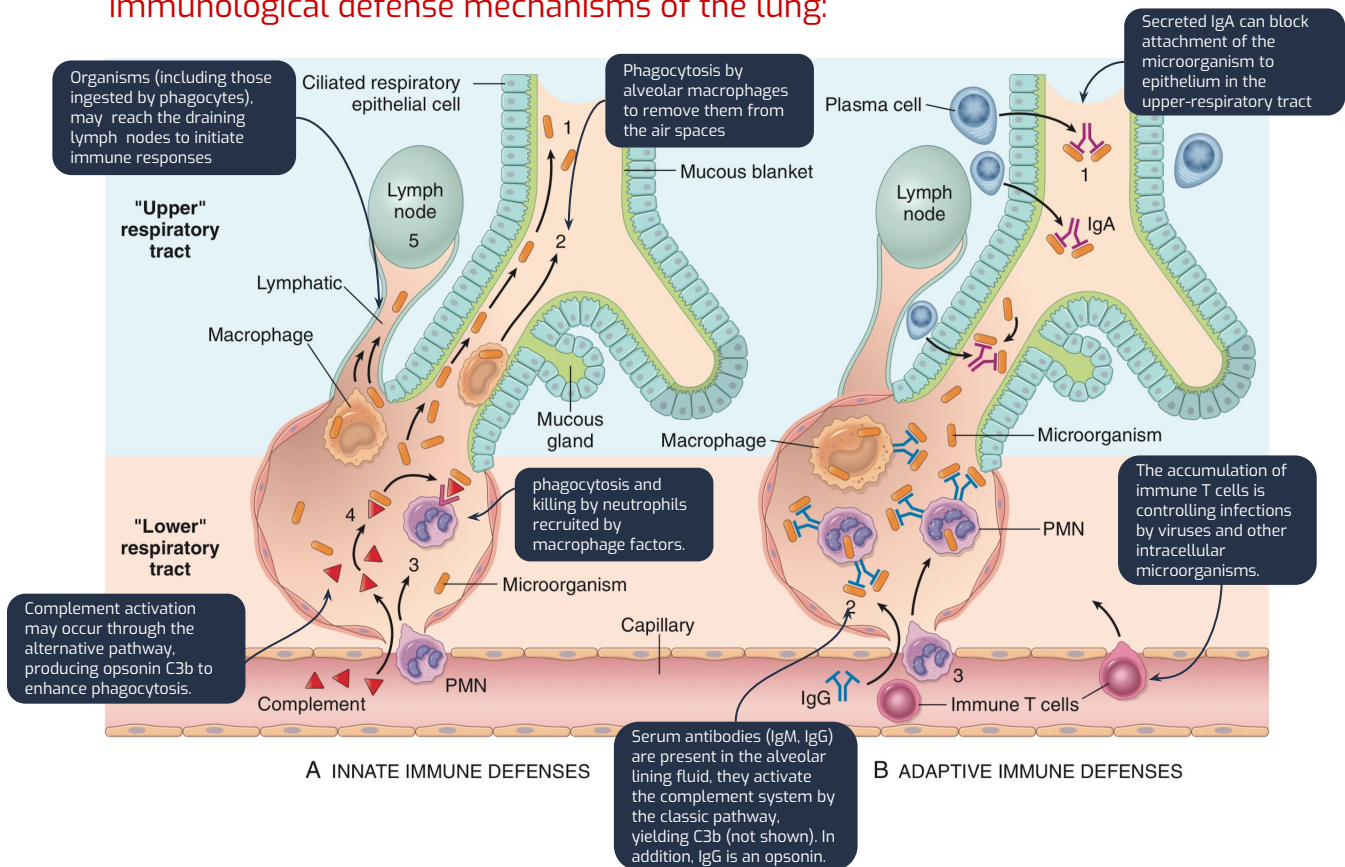
¹You won't see histiocyte + macrophages in the circulation, so u won't see them in CBC. Just increase in neutrophils

²Shift to the left: the bone marrow producing immature form of neutrophils
Why? Because there's much demand from the body because of the bacteria

Defense mechanisms in the respiratory system

Normally, the lung parenchyma remains sterile because of a number of highly effective immune and non-immune defense mechanisms that extend throughout the respiratory system from the nasopharynx to the alveolar air spaces. Failure in any of these mechanisms can lead to the development of pneumonia.

Immunological defense mechanisms of the lung:



Patients with inherited or acquired defects in innate immunity or adaptive immunity have an increased incidence of infections with pyogenic bacteria.

- Patients with mutations in MYD88 (an adaptor protein required for signaling by Toll-like receptors), are extremely susceptible to severe necrotizing pneumococcal infections.
- Patients with congenital defects in IgA production are at increased risk for pneumonias caused by encapsulated organisms such as pneumococcus and H. influenzae.
- Defects in TH1 cell-mediated immunity lead mainly to increased infections with intracellular microbes such as atypical mycobacteria.

Note that lifestyle choices may also interfere with host immune defense mechanisms and facilitate infections. For example, cigarette smoke compromises mucociliary clearance and pulmonary macrophage activity, and alcohol impairs neutrophil function as well as cough and epiglottic reflexes.

Pneumonia classification

Classification

Etiology

- **Streptococcus pneumoniae (Pneumococcal)**
- **klebsiella pneumoniae:** "in chronic alcoholic people and who are debilitated"
- **legionella pneumonia:** "Especially in immunocompromised - posttransplant. the bacteria loves water tanks or any wet things."
- **haemophilus influenzae:** "is the most common bacterial cause of acute exacerbations of COPD"
- **moraxella catarrhalis organisms:** "It is the second most common bacterial cause of acute exacerbation of COPD in adults"
- **Staphylococcal species.**
- **streptococcus pyogenes.**

Clinically

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

1. Community-Acquired acute Pneumonia.
2. Community-Acquired Atypical Pneumonia.
3. Hospital-Acquired (Nosocomial) Pneumonia.
4. Aspiration Pneumonia
5. Chronic Pneumonia
6. Necrotizing Pneumonia and Lung Abscess
7. Opportunistic pneumonias (Pneumonia in the Immunocompromised Host)

Morphology "Anatomically"

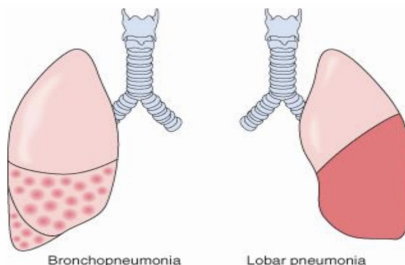
Alveolar "Typical"

A- Lobar pneumonia:
It happens to one lobe in the lung or sometimes two lobes. (Streptococcus pneumoniae)
Acute bacterial infection of a large portion of a lobe or entire lobe. Classic lobar pneumonia is now infrequent.

B- Bronchopneumonia:
Multifocal and patchy Infection inflammation of the bronchi, and surrounding the alveoli. (Streptococcus pneumoniae, Haemophilus influenza, Staphylococcus aureus)
Represent an extension from preexisting bronchitis or bronchiolitis. Extremely common tends to occur in two extremes of life.

Interstitial "Atypical"

C- Interstitial (Atypical or Viral) pneumonia:
It doesn't affect the alveoli. It appears as LINEAR density in X-RAY.
It caused by Influenza virus (children), Mycoplasma pneumoniae. The major inflammatory cell is Lymphocyte, so when we find neutrophils it means there's a secondary infection



1) Community-Acquired Acute Pneumonia

Causing organisms:

Most common	Streptococcus pneumoniae
intravenous drug abuser	Staphylococcus aureus
Others	Haemophilus influenzae, Moraxella catarrhalis, Staphylococcus aureus, Legionella pneumophila, Klebsiella pneumoniae and Pseudomonas aeruginosa spp.

Community-Acquired Acute Pneumonia can be Lobar or Bronchopneumonia, it's usually bacterial and can follow URT infections.

How to diagnose

We don't use Biopsy to diagnose pneumonia

A- Culture

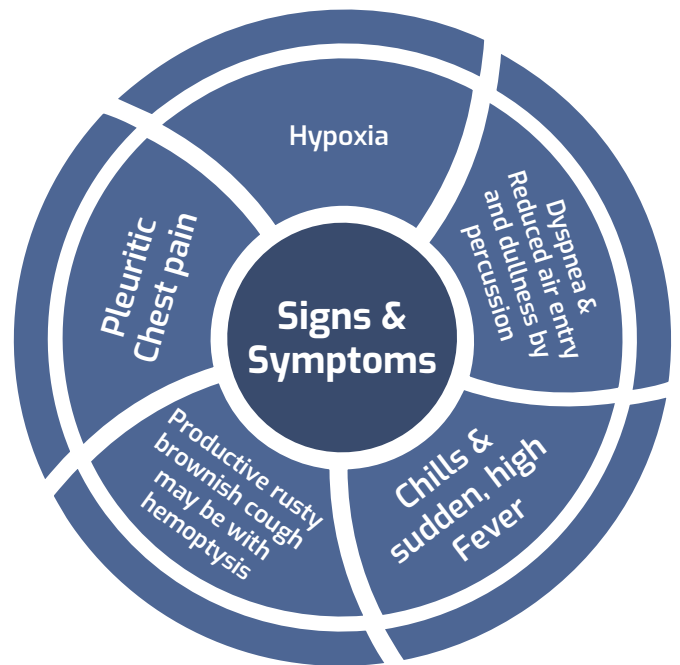
B- Clinical

C- Blood test

- Leukocytosis with a predominance of neutrophils

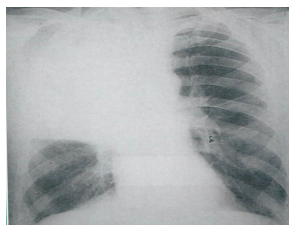
D- Radiology

- in lobar pneumonia there is a radio opaque (consolidation) well circumscribed lobe
- in bronchopneumonia there are multiple small opacities usually basal and bilateral



Complications:

1. Tissue destruction and necrosis (abscess).
2. Spread of infection to the pleura leading to empyema.
3. Organization of the exudate which converts the lung into solid tissue.
4. Bacteremic dissemination to heart valves (infective endocarditis), pericardium, brain (meningitis), kidneys, spleen or joints (arthritis).



Bacterial pneumonia, radiograph Chest x-ray showed consolidation of the upper lobe in Rt. lung

1) Community-Acquired Acute Pneumonia (cont.)

A- Lobar Pneumonia:

- It happens to one lobe in the lung or sometimes two lobes. It is usually community acquired. 90-95% are caused by **Streptococcus Pneumoniae (Pneumococci) type 1,2,3&7**. Rarely by: *K. pneumoniae* (in elderly) - *H. influenzae* - *Pseudomonas* - *Proteus* - *Legionella pneumophila*

Stages of Lobar Pneumonia



Congestion

lung is heavy, boggy and red. The intra alveolar space is filled with fluid, few scattered neutrophils and numerous bacteria. **vascular dilatation + exudate and fibrin**



Red hepatization (solidification)

alveolar spaces are filled with neutrophils, red cells (congestion) and fibrin. Grossly the lung is firm/solid red and liver-like. **The lung will look like the liver, Because of the red inflammatory exudate**

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).



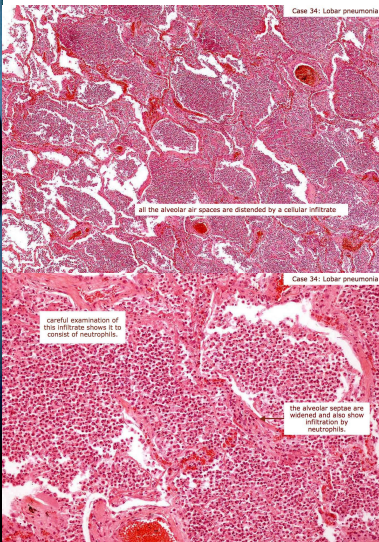
Gray hepatization

here the red cells are reduced but neutrophils and fibrin are still present. Grossly the lung is still firm/solid and liver-like but gray to brown cut surface. **More macrophages, less neutrophils and fibrin**



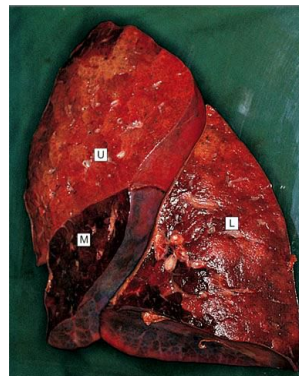
Resolution

exudates within the alveoli are being enzymatically digested, resorbed, ingested by macrophages or coughed up. **Exudate is broken down → debris**

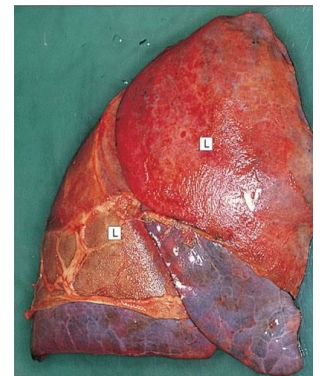


Red hepatization

Alveoli are filled with fibrin, RBC's and neutrophils



Lobar pneumonia. The upper (U) and lower (L) lobes are consolidated compared to the congested but uninvolved middle lobe (M).



Acute pleurisy in lobar pneumonia. The pleural surfaces over consolidated lobes (L) are covered by a patchy, white, fibrinous exudate, causing acute pleurisy.

1) Community-Acquired Acute Pneumonia (CONT.)

B- Bronchopneumonia

Definition: 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 it involves lower lobes (basal) because there is a tendency of the secretions to gravitate into the lower lobes.
- Well developed lesions are 3 to 4 cm dry grey red ill defined nodules.

Etiology:

- Usually *Streptococcus pneumoniae*, also almost there's a predisposing cause (DM, COPD, Age).
- Staphylococci "after URTI"
- Haemophilus Influenzae "In COPD"
- Pseudomonas Aeruginosa "in cystic fibrosis"
- It can be secondary to TB.
- Staphylococcus aureus is an important cause of secondary bacterial pneumonia after viral respiratory illnesses (e.g., measles in children and influenza in both children and adults)

Diagnose:

- Microscopy: neutrophil rich exudate filling the bronchi, bronchioles and adjacent alveolar spaces
- BAL (Bronchoalveolar lavage) test, which is conducted with 3 STEPS

STEP 1

use a bronchoscope to reach the lungs then 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.

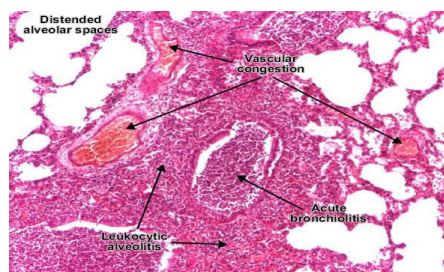
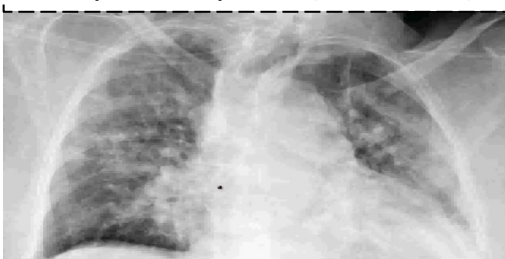
STEP 2

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".

STEP 3

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.

multiple small opacities (consolidation)



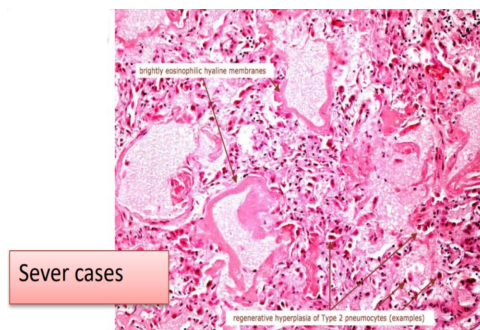
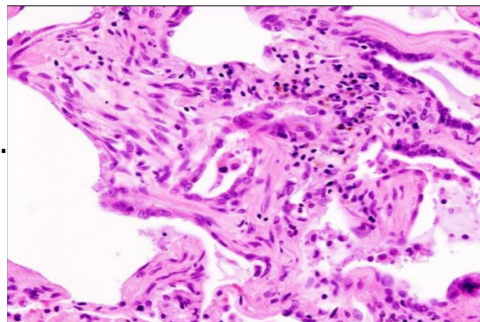
2) Community-Acquired Atypical Pneumonia

(Also called Primary atypical pneumonia or interstitial pneumonitis)

characteristics & features	<ul style="list-style-type: none"> • Characterized by patchy inflammation in the lungs confined to the alveolar septae and pulmonary interstitium and therefore it is called interstitial pneumonitis . • The major inflammatory cell is lymphocyte , so when we find neutrophils it means there's a secondary infection. • It's called atypical pneumonia because it not the typical pneumonia in which the inflammation is primarily in the alveolar spaces.
Clinical course	<ul style="list-style-type: none"> • Extremely variable course. Patient usually present with flu like symptoms which may progress to life threatening situations. • Identification of the organism is difficult. • Prognosis in uncomplicated pt. is good
Predisposing factors	<ul style="list-style-type: none"> • malnutrition, alcoholism and any underlying debilitating disease.
How to diagnose it	<ul style="list-style-type: none"> • By Cold Agglutinin 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 from a sheep (lamb) to it. The RBC's of the lamb will agglutinate because of the IgM. • Serological assays. • polymerase chain reaction (PCR).

Microscopy

- Predominantly there is **inflammation** in the interstitium/alveolar wall.
- Alveolar septa are **widened** and edematous with mononuclear inflammatory infiltrate (and neutrophils in acute cases only)
- Severe cases: Intra-alveolar proteinaceous material with pink hyaline membrane lining the alveolar walls (diffuse alveolar damage)



Gross

- Pneumonic involvement may be **patchy**, or involve whole lobes bilaterally or unilaterally.
- Affected areas are red-blue congested.

2) Community-Acquired Atypical Pneumonia

Mycoplasma pneumoniae

- This is the most common form of interstitial (atypical) pneumonia; it usually occurs in children and young adults, and it may occur in epidemics.
- it can also cause Mycoplasma pneumonia (it's a community acquired disease).
- Onset is more insidious compared to bacterial pneumonia and usually follows a mild, self-limited course.
- Characteristics include an inflammatory reaction confined to the interstitium, with no exudate in alveolar spaces, and intra-alveolar hyaline membranes.
- Diagnosis is by sputum cultures, requiring several weeks of incubation, and by complement-fixing antibodies.
- Mycoplasma pneumoniae may be associated with nonspecific **cold agglutinins** reactive to red cells. This phenomenon is the basis for a facile laboratory test that can provide early diagnostic information.

Viral pneumonias

- Viral pneumonias are the most common types of pneumonia in childhood.
- They are caused most commonly by:
 - influenza virus (children)
 - influenza A and B (adults)
 - Adenoviruses
 - rhinovirus
 - respiratory syncytial virus
 - SARS virus.
- may also arise after childhood exanthems (viral eruptions) such as rubeola (measles) or varicella (chicken pox); the measles virus produces giant cell pneumonia, marked by numerous giant cells and often complicated by tracheobronchitis.

Coxiella burnetii

- Q fever is the most common rickettsial pneumonia.
- it is caused by Coxiella burnetii.
- It may infect persons working with infected cattle or sheep, who inhale dust particles containing the organism, or those who drink unpasteurized milk from infected animals.

Chlamydia

- Causes **Ornithosis (psittacosis)**, which is transmitted by inhalation of dried excreta of infected birds.

Other types of Pneumonia

Type	Patient status	Causes
3- Nosocomial pneumonia (Hospital acquired Pneumonia)	<ul style="list-style-type: none"> Severe underlying conditions, e.g. immunosuppression prolonged antibiotic therapy intravascular catheter Patients with mechanical ventilator. 	Gram-negative organisms like Klebsiella, Pseudomonas aeruginosa and E.coli.
4- Aspiration pneumonia A necrotizing pneumonia with fulminant clinical course, common complication (abscess) and frequent cause of death.	<ul style="list-style-type: none"> Debilitated patients Comatose Alcoholic those who aspirated gastric contents. 	Chemical injury due gastric acid and bacterial infection (anaerobic bacteria admixed with aerobic bacteria, e.g. Bacteroides, Fusobacterium and Peptococcus). (usually during surgery)
5- Chronic pneumonia	Often a localized lesion in Immunocompetent person , with or without regional lymph node involvement. (In the immunocompromised, there is usually systemic dissemination of the causative organism, accompanied by widespread disease).	There is typically granulomatous inflammation, <ul style="list-style-type: none"> Which may be due to bacteria (M.Tuberculosis) or Fungi (Histoplasma capsulatum , coccidioides immitis , blastomyces) Tuberculosis is the most important entity within the spectrum of chronic pneumonias.
6- Opportunistic pneumonia	Immunosuppressed patients (AIDS, cancer patients and transplant recipients).	Cytomegalovirus , Pneumocystis jiroveci (carinii) , Mycobacterium avium-intracellulare , Invasive aspergillosis , Invasive candidiasis and "Usual" bacterial, viral, and fungal organisms.

Pneumocystis pneumonia is confined to the lung, produces an interstitial pneumonitis.
 > caused by: Pneumocystis jiroveci (carinii)
 > seen in immunocompromised patients especially HIV patients
 > Effective methods of diagnosis are:
 - identify the organism in bronchoalveolar lavage fluids or in a transbronchial biopsy specimen.
 - immunofluorescence antibody kits and PCR-based assays

Causative agents of pneumonia (Robbins)	Aspiration Pneumonia
Community-Acquired Bacterial Pneumonia Streptococcus pneumoniae Haemophilus influenzae Moraxella catarrhalis Staphylococcus aureus Legionella pneumophila Enterobacteriaceae (Klebsiella pneumoniae) and Pseudomonas spp. Mycoplasma pneumoniae Chlamydia pneumoniae Coxiella burnetii (Q fever)	Anaerobic oral flora (Bacteroides, Prevotella, Fusobacterium, Peptostreptococcus), admixed with aerobic bacteria (S. pneumoniae, S. aureus, H. influenzae, and Pseudomonas aeruginosa)
Community-Acquired Viral Pneumonia Respiratory syncytial virus, human metapneumovirus, parainfluenza virus (children); influenza A and B (adults); adenovirus (military recruits)	Chronic Pneumonia Nocardia Actinomyces Granulomatous: Mycobacterium tuberculosis and atypical mycobacteria, Histoplasma capsulatum, Coccidioides immitis, Blastomyces dermatitidis
Nosocomial Pneumonia Gram-negative rods belonging to Enterobacteriaceae (Klebsiella spp., Serratia marcescens, Escherichia coli) and Pseudomonas spp. S. aureus (usually methicillin-resistant)	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)

Lung Abscess

Definition

Localized suppurative necrotic process within the pulmonary parenchyma.

Features

- Tissue necrosis
- marked acute inflammation.

Causative organisms

Staphylococci

Streptococci

Gram-negative organisms

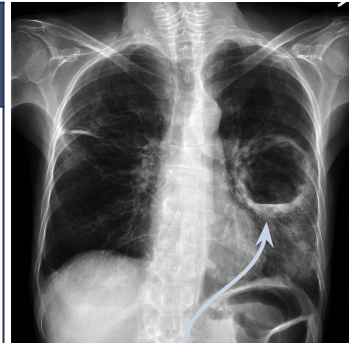
Anaerobes

Pathogenesis:

- Can follow aspiration.
- As a complication of bronchopneumonia.
- Septic emboli.
- Tumors.
- Direct infection.

Clinical features:

- Prominent cough producing copious amount of foul smelling and bad-tasting purulent sputum.
- Change in position evoke paroxysm of cough.
- Fever malaise and clubbing of fingers.
- Radiology shows fluid filled cavity.



Single fluid filled cavity.

Complications

- Bronchopleural fistula and pleural involvement resulting in empyema.*
- Massive hemoptysis, spontaneous rupture into uninvolved lung segments.
- Non-resolution of abscess cavity.
- Bacteremia could result in brain abscess and meningitis.



Abscess is filled with necrotic suppurative debris

Prognosis

With antibiotic therapy, 75% of abscess resolve (if it is not resolving, surgery is needed).

*Empyema: accumulation of pus and purulent material in the pleural cavity.

Summary

Definition

Pneumonia is an inflammatory process of infectious origin affecting the pulmonary parenchyma.

Characteristics

- It is characterized by chills and fever, productive cough, blood-tinged or rusty sputum, pleuritic pain, hypoxia with shortness of breath, and sometimes cyanosis.
- If bacterial, it is most characteristically associated with neutrophilic leukocytosis with an increase in band neutrophils ("shift-to-the-left").

Morphologic types of pneumonia:

Causative organism

characteristics

Lobar pneumonia

Most frequently *Streptococcus pneumoniae* (pneumococcus).

Predominantly intra-alveolar exudate resulting in consolidation
May involve the entire lobe
If untreated, may morphologically evolve through four stages: congestion, red hepatization, gray hepatization, and resolution.

Bronchopneumonia

Many organisms, including *Staphylococcus aureus*, *Haemophilus influenzae*, *Klebsiella pneumoniae*, and *Streptococcus pyogenes*.

Acute inflammatory infiltrates extending from the bronchioles into the adjacent alveoli
Patchy distribution involving one or more lobes.

Interstitial pneumonia

Most frequently viruses or *Mycoplasma pneumoniae*.

Diffuse, patchy inflammation localized to interstitial areas of the alveolar walls
Distribution involving one or more lobes.

Causative agents of pneumonia:

Organism

Characteristics

Complications

Streptococcus pneumoniae

Most common in elderly or debilitated patients, especially those with cardiopulmonary disease, and malnourished persons

May lead to empyema (pus in the pleural cavity)

Staphylococcus aureus

Often a complication of influenza or viral pneumonias or a result of blood-borne infection in intravenous drug users; seen principally in debilitated hospitalized patients, the elderly, and those with chronic lung disease

Focal inflammatory exudates or abscess formation frequent; may lead to empyema or to other infectious complications, including bacterial endocarditis and brain and kidney abscesses

Streptococcus pyogenes

Often a complication of influenza or measles

Lung abscess

Klebsiella pneumoniae

Most frequent in debilitated hospitalized patients and diabetic or alcoholic patients; high mortality rate in elderly patients

Considerable alveolar wall damage, leading to necrosis, sometimes with abscess formation

Haemophilus influenzae

Usually seen in infants and children, but may occur in debilitated adults, most often those with chronic obstructive pulmonary disease

Meningitis and epiglottitis in infants and children

Legionella pneumophila pyogenes

Infection from inhalation of aerosol from contaminated stored water, most often in air-conditioning systems

Types of Interstitial Pneumonia

Viral pneumonias

It is the most common types of pneumonia in childhood. They are caused most commonly by influenza viruses, adenoviruses, rhinovirus and respiratory syncytial virus, may also arise after childhood exanthems (viral eruptions) such as rubeola (measles) or varicella (chicken pox); the measles virus produces giant cell pneumonia, marked by numerous giant cells and often complicated by tracheobronchitis.

Rickettsial pneumonias

Q fever is the most common rickettsial pneumonia; it is caused by *Coxiella burnetii*. It may infect persons working with infected cattle or sheep, who inhale dust particles containing the organism, or those who drink unpasteurized milk from infected animals.

Ornithosis (psittacosis)

caused by an organism of the genus *Chlamydia*, which is transmitted by inhalation of dried excreta of infected birds.

Pneumocystis carinii

Pneumocystis carinii pneumonia is the most common opportunistic infection in patients with acquired immunodeficiency syndrome (AIDS); it also occurs in other forms of immunodeficiency.

- It is caused by *pneumocystis carinii* (recently renamed *Pneumocystis jirovecii*) which is now classified as a fungus.
- Diagnosis is by morphologic demonstration of the organism in biopsy or bronchial washing specimens.

Hospital Acquired Pneumonias

- These pneumonias are often fatal and occur in hospitalized patients, usually those with serious, debilitating diseases. Causes include many gram-negative organisms, including *Klebsiella*, *Pseudomonas aeruginosa* and *Escherichia coli*. Endotoxins products by these organisms play an important role in the infection

Dr. AlRikabi's notes

Pneumonia

Definition: it's inflammatory disease of the lung parenchyma which is caused usually caused by an infectious agent.

Symptoms:

- Fever (spiking in bacterial, mild/fluctuating in viral/atypical)
- Cough (mucopurulent/rusty/blood tinged sputum)→ usually productive
- Pleuritic Chest pain (can lead to empyema)→ exudate within the pleural cavity + pus)
- Chills
- Sweating
- Cyanosis (due to hypoxemia) → uncommon

Classifications (Morphology-based):

- Lobar: Affects one or two lobes→S. Pneumonia (or S. Aureus but not often)
- Bronchopneumonia: Multifocal/patchy consolidation→can be bilateral
- Atypical (interstitial): Viruses (RSV, Influenza A/B, Adenovirus, Rhinovirus, Measles), Mycoplasma, Chlamydia, or fungi

Classification (Epidemiological):

- Nosocomial (Hospital-Acquired): Caused by gram negatives (E.coli, pseudomonas, bacteroides)
- Community-Acquired: Caused mainly by S.pneumonia

Classification (Etiological):

- Pneumococcal Pneumonia (other bacteria names too. Ex: Mycoplasmic Pneumonia)
- Viral pneumonia

Opportunistic Pneumonia (only in immunocompromised):

Candida

- Most common disease-causing fungus
- Cause candidiasis

Aspergillus:

- Filamentous septate hyphae

Cytomegalovirus:

- Large nuclei

Pneumocystis:

- Caused by P. Jirovecii/Carinii (fungus)
- Most common in AIDS
- Diagnosed by bronchoalveolar lavage (washing)
- Soap-bubble frothy exudate
- No inflammatory cells due to AIDS (CD4 less than 300-200 microliters)

Community-Acquired Pneumonia (typical + atypical):

S.Pneumonia (purulent):

- Affects Elderly

S. Aureus (purulent):

- Complication of viral pneumonia or due to aspiration

Klebsiella (purulent):

- In Chronic alcoholics

H. Influenza/Moraxella Catarrhalis:

- Most common in those with COPD

Legionella:

- Flourishes in aquatic environments
- In Immunocompromised + post transplantation

Mycoplasma:

- Tested for by Cold agglutinins test^{*Tests for antibodies that become activated only when serum temp is low*}

- Sample RBC's obtained from animals

Chlamydia:

Intracellular organism, can cause 3 diseases

- Chlamydial pneumonia (can be transmitted via birds→ Psittacosis/Ornithosis)
 - Non-specific urethritis
 - Conjunctivitis (Chlamydial trachoma)

CA Viral Pneumonia:

- Caused by viruses mentioned in the previous page and the table
 - Inflammatory cells + little exudate
 - Can develop secondary bacterial pneumonia (either by S.Pyogenes or S.Aureus)
- RSV→common in children→forms syncytia (RSV is respiratory syncytial virus)

Quiz

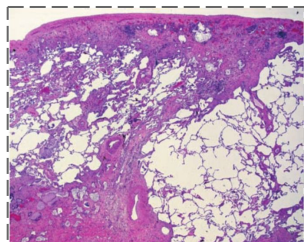
1) A 40-year-old alcoholic man is admitted to the hospital in severe respiratory distress. The temperature is 38.7°C (103°F), respirations are 32 per minute, and blood pressure is 130/90 mm Hg. He coughs constantly and expectorates "currant-jelly" sputum. A chest X-ray reveals bilateral diffuse pulmonary consolidation. Physical examination shows bilateral crackles, dullness to percussion over both pulmonary fields, and use of accessory muscles. The patient subsequently dies from complications of bacterial sepsis. The left lung at autopsy (shown in the image) shows a red, engorged lower lobe. What is the appropriate diagnosis?

- (A) Atypical pneumonia
- (B) Bronchopneumonia
- (C) Interstitial pneumonia
- (D) Lobar pneumonia
- (E) Pulmonary abscess



3) A 53-year-old man presents with increasing shortness of breath on exertion and dry cough that has developed over a period of a few years. Physical examination shows clubbing of the fingers. A chest X-ray discloses diffuse bilateral infiltrates, predominantly in the lower lobes, in a reticular pattern. Two years later, the patient suffers a massive stroke and expires. Histologic examination of the lung at autopsy is shown in the image. Patchy scarring with extensive areas of honeycomb cystic change predominantly affects the lower lobes. Which of the following is the most likely diagnosis?

- (A) Desquamative interstitial pneumonia
- (B) Churg-Strauss syndrome
- (C) Goodpasture syndrome
- (D) Usual interstitial pneumonia
- (E) Wegener granulomatosis

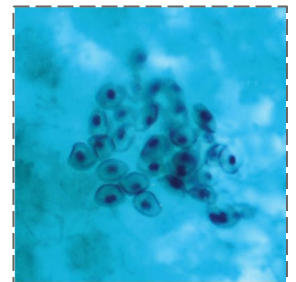


2) A 60-year-old alcoholic woman presents to the emergency room with fever, chills, and shortness of breath. The sputum is rusty-yellow and contains numerous neutrophils, red blood cells, and Gram-positive cocci. A chest X-ray shows diffuse haziness over both lungs. One week following admission, the patient develops empyema. This pulmonary condition is associated with the spread of bacterial infection to which of the following anatomic locations?

- (A) Blood
- (B) Bronchi
- (C) Interstitial space
- (D) Pericardium
- (E) Pleural space

4) A 36-year-old man with AIDS presents with fever, dry cough, and dyspnea. A chest X-ray shows bilateral and diffuse infiltrates. Laboratory studies reveal a CD4+ cell count of less than 50/L. A lung biopsy discloses a chronic interstitial pneumonitis and an intra-alveolar foamy exudate. A silver stain of a bronchoalveolar lavage is shown in the image. Which of the following organisms is the most likely pathogen responsible for these pulmonary findings?

- (A) Cryptococcus neoformans
- (B) Cytomegalovirus
- (C) Histoplasma capsulatum
- (D) Mycoplasma pneumoniae
- (E) Pneumocystis jiroveci



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Thank you

