



RS

MICROBIOLOGY

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Bacterial Infections of the Respiratory Tract

ملاحظة هامة

الملف يحتوي على أسئلة كLINICAL تساعد
لهيك عدد , على فهم المادة المشروحة
معلش , السلايدات كبير شوي

Color code

Black	Slides
Dark Green	Doctor
Blue	Additional info
Red	Important

Atypical Pneumonia

- Pneumonia that is caused by certain bacteria and viruses that **do not produce the typical symptoms and radiologic findings** seen with "typical" bacterial pneumonia
- **less obvious signs and symptoms** and may **not be effectively treated with standard antibiotics** that work for typical pneumonia
- It produces milder symptoms that appear more gradually than in other types of more serious pneumonia

Atypical Pneumonia

- Bacteria that cause atypical pneumonia include:
 - **Mycoplasma pneumoniae**-**most common cause** often affects people younger than age 40.
 - **Chlamydophila pneumoniae** bacteria occurs year round.
 - **Legionella pneumophila**
 - Legionnaire disease.

- The difference in symptom severity between typical and atypical pneumonia is largely due to the nature of the causative organisms. Typical pneumonia is caused by **extracellular organisms**, such as *Streptococcus pneumoniae*, which live and multiply outside the host cells, particularly in the alveoli. This triggers a strong and obvious immune response, as the immune system can easily recognize these organisms. The resulting inflammation causes classic symptoms such as high fever, productive cough with purulent or rusty-colored sputum, and pleuritic chest pain. Additionally, extracellular organisms release toxins that directly damage lung tissue, leading to more severe symptoms and clear imaging findings, such as lobar consolidation on chest X-rays. In contrast, atypical pneumonia is caused by **intracellular organisms**, such as *Mycoplasma pneumoniae* or *Chlamydia pneumoniae*, which invade and replicate within host cells. These organisms are less detectable by the immune system, resulting in milder symptoms, such as low-grade fever and dry cough. Furthermore, intracellular organisms cause less direct tissue damage, leading to subtle or nonspecific imaging findings, such as interstitial infiltrates. This distinction between extracellular and intracellular pathogens explains the variability in symptom intensity and clinical presentation.

Mycoplasma Pneumonia

- **Primary atypical pneumonia** is caused by **Mycoplasma pneumonia**
- **Walking pneumonia**
 - **Mild** case of pneumonia that does not require bed rest or hospitalization, allowing the affected person to continue with their daily activities
- Not part of the respiratory tract's normal microbiota
- common in crowded environments
 - College campuses and military bases.
- It is spread by respiratory droplet formed when coughing or sneezing.

Mycoplasma Pneumonia

- Do not have cell walls-we will not use cell wall inhibitors
- Mycoplasma grow very slowly when cultured.
- Without a cell wall, the microbial cells appear **pleomorphic**.
- M. pneumoniae infections tend to be self-limiting but may also respond well to **macrolide antibiotic therapy**.
 - Mild, with a low fever and persistent cough
- β -lactams, which target cell wall synthesis, are not indicated for treatment of infections with this pathogen

Mycoplasma pneumoniae, often referred to as “walking pneumonia,” is so named because patients typically present with mild symptoms and are still able to walk and carry out their daily activities. Despite these mild symptoms, a chest X-ray often reveals pneumonia. These patients usually don’t require hospitalization and can be safely managed at home.

a student asks, “How can we identify pneumonia when the patient has very mild symptoms and can walk?” the answer lies in taking a detailed **patient history**.

1. Symptoms in the history:

- The patient may report a persistent cough, often dry, that has lasted for days or weeks.
- Low-grade fever, mild fatigue, or general discomfort may be present.
- Some patients might mention mild chest discomfort or slight difficulty with deep breathing.
- There could be a history of an upper respiratory tract infection (e.g., sore throat, runny nose) before the current symptoms.

2. Exposure history:

- The patient may have been in close contact with others showing similar symptoms (e.g., in schools, crowded places).
- *Mycoplasma pneumoniae* is contagious and spreads through respiratory droplets, so recent exposure increases suspicion.

3. When pneumonia is suspected despite mild symptoms:

- Persistent symptoms, especially a cough that doesn’t improve, even if mild, can raise concern.
- On clinical examination, abnormal lung sounds like crackles or wheezing might be detected, which can suggest pneumonia.

4. Confirmation with imaging:

- A chest X-ray is key to diagnosing pneumonia in these cases. Even if the symptoms are mild, the X-ray often shows interstitial infiltrates, confirming the presence of pneumonia.

Chlamydial Pneumonias and Psittacosis

- *Chlamydia pneumoniae* – *the second most common cause atypical pneumonia*
 - Most common and is transmitted via **respiratory droplets** or aerosols.
- *Chlamydia psittaci* (parrot fever)
 - Causes psittacosis, a **zoonotic disease** that primarily affects domesticated birds such as parakeets, turkeys, and ducks, but can be **transmitted from birds to humans**
- *Chlamydia trachomatis*.
 - the causative agent of the **sexually transmitted disease** chlamydia, can cause pneumonia in infants when the infection is passed from mother to baby during birth.
- Obligate intracellular pathogens
- Cause mild to severe pneumonia and bronchitis

- Diagnosis
 - Culturing tends to be difficult and slow.
 - Intracellular pathogens,
 - A variety of PCR- and serologically based tests
- Antibiotics targeting intracellular organisms:
 - **Macrolides** (e.g., azithromycin)---- most common
 - **Tetracyclines** (e.g., doxycycline).
 - **Fluoroquinolones** (e.g., levofloxacin).

Mainly clinical diagnosis

Legionnaires Disease

- An atypical pneumonia called Legionnaires disease (also known as legionellosis) is caused by an aerobic gram-negative bacillus **Legionella pneumophila**
- Human-made reservoirs such as **air-conditioning** cooling towers (Air-conditioning cooling towers can transmit Legionnaires' disease by creating and dispersing fine water droplets, or aerosols, that are contaminated with Legionella bacteria.) , humidifiers, misting systems, and fountains.
- Legionella is not spread person-to-person.
- Aerosolized water droplets
- Aerosols from these reservoirs can lead to infections of susceptible individuals, especially those suffering from chronic heart or lung disease or other conditions that weaken the immune system.

Legionnaires Disease

- **Severe Pneumonia**, remember that there's no person-to-person transmission, infection occurs when person exposed to pollutant water vapor , air conditioner with this bacteria
- **Incubation period:** 2–10 days.
- **Symptoms, there's no X-Ray consolidation because this infection is an interstitial infiltrate :**
 - **Severe pneumonia** with high fever, chills, and cough.
 - **Chest pain** and shortness of breath (dyspnea).
 - Muscle aches (myalgia) and fatigue.
 - Headache, confusion, or altered mental status.
 - **GI symptoms:** Diarrhea, nausea, vomiting.
 - **Renal impairment** may occur in severe cases.
- **Severe cases** may lead to respiratory failure or septic shock.
- **Mortality** :10–30% without treatment, which considered high .

- Can be effectively treated with **fluoroquinolone and macrolide(1st choice treatment) antibiotics** as well as **Tetracyclines**
- However, the disease is sometimes fatal; about 10% of patients die of complications.
- There is currently no vaccine available

Important slide

- Pneumonia caused by **K. pneumoniae** is characterized by **lung necrosis**
- and “**currant jelly sputum** ,” due to necrosis , bleeding that caused by this bacteria
 - consists of clumps of blood, mucus, and debris from the thick polysaccharide capsule produced by the bacterium.
- K. pneumoniae is often **multidrug resistant**.
- Aminoglycoside and cephalosporin are often prescribed but are not always effective .**Because it has a resistance to many antibiotics .**
- Klebsiella pneumonia is frequently fatal even when treated



Klebsiella pneumoniae

- pneumonia.
- Urinary tract infections (UTIs),
- Bacteremia,
- Wound infections
- Meningitis.
- **It is an opportunistic pathogen, often infecting individuals with weakened immune systems, chronic conditions, or those who are hospitalized.**

Key Features of *Klebsiella pneumoniae*

Characteristics:

- Gram-negative rod-shaped bacterium.
- Capsule: A prominent feature that contributes to its virulence.
 - The capsule allows it to evade the host immune system.
- Non-motile.
- Ferments lactose, producing a characteristic pink color on MacConkey agar.
- Oxidase-negative and catalase-positive.
- Facultative anaerobe: Can grow in both aerobic and anaerobic environments





- **Transmission:**

- Klebsiella pneumoniae is **part of the normal flora** of the respiratory and gastrointestinal tracts in humans.
- It is transmitted through **direct contact** (e.g., hand contact with contaminated surfaces) or **aerosolized droplets** from an infected individual.
- Healthcare-associated infections are common, especially in **intensive care units (ICUs)** or **ventilator-associated pneumonia (VAP)**.



- **Klebsiella Pneumonia:**

- A significant cause of **community-acquired** and **hospital-acquired pneumonia**, particularly in immunocompromised patients or those with **chronic lung diseases** (e.g., COPD, alcoholism).

- **Symptoms:**

- **Severe pneumonia** with high fever, chills, and **productive cough** (often with **bloody, thick, "currant jelly" sputum**).
- Chest pain and difficulty breathing.
- Often associated with **pleural effusion** or **lung abscesses**.

- **Risk Factors:**

- **Chronic alcohol use**, diabetes, immunosuppressive therapy, and **mechanical ventilation**

Health Care-Associated Pneumonia (HCAP)

- Is a type of pneumonia that occurs in individuals who have had **significant contact with the healthcare system**, even if they were not hospitalized at the time of infection.
- It is similar to **hospital-acquired pneumonia (HAP)** but includes patients who have received care outside of a hospital setting.
- HCAP is usually caused by more resistant or virulent bacteria compared to community-acquired pneumonia, and these bacteria can be harder to treat.
- Common pathogens include:
- Multidrug-resistant (MDR) bacteria:
 - Methicillin-resistant *Staphylococcus aureus* (MRSA). *Pseudomonas aeruginosa*. *Acinetobacter* species. Enterobacteriaceae (e.g., *Klebsiella*, *Escherichia coli*).

Health Care-Associated Pneumonia (HCAP) refers to pneumonia that occurs in patients with significant exposure to healthcare environments, which increases their risk of infection with multidrug-resistant (MDR) organisms. It is distinct from community-acquired pneumonia (CAP) and is associated with healthcare facilities like hospitals, long-term care facilities, or outpatient clinics.

1. A 58-year-old male with a history of chronic heart disease presents with high fever, chills, severe pneumonia, and shortness of breath. His symptoms started 5 days ago after spending time in a building with air-conditioning cooling towers. Chest X-ray reveals no consolidation in the lungs. What is the most likely cause of this patient's pneumonia?

- A) *Klebsiella pneumoniae*
- B) *Mycoplasma pneumoniae*
- C) *Legionella pneumophila*
- D) *Streptococcus pneumoniae*

Answer: C) *Legionella pneumophila*

2. A 65-year-old immunocompromised patient develops pneumonia after prolonged mechanical ventilation. The patient presents with high fever, chills, chest pain, difficulty breathing, and "currant jelly" sputum. The organism most likely causing the infection is:

- A) *Klebsiella pneumoniae*
- B) *Legionella pneumophila*
- C) *Staphylococcus aureus*
- D) *Pseudomonas aeruginosa*

Answer: A) *Klebsiella pneumoniae*

3. A 72-year-old patient with chronic obstructive pulmonary disease (COPD) develops a severe pneumonia with a productive cough that includes blood-tinged, thick sputum. The most likely pathogen responsible for his pneumonia is:

- A) Legionella pneumophila
- B) Mycobacterium tuberculosis
- C) Klebsiella pneumoniae
- D) Haemophilus influenzae

Answer: C) Klebsiella pneumoniae

4. A 35-year-old pet store worker develops fever, chills, muscle aches, and a dry cough. She reports recent close contact with parakeets. What is the most likely diagnosis?

- A. Psittacosis
- B. Tuberculosis
- C. Influenza
- D. Q fever

Answer: A. Psittacosis

Explanation: Psittacosis, caused by *Chlamydia psittaci*, is a zoonotic disease transmitted from birds to humans. The patient's occupation and contact with birds point to this diagnosis.

5. Which of the following antibiotics is the most appropriate initial treatment for **Chlamydia pneumoniae-associated atypical pneumonia?**

- A. Amoxicillin
- B. Azithromycin
- C. Ceftriaxone
- D. Vancomycin

Answer: B. Azithromycin

6. An infant presents with **conjunctivitis and pneumonia at 6 weeks of age. The mother recalls being treated for a genital infection during pregnancy.** What is the most likely causative agent?

- A. Chlamydia trachomatis
- B. Streptococcus agalactiae
- C. Escherichia coli
- D. Listeria monocytogenes

Answer: A. Chlamydia trachomatis

Explanation: Chlamydia trachomatis can be transmitted from mother to baby during delivery, causing conjunctivitis and pneumonia in neonates.

7. A patient with **hospital-acquired pneumonia (HAP)** is found to be infected with **multidrug-resistant bacteria**. The pathogens most likely responsible for this infection include:

- A) Streptococcus pneumoniae and Haemophilus influenzae
- B) Methicillin-resistant Staphylococcus aureus (MRSA) and Pseudomonas aeruginosa
- C) Legionella pneumophila and Klebsiella pneumoniae
- D) Escherichia coli and Mycoplasma pneumoniae

Answer: B) Methicillin-resistant Staphylococcus aureus (MRSA) and Pseudomonas aeruginosa

سُورَةُ النَّصْرِ

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
 إِذَا جَاءَ نَصْرُ اللَّهِ وَالْفَتْحُ ﴿١﴾ وَرَأَيْتَ النَّاسَ
 يَدْخُلُونَ فِي دِينِ اللَّهِ أَفْوَاجًا ﴿٢﴾ فَسَبِّحْ بِحَمْدِ رَبِّكَ
 وَأَسْتَغْفِرْ لَهُ إِنَّهُ كَانَ تَوَّابًا ﴿٣﴾

VERSIONS	SLIDE #	BEFORE CORRECTION	AFTER CORRECTION
V1 → V2			
V2 → V3			



امسح الرمز و شاركنا بأفكارك لتحسين أدائنا !!