# Lecture 6: Treatment of bacterial respiratory infections 2

Respiratory system
Second year
Medical school
Hashemite University
2nd semester 23/24
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# Respiratory tract infections

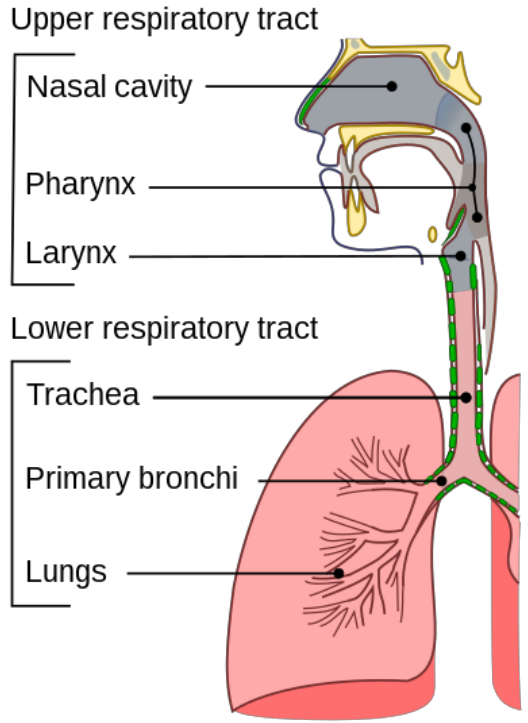
- Divided to:

I. Upper Respiratory tract Infection (URTI)

(common cold, pharyngitis, epiglottitis, & otitis media etc.)

II. Lower Respiratory tract Infection (LRTI)

(bronchitis, bronchiolitis & pneumonia)

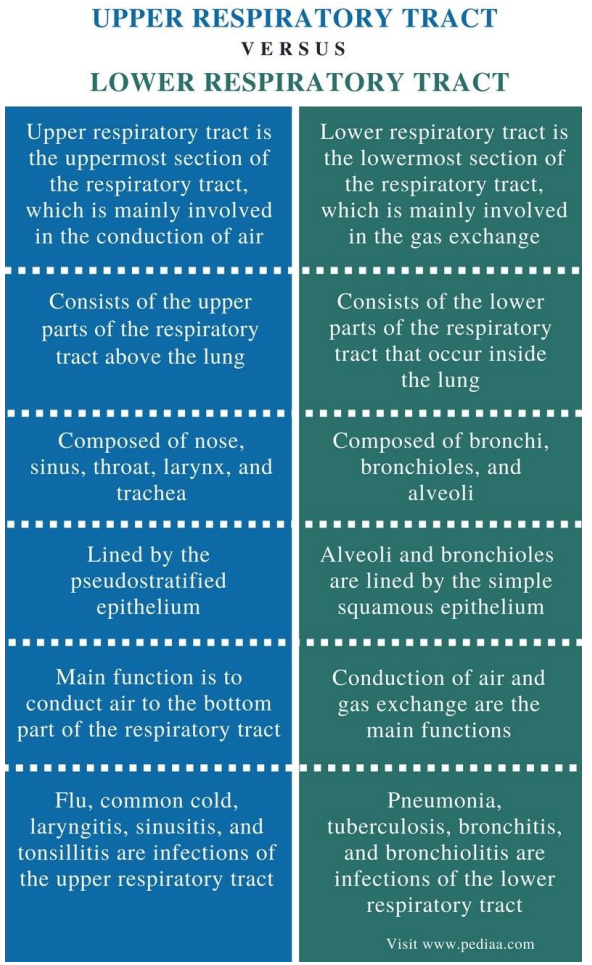


# Lower respiratory tract infection (LRTI)

- A group of disease effect the respiratory system below the throat
- Pneumonia, lung abscess, bronchiolitis and bronchitis.
- Symptoms include shortness of breath, weakness, fever, coughing and fatigue

**Antibiotics:**

- the first line treatment for pneumonia
- NOT effective and NOT indicated for parasitic or viral infections.
- Acute bronchitis typically resolves on its own with time.
- Vaccines available for many pathogens



# Lower respiratory tract infection: **bronchitis**

- Bronchitis: inflammation of the bronchi (medium and large airways)

**Acute bronchitis:**

- cough that lasts around three weeks, wheezing, shortness of breath, chest pain. → Mainly it's viral → اذا viral بتركه بحاله بنشف وبموت / if It's bacterial → Think about antibiotics
- primarily viral (parainfluenza and influenza), could be bacterial infection (Mycoplasma)
- Paracetamol and nonsteroidal anti-inflammatory drugs (NSAIDs)* *Cough suppressants if It's dry
- Antibiotics should generally not be used

if antibiotics aren't available →

**Chronic bronchitis (COPD)**

# Lower respiratory tract infection: **bronchiolitis**

- acute inflammatory injury of the bronchioles (small airways) Not the alveoli
- Mainly viral (RSV).
- any age, but severe and more common <2 years
- Fever, cough, runny nose, wheezing, and breathing problems.
- Complications: dehydration and aspiration pneumonia → gastric contents enter the lung and cause damage (Some kind of self infection)
- No diagnostic test are required → بكله ببساطة بركز عالصدر الاكرافت
- No specific treatment, home care is sufficient → Antibiotic/preventive لا مافي داعي
- Hospital admission for oxygen, support with feeding, or intravenous fluids
- No clear evidence for antibiotics, antivirals, bronchodilators, or nebulized epinephrine?!

| Disease | Symptoms | Pathogens (common) | Pharmacotherapy |
|---|---|---|---|
| bronchitis | **Acute:** cough (≤3 weeks (Sputum?), wheezing, shortness of breath, chest pain.<br><br>**Chronic**: productive cough that lasts for three months or more per year for at least two years**. (remember COPD)** | primarily viral (parainfluenza and influenza), could be bacterial infection (Mycoplasma) | **Acute:** Paracetamol and nonsteroidal anti-inflammatory drugs (NSAIDs)<br>Antibiotics should generally not be used<br><br>**Chronic:** Quit smoking, vaccinations, rehabilitation, and inhaled bronchodilators and steroids |
| bronchiolitis | Fever, cough, runny nose, wheezing, and breathing problems.<br>Complications: dehydration and aspiration pneumonia | Mainly viral (RSV) | No diagnostic test are required<br>No specific treatment, home care is sufficient<br>Hospital admission for oxygen, support with feeding, or intravenous fluids<br>No clear evidence for antibiotics, antivirals, bronchodilators, or nebulized epinephrine?! |

# Pneumonia

- A common **acute** inflammatory respiratory infection that affects the alveoli and distal bronchial tree of the lungs.
- **Classification by site of acquisition:**

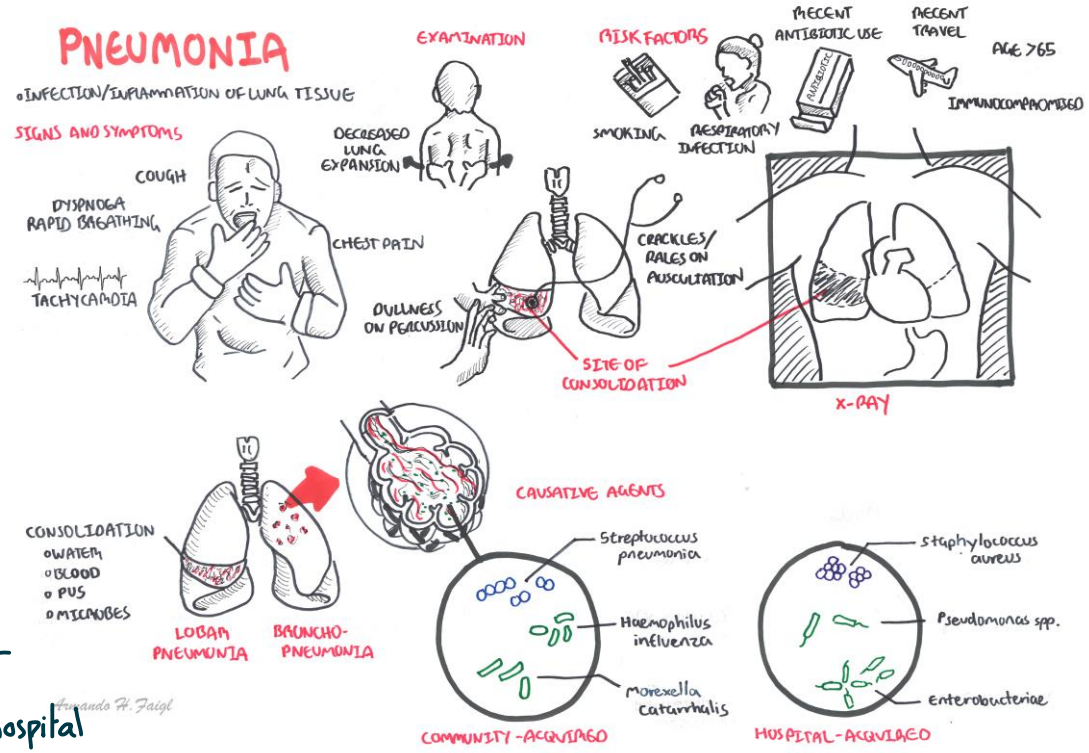
1. Community-acquired pneumonia (CAP) → Most common
2. Hospital-acquired pneumonia (HAP), Cut-off point 48 hours
3. Aspiration pneumonia

Mainly associated with ventilators

مكان ما لقطت المرض

كيفها فوق

Acquired after More than 2 days in the hospital walls regardless where the patient is → Most dangerous



# Classification by etiology

1. Atypical pneumonia: caused by "atypical" bacterial pathogens including **Legionella**, **Mycoplasma** pneumoniae and **Chlamydia** pneumoniae. → treated differently
2. Aspiration pneumonia: adverse pulmonary consequences due to **entry of gastric or oropharyngeal fluids**, which may contain bacteria and/or be of low pH, or exogenous substances (ingested food particles or liquids, mineral oil, salt or fresh water) into the lower airways
3. Chemical pneumonitis: Aspiration of substances (acidic gastric fluid) that cause an inflammatory reaction in the lower airways, **independent of bacterial infection**

# Pathogens & Risk factors

- Bacteria or viruses and less commonly by fungi and parasites.
- The causative agent may not be isolated in about half of cases despite careful testing
- Predisposing factors: smoking, immunodeficiency, alcoholism, chronic obstructive pulmonary disease, sickle cell disease (SCD), asthma, chronic kidney disease, liver disease, and biological aging.

it damages the spleen and as a consequence there is higher risk of infections

إذ أجاني مريض بالطوارئ وفحصته وشخصته pneumonia بعطيه empirical therapy لحد ما اعمل culture ويجهز ، ال culture شرط أساسي للتشخيص بس عادي بدونه بصير (مكمّل للتشخيص وليس مشخص) ال pneumonia بشكل عام تشخص clinically و كل ال tools such as X-rays and بس لل confirmation

# Signs and symptoms

Not specific

- **Pulmonary:**

Cough (with or without sputum production), dyspnea, and pleuritic chest pain

tachypnea, increased work of breathing, and adventitious breath sounds

- **Systemic:**

Fever, chills, fatigue, malaise, chest pain (which may be pleuritic), and anorexia.

Tachycardia, leukocytosis or leukopenia are also findings that are mediated by the systemic inflammatory response.

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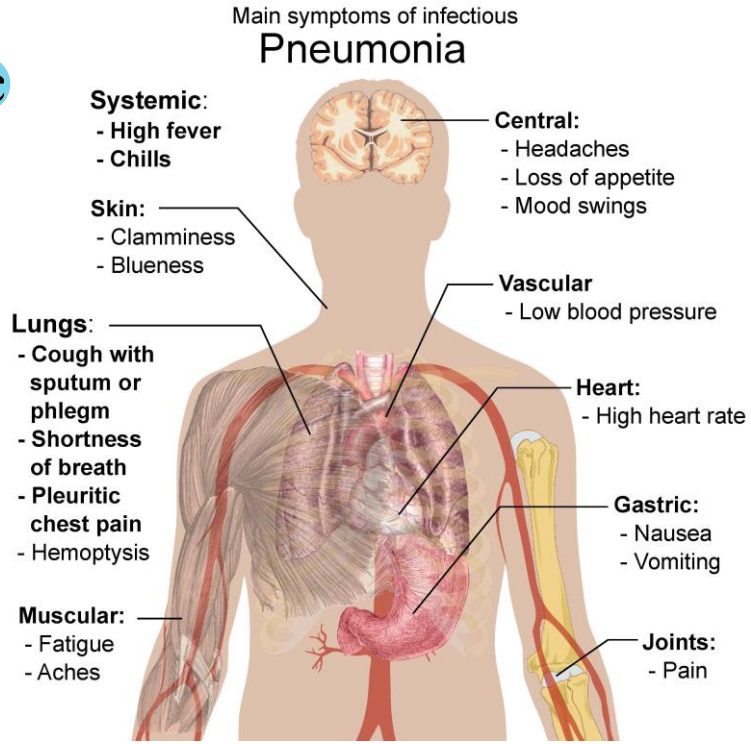
Inflammatory markers, such as the erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and procalcitonin may rise, though the latter is largely specific to bacterial infections.

inflammation



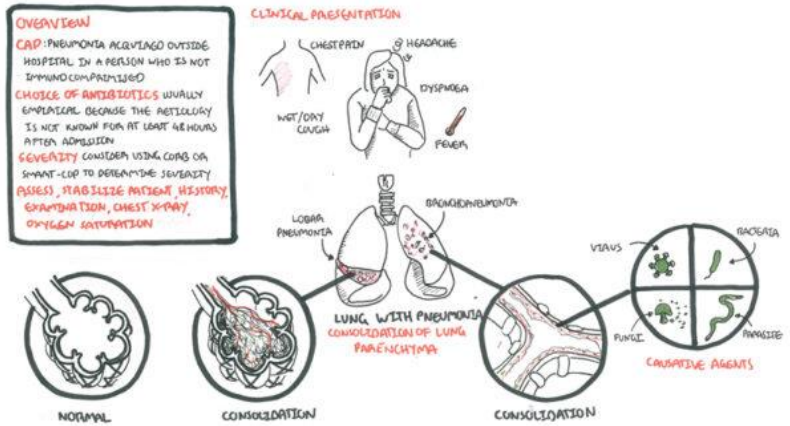
# Community-acquired pneumonia (CAP)

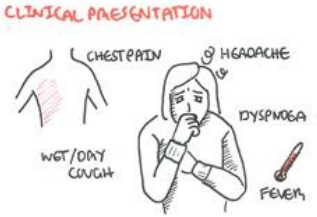
- WHO estimates that lower respiratory tract infection is the most common infectious cause of death in the world.
- Signs and Symptoms:

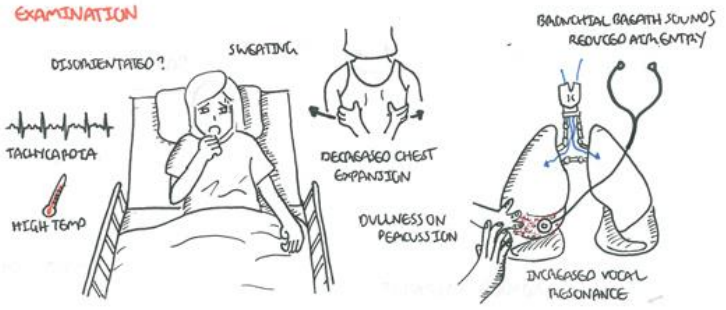
1. Fever or hypothermia
2. Sweats, rigors or chills
3. Cough, sputum production
4. Pulmonary lesions observed on radiographic examination
5. Nonspecific symptoms are common, including loss of appetite, fatigue, and confusion.

- **Choice of antibiotics are usually empirical.**

**مجرد ما شخّصتها ببلش ما بستنى ال culture إذا طلعت النتيجة compatible**
**مع ال antibiotic الي بستخدمه بكمل فيه إذا لا بغيره عال sensitive**



# Community-acquired pneumonia (CAP)

- CAP: *Streptococcus pneumoniae*, respiratory viruses, *Haemophilus influenzae* and *Mycoplasma pneumoniae*

- Management:

1. Oxygen
2. Analgesia for chest pain (Standard)
3. **Antibiotics (IV or oral)** → اذا المريض كتير تعبان بعمله admession و بعطيه IV ما رح يصير معه HAP already معه pneumonia معه
4. Steroids (could be considered in severe pneumonia) Not used frequently in pneumonia cause it's acute → can be used as a nebulizer to reduce bronchospasms in severe cases

# Community-acquired pneumonia (CAP)

- Empirical therapy should start ASAP with broad-spectrum than definitive therapy with narrow and target antibiotics 'de-escalation' of therapy

current guidlines is to finish the course

- 7-10 days, but increasing evidence suggests that shorter courses (3–5 days) may be effective for certain types of pneumonia and may reduce the risk of antibiotic resistance.

# Community-acquired pneumonia (CAP)

- In general, adjunctive corticosteroid therapy might benefit those with severe CAP and a high inflammatory response

- **First line:**

الـ الاولوية

Amoxicillin **OR** macrolide (azithromycin or clarithromycin) **OR**

Doxycycline → if the patient is allergic to penicillins we use one of the others

# Community-acquired pneumonia (CAP)

- Patients >65, with **comorbidities** such as chronic heart, lung, liver, or renal disease; diabetes mellitus; alcoholism; malignancy; asplenia; immunosuppression, prior antibiotics within 90 days:

no spleen

mixed in one pill

① this Or this

**First: amoxicillin/clavulanate + macrolide OR doxycycline** → Used for high risk patients

**Alternative**: cefuroxime + macrolide OR doxycycline

if the patient is allergic to penicillins

Duration of therapy:

if the patient wasn't feverish in the past 2 days I can stop the drug بالإضافة لبقية الأعراض

minimum of 5 days, should be afebrile for at least 48 hours, clinically improving (based on symptoms and vital signs).

Patients with documented MRSA or Pseudomonas aeruginosa should receive a **minimum of 7** days treatment.

# Community-acquired pneumonia (CAP)

hospitalized patient

This → Same capsule

Ampicillin/sulbactam / OR ceftriaxone + azithromycin / or doxycycline

or — This with this — or this

Fluoroquinolone (Levofloxacin or Moxifloxacin)

# Hospital-acquired pneumonia (HAP)

less than 5 days of admission

- Bacteria > virus.
- NO MDR: Piperacillin-tazobactam
- MDR: Meropenem

Multidrug resistant

One capsule

treatment

- MDR:
- Ventilatory support for HAP
- Septic shock
- Intravenous (IV) antibiotic use within the previous 90 days

إذا مر بواحدة من هاي ال **situations** بعطيه **meropenem**

# Atypical pneumonia

- Any type of pneumonia not caused by one of the pathogens most commonly associated with the disease. (belongs mainly CAP)
- No response to common antibiotics such as beta-lactams (penicillin)
- No signs and symptoms of lobar consolidation (infection is restricted to small areas, rather than involving a whole lobe).
- Absence of leukocytosis.

What is the difference between typical and atypical community-acquired pneumonia?

| Variable | Typical | Atypical |
|---|---|---|
| Etiology | S.pneumoniae, H.influenza | Mycoplasma pneumoniae, chlamydophila pneumoniae , legionella, TB, viral or fungal |
| Clinical presentation | Sudden onset of fever, chill, productive cough, shortness of breath and chest pain | Gradual onset headache, sore throat and body ache |
| Diagnosis Gram Stain | Useful | Useless (no cell wall) |
| Radiography | Lobar infiltrate | Dramatic changes: patchy or interstitial |
| Treatment with penicillin | Sensitive | Resistant |

- ***Mycoplasma pneumoniae*:** doxycycline, macrolide
- ***Chlamydophila pneumoniae*:** doxycycline, macrolide, fluoroquinolones.
- ***Legionella* spp.:** macrolide +/– rifampicin.

# Aspiration pneumonia

- Relatively large amount of material inhaled from the stomach or mouth entering the lungs
- Fever, cough, increased respiratory rate, foul-smelling sputum, hemoptysis
- Risk factors: decreased level of consciousness, problems with swallowing, alcoholism, tube feeding, and poor oral health.

- Treatment depends on the setting in which aspiration occurred (CAP or HAP):

CAP: ampicillin-sulbactam or fluroquinolone (high risk: add clindamycin)

HAP: : vancomycin + piperacillin-tazobactam

# Viral pneumonia

- No specific antiviral medications are recommended for community acquired viral pneumonias including SARS coronavirus, adenovirus, hantavirus, and parainfluenza virus.
- Influenza A may be treated with rimantadine or amantadine, while influenza A or B may be treated with oseltamivir, zanamivir or peramivir.
- These are of most benefit if they are started within 48 hours of the onset of symptoms

- The use of antibiotics in viral pneumonia is recommended by some experts, as it is impossible to rule out a complicating bacterial infection.

بعطي ال antibiotics عشان إذا دخلت بكتيريا مع ال virus اقدر اخلص منها وما يتفاقم الوضع

| | |
|---|---|
| CAP | ❖ Patients without comorbidities: Amoxicillin **OR** A macrolide (azithromycin or clarithromycin) **OR** Doxycycline<br>❖ Patients with comorbidities: amoxicillin/clavulanate + macrolide or doxycycline ^^><br>**Alternative**: cefuroxime + macrolide OR doxycycline<br>❖ <u>hospitalized patient :</u><br>Ampicillin/sulbactam **OR** ceftriaxone + azithromycin or doxycycline<br>**Alternative:** Fluoroquinolone (Levofloxacin or Moxifloxacin) |
| HAP | • **NO MDR**: Piperacillin-tazobactam<br>• **MDR**: Meropenem |
| Atypical | ➢ Mycoplasma : doxycycline or macrolide<br>➢ Chlamydophila : doxycycline, macrolide, fluoroquinolones.<br>➢ Legionella: macrolide +/– rifampicin. |
| Aspiration | Depends on the setting in which aspiration occurred:<br>CAP: ampicillin-sulbactam or fluroquinolone (high risk: add clindamycin)<br>HAP: : vancomycin + piperacillin-tazobactam |
| Viral | No specific antiviral medications are recommended<br>Influenza A: rimantadine or amantadine<br>Influenza A or B may be treated with oseltamivir, zanamivir or peramivir. |

# Quiz

**Q1)** When does the passage recommend the use of piperacillin-tazobactam?

A) For primary treatment of influenza A

B) As part of HAP therapy

C) As monotherapy for bacterial infections

D) For treatment of viral influenza

**Q2)** What is the most common infectious cause of death worldwide?

A) HIV/AIDS

B) Lower respiratory tract infection

C) Tuberculosis

D) Malaria

**Q3)** What is the primary cause of atypical pneumonia?
A) Viral infection of the lungs
B) Bacteria including Legionella, Mycoplasma pneumoniae and Chlamydia pneumoniae
C) Inhalation of noxious fumes or chemicals
D) Aspiration of gastric contents

**Q4)** When does empirical antibiotic therapy commence for community-acquired pneumonia?
A) As soon as possible upon presentation of symptoms
B) After ruling out viral or non-infectious causes
C) Only if symptoms worsen despite other interventions
D) After diagnostic testing identifies the pathogen

**Q5)** When does bronchiolitis most commonly occur?
A) In infants under 2 years of age
B) In the elderly
C) During spring allergy season
D) Following influenza infection

**Q6)** When does adjunctive corticosteroid therapy benefit patients with community-acquired pneumonia?
A) Only in intubated patients on mechanical ventilation
B) For all hospitalized patients with CAP
C) In cases of severe pneumonia with a high inflammatory response
D) Never, as antibiotics alone are always sufficient treatment

**Q7)** When does pneumonia qualify as hospital-acquired?
A) If it occurs within 30 days of a previous hospital discharge
B) If the patient was recently treated with antibiotics
C) If symptoms develop during outpatient treatment
D) If symptom onset occurs after 48 hours or more of hospitalization

**Q8)** What distinguishes community-acquired pneumonia from hospital-acquired pneumonia?
A) Site of infection acquisition
B) Need for mechanical ventilation
C) Causative bacterial pathogen
D) Severity of symptoms

Answers B/B/B/A/A/C/D/A