

L19: Community acquired pneumonia



objectives

- 1-Define pneumonia and be familiar with the possible causative agents.
- 2-Explain different types of pneumonia with special emphasis on the causative organisms for each.
- 3-Familiarize with the diagnostic tools and for pneumonia.
- 4-Identify which patient can be managed as outpatient.

Definition

- **Pneumonia** is an inflammatory condition of the lung, characterized by inflammation of the parenchyma of the lung (alveoli)
- Abnormal alveolar filling with fluid causing Air space disease (consolidation and exudation)
- Pneumonia is an acute respiratory illness associated with recently developed radiological pulmonary shadowing which may be segmental, lobar or multilobar.
- Lobar pneumonia' is a radiological and pathological term referring to homogeneous consolidation
- of one or more lung lobes, often with associated pleural inflammation.
- **Bronchopneumonia** refers to more patchy alveolar consolidation associated with bronchial and bronchiolar inflammation often affecting both lower lobes.



“Classic” CAP presents with a sudden chill followed by fever, pleuritic pain, and productive cough.

- The “atypical pneumonia” syndrome, associated with *Mycoplasma* or *Chlamydia* infection, often begins with a sore throat and headache followed by a nonproductive cough and dyspnea.

Types of pneumonia

- 1) Community-acquired pneumonia (**CAP**) : Cough/fever/sputum production + infiltrate.
- 2) Healthcare-associated pneumonia (**HCAP**) : Pneumonia that develops within 48 hours of admission in patients with:
 - Hospitalization in acute care hospital for ≥ 2 days in past 90 days.
 - Residence in nursing home or long term care facility.
 - Chronic dialysis within 30 days.
 - Home IV therapy, home wound care in past 30 days.
 - Family member with MDR pathogen.
- 3) Hospital-acquired pneumonia (**HAP**): Pneumonia after 48 hours of admission.
- 4) Ventilator-associated pneumonia* (**VAP**): pneumonia after 48 hours of intubation.

A. Patients on mechanical ventilation are at risk of developing pneumonia because the normal mucociliary clearance of the respiratory tract is impaired (cannot cough). Also, positive pressure impairs the ability to clear colonization.

B. Findings to help with diagnosis: new infiltrate on chest x-ray, purulent secretions from endotracheal tube, fever, rising WBC count

C. Bronchoalveolar lavage (BAL)—bronchoscope passed into lungs to get cultures

D. Treatment is with a combination of the following three different drugs:

1. Cephalosporin (ceftazidime or cefepime) OR penicillin (piperacillin/tazobactam) OR carbapenem (imipenem)
2. Aminoglycoside OR fluoroquinolone
3. Vancomycin OR linezolid

Pathophysiology

- ❑ Inhalation, aspiration and hematogenous spread are the 3 main mechanisms by which bacteria reaches the lungs.

1)Primary inhalation: when organisms bypass normal respiratory defense mechanisms or when the patient inhales aerobic Gram negative organisms that colonize the upper respiratory tract or respiratory support equipment.

2)Aspiration: occurs when the patient aspirates colonized upper respiratory tract secretions {Stomach: reservoir of Gram negative rods that can ascend, colonizing the respiratory tract}.

3)Hematogenous: originate from a distant source and reach the lungs via the blood stream.

- ❑ Microaspiration from nasopharynx: **Streptococcus pneumonia** {most common pathogen in outpatients,inpatients, and ICU patients}
- ❑ Inhalation: **TB, viruses, Legionella.**
- ❑ Aspiration: **anaerobes.**
- ❑ Bloodborne: **Staph endocarditis, septic emboli.**
- ❑ Direct extension: **trauma.**

Risk Factors

Factors that predispose to Community acquired pneumonia:

- ❖ Cigarette smoking
- ❖ Upper respiratory tract infections (common cold, Acute pharyngitis, Sinusitis, Acute epiglottitis)
- ❖ Alcohol
- ❖ Corticosteroid therapy
- ❖ Old age
- ❖ Recent influenza infection
- ❖ Pre-existing lung disease
- ❖ HIV
- ❖ Indoor air pollution

Factors that predispose to health acquired pneumonia :

- ❖ Length of hospital stay
- ❖ Surgery
- ❖ Wounds
- ❖ Previous infection (independent of previous Abx use)
- ❖ Fecal colonization with *Acinetobacter*
- ❖ Treatment with broad spectrum antibiotics
- ❖ Indwelling central intravenous or urinary catheters
- ❖ Admission to burns unit or ICU
- ❖ Parenteral nutrition
- ❖ Mechanical ventilation

Community acquired pneumonia (CAP)

- CAP divided into two types :

Typical CAP

S. pneumoniae (60%) (most common)

Haemophilus influenzae (15%)

Aerobic gram-negative rods (6% to 10%)—*Klebsiella* (and other *Enterobacteriaceae*)

S. aureus (2% to 10%)

Atypical CAP

Mycoplasma pneumoniae (most common)

Chlamydia pneumoniae

Chlamydia psittaci

Coxiella burnetii (Q fever)

Legionella spp.

Viruses: influenza virus (A and B), adenoviruses, parainfluenza virus, RSV

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

! In next slides more details about EACH organism

Signs and symptoms of CAP

	Typical CAP	Atypical CAP
<u>Symptoms</u>	<ul style="list-style-type: none"> • Acute onset of fever and shaking chills. • Cough productive of thick, purulent sputum. • Pleuritic chest pain (suggests pleural effusion). • Dyspnea. 	<ul style="list-style-type: none"> • Insidious onset—headache, sore throat, fatigue, myalgias • Dry cough (no sputum production) • Fevers (chills are uncommon)
<u>Signs</u>	<ul style="list-style-type: none"> • Tachycardia, tachypnea. • Late inspiratory crackles, bronchial breath sounds, increased tactile and vocal fremitus, dullness on percussion. • Pleural friction rub (associated with pleural effusion). 	<ul style="list-style-type: none"> • Pulse–temperature dissociation—normal pulse in the setting of high fever is suggestive of atypical CAP. • Wheezing, rhonchi, crackles
<u>CXR</u>	<ul style="list-style-type: none"> • Lobar consolidation. • Multilobar consolidation indicates very serious illness. 	<ul style="list-style-type: none"> • Diffuse reticulonodular infiltrates. • Absent or minimal consolidation.



“Atypical” pneumonia refers to organisms not visible on Gram stain and not culturable on standard blood agar.

Organisms of CAP

1) typical CAP:

A. *Streptococcus pneumoniae*

- Most common cause of CAP.
- Gram positive diplococci.
- “Typical” symptoms (e.g. malaise, shaking chills, fever, rusty sputum, pleuritic chest pain, cough).
- Lobar infiltrate on CXR.
- 25% bacteremic.

Risk factors for *S.pneumoniae*:

- **Splenectomy** (Asplenia) .
- Sickle cell disease, hematologic diseases.
- Smoking.
- Bronchial Asthma and COPD.
- HIV.
- ETOH.



S. pneumoniae accounts for up to 66% of all cases of bacteremic pneumonia, followed by *H. influenzae*, influenza virus, and *Legionella* spp.

Organisms of CAP

B. Haemophilus influenzae

- Nonmotile, Gram negative rod
- Secondary infection on top of Viral disease, immunosuppression, **splecnectomy patients**
- Encapsulated type b (Hib)
- The capsule allows them to resist phagocytosis and complement-mediated lysis in the non-immune host
- Hib conjugate vaccine

 Influenzae is the most common cause in children

Organisms of CAP

- More common cause in children
 - RSV, influenza, parainfluenza
- Influenza most important viral cause in adults, especially during winter months
- Inhale small aerosolized particles from coughing, sneezing → 1-4 day incubation → 'uncomplicated influenza' (**fever, myalgia, malaise, rhinitis**) → Pneumonia


Organisms of CAP

2) Atypical CAP:

<p><u><i>Mycoplasma pneumoniae</i></u></p>	<ul style="list-style-type: none"> • Most common casus • Young healthy people
<p><u><i>Coxiella burnetii</i></u></p>	<ul style="list-style-type: none"> • Cause Q fever. • Spread from farm animal. • Epidemic in middle east. • Cause acute pneumonia and hepatitis. • Needs: serology
<p><u><i>Francisella tularensis</i></u></p>	<ul style="list-style-type: none"> • Cause Tularemia disease. • transmitted from Rabbits, squirrels, rodents. • it spread to Landscapers, Hunters. • Treatment is streptomycin.
<p><u><i>Chlamydia psittaci and Chlamydia pneumoniae</i></u></p>	<ul style="list-style-type: none"> • Cause Psittacosis. • transmitted from birds. • treatment is Tetracycline.
<p><u><i>Legionella spp</i></u></p>	<ul style="list-style-type: none"> • Old people • GI, CNS problems e.g. diarrhea • Smoker and COPD
<p><u>PCP</u></p>	<ul style="list-style-type: none"> • HIV patient

Remember these associations

- **Asplenia:** *Strep pneumo*, *H.flu*.
- **Alcoholism:** *Strep pneumo*, oral anaerobes, *K. pneumo*, *Acinetobacter*, MTB.
- **COPD/smoking:** *H. influenzae*, *Pseudomonas*, *Legionella*, *Strep pneumo*, *Moraxella catarrhalis*, *Chlamydomphila pneumoniae*.
- **Aspiration:** *Klebsiella*, *E. Coli*, oral anaerobes.
- **HIV:** *S. pneumo*, *H. influ*, *P. aeruginosa*, MTB, PCP, *Crypto*, *Histo*, *Aspergillus*, atypical mycobacteria.
- **Recent hotel, cruise ship:** *Legionella*.
- **Structural lung disease (bronchiectasis):** *Pseudomonas*, *Burkholderia cepacia*, *Staph aureus*.

- 
- In alcoholics, think of *Klebsiella pneumoniae*; in immigrants, think of TB.
 - In nursing home residents, consider a nosocomial pathogen and predilection for the upper lobes (e.g., *Pseudomonas*).
 - HIV-positive patients are at risk for *Pneumocystis carinii* and *Mycobacterium tuberculosis*, but are still more likely to have a typical infectious agent.
 - *Legionella* pneumonia is common in organ transplant recipients, patients with renal failure, patients with chronic lung disease, and smokers. *Legionella* pneumonia is rare in healthy children and young adults.

Investigations in Community acquired pneumonia

- **PA and lateral CXR** : usually provides confirmation of the diagnosis.

In lobar pneumonia, a homogeneous opacity localized to the affected lobe or segment usually appears within 12–18 hours of the onset of the illness.

- **CBC**: Neutrophils leukocytosis.

- **Sputum gram stain** : Gram-positive diplococci characteristic of Strep. Pneumonia.

Acid-fast stain (*Mycobacterium* spp.) if tuberculosis is suspected.

Silver stain (fungi, *Pneumocystis carinii*) for HIV/immunocompromised patients

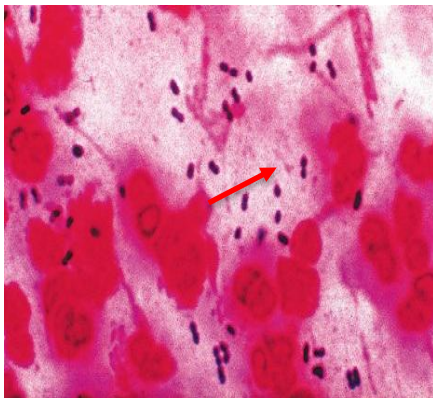
- **Blood Culture**: Positive in Strep. Pneumonia.

- **ABG**: Measure when Saturated O₂ < 93%.

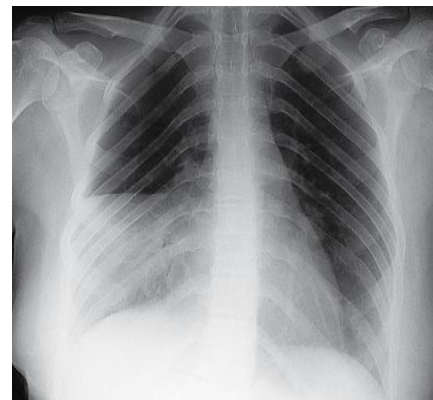
- **Urea & Electrolytes** :

Urea > 7 mmol/L (~ 20 mmol/L) : marked of severity.

Hyponatremia : Marked of severity.



Strep. Pneumonia: Gram-positive diplococci



Pneumonia of the right middle lobe. PA view: consolidation in the right middle lobe with characteristic opacification beneath the horizontal fissure and loss of normal contrast between the right heart border and lung.

How To Diagnose Community acquired pneumonia

On examination :

- Respiratory and pulse rate may be raised and the blood pressure low, while assessment of the mental state may reveal a delirium. Oxygen saturation on air may be low and the patient cyanosed and distressed.
- Percussion: Dull notes over consolidated area.
- Auscultation: Bronchial breath sounds.



General Approach to Diagnosis of Community-Acquired Pneumonia (CAP)

The first task is to **differentiate lower respiratory tract infection from the other causes of cough and from upper respiratory infection.**

- If nasal discharge, sore throat, or ear pain predominates, upper respiratory infection is likely.
- Once lower tract infection is suspected, the next task is to differentiate between pneumonia and acute bronchitis. Unfortunately, clinical features (cough, sputum, fever, dyspnea) are not reliable in differentiating between the two.
- CXR is the only reasonable method of differentiating between pneumonia and acute bronchitis.

Infiltrate Patterns

Pattern	Possible Diagnosis
Lobar	S. pneumo, Kleb, H. flu, GN
Patchy	Atypicals, viral, Legionella
Interstitial	Viral, PCP, Legionella
Cavitary	Anaerobes, Kleb, TB, S. aureus, fungi
Large effusion	Staph, anaerobes, Kleb

Pneumonia: Outpatient or Inpatient?

A **CURB-65** scoring system to assess disease severity helps guide antibiotic and admission policies.

Any of:

- **C**onfusion*
- **U**rea > 7 mmol/L
- **R**espiratory rate > 30/min
- **B**lood pressure (systolic < 90 mmHg or diastolic < 60 mmHg)
- Age > **65** years

(Score 1 point for each feature present)

Pneumonia: Medical floor or ICU?

1 major or 3 minor criteria= severe CAP→ICU

- **Major criteria:**
 - Invasive ventilation, septic shock on pressors
- **Minor criteria:**
 - RR>30,multilobar infiltrates,confusion
 - BUN >20.
 - WBC <4,000.
 - Platelets <100,000.
 - Temp <36.
 - hypotension requiring aggressive fluids, PaO₂/FiO₂ <250.



Mortality:

- 2 factors→9%
- 3 factors→15%
- 5 factors→57%

Score 0-1→outpatient.

Score 2→inpatient.

Score ≥3→ICU.



The following steps are appropriate in patients admitted to the hospital with suspected pneumonia:

- CXR (PA and lateral)
- Laboratory tests—CBC and differential, BUN, creatinine, glucose, electrolytes
- O₂ saturation
- Two pretreatment blood cultures
- Gram stain and culture of sputum
- Antibiotic therapy

Treatment of CAP

“Was not included in the objectives but we thought it is important”



Test for microbial diagnosis for outpatients is not required. Empiric treatment is often successful if CAP is suspected.

1. Decision to hospitalize

- a. The decision to hospitalize or treat as an outpatient is probably the most important decision to be made and is based on severity of disease
- b. Patients are stratified into five classes based on severity. The Pneumonia Severity Index can serve as a general guideline, but clinical judgment is critical in making this decision. The decision to admit the patient is not based on a specific organism (one does not have this information when making this decision).

2. Antimicrobial therapy

- a. Because the specific cause is usually not determined on initial evaluation, empiric therapy is often required.
- b. For outpatients
 - In people younger than 60 years of age, the most common organisms are *S. pneumoniae*, *Mycoplasma*, *Chlamydia*, and *Legionella*. Macrolides (azithromycin or clarithromycin) or doxycycline cover all of these organisms and are the first-line treatment. Fluoroquinolones are alternative agents. Penicillins or cephalosporins do not cover the atypical organisms in this age group.
 - In older adults and patients with comorbidities (more likely to have typical CAP) or those treated with antibiotics in the last 3 months, a fluoroquinolone is the first-line agent (levofloxacin, moxifloxacin). A second- or third-generation cephalosporin is the first-line treatment.
 - For outpatients, treatment is continued for 5 days. Do not stop treatment until patient has been afebrile for 48 hours.
- c. For hospitalized patients, a fluoroquinolone alone or a third-generation cephalosporin plus a macrolide (i.e., ceftriaxone plus azithromycin) is appropriate.

Treatment of Hospital Acquired Pneumonia

“Was not included in the objectives but we thought it is important”

1. Treatment is tailored toward gram-negative rods (any of the following 3 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)

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

! Uncomplicated CAP in patients without significant comorbidities, treat with azithromycin or clarithromycin. If patient has comorbidities, give a fluoroquinolone.

Complications of pneumonia

“Was not included in the objectives but we thought it is important”

- Pleural effusion (seen in 50% of patients with CAP on routine CXR, and resolve with treatment), **Empyema**.
- **Bacteremia** .
- Retention of sputum causing lobar collapse.
- DVT and pulmonary embolism.
- Pneumothorax, particularly with Staph. Aureus.
- Suppurative pneumonia/lung abscess.
- ARDS, renal failure, multi-organ failure.
- Ectopic abscess formation (Staph. aureus).
- Hepatitis, pericarditis, myocarditis, meningoencephalitis.
- Pyrexia due to drug hypersensitivity.
- Acute respiratory failure may occur if the pneumonia is severe.

Prevention

“Was not included in the objectives but we thought it is important”

There are two recommended methods of prevention:

- A. Influenza vaccine—give yearly to people at increased risk for complications and to health care workers
- B. Pneumococcal vaccine—for patients > 65 years and for younger people at high risk (e.g., those with heart disease, sickle cell disease, pulmonary disease, diabetes, or alcoholic cirrhosis, or asplenic individuals)

MCQs

1- A 30 year old man had road traffic accident and sustained fracture of femur. Two days later he developed sudden breathlessness. The most probable cause can be?

- A. Pneumonia
- B. CHF
- C. Bronchial asthma
- D. Fat Embolism

2- To assist in the decision whether to hospitalize a patient with community acquired pneumonia (CAP), each of the following may be a factor in favor of hospitalization except for which one?

- A. The patient is confused
- B. Serum creatinine > 2.0 mg/dL
- C. RR > 30
- D. BP < 90 mmHg
- E. Age > 64

3- Which is the most common organism causing community acquired pneumonia?

- A. Pneumococcus
- B. Hemophilus influenzae
- C. viral
- D. Gm negatives
- E. Mycoplasma

MCQs

4- Which organism causing pneumonia has an increased association with COPD

- A. Pneumococcus
- B. Hemophilus influenzae
- C. Viral
- D. Gm negatives
- E. Mycoplasma

5- Which organism causing pneumonia has an increased incidence in IV drug users and those post-influenza?

- A. Pneumococcus
- B. Staph aureus
- C. Viral
- D. Gm negatives
- E. Mycoplasma

! Answers : 1-A 2-B 3-A 4-B 5-B



Medicine433



Medicine433

DONE BY

Faroq Abdulfattah	Raneem Alotaibi
Abdulrhaman AlThaqib	Kholoud AlDosari
Mubark AlDossari	Shahad Almazroa



*Medicine is a science of uncertainty
and an art of probability*



MEDICINE 433