Lecture :
Community Acquired Pneumoniae

important
Extra notes
Doctors notes

"لا حول ولا قوة إلا بالله العلي العظيم "وتقال هذه الجملة إذا دهم الإنسان أمر عظيم لا يستطيعه ، أو يصعب عليه القيام به .

Introduction to Pneumonia:

Definition: it is an infection of the pulmonary parenchyma (the alveoli) that causes inflammation, consolidation and exudation. Can be : Acute (fulminant) or chronic

Histologically:

	(1)	(2)	(3)
Histological spectrum	Fibrinopurulent alveolar exudateis (Pus exudate that contains a large amount of fibrin)	Mononuclear interstitial infiltratesin	Granulomas and cavitationseen
Happen in	acute bacterial pneumonias.	viral and other atypical pneumonias	chronic pneumonias **(happen in some TB cases)**

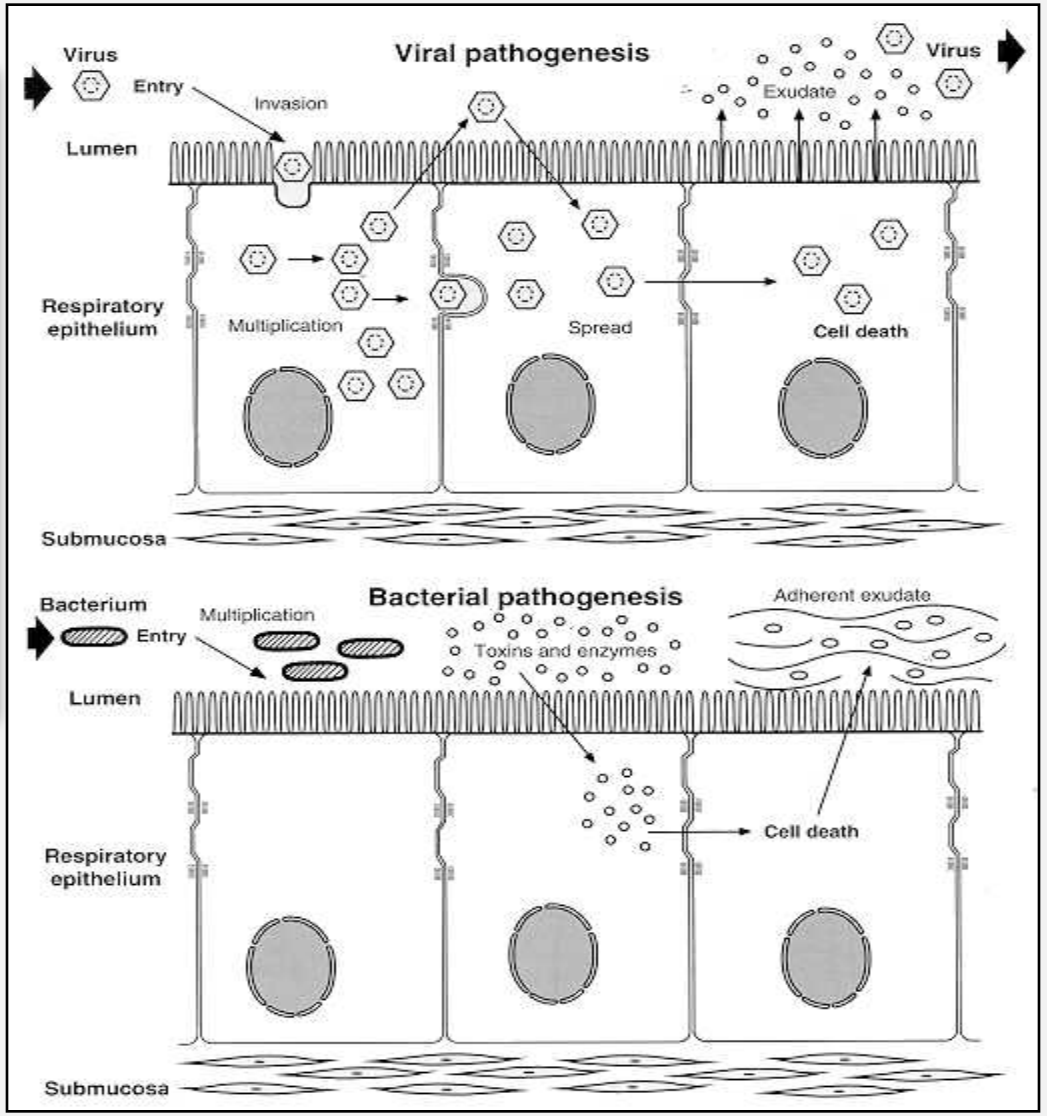
Epidemiology:

- Common in winter
- Overall the rate of CAP 5-6 cases per 1000 persons per year
- Mortality 23%
- Pneumonia are high especially in old people
- Almost 1 million annual episodes of CAP in adults ≥ 65 yrs in the US

Pathogenesis

Two factors involved in the formation of pneumonia

- pathogens
- host defenses.



Defense Mechanisms of the Respiratory Tract

- Filtration and deposition of environmental pathogens in the upper airways.
- Cough reflex.
- Mucociliary clearance.
- Alveolar macrophages.
- Humoral and cellular immunity.
- Oxidative metabolism of the neutrophils.

Pathophysiology :

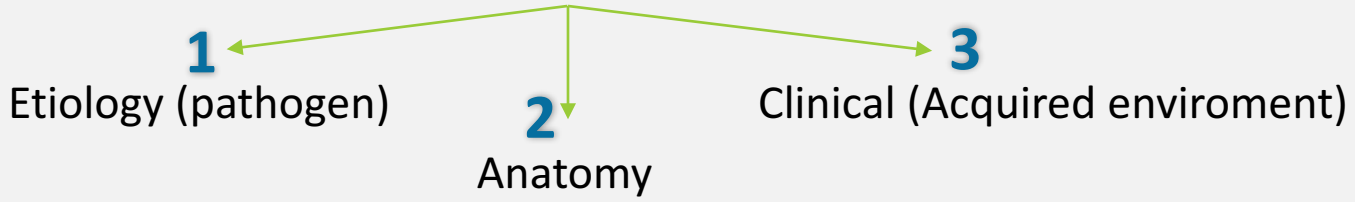
1. Inhalation or aspiration of pulmonary pathogenic organisms into a lung segment or lobe.

2. Result from Secondary bacteraemia from a distant source, such as Escherichia coli urinary tract infection and/or bacteraemia (Less common)
3. Aspiration of Oropharyngeal contents (multiple pathogens).

Risk factors:

- Age < 2 yrs , > 65 yrs (extreme ages)
- alcoholism ,smoking
- Asthma and COPD
- Aspiration
- Dementia (A chronic mental disorder marked by memory loss, personality changes, and impaired reasoning)
- prior influenza
- **Immunosuppression ,HIV**
- Institutionalization (The process of committing someone to a facility like prisons and mental hospitals)
- **Travelling** and staying in hotels**: Legionella bacteria** (تعيش في وحدات التكييف خصوصًا في الفنادق وغرف العناية المركزة .بكتيريا المكيفات المركزية) **(waterborne transmission)**
- pets, occupational exposures- **birds C- psittaci = (Chlamydophila psittaci)**
- Chronic lung & heart (S.pneumoniae)

Classification of pneumonia : according to



1- Pathogens:

1- Bacteria (dominant)				2- Fungal pneumonia	3- Viral pneumonia common cause of pneumonia in children less than 5 years	4- Others
Typical pneumonia			Atypical pneumonia			
Gram +	Gram -	Anaerobic				
1)**Streptococcus pneumoniae** (most common Typical pneumonia) 2)Staphylococcus aureus 3) Group A hemolytic streptococci	1)Klebsiella pneumoniae 2)**Hemophils influenzae** 3)**Moraxella catarrhal** 4)Escherichia coli		1)**Legionnaies pneumonia(Legionella)** 2)**Mycoplasma pneumoniae** (most common) 3)**Chlamydiophila pneumoniae** 4)Chlamydophila Psittaci 5)Rickettsias. 6)Francisella tularensis (tularemia)	1)Candida. 2)Aspergillosis. 3)Pneumocystis jiroveci (carinii), It causes PCP.	1)Respiratory syncytial V. 2)Influenza V. 3)Adenoviruses. 4)Human metapneumovirus. 5)SARS and MERS CoV. 6)Cytomegalovirus. 7)Herpes simplex virus.	1)Parasites 2)Protozoa 3)Chemical 4)Allergy

1)Streptococcus pneumoniae, H.influenzae and Moraxella: have cell wall therefore are gram stained and respond to Penicillin and B-lactam

2)Mycoplasma pneumoniae, Legionella and chlamydia: doesn't have cell wall (resistant to drugs that work on cell wall E.g (penicillin and B-lactam)

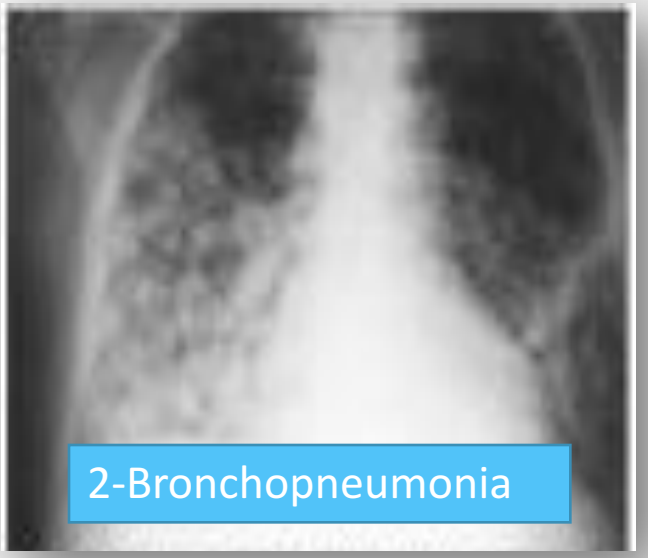
- Parasites and protozoa infections are rare
- Immunocompromised patients are more likely to develop fungal + viral pneumonia

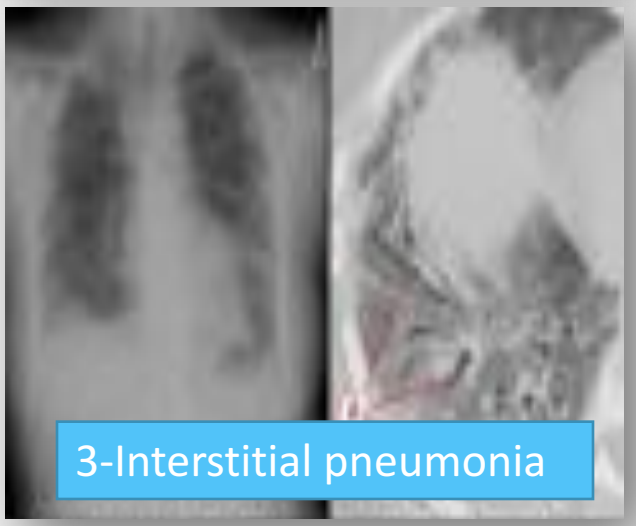
2- Anatomical pneumonia:

1-Lobar pneumonia

Entire Lobe

Lobular





CAP and bioterrorism agents

- *Bacillus anthracis (anthrax)*
- *Yersinia pestis (plague)*
- *Francisella tularensis (tularemia)*
- *Coxialla . burnetii (Q fever)*

- Level three agents

3- Classification by acquired environment:

- Community Acquired Pneumonia (CAP)
- Hospital Acquired Pneumonia (HAP)
- Nursing Home Acquired Pneumonia (NHAP)
- ImmunoCompromised Host Pneumonia (ICAP)

Outpatient	Inpatient Non-ICU	ICU
• Streptococcus pneumoniae • Mycoplasma / Chlamydophila • H. influenzae, Staph aureus • Respiratory viruses	• Streptococcus pneumoniae • Mycoplasma / Chlamydophila • H. influenzae, Staph aureus • **Legionella** • Respiratory viruses	• Streptococcus pneumoniae • Staph aureus, **Legionella** • Gram neg bacilli (Enterobacteriaceae, and Pseudomonas aeruginosa) • H. influenzae

Community Acquired Pneumonia (CAP):

- **Definition**: Pneumonia **acquired <u>outside of hospitals</u>** or extended-care facilities for >14 days before the onset of symptoms.

  Streptococcus pneumoniae (most common)
  Haemophilus influenzae
  mycoplasma pneumoniae
  Chlamydia pneumoniae
  Moraxella catarrhalis
  Staph.aureus

- Commonly caused by **Streptococcus pneumoniae** , and **drug resistant *streptococcus pneumoniae* (DRSP)** is a **major concern** on this aspect.

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

Important

	Typical	Atypical
Etiology	• S.Pneumoniae (Lobar Pneumoniae) • H.influenza • Moraxella catarrhal	• Mycoplasma pneumonia • chlamydophila pneumoniae • Legionella • TB • Viral, Influenza and Adenovirus • or fungal
Clinical presentation	• Sudden onset of fever, chill, productive cough, shortness of breath and chest pain. Rusty Sputum.	• Gradual onset headache, sore throat and body ache
Gram stain	• Useful	• **Useless (no cell wall)**
Radiography	• Lobar infiltrate **Condolidation**	• Dramatic changes: patchy or interstitial **No Consolidation**
Treatment with penicillin	• Sensitive	• Resistant, treated with **Macroides**
Diagnosis	• History & physical examination • X-ray examination • Laboratory : ✓ **CBC- leukocytosis** ✓ **Sputum Gram stain**- 15% ✓ **Blood culture**- 5-14% ✓ Pleural effusion culture	• Serology test • X-ray • **liver enzyme high**

Drug Resistant Strep Pneumoniae:

Not Important

- 40% of U.S. Strep pneumo CAP has some antibiotic resistance:
  - PCN, cephalosporins, macrolides, tetracyclines, clinda, bactrim, quinolones.
- All MDR strains are sensitive to vancomycin or linezolid; most are sensitive to respiratory quinolones.
- β-lactam resistance – Not for meningitis (CSF drug levels).
- PCN is effective against pneumococcal.
- Pneumonia at concentrations that would fail for meningitis or otitis media.
- For Pneumonia, pneumococcal resistance to β-lactams is relative and can usually be overcome by increasing β-lactam doses (not for meningitis!)

Boys slides

	PCN Minimum Inhibitory Concentration (MIC) mcg/mL to Streptococcus Pneumonmoniae:		
	Susceptible	Intermediate	Resistant
2011CAP Guidelines	MIC <2	4	MIC ≥ 0.12
Meningitis	MIC <0.06	---	MIC ≥0.12

Girls slides

	PCN Minimum Inhibitory Concentration (MIC) mcg/mL to Streptococcus Pneumonmoniae:		
	Susceptible	Intermediate	Resistant
2008	MIC ≤ 2	MIC = 4	MIC ≥ 8
2007 CAP Guidelines	MIC <2	---	MIC ≥ 2
Meningitis	MIC <0.06	---	MIC ≥0.12

- Pneumococcal CAP: Be cautious if using PCN if MIC >4. Avoid using PCN if MIC ≥8.
- Remember that if MIC <1, pneumococcus is PCN-sensitive in sputum or blood (but need MIC <0.06 for PCN-sensitivity in CSF).

Atypical Pneumonia

Organisms that cause Atypical Pneumonia:

- Chlamydia pneumonia
- Mycoplasma pneumonia
- Legionella spp
- Psittacosis – Parrots (Caused by birds droplets) مرض الطيور
- Coxiella burnettii (Q fever)مرض الماعز
- Viral (Influenza, Adenovirus)
- AIDS
- PCP
- TB (M. intracellular)

About Atypical Pneumonia:

- Approximately 15% of all CAP(Community-Acquired Pneumonia)
- Not detectable on gram stain
- Won't grow on standard media
- Often extra-pulmonary manifestations:
  - Mycoplasma: otitis, non-exudative pharyngitis, watery diarrhea, erythema multiform, increased cold agglutinin titer
  - Chlamydophilla: laryngitis
- Most don't have a bacterial cell wall→ Don't respond to β-lactams
- Therapy: macrolides, tetracycline, quinolones (intracellular penetration, interfere with bacterial protein synthesis)

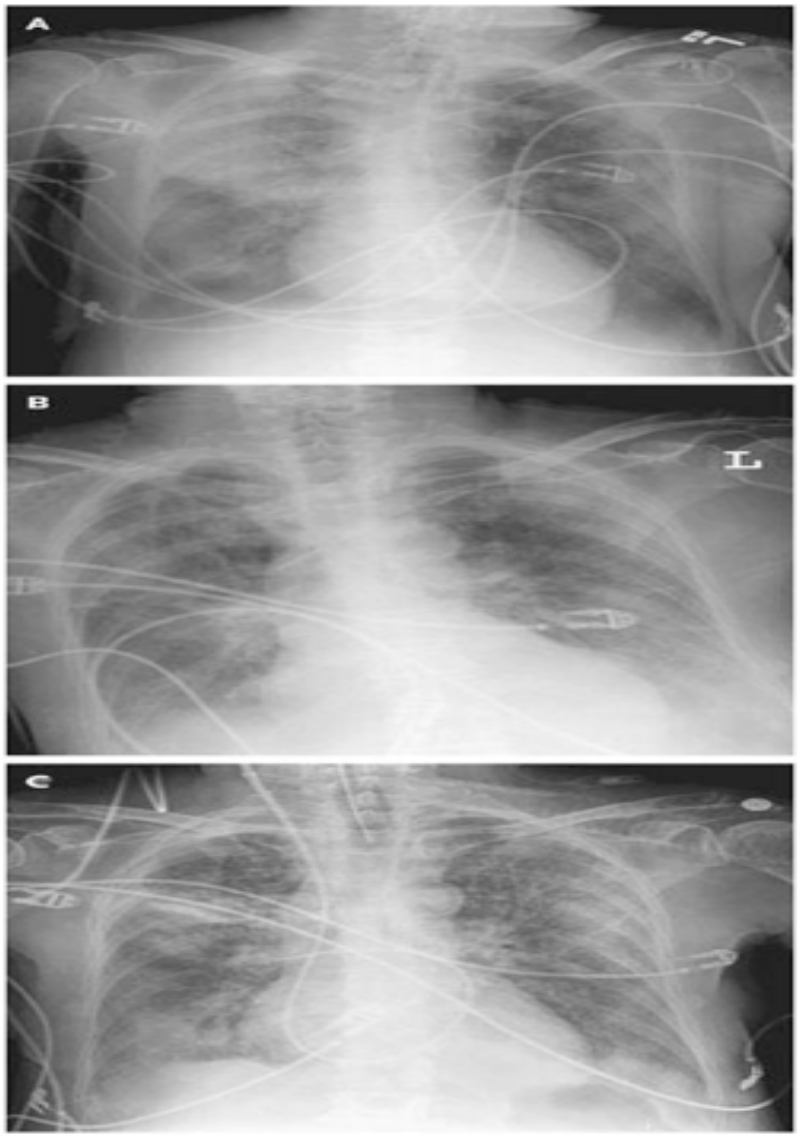
Mycoplasma pneumonia:

- Eaton agent (1944).
- No cell wall.
- **Common.**
- Rare in children and older than 65 years.
- People **younger than 40.**
- Crowded places like schools, homeless shelters, prisons.
- Usually **mild and responds** well to antibiotics.
- Can be very serious.
- May be associated with a **skin rash**, hemolysis, myocarditis or pancreatitis.

- Mortility Rate 1.4%

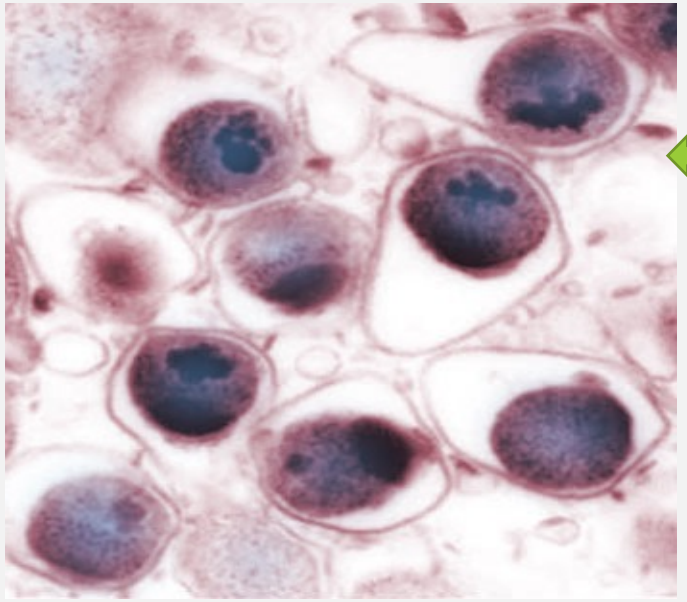
- Detection through serum antibodies
- Low mortality rate

Mycoplasma pneumonia x-ray



Chlamydia Pneumonia:

- **Chlamydophila pneumoniae** is a species of Chlamydophila, and it's Obligate intracellular organism
- 50% of adults sero-positive
- Mild disease
- Sub clinical infections common
- 5-10% of community acquired pneumonia
- This atypical bacterium commonly causes pharyngitis, bronchitis, coronary artery disease and atypical pneumonia in addition to several other possible diseases.



Chlamydophila pneumoniae

وجه الشبه بين مايكوبلازم و الكالميديا: لا عدم وجود الجدار الخلوي، لا يصيب كبار السن و الأطفال، يسبب حالات خطيرة (غالبًا).

وجه الاختلاف بين الاثنين (مهم جدًا): المايكوبلازما تسبب طفح جلدي و أمراض في القلب و البنكرياس، بالإضافة لأماكن العدوى.

Important

Psittacosis:

-Chlamydophila psittaci

-Exposure to birds

-Bird owners, pet shop employees, vets

Parrots, pigeons and poultry (الدواجن).

-Birds often asymptomatic (because it is normal flora for them).

1st: Tetracycline

Alt: Macrolide

Q Fever:

Coxiella burnetti

Exposure to farm animals mainly sheep ماعز

1st: Tetracycline, 2nd: Macrolide

Legionella pneumophila:

- Legionnaire's disease.
- Serious outbreaks linked to exposure to cooling towers
- ICU admissions.
- Hyponatremia common (<130mMol) (low sodium)
- Bradycardia
- WBC < 15,000
- Abnormal LFTs (liver function test)
- Raised CPK (creatine phosphokinase)
- Acute Renal failure
- Positive urinary antigen

Symptoms :

-Insidious onset
-Mild URTI (upper resp tract infection) to severe pneumonia
-Headache
-Malaise
-Fever
-Dry cough
-Arthralgia (pain in a joint)/ myalgia(pain in a muscle)

Signs :

-Minimal Few crackles
-Rhonchi (rattling sound of the lung خشخشة)
-Low grade fever

Cont…

Diagnosis:

-CBC

Mild elevation WBC

-U&Es

-Low serum Na (Legionella)

-Deranged LFTs = Increase Liver enzymes

↑ ALT (Alanine transaminase enzyme)

↑ Alkaline phosphatase

-Culture on special media BCYE

(لكن عمليا ما يسوونه لانه يطول اكثر من اللازم)

-Cold agglutinins (Mycoplasma)

-Serology

-DNA detection

Differential diagnosis : (ما ركز عليها)

-Pulmonary tuberculosis

-Lung cancer

-Acute lung abescess

-Pulmonary embolism

-Noninfectious pulmonary infiltration

Treatment:

Macrolide (Erythromycin)

Rifampicin

Quinolones

Tetracycline

Treat for 10-14 days

(21 in immunosuppressed)

Importance of history taking in patient with community-Acquired pneumonia:

History	
• Solid organ transplant	Any pathogen Bacterial , viral, fungal,or parasitic
• HIV	Pneumocystis jeroveci
• Travel to some area in USA	Endemic Mycosis
• Exposure to air-conditioning, cooling towers, hot tub, hotel stay, grocery sore mist machine	Legionella pneumophilla
• Exposure to Turkeys, chickens, ducks or parrots	Chlamydia psittaci
• Exposure to contaminated bat caves	Histoplasma capsulatum
• Exposure tosheep, goat or cattle	Coxiella burnetii
• Exposure to rabbits	Francisella tularensis
• Occupation	Mycobacterium tuberculosis, HIV

Evaluate the severity & degree of pneumonia:

Is the patient will require hospital admission?

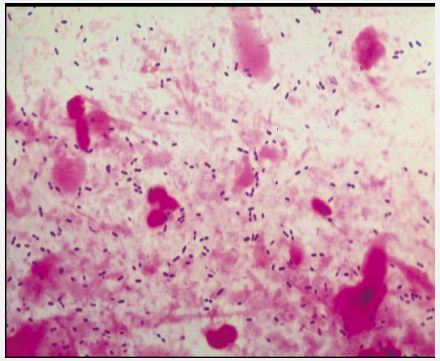
- patient characteristics
- comorbid illness
- physical examinations
- basic laboratory findings

Diagnosis: -no culture -urine test is used

- **Physical examination:**
  - ✓ Respiratory signs on consolidation
  - ✓ Other systems
- **Chest x-ray examination**
- **Laboratory**:
  - ✓ CBC- leukocytosis
  - ✓ Electrolytes (↓Na in legionella)
  - ✓ Urea, creatinine, LFT

Only in girls slides

- Sputum Gram stain- 15%
- Sputum culture
- Bronchoscopic specimens
- Blood culture 6-10%
- NP swab for respiratory viruses
- Legionella urine antigen
- Serology for M.pneumoniae, C.pneumoniae
- Cold agglutination M.pneumoniae
- More Invasive procedure in sick patient



Management:

Girls slides

- Outpatient or inpatient (hypotension, confusion and oxygenation) and age
- Previous treatment in the past 3 months
- Resistance patterns in the community

Boys slides

- Outpatient, healthy patient with no exposure to antibiotics in the last 3 months
- Outpatient, patient with co-morbidity or exposure to antibiotics in the last 3 months
- Inpatient : Not ICU
- Inpatient : ICU

Antibiotic Treatment:

- Macrolide: Azithromycin, Clarithromycin
- Doxycycline
- Beta Lactam :Amoxicillin/clavulinic acid, Cefuroxime
- Respiratory Flouroquinolone:Gatifloxacin, Levofloxacin or Moxifloxacin
- Antipeudomonas Beta lactam: Cetazidime
- Antipneumococcal Beta lactam: Cefotaxime

		Macrolides	Doxycycline	Levofloxacin	B-lactam And Macrolide	B-lactam And Levofloxacin
Outpatient, healthy patient with **no exposure to antibiotics** in the last 3 months	• **S pneumoniaes,** • **M pneumoniae,** • **Viral**					
Outpatient, patient with comorbidity or **exposure to antibiotics in the last 3 months**	• **S pneumoniaes,** • **M pneumoniae,** • **C. pneumoniae,** • **H influenzae** • **M.catarrhalis** • **anaerobes** • **S aureus**					
Inpatient : Not ICU (not important)	• **Same as above +legionella**					
Inpatient : ICU (not important)	• **Same as above + Pseudomonas**					

Summery:

Macrolides and Levofloxacin = are effective for both Typical and Atypical

B-lactam only work on Typical therefore need to be combined with **Macrolides**

in the exam they may ask about the antibiotic that covers the typical and nontypical bacteria (important)

The diagnostic standard of severe pneumonia: not important

(It means : the problems that a severe pneumonia patient will have)

1-Altered mental status

2-Pa02<60mmHg. PaO2/FiO2<300, needing MV

3-Respiratory rate>30/min

4-Blood pressure<90/60mmHg

5-Chest X-ray shows that bilateral infiltration, multilobar infiltration and the infiltrations enlarge more than 50% within 48h.

6-Renal function: (Under <20ml/h) and (Under<80ml/4h)

Not Important

Notes:

- Normal respiratory rate is 12-16
- -PaO2/FiO2 ratio. The ratio of partial pressure arterial oxygen and fraction of inspired oxygen, sometimes called the Carrico index, is a comparison between the oxygen level in the blood and the oxygen concentration that is breathed.

Complications:

1-Death 10% , 40% (ICU) within 5 days

2-Mainly old age with sever pneumonia

3-Respiratory and cardiac failure

4-Empyema 10%

prevention

- By giving Vaccination :
  - Influenza
  - S.pneumoniae
- Prevention of Aspiration by:
  - Head Position
  - Teeth cleaning

- **Community Acquired Pneumonia not common in young**
    - Young have twice Pneumonia within 3 months is an immunocomprmised and suspect HIV
    - Young travelled also suspect HIV
- **Anthrax and Coxiella (Q fever- ماعز) cause Pneumonia.**
    - Anthrax is a deadly disease
- **Liganella come from hot water, hospital fountain, aircoditioning**
    - Have High fever, don’t respond to Penicillin and effect old and immunocomprmised patient
- **Good sputum have: Macrophages, WBC, Columnar ciliated epithelial cells (No Squamous cells)**
- **Mycoplasma and chlamydia :** we don’t do culture , we **do PCR and serology** (because it require living cell wich takes time patient would be already dead)

MCQs:

1-The most common organism that causes Atypical pneumonia ?

A- Klebsiella pneumonia

B- Legionella

C- Mycoplasmal pneumonia

D- Ricketsias

2-Patient came with productive cough , shortness of breath and chill , which organism could cause these symptoms ?

A- Legionnaires pneumonia

B- adenovirus

C- M. tuberculosis

D- H. infleunza

3-What possible drug you could prescribed for a patient who has Mycoplasma pneumoniae ?

A- Penicillin G

B-Erythromycin

C- ceftriaxone

D- cephalexin

3-B
2- D
1- C

SAQ:

1-A patient have been admitted to the ICU suffer from fever. what is the most common micro-organism causing this?

2- what will you do to confirm the diagnosis?

3-How will you treat this condition?

4- Sara had a flu tow days ago, now she suffers from diarrhea, otitis, and erythema. what is the diagnosis?

5- List the possible causative agents and the micro-organisms for the diagnosis above?

1- legionella pneumophila
2- CBC, Mild elevation WBC, U&Es, Low serum Na, Deranged LFTs, ↑ ALT (Alanine transaminase enzyme), ↑ Alkaline phosphatase, Culture on special media BCYE, Cold agglutinins (Mycoplasma), Serology DNA detection
3- Macrolide (Erythromycin), Rifampicin, Quinolones, Tetracycline, Treat for 10-14 days (21 in immunosuppressed)
4-Atypical pneumonia
5- Chlamydia pneumonia, Mycoplasma pneumonia, Legionella spp, Psittacosis, Coxiella burnettii

GOOD LUCK!

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