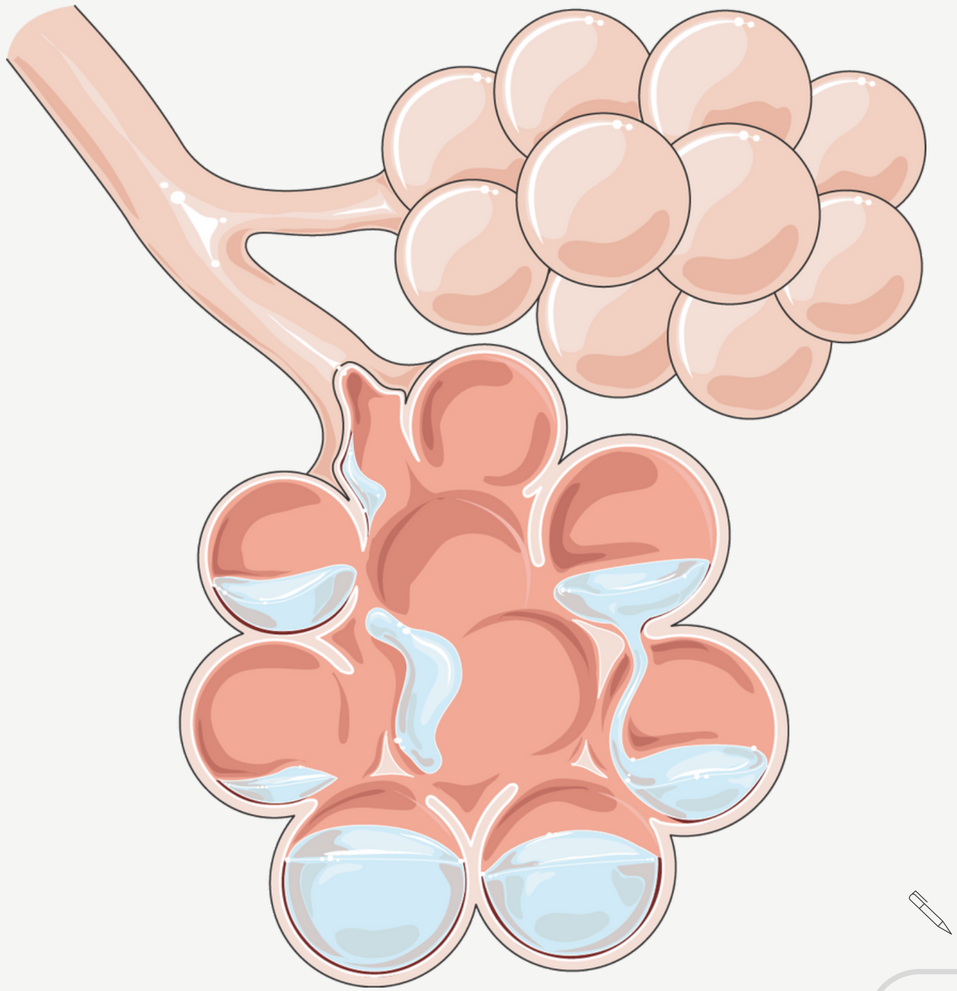
COMMUNITY AQCUIRED PNEUMONIA

Lecture no.3



Editing File

Color index:

Main text	Girls' slides
Important	Boys' slides
Dr. notes	Extra

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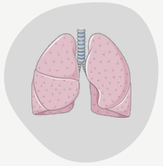
OBJECTIVES



Discuss the epidemiology and pathophysiology of pneumonia and CAP

Explain the different classifications of pneumonia

Recognize clinical presentations associated with CAP

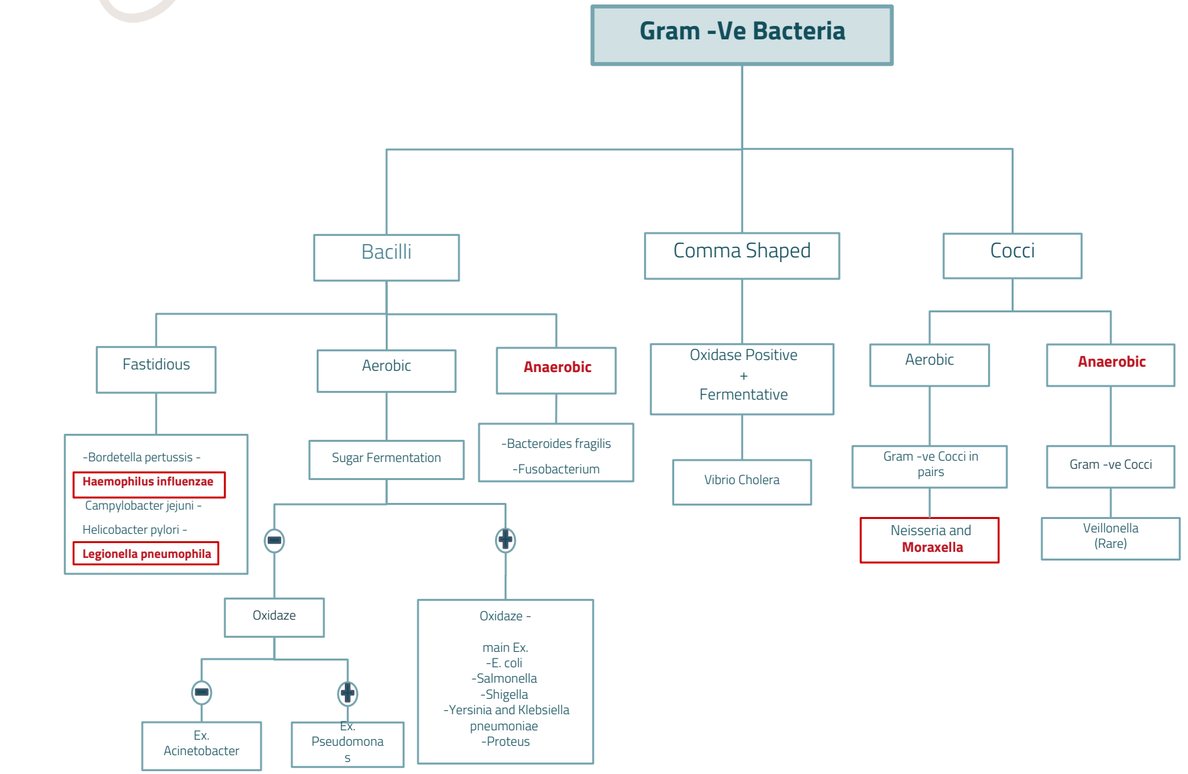
Discuss the diagnosis and treatment of CAP

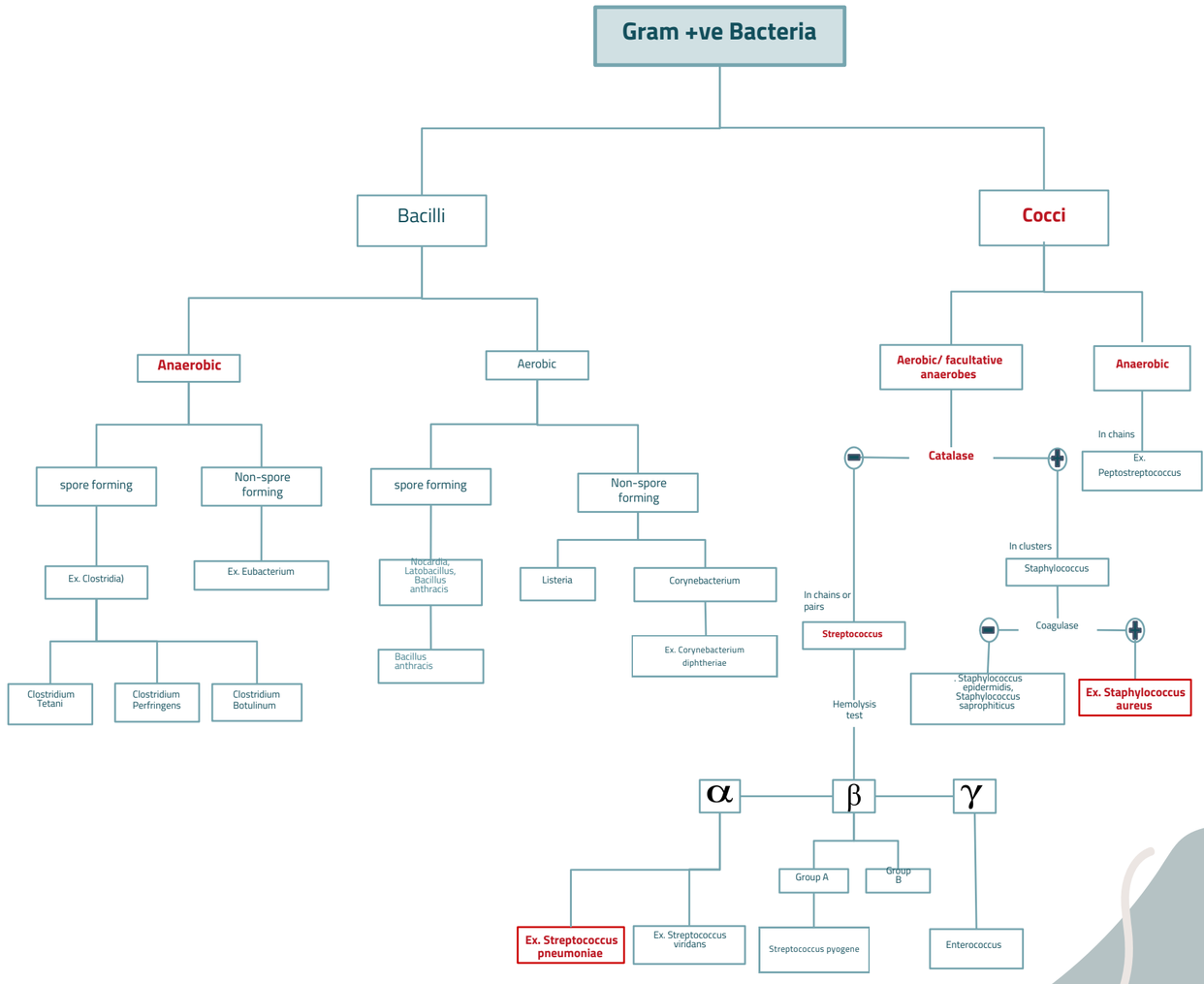
Identify common etiological agents causing CAP and discuss their laboratory work up

Discuss virulence factors and prevention of streptococcus pneumoniae

Click Here for an unofficial telegram sketchy BOT.

BACTERIA (IN THIS LECTURE)



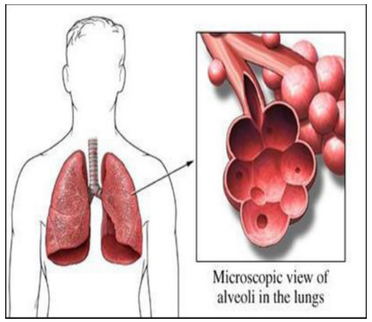


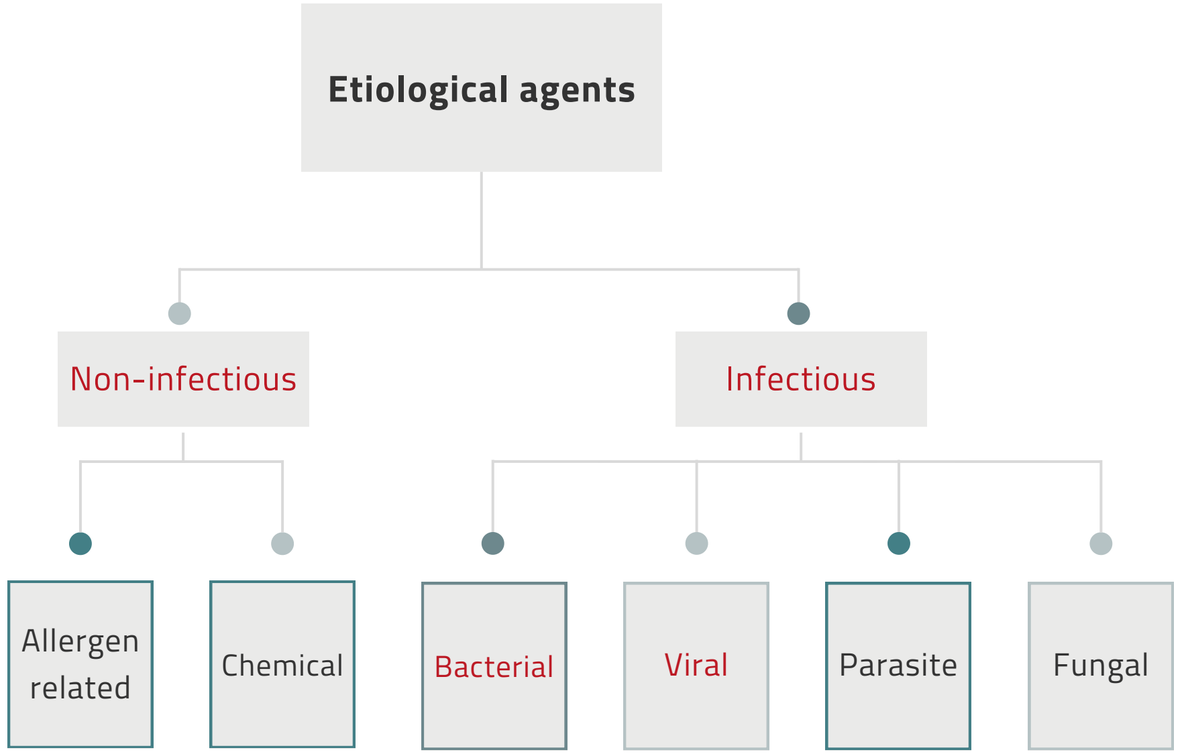
PNEUMONIA

Definition

- Pneumonia is an infection that leads to inflammation of the parenchyma of the lung (the alveoli) (consolidation and exudation)

- It may present as acute, fulminant clinical disease or as a chronic disease with a more prolonged course.





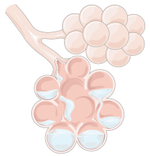
The most common cause is **bacteria** but know that it's can come with other infectious agent

Epidemiology

- Overall the rate of CAP: 5-6 cases per 1000 persons per year.

- Mortality 23% – High, especially in old people.

- Almost 1 million annual episodes of CAP in adults > 65 yrs in the US.



PNEUMONIA

Risk factors:

1. Age (younger than 2 years, and older than 65 years)
2. Immunosuppression.
3. Asthma and COPD (Uncontrolled or severe)
4. Alcoholism
5. HIV
6. Smoking
7. Institutionalization (nursing homes, prisons)
8. Aspiration
9. Recent hotel: Legionella
10. Prior influenza. 443: (important risk factor), انفلونزا اذا جت للانسان تسهل للبكتيريا تجي بعدها
11. Dementia
12. Travel, pets, occupational exposures- birds (C.psittaci

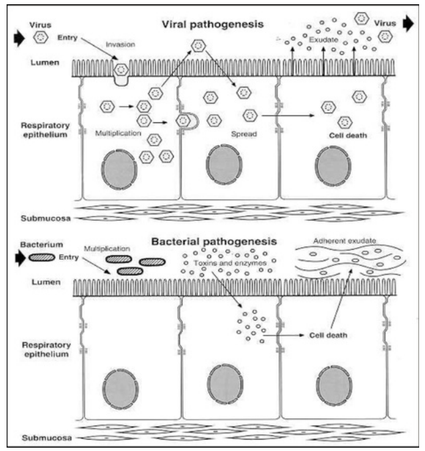
PATHOGENESIS

Factors involved in the formation of pneumonia

- Host defenses
- Pathogens

Defense Mechanism of Respiratory Tract

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



Pathophysiology

1. Inhalation or aspiration of pulmonary pathogenic organisms into a lung segment or lobe. (Mainly)
2. Results from secondary bacteraemia from a distant source, such as Escherichia coli urinary tract infection and/or bacteraemia (less commonly).
   Infection in other organ / place such as urinary tract leads to bacteremia then infects the lung.
3. Aspiration of oropharyngeal contents (multiple pathogens).

CLASSIFICATION OF PNEUMONIA

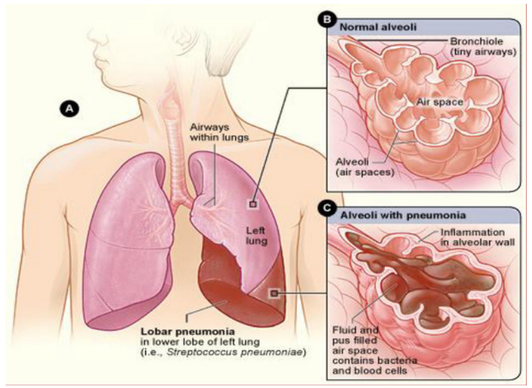
Pneumonia is Classified According to

Acquired Pathogen

- Viral
- Fungal
- Parasite
- **Bacterial**
  - **Typical**
    Typical presentation of pneumonia, fever, productive, cough, leukocytosis, chest pain, low oxygenation etc..
  - **Atypical**
    Less sick than typical, also called walking pneumonia, dry cough, less dangerous.

Acquired Enviroment

- Community acquired pneumonia(CAP)
- Hospital acquired pneumonia (HAP)
- Nursing home acquired pneumonia (NHAP)

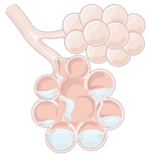


Anatomy

- **Lobular: bronchopneumonia**
  (Around alveoli and bronchi),
  443: Most common in viral infection St.pneumoniae (usually).

- **Interstitial**
  443:Around the lung interstitium
  Usually caused by: Atypical or Viruses.

- **Lobar: Entire lobe.**
  443: caused by typical pneumoniae.



COMMUNITY ACQUIRED PNEUMONIA

Overview

- CAP is a pneumonia acquired outside of hospitals or extended care facilities.
- Fever, productive cough, infiltrate (we see it in x-ray).

Prevalence of CAP

1. **Strep pneumonia** 48% **(most common)**
2. Viral 23% (most common on URTI)
3. Atypical orgs (MP,LG,CP) 22%
4. Haemophilus influenzae 7%
5. Moraxella catarrhalis 2%
6. Staph aureus 1.5%
7. Gram negative organisms 1.4%
8. Anaerobes

Typical Pneumonia

- Detectable by gram stain, can be cultured easily.
- 443: Mainly lobar and lobular

- Caused by:

- Streptococcus pneumoniae (Lobar Pneumonia)

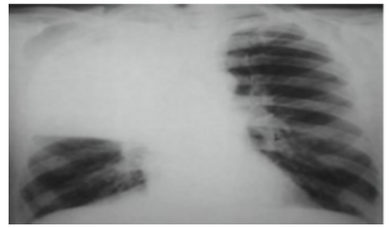
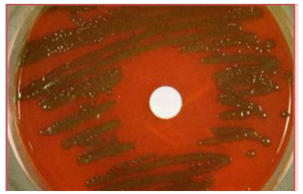
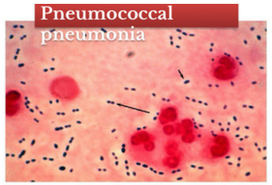
- Haemophilus influenzae.
- Moraxella catarrhalis.
- Staph Aureus.
- Gram negative organisms.

Atypical Pneumonia

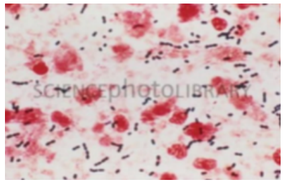
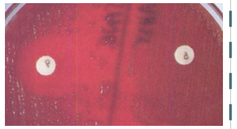
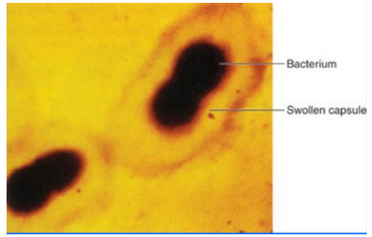
- Approximately 15% of all CAP
- Not detectable on gram stain, and won't grow on standard media.
- Some don't have cell wall, so they will not respond to β lactams.
- 443: mainly Interstitial

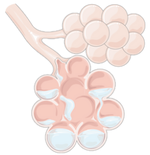
- Caused by:
- Mycoplasma pneumoniae
- Chlamydia pneumoniae
- Legionella pneumoniae (less common but very severe, leading to ICU admission)
- Coxiella burnetii (Related to sheep)
- Chlamydia psittaci (Related to birds)

TYPICAL PNEUMONIA

Overview		• The onset is acute. • Prior viral upper respiratory infection.
Respiratory symptoms		• Fever • Shaking chills • Cough with sputum production (rusty-sputum) • Chest pain or pleurisy • Shortness of breath
Diagnosis	**Clinical**	• History (fever, cough, chest pain) • Physical examination (Decreased air entry & dullness on percussion)
	Radiological	• X-ray examination (used to confirm the diagnosis pneumonia, and to determine the type,lobar/interstitial /lobular) • X-ray of typical is usually lobar or lobular 
	Laboratory	• CBC Shows leukocytosis (Higher WBCs than normal) • Sputum 1- Gram stain- 15% 2- Culture • Blood culture-5-14% • Pleural effusion gram + culture  

STREPTOCOCCUS PNEUMONIAE (CAUSES TYPICAL PNEUMONIAE)

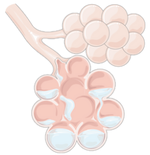
Overview	Normal flora of upper respiratory tract in 20- 40% of people	
Organism	• Gram Positive diplococci • Alpha hemolytic streptococci • Catalase Negative	
Other Features	• Sensitive to Optochin • Lysed by bile (bile soluble) } 443: These 2 methods are used to differentiate Features between S.viridans, & S.pneumonia. (Remember S.viridans is normal flora in the GIT so it can survive in bile unlike S.pneumoniae which can't)	Optochin test: 
Virulence Factors	• **Capsule** (Most important virulence factors) more than 90 capsular types • Pneumolysin (Pore forming toxin that destroys host cells -> Hemolysis) • Autolysin (Hydrolyzes its own cell wall to release the pneumolysin) • Neuraminidase (Used for attachment to host cell)	
Prevention	Vaccination	
Infections	**Respiratory infections**	• Pneumonia. • Sinusitis. • Otitis.
	Non Respiratory infections	• Bacteremia. • Meningitis.



ATYPICAL PNEUMONIA

- **Approximately 15% of all cases of community acquired pneumonia.**
- **Not detectable on gram stain, and won't grow on standard media.**
- **Some don't have a bacterial cell wall, thus they will not respond to β-lactams.**

Signs	Symptoms
• **Minimal** • **Low grade fever** • **Few crackles** (clicking, rattling, or crackling noises that may be made by lungs with a respiratory disease during inhalation). • **Rhonchi** (continuous sound produced in the lungs due to an obstruction).	• **Mild to severe** (legionella is the most severe). • **Insidious onset** • Headache, malaise, and fever. • **Dry cough** • Arthralgia / Myalgia (Pain in joints / Pain in muscles). • Atypical pneumonia symptoms are less acute, less severe (more mild), more insidious, and takes a longer time compared to typical pneumonia.



ATYPICAL PNEUMONIA CONT…

Diagnosis

- X-Ray (Mainly interstitial pattern, with the exception of legionella, which can have any pattern)
- CBC
- Mild elevation in WBC
- U&Es (urea & electrolytes)
- Low serum Na for Legionella (Hyponatremia)
- LFTs (liver function tests): Elevated liver enzymes for Legionella.
- Increase in ALT (Alanine aminotransferase)
- Increase in Alk Phos (ALP or Alkaline phosphatase)
- Legionella may affect the kidney and cause elevated creatinine.
- N.B. We cannot grow atypical pneumonia organisms on standard media and we cannot gram stain them, so we will use other methods.
- Sputum Culture on special media (BCYE) for Legionella
- Urine antigen for Legionella
- Serology for detecting antibodies
- DNA detection (Molecular testing/PCR)

Important: You won't be asked specifically about what's specific for legionella or what's specific for mycoplasma, but you may be asked about what can be done to diagnose atypical or typical organisms in general.

Treatment

- Macrolide → Erythromycin
- Quinolones
- Tetracycline
- Those 3 can also work on typical pneumonia organisms.
- (We can use one, or a combination of these in case of resistance)
- β-lactams have no activity.
- Treat for 10-14 days.

MYCOPLASMA PNEUMONIA

Eaton's agent (1944).

No cell wall. (so antibiotics that affect the cell wall won't work, e.g β-lactams)

Common.

Rare in children and in patients older than 65.

Common in people younger than 40 (Young adults and adults).

Transmits well in crowded places like schools, homeless shelters, prisons.

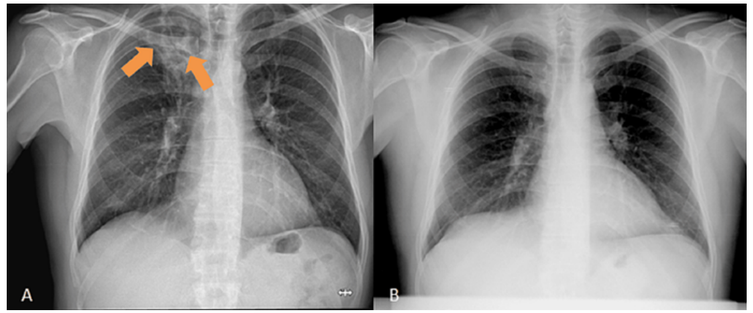
Can cause URT symptoms. e.g. cough, sore throat, nasal congestion, headache, fever...

Usually mild and responds well to antibiotics.

Can be very serious.

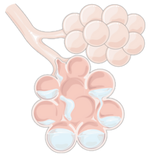
Diagnosis

- Serology (Antibody detection)
- NAAT (Molecular testing)
- Culture can be done but requires special media and slow grower (weeks) (It takes very long, so it is not usually used)
- X-Ray (It has interstitial pattern)



Maybe associated with extra pulmonary findings

1- Skin rash
2- Hemolysis
3- Myocarditis
4- Pancreatitis
5- Encephalitis

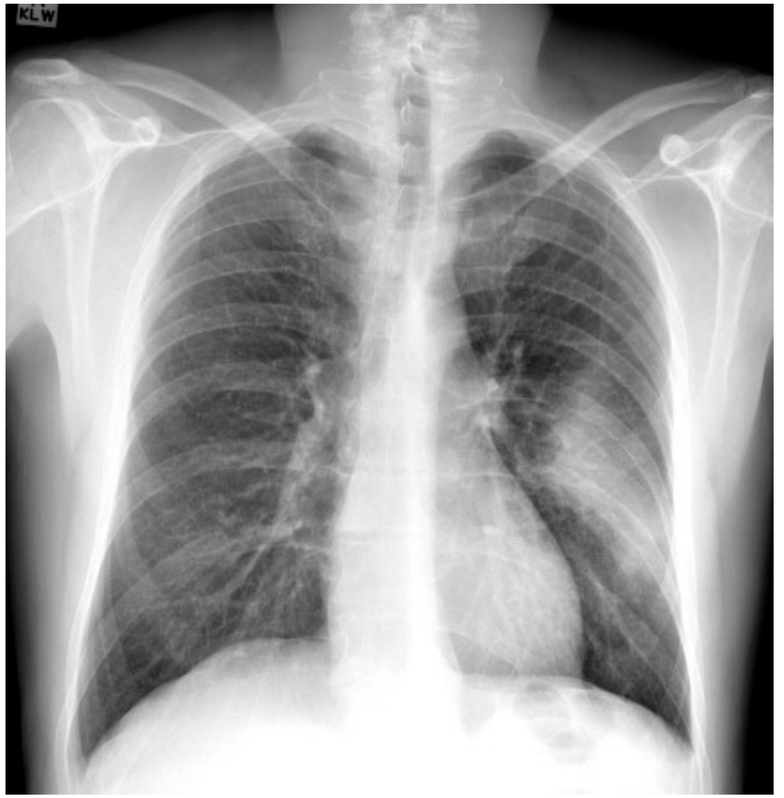


CHLAMYDIA PNEUMONIA

- They are obligate intracellular organism.
- 50% of adults are sero-positive.
- They can cause mild disease.
- Subclinical infections are common.
- Institute 5-10% of community acquired pneumonia.

Diagnosis

- **Serology** (Antibody detection)
- **NAAT** (Molecular testing)



Chest X-Ray of a patient infected with chlamydia pneumonia... Note the consolidation found within the apical segment of left lower lobe.

Q FEVER

It is a zoonotic disease, which refers in general to diseases transmitted from animals to humans.

Organism: **Coxiella burnetii**.

Cause of infection: **Individuals can be infected by exposure to farm animals, mainly sheep.**

Spreading: **It spreads by inhalation of infected animal birth products.**

Complications: **Manifestation of acute Q fever include acute pneumonia.**

Diagnosis

- **Serology** (Antibody detection)

Psittacosis

It is also a zoonotic disease.

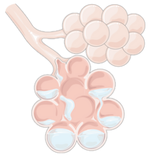
Organism: **Chlamydia psittaci.**

Cause of infection: **Individuals can be infected by exposure to birds, like parrots.**

Usual patients: **Individuals at risk include bird owners, pet shop employees, and vets.**

Carriers: **Transmitted by parrots, pigeons, and poultry.**

Birds often asymptomatic (Do not show symptoms)



LEGIONELLA PNEUMOPHILA

تحب الماء وتعيش في الماء

- **Causes Legionnaires' disease**
- **Serious outbreaks linked to exposure to cooling (water) towers**
- **Can be very severe and lead to ICU admission.**

Can cause

- **Hyponatraemia** (common) (<130mMol)
- Decrease in serum sodium concentration < 130 mMol
- **Bradycardia**
- **WBC < 15,000**
- **Abnormal LFTs (liver function test)**
- **Acute renal failure**
- **Raised CPK** (creatinine phosphokinase) → affect muscles

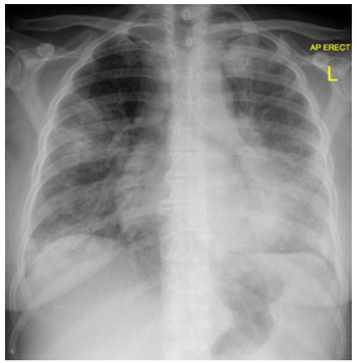
Potiac fever

- **Non pneumonic** (It is legionnaires' disease but without pneumonia).
- **Influenza like illness**
- **Self limiting** (Can resolve without treatment)
- **Related to exposure to environmental aerosols containing Legionella (potentially a reaction to bacterial endotoxins).**

Diagnosis

- **X-Ray** (Can show either interstitial, lobar, or lobular pattern).
- **Using sputum as a specimen:**
- **Culture on specialized media (BCYE)**
- **DFA (It has low sensitivity)**
- **NAAT** (Molecular testing/PCR)
- **Urine antigen testing**

Chest X-Ray of a patient infected with Legionnaires' disease...



ANTIBIOTIC TREATMENT OF CAP

Factors to consider in selection of antibiotics:

1

Co morbidities

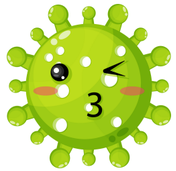
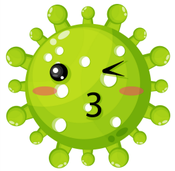
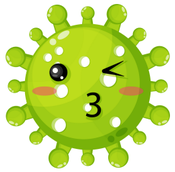
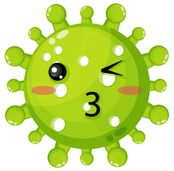
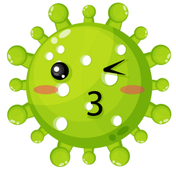
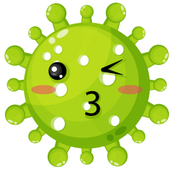
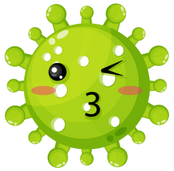
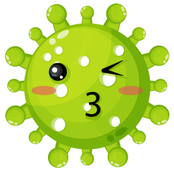
2

Previous antibiotic exposure in the last 3 months

3

Severity

Outpatient management vs requiring inpatient admission vs requiring ICU

Severity	Microorganism	Macrolides	Doxycycline	Levofloxacin	β-lactam and Macrolide	β-lactam and Levofloxacin
Outpatient, healthy, with no exposure to antibiotics in the last 3 months.	- S. pneumoniae - Atypical pathogens - Viral					
Outpatient, with comorbidities or exposure to antibiotics in the last 3 months	All of the above and: - Anaerobes - S. aureus					
Inpatient: Not ICU	All of the above and: - Coliforms					
Inpatient: ICU	All of the above and: Pseudomonas					

Q1: C
Q2: C
Q3: D

MCQs:

Q1/ A 23-year-old man who has recently started working on a sheep farm develops pneumonia shortly after helping with lambing. Which agent is most likely to be the cause of his pneumonia?

A	Chlamydia pneumoniae	B	Chlamydia psittaci	C	Coxiella burnetii	D	S. pneumonia

Q2/ which of the followingis considered a non-infectious cause of Pneumonia?

A	Bacteria	B	Virus	C	Allergy	D	Parasite

Q3/ Most common bacteria to cause Pneumonia?

A	Staph Aureus	B	Moraxella catarrhalis	C	Coxiella burnetii	D	Streptococcus pneumoniae

Q4: B
Q5: D
Q6: C

MCQs:

Q4/ A 25-year old man who owns many kinds of pigeons presented with fever, cough, chills and breathing difficulties. Which of the following is the causative organism?

A	Coxiella burnetii	B	Chlamydia psittaci	C	Mycoplasma pneumoniae	D	Chlamydia pneumoniae

Q5/ Typical bacterial pneumonia is caused by:

A	Mycoplasmal pneumonia	B	Legionnaires pneumonia.	C	Pneumocystis carinii.	D	Staphylococcus aureus.

Q6/ Which of the following is true about S.pneumonia?

A	gram+ and beta hemolytic	B	gram- and beta hemolytic	C	gram+ and alpha hemolytic	D	gram- and alpha hemolytic

SAQs:

Q1/ 15-year-old COPD patient presenting with fever, productive cough, and shortness of breath, along with lobar consolidation on X-Ray, is the pneumonia typical or atypical?

Typical.

what is the most likely organism when a sputum sample reveals gram-negative diplococci? Moraxella catarrhalis.

what if the sputum sample reveals gram-positive diplococci? Streptococcus Pneumoniae

Q2/ 65-year-old COPD patient presenting with low-grade fever, dry cough, and interstitial infiltrate on X-Ray likely typical or atypical?

Atypical

what are the most probable causative organisms?(mention 2) Mycoplasma pneumoniae, Chlamydia pneumoniae, Legionella pneumoniae

Q3/ A 35-year-old woman presents to a clinic in Australia for evaluation of fever, fatigue, and non-productive cough for 1 week. She had been doing a work-stay program on a sheep farm that is specialized in exporting high-quality organic wool. On physical exam, she has rhonchi in the left lower lobe of the lung and chest radiography.

Your diagnosis? Q fever. Causative organism? Coxiella burnetii. Cause of infection? Exposure & inhalation of sheep's birth products.

Suggested diagnostic method? Serology

Meet The Team :)

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