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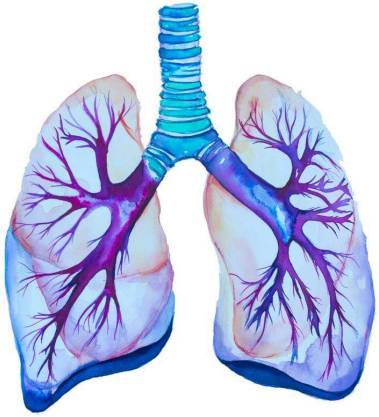


Community Acquired Pneumonia

Color index:

- Important
- Doctor Notes
- Extra, TN

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

What is Pneumonia?

- It's 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.** (very severe)
- **chronic disease** with a more prolonged course.

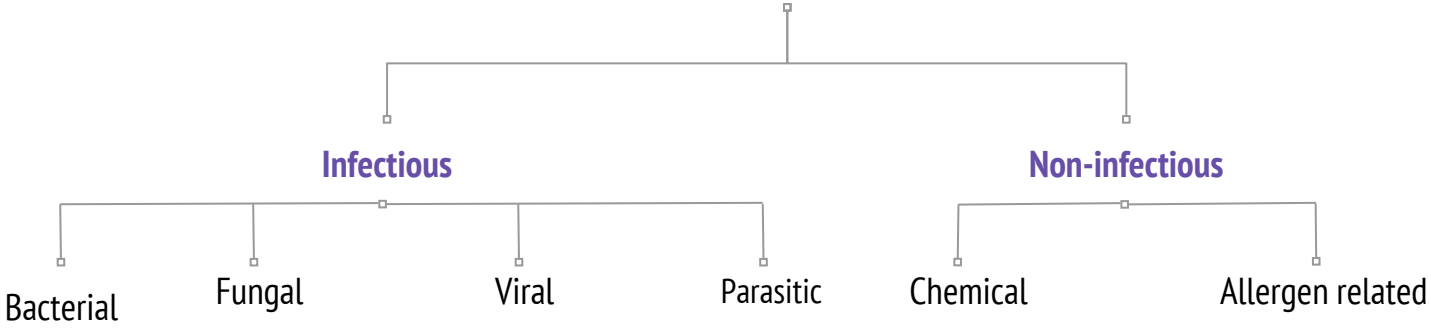
Epidemiology :

- 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.

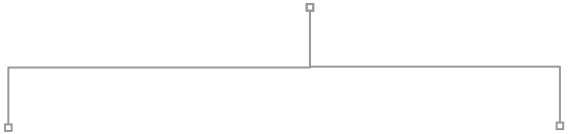
Risk factors :

– Age < 2yrs and > 65yrs
– Alcoholism (mostly gram -ve)
– Smoking
– Asthma and COPD.
– Aspiration (inhaling the secretion of nasopharynx to the lung directly which is abnormal. the person might have aspiration when they lose their conscious like alcoholic and intubation)
– Dementia. (A chronic mental disorder marked by memory loss, personality changes, and impaired reasoning)
– Prior influenza.
– HIV.
– Immunosuppression.
– Institutionalization.
– Recent hotel : Legionella.
– Travel, pets, occupational exposures- birds owner (C.psittaci)

Etiological agents

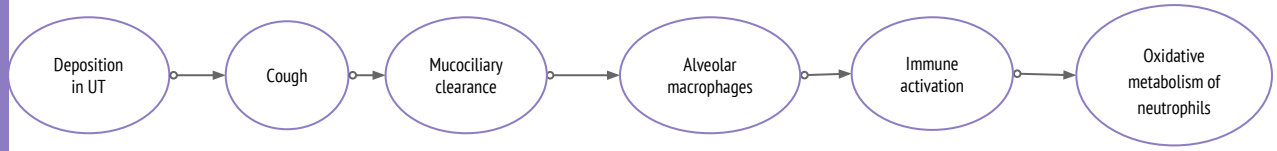


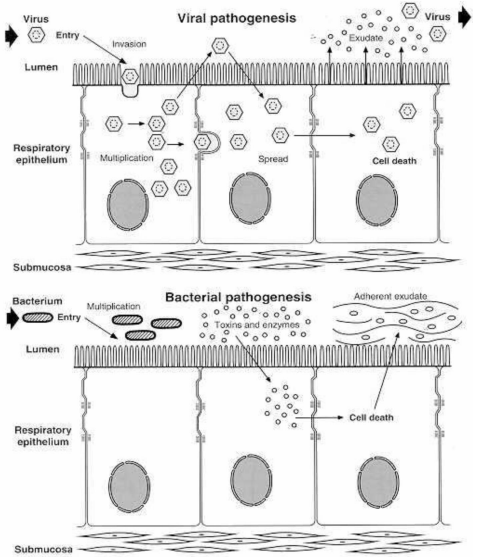
Two factors involved in the formation of pneumonia :



Defense mechanism of respiratory tract :

- Filtration and deposition of environmental pathogens in the upper airways
- Cough reflux
- Mucociliary clearance
- Alveolar macrophages
- Humoral and cellular immunity (IgA is the main immunoglobulin found in mucous secretions, therefore some microorganisms secrete enzymes that destruct IgA causing infections)
- Oxidative metabolism of neutrophils



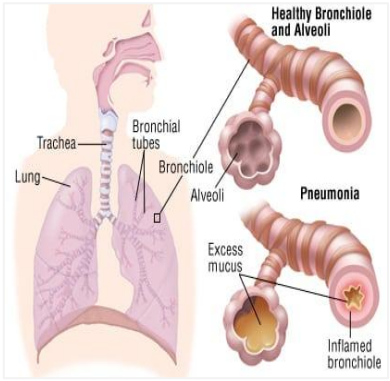


Pathophysiology :

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

2- Results from secondary bacteraemia from a distant source, such as **Escherichia coli** urinary tract infection and/or bacteraemia (less commonly).

3- Aspiration of oropharyngeal contents (multiple pathogens).



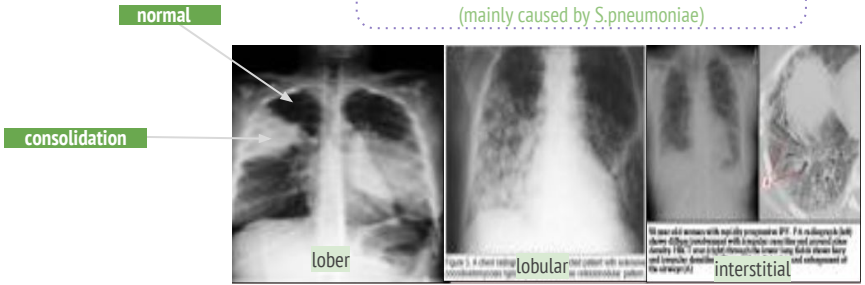
Classification of pneumonia

Pathogen

- Bacterial
  - Typical
  - Atypical
- Viral
- Fungal
- Parasite

Anatomy

- Lobular: (bronchopneumonia).
  (around the bronchi, and mainly caused by bacteria).
- Interstitial
  (mainly caused by virus & Atypical pneumonia organisms).
- Lobar: entire lobe either 1 or 2 lobes
  (mainly caused by S.pneumoniae)



Acquired environment

- Community Acquired Pneumonia (**CAP**)
- Hospital Acquired Pneumonia (**HAP**)
- Nursing Home Acquired Pneumonia (**NHAP**)

Community Acquired Pneumonia
fever + productive cough + infiltrate

CAP: pneumonia acquired outside of hospitals or extended-care facilities

Strep pneumonia (most common cause of CAP).	**48%**	Moraxella catarrhalis (Gram -ve diplococci).	2%
Viral (most common cause of URTI).	23%	Staph aureus (Gram +ve cocci in clusters).	1.5%
Atypical orgs (MP "mycoplasma pneumonia" ,LG "Legionella pneumophila" ,CP "Chlamydia pneumophila")	22%	Gram –ve orgs (mainly in hospital acquired pneumonia).	1.4%
Haemophilus influenza (Gram -ve coccobacilli).	7%	Anaerobes	–

The percentages are for explanation.

Community Acquired Pneumonia

1- Typical

★	Strept. pneumoniae – (lobar pneumonia)
★	Haemophilus influenzae
★	Moraxella catarrhalis
★	S.aureus
★	Gram-negative organisms

The patient will be very sick, toxic, productive cough, sometime chills, leukocytosis. By culture you can see the organism.

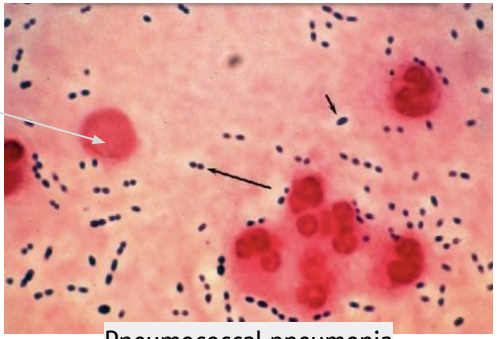
2- Atypical

★	Mycoplasma pneumoniae (most common cause of atypical)
★	Chlamydia pneumoniae
★	Legionella pneumophila

Not detectable on gram stain; won't grow on standard media (we see in the sample **pus cells** which indicated infection but no organisum), (Non-Gram-Stainable bacteria).

Less acute, known as "walking pneumonia" which means that the patient is able to walk with less severe symptoms unlike typical pneumonia

1- Typical pneumonia



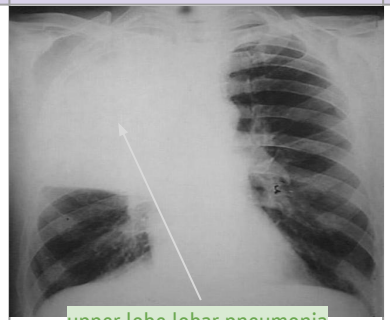
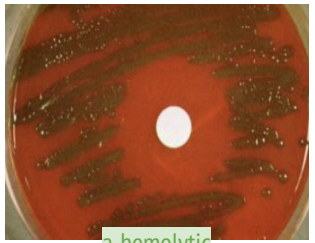
Pneumococcal pneumonia

- The onset is **acute.** (2-3 days)
- Prior viral upper respiratory infection.
- Respiratory symptoms.

– Fever – Shaking chills – Shortness of breath – Chest pain- or pleurisy (happens during inspiration they cannot take a full breath because of the pain)

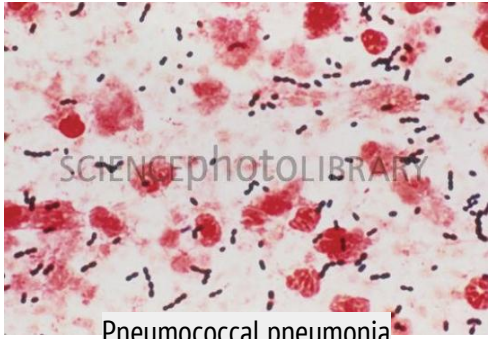
– Cough with sputum production (rusty-sputum)

Diagnosis :

Clinical	X-ray examination	Laboratory
History & physical	 upper lobe lobar pneumonia	– CBC-leukocytosis – Sputum • Gram stain- 15% • Culture – Blood Culture-5-14% – Pleural Effusion Gram+culture  a-hemolytic

* Streptococcus pneumonia

The most common bacteria causes CAP



Pneumococcal pneumonia

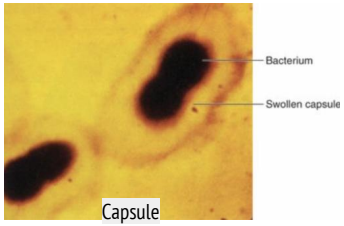
Gram positive diplococci

- Alpha hemolytic streptococci
- Catalase negative
- Normal flora of upper respiratory tract in 20- 40% of people.

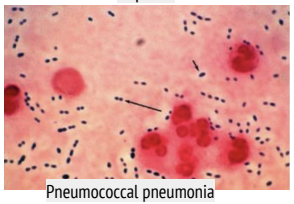
Causes:

Resp infections	Non resp infections
pneumonia, sinusitis, otitis	bacteremia, meningitis

Virulence factors:



Capsule


Pneumococcal pneumonia

–**Capsule**

- More than 90 capsular types

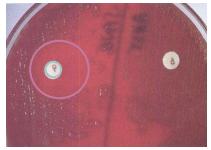
–Pneumolysin it has the ability to stimulate cytokines and disrupt the cilia of human respiratory epithelial cells.

– Autolysin Similar to lysozyme.

– Neuraminidase (help them to spread)

Characteristics

- Sensitive to **Optochin**
  We use this test to differentiate between the Alpha hemolytic organisms, S.pneumonia (sensitive) and other Alpha organisms <S.viridans> (resistance)


1- zone of inhibition because it's sensitive to optochin
2- desk to identify 100% that this a P.coccus

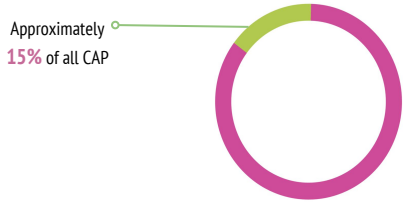
- Lysed by bile (bile soluble)

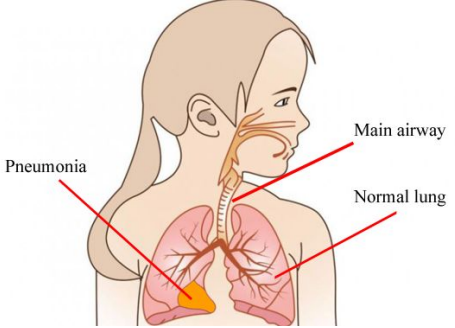
(usually mild soluble. after a while its will disappear)

Prevention: vaccination

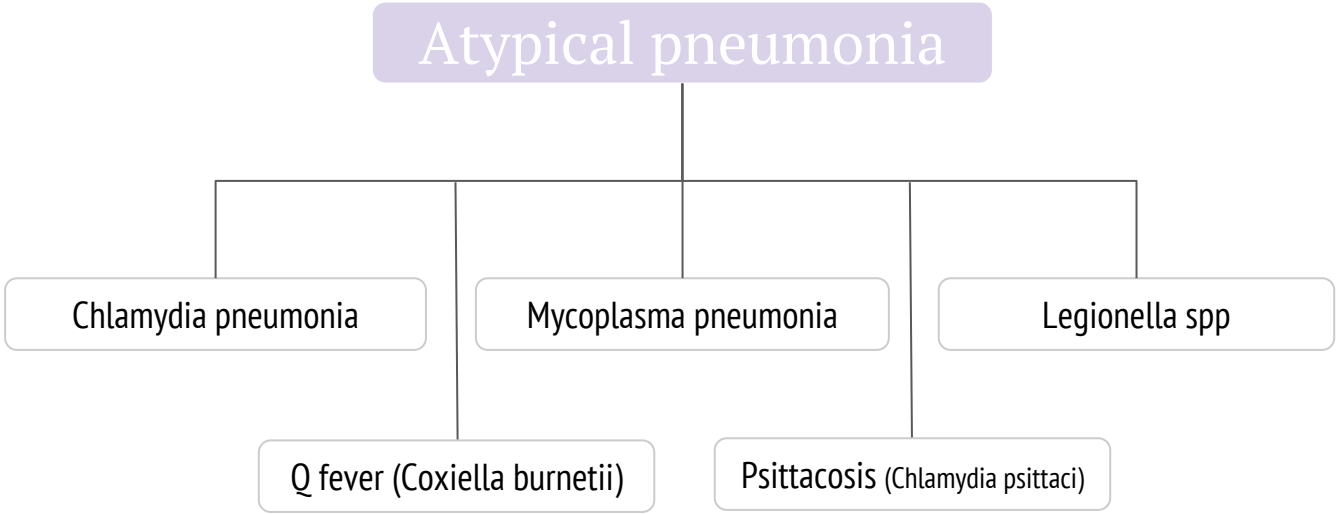
(the body produces anticapsual AB)

Atypical pneumonia





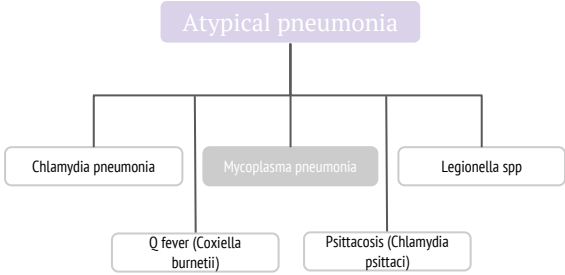
- Not detectable on gram stain
- Won't grow on standard media
- Most don't have a bacterial cell wall (⟶ Don't respond to β-lactams)



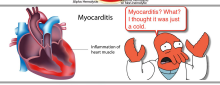
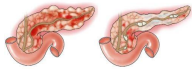
Atypical pneumonia

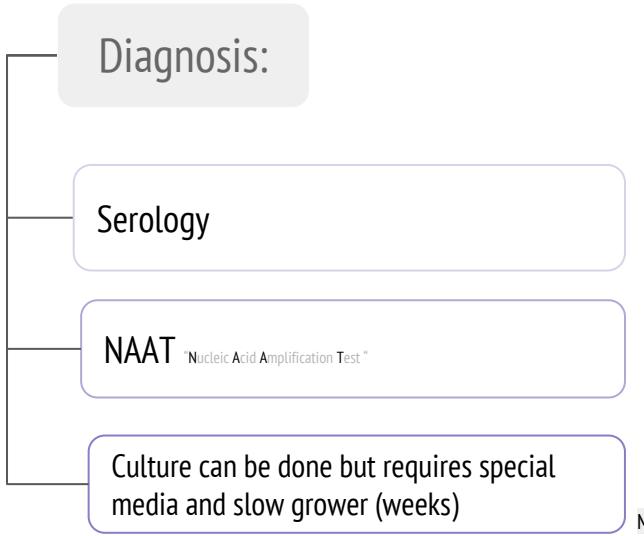
Symptoms:	• Insidious onset • Usually mild in all typical organisms, **except** Legionella it is the most severe. • Headache. • Malaise • Fever • Dry cough • Arthralgia / myalgia	**Diagnosis:**	• X-ray •CBC (Mild elevation WBC) • U&Es "Urea & Electrolytes" (Low serum Na) (Legionella) • LFTs "Liver Function Tests" (↑ ALT "ALanine aminoTransferase" and ↑ Alk "Anaplastic Lymphoma Kinase" Phos) • Sputum Culture on special media (BCYE " Buffered Charcoal Yeast Extract") for Legionella • Urine antigen for Legionella • Serology for detecting antibodies • DNA detection
Signs:	• Minimal • Low grade fever • Few crackles • Rhonchi (a **continuous sound** consisting of a dry whistle like noise with a lower pitch than that of a **wheeze**, produced in the throat or bronchial tube due to a partial obstruction.)		
Treatment:	•Macrolide • Quinolones • Tetracycline (B lactams have no activity) • Treat for 10-14 days		

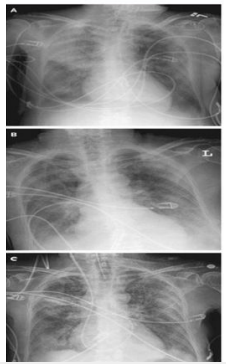
Mycoplasma pneumonia



- Eaton's agent (1944) "a bacterium of the genus (*M. pneumoniae*) that is the causative agent of primary atypical pneumonia"
- No cell wall (thus no response to β-lactams)
- Common
- Rare in children and in > 65
- People younger than 40.
- Crowded places like schools, homeless shelters, prisons.
- Can cause URT symptoms
- Usually mild and responds well to antibiotics.
- Can be very serious

May be associated with extrapulmonary findings:	
skin rash	
hemolysis	
myocarditis	
pancreatitis	
encephalitis	




Mycoplasma pneumonia Cx-ray

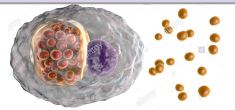
Chlamydia pneumonia

- Obligate intracellular organism
- 50% of adults sero-positive
- Mild disease
- Subclinical infections common
- 5-10% of community acquired pneumonia
- (have a cell wall but no "peptidoglycan", thus no response to b-lactant)

Diagnosis:

- Serology
- NAAT "Nucleic Acid Amplification Test "

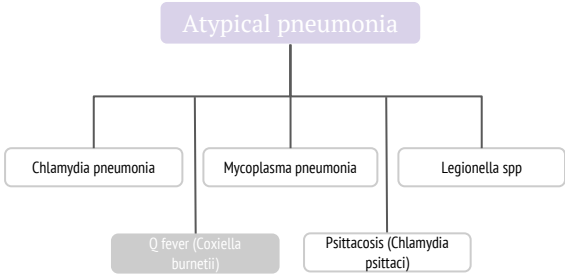
* Psittacosis

key information about psittacosis:	
Chlamydia psittaci	
Bird owners, pet shop employees, vets	
Parrots, pigeons and poultry	
Birds often asymptomatic	

Atypical pneumonia

- Chlamydia pneumonia
- Mycoplasma pneumonia
- Legionella spp
- Q fever (Coxiella burnetii)
- Psittacosis (Chlamydia psittaci)

Q fever (Coxiella burnetii)



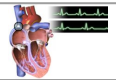
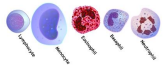
- Pneumonia is acute form of infection
- Exposure to farm animals mainly sheep
- Spread by inhalation of infected animal birth products

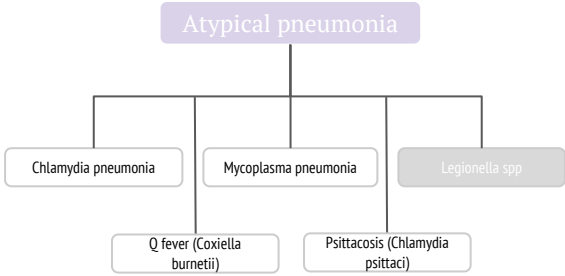
Diagnosis:

- Serology

Legionella pneumophila

- The Most severe one.
- Cause Legionnaires disease
- Serious outbreaks linked to exposure to cooling towers
- Can be very severe and lead to ICU "Intensive Care Unit" admission.
- It's a **waterborne bacteria**, and usually target the immunosuppressed patient
- People usually get infected from the **air conditioning** system of **hotels**

-> Can cause:	
Hyponatraemia common • (< 130 mMol)	low sodium level in the blood 
Bradycardia	
WBC < 15,000	
Abnormal LFTs "Liver Function Tests"	
Raised CPK "Creatine PhosphoKinase"	
Acute Renal failure "ARF:)"	



Diagnosis:

- Specimen: sputum
  - Culture on specialized media (BCYE)
  - DFA "Direct Fluorescent Antibody" (low sensitivity)
  - NAAT "Nucleic Acid Amplification Test"
- Urine antigen testing


Legionnaires in ICU

Pontiac fever: (milder disease)

- Non pneumonic
- Influenza like illness
- Self limiting
- Related to exposure to environmental aerosols containing Legionella (potentially reaction to bacterial endotoxins)

Antibiotic Treatment of CAP

Factors to consider in selection of antibiotic:

- **Co morbidities**
  ex. old patient with underlying diseases
- **Previous antibiotic exposure in last 3 months**
- **Severity**
  (Outpatient management vs requiring inpatient admission vs requiring ICU)

Summary of Treatment.		Macrolides	Doxycycline	Levofloxacin	B-lactam And Macrolide	B-lactam And Levo
Outpatient, healthy patient with no exposure to antibiotics in the last 3 months	-S. pneumoniae -Atypical pathogens -Viral					
Outpatient, patient with comorbidity or exposure to antibiotics in the last 3 months	As above + Anaerobes S. aureus					
Inpatient: Not ICU	Same as above + coliforms					
Inpatient: ICU	Same as above + Pseudomonas (HAP)					

Summary

Diagnosis >	Typical CAP	Atypical (interstitial) CAP
Keys	• Fever • **Productive** cough • Lobar consolidation • Shortness of breath	• Fever • **Dry** cough • X-ray showing interstitial • Bird owners –> (Chlamydia psittaci) • Farmers (Coxiella burnetii) • Severe infection leads to ICU administration –> (Legionella)
Causes	• Gram +ve diplococci (in pairs or chains), Alpha hemolytic, sensitive to optochin –> **Streptococcus pneumonia**. • Gram -ve diplococci, catalase +ve –> **Moraxella catarrhails** • Gram -ve coccobacilli catalase +ve –> **Haemophilus influenzae** • Gram +ve cocci, in clusters –> **Staph aureus**	• Mycoplasma pneumonia • Chlamydia pneumonia • Legionella • Chlamydia psittaci (Psittacosis) • Coxiella burnetii (Q fever) • Viral

- Summary of Treatment in the previous slide.
- You should differentiate between Typical and Atypical CAP diagnosis.
- For more summaries click on Summary.

Quiz :

1) A 64-year-old man who had smoked a pack of cigarettes for 40 years and carried a diagnosis of chronic obstructive pulmonary disease (COPD) noted the sudden onset of fever and dry cough. With worsening dyspnea over the next 2 days, he reported to the ER where his x-ray showed interstitial pneumonia in the right middle lobe and left lower lobe. A sputum specimen cultured on charcoal-yeast-extract agar showed growth of which pathogen?			
A.Chlamydophila pneumonia	B.Mycoplasma pneumonia	C.Legionella pneumophila	D.Moraxella catarrhalis
2) what's the most likely organism if the patient severe condition leading to ICU admission?			
A.Legionella pneumophila	B.Moraxella catarrhalis	C.Mycoplasma pneumonia	D.Chlamydophila pneumonia
3) What kind of media is most commonly used to grow Legionella pneumophila?			
A.Chocolate (CHOC).	B.Blood agar plate (BAP).	C.MacConkey agar (MAC).	D.Buffered charcoal yeast extract agar (BCYE)

1-C 2-A 3-D

1)Aman from a semi-rural area, 36 years of age, presented to his general practitioner (GP) with a three-day history of a febrile illness and worsening headaches. His symptoms included fever, lethargy, headache and dry cough. The patient worked as a tradesperson and kept pet birds as a hobby. He had not travelled recently and no other household members were unwell. On examination, the patient had a temperature of 37.5°C, heart rate of 145 beats per minute, respiratory rate of 24 breaths per minute, oxygen saturation of 96% on room air and scattered crepitations on auscultation. He had been previously well, was a current smoker, and did not have any other medical comorbidities.
A/ what is the most likely diagnosis? Psittacosis B/ what the antibiotics you will suggest in his case? Macrolides and doxycycline

2)A 31 year old female presented to the accident and emergency of KKUH with sudden onset of fever, right sided chest pain and a productive cough of purulent sputum. On examination her temperature was 39 °C. There were rhonchi and dullness on the right side of the chest. X-ray showed massive consolidation on the right side of the chest.
A/what is the most likely organism? S.pneumoniae. B/what other organisms can cause this infection? Haemophilus influenzae, Moraxella catarrhalis,

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Thanks

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