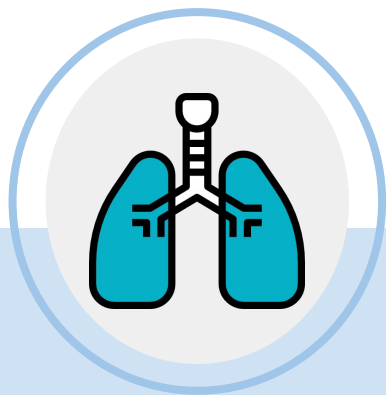


# Community acquired Pneumonia

No.9

Editing file



## Objectives :

- ★ List the 3 most common organisms of CAP .
- ★ Be able to triage patients appropriately based on the pneumonia severity index (PSI) .
- ★ Identify 3 criteria for clinical stability and discharge.

### Color index

Original text

Females slides

Males slides

Doctor's notes<sup>438</sup>

Doctor's notes<sup>439</sup>

Doctor's notes<sup>442</sup>

**New text in slides**<sup>442</sup>

Text book

**Important**

Golden notes

Extra

# Community Acquired Pneumonia

## Definition

- Lower respiratory tract infection in a non-hospitalized person associated with symptoms of acute infection **with or without** new opacity on chest radiograph.
- Acute infection of the **pulmonary parenchyma** acquired outside of a health care setting.
- CAP is one of the leading causes of hospitalization and death.

## Classes of pneumonia



A patient was in the hospital for lobectomy after that he got pneumonia which type of pneumonia is it?



CAP (the most common)

1. Typical CAP
2. Atypical CAP



Health care associated:

1. **hospital acquired** → role of 2 (2 **days** after admission or 2 **weeks** after discharge)
2. **ventilator associated**



Aspiration<sup>1</sup> pneumonia



Pneumonia in immunocompromised.



## Types & Microbiology of CAP



If you find in the exam a COPD patient diagnosed with pneumonia and I asked you about the most common organism? the answer will be Haemophilus influenzae

→ Streptococcus pneumoniae (pneumococcus) and respiratory viruses are the most frequently detected pathogens in patients with CAP.

Typical CAP (60% - 70%)	Atypical CAP (30%- 40%)	
	<a href="#">Click here to check the table from the slides</a>	
Typical <sup>2</sup> bacteria:	Atypical <sup>3</sup> bacteria:	Respiratory viruses:
<p>★ <b>Strept .pneumoniae</b> <b>(most common bacterial cause)</b> <small>Particularly among young adults. Also the most common cause of pneumonia in injection drug users.</small></p>	<p><b>Most common in Tropical region</b> <b>Legionella spp<sup>4</sup></b> (contaminated water, air, ventilation systems)</p>	<p>Influenza A and B viruses</p>
<p><b>Haemophilus influenzae</b> <b>(the most common in smokers and COPD)</b></p>	<p>Mycoplasma pneumoniae (After trauma/splenectomy/in HIV)</p>	<p>Rhinoviruses</p>
<p>Moraxella catarrhalis</p>	<p>Chlamydia pneumoniae (joints pain, headache, sinusitis)</p>	<p>Para influenza viruses</p>
<p>Staphylococcus aureus (Particularly after a recent influenza infection)</p>	<p>Chlamydia psittaci (birds)</p>	<p>Adenoviruses</p>
<p>Group A streptococci <small>Streptococcus pyogenes</small></p>	<p>Coxiella burnetii (farmers)</p>	<p>Respiratory syncytial virus</p>
<p>★ <b>Aerobic gram-negative bacteria</b> <small>e.g. Pseudomonas aeruginosa (associated with cystic fibrosis) &amp; Klebsiella pneumoniae</small></p>		<p>Human metapneumovirus</p>
<p>★ <b>Anaerobes</b> <b>(associated with aspiration)</b> <small>Bacteroides, Prevotella, Fusobacterium, Peptostreptococcus Most commonly seen in alcoholic patients presenting with "current jelly sputum"</small> <small>(Klebsiella pneumoniae is aerobic but it is often seen in aspiration lobar pneumonia in alcoholics)</small></p>		<p><b>Coronaviruses</b> <b>(e.g. COVID-19 or Middle East respiratory syndrome coronavirus)</b> <small>Transmitted mainly from infected camels</small></p>
		<p>Human bocaviruses</p>

1- A type of pneumonia that occurs as a result of oropharyngeal secretions and/or gastric contents aspiration. The inhalation of foreign material into the respiratory tract after instrumentation of the upper airways or esophagus (e.g., upper GI endoscopy) or secondary to vomiting and regurgitation of gastric contents.

2- Related to Streptococcus pneumoniae, classical symptoms (fever, cough, SOB, chest pain) as well as classical radiological findings (opacity on CXR)

3- Presents with unclassical symptoms and chest x ray eg. Legionella (GI symptoms, headache and chest pain, malaise) causes Legionnaires + history of travel is important (molds in air conditioning of hotels). Diagnostic test is serum/urine antigen.

4- Most common cause of atypical pneumonia.

# Risk factors

## Older age:

- The risk of CAP rises with age.
- The annual incidence of hospitalization for CAP among adults  $\geq 65$  years old
- Due to chronic diseases and comorbid conditions<sup>1</sup>
- They lose the elasticity of cilia in the airways  $\rightarrow$  inability to clear the airways

In old old age patients the immunity is weak that will increase lower respiratory tract infections and another cause is decreased lung capacity

## Chronic comorbidities:<sup>2</sup>

- COPD, chronic lung disease (eg, bronchiectasis, asthma), chronic heart disease (particularly CHF), stroke (because stroke will affect cough reflex), diabetes mellitus, malnutrition and immunocompromising conditions.
- **COPD + smoking** are associated with **Haemophilus influenzae**. (Possible exam Q)
- **Bronchiectasis** : most likely gram -ve bacteria such as **pseudomonas** , and they will have Colonization.

Malnutrition because loss of immunoglobulins

## Viral respiratory tract infection:<sup>3</sup>

- Viral respiratory tract infections can lead to primary viral pneumonias and also predispose to secondary bacterial pneumonia
- **MERS and COVID19** pneumonia + influenza A&B and H1N1
- Patients usually firstly present as **upper respiratory tract infection**. After couple of days, they will get **secondary pneumonia** with its classical symptoms.

## Impaired airway protection: Aspiration<sup>4</sup>

(Exam Q)

- Conditions that increase risk of macroaspiration of stomach contents and/or microaspiration of upper airway secretions predispose to CAP, such as loss/alteration in consciousness (eg, due to **stroke, seizure**, anesthesia, drug (opioids) or alcohol use) or **dysphagia** due to **esophageal lesions** or **dysmotility, achalasia**, uncontrolled **GERD, vomiting**, Parkinson's, cerebral palsy, neuromuscular disorders, old age.
- Usually caused by **anaerobes**.

If you find a case in the exam: about a patient had a seizure that caused microaspiration and presented with classical findings of pneumonia the answer will be Aspiration Pneumonia

## Smoking and alcohol overuse:

- Smoking, alcohol and opioid use are key modifiable behavioral risk factors for CAP .

## Other lifestyle factors:

- Other factors that have been associated with an increased risk of CAP include crowded living conditions (eg, prisons, homeless shelters, **Haji**) associated with **staph aureus**, residence in low-income settings, and exposure to environmental toxins (eg, solvents, paints, or gasoline)

1- immobility leads to poor ventilation of the lungs, which increases the risk of bacterial colonization and infection

2- Most importantly are patients with interstitial lung disease, those patient get streptococcal like others.

3- Uncommon compared to bacterial pneumonia but if it happened it will be more severe.

4- Young lady with classical symptoms of pneumonia but with uncontrolled seizure.

# Signs, symptoms and diagnosis



## Clinical symptoms




- **Cough**<sup>1</sup> (productive or non-productive) sometimes with haemoptysis
- **Fever** which, if swinging, may indicate empyema, Chills /Rigors<sup>2</sup>
- **Dyspnea**<sup>3</sup> (due to the inflammation and mucus formation. These will narrow the airway)
- **chest pain** may be experienced, commonly pleuritic in nature and due to inflammation of the pleura; a pleural rub may be heard early on in the illness
- **Fatigue/Myalgia** (because the body tries to fight an infection)
- **extrapulmonary manifestation** (meningitis, bacteremia (septic shock), reactive arthritis (after hepatitis A infection) **(Exam Q)**)
- **Gastrointestinal** (Common in viral infections and **Legionella**)

In the elderly, CAP can present with confusion or non-specific symptoms such as recurrent falls. CAP should always be considered in the differential diagnosis of sick elderly patients, given their frequently atypical presentation.



## Physical exam (Exam Q)



- ★ Dullness<sup>4</sup> to percussion of chest
  - Crackles<sup>5</sup> on auscultation
  - Increase in vocal and tactile fremitus<sup>5</sup>
- ★ Bronchial breath sounds<sup>6</sup>
  - Egophony ("E" to "A" changes)<sup>7</sup> 



you might find a long scenario in the exam about patient with stony dullness

Stony dullness like percuss on wood.

## Diagnosis - labs

If there is a pneumonia case and I ask you Q) what is the initial diagnostic test? (CXR)

Intervention	Comments
CXR	All patients with suspected CAP should have chest radiograph PA and lateral CXR required to confirm the diagnosis. In classical pneumonia: clinical features and CXR are enough to diagnose.
Sputum Gram stain and antimicrobial sensitivity	In many patients, it comes negative, but that does not rule out the possibility of pneumonia. (not sensitive, in 100 patient with CAP only <7% will have positive stain)
★ Blood cultures x 2	×2 means take blood samples from both hands. Usually positive in sick patients, patients who develop septic Shock marker of severity (negative unless the pt develop septicemia)
Serum/ urine antigen	When we suspect Legionella Pneumophila (Legionella antigen) Urinary antigen assay for Legionella in selected patients. This test is very sensitive. The antigen persists in the urine for weeks (even after treatment has been started)
organ dysfunction	such as renal dysfunction, liver dysfunction, and/or thrombocytopenia . important especially for evaluating patient with known hepatic or renal disease
PCR	For influenza, COVID-19 swab
Other tests:	Leukocyte count ,Inflammatory markers, (ESR), (CRP),procalcitonin <sup>8</sup> ,CBC MERS-CoV, very important nowadays to do swab for COVID-19 The laboratory abnormalities never ever diagnosis's Pneumonia it is only support Inflammatory markers It will support the diagnosis. For example, if I have a patient with a cough, fever,Consolidation on an x-ray , I did a lab test, and the results were normal. Is this excluding pneumonia? No, So if the lab results were normal, this does not exclude pneumonia

1- Typical CAP usually presents with greenish productive cough while atypical CAP usually presents with unproductive cough

2- What is the difference between chills and rigors? A chill is a sensation of cold occurring in most fevers. A rigor is a profound chill with piloerection associated with teeth chattering and severe shivering, and it's usually caused by pyelonephritis and dental abscess.

3- Common but if it's progressing that is a bad sign. Patient may develop complications such as: pleural effusion, ARDS, or respiratory failure.

4- Dullness is caused by the consolidation (solid or pus) while in pleural effusion or fluid accumulation you will hear stony dullness.

5- Not very common.

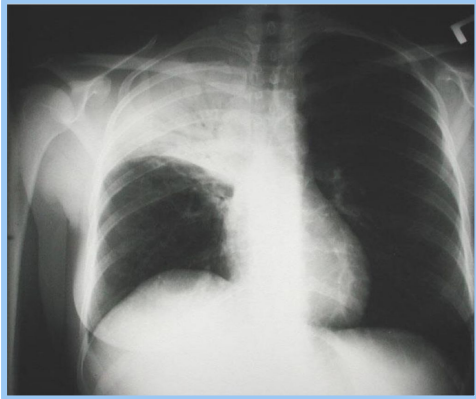
6- Indicative of consolidation.

7- common in the ER (you will not hear it usually in admitted patients after treatment with antibiotics)

8- Is a substance produced by many types of cells in the body in response to bacterial infections

# Diagnosis

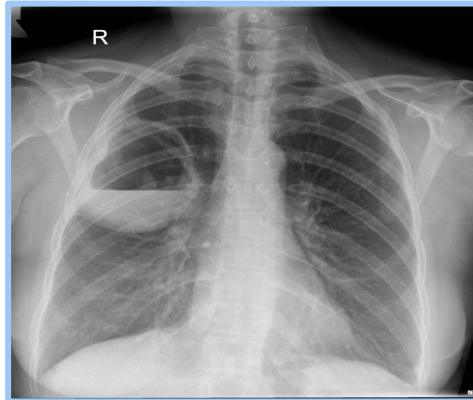
## ← Radiologic evaluation<sup>1</sup>



**Consolidation**

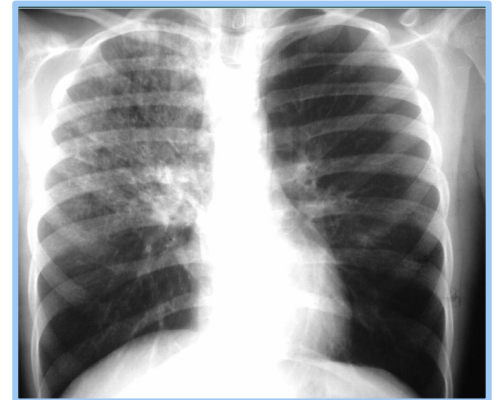
**Classical finding in pneumonia**  
Opacity (semi rounded white area)  
cause by either:  
A. Mass  
B. Consolidation

usually caused by streptococcus pneumoniae



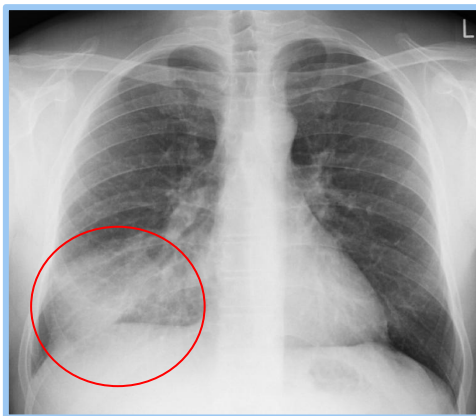
**Cavity**

Air fluid level : it's the line between the puss and normal lung tissue(air) in a cavity  
When we see a cavity it's either anaerobes or staph  
**In the upper zone: most likely staph**  
**In the lower zone : anaerobes**  
**Why ?** Anything will enter to the lung will go most likely to the right because of the early bifurcation of the right bronchus and to the lower zone by gravity.  
That's why when we see a cavity in the right lower zone we will think about an organism associated with aspiration



**Interstitial Infiltrates**

Comes with crackles  
Usually appears in atypical organisms  
(especially viral which gives bilateral infiltrate)



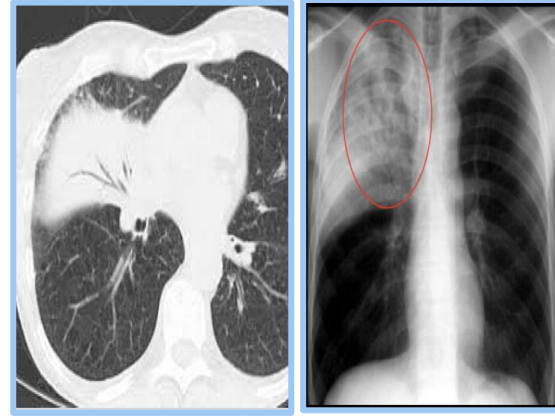
**Consolidation**

Consolidation  
Finding > Opacity = White  
It can be localized to one lung or generalized (bilateral) to both lungs.  
Opacity > **Typical changes**  
**Q) What is the most likely cause of this ?**  
streptococcus pneumoniae



**Interstitial Infiltrates**

Interstitial Infiltrates  
**Atypical Changes**  
**Q) What is the most likely cause of this ?**  
Atypical pneumoniae



**Air bronchogram**

**The classical sign of consolidation**  
This is classical comes with typical  
it's rare

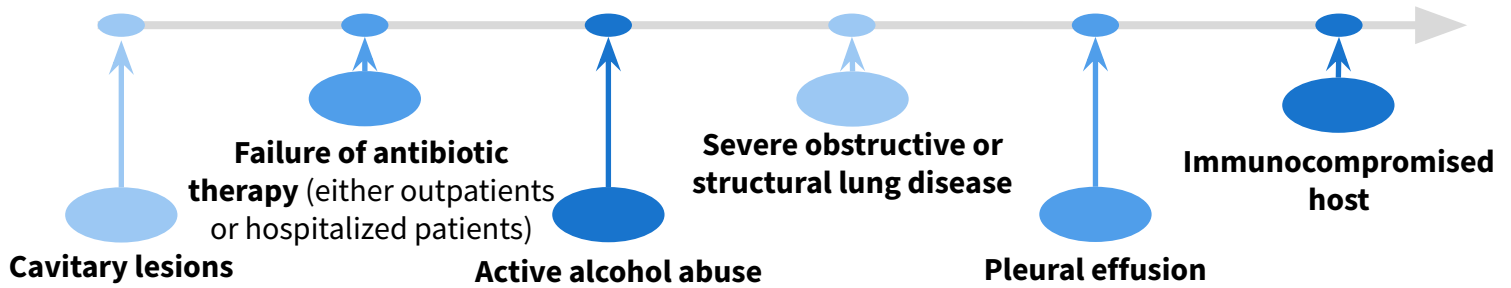
<sup>1</sup>About the most likely organisms in relation to radiological findings : it's just a clinical information not a rule!

Causes (of cavitory mnemonic CAVITY):

C: Cancer. finding)A: Autoimmune (Rheumatoid Arthritis, Wegener's) V: Vascular (AV malformation)

I: Infection (Staph., TB) T: Trauma (Pneumatocele) Y: Young (Congenital infected cyst) ( from 437 team)

## Intensive care unit admission



**Site of Care :** They decision regarding the site of care depends on many variables including :

1. severity of illness.
2. associated disease.
3. presence of hypoxemia.
4. adequacy of home support.
5. probability of adherence to treatment.

## Effects and patterns of microbial colonization

### Alveolar

- In alveolar lumen

### Interstitial

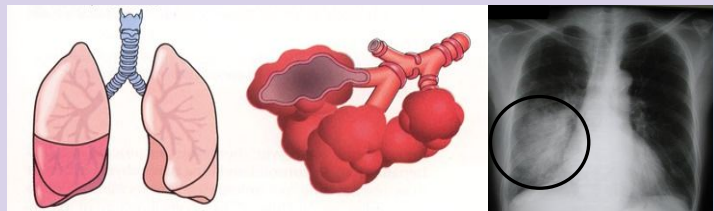
- Mostly in alveolar wall

Many viral almost gives you Interstitial

### Lobar pneumonia

- lobar distribution
- "Typical" CAP
- S.pneumonia and Haemophilus influenza

always serious.

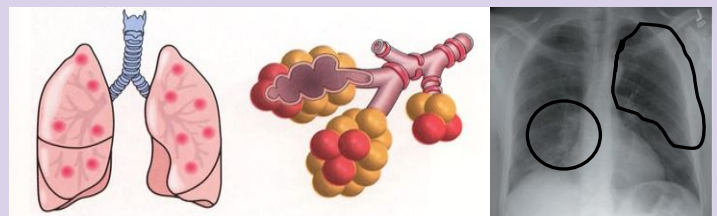


Affect one lobe , it could be bilateral

### Bronchopneumonia

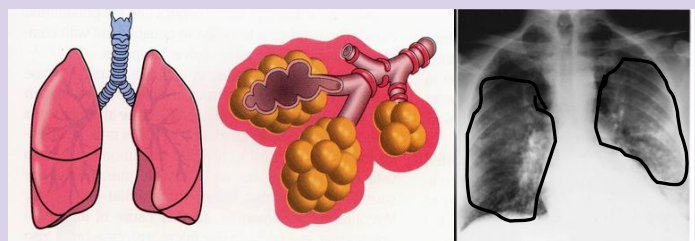
- Patchy distribution
- Aspiration, intubation and bronchiectasis
- Staph.Aureus and pseudomonas

Affect the bronchus, part of the lobe  
sometimes could be bilateral



### Atypical pneumonia

- Diffuse infiltrate with perihilar concentration
- Mycoplasma, Chlamydoiphila and Legionella
- Respiratory viruses. Such as:influenza



# Evaluation and Initial Management of Community-Acquired Pneumonia (CAP)

- After assessment of CAP (Clinical, PE, Radiological, Labs) what is the **next best step** in management?
  - Allocate the pt based on the CURB-65 criteria
- The severity of a patient's illness is primarily a determination based on clinical judgment, and the use of severity scores
- The most commonly used severity scores is CURB-65.

(Exam Q)

أهم من حياتك، لازم يجي سؤال عليها



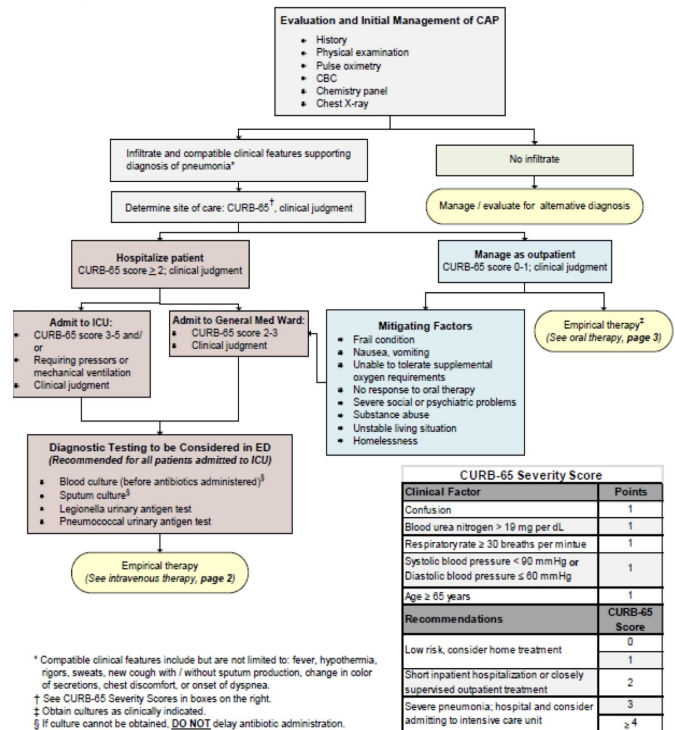
Table 1. CURB-65 Scoring<sup>46</sup>

Symptom	Points
Confusion	1
Urea: BUN >19 mg/dL (>7 mmol/L)	1
Respiratory rate ≥30 breaths/min	1
Systolic BP <90 mm Hg or diastolic BP ≤60 mm Hg	1
Age ≥65 years	1
Total	

Score	Risk	Disposition
0 or 1	1.5% mortality	Outpatient care
2	9.2% mortality	Inpatient versus observation admission
≥3	22% mortality	Inpatient admission; consider ICU admission with score of 4 or 5

Abbreviations: BP, blood pressure; BUN, blood urea nitrogen; ICU, intensive care unit.



## Ambulatory Patients

Very important

For most patients who are younger than 65 years of age, otherwise healthy, and **have not recently received treatment with antibiotics**, recent guidelines recommend one of the following 3 oral medication options:

- **Amoxicillin** (1 g three times daily).
- **Doxycycline** (100 mg twice daily),
- or A **macrolide** (**azithromycin** at a dose of 500 mg
- or **clarithromycin** at a dose of 500 mg twice daily

For patients who have **taken antibiotics with- in the past 3 months, have serious coexisting conditions** (e.g., chronic heart, lung, kidney, or liver disease; diabetes mellitus; or alcohol dependence), or who are smokers.

- **Amoxicillin clavulanate**
- and either a **macrolide** (preferred)
- or **Doxycycline** are recommended.

patients who **cannot take beta-lactam** agents due to owing to **hypersensitivity or adverse effects** can instead be treated with a

fluoroquinolone (levofloxacin or moxifloxacin)

# Complications of pneumonia

## 1. Pleural effusion

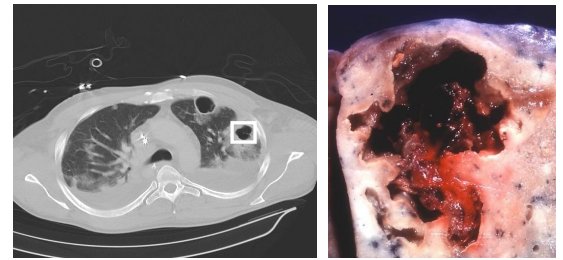
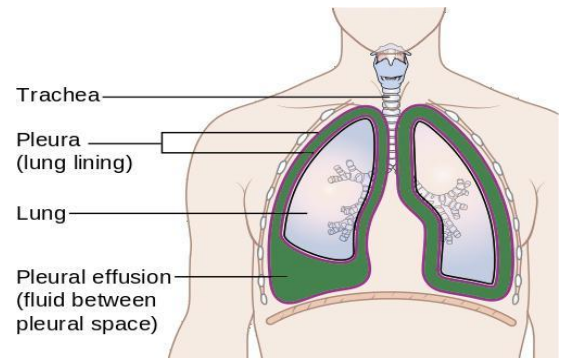
- Inflammation leads to exudation of fluid into pleural space
- Can compromise lung function

## 2. Empyema

- Purulent pus in pleural space
- Necrosis/ breakdown of visceral pleura and / or spread of infection into pleura

## 3. Abscess / Cavity lesion

- circumscribed focus of liquefactive necrosis within lung tissue
- associated with necrotizing Staph or Strep infections or Gram-neg rods (e.g. aspiration)



Here, I want you to know that pneumonia has complications. Don't go into more details than knowing these.

1- Pleural effusion 2- Empyema. 3-Abscess / Cavity lesion

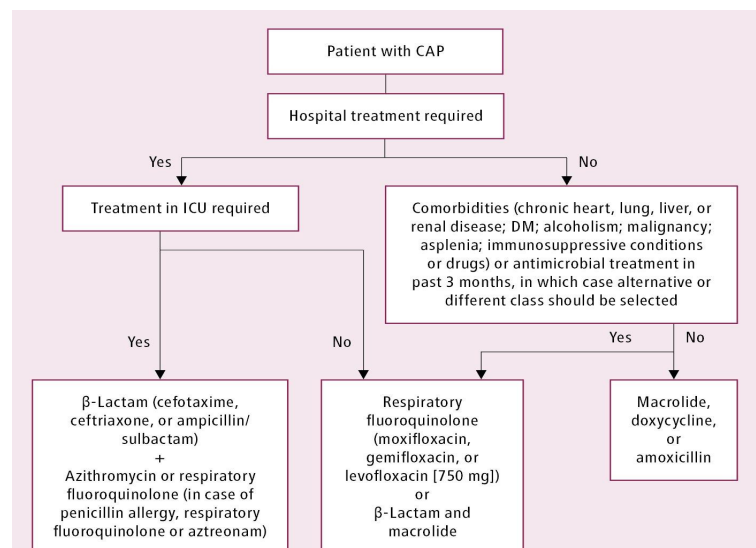
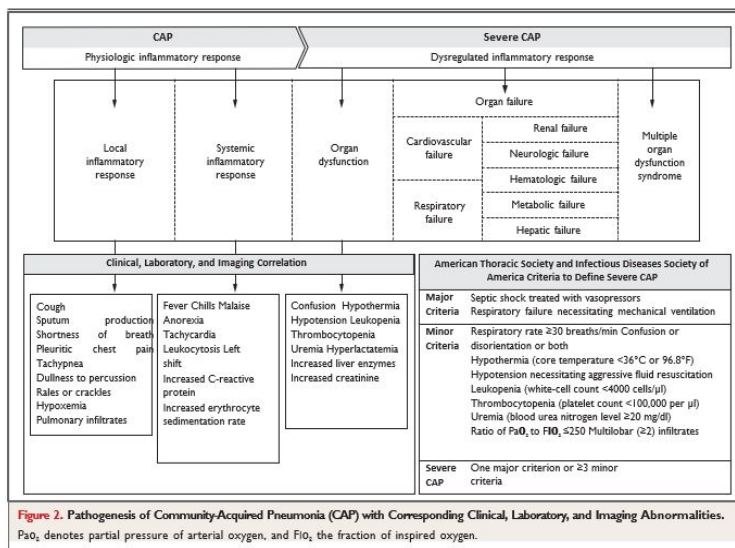
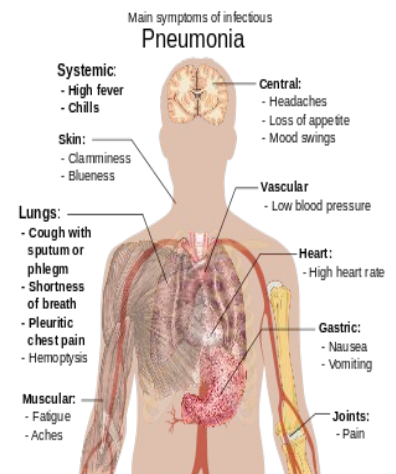
# Extrapulmonary manifestations of pneumonia

Pneumonia can cause extrapulmonary manifestations, such as:

1. Meningitis
2. Conjunctivitis
3. Rhinosinusitis > Very common
4. Infective endocarditis > the cause of mortality
5. Reactive arthritis
6. Gastroenteritis ( especially viral )
7. Hepatitis (Jaundice)

Don't underestimate hepatitis

It is very important that you don't underestimate pneumonia.



Read the summary of the extrapulmonary manifestations.

I don't want you to know more than what I mentioned in the lecture





Table 1. Respiratory Pathogens in Community-Acquired Pneumonia (CAP).*	
Pathogen Group	Pathogen
<b>Common or core</b>	More than 50% of patients comes with <i>Strept.pneumonia</i> , most common bacterial cause
Gram-positive bacteria	<i>Streptococcus pneumoniae</i> , methicillin-susceptible <i>Staphylococcus aureus</i> , <i>Strep. pyogenes</i> , other streptococci
Gram-negative bacteria	<i>Hemophilus influenzae</i> , <i>Moraxella catarrhalis</i> , Enterobacteriaceae (e.g., <i>Klebsiella pneu- moniae</i> )
Atypical bacteria	<i>Legionella pneumophila</i> , <i>Mycoplasma pneumoniae</i> , <i>Chlamydo- phila pneumoniae</i>
Respiratory viruses	Influenza virus, SARS-CoV-2, respiratory syncytial virus, parainfluenza virus, human meta- pneumovirus, rhinoviruses, common human coronaviruses
<b>Uncommon or infrequent</b>	This is general; the doctor skip it.
Gram-positive bacteria	Methicillin-resistant <i>Staph. aureus</i> , nocardia spe- cies, <i>Rhodococcus equi</i>
Gram-negative bacteria	Enterobacteriaceae, including extended-spectrum beta-lactamases or carbapenem-resistant enterobacteriaceae; nonfermenting bacilli (e.g., pseudomonas or acinetobacter); <i>Francisella tularensis</i>
Atypical bacteria	<i>Chlamydia psittaci</i> , <i>Coxiella burnetii</i>
Mycobacteria	<i>Mycobacterium tuberculosis</i> , nontuberculous mycobacteria
Viruses	Cytomegalovirus, herpes simplex, varicella zoster, MERS-CoV
Fungi	<i>Pneumocystis jirovecii</i> , aspergillus species, muco- rales species, histoplasma species, cryptococ- cus species, blastomyces species, coccidioi- des species
Parasites	<i>Strongyloides stercoralis</i> , <i>Toxoplasma gondii</i>

## ★ Dr. Alharbi's Case

### History

a 63 y.o. patient that presents to your urgent care office today with a history of **coughing** and **wheezing** for the past 5 days. Originally, she thought she was getting a **cold**; however, her symptoms have been getting worse, and she states **she has never felt this** "wiped out" from a cold. She has come to see you today because she feels like she has become more short of breath over the past 24 hours. vitals. **Looks oriented , not in distress**

**BP: 110/80, HR: 96, RR: 26, T: 101.6, SpO2: 94%, Ht: 5'5" ( not important) ,**

**Wt: 130lbs Initial laboratory : Wbc = 16 ( leukocytosis ) Urea = 30**

Respiratory symptoms suggested pneumonia

CURB-65

1. Confusion = 0
2. Urea = 1 ★
3. Respiratory rate = 0
4. Systolic and diastolic BP = 0
5. Age > 65 = 0

Based on CURB-65 scoring this patient has one point because Urea is high more than 19 mg/ dl. so it's outpatient care

### Physical Examination - Lungs:

Resonance percussed over upper chest; area of **dullness** percussed over right lower lobe. Increased fremitus palpated in left lower lobe. Breath sounds (BS) are clear bilaterally in upper lobes. Expiratory wheezing, rales, and diminished BS auscultated right lower lobe. BS clear and diminished in left lower lobe

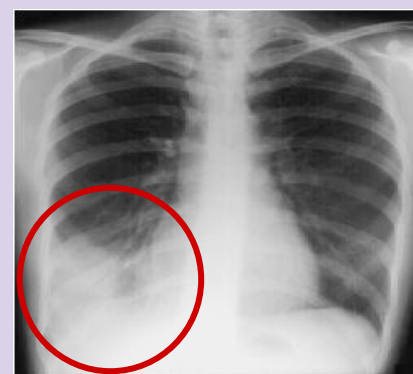
**Abnormal, support our suggestion of pneumonia**

Q) How to manage this patient ?

If the organism suspected to be typical > give Amoxicillin


If the organism suspected to be Atypical > give Macrolide ( Azithromycin )

### Chest X-ray



X-ray showed Opacity on the right

Table 2: Oral Therapy

Patient Population	Antibiotic	Recommended Dosing	Notes
<b>Previously Healthy and No Recent Antibiotic Therapy in Past 3 Months</b> <i>If previous therapy known, use an alternative agent</i>	azithromycin or doxycycline	500 mg PO Q24 hrs. 100 mg PO Q12 hrs.	If comorbidities, consider moxifloxacin as an alternative. 
	amoxicillin / clavulanate or amoxicillin (high dose) or cefdinir	2000/125 mg PO Q12 hrs.* 1 g PO Q8 hrs.* 300 mg PO Q12 hours*	High dose amox/clav targets drug-resistant S. pneumoniae (DRSP). Patients with co-morbidities or recent antimicrobial therapy are at risk of DRSP.
	<b>Plus (+) either</b> azithromycin or doxycycline	500 mg PO Q24 hrs. 100 mg PO Q12 hrs.	
	<b>OR monotherapy</b> levofloxacin	750 mg PO Q24 hrs.*	
<b>Suspected Aspiration</b>	amoxicillin / clavulanate or clindamycin	2000/125 mg PO Q12 hrs.* 300-450 mg PO Q8 hrs.	High dose amox/clav targets drug-resistant S. pneumoniae (DRSP). Patients with co-morbidities or recent antimicrobial therapy are at risk of DRSP.

\* Dose should be adjusted for renal function.

Note: Patients presenting from the community with any of the following health care exposures are at risk for MRSA and

Patient Population	Antibiotic	Recommended Dosing	Notes
<b>Non-ICU Patient without Pseudomonal Risk</b>	ceftriaxone <b>Plus (+)</b> azithromycin <b>OR monotherapy</b> levofloxacin	2 g IV Q24 hrs.* 500 mg IV Q24 hrs. 750 mg IV Q24 hrs.**	If < 65 years of age and no risk factors for drug-resistant pneumococcus, azithromycin is appropriate at discharge.
<b>ICU Patient without Pseudomonal Risk</b>	ceftriaxone*	2 g IV Q24 hrs.	If documented severe beta-lactam allergy, use levofloxacin plus aztreonam (2 g IV Q8 hrs.***) as an alternative.
<b>ICU and Non-ICU Patients with Pseudomonal Risk****</b>	<b>Plus (+) either</b> azithromycin or levofloxacin	500 mg IV Q24 hrs. 750 mg IV Q24 hrs.**	If documented severe beta-lactam allergy, use aztreonam plus levofloxacin with tobramycin (7 mg/kg IV Q24 hrs.***) as an alternative.
	piperacillin / tazobactam or cefepime	4.5 g IV Q8 hrs.** 2 g IV Q8 hrs.**	
<b>Suspected Aspiration****</b>	<b>Plus(+)</b> tobramycin <b>and</b> azithromycin	7 mg/kg IV Q24 hrs.** 500 mg IV Q24 hrs.	
<b>Suspected MRSA Pneumonia</b>	ampicillin / subactam or ertapenem	3 g IV Q8 hrs.** 1 g IV Q24 hrs.**	Ertapenem should be used in patients with penicillin allergies.
	<b>Add</b> vancomycin	15-20 mg/kg Q12 hrs.**	Consider loading dose of 25 mg/kg.

\*Ceftriaxone 1 g IV Q24 hrs. is adequate for patients weighing < 80 kg.

## Doctor's Notes



A patient diagnosed with pneumonia with a history of skin reaction before 3 months due to using Augmentin What is the first choice of treatment?

### How to manage a patient with CAP?

First allocate the patient using **CURB-65 score**:

- Score **0 or 1** = **send home** with **azithromycin for 3-5 days**
- Score **2** = **admit to hospital** and treat with **ceftriaxone + azithromycin**
- Score **3 or more**: **ICU** and treat with **Tazocin (Piperacillin/tazobactam)** also called **piptaz**.

### Special conditions:

- If the history is suggestive of **aspiration pneumonia** (even if the patient was not hospitalized) : **clindamycin** is the drug of choice
- Risk of **staph**: **vancomycin**
- **bronchiectasis**: gm -ve like **pseudomonas**, start them on **levofloxacin** or **ciprofloxacin**.



	Typical	Atypical
Findings on X-ray	Consolidation , classical <b>Opacity</b> Consolidation it could be mass	<b>interstitial</b> changes
Symptoms	<ul style="list-style-type: none"> <li>• Fever</li> <li>• Cough</li> <li>• SOB</li> </ul>	<ul style="list-style-type: none"> <li>• Sore throat</li> <li>• Headache</li> <li>• Sinusitis</li> <li>• GI symptoms</li> </ul>
Physical exam	<ul style="list-style-type: none"> <li>• Dullness to percussion</li> <li>• Crackles on auscultation</li> <li>• <b>Bronchial breath sounds</b></li> <li>• <b>Increase in vocal and tactile fremitus</b>( Ask the patient to say “99, 44 ” and feel for vibrations transmitted throughout the chest wall.</li> </ul>	
Complications of pneumonia	<ol style="list-style-type: none"> <li>1. Pleural effusion</li> <li>2. Empyema</li> <li>3. Abscess / cavitary lesion</li> </ol>	

Based on CRUB-65 Scoring, we classify patient admission into outpatient, inpatient ( general floor, ward ), and ICU. The management will be accordingly.

**Score 0 or 1 = outpatient send home with treatment**

<b>Outpatient</b> <ul style="list-style-type: none"> <li>• Healthy</li> <li>• No history of antibiotics use</li> </ul>	<b>Amoxicillin</b> <b>Or Doxycycline</b> ( Doxycycline has the same use of amoxicillin, but it's <b>not used in KSA</b> so forget about it )	<b>Macrolide ( Azithromycin )</b>
<b>Outpatient</b> <ul style="list-style-type: none"> <li>• Sick ( chronic disease)</li> <li>• History of antibiotics use</li> </ul>	<b>Augmentin</b> ( <b>Augmentin= amoxicillin+ clavulanic acid</b> ) <b>Hypersensitivity?</b> fluoroquinolone (levofloxacin-moxifloxacin) <b>Important ★ Scenario in the exam.</b> <b>the middle of the scenario: before 6 months the patient take Augmentin for dental abscess and get reaction &gt; so patient has allergy</b> <b>And the then diagnosed with Community Acquired pneumonia . if there is one of the choices in MCQ (Augmentin ) don't choose it it's wrong.</b> <b>But if the patient doesn't have allergy which first choice ? Augmentin Or Doxycycline</b> <b>?Augmentin</b>	+ <b>Macrolide ( Azithromycin )</b>

**Score 2= admit to hospital**

<b>Inpatient</b> > General floor ( ward )	third generation cephalosporin( <b>ceftriaxone</b> )+ macrolide ( <b>azithromycin</b> ) both at the same time to cover typical and atypical . Why ? Because they find that many patients they get atypical organisms after admission
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**Score 3 or more = ICU**

<b>Inpatient</b> > ICU	<b>Tazocin(piperacillin-tazobactam)</b> ★ If I give you scenario and CRUB - 65 was = 5 and one of choices of MCQ <b>Oral Azithromycin &gt; This choice is wrong</b>
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<b>Extra notes</b>	<ul style="list-style-type: none"> <li>• History of crowded places(hajj) &gt;&gt; viral infection: oseltamivir +antibiotic</li> <li>• Suspect aspiration? Clindamycin</li> </ul>
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## General management

### Oxygen

-Supplemental oxygen should be administered to maintain saturations between 94% and 98%

### Intravenous fluids

-These are required in hypotensive patients showing any evidence of volume depletion and hypotension.

### Antibiotics

-The first dose of antibiotic should be administered within 1 hour of identifying any high-risk criteria and treatment should not be delayed while investigations are awaited.

-The antibiotic regimen should be adjusted specifically once culture and sensitivity results are available.

### Analgesia

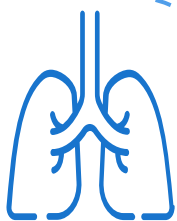
-Simple analgesia, such as paracetamol or an NSAID, helps treat pleuritic pain, thereby reducing the risk of further complications due to restricted breathing because of pain

## Prophylaxis of recurrent pneumonia

- ★ • Pneumococcal and influenza virus vaccine

What is the most common cause of death?

Sepsis-> infective endocarditis



### Complications of pneumonia

- Severe pneumonia in certain patients can lead to septic shock and eventually acute kidney injury (AKI) or liver failure.
- Meningitis (especially in Hajj)
- Infective endocarditis
- Hepatitis
- Reactive arthritis
- Para-pneumonic effusion
- Empyema
- Retention of sputum causing lobar collapse
- Deep vein thrombosis and pulmonary embolism
- Pneumothorax, particularly with Staphylococcus aureus
- Suppurative pneumonia/lung abscess
- ARDS, renal failure, multi-organ failure
- Ectopic abscess formation (Staph. aureus)
- Hepatitis, pericarditis, myocarditis, meningoencephalitis
- Arrhythmias (e.g. atrial fibrillation)
- Pyrexia due to drug hypersensitivity



## ❖ Case 1:

"عندي احساس ان السيناريو مهم"

A 35 year old male, presents with fever and cough. He was well until 3 days earlier, when he suffered the onset of nasal stuffiness, mild sore throat, and a cough productive of small amounts of clear sputum. Today, he decided to seek physician assistance because of an increase in temperature to 38.3°C and spasms of coughing that produce purulent secretions. On one occasion, he noted a few flecks of bright red blood in his sputum. The patient has no history of familial illness, hospitalizations.

### ● What questions will you ask first?

- If anyone around the patient has experienced the same symptoms → suspect COVID-19.
- Pattern of fever (continuous (for +24hrs), intermittent, remittent (as in malaria).
- Other associated symptoms?

## ❖ Case2:

University student presented with cough, fever, shortness of breath. Examination revealed dullness, bronchial breathing, and consolidation in his x-ray.

- **What is the most likely organism?** Strept .pneumoniae
- What are the extrapulmonary manifestation of Streptococcus pneumonia ? Meningitis, bacteremia (septic shock), reactive arthritis. (When a patient has hepatitis A and he developed arthritis later on we call it reactive arthritis)
- **What if history of smoking was added to the scenario?** Haemophilus influenzae
- **What if parkinson's disease was mentioned in the scenario?** Anaerobes (also applicable for any risk of aspiration pneumonia e.g. seizures/anesthesia)

## ❖ Case3:

A 50 years old patient presented to ED complaining of cough and fever. The patient has a recent travel history to Malaysia

- **What is the most likely organism?** Legionella
- **What is the next step?** Urine antigen test

## Case study 1:

- ❖ A 68 y/ male presented to the ED with SOB and productive coughing for 2 days. Reports poor oral intake since onset due to nausea and intermittent vomiting. His wife had similar symptoms 1 week ago which improved with an unknown antibiotic. Patient is requesting to go home with antibiotic. He previously had tongue swelling and skin rash with use of augmentin. Reports good health otherwise. Denies chest pain, swelling of extremities, or diarrhea.
- ❖ **His vital signs are :**  
T 38.5 C, P 76, BP 128/82, spO2 94%, RR 16. Patient is alert and oriented. Crackles were heard over left lower lung field. Labs showed WBC 14, BUN 20 mg/dL. Chest X-ray had a consolidation in left lower lobe.

- **What is the best way to further manage this patient?**

- A. Send home with oral azithromycin
- B. Send home with oral levofloxacin
- C. Admit to medicine floor with iv levofloxacin
- D. Admit to medicine floor with iv ceftriaxone and azithromycin
- E. Admit to ICU with iv ceftriaxone and iv azithromycin

**Answer:** C

### Doctor's notes:

First Allocate the patient by **CURB-65** Severity Score:

**C:** Confusion (Absent) = 0

**U:** BUN (20 mg/dl) = 1

**R:** RR (Does not meet criteria) = 0

**B:** BP (Does not meet criteria) = 0

**65:** Age (68 years old) = 1

Overall score= **2 (inpatient admission)**

- Based on the score we will **exclude A,B and E**
- The patient has augmentin allergy so we will avoid ceftriaxone (due to cross reactivity).The **answer is C**, if the patient doesn't have augmentin allergy the **answer is D**.

## Case study 2:

- ❖ 20 years old female, Queen's student on the track team, came to the hospital complaining of 24 hours of SOB, has fever, malaise, cough and sputum, but no chest pain. She is a non-smoker. She lives alone in residence.
- ❖ **Her vitals signs are :** Temperature 39.5.C, Pulse 130 bpm, RR: 35, BP: 70/40 ,% Oxygen Saturation: 87/RA (Room Air)
- ❖ **On examination:** she Looks unwell, Bronchial breathing heard in Upper Rt, dullness on percussion, and Increased fremitus
- ❖ **Procedures and Investigations are:** CXR (PA/LAT),ABG, CBC, and Sputum Culture]



MRN	ROOM	TEMP °C	PULSE	RESP	BLOOD PRESSURE	% O2 SAT RA	WTF INP	REFERRED BY MD
Time: 2301	A8	39.5	130	35	70 / 40	87 / RA		NAME: LAURIE K SW
20 y/o ♀ Queen's Student (Track Team) 24 hrs SOB Malaise, Fever, Cough Sputum, No chest pain Smoker Living alone in residence Looks unwell Fremitus ↑ Dullness Bronchial breathing								ALLERGIES: NEDA MEDICATIONS: None attached ROOMS: A135 K996
PROCEDURES / INVESTIGATIONS CXR PA/LAT, ABG, CBC, Sputum Culture								DISCHARGE / TREATMENT INSTRUCTIONS Consult Medicine / Resp
CONSULTS / TRANSFERS MEDICINE / RESP								HOUSESTAFF / NAME / STATUS [Redacted]

- **What are the features of Jane's history that suggest which organisms are most likely to be responsible for her presentation?**

She has CAP, and the most common most likely organism is streptococcus pneumoniae, and she doesn't seem to have the risk factors related to the other organisms.

- **What additional information from her history would you like to know and why?**

Look for any risk factors in the patient from what was mentioned before.

- **What are the features of Jane's physical examination that indicate pneumonia?**

Bronchial breathing (means consolidation), increased fremitus (tactile and vocal).

- **What are signs of pleural involvement? Does she have any?**

Decreased tactile fremitus, stony dullness, decreased or absent bronchial breathing. No, she doesn't have any.

- **What are signs of serious sepsis? Does she have any?**

Fever, hypotension, tachycardia, tachypnea, oxygen desaturation<sup>1</sup>. Yes she have.

- **Bonus: What are examples of extra-pulmonary infection that may complicate pneumonia?**

Meningitis, pericarditis, reactive arthritis<sup>2</sup>, and hepatitis and AKI (acute kidney injury)  
 Most dangerous? Infective endocarditis (high mortality if present) esp staph aureus

- **Where should Jane be managed?**

CURB-65 Severity Score: C: Confusion (Absent) = 0, U: BUN (30 mg/dl) = 1, R: 35 = 1, B: BP 70/40 = 1, 65: Age (20 years old) = 0

Overall score= 3

where to manage her?

- In ICU, stabilize the patient (ABC..) and start **broad spectrum antibiotics**.

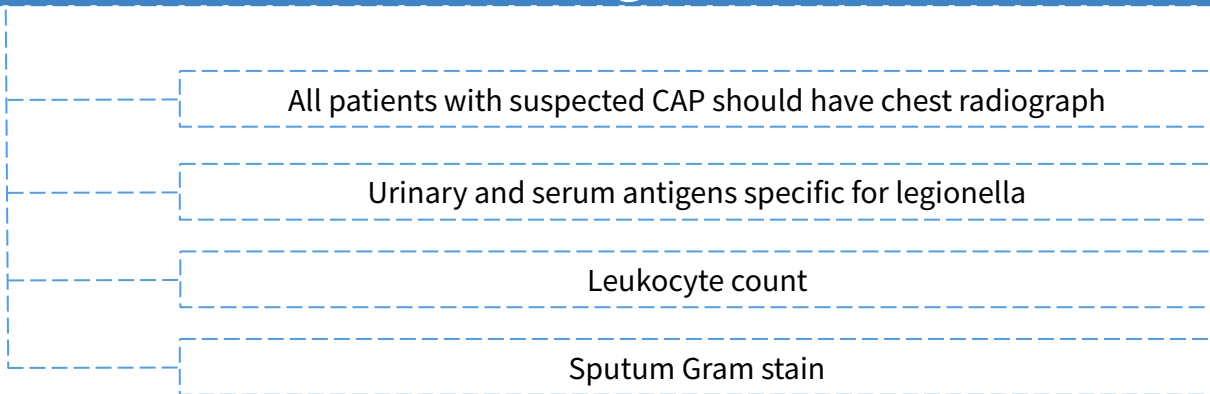
1- normal is >92%

2-reactive or septic arthritis and the favourite place is the knee (causing swelling in the knee)

# Summary

<b>Types</b>	<ul style="list-style-type: none"> <li>● <b>Typical</b> : S.pneumoniae (most common bacterial cause)</li> <li>● <b>Atypical</b> : legionella spp contaminated water source , air conditioning.</li> </ul>
<b>Viruses</b>	<p>Very important causes especially in children.</p> <ol style="list-style-type: none"> <li>1. Coronaviruses</li> <li>2. Influenza A and B viruses</li> </ol>
<b>Clinical signs and symptoms</b>	<ul style="list-style-type: none"> <li>● Cough (if productive rusty colored sputum)</li> <li>● Fever, Chills</li> <li>● Dyspnea</li> <li>● Fatigue</li> <li>● Gastrointestinal (Legionella) → history of travel</li> <li>● Dullness to percussion</li> <li>● Crackles on auscultation</li> <li>● Bronchial breath sounds</li> <li>● Egophony (“E” to “A” changes)</li> <li>● Increased vocal tactile fremitus</li> </ul>
<b>Risk factors</b>	<ul style="list-style-type: none"> <li>● Older age</li> <li>● Chronic comorbidities (smoking + COPD = Haemophilus influenzae)</li> <li>● Viral respiratory tract infection</li> <li>● Impaired airway protection Aspiration → anaerobes</li> <li>● Smoking and alcohol overuse</li> <li>● Other lifestyle factors</li> </ul>

## Diagnosis



## Evaluation :

CURB-65	Clinical Feature	Points
C	Confusion	1
U	Urea > 7 mmol/L	1
R	RR ≥ 30	1
B	SBP ≤ 90 mm Hg OR DBP ≤ 60 mm Hg	1
65	Age > 65	1

CURB-65 Score	Risk group	30-day mortality	Management
0-1	1	1.5%	Low risk, consider home treatment
2	2	9.2%	Probably admission vs close outpatient management
3-5	3	22%	Admission, manage as severe

## Management :

1- Healthy Individual with no risk factor (classified by the CURB-65 score as outpatient)	Azithromycin
2- Risk of aspiration (Anaerobes)	Clindamycin or Augmentin
3- Patient admitted but not ICU	Azithromycin + 3rd generation Cephalosporin (Ceftriaxone)
4- ICU patients (Sepsis)	Empirical treatment (Piptaz)



# Lecture Quiz

**Q1: 500Best:** A 55-year-old man, who has never smoked and with no past medical history, has been diagnosed with right basal community-acquired pneumonia. There are minimal changes on his chest x-ray and bloods reveal a neutrophil count of 8.2 and a C-reactive protein (CRP) of 15. He has no drug allergies. Although he has a productive cough of green sputum, his respiratory rate is 16, oxygen saturations are 97 per cent on room air and his temperature is 37.4°C. You are asked to place him on treatment. Which of the following treatment options would be appropriate for this patient ?

- A- Oral amoxicillin
- B- Oral erythromycin
- C- Intravenous ertapenem
- D- Intravenous ertapenem with a macrolide (e.g. clarithromycin)
- E- Intravenous tazocin

**Q2: 500Best:** Which of the following organisms would typically be found in a patient with atypical community-acquired pneumonia ?

- A- Staphylococcus aureus
- B- Pseudomonas spp.
- C- Streptococcus pneumoniae
- D- Legionella pneumophila

**Q3: 4.** Which of the following conditions is not associated with an increased incidence or severity of pneumococcal pneumonia?

- A- Poorly controlled hypertension
- B- Diabetes mellitus
- C- Renal insufficiency
- D- Cirrhosis of the liver
- E- Multiple myeloma

**Q4: 500Best:** A 54-year-old investment banker presents to accident and emergency with a 5-day history of productive cough of green sputum, fevers and feeling generally unwell. On examination, there is bronchial breathing in the left lower zone. Chest x-ray demonstrates left lower zone consolidation. What is the most likely causative organism ?

- A- Mycoplasma pneumoniae
- B- Klebsiella pneumoniae
- C- Staphylococcus aureus
- D- Haemophilus influenzae
- E- Streptococcus pneumoniae

**Q5: 500Best:** A 67-year-old woman is admitted to accident and emergency with pyrexia (38.1°C) and a cough productive of green sputum. The observations show a pulse rate of 101, BP 80/60 and respiratory rate of 32. She is alert and orientated in space and time. Blood results reveal a WCC of 21, urea of 153 mg/dL and chest x-ray shows a patch of consolidation in the lower zone of the right lung. She is treated for severe community-acquired pneumonia. Which of the following is the correct calculated CURB-65 score?

- A- 6
- B- 8
- C- 4
- D- 0
- E- 1

**Q6: 500Best:** Which of the following organisms, responsible for causing chronic pneumonia, is most commonly found in patients with longstanding cystic fibrosis?

- A. L. pneumophila
- B. S. pneumoniae
- C. Burkholderia cepacia
- D. Pseudomonas aeruginosa
- E. H. influenza

**Q7: Pre-test:** A 40-year-old alcoholic develops cough and fever. Sputum is fetid and examination reveals crackles in the right base. Chest x-ray, shown below, shows an air-fluid level in the superior segment of the right lower lobe.

Which of the following is the most likely etiologic agent?

- A. Streptococcus pneumoniae
- B. Haemophilus influenzae
- C. Legionella pneumophila
- D. Anaerobes
- E. Mycoplasma pneumoniae

**Q8: Pre-test:** A 40-year-old man without a significant medical history comes to the emergency room with a 3-day history of fever and shaking chills, and a 15-minute episode of rigor. He also reports a cough productive of yellow-green sputum, anorexia, and the development of right-sided pleuritic chest pain. Shortness of breath has been present for the past 12 hours. Chest x-ray reveals a consolidated right middle lobe infiltrate, and CBC shows an elevated neutrophil count with many band forms present. Which feature would most strongly support inpatient admission and IV antibiotic treatment for this patient??

- A. Recent exposure to a family member with influenza
- B. Respiratory rate of 36/min
- C. Recent sexual exposure to an HIV-positive patient
- D. Purulent sputum with gram-positive diplococci on Gram stain
- E. Signs of consolidation (bronchial breath sounds, egophony) on physical examination



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