



# Community acquired pneumonia

Objectives: Not found

Team Members: Ghada Alhadlaq , shorog Alsomali , mohammed alhakami , abdulaziz alqarmoshi

Team leader: Haneen Alsubki

Revised By: Basel almeflh

Resource: 436 slides, Davidson , 435 team , 1000 questions and answers kumar

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# ★ Definition and types of CAP

What are the 4 types of pneumonia?

1- **community acquired pneumonia** : it is when the patient come from home with symptoms and signs of pneumonia

2-Health care associated pneumonia:

a- **hospital acquired pneumonia**

b- aspiration pneumonia

c- pneumonia in immunocompromised

## Definition :

Lower respiratory tract infection in a **non-hospitalized** person associated with symptoms of acute infection **with or without** new infiltrate on chest radiograph.

another definition : Acute infection of the pulmonary parenchyma acquired **outside of a health care** setting where abnormal alveolar filling with **fluid** causing *air space disease (consolidation and exudation)*.

what do we mean by non hospitalized ? before entering the hospital or within 48 hours of hospital admission .

## Types :

CAP is divided into **two** main types : **Typical** and **Atypical** . \* depends mainly on the etiological factor and the presentation.

Typical (60% - 70% cases of CAP)	Atypical (30% - 40% of cases of CAP)
<ul style="list-style-type: none"> <li>● <b>S. pneumoniae (most common bacterial cause)</b> * remember pneumonia is caused by s. pneumonia</li> </ul>	<ul style="list-style-type: none"> <li>● <b>Legionella spp</b> * contaminated water source air conditioning , ventilation systems , is called legionnaires' disease its <b>severe</b> form</li> </ul>
<ul style="list-style-type: none"> <li>● Haemophilus influenzae * with COPD, smokers in particular</li> </ul>	<ul style="list-style-type: none"> <li>● Mycoplasma pneumoniae in young healthy patients</li> </ul>
<ul style="list-style-type: none"> <li>● Moraxella catarrhalis</li> </ul>	<ul style="list-style-type: none"> <li>● Chlamydia pneumoniae usually associated with hoarseness</li> </ul>
<ul style="list-style-type: none"> <li>● Staphylococcus aureus * after a recent viral infection usually influenza + dialysis</li> </ul>	<ul style="list-style-type: none"> <li>● Chlamydia psittaci with birds</li> </ul>
<ul style="list-style-type: none"> <li>● Group A streptococci</li> </ul>	<ul style="list-style-type: none"> <li>● Coxiella burnetii</li> </ul>
<ul style="list-style-type: none"> <li>● Aerobic gram-negative bacteria *in nosocomial pneumonia + pseudomonas with bronchiectasis(causes structural changes)</li> </ul>	
<ul style="list-style-type: none"> <li>● anaerobes (associated with aspiration) *alcohol</li> </ul>	

-typical: means typical symptoms and signs + you can see abnormality on radiology

-Atypical: the symptoms of atypical CAP don't stick with the typical symptoms, meaning the patient doesn't always present with it, more of generalized symptoms such as headache and fever + normal radiology

\*The etiological agents for CAP are divided into two groups: **Typical and Atypical** according to whether the organism has a cell wall or not. Gram stain is a pigment that dyes the organism's cell wall, and  $\beta$ -Lactams (Penicillins, Cephalosporins, Monobactams and Carbapenems) are a group of antibiotics that kill the organism by attacking its cell wall. Consequently, atypical organisms are marked by their inability to be identified by gram stain, and their resistance to  $\beta$ -Lactams; but that does not necessarily mean that all typical organisms will be sensitive to  $\beta$ -Lactams. Haemophilus Influenzae (gram negative coccobacilli that is one of CAP's typical causative organisms) for example, is able to produce an enzyme "Beta-Lactamase" that inactivates the antibiotic causing resistance.

Treatment of atypical organisms requires antibiotics that penetrate the cell and interfere with bacterial protein synthesis, such as macrolides, tetracyclines, quinolones. Finally, typical organisms tend to cause prominent intrapulmonary symptoms e.g. cough and chest pain, meanwhile atypical organisms often cause extrapulmonary symptoms e.g. otitis media and laryngitis, making atypical pneumonia a diagnostic challenge.

CAP is also caused by number of viruses, which are **respiratory viruses** and they are very important causes esp. in children .

- **Influenza A and B viruses**
- Rhinoviruses
- Parainfluenza viruses
- Adenoviruses
- Respiratory syncytial virus
- Human metapneumovirus
- Coronaviruses (eg, Middle East respiratory syndrome coronavirus) **any pt with fever should be screen for MERS لأنه منتشر في مجتمعنا**
- Human bocaviruses

to summarize, the most frequently detected organisms in CAP are : **Streptococcus pneumoniae (pneumococcus)** and **respiratory viruses**.

## ★ Clinical features : signs and symptoms of CAP

**most of the times CAP is presented as acute illness with acute presentation of :**

### **Clinical symptoms :**

- Cough (productive **rusty colored sputum** or non-productive) and it could be associated with hemoptysis
- Fever Chills/Rigors a general symptom of infection, rigors is a sign of bacteremia
- Dyspnea in **severe** infections !
- Fatigue/Myalgia a general symptom of infection
- Gastrointestinal (Legionella) " abdominal pain " and is also associated if the infection involves the lower lobes as it irritates the intestine

what will we find on physical exam ?

### **Physical exam :**

- Dullness to percussion of chest because of consolidation, and will be stony if effusion has developed
- Crackles on auscultation
- Bronchial breath sounds
- Egophony ("E" to "A" changes)
- **Increased Tactile Fremitus** because sound travels faster in liquid medium .
- changing mental status as delirium is common esp. in elderly patients

★ **Risk factors : IMPORTANT** The risk factors can give you a clue about the organism.

<ul style="list-style-type: none"> <li>● <b>Impaired airway protection</b> – Conditions that increase risk of macroaspiration of stomach contents and/or microaspiration of upper airway secretions predispose to CAP, such as alteration in consciousness (eg, due to stroke, seizure, anesthesia, drug or alcohol use) or dysphagia due to esophageal lesions or dysmotility</li> </ul>	<ul style="list-style-type: none"> <li>● <b>Chronic comorbidities</b> – (COPD), chronic lung disease (eg, bronchiectasis, asthma), chronic heart disease (particularly congestive heart failure), stroke, diabetes mellitus, malnutrition and immunocompromising conditions most of these diseases are also common in elderly, so remember age is very important risk :) pneumonia is the old man’s friend . “Haemophilus influenzae”</li> </ul>
<ul style="list-style-type: none"> <li>● <b>Viral respiratory tract infection</b> – Viral respiratory tract infections can lead to primary viral pneumonias and also predispose to secondary bacterial pneumonia. and is common in children</li> </ul>	<ul style="list-style-type: none"> <li>● <b>Smoking and alcohol overuse</b> – Smoking, alcohol overuse (eg:&gt;80 g/day), and opioid use are key modifiable behavioral risk factors for CAP “Haemophilus influenzae”</li> </ul>
<ul style="list-style-type: none"> <li>● <b>Other lifestyle factors</b> – Other factors that have been associated with an increased risk of CAP include crowded living conditions (eg, prisons, homeless shelters), residence in low-income settings, and exposure to environmental toxins (eg, solvents, paints, or gasoline)</li> </ul>	<ul style="list-style-type: none"> <li>● <b>Older age</b> – The risk of CAP rises with age and become very common in elderly ]. &gt;= 65 .</li> </ul>

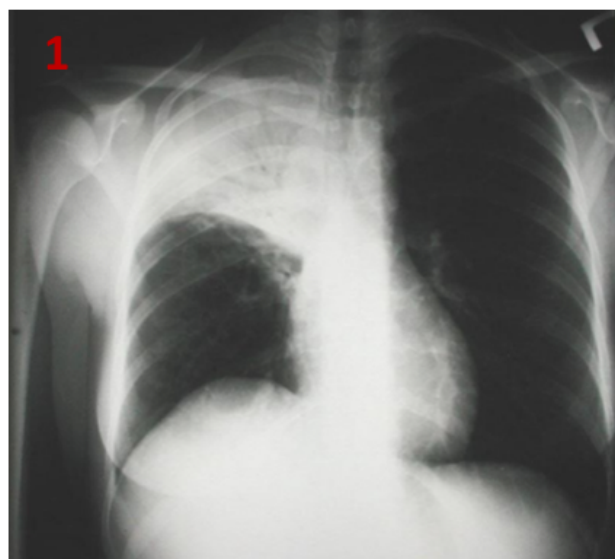
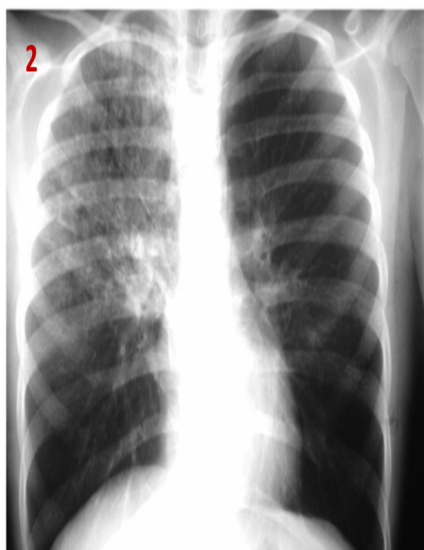
★ **Diagnosis of CAP**

- All patients with suspected CAP should have chest radiograph CXR is the best initial test for all respiratory infections but cannot determine the **specific** etiologic factor
- Leukocyte count
- Sputum Gram stain is the best initial test to determine the specific etiology , but many organisms will not be detected which are the atypical ones causing atypical pneumonia
- Blood cultures x 2
- Serum/urine antigens to detect the antigen of the organisms, **especially legionella**

## 1 / radiological investigations : **GOLD STANDARD**

three main features are seen in CXR for CAP which are : consolidation (pic1), interstitial infiltrate (pic2) and cavitation (pic3)

**consolidation: you can see air bronchogram** (refers to the phenomenon of air-filled bronchi (dark) being made visible by the opacification of surrounding alveoli (grey/white)) **it can occur in 1 lobe or more + unilateral or bilateral.**



## 2/General investigations :

which includes :

- 1- **CBC** : for leukocytosis and to determine the predominant WBC can give u a hint about the nature of the organism “ bacteria or virus “
- 2- **Organ dysfunction** : liver function test, renal function test and/or thrombocytopenia
- 3- **Blood culture** : **needs days + majority of the pt will have -ve result in blood culture and sputum but they may be in a septic shock** if bacteremia is present it means its severe, its positive in 5% to 15% of CAP cases.
- 4- **inflammatory markers** : ESR, CRP<sup>1</sup> are elevated , procalcitonin “it is one of the new inflammatory markers”

## 3/ sputum :

- for gram stain “quick” to determine specific organism of typical organisms , culture, and antibiotic sensitivity
- very low yield in pneumonia, but as you go deeper: intubation or bronchoscopy are higher yield options and it may be positive.

## 4/ Urinary and serum antigen

to detect antigen of organisms, **legionella** and pneumococcal antigen .

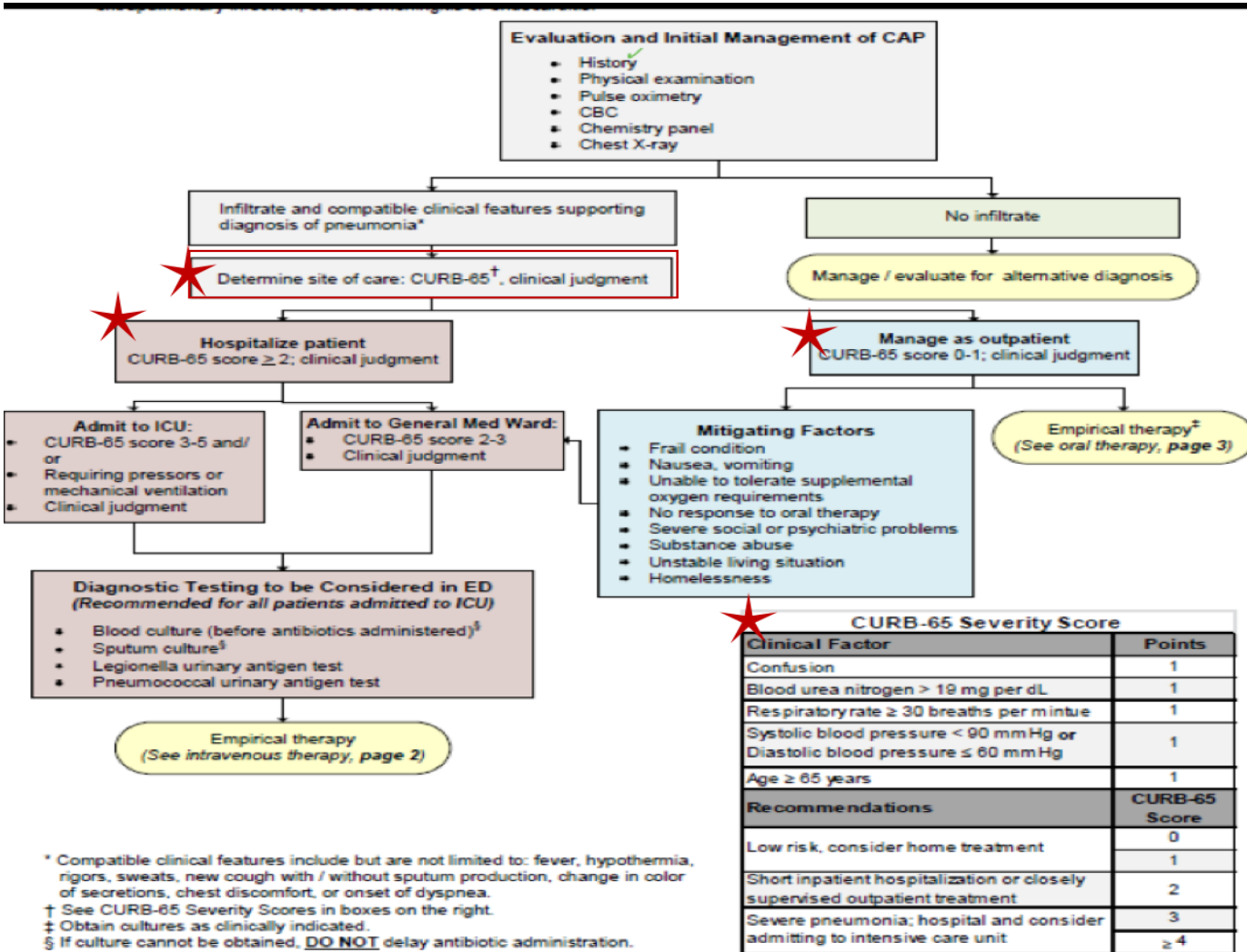
## 5/ MERS(middle east respiratory syndrome)-CoV you have to screen for it because it is endemic .

19.44 Investigations in CAP	
<b>Blood</b>	
<b>Full blood count</b>	
• Very high ( $> 20 \times 10^9/L$ ) or low ( $< 4 \times 10^9/L$ ) white cell count: marker of severity	
• Neutrophil leucocytosis $> 15 \times 10^9/L$ : suggests bacterial aetiology	
• Haemolytic anaemia: occasional complication of <i>Mycoplasma</i>	
<b>Urea and electrolytes</b>	
• Urea $> 7$ mmol/L ( $\sim 20$ mg/dL): marker of severity	
• Hyponatraemia: marker of severity	
<b>Liver function tests</b>	
• Abnormal if basal pneumonia inflames liver	
• Hypoalbuminaemia: marker of severity	
<b>Erythrocyte sedimentation rate/C-reactive protein</b>	
• Non-specifically elevated	
<b>Blood culture</b>	
• Bacteraemia: marker of severity	
<b>Serology</b>	
• Acute and convalescent titres for <i>Mycoplasma</i> , <i>Chlamydia</i> , <i>Legionella</i> and viral infections	
<b>Cold agglutinins</b>	
• Positive in 50% of patients with <i>Mycoplasma</i>	
<b>Arterial blood gases</b>	
• Measure when $SpO_2 < 93\%$ or when severe clinical features to assess ventilatory failure or acidosis	
<b>Sputum</b>	
<b>Sputum samples</b>	
• Gram stain (see Fig. 19.32), culture and antimicrobial sensitivity testing	
<b>Oropharynx swab</b>	
• PCR for <i>Mycoplasma pneumoniae</i> and other atypical pathogens	
<b>Urine</b>	
• Pneumococcal and/or <i>Legionella</i> antigen	
<b>Chest X-ray</b>	
<b>Lobar pneumonia</b>	
• Patchy opacification evolves into homogeneous consolidation of affected lobe	
• Air bronchogram (air-filled bronchi appear lucent against consolidated lung tissue) may be present (see Fig. 19.34)	
<b>Bronchopneumonia</b>	
• Typically patchy and segmental shadowing	
<b>Complications</b>	
• Para-pneumonic effusion, intrapulmonary abscess or empyema	
<b>Staph. aureus</b>	
• Suggested by multilobar shadowing, cavitation, pneumatoceles and abscesses	
<b>Pleural fluid</b>	
• Always aspirate and culture when present in more than trivial amounts, preferably with ultrasound guidance	

<sup>1</sup> c-reactive protein

# ★ Evaluation and initial Management of CAP

## 1/ Evaluation : VERY IMP pic



The aim of CURB-65 is: to know the severity AND to allocate the pt . you can see that each letter of CURBS and the age number above 65, for a score indicates a factor . you assess the patient whether he has those factors or not and add them up . then you see the recommendations depending on your score .



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 <i>or</i> doxycycline	500 mg PO Q24 hrs.  100 mg PO Q12 hrs.	If comorbidities, consider moxifloxacin as an alternative.
	amoxicillin / clavulanate <i>or</i> amoxicillin (high dose) <i>or</i> 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 <i>or</i> 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 <i>or</i> clindamycin	2000/125 mg PO Q12 hrs.*  300-450 mg PO Q6 hrs.

Patient Population	Antibiotic	Recommended Dosing	Notes
<b>Non-ICU Patient without Pseudomonal Risk</b>	ceftriaxone <b>Plus (+)</b> azithromycin	2 g IV Q24 hrs.*  500 mg IV Q24 hrs.	If < 65 years of age and no risk factors for drug-resistant pneumococcus, azithromycin is appropriate at discharge.
	<b>OR monotherapy</b> levofloxacin	750 mg IV Q24 hrs.**	
<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>Plus (+) either</b> azithromycin <i>or</i> levofloxacin	500 mg IV Q24 hrs.  750 mg IV Q24 hrs.**	
<b>ICU and Non-ICU Patients with Pseudomonal Risk***</b>	piperacillin / tazobactam <i>or</i> cefepime	4.5 g IV Q8 hrs.**  2 g IV Q8 hrs.**	If documented severe $\beta$ -lactam allergy, use aztreonam plus levofloxacin with tobramycin (7 mg/kg IV Q24 hrs.***) as an alternative.
	<b>Plus(+)</b> tobramycin <b>and</b> azithromycin	7 mg/kg IV Q24 hrs.**  500 mg IV Q24 hrs.	
	<b>Suspected Aspiration****</b>	ampicillin / subactam <i>or</i> ertapenem	
<b>Suspected MRSA Pneumonia</b>	<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.

\*\*Dose should be adjusted for renal function.

- pt who looks healthy, no risk of aspiration, non-smoker, not morbid obese, not immunocompromised and his CURB-65 goes with outpatient: → macrolides: azithromycin (macrolides) or amoxicillin, the recommendation says for 3 days but the doctors prefer for 5 days
- If the patient drinks alcohol (high risk for aspiration): anaerobes → augmentin<sup>2</sup> or clindamycin
- pt 65 y/o diabetic hypertensive has a seizure and vomited: anaerobes → augmentin or clindamycin
- Pt admitted in the hospital BUT NOT ICU: combination of macrolides + cephalosporins: (ceftriaxone)
- Pt presented with septic shock : should cover all organism



### #1 A case from the Doctor :

Jane is a 20 year old student from Queens University, she is in the track team but is complaining of a 24h S.O.B with malaise, fever, cough, sputum, she has no chest pain and she doesn't smoke. Temp: 39c PR:130 RR: 35 Bp: 70/40, she looks unwell, O2sat: 87%, she has an increased tactile fremitus with present breath sounds. the doctor said assume that her BUN is 30

MD:	ROOM	TEMP. °C	PULSE	RESP.	BLOOD PRESSURE	% O <sub>2</sub> SAT'N	WT. (kg)	<input type="checkbox"/> REFERRED BY MD
TIME: 2301	A8	39.5	130	35	70 / 40	87/RA	—	NAME: <i>WAZK 22</i>
20 y/o ♀ Queen's Student (Track team) 24 HRS C/O SOB ⊕ Malaise, ⊕ Fever, ⊕ Cough ⊕ Sputum, NO chest pain ⊖ Smokes Living alone in residence. Vitals as above! looks unwell Anemia (R) Breathing Pleurisy ↑ Fremitus								<input checked="" type="checkbox"/> NONE NKA <input checked="" type="checkbox"/> HIST ATTACHED φ CODING A135 K996.
PROCEDURES / INVESTIGATIONS CXR PA/LAT, ABG, CBC Sputum Culture.								<input type="checkbox"/> REASSESSMENTS / ADDITIONAL NOTES ON REVERSE DISCHARGE DIAGNOSIS: [REDACTED]
DISPOSITION: <input type="checkbox"/> HOME <input checked="" type="checkbox"/> ADMIT/TRANSFER TO: 2008/01/02 0135 <input type="checkbox"/> D.O.A. <input type="checkbox"/> D.I.E.								DISCHARGE TREATMENT/ADVICE: <input type="checkbox"/> PRINTED INSTRUCTIONS PROVIDED Consult Medicine / Resp.
FOLLOW-UP: <input type="checkbox"/> F.P. <input type="checkbox"/> E.R. <input type="checkbox"/> CLINIC: <input type="checkbox"/> OUTPT. INVESTIGATIONS: <input type="checkbox"/> OTHER:								<input type="checkbox"/> CARE TRANSFERRED TO NEW E.R. PHYSICIAN MD NAME: DATE: TIME: ATTENDING PHYSICIAN #2 NAME/SIGNATURE: [REDACTED] DATE & TIME: 2008/01/02 23:20



### On X-ray:

- 1- consolidation
- 2- there is costophrenic angle that means there is no effusion (parapneumonic effusion)

1. What Are the features of jane's history that suggests which organisms are most likely to be responsible for her presentation ? **Pneumococcal**
2. What additional information from her history would you like to know and why ?  
If she has: **GI symptoms + about risk factors**
3. What are the features of jane's physical examination that indicate pneumonia ?  
increased tactile fremitus + bronchial breath sounds
4. What are signs of pleural involvement ? does she have any ?  
1- shifted trachea 2- stoney dullness 3- decrease tactile fremitus  
Ans:No
5. What are sign of serious sepsis ? does she have any ? **Low Bp**
6. What are examples of extra-pulmonary infection that may complicate pneumonia ?  
1- **infective endocarditis** 2- GI involvement 3- hepatitis  
4- meningitis 5- acute kidney injury
7. Where should jane be managed ?  
\* C= 0 / U= 1 / R=1 / B=1 / 65=0  
\*CURB-65 = 3 = ICU

\*Septic shock → piptaz/tazocin (covers all organisms)



## #2 A case from the doctor

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 he has allergy . Reports good health otherwise. Denies chest pain, swelling of extremities, or diarrhea "means not legionella".  
-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

The answer is C :

1- C= 0 / U= 1 / R=0 / B=0 / 65=1 CURB-65 = 2 = inpatient.

2- levofloxacin is preferable with patients allergic to beta-lactam.

“ إذا المريض طلع ٢ ممكن يتنوم (ان بيشنت) أو ينحط تحت الملاحظة في الطور اىء لمدة 24 ساعة بعدين يطلعونه مع التنبيه انه في حالة زادت الأعراض يرجع على طول فهذا يعتمد على حكم الطبيب ( clinical judgment) ”

## Summary

Types	Typical (60% - 70% cases of CAP) -S.pneumoniae ( <b>most common bacterial cause</b> )	Atypical (30% - 40% of cases of CAP) -legionella spp contaminated water source , air conditioning .
Viruses	Viruses: <b>very important causes esp. in children.</b>	- Influenza A and B viruses - Coronaviruses
Clinical symptoms  +  physical exam	- Cough (if productive <b>rusty colored sputum</b> ) - Fever, Chills - Dyspnea - Fatigue - Gastrointestinal (Legionella)	-Dullness to percussion - Crackles on auscultation - Bronchial breath sounds -Egophony (“E” to “A” changes) - <b>Increased Tactile Fremitus</b>

### Diagnosis :

- All patients with suspected CAP should have chest radiograph
- Leukocyte count
- Sputum Gram stain
- Urinary** and serum antigen specific for ( **legionella** )

**Evaluation:** CURB 65

### Management:

- Previously healthy + no antibiotics for 3 months: Azithromycin
- Suspected aspiration: Augmantin
- ICU pseudomonal risk: piperacillin / tazobactam

## Questions

1. 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*
  - E. *Haemophilus influenzae*
2. 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 oriented in space and time. Blood results reveal a WCC of 21, urea of 8.5 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. 3
  - D. 0
  - E. 1
3. A 32 year old man presents with a 5-day history of left -sided pleuritic chest pain, fever and cough productive of rusty sputum. Observations include: BP 100/60 mmHg, pulse 105 beats/min, temperature 38.2°C, respiratory rate 21 breaths/min, oxygen saturations 87% on room air. Examination reveals dullness to percussion and bronchial breathing on the left. Nasolabial cold sores are noted. Which organism is likely to be responsible for this presentation?
  - A. *Aspergillus fumigatus*
  - B. Herpes simplex virus (HSV)
  - C. *Mycobacterium tuberculosis*
  - D. *Pneumocystis jirovecii*
  - E. *Streptococcus pneumoniae*
4. A 45 year old man has returned home from a holiday in Spain with a dry cough, left-sided pleuritic chest pain and fever. He had started some amoxicillin he bought whilst in Spain. He has been sent to the medical assessment unit after a family physician visit at home where he was found to, be quite muddled. He has a fever of 39.5°C and oxygen saturations of 85% on ait. Respiratory rate is 26 breaths/min, BP is(89/63 mmHg, pulse 112 beats/min. Examination reveals left-sided bronchial breathing with/ increased vocal resonance. Blood tests reveal: haemoglobin 143 g/L, WCC 12 x 10<sup>9</sup> /L {neutrophilia), platelets 435 x 10<sup>9</sup> /L, urea 9 mmol/L (54 mg/dL), creatinine 1.02 J.I.mol/L (1.15 mg/dL), sodium 128 mmol/L, bilirubin 12 J.I.rmol/L (0.70 mg/dL), alanine transaminase (ALT) 243 U/L, y-glutamyl transferase (GGT) 354 U/L, alkaline phosphatase 250 U/L, CRP 334 mg/L. His · CXR is below. what is his CURB-65 score?
  - A. 0
  - B. 1
  - C. 2
  - D. 3
  - E. 4

5. A 35-year-old homeless man presents to the emergency department with chief complaints of a cough and fever. He is intoxicated. He admits to drinking about a fifth of vodka every day and confirms a history of delirium tremens and blackouts. X-ray of the chest is significant for an air-fluid level in the superior segment of the right lower lobe. Which of the following is the most appropriate first-line agent for treating this patient's condition?
- A. Azithromycin
  - B. Clindamycin
  - C. Isoniazid
  - D. Moxifloxacin
  - E. Piperacillin-tazobactam
6. 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 percent 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

**Answers:**

**1. D 2.C 3.E 4.C 5.B 6.A**