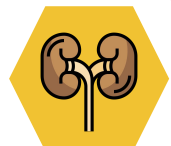
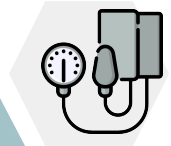
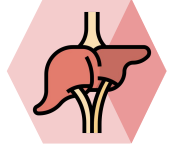


Community Acquired Pneumonia



Objectives :

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

Done by :

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Revised by: Aseel Badukhon

Resources :

Dr. Abdullah AlHarbi's slides & notes.

Cases:

1st case

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



EXAM QUESTIONS WILL BE SIMILAR TO THIS.

- They are asking, in part, about the patient allocation so use the 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)

- Notice that the patient is **allergic to penicillins**, and those patients may also be allergic to cephalosporins (eg. Ceftriaxone) due to cross-reactivity between those two types of antibiotics.

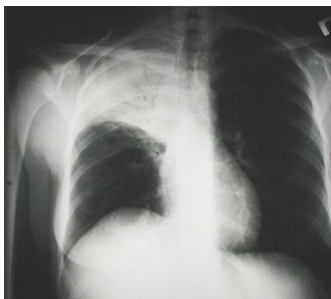
Answer: C

2nd case

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.

- Vitals:
 - Temperature; 39.5C
 - Pulse: 130 bpm
 - RR: 35
 - BP: 70/40 (very low)
 - % Oxygen Saturation: 87/RA (Room Air)
- On examination:
 - Looks unwell
 - Bronchial breathing heard in Upper Rt. Lung.
 - Decreased percussion.
 - Increased fremitus
- Procedures and Investigations:
 - CXR (PA/LAT)
 - ABG
 - CBC
 - Sputum Culture
- Diagnosis: Community Acquired Pneumonia (CAP)

1. 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.
2. What additional information from her history would you like to know and why?
 - Contact History, Recent Antibiotics, Risk of Aspiration (Alcohol Consumption, Seizures, Esophageal Dysmotility, Weakness), etc.
3. What are the features of Jane's physical examination that indicate pneumonia?
 - Bronchial breathing (means consolidation), increased fremitus (tactile and vocal).
4. What are signs of pleural involvement? Does she have any?
 - Decreased tactile fremitus & Dullness to percussion.
 - No, she doesn't have any.
5. What are signs of serious sepsis? Does she have any?
 - Fever, hypotension, tachycardia, oxygen desaturation.
 - Yes she have.
6. Bonus: What are examples of **extrapulmonary infection** that may **complicate pneumonia**?
 - Meningitis, pericarditis, reactive arthritis, and liver and renal dysfunction.
 - Most dangerous? Infective endocarditis (100% mortality if present) esp staph aureus
7. Where should Jane be managed?
 - In ICU
 - Oxygen supplements, fluids, start broad spectrum antibiotics



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.

Mostly presents with: Fever, SOB, Productive Cough, Chest Pain, Extrapulmonary manifestations.

Types & Microbiology of CAP

Typical CAP (60% - 70%)
Streptococcus pneumoniae

Typical bacteria :

- **S.pneumoniae** (most common bacterial cause)
- **Haemophilus influenzae** smokers
- Moraxella catarrhalis
- Staphylococcus aureus
- Group A streptococci
- Aerobic gram-negative bacteria
- **Anaerobes** (associated with aspiration)

Rare

Atypical CAP (30%- 40%)

Influenza virus
Mycoplasma
Chlamydia
Legionella

Atypical bacteria:

- Legionella spp
- Mycoplasma pneumoniae
presents with GI symptoms and joint pain (reactive arthritis)
- Chlamydia pneumoniae
- Chlamydia psittaci
The host of these organisms are feral birds and domesticated poultry, as well as cattle, pigs, sheep, and horses.
- Coxiella burnetii

Respiratory viruses:

- Influenza A and B viruses
- Rhinoviruses
- Parainfluenza viruses
- Adenoviruses
- Respiratory syncytial virus
- Human metapneumovirus
- **Coronaviruses (eg, Middle East respiratory syndrome coronavirus)** treated symptomatically
- Human bocaviruses

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

IMPORTANT TO KNOW:

- Clinical signs of pneumonia.
- Organisms and the risk factors that suggest the specific organism.
- **Risk Factors:**
 - **Smokers: Haemophilus influenzae.**
 - **Aspiration: Anaerobes**
- Typical CAP is related to organisms and classical symptoms, Streptococcus pneumoniae presents with classical symptoms: fever, cough, SOB, chest pain.
- Atypical CAP presents with symptoms other than the classical ones eg. ENT symptoms and headache. Viruses and Legionella are the most common out of this group.
 - Legionella (**Diarrhea**)
- Legionella causes Legionnaires Disease (Legionellosis), water transmitted, more common in old people, and in humid areas eg. South America, Singapore and Malaysia.
 - Hints in the scenario: Travel Hx, hotel stay, >60 (but could be young), fever, cough, **diarrhea** (but keep in mind not every diarrhea means legionella)
- Rhinoviruses and Parainfluenza viruses are the most common causes of viral pneumonia.

Signs & Symptoms: VERY IMPORTANT

Physical exam	Clinical symptoms
<ul style="list-style-type: none"> • Dullness to percussion of chest • Crackles on auscultation and increase in tactile fremitus • Bronchial breath sounds <small>Consolidation</small> • Egophony (“E” to “A” changes) <small>Transmitted sound, heard through the stethoscope.</small> • Very imp: Tactile fremitus is increased here (solid) while in pleural effusion its decreased (fluid) 	<ul style="list-style-type: none"> • Cough (productive or non-productive) • Fever Chills/Rigors • Dyspnea • Fatigue/Myalgia • Gastrointestinal (<i>Legionella</i> & <i>Mycoplasma</i>) <small>might affect the kidneys in advanced disease, and cause acute kidney injury.</small>

Risk factors: VERY VERY IMPORTANT

Older age	The risk of CAP rises with age. The annual incidence of hospitalization for CAP among adults ≥ 65 years old <small>Risk Factors: DM, HTS, immunocompromised. Increased risk of aspiration and stroke (anaerobes).</small>
Chronic comorbidities	(COPD), chronic lung disease (eg, bronchiectasis, asthma), chronic heart disease (particularly congestive heart failure), stroke, diabetes mellitus, malnutrition and immunocompromising conditions Smoking, Vaping, COPD. Bronchiectasis: <i>Haemophilus influenzae</i>. Chronic comorbidities present with atypical organisms eg. H. Influenzae, mycoplasma, and Staph in hospitals.
Viral respiratory tract infection	Viral respiratory tract infections can lead to primary viral pneumonias and also predispose to secondary bacterial pneumonia. <small>Maybe Strept. and if there is a risk of aspiration they will get anaerobes.</small>
Impaired airway protection <small>Aspiration</small> <small>Very imp: need to know all the risk factors of aspiration</small>	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. <small>Other risk factors of aspiration pneumonia: Parkinson's, GERD, cerebral palsy, poor dentition, neuromuscular disorders, old age.</small>
Smoking and alcohol overuse	Smoking, alcohol overuse (eg, >80 g/day), 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 <small>They consider it health associated</small> (eg, prisons, homeless shelters), residence in low-income settings, and exposure to environmental toxins (eg, solvents, paints, or gasoline)

Scenarios:

- A patient has esophageal cancer => Aspiration pneumonia.
- After Surgery, there is a loss of level of consciousness due to sedation leading to aspiration pneumonia.
 - Location of radiological change in aspiration pneumonia? (Right lower lobe)
 - The rule of two in hospital acquired pneumonia:
 - after 2 days of admission, or 2 weeks after discharge.
- A patient underwent lap chole, and after 36 hours developed fever, cough, leukocytosis and the CXR showed consolidation, is this pneumonia hospital or community acquired? Community Acquired, because it developed less than 48 hours after admission.

Diagnosis- labs

VERY IMPORTANT

All patients with suspected CAP should have chest radiograph.

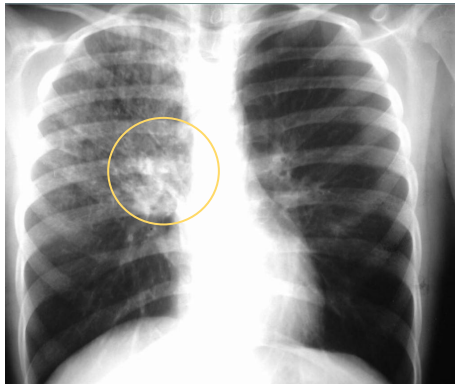
Other tests:

- **Leukocyte count**
- **Sputum Gram stain** Low yield
- **Blood cultures x 2** If there is a fever, +ve in septic shock, majority of CAP -ve
- **Serum/urine antigens** Only in legionella
- Inflammatory markers, (ESR), (CRP) procalcitonin .
- CBC
- **Organ dysfunction** such as renal dysfunction, liver dysfunction, and/or thrombocytopenia .
- **Sputum**
- Intensive care unit admission
- Failure of antibiotic therapy (either outpatients or hospitalized patients)
- Cavitory lesions
- Active alcohol abuse
- Severe obstructive or structural lung disease
- Immunocompromised host
- Pleural effusion
- **MERS-CoV.**
- **Urinary antigen**

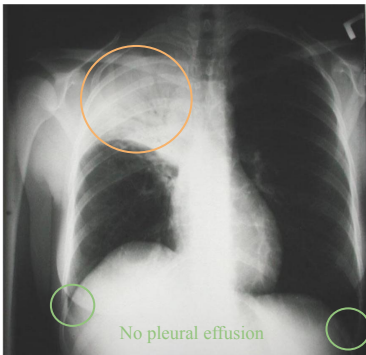
Leukocyte count might be normal due to decreased immunity or meds eg. Antipyretics, paracetamol

Radiologic evaluation :

Chest X-Ray (CXR)



Consolidation

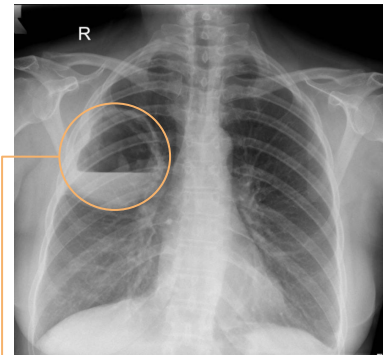


No pleural effusion

Interstitial Infiltrates

Usually appears in atypical organisms.

Cavitation



Cavity (air fluid level) appears in pneumonia in immunocompromised patients and in Staph.

Causes (Differentials) of cavitory lung lesions: mnemonic CAVITY:

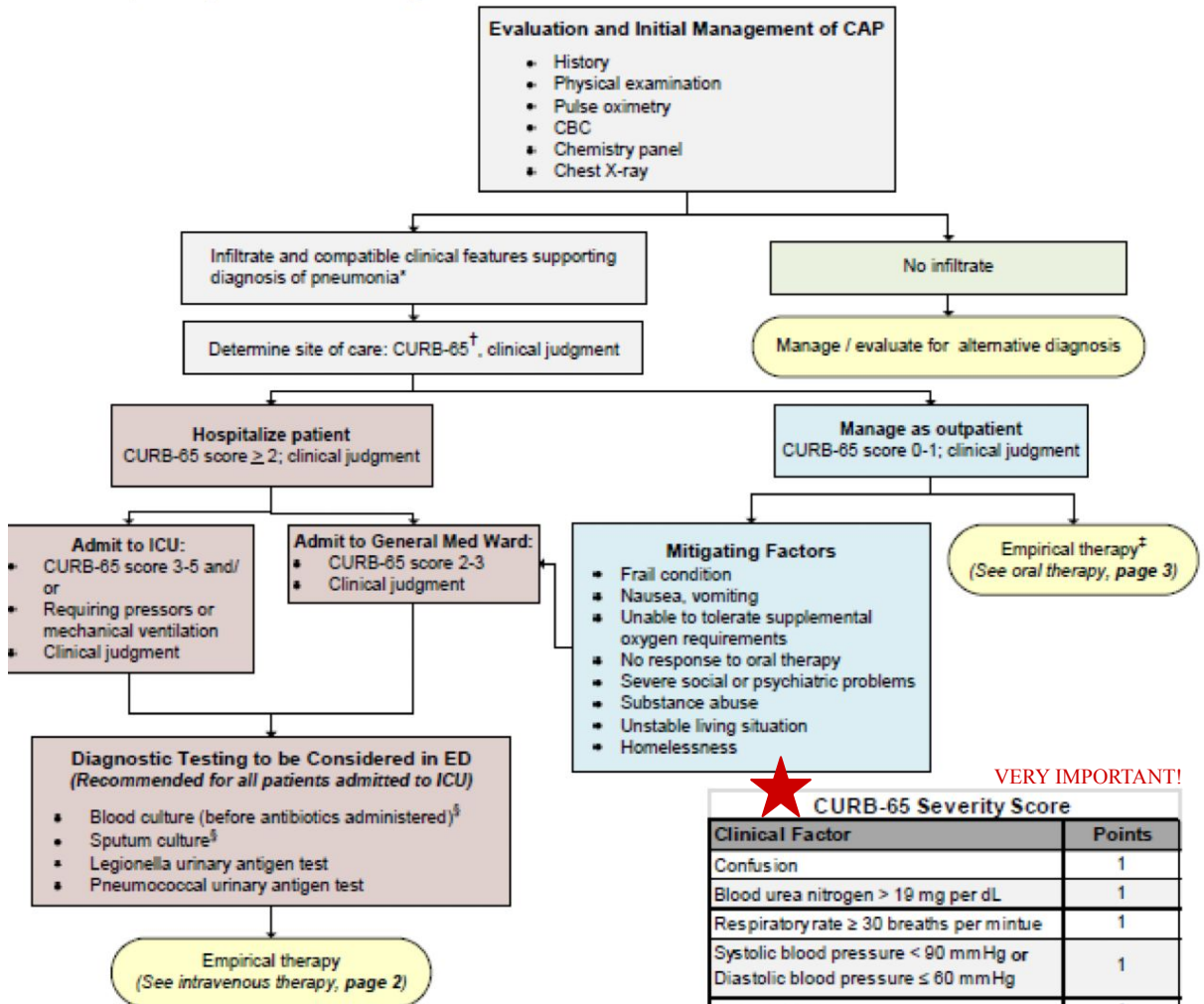
- C: Cancer.
- A: Autoimmune (Rheumatoid Arthritis, Wegener's)
- V: Vascular (AV malformation)
- I: Infection (Staph., TB)
- T: Trauma (Pneumatocele)
- Y: Young (Congenital infected cyst)

Classical findings:

1. Opacity (white spot) cause by either:
 - a. Mass
 - b. Fluid eg. pleural effusion
 - c. WBC
2. **Air bronchogram** (classic radiological finding).

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



VERY IMPORTANT!

CURB-65 Severity Score

Clinical Factor	Points
Confusion	1
Blood urea nitrogen > 19 mg per dL	1
Respiratory rate ≥ 30 breaths per minute	1
Systolic blood pressure < 90 mmHg or Diastolic blood pressure ≤ 60 mmHg	1
Age ≥ 65 years	1
Recommendations	CURB-65 Score
Low risk, consider home treatment	0
	1
Short inpatient hospitalization or closely supervised outpatient treatment	2
Severe pneumonia; hospital and consider admitting to intensive care unit	3
	≥ 4

* Compatible clinical features include but are not limited to: fever, hypothermia, rigors, sweats, new cough with / without sputum production, change in color of secretions, chest discomfort, or onset of dyspnea.




[†] See CURB-65 Severity Scores in boxes on the right.

[‡] Obtain cultures as clinically indicated.



[§] If culture cannot be obtained, **DO NOT** delay antibiotic administration.

CURB-65 is used to determine patient allocation.

Table 2: Oral Therapy

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

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

Choice of antibiotic depends on:

- Risk Factor of organism.
- Patient allocation.

Antibiotic Selection:

- Outpatient: Azithromycin (macrolide) 3-5 day (Doxycycline is not used)
- Inpatient: Ceftriaxone (Cephalosporin) + Azithromycin
- ICU: Tazocin (Piperacillin/Tazobactam) (Broad spectrum antibiotic)
- Aspiration: Clindamycin
- MRSA & Staph. In Hospital: Vancomycin.

Summary:

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

Diagnosis:

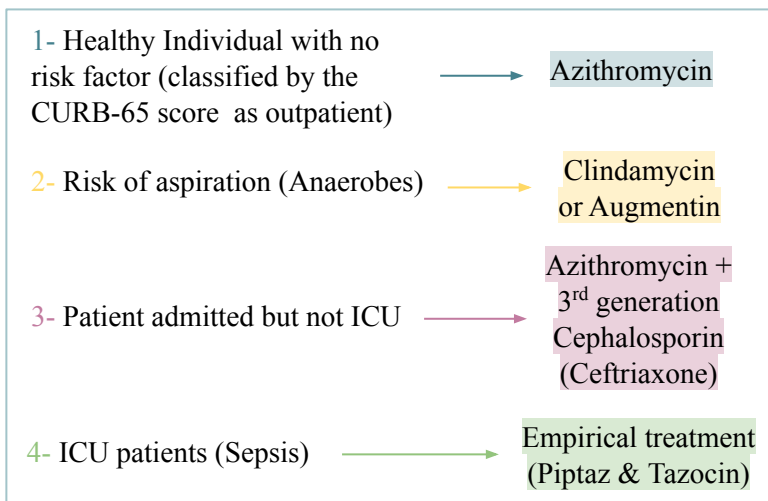
- All patients with suspected CAP should have chest radiograph
- Urinary and serum antigens **specific for legionella**
- Leukocyte count might be normal in decreased immunity or some meds; paracetamol and antipyretics
- Sputum Gram stain

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:



Questions:

4) 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

5) 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 10⁹ /L {neutrophilia), platelets 435 x 10⁹ /L, urea 9 mmol/L (54 mg/dL), creatinine 1.02 J.l.moi/L (1.15 mg/dL), sodium 128 mmol/L, bilirubin 12 J.l.moi/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. what is his CURB-65 score?

- A. 0
- B. 1
- C. 2
- D. 3
- E. 4

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)

Answers:

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

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*