

Community acquired pneumonia

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.

The risk factors and the most likely organisms associated with them are very important

Color index:

Original text Females slides Males slides
Doctor's notes Textbook 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.

Classes of pneumonia



CAP (the most common)



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



Aspiration pneumonia



Pneumonia in immunocompromised.

Types & Microbiology of CAP

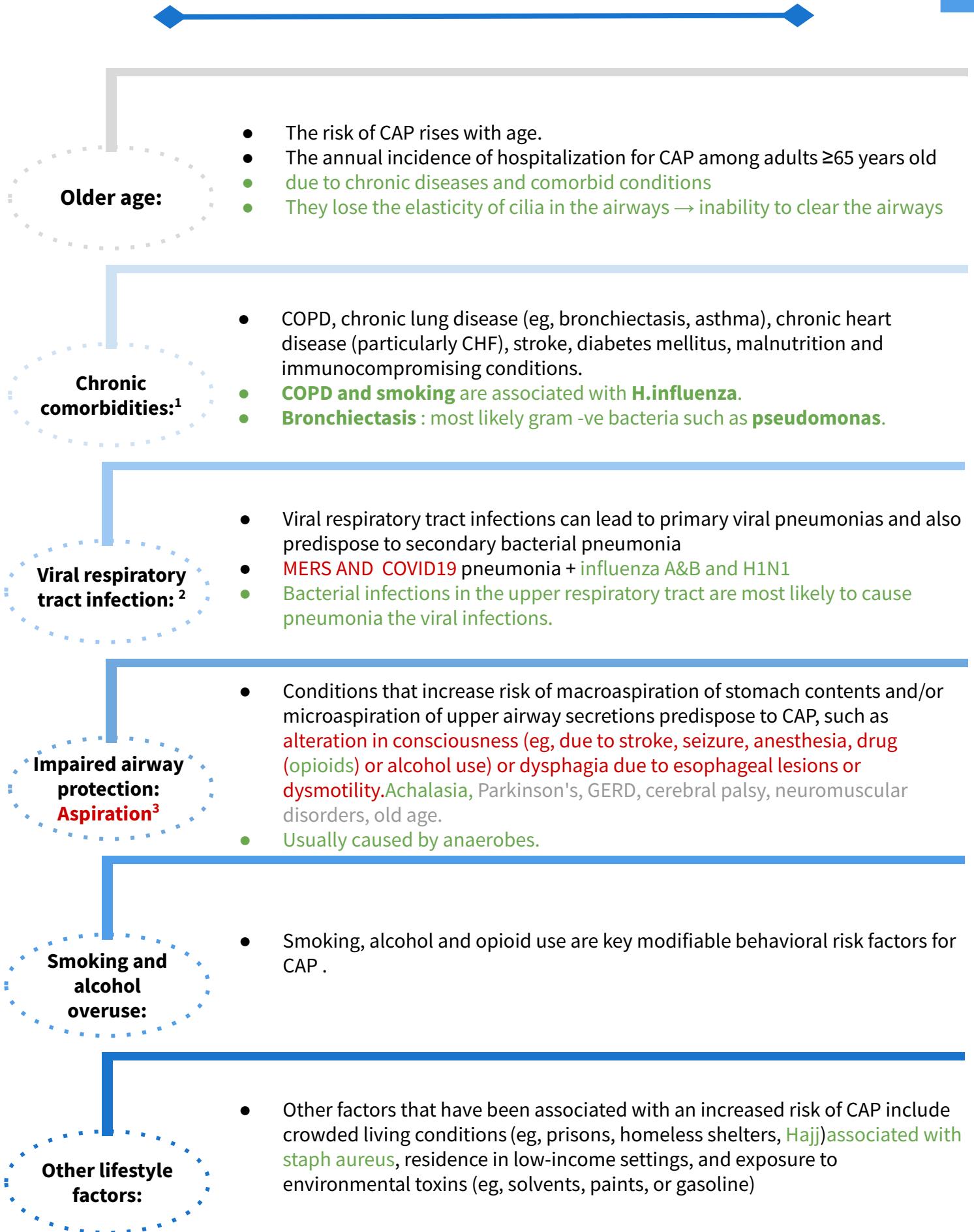
→ Streptococcus pneumoniae (pneumococcus) and respiratory viruses are the most frequently detected pathogens in patients with CAP.

Typical CAP (60% - 70%)	Atypical CAP (30%- 40%)	
Typical ¹ bacteria:	Atypical ² bacteria:	Respiratory viruses:
<i>S.pneumoniae</i> (most common bacterial cause)	<i>Legionella spp</i> ³ (contaminated water, air, ventilation systems)	Influenza A and B viruses
<i>Haemophilus influenzae</i> (the most common in smokers and COPD)	<i>Mycoplasma pneumoniae</i> (young, healthy people)	Rhinoviruses
<i>Moraxella catarrhalis</i>	<i>Chlamydia pneumoniae</i> (joints pain, headache, sinusitis)	Para influenza viruses
<i>Staphylococcus aureus</i> (recent viral infection 'influenza')	<i>Chlamydia psittaci</i> (birds)	Adenoviruses
Group A streptococci	<i>Coxiella burnetii</i> (farmers)	Respiratory syncytial virus
Aerobic gram-negative bacteria		Human metapneumovirus
★ Anaerobes (associated with aspiration) (<i>Klebsiella pneumoniae</i> has a specific association with alcohol abuse)		Coronaviruses (e.g. Middle East respiratory syndrome coronavirus)
		Human bocaviruses

1-Related to *Streptococcus pneumoniae*, classical symptoms (fever, cough, SOB, chest pain) as well as classical radiological findings (opacity on chest X Ray).

2-Presents with unclassical symptoms and chest x ray eg. **Legionella (GI symptoms, headache and chest pain)** causes Legionnaires

3-Most common cause of atypical pneumonia.



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

2-uncommon compared to bacterial pneumonia but if it happened it will be more severe.

3-young lady with classical symptoms of pneumonia but with uncontrolled seizure.

Signs, symptoms and diagnosis

the clinical presentation varies according to the immune state of the patient and the infecting agent. Features include:

- **Cough** (productive or non-productive) sometimes with haemoptysis
- **Fever** which, if swinging, may indicate empyema ,Chills /Rigors
- **Dyspnea**¹
- **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**
- **extrapulmonary features**
- **Gastrointestinal** (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.

- ★ Dullness² to percussion of chest
 - Crackles³ on auscultation
 - **Increase in vocal and tactile fremitus**
- ★ Bronchial breath sounds⁴
 - Egophony (“E” to “A” changes)⁵

Clinical symptoms



Clinical symptoms

Physical exam



Physical exam

◀ Diagnosis - labs

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	(not sensitive, in 100 patient with CAP only <7% will have positive stain)
Blood cultures x 2	marker of severity (negative unless the pt develop septicemia)
Serum/ urine antigen	(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
Other tests:	Leukocyte count ,Inflammatory markers, (ESR), (CRP),procalcitonin ,CBC MERS-CoV, very important nowadays to do swab for COVID-19

1- common but if it's progressing that is a bad sign. The patient may develop complications such as: pleural effusion, Acute respiratory distress syndrome (ARDS) or respiratory failure.

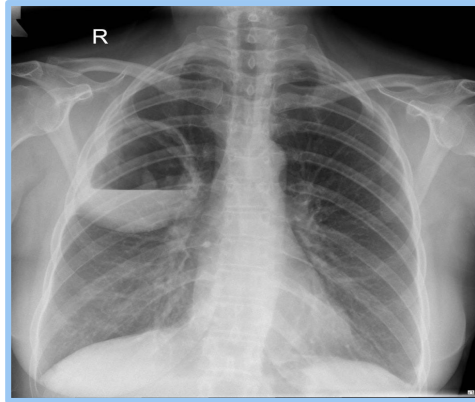
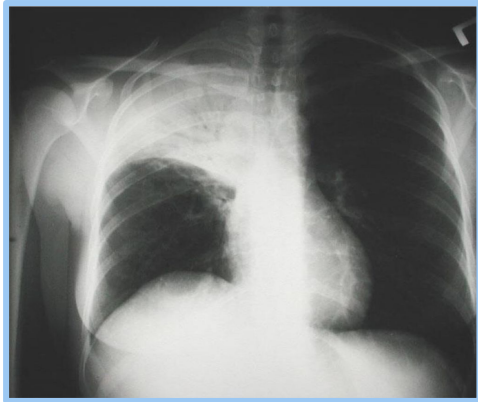
2- Dullness is caused by the consolidation (solid or pus) while in pleural effusion or fluid accumulation you will hear stony dullness.

3- Not very common.

4- Common in any consolidation.

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

◀ Radiologic evaluation¹



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

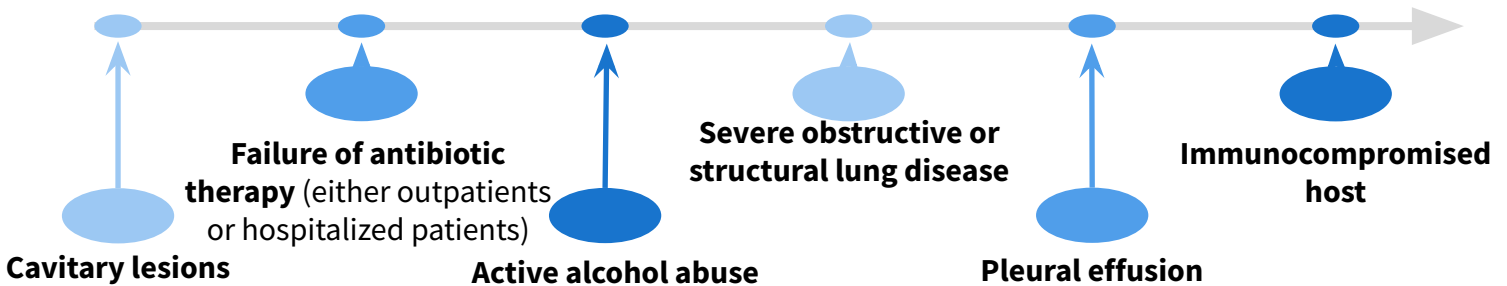
Why ? Anything will enter to the lung will go most likely to the right because of the early bifurcation of the right bronchus and to the lower zone by gravity.

That's why when we see a cavity in the right lower zone we will think about an organism associated with aspiration

Interstitial Infiltrates

Usually appears in atypical organisms

◀ Intensive care unit admission



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

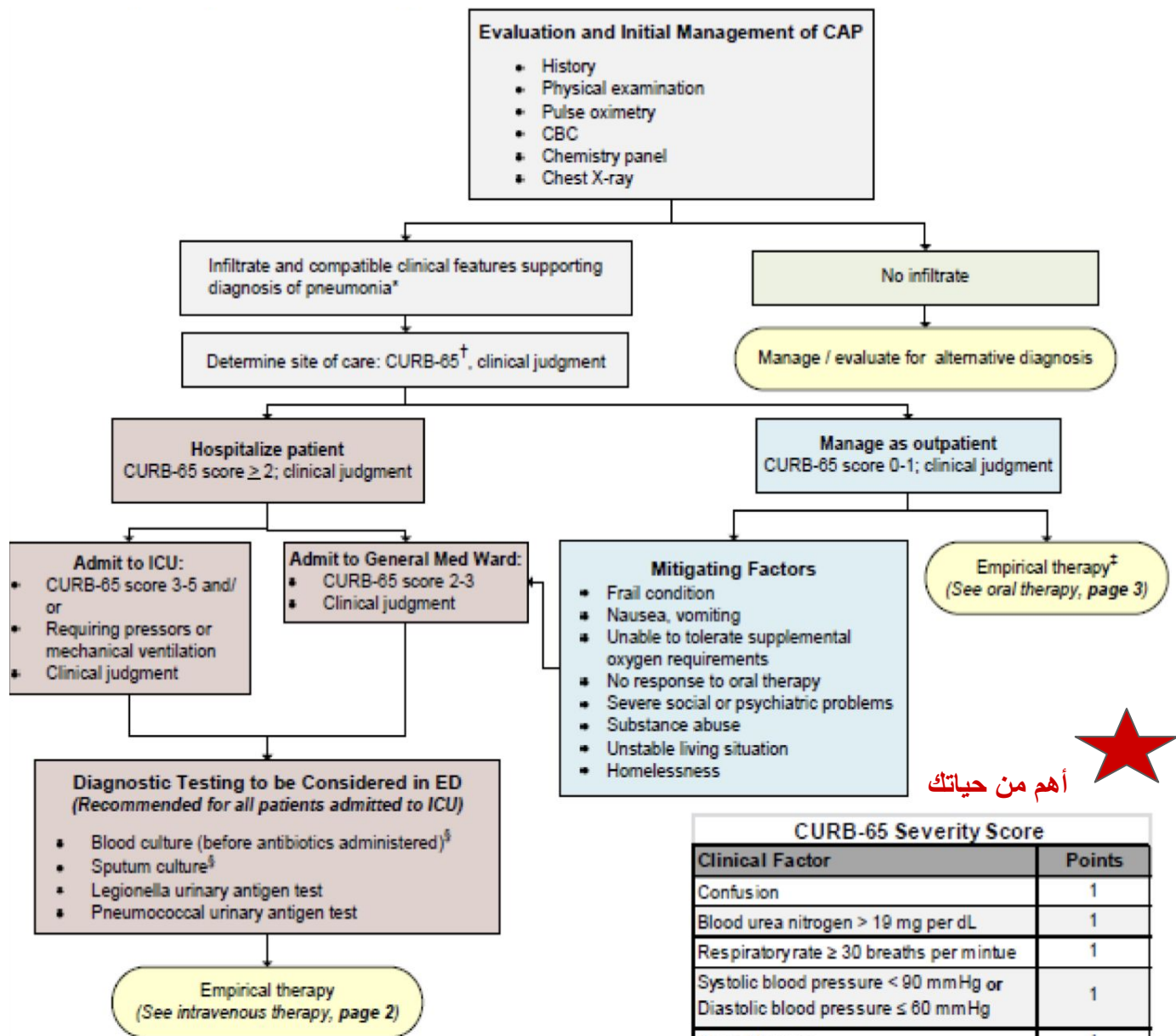
Causes (of cavitary mnemonic CAVITY):

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)

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



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.

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 or doxycycline	500 mg PO Q24 hrs. 100 mg PO Q12 hrs.	If comorbidities, consider moxifloxacin as an alternative. High dose amox/clav targets drug-resistant S. pneumoniae (DRSP). Patients with co-morbidities or recent antimicrobial therapy are at risk of DRSP.
	amoxicillin / clavulanate or amoxicillin (high dose) or cefdinir	2000/125 mg PO Q12 hrs.* 1 g PO Q8 hrs.* 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.*	
	amoxicillin / clavulanate or clindamycin	2000/125 mg PO Q12 hrs.* 300-450 mg PO Q6 hrs.	
Suspected Aspiration			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
Non-ICU Patient without Pseudomonal Risk	ceftriaxone Plus (+) 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.
	OR monotherapy levofloxacin	750 mg IV Q24 hrs.**	
ICU Patient without Pseudomonal Risk	ceftriaxone*	2 g IV Q24 hrs.	If documented severe β-lactam allergy, use levofloxacin plus aztreonam (2 g IV Q8 hrs.***) as an alternative.
ICU and Non-ICU Patients with Pseudomonal Risk***	Plus (+) either azithromycin or levofloxacin	500 mg IV Q24 hrs. 750 mg IV Q24 hrs.**	
	piperacillin / tazobactam or cefepime	4.5 g IV Q8 hrs.** 2 g IV Q8 hrs.**	
	Plus(+) tobramycin and azithromycin	7 mg/kg IV Q24 hrs.** 500 mg IV Q24 hrs.	
Suspected Aspiration****	ampicillin / subactam or ertapenem	3 g IV Q6 hrs.** 1 g IV Q24 hrs.**	Ertapenem should be used in patients with penicillin allergies.
Suspected MRSA Pneumonia	Add vancomycin	15-20 mg/kg Q12 hrs.**	

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

Doctor's Notes



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** : **clindamycin** is the drug of choice
- Risk of **staph**: **vancomycin**
- **bronchiectasis**: gm -ve like **pseudomonas**, start them on **levofloxacin** or **ciprofloxacin**.

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.

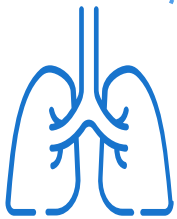
Antibiotics

-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



Complications of pneumonia

- 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 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 39.5C, 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	WTF	REFERRING MD
Time: 2301	A8	39.5	130	35	70/40	87/RA		NAME: LAURIE SW
20 y/o ♀ Queen's Student (Track Team) 24 hrs SOB Malaise, Fever, Cough Sputum, No chest pain Lives alone in residence Looks unwell Fremitus ↑ Dullness Bronchial breathing								ALLERGIES: N/A MEDICATIONS: None CHIEF COMPLAINT: SOB HISTORY OF PRESENT ILLNESS: 24 hrs SOB PHYSICIAN'S ASSESSMENT: CAP PROCEDURES / INVESTIGATIONS: CXR PA/LAT, ABG, CBC, Sputum Culture DISCHARGE / TREATMENT INSTRUCTIONS: Consult Medicine / Resp
CONSULT / TRANSFER TO: MEDICINE / RESP DATE: 2022/01/02 08:30 TIME: 08:30 BY: [Signature]								HUSBAND / SIGNATURE: [Signature]

- **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 desaturation¹. Yes she have.

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

Meningitis, pericarditis, reactive arthritis², 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: RR (Does not meet criteria) = 1, B: BP (Does not meet criteria) = 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.**

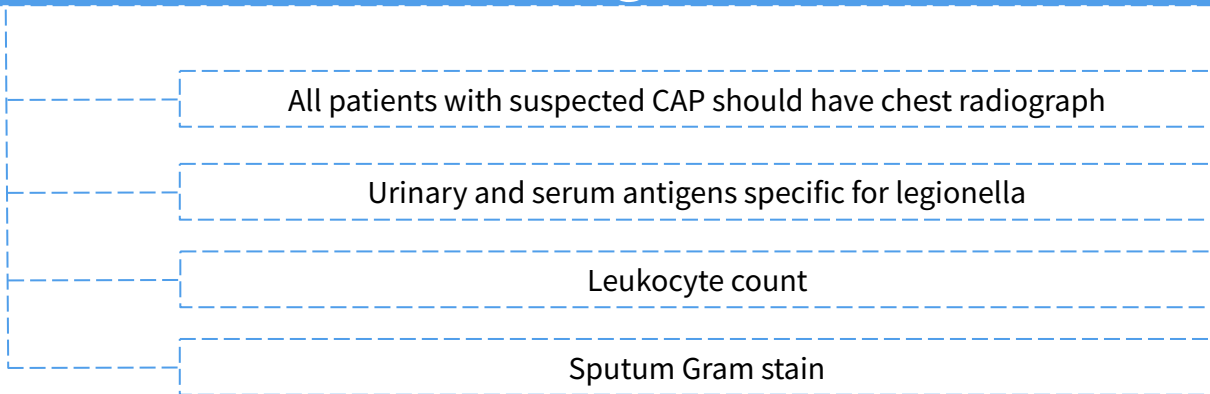
1- normal is >92%

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

Summary

Types	<ul style="list-style-type: none"> ● Typical : S.pneumoniae (most common bacterial cause) ● Atypical : legionella spp contaminated water source , air conditioning.
Viruses	<p>Very important causes especially in children.</p> <ol style="list-style-type: none"> 1. Coronaviruses 2. Influenza A and B viruses
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 vocal tactile fremitus
Risk factors	<ul style="list-style-type: none"> ● Older age ● Chronic comorbidities ● Viral respiratory tract infection ● Impaired airway protection Aspiration ● Smoking and alcohol overuse ● Other lifestyle factors

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: 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: 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: 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: Assessment of pneumonia 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 153mg/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

THANKS!!

This lecture was done by:

- Renad Alhaqbani
- Razan Alrabah

Quiz and summary maker:

- Sarah Alarifi

Note taker:

- Lama Alzamil
- Mohanad makkawi



Females co-leaders:

Raghad AlKhashan
Amirah Aldakhilallah

Males co-leaders:

Mashal Abaalkhail
Ibrahim AlAsous

*Send us your feedback:
We are all ears!*

