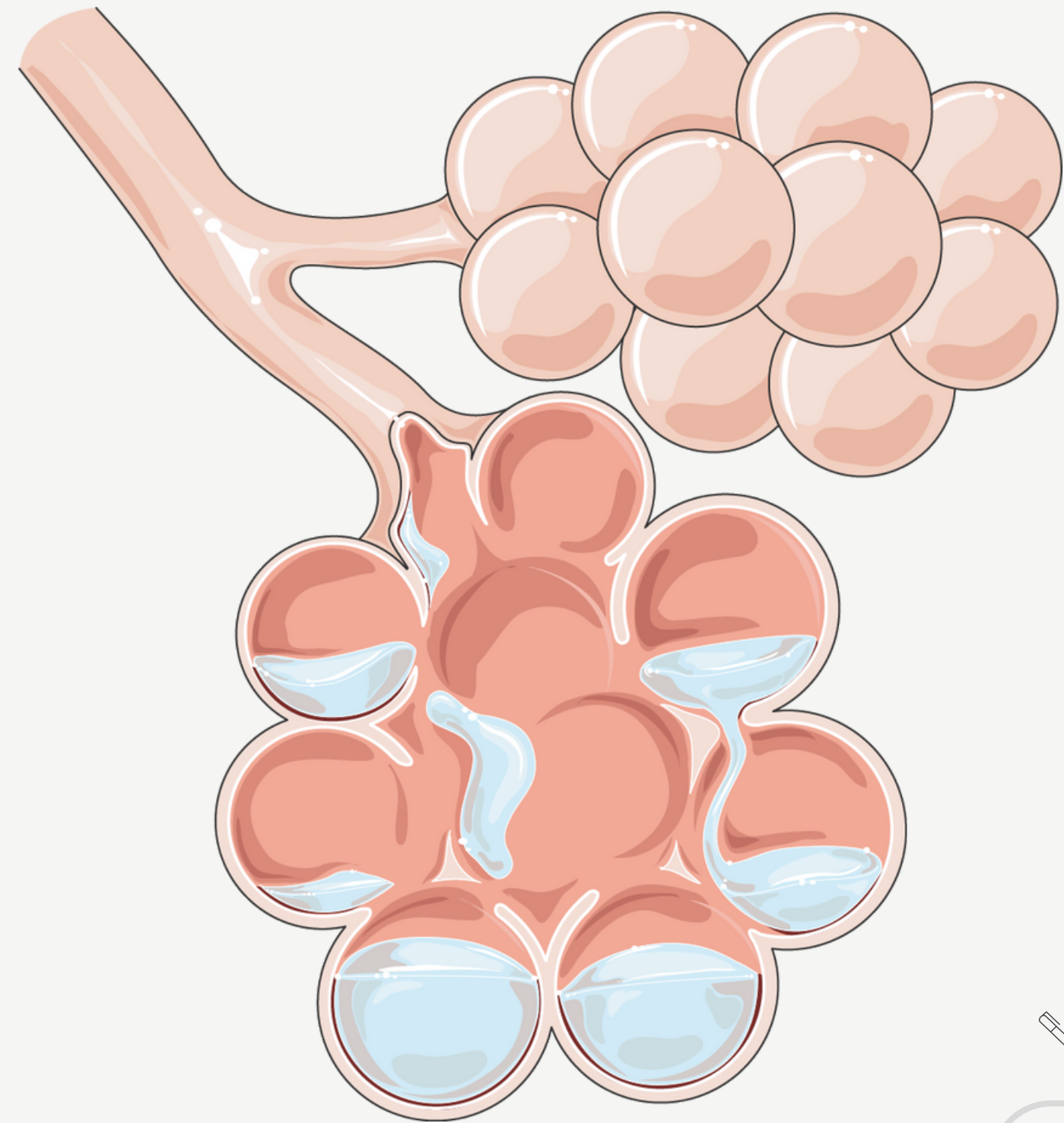
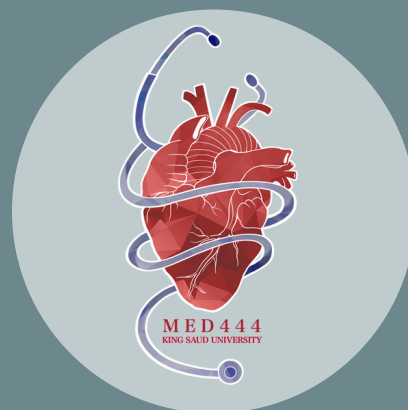


# HOSPITAL ACQUIRED PNEUMONIA

Lecture no.2



 Editing File

Color index:

Main text

Girls' slides

Important


Boys' slides

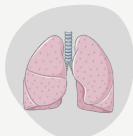
Dr. notes


Extra

# OBJECTIVES

 Define the terms, pneumonia, community acquired pneumonia, health care associated pneumonia

 ( HCAP) and ventilator associated pneumonia (VAP).

 Describe the pathogenesis of the health care associated pneumonia (hospital associated pneumonia ) and VAP

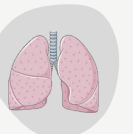
 Name the different causative bacterial agents

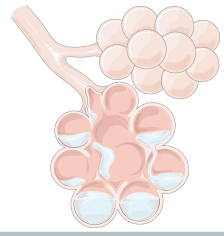
 Classify and describe types of VAP.

 Recognize the ways by which VAP is prevented.

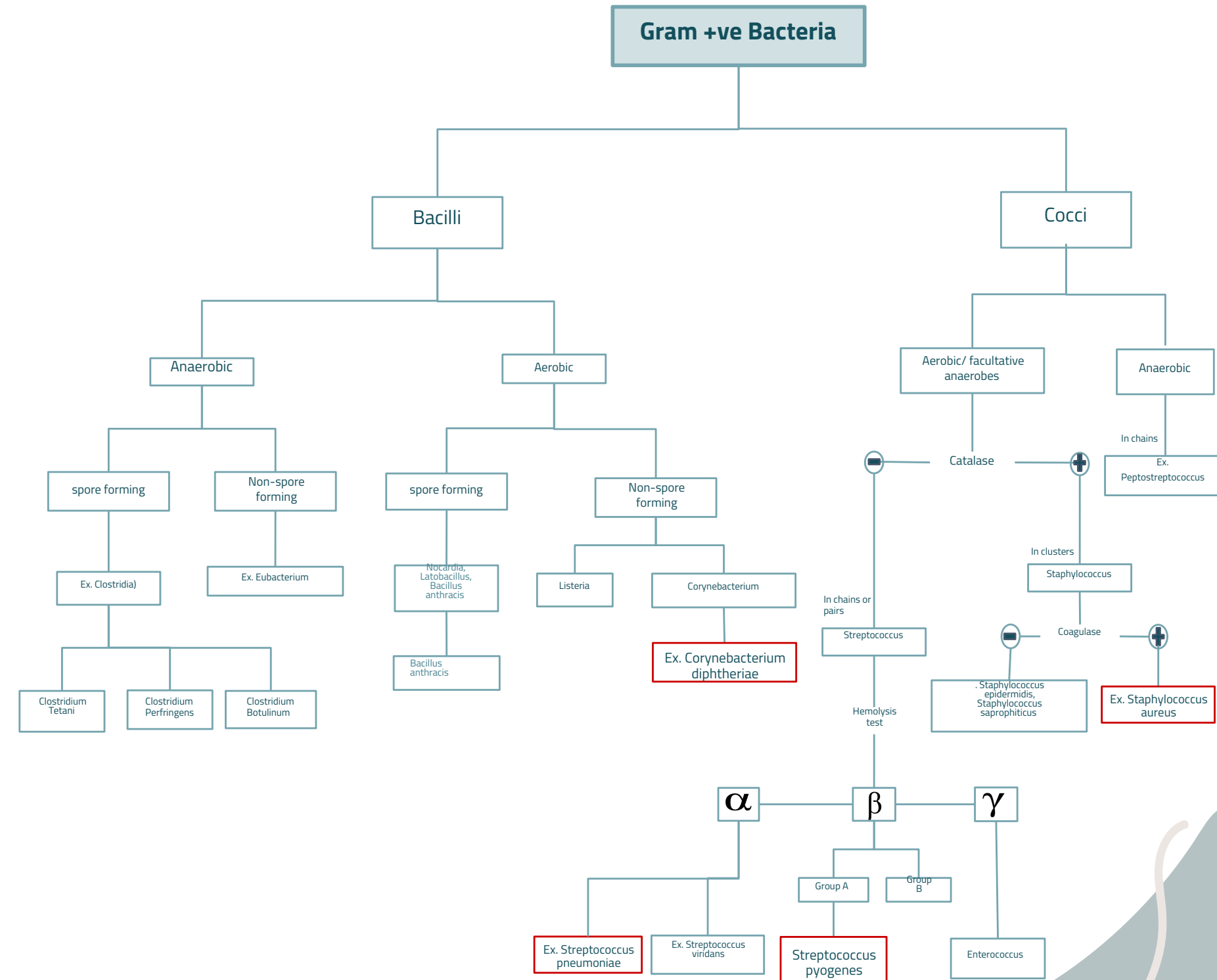
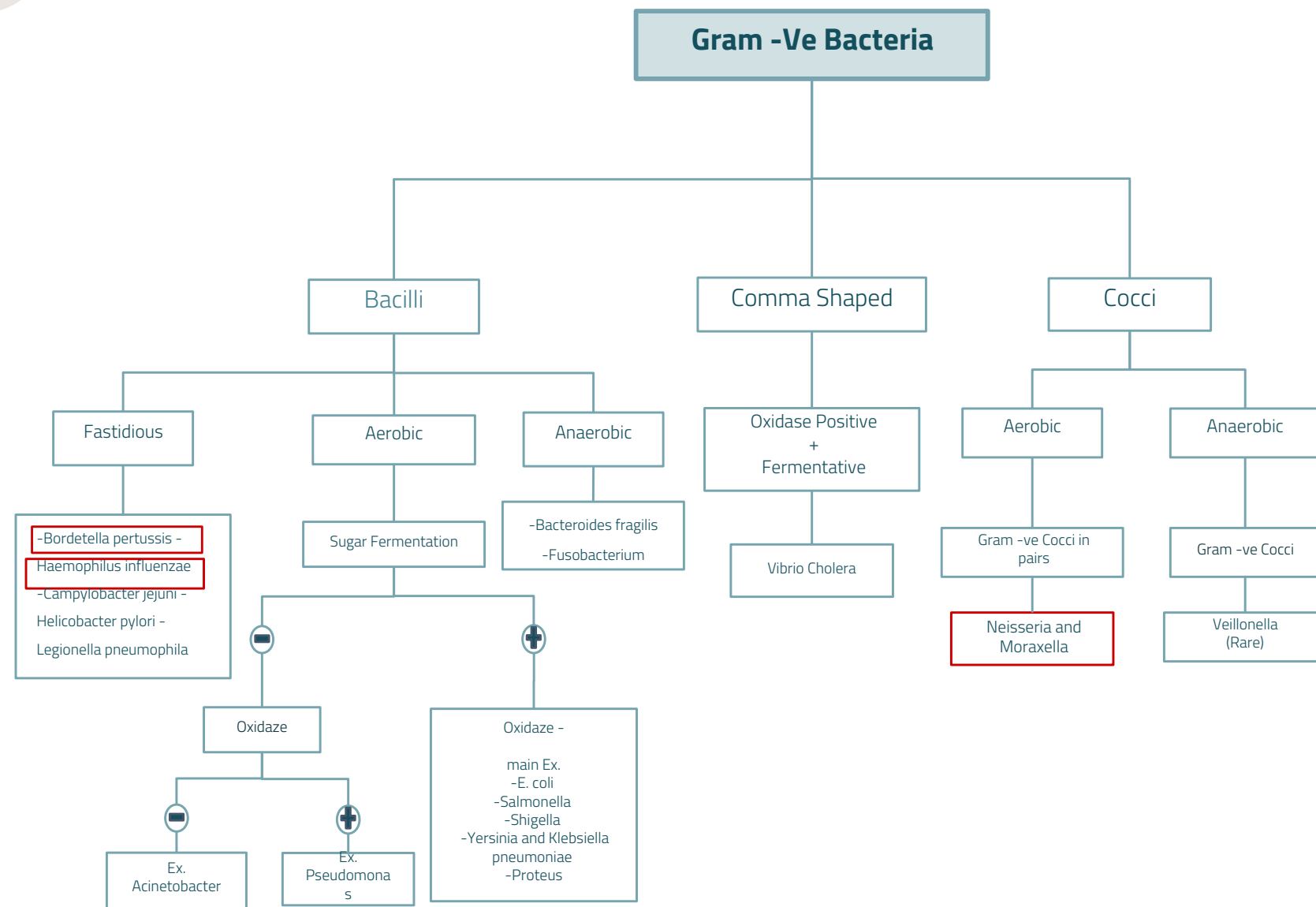
 Classify HCAP according to the time of onset .

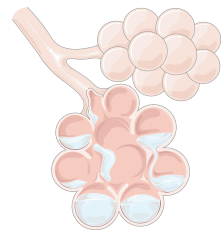
 Describe the different chemotherapeutic antimicrobial agents used for the treatment of health care associated pneumonia

 Evaluate response to treatment and recognize reasons for failure of treatment

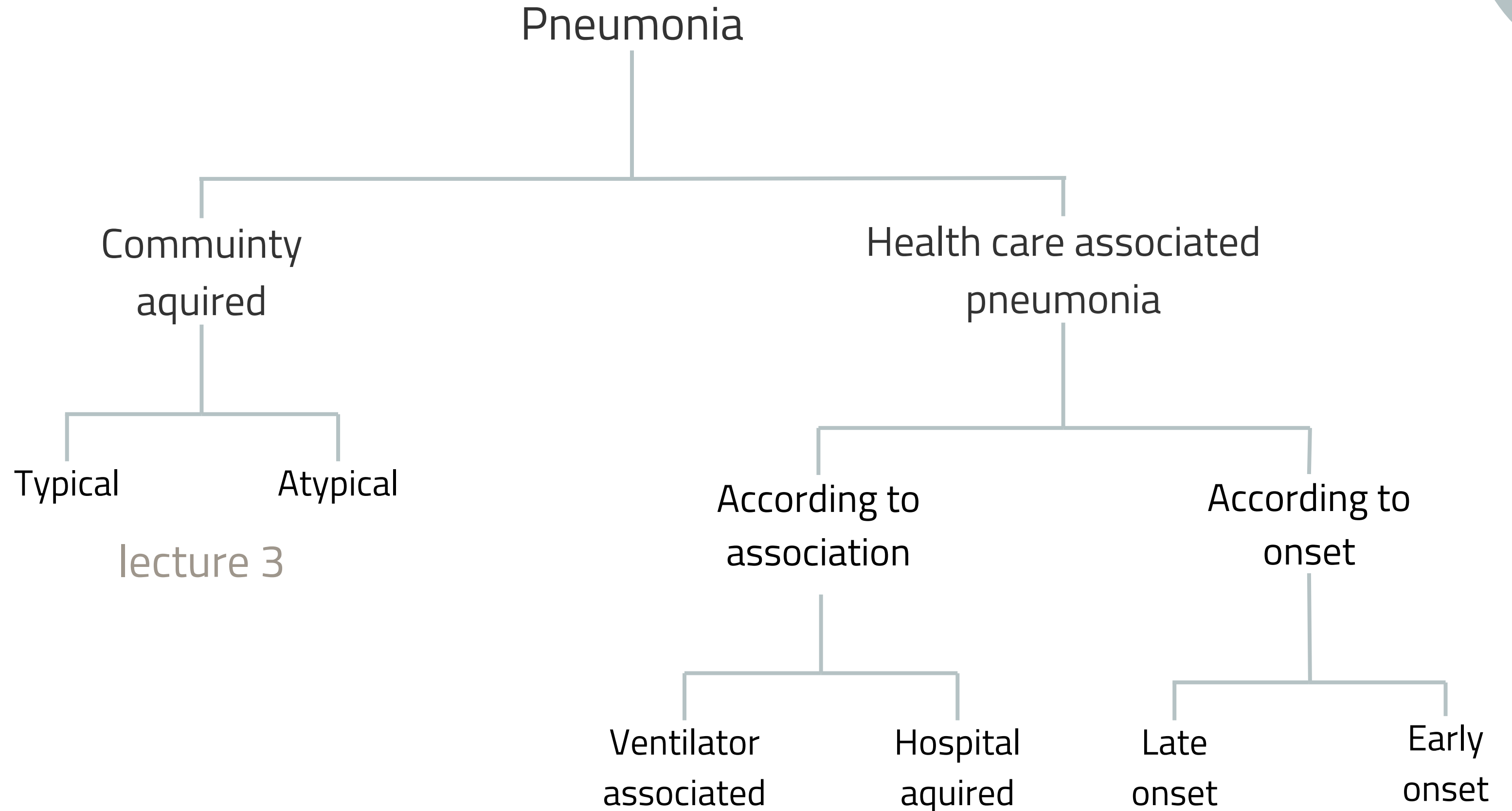


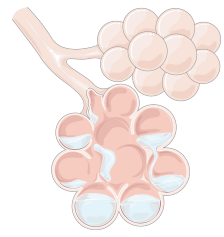
# BACTERIA (IN THIS LECTURE)





# LECTURE OUTLINE :





# PNEUMONIA (Infection of the pulmonary parenchyma)

Also Called **NOSOCOMIAL PNEUMONIA**

## Community Acquired Pneumonia (CAP):

Acquired in the community acquired organisms.

eg. Streptococcus pneumoniae  
it's usually susceptible to antibiotics.

يجي المرض للمريض وهو خارج المستشفى

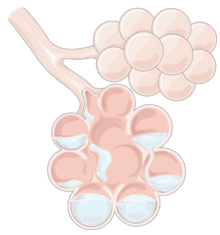
## Types of Pneumonia

Why do we need to know the difference between CAP/HAP ?  
Because the pathogenesis ,organism, x-ray, treatment and the outcome are all (different)

## Health care associated pneumonia (HAP):

Acquired **48-72 hours after admission** to health care institutions.  
Caused by organisms in hospital which are usually resistant to antibiotics  
eg. Pseudomonas aeruginosa

تجي العدوى للمريض بعد ما يدخل المستشفى



# INTRODUCTION TO (HAP)

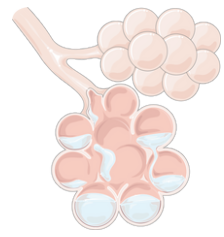
<b>Definition of nosocomial pneumonia</b>	Hospital acquired pneumonia <b>(HAP)</b> or health care associated pneumonia <b>(HCAP)</b>
<b>When does it occur?</b>	<b>At least 48 hours</b> after admission without being intubated at the time of hospitalization (put on a ventilator)
<b>How severe?</b>	<ul style="list-style-type: none"><li>-Nosocomial pneumonia(HAP) is the 2nd most common hospital-acquired infections after urinary tract infection accounting for 31% of all nosocomial infections</li><li>-Nosocomial pneumonia is the leading cause of death from hospital-acquired infections</li><li>-The incidence of nosocomial pneumonia is highest in <b>ICU (intensive care unit)</b> patients</li></ul>

## Intensive care unit(ICU)

the incidence on nosocomial pneumonia in **ventilated patients** is **10-folds higher** than non-ventilated patients  
The reported crude **mortality** for HAP is 30% to greater than 70%

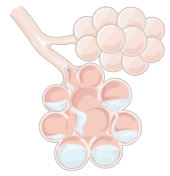




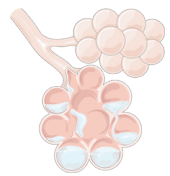


# PATHOGENESIS OF HAP

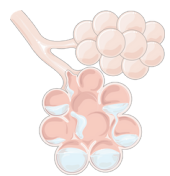
الدكتور قال انه مهم



Significant **impairment of host defenses** مناعة المريض تكون ضعيفة



Introduction of a **sufficient-size inoculum** to overwhelm the host's lower respiratory tract defenses  
يكون المريض عنده كميه كبيره من البكتيريا في جهازه التنفسي

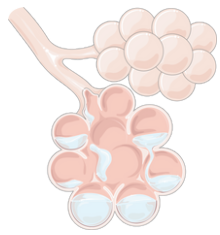


The introduction of highly **virulent organisms** into the lower respiratory tract تكون العدوى قوية و شديدة

## MOST COMMON WAY OF TRANSMISSION : الدكتور قال لازم تعرف الطريقة

by **microaspiration of oropharyngeal secretions** colonized with pathogenic bacteria.

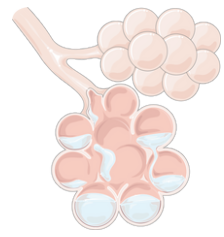
- Microaspiration: saliva goes to the lung.
- It is rarely inhaled as large droplets
- Symptoms of HAP might be, dyspnea (shortness of breath) , cough, fever.
- The oropharyngeal secretions that contains high number of bacteria goes to patient's lung.



# CLASSIFICATION OF HAP ACCORDING TO ONSET

	<b>Early-onset</b> <b>Nosocomial pneumonia</b>	<b>Late-onset</b> <b>Nosocomial pneumonia</b>
<b>Time</b>	Occurs during the <b>first 4 days</b> of admission	Occurs after <b>more than 4 days</b> of admission
<b>Overview</b>	Usually similar to CAP	Includes more Gram-ve bacteria & more resistant bacteria, multi drug resistant, hospital infection.
<b>Causative organisms</b> <b>IMPORTANT</b>	Usually is due to <b>Streptococcus pneumonia</b>	More commonly by <b>Gram-ve</b> organisms, especially: <b>-Pseudomonas aeruginosa</b> <b>-Acinetobacter</b>
	<b>MSSA</b> Methicillin Sensitive Staph Aureus	<b>MRSA</b> Methicillin Resistant Staph Aureus
	H.influenza & Anaerobes	Enterobacteriaceae (enteric bacteria e.g Klebsiella, Enterobacter, serratia)





# CAUSATIVE AGENTS

**Pseudomonas aeruginosa**

Gram-ve  
Oxidase+ve

Common causes of late-onset pneumonia, Particularly in ventilated patients.

**Acinetobacter**

Gram-ve  
Oxidase-ve

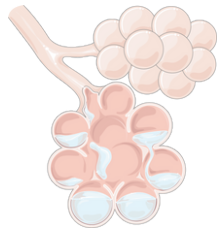
**Enterobacteria**  
**Enteric Gram negative**  
**bacilli**  
**e.g. (Escherichia,**  
**Enterobacter, Serratia)**

- Isolated most frequently particularly in patients with :  
(1)late-onset disease and in patients with serious underlying disease  
(2)already on broad-spectrum antibiotics (fourth generation cephalosporin).

(Prior use of broad-spectrum antibiotics and an immunocompromised state make resistant Gram-negative organisms more likely.)

**Anaerobes**

- Common in patients predisposed to aspiration. (VAP)
- (especially) VAP with anaerobes occurred more often with oropharyngeal intubation than nasopharyngeal intubation. لأن ال oropharynx تكون مليانه anaerobes



# CONT.CAUSATIVE AGENTS

## Staph.Aureus

Gram+ve

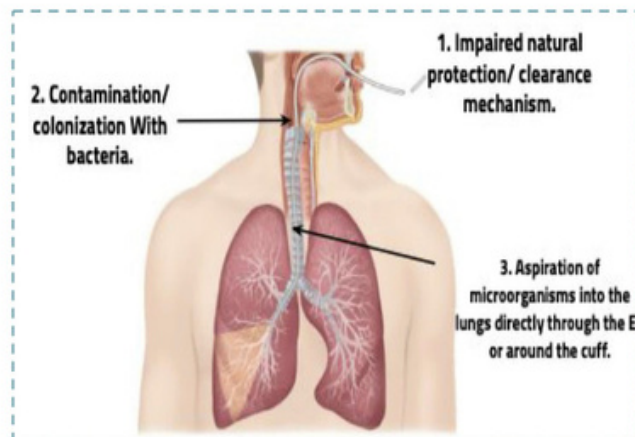
لازم اعرف الهستوري حق المريض  
MSSA في البدايه بتكون  
MRSA بعدين بيكتسب المريض

Isolated in about 20-40% of cases and is particularly common in:

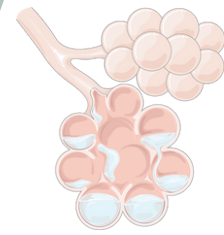
1. Ventilated patients after head **trauma, neurosurgery**, and wound infection
2. In patients who had received prior antibiotics or Prolonged care in ICU

**MRSA (Methicillin Resistant Staph Aureus)** is seen more commonly in patients who:

- 1-Received corticosteroids as they suppress the immune system.
- 2- Undergone mechanical ventilation for more than 5 days (**The longer the incubation period, the higher the risk of getting more resistant organisms**)
- 3-Presented with chronic lung disease
- 4-Had prior antibiotics therapy

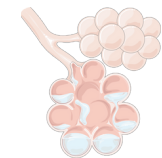
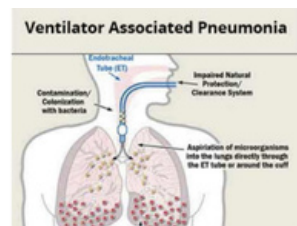


**Note: If the patient needs increased ventilation support (e.g. increased tidal volume) then this is a clear sign of VAP and we need x-ray to confirm it (infiltrate)**



# VENTILATOR ASSOCIATED PNEUMONIA (VAP)

Type of Nosocomial pneumonia that has developed in patient who are receiving mechanical ventilation. (Ventilation is Tracheal intubation : tube through the trachea) which complicates the intubation process.



## Classification of VAP

	Early-onset	Late-onset
Time	Within 48-72 hrs after tracheal intubation	After 72 hrs of tracheal intubation
Overview	We start counting the days of The onset of the disease from the tracheal intubation, not from the admission to the hospital.	
Causative Organism	Same as HAP	

# PATHOGENESIS OF VAP (IMPORTANT)

**Mechanical ventilation prevents mechanical clearance by cough and the mucociliary escalator.**  
المريض مايقدر يتنفس طبيعي فما يقدر يكح (عامل الدفاع) ف ما يقدر يطرد البكتيريا

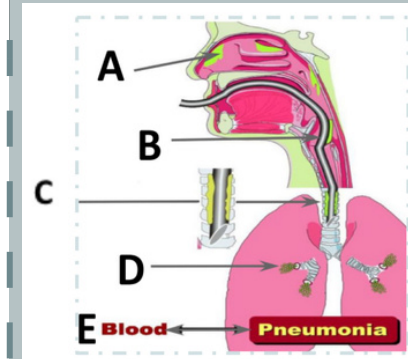
**Bacterial colonization of the aerodigestive tract**  
البكتيريا تتكاثر و راح يصير استعمار للبكتيريا

**Aspiration of contaminated secretion into the Lower airway (Microaspiration)**  
المريض راح يشفط الافرازات ويتنفسها وتنتقل لجهاز التنفسي

**Biofilm :** Thin layer from the secretion of the organism will cover the tube so it will be colonized with a lot of bacteria and aspirated, this protects Biofilm the bacteria from antibiotics & the immune system.

## Source of infection:

### Endogenous : من المريض نفسه



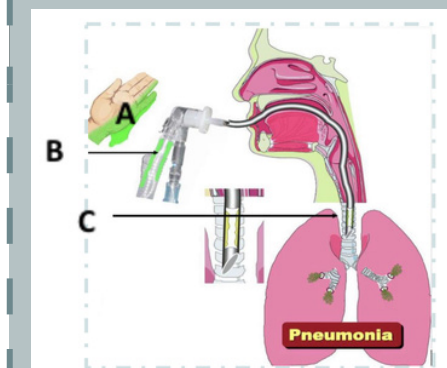
Source of microorganism:

- (A) Impaired natural protection/ clearance system allows increased colonization of nasopharynx.
- (B) Colonized oropharynx and gastric fluid pool along tube in neonates.
- (C) Colonized tracheal secretions.

Mechanism of Pneumonia:

- (D) Aspiration of colonized fluids any of the above sources into the lungs can result in pneumonia.
- (E) A hematogenous sources seeding the lungs may rarely cause pneumonia. (يكون الدم مصدر البكتيريا).

### Exogenous : من المريض

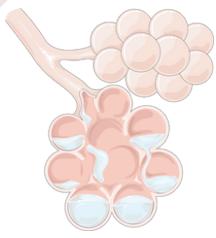


Source of microorganisms:

- (A) Hands of health care worker.
- (B) Ventilator circuit.  
(دائرة الجهاز تكون ملوثة)
- (C) Biofilm of endotracheal tube.

Mechanism of Pneumonia:

- Pneumonia occurs when colonized secretions are inhaled into the lungs through the endotracheal



# PREVENTION FOR VAP

## NonStrategies-Pharmacologic

Effective hand washing and use of protective gowns and gloves.

Semi Recumbent positioning.  
(يكون المريض نصف جالس) degree °45

Avoidance of large gastric volume  
(تكون الوجبات صغيرة)

.Oral (non-nasal) intubation  
(يمنع ال colonization)

Continuous subglottic suctioning .  
(شفط الافرازات لمنع التراكم)

Humidification with heat and moisture exchanger  
(ترطيب الجو)

Posture change (تغيير وضعية المريض باستمرار)

## Pharmacologic Strategies:

Avoiding stress-ulcer prophylaxi.

(Patients in ICU are in risk of ulcer they can be given prophylaxis to reduce stomach pH but the problem is that this would increase the risk of infection med439)

Prophylactic antibiotic therapy.  
(Oral or systematic)

### ● Vaccines

(Influenza vaccine Or strept coccus pneumonia vaccine )

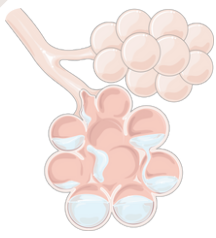
Chlorhexidine (oral rinse)  
(antiseptic) Disinfects the oral secretion from Gram +ve mainly staphylococcus aureus. (med439)

Prophylactic treatment of neutropenic patients.  
فاعطي الدواء للمريض اللي عنده نقص في النيتروفيلز  
عشان امنع العدوى

Oral Regimen :

**Topical Gentamicin, Colistin, Vancomycin cream (given every 6h for 3 weeks) treating oropharyngeal colonization could prevent VAP (ventilator associated pneumonia.)**





# TREATMENT

Most initial therapy is **empiric تجريبي** because no pathogen is identified or results are not available when antimicrobial decisions are made in most patients.

اخذ عينة من المريض

Initially be treated with a broad- spectrum antibiotic regimen aimed at covering all likely bacterial pathogens

خلال انتظار نتيجة الفحص نبدا  
بال

empiric antibiotic

يغطي

+ve and -ve

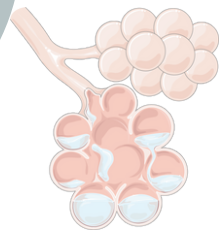
This regimen should subsequently be narrowed, according to the result of culture.

لما تطلع نتيجة الفحص نبدا  
نعطيه

بناء ع النتيجة antibiotic

## The pathogen may be influenced by :

- coexisting illnesses, prior treatment, and length of hospitalization.
- The frequency of ICU-acquired *P. aeruginosa* carriage or colonization/infection was 23.4% at 7 days and 57.8% at 14 days.
- The mortality can be reduced with early appropriate empiric therapy by about 30%. كل مازادت عدد الايام زادت احتمالية الإصابة



# Drugs that use in case of pneumonia

## Levofloxacin

A broad spectrum antibiotic of the fluoroquinolone drug class.

## Vancomycin / Linazolid

Used when there is a risk of MRSA or more severe infections. (Used with above drugs)

# DRUGS

## Meropenem

A broad-spectrum carbapenem antibiotic.

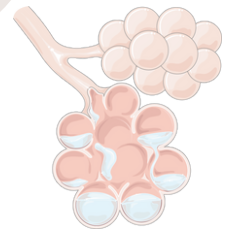
## Piperacillin-tazobactam

A combination of the antibiotic piperacillin, and the  $\beta$ -lactamase inhibitor tazobactam لازم مع بعض

## Cefepime

A fourth-generation cephalosporin, has a broad spectrum





# Response to therapy

If no clinical response is noted or deterioration occurs, we need to consider:

## Infectious causes:

- 1-Resistant pathogen
- 2-Superinfection عدوى إضافية
- 3-Unusual pathogens.
- 4-Lung abscess.
- 5-Extrapulmonary infection.

## Non-infectious events:

- 1-Heart: congestive heart failure (CHF).
- 2-Lung: fibroproliferative acute respiratory distress syndrome (ARDS), pulmonary emboli, Atelectasis.

# MCQs:



Q1: A  
Q2: D  
Q3: D

Q1/ which of the following is an Infectious cause:

A	Lung abscess	B	Heart: congestive heart failure (CHF).	C	A & B	D	Non-of them
---	--------------	---	--	---	-------	---	-------------

Q2/ which of the following drugs is Used when there is a risk of MRSA or more severe infections.

A	Cefepime	B	Meropenem	C	Levofloxacin	D	Vancomycin / Linazolid
---	----------	---	-----------	---	--------------	---	------------------------

Q3/ which of the following is a pathogenesis of HAP:

A	Significant impairment of host defenses	B	Bacterial colonization of the aerodigestive tract	C	The introduction of highly virulent organisms into the lower respiratory tract	D	A&C
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# MCQs:



Q4: C  
Q5: A  
Q6: D

Q4/ Ventilator associated pneumonia is commonly found in which of the following wards ?

A	Day surgery	B	General medicine	C	Intensive care unit	D	Psychiatry
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Q5/ One of the Most common way of transmission in HAP

A	Oropharyngeal secretions	B	Ears secretion	C	Blood transfusion	D	Tears
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Q6/ A hospitalized patient has COPD and was diagnosed with nosocomial pneumonia, the culture was Gram negative bacilli, non lactose fermenter and oxidase positive which of the following is the organism

A	Acinetobacter	B	Haemophilus influenzae	C	Streptococcus pyogens	D	Pseudomonas aeruginosa
---	---------------	---	------------------------	---	-----------------------	---	------------------------

# SAQs:

Q1/ A 47 years old patient is admitted to the hospital. 6 days later he developed cough, fever & shortness of breath. A chest radiograph showed chest infiltrates. A culture shows gram+ve cocci in clusters.

A) What is the most probable diagnosis?

B) Describe the onset ?

C) Most likely causative agent?

A) Hospital acquired pneumonia

B) Late onset

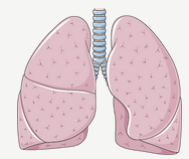
C) MRSA



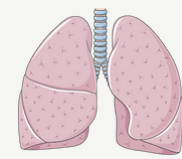
# Meet The Team :)

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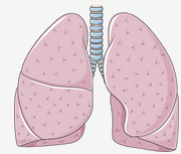
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Omar Albaqami