

**Internal
medicine**

الطب والجراحة
بجنته

PNEUMONIA

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PNEUMONIA

Definition:

It is a syndrome of acute infection of the lung parenchyma, characterized by clinical and / or radiological picture of consolidation. Commonly due to bacterial infection when the cause is non Infectious, it is termed pneumonitis.

Classification of Pneumonia

1) Anatomical Classification:

Lobar pneumonia.

Every lobe divide into segments (10 in RtL& 8-9 in LtL)

Segmental or subsegmental pneumonia.

Bronchopneumonia. Diffused and patchy

2) Aetiological Classification:

According to responsible micro organisms.

3) Environmental Classification:

Community or hospital acquired pneumonia

1 Anatomical Classification:

Lobar pneumonia: One or more lobes are uniformly affected by inflammation and consolidation.

Segmental or subsegmental pneumonia: There is only part of the lobe is affected.

Bronchopneumonia: There is a patchy involvement of lung parenchyma, particularly in lower zone

2 - Aetiological Classification:

• Bacterial :

Specific :TB

Non-specific :

-Gram +ve organism / Gram-ve organism

- Atypical e.g. Mycoplasma and Legionella species Chlamydia,

• Viral: e.g. H1N1

• Fungal: e.g. Histoplasmosis and Aspergillosis

• Parasitic: e.g. Malaria **Inflammation w/o infection**

• Other causes of pneumonia :

Allergic pneumonitis: e.g., Lupus pneumonitis. **May be sever need corticosteroids to treat**

Chemical pneumonitis e.g: Lipoid pneumonia. **Lipid deposits in alveoli result from Oxygenous source as some people use oily nasal drops—> accidental inhalation then enter the lung causing chemical reactions which called lipoid pneumonia, OR may the source from endogenous (lipid metabolism)**

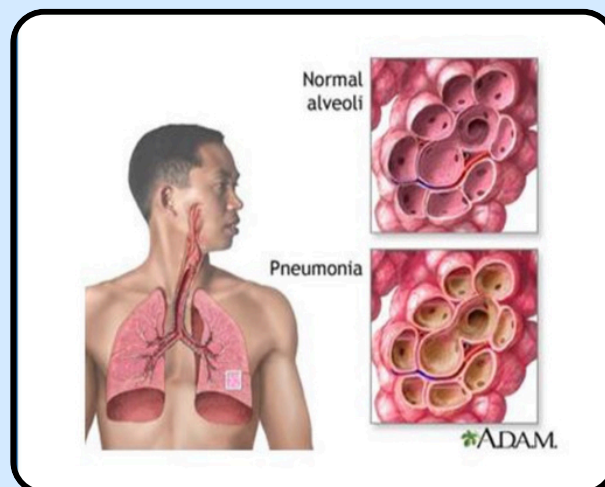
Radiation: e.g. Radiation Pneumonitis

Specially in chest radiation and will cause complications like ILF

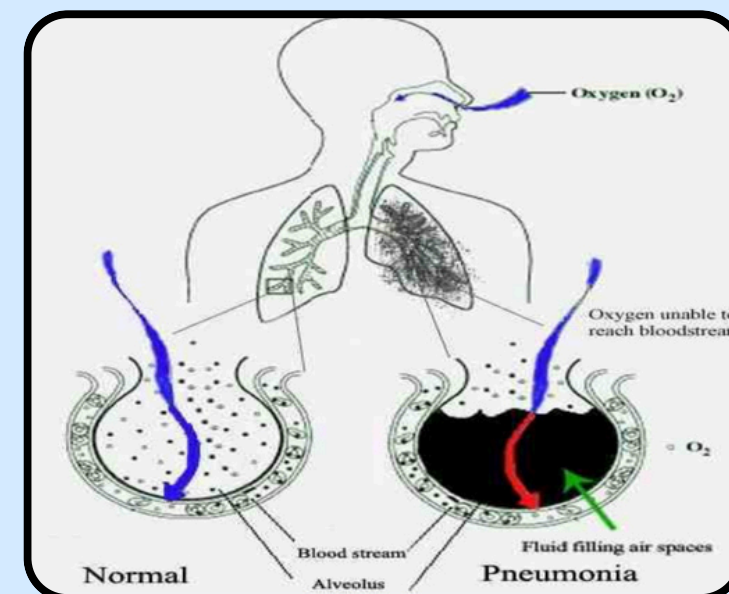
3- Community or hospital acquired pneumonia:

Community acquired pneumonia:

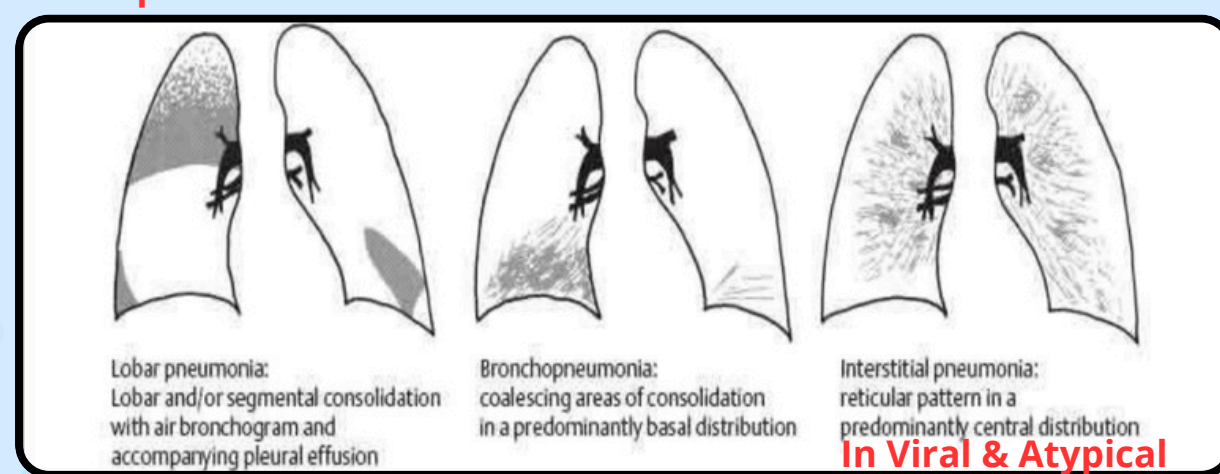
➤ Pneumonia which is acquired in the community or at hospitalization within the first 2 days



Exudate will interfere gas exchanging result in complication



Usually is bilateral



In Viral & Atypical pneumonia

➤ The most common organisms are Streptococcal pneumonia, Atypical, Staph. Aureus and Hemophilus influenza

Hospital acquired pneumonia: or Nosocomial pneumonia:

➤ It is a pneumonia which is acquired in the hospital after 2 days of hospitalization.

➤ The commonest organisms are G-ve bacilli e.g: pseudomonas aeruginosa, Klebsiella and proteus

Community Acquired Pneumonia (CAP) Epidemiology

- 6th leading cause of death
- 1 -25 cases / 1000 inhabitants / year
- 20% require admission
- 14% Average mortality rate
- Mortality disproportionately high in old age

Community Acquired Pneumonia (CAP)

Predisposing factors:

1. Impaired cough reflex e.g. Anesthesia, Alcoholism, Tracheostomy. **Due to loss of consciousness**
2. Impairment of mucociliary activity **surface of cilia has a mucus , cilia Move upward to coughing up any organisms may impairment if mucus becomes thick as in cystic fibrosis Or movement is weak as in mortality cilia syndrome**
3. Decrease of effective phagocytic activity of alveolar macrophages and neutrophils.

Community Acquired Pneumonia (CAP)

Mode of infection and causative organisms:

A- Aspiration: **Organisms in the content of aspiration**

Predisposed by impaired cough:

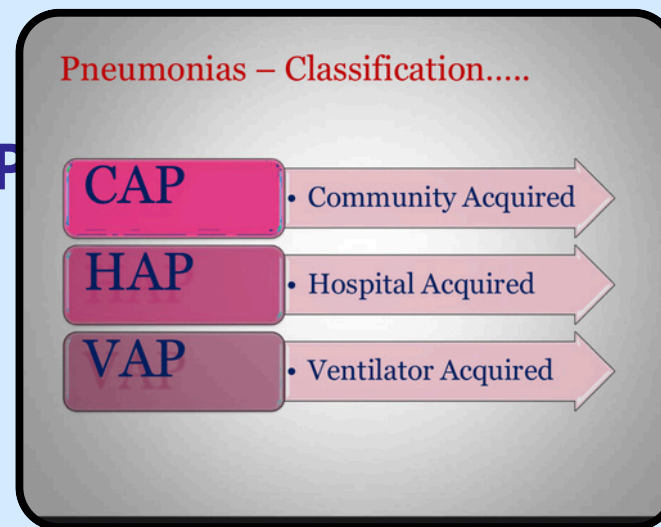
Anesthesia, Alcoholism, Tracheostomy.

B- Inhalation:

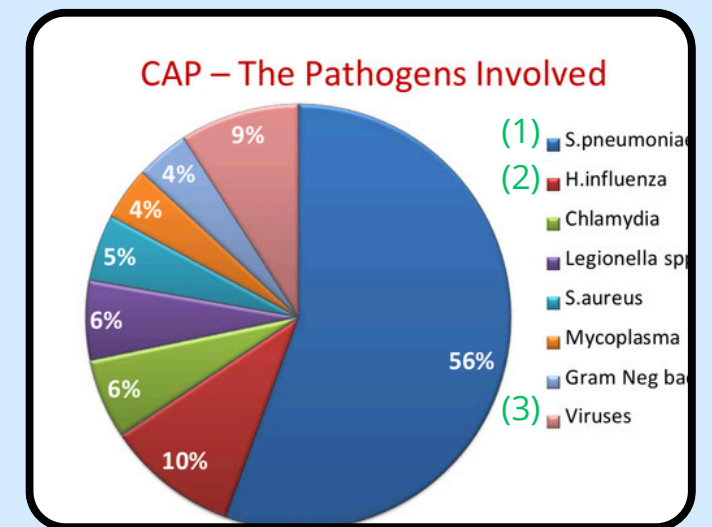
Patient to patient by direct contact through droplet infection Or Airborne infection.

C- Colonization: In chronically ill patients e.g. COPD, Bronchiectasis.

D- Blood spread: IV. Cannula, CV lines, and IV drug abusers



VAP is sub of HAP but the difference is VAP come from ventilation tools after 48 hs



Result in aspiration which may form environment for growth bacteria or cause pneumonia by itself

Pathology of Pneumonia

➤ The commonest feature of pathology is the presence of cellular exudate in the alveolar spaces.

➤ In pneumococcal and viral pneumoniae, resolution occurs through the action of macrophages and lung tissue may return to former state

Diagnosis of pneumonia

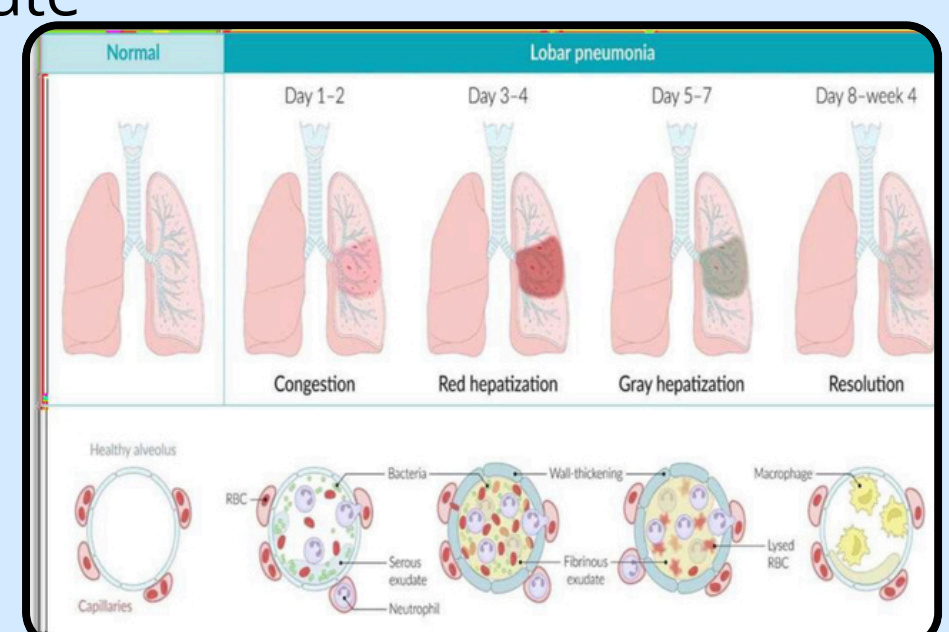
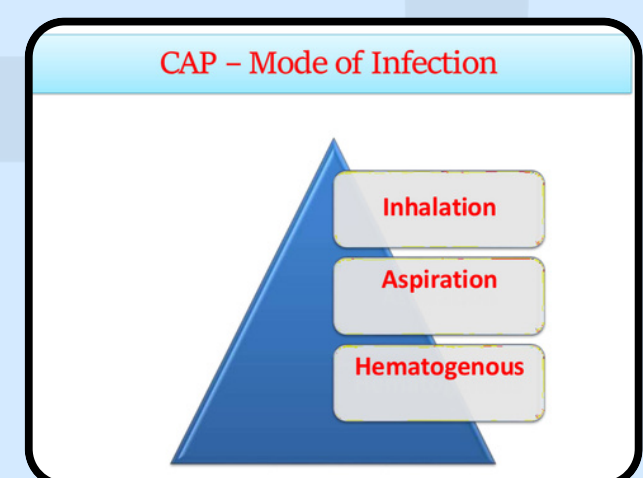
History and examination

• Symptoms:

➤ Systemic: Fever, malaise, anorexia, body pain, sweating

➤ Chest: Cough, purulent expectoration, sometimes blood tinged, Dyspnea and Pleuritic chest pain.

More with lower= classic pneumonia



- Bacillus enter the alveoli where macrophages neutrophil are found with serous exudate
- Fluidy (serous Exudate → fibrous exudate (more thick) + ^ in Cells
- As Red hepatization but cells broken down → turn to gray color
- Macrophage start lung clearance and lysis all dead tissue and microbs

Examination

➤ General:

- Fever
- Tachypnea: Short and rapid breathing [^]with fever
- Tachycardia: Relative Bradycardia in viral pneumonia. **when there is fever but no ^ in Rate as viral inf.**
- Cyanosis in severe pneumonia.

➤ Local chest symptoms: = Clinical picture of consolidation (very important)

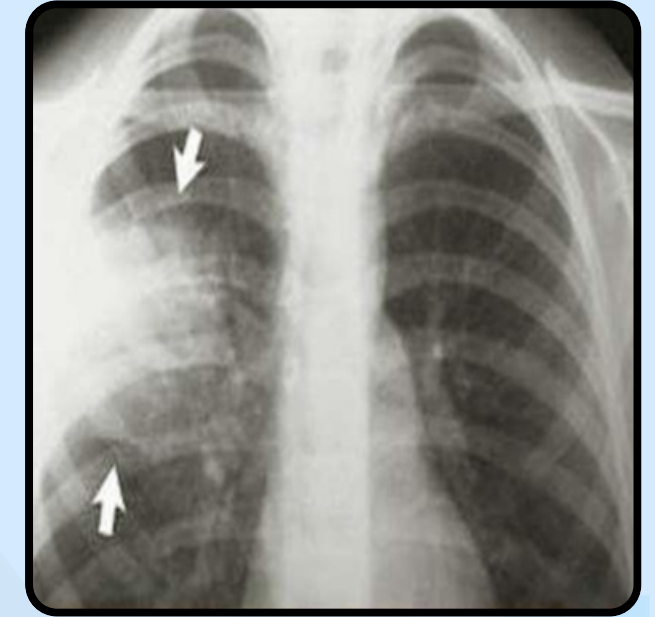
- Increased TVF,
- Impaired note or Dullness to percussion,
- Bronchial breath sounds, or crackle

bronchophony: +ve , as TVF but in auscultation

Egophony : patient say (A) we here it (E)

CAP – Two Types of Presentations

Classical	Atypical
<ul style="list-style-type: none">• Sudden onset• High fever, chills• Pleuritic chest pain, SOB• Productive cough, Rusty sputum, blood tinge• Poor general condition• High mortality up to 20% in patients with bacteremia• <i>S.pneumoniae</i> causative	<ul style="list-style-type: none">• Insidious onset• Low grade fever, Confusion• SOB• Dry cough .• Diarrhea, abdominal pain• Low mortality 1-2%; except in cases of Legionellosis• <i>Mycoplasma, Chlamydia, Legionella, and Viruses</i>



Streptococcus Pneumonia

- Most common cause of CAP (about 2/3 of cases of CAP)
- These are gram positive diplococci
- Typical presentation (e.g. fever, chills, Pleuritic chest pain, cough with rusty sputum)
- Lobar infiltrate on CXR

Atypical Pneumonia

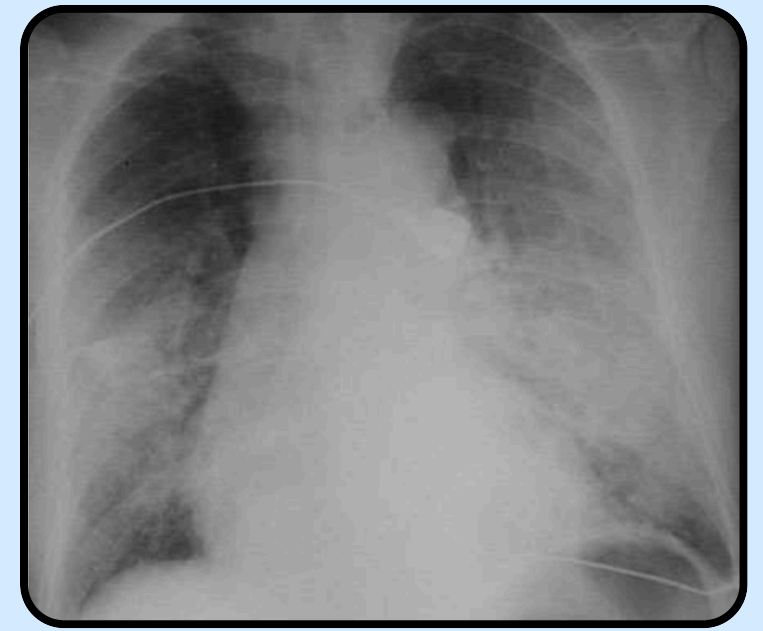
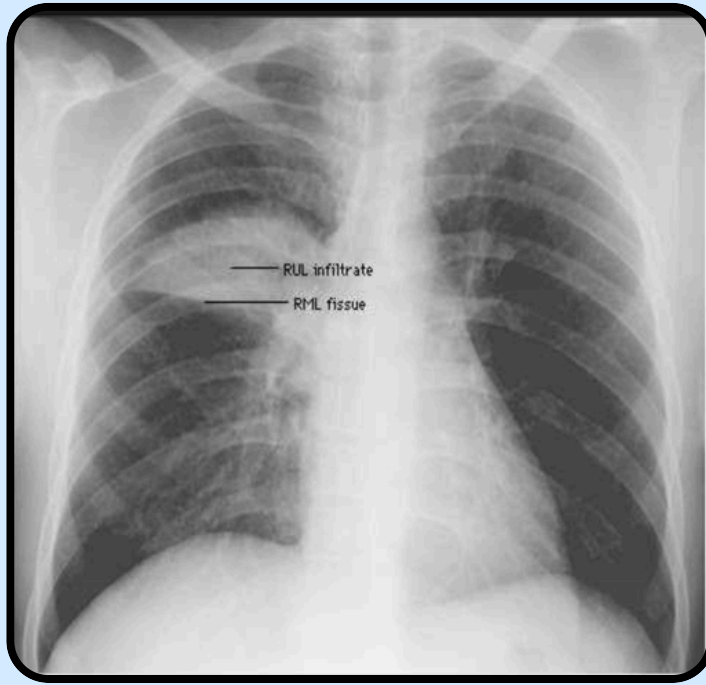
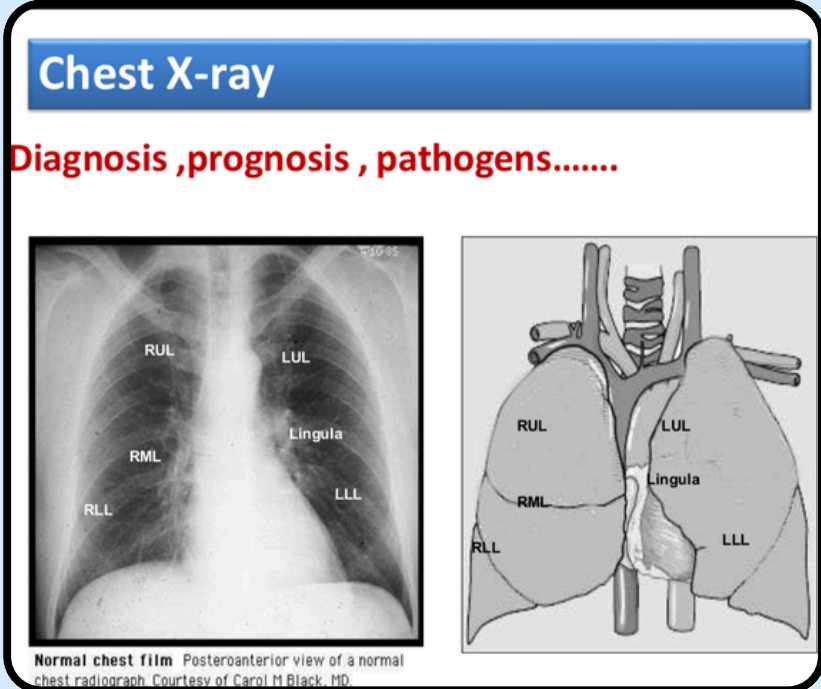
- Legionella pneumonia
 - Legionnaires' disease is a lung infection occur by inhaling the bacteria from contaminated water system like air conditioning or hot tubs.
 - Older adults, smokers and people with weakened immune systems are particularly susceptible.
 - May be presented with fever, headache, myalgia and diarrhea. **On X-Ray = interstitial pneumonia or bronchopneumonia**
- Mycoplasma pneumoniae: mostly presented with extrapulmonary manifestations such as **More with healthy young adults**
 - Myringitis **inf. Tympanic membrane (ear drum)**
 - Encephalitis
 - Myocarditis

S. aureus CAP- Dangerous **Sever pneumonia with diffuse nodule**

- Not common
- Post Influenza complication.
- Compromised host, Co-morbidities, Extreme of age
- May be MSSA or MRSA (community acquired MRSA)
- Multi lobar involvement, necrosis of lung with cavitations causing lung abscess or multiple pyemic abscesses and empyema
- Septic Arthritis
- Hypoxemia, and Hypotension are common

above transverse fissure mostly (upper lobe)
under it (middle or lower lobe)

Bilateral opacity in middle and lower lobe (multilobar pneumonia)

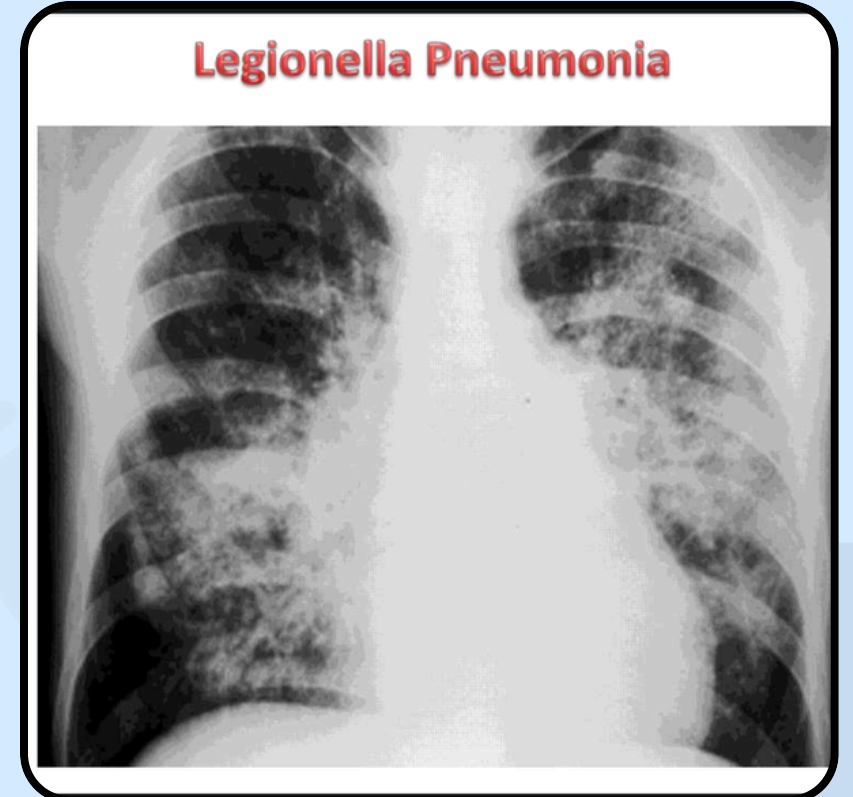
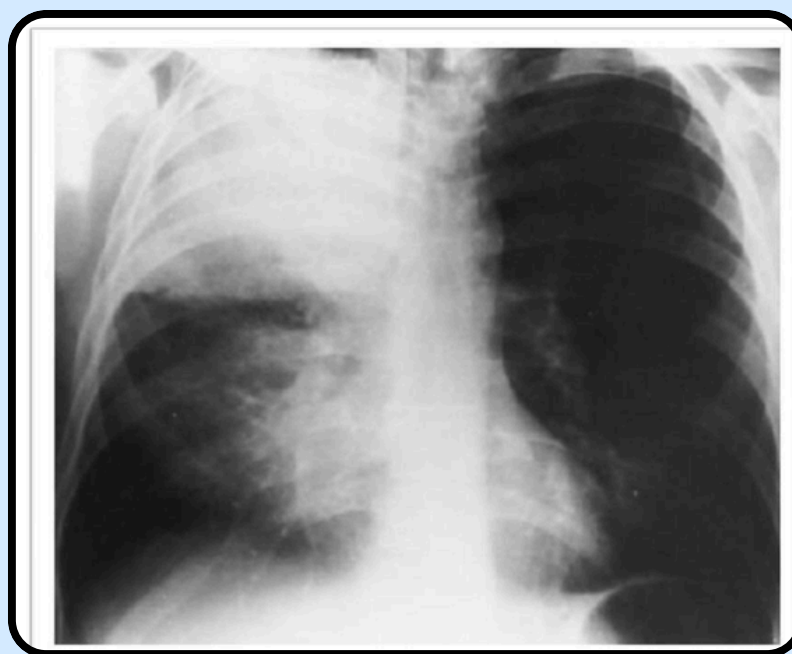
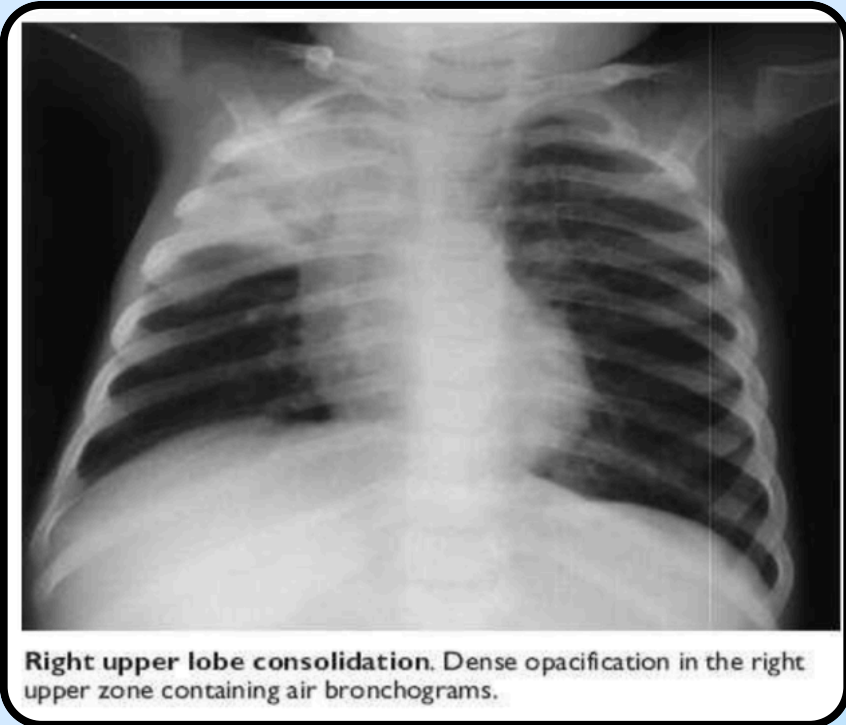


Appearance in X-Ray help you to detect severity

Rt Upper lobe pneumonia

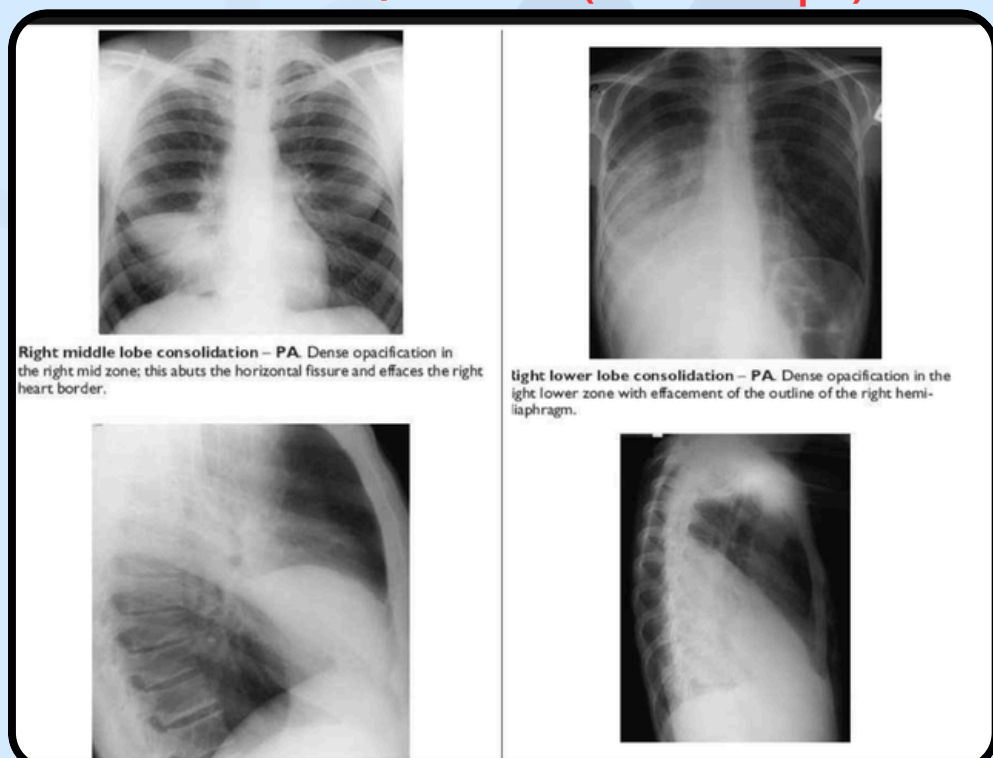
Rt Upper lobe pneumonia

Patchy + diffused in upper + lower zone " heterogeneous "(bronchopneumonia)



Opacity under fissure joined with Rt border of heart (it's middle lobe)

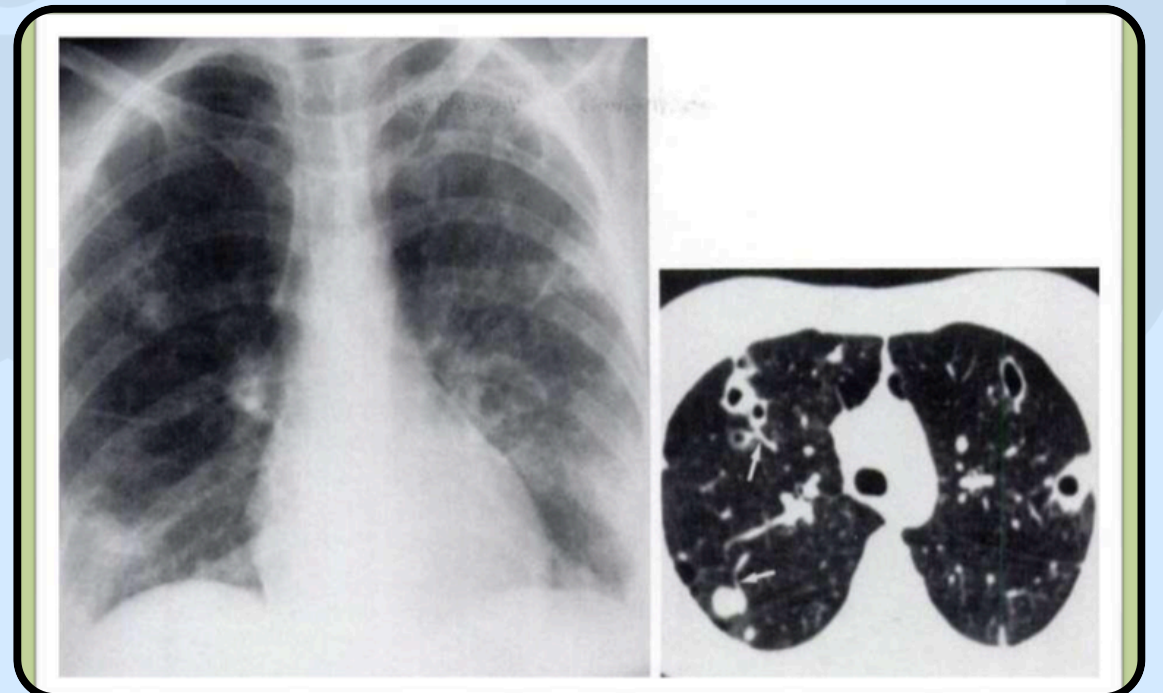
Opacity under fissure joined w/ Diaphragm (its lower lobe)



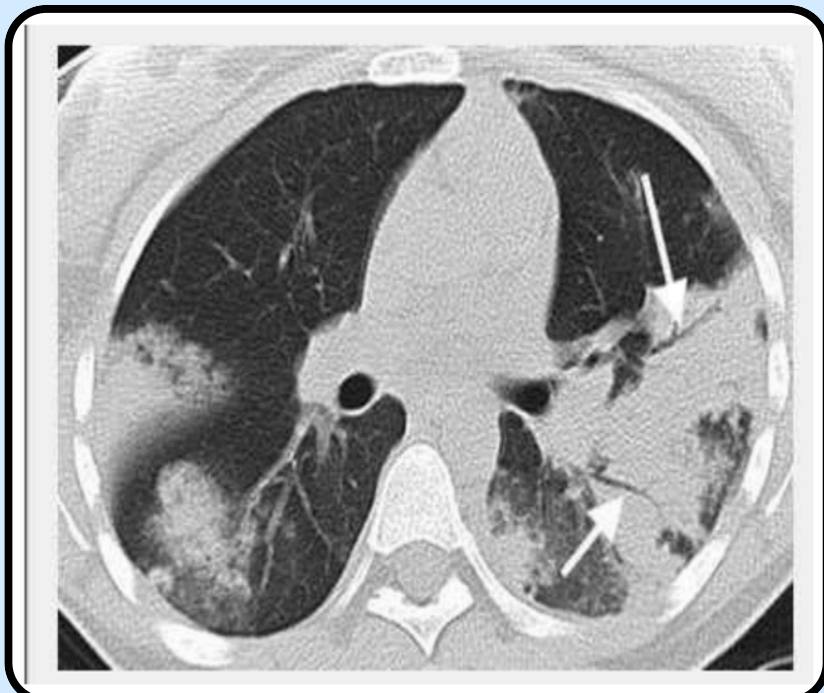
Laterl X-Ray help in localization if opacity extreme above toward sternum (it's upper lobe)
if lean to heart (middle lobe)

if down toward diaphragm (lower lobe)

In staph.A diffused nodules with cavitation in CT



Consolidation ear bronchogram (whitish) inside it black color



Characteristic for consolidation



Same

When patient need hospitalization

Laboratory Tests for CAP

- CBC.
- Gram stain of sputum.
- Culture of sputum.
- Blood cultures.
- Liver enzymes
- ABG
- CRP and ESR
- BUN and Creatinine
- Serum electrolytes

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Complications of CAP

- Parapneumonic effusion. **Accumulating fluid in plural cavity**
- Empyema
- Lung abscess- destruction of lung .
- Multiple Pyaemic Abscesses
- Septicemia- Brain abscess, Liver Abscess
- Hypotension and septic shock

Risk Factors for Hospitalization in CAP

- Old Age
- Comorbidities:
 - Asthma,
 - COPD,
 - Bronchiectasis
- Chronic diseases:
 - Diabetes,
 - CHF,
 - Neoplasia

Criteria for severe pneumonia:

Minor criteria

If patient has 3=/ **sever pneumonia ,admit to ICU**

1. Confusion
2. Respiratory rate> 30 breaths/min
3. Hypothermia (core temperature, <36C)
4. Hypotension requiring aggressive fluid resuscitation
5. Multilobar infiltrates
6. Leucopenia: (WBC <4000 cells/mm³)
7. Thrombocytopenia (<100,000 cells/mm³)
8. Uremia (BUN level, 20 mg/dL)
9. PaO₂/FiO₂ ratio< 250

Patient Arterial O₂ from ABG devide on intake (ventilated) O₂

Major criteria

If has one just admit to ICU

1. Invasive mechanical ventilation
 2. Septic shock with the need for vasopressors
- ICU admission = one major or 3 minor

Infiltrate Patterns and Pathogens	
CXR Pattern	Possible Pathogens
Lobar	• Strept. Pneumoniae. • Gram neg. e.g. Klebsiella, H. influ.
Patchy	• Atypical, Viral
Interstitial	• Viral, Legionella
Cavitatory	• S.aureus, Klebsiella, Anaerobes • TB, Fungi
pleural effusion	• Staph • Klebsiella

CURB-65 AND CRB-65 SEVERITY SCORES FOR COMMUNITY-ACQUIRED PNEUMONIA

Clinical factor	Points
Confusion	1
Blood urea nitrogen > 19 mg per dL	1
Respiratory rate ≥ 30 breaths per minute	1
Systolic blood pressure < 90 mm Hg or Diastolic blood pressure ≤ 60 mm Hg	1
Age ≥ 65 years	1
Total points:	

<important>

To detect How treat the patient (in/ outpatient /hospitalization orICU)

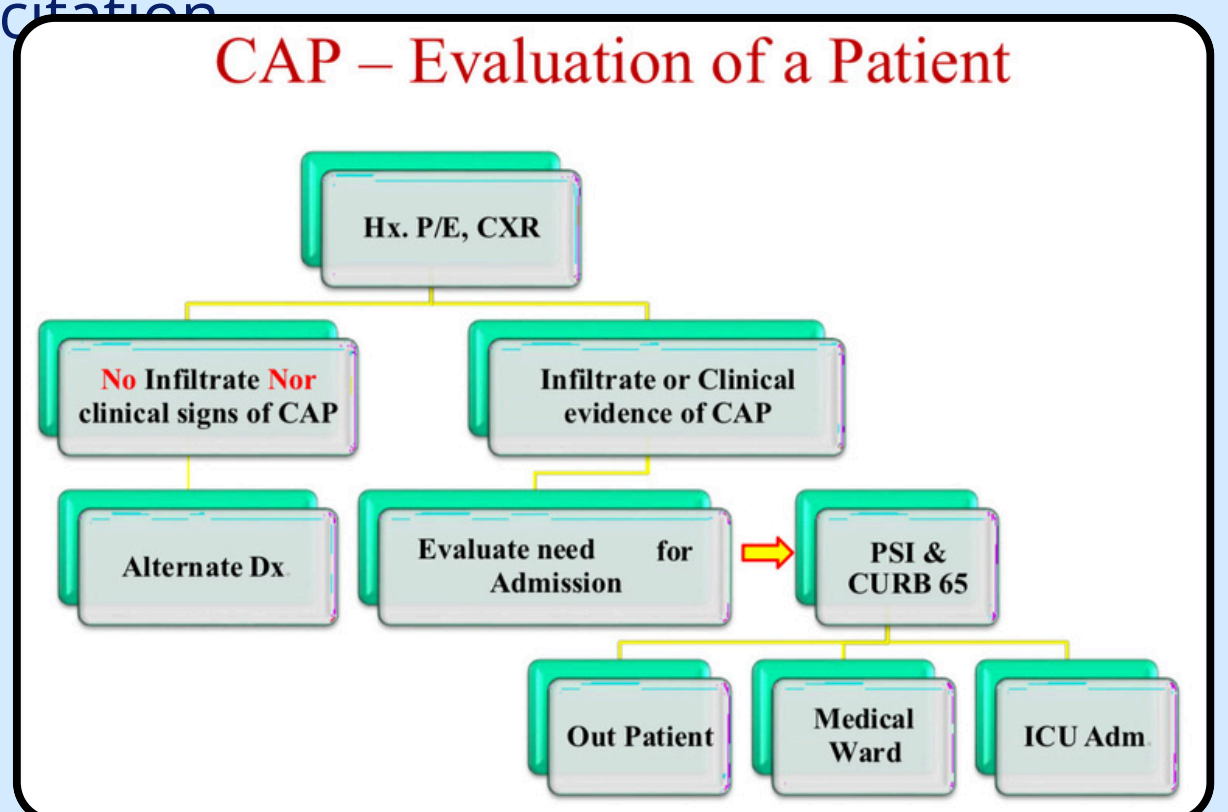
CURB-65 score	Deaths/total (%)*	Recommendation†
0	7/1,223 (0.6)	Low risk; consider home treatment
1	31/1,142 (2.7)	
2	69/1,019 (6.8)	Short inpatient hospitalization or closely supervised outpatient treatment
3	79/563 (14.0)	Severe pneumonia; hospitalize and consider admitting to intensive care
4 or 5	44/158 (27.8)	

PNEUMONIA SEVERITY INDEX FOR COMMUNITY-ACQUIRED PNEUMONIA

Risk factor	Points
Demographics	
Men	Age (years): ____
Women	Age (years) - 10: ____
Nursing home resident	+10
Comorbidities	
Neoplasm	+30
Liver disease	+20
Heart failure	+10
Stroke	+10
Renal failure	+10
Physical examination findings	
Altered mental status	+20
Respiratory rate ≥ 30 breaths per minute	+20
Systolic blood pressure < 90 mm Hg	+20
Temperature < 95°F (35°C) or ≥ 104°F (40°C)	+15
Pulse rate ≥ 125 beats per minute	+10
Laboratory and radiographic findings	
Arterial pH < 7.35	+30
Blood urea nitrogen > 30 mg per dL	+20
Sodium < 130 mmol per L	+20
Glucose ≥ 250 mg per dL	+10
Hematocrit < 30 percent	+10
Partial pressure of arterial oxygen < 60 mm Hg	+10
Pleural effusion	+10
Total points:	

Not for memorize

Point total	Risk class	Adults with CAP*	Nursing home patients with CAP†	Recommendation‡
< 51	I	3/1,472 (0.2)	None	Outpatient therapy should be considered, especially for patients in classes I and II
51 to 70	II	7/1,374 (0.5)	None	
71 to 90	III	41/1,603 (2.6)	1/21 (4.8)	
91 to 130	IV	149/1,605 (9.3)	6/50 (12.0)	Patient should be hospitalized
> 130	V	109/438 (24.9)	28/85 (32.9)	



Treatment

Patients should initially be treated empirically, based on the likely pathogens for each patient group.

Supportive measures

- Bed rest.
- Adequate nutrition either orally or IV in severe cases.
- Fluid and electrolytes replacement.
- Analgesics for pain and antipyretics for fever.
- Respiratory support by oxygen supply or mechanical ventilation.
- Circulatory support by inotropic agent in hypotension.
- Steroids may be used to suppress the inflammatory response to infection.

CAP

The patient may be Previously Healthy or has Comorbidities such as:

- Chronic heart, lung, liver, and renal disease,
- Diabetes mellitus, Alcoholism,
- Malignancies, Immunosuppression
- Asplenia,
- Use of antimicrobials within the previous 3 months

Group I: Outpatients but no Comorbidities

Organisms

- Streptococcus pneumoniae
- Hemophilus influenza
- Mycoplasma pneumoniae
- Chlamydia pneumoniae
- Legionella spp
- Respiratory viruses

Therapy One of these Macrolide:

- Azithromycin 500mg once or
- Clarithromycin 500mg bid
- Erythromycin

or Beta-lactam

- Amoxicillin or
- amoxicillin + clavulanic acid

Erythromycin is not active against H. Influenza and the advanced generation Macrolides Azithromycin and Clarithromycin are better tolerated.

Many isolates of S.pneumoniae are resistant to tetracycline, and it should be used only if the patient is allergic to or intolerant of macrolides.

Group III: Inpatient (Not in ICU)

ORGANISMS

- Strept. pneumoniae (including DRSP)
- Hemophilus influenza
- Mycoplasma pneumoniae
- Chlamydia pneumoniae
- Legionella spp.,
- Enteric gram-negatives
- Aspiration(anaerobes)
- Respiratory viruses

Therapy

β-Lactam ;

- Cefpodoxime,
- Cefuroxime, 1.5 g bid or tds
- Amoxicillin /clavulanate, 1.2 g bid or tds
- Ampicillin-sulbactam
- Ceftriaxone, 1-2 gm od
- Cefotaxime

+

Macrolide

Or combination

B-lactam + Lung Fluoroquinolones

Group II: Outpatient, with Comorbidities

ORGANISMS

- Strept. pneumoniae (including DRSP)
- Hemophilus influenza
- Mycoplasma pneumoniae
- Chlamydia pneumoniae
- Legionella spp.,
- Enteric gram-negatives
- Aspiration(anaerobes)
- Respiratory viruses

Therapy

β-Lactam ;

- Amoxicillin,
- Cefpodoxime,
- Cefuroxime
- Amoxicillin /clavulanate
- Ampicillin-sulbactam
- Ceftriaxone

+ Macrolide

Or One of these

Lung Fluoroquinolones as Monotherapy

- Levofloxacin 750 mg OD
- Moxifloxacin 400 mg OD
- Gemifloxacin 320 mg OD

Group IV : ICU- Admitted Patients

A. No Risks for Pseudomonas aeruginosa or MRSA

Organisms

- Streptococcus pneumoniae (including DRSP)
- Hemophilus influenzae
- Legionella spp.
- Mycoplasma pneumoniae
- Enteric gram-negatives
- Aspiration(anaerobes)
- Respiratory viruses

Therapy

Intravenous β-lactam;

- Amoxicillin /clavulanate
- Ampicillin-sulbactam
- Cefotaxime
- Ceftriaxone

+

Intravenous Macrolide

or

IV B-lactam + Intravenous Fluoroquinolones

Group IV : ICU- Admitted Patients	
B. Risks for Pseudomonas aeruginosa or MRSA	
<p>Organisms</p> <p>All above pathogen.</p> <p>+</p> <ul style="list-style-type: none"> • P. Aeruginosa • MRSA 	<p>Antipseudomonal B- lactam</p> <p>+</p> <p>Antipseudomonal Fluroquinolones</p> <p>or</p> <p>Aminoglycoside + Azithromycin</p> <p>NB: Antipseudomonal B- lactam:</p> <ul style="list-style-type: none"> •Ceftazidime, Cefepime •Piperacillin / tazobactam, •Imipenem cilastien, or Meropenem <p>NB: Antipseudomonal Fluroquinolones:</p> <ul style="list-style-type: none"> •Ciprofloxacin •Levofloxacin.
<p>If MRSA is suspected</p> <p>Vancomycin 1 gm /8-12 h</p> <p>or</p> <p>Linezolid 600mg /12 h</p>	

Anti-influenza treatment, such as oseltamivir, be prescribed for adults with CAP who test positive for Influenza in the inpatient setting, independent of duration of illness before diagnosis (strong recommendation).

Treatment with oseltamivir is associated with reduced risk of death in patients hospitalized for CAP who test positive for influenza virus

Treatment within 2 days of symptom onset or hospitalization may result in the best outcomes, although there may be benefits up to 4 or 5 days after symptoms begin

Antiviral drugs against COVID-19 e.g. Favipiravir should be used in case of confirmed

Patient follow up

Patients should be evaluated after 2-3 days for initial improvement in:

- Clinical parameters e.g. Fever and toxic symptoms.
- Lab parameters e.g. leukocytosis and acute phase reactant.
- Chest radiograph findings shows no progression but usually clear within 1-4 weeks but may persist for longer duration in older individuals and those with underlying pulmonary disease

Switch to Oral Therapy

Four criteria

1. A febrile on two occasions 8 h apart
2. Improvement in cough, dyspnea & clinical signs
3. WBC decreasing towards normal
4. Functioning GI tract with adequate oral intake

Duration of Therapy

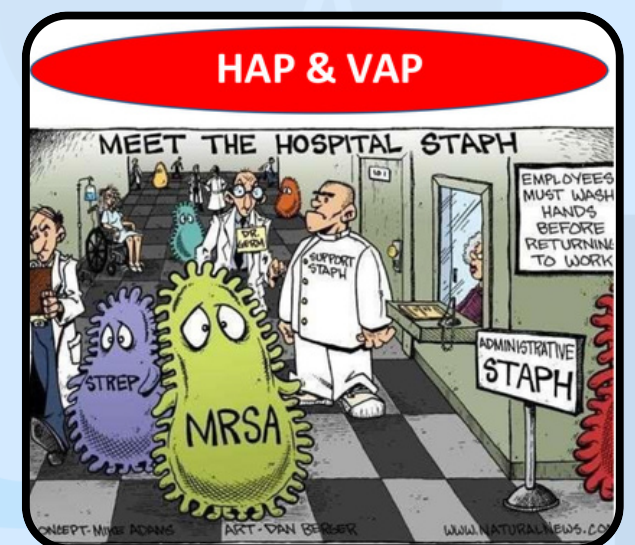
- For patients with low or moderate severity and uncomplicated pneumonia, 5-7 days of appropriate antibiotics is recommended.
- For those with high severity and complicated pneumonia or microbiologically-undefined pneumonia, 7-10 days treatment is proposed.
- If S. aureus or Gram-negative enteric bacilli pneumonia is suspected or confirmed 14 - 21 days treatment is used

Risk factors for treatment failure:

1. Age > 65
2. Patient with comorbidities:
 - Neoplasia .
 - Liver disease .
 - Neurologic disease.
 - Structural lung disease e.g. Bronchiectasis.
3. Multilobar pneumonia .
4. Cavitation, pleural effusion .
5. Leukopenia .
6. Aspiration pneumonia .
7. Infection with MRSA, Legionella, or gram-negative bacilli

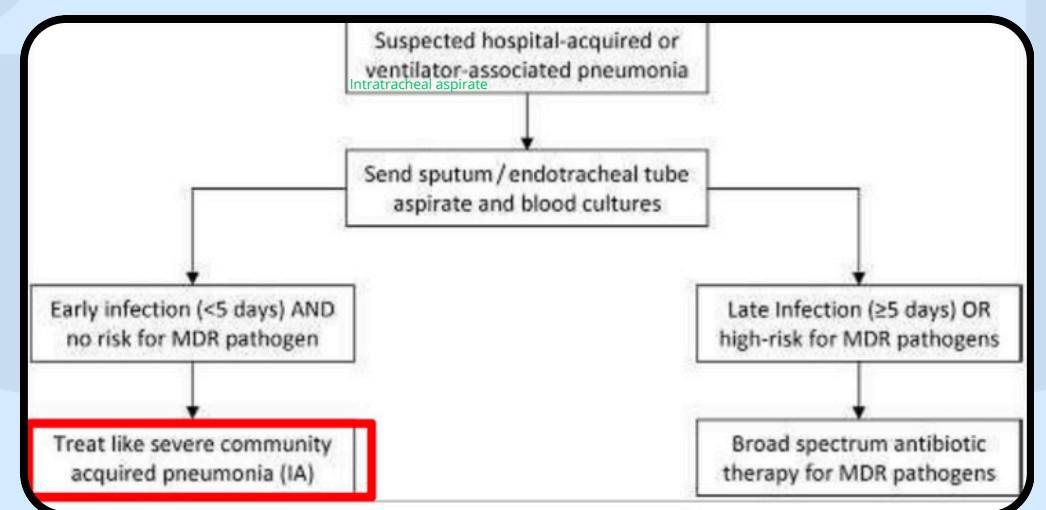
CAP- Management summery.....

- CURB-65 scoring and Classification of cases
- Sputum and Blood culture collection in the first 24 h prior to Antibiotic administration.
- Early Empirical Antibiotic administration within 4-6 hours
- Empirical on non Empiric Bases
- Change Antibiotic according to pathogen & sensitivity pattern
- Pneumococcal & Influenza vaccination; Smoking cessation
especially old age or COPD



Hospital acquired pneumonia (HAP)

- Defined as pneumonia that occurs 48 hours or more after admission



Risk Factor For MDR pathogens

Antimicrobial therapy in the preceding 3 months

Present hospitalization of ≥5 days

High frequency of antibiotic resistance in the community or in the specific hospital unit

Hospitalization for ≥48 h in the preceding 3 months

Home infusion therapy including antibiotics

Home wound care

Chronic dialysis within 1 month

Family member with MDR pathogen

Immunosuppressive drug and/or therapy

Deal with him as sever pneumonia

Group IV : ICU- Admitted Patients A. No Risks for Pseudomonas aeruginosa or MRSA		Group IV : ICU- Admitted Patients B. Risks for Pseudomonas aeruginosa or MRSA	
Organisms	Therapy	Organisms	Antipseudomonal B- lactam
<ul style="list-style-type: none"> • Streptococcus pneumoniae (including DRSP) • Hemophilus influenzae • Legionella spp. • Mycoplasma pneumoniae • Enteric gram-negatives • Aspiration(anaerobes) • Staphylococcus aureus • Respiratory viruses 	<ul style="list-style-type: none"> • Intravenous β-lactam: • Amoxicillin-clavulanate • Ampicillin-sulbactam • Cefotaxime • Ceftriaxone + • Intravenous Macrolide OR • Intravenous Fluoroquinolones 	<ul style="list-style-type: none"> • All above pathogen. + • P. Aeruginosa • MRSA 	<ul style="list-style-type: none"> • Antipseudomonal Fluoroquinolones OR • Aminoglycoside + Azithromycin
		<p>If MRSA is suspected (as predicted using Urinary Vancomycin 1 gm /8-12 h or Linezolid 600mg /12 h</p>	<p>NB: Antipseudomonal B- lactam:</p> <ul style="list-style-type: none"> • Cefazidime, Cefepime • Piperacillin / tazobactam, • Imipenem cilastien, or Meropenem <p>NB: Antipseudomonal Fluoroquinolones:</p> <ul style="list-style-type: none"> • Ciprofloxacin • Levofloxacin.

Duration of Therapy

- Optimal duration of antimicrobial therapy in HAP patients is 10-14 days.
- A trend to greater rates of relapse for short duration therapy was seen if the etiologic agent was P. aeruginosa or an Acinetobacter species, so treatment duration is 14-21 day