

Pneumonias

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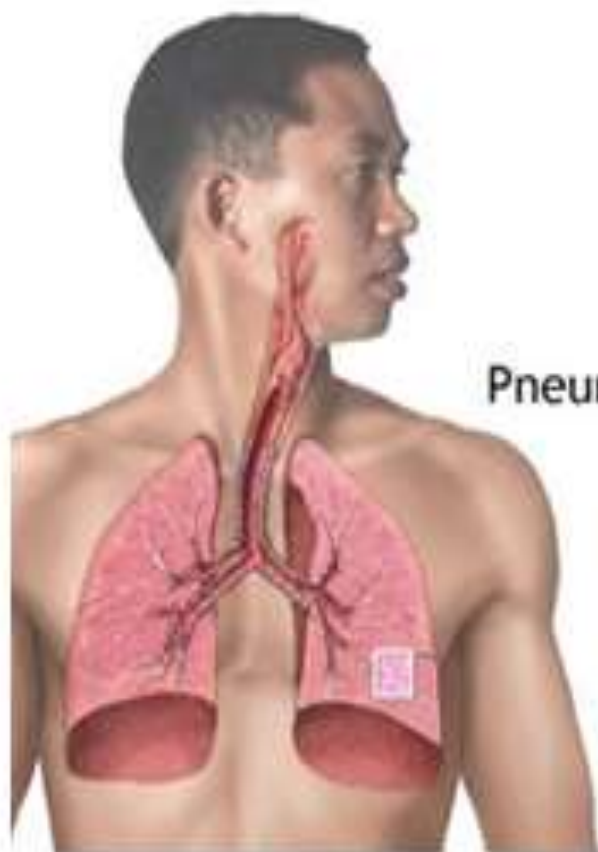


Definition of Pneumonia

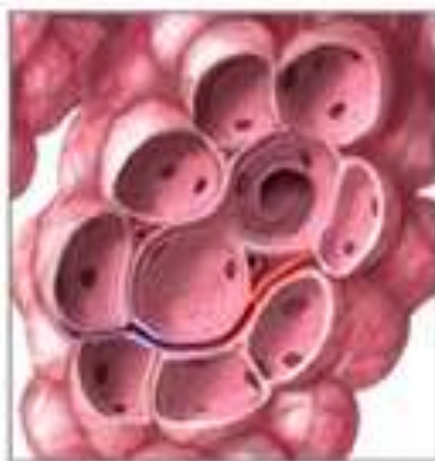
Definition:

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



Normal
alveoli

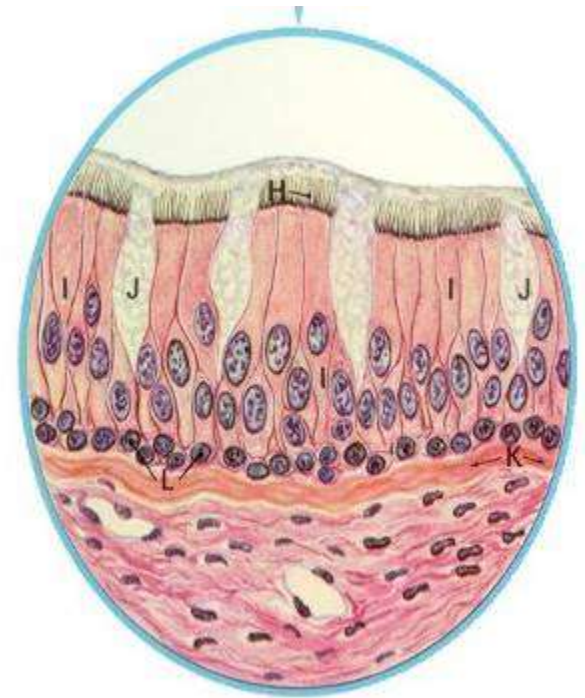


Pneumonia



Defense Mechanisms

- 80% of cells lining central airways are ciliated, pseudostratified, columnar epithelial cells
- Each ciliated cell contains about 200 cilia that beat in coordinated waves about 1000x/minute
- So the lower respiratory tract is normally sterile





Predisposing factors:

- a- Suppression or reduction of cough reflex
- b- Impairment of mucociliary activity.
- c- Decrease of effective phagocytic activity of alveolar macrophages and neutrophils.
- d- Impairment of immunoglobulin production.

Classification of pneumonia

1-According to causes

Bacterial Specific :TB

- Non-specific

Gram +ve organism

Gram-ve organism

- **Viral pneumonia** e.g. H1N1
- **Fungal pneumonia** e.g. Histoplasmosis and Aspergillosis
- **Parasitic:** e.g. Malaria

Atypical micro organisms:

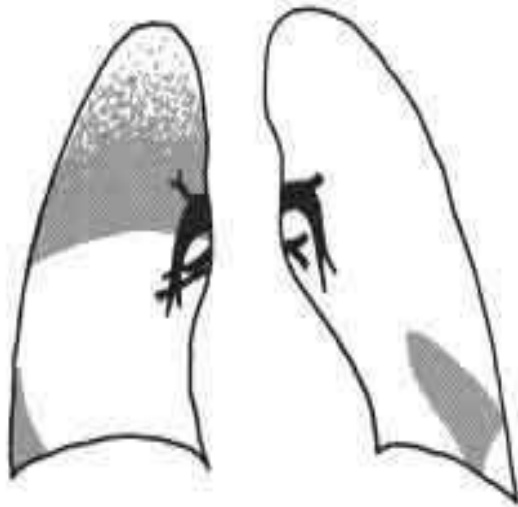
- Mycoplasma pneumonia (primary atypical pneumonia).
 - Chlamydia (psittacosis – ornithosis).
 - Coxiella burneti.
 - Legionnaires (Legionella pneumophila).
 - viruses

- **Other causes of pneumonia :**
 - Allergic pneumonitis: e.g., Lupus pneumonitis.
 - Chemical pneumonitis e.g: Lipoid pneumonia.
 - Radiation: e.g. Radiation Pneumonitis

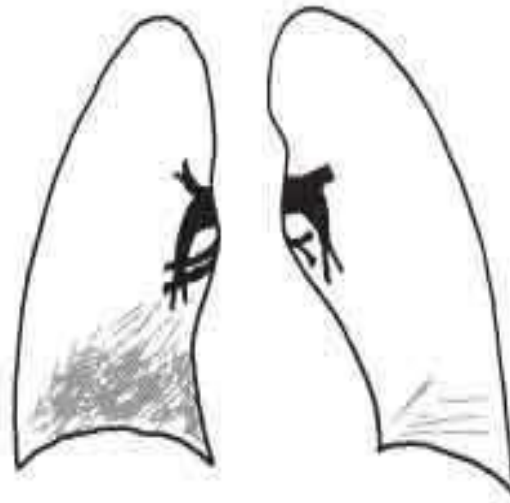
Classification of pneumonia (cont...)

2-According to areas involved

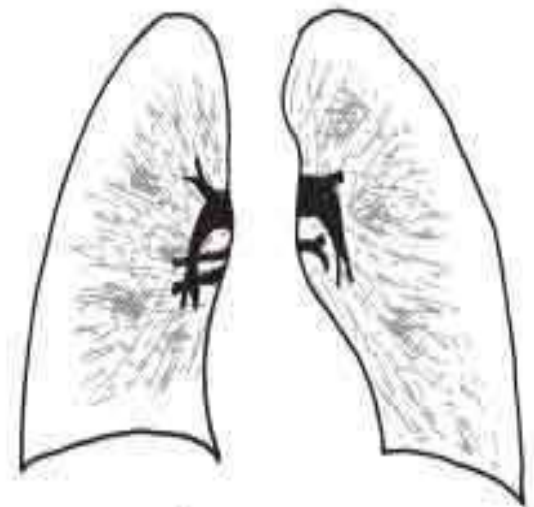
- **Lobar pneumonia;** if one or more lobe is involved
- **Segmental or subsegmental pneumonia:** There is only part of the lobe is affected.
- **Broncho-pneumonia;** the pneumonic process has originated in one or more bronchi and extends to the surrounding lung tissue.



Lobar pneumonia:
Lobar and/or segmental consolidation
with air bronchogram and
accompanying pleural effusion



Bronchopneumonia:
coalescing areas of consolidation
in a predominantly basal distribution



Interstitial pneumonia:
reticular pattern in a
predominantly central distribution

3- According to Community or hospital acquired pneumonia.

CAP

• Community Acquired

HAP

• Hospital Acquired

VAP

• Ventilator Acquired

Community Acquired Pneumonia (CAP)

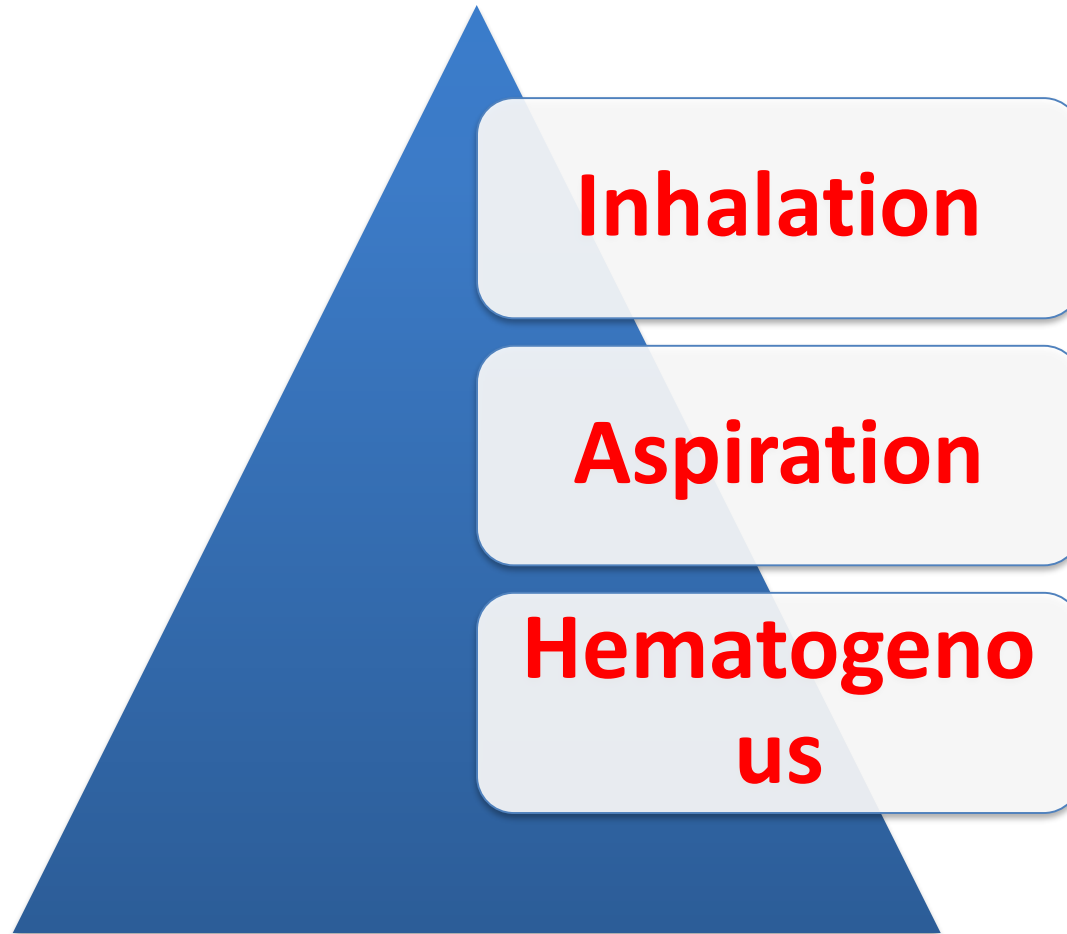
- Pneumonia which is acquired in the community or at hospitalization within the first 2 days.
- The most common organisms are Streptococcal pneumonia, Atypical, Staph. Aureus, Hemophilus influenza, and Branhamella catarrhalis.

Community Acquired Pneumonia (CAP)

Epidemiology

- 6th leading cause of death
- 5 million cases annually
- 20% require admission
- 14% Average mortality rate
- Mortality disproportionately high in old age

CAP – Pathogenesis



Community Acquired Pneumonia (CAP)

Mode of infection and causative organisms:

A- Aspiration:

Predisposed by impaired cough: Anesthesia, Alcoholism, Tracheostomy.

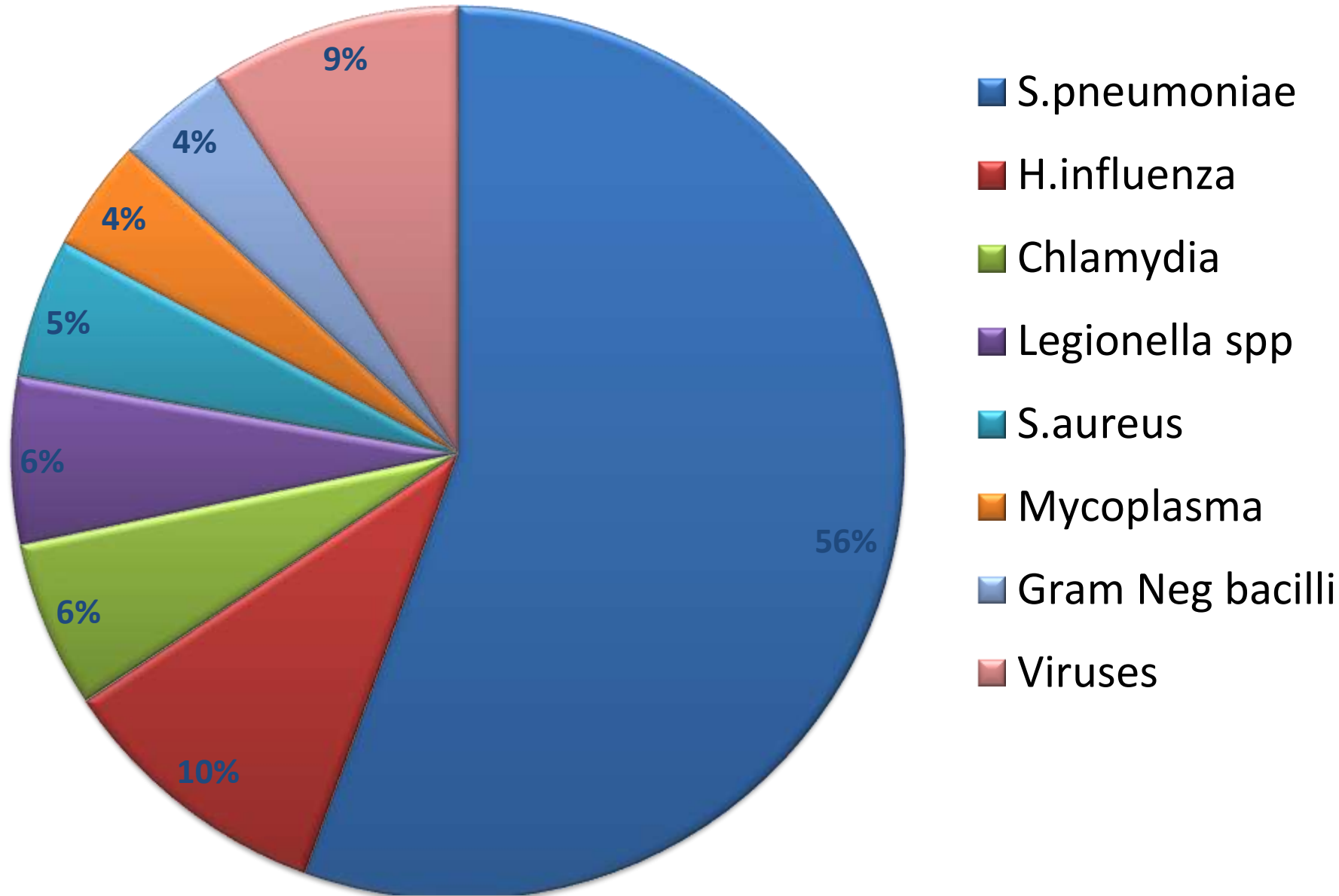
B- Inhalation:

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 .

CAP – The Pathogens Involved



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.**

Normal

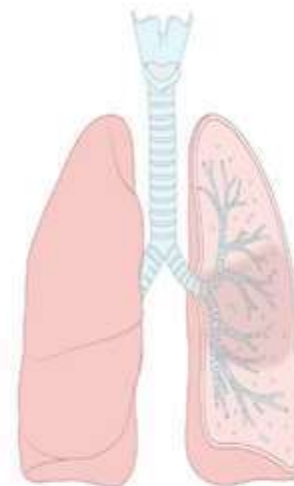
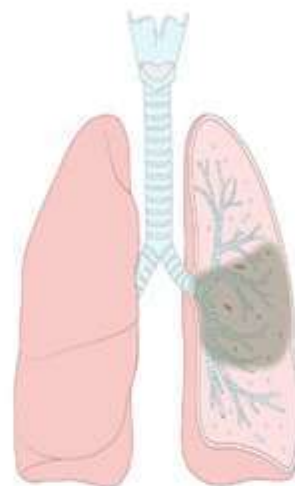
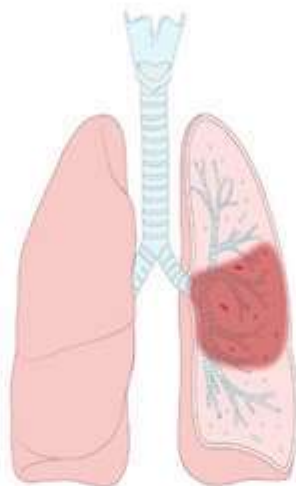
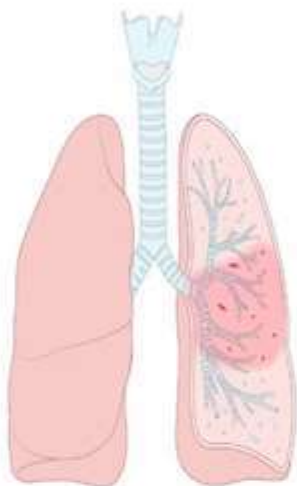
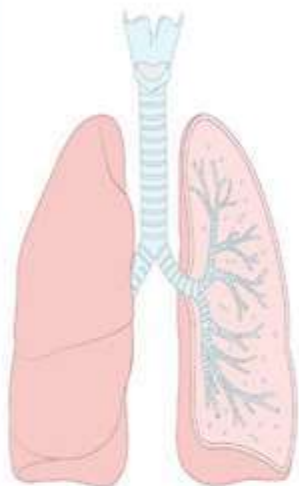
Lobar pneumonia

Day 1-2

Day 3-4

Day 5-7

Day 8-week 4



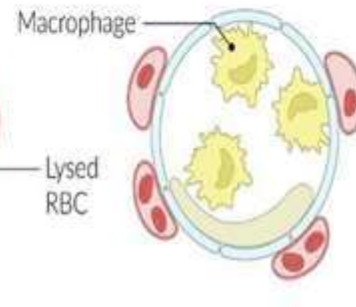
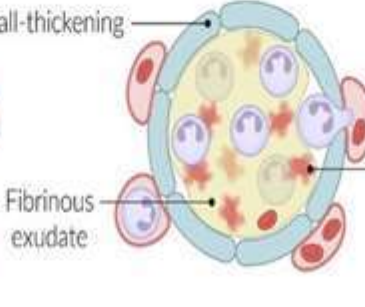
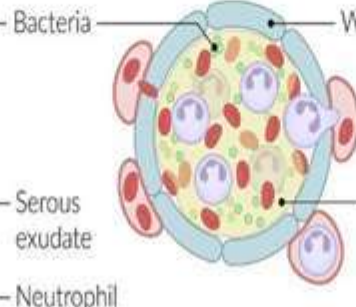
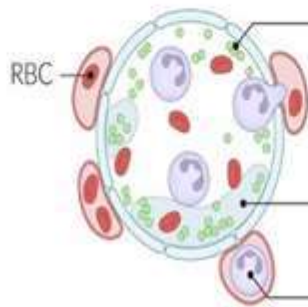
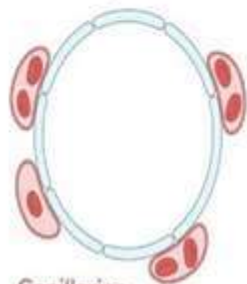
Congestion

Red hepatization

Gray hepatization

Resolution

Healthy alveolus





Diagnosis of pneumonia

➤ Hx:

Fever/chills	85%
Dyspnea	70%
Purulent sputum	50%
Chest pain	40%

➤ P/E: most useful in predicting severity. Physical exam may reveal fever, tachypnea, tachycardia.

Lung exam; increased tactile fremitus, dullness to percussion, bronchial breath sounds, presence of crackles

➤ CXR is gold standard - may be normal in up to 7% on admission; assume pneumonia present if convincing hx and focal P/E

CAP – The Two Types of Presentations

Classical

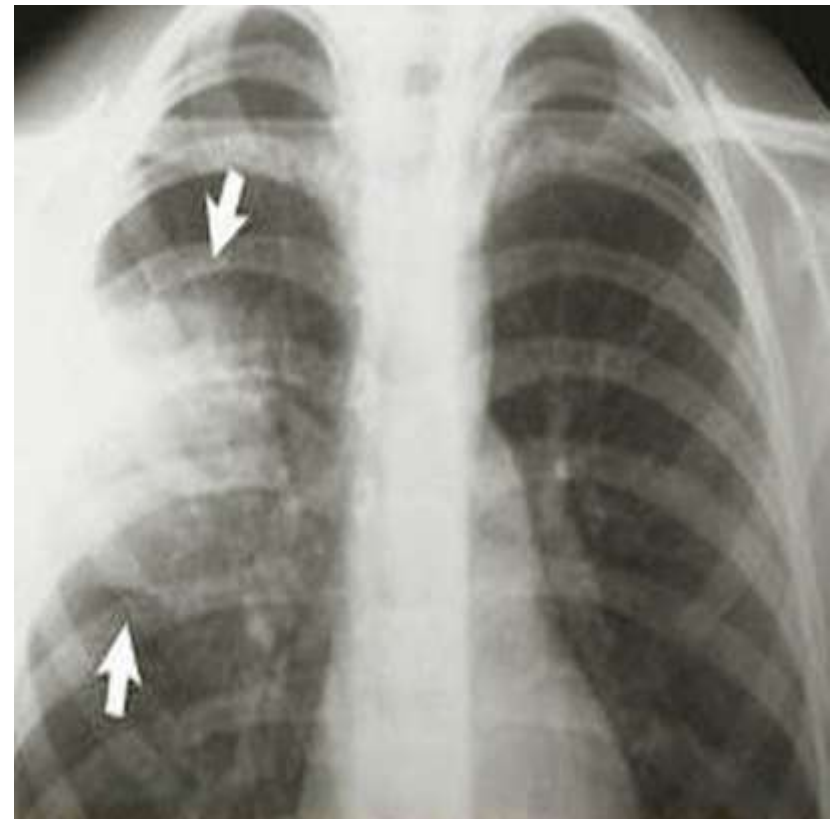
- Sudden onset of CAP
- High fever, shaking chills
- Pleuritic chest pain, SOB
- Productive cough
- Rusty sputum, blood tinge
- Poor general condition
- High mortality up to 20% in patients with bacteremia
- **S.pneumoniae causative**

Atypical

- Gradual & insidious onset
- Low grade fever
- Dry cough .
- **Confusion**
- **Diarrhea. Abdominal pain**
- Low mortality 1-2%; except in cases of Legionellosis
- **Mycoplasma, Chlamydiae, Legionella, Rickettsiae, Viruses are**

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.

➤ **Mycoplasma pneumoniae:**

mostly presented with extrapulmonary manifestations such as

- ❑ Myringitis
- ❑ Encephalitis
- ❑ Myocarditis

S. aureus CAP – Dangerous

- ❑ 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

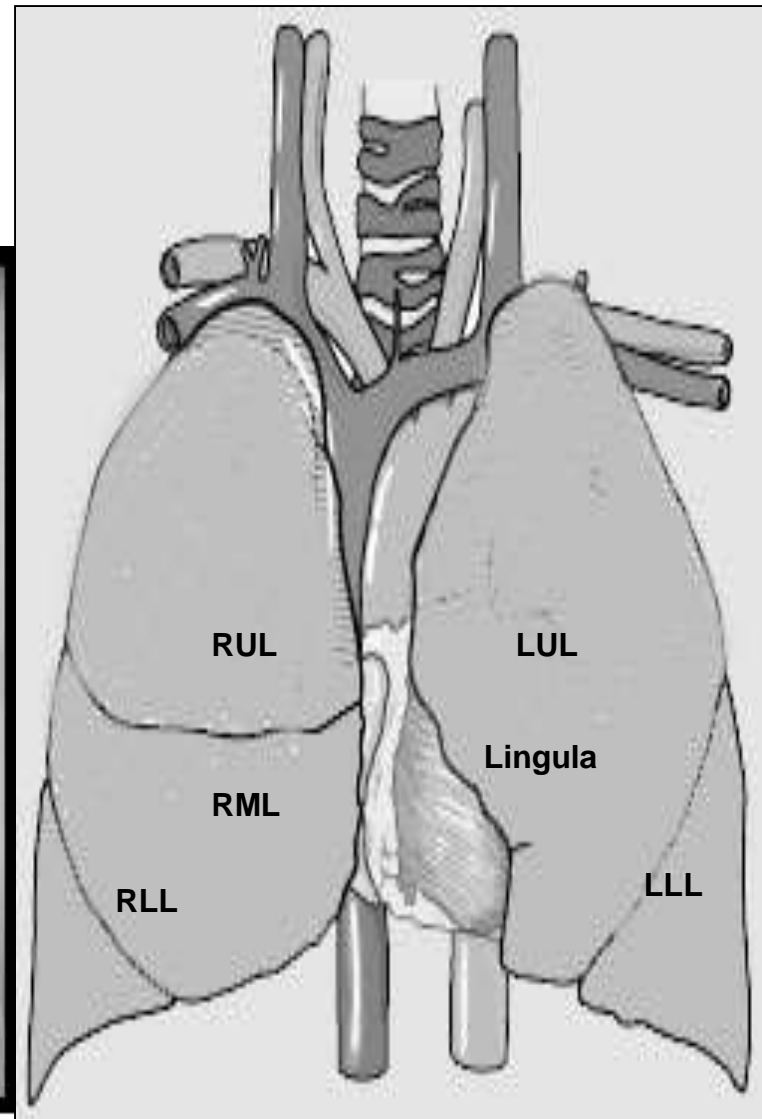
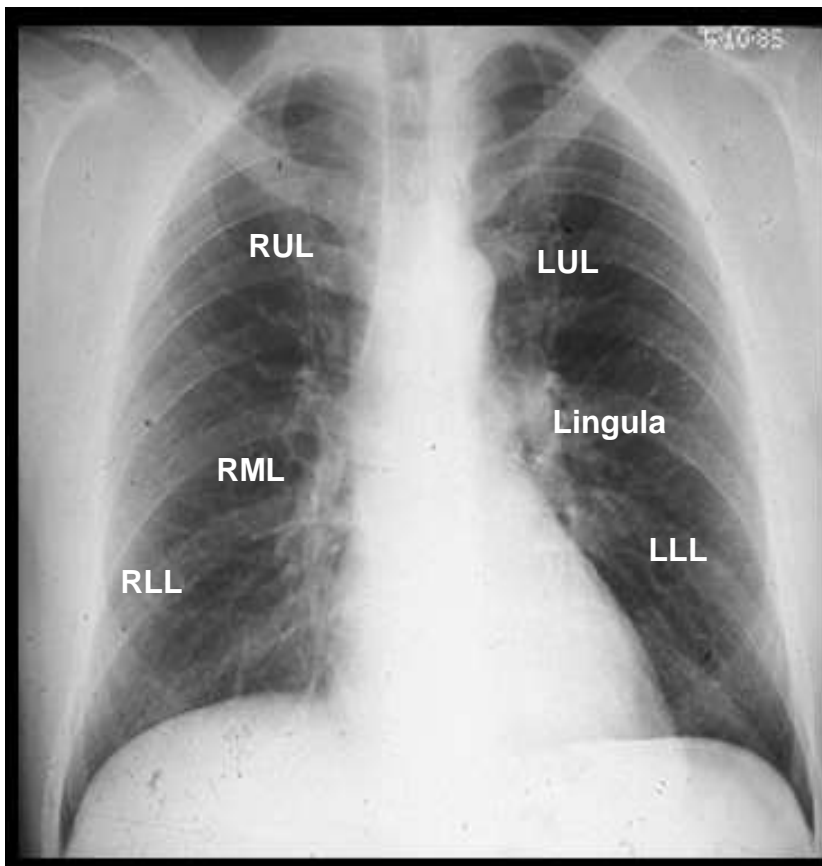
CAP – Laboratory Tests

- **CBC with Differential**
- **BUN and Creatinine**
- **Liver enzymes**
- **Serum electrolytes**
- **Oxygen saturation**

- **ABG**
- **Gram stain of sputum**
- **Culture of sputum**
- **blood cultures**
- **Septic work up**

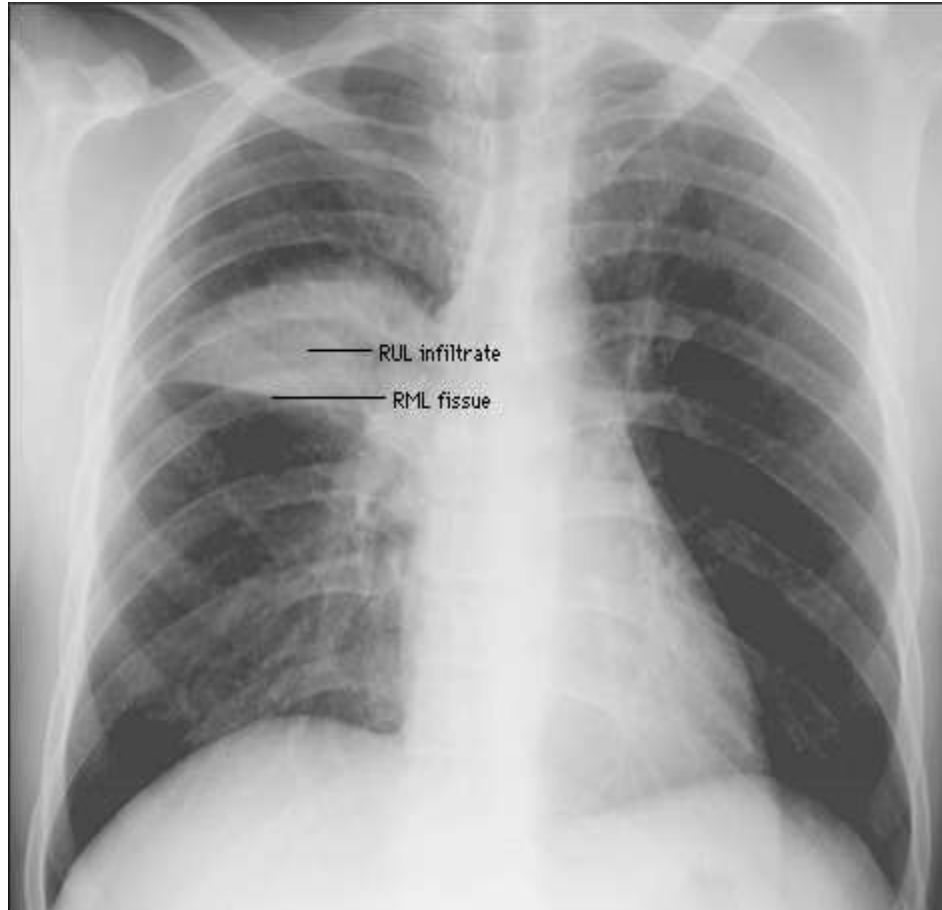
Chest X-ray

Diagnosis , prognosis , pathogens.....

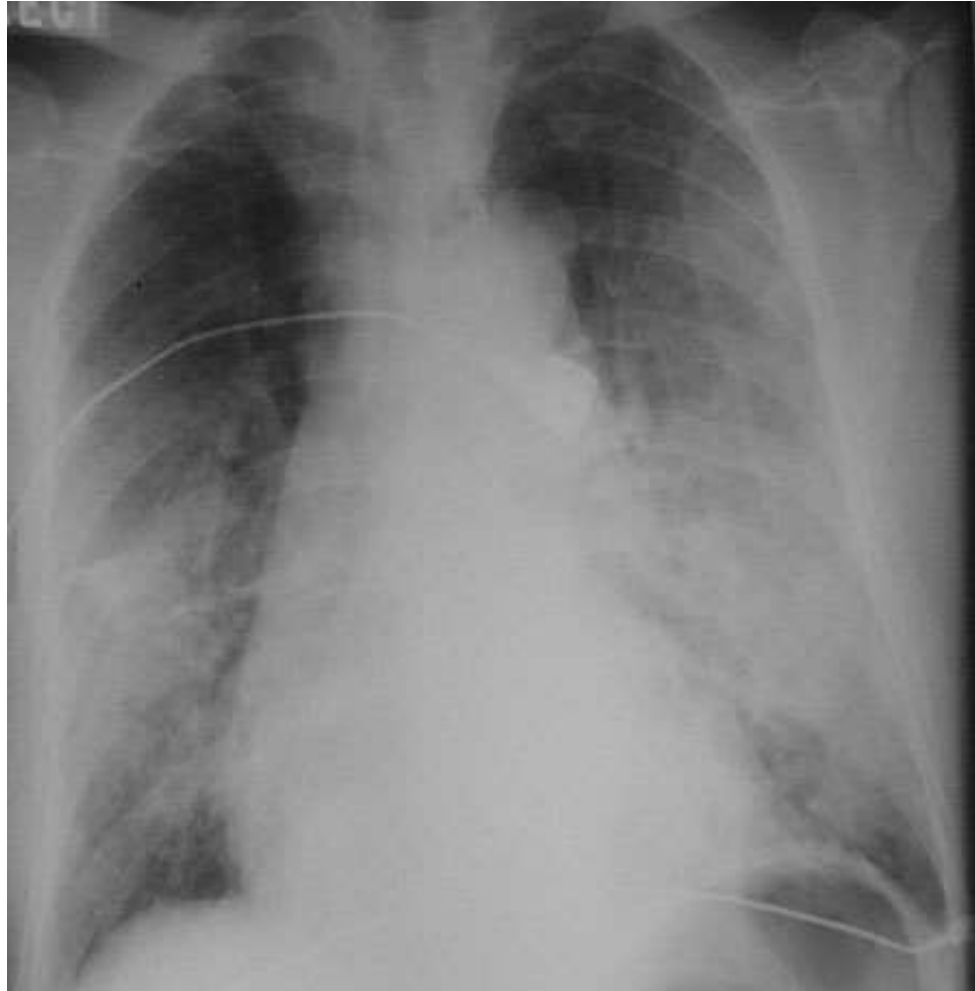


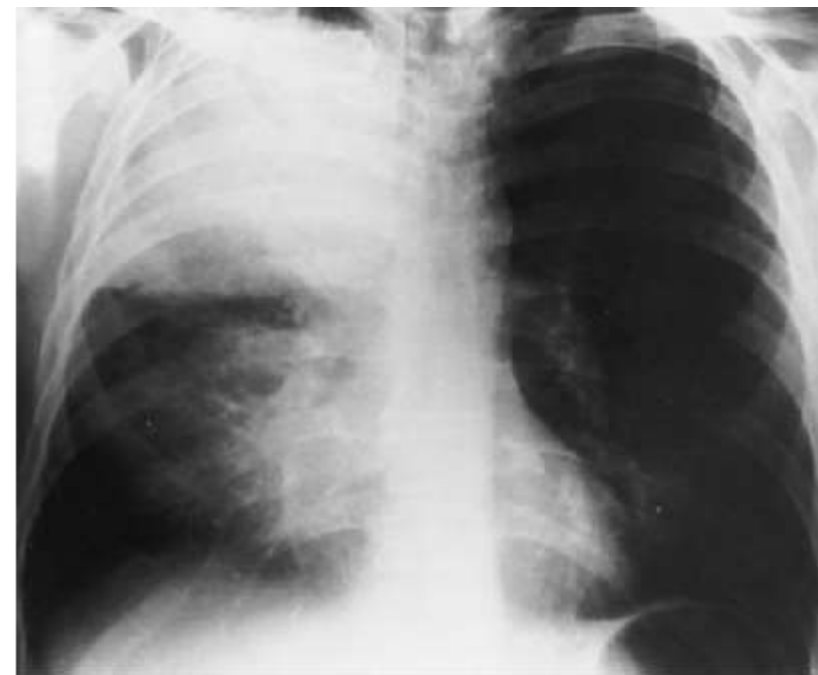
Normal chest film Posteroanterior view of a normal chest radiograph. Courtesy of Carol M Black, MD.

Chest X-ray – Pneumonia



Chest X-ray – Pneumonia





Right upper lobe consolidation. Dense opacification in the right upper zone containing air bronchograms.





Right middle lobe consolidation – PA. Dense opacification in the right mid zone; this abuts the horizontal fissure and effaces the right heart border.



Right lower lobe consolidation – PA. Dense opacification in the right lower zone with effacement of the outline of the right hemidiaphragm.



Infiltrate Patterns and Pathogens

CXR Pattern	Possible Pathogens
Lobar	S.pneumo, Kleb, H. influ, Gram Neg
Patchy	Atypicals, Viral, Legionella
Cavitatory	Anerobes, Kleb, TB, S.aureus, Fungi
Large effusion	Staph, Anaerobes, Klebsiella

Risk Factors for Hospitalization in CAP

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

Complications of CAP

- **Parapneumonic effusion.**
- **Empyema**
- **Lung abscess – destruction of lung .**
- **Multiple Pyaemic Abscesses**
- **Septicemia – Brain abscess, Liver Abscess**
- **Hypotension and septic shock**

CAP – Management Guidelines

- Proper diagnosis :Hx, P/E, CXR
- Decision to hospitalize based on prognostic criteria – CRB65, CURB 65,.. scores
- Pathogen directed antimicrobial therapy whenever possible
- Prompt initiation of Antibiotic therapy

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 \geq 30 breaths per minute	1
Systolic blood pressure < 90 mm Hg or Diastolic blood pressure \leq 60 mm Hg	1
Age \geq 65 years	1
Total points:	

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)	

CRB-65 score‡	Deaths/total (%)*	Recommendation†
0	2/212 (0.9)	Very low risk of death; usually does not require hospitalization
1	18/344 (5.2)	Increased risk of death; consider hospitalization
2	30/251 (12.0)	
3 or 4	39/125 (31.2)	High risk of death; urgent hospitalization

Criteria for severe pneumonia:

Minor criteria

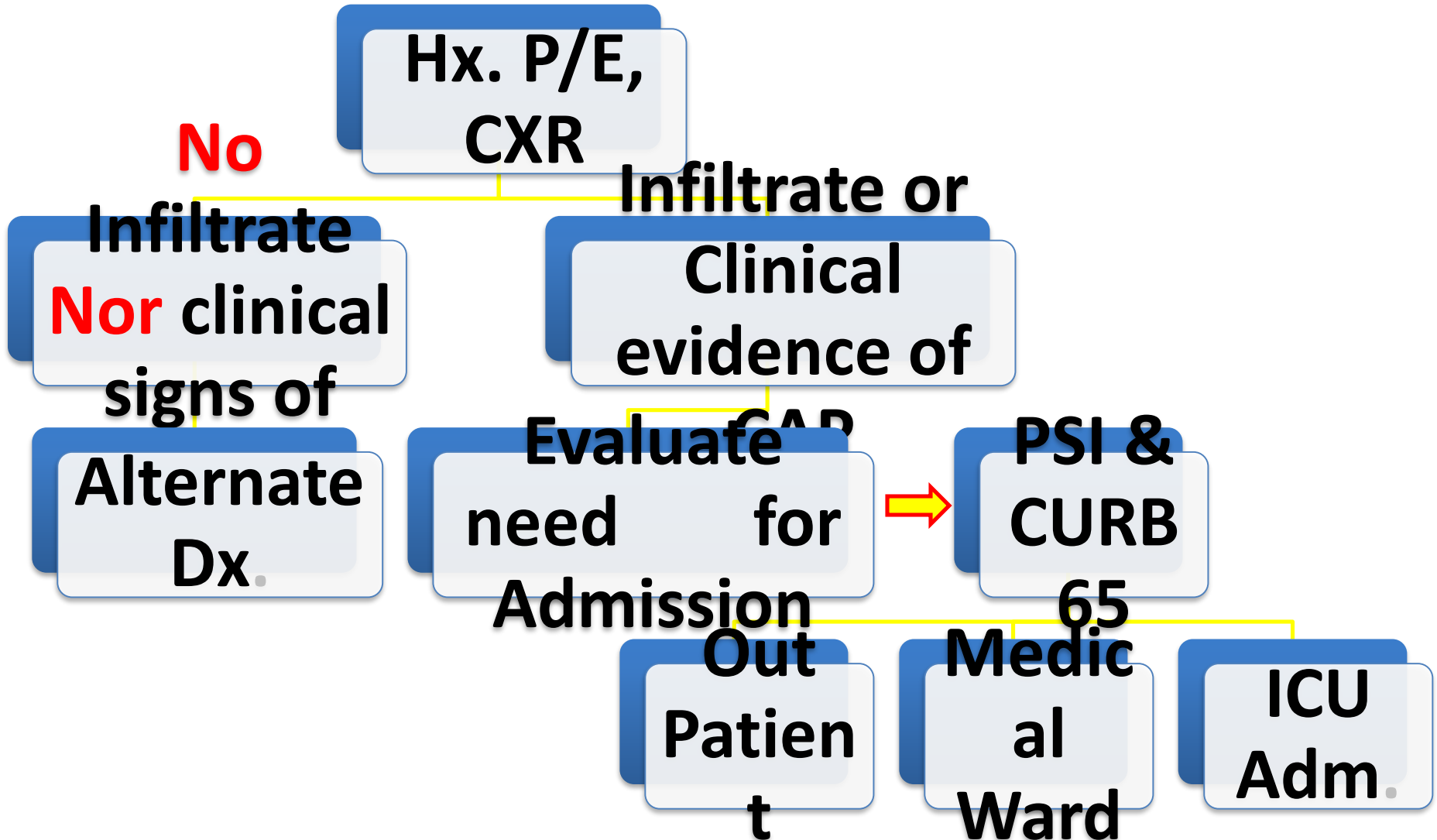
1. Confusion
2. Respiratory rate > 30 breaths/min
3. Hypothermia (core temperature, <36C)
4. Hypotension requiring aggressive fluid resuscitation
5. Multilobar infiltrates
6. Leucopenia: (WBC <4000 cells/mm³)
7. Thrombocytopenia (<100,000 cells/mm³)
8. Uremia (BUN level, 20 mg/dL)
9. PaO₂/FiO₂ ratio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

Major criteria

1. Invasive mechanical ventilation
2. Septic shock with the need for vasopressors

ICU admission = one major or 3 minor

CAP – Evaluation of a Patient



Treatment

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

Supportive measures

- a. Bed rest.
- b. Adequate nutrition either orally or IV in severe cases.
- c. Fluid and electrolytes replacement.
- d. Analgesics for pain and antipyretics for fever.
- e. Respiratory support by oxygen supply or mechanical ventilation.
- f. Circulatory support by inotropic agent in hypotension.
- g. 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

Macrolide:

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

or

- Amoxicillin or
- amoxicillin + clavulanic acid

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

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

Lung Fluroquinolones as Monotherapy

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

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

B-lactam + Lung Fluroquinolones

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 Fluroquinolones

Group IV : ICU- Admitted Patients

B. Risks for Pseudomonas aeruginosa or MRSA

Organisms

All above pathogen.

+

- P. Aeruginosa
- MRSA

If MRSA is suspected

Vancomycin 1 gm /8-12 h

or

Linezolid 600mg /12 h

Antipseudomonal B- lactam

+

Antipseudomonal Fluroquinolones

or

Aminoglycoside + Azithromycin

or

Aminoglycoside + Lung Fluroquinolones

NB: Antipseudomonal B- lactam:

- Ceftazidime, Cefepime
- Piperacillin / tazobactam,
- Imipenem cilastien, or Meropenem

NB: Antipseudomonal Fluroquinolones:

- Ciprofloxacin
- Levofloxacin.

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.

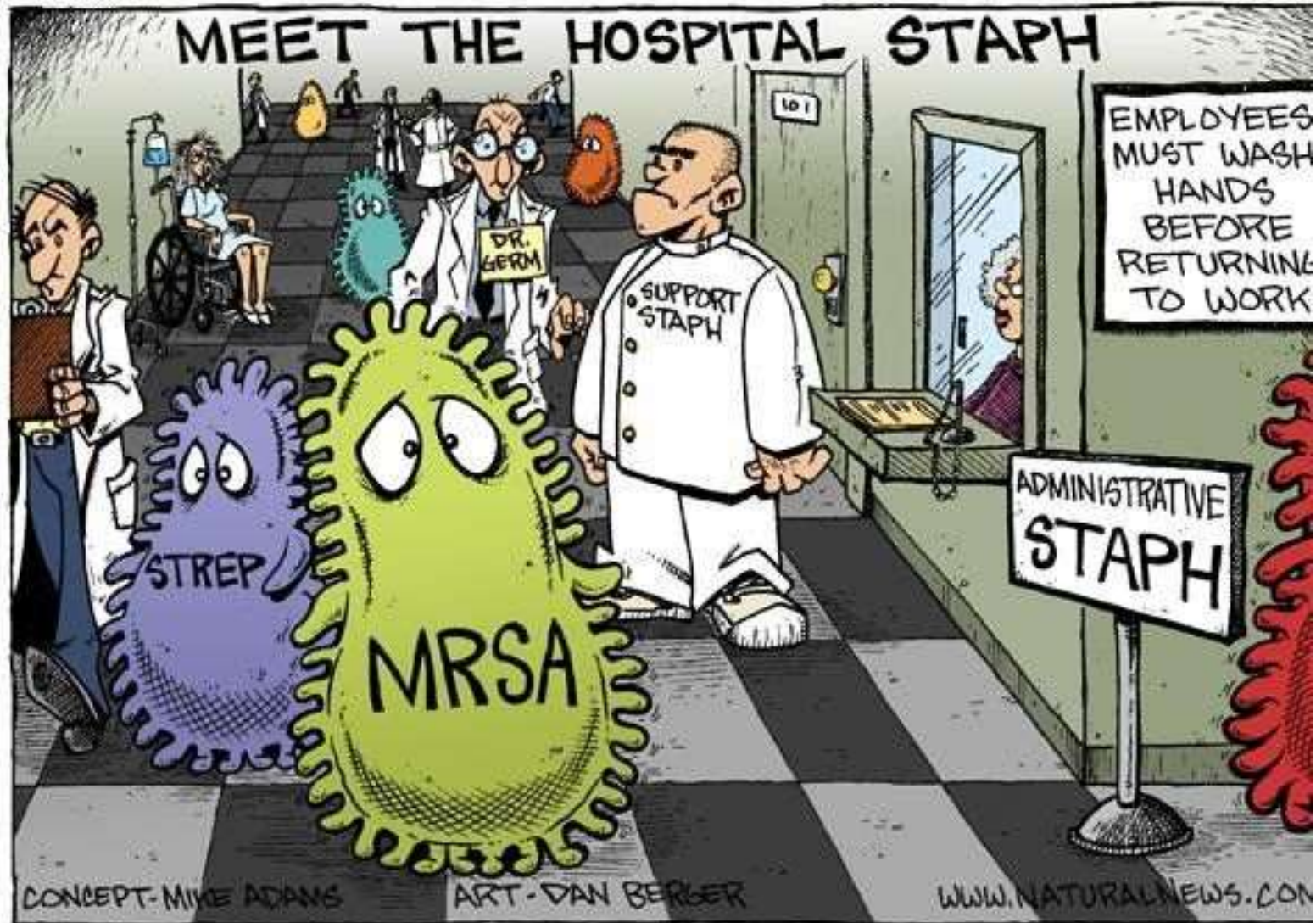
Risk factors for treatment failure:

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.....

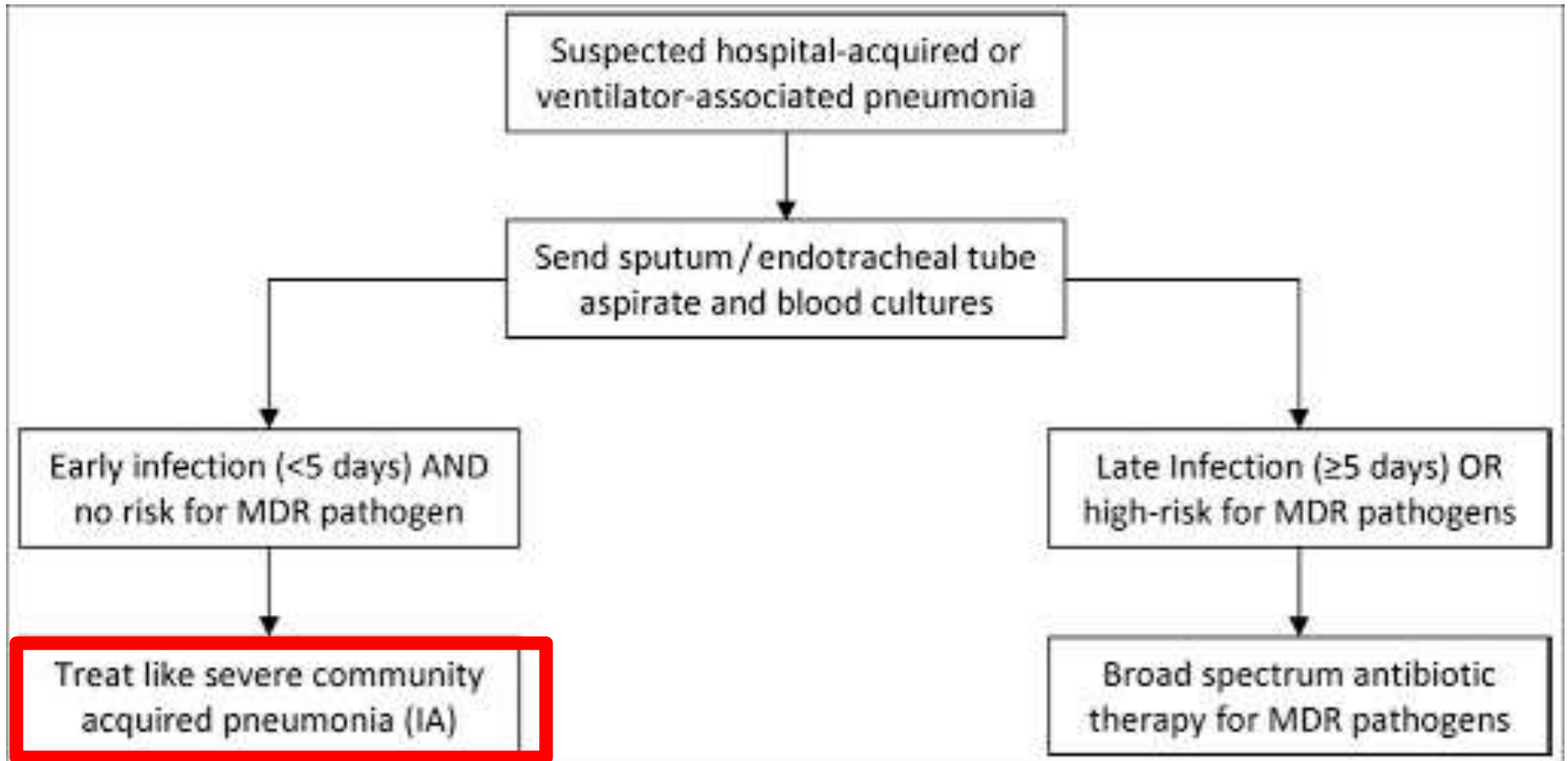
- CURB-65 scoring and Classification of cases
- Sputum and Blood culture collection in the first 24 h prior to Antibiotic administration.
- Early Empirical Antibiotic administration within 4-6 hours
- Change Antibiotic according to pathogen & sensitivity pattern
- Pneumococcal & Influenza vaccination; Smoking sessation

HAP & VAP



Hospital acquired pneumonia (HAP)

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



Risk Factors 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



*THANK
YOU*