Pneumonia

Community acquired pneumonia

(CAP)

Definition

- Pneumonia is acute infection leads to inflammation of the parenchyma of the lung (the alveoli) (consolidation and exudation)
- It may present as acute, fulminant clinical disease or as chronic disease with a more protracted course
- The histologically
  1. Fibrinopurulent alveolar exudate seen in acute bacterial pneumonias.
  2. Mononuclear interstitial infiltrates in viral and other atypical pneumonias
  3. Granulomas and cavitation seen in chronic pneumonias

Epidemiology

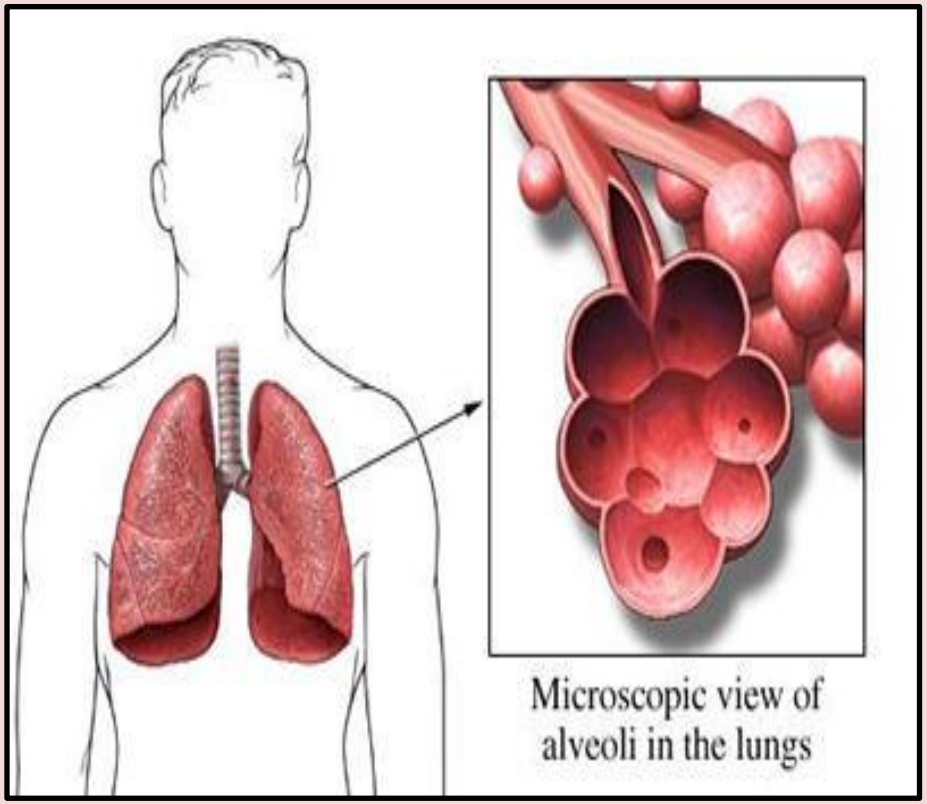
- Overall the rate of CAP 5-6 cases per 1000 persons per year
- Mortality 23%
- Pneumonia are high especially in old people
- Almost 1 million annual episodes of CAP in adults ≥ 65 yrs in the US

Risk factors

- Age < 2 yrs, > 65 yrs
- alcoholism
- smoking
- Asthma and COPD
- Aspiration
- Dementia
- prior influenza
- HIV
- Immunosuppression
- Institutionalization
- Recent hotel : *Legionella*
- Travel, pets, occupational exposures- birds(C- psittaci)

Etiological agents

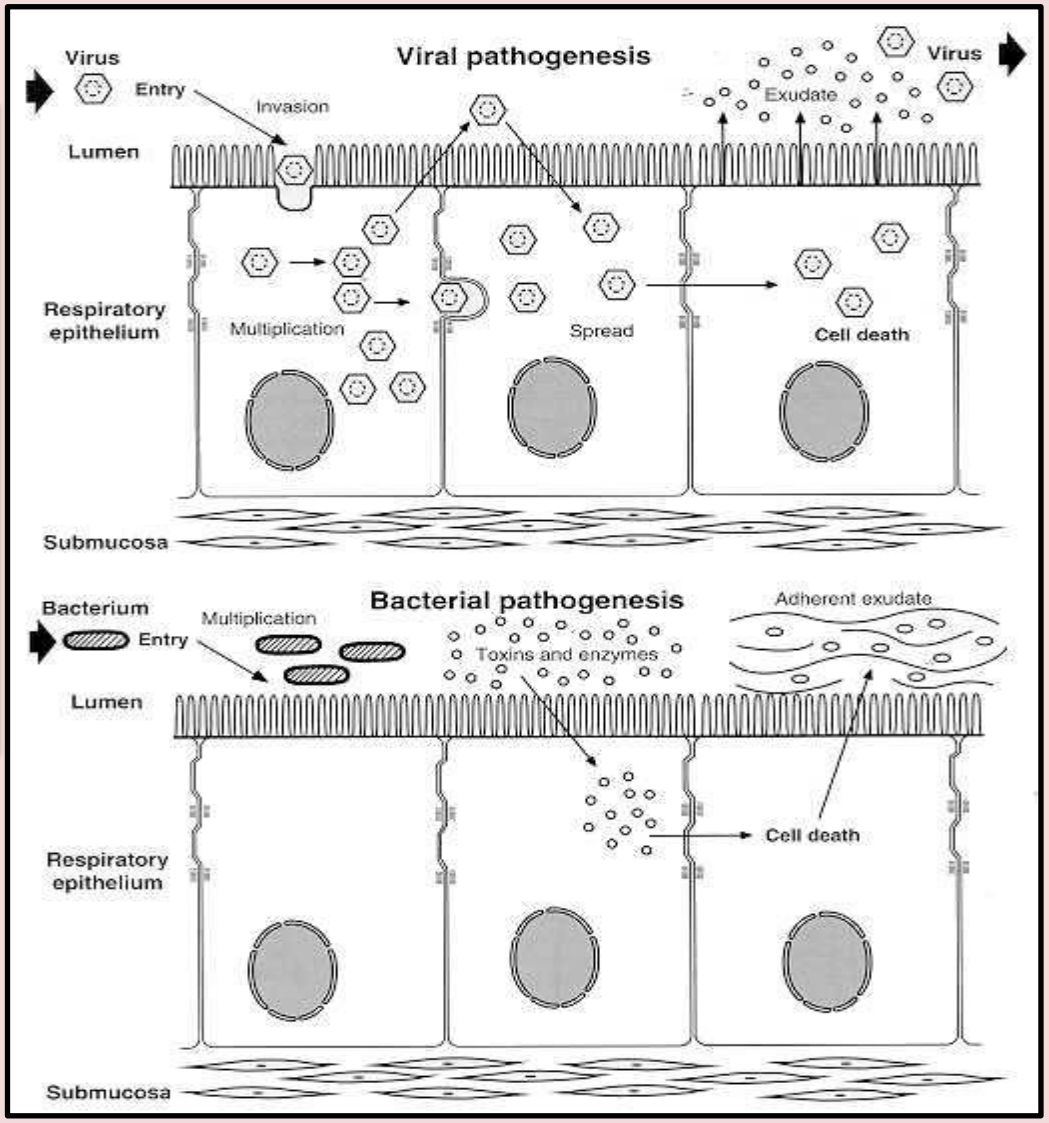
- Bacterial
- Fungal
- Viral
- Parasitic
- Other non-infectious factors like
  - Chemical
  - Allergen



Pathogenesis

Two factors involved in the formation of pneumonia

- Pathogens
- Host defenses.



Defense mechanism of respiratory tract

- Filtration and deposition of environmental pathogens in the upper airways
- Cough reflux
- Mucociliary clearance
- Alveolar macrophages
- Humoral and cellular immunity
- Oxidative metabolism of neutrophils

Pathophysiology :

1. Inhalation or aspiration of pulmonary pathogenic organisms into a lung segment or lobe.
2. Results from secondary bacteraemia from a distant source, such as Escherichia coli urinary tract infection and/or bacteraemia(less commonly).
3. Aspiration of Oropharyngeal contents (multiple pathogens).

Classification

- **Bacterial pneumonia classified according to:**
  1. Pathogen-(most useful-choose antimicrobial agents)
  2. Anatomy
  3. Acquired environment

Typical pneumonia

1. Gram-positive bacteria as
   - ***Streptococcus pneumoniae is the most common cause of typical pneumonia***
   - ***Staphylococcus aureus***
   - Group A hemolytic streptococci
2. Gram-negative bacteria
   - *Klebsiella pneumoniae*
   - *Hemophilus influenzae*
   - *Moraxella catarrhal*
   - *Escherichia coli*
3. Anaerobic bacteria

- **Atypical pneumonia**
  - *Legionnaies pneumonia*
  - *Mycoplasma pneumonia*
  - *Chlamydophila pneumonia*
  - *Chlamydophila Psittaci*
  - *Rickettsias*
  - *Francisella tularensis (tularemia),*
- **Fungal pneumonia**
  - *Candida*
  - *Aspergilosis*
  - *Pneumocystis jirvocii (carnii) PCP*

Viral pneumonia

the most common cause of pneumonia in children < than 5 years

-*Respiratory syncytial virus*
-*Influenza virus*
-*Adenoviruses*
-*Human metapneumovirus*
-*SARS and MERS CoV*
- *Cytomegalovirus*
- *Herpes simplex virus*

Pneumonia caused by other pathogen

-Parasites
- protozoa

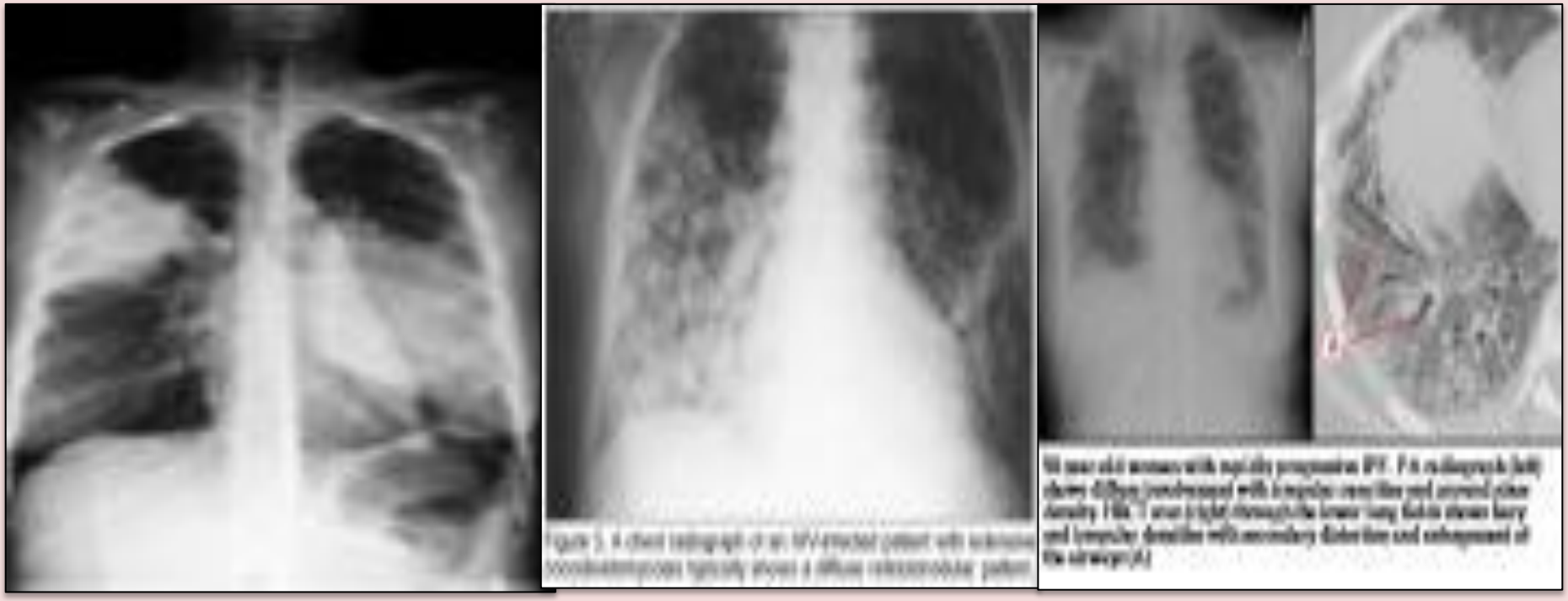
CAP and bioterrorism agents

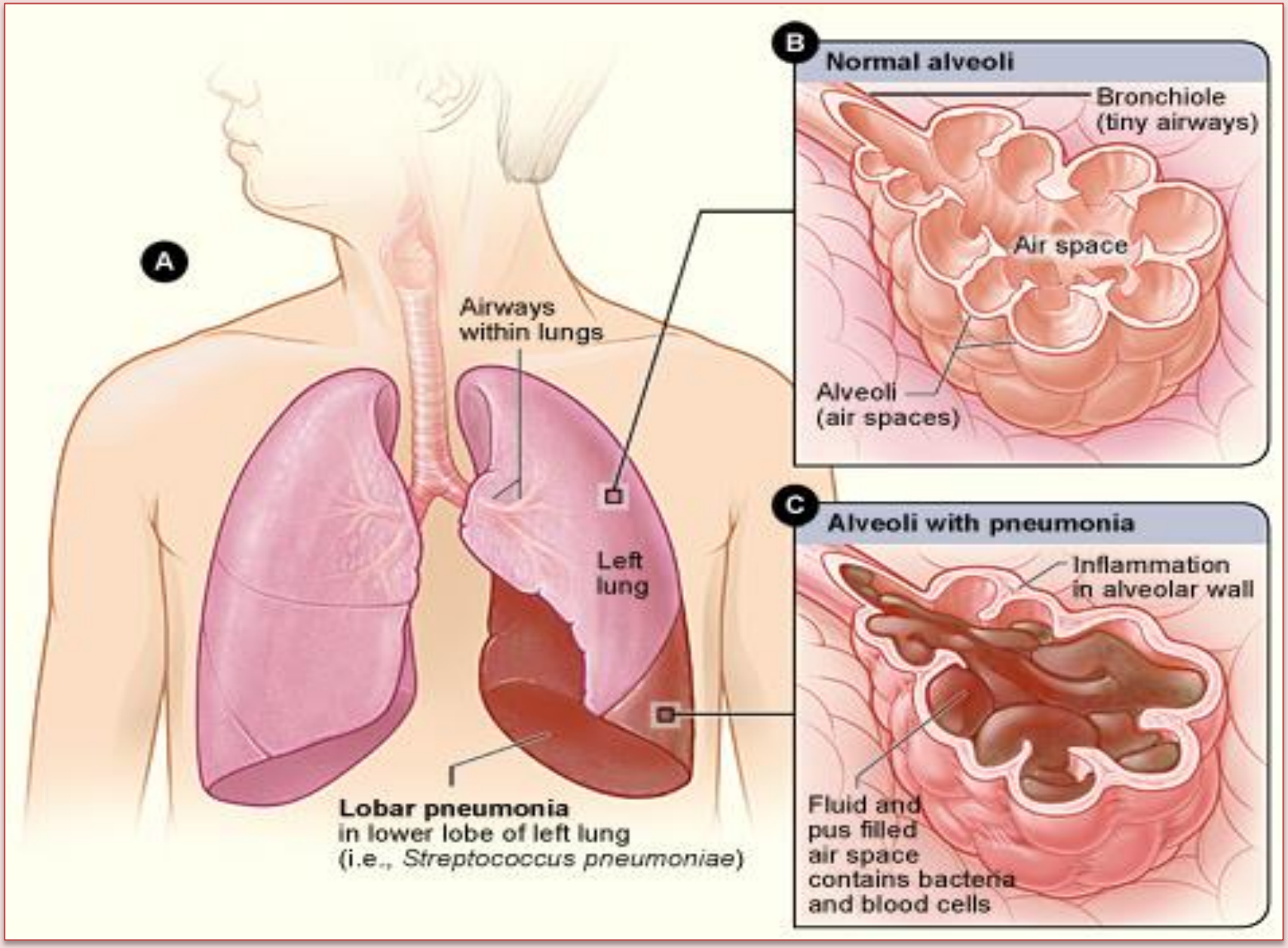
- *Bacillus anthracis (anthrax)*
- *Yersinia pestis (plague)*
- *Francisella tularensis (tularemia)*
- *Coxialla . burnetii (Q fever)*

- Level three agents

Classification by anatomy

1. Lobar: entire lobe
2. Lobular: (bronchopneumonia).
3. Interstitial





Lobar pneumonia

Classification by acquired environment

- Community acquired pneumonia (CAP)
- Hospital acquired pneumonia (HAP)
- Nursing home acquired pneumonia (NHAP)
- Immunocompromised host pneumonia (ICAP)

Outpatient	Streptococcus pneumoniae Mycoplasma / Chlamydophila H. influenzae, *Staph aureus* Respiratory viruses
Inpatient, non-ICU	*Streptococcus pneumoniae* *Mycoplasma / Chlamydophila* *H. influenzae*, *Staph aureus* *Legionella* Respiratory viruses
ICU	*Streptococcus pneumoniae* *Staph aureus*, *Legionella* Gram neg bacilli(Enterobacteriaceae, and Pseudomonas aeruginosa), *H. influenzae*

CAP- Cough/fever/sputum production + infiltrate

- CAP : pneumonia acquired outside of hospitals or extended-care facilities for > 14 days before onset of symptoms.
  - *Streptococcus pneumoniae* (most common)
  - *Haemophilus influenzae*
  - *mycoplasma pneumoniae*
  - *Chlamydia pneumoniae*
  - *Moraxella catarrhalis*
  - *Staph.aureus*
- Drug resistance streptococcus pneumoniae(DRSP) is a major concern.

Classifications

Typical

- Typical pneumonia usually is caused by bacteria
- *Strept. Pneumoniae*
  - *(lobar pneumonia)*
- *Haemophilus influenzae*
- Gram-negative organisms
- *Moraxella catarrhalis*
- *S. aureus*

Atypical

- Atypical': not detectable on gram stain; won't grow on standard media
- *Mycoplasma pneumoniae*
- *Chlamydophilla pneumoniae*
- *Legionella pneumophila*
- *Influenza virus*
- *Adenovirus*
- TB
- Fungi

Community acquired pneumonia

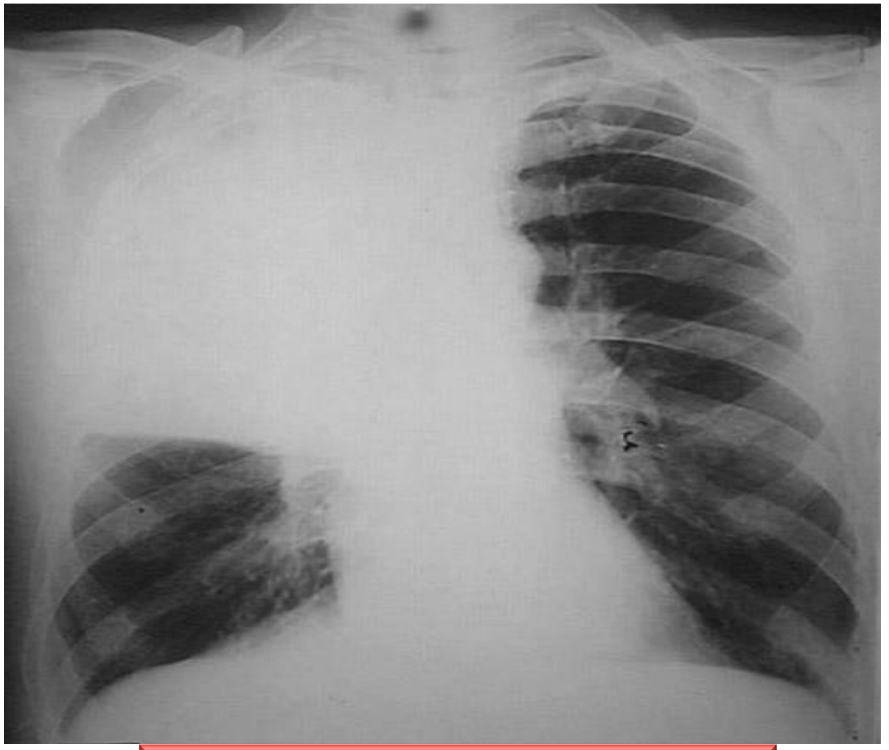
- *Strep pneumonia* 48%
- Viral 23%
- Atypical orgs(MP,LG,CP) 22%
- *Haemophilus influenza* 7%
- *Moraxella catharralis* 2%
- *Staph aureus* 1.5%
- Gram –ive orgs 1.4%
- Anaerobes

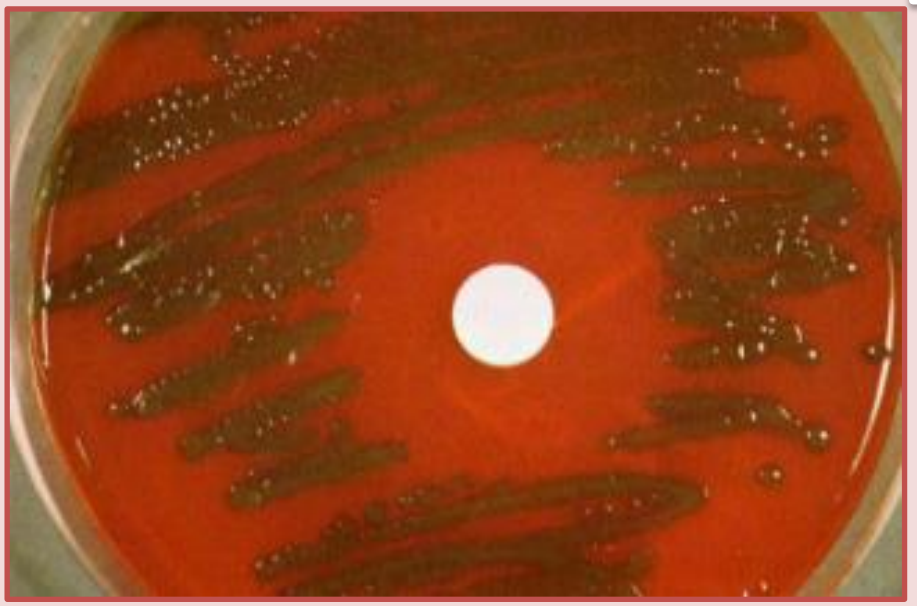
Clinical manifestation lobar pneumonia

- The onset is acute
- Prior viral upper respiratory infection
- Respiratory symptoms
  - Fever
  - Shaking chills
  - Cough with sputum production (rusty-sputum)
  - Chest pain- or pleurisy
  - Shortness of breath

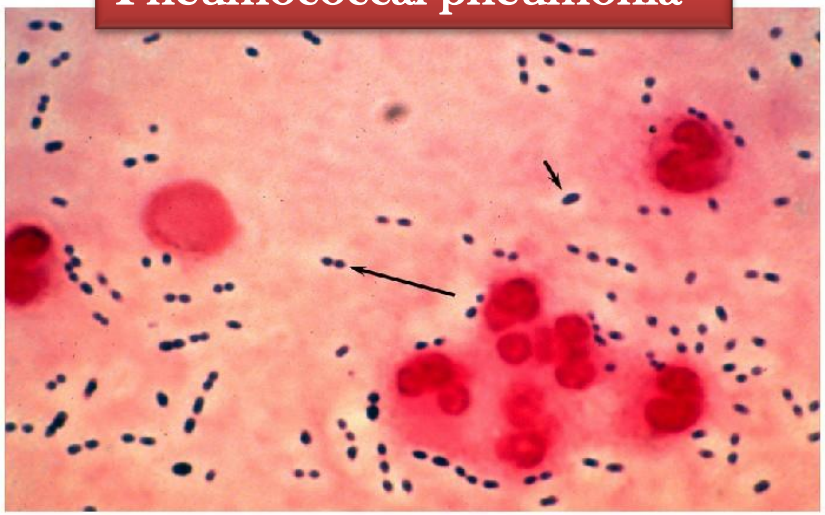
Diagnosis

- Clinical
  - History & physical
- X-ray examination
- Laboratory
  - CBC- leukocytosis
  - Sputum Gram stain- 15%
  - Blood culture- 5-14%
  - Pleural effusion culture





Pneumococcal pneumonia



Drug Resistant Strep Pneumoniae

- 40% of U.S. *Strep pneumo* CAP has some antibiotic resistance:
  - PCN, cephalosporins, macrolides, tetracyclines, clindamycin, bactrim, quinolones
- All MDR strains are sensitive to vancomycin or linezolid; most are sensitive to respiratory quinolones
- For Pneumonia, pneumococcal resistance to β-lactams is relative and can usually be overcome by increasing β-lactam doses (not for meningitis!)

Atypical pneumonia

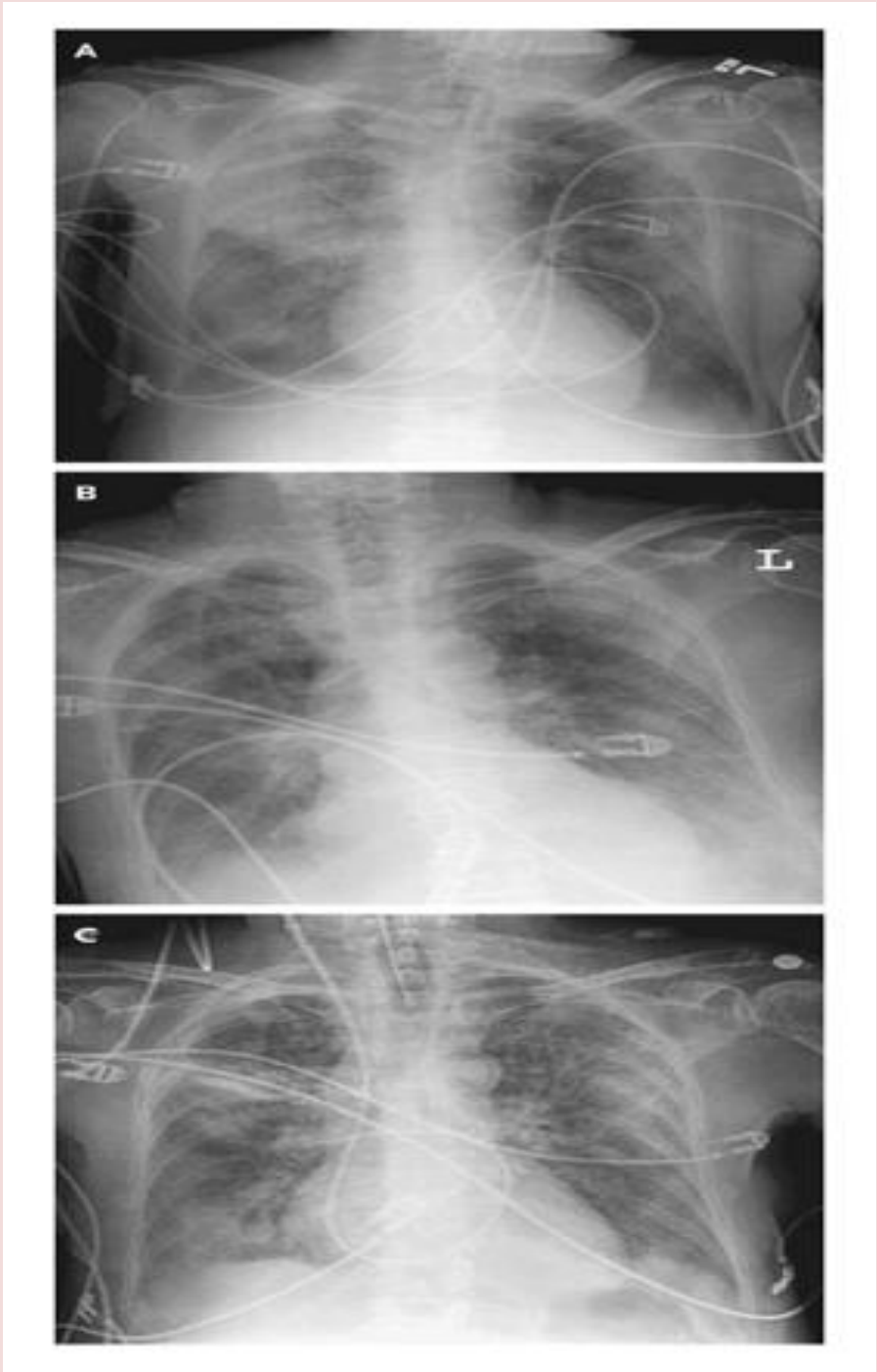
- *Chlamydia pneumonia*
- *Mycoplasma pneumonia*
- *Legionella spp*
- Psittacosis (parrots)
- Q fever (*Coxiella burnettii*)
- Viral (*Influenza, Adenovirus*)
- AIDS
  - PCP
  - TB (M. intracellulare)

- Approximately 15% of all CAP
- Not detectable on gram stain
- Won't grow on standard media
- Often extrapulmonary manifestations:
  - *Mycoplasma*: otitis, nonexudative pharyngitis, watery diarrhea, erythema multiforme, increased cold agglutinin titre
  - Chlamydophilla: laryngitis
- Most don't have a bacterial cell wall→ Don't respond to β-lactams
- Therapy: macrolides, tetracyclines, quinolones (intracellular penetration, interfere with bacterial protein synthesis)

Mycoplasma pneumonia

- Eaton agent (1944)
- No cell wall
- Common
- Rare in children and in > 65
- People younger than 40.
- Crowded places like schools, homeless shelters, prisons.
- Mortality rate 1.4%

- Usually mild and responds well to antibiotics.
- Can be very serious
- May be associated with a skin rash, hemolysis, myocarditis or pancreatitis



Mycoplasma pneumonia Cx-ray

Chlamydia pneumonia

- Obligate intracellular organism
- 50% of adults sero-positive
- Mild disease
- Sub clinical infections common
- 5-10% of community acquired pneumonia

Psittacosis

- *Chlamydophila psittaci*
- Exposure to birds
- Bird owners, pet shop employees, vets
- Parrots, pigeons and poultry
- Birds often asymptomatic
- 1st: Tetracycline
- Alt: Macrolide

Q fever

- *Coxiella burnetti*
- Exposure to farm animals mainly sheep
- 1st: Tetracycline, 2nd: Macrolide

Legionella pneumophila

- Legionnaire's disease.
- Serious outbreaks linked to exposure to cooling towers
- ICU admissions.

- Hyponatraemia common
  - (<130mMol)
- Bradycardia
- WBC < 15,000
- Abnormal LFTs
- Raised CPK
- Acute Renal failure
- Positive urinary antigen

Legionnaires on ICU

Symptoms

- Insidious onset
- Mild URTI to severe pneumonia
- Headache
- Malaise
- Fever
- Dry cough
- Arthralgia / myalgia

Signs

- Minimal
- Few crackles
- Rhonchi
- Low grade fever

Diagnosis & Treatment

- CBC
- Mild elevation WBC
- U&Es
- Low serum Na (Legionalla)
- Deranged LFTS
- ↑ ALT
- ↑ Alk Phos
- Culture on special media BCYE
- Cold agglutinins (*Mycoplasma*)
- Serology
- DNA detection

- Macrolide
- Rifampicicn
- Quinolones
- Tetracycline
- Treat for 10-14 days
- (21 in immunosupressed)

Differential diagnosis

- Pulmonary tuberculosis
- Lung cancer
- Acute lung abecess
- Pulmonary embolism
- Noninfectious pulmonary infiltration

Evaluate the severity & degree of pneumonia

Is the patient will require hospital admission?

- Patient characteristics
- Co-morbid illness
- Physical examinations
- Basic laboratory findings

The diagnostic standard of sever pneumonia (Do not memorize)

- Altered mental status
- Pa02<60mmHg. PaO2/FiO2<300, needing MV
- Respiratory rate>30/min
- Blood pressure<90/60mmHg
- Chest X-ray shows that bilateral infiltration, multilobar infiltration and the infiltrations enlarge more than 50% within 48h.
- Renal function: U<20ml/h, and <80ml/4h

Patient Management

- Outpatient, healthy patient with no exposure to antibiotics in the last 3 months
- Outpatient, patient with comorbidity or exposure to antibiotics in the last 3 months
- Inpatient : Not ICU
- Inpatient : ICU

Antibiotic Treatment

- Macrolide: Azithromycin, Clarithromycin
- Doxycycline
- Beta Lactam :Amoxicillin/clavulinic acid, Cefuroxime
- Respiratory Flouroquinolone:Gatifloxacin, Levofloxacin or Moxifloxacin
- Antipeudomonas Beta lactam: Cetazidime
- Antipneumococcal Beta lactam :Cefotaxime

		Macrolides	Doxycycline	Levofloxacin	B-lactam And Macrolide	B-lactam And Levo
Outpatient, healthy patient with no exposure to antibiotics in the last 3 months	S pneumoniaes, M pneumoniae, Viral					
Outpatient, patient with comorbidity or exposure to antibiotics in the last 3 months	*S pneumoniaes, M pneumoniae, C. pneumoniae, H influenzae M.catarrhalis anaerobes S aureus*					
Inpatient : Not ICU	Same as above +legionella					
Inpatient : ICU	Same as above + *Pseudomonas*					