

# Pneumonia

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# Overview of Pneumonia

- Pneumonia = infection in the lung parenchyma.
- Responsible for  $\sim 1/6$  of all US deaths.
- Normally sterile lungs due to strong immune defenses.
- Vulnerability: airborne microbes, aspiration, and reduced local immunity.

# Lung Defense Mechanisms

- Innate defenses: mucociliary clearance, macrophages, neutrophils, complement.
- Adaptive immunity: IgA blocks attachment, IgG activates complement, T cells control viral/intracellular infections.

# Immune Defects and Susceptibility

- • Innate immunity defects → pyogenic infections.
- • MYD88 mutation → severe pneumococcal infections.
- • IgA deficiency → risk for encapsulated bacteria.
- • Lifestyle (smoking, alcohol) lowers defenses.

# Classification of Pneumonia

- By pathogen or clinical setting:
  1. Community-acquired (bacterial, viral)
  2. Nosocomial (hospital-acquired)
  3. Aspiration
  4. Chronic
  5. Necrotizing/lung abscess
  6. Immunocompromised host.

# Common Pathogens (Community-Acquired)

- *Streptococcus pneumoniae* (most common)
- *Haemophilus influenzae*
- *Moraxella catarrhalis*
- *Staphylococcus aureus*
- *Klebsiella pneumoniae*
- *Pseudomonas aeruginosa*
- *Legionella pneumophila*
- *Mycoplasma pneumoniae*

# Streptococcus pneumoniae

- Common after viral URTI.
- Risk: chronic disease, Ig deficiency, asplenia.
- Lobar consolidation pattern.
- Vaccines available.

# Haemophilus & Moraxella

- *H. influenzae*: COPD exacerbations, epiglottitis in children.
- *M. catarrhalis*: older adults, otitis media in kids, COPD exacerbations.

# Staphylococcus aureus

- Secondary after viral infections (flu, measles).
- Complications: abscess, empyema.
- Risk: IV drug use → right-sided endocarditis.

# Klebsiella pneumoniae

- Gram-negative, affects alcoholics, and malnourished.
- Thick, gelatinous sputum due to capsular polysaccharide.

# Pseudomonas aeruginosa

- Common in CF, neutropenia, burns and ventilated patients.
- Invades blood vessels → bacteremia and necrosis.

# Legionella & Mycoplasma

- Legionella → severe, waterborne, immunocompromised.
- Mycoplasma → young adults, closed communities.

# Morphologic Patterns

1. Bronchopneumonia – patchy consolidation.
  2. Lobar pneumonia – entire lobe involved.
- Term: consolidation = alveoli filled with exudate.

# Lobar Pneumonia Stages

1. Congestion: Heavy, red lung.
2. Red hepatization: Neutrophils + fibrin.
3. Gray hepatization: Disintegration of RBCs.
4. Resolution: Macrophage cleanup & repair.

# Clinical Features

- Abrupt fever, chills, productive cough, Pleuritic pain, radiographic consolidation.
- Treated → recovery in 48–72 hrs.
- Mortality <10%, complications: empyema, and meningitis.

# Viral Pneumonia

- Common agents: Influenza, RSV, parainfluenza, and adenovirus.
- Interstitial inflammation → clear alveoli.
- Can predispose to bacterial infection.

# Viral Pneumonia Pathology

- Septal thickening, lymphocytes, and macrophages.
- Severe cases → diffuse alveolar damage + hyaline membranes.

# Influenza Pathogenesis

- RNA virus (A, B, C) – Type A causes pandemics.
- Antigenic drift = mutations → epidemics.
- Antigenic shift = recombination → pandemics.
- H and N antigens define subtypes (e.g., H1N1).

# Hospital-Acquired Pneumonia

- Nosocomial (during hospital stay).
- Risk: intubation, immunosuppression, and antibiotics.
- Pathogens: Gram-negative rods, and pseudomonas, MRSA.

# Aspiration Pneumonia

- Inhalation of gastric/oral contents.
- Chemical + bacterial.
- Necrotizing → abscess.
- Common in debilitated/unconscious patients.

# Lung Abscess

- Localized necrosis forming cavities.
- Causes: aspiration, necrotizing pneumonia, obstruction, and septic emboli.
- Sx: foul sputum, fever, and clubbing.
- Complications: empyema, and brain abscess.

# Chronic Pneumonia

- Localized lesion, granulomatous inflammation.
- Agents: *Mycobacterium tuberculosis*, and fungi.
- In immunocompromised → disseminated disease.

# Tuberculosis Overview

- Caused by *M. tuberculosis*.
- Spread by inhalation.
- Pathology = caseating granulomas.
- Hypersensitivity = tissue destruction.

# Summary of Acute Pneumonias

- *S. pneumoniae*: lobar pattern.
- Lobar stages: congestion → resolution.
- Viral pneumonia: interstitial, and non-exudative.
- Bacterial: neutrophilic exudate, and consolidation.