•Pneumonia can be broadly defined as any infection in the lung.

•The vulnerability of the lung to infection is high because:

(1) many microbes are airborne and readily inhaled into the lungs.
(2) nasopharyngeal flora are regularly aspirated during sleep, even by healthy individuals.
(3) lung diseases often lower local immune defensest

Normally, the lung parenchyma remains sterile because of a number of highly effective immune and non-immune defense mechanisms that extend throughout the respiratory system from the nasopharynx to the alveolar air spaces

mutations in MYD88, a protein required for signaling by Toll-like receptors, lead to severe necrotizing pneumococcal infections

congenital defects in IgA production can increased risk for pneumonias caused by encapsulated organisms such as pneumococcus and H.

So any patients with inherited or acquired defects in:
- innate immunity (including neutrophil and complement defects).
- •adaptive immunity (e.g., humoral immunodeficiency)

⇓

increased incidence of infections with pyogenic bacteria .

PULMONARY INFECTIONS

COMMUNITY-ACQUIRED BACTERIAL PNEUMONIAS

- Streptococcus pneumonia
  - The most common cause of community acquired pneumonia
  - Risk factors :
    - chronic diseases such as CHF, COPD, or diabetes.
    - congenital or acquired defects in immunoglobulin production (e.g., acquired immune deficiency syndrome [AIDS]).
    - decreased or absent splenic function (e.g., sickle cell disease or after splenectomy).
  - Diagnosis
    - presence of numerous neutrophils in sputum containing the typical gram-positive, lancet-shaped diplococci supports the diagnosis of pneumococcal pneumonia
    - Isolation of pneumococci from blood cultures.
  - Prevention
    - Pneumococcal vaccines containing capsular polysaccharides from the common serotypes are used in individuals at high risk for pneumococcal sepsis.

يالي بيشل الـ spleen
بجسم اكثر عرضة لـ :-
- encapsulated bacteria
  - S.pneumonia
  - H.influenzae
  - Neisseria meningitis

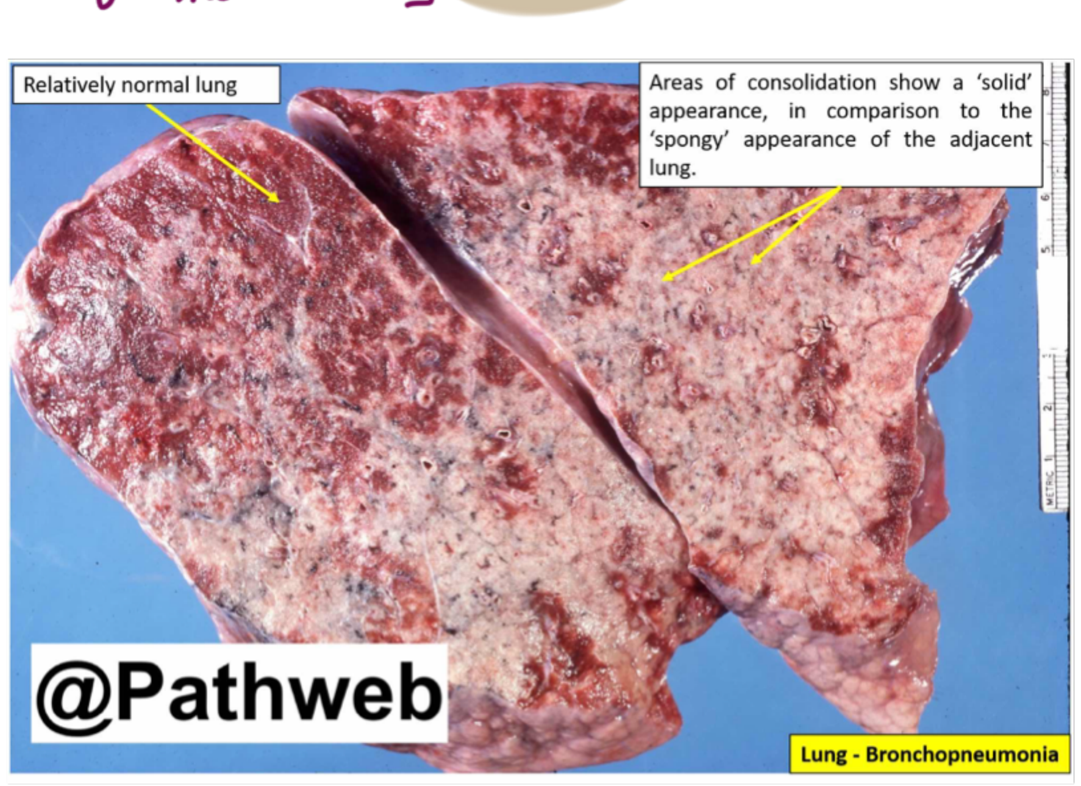
- Haemophilus influenza
  - Both encapsulated and unencapsulated forms of H. influenzae are important causes of community-acquired pneumonia.
    - Encapsulated: can cause life threatening pneumonia, epiglottitis and suppurative meningitis in children.
  - Adults at risk for developing infections include those with
    - chronic pulmonary diseases
    - chronic bronchitis,
    - cystic fibrosis,
    - bronchiectasis
  - H. influenzae is the most common bacterial cause of acute exacerbations of COPD
- Moraxella catarrhalis
  - It is the second most common bacterial cause of acute exacerbation of COPD in adults , especially in older adults
  - Is one of the three most frequent causes of otitis media.
- Staphylococcus aureus
  - is an important cause of secondary bacterial pneumonia in children and healthy adults after viral respiratory illnesses (e.g., measles in children and influenza in both children and adults).
  - associated with a high incidence of complications, such as :
    - lung abscess and empyema
    - right-sided staphylococcal endocarditis
    - nosocomial pneumonia
- Klebsiella pneumonia
  - is the most frequent cause of gram-negative bacterial pneumonia.
  - frequently afflicts debilitated and malnourished individuals, particularly chronic alcoholics.
  - Thick and gelatinous sputum is characteristic, because the organism produces an abundant viscid capsular polysaccharide.

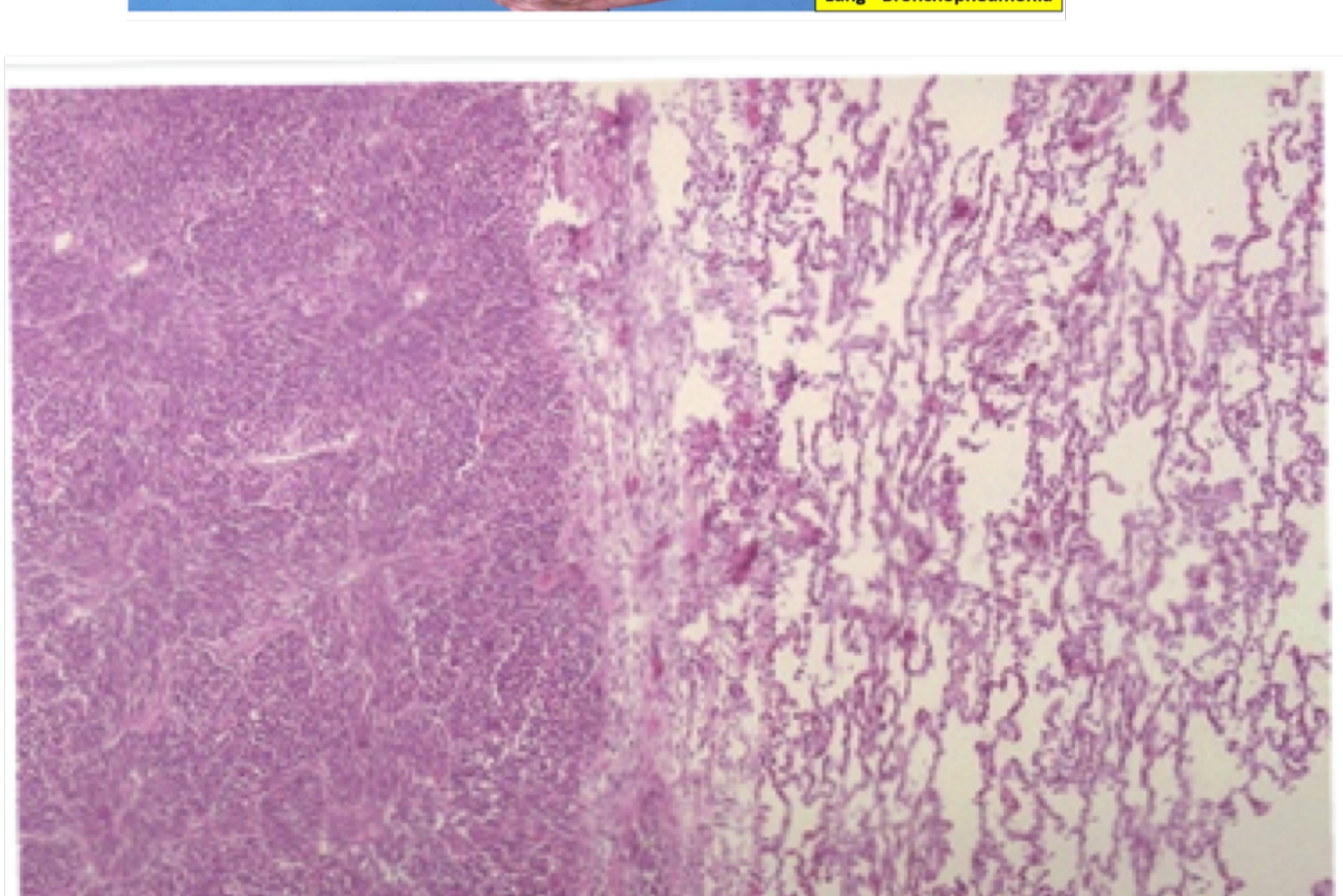
* current jelly sputum

- Mycoplasma pneumoniae
  - common among children and young adults. They occur sporadically or as local epidemics in closed communities (schools, military camps, prisons).
  - Tests for Mycoplasma antigens and polymerase chain reaction (PCR) testing for Mycoplasma DNA are available
- PSEUDOMONAS AERUGINOSA
  - is most commonly seen in:
    - nosocomial settingsy
    - cystic fibrosis.
    - Neutropenic patient, usually secondary to chemotherapy
    - In victims of extensive burns
    - in patients requiring mechanical ventilation
  - •has a propensity to invade blood vessels at the site of infection, with consequent extrapulmonary spread.
  - Histologic examination: Pseudomonas vasculitis*

- LEGIONELLA PNEUMOPHILA
  - is the agent of Legionnaire disease.
  - flourishes in artificial aquatic environments
  - Mode of transmission
    - either inhalation of aerosolized organisms or aspiration of contaminated drinking water.
  - Risk factors
    - condition such as cardiac, renal, immunologic, or hematologic disease
  - Legionella pneumonia
    - may be quite severe, frequently requiring hospitalization and producing a fatality rate of 30% to 50% in immunosuppressed individuals.
    - Rapid diagnosis is facilitated by
      - demonstration of Legionella antigens in the urine
      - positive fluorescent antibody test on sputum samples.
      - But culture remains the standard diagnostic modality
      - PCR-based tests can be used on bronchial secretions in atypical cases

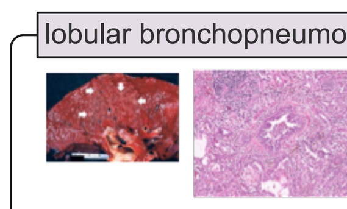
Morphology of pneumonia :-
·consolidation ⇒ solidification of the lung due to replacement of the air by exudate in alveoli



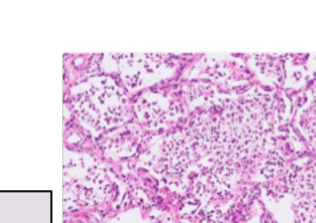


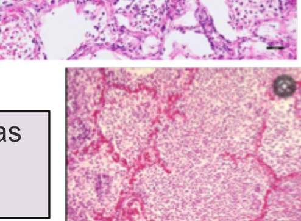
At the left the alveoli are filled with a neutrophilic exudate that corresponds to the areas of consolidation seen grossly with the bronchopneumonia. This contrasts with the aerated lung on the right of this photomicrograph.

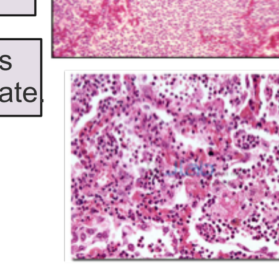
- Bacterial pneumonia has two patterns of anatomic distribution:
  - lobular bronchopneumonia
    - Patchy consolidation.
    - Foci of bronchopneumonia are consolidated areas of acute suppurative inflammation.
    - The consolidation frequently bilateral and basal because of the tendency of secretions to gravitate to the lower lobes.
    - Histologically
      - neutrophil-rich exudate fills the bronchi, bronchioles, and adjacent alveolar space.

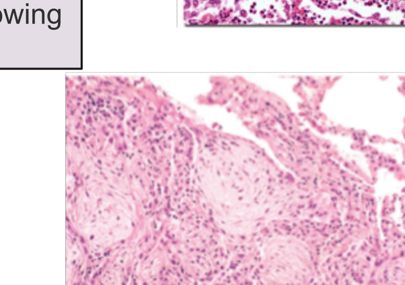


  - lobar pneumonia
    - consolidation of a large portion of a lobe or of an entire lobe
    - four stages of the inflammatory response have classically been described:
      - congestion:
        - characterized by vascular engorgement, intraalveolar fluid with few neutrophils, and numerous bacteria.
      - red hepatization:
        - characterized by massive confluent exudation, as neutrophils, red cells, and fibrin fill the alveolar spaces.
      - Gray hepatization
        - •marked by progressive disintegration of red cells and the persistence of a fibrinosuppurative exudate.
      - Resolution:
        - ➢the exudate within the alveolar spaces is broken down by enzymatic digestion to produce granular, semifluid debris that is resorbed, ingested by macrophages, or organized by fibroblasts growing into it.

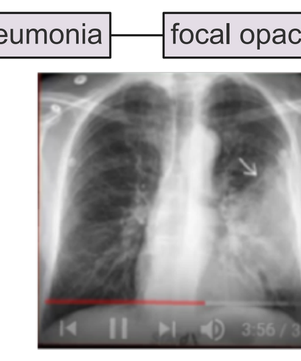


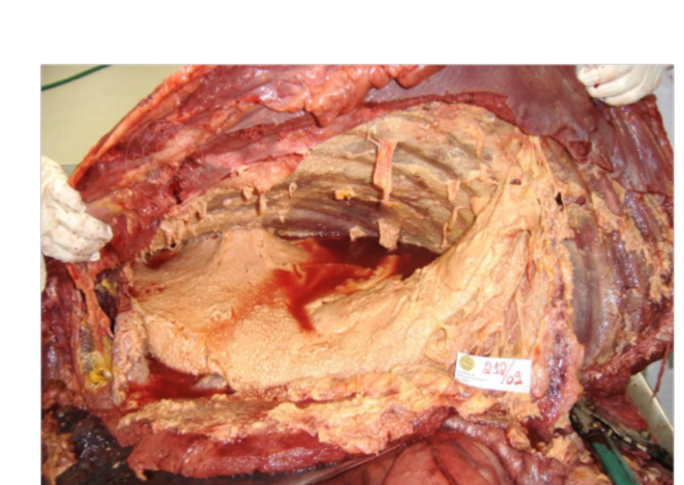






- Clinical features
  - abrupt onset of high fever and shaking chills
  - cough producing mucopurulent sputum
  - When pleuritis is present, it is accompanied by pleuritic pain.
- Radiology
  - lobar pneumonia — whole lobe is radiopaque
  - bronchopneumonia — focal opacities .
- Treatment — antibiotics



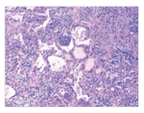


pleuritis :-
pleural fibrinous reaction to the underlying inflammation is often if the consolidation extends to the surface.

Pulmonary infections

COMMUNITY-ACQUIRED VIRAL PNEUMONIAS.

- •The most common causes of community-acquired viral pneumonias are:
  Nearly all of these agents also cause upper-respiratory tract infections (“common cold”).
  - influenza types A and B.
  - ≻ the respiratory syncytial viruses.
  - human metapneumovirus
  - Adenovirus and rhinoviruses
  - rubeola virus and varicella virus.
- Pathogenesis
  - These pathologic viruses share a propensity to infect and damage respiratory epithelium, producing an inflammatory response
    - When the process extends to alveoli, there is usually interstitial inflammation.
      - damage leading to necrosis of the respiratory epithelium inhibits mucociliary clearance and predisposes to secondary bacterial infections
- MORPHOLOGY
  - inflammatory reaction is largely confined to the walls of the alveoli.
  - •The septa are widened and edematous; they usually contain a mononuclear inflammatory infiltrate of lymphocytes, macrophages and, occasionally, plasma cells.
  - In the classic case, alveolar spaces in viral pneumonias are free of cellular exudate



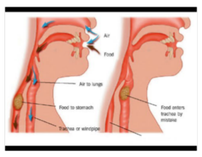
- CLINICAL FEATURES
  - a severe upper-respiratory tract infection or “chest cold” that goes undiagnosed.
  - manifest as a fulminant, life-threatening infection in immunocompromised patient.
  - Generally the patient presented with:
    - Fever
    - Headache
    - Malaise
    - Cough with minimal sputum

HOSPITAL-ACQUIRED PNEUMONIAS

- ●Nosocomial, or hospital-acquired, pneumonias are defined as pulmonary infections acquired in the course of a hospital stay.
- Nosocomial infections are common in:
  - hospitalized individuals with severe underlying disease.
  - Immunosuppressed
  - those on prolonged antibiotic regimens.
  - •Patients on mechanical ventilation
- ●Most common organisms:
  - Gram-negative rods
    - Enterobacteriaceae
    - Pseudomonas spp.
  - S.aureus

ASPIRATION PNEUMONIA

- occurs in debilitated patients or those who aspirate gastric contents while unconscious (e.g., after a stroke) or during repeated vomiting.
- The resultant pneumonia is partly chemical, due to the extremely irritating effects of the gastric acid, and partly bacterial.
- Complication of Aspiration pneumonia is
  - death in individuals predisposed to aspiration.
  - • In those who survive, abscess formation is a common complication.



LUNG ABSCESS

refers to a localized area of suppurative necrosis within the pulmonary parenchyma, resulting in the formation of one or more large cavities.

- •The causative organism may be introduced into the lung by any of the following mechanisms:
  - Aspiration of infective material from carious teeth or infected sinuses or tonsils
  - . Aspiration of gastric contents.
  - As a complication of necrotizing bacterial pneumonias
  - Bronchial obstruction
  - Septic embolism
- MORPHOLOGY
  - Abscesses range in diameter from a few millimeters to large cavities 5 to 6 cm across.
  - •On histologic examination:
    - The suppurative focus is surrounded by variable amounts of fibrous scarring and mononuclear infiltration (lymphocytes, plasma cells, macrophages), depending on the chronicity of the lesion.

- CLINICAL FEATURES
  - prominent cough that usually yields copious amounts of foul-smelling, purulent, or sanguineous sputum.
  - Spiking fever and malaise.
  - Clubbing of the fingers, weight loss, and anemia.
  - Abscesses occur in 10% to 15% of patients with bronchogenic carcinoma.