* **LOWER RESPIRATORY TRACT INFECTIONS**
* Dr. Syed Yousaf Kazmi
* Assist Prof Microbiology
* LEARNING OBJECTIVES
* List microorganisms causing typical and atypical pneumonia
* Describe transmission, pathogenicity and lab diagnosis of pneumococcal pneumonia
* Briefly discuss etiology, transmission, pathogenicity and lab diagnosis of legionnaires' disease, Mycoplasma pneumonia and Klebsiella pneumonia
* Describe the role of vaccination in prevention of lower respiratory tract infections
* INTRODUCTION

TYPICAL PNEUMONIA

* Shaking chills
* Purulent sputum
* X-rays abnormalities proportional to physical signs
* Usually bacterial cause e.g. *Streptococcus pneumoniae*

ATYPICAL PNEUMONIA

* Insidious onset
* Scant sputum
* X-rays abnormalities greater than physical signs
* Usually viral/atypical bacteria
* e.g. Influenza virus, *Mycoplasma pneumoniae*
* INTRODUCTION

COMMUNITY ACQUIRED PNEUMONIA

* From community e.g. *S. pneumoniae*

HOSPITAL ACQUIRED PNEUMONIA

* In hospital setting e.g. *Klebsiella pneumoniae*

VENTILATOR ASSOCIATED PNEUMONIA

* Associated with ventilators

PNEUMONIA IN IMMUNODEFICIENCY

* Associated with low immunity e.g. *P. jirovecii*
* LIST OF MICROORGANISMS CAUSING PNEUMONIA
* PNEUMOCOCCAL PNEUMONIA

**ETIOLOGY**

* *Strep pneumoniae*
* Gram positive lancet shaped diplococci
* Polysaccharide Capsule-virulence factor & anti-phagocytic
* 90 serotypes based on capsular polysaccharides
* PNEUMOCOCCAL PNEUMONIA

**TRANSMISSION**

* Community acquired
* Acquired by aerosolized droplets/ contact
* Also part of normal flora of oropharynx
* Innate immune system prevent disease
* PNEUMOCOCCAL PNEUMONIA
* Risk of disease
* Splenectomy
* Malnutrition
* Old /young age
* Smoking, Viral infections
* Immune suppressing drugs
* Alcohol intake
* Pulmonary congestion, heart failure
* Sickle cell anemia
* Complement deficiency
* PNEUMOCOCCAL PNEUMONIA

**PATHOGENICITY**

* No toxins/ enzymes
* Ability to multiply in tissues
* Antiphagocytic capsule most imp
* Antibodies against type specific capsule prevent infection
* Spleen is crucial in filtering *S. pneumoniae* from blood born infection
* Splenectomized individuals-risk
* PNEUMOCOCCAL PNEUMONIA

**COMPLICATIONS**

* Sinusitis
* Otitis media
* Mastoiditis
* Bacteremia
* Meningitis
* Endocarditis
* Septic arthritis
* PNEUMOCOCCAL PNEUMONIA  
  LAB DIAGNOSIS

NON SPECIFIC INVESTIGATIONS

**CBC**

* High TLC
* Low TLC-severe disease
* Thrombocytopenia-increased mortality

**SERUM UREA/ ELECTROLYTES**

* High urea and low Sodium-severe inf

**ARTERIAL BLOOD GAS ANALYSIS**

**PLEURAL FLUID ANALYSIS**

* If empyema/ effusion +ve
* PNEUMOCOCCAL PNEUMONIA  
  LAB DIAGNOSIS

**SPUTUM GRAM STAIN**

* Neutrophils, RBCs
* Gram positive lancet shaped diplococci

**SPUTUM C/S**

* Difficult to differentiate b/w pathogen and flora
* Very heavy and pure growth-helps in diagnosis

**BLOOD C/S**

* Very significant
* Often positive

**URINE ANTIGEN TEST**

* In very serious infections
* LEGIONNAIRES’ DISEASE

**ETIOLOGY**

* Responsible for outbreak of pneumonia in persons attending American Legion convention in 1976
* *Legionella pneumophila*
* Fastidious, Gram neg bacillus
* 16 serotypes; serotype 1 responsible for >70% of infections
* Poorly stained by Gram stain
* LEGIONNAIRES’ DISEASE

**TRANSMISSION**

* Ubiquitous in warm moist environment
* Lakes, streams & other water bodies
* Aerosols generated from contaminated AC system, shower head, other sources
* Inhalation of aerosols
* Person to person transmission does not occur
* LEGIONNAIRES’ DISEASE

**PATHOGENICITY**

* Usually in individual >55 years
* Risk factors:

Smoking, Chronic bronchitis, Emphysema, Steroids/ other immunosuppressive drugs, Diabetes mellitus

* Inhalation of contaminated aerosol
* Reach alveolar macrophage
* Not efficiently killed
* Failure of fusion of phagosome with lysosome
* LEGIONNAIRES’ DISEASE  
  LAB DIAGNOSIS
* **SMEAR STAIN**

Bronchial washings, pleural fluid, lung biopsy

Gram stain not suitable

* **DIRECT IMMUNO-FLUORESCENT TEST**
* **CULTURE**

BCYA-Slow growth

* **URINE ANTIGEN TEST**-only serotype 1
* **SEROLOGICAL TEST**-Serum antibodies to organism by ELISA test
* MYCOPLASMA PNEUMONIA

**ETIOLOGY & TRANSMISSION**

* *Mycoplasma pneumoniae*
* No cell wall-No Gram reaction
* Person to person transmission
* Infected resp secretions
* Receptors on respiratory epith
* Usually 5-20 years population
* MYCOPLASMA PNEUMONIA

**PATHOGENESIS**

Primary Atypical pneumonia

Mild disease: Walking pneumonia

Extra-pulmonary involvement frequent

Hemolytic anemia, skin rashes, ear discharge

Consolidation of lungs with minimal symptoms

Death is rare

* MYCOPLASMA PNEUMONIA  
  LAB DIAGNOSIS

**SPUTUM CULTURE**

* Only specialized institutes

**COLD HEAMAGGLUTININS**

* In 50% patients

**SEROLOGY**

* ELISA for IgM & IgG very sensitive tests

**PCR**

* On throat swab –sensitive but expensive
* KLEBSIELLA PNEUMONIA
* Gram Neg Capsulated Bacillus
* Person to person or from environment to person
* Rapid extensive hemorrhagic necrotizing consolidation of lungs
* In alcoholics/ COPD patients
* Gelatinous reddish brown sputum-sticks to container
* Gram staining and culture of sputum specimen
* IMMUNIZATION FOR PREVENTION OF PNEUMONIA
* Inactivated Polysaccharide vaccine for Strep pneumoniae
* 23 polysaccharide antigens
* 90% protection against bacteremic pneumonia
* Elderly, debilitated or immuno-suppressed, splenectomized
* Pneumococcal Conjugate vaccine with diphtheria protein for children 2-23 months