LOWER RESPIRATORY TRACT INFECTIONS

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- 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 IMMUNOFLUORESCENT 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