

- **LOWER
RESPIRATORY
TRACT
INFECTIONS**

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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 immunosuppressed, splenectomized
- Pneumococcal Conjugate vaccine with diphtheria protein for children 2-23 months