



***Streptococcus* spp.**

(in respiratory system)
cont.

Istar Dolapci, MD, PhD

Ankara University School of Medicine

Department of Medical Microbiology

Objectives of today's class

- Describe the general characteristics of *Streptococcus* spp.
- Explain the classification system for *Streptococcus* spp.
- Identify the respiratory infections associated with *Streptococcus* spp.
- Identify a clinical isolate based on the results from standard laboratory diagnostic procedures

CONTENTS (Description Headings)

Streptococcus agalactiae

- Classification
- Epidemiology
- Pathogenicity
- Diseases
- Laboratory diagnosis
- Treatment & prevention

Streptococcus pneumoniae

- Physiology & structure
- Pathogenesis & Immunity
- Epidemiology
- Clinical diseases
- Laboratory diagnosis
- Treatment, prevention & control

Streptococcus agalactiae (GBS)

■ Epidemiology

- GI
- Urogenital

■ Pathogenicity

- Capsule
 - is most significant virulence factor
- Enzymes
 - Proteases
 - Hemolysins
 - Beta hemolysis
 - Hyaluronidase

■ Disease

- Puerperal fever
- Vaginitis
- UTI
- Endocarditis
- Osteomyelitis
- Newborn
 - Sepsis
 - **Pneumonia**
 - Meningitis

Streptococcus agalactiae (GBS)

Laboratory Diagnosis

- Antigen detection
 - too insensitive
- Nucleic acid based tests
 - for rectal/vaginal swabs from pregnant women
- Culture
 - Blood agar- β hemolysis; may be difficult to detect or absent **x**
 - LIM broth with colistin & nalidixic acid **✓**

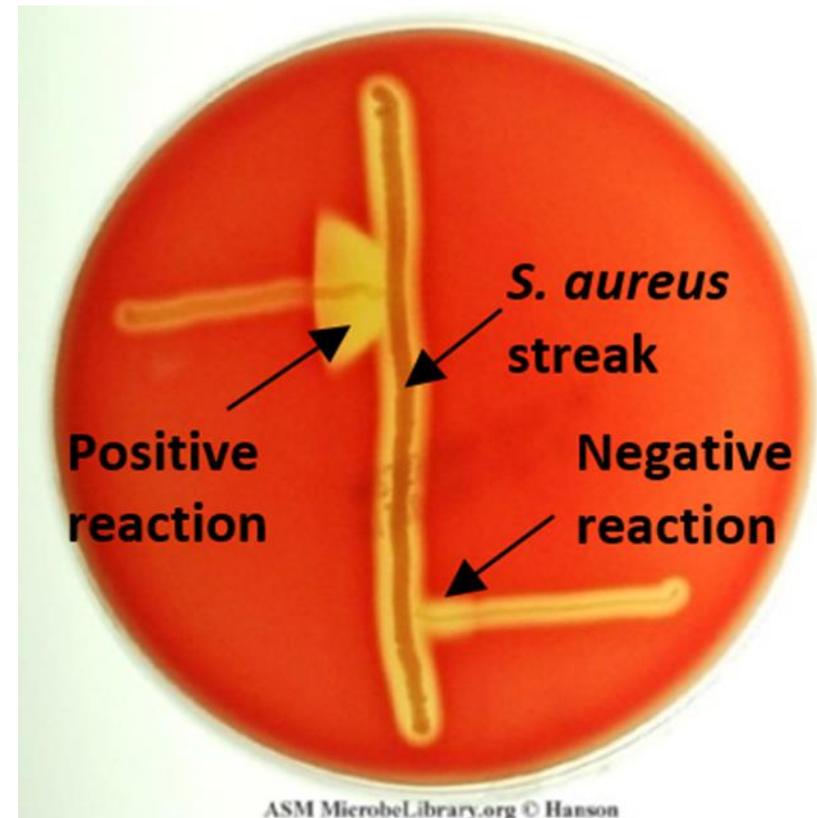


β -hemolytic colonies of *Streptococcus agalactiae*, blood agar 18h at 36°C

Streptococcus agalactiae (GBS)

Identification

- Demonstration of the group-specific cell wall carbohydrate
- CAMP test
 - is used to differentiate group B streptococci (*Streptococcus agalactiae* – positive) from other streptococcal species



CAMP test

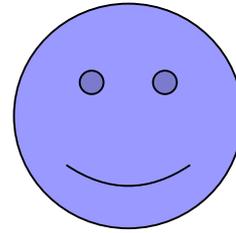
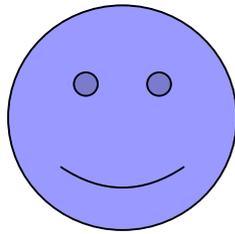
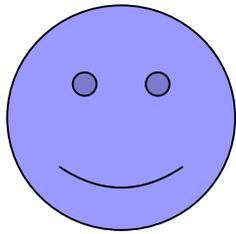
Streptococcus agalactiae (GBS)

Treatment

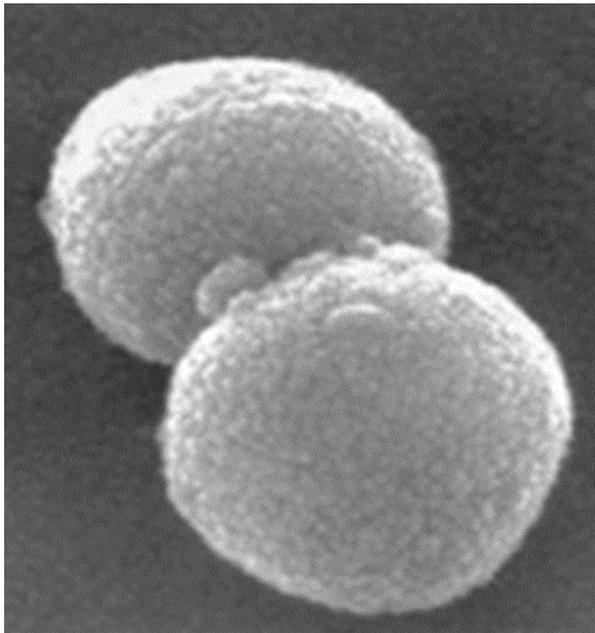
- Penicillin
 - Cephalosporin
 - Vancomycin

Prevention

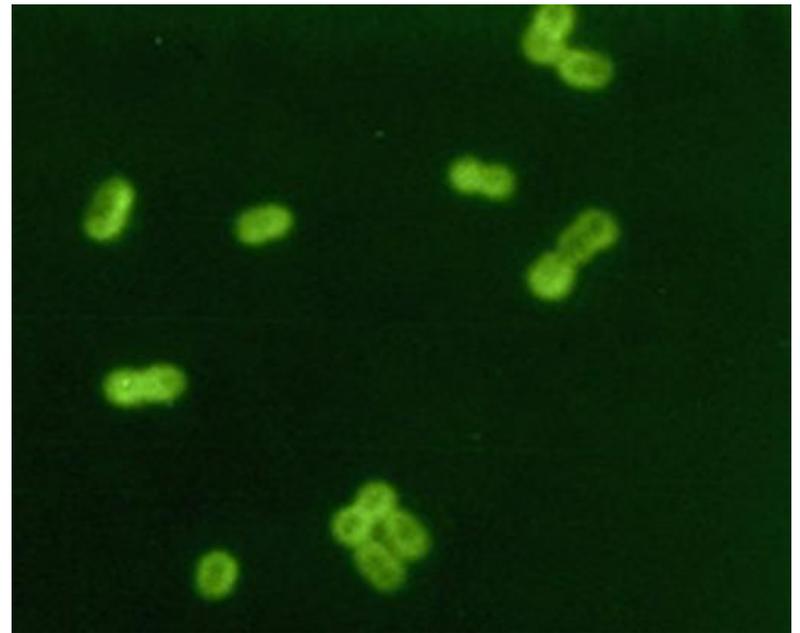
- Screened for colonization of group B streptococci
 - at 35 to 37 weeks' gestation
 - Chemoprophylaxis



Streptococcus pneumoniae



Streptococcus pneumoniae
scanning electron micrograph of a
pair of diplococci. CDC.



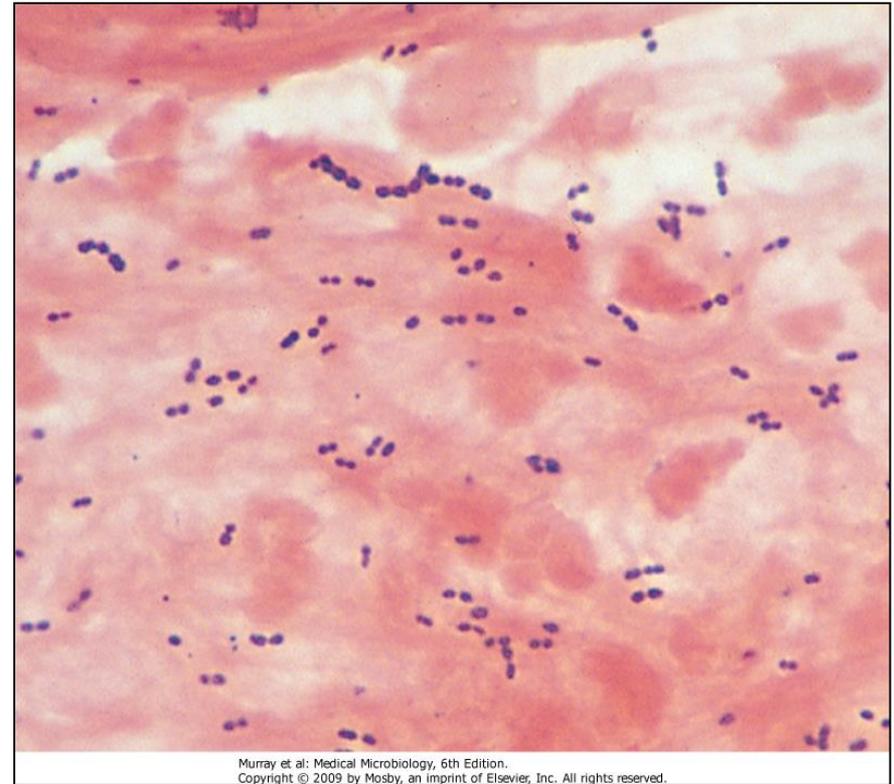
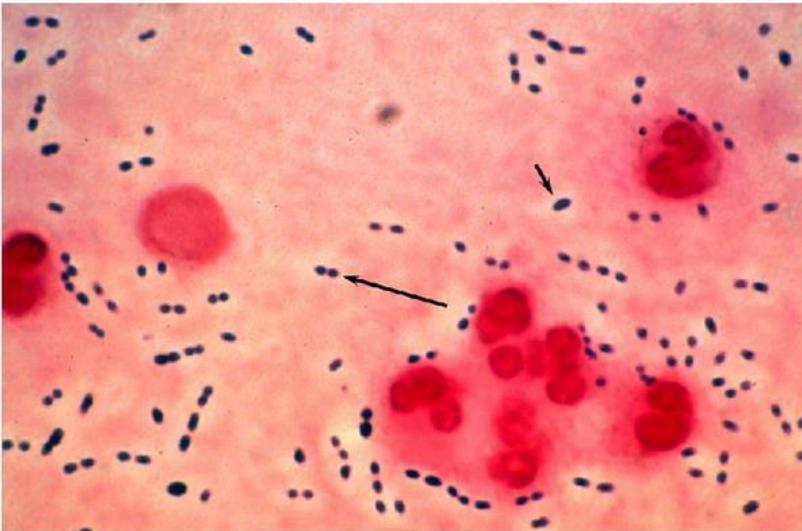
Streptococcus pneumoniae
Fluorescent antibody stain of capsular
material. CDC

Streptococcus pneumoniae

- Physiology & Structure
- Virulence
- Pathogenesis & Immunity
- Epidemiology
- Clinical diseases
- Laboratory diagnosis
 - Microscopy
 - Antigen detection
 - Nucleic acid based tests
 - Culture
 - Identification
- Treatment, prevention & control
 - Vaccines

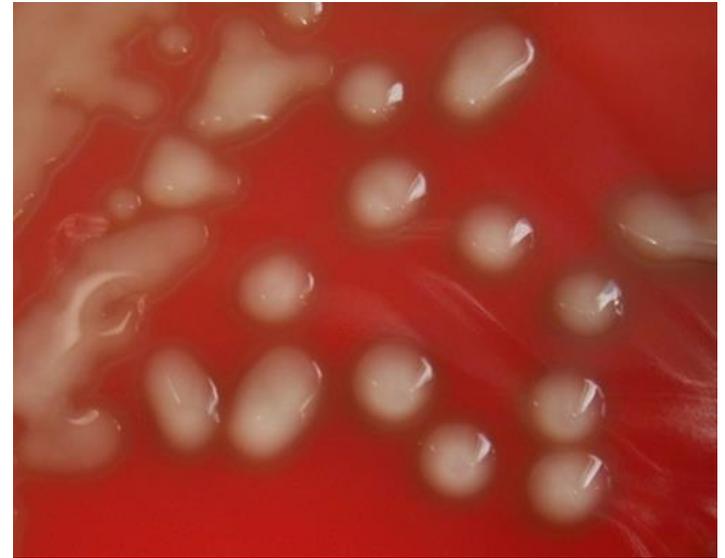
Streptococcus pneumoniae

- Encapsulated, gram positive cocci
 - Can be nonencapsulated
- Diplococci or short chains



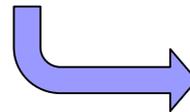
Streptococcus pneumoniae

- Colonies on blood agar;
 - encapsulated strains generally, round, and mucoid
 - nonencapsulated strains smaller and flat



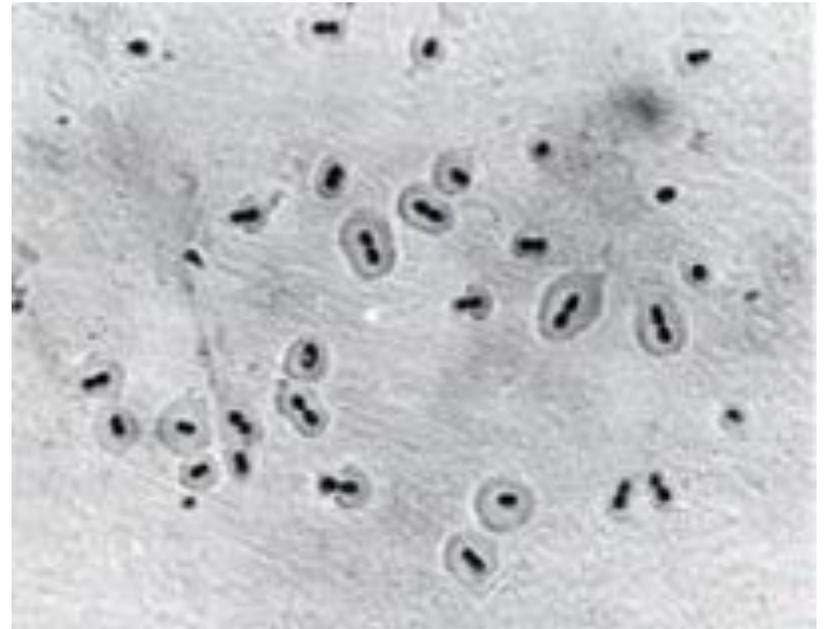
Streptococcus pneumoniae

- α -hemolytic
 - results from production of pneumolysin
- β -hemolytic
 - **if grown anaerobically**
- All colonies undergo autolysis



Streptococcus pneumoniae

- Complex polysaccharide capsule
 - Used for the serologic classification
 - don't have group specific carbohydrate
 - Used in a polyvalent vaccine



<https://microbeonline.com/streptococcus-pneumoniae-pneumococcus-disease-properties-pathogenesis-and-laboratory-diagnosis/>

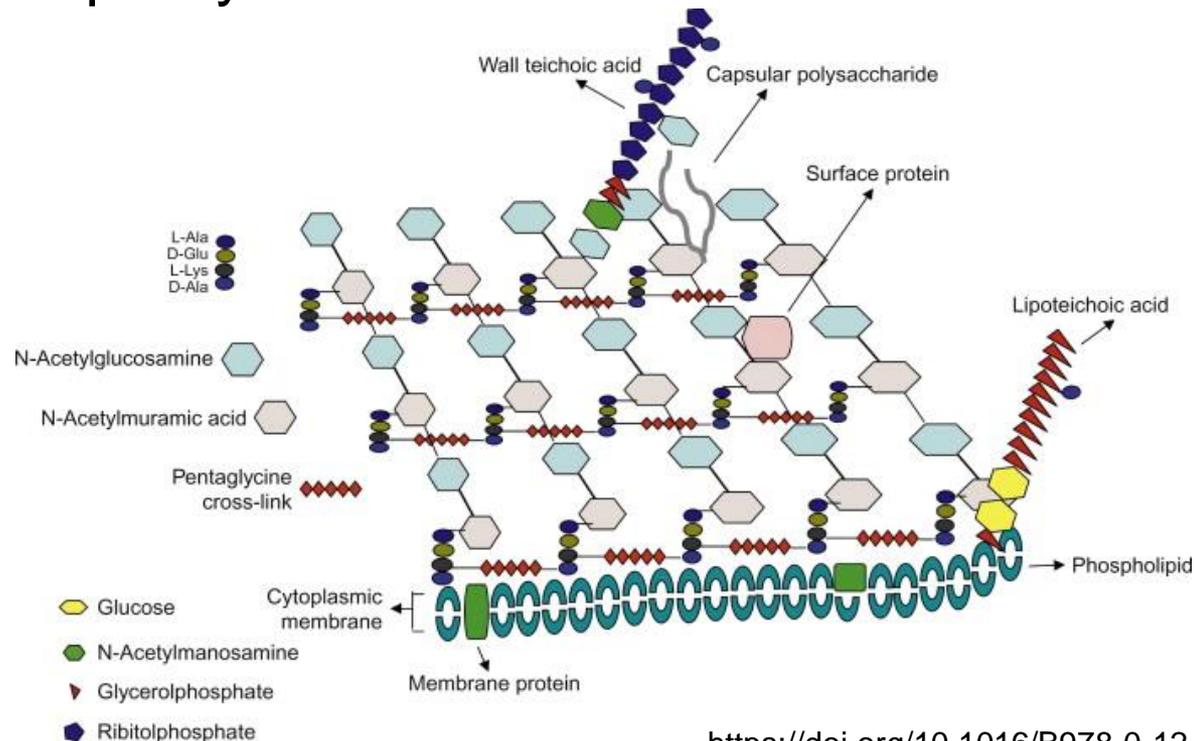
Streptococcus pneumoniae

■ Typical of gram-positive cocci

□ Two forms of teichoic acid;

1. exposed on the cell surface (C polysaccharide)
2. bound to lipids in the bacterial cytoplasmic membrane (F antigen)

□ Phosphoryl choline



Streptococcus pneumoniae

Virulence

■ Capsule

- Encapsulated (smooth) strains can cause disease in humans and experimental animals, whereas nonencapsulated (rough) strains are avirulent
- Antibodies directed against the type-specific capsular polysaccharides protect against disease caused by immunologically related strains
- The capsular polysaccharides are soluble and have been called **specific soluble substances**

Streptococcus pneumoniae

Pathogenesis & Immunity

- The disease depends on primarily by the host response to infection
 - rather than the production of organism-specific toxic factors
- Colonize in the oropharynx
 - by binding to epithelial cells with surface protein adhesins
- Able to spread to the lungs
 - by producing secretory IgA protease and pneumolysin

Streptococcus pneumoniae

Pathogenesis & Immunity

- Teichoic acid and the peptidoglycan fragments
 - activate the alternative complement pathway
- Amidase
 - enhances release of the cell wall components
- Pneumolysin
 - activates the classic complement pathway
- Hydrogen peroxide
 - lead to tissue damage caused by reactive oxygen intermediates
- Cytokines are produced by the activated leukocytes
 - leading to further migration of inflammatory cells to the site of infection

Streptococcus pneumoniae

Epidemiology

- Common inhabitant of the throat and nasopharynx in healthy people
 - The strains of pneumococci that cause disease are the same as those associated with carriage
 - Pneumococcal disease occurs when organisms colonizing the nasopharynx and oropharynx spread to the lungs
- Endogenous oral organisms can be aspirated into the lower airways
- Strains can spread on airborne droplets from one person to another
- Commonly associated with a previously viral respiratory disease

Streptococcus pneumoniae

Clinical Diseases

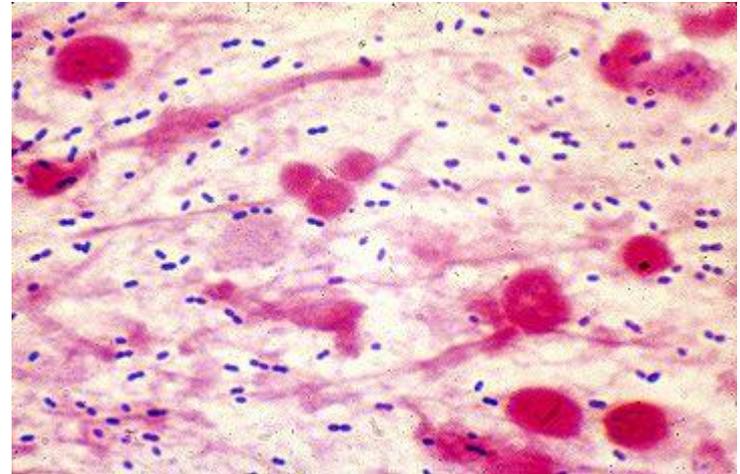
- Pneumonia
- Sinusitis & Otitis Media
- Meningitis
- Bacteremia

Streptococcus pneumoniae

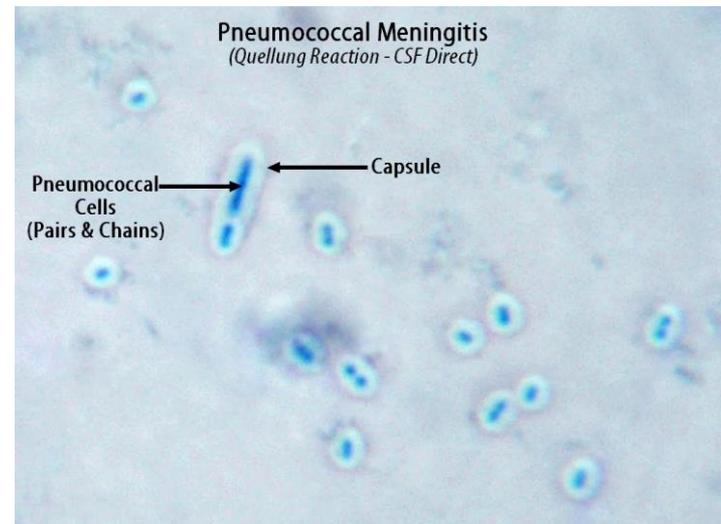
Laboratory Diagnosis

■ Microscopy

- Gram stain of sputum
 - elongated pairs of gram-positive cocci surrounded by an unstained capsule
- Quellung reaction



Pneumococcus in sputum



Quellung reaction

Streptococcus pneumoniae

Laboratory Diagnosis

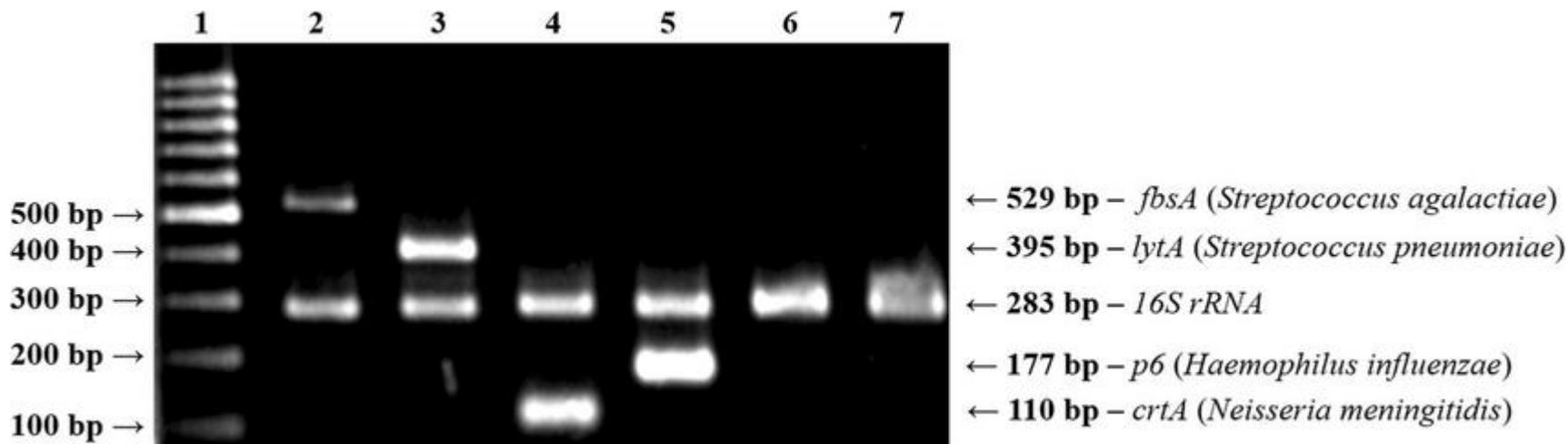
- Antigen detection
 - Sample: Urine
 - Sensitivity: ~ 70%
 - is not recommended for children



Streptococcus pneumoniae

Laboratory Diagnosis

- Nucleic acid based tests
 - PCR
 - Molecular panels



Streptococcus pneumoniae

Laboratory Diagnosis

■ Culture

- Specimen: Sputum
- Media: 5% Sheep Blood Agar
- Incubation conditions: 5% to 10% carbon dioxide
- Duration: 24-48 hr
- Colonial appearance: Small, grey, glistening; may be umblicated; may be mucoid; alpha-hemolytic



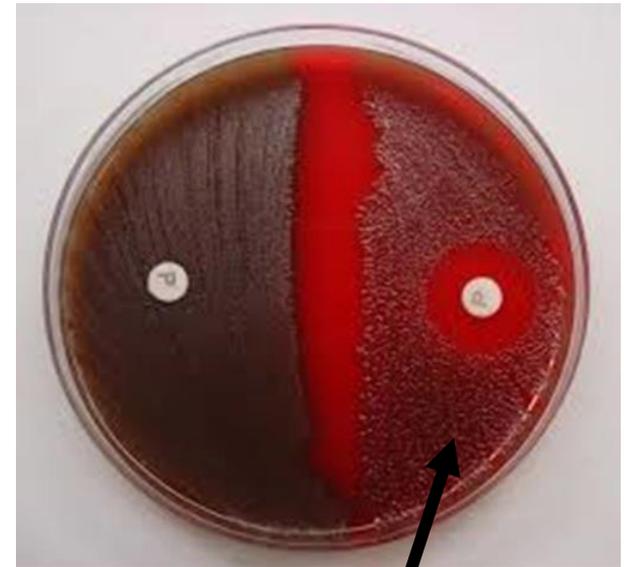
Streptococcus pneumoniae

Laboratory Diagnosis

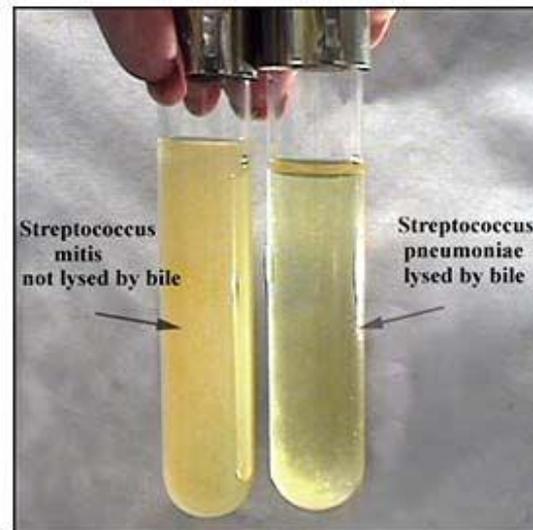
■ Identification

- Bile solubility test
- Susceptibility to optochin
 - ethylhydrocupreine dihydrochloride

Bile Solubility Test



S.pneumoniae



Streptococcus pneumoniae

Treatment

- Penicillin resistance emerging
 - decreased affinity of PBP's to penicillin
- Resistance to macrolides and cephalosporins spreading
- **In vitro susceptibility tests required**
- Combination treatment with vancomycin and ceftriaxone
 - until in vitro susceptibility results are available

Streptococcus pneumoniae

Prevention & Control / Vaccines

- 23-valent pneumococcal polysaccharide vaccine
 - For children older than 2 years of age and adults
 - Single dose

- 13-valent conjugated pneumococcal vaccine
 - Infants younger than 2 years of age
 - A series of 4 doses (at 2, 4, 6, and 12 to 15 months)

CDC recommendations for vaccine

The pneumococcal conjugate vaccine, **PCV13 or Prevnar 13[®]**, is currently recommended for all children younger than 5 years of age, all adults 65 years or older, and persons 6 through 64 years of age with certain medical conditions.

Pneumovax[®] is a **23-valent** pneumococcal polysaccharide vaccine (PPSV23) that is currently recommended for use in **all adults 65 years of age** or older and for persons **who are 2 years and older and at high risk for pneumococcal disease** (e.g., those with sickle cell disease, HIV infection, or other immunocompromising conditions). PPSV23 is also recommended for use in adults 19 through 64 years of age who smoke cigarettes or who have asthma.

References

- Medical Microbiology; Murray, Rosenthal, Pfaller; 7th Ed; Elsevier Saunders; 2013
- Jawetz, Melnick & Adelberg's Medical Microbiology; Brooks G, Carroll KC, Butel J, Morse S (Eds); 27th Ed; McGraw Hill Lange; 2016
- Sherris Medical Microbiology; 6th Ed; Ryan KJ, Ray CG; McGraw Hill Education; 2014



**KEEP
CALM**

AND

**THANKYOU FOR
LISTENING**