STREPTOCOCCUS

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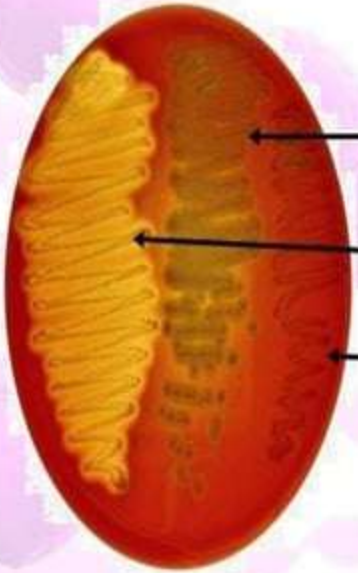
Streptococci is Gram-positive spherical/ovoid cocci arranged in long chains; commonly in pairs.

- **Classification** of streptococci includes;
  - Classification system is based on hemolysis reactions.
    - β - hemolytic – A, B, C, D and G (S. pyogenes)
    - α - hemolytic – *S. pneumoniae* and *viridans*
    - γ – hemolytic – S.faecalis
  - Lancefield classification of b - hemolytic streptococci based on presence of carbohydrate antigen in cell wall – 17 groups (A, B, C,….)



alpha hemolysis – partial; *S. pneumoniae*

beta hemolysis – complete; *S. pyogenes*

gamma hemolysis – none; *E. faecalis*

Human Streptococcal Pathogens

- S. Pyogenes
- S. Viridans
- S. Pneumoniae
- S. Faecalis

General Characteristics of Streptococci

- Gram-positive spherical/ovoid cocci arranged in long chains; commonly in pairs.
- Non-spore-forming, nonmotile.
- Can form capsules
- Facultative anaerobes
- Most parasitic forms are fastidious and require enriched media.
- Small, non pigmented colonies.
- Sensitive to drying, heat, and disinfectants.

S. Pyogenes

- Most serious streptococcal pathogen. It a parasite and inhabits throat, nasopharynx, occasionally skin.

Morphology

- Gram-positive
- Spherical/ovoid cocci arranged in long chains.
- Nonmotile.
- Can form capsules.

Cultural characteristics

- Facultative anaerobes.
- Best growth achieved at pH 7.4-7.6 and temperature 37^0C.
- Required enriched media for growth.
- Colonies are around 1mm in diameter, surrounded by a zone of clear hemolysis, semi transparent and vary in appearance.

Biochemical properties

- Produces many virulence factors. i.e production of enzymes and toxins.

Virulence factors of S. Pyogenes

- **Enzymes**:
  - Streptokinase – digests fibrin clots
  - Hyaluronidase – breaks down connective tissue
  - DNase – hydrolyzes DNA
- **Toxins :**
  - Streptolysins (hemolysins):- streptolysin O (SLO) and streptolysin S (SLS) – both cause cell and tissue injury.
  - Erythrogenic toxin (pyrogenic):- Induces fever and typical red rash.
  - Superantigens:- Strong monocyte and lymphocyte stimulants; cause the release of tissue necrotic factor.

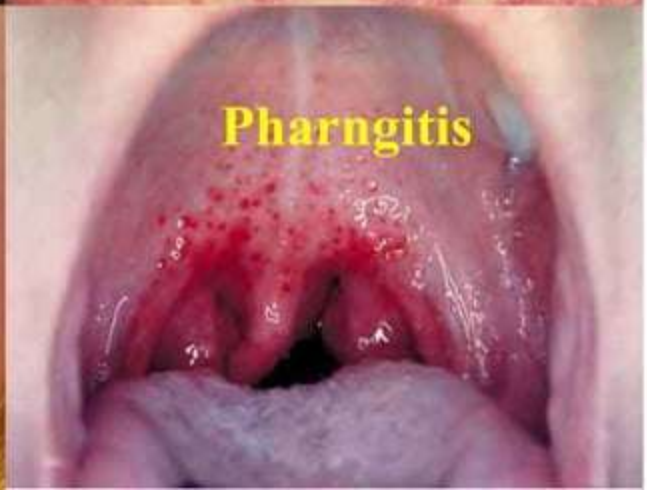
Pathogenesis

- Humans are the only reservoir.
- In apparent carriers.(visible carriers of toxins and enzyme)
- Transmission is through contact, droplets, food, fomites
- Portal of entry is generally through skin or pharynx.
- Children are predominant group affected for cutaneous and throat infections
- Systemic infections and progressive diseases may occur if untreated.

S. pyogenes diseases

- **Impetigo (pyoderma)-** It is a skin infection with superficial lesions that break and form highly contagious crust.
- **Throat infections**
- **Rheumatic fever –** It has subclinical pharyngitis in children; carditis with extensive heart valve damage possible, arthritis, chorea, fever.
- **Acute glomerulonephritis –** It is the inflammation of the nephrons.


Impetigo


Pharngitis

Laboratory diagnosis

- S. pyogenes is frequently isolated from samples such as skin, throat, sputum, urine, and blood.
- Different methods for laboratory diagnosis of S. pyogenes are:
  - ❖Gram staining
  - ❖Culture
  - ❖Catalase test

❖**Gram staining**

The diagnosis is suggested by the finding of gram positive bacteria cocci in chains in the sample.

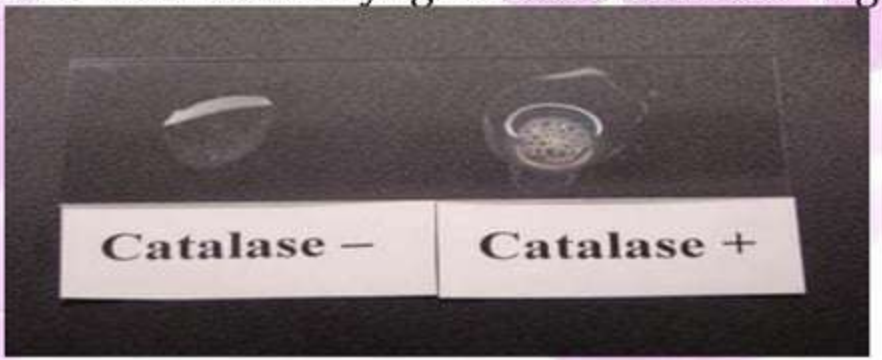
❖**Culture**

The organism is cultured on blood agar with an added bacitracin antibiotic disk to show beta-hemolytic colonies and sensitivity (zone of inhibition around the disk) for the antibiotic.

❖ Catalase test

Transfer a small amount of bacterial colony to a surface of clean, dry glass slide using a loop or sterile wooden stick. Place a drop of 3% H_2O_2 on to the slide and mix.

A positive result is the rapid evolution of oxygen (within 5-10 sec.) as evidenced by bubbling. A negative result is no bubbles or only a few scattered bubbles. S. Pyogenes are catalase negative.



Treatment

- S. Pyogenes infections are treated with penicillin
- Erythromycin is recommended for patients who are allergic to penicillin.

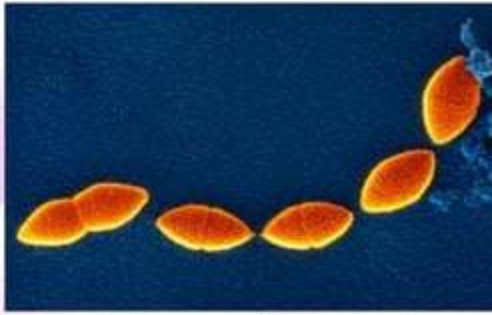
Prevention

- Long-term penicillin prophylaxis for people with a history of rheumatic fever or recurrent strep throat.
- *S. Pyogenes* infections are best prevented through effective hand hygiene.

STREPTOCOCCUS PNEUMONIAE

These are commonly seen in nasopharynx of healthy persons. It will not cause any illness itself unless a viral infection or other factors provokes.

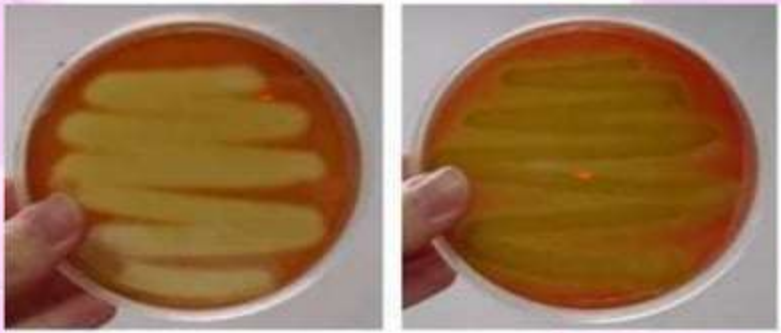
Morphology



- They are gram positive cocci.
- Measures 0.5 – 1.25 µm
- Non motile and non sporing
- Capsulated
- Small, oval-shaped cells arranged in pairs and short chains.

Cultural characteristics

- Culture requires blood or chocolate agar.
- Growth improved by 5-10% CO_2.
- Facultative anaerobes.
- Best growth achieved temperature 25 - 40^{0}C.
- Colonies are surrounded by greenish hemolysis under aerobic conditions and clear under anaerobic conditions.



Biochemical properties

- No significant toxin is produced in pneumococci.
- Presence of some of the extra cellular products
  - Haemolysin
  - Immunoglobilin A1 protease
  - Neuraminidase
  - Hyaluronidase
- Lack catalase and peroxidases.
- Ferment glucose, lactose and sucrose with production of acid.

Pathogenesis

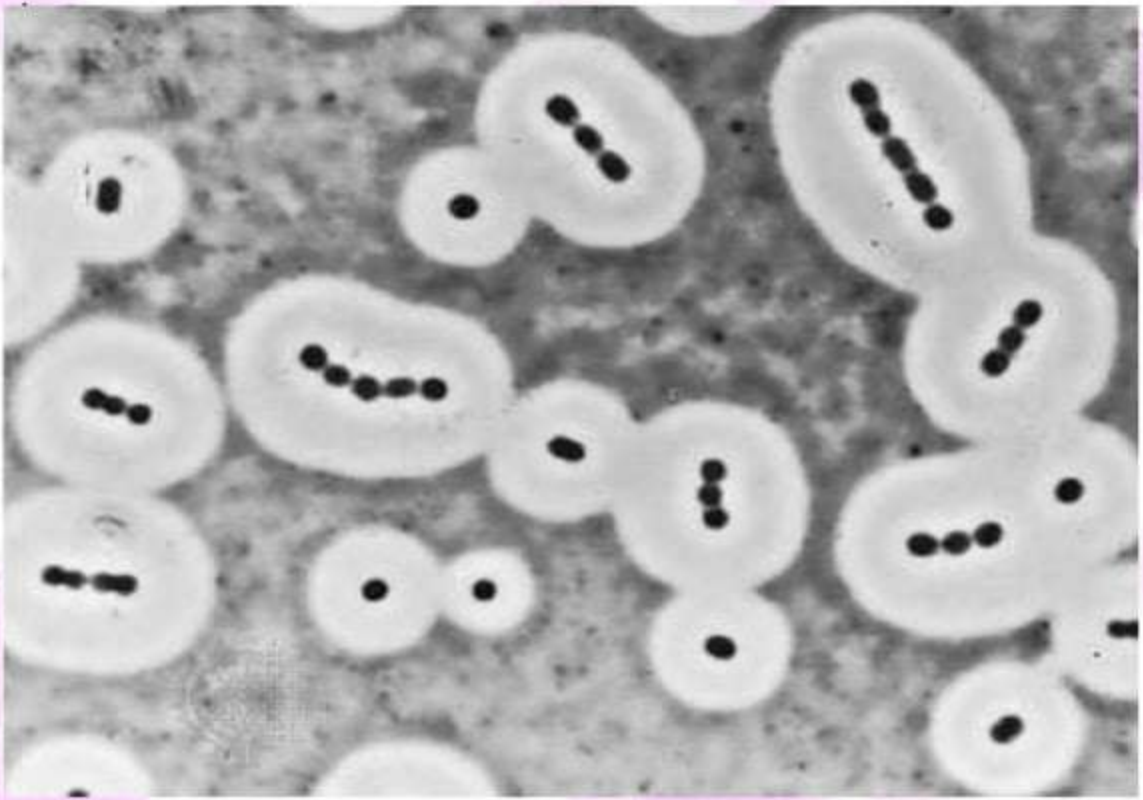
- 5-50% of all people carry it as normal flora in the nasopharynx.
- Young children, elderly, immune compromised, those with other lung diseases or viral infections, are at risk.
- Pneumococci multiply and induce an inflammatory response.
- Gains access to middle ear by way of eustachian tube.

Pneumococci diseases

- Pneumonia : infection of lung parenchyma.
- Otitis media : infection of middle ear

Laboratory diagnosis

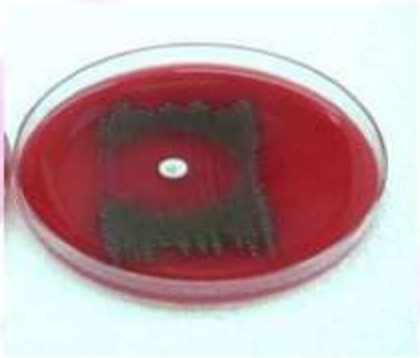
- S. Pneumococci is frequently isolated from samples such as sputum, blood, wound, CSF.
- Different methods for laboratory diagnosis of S. Pneumococci are:
  - ❖Gram staining
  - ❖Quellung test
  - ❖Culture
  - ❖Catalase test



❖ **Culture**

The organism is cultured on blood agar or chocolate agar with incubation in an environment of carbon dioxide.

The organism is cultured on blood agar with an added optochin disk to show alpha-hemolytic colonies.



❖ **Catalase test**

S. pneumococci is catalase negative.

Treatment and Prevention

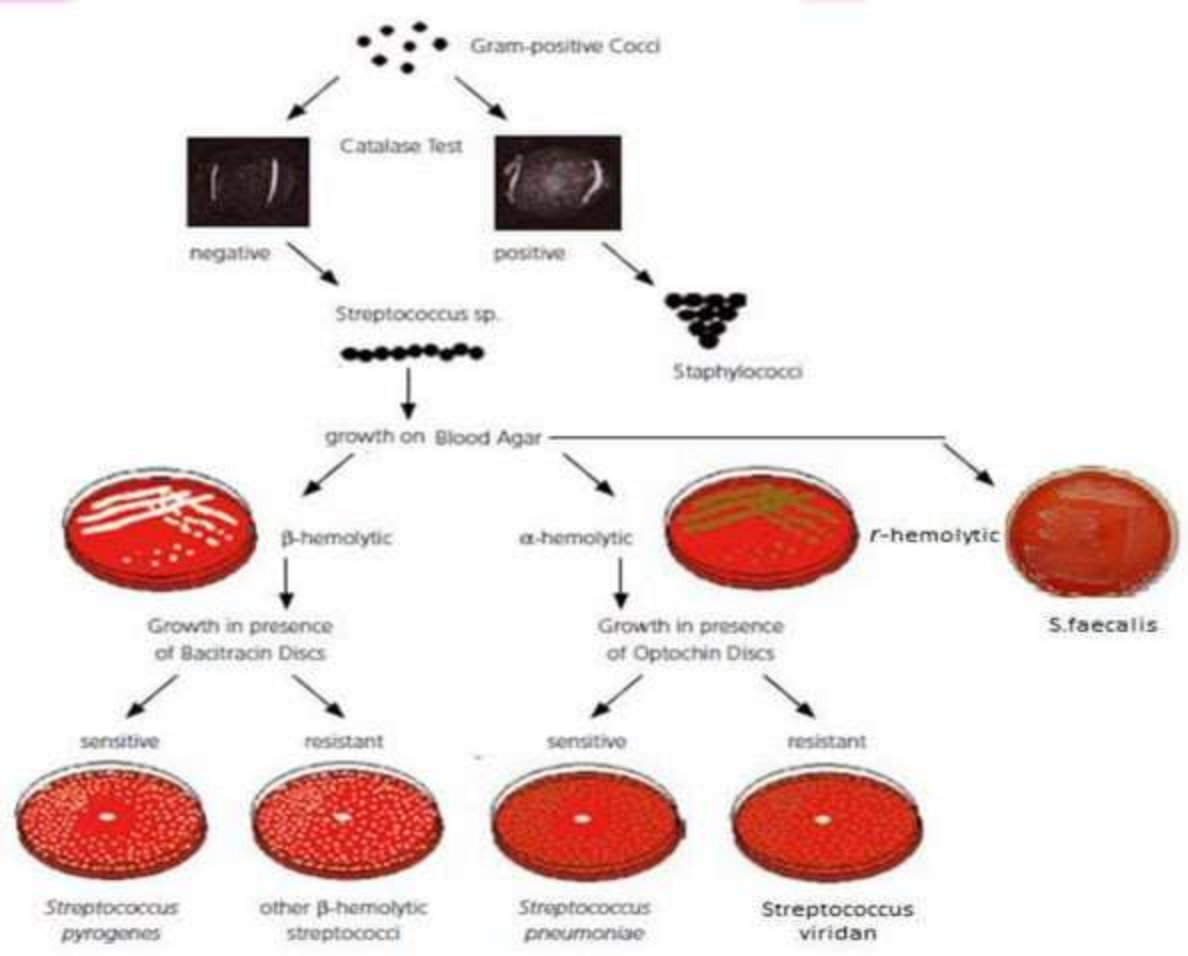
- Traditionally treated with penicillin G or V.
- Broad spectrum antibiotics are recommended for patients who are allergic to penicillin.
- Two vaccines available for high risk individuals:
  - Capsular antigen vaccine for older adults and other high risk individuals – effective 5 years.
  - Conjugate vaccine for children 2 to 23 months.

S. Viridans

- It is alpha haemolytic streptococci.
- It is oval in shape and found in short chains.
- It has six species groups (viridans group);
  S. mutans, S. oralis, S. salivarus,
  S. sanguis, S. milleri, S. mitis
- Found in gums and teeth, oral cavity, and also in nasopharynx, genital tract, skin.
- Not very invasive; dental or surgical procedures facilitate entrance.
- It causes dental caries, sepsis and endocarditis.
- Persons with preexisting heart conditions should receive prophylactic antibiotics before surgery or dental procedures.

S. Faecalis

- It is also known as enterococci.
- It is a Gram-positive
- Oval cocci in pairs or short chains.
- Identified in MaConkey agar. Colonies are magenta in color and pin point.
- It can grow in the range of 10 to 45°C and survive at temperatures of 60°C for 30 min.
- It is non-motile, facultative anaerobic microbe.
- It ferments glucose and does not produce a catalase.
- It is associated with urinary tract infections, biliary tract infections, septicemia, endocarditis and intra abdominal abscess.
- Aminogycosides are drug of choice.


Gram-positive Cocci
Catalase Test
negative
positive
Streptococcus sp.
Staphylococci
growth on Blood Agar
β-hemolytic
α-hemolytic
r-hemolytic
S.faecalis
Growth in presence of Bacitracin Discs
Growth in presence of Optochin Discs
sensitive
resistant
sensitive
resistant
Streptococcus pyrogenes
other β-hemolytic streptococci
Streptococcus pneumoniae
Streptococcus viridan

THANK YOU