

STREPTOCOCCAL INFECTIONS

Streptococci

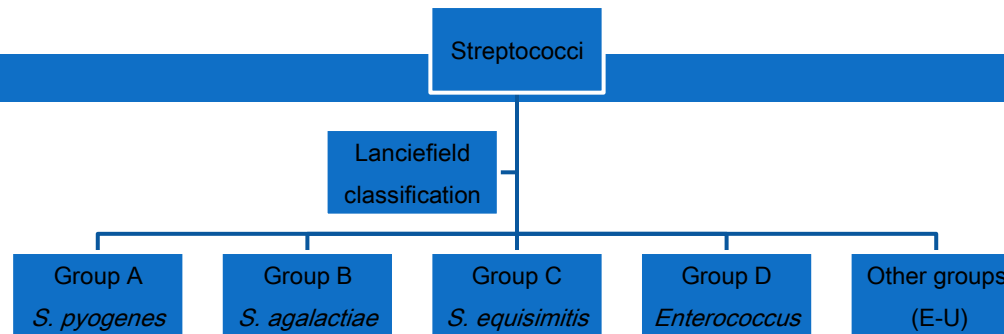
- ▣ Gram positive cocci
- ▣ Chains or pairs
- ▣ Usually capsulated



Classification of Streptococci

- Streptococci can be classified according to:
 - Oxygen requirements
 - Anaerobic (*Peptostreptococcus*)
 - Aerobic or facultative anaerobic (*Streptococcus*)
 - Serology .
 - Hemolysis on Blood Agar (BA)

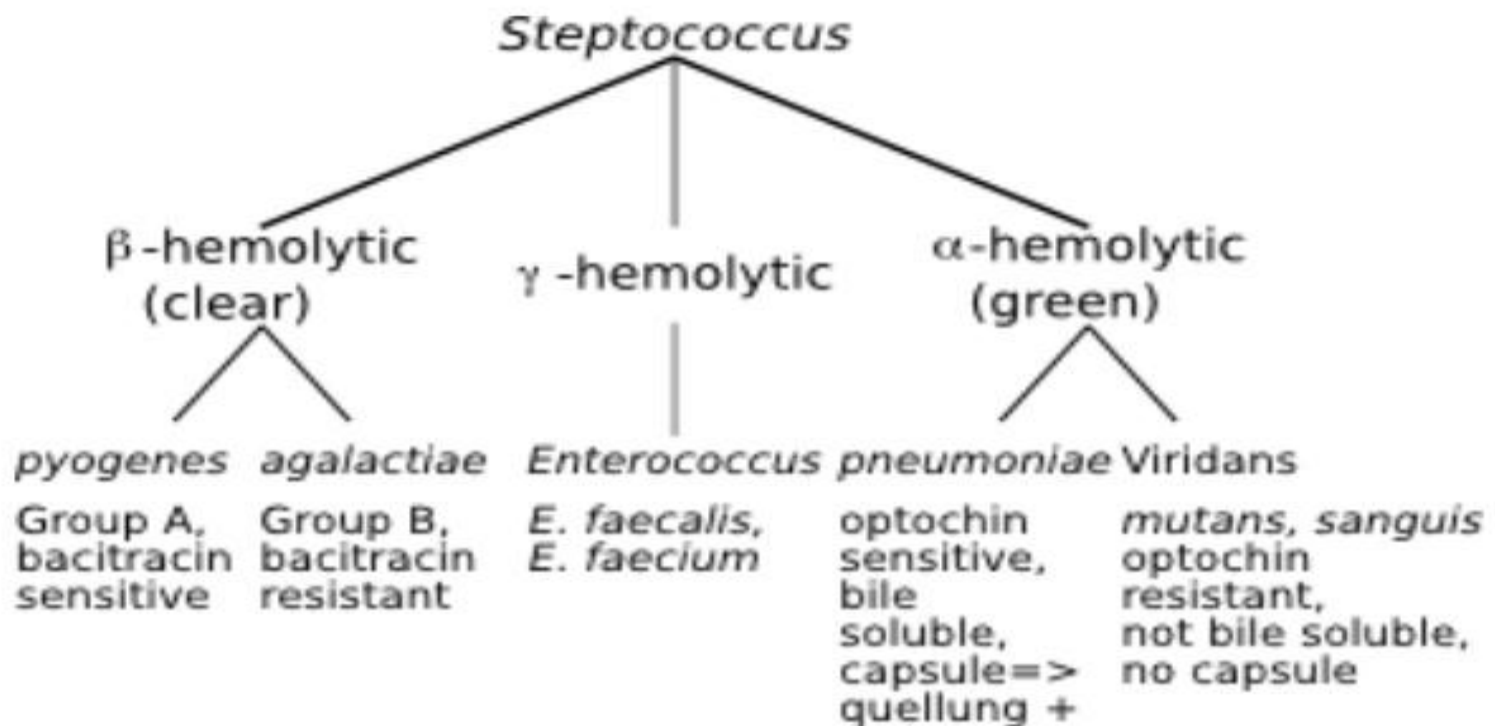
Serology: Lancefield Classification



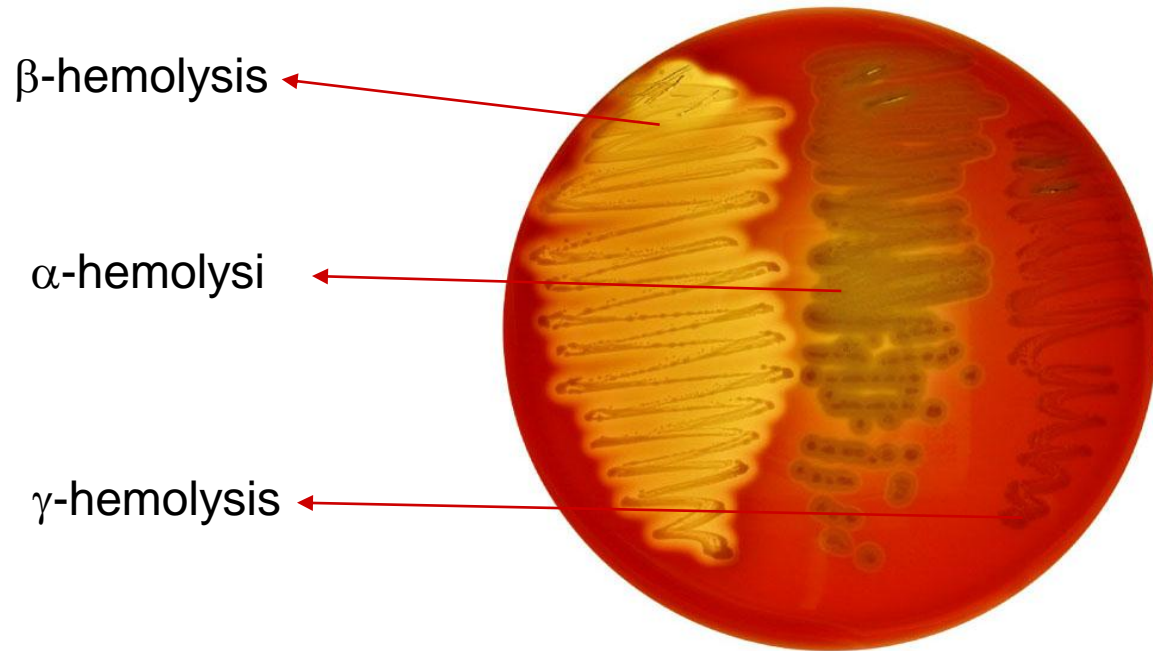
- Streptococci classified into many groups from A-K & H-V
- One or more species per group
- Classification based on C- carbohydrate antigen of cell wall
 - ▣ Groupable streptococci
 - A, B and D (more frequent)
 - ▣ Non-groupable streptococci
 - *S. pneumoniae* (pneumonia)
 - viridans streptococci
 - e.g. *S. mutans*
 - Causing dental carries

Classification of Streptococci Based on Hemolysis on Blood Agar

Brown`s classification



Hemolysis on Blood agar



Pathogenesis and Virulence Factors

- Structural components
 - M protein M, which interferes with opsonization and lysis of the bacteria
 - Lipoteichoic acid & F protein → adhesion
 - Hyaluronic acid capsule, which acts to provokes no immune response to the bacteria
- Enzymes
 - Streptokinases
 - Deoxynucleases
 - C5a peptidase

→ facilitate the spread of streptococci through tissues
- Pyrogenic toxins that stimulate macrophages and helper T cells to release cytokines
- Streptolysins
 - Streptolysin O lyse blood cells.
 - Streptolysin S

Human Streptococcal Pathogens

- *S. pyogenes*
- *S. agalactiae*
- Viridans streptococci
- *S. pneumoniae*
- *Enterococcus faecalis*

Streptococcus pyogenes

Pyogenes means pus producing

- One of the most important pathogens
- Gram positive cocci in chains
- Lancefield Serological Group A

Hemolysis on Blood Agar Plates

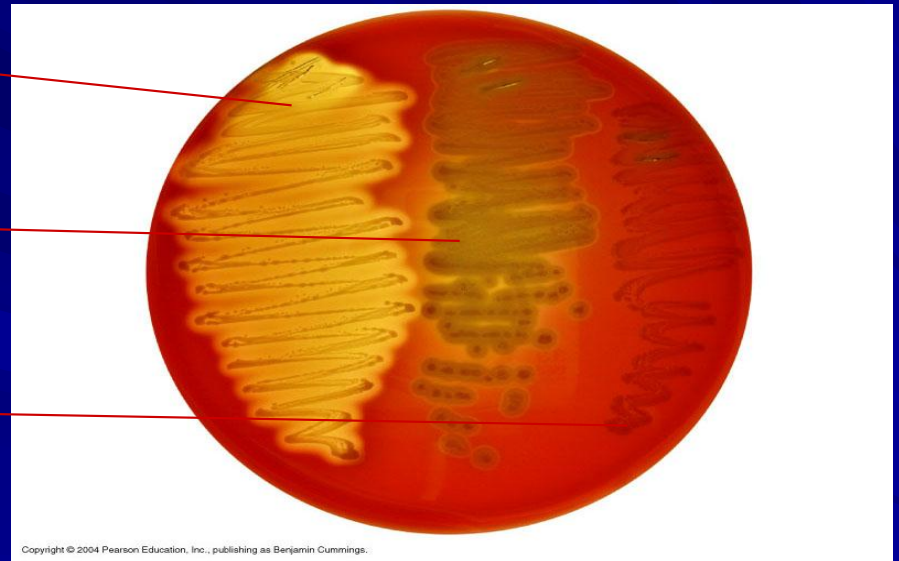
- **Beta hemolysis**-organisms excrete potent hemolysins which completely lyse RBC (complete hemolysis) thus a clear zone appears around colony.
S. pyogenes

Hemolysis on Blood agar

β -hemolysis

α -hemolysis

γ -hemolysis



Disease caused by *S. pyogenes*

- Suppurative
 - Non-Invasive
 - Pharyngitis (“strep throat”)-inflammation of the pharynx
 - Skin inf
 - Invasive
 - Scarlet fever-rash that begins on the chest and spreads across the body
 - Pyoderma-confined, pus-producing lesion that usually occurs on the face, arms, or legs
 - Necrotizing fasciitis-toxin production destroys tissues and eventually muscle and fat tissue
- Non Suppurative
 - Rheumatic fever: Life threatening inflammatory disease that leads to damage of heart valves muscle
 - Glomerulonephritis
 - Immune complex disease of kidney
 - inflammation of the glomeruli and nephrons which obstruct blood flow through the kidneys

Clinical Diseases

Skin infections

- **Impetigo (pyoderma)** – superficial lesions that break and form highly contagious crust; often occurs in epidemics in school children; also associated with insect bites, poor hygiene, and crowded living conditions
- **Erysipelas/Cellulitis** – pathogen enters through a break in the skin and eventually spreads to the dermis and subcutaneous lymphatics.

Throat infections

- **Streptococcal pharyngitis** – strep throat

Beta-Hemolytic *Streptococcus pyogenes*

- Superficial infections

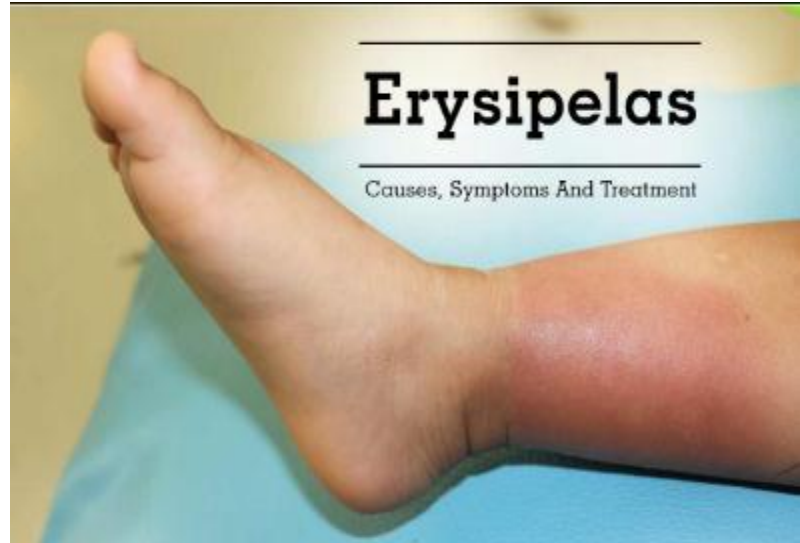
- Skin

- Superficial – Impetigo or pyoderma
 - Invasive – cellulitis or erysipelas

- Pharynx

- Pharyngitis – strep throat
 - Tonsillitis





Scope of Clinical Disease

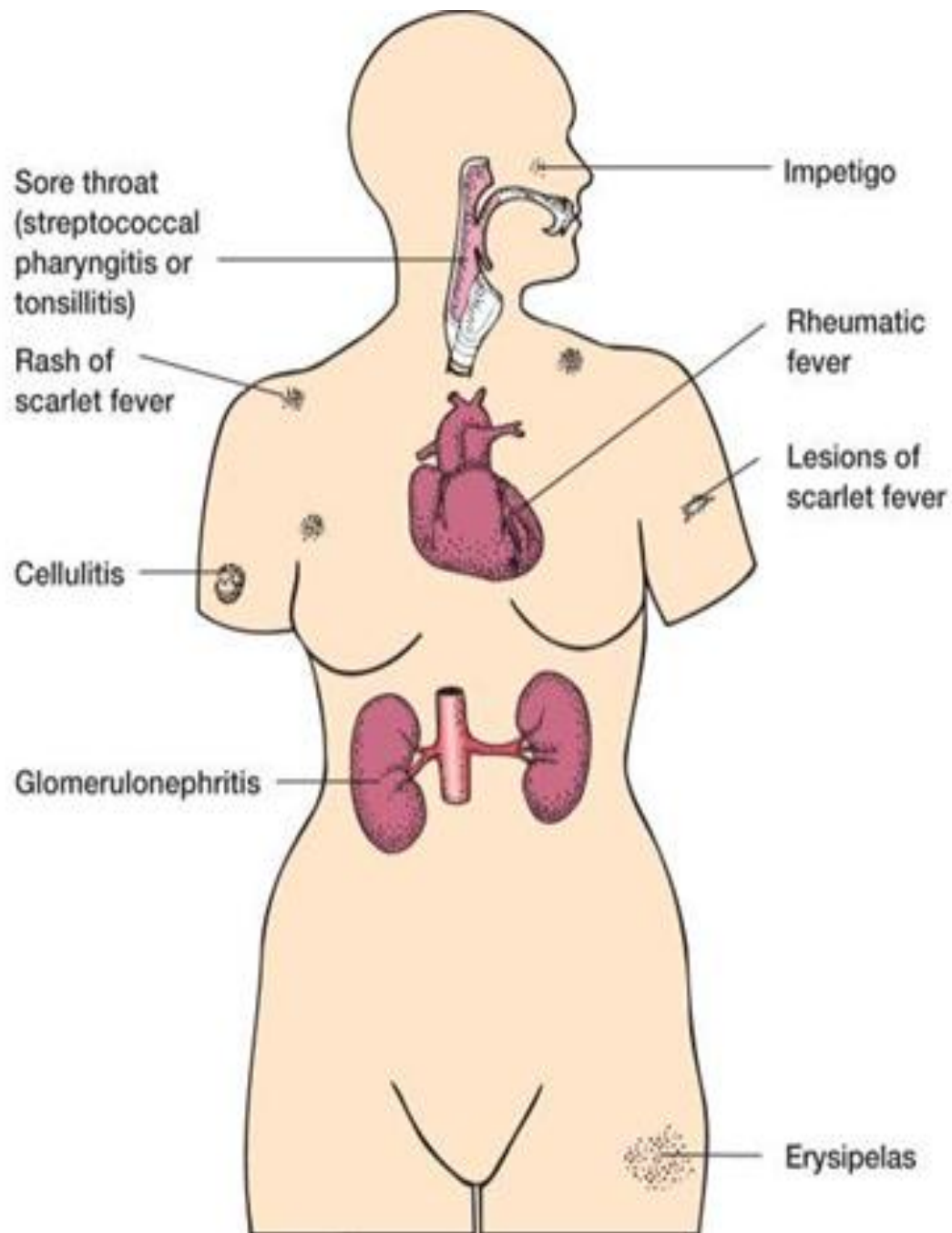
Systemic infections

- **Scarlet fever** – strain of *S. pyogenes* carrying a prophage that codes for pyrogenic toxin; can lead to sequelae
- Septicemia
- Pneumonia
- Streptococcal toxic shock syndrome



How to spot scarlet fever

- Fine red rash, feels like sandpaper
- White coating on tongue that peels after few days leaving it swollen and red (AKA "strawberry tongue")
- Fever over 38.3 C (101F)
- Flushed red face, but pale around mouth
- Swollen glands on neck



Strep Throat

- Most common of all Strep diseases
- Spread by saliva or nasal secretions
- Incubation period 2-4 days
- Sore throat, slight fever (101)
- Important to treat immediately to avoid post strep diseases



Strawberry Tongue-scarlet fever



Sandpaper rash



Poststreptococcal diseases

- **Rheumatic Fever**-autoimmune disease involving heart valves, joints, nervous system. Follows a strep throat
- **Acute glomerulonephritis** -inflammatory disease of renal glomeruli and structures involved in blood filter of kidney. Due to deposition of Ag/Ab complexes

Erythema marginatum



Shutterstock



Nodules



Shutterstock

Streptococcus Pneumonia

- Caused by infection with *Streptococcus pneumoniae*
- Gram positive, alpha hemolytic, not of lancefield serotype A
- Often part of normal flora of respiratory track and becomes infective once hosts resistance is lowered. Classified as an **endogenous infection**.

- Alpha hemolysis-organism excretes hemolysins which partially break down rbc (incomplete hemolysis) thus a greenish zone appears around colony. *S. pneumoniae*

A 45-year-old male presented with a 1-day history of fevers, shaking chills, and productive cough. He stated that he was coughing up blood-tinged sputum that had a rusty appearance. The patient also remarked that he had some left-sided chest pain that was worse when he breathed in or coughed (pleuritic pain) and some dyspnea (shortness of breath).

He denied any significant past medical history, and was not taking any medications. He reported a 20-pack per-year history of smoking.

On physical exam he has a normal built and was in moderate distress. His temperature was 40°C, pulse 110 beats per minute, blood pressure 140/80 mmHg

- respiratory rate 24, and O2 saturation 90% on room air. His lung examination revealed decreased breath sounds and dullness to percussion in the left lower lung base. There
- were some crepitations and bronchial breathing present.
- A sputum sample and blood were collected and a chest X-ray was ordered.



Strep pneumonia

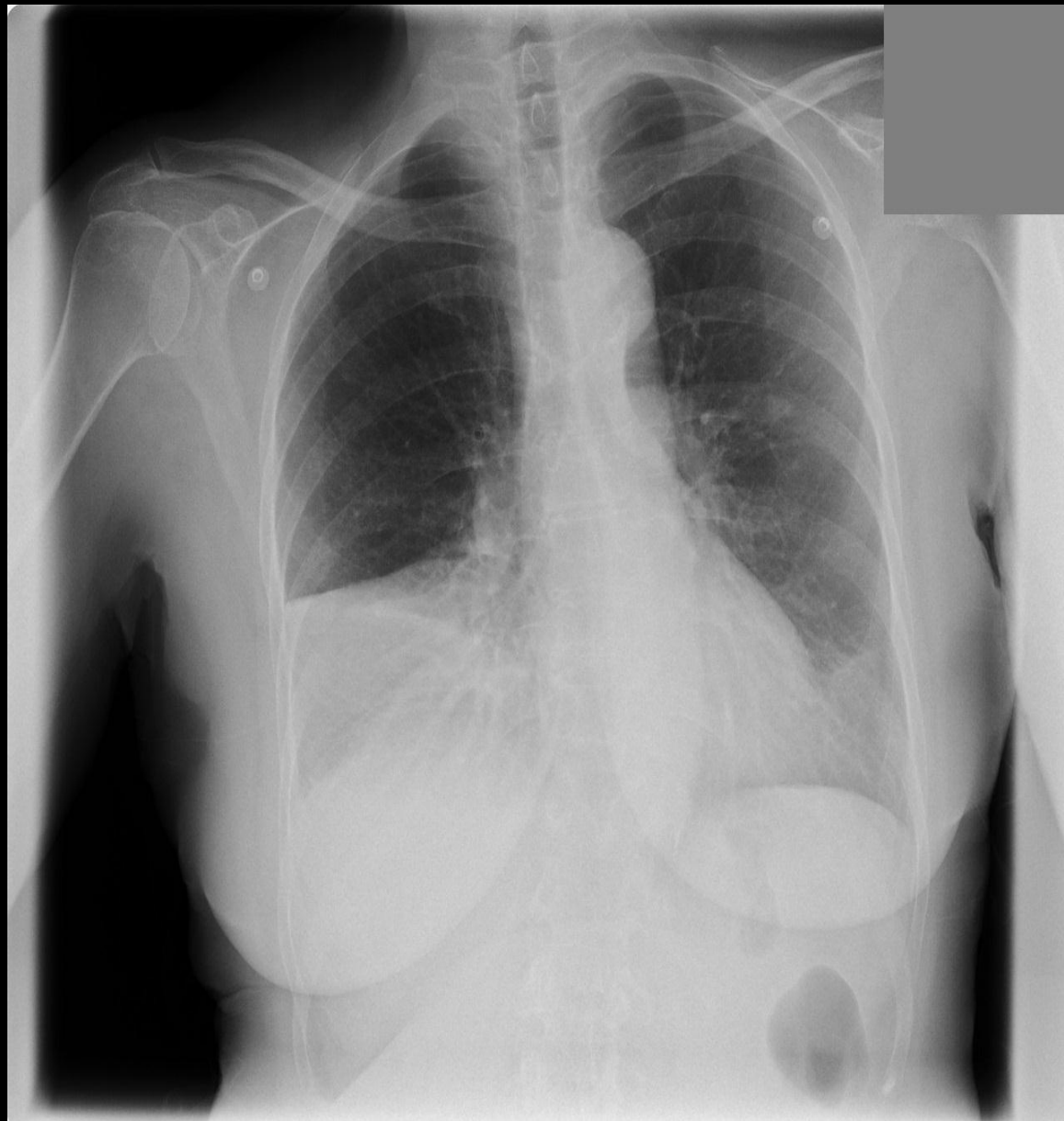
- **Predisposing factors:** upper respiratory viral infection, diabetes, alcoholism
- 60-80% of all pneumonias

Symptoms of Strep Pneumonia

- Onset abrupt
- Chest pain
- Chills
- Labored breathing

Right upper lobe

Lobar pneumonia



Treatment of Strep Pneumonia

- **Treatment:**

- Penicillin, ampicillin, amoxycillin
- Cephalosporins 2-3 gen.
- Macrolides

- Pneumococcal vaccine (Pneumovax 23 or Pnu-immune 23) is available for the elderly

Group B: *Streptococcus agalactiae*

- Regularly resides in human vagina, pharynx and large intestine
- Can be transferred to infant during delivery and cause severe infection
 - most prevalent cause of neonatal pneumonia, sepsis, and meningitis
 - Pregnant women should be screened and treated.
- Wound and skin infections and endocarditis in debilitated people

Group D Enterococci and Groups C and G Streptococci

- Group D:
 - *Enterococcus faecalis*, *E. faecium*, *E. durans*
 - normal colonists of human large intestine
 - cause opportunistic urinary, wound, and skin infections, particularly in debilitated persons

α -Hemolytic Streptococci: Viridans Group

- Large complex group
 - *Streptococcus mutans*, *S. oralis*, *S. salivarius*,
S. sanguis, *S. milleri*, *S. mitis*
- Most numerous and widespread residents of the gums and teeth, oral cavity and also found in nasopharynx, genital tract, skin
- Not very invasive; dental or surgical procedures facilitate entrance

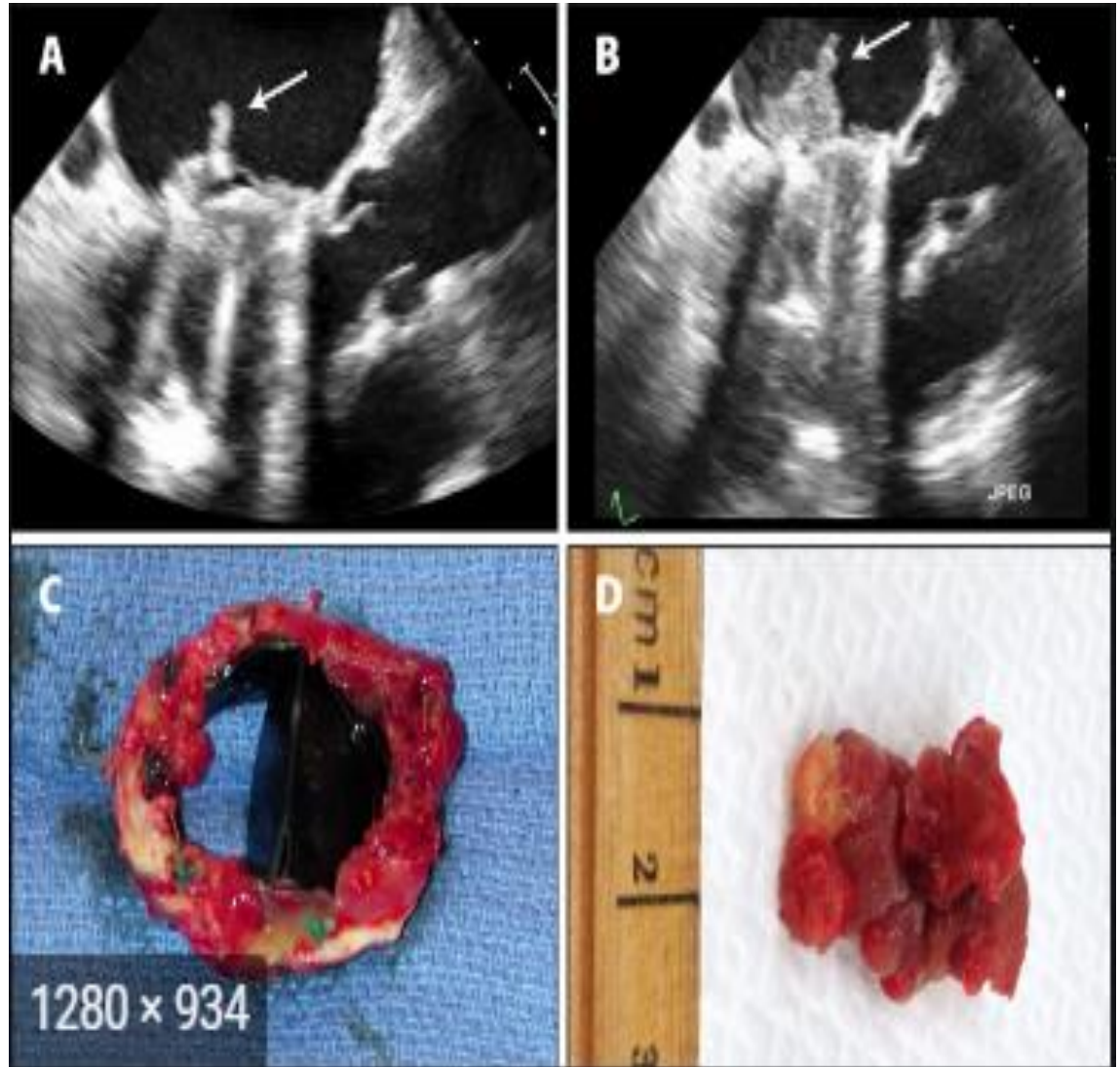
Viridans Group

- Bacteremia, meningitis, abdominal infection, tooth abscesses
- Most serious infection – **subacute endocarditis**
– blood-borne bacteria settle and grow on heart lining or valves
- Persons with preexisting heart disease are at high risk.
- Colonization of heart by forming biofilms

Viridans Group

Involved in dental caries

Persons with prosthetic valves should receive prophylactic antibiotics before surgery or dental procedures.

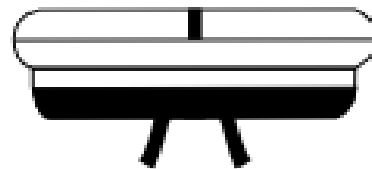


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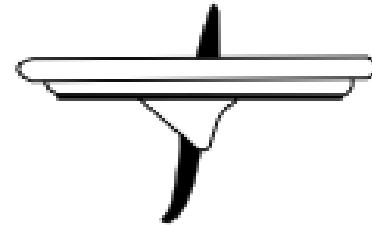
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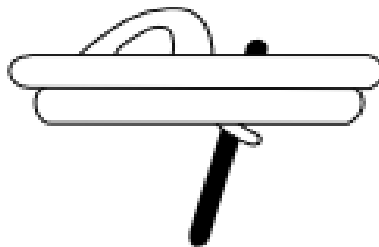
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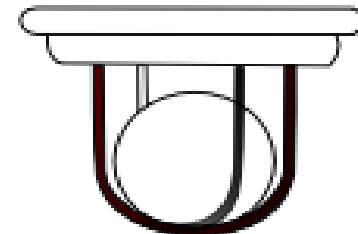
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