

Bacterial Respiratory Infection (3rd Year Medicine)

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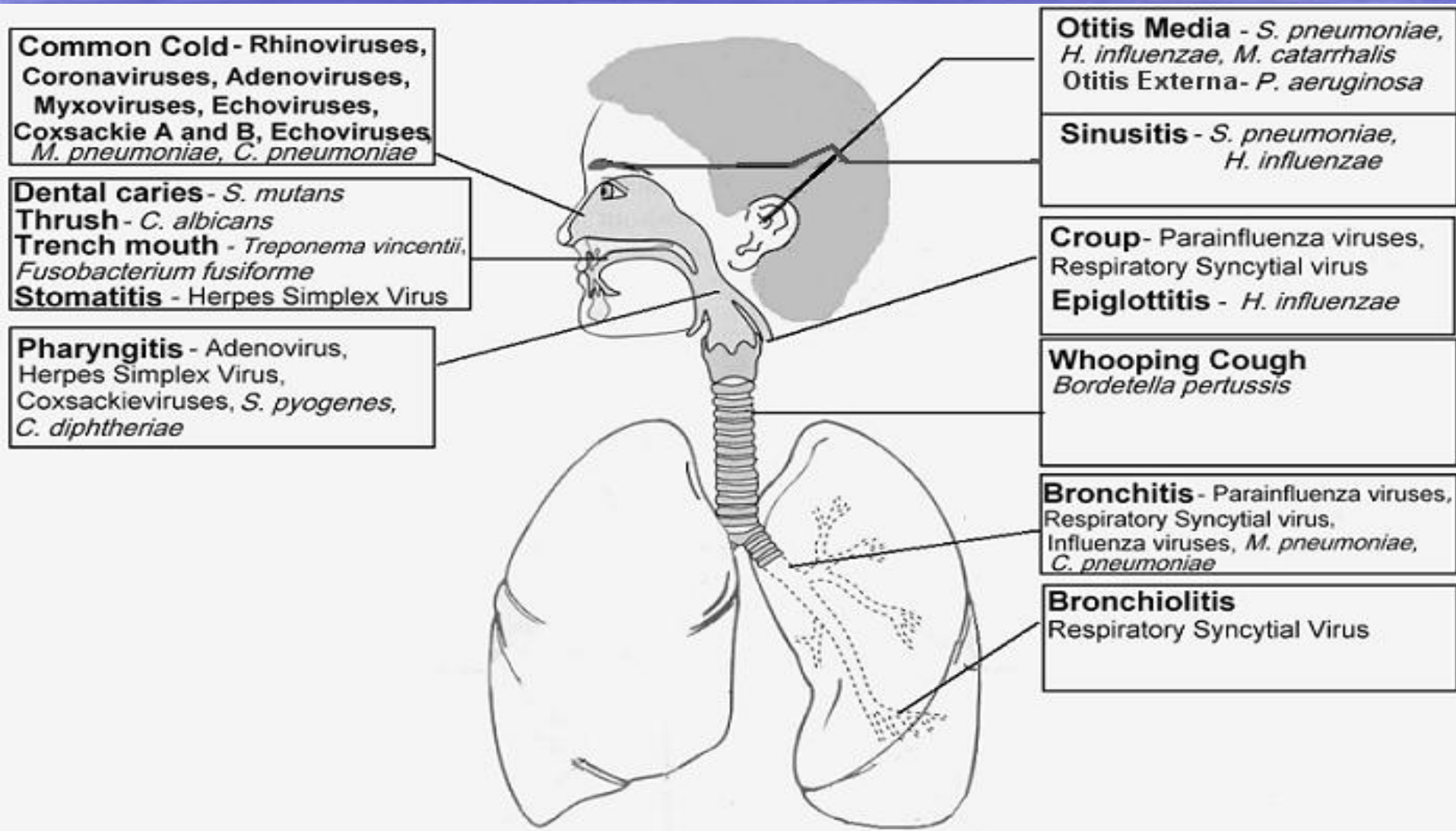
Introduction

- The respiratory tract is the most common site of body exposed for infection by **pathogens and opportunistic pathogens.**
- RT site becomes infected frequently because it comes into direct contact with the physical environment and is exposed continuously to many **microorganisms & their spores in the air.. Smoke, dust & human air droplets.**
- It has been calculated that the average individual inhaled & ingests at least **8 microbial cells** per minute or **10,000 per day.**

- 2/
- Before a **Respiratory Disease** is developed, the following conditions need to be met:
- There must be a **sufficient number** or "dose" of infectious agent inhaled.
- The infectious organism must remain **alive and viable** while in the air.
- The organism must be **deposited on susceptible** respiratory mucosa & attached.
- The infectious agent must **overcome the host immune system**.
- The importance role of normal flora

Fig.1 Upper Respiratory Tract Infection

Most infections are mixed Viruses plus Bacteria



Normal Bacterial Respiratory Flora

- Most of the surfaces of **nasopharynx, oropharynx, and trachea**) are colonized by normal flora. These organisms are usually normal inhabitants of these surfaces and rarely cause disease (Fig.1):
- **Common types >10%:** *Viridans Streptococci* (*S. mutans*, *S. mitis*), *Neisseria* (*N. flava*, *N. sicca*) *Haemophilus* /*Parahaemophilus* , *Corynebacteria*, Anaerobic Bacteria (*Bacteroides fragilis*, *Spirochities*).
- **Less Common <10/ Transients :** *Group A streptococci* , *H. influenzae*, *S. pneumoniae*, *Candida* , Gram-ve bacilli & other bacteria.

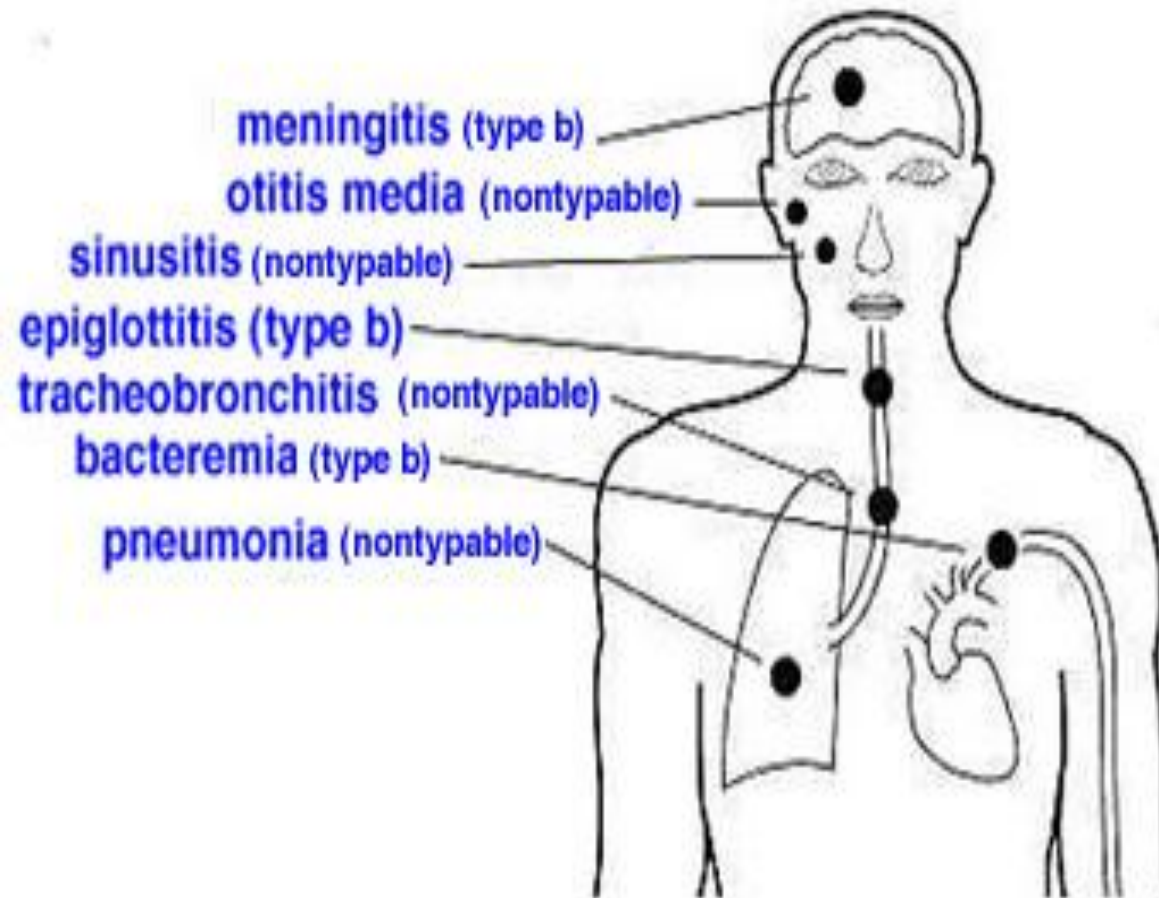
Common Bacteria Agents cause of Upper Respiratory Infections

- **Haemophilus influenzae type b.** Capsule.. Lipooligosaccharides.. invasive ..Highly susceptible to cold & room and high temperatures .. Autolysis rapidly.
Clinical Features: Rare Sore Throat.. Common Otitis – Sinusitis.. Conjunctivitis.. Blood sepsis/ Meningitis.. Children (6 months-5 years), Fig.2 , Hib-vaccine.. polysaccharide-protein conjugate vaccine.. combined with diphtheria-tetanus-pertussis and Hepatitis B vaccines.. starting after the age of 6 weeks.
- **Staph. aureus** : All ages.. Sinusitis, Pneumonia Conjunctivitis, Rare Sore Throat.. Blood sepsis.. Rare Meningitis.. Staphylococcal pneumonia is a frequent complication following influenza infection.. Infants, Elderly patients, immunosuppressed.

Fig.2 *Haemophilus influenzae*

Gram-stain: G-ve coccobacilli + fimbriae

Haemophilus influenzae infections



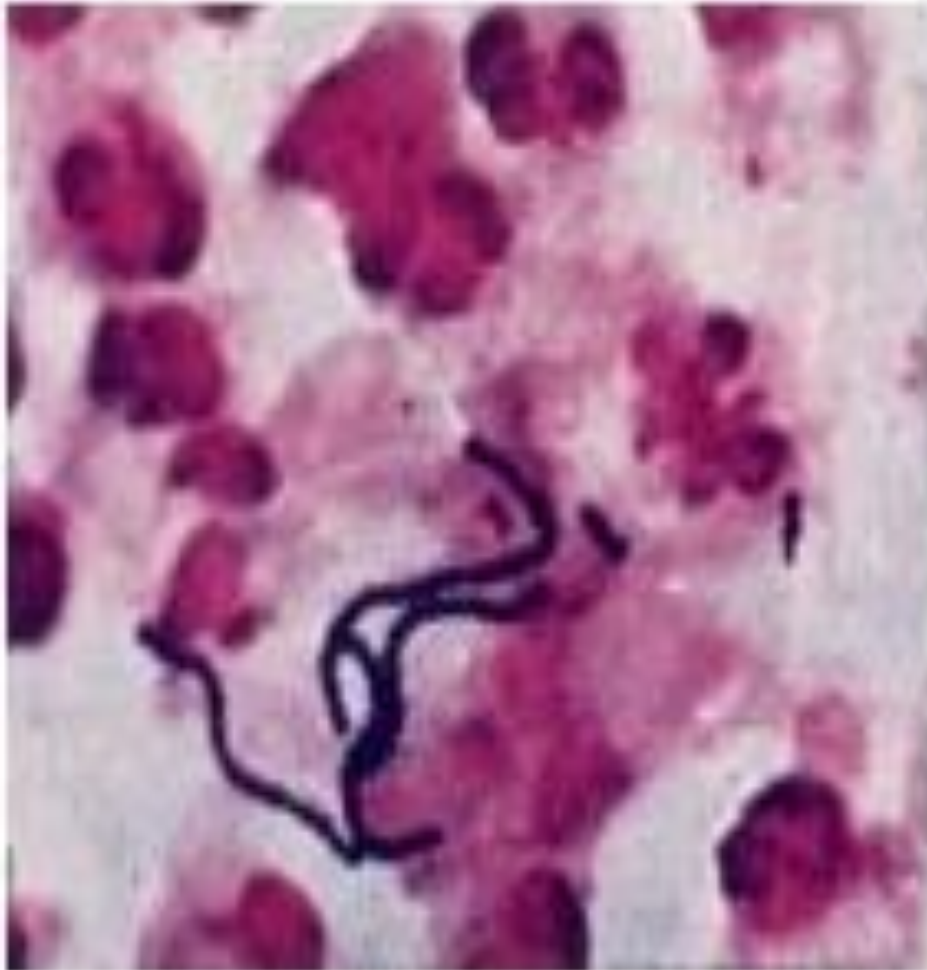
Streptococcus infections

- The genus **Streptococcus** consists of gram-positive cocci, catalase-ve.. Human commensals & opportunistic pathogens Respiratory Tract.. **Beta-H-streptococci group, Viridans Streptococci group**
- Definitive identification of hemolytic pyogenic streptococci types based on the serologic reactivity of cell wall polysaccharide antigens (**Lancefield groups**).
- The most important groups are A, B, C, D, G, F
- **Group A Hemolytic Streptococcus** cause about 10% Pharyngitis-Tonsillitis/Sore Throat.. less Otitis—Sinusitis, Skin in all Children..Virulence factors (Fig-4).
- Complication: Post-streptococcal diseases

S. pyogenes (Group A Hemolytic-1

- **Groups A:** common human pathogens .. beta hemolytic reaction.. on blood agar (Fig-3).
- Group A is one of the most frequent pathogens of humans. It is estimated that between 5-15% of normal individuals carry this bacterium, usually in the respiratory tract, without signs of disease as normal flora.. Healthy Carriers
- **Streptococcal Infections:** Mostly occur in Children < 12 years.. begin as acute Pharyngitis/Tonsillitis.. Also infection by contact with infected skin wound..**Strept. Diseases (Fig-5)**
- About 1-3 % infected children may develop **post-streptococcal complications**.

Fig.3-Beta-Hemolytic Streptococci



Pathogenesis of Group A-2

- Systemic infections found mostly children.. **Strept.virulence** is related to cell structures, enzymes & toxins produced (Fig-5).
- It has ability to colonize and rapidly multiply and spread in host while resist phagocytosis due to the hyaluronic acid capsule + cell surface **T, R, M-proteins**.. About 100 serotypes
- Resistance & Immunity to infection developed by presence of **specific M-protein antibodies**
- Infection may spread easily to other body sites..Children.. Common sinusitis, otitis, blood sepsis. Skin.. rarely pneumonia.. Repeat Streptococcal Throat infection is common in young children.. each 1-3 months.

Fig.4-Infections of Streptococcus pyogenes

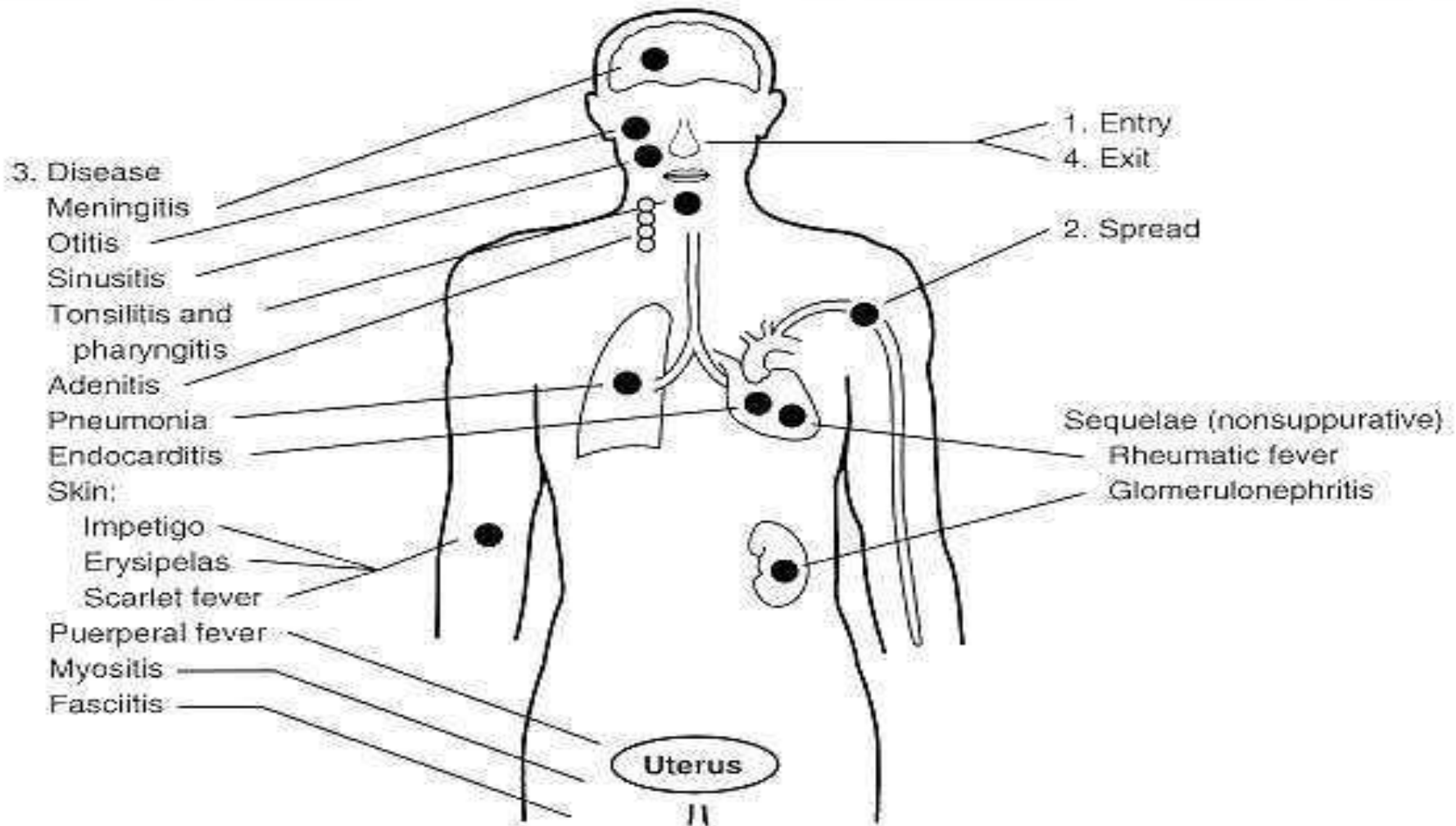
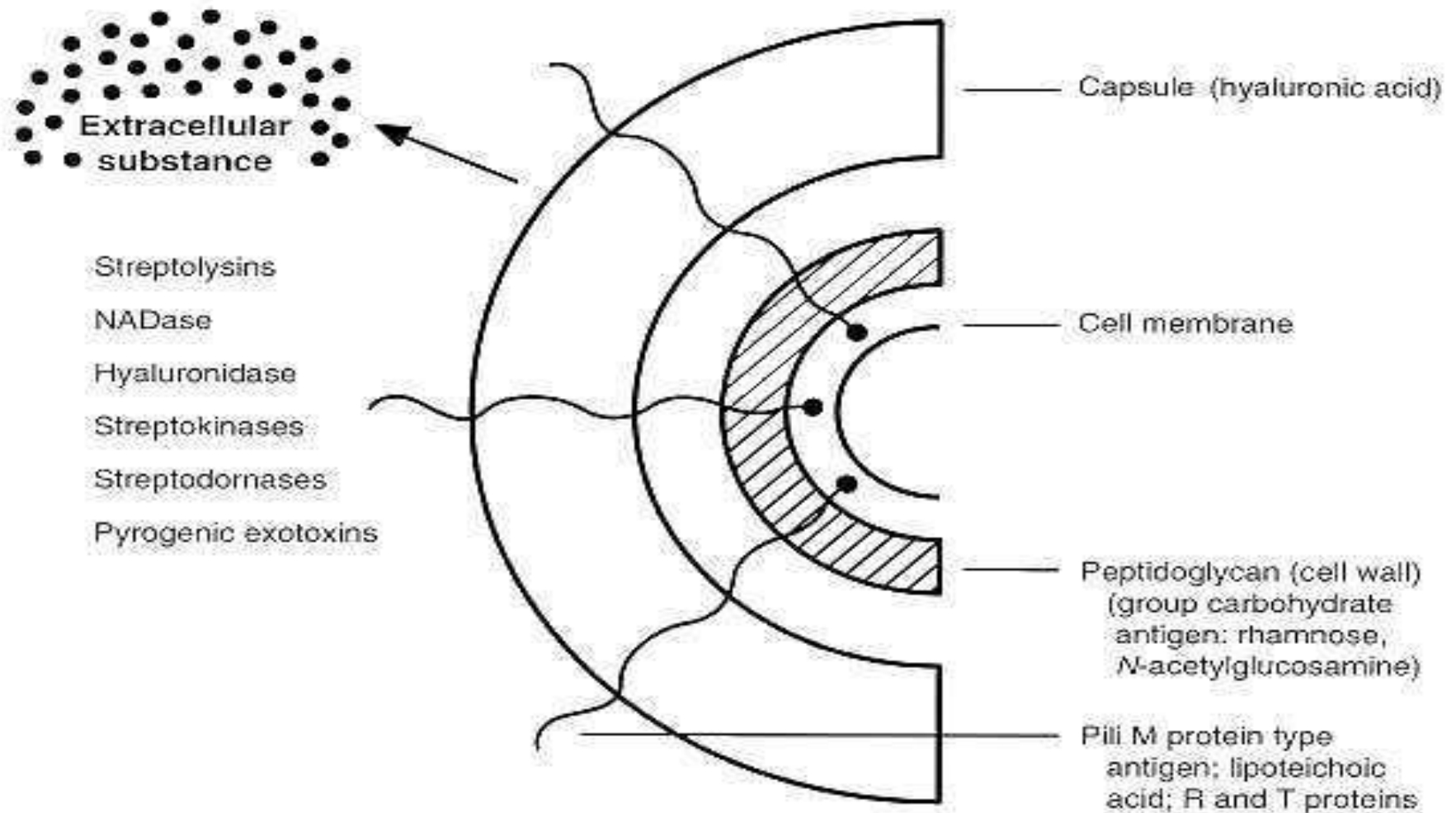


Fig.5- Streptococcus pyogenes



Group A Streptococcus-3

- **Scarlet fever:** children.. begins as pharyngitis ..Few lysogenic strains producing **pyrogenic /erythrogenic exotoxins** (A,B,C).. Diffuse erythematous rash in **oral mucous membranes** (Red Tong) & **Skin**.. Results in lifelong immunity.
- **Pyoderma** .. superficial localized blisters (**impetigo**) associated with massive brawny edema.
- **Cellulitis /Erysipelas:** Skin infection rapidly spread to subcutaneous tissues & lymphatic system.. highly communicable in children.. may cause later **Glomeronephritis**
- **Streptococcal Toxic Shock Syndrome:** Few strains.. Host systemic responses to increased circulating **pyrogenic toxins superantigens** ..High fever, Bacteriemia, Diarrhea, Shock & Organ failures, high fatal.

Scarlet Fever



Group A *Streptococcus*-4

- **Necrotizing fasciitis:** Few strains.. Wound infections.. Rapid & extensive necrosis in subcutaneous tissues & fascia.. associated with Bacteremia, Endocarditis, Heart failure.. High fatality without rapid antibiotics treatment.
- Rarely **Puerperal fever** .. blood sepsis (caused mostly **Group B Streptococcus**).. infected injured uterus after delivery..**neonatal sepsis.**
- Post streptococcal diseases:
- **Rheumatic fever & Glomerulonephritis:** followed repeat throat infection ..Autoimmunological reactions..
- Both diseases and their pathology are not due to dissemination of bacteria, but to late **immunological reactions to Group A streptococcal antigens**.. mainly Cell wall antigens & M-protein.

Diagnosis & Treatment

- **Lab Diagnosis:** Culture on sheep blood agar.. Hemolytic Strept. Type confirmed by using specific antistreptococcal sera by slide agglutination test.
- **Detection Specific Antibodies:** 2-4 weeks after throat or skin infection.. **Antistreptolysin O (ASO)** titer > 240 IU, positive **Streptokinase** , **Anti-M Protein**
- **Treatment:** Clinical cases/ healthy Carrier.. Penicillin G /V ..Monthly injection for children.. cotrimoxazole
- Group A is still highly susceptible to Penicillin .. Less to Cephalosporins & Macrolides and other antibiotics
- No Vaccine is available

Corynebacterium diphtheriae, C. ulcerans

- Sore Throat..Not invasive.. Intensive inflammation pharyngeal mucosa, **Gray Pseudomembranous**.. Release Diphtheria exotoxin.
- Clinical Features: Myocarditis.. Peripheral nervous system/ Neuritis, Adrenal glands.. **Laryngeal obstruction.. Respiratory & Heart Failure, Death**
- Permanent Immunity by Vaccination.. Rapid diagnosis .. antibiotic treatment + Diphtheria Antitoxin
- **Lab Diagnosis:** Throat swab .. Direct Smear not significant, Culture for *C. diphtheria*.. selective Tellurite Blood agar ..Toxin test..Not all strains are toxigenic.
- **Vincet Angina / Trench Mouth** : Mixed infection.. Oral Normal flora..**Borrelia /Treponema vincenti/ Fusobacterium** ..Oral mucosa Lesions/ Gingivitis.. gum swelling (gingivitis)

Gingivitis

