Streptococcus and Enterococcus

Introduction

Streptococcus genus includes important pathogen and commensals

Enterococcus genus related to other streptococci but is classified separately

General Characteristics

- Gram positive cocci (GPC) arranged in chains
- Cell division: single plane…..Chains , or pairs

Classification

A. Lancefield classification
B. Hemolytic activity
C. M protein
D. Biochemical identification
E. Molecular biology

Streptococcus species of clinical importance

Group	Species	Lancefield Group	Type of Haemolysis
Pyogenic	***S. pyogenes***	A	β
	S. agalactiae	B	β
	S. eqisimilus	C	β
Mitis	***S. pneumoniae***	O	α
	S. mitis	O	α
	S. sanguis	H	α
Anginosus	*S. anginosus*	G, F	α
Salivarius	*S. salivarius*	K	γ
Bovis	*S. bovis*	D	α
Mutans	***S. mutans***	No	γ

Opportunistic bacteria

The viridans Group

Epidemiology Table 14.1

Organism	Habitat (reservoir)	Mode of Transmission
Streptococcus pyogenes (group A)	Not considered normal microbiota Inhabits skin and upper respiratory tract of humans; carried on nasal, pharyngeal, and sometimes anal mucosa; presence in specimens is almost always considered clinically significant	Direct contact: person to person Indirect contact: aerosolized droplets from coughs or sneezes
Streptococcus agalactiae (group B)	Normal microbiota: female genital tract and lower gastrointestinal tract Occasional colonizer of upper respiratory tract	Endogenous strain: gaining access to sterile site(s) probable Direct contact: person to person from mother in utero or during delivery; or nosocomial transmission by unwashed hands of mother or health care personnel
Groups C, F, and G beta-hemolytic streptococci	Normal microbiota: skin, nasopharynx, gastrointestinal tract, genital tract	Endogenous strain: gain access to sterile site Direct contact: person to person
Streptococcus pneumoniae	Colonizer of nasopharynx	Direct contact: person to person with contaminated respiratory secretions
Viridans streptococci	Normal microbiota: oral cavity, gastrointestinal tract, female genital tract	Endogenous strain: gain access to sterile site; most notably results from dental manipulations
Enterococcus spp.	Normal microbiota: humans, animals, and birds *E. faecalis* and *E. faecium* are normal flora of the human gastrointestinal tract and female genitourinary tract Colonizers	Endogenous strain: gain access to sterile sites Direct contact: person to person Contaminated medical equipment; immunocompromised patients are at risk of developing infections with antibiotic-resistant strains

S. pyogenes (Group A Streptococci, GAS)

- **Pathogenesis**
  - ✓ Evasion of host immunity
  - ✓ Adherence
  - ✓ Tissue damage

- **Virulence factors**
  - F protein
  - M protein
  - Capsule
  - DNAse
  - Streptolysins S, O
  - C5a peptidase
  - Streptococcal Pyrogenic exotoxins (SPEs)
  - Streptokinase
  - Lipoproteinase

Infections and clinical features of GAS

Organism	Virulence Factors	Spectrum of Diseases and Infections
Streptococcus pyogenes	Protein F mediates epithelial cell attachment (fibronectin binding); hyaluronic acid capsule inhibits phagocytosis; M protein is antiphagocytic (>100 serotypes); produces several enzymes and hemolysins that contribute to tissue invasion and destruction, including streptolysin O, streptolysin S, streptokinase, DNase, and hyaluronidase. Streptococcal pyrogenic exotoxins (SPEs) mediate production of rash (i.e., scarlet fever) or multisystem effects that may result in death; C5a peptidase-destroying complement chemotactic factors	Acute pharyngitis, impetigo, cellulitis, erysipelas, necrotizing fasciitis and myositis, bacteremia with potential for infection in any of several organs, pneumonia, scarlet fever, streptococcal toxic shock syndrome
	Cross-reactions of antibodies produced against streptococcal antigens and human heart tissue	Rheumatic fever
	Deposition of antibody-streptococcal antigen complexes in kidney results in damage to glomeruli	Acute poststreptococcal glomerulonephritis

A. Non-invasive diseases

I. **Pharyngitis**
   - Enlarged tonsils

II. **Scarlet fever**
   - (strawberry tongue)

III. **Skin infections**
   - Impetigo
   - Erysipelas

B. Invasive soft tissue infections

I. Necrotizing fasciitis

- Destroying fat and fascia (''flesh-eating bacteria'')

II. Streptococcal toxic shock syndrome

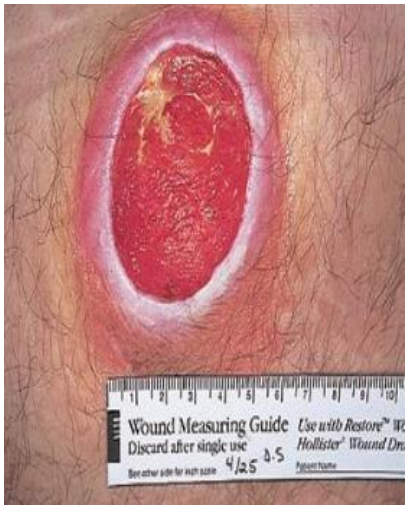
- Without ttt, progress to shock and general organ failure

III. Other suppurative infections

- Puerperal sepsis

IV. Bacteraemia

- Mortality rate 40%



C. Non-suppurative sequelae

I. Rheumatic fever

- Caused by immune reaction induced by pharyngitis

II. Acute glomerulonephritis

- An immune complex-mediated disease

Streptococcus agalactiae (GBS)

- Primary human habitat is the colon and 10-40 % of women intermittently carry *str. Agalactiae* in the vagina
- **Pathogenesis**
  - Capsule, C5a peptidase and haemolysin
- **Clinical features**
  - **Infection in the neonate**
    - **Early-onset disease**
    - **Late-onset disease**
  - **Infection in the adult**

Modes of transmission

Streptococcus pneumoniae

- **Pathogenesis**
  - Capsule 90 different serotypes of encapsulated strains
  - *IgA1* protease
  - Pneumolysin

- **Clinical features**

Pneumonia, otitis media, sinusitis and **meningitis**

The viridans Streptococci

- Inhibiting the colonization of many pathogen including pyogenic streptococci by:
  - Production of bacteriocins
  - Production of hydrogen peroxide
- Present as normal flora in the oral cavity, oropharynx, gastrointestinal tract, and vagina
- **Clinical features**
- *Mitis* group colonize tooth surfaces
- *subacute bacterial endocarditis*

Enterococcus species

- **Characteristics**
  - GPC in pairs and chains
  - Facultative anaerobe
  - 16 species; *E. faecalis* and *E. faecium*

- **Clinical features**
  - UTI
  - Abdominal infection
  - Endocarditis
  - Wound and soft tissue infections

Laboratory diagnosis

1. **Specimen:**
2. **Processing of specimens:**
   - 5% sheep Blood agar
   - Incubation at 37 ºC for 24-48 h
3. **Rapid identification:**
   - Antigen detection tests
   - Molecular methods: Quantitative (PCR)
   - Serodiagnosis:
     - The ASO test, AntiDNAse B, antistreptokinase and antihyaluronidase

Laboratory diagnosis

4. **Media:**
   - 5% sheep blood agar supplemented with SXT
   - Todd-Hewitt broths contain antimicrobials (gentamicin, nalidixic acid, or colistin and nalidixic acid)
     - CHROMagar Strep B
   - Enterococcosel agar, a selective differential medium based on the esculin hydrolysis and is also selective by incorporation of inhibitory oxgall (bile salts)
5. **Incubation Conditions and Duration:**
   - Facultative anaerobe
   - Blood or chocolate agar - 5% - 10% CO_2

S. pyogenes and S. agalactiae

- GPC in chains
- β hemolytic on blood agar
- Catalase negative
- Bacitracin sensitive for *S. Pyogenes*
- PYR positive for *S. Pyogenes*
- Hippurate hydrolysis positive for *S. agalactiae*
- CAMP positive for *S. Agalactiae*
- ASO titer

Streptococcus pneumoniae

- **Characteristics**
  - GPC in pairs (diplococci)

- **Laboratory identification**
  - a haemolytic activity on blood agar
  - Draughtsman colonies
  - Optochin sensitive
  - Bile soluble
  - Polysaccahride capsule–95 serotypes

Enterococcus species

- **Laboratory identification**
  - α, β or non-haemolytic on blood agar
  - Resistant to Optochin and Bile
  - Lancefield group D
  - Able to grow at 45°C, 6.5% NaCl
  - PYR positive

Treatment

- **Antibiotic treatment**
  - Penicllin G –drug of choice
  - Erythromycin
  - Glycopeptides (VRE)

Table 14.7 Antimicrobial Therapy and Susceptibility Testing

Prevention and control

- Proper hygiene
- **Chemoprophylaxis**

  (penicillin G 1.2 M units, IM every 3-4 weeks or orally)

- **Vaccination**

Pneumococcal vaccines

pneumococcal conjugate vaccine (PCV13)