Staphylococci

- G+ (clusters); skin & mucous membranes (usually harmless)
- Pathogenicity variable (S. aureus, S. saprophyticus - Yes, S. epidermidis - rare, but possible).
- Easily cultured; Catalase Test +; Humans are major reservoir
- Produce variety of infections (abscess, boils, wound, pneumonia, food poisoning, endocarditis, septicemia, common in eye)
- Person-to-person and endogenous infection (30-60% carrier rate for S. aureus, esp. healthcare)

<table>
<thead>
<tr>
<th>S. aureus</th>
<th>S. epidermidis</th>
</tr>
</thead>
<tbody>
<tr>
<td>β-hemolytic (often)</td>
<td>β-hemolytic (rarely β)</td>
</tr>
<tr>
<td>Yellow pigment (common)</td>
<td>Usually white</td>
</tr>
<tr>
<td>Mannitol + (80%)</td>
<td>Mannitol + usually</td>
</tr>
<tr>
<td>Coagulase +</td>
<td>Coagulase +</td>
</tr>
<tr>
<td>Often pathogenic</td>
<td>Rarely pathogenic</td>
</tr>
</tbody>
</table>

Pathogenic Factors

1) Hemolysins
2) Toxins - Leukocidin
   - Enterotoxin
   - Protein A
3) Enzymes - Penicillinase (β-lactamases)
   - Nuclease (Cleaves DNA + RNA)
   - Staphylokinase - helps spread (tissue damage)
   - Slime production - adherence

Commonly seen in conjunctivitis, hordeola, blepharitis, dacryocystitis

Treatment: Remove crusts w/warm compresses
   - Erythromycin, Mupirocin, bacitracin, polysporin, genta
   - To lid margin
Streptococci

- Gram + C (Chains - diplococci to long chains); catalase negative
- Commonly colonize and infect humans and other animals (normal flora (oral, intestinal)). Humans act as carriers (Asymptomatic)
- Strep throat, scarlet fever, wound infections, UTI, cellulitis, septicemia, endocarditis (often of oral origin), ocular infections, rheumatic fever, necrotizing fasciitis, dental caries

Classification Schemes
1) Hemolysis
2) Lancefield Groups - serological groups based on antigenic structure of cell wall (Grps A-O)
   Not all streps are groupable.
3) Biochemical tests - 04U bacitracin, CAMP test, esculin hydrolysis, etc.

Most infections caused by - Groups A, B, C, D, and G (of the groupable strains)

Pathogenicity
- Streptokinase - dissolves fibrin
- Hyaluronidase - splits hyaluronic acid (holds connective tissue)
  - "Spreading factor"

Hemolysins - Streptolysin O & Streptolysin S

Erthroagglutinin - rash
M protein - inhibits phagocytosis
Nuclease

Beta-hemolytic Strep - identify by A/5XT disk test & CAMP test

<table>
<thead>
<tr>
<th>Category</th>
<th>Hemolysis</th>
<th>Susceptibility</th>
<th>CAMP</th>
<th>Esculin</th>
<th>P-disk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>β</td>
<td>+</td>
<td>−/−</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Group B</td>
<td>β</td>
<td>−/−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Non A or B</td>
<td>β</td>
<td>+/−</td>
<td>+</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Group D (enterococci)</td>
<td>α</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Streptococcus pneumoniae</td>
<td>α</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>Strep. viridans</td>
<td>α/β</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>−</td>
</tr>
</tbody>
</table>

Treatment: Further treatment: beta-lactamase penicillin, amoxicillin, clindamycin
Streptococcus pneumoniae
- G⁺C (lance-shaped diplococci); catalase test
- Often encapsulated (may see "halo" on Gram stain); antiphagocytic
- Always α-hemolytic; Initially, wet, mucoid, α-colonies, then "collapses" \( \Rightarrow \) "checker-like" or "button-shaped" colonies.
- Reservoir is humans and transmission is generally person-to-person.
  (Many carriers are asymptomatic)

<table>
<thead>
<tr>
<th>Likelihood of Colonization w/ S. pneumoniae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preschoolers</td>
</tr>
<tr>
<td>Elementary School</td>
</tr>
<tr>
<td>Jr High</td>
</tr>
<tr>
<td>Adults w/ Children at Home</td>
</tr>
<tr>
<td>Adults w/o Children</td>
</tr>
</tbody>
</table>

- Are many more healthy carriers than sick, most links in chain of transmission from person-to-person are invisible.
- Requires blood agar
- Often seen in acute conjunctivitis; Most common cause of Community acquired bacterial pneumonia; otitis media, meningitis, Septicemia, sinusitis, joint infections, corneal ulcers.

Identification: Gram stain - Many polymorphonuclear leukocytes
- G⁺ encapsulated diplococci

Culture: Alpha-hemolytic (mucoid, checker-shaped) colonies
- P-disk (Optochin) Susceptible, α-strept.

Treatment: Sulfacetamide, Chloramphenicol, erythromycin, bacitracin, Polymyxin; polymyxin

Systemic: Penicillin-resistance much more common
- Use 3rd gen Cephalosporin (Ceftriaxone, Cefotaxime)

Vancomycin for resistant strains
Minimal Inhibitory Concentration (M.I.C.): More precise than K.B., determines minimal concentration of antibiotic required to inhibit bacterial growth.

1. Prepare subcultures on nutrient agar with same dilution of inoculum as used for K.B. plates. Incubate for 18 hours.

2. Filter (CSF), (USE EXACT INJECTOR DISK FOR DETECTION OF PNEUMONIA RESISTANCE FOR 3 PNEUMONIAE (19MM-R))

Minimal Inhibitory Growth (M.I.G.): Determination of antibiotic concentration which inhibits growth of organism.

Remove END point with 2-3 drops of disk solution and measure 18 mm zones of inhibition diameters (in mm). (Using formula for VIVC.) Use exacellular leucine-arginine for detection of Pneumonia resistance for 3 pneumococci (19mm-R)

Disk Diffusion Antibiotics (Key: B): Paper disks impregnated with various antibiotics are tested against appropriate organisms. Using sterile tipped swab, inoculate Mueller-Hinton plates with Mueller-Hinton broth to yield a 5 mauerland turbidity (just visible turbidity).