## Staphylococci and Streptococci

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| *Staphylococcus* | - Spherical gram-positive cocci arranged in irregular grapelike clusters.  - Produces a carotenoid pigment called staphyloxanthin, which imparts a golden color to its colonies. | - Catalase positive  
- Coagulase positive  
- β-hemolysis of red blood cells  
- Ferments mannitol → yellow agar  
- Protein A on surface  
- More than 90% of S. aureus strains contain plasmids that encode β-lactamase (degrades penicillin).  
- Some strains are methicillin-resistant (MRSA), some with intermediate resistance to vancomycin (VISA), some with full resistance to vancomycin (VRSA) and some with resistant to nafcillin (NRSA).  
- Colonizes: nose, skin.  
- Hand contact is an important mode of transmission.  
- Exotoxins produced: enterotoxin, TSST, exfoliatin, alpha toxin and P-V leukocidin.  
- Blood cultures typically do not grow S. aureus. | - Abscesses and various pyogenic (pus producing) infections (such as endocarditis, septic arthritis, and osteomyelitis) → due to its ability as a facultative anaerobe.  
- Food poisoning → due to production of a toxin.  
- Scalded skin syndrome and toxic shock syndrome → due to production of two exotoxins.  
- Hospital-acquired pneumonia, septicemia, and surgical-wound infections (most common cause).  
- An important cause of skin infections, such as folliculitis, cellulitis, and impetigo.  
- The most common cause of bacterial conjunctivitis (eye rubbing).  
- Kawasaki syndrome may be caused by S. Aureus. | - Strains that produce β-lactamase are resistant to penicillin G, so don’t give it.  
- Such organisms can be treated with β-lactamase–resistant penicillins (e.g., nafcillin or cloxacillin), some cephalosporins, or vancomycin.  
- Treatment with a combination of a β-lactamase–resistant penicillin (e.g., amoxicillin) and a β-lactamase inhibitor (e.g., clavulanic acid) is also useful.  
- Ceftaroline fosamil is useful for the treatment of MRSA infections.  
- Daptomycin (Cubicin) and Quinupristin-dalfopristin (Synercid)-streptogramins (linezolid) can be used to treat infections by VISA and VRSA strains.  
- Mupirocin is a topical antibiotic in skin infections.  
- Drainage is the cornerstone of abscess treatment.  
- Cefazolin is used peri-operatively to prevent staphylococcal surgical wound infections. |
| *epidermis*       | - Spherical gram-positive cocci arranged in irregular grapelike clusters  
- Produces white colonies | - Catalase positive  
- Coagulase negative  
- Urease positive  
- Sensitive to novobiocin  
- Doesn’t produce exotoxins.  
- Almost always hospital-acquired | - Endocarditis  
- Prosthetic joint infections  
- Major cause of sepsis in neonates | - S. epidermidis is highly antibiotic resistant.  
- MSSE are sensitive to β-lactamase–resistant drugs such as nafcillin.  
- MRSE is treated by vancomycin. |
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<td><strong>Staphylococcus saprophyticus</strong></td>
<td>Spherical gram-positive cocci arranged in irregular grapelike clusters</td>
<td>- Catalase positive &lt;br&gt;- Coagulase negative &lt;br&gt;- Urease positive &lt;br&gt;- Resistant to novobiocin &lt;br&gt;- Doesn’t produce exotoxins &lt;br&gt;- Almost always community-acquired</td>
<td>- Urinary tract infections &lt;br&gt;- Found primarily on the mucosa of the genital tract</td>
<td>- Treated with trimethoprim-sulfamethoxazole or a quinolone (ciprofloxacin).</td>
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<tr>
<td><strong>Streptococcus pyogenes</strong></td>
<td>Gram positive cocci arranged in chains or pairs</td>
<td>- All streptococci are catalase-negative &lt;br&gt;- β-hemolytic &lt;br&gt;- Encapsulated &lt;br&gt;- Has M protein &lt;br&gt;- Produce three important inflammation related – Invasion related factors: hyaluronidase, streptokinase (fibrinolysin) and DNase (streptodornase). &lt;br&gt;- Produces five important EXOtoxins and hemolysins: Erythrogenic toxin, Streptolysin O, Streptolysin A, Pyrogenic exotoxin A, Exotoxin B.</td>
<td>- The leading bacterial cause of pharyngitis and cellulitis &lt;br&gt;- Impetigo (similar to S.a.) &lt;br&gt;- Necrotizing fasciitis &lt;br&gt;- Streptococcal toxic shock syndrome (similar toxin to that present in S.a.) &lt;br&gt;- Rheumatic fever – which also affects the heart &lt;br&gt;- Acute glomerulonephritis- affects the kidney &lt;br&gt;- Scarlet fever</td>
<td>- <strong>Diagnosis:</strong> bacitracin sensitive &lt;br&gt;- <strong>Treatment:</strong> &lt;br&gt;- Penicillin G or amoxicillin, &lt;br&gt;- In mild group A streptococcal infections, oral penicillin V can be used. &lt;br&gt;- In penicillin-allergic patients, erythromycin or one of its long-acting derivatives (e.g., azithromycin) can be used. &lt;br&gt;- Clindamycin can also be used in penicillin-allergic patients &lt;br&gt;- <strong>Prevention:</strong> rheumatic fever can be prevented by prompt treatment of group A streptococcal pharyngitis with penicillin.</td>
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| **Streptococcus agalactiae**  | Gram positive cocci arranged in chains or pairs | - All streptococci are catalase-negative <br>- Group B <br>- β-hemolytic <br>- It colonizes the genital tract of some women <br>- In the vagina and colon | - The leading cause of neonatal sepsis and meningitis <br>- GBS is capable of causing infections in adults (such as pneumonia, endocarditis, arthritis, cellulitis, and osteomyelitis), postpartum endometritis also occurs | - **Diagnosis:** bacitracin resistant; hippurate hydrolyzed <br>- **Treatment:** penicillin G or amoxicillin <br>- **Prevention:** neonatal sepsis can be reduced by a combination of two approaches: <br> 1. If vaginal and rectal cultures are positive, penicillin or ampicillin should be
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<td>Streptococcus agalactiae (Cont.)</td>
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<td>administered intravenously at the time of delivery.</td>
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<td>2. If the patient has not had cultures done, then penicillin G (or ampicillin) should be administered intravenously at the time of delivery to women who experience prolonged (longer than 18 hours) rupture of membranes.</td>
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</table>
| Streptococcus pneumonia | Gram positive lancet-shaped cocci arranged in pairs (diplococci) or short chains | - All streptococci are catalase-negative  
- Group NA  
- α-hemolytic  
- Found on the skin and in the oropharynx in small numbers  
- Has polysaccharide capsules  
- Cell wall contains teichoic acid (C substance) which reacts with CRP.  
- Humans are the natural hosts for pneumococci | - Pathogenesis by S. pneumoniae and the viridans streptococci is uncertain, as no exotoxins or tissue-destructive enzymes have been demonstrated  
- Causes pneumonia, otitis media, sinusitis, mastoiditis, conjunctivitis, purulent bronchitis, pericarditis, UTRI, bacterial meningitis, bacteremia, and sepsis.  
- Pneumonia: sputum is a red or brown “rusty” color | - **Diagnosis**: bile-soluble; inhibited by optochin (are lysed by bile or deoxycholat)  
- Culture of cerebrospinal fluid is usually positive in meningitis.  
- **Treatment**: - Penicillin  
- If penicillin-resistant: erythromycin and vancomycin.  
- A fluoroquinolone with good antipneumococcal activity, such as levofloxacin, can also be used.  
- Ceftriaxone or levofloxacin can be used for less severely ill patients  
- **Prevention**: immunization with the 13-valent pneumococcal conjugate vaccine (Prevnar 13). |
| Viridans group (S. sanguinis, S. mutans, S. mitis, S. gordonii, S. salivarius, S. anginosus, S. milleri, S. intermedius) | Gram positive cocci arranged in chains or pairs | -- All streptococci are catalase-negative  
- Group NA  
- α-hemolytic  
- Found chiefly in the oropharynx | - The most common cause of endocarditis  
- The main cause of dental caries  
- Often found in brain abscesses following dental surgery | - Diagnosis: not bile-soluble; not inhibited by optochin (resistant to lysis by bile)  
- Endocarditis caused by most viridans streptococci is curable by prolonged penicillin treatment |
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<td><strong>Viridans group</strong> (Cont.)</td>
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<td>-Many of the strains of viridans streptococci that cause endocarditis produce a glycocalyx that enables the organism to adhere to the heart valve</td>
<td>-Pathogenesis by S. pneumoniae and the viridans streptococci is uncertain, as no exotoxins or tissue-destructive enzymes have been demonstrated</td>
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| **Enterococcus faecalis** | Gram positive cocci arranged in chains or pairs | -All streptococci are catalase-negative  
-Group D  
-Grow on bile-esculin agar  
-α, β or non-hemolytic  
-Enterococci and anaerobic streptococci are located in the colo | -An important cause of hospital-acquired urinary tract infections and endocarditis.  
**Diagnosis**: growth in 6.5% NaCl, hydrolyze esculin in the presence of bile (i.e., they produce a black pigment on bile-esculin agar).  
-Resistant to penicillins  
- **Treatment**: we utilize the synergistic combination of penicillin or vancomycin and an aminoglycoside (e.g., gentamicin) to kill enterococci  
-Vancocin resistant enterococci are killed by a linezolid (Zyvox) and daptomycin (Cubicin). |
| **Streptococcus bovis** | Gram positive cocci arranged in chains or pairs | -All streptococci are catalase-negative  
- Group D  
-Grow on bile-esculin agar  
-α or non-hemolytic | -Causes endocarditis  
**Diagnosis**: no growth in 6.5% NaCl, hydrolyze esculin in the presence of bile (i.e., they produce a black pigment on bile-esculin agar).  
-Sensitive to penicillins |
| **Peptostreptococci** |                                          | -Grow under anaerobic or microaerophilic conditions  
- Produce variable hemolysis  
- Members of the normal flora of the gut, mouth, and female genital tract | -Participate in mixed anaerobic infections  
- Often found in brain abscesses following dental surgery |

Done by: Rama Abbady