# Gram Positive and Negative Cocci

Thursday, February 26, 2015 3:44 AM

Gram Positive Cocci

Staphylococcus aureus

- "Staphule" means grape in Greek
- Toxins are quite the problem:
  - Cytotoxins
  - Haemolysins
  - Entertoxin (A-E, G-I) - food poisoning
  - Exfoliative toxins (ETA, ETB)
  - Toxic shock syndrome toxin 1 (used to be exotoxin and entertoxin F)
- Enzymes:
  - Coagulase (coagulation of fibrin)
    - Made by almost all pathogenic staphylococci
    - Used in laboratory test to differentiate from S. epidermidis, S. Capitis and S. saprophyticus
  - Beta-lactamase (penicillinase)
    - Destroys penicillin
- Many strains are found in normal population (~15%)
- Carried in anterior nares, axilla, perineum and hands
- Problem:
  - 85-90% of strains located in hospital are penicillin resistant
  - Localized purulent infections (pustules, boils, styes. Conjuctive otitis, etc.)
  - Pneumonia, osteromyelitis, septicaemis, endocarditis
  - Food poisoning, toxic shock syndrome, scaled skin syndrome
- Important cause of hospital acquired nosocomial infection from stitch abscesses, infected wounds or generalized infections
- Preventative measures include
  - Aseptic technique in ER and OR, wound precaution
  - Education of personnel health
  - Handwashing

Staphylococcus epidermidis

Staphylococcus epidermidis

- Part of normal skin/mucous membrane flora
- Non-pathogenic, except in compromised patients when cauce post-operative infections (brain, open heat, endocarditis, shunt infections)
- Considered an opportunistic pathogen

Streptococci

- Arranged in pairs for forming chains
- "streptos" - Greek for twisted
- Subdivided into groups based on
    - Haemolytic properties (alpha, beta)
    - Carboydrate C antigen (Lancefield classification)
    - M-protein
        - Divides beta-haemolytic
        - Mostly group A

Streptococcus pyogenes

- Group A, beta-haemolytic, S. pyogenes causes:
    - Acute tonsillitis (strpt throut) - can lead to rheumativ heart disease
    - Impetigo, cellulitis, etc (skin infections)
    - Fever and septicaemia
- Caused by toxins
    - Strptolysins (O and S)
        - Neutrophils and macrophages
    - Streptococcal pyrogenic exotoxins (Spes)
        - Scarlet fever rash
- Enzymes
    - Hyaluronidase (helps spreading of bacteria)
- Virtually all are penicillin G sensitive (vs. S. aureus)
- Education of health personnel
- Aseptic obstetric procedures
- Early detection procedures
- Early detection and treatment

Necrotizing Fasciitis

- Streptococcus pyogenes culprit
- Does not actually "eat" anything
- Toxin is responsible for damage
- Research indicates that

Research indicates that
    - Hijacking human plasminogen from blood, attach to surface and activate it into protease… good for spreading…
    - Bacteriophage has gene encoding for enztme allowing bacteria to escape entrapment and killing by neutrophils (white blood cells)

Streptococcus Agalactiae

- Group B
- Founf in vagina of health woman (can cause neonatal infections)
    - Early septicaemia
        - Respiratory distress or shock at birth
        - High fatality rate (serious)
    - Delayed meningitic form
        - 1-12 weeks post-partum
        - Sequelae

Streptococcus Faecalis

- Group D, aka Enterococcus
- Part of normal flora of GI-tract
- Prey on compromised individuals

Viridens Streptococci

- Found in oral cavity of health individuals
- Can cause endocarditis in individuals with damaged heart valves

Streptococcus Pneumoniae

- Also known as pneumococcus
- Polysaccharide capsule has antiphagocytic properties
    - ~90 distinct capsular serotypes
- Found in naso-pharynx of healthy individuals
- Can cause
    - Lobar pneumonia
    - Meningitis
- Prevention strategies (elderly, alcoholics, crowded living, vaccinations)

Gram Negative Cocci

Neisseria Meningitidis

- Gram negative diplococci
- Laboratory isolation using chocolate agar, 5-10% carbon dioxide, 37C
    - Use selective media (Thayer-Martin) when isolating from nasopharynx
- Frequently found in the naso-pharynx of healthy individuals
- Antiphagocytic polysaccharide capsule
    - 13 different serogroups
    - A, B, C, X, Y and W135 most prevalent
- Carriers can occasionally develop infection or pass organism to non-immune individuals who develop infection
- Only infects humans
    - Usually children or those living in crowded living quarters
    - Occasional epidemics
- Infection can result in
    - Meningitis
    - Septicaemia (starts as skin rash)
    - Waterhouse-Friderichsen Syndrome (complication of septicaemia… most severe form of septicaemia by N. meningitidis)
- First described in 1894 by Arthur Francis Volcker (1861-1946)
    - Then in 1901 by the British dermatologist Ernest Gordon Graham Little (1867-1950)
    - It was first reported as an entity by Waterhouse in 1911, and the subject was comprehensively reviewed in 1918 by the Danish paediatrician Carl Friderichsen
    - Thus called Waterhouse-Friderichsen syndrome
- Prevention and treatment
    - Penicillin is primary antibiotic used
    - Vaccination is recommended for children (11-12 years), teenagers and college/university students living in dormitories
    - Conjugated vaccine for serogroups A, C, Y and W135
    - Now have meningococcus vaccine for infants at 2-5 months (serogroup C)

Neisseria Gonorrhoeae

- Gram negative diplococci, 0.6-1 um in diameter
- In a clinical lab, grow on Thayer-Martin plates, in damp environment with carbon dioxide
    - Very sensitive to frying a changes in temperature
- Causative agent of STD gonorrhea
- In US, it is the second highest reported STD, after chlamydia

    - >350,00 cases/year reported in the US (2001)
    - Number of cases is now decreasing every year
- Clinical gonorrhea
    - Men: causes acute infection of urethra (90-95%)
    - Women: 50% are asymtomatic
        - Cervicitis
        - If untreated can cause PID, sterility
- Disseminated Gonococcal Infection (DGI)
    - 1-3% cases, usually women
    - Fever, skin infection, arthritis
- Neonatal infections
    - Rare, but newborns can acquire infection from mother furing birth
    - Causes gonococcal opthalmia neonatorum (acture purulent conjunctivitis)
- Diagnosis
    - Men: use microscopy to directly observe swabs of urethral discharge
    - Women: culture is necessary from endocervical, urethral and anal swabs
- Prevention and treatment
    - Penicillin resistance is emerging
    - Treat using ceftriaxone, cefixime, ciproflocaxin or ofloxacn combined with doxyxyxline/azithromycin
    - Resistance to ciproflaocacin (quinolones) emerging
    - Simultaneous treatment of partners is essential
    - No vaccine available