Gram Negative Cocci and Coccobacilli

Mahmoud Alkawareek, PhD

Neisseria

- *Neisseria* spp. are fastidious intracellular Gram negative diplococci which are oxidase positive

- *Neisseria* grow best on blood/chocolate agar at 37 °C in presence of humidity and 5-10% CO_2

- It is highly susceptible to dryness and low/high temperature and hence does not survive long in the environment

- Although many *Neisseria* spp. colonize humans, only *N. gonorrhoeae* (gonococcus) and *N. meningitidis* (meningococcus) are pathogenic to humans
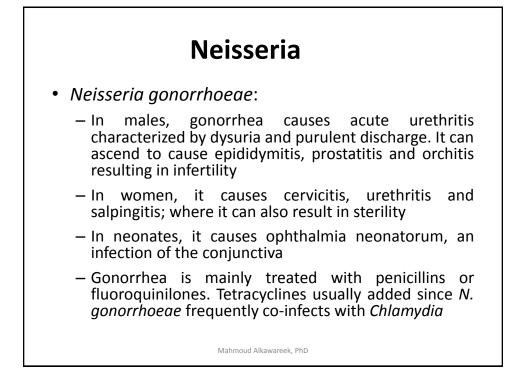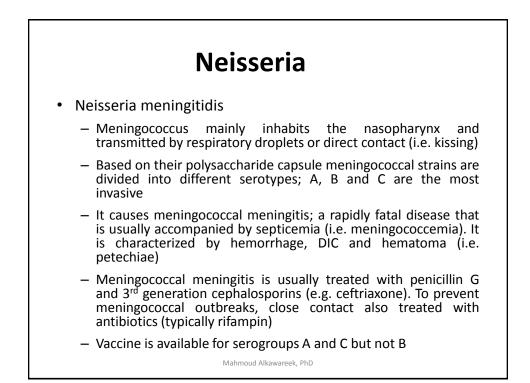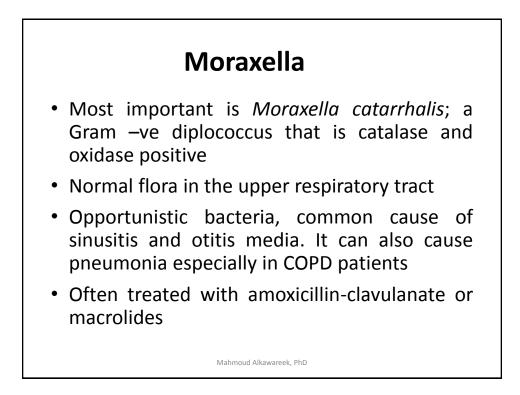
Mahmoud Alkawareek, PhD

Neisseria

- *Neisseria gonorrhoeae*:
  - Characterized by presence of pilli and produce IgA protease which enable it to colonize mucous membranes; mainly in genital tract and anal canal
  - Gonococcal infection is often asymptomatic in females (as asymptomatic carriers that act as the main reservoir)
  - Gonococcus is transmitted via direct contact (i.e. sexual contact and hence considered STD) and mainly infects sexually active young adults. It can also transmitted to neonates during birth
  - Gonococcus causes gonorrhea; an STD that mainly affects the genital tract in both males and females, it can also affect other body parts such as joints, skin and eyes

Mahmoud Alkawareek, PhD

Neisseria

- *Neisseria gonorrhoeae*:
  - In males, gonorrhea causes acute urethritis characterized by dysuria and purulent discharge. It can ascend to cause epididymitis, prostatitis and orchitis resulting in infertility
  - In women, it causes cervicitis, urethritis and salpingitis; where it can also result in sterility
  - In neonates, it causes ophthalmia neonatorum, an infection of the conjunctiva
  - Gonorrhea is mainly treated with penicillins or fluoroquinilones. Tetracyclines usually added since *N. gonorrhoeae* frequently co-infects with *Chlamydia*

Mahmoud Alkawareek, PhD

Neisseria

- Neisseria meningitidis
  - Meningococcus mainly inhabits the nasopharynx and transmitted by respiratory droplets or direct contact (i.e. kissing)
  - Based on their polysaccharide capsule meningococcal strains are divided into different serotypes; A, B and C are the most invasive
  - It causes meningococcal meningitis; a rapidly fatal disease that is usually accompanied by septicemia (i.e. meningococcemia). It is characterized by hemorrhage, DIC and hematoma (i.e. petechiae)
  - Meningococcal meningitis is usually treated with penicillin G and 3rd generation cephalosporins (e.g. ceftriaxone). To prevent meningococcal outbreaks, close contact also treated with antibiotics (typically rifampin)
  - Vaccine is available for serogroups A and C but not B

Mahmoud Alkawareek, PhD

Moraxella

- Most important is *Moraxella catarrhalis*; a Gram –ve diplococcus that is catalase and oxidase positive

- Normal flora in the upper respiratory tract

- Opportunistic bacteria, common cause of sinusitis and otitis media. It can also cause pneumonia especially in COPD patients

- Often treated with amoxicillin-clavulanate or macrolides
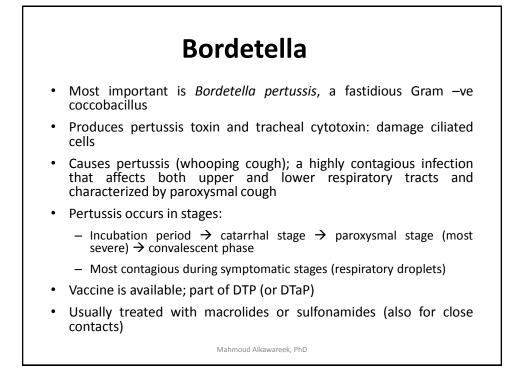
Mahmoud Alkawareek, PhD

Haemophilus

- Most important is *Haemophilus influenzae*; a large fastidious Gram –ve coccobacillus that grows only in enriched media (i.e. blood agar containing X- and V-factors)

- Type b capsulated serotype (Hib) is most virulent

- Normal flora in the upper respiratory tract but as an opportunistic bacteria it causes many infections, some of which can be serious, including:
  - Upper RTI: sinusitis, otitis media, pharyngitis and epiglottitis
  - Lower RTI: pneumonia
  - CNS: meningitis

- Hib vaccine: highly recommended for children below 5

- Traditionally treated with a broad spectrum penicillin (e.g. amoxicillin) but since many strains are β-lactamase producing it is often replaced by amoxicillin-clavulanate, 2nd & 3rd generation cephalosporins, macrolides or fluoroquinolones

Mahmoud Alkawareek, PhD

Bordetella

- Most important is *Bordetella pertussis*, a fastidious Gram –ve coccobacillus

- Produces pertussis toxin and tracheal cytotoxin: damage ciliated cells

- Causes pertussis (whooping cough); a highly contagious infection that affects both upper and lower respiratory tracts and characterized by paroxysmal cough

- Pertussis occurs in stages:
  - Incubation period → catarrhal stage → paroxysmal stage (most severe) → convalescent phase
  - Most contagious during symptomatic stages (respiratory droplets)

- Vaccine is available; part of DTP (or DTaP)

- Usually treated with macrolides or sulfonamides (also for close contacts)

Mahmoud Alkawareek, PhD

Brucella

- Intracellular non-motile non-capsulated Gram –ve cocoobacillus

- Three pathogenic species are known, most important is *Brucella melitensis* which is mainly present in goats and sheep

- Transmitted by unpasteurized milk/dairy products, undercooked meat and direct contact with animals secretions

- Causes brucellosis; a chronic zoonotic disease that affects many body parts

- Treated with antibiotic combination, usually including rifampin and tetracyclines

Mahmoud Alkawareek, PhD