Lecture 4

**Genus Neisseriae**

The Neisseria species are gram negative cocci that usually occur in pairs, *Neisseria gonorrhea* “gonococci” and *Neisseria meningitidis* “meningococci” are pathogenic for human and typically are found associated with or inside polymorphonuclear leukocytes (PNL).

Some Neissriae are normally inhabitant of human respiratory tract and occur extracellularly. Gonococci and meningococci are closely related with 70% DNA homology and are differentiated by few LAB tests and specific characteristics:

**Meningococci:** 1) have polysaccharide capsules  
2) Rarely have plasmids  
3) They cause a disease called meningitis.  
4) Ferment glucose and maltose

**Gonococci:** 1) do not have capsules  
2) They have plasmids  
3) They cause genital infection  
4) Ferment glucose only
Neisseria meningitidis within PNC in spinal fluid

Neisseria gonorrhoeae

Neisseria gonorrhoeae in urethral discharge

The Neisseriae are:
1) Human pathogens
   - Neisseria gonorrhoea (gonococcus) cause genital infection.
   - Neisseria meningitidis (meningococcus) cause acute meningitis or subacute septicemia with petechial rash.
2) Non pathogenic:
- *Neisseria sicca*
- *Neisseria subflava*
- *Neisseria lactamica*
- *Neisseria mucosa*

These are normal inhabitants of human respiratory tract.

**Morphology and Identification**

A) Typical organisms: they are Gram negative, non motile, non spore forming diplococcus, 0.8 μm in diameter, and kidney in shape, arranged in pairs. Pathological spp. are intracellular while non pathogenic are extracellular.

B) Culture: in 48 hours on enriched medium gonococci and meningococci form convex elevated mucoid colonies 1-5 mm in diameter colony are opaque, non pigmented and non hemolytic. The non pathogenic spp. can grow in simple media while the pathogenic spp. need enriched media e.g (blood and chocolate agar) selective media for Neisseria called (Modified Thyer martin agar).

C) Growth characteristics: Neisseria grow best under aerobic conditions, ferments carbohydrates producing acid but not gas, they give +ve oxidase test. The microorganism are rapidly killed by drying, sunlight and many disinfectants.
Biochemical test :-

1) Oxidase test

2) Sugar fermentation test

These tests can differentiate the pathogenic Neisseria from the non pathogenic and can also differentiate spp. from each other.

*Neisseria gonorrhoeae* produces acid from oxidation of glucose but not from maltose, sucrose, or lactose. *Neisseria* species produce acid end products from an oxidative pathway rather than from fermentation. The acid turns the pH indicator phenol red from red to yellow. Lactose, not shown here, is not utilized by *N. gonorrhoeae*. 
1) Neisseria gonorrhea (gonococcus)
One of the pathogenic spp. of Neisseria it’s responsible for a human disease (Gonorroea) which is a sexually transmitted disease (STD) the clinical infection cause by this M.O is divided into 2 types:
1) Localized infection.
2) Systemic infection.
Localized infection:

The microorganism cause localized infection in the genital organs (on the mucous membrane) and to a lesser extent the mucous membrane of the rectum, eye, throat. So when the m.o invade the tissue it will cause suppurative inflammation in the area characterized by pus cell formation it can be followed by chronic infection which is associated with fibrosis. Localized infection can be divided into:-

A) Genital infection: which differ in male than in female.
In male it causes urthritis associated with mucopurulent discharge from anterior urethra and dysurea the infection can extend to the epidedimis leading to epidedmitis and if not treated it will be complicated by fibrosis and urethral stricture.
In female the first site of infection is the cervix causing cervicitis the infection is going to spread from cervix to the vagina causing vaginitis and presented by vaginal discharge which is
mucopurulent in nature, if not treated it will spread upward to involve fallopian tube resulting in salpingitis which lead to fibrosis with tube stricture leading to infertility due to tubal damage.

B) Rectal involvement: This is also a localized infection caused by gonococcus called proctitis and the patient presenting symptoms are purulent discharge from anus with tensmus.

C) Eye infection: occur in new born babies during their passage through infected birth canal causing a condition called (ophthalmia – neonatorum) which is a very serious condition and if untreated it will lead to blindness.

Prevention of this condition is by using antimicrobial agent as silver nitrate and erythromycin.

D) Throat infection occur in abnormal person’s suffering from Gonococal pharyngitis it’s common in homosexual person.

2) Systemic infection:

The m.o. spread from the site of infection via the blood stream to the distant organs it will mainly involve the skin, bone, joints causing arthritis or the brain in form of meningitis some time it cause endocardaitis.
Diagnostic LAB tests:

a) Specimens:

Pus and secretion are taken from the urethra, cervix, rectum, conjunctiva, throat or synovial fluid for culture and smear.

b) Smears:

Gram stained smears of urethral or endocervical exudate reveal many diplococci within pus cells.

c) Culture:

Immediately after collection pus or mucous is streaked on enriched selective medium.

d) Serology:

Serum and genital fluid contain IgG and IgA antibodies against gonococcal infection, but it is not of great value in the diagnosis because of the antigen diversity of Gonococci and there is delay in the development of these antibodies so it is more important to detect Gonococcal antigens using a technique called ELISA i.e that is Enzyme linked immunosorbent assay or using radioimmuno assay (RIA).

e) Detection of Gonococcal nucleic acid using DNA probe which can detect nucleic acid of the m.o.
Antigenic structure

Gonococci are antigenically Heterogenous both in vivo and in vitro. These antigenic changes help the m.o. to escape from the immune system causing damage to the body tissues these include:

A- Pilli:

Are hair like structures that extend up to several microns from the gonococcal surface. The function of the pilli is by which the m.o. will attached to the host cell m.m. these pilli are antiphagocytic and it will stimulate Abs formation.

B- Por (protein I):

Extends through the gonococcal cell membrane each strain of gonococcus expresses only one type of por but the por of different strains is antigenically different.

C- Opa (protein II)

This protein function is adhesion of gonococci to host cell.

D- RMP (protein III)

It is associated with Opa protein in the formation of pores.

E- Lipo oligosaccharide:

It has Endotoxic effect and it is responsible for toxicity of gonococci.

F- IgA protease:
An enzyme protein produced by gonococci which split IgA making it in non functioning form, so IgA protease is a virulent factor that enhances colonization of bacteria.

Treatment

Uncomplicated urethral or rectal infection can be treated with cefotaxime I.M. as single dose, the other antibiotic is penicillin but 50% of Gonococci are penicillin resistant doxycyclin is recommended but not suitable for pregnant women so erythromycin is used.

2) Neisseria meningitidis (meningococcus)

It is the pathogenic spp. of Neisseria causing C.N.S. in form of meningitis and the m.o. can normally carried in the upper respiratory tract (carrier ) which are the most important clinical source of infection.

Antigenic structure
1) At least 13 serogroups of meningiococci have been identified by immunologic specificity and capsular polysaccharides the most important serogroups associated with disease in human are A,B,C,Y, W135 ,they are associated with fulminant sepsis with or without meningitis which is used for the preparation of vaccines.
2) Outer membrane protein
3) pilli
4) Opa
5) Lipooligopolysaccharide

Pathogenicity

The source of the infection is either the patient or the carriers which have asymptomatic infection.

The route of entry is through the nasopharynx by droplet infection then the m.o. will attached to the epithelial cell by pilli. From the nasopharynx the meningococci will spread through the blood stream to the target organ causing bacteremia. So the sequelae is either meningitis or suffer from fulminating meningococcemia.

Meningitis is the most common complication it is usually begins suddenly with headache, vomiting and stiff neck, this will progress to coma within few hours.

Fulminating meningococcemia is more sever with high fever and hemorrhagic rash; there may be disseminated intravascular coagulation and circulatory collapse (water- house- friderichsen syndrome).
Diagnosis by LAB. Tests:

a) Specimens:

Specimens of blood are taken for culture and specimens of CSF are taken for smear, culture and chemical determination and nasopharyngeal swab are taken for carrier survey’s.

b) Smears:

Gram stain smear of CSF show typical Neisseria within polymorphnuclear leukocytes.

c) Culture:

CSF specimens are placed on heated blood agar (chocolate agar and Thyer martin media) and incubated at 37c.

d) Serology:

Antibodies to meningococcal polysaccharides can be measured by latex agglutination or by immuno electrophoresis.

e) PCR

Treatment:

Penicillin G is the drug of choice for treating meningococcal disease. In patient allergic to penicillin chloramphenicol and ceftriaxone (or ceftriaxone) can be used.
Prevention:
1) Irradication of the carrier states (major source).
2) Isolation of the patient.
3) Chemoprophylaxis for contact people.
4) Vaccination.

Moraxella catarrhalis:

Previously they are called Neisseria catarrhalis, the name changed to Branhamella and now they are separated genus “Moraxella”.

They are normally found in upper respiratory tract especially among school children. (50% of school children carry this microorganism) it has been reported that this species may cause pneumonia otitis media, sinusitis and other infections. It is oxidase +ve.