

# Family Neisseriaceae

## **Genus : Neisseria**

### **General characters**

- 1- Gram-negative diplococci with adjacent sides flattened (like coffee beans)
- 2- They are aerobic but grow better at 5-10% CO<sub>2</sub>
- 3- Catalase and oxidase +ve ( last one is very important test)
- 4- Very delicate bacteria and rapidly killed by drying, sunlight and heat
- 5- Oxidize CHO and their sugar patterns are used for species differentiation
- 6- Two important strict human pathogens namely *N.gonorrhoeae* cause STD or venereal disease called Gonorrhea or GC and *N.meningitidis* which cause meningitis (epidemic). Other species normally colonize mucosal surfaces of oropharynx and nasopharynx and occasionally anogenital mucosal membranes.
- 7- They are fastidious bacteria require enriched media like chocolate agar (non-selective) and selective media like modified Thayer-Martin media, Martin Lewis agar containing antibacterial and antifungal drugs)

## **N.gonorrhoeae**

What is the difference between venereal or STD and ST infection? Sexually transmitted infections but without signs and symptoms like HIV and HBV but in venereal diseases there are signs and symptoms.

1- Gram-negative diplococci flattened along the adjoining side.

2- oxidize only glucose

3- Cause gonorrhea (Gonus=seeds or semen, rhoea=flow) is a venereal disease or STD transmitted by sexual contact

4- **Fastidious** (enriched media), **capnophilic (5-10%)** and **very delicate** (die rapidly outside of the body)

5- Undergoes frequent antigenic variation in their surface proteins in order to evade from immune system

6- There are four main surface proteins

A- **Pili** or fimbriae (Protein I): extrude from the surface and mediates **attachment** to host cells and resistance to **phagocytosis**.

B- Por or Porin (protein II): Impedes intracellular killing of GC within neutrophils by preventing phagosome-lysosome fusion.

C- RMP (Reduction modifiable Protein) or Protein III: associates with Por proteins to form porins in the cell membrane (Figure 1).

D- Opa protein :These proteins function in **adhesion of gonococci** within colonies and in **attachment** of gonococci to host cell receptors

7- Lipooligosaccharide (LOS) differ from lipopolysaccharide (LPS) in enteric bacteria by absence of somatic antigen (O-Ag) and structurally resemble to **host cell lipid** which help GC to **evade immune system**. It is responsible for toxicity in GC infection.

8- Secretes IgA1 protease inactivates IgA , a major mucosal Ig.

9- Produce beta lactamase (plasmid encoded and transmitted by conjugation)

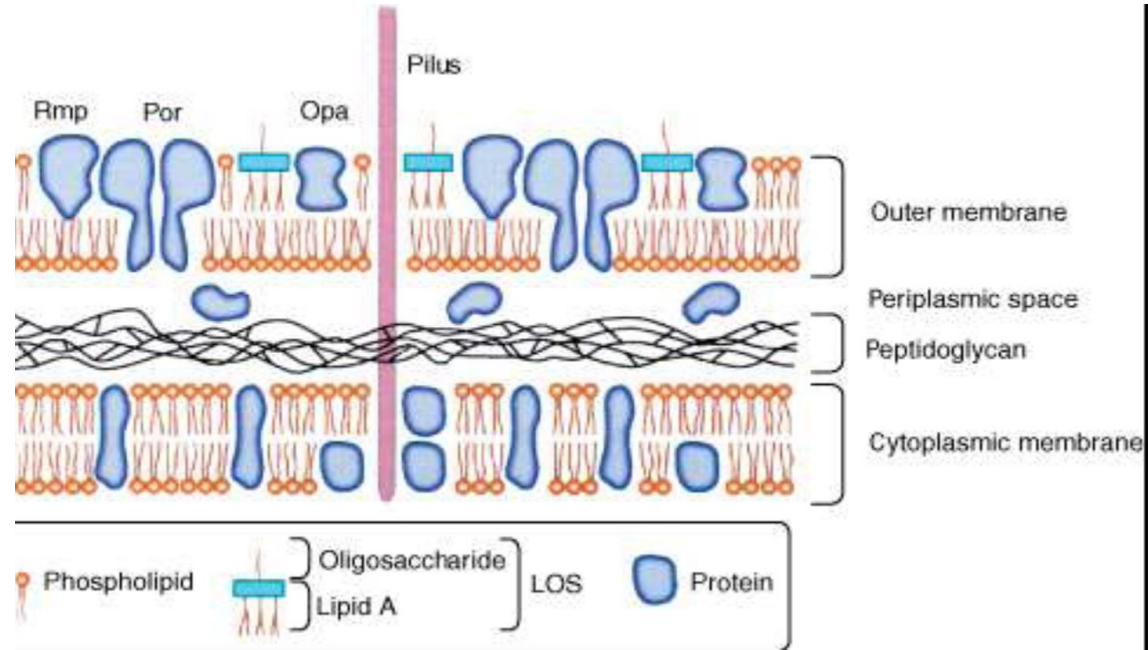


Fig.1. Cell wall structure of *N.gonorrhoeae*

## Clinical findings

<u><b>Gonorrhea</b></u> or GC in Females	<u><b>GC in Males</b></u>
<b>Most asymptomatic infections (50%) or carrier especially among prostitutes</b>	<b>Most symptomatic (95% acute) and only 5-10% asymptomatic</b>
<b>Genital infection primary site is cervix (cervicitis), but vagina, urethra, rectum can be colonized (Figure 2).</b>	<b>Genital infection generally restricted to urethra (Acute anterior urethritis with LP 2-3 days.) with purulent discharge and dysuria as shown in figure 3 if left untreated can lead to chronic urethritis manifested as morning drop.</b>
<b>Ascending infections in 10-20% including salpingitis, tubo-ovarian abscesses, pelvic inflammatory disease (PID) , chronic infections can lead to infertility or ectopic pregnancy.</b>	<b>Rare complications may include epididymitis (infertility), prostatitis, and periurethral abscesses and urethral stricture</b>
<b>Disseminated infections more common, including septicemia, infection of skin (Figure 4 )and joints (Figure 5) (1-3%). People with complement deficiency (C6789) are more susceptible to disseminated infections.</b>	<b>Disseminated infections are very rare</b>
<b>Can infect infant at delivery (conjunctivitis, <b>ophthalmia neonatorum</b> (Figure 6). In young girls can cause <b>vulvo-vaginitis</b></b>	

**Proctitis among homosexuals or pharyngitis among orosexuals.**



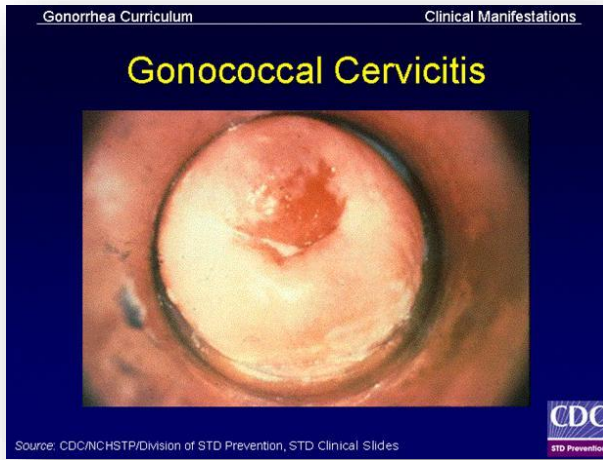


Fig.2. Cervicitis



Fig.3. Urethritis



Fig.4. Skin lesions (DGI)



Fig.5. Septic arthritis (DGI)

### OPHTHALMIA NEONATORUM:

- EYE INFECTION IN THE NEWBORN.
- RESULTS DUE TO DIRECT INFECTION DURING PASSAGE THROUGH THE BIRTH CANAL.



Fig.6. Neonatal gonococcal eye infection

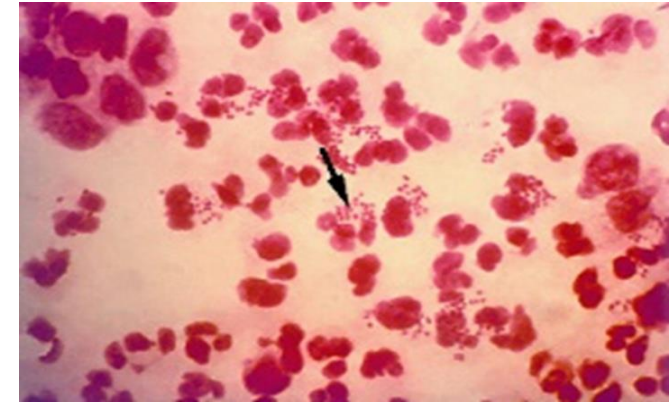
## Laboratory diagnosis

### Specimens

Pus or secretion collected from: Urethral discharge, cervix swab, rectal swab, throat swab, conjunctival swab, synovial fluid

### Direct microscopic examination

Gram stained smear from male urethral discharge reveal Gram negative intracytoplasmic diplococcic is **diagnostic for GC in males** (Figure 7) but not for women.



### Culture

**Immediate culture samples** on either enriched non selective media like chocolate agar or selective media like modified Thayer-Martin agar (MTM) same of Thayer Martin agar but with trimethoprim (chocolate agar supplemented with vancomycin = inhibits +ve), colistin (inhibits Gram -ve, Nystatin =inhibits fungi an trimethoprin inhibits swarming Proteus. Martin Lewis agar decrease cons. Of vancomycin because some strains of GC are vancomycin sensitive (Amphotericin B, vancomycin, trimethoprim, lincomycin and colistin).

Incubate at 37C for 24 to 48 hours under 5-10% CO<sub>2</sub>

Colonies are small, round, translucent, convex or slightly umbonate with finely granular surface & lobate margins as shown in figure 8.

### Biochemical reactions

Oxidase positive (Figure 9) and oxidize only glucose and not maltose (Figure 10)



Fig.8. Colonies of GC on MTM.

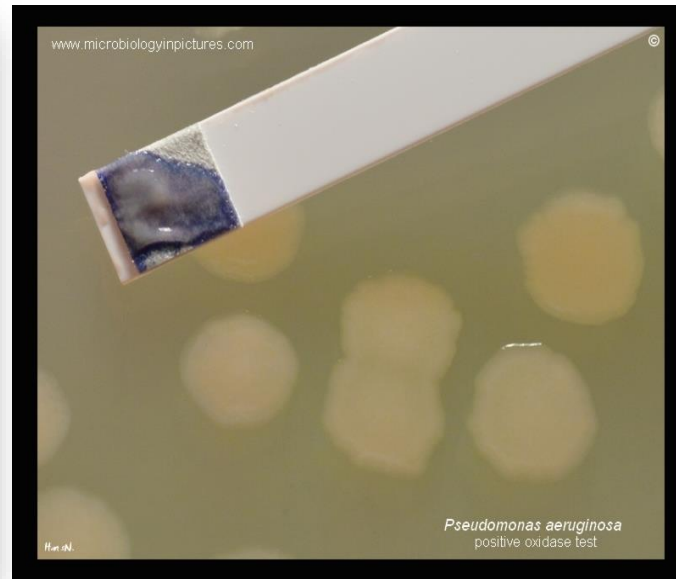


Fig.9. Oxidase positive test.



Fig.10. Sugar oxidation test

PCR method



## Treatment

Ceftriaxone 250 mg I.M as a single dose or Cefixime 400 mg as a single dose or ciprofloxacin 500 mg as a single dose + azithromycin 1 g orally in a single dose with doxycycline 100 mg 1X2 for 7 days ( except for pregnant women) to affect concomitant Chlamydial infections)

## Prevention

- 1- No vaccine
- 2- Avoid adultery
- 3- Use condoms



## **N.meningitidis**

### **General characters**

- 1- Morphologically and in cultural characteristics similar to GC. But oxidize both glucose and maltose
- 2- At least 13 different serogroups have been identified based on capsular antigen but serogroups A,B,C,X, Y and W-135 are most commonly associated with human infections and each serogroup has different serotypes according to outer membrane protein (**Por protein**).
- 3- The highest levels of endotoxin measured in sepsis have been found in patients with meningococemia (50 to 100 times greater than those in Gram negative enteric infections).
- 4- About 5-30 % of people may carry in the nasopharynx and the route of infection is inhalation
- 5- The infection can be prevented using capsular vaccine
- 6- They produce cerebrospinal meningitis and meningococcal septicemia. Bacteremia favored by absence of bactericidal antibody (IgG) or its inhibition by blocking IgA antibody or a complement deficiency (C5, C6, C7 or C8).

7- From nasopharynx, meningococci reach CNS via blood or along perineural sheath of olfactory nerve producing suppurative inflammation of the meninges. (Transmitted by droplets or airborne)

8-Meningococcemia may occur with or without **meningitis**. Meningitis (epidemic) characterized by fever, vomiting, headache and neck stiffness. The most severe form of infection is **meningococcal septicemia** which clinically characterized by high fever, and hemorrhagic rashes (Figure 11) due to blood vessels thrombosis which may develop into DIC and circulatory failure (Waterhouse-Friderichsen syndrome=adrenal gland hemorrhage-Hormone insufficient-death)

## Laboratory diagnosis

### Specimens

**Blood, CSF and petechial rashes from clinical cases, while nasopharyngeal swabs from carriers**

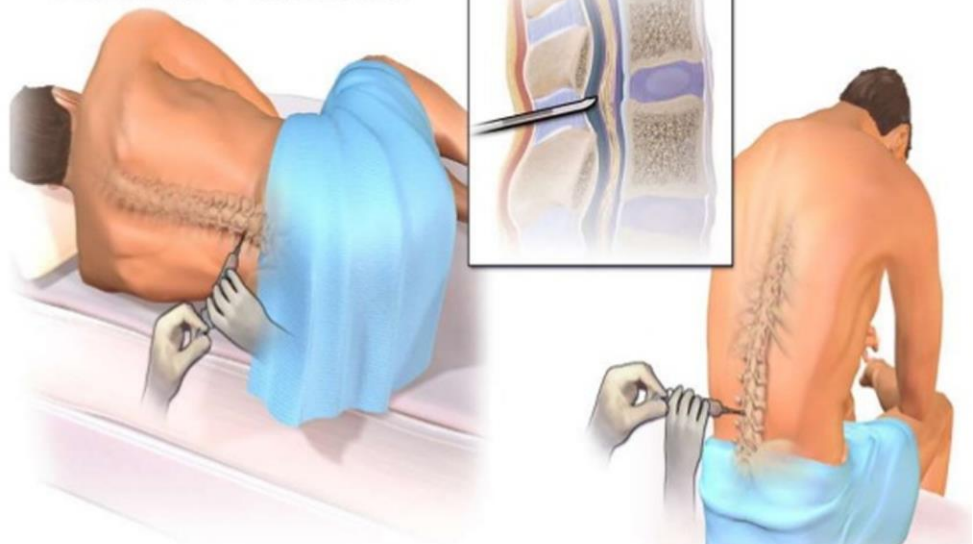
**Direct microscopic examination of the Gram stained smear from the sediment of centrifuged CSF or petechial hemorrhage fluid reveals Gram negative extra or intracytoplasmic Diplococci associated with many neutrophils.**



Fig..11. Hemorrhagic skin rashes

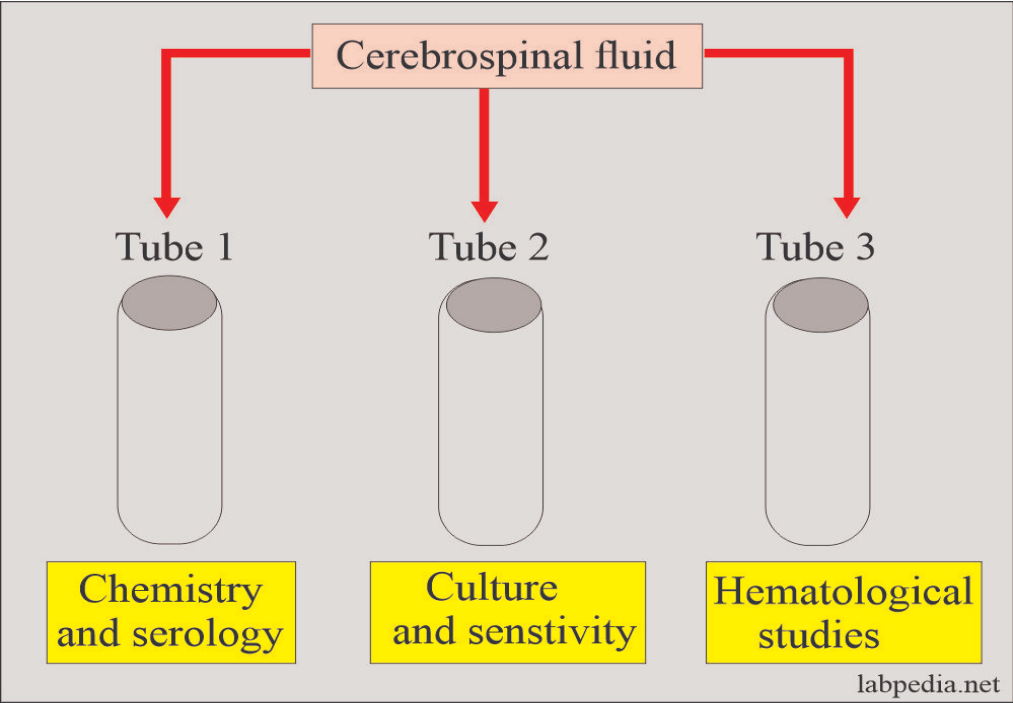
# Patient Position

Lumbar Puncture



Lying Position

Sitting Position



	Opening Pressure (mm Hg)	Cell Count (WBC Cells/microL)	Protein (mg/dL)	Glucose (mg/dL)
Normal	8 - 15 <small>(100 - 180 mm of H<sub>2</sub>O) with patient lying on their side</small>	0 - 5	< 40	40 - 70
Bacterial	↑	↑ PMNs	↑	↓
Viral	↑ or normal	↑ Lymphocytes	↑ or normal	normal
Fungal/TB	↑	↑ Lymphocytes	↑	↓



**Serological diagnosis by latex agglutination test to detect meningococcal capsular antigens in the CSF.**

**Culture: CSF on chocolate agar at 37 under 5-10% CO<sub>2</sub>, while nasopharyngeal swab on Modified Thayer-Martin agar**

**Colony morphology: small gray colonies**

**Gram stain: Gram negative diplococci**

**Biochemical reactions**

**1- Oxidase positive**

**2- Oxidize both glucose and maltose**

**PCR from CSF or blood**



## **Treatment**

**Empirical therapy like combination between ceftriaxone and ampicillin or cefotaxime**

**Rifampin 600 mg orally 2X2 for 2 days or Ciprofloxacin 500 mg single dose can eradicate carriers. Chemoprophylaxis for household and other close contact.**

**Vaccination of risk group is necessary. Meningococcal conjugative vaccine (Groups A,C ,Y and W135)**

A 25 years old boy suffered from severe pain during urination with copious creamy pus discharge. He practiced sex illegally before one week without condoms.

What is the diagnostic test for this case?

What is the main complication if left untreated?

A prostitute woman presented with lower abdominal pain, pain during sex (dyspareunia) with few drops of blood after sex. During vaginal examination the cervix is inflamed with pus discharging for cervical os.

What is most likely cause of this condition?

Name the diagnostic test for this case?

Name the main complication that may lead to infertility?