

NEISSERICAE

NEISSERIA

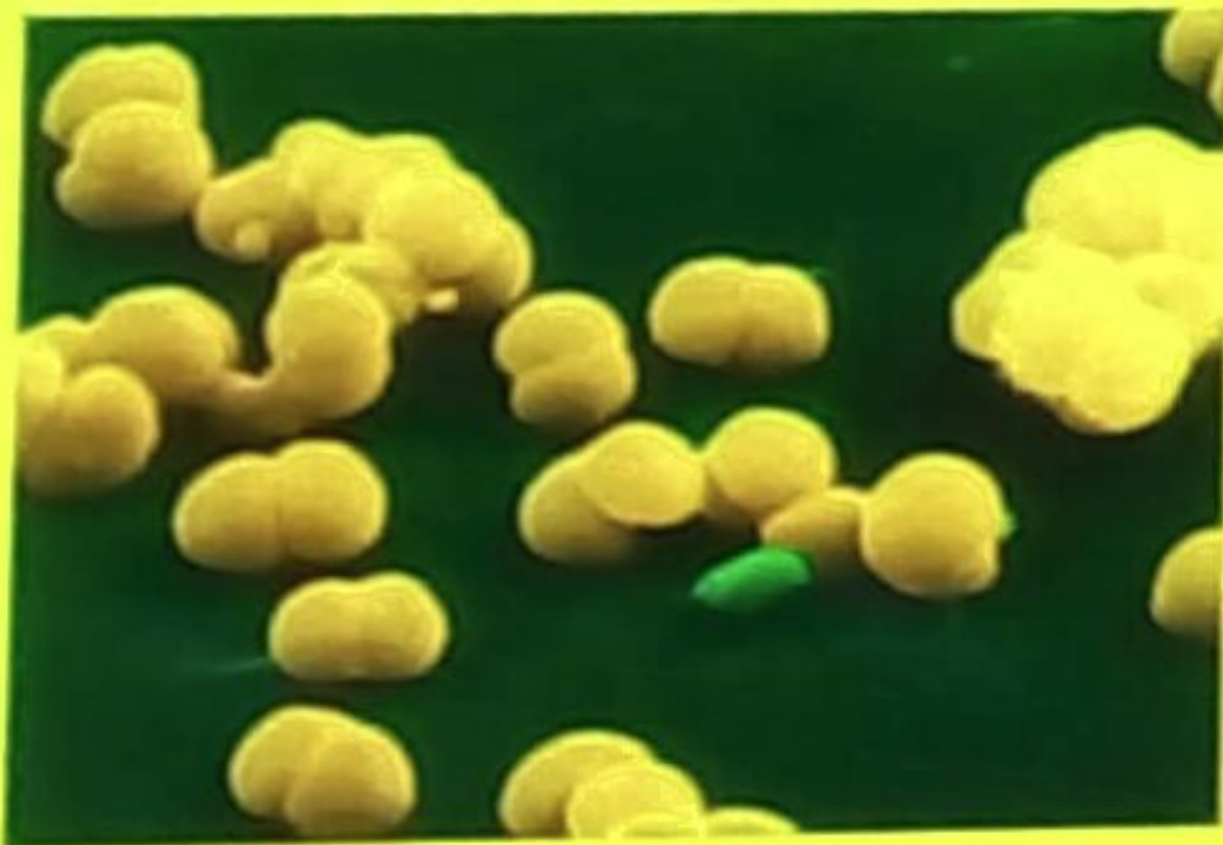
IMPORTANT PROPERTIES

1. Neisseriae are gram negative oval cocci occurring in pairs (kidney beans shape).

Gram negative cocci

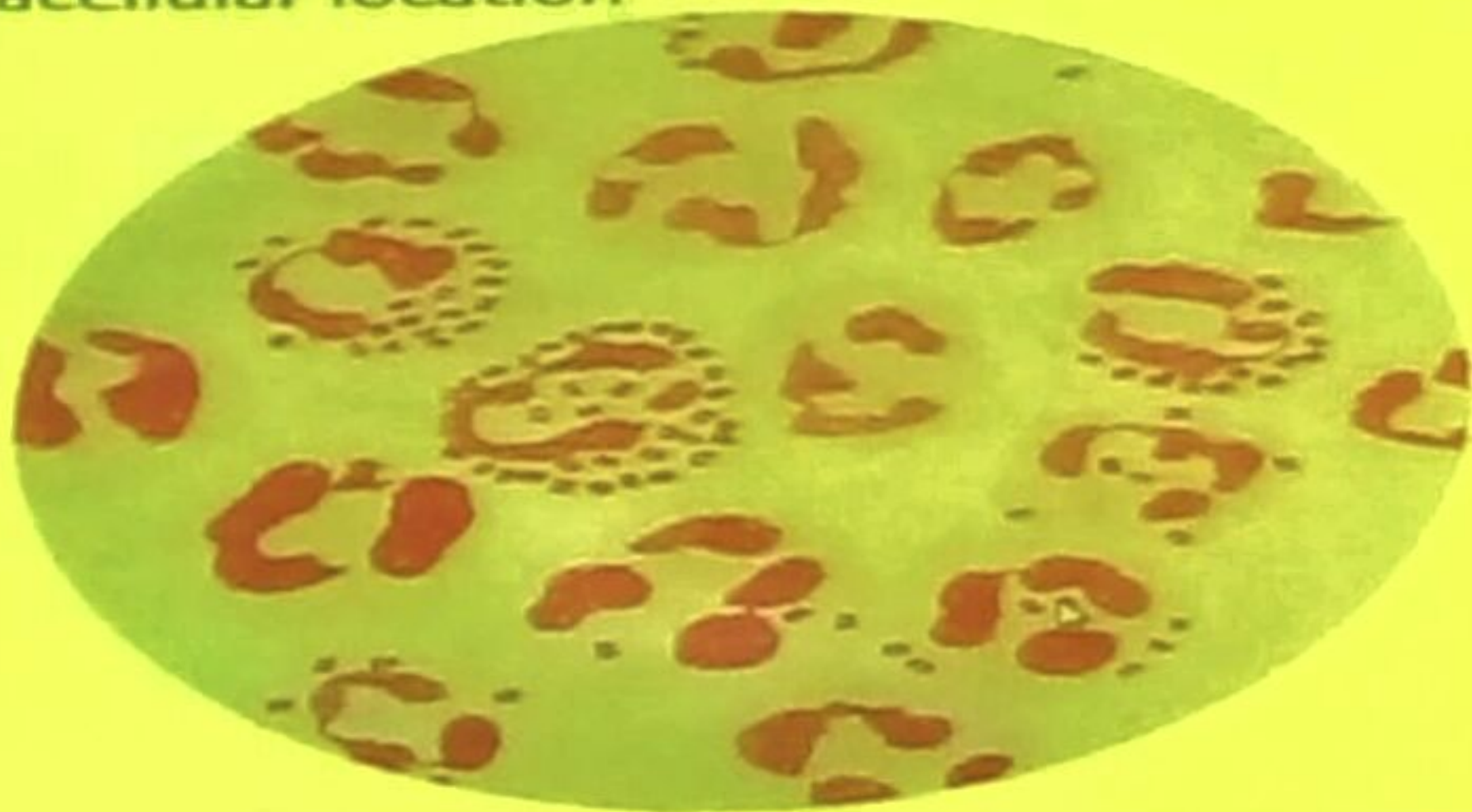


Kidney bean shape in pairs



2. The pathogenic members, the meningococcus and the gonococcus are found inside polymorphonuclear pus cells of the inflammatory exudates.

Intracellular location



3. Neisseriae contain endotoxin in their outer membrane.

- *N. meningitidis* is a lipopolysaccharide(LPS)
- *N. gonorrhoeae* is a lipooligosaccharide (LOS)

4. They possess the enzyme cytochrome c which makes them oxidase positive. All clinically relevant species.

5. Species identification depends on carbohydrate utilization among other tests. (maltose, glucose, sucrose)

- 6. Both organisms may bear fimbriae.
 - The more virulent gonococcal strains bear numerous fimbriae

7. Other members of the genus are common commensals of the upper respiratory tract (11 species) which is also the reservoir of the meningococcus.
- *N. lactamica* and *N. polysacchareae*: isolated from the nasopharynx.
 - Others: *N. subflava*, *N. sicca*, *N. mucosa*, *N. flavescens*, *N. elongata* and *N. weaveri*.

Neisseria meningitidis

- Humans are the only natural hosts for meningococci: upper respiratory tract

Bacteria's inability to get iron from other sources other than human transferrin and lactoferrin

- Transmission by airborne droplets. Also spreads thru saliva and respiratory secretions during coughing, sneezing, kissing, chewing on toys



- From the nasopharynx, the organism can enter the bloodstream and spread to specific sites eg meninges, joints or throughout the body (meningococemia).
- Carriers are asymptomatic...(5-15% of adults)
- Carrier rate is high in people who live in close quarters
- Causes only form of bacterial meningitis known to occur epidemically..(mainly Africa, Asia)

➤ Meningococci have important virulence factors:

1. A polysaccharide capsule-

- resists phagocytosis by polymorphonuclear leukocytes (PMNs).
- defines the serologic groups
- detected in the spinal fluid of patients
- is the antigen in the vaccine.

2. Pili, Surface proteins Opa and Opc-
attachement to cells

3. Endotoxin (LPS)-

- causes fever, shock, DIC

4. Immunoglobulin A (IgA) protease

- cleaves secretory IgA

- helps the bacteria attach to membranes
in the upper respiratory tract.

IMMUNE RESPONSE

- Resistance to disease correlates with presence of antibody to the capsular polysaccharide.
- Immunity is sero-group specific
- People with complement deficiencies have increased incidence of meningococcal bacteremia.

SEROLOGICAL CLASSIFICATION

- Serogroup of meningococcus is determined by its lipopolysaccharide capsular antigen.
- Identified by slide agglutination with absorbed group specific antisera.
- DNA sequence analysis used to fully characterize strains.

Examples of serogroups that have been identified:

- **Group A-** associated with cerebral epidemic meningitis. Most prevalent in Africa, Asia
- **Group B-** seen in epidemic and outbreak situations
- **Group C-** seen in epidemic and local outbreaks
- **Serogroup W 135-** isolated occasionally, major outbreak in Mecca pilgrimage 2000/2001
- **Serogroups X and Y**
- **Serogroups Z and 29E-** causes disease in patients with underlying disease

CLINICAL MANIFESTATIONS

2 important clinical manifestations:

- meningitis (fever, headache, stiff neck, increased PMNs in spinal fluid).
- meningococemia
 - Typically causes purpuric rash (non-blanching rash)
 - 50% mortality rate
 - massive bilateral hemorrhage into adrenal glands caused by fulminant meningococemia, disseminated intravascular coagulation, thrombocytopenia, adrenal insufficiency)

(Waterhouse-Friderichsen syndrome)

OUTLINE OF LABORATORY ISOLATION AND IDENTIFICATION

Specimen collection and transport



Gram stain from specimen



Culture in media



Colonial morphology



Gram stain of colony



Biochemical tests



Antibiotic susceptibility test

Class: fill in this outline
using our previous discussion.

LABORATORY DIAGNOSIS

1. Specimen: Blood, CSF, disseminated sites
2. Gram stain: of centrifuged deposit of spinal fluid: gram negative diplococci inside PMNs



3. Culture:

- Media: Blood in blood culture bottles-
Castenada

CSF in Chocolate Blood Agar

- Incubation temp.: 35-37°C
- Duration: 18-24 hours
- Increased CO₂ atmosphere (5-10%)

Castenada Blood Culture bottle.

After growth on solid phase, organism is subcultured to Chocolate Blood Agar

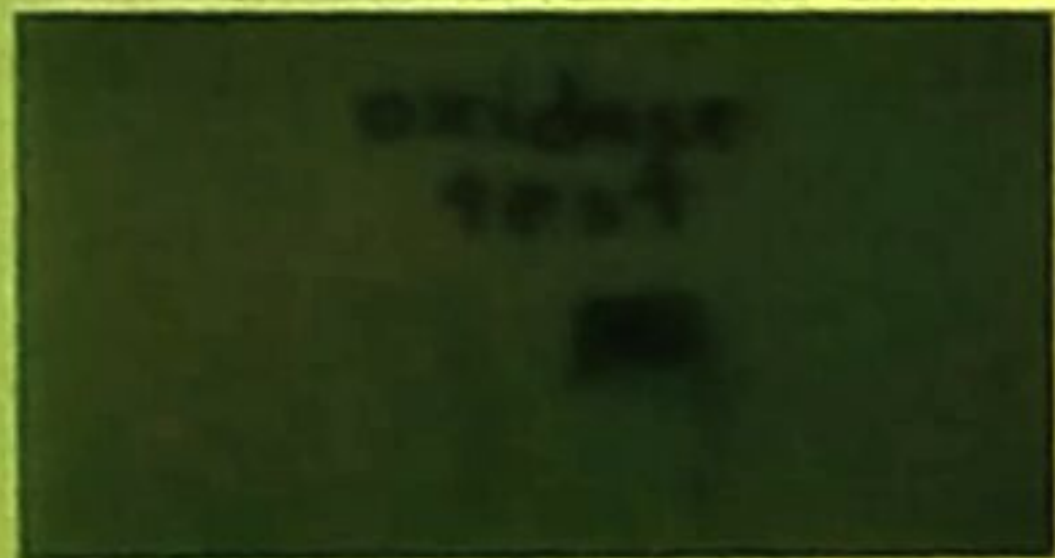


4. Colonial morphology: Small translucent grey colonies on EBA
5. Gram stain of colonies: Gram negative diplococci



6. Biochemical Tests:

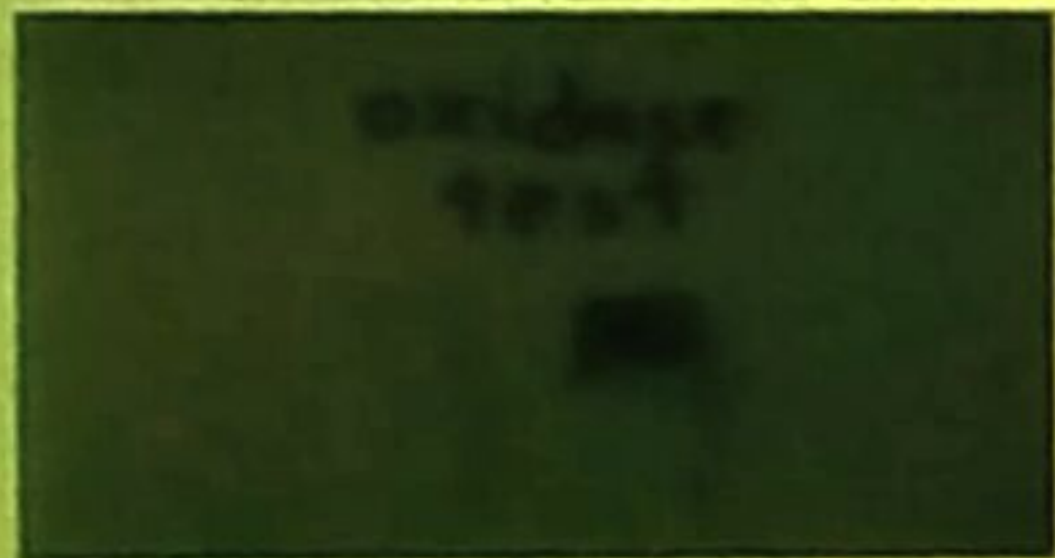
- Positive oxidase test



- Sugar Fermentation Tests: Ferments glucose and maltose

6. Biochemical Tests:

- Positive oxidase test



- Sugar Fermentation Tests: Ferments glucose and maltose

Other tests:

Meningococcal capsular polysaccharide may be demonstrated rapidly in CSF by

- counter-current electrophoresis
- latex agglutination
- PCR.

TREATMENT AND CONTROL

3rd generation cephalosporins

- cefotaxime
- ceftriaxone

- Chemoprophylaxis
 - Can be used to control outbreaks of the disease by eradicating the organism from carriers.
 - Recent contacts of infected patients, child caregivers, direct exposure to patients eg thru mouth to mouth resuscitation
 - Oral rifampicin

- **Vaccines**

- **Contain the pure group specific capsular polysaccharide.**

- **Vaccines for meningococci of groups A, C, Y and W135 are available and are good immunogens.**

- ❖ **The protection provided is group specific.**

Neisseria gonorrhoeae

First described...Albert Neisser, 1879

Gonorrhoeae derived from the Greek words *gonos* (seeds) and *rhoia* (flow).

Species of gram negative coffee bean shaped diplococci bacteria responsible for a sexually transmitted infection- gonorrhoea

EPIDEMIOLOGY AND PATHOGENESIS

- *N. gonorrhoeae*: exclusively a human pathogen although chimpanzees have been infected artificially.
- Transmitted: sexually, during birth.
- Genital tract infections, anorectal and pharyngeal infections have also been observed.

➤ Important virulence factors include:

- Pili- mediates attachment to mucosal surfaces and movement along surfaces, gene transfer
- type IV pili...have the Pil F (extension) and Pil T (retraction) proteins that mediate the twitching motility of the bacteria
- type IV pili...have the Pil Q proteins that make the bacteria naturally competent for DNA exchange...ability to conjugate contributes to spread of antibiotic resistance

- Outer membrane proteins (OPA) bind receptors on host immune cells to prevent an immune response; also to prevent establishment of an immunological memory

Evasion of immune system also thru antigenic variation of pili IV and OPA proteins

- IgA protease- hydrolyzes secretory IgA.
 - Porin A- a porin protein in the cell wall inactivates the C3b component of the complement system.
 - Lipooligosaccharide- an endotoxin
- Gonococci have no capsules.

- Gonococci primarily infect the mucosal surfaces in the urethra and vagina
- Certain strains disseminate more than others due to their resistance to being killed by antibodies and complement.
- Host defences against gonococci are antibodies (IgA and IgG), complement and neutrophils

- Persons with a deficiency of the late acting complement components (C6-C9) are at risk for disseminated infections.

CLINICAL MANIFESTATIONS

- In women:
- Asymptomatic carriage is common.
- Infection is primarily in the endocervix, causing a purulent vaginal discharge
- Gonococci ascend the fallopian tubes leading to acute salpingitis, pelvic inflammatory disease and a high probability of sterility.
- Ectopic pregnancy can occur as a result of scarring of tubes.

- In men:
- Acute urethritis, dysuria, purulent penile discharge.
- Truly asymptomatic infection is rare in the male.

- **Babies: ophthalmia neonatorum.**
- **A severe purulent eye discharge with peri-orbital oedema occurs a few days after birth.**
- **can result in blindness.**
- **1% aqueous silver nitrate can be used, or topical erythromycin (active against Chlamydia also).**

- **Dissemination:**
 - **Peritoneal spread occasionally occurs and may produce perihepatic inflammation (Fitz- Hugh- Curtis syndrome)**
 - **Disseminated infection can also present with painful joints, fever, septic lesions. Rarely endocarditis .**

- LABORATORY DIAGNOSIS

- Specimen:

- urethral and cervical exudates
- centrifuged urine from males
- rectal swab if indicated
- eye swab in ophthalmia neonatorum
- Stuart transport media must be used to carry the material on swabs.

- Culture: on Chocolate Blood Agar, Thayer-Martin medium (chocolate agar with antibiotics- vancomycin, colistin, trimethoprim and nystatin to suppress the normal flora.



- 35-37°C, 5-10% CO₂, 18-24 hours

- Colonial morphology: small, raised grey translucent colonies
- Gram stain of colony: Gram negative diplococci



➤ **Biochemical Tests:**

- **Oxidase positive colony**
- **Carbohydrate utilization tests indicate fermentation of glucose.**

➤ **Serological Tests:**

- **rapid tests include**
 - **ELISA- to detect gonococcal antigens**
 - **DNA probe assay to detect gonococcal ribosomal genes.**

TREATMENT AND CONTROL (WHO STI GUIDELINES)

** Emphasis should be on local resistance data for dual and single therapy

Genital and anorectal gonococcal infections

Dual therapy (one of the following)

- ceftriaxone 250 mg intramuscular (IM) as a single dose PLUS azithromycin 1 g orally as a single dose
- cefixime 400 mg orally as a single dose PLUS azithromycin 1 g orally as a single dose

Single therapy (one of the following, based on recent local resistance data confirming susceptibility to the antimicrobial)

- ceftriaxone 250 mg IM as a single dose
- cefixime 400 mg orally as a single dose
- spectinomycin 2 g IM as a single dose.

Gonococcal ophthalmia neonatorum- neonates
with gonococcal conjunctivitis

- ceftriaxone 50 mg/kg (maximum 150 mg) IM as a single dose
- kanamycin 25 mg/kg (maximum 75 mg) IM as a single dose
- spectinomycin 25 mg/kg (maximum 75 mg) IM as a single dose.

Topical ocular prophylaxis on neonates- for the prevention of gonococcal and chlamydial ophthalmia neonatorum

- tetracycline hydrochloride 1% eye ointment
- erythromycin 0.5% eye ointment
- povidone iodine 2.5% solution (water-based)
- silver nitrate 1% solution
- chloramphenicol 1% eye ointment.

- Prevention of gonorrhoea will encompass
 - use of condoms
 - rapid diagnosis
 - use of effective antibiotics
 - prompt tracing and treatment of symptomatic patients and their contacts.

- Emergence of antimicrobial resistance in *N. gonorrhoeae*
- Penicillin resistance
- Fluoroquinolone resistance

Study paper:

Emergence of fluoroquinolone resistance in *Neisseria gonorrhoeae* isolates from four clinics in three regions of Kenya.

Authors: Philippe R S Lagace-Whelan, Sara Duncan, Joshua Kimani, Alexander Thiong'o, Jama Shafi, Scott McClelland

Journal: Sexually Transmitted Diseases 05/2012; 39(5): 332-4

MORAXELLA/BRANHAMELLA

Identified species include:

- *Moraxella atlantae*
- *Moraxella bovis*
- *Moraxella* (*Branhamella*) *catarrhalis*
- *Moraxella* (*Branhamella*) *caviae*
- *Moraxella* (*Branhamella*) *cuniculi*
- *Moraxella* (*Branhamella*) *lacunata*
- *Moraxella nonliquefaciens*
- *Moraxella osloensis*
- *Moraxella* (*Branhamella*) *ovis*
- *Moraxella phenylpyruvica*

- *M. catarrhalis* is the major pathogen in this genus.
- It is only found in humans and is transmitted by respiratory aerosols.
- A respiratory tract commensal
- Can gain access to the lower respiratory tract of patients with chronic obstructive pulmonary disease.
- Has been implicated in otitis media and sinusitis, primarily in children.

- Treatment:

- Trimethoprim sulphamethoxazole or amoxicillin- clavulanate

- *Moraxella nonliquefaciens* is one of the two common causes of blepharitis (eyelid infection), the other being *Staph. aureus*. Treatment is local application of antibiotic eg erythromycin.

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