

### ***Neisseria spp.***

- Aerobic g<sup>-ve</sup> diplococci
- Non-spore formers
- Optimal growth temp. for most spp. is 35c to 37c.
- Produce acid from carbohydrates oxidatively, as opposed to fermentatively.
- Oxidase positive
- Most spp. are catalase positive.
- Pathogenic spp. tend to be more fastidious than non-pathogenic spp. they are more nutritionally demanding and their growth is stimulated by CO<sub>2</sub> and humidity.
- The following *N. spp* may be isolated from human clinical specimens:

a. *N. gonorrhoeae*: the cause of gonorrhea; always considered as pathogen, regardless of the anatomical site from which it is isolated.

b. *N. meningitides*: a significant pathogen, but can also colonize the human nasopharynx without causing disease.

c. *N. lactamica*

d. *N. mucosa*

- Nonpathogenic spp. are members of indigenous flora of the URT.

### ***N. gonorrhoeae: gonococci (GC)***

Infections by bacteria have many clinical manifestations. Localized infections include urethritis, Cervicitis, proctitis (inflammation of the mucous lining of the rectum), conjunctivitis, and oropharyngitis (inflammation of the oral portion of the throat).

Neonates can be infected during their passage through the birth canal, leading to Ophthalmia neonatorum or gonococcal conjunctivitis. (Rx: tetracycline or erythromycin ointment into the neonates eyes within 1hr of birth).

Additional manifestations of gonorrhea include gonococcemia (presence of bacteria in blood stream), septicemia, skin and joint infections, and pericarditis.

### **Virulence factor:**

- Pili: enable attachment to host epithelial cells (ability to produce pili can be lost in older cultures and subculture).
- IgA protease: cleave IgA on mucosal surface.
- Outer membrane proteins play a role in the phagocytic uptake (survive within phagocyte)
- Cell wall component (lipooligosaccharide)– endotoxin damage host cell (like all g-ve).
- Capsule.
- All strains are susceptible to ceftriaxone even penicillinase producing strains.

### **Pyogenic (pus-producing) infection of columnar and transitional epithelial cells**

**urethral, endocervix, anal canal, pharynx, and conjunctiva**

**Incubation period: 2 to 7 days**

**Transmitted by sexual contact**

#### **— Disease in the male**

- **95% show symptoms of acute infection**
- **Symptoms include dysuria, urethral discharge**
- **Complications include epididymitis and urethral stricture, and prostatitis**

#### **— Disease in the female**

- **20% to 80% are asymptomatic**
- **Symptoms include:**
  - Burning or frequency of urination, vaginal discharge, fever and abdominal pain**
- **Complications include pelvic inflammatory disease (PID), and sterility**

#### **— Disseminated gonococcal disease**

- **Acute form has the following symptoms: fever, chills, malaise, intermittent bacteremia, and skin lesions**

- If untreated will progress to septic joint form of the disease (inflamed joints, swollen, hot, full of pus and fluid)
- Gonococcal arthritis occurs as a result of disseminated gonococcal bacteremia

— Disease in children

- In infancy, an eye infection (ophthalmia neonatorum) may occur during vaginal delivery
- May cause blindness if not treated
- Infection is preventable with the application of antibiotic eye drops at birth
- Extragenital infections
- Pharyngitis
- Anorectal infections

**Lab dx:**

— Clinical specimens

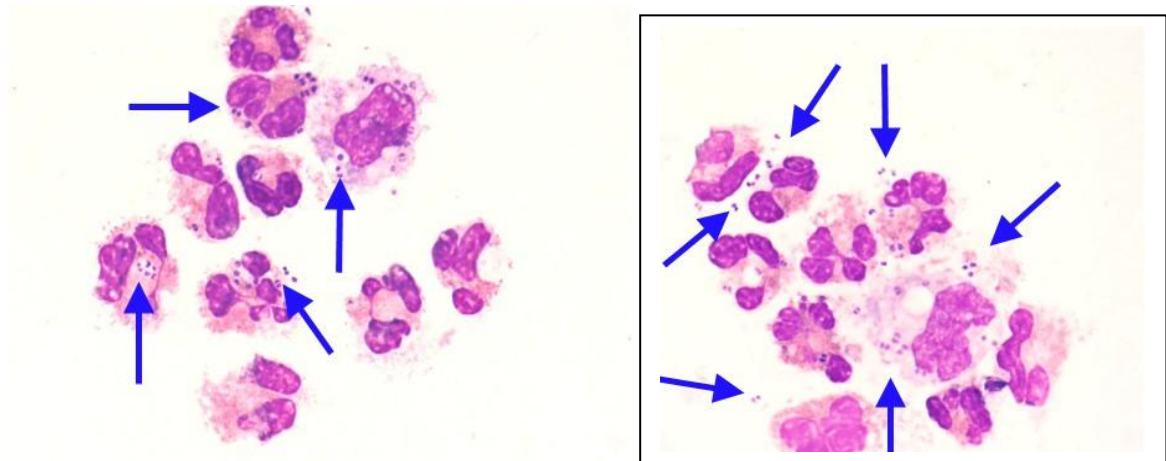
- Genital sites
  - Female: endocervix
  - Male: urethra
- Anal
- Oral/pharyngeal
- Eye
- Blood/joint fluids

— Swabs transported in Amies medium with charcoal

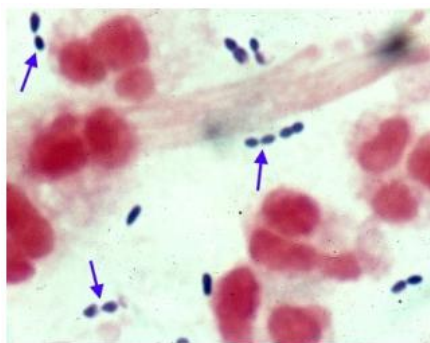
— Inoculate media within 6 hours of collection, avoid drying

Gram stain of urethral discharge specimen is useful for diagnosis of gonorrhea in male but because of the possible presence of "look alike" bacteria, vaginal or cervical swab cannot be used to dx gonorrhea in female patients.

Gram -ve diplococcic resemble two side-by side kidneys. Smear will typically reveal numerous polymorphnuclear WBCs and numerous intracellular and extracellular G-ve diplococcic. Smears of female genital tract are not performed.



Intracellular and extracellular N.



Peumococci

#### Colony morphology:

Fastidious, required enriched media, 3-5 % CO<sub>2</sub> and 35-37 c incubation temp.

Grows well on chocolate agar and will grow on blood agar if incubated in CO<sub>2</sub> incubator or candle extinction jar. Incubators should contain a pan of water to provide humidity and keep the media from drying out. Plates should be inspected at 24, 48, 72 hrs before reporting no growth.

Neither *N. gonorrhoeae* nor *N. meningitides* will grow on nutrient agar at RT without CO<sub>2</sub> whereas other *N. spp* will grow under those conditions.

Selective media (Thayer-Martin and Martin-Lewis media)

Colonies on chocolate agar are gray-brown, translucent and smooth.



Oxidase test positive: filter paper is saturated with one drop of dimethyl or tetramethyl oxidase reagent and then colony is rubbed onto the saturated area of filter paper. A dark purple color appearing in 10 sec.

Catalase test positive

Sugar oxidation patterns are used to distinguish *N. gonorrhoeae* from other *N.* spp. traditionally, CTA sugars were used (CAT: cystine-tryptic digest semisolid agar based media which contain 1% carbohydrate and phenol red pH indicator. Glucose, maltose, lactose, and sucrose were the sugars usually tested. Production of yellow color means positive result. *N. gonorrhoeae* will oxidize glucose but not maltose, lactose, sucrose, or fructose.



***N. meningitidis*: referred to as Meningococcus**

Colonize nasopharyngeal mucosa of some people (carriers) and also may colonize genital tract and conjunctiva.

Transmission occur through respiratory secretions or aerosolized droplets.

The usual manifestations of meningitis disease are meningococemia and meningococcal meningitis.

Causes of meningitis (2-18 y major cause *N. meningitidis*, *S. pneumoniae*, *H. influenzae*), frequent cause of neonatal meningitis are *S. agalactiae*, *L. monocytogenes*, *E. coli*. Viral meningitis is caused by enteroviruses, herpes simplex viruses.

**Virulence factors:**

Capsules, pili, and endotoxin.

**Lab dx:**

Sediment from centrifuged CSF ---G -ve diplococci intracellular and extracellular + PMN.

Other body sites include nasopharyngeal swabs, sputum.

*N. meningitidis* will oxidize glucose and maltose but not lactose, sucrose, or fructose.



Colonies on sheep blood agar after incubation for 24 hr at 35 to 37 c in 5-7% CO<sub>2</sub> atmosphere.

**Treatment:**

— Penicillin, Other options: rifampin or sulfonamide

***Moraxella catarrhalis***

G -ve coccobacilli in pairs and sometimes in short chains. They have a tendency to resist decolorization in the gram stain procedure, thus appearing G+ve.

*Moraxella catarrhalis* causes ear and upper and lower respiratory infections.

Previously classified as *Micrococcus*, then *Neisseria*, and also known as *Branhamella catarrhalis*, this organism is a frequent cause of otitis media in children, acute and chronic sinusitis at all ages, and lower respiratory infection in adults with chronic lung disease. It is the 2nd most common bacterial cause of COPD exacerbations after nontypeable *Haemophilus influenzae*. *M. catarrhalis* pneumonia resembles pneumococcal pneumonia.

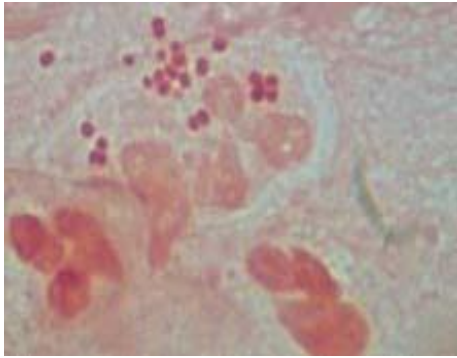
The prevalence of *M. catarrhalis* colonization depends on age. About 1 to 5% of healthy adults have upper respiratory tract colonization. Nasopharyngeal colonization with *M. catarrhalis* is common throughout infancy, may be increased during winter months, and is a risk factor for acute otitis media. Substantial regional differences in colonization rates occur. Living conditions, hygiene, environmental factors (eg, household smoking), genetic characteristics of the populations, host factors, and other factors may contribute to these differences.

The organism appears to spread contiguously from its colonizing position in the respiratory tract to the infection site.

All strains now produce  $\beta$ -lactamase. The organism is generally susceptible to  $\beta$ -lactam/ $\beta$ -lactamase inhibitors, sulfamethoxazole, tetracyclines, extended-spectrum oral cephalosporins, aminoglycosides, macrolides, and fluoroquinolones.

Colonies of *M. catarrhalis* may have a rough surface and be friable in consistency, pinkish-brown in color, and opaque. Whereas *Neisseria* spp. have an optimal growth temperature of 35C-37C, *M. catarrhalis* strains tolerate lower temperatures and grow well at 28C.

Lab dx:



Direct smear from an otitis media sample



*Moraxella catarrhalis* growing on chocolate

agar after 24 hours of incubation

Oxidase positive

All CTA sugars negative

Produce beta- lactamase