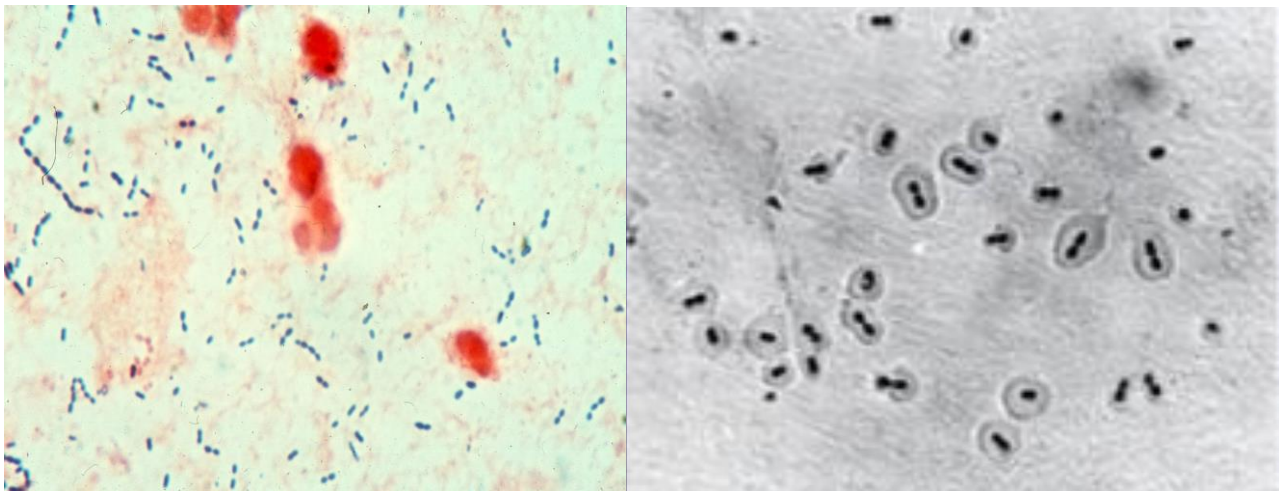
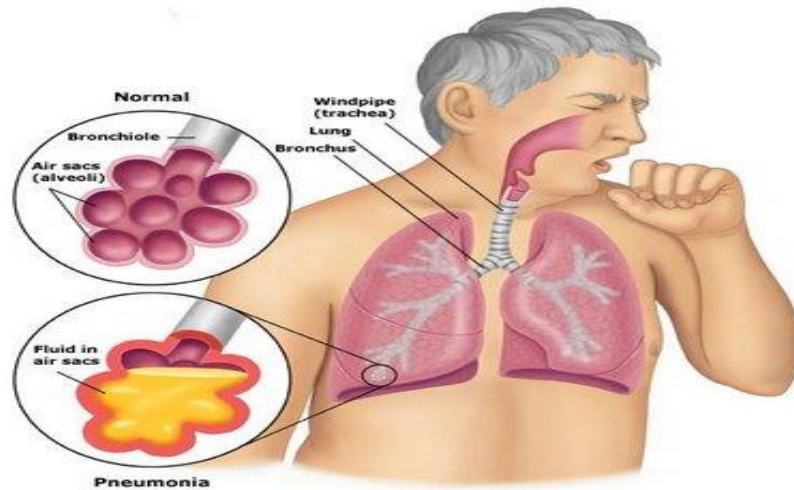


# Streptococcus pneumoniae pneumococcus

## Lecture 01

This bacterium G +ve, diplococci gived alpha hemolytic on blood agar, which caused lobar pneumonia but it, May also cause otitis media, sinusitis, meningitis and endocarditis



Streptococcus pneumoniae



Streptococcus pneumoniae,  
mucoid colonies

### **Way of infection**

By the droplet

Clinical picture of lobar pneumonia:

- 1- Sudden onset of fever.
- 2- Sharp pleural pain.
- 3- Sputum is exudative and rusty.
- 4- In untreated cases consolidation of the lung will occur.

### **Virulence factor**

- The virulence of the organism is a function of its capsule which prevent or delays ingestion of pneumococcus by phagocytes,

### **Pathology**

- Capsule protects the pathogens from phagocytosis and is the most important determinant of pneumococcal virulence.
- Unencapsulated variants are not capable of causing disease. Other potential virulence factors include: pneumolysin and IgA protease.

### **Predisposing factor of pneumococcus**

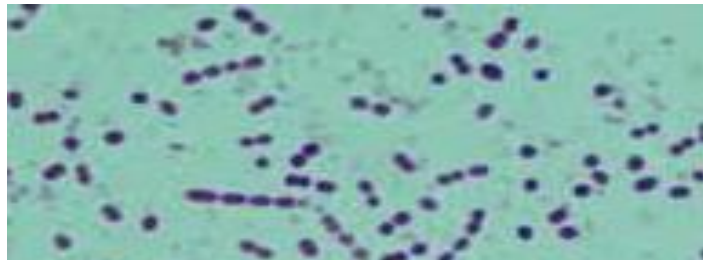
- 1- Viral and other respiratory infection that damage surface cells.
- 2- Alcohol drinking.
- 3- Pulmonary congestion
- 4- Malnutrition
- 5- Heavy smoking

### **Antigenic structure**

- 1- Peptidoglycan
- 2- Teichoic acid
- 3- Polysaccharide capsule, so the pneumococcus can be serologically classified into more than 90 types
- 4- M-protein

## Diagnosis

- Blood is drawn for culture and sputum is collected for demonstration of pneumococci by smear and culture.
- The sputum is examined by:
  - 1- direct smear stained by gram stain, show G+ve diplococci lancet – shaped, there is unstained halo around the organism which represent its capsule
  - 2- Culture on blood agar: the colonies r alpha haemolytic and similar to Strep. Viridinas
  - 3- Biochemical reaction its bile solubility, sensitive to optochin, and ferement inulin to produce acid only.
  - 4- Intraperitoneal injection of the sputum into white mouse, will lead to severe fatal septicaemia in the inoculated animal, and pneumococcus can be isolated and demonstrated in blood smear.
  - 5- Serological typing: fresh emulsified sputum mixed with antiserum gives capsule swelling this reaction called quellung reaction.



### Optochin Sensitivity

Pneumococci are sensitive to optochin (ethylhydrocupreine hydrochloride).

**Method:** Placing a disc (5g) on a primary sputum culture and culturing the plate aerobically (not in CO<sub>2</sub>) can help to provide a rapid.

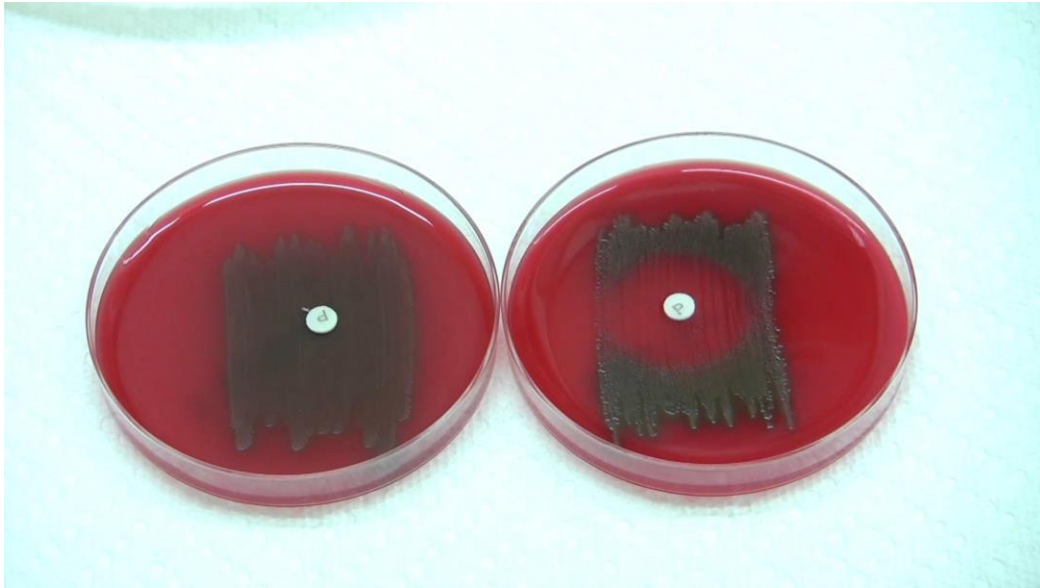
**Result:** The zone of inhibition should be at least 10mm. Most viridans streptococci and other alpha-haemolytic streptococci are resistant to optochin. If the zone of inhibition is less than 10mm (6mm disc) the colonies should be tested for bile solubility.

### Bile Solubility Test

**Method:** a tube technique, the results of which are easy to read. Some workers, however prefer to test suspect alpha-haemolytic colonies directly on a culture plate by touching a colony with loopful of 2% sodium deoxycholate.

**Incubation:** at 35-37 C for 30 minutes.

**Result:** examining for lysis (disappearance of the colony, indication *S. pneumoniae*).



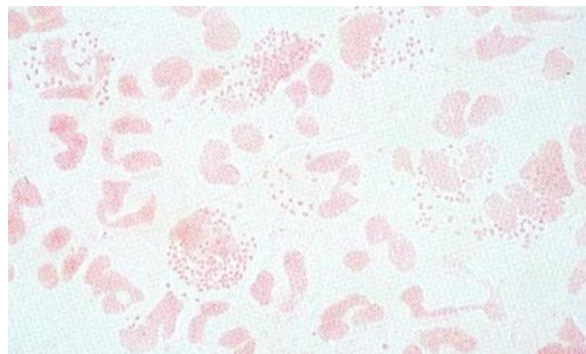
Right (optochin positive), left (optochin negative)

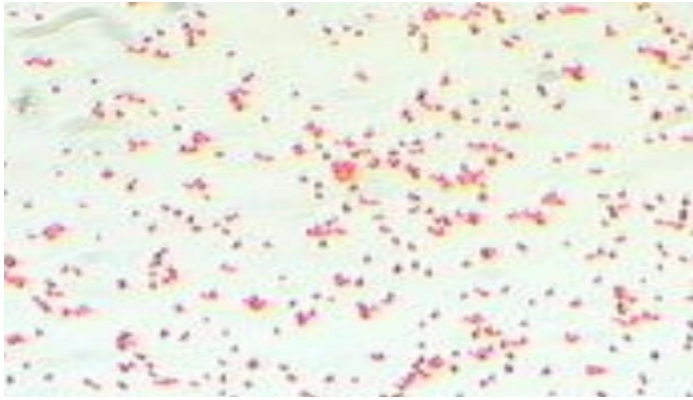
#### **Treatment**

- Pneumococcus is sensitive to many antimicrobial drugs, early treatment usually results in rapid recovery.
- Penicillin G is the drug of choice, other beta lactam drugs like cephalosporin generations
- Also pneumococcus susceptible to vancomycin.

## Neisseria

The genus *Neisseria* includes large number of Gram-negative cocci. Many of these are commensals in the respiratory tract, which is called *N. pharynges*. In this genus, there are two pathogenic members called: *N. gonorrhoeae* (gonococcus) & *N. meningitides* (meningococcus).

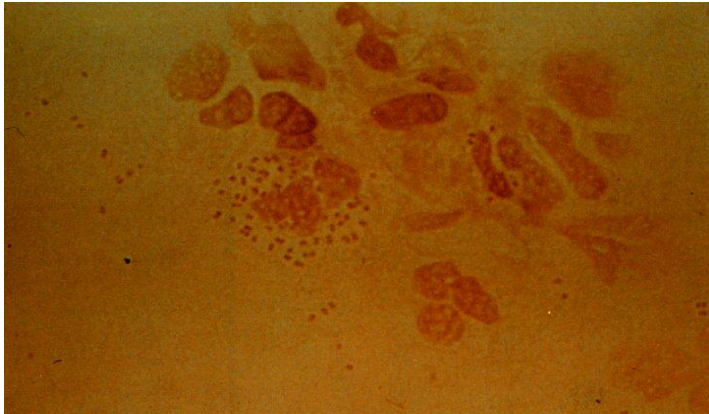




Neisseria gram stain

### Neisseria gonorrhoeae

- This species can cause 2 types of infections include :-
  - A. **Venereal infection** : gonorrhoea which is transmitted by sexual contact .
  - B. **Non-venereal infection** : Ophthalmia neonatorum is transmitted by contamination of infant's eye during labour through the birth canal of a gonorrhoeal mother and vulvo-vaginitis in small girls through contaminated toilet seats & contaminated towels .



Gram stain of  
N.gonno

### Antigenic structures of Neisseria:

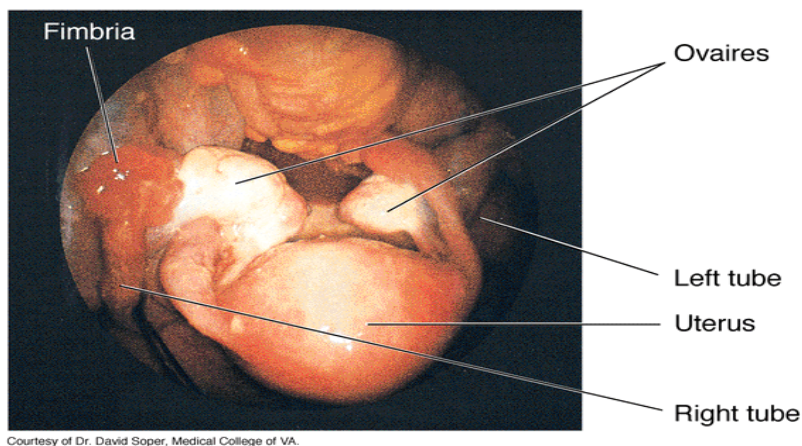
- 1- Outer membrane protein (omp): which antigenic and antiphagocytic factor
- 2- Lipopolysaccharide which act as endotoxine
- 3- Pili which help neisseria to attach with epithelial host cells

### Virulence Factor

- Pili: most important virulence factors helping the gonococci to stick on the epithelial cells.
- IgA protease that cleave IgA on mucosal surface.
- Lipopolysaccharide damage tissue and prevent phagocytosis.

### Clinical manifestations

- In the male, there is cause urithritis with yellow creamy pus & painful urination, the process may extend to prostate & epididymis.
- In female the infection may extend to the cervix to cause mucopurulent discharge, it may be then progress to the fallopian tube causing pelvic inflammation, fibrosis & obliteration of tubes with consequent sterility, chronic gonorrhoea is often asymptomatic.



### Diagnosis of gonorrhea:-

#### Acute gonorrhea can be detect by:

- Microscopically examination:** direct smear from the discharge stained with Gram's stain to show the kidney shape  $G^{-ve}$  diplococci present intracellular & extracellularly, non-spore forming.
- Culture:** this perform on blood agar or chocolate agar or Thayer-Martin medium incubated in 5%  $CO_2$ . The colonies are non-hemolytic, non-pigmented or gray in color, smooth, circular, small & convex.
  - While in case of chronic gonorrhea, in male, the morning drop of discharge or prostatic secretion after massage can be examined as before. In female, cervical swab may give positive results.

- c. **Serology** : in this tests can be use serum & genital fluid that contain IgG and IgA antibodies against gonococcal pili , outer membrane proteins and lipopolysaccharide

#### Treatment :-

- Gonococci is treat by penicillin , but sensitivity test is indicated because gonococcal resistance to pencillin has gradually increased, therefore used new drugs like Ciprax single dose.

#### Antimicrobial Susceptibility Testing

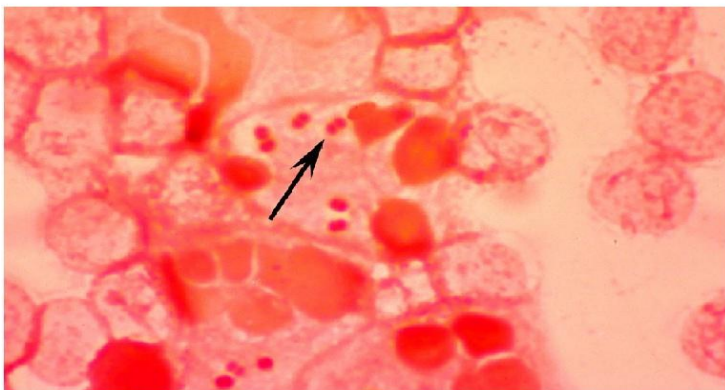
- Ceftriaxone
- Penicillin
- Chloramphenicol
- Ampicillin
- Trimethprimsulphonate

#### Neisseria meningitides

This bacterium mainly cause cerebrospinal meningitis but it also can cause pharyngitis , adrenal haemorrhages & rarely myocarditis , the infection transmitted from the patient or carrier by droplets of nasopharyngeal secretions .

#### Virulence Factor

- Polysaccharide capsule (13 serogroup the most pathogenic is A, B, C, Y, and W-135).
- Pili.
- IgA protease.
- Endotoxins.



N.meningitidis

## Clinical manifestation of cerebrospinal meningitis:

This infection causes sudden onset of fever, vomiting, stiff neck, hemorrhage, skin rash and coma within a few hours.

## Diagnosis :

### 1. C.S.F. examination :

Lumber puncture is done under complete aseptic conditions, the CSF appear turbid (it's clear colorless in normal case).

- a. **Direct smear:** stained by Gram's stain, the bacteria appear as G<sup>-ve</sup> diplococci mainly intracellularly usually coffee bean in shape, non-spore forming.
  - b. **Culture :** this bacteria no growth in ordinary media , but grow on blood & chocolate agar in the presence of 5% CO<sub>2</sub> , the colonies on blood agar are non-hemolytic , moist , devoted , smooth , translucent , round & convex . Thayer-Martin medium containing antibiotic can also be used.
2. **Blood culture** is perform in case of septicemia.
  3. **Nasopharyngeal swab** for culture is perform.
  4. **Biochemical reaction tests:** this include fermentation of glucose & maltose with acid only. catalase & oxidase tests are positive

	GLUCOSE FERMENTATION	MALTOSE FERMENTATION	PLASMIDS	VACCINE AVAILABLE	POLY-SACCHARIDE CAPSULE	β-LACTAMASE PRODUCTION	OXIDASE
<i>Neisseria gonorrhoeae</i>	+	-	Common	-	-	Common	+
<i>Neisseria meningitidis</i>	+	+	Rare	Serogroups A, C, W-135, Y	+	None	+

### 5. Serological test :

Antigenically , meningococci are divided into several groups are A,B,C,w- 135&y , group A found in a most countries , while group c and w-135 associated with the epidemiology .

Specific anti-meningococcal antibody in serum to detect colony by agglutination test, meningococcal antigen can be detect in C.S.F. of patient with active disease.

## Treatment

- Penicillin G has become the drug of choice, also 80-90 % of strains are sensitive to sulfonamide that is diffuse readily into C.S.F. Chloramphenicol or third generation cephalosporin is used in-patient with allergy to penicillin.

