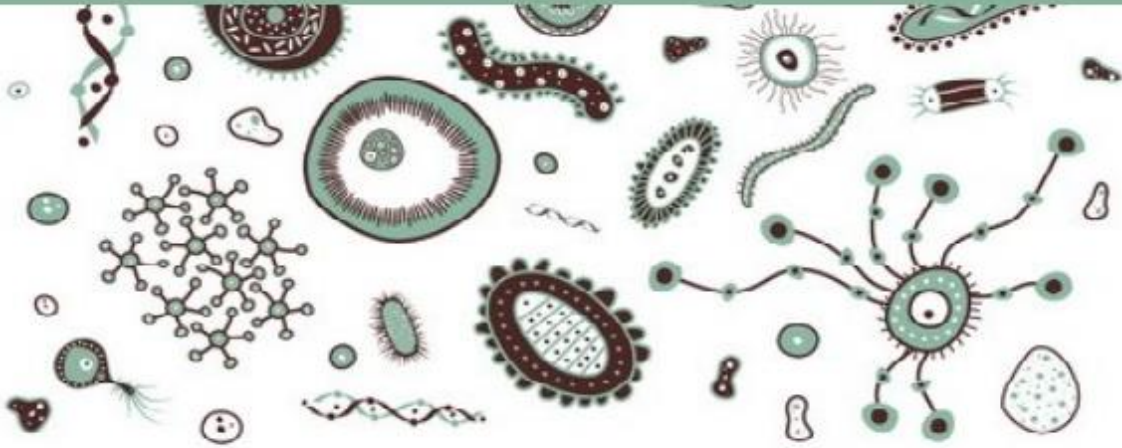




Microbiology



☒ Sheet

☐ Slides

Number :10

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Subject: G +ve Cocci Bacteria: Strep. & G +ve bacilli

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Gram Positive Cocci Bacteria: Strep

Remember: to differentiate between staph and strep use **catalase test**. Strep are catalase negative. **Coagulase test** is used to differentiate between different Staph species.

According to composition of cell wall carbohydrates (which differs), strep bacteria group is divided into:

- Group A (*Streptococcus pyogenes*): Beta hemolysis
- Group B (*Streptococcus Agalacticae*): Beta hemolysis
- Group D (*Enterococcus*)
- *Streptococcus pneumoniae*: Alpha hemolysis
- Viridans Strep: Alpha hemolysis

Groups other than Group A and B are less associated with clinical infection.

Viridans Streptococcus

- Normal respiratory flora (found in the oral cavity/protect the oral mucosa by secretions it produces as those secretions prevent the attachment of other microbes –pathogens-), rarely pathogenic, nevertheless it might in certain conditions -in dental procedures for example- gain access to the subcutaneous tissue and cause localized infection **OR** if reached the blood stream and the heart valves it will cause **endocarditis** (severe case), especially if the patient have had a heart surgery, or there's heart abnormality to begin with . It might accumulate in the oral cavity and cause dental caries and plaques , due to increasing acidity , causes mild inflammatory response results in slight damage of teeth surface and might lead to loss of teeth (mild case).

Beta-hemolytic streptococci

- More complex strep species due to the fact that they carry specific carbohydrates on their cell wall. This group is divided Serogroups – سلاطات - (serogroup A,B,C,D,E,F,G) depending on their carbohydrates composition, A and B serogroups are the most important medically (associated to infections).



Group A (Streptococci pyogenes)

-Pyogenes means pus producing organisms.

- It is an infrequent invasive pathogens, part of skin flora and upper respiratory tract. 5-50% are actually carriers of it but with no harm.
- **Pathogenesis:**

Repeated occurrence infections in the skin or upper respiratory tract might result in accumulation of bacterial surface antigen & cell membrane antigen in tissues of infected person and produce **post-streptococcal diseases** (comes after the infection) which are not recognized after 1 or 2 months but can take years of recognize it).

Infections caused by this group:

- 1) Pharyngitis (strep throat)
- 2) Localized skin infections.
- 3) Rheumatic fever: damage to muscle and valves of the heart.
- 4) Glomerulonephritis: antigen of cocci produce a complex structure in kidney tissues associated with kidney failure and death.

The last two are examples of post-streptococcal diseases (complications).

➤ **Tests:**

1. Hemolytic reaction to distinguish between different groups.
2. Bacitracin test since Group A streptococcus is only sensitive to it while all the other streptococci are resistant.
3. The use of antiserum to make sure that group A is a true group A.

Similar to Staph aureus in that they both produce 20 types of enzymes and toxins.

These products cause infection in the respiratory tract mucosa of children causing tonsillitis, so it is the most common cause of children tonsillitis (~90% of cases).

Different from Staph aureus is that group is susceptible to penicillin while S.aureus isn't.



➤ **Treatment:**

Mainly Penicillin.

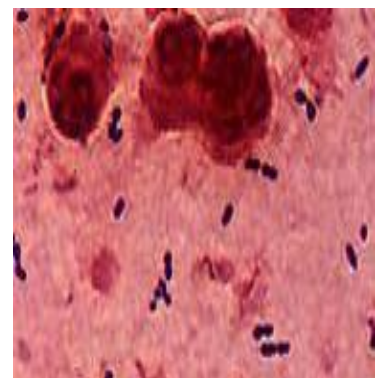
- Note: there is **NO vaccination** due to presence of more than one subtype (~80 subtype) , theoretically it's possible but it's not practical.

Group B streptococci

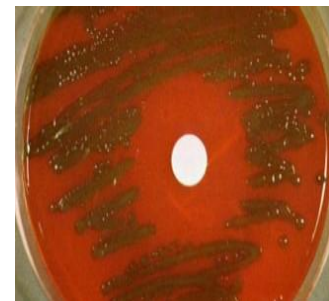
- Part of the microbiota colonizing the gastrointestinal tract and from there move to the vagina where it's harmless.
- Nevertheless, this opportunistic harmless bacterium can, in some circumstances, cause severe invasive infections, for example:
- During pregnancy while delivering the baby this bacteria can enter the neonate and cause neonatal **meningitis** and blood sepsis which is fatal if not treated. Also, if damage happens in the uterus (rupture) the bacteria can move to subcutaneous tissue then to the blood causing severe blood sepsis known as **puerperal sepsis** (حمى النفاس) .
- Normally found in vagina of 5-20% of women around the world with no harm in general but sometimes it can cause urinary tract infection which is easily treated.
- Before Sulfonamides and penicillin the mortality associated to puerperal sepsis was 20-30%.
- No vaccine

Streptococcus Pneumoniae (diplococcus pneumonia)

- G +ve diplococci (exist in pairs) surrounded by respectively large polysaccharide capsule (encapsulated bacteria).



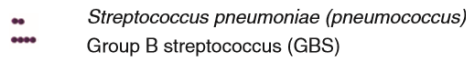
- Part of the upper respiratory tract flora, but can become pathogenic under the right conditions, for example if the immune system is suppressed like in children, elderly, viral infections cases, and immune-deficient patients.
- In respiratory viral infections, like influenza, the virus produces damage and inflammation in the lower respiratory tract ,and as there is mucosal damage ,the resident flora becomes aggressive, pneumonococi is encapsulated (making it virulent) and produces enzymes like pneumolysin disrupts cells and cilia and increases cell necrosis.
- Most common form of infection is pneumonia, the bacteria may then spread from the lungs to the blood stream and to other organs causing meningitis.
- Pneumococci doesn't cause pharyngitis or tonsillitis.
- This bacteria is aggressive due to the presence of a polysaccharide capsule. (Anti-phagocytic capsule with different antigens and according to the capsule this bacteria has more than 85 serotypes)
- Can be differentiated from Streptococcus viridans using an **optochin test** as S. pneumoniae is optochin sensitive.(the optochin test is an antibiotic like substance prepared on a special filter paper disc and placed on the culture) ,the optochin test is screening test as it is 99% accurate.



- S. pneumoniae also produces green pigmentation on blood –but it can't be distinguish this way as strep viridans does that too- .
- Another test is the anti-capsular serum test, if it's positive then it is strep pneumoniae.
- Like group A, streptococcus pneumoniae has more than 85 capsular serotypes (great variety)., the importance of this is that in some countries certain capsular types are circulating within causing infection, therefore a vaccine (related to the capsule) can be introduced especially for those (adults & children) with problems in spleen, lymph system, lungs and it is important as they are capable to have repeated infection by S.pneumoniae and that will be fatal for them. However, it is protective for a short period of time (1-2yrs)

- Unfortunately, streptococcus pneumoniae is slowly developing resistance to penicillin & cephalosporin , -90% of middle East strep pneumoniae are resistant to penicillin-.

-Pneumococcus mostly causes **pneumonia** in the lungs but can go to the blood stream and thus to other organs most importantly CNS causing purulent **meningitis**. But Group B strep. is the leading cause of **sepsis** and **meningitis**.



Group D (Enterococci)

- More common in animal intestines than in human intestines. Why is it slowly increasing in humans? Due to the **intrinsic antibiotic resistance** to cephalosporin. (this is an important feature).
- Enterococci faecalis and faecium are the cause of 5% of all types of bacterial infection of urinary tract. The Enterococci also cause hospitalized acquired infection to hospitalized patients who use a lot of antibiotics and rarely cause meningitis.

Gram Positive Bacilli

Two categories:

- **Spore-forming:** Bacillus and Clostridium
 - **Not spore forming:** Corynebacterium and Listeria
- Another division is **aerobic** or **anaerobic**.

Corynebacterium

- Gram positive, aerobic, rod-shaped bacteria. It has variety of morphologic structure (polymorphic organism) , it is not easily recognized, even between cocci and bacilli. We'll discuss C. diphtheria.



Note: - true bacilli can be easily recognized by Gram stain whether it is spore forming or non-spore forming.

- Put in mind that Gram stain doesn't stain spores so it looks like empty spaces.

This bacteria can be pathogenic or non-pathogenic. The non-pathogenic type of it can be found as part of the body flora (in hair follicles, the respiratory tract, oral cavity, throat,...etc). The pathogenic type (*Corynebacterium diphtheria*) is highly infectious in general.

Corynebacterium diphtheria is divided into:

- **Toxigenic-Lysogenic:** Where the bacteria is infected by a bacteriophage which carries genes responsible for production of diphtheria toxin causing inflammation of throat-pharynx-larynx and tonsils. If toxins reach the bloodstream damage can happen to the heart.
- **Non-toxigenic (non-pathogenic):** If the bacteria hasn't been infected by a bacteriophage then it's harmless and it's part of the upper respiratory tract and skin (pores and hair follicles) and is important for the production of extracellular enzymes that kill pathogenic bacteria.
- Childhood diphtheria has killed 10-20% of infected children of ages up to 14 years (that's before the triple vaccine).
- Vaccination with toxoid meaning injecting an inactivated or suppressed toxin of a bacteria by formalin. It is part of the triple vaccine given against: diphtheria, tetanus and pertussis (or whooping cough).

