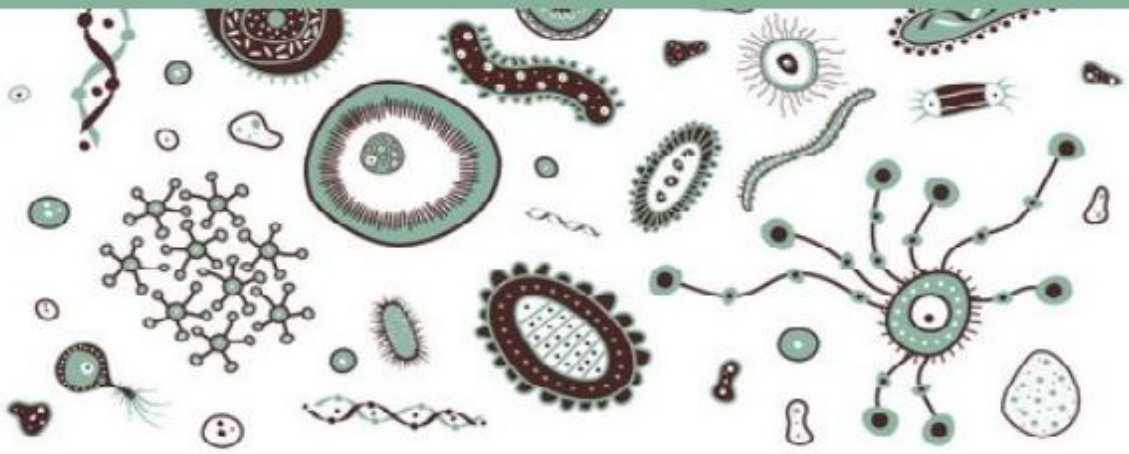
Microbiology



◉ Sheet ○ Slides

Number : 17

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Subject: G-ve bacteria (Spirochetes)

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Legionella pneumonphila:

This was discovered by accidents in 1976 in USA, there was an outbreak of pneumonia among retired military. At the beginning they thought it was caused by streptococcus pneumoniae, and then thought it was caused by Haemophilus influenzae. But by more investigation they found that it was caused by **Legionella.**

And so they called this pneumonia **Legionnaires' disease**. (مرض الفيالقة أو مرض المحاربين)

- This organism is rarely associated with outbreaks or disease or clinical cases of pneumonia.

- It is **G-ve** but it has **less amount of Lipopolysaccharides** than other G-ve bacteria.

- The most important feature in this organism that it can survive in wide range of temperature, **between 0° and 80°**. So it can survive in cold water or hot water. Therefore, most infections of this organism are due to **inhalation of aerosols or water spray** by using air conditions or sauna which may be contaminated by moist soil. This results in a not clear picture of pneumonia (It gives impression that there is an allergy reaction or ***atypical pneumonia*** by resulting in dry cough without presence of inflammation). But slowly it may increase and reach organisms by blood stream and induces systemic infection which can affect any part of the body.

- It might be specially associated by abdominal pain, diarrhea, kidney failure, etc...

- It normally begins in ***invading the macrophages and monocytes***, but it can grow outside them.

- It is considered a **non-infectious (non-contagious)** agent, so it can't be spread from person to another.

Note: Pathogens usually divided to infectious and non-infectious pathogens (or contagious and non-contagious). Contagious pathogens might be spread by any means -water, food, direct contact…-. Whereas non-contagious is often followed by respiratory tract inhalation, but it is rarely transmitted from one person to other.

- The **complications** of this disease are related to old age or people that have lung problem specially who have immunodeficiency,malignancy, fibrosis and heavy smokers. In healthy people the infection is usually mild and not associated with complications.

- ***Clinical diagnosis*** is not easy; therefore it must be confirmed by culture. It is cultured in special artificial media. There is another way to detect the presence of Legionella and it by looking for the presence of specific antibodies which may be detected during the incubation period (which may range between few days to few weeks).

- Treatment is by using special drugs. (The doctor said that he won't mention it now)

- No vaccine available.

Now we will move to the last group of bacteria that are called **Spirochetes**.

Spirochetes Group:

The name Spirochetes is related to the morphological structure of the organism, as it has a special long multi-folded thread (**spiral**) structure which might be composed of approximately 10-16 folds.

Spirochetes have ***few LPS***, which means that it is **G-ve bacteria**. But it can't be demonstrated by gram stain as it can't show the morphological structure. So we must use a special stain like **silver stain** or to use ***dark filed microscopy*** to recognize the movement of this organism.

Note: Not all Spirochetes can be cultured.

These spiral form bacteria are divided into pathogenic and non-pathogenic.

1- Treponema species:

May be found in humans or animal, May be found in the oral cavity as non-pathogenic. But there is another pathogenic type which is called **Treponema palldium**.

Treponema palldium: Can infect only humans. It is associated with ***sexually transmitted diseases*** as it causes **Syphilis**. In the past it caused millions of deaths in Europe countries proceeded by severe damage in the CNS and internal organs. (Now the incidence of syphilis increased worldwide and 10000-15000 cases are reported yearly to the WHO)

The presence of syphilis in our country or in any community must be registered and reported in order to control the infection in this community.

Note: Syphilis was called in the past ***Veneral Sexual Disease***.

This bacteria is highly susceptible to environmental factors, it can't survive outside the body for more than few minutes.

The primary Syphilis infection can be easily recognized in males more than females, due to the fact that the lesions often develop in the extra genitalia in males and so can be easily recognized by the presence of lesions with few inflammatory reactions and erythema lesions which known as **Chancre**.

These lesions exist for only few days to 2 weeks and then disappear. But later, if the patient wasn't treated by antibiotics, the lesions may appear again and spread through the blood stream and the lymph system and result in complication related in developing of auto-immune bodies in form of **granuloma** in any part of the body (the meninges, liver, kidneys, etc…) and produce severe damage to the organs. Therefore, it is important to treat patients early as possible to prevent the tertiary (third) stage of the disease that is associated with more serious complications, which can't be then cured by antibiotics.

Note: Syphilis has three stages: Primary, Secondary and Tertiary. The first two can be successfully treated. The third stage is more related to immunological reactions and granulomas appear in any part of the body specially the **CNS, Skin and Genitalia**, and it can't be cured by antibiotics and the patient usually dies following meningitis or hepatitis.

If a pregnant woman was infected by syphilis, the syphilis might infect the fetus (vertical infection)**(Congenital Syphilis)**. At the beginning, the fetus will not be recognized to have the disease, but later (after one or two years) certain organ of the infant will be damaged specially the gum, nose and the CNS.

Syphilis may -in certain conditions- result in abortion.

Diagnosis:

In males, by the presence of lesions in the extra genitalia and is diagnosed easily. In women the lesions are inside the vagina and it is more difficult to be recognized. (This is the first stage of diagnosis)

However, in both cases we collect specimens directly from the lesions and look for the presence of spirochetes by **dark filed microscopy**. But this is not enough to confirm syphilis.

In addition we do the **serological screening test** that demonstrate the presence of specific antibodies (against the syphilis antigens) like the **VDRL** test-**V**enereal **D**isease **R**esearch **L**aboratory-, but this test is also not enough to confirm syphilis, it indicates the possibility of having the disease.

The conformation is done by another test which is hard to perform but it must be done, this test is called **Fluorescent Treponema Palldium Antibody test(FTA)**.

Note: There is another screening test which is more significant than the VDRL, called Rapid Plasma Reagin (RPR). (But again, it must be confirmed by FTA)

There is no culture available until now. (Experimentally, you might observe the presence of granulomatous lesions in animals like mice. But that's difficult to do and also not necessary)

2- Borrelia Burgdorferi:

Borrelia Burgdorferi Causes **Lyme disease**. This spirochete has similar antigens and biological characteristics to Treponema Palldium. However, unlike Treponema, Borrelia ***can be cultured in a fluid media*** and it reside in certain types of animals.

It can't induce infection to the human directly. There must be certain types of insects like **Ticks** (القراد), this insect live on skin of certain animals, if these animals were infected with Borrelia, Ticks will be infected if they ingest blood of that animal.

Then they may inject Borrelia in the skin of humans. This result in allergic reactions at the beginning inform of erythema lesions and may not recognized as a result of Borrelia.

Later, Borrelia can be spread by the blood stream and the lymph system (just like Treponema) resulting in more systemic infection associated mainly with **Arthritis**. CNS may be also be affected. It also may result in **cardiac abnormalities**.

Note: Lyme Disease is not found in our country. The most cases reported from Canada.

There are other **Borrelia Species** associated mainly with animals, but contact with these animals or their feces or urine will result in infection to the human. This infection has two types, one known as **Endemic Relapsing Fever**and the other known as **Epidemic Relapsing Fever**.

This bacteria multiplies firstly in the liver and the spleen. The antigen of this bacteria produce allergic reaction and a not high fever, this ***fever disappears in few days and then return back and thus called relapsing fever.***

According to the immuno-response of the patient, he may manage to control the infection if his body produced sufficient specific antibodies. Otherwise, patients will suffer from severe fever, abdominal pain, gastro-intestinal syndrome and may affect the CNS. Therefore, this must be treated with antibiotics as fast as possible.

Note: Sometimes treatment with antibiotics is not easy, because lot of patients may develop a chronic infection.

Diagnosis: Quite similar to Borrelia Burgdorferi. We use ***fluid culture*** and biochemical test, and recently we use PCR.

Note: This bacteria is rarely found in our country, only 2 cases were reported.

3- Leptospira:

Causes **Liptospiral diseases**. These bacteria are widely distributed in the nature associated with many types of animals, all types of domestic animals can be infected (dogs, cats, etc…). And this bacteria is excreted with feces and urine, which may contaminate food and water or it may infect humans directly.

These bacteria are more common in countries that have wide areas of surface water. (Therefore, this disease is rare in Jordan)

This disease is also known as **Weils's disease**. (The name of the Australian scientist that discovered it)

This disease causes **high fever**, **Jaundice** and **vasculitis** (inflammation of the small blood vessels causing bleeding, often from the oral cavity and the nose and sometimes from the skin).

Diagnosis: Similar to Borrelia. We use ***fluid culture*** and we also use molecular techniques which can detect the DNA of the bacteria. Also, we use **serological tests.**

Note: Any type of Borrelia infection is not easy to treat by antibiotics in the latest stages, so it must be treated as fast as possible.

The end