



Microbiology

Lecture No: 25

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Almajali Sheet Slide

Enteric Bacteria

- Brucella Species:

*We have mentioned lately that we have a group of bacteria called Brucella. This group -as G -ve coccobacilli or short bacilli- is not a part of the family Enterobacteriaceae like salmonella, shigella etc. IT IS A SPECIAL GROUP that belongs to a different family (Brucellaceae), but it's mentioned with the species of Enterobacteriaceae in order to understand its pathogenesis in comparison to that of Enterobacteriaceae. (Brucella also affects the GI tract).

- Brucella in animals:

*Brucella is more related to animals than humans (a typical zoonosis). Infection in pregnant animals often leads to abortion. They are of particular zoonotic and economic importance as a cause of highly transmissible disease in cattle, sheep, goats and pigs.

* We have several species of Brucella and each species is restricted to one or group of animals:

- **Brucella abortus:** Infection of the cattles mainly and later transmitted to horses and camels (Abortus originated from abortion because the infection in animals affects the genital tract and results in abortion).

- **Brucella melitensis:** The host species are domestic sheep and goat. (melitensis originated from Mediterranean referring to Malta Island found there).

*NOTE : The first cases of brucellosis were discovered in Malta island among sheep and then in British soldiers. There was an outbreak of the disease and therefore brucellosis was called Malta fever in relation to the island . There are several other names but Brucellosis and Malta fever are the most common.

- Brucella in Humans:

* Another distinct feature in Brucella's infection is that it persists for several months before causing any symptoms and can't be recognized in the first few days or weeks. It might later be recognized in association with certain non specific symptoms like what we call: "**Fever of unknown origin**" (FUO). This occurs typically because Brucella is an INTRACELLULAR parasite; they normally multiply in macrophages resulting in granulomas and abscesses which leads to complications that may involve any part of the body and lead to fever. Brucella is slow growing and is less associated with Enteric fever (Typhoid fever).

The main difference between Enteric fever (Salmonella Typhi or Paratyphi) and undulant fever (different than FUO) that is caused by Brucella is the characteristic of intermittent waves of increased temperature associated with brucellosis. This means that the body temperature swings between the early morning and the late evening. At the early morning, patients may not suffer from presence of fever ,but slowly afternoon they will recognize increase in their temperature and it will increase gradually until midnight reaching 40°C. (Rising and falling fevers) and it is the main indication of the presence of Brucella. Also it's called swinging fever or intermittent fever.

* In addition, releasing of endotoxins from macrophages by brucellaceae will lead to general weakness associated with extensive noticeable sweating.

* Similar to typhoid fever, Brucella infection can cause hepatosplenomegaly (which is the simultaneous enlargement of spleen and liver).

* Because it affects the GI tract it can cause some effects similar to enterobacteriaceae such as vomiting, diarrhea and abdominal pain.

- **Infection routes:**

* The root of infection of this organism is associated mainly with consumption of contaminated unpasteurized dairy products ; like: white cheese , yoghurt ,milk and so on.

*In addition , direct contact with infected animals(especially sheep and goats) or contact with animals' waste like urine can lead to infection . Also, animals may contaminate the surroundeg environment and this might later result in developing of infection. Therefore, the root of Brucella infection is to some extent more complicated than other types of enteric bacteria.

For example, the organism might be carried on dust particles and may infect the eye for instance and result in eye infection and then it can spread to other parts of the body. It also results in gastroenteritis following the consumption of contaminated material or direct contact with infected animals. Therefore, after the identification of signs and symptoms, a blood culture is required repeatedly especially in the acute phase.

- **Lab Diagnosis:**

*These organisms can't be discovered easily, you have to prepare several cultures from different clinical specimens.

*Culturing of Brucella is considered difficult to some extent. It can't be detected within 48 hours, and blood cells must be incubated in the laboratory for at least **1-4 weeks** to discover the organism.

*What clinical specimens can diagnose a case of brucellosis?

Feces and urine aren't quite used , the only major three types of clinical specimens used are :

- 1) Blood.
- 2) CSF, in case of meningitis.
- 3) Bone marrow, in case of chronic brucellosis.

It's sometimes so difficult to differentiate Brucellosis from other diseases caused by spirochetes and other types of organisms. Therefore, it's normally encountered in chronic prolonged cases and cases that has been treated unsuccessfully with antimicrobial drugs(we will discuss this when we reach the treatment section).

*Brucella can't be diagnosed easily due to several common signs and symptoms with other enteric bacterial infections and the characteristic undulant fever of brucellosis is usually seen only in long-standing untreated cases.

* We have a differential diagnosis of brucellosis from other enteric infections. It requires the patient history which can help greatly in determining the causative agent.

- **Treatment :**

* In fact, treatment of brucellosis with antibiotics requires experience of the treating physician. The patient should receive antibiotics for at least 6 weeks in order to eradicate the intracellular organism from blood stream as well as from bone marrow .

*A significant problem in our country is that several general practitioners treat brucella for short courses which aren't sufficient for complete eradication. Unsuccessful treatment with antibiotics and prolonged illness result in severe complications such as endocarditis and various irreversible neurologic disorders that's why it's essential to treat the patient for at least 6 weeks with a combination of antibiotics.

- **Vaccination:**

*There's a vaccine available but it is used mainly in animals.

* In case there is a positive cases as in our country, the only way to prevent the spread of disease is to recognize the positive cases at the beginning by skin test or brucella antigen test .Secondly, you have to send the animals to a certain separated houses in order to get rid from the infection and be treated. And in other cases (not positive for brucella antigen test) they should be vaccinated by brucella vaccine.

* The brucellin skin test doesn't differentiate active from past or subclinical infection and is no longer recommended. And vaccines are mainly used to protect pregnant cattles from abortion and so reduce the spread of disease.

*This vaccine is recommended for animals ,not for humans because it will produce severe allergic reactions in humans.

*NOTE: About 10 -15 years ago, a few thousands of brucella cases were diagnosed in Jordan ,but nowadays only 100-200 cases are discovered.



*Brucella:

A typical zoonosis associated with abortion in infected animals

Intracellular organism.

***Some symptoms in humans:**

- Intermittent fever.
- General weakness associated with extensive sweating.
- Hepatosplenomegaly.
- Vomiting, diarrhea and other features of GI tract infection.

***Infection routes:**

- Consumption of contaminated unpasteurized dairy products.
- Direct contact with infected animals or their wastes and even infected carcasses.
- Indirectly from contaminated environment.

***Lab diagnosis :**

- Specimens from blood,CSF and bone marrow.
- Incubation period 1-4 weeks.

***Treatment:**

- Long courses (6-8) weeks.

- Unsuccessful treatment with antibiotics result in irreversible complications in the central nervous system and spinal cord .

***Vaccination :**

- Only effective for animals. (الإِنسان اِغلى ما نملك .)

• **Campylobacter Species:**

Another important group which is not part of the family enterobacteriaceae (enteric bacteria :P) .

• **Campylobacter in animals:**

* Again, like Brucella, it can affect animals and then it's transmitted to humans.

*We have many species of campylobacter and each species can be associated with certain group of animals. Most of the species are pathogenic and can infect humans and animals. But the most common species which is related to humans are Campylobacter jejuni (in relation to jejunum) and Campylobacter coli .And these two species can be found in wild animals, domestic animals beside cats, dogs, etc.

* It produces abortion in certain animals as well as it might produce enteritis similar to humans. It might be more severe in young animals than in old ones and the same can be applied to humans.

• **Route of infection:**

*The most common source of infection in humans especially in western countries is domestic animals as well as poultry (especially chicken), because campylobacter can be part of the intestinal flora of these type of animals (birds).

Contaminated food (chicken mainly) and not properly cooked also lead to campylobacter infection. Campylobacter infection is similar to salmonella or shigella infection.

- **Clinical features:**

Campylobacter enteritis can't be clinically distinguished from salmonella or shigella infection but abdominal pain tend to be more severe in campylobacter infection. Both infections lead to watery to bloody diarrhea.

* In addition Campylobacter produce ulceration in intestines and stomach and this is associated with released of damaged blood vessels and release of blood filled stool. (similar to shigella)

*Campylobacteriosis is usually self-limiting. For instance, C.jejuni causes a mild disease in children and doesn't require treatment with antimicrobial drugs like shigellosis. The patient may suffer from diarrhea for two or three days , abdominal pain ,abdominal cramps ,etc and doesn't require antimicrobial drug treatment . Antimicrobial treatment should be reserved for patients with severe or complicated infections. (severe bloody diarrhea).

*It can infrequently cause bacteraemia in patients with immune deficiency besides infecting firstly the intestines so they are more dangerous in such patients. It is invasive to some extent, and in comparison with shigella ,campylobacter is considered more invasive especially in these categories of patients and this is a way of differential diagnosis.

* In addition, complications associated with campylobacter infection ,even asymptomatic infection, might later be manifested in form of aseptic arthritis. Therefore, it's recommended if there's watery bloody diarrhea especially in the children, to identify the causative agent rapidly which might be associated(e.g. shigella , certain types of salmonella ,campylobacteria, yersinia, and some other **parasites**) to prevent such complication.

- **Lab Diagnosis:**

Campylobacter is not easily to be diagnosed within routine laboratory. The physician normally ask for a special culture especially in certain types of patients .

***Morphological structure:**

(please refer to the slides whenever they're available)

1- The figure in the middle: you will recognize the presence of bipolar flagella. Which means that this organism is motile and this motility is responsible for clearance from intestines and the bacterial pathogenicity .

2- Campylobacter means the curved bacteria and it was originally thought to be vibrios (V.cholerae). But campylobacter appears as very thin curved bacilli in comparison to vibrio which is comma shaped. Moreover Campylobacter is more numerous. (many cells).

NOTE: Campylobacter is found in clusters whereas V.cholerae is found as a single cluster

* In addition , not like other type of bacteria we have to use special selective medium that contains three types of antibiotics in order to inhibit the growth of other intestinal or faecal flora.

*The incubation temperature for stool diagnosis is 42C. It is related more to the temperature of animals .42 is the optimal temperature for growth not at 37 degree. And this can help us to suppress other organisms and support the growth of campylobacter species.

- **Vaccination:**

*No vaccines available for humans.

* For animals, there's a vaccine but it's not used.



***Campylobacter in animals :**

- It produces abortion and enteritis.

***Route of infection:**

- The most common route of infection is domestic animals as well as poultry (especially chicken).
- Contaminated and not properly cooked food.

***Clinical features:**

- Similar to shigella in:
- Watery to bloody diarrhea.
- Produces ulceration in intestines ,releasing of damaged blood vessels and release of blood filled stool

***Treatment:**

- Doesn't require treatment with antimicrobial drug unless the infection is complicated.
- May produce blood sepsis in patients with immune deficiency .
- It is considered invasive to some extent .
- Complications include arthritis and Gullian-Barre syndrome.

***Morphological structure:**

- 1- Flagella at one or both poles. (motile)
- 2- Thin curved rods.

*We have to use special selective medium that contains three types of antibiotics.

*The incubation temperature for stool is 42C.

***Vaccination;**

- No vaccines available for humans. For animals there's a vaccine but it's not used.

- **Helicobacter Species: (H. pylori)**

*It was previously called campylobacter pylori, but then it was evident that it constitute a different family and it was called Helicobacter pylori. H. pylori affects humans only and cause peptic ulcers.

*This organism is a special organism ,it is the only organism which can survive in the lining mucosa of the stomach despite its high acidity(pH at least 2) which can kill any type of microorganism. But this organism managed to live there due to the fact that once it's attached by means of multi unipolar flagella to the lining mucosa of the stomach ,it tends to produce a very potent enzyme called Urease. Urease splits urea which originates from the presence of proteins (amino acids) in the mucosal cells to carbon dioxide and ammonia, and carbon dioxide will interact with the water and produce bicarbonate.

*Both NH_3 with bicarbonate produce what we call” neutralizing action” against HCl -the acidity of the stomach- and the organism attaches to the submucosa of the stomach and duodenum and produces infection .Therefore, this organism is associated with presence of chronic active gastritis and this gastritis forms a launch pad for peptic ulcers. It includes duodenal and gastric ulcers which is a severe inflammation in the lining mucosa of stomach or duodenum. It is painful and might be associated with vomiting during ingestion of food. It differs in severity. In the long run, if H.Pylori wasn't eradicated it might increase the risk of stomach cancer and lymphoma (in a very few percentage of people).

- **Infection of H.pylori:**

*Children's root of infection is not well established. But in general, close contact with a healthy carrier ,like the mother of the child or father, will result in infection . 10% of children worldwide might be infected asymptotically with this organism. And this infection will progress with aging and nearly by the age of fifty 80% of the population are already infected with H pylori.

* These organisms colonize in the intestinal tract or oral cavity but it doesn't develop to disease in all cases. Certain triggers such as certain drugs or alcohol consumption increase the activity of H.pylori and it develops Gastritis or peptic Ulcer. The availability of certain conditions are necessary for the disease to progress.

Therefore, it's not easily sometimes to distinguish between a person who is asymptotically infected (there might be mild ulceration) or with a healthy one by using culture methods or serological methods.

- **Lab Diagnosis:**

*In our country they don't rely on culturing because culturing of *H pylori* is difficult. It requires experience and selective culture media and needs at least one to two weeks to recognize the organism and to do biochemical tests.

*Many of the physicians rely on "serological test" to detect specific antibody in a blood sample. But this might not be enough to clinically detect gastritis or peptic Ulceration. The only way is to culture and to do other test known as "urea breath test". It detects bacterial urease activity in the stomach by measuring the output of carbon dioxide resulting from the splitting of carbon-13 or carbon-14 labelled urea into carbon dioxide and ammonia; infected patients give high readings.

- **Biopsy urease test:**

This is a simple and cheap test that can be performed at the bedside. A biopsy specimen is placed into a small quantity of urea solution with a dye such as phenol red, which detects alkalinity resulting from the formation of ammonia.

So, if you want to prove 100% the presence of *Hpylori* the best way is by culture and a biopsy from the ulceration site in order to start the treatment.

- **Treatment:**

_To eradicate *H. pylori* infection, at least two antimicrobial agents must be given in combination with an acid-lowering agent (triple therapy), as monotherapy rapidly leads to antibiotic resistance. It is not eradicated 100% only 90% and it remains in the mucosal lining of stomach and duodenum. Therefore, reinfection is very common.

-Altering the stomach acidity is essential in order to prevent the growth of the bacteria.

- Generally ,antimicrobial drugs might relief the patient for short period but not necessarily to eradicate the organism and cure the patient 100% due to the ability to reinfect and the consistent presence of bacteria.

- **Vaccination:**

- No vaccine is available.

" it's so sad how I was picked randomly to write a sheet about the bug which made my tawjihi way harder and harder ☹ " -Rayya



***Root of infection** : close contact.

*Colonization doesn't mean developing a disease.

*Treatment is with a combination of drugs , eradicate 90% , reinfection is common

*Lab diagnosis mainly by Urea Breath Test.

*Causes gastritis and peptic ulcer , pain , nausea , vomiting.

*No vaccines are available.

- **Acinetobacter Species:**

*This organism has no relation to the enteric bacteria which means it's not part of the intestinal flora and often when it reaches the intestinal tract it's not associated with any clinical symptoms like diarrhea ,or systemic infection. Its importance lies in its biological characteristics such as being a G- bacteria similar to Pseudomonas aeruginosa . Acinetobacter is associated with nosocomial infections.

*It can be a part of the skin flora in healthy individuals and it is associated with our skin foldings and also found as a part of the nasal flora but for a

short period without any significance. They are not that virulent as they are not motile and therefore named *Acinetobacter*. It requires certain fatty acids in our skin secretions to increase in number and grow.

*In the past, it was considered as commensal flora without any significance, and when it was isolated from a clinical specimen it was thought to be a contamination.

*But lately during the Iraq War a large number of wounded American soldiers were infected by *acinetobacter* encountered from the surrounding environment and it can be fatal especially if it reaches the subcutaneous tissue or the respiratory tract. Lately, it became one of the most causative agents of hospitalized infections, especially who are treated in ICU. Many of the patients there require respiratory equipments which facilitate the reaching of bacteria to the lungs and results in pneumonia, which might then spread to blood and cause blood sepsis and meningitis.

- Drug Resistance:

- Normally it is susceptible for most antibiotics in the environment but during infection and while giving antibiotics it begins to produce and develop mechanisms to resist them and become multiresistant.

*In hospital, many of our patients die after being infected with this organism especially in the lung or blood. Therefore, this organism is very dangerous especially in relation to immune deficient hospitalized patients, and patients who had any type of surgical procedure. They require extensive treatment with antibiotics and other drugs. These infections are most commonly associated with **A. baumannii**. *Acinetobacter* is a genus with several different species but we normally refer to it by *A. baumannii*.

• Treatment:

*It is not easily treated with antimicrobial drugs. The only drug available now is **colistin** but it is very toxic, and during treatment it may cause renal failure and other complications.

*It often survives exactly like *Pseudomonas aeruginosa* in the hospitalized environments especially on the hands of physicians, nurses or clothes and floor. (any artificial surfaces for extended periods).

*As you can see it is not easy to get rid of these microorganisms . We have what we call “infection control” used to prevent the spread of such microorganisms. Usage of disinfectant solutions ,washing hands ,using gloves, are simple methods to control the infection.

- **Vaccination:**

There are no vaccines for Acinetobacter.



*Can cause pneumonia , meningitis and blood sepsis.

*Will develop multiresistance during treatment.

*No vaccines available

*The only drug “colistin” is very toxic.

أيضًا - لن تخلو حياتك الجامعية من إختبار واحد صعب على الأقل، ومن صديق واحدٍ رائع،
ومن زاوية واحدة مريحة تفضلها دائمًا للإستراحة بين المحاضرات، ومن أيامٍ مملة كذلك.."

Good Luck

Raya Abdalhameed Almajali