 **Sheet no: 25**

**Refer to slide no:**

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We are not going to talk about all parasites. We will pick the most important ones and without telling many details.

***Amoeba:***

Protozoan parasites which are of 2 types:
1) **Parasitic amoebas** found in humans and they are 6 in number (the most important one is **Entamoeba histolytica** which is pathogenic)
2)**Non-parasitic amoebas** are free living and live in nature and water. In most cases they don’t cause diseases.

***Entamoeba histolytica***:

Trophozoite is the free living part of the organism, which metabolizes yeast and causes disease.
We can divide the cytoplasm of trophozoite into two parts:

1- **ectoplasm**: outer rims which are clear and important for the movement.

2-**endoplasm**: inner part which is granular and contains nucleus and many vacuoles which may contain bacteria.

Amoeba is part of Rhizopoda, which moves by means of pseudopodia; extension of ectoplasm.
\*Rhizopoda: group of parasites which moves by pseudopodia.

We have 4 types of Protozoa: Rhizopoda (like Amoeba), flagellates, ciliates and apicomplexan.

In the case of Entamoeba histolytica which is a pathogenic type of amoeba, we usually find ingested RBC's in the vacuoles which indicates pathogenicity.
Entamoeba histolytica lives in the colon inside the lumen of the large intestine; luminal parasite.

For Entamoeba Histolytica to be transmitted to other people it undergoes morphological changes; producing cysts.
We have 2 varieties here, when we have cysts there is no intermediate host.

*Life-cycle of Entamoeba Histolytica:*

The trophozoites produce cysts in the large intestine, and these cysts will be transmitted through feces to somebody else ending up with infection.
If someone is infected with Entamoeba histolytica used the toilet and didn’t wash his hands, then prepared food for someone else, the food will be contaminated with cysts which will produce infection in the person who will eat the food. These cysts release nuclei in the small intestine and the nuclei go into amoeba.

*Clinical picture*:

Amoeba will cause **dysentery.**
Bacillary dysentery caused by Shigella
Amoeba dysentery is more common and caused by entamoeba histolytica
Amoeba will become cysts inside the intestine then get out to environment by the feces.
Amoeba will stay in the intestine, but cysts whenever they are formed they get out of the body by feces, they can’t stay in the intestine🡺 passage of cysts is continuous

*What will happen if someone eats food contaminated by cysts?*

Two possibilities:
1)He won’t be affected by cysts🡪 no disease
2)He will become infected with the disease.

If someone got infected, he will be either ***carrier*** or will have ***dysentery***.

***Carrier***: The person doesn’t show signs or symptoms although he got infected with cysts. He is a reservoir for cysts and can pass cysts to other people, and sometimes may develop mild symptoms after long time, or may have chronic symptoms such as hepatitis and Jaundice…
***Dysentery***: He will have blood (due to ulceration), mucus (due to irritation) and pus in the stool.

Dysentery can lead to:
1) Fatal outcome if not treated (very serious disease). It may cause perforation in the colon leading to peritonitis.
2) Amoeba may go to blood, then to liver (liver abscess), lungs (lungs abscess) or brain (brain abscess). Abscess can be fatal as well.

🡺 Amoeba known as luminal parasite and can be tissue parasite as well.
10% of people worldwide have Entamoeba histolytica, but not all of them develop symptoms.

We have 2 strains of Amoeba:
1) Entamoeba histolytica which is pathogenic.
2) **Entamoeba dispar**; it has identical morphology and cysts to Entamoeba histolytica.
Both strains have the same morphology. They differ in pathogenicity. Entamoeba histolytica is pathogenic, but Entamoeba dispar is non-pathogenic.
Entamoeba histolytica can produce lectin which causes adherence, and proteases which attack the tissue and protect the Entamoeba histolytica from being killed by the complement. we have also pore formation which makes Entamoeba histolytica pathogenic.
The other stain (Entamoeba dispar) has enzymes in small amounts, and that’s why it doesn’t produce the disease.
Although Entamoeba dispar is very widely prevalent, the disease is not that common because it’s confined with Entamoeba histolytica.

***Entamoeba coli:***

Important because it’s present as commensal and part of the normal flora in large intestine. It's not pathogenic.
30% of people have Entamoeba coli 🡪 very common.
Since it’s very common, you should be able to differentiate between it and Entamoeba histolytica.
For diagnostic purposes, you should be aware of the morphological changes between the trophozoite and cysts of Entamoeba coli and Entamoeba histolytica.

***Entamoeba gingivalis:***

It's found in mouth, and associated with gingival diseases.
Nobody knows if it causes the disease.
It’s probably associated with the diseases of the gum (most likely they are not the cause).
E. gingivalis the only one related to oral cavity.

As we mentioned earlier, we have non-parasitic free living amoebas. They don’t live in humans. They live outside in the water.
If someone went to swim in natural swimming pool (not in chlorine pools), and the contaminated water with the amoebas got into his eyes he will get **keratitis** (corneal inflammation), especially in people who wear contact lenses. Keratitis is not treatable and can lead to blindness.
If someone inhaled water contaminated with amoebas, the amoebas will reach the roof of the nose in the cribriform plate where the refractory nerves pass through and then amoebas will go to CNS entering subarachnoid space and lead to meningitis and meningoencephalitis which is a fatal disease.
These two diseases mentioned above are very rare.

***Giardia lamblia:***

Flagellates luminal parasite which has a pear shape with 2 nuclei, each one with prominent nucleolus showing an "owl eyes" appearance under microscope.
It has 4 pairs of flagella that extend from the sides giving “kite like appearance”.
If you look at it from the side, it appears convex dorsally and flattened ventrally; it looks like “lady bird”.
In ventral aspect there is a sucker which helps the parasite to anchor to the wall of small intestine.
The Cyst has 4 nuclei which will pass through the feces and then go and infect other people.
This parasite actually lives in small intestines.
Transmissions in most cases are waterborne.
It is common in children.
Parasitic diseases mostly affect children because they don’t have good hygiene habits.
The life cycle is simple, there’s no intermediate host; trophozoite produces cyst which goes out with the feces, and when it reaches to someone else, cyst will become trophozoite.
Giardia lamblia produces watery diarrhea and sometimes it can be associated with malabsorption. Suckers will attach to the lining of the small intestines and will destroy the microvilli whether by mechanical effacement or chemical (by producing toxins) resulting in malabsorption which will lead to Steatorrhea; diarrhea which has a sticky and fatty stool due to malabsorption of fat, with bad smell and grey or white in color. It's most common in children
You should examine stool. By doing so you will find the cysts (not the trophozoite).
In severe diarrhea you examine stool freshly, and you may find trophozoite.

***Trichomonas Vaginalis:***

-Flagellates, large and oval in shape.
-Anteriorly we have 4 or 5 flagella.
-Posteriorly there is only 1 flagella.
-A big nucleus in the middle.
-On the side we have undulating membrane and flagella which make it very motile.
-Trichomonas Vaginalis is faster than Giardia Lamblia, and the later is faster than Amoeba.
-In females it lives in vagina.
-In males it lives in urethra or prostate.
-It’s most likely a sexually transmitted disease (STD), but not all the time. It can be also mechanically transmitted (by sharing towels) since it can last outside the body for one or two days.
-It has an exception, there’re no cysts because either it's sexually transmitted so there is no need for cysts or because the trophozoite can last outside the body for a couple of days.
-Usually females are symptomatic. There’s vaginal discharge, frothy and grayish in color. There may be irritation and reddening of the walls of the vagina due to inflammation. The infection doesn’t go any further, unlike the gonorrhea which goes to the uterus or to the fallopian tubes. Trichomonas Vaginalis stays confined to the vagina.
-In males, most likely the disease is asymptomatic. If it’s in the urethra, we will have very little urethral discharge, and very little symptoms. It may produce urethritis, dysuria and prostatitis. Males are silent carrier for the disease.
-Examination: by examining the secretion (vaginal, urethral or prostatic secretion) under the microscope. It’s very easy to detect the organism because it’s very motile.
-Metronidazole (antiparasitic and antibiotic) and flagyl can be used as treatment for amoeba, giardia and trichomonas.
Amoeba can go to circulation and cause abscesses in tissue, but giardia and Trichomonas don’t go into circulation because they are luminal.

***Balantidium Coli:***

Balantidium means "sac".
The largest protozoa. It’s ciliated, so it moves by paramecium; type of cilia.
The trophozoite is ciliated which means it's very motile.
Anteriorly it has opening called “cytostome” through which fluids and nutrients go in and fill the vacuoles.
Any excreted material will pass through the Posterior opening which is known as “cytopyge”.
It has 2 nuclei:
1)**Macronucleus**: a kidney shaped nucleus which controls everything in the organism like metabolism and production of proteins...
2)**Micronucleus**: concerned with reproductive function; sexual production.
They live in the large intestine, and they produce bloody diarrhea.
For diagnosis, you should examine the stool for characteristic cysts.
Unlike Giardia, Amoeba and Trichomonas Vaginalis, It has an animal reservoir (found in the gut of pigs).
Pigs are not intermediate host, however they are considered as reservoir which can transmit the disease to humans.
A person may get the disease either by eating cysts, or from the gut of the pigs.
(intermediate host means that infection must be transmitted from one person to another by intermediate host)
Balantidium coli is a zoonotic parasite; found in humans and also in animals.
\*\*Giardia, Amoeba and Trichomonas Vaginalis are restricted to human beings.

***Toxoplasma gondii:***

-Pear shaped and has a small size (4-5 micron).
-It can be shunted inside the cell causing intracellular infection because of its small size.
In tissue infection, the parasite doesn't have to be inside the cell, it may be between the cells.
If the parasite was inside the cell we can say it’s an intracellular parasite🡺 Toxoplasma Gondii is an intracellular parasite.
Anteriorly it has apparatus for penetration into the cell. So it’s a complex which is found on the apex of the cell known as Apixompelxa or coccidia.
It has a funny way of dividing. Usually dividing happens by binary fission, but here we have 2 new organisms dividing within the mother cell then they are separated (Usually the mother is separated into 2 daughter cells) and at the end the mother cell will disintegrate.
This mechanism of dividing is known as **endodyogeny.**

GOOD LUCK ☺