Parasite Lecture

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INTRODUCTION:

First, I will go into an introduction that the doctor didn't mention in the lecture, you are free to skip this part, but I advise you to read it.

First of all, parasites are divided into three phyla:

I- Protozoa. II- Helminths. III- Arthropods. (we will talk about some species of the first 2).

I- Protozoa: they are unicellular parasites. We will talk about three species from this phylum, which are: *Entamoeba histolytica*, *Giardia lamblia, Cryptosporidium parvum.*

II- Helminths: or metazoa they are multicellular parasites -worm like-, in this lecture we will talk about: Ascaris lumbricoides, Entrobius vermicularis-these 2 are nematodes-, *Echinococcus granulosus-this one is cestode-*, *Schistosomia mansoni –this one is a trematode-***.**

Both protozoa and metazoa are eukaryotes.

Now a brief reminder of the type of hosts:

Definitive host (D.H): harbors the mature adult stage of the parasite or in which sexual reproduction takes place.
Reservoir host (R.H): maintains the parasite in nature, and it is the source of human infection.
Intermediate host (I.H): harbors larval stage (immature or non-sexually reproducing forms of the parasites).
Infective stage (I.S):in this stage the parasite enters the body and causes the disease.
Diagnostic stage (D.S): it is the stage when the parasite leaves the body and can be detected in stool or sputum for example.

I advise you to watch sketchy videos before studying each pathogen, it is very useful.
https://mega.nz/folder/V34GnbjY#aVSJs94squ4n1tbp1PB_Tw/folder/k3RklBoK

Now let's start with our lecture.

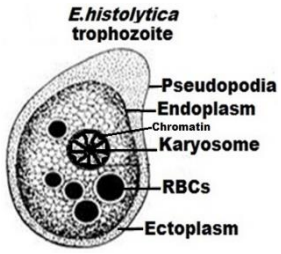
ENTAMOEBA HISTOLYTICA:

It causes Amoebiasis or amoebic dysentery-blood and mucus in stool-,
Habitat: Large intestine (caecum, colonic flexures and sigmoidorectal region) in these places there is stasis of stool, which gives opportunity for the parasite to invade the mucosa.

D.H: Man.

R.H: Man, Dogs, pigs, rats and monkeys.

It has 2 stages trophozoite and cyst, the trophozoite is the stage which is found inside the body, it is the vegetative form of the parasite, it is characterized by the presence of pseudopods, and ingested RBCs –this one is pathognomonic for E.histolytica- which causes the disease other species like Entamoeba.coli are present but they don't cause the disease and don't have ingested RBCs .



the cyst form is the one found outside the body it can resist harsh environment. there is **Immature** cyst (**Uninucleated** cyst and **Binucleated** cyst): these ones do not cause the disease, **Mature** cyst (**Quadrinucleated** cyst): these ones cause the disease.

The transmission is feco-oral, by ingestion of Quadrinucleated cyst: infective stage, the cyst hatches in the body and produces 8 trophozoites. diagnostic stage is trophozoite and cyst mono or bi or quadrinucleated.

Modes of transmission: feco-oral, inscets and flies that carry cyst from feces, autoinfection, homosexual, also from vegetables by using human feces as a fertilizer.

Once you ingest the cyst there is 2 scenarios: 1- **80% are asymptomatic** they are called healthy carrier and cyst passers. The trophozoite is living in the lumen but it doesn't invade the mucosa

2- 20% are symptomatic out of those 20%, 90% have intestinal disease which can be acute or chronic. Both present with fever and abdominal pain and dysentery.

the difference between the chronic and the acute is in the stool findings, in **acute** you find **both trophozoite and cyst in stool**. In the **chronic** form there is **only cyst in the stool**.

There are complications of the disease and they are most hemorrhages caused by the invasion of mucosa and submucosa and causing ulcers. There could be amoeboma -(Amoebic granuloma**)** around the ulcer- also there could be strictures of the affected area.
the ulcer is caused by lytic enzymes and it is called flask shaped ulcer which contains lysed cells and trophozoits.

Extra intestinal: most common site is the liver especially the right lope where it causes abscess and pus – the pus is described as anchovy paste-. it can go to the liver directly from the right colic flexure or through the blood. Second most common site is the lung; especially the lower lope of the right lung. They can get there from the blood or directly from the liver through the diaphragm. brain is the most fatal where it causes brain abscess and encephalitis. Skin can also be involved called (Amoebiasis cutis) around the perianal region.

Laboratory diagnosis: either direct through: **microscopic examination** of the stool and finding cyst or trophozoite, or **sigmoidoscopy** to look for ulcers and **barium enema**. Indirect methods are serological test that look for antibodies, these tests are only positive when there is invasion, so they will be positive in intestinal and extra intestinal disease but they will be negative in asymptomatic patients.

Diagnosis of extra intestinal disease can be direct through: X- ray, Ultrasonography, CT scan& MRI also, Aspiration of liver abscess to detect trophozoites.

Treatment: asymptomatic: paromomycin and Diloxanide furoate.

Intestinal: Metronidazol (Flagyl) or tinidazole.

Extra intestinal: Metronidazol (Flagyl) + Paromomycin or Diloxanide furoate.

The problem with the cyst is they are only killed by boiling, chlorination doesn't work it needs high concentration of chloride and the water becomes undrinkable, but they can be killed by iodine tablets-high dose- these are given to hikers or travelers.

GIARDIA DUODENALIS:

Also called giardia lamblia and intestinalis.it causes giardiasis also called beaver fever. Because the beaver is said to be the reservoir host.

The disease takes place in the small bowel unlike E.histolytica which is In the large intestine.

The trophozoit form is heart shaped has 4 pairs of flagella and a pair of nuclei and it has a ventral disk that is used for attachment to the wall of the small bowel, the cyst is spherical and quadri nucleated. It is motile it has flagella and the movement pattern is called "falling leaf".

It is transmitted feco-oral and other routes like E. histolytica . people with IgA deficiency are more prone to develop both diseases mentioned.

Clinical manifestations: the patients can be asymptomatic 50%, or they can develop giardiasis, which is characterized by watery diarrhea which then becomes greasy and foully smelling (steatorrhea) plz note that it is watery diarrhea, there is no blood or mucus, also there is no fever; because there is no invasion. The disease is caused by malabsorption since this pathogen attacks the small bowel which can lead to weight loss

The **infective** stage is the **quadrionucleated** cyst. the diagnostic is cyst and trophozoit, each cyst gives 2 trophozoites – that are binucleated-.

Diagnosis can be done by stool examination to look for cyst and trophoz. antigen detection can also be used.

Treatment: metronidazole and tinidazole. Metronidazole has side effects like disulfiram reaction-so patients shouldn't drink alcohol for three days after the course- also it is teratogenic.

CRYPTOSPORIDIUM SPP:

These species don't have an organ of locomotion. Used to be called C.parvum, now it is called C.hominis. the disease is called cryptosporidiosis; from their name they live in the crypts of the small intestine. in healthy individuals it is usually asymptomatic, if there are symptoms it is mild self-limited diarrhea. **The problem is with immunocompromised patients** especially HIV patients, it causes sever profuse ***copious*** diarrhea, they lose 3-17 liters of water per day.

This organism has a sexual life cycle so there will be a difference in naming the stages. The infective stage is the oocysts.

Diagnosis is by using **modified** **acid fast stain** -the heating step is not done-.

Treatment: in healthy patients it is self-limited with rehydration, in immunocompromised patients we give **nitazoxanide**.

We finished talking about protozoa.

Now we will start talking about helminths or metazoa

ASCARIS LUMBRICOIDES:

Let's start with nematodes: these are round worms.

They have separate sexes, and each egg gives one worm-there is no multiblication-, the females are always longer than the males and the males have a curved end called copulatory specule the egg is brown with pumps on it. the disease is called ascaris or ascriasis.

Route of transmission is fecal-oral. the habitat is the small intestine.

Infective stage is the **embryonated** eggs. The female lays around 200,000 eggs a day- whether fertilized or not-. **It is a soil transmitted** helminthes; meaning that the fertilized eggs that are excreted in feces are not immediately infectious, but rather need 3-6 weeks to become embryonated and become infective.

When ingested, they hatch in small intestine producing larvae that migrate through the venous system-either portal or systemic- to lungs, where they break into the alveoli, then to the bronchial tree, then they are swallowed and develop into mature worm in the intestine.

Pathogenesis: many A.lumbricoides infections are asymptomatic **.**

Symptomatic:

GI manifestation: there is **alteration in bowel habits, steatorrhea, intestinal obstruction and it can cause biliary obstruction and jaundice** and malnutrition and anemia.

Also there is pulmonary symptoms during migration: it causes loeffler's syndrome characterized by pneumonitis and lung infiltrates and eosinophilia.

DIAGNOSIS: eosinophilia or microscopic examination to look for eggs in the stool (both fertilized and non-fertilized eggs are diagnostic), adult worm may also be seen in stool, also you might see larva in the sputum – during migration-or gastric aspirates.

Treatment: oral Albendazole.

ENTEROBIUS VERMICULARIS (PINWORM)-ALSO NEMATODES-:

It is common in children population. The tail of the female look like a pin and the female is longer than the male, the male has a copulatory specule, also it dies after fertilization and can be found in the stool. **Habitat is the large intestine (ceacum)** the disease is called enterobiasis.

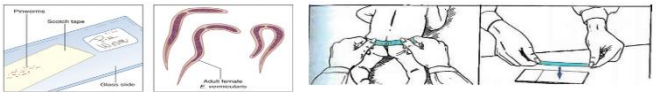
Mode of transmission:

feco-oral (external auto infection –the boys scratches his anus and puts his hand in his mouth-)
the doctor said it can be inhalational also.

Life cycle: The female migrate at night to the perianal area where they deposit eggs, they lay around 200,000 eggs and these **eggs are immediately infectious**; that is why there can be an autoinfection. These eggs cause itching so the main complaint is a child with pruritic perianal region that cannot sleep at night.

the infective stage is embryonated eggs which hatch in the small intestine producing larvae which mature to adults in the large intestine.

Again the clinical scenario will be a child with itching or pruritus in perianal region which prevents him from sleeping at night so there will be failure to thrive.



The diagnosis is made by cellophane (Scotch) tape, we put the tape aroung the perianal region then we put it on slide and we see the american football shaped egg.

Treatment: is albendazole.

HYDATID CYSTS (ECHINOCOCCUS GRANULOSUS):

These are cystodes or tapeworms-they are flat-, they are segmented.

Also called dog tapeworm it is the smallest of all tapeworms. It has 3 segments a scolex (head) and the other 2 segments are proglottids.

The definitive host are canins(dogs). humans can be an intermediate host -they are accidental host-, they get the disease by eating or drinking water contaminated with dog feces.

It causes hydatid cyst mainly in the liver and also in the lung –granulosis-

The one that causes lung cysts only is –E. multilocularis-

The eggs hatch in the small intestine releasing larvae that travel to the liver where they undergo encystation causing hydatid cyst- the cyst is filled with fluid thus the name hydatid and this fluid is immunogenic- if it leaks out of the cyst it causes anaphylactic shock.

The cyst are grape like in shape and they contain hydatid sand and protocolosis –larvae- and fluid and these are all highly immunogenic. Hydatid cyst grow slowly 2-3 cm a year

Diagnosis is usually incidental by radiology, but if the cyst gets large enough they could produce pain and space occupying lesion –they compress other organs-.

Treatment is: surgery and albendazole. there is a special surgery called **PAIR**- **P**uncture of the cyst wall, **A**spiration of cyst contents, **I**nstillation and **R**easpiration of the hyper tonic saline to kill the scolexes.

SCHISTOSOMA:

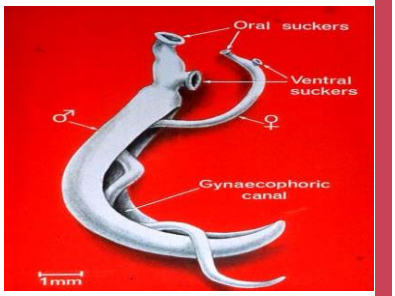
These are trematodes they are flat and they have complex life cycle; they need an intermediated host, they have multiple forms, the (snail seeking) meracedium, and infective forms cercariae and metacercariae.

There are 3 species: S.mansoni and S.japonicum these 2 cause GI disease and S.hematobium this one causes Urinary tract disease. These are blood trematodes; they live in blood vessels. Mansoni lives in superior mesenteric vein, japonicum lives in sup+inf.mesentric veins, hematobium lives in the venous plexus of the urinary bladder.

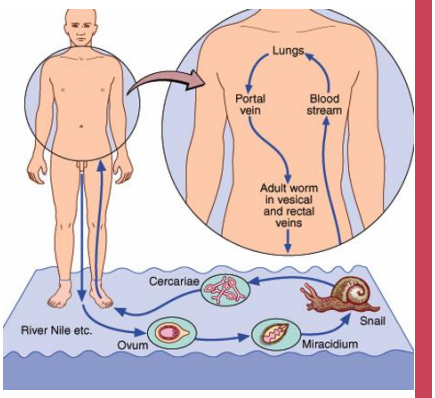
In this pathogen the problem is not with the adult worms but rather in the eggs, around these eggs there will be granulomatous inflammation.

This organism needs intermediate host (snails). the eggs crack and give miracidium that enters the snail, in which it multiplies then cercariae or metacercariae are liberated to the water. **The route of transmission here is by penetration of the skin** (all the ones we have taken so far is by ingestion -feco oral-).

There is a male and a female, the male is characterized by the gynacophoric canal, also called “schisto” in which the female sits. You can also see from the pic that they both have oral and ventral suckers.



So the clinical scenario will be someone who has swam in water contaminated with snails.



One of the chief complaints the patients have; is a <u>"ground itch"</u> in the place where the parasites penetrated the skin.

Another manifestation is the **katayami fever**-mainly in japonicum-: it is a systemic hyper sensitivity that occurs 2-3 weeks after penetration, it is characterized by: fever, hepatosplenomegaly and respiratory symptoms and urticaria.

The eggs can be laid in the portal venous system; causing granulomatous inflammation and sclerosis; which leads to portal hypertension and varices-esophageal- and liver failure.

DIAGNOSIS:

Is by Detecting ova(eggs) in STOOL or tissue biopsy the eggs of each species is different – the eggs of mansoni have lateral spine, hematobuim have terminal spine, japonicum has knobby or rudimentary spine -.

Treatment: Praziquantel.

"The mystery of human existence lies not in just staying alive, but in finding something to live for."