



THE



SYSTEM

Microbiology

Sheet

Slide

Handout

Number: 2

Subject: Parasitology-2

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Price:

This sheet written by the record for section 2 , and I had help from last year sheet, I hope you well enjoy it.

Today, we will start continuing talking about the nematodes of the gastrointestinal tract.

1. Enterobius Vermicularis (pinworm): we have talked about it in last lecture.

2. Trichuris Trichiuria : It's called the whipworm, it majors as 4-5 cm in length, the anterior appendices it's very thin, and the posterior end is thick and presence as a wing.

It's usually found in the caecum area.

When mature it moves to the caecum where it embeds its anterior end into the mucosa and derives nourishment. It has a long span of life reaching several months to a year.

Some ***Trichuris trichiuria*** produce eggs and some of those eggs pass with the feces, they are very characteristic, they are differentiated as a vacuole, you see inside the egg amorphous, so it's not mature egg, and those eggs must stay in the soil 4-5 weeks so they became mature, there are a larval material inside the egg this can be eaten while the egg is growing in the soil. Those how are eaten while it still in egg stage they will not cause infection because they are not really mature.

The life cycle of trichuris trichiuria :

The infection happened **feco-orally** by usually children who always playing in the ground, the first place the eggs will go to because the maturation takes place there, then stomach then to the small intestine and they will hatch there and release the larvae that mature and establish themselves as adults in the colon. The adult worms live in cecum and ascending colon. The

adult worms are fixed in that location. Female worms in cecum shed their eggs, which are not infective neither mature, then pass with stool to start their maturation in soil.

Notice again:

Those larval eggs they can't cause harm until they become mature in the soil and stay there for 4-5 weeks at least to become mature.

SYMPTOMES:

Abnormal pain in wall of the intestine

May get some bleeding with feces

In children that goes to bathroom a lot, they may have a collapse in the rectum because the rectum in children are very loose.

DYAGNOSES:

Look for the output of the feces, do they have eggs or not?

3. Ascaris lumbricoides:

Very large in size, Up to 30 cm in length.

Life span: 1-2 years

They eat the wall of the small intestine; it is a very muscular worm. **These muscles help the worm stick to the lumen of the small intestine and move against the intestinal juices.**

It is yellow or pink in colour, due to staining from the bowel. There is a clear, surrounding albuminous layer around the egg and it is coarse, not smooth. The eggs are not immediately infective, because they are not mature. This is similar to the Trichuris Trichiuria. They have to spend some time developing in the soil, as well.

THE LIFE CYCLE:

The released larvae will penetrate the wall of the intestine and reach the blood stream. From the blood stream, it will **go to the liver.** From the liver, it will eventually get stuck in **the blood vessels of the lungs.** In the lungs, the *Ascaris lumbricoides* mature further and could break into the alveoli of the lungs and then go up with the mucus, **ascend the trachea,** reach the pharynx, and get **swallowed again** to re-enter the gastrointestinal tract. After this, they perform their **final maturation in the small intestine to become adult worms.**

Even the infection is feco-oral; it must go to many cycles to get full maturation.

SYMPTOMS:

The worm may go into the appendix and cause appendicitis, but this is a rare occurrence. Occasionally, the worm may enter the ampulla of Vater and produce pancreatitis or biliary duct obstruction.

These worms can sometimes be vomited. Some of these worms even continue their journey and leave the body through the umbilicus in children (especially children with Meckel's diverticulum), or inguinal region in adults.

All of these occurrences are rare.

A lot of people with *Ascaris lumbricoides* **look very pale and weak.** Some may assume that it's because the worm is deriving the patient's nutrition, but that is very unlikely. **The likely explanation is that the worm releases a toxin which suppresses the appetite, causing the patient to eat less.** **This is why the patient is pale.**

DIAGNOSIS:

Look at the diagnostic characteristics of the eggs or the worm itself that present in the feces, or it come out from his mouth.



4. Hookworms:

They look like a hook in shape , there is 2 classifications for this worm:

1. The old world hookworms are known as **Ankylostoma duodenale**.
2. The new world hookworms are known as **Necator americanus**.

There are some differences between them. These nematodes have teeth in their mouth. These teeth anchor them to the wall of the intestine.

The *A. duodenale* hookworm's teeth are like spikes (picture on the right), meanwhile, the *N. americanus* hookworm's teeth are like semilunar disks (picture on the left).



Ankylostoma duodenale can live up to **3-5 years** and Necator americanus **up to 1-2 years**, meaning Ankylostoma duodenale has a longer life span.

1-2 cm in length, Present in small intestine , They inhabit the small intestine. These worms attach themselves to the villus of the small intestine. These worms are actually blood sucking worms. They suck blood from the villi of the small intestine.

THE LIFE CYCLE:

It starts to produce eggs in the body and then those eggs goes out from the feces and when they get out they start to divide, they were at the 8 cell stage.

Once they are passed in the feces, they rapidly hatch into larvae outside of the body, in the soil. These larvae are thick and are known as **rhabditiform larvae**. These larvae are free-living and feed on bacteria and debris in the soil.

They mature, become bigger and thinner, and are then known as **filariform larvae**.

If someone were to walk barefoot **on the soil** where this filariform larvae inhabited, the filariform larvae could penetrate the skin of the dorsum of the foot or between the toes (where the skin is the weakest).

These larvae could go through the circulation by entering firstly to lymph nodes, gain access to the lungs, and we end up with a similar story of that to the Ascaris, where they ascend the trachea, are swallowed again, and go back to the small intestine, where they become adult worms. That is the life cycle of hook worms.

SYMPTOMES:

1. Mainly abdominal pain.
2. Rash at the site of entry.
3. The blood loss in many surfaces then eventually will produce anemia.
4. They suck blood, so they could cause iron-deficiency anemia. Since they also move a lot, they could cause bleeding in the GIT, there may also be occult blood. So many millions of people are affected by hookworms around the world.

Diagnosis:

Examine the feces and look for the eggs. The eggs are very thin, transparent and embryonated. You should clearly see 2-8 cells in the egg.



5. Strongyloids stercoralis:

- Very small worm (2-3 mm).
- They live in the submucosa.
- They don't live in the lumen of the small intestine.
- They lay eggs very quickly become larvae in to the small intestine.
- You will never find the male; you will find only the female. However, the female is still present in the small

intestine, producing fertile eggs, without the male. This is known as parthenogenesis.

- They come out with the feces, not as eggs, but as larvae. So, in the feces, you look for larvae. These larvae are thick and are known as rhabditiform.

❖ These parasites have 3 ways of completing the life cycle:

1) Direct cycle(exactly like hookworms): The rhabditiform larvae mature into infective filariform larvae, which penetrate the skin of the host, enter the lungs, ascend the trachea, and are swallowed to enter the GIT. This process takes 30 days.

2) Indirect cycle: The rhabditiform larvae develop into free living male and female larvae in the soil. After fertilization the eggs develop into rhabditiform larvae, which may become infective filariform larvae or repeat the free living cycle. Therefore, the male is present in the free living stage, just not in the human.

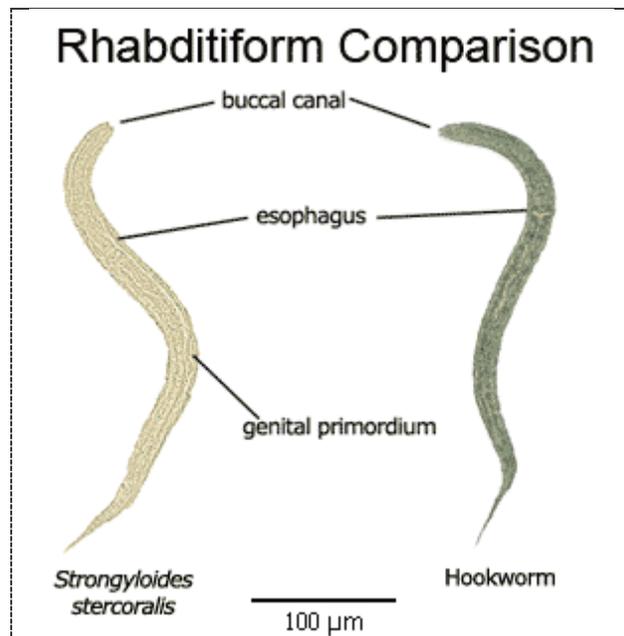
3) Autoinfection: Some of these larvae are similar to some of the lazier medical students.

They don't bother leaving their place to go to the lecture, as the larvae don't bother leaving the small intestine. The rhabditiform larvae develop into filariform larvae in the small intestine itself, and reinfect the host by penetrating the lumen of the small intestine. They enter the blood stream, go up with the sputum, and once again end up in the large intestine. This type of infection is going to give you a very large amount of worms.

This is known as **hyperinfection syndrome**. This is an even bigger problem when the patient is receiving steroids, because steroids encourage hyperinfection. This type of infection can be fatal.

Diagnosis:

By examination of feces and **looking for larvae, rather than eggs.**



6. Visceral Larva Migrans

a situation defined as the presence of larvae that are not natural to the human host.

produced by an Ascaris species known as *Toxocara canis* / *Toxocara cati*

<canis related to Dogs , cati related to cats >

[wiki:Ascaris is a genus of parasitic nematode **worms** known as the "small intestinal roundworms", which is a type of helminth]

THE Life cycle

1. The Cat/dog eats feces (that contain *Toxocara canis* / *Toxocara cati*) of another infected dog or cat .
2. The eggs mature in their small intestines >>maturing of other worms >> the worm passes its egg to the animal feces.

If "somehow " the human ingest these eggs :

- ✓ The larvae (developed eggs) is released and distributed in small intestines.
- ✓ Then distributed to other organs (liver, heart, lung..) actually because of this distribution and its tendency to migrate to other organs part of the situation's name is "**Visceral Larva Migrans**".
- ✓ The problem with this organism that in cats and dogs it tends to settle in their tissues >>so when it does so with humans it produce Lesions.
the lesion is characterized by , lymphocytes and giant cells surrounding the larva .
- ✓ It can cause really damage vital tissue >>Brain damage! and also can damage eyes >> causes choroiditis & iritis may also cause partial blindness.
- ✓ Generally ,These types of infections are more common among children >> they play with cats and dogs more.~x~
- ✓ Some peoples do not shows any complications.

Diagnosis:

- ✓ **Serology** : look for specific antibodies.
- ✓ **Clinically** , there are a triad of sigs : eosinophilia , hepatomegaly & hyper-globulinemia (Igs>>serology)
- ✓ The most effective method is to take a biopsy from the lesion and identify the larvae.

we finish talking about **Nematodes** \ (•~•) /

Trematodes

recall flatworms are either :trematodes (flukes) , cestodes (tapeworm)

not many trematodes (Flat worms=flukes) cause GI infections ,

*there's a trematode known as Schistosoma , it's a tissue trematode (we'll take it next year in urogenital system)

we will focus on some Luminal trematodes now:

1. Fasciolopsis Buski

the largest fluke of humans (2-8 cm)
go to the lumen of small intestines.

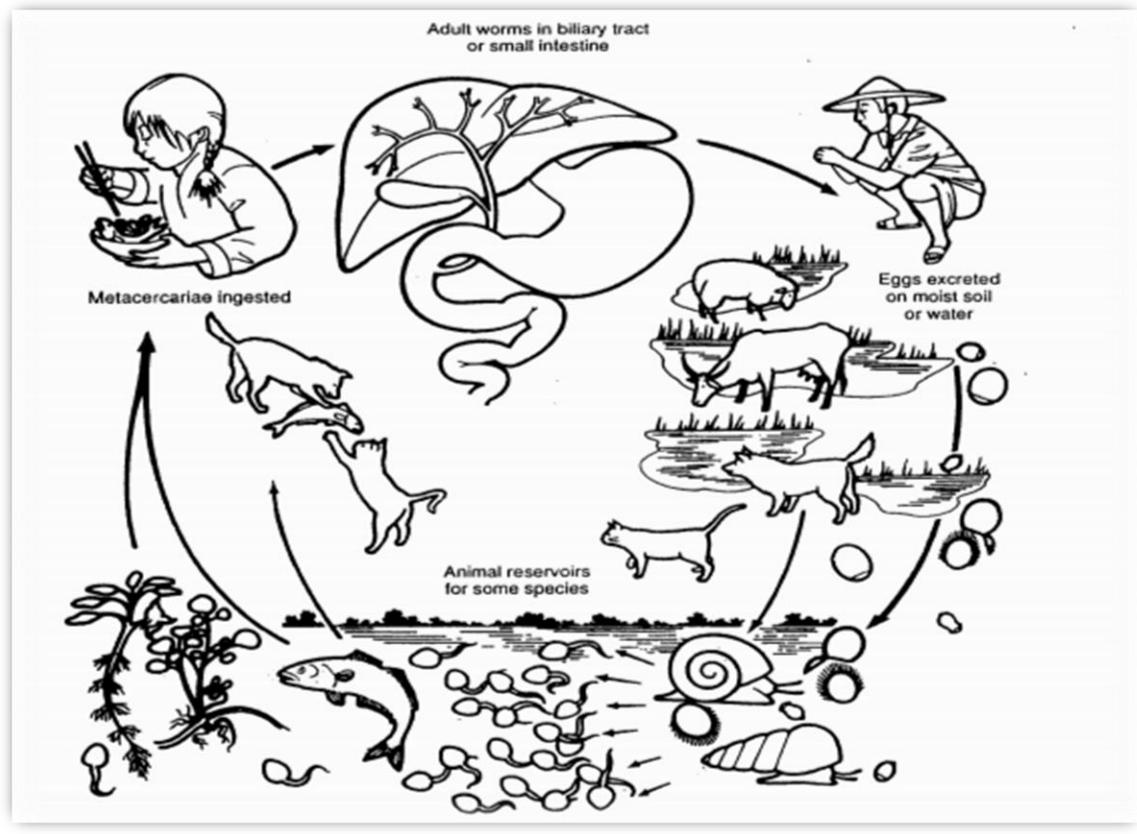
2. Fasciola Hepatica.

Smaller , related to the liver .

Life cycle:

1. Production of eggs in the small intestines by mature worms.(the eggs are large and stained)
2. Eggs passed to feces.
3. Ciliated Miracidia is released from the eggs.
4. Snail eats miracidia.
5. The ciliae turn into flagella and the miracidium become sporocyst
6. Sporocyst will give rise to rediae.
7. Rediae will give rise to cercariae
8. Cercariae exit the snail (they have tails>swim)
9. They encyst and stuck to aquatic plants, now they are known as meta-cercariae (mechanism below)
10. We eat these contaminated plants and so on ..

life cycle (of both)



Notes:

- it is very difficult to differentiate between eggs of Fasciola Buski and hepatica. (generally Buski is less stained)
- miracidia is ciliated in order to swim in the moist water >>to reach their intermediate host .
- encystation of cercariae into meta-cercariae>>simply the tail of the cercariae circulates its body and become a cyst.
- The contaminated plants could be eaten by fish , if we ate those fish , we will be infected (wrong structure of if clause :P)
however, if the fish/plants are cooked , the meta-cercariae die.
- (buski)
In the small intestine the worm invade the wall of mucosa to reach the lumen. So we expect ulceration, obstruction ..

abdominal pain ..

- Hepatica cause jaundice , enlarged tender liver

Diagnosis

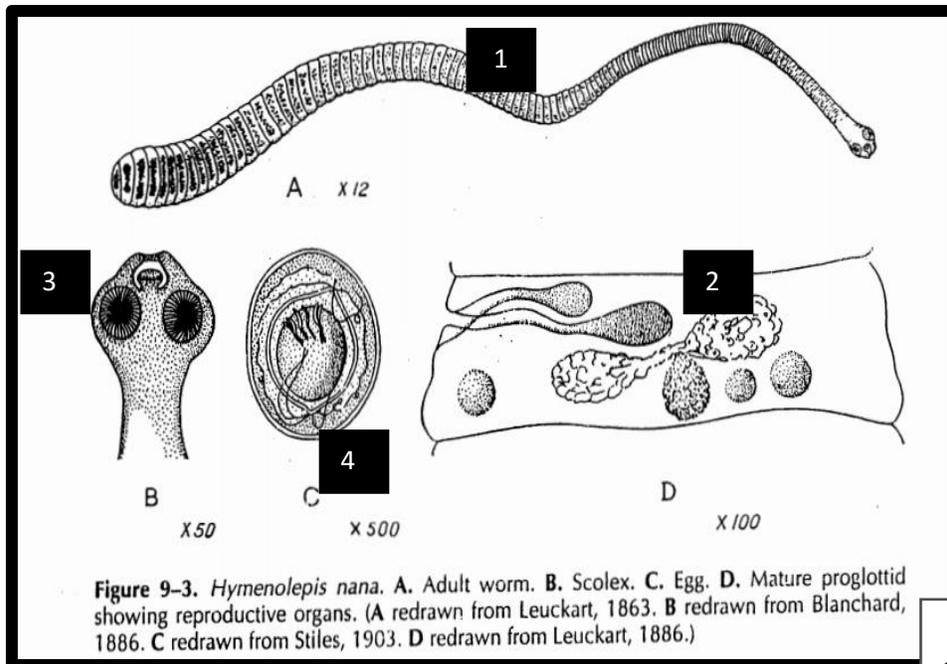
Look for the eggs in the stool .



1. Hymenolepis nana

(structure indicated in the figure below, Note: the doctor's figures are "classic" but they are clear enough :)

- ✓ the smallest cestode (tapeworm) infecting humans.
- ✓ 2 cm in length
- ✓ Consist of 200 proglottids[recall: proglottid is the segment of the worm , each segment have its own reproductive system]
- ✓ The scolex is composed of 4 suckers (2 at each side) and hooks that's goes IN the tissue
- ✓ Their eggs are characteristic:
straighter outer border , inner border , hexacanth embryo
the inner membrane has two thickenings (polar thickening)
from which few filaments radiate.



✓

Life cycle:

1. Eating something contaminated with feces.(eggs reach small intestines)
2. Onchosphere hatches from the eggs .
3. Onchospheres enter the villi”in the submucosa not mucosa” (**tissue worm**)
4. In the villus the onchosphere develop into cercocus .
5. Cercocus grows >>breaks up the villus>>go to the lumen (**luminal worm**)
6. Mature worm produce eggs ,passed to feces again

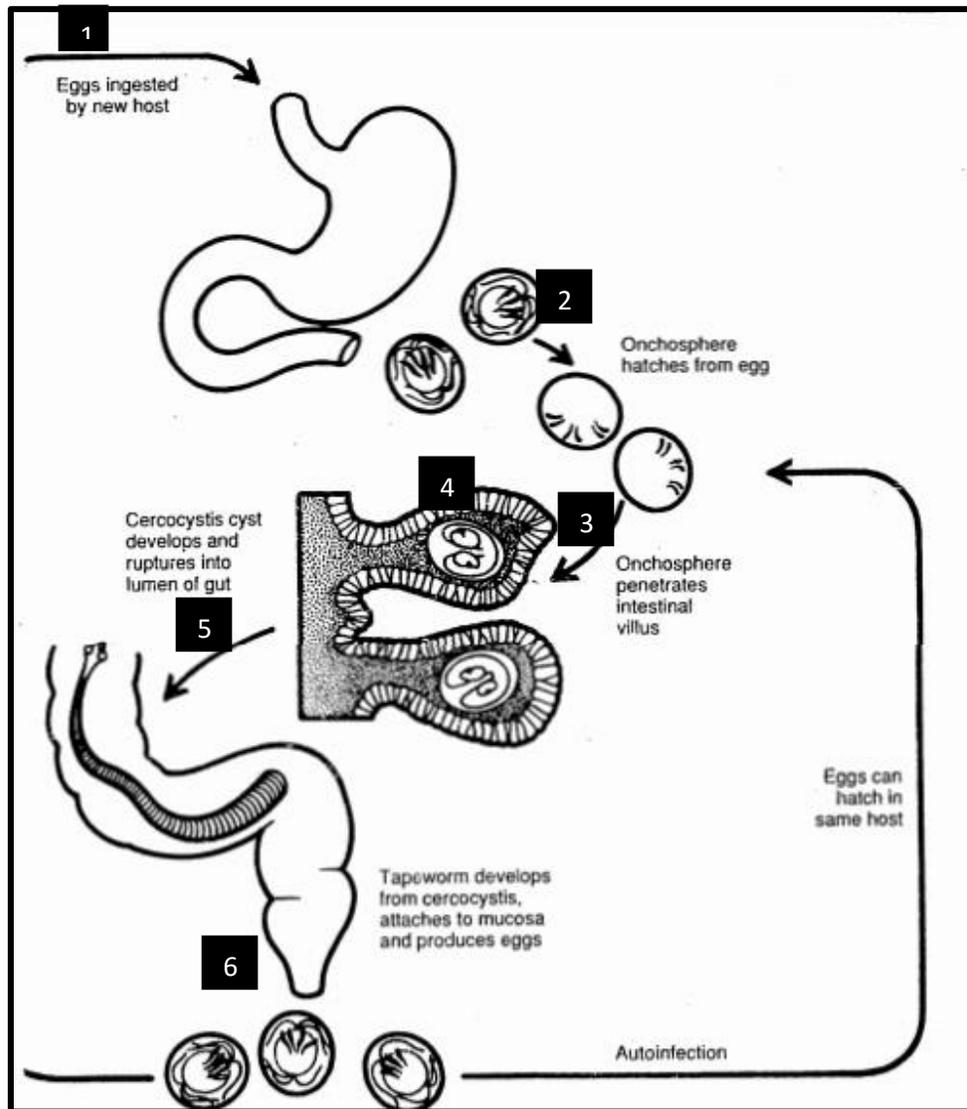
1: H.nana notice the segments(proglottids)

2:they took a proglottid and open it , this the reproductive system

3:the scolex with the four suckers (two are shown here another 2 are on the other side)

4:egg[notice the inner, outer membranes and the hexacanth embryo]

Life cycle



- No intermediate host. BUT actually we can consider the human as both intermediate host and primary.
- The worm is both **tissue and luminal** cestodes.
- **Auto-infection** , some eggs shorten the cycle as they do not pass with feces .rather than that they directly produce the Onchosphere..which develop .. and overall the load of the organism gets higher(up to 2000 worms).

End of text :3