

Digestive System

University of Jordan
Faculty of Medicine
Batch of 2013-2019



Slide Sheet Handout Other

- | | |
|--|---------------------------------------|
| <input type="checkbox"/> Anatomy | <input type="checkbox"/> Embryology |
| <input type="checkbox"/> Physiology | <input type="checkbox"/> Histology |
| <input type="checkbox"/> Pathology | <input type="checkbox"/> Pharmacology |
| <input checked="" type="checkbox"/> Microbiology | <input type="checkbox"/> PBL |

Sheet #: 4 (2-parasitology)
Done by: Ula Nael Isleem

Date:
Price:



Gastrointestinal Tract Parasitology

Nematodes

Today, we will start by discussing the nematodes of the gastrointestinal tract. We discussed nematodes, in general, during the last term.

Enterobius Vermicularis

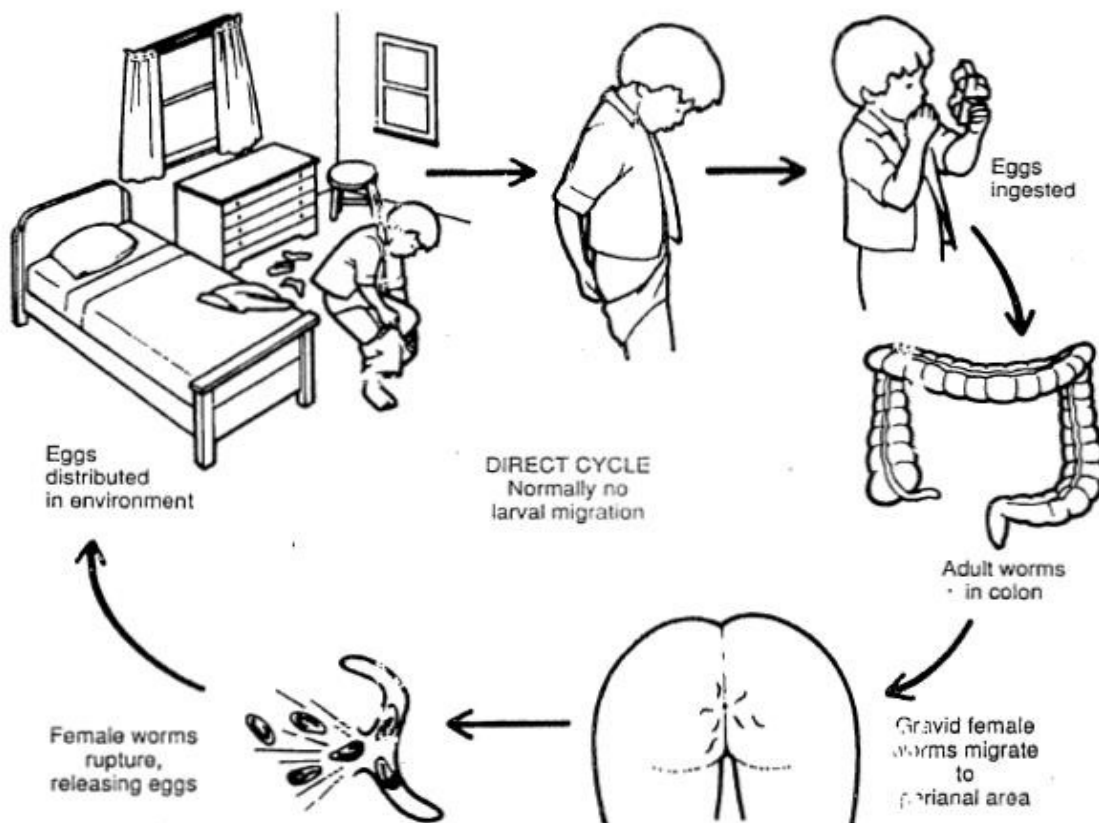
The first one worm we're going to talk about today is the *Enterobius vermicularis*, or the **pinworm**. This worm is a small one, as the name 'pin' implies. The worm is about 1cm, or 8mm, in length. We have both male and female worm. The females are usually larger than the males.

They inhabit the **large intestine** and have a short lifetime. Their lifetime is about 8 weeks. The eggs are not deposited into the lumen of the large intestine. The gravid female worms migrate to the anal opening (the perianal area) and lay their eggs around the skin of the anal opening. The migration of the female worms to the perianal skin happens at night. These eggs mature rapidly and are soon able to cause infection. **As soon as they are deposited on the skin, they are able to cause infection.** The deposited eggs cause itching and this is known as pruritis. Since this happens around the anus, it is known as **pruritis ani**. The main symptom of pruritis ani is itching around the anal opening and nothing else.

Pruritis ani is mainly a disease of children. The child will scratch the anal opening, especially at night. As he does that, he will pick up the eggs underneath his fingernails. The next day when he goes to his school, he may transmit some of the eggs to his friends, through food he has shared with them. These eggs will hatch in another child's small intestine, giving rise to more worms, and so on. That is the whole cycle of the *Enterobius vermicularis*.

This whole cycle should take about 6-8 weeks, from the time we ingest the eggs, to the time the worms come out and lay their eggs around the perineum. Indeed, **this infection is self limiting**. This is because, no matter how many eggs you have eaten, the worms will still come out of the anal opening and lay their eggs on the skin around it, eventually it will not stay in the large intestines.

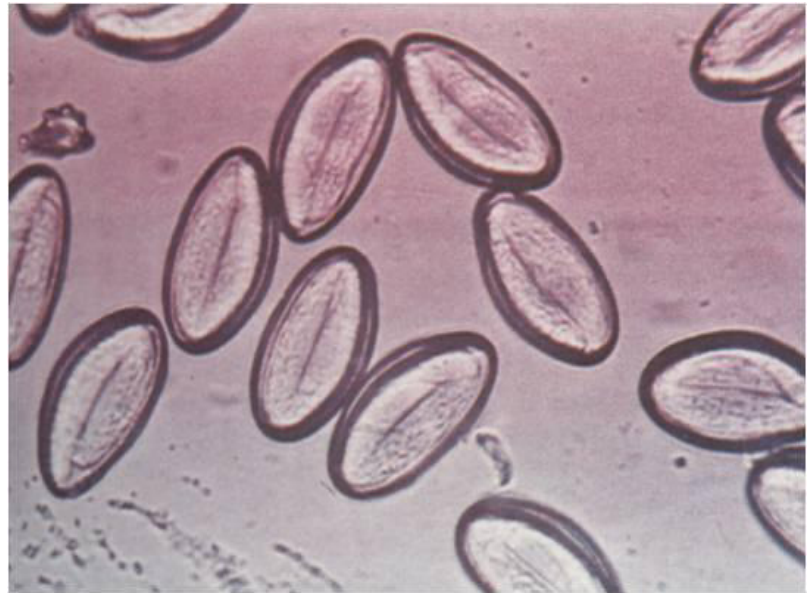
A lot of children self-infect themselves . The child who has the eggs underneath his/her fingernails will not only pass it on to their friends and family, but will infect themselves by sucking on their fingers. So, although the infection is self limiting, it can also be perpetual and go on for a long time, in the case of self infection. This is also known as auto infection and this worm has no intermediate host .



These worms have nothing to do with any other disease and nothing to do with hygiene. Parents may be too embarrassed to share that their children have been infected by a worm, as it may imply a lack of hygiene, however this is a very common disease. One child at school may infect a whole class. Especially kindergarteners and other small children.

Diagnosis

If there is a large amount of these pin worms, then they may be seen in the faeces. If the child's mother is observant, she may see the worm crawling on the child's perineal skin. But, there is no clear visual diagnosis, without using **cellotape (scotch tape)**. Stick it on the perianal skin and observe it on a slide



under the microscope. The sample is best taken in the morning before defecation. The eggs are shaped very distinctively. They are asymmetrical, as one side is convex and the other is straight. Their shape is similar to that of **coffee beans or almonds**.

Treatment:

The drug used for treatment is **Vermox (mebendazole)**. You give the patient **one dose, and then, it is recommended that you give another dose 2 weeks later to prevent auto-infection**. Also, strict hygiene is recommended. Make sure to keep your nails covered, cut and clean to prevent spread of the infection.

Trichuris Trichiuria

The second nematode is *Trichuris trichiura*, or **whipworm**. It resembles a whip due to the fact that the anterior 3/5th of the worm is very thin and the posterior 2/5ths are thick (the posterior 2/5th resembling the handle). This worm is relatively large, between **3-5cm in length**. It has a long lifespan of several months to a year. It usually inhabits the **cecum**.

Pay attention to the importance of the thin, anterior end of the whipworm. The worm usually uses this end to **insert itself into the mucosa**, the way a pin is inserted into a pillow. The worm does this to anchor itself to keep from being swept up during peristalsis. The worms lay eggs there and the eggs are excreted with the faeces. **The eggs are very distinctive, almost lemon-shaped or tea tray shaped.**

The eggs are not embryonated. As they pass through your digestive system so they are not infective, they are asymptomatic, **UNLIKE** *Enterobius vermicularis*, which are highly infective with eggs that become embryonated after several hours from excretion. The eggs of *trichuris trichiura* must be passed into wet soil, and **after 3-4 weeks, they mature and become embryonated and infective.** Then after maturation in the soil, you can see the embryo inside the egg itself. The eggs are picked up from the soil from fruits and vegetables. When these fruits and vegetables are eaten, the eggs will hatch into larvae in the small intestine, then migrate to the cecum, and hatch more eggs which are excreted. This is the whole life cycle. It doesn't really involve any intermediate host.

Symptoms:

The main symptoms include some abdominal pain and discomfort. Since this worm sticks to the wall of the intestine and derives its nutrients from the wall, it can lead to blood loss or anemia. These worms in children sometimes cause

rectal prolapse (a condition where rectal walls prolapse and protrude through the anus), due to frequent straining during defecation in children.

Diagnosis:

Examine the faeces and look for the characteristically shaped eggs. The eggs are either lemon, or tea-tray shaped.



Ascaris lumbricoides:

The next nematode is *Ascaris lumbricoides*. This worm is quite large. **This worm can reach up to 30cm in length.** It inhabits the lumen 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.**

The eggs of this worm pass through the faeces and can live for up to a year, or a year and a half. The eggs are rounded, and usually yellow-brown in color, 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. which is similar to the *Trichuris trichiuris*. They have to spend some time developing in the soil, as well.

Once they are mature and embryonated, if they are eaten, they will travel through the stomach and small intestine and release larvae. The life cycle of this worm is a little more complicated. **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.**

Symptoms:

- 1) A few worms(5-10 worms): asymptomatic. You may notice the alarming passage of the worm in your faeces, but otherwise, they're harmless.
- 2) More worms: They may become entangled in the lumen of the small intestine and give rise to **intestinal obstruction** which must be surgically relieved.

Sometimes, 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 Meckle'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:

You can examine the worm when it passes through the faeces, since it is large(30cm). If you don't have the worm, once again, you can look for the **eggs in the faeces, which are rounded and yellow-brown in color.** They are

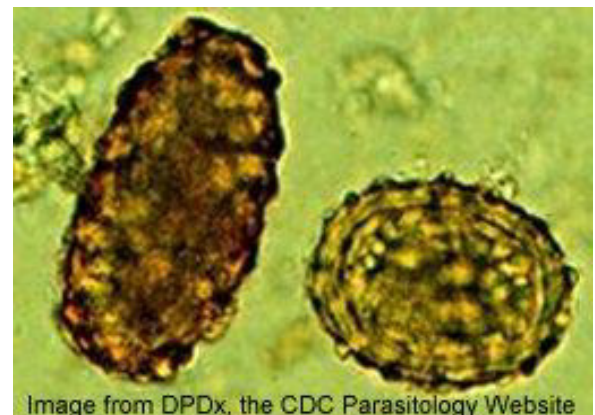


Image from DPDx, the CDC Parasitology Website

surrounded by a **clear albuminous layer**, and they are **coarse** , not soft.

Treatment:

You can take **Piperazine**. What Piperazine does is, **it paralyzes the worm** and **allows it to be excreted by peristalsis**. It does not kill the worm. The worm comes out paralyzed. That's how the treatment works.

Viscera Larvae Migrans:

There is a condition known as Viscera larvae migrans, also known as **Toxocariasis**. Viscera, because it involves the viscera , larvae because the larvae of the worms cause disease in humans, and migrans because it is capable of migration. This is a disease that affects many children and is **due to worms carried by many animals**. We have **Toxocara canis(the worm of the dog)**, and **Toxocara cati(the worm of the cat)**. What happens if you swallow the eggs of these worms? They pass through your abdomen, hatch in your small intestine, then go into your tissues. From there, they can't really develop any further. That is because they can only fully develop in their main hosts: the cat or dog. Eventually, they die. As they die, they produce inflammation around them . These larvae are distributed in the organs of the body, and as they die, they cause **eosinophilic granulomas**.

Symptoms and diagnosis:

Viscera larvae migrans consists of a **triad of symptoms**

- 1) Eosinophilia
- 2) Enlargement of the liver(hepatomegaly)
- 3) Hyperglobulinemia- an increase in blood globulin

This Viscera larvae migrans can settle in the brain or the eye, causing choroiditis or iritis.

Hookworms:

They are known as hook worms because the hook worms latch on to things. They are also **curved**, like a hook. They are about 1cm long. There are two varieties of hookworms. One belongs to the new world and one to the old world. The old world hookworms are known as **Ankylostoma duodenale**, and the new world hookworms are known as **Necator americanus**. Ankylostoma duodenale can live up to **5 years** and Necator americanus **up to 1-2 years**, meaning Ankylostoma duodenale has a longer life span.

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).



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.

They produce eggs and these eggs are excreted with the faeces. When these eggs are passed in the faeces, they are already embryonated. They are at the 8 cell stage. Once they are passed in the faeces, 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 which 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, 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 hookworms.

Symptoms:

The symptoms are mainly abdominal pain. 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 (over half a billion people), it is said that the total combined blood loss due to hookworms is 1 million liters of blood per day.

Diagnosis:

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



Cutaneous larvae migrans

This is an infection by hookworms from animals. The filariform larvae of these worms, which live in the soil and the sand, attempt to penetrate the skin of human beings. However, the skin of humans is not easily penetrated, so, the larvae dig channels in the skin, wander in the skin producing itching then eventually die.

Strongyloides stercoralis :

This worm is a nematode and a very small one, at about 2-3mm. These nematodes are males and females and live in the small intestine. They actually live in the mucosa itself. Although, there are males and females, the male worm has never been found in humans. However, the female is still present in the small intestine, producing fertile eggs, without the male. This is known as **parthenogenesis**. The eggs are produced, they hatch into larvae and exit through the lumen of the small intestine. They come out with the faeces, not as eggs, but as larvae. So, in the faeces, 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 fertilisation the eggs develop into rhabditiform larvae, which may become infective filariform larvae or

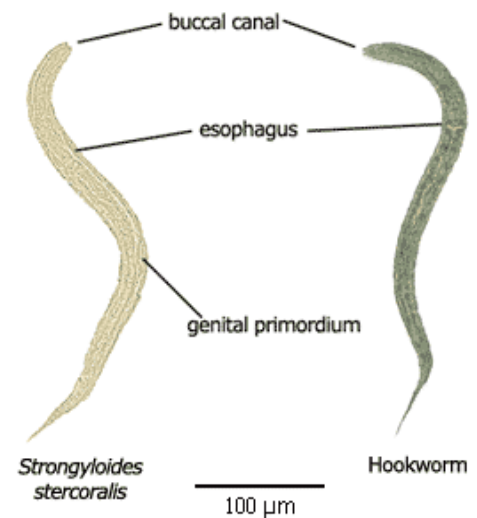
repeat the free living cycle. Therefore, the male is present in the free living stage, just not in the human.

- 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 reinfest 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 faeces and looking for larvae, rather than eggs.

Rhabditiform Comparison



Summary

Enterobius Vermicularis

Mnemonic: Enter the Bus(Enterobius)while sucking your thumb at your own risk. The PERINEUM is VERY (vermicularis) dangerous.

- 1) Eggs are ingested by placing fingers in mouth
 - 2) Larvae hatch in the small intestines
 - 3) Larvae migrate to the colon
 - 4) Adults mature in the colon
 - 5) Gravid adults migrate out of the anus (ITCHING) and unto the perineum at night
 - 6) The eggs embryonate on the perineum; therefore EGGS NOT IN STOOL
- Diagnosis - scotch tape test

Eggs: Coffee bean-shaped

Trichuris Trichiura (Whipworm)

Mnemonic: Let me show you a trick(Trichuris Trichuria) with my whip; I'll make my rectum prolapse

- 1) Eggs ingested
- 2) Eggs hatch in small intestine
- 3) Larvae migrate to colon
- 4) Adults mature in colon
- 5) Adult females lay eggs that cause inflammation around the rectum and lead

to PROLAPSED RECTUM

6) Unembryonated eggs pass out in stool (Diagnosis)

Eggs: Lemon, or tea-tray-shaped eggs in stool

Ascaris Lumbricoides (Giant Roundworm)

MNEMONIC=> A Scary Lumberjack (*Ascaris Lumbricoides*) does NOT live in the South (doesn't go to the perineum and hatch) and uses his ax to obstruct my bowel

- 1) Eggs ingested
- 2) Larvae hatch in small intestine and enter bloodstream, then go to liver
- 3) Larvae go to heart
- 4) Larvae go to lungs (enter alveolar spaces)
- 5) Larvae get too big and migrate up trachea and are swallowed
- 6) Adults mature in small intestine and cause intestinal obstruction.
- 7) Eggs are present in the stool (DIAGNOSIS)

Eggs: Rounded, yellow-brown in color, transparent outer layer, coarse covering

Toxocara Canis/Catis

MNEMONIC: Look at the cats and dogs eating on the soil and then pooping in the soil.

- 1) Animals eat embryonated eggs
 - 2) Eggs pass in feces and embryonate in soil
 - 4) Humans ingest the eggs and the larvae hatch in small intestine and penetrate wall
 - 5) The larvae then migrate to all organs (Liver, CNS, Eye) via the bloodstream
- DIAGNOSIS: Larvae in tissues

Ancylostoma Duodenale/Nectar Americanus (Hookworm)

Mnemonic: I can picture an American(N. Americanus) encyclopedia (Ancylostoma) covered with grass inside of the duodenum. Then I can see a larvae swivel up to it, hooks it, and then nectar starts pouring out.

- 1) walk on grass
- 2) larvae enter blood
- 3) Larvae then go to lungs (alveolar spaces) then to trachea, then are coughed up and swallowed again.
- 4) larvae go to small intestine and mature
- 5) Can lead to anemia or eggs pass out in faeces

Eggs: Thin, transparent, embryonated with 2-8 cells.

Strongyloides Stercoralis

MNEMONIC: I'm so strong that I can live in the soil and go through intact skin

- 1) Larvae in soil get stepped up
 - 2) Larvae enter blood stream by going through unbroken skin
 - 3) Larvae go to lungs and alveolar spaces
 - 4) Larvae go to trachea
 - 5) Larvae are coughed up and then swallowed
 - 6) Adult worms live in small intestine
 - 7) Larvae are passed out in the stool
- (DIAGNOSIS - larvae in stool along with peripheral eosinophils (foot); itching on foot)

Summary: courtesy of Quizlet