Trichuris trichura

Enterobius vermicularis

Strongyloides

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Microbiology

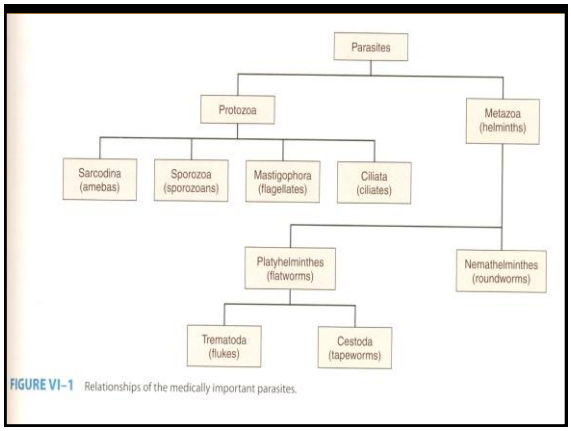
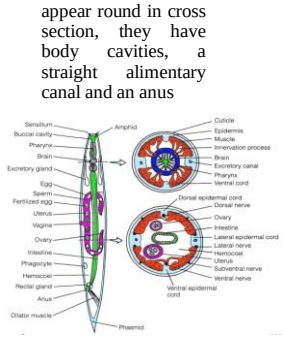
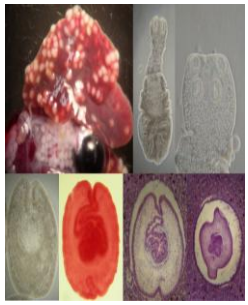


FIGURE VI–1 Relationships of the medically important parasites.

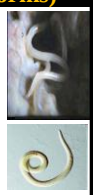
Why They Are Called As Round Worm

- Round worms; appear round in cross section, they have body cavities, a straight alimentary canal and an anus





Characteristics of Nematodes (Round worms)

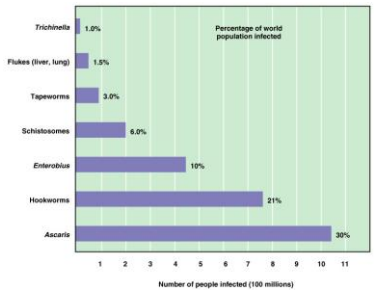


- Elongated cylindrical worm,
- Unsegmented body,
- Well define alimentary cannal uptil anus.
- Head does not have sucker and hook
- Have a buccal capsule with teeth or cutting plates.
- Sexes are separate. (Dioecious)
- Some produce egg (oviparous) or larvae (viviparous) and Some lays eggs contaning larvae which immediately hatch out (ovoviviparous)
- Infection with round worms constitutes largest group of helminthic infections
- 1 billion cases of Ascariasis and 800 million cases of Trichuriasis occur annually

Taxonomic classification of helminths

Sub kingdom	Phylum	Class	Genus – examples
Metazoa	**Nemathehelminthes** Round worms; appear round in cross section, they have body cavities, a straight alimentary canal and an anus	Nematodes	Ascaris (roundworm) **Trichuris (whipworm)** Ancylostoma (hookworm) Necator (hookworm) **Enterobius (pinworm or threadworm)** **Strongyloides**
	Platyhelminthes Flat worms; dorsoventrally flattened, no body cavity and, if present, the alimentary canal is blind ending	**Cestodes** Adult tapeworms are found in the intestine of their host They have a head (scolex) with sucking organs, a segmented body but no alimentary canal Each body segment is hermaphrodite	Taenia (tapeworm)
		Trematodes Non-segmented, usually leaf-shaped, with two suckers but no distinct head They have an alimentary canal and are usually hermaphrodite and leaf shaped Schistosomes are the exception. They are thread-like, and have separate sexes	Fasciolopsis (liver fluke) Schistosoma (not leaf shaped!)

Helminthic Diseases of the Digestive System



Nematodes (Round worms)

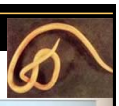


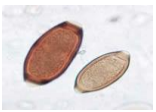
TABLE 56–1 Features of Medically Important Nematodes

Primary Location	Species	Common Name or Disease	Mode of Transmission	Endemic Areas	Diagnosis	Treatment
Intestines	*Enterobius*	Pinworm	Ingestion of eggs	Worldwide	Eggs on skin	Mebendazole or pyrantel pamoate
	Trichuris	Whipworm	Ingestion of eggs	Worldwide, especially tropics	Eggs in stools	Mebendazole
	Ascaris	Ascariasis	Ingestion of eggs	Worldwide, especially tropics	Eggs in stools	Mebendazole or pyrantel pamoate
	Ancylostoma and *Necator*	Hookworm	Larval penetration of skin	Worldwide, especially tropics (*Ancylostoma*), United States (*Necator*)	Eggs in stools	Mebendazole or pyrantel pamoate
	Strongyloides	Strongyloidiasis	Larval penetration of skin, also autoinfection	Tropics primarily	Larvae in stools	Ivermectin
	Trichinella	Trichinosis	Larvae in undercooked meat	Worldwide	Larvae encysted in muscle; serology	Thiabendazole against adult worm
	Anisakis	Anisakiasis	Larvae in undercooked seafood	Japan, United States, Netherlands	Clinical	No drug available
Tissue	*Wuchereria*	Filariasis	Mosquito bite	Tropics primarily	Blood smear	Diethylcarbamazine
	Onchocerca	Onchocerciasis (river blindness)	Blackfly bite	Africa, Central America	Skin biopsy	Ivermectin
	Loa	Loiasis	Deer fly bite	Tropical Africa	Blood smear	Diethylcarbamazine
	Dracunculus	Guinea worm	Ingestion of copepods in water	Tropical Africa and Asia	Clinical	Thiabendazole prior to extracting worm
	Toxocara larvae	Visceral larva migrans	Ingestion of eggs	Worldwide	Clinical and serologic	Albendazole or mebendazole
	Ancylostoma larvae	Cutaneous larva migrans	Penetration of skin	Worldwide	Clinical	Thiabendazole

Trichuris trichura

The 'Whip-worm'

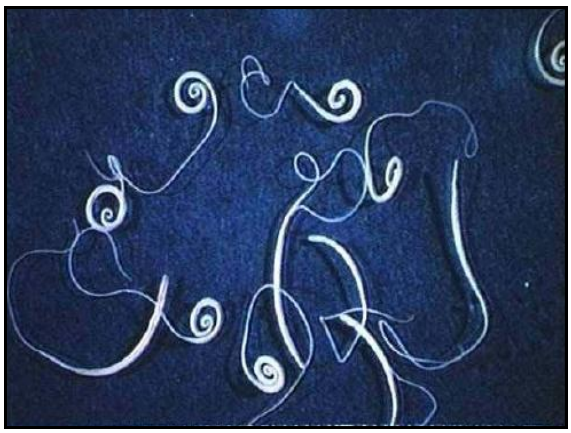
Trichuris trichiura



- Geographical distribution
- Morphology
  - Adult male is 30 to 45mm long with coiled posterior end, female is 35 to 50mm long
  - Anterior 3/5 is elongated and thin, while post. 2/5 is thicker and stout the stock
  - Adults mainly located in caecum
  - Eggs are passed in human faeces, not infective when passed

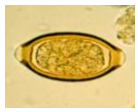
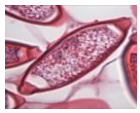
Morphology - of Adult worms

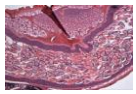
50 mm long with a slender anterior and a thicker posterior end
The male is smaller and has a coiled posterior end



Morphology- of Eggs

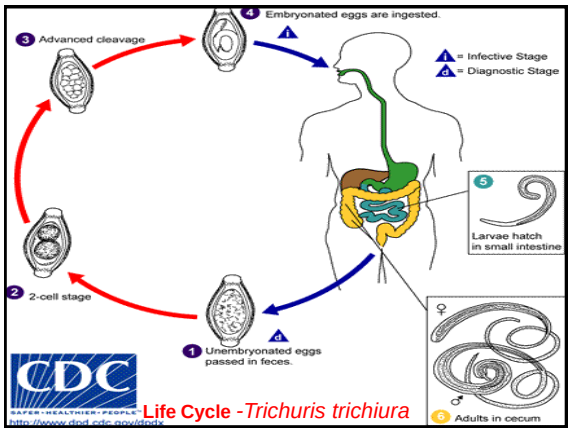
- Eggs in stool
- Size: 50µm by 25 µm,
- Shape is a **typical barrel**
- Color is yellow-brown (bile stained)
  - Unstained **two polar plugs**
- Shell quite thick
- Contains unembryonated egg

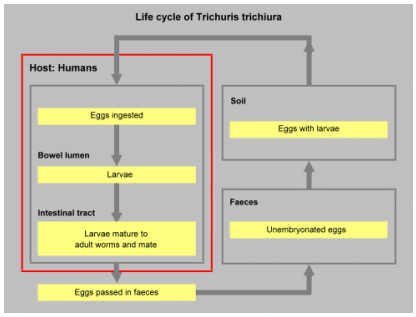



Pathogenesis

- Humans sole host
- Transmission
  - Fecal-oral via embryonated ova
- Frequently coexists with ascaris
- Reservoir
  - Mainly human, others possible but host specificity not well documented
- **Pathogenic potential**
  - Low to moderate, dependent on worm numbers and location in LI.
  - It is related to the burrowing effect of worm that damages the mucosa & causes hemorrage (although slight than that caused by *A. duodenale*).



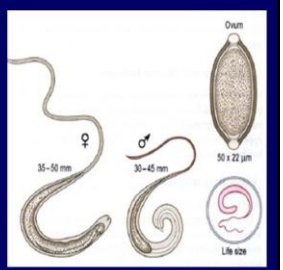
Life cycle

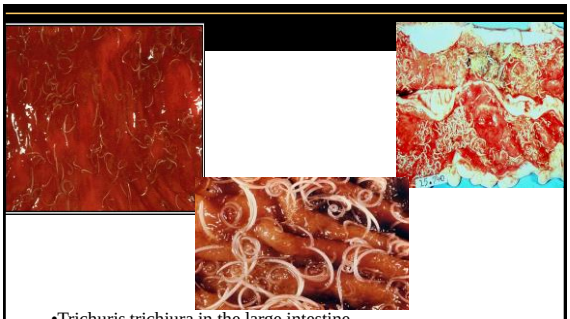


Clinical aspects

- Infection heaviest and frequent in children
- Light infections (< 10,000 eggs/gram of faeces) usually **asymptomatic**
- Heavy infections (>30,000 eggs/gram of faeces) associated with **abdominal pain**, **bloody (frank)/ mucoid diarrhea, abdominal pain and distention, rectal prolapse, anemia and weakness**
- Complications
  - Tenesmus and **rectal prolapse in children**
  - Anaemia
  - Acute appendicitis
  - Rarely, elephantiasis in adults


- Asymptomatic
- Dysentery.
- Rectal prolapse.
- Rectal bleeding
- Anemia.

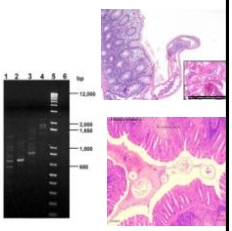




•Trichuris trichiura in the large intestine
•Many worms are present, each with its anterior end embedded in the intestinal mucosa, resulting in the erythema

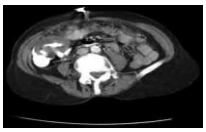
Lab Diagnosis

- **Specimen - Stool**
  - Direct examination (Iodine stain)
  - Based on finding eggs in faeces, formol ether concentration technique rarely required
  - Eggs are 50um long, barrel shaped
  - Rarely adult worms
- **Blood**
  - Eosinophilia
- **Histopathology of the intestinal mucosa**
- **PCR**



Lab Diagnosis

- **Imaging**
  - X-Rays Abdomen
    - Plain
    - With contrast / dye
  - CT Scan
- **Sigmoidoscopy/ proctoscopy** show stocks of worm attached to the mucous membrane



Treatment and Prevention

- **Albendazole** 400 mg once
- **Mebendazole**
  100 mg BD for 3 days
  (600 mg, repeated after 2 weeks)
- **Oxantel pamoate** 15mg/kg body weight for 2 days

- Pay attention to personal hygiene and eating habits
- Environmental sanitation
- Avoidance of raw vegetables where human faeces are used as night soil

Enterobius vermicularis

The 'Pin-worm, Thread-worm'

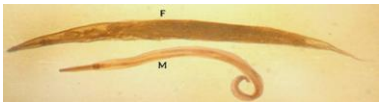
Epidemiology

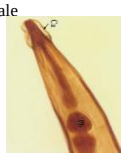
- Geographic Distribution- cosmopolitan, but more in temperate areas with about 30 to 50% of the population infected.
- More prevalent in children than adults. Pre-school & elementary school children affected most often
- Enterobiasis is most common where people live under crowded conditions such as orphanages, kindergartens, and large families.

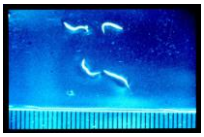
- Host: humans are the only normal host of *vermicularis* other species infect goats, sheep, horses, rabbits and others.
- No intermediate host (direct life cycle)

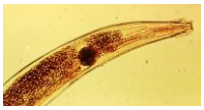
Morphology of Adult

- Adult
  - **Female**: White 8~13 mm in size
    Fusiform body with a long, thin, sharply tapering tail
    Alae (cuticular, wing like extension of head) on ant. end
    Prominent bulb – Rhabditiform esophagus
    The greater part of the body is occupied by the uterus filled with eggs
    Has three lips surrounding the mouth and a bulb on the posterior end of the esophagus
  - **Male**: Like female, but about 1/3 to 1/2 size of female
    The tail is curved, it is rarely seen





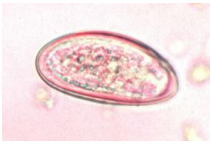




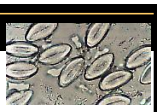
- 0.8-1.3 cm in length , spindle-shaped with a long pointed posterior end. The greater part of the body is occupied by the uterus filled with eggs.

Enterobius eggs

- Elongated-oval and flattened on one side (plano-convex), measuring 50 - 60 um by 20 - 30 um
- Colourless and transparent, thick and asymmetric shell
- Contains a coiled tadpole-larva

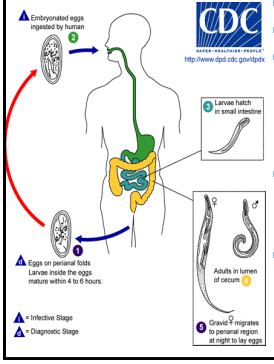


Transmission



- **Faeco – oral** thru ingestion of eggs.
- Eggs are ingested via **person-to-person transmission** through the handling of contaminated surfaces (such as clothing, linen, curtains, and carpeting).
- Clothing and bedding become infested quickly, also found in dust in school rooms and cafeterias.
- Most commonly infection occurs form soiled fingers or objects
- Airborne - eggs can also be inhaled and swallowed.
- **(Auto-infection) Self-infection** may also occur if eggs are transferred to the mouth by fingers that have scratched the peri-anal area.
- **Retro-infection** – eggs laid on perianal skin immediately hatch into infective - stage larvae &migrate thru anus to develop into adult worm into colon.

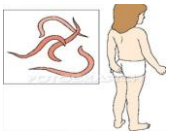
Life cycle



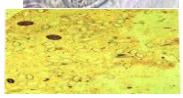
- Definitive host ---Human
- Eggs are ingested
- Larvae hatch from the eggs in the small intestine. The adults then migrate to the colon. The life span of the adults is about two months. Adults mate in the colon, and the males die after mating.
- Gravid females migrate nocturnally to the anus and deposit eggs in the perianal area. The females die after laying their eggs.
- The larvae develop and the eggs become infectious within 4-6 hours. Newly hatched larvae may also migrate back into the anus, and this is known as **retroinfection.**

Clinical Features

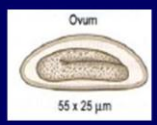
- Mostly asymptomatic
- Nocturnal anal pruritis is cardinal feature due to migration and laying of eggs
- Perianal pruritus may lead to excoriations and bacterial superinfection of perianal region
- Occasionally, invasion of the female genital tract with vulvovaginitis and pelvic or peritoneal granulomas can occur
- Children may experience anorexia, irritability, abdominal pain, insomnia, & possible emotional symptoms
- Ectopic migration causing appendicitis
- Nocturnal enuresis



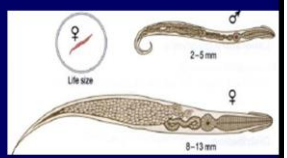
Laboratory Diagnosis



- **Direct fecal smear**
  - **Microscopic identification of eggs** collected from the perianal area is the method of choice by
    - **Scotch tape technique**
    - Cellophan tape impression
  - This must be done in the morning, before defecation and washing
  - **Worms in stool** – small white thread like
- Alternatively, **anal swabs** can also be used
- Brine-floatation method
- Detection of adult on anal skin at night, when the child is sleeping
- Larval cultivation



- ✓Asymptomatic
- ✓Perianal itching
- ✓Pruritis vulvae ?
- ✓Vaginitis ?
- ✓Appendicitis ?
- ✓Salpingitis ?



Treatment

- Since the life span of the pinworm is less than two months, the major problem is re-infection
- Repeat the treatment after 2 weeks
- Repeated re-treatment may be necessary for a radical cure
- **Albendazole** is the drug of choice. 400 mg single dose,repeat after 2 weeks
- **Mebendazole** 100 mg single dose
- **Pyrantel pamoate** 10 mg/kg body weight are the alternative drugs

Prevention

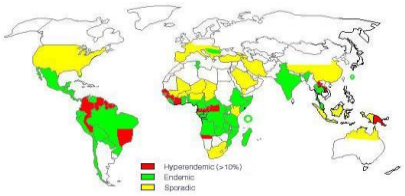
- Treat and re-treat the patients and carriers
- Avoidance of over crowding in rooms
- Laundering of bedding, clothing at > 80 C
- Individual health
  - Observation and correction of personal hygienic and eating habits
- Public health
- Health education

Strongyloides

(Strongyloidiasis)

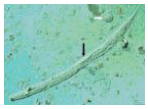
Epidemiology

- Found worldwide - An estimated 50 - 100 million cases
- Favors warmer tropical and subtropical climates
  - Endemic in sub-Saharan Africa, Latin America, southeast Asia, and the southeastern United States



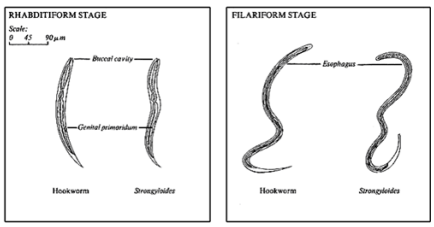
Epidemiology

- Worms can be free-living in the soil or live in a host
- Only females are parasitic
- The definitive host is human, but may also affect other primates and dogs
- Habitat
  - Parasitic adult in duodenum and jejunum of man
  - Larvae not eggs are passed in human faeces
  - Infective larvae found in soil, intestine and perianal skin
- Mode of Transmission
  - **Skin penetration by larva**



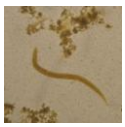
Morphology

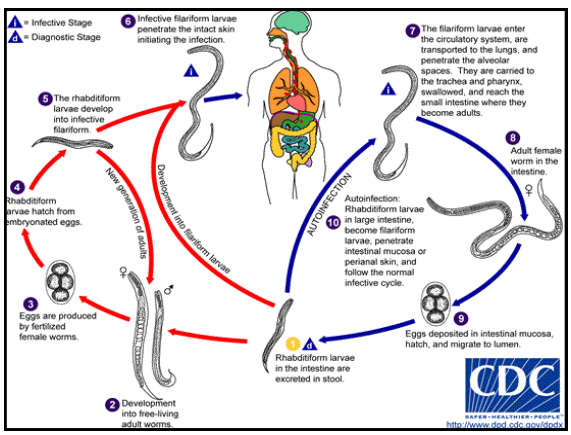
- It's a nematode, so it has two larval forms
  Rhabditiform larvae (noninfectious, feeding form)
  Filariform larvae (infectious, nonfeeding form)

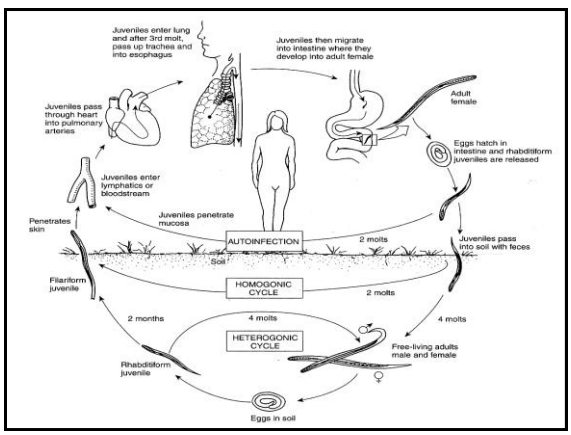


Morphology

- The size and shape of the adult female are dependent on whether it's parasitic or free-living
  - Free-living females 1 mm by 60 µm
  - Parasitic females 2.2 mm by 45 µm
  - Eggs 55 µm by 30 µm
- Adult Male
  - Reproduction parthenogenetic







Symptoms

- Dependent on the stage in the worm's life cycle

Stage	Site	Symptoms
egg	intestine	---
rhabditiform	intestine, soil	--- ("free living")
filariform	soil	ground itch larva currens
	lungs	wheezing, cough hemoptysis eosinophilia
adult	intestines	abdominal pain ulcers diarrhea/constipation weight loss bowel obstruction malabsorption

- 1/3 of patients are asymptomatic
- Ground itch
  - Pruritic papulovesicular cutaneous eruption
- Larva Currens ("racing larvae")
  - Pathognomonic rash
  - Pruritic wheal or linear urticaria
  - Creeps 5-15 cm/hr!
  - **migratory serpiginous dermatitis**

Migrating larvae of Strongyloides stercoralis in skin

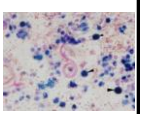
Strongyloidiasis

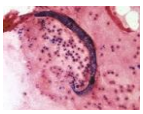
- Symptoms and Signs of Hyperinfection
  - Diarrhea
  - Pleuritic pain
  - Peripheral eosinophilia
  - Severe generalized abdominal pain, diffuse pulmonary infiltrates, shock, sepsis may occur

Lab Diagnosis

- Direct microscopy
  - Rhabditiform larvae in stool
    - Larvae are seen in stool approximately 1 month after skin penetration
    - >90% sensitivity for stool samples if 7 or more samples are examined
  - Larvae in sputum sample
- Serology

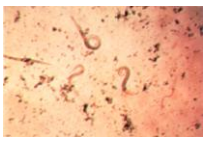
  An enzyme immunoassay that detect antibody to larval antigen





Lab Diagnosis

- With hyperinfection
  - Filariform larvae may also be recovered in stool if fixed rapidly
  - Sputum samples
  - Bronchioalveolar lavage
  - Urinalysis
  - Semen analysis
  - CSF analysis
  - Striking Eosinophilia



Lab Diagnosis

- Features of Rhabditiform larvae
  - Actively motile
  - 200-250µm x 16 µm in size
  - Short buccal cavity
  - Rhabditiform large bulbed esophagus

Treatment

- **Ivermectin** (drug of choice)
  - 200 mcg/kg/d PO for 2 days
  - Binds to chloride ion channels
  - Causes hyperpolarization → paralysis
  - Affects adults only…
  - Cure rate of up to 97%
- **Albendazole** (2nd line drug)
  - 400 mg BID x 7 days
- **Thiabendazole** (2nd line drug before)
- Hyperinfection - treatment for 2-3 weeks may be life saving but the mortality is very high

Prevention

- Properly dispose of human wastes
- Wear Shoes
- …Don't eat dirt