THE HUMAN WHIPWORM TRICHURIS TRICHIURIA

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BATCH A
21st CBME BATCH

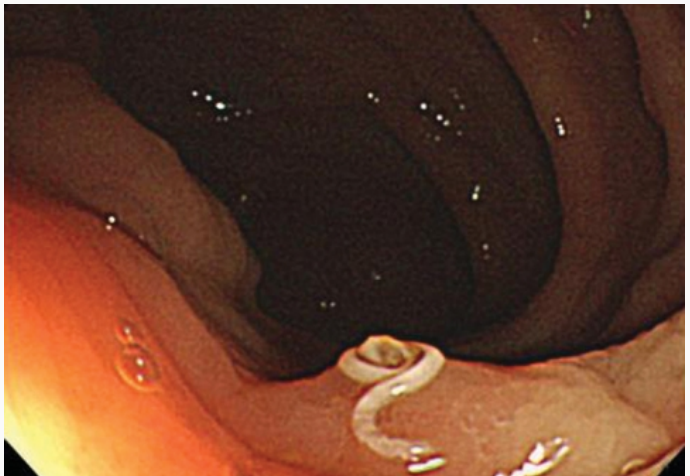
SET INDUCTION

A 55 year old man was admitted for epigastric discomfort and intermittent diarrhea for the past 1 month. The stool examination revealed—barrel shaped eggs with bipolar prominences. Blood investigations shows mild eosinophilia. He was found to have a small, white worm within the ileocecal valve with relatively normal colonic mucosa during colonoscopy.

1. Identify the disease and the probable causative agent(s).

2. Write briefly about the life cycle of the etiological agent(s).

3. What is the method of treatment?



History

- ***Trichuris trichiura***, the human whipworm, was first described *by Linnaeus in 1771.*
- The name Trichuris means a ‘hair-like tail’ (Greek trichos— hair, oura—tail).
- The name whipworm is more apt as the thick **posterior part resembles the stock** and the **thin anterior end resembles the lash of a whip.**
- The antiquity of the whipworm as a human parasite is indicated by the demonstration of its eggs in colonic contents of a young man, who died on the Alps some **5,300 years ago** and whose well-preserved body was discovered in 1990.

Burden of disease (*A. lumbricoides*, *T. trichiura* and hookworms only)

About 1.5 billion
people estimated to be infected with STH[1] in 2016

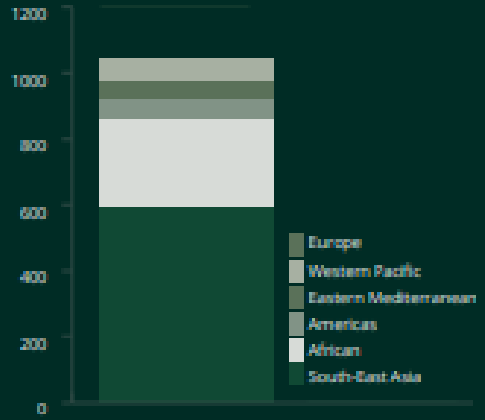
About 6300
deaths reported in 2016[1]

About 3.5 million
DALYs in 2016[1]

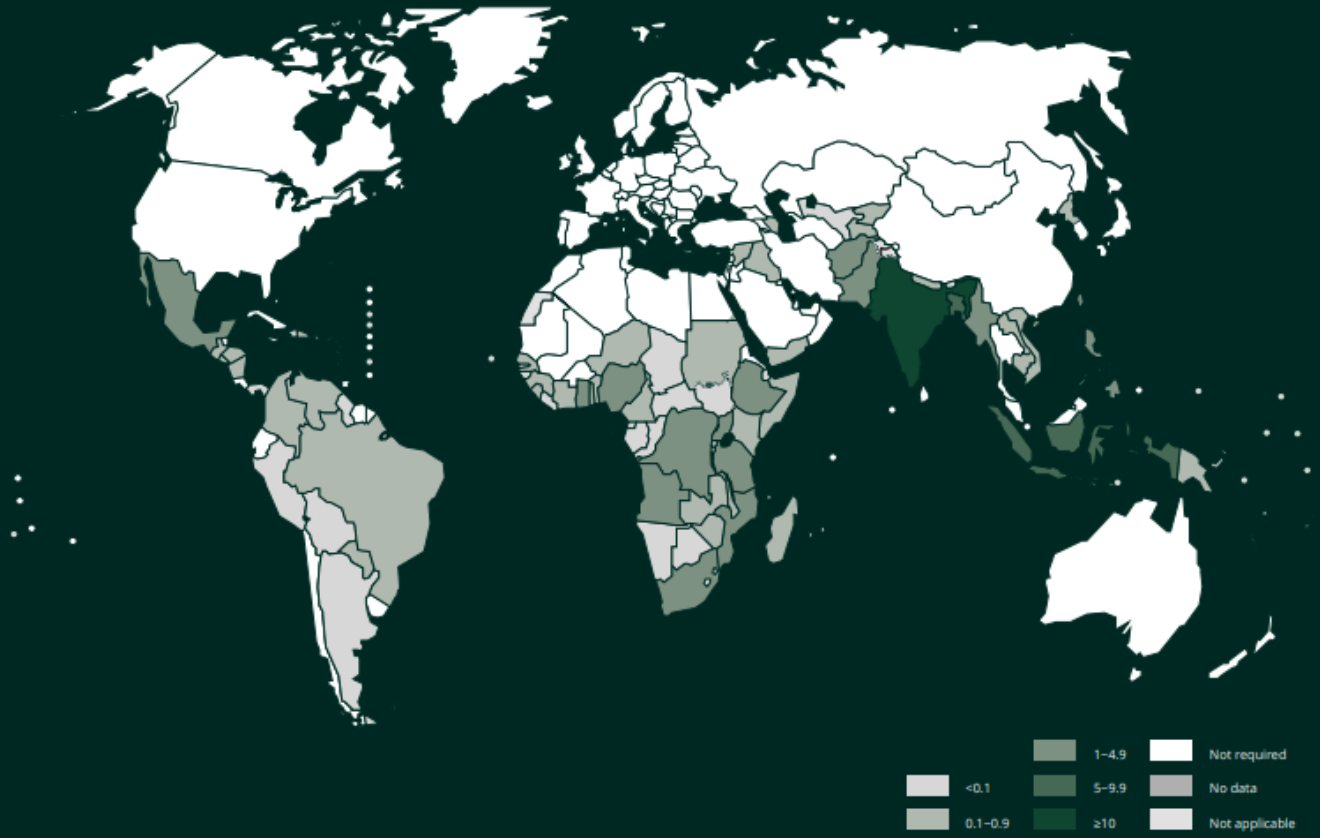
In 2019, 92 countries required MDA, mostly in tropical and subtropical areas across sub-Saharan Africa, Latin America and Asia but also in some areas of the European Region.

The burden of *S. stercoralis* should be quantified precisely.

Population requiring preventive chemotherapy for STH by WHO region, 2019, million



Proportion (%) of children requiring preventive chemotherapy globally, 2019



[1] Control of strongyloidiasis was not included in the targets for 2020

Epidemiology

- It is **worldwide in distribution**, but is much more **common in the tropics**. The infection is widespread in tropical Africa, South America, and South-east Asia. Trichuris infection is **found throughout India.**
- Some **500 million people are estimated** to be infected with this worm.
- While whipworm infection is extremely frequent, whipworm disease is relatively rare.
- **Children** are commonly affected.

Morphology

- Similar to other nematodes, T. trichiura exists in **three forms: adult, larvae (four stages the L1,L2,L3 and L4) and egg**.

ADULT WORM

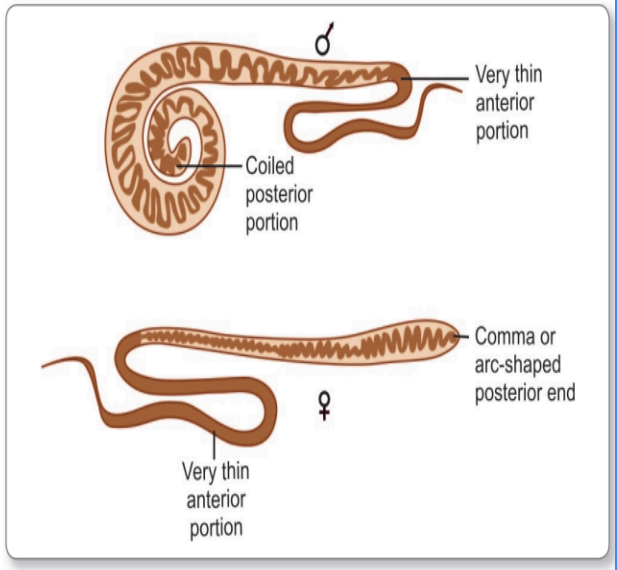
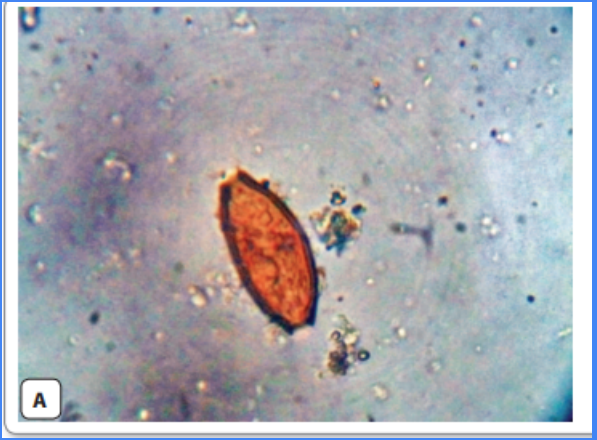
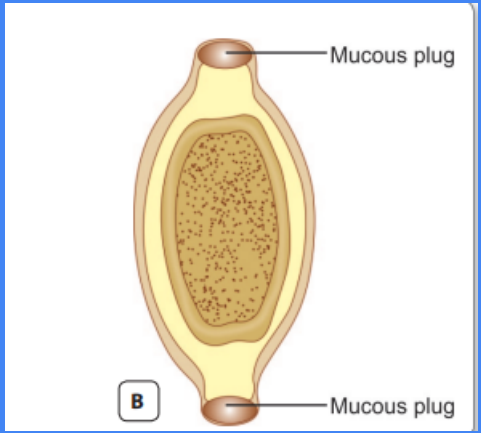


Fig. 16.1: Adult *Trichuris trichiura* worms (male and female)

- The male worm is 30–45 mm long, while the female is slightly larger, about 40–50 mm.
- The worm is flesh-colored. In shape, it resembles a whip, with the anterior three-fifth thin and thread-like and the posterior two-fifth thick and fleshy, appearing like the handle of a whip.
- posterior part contains the intestines and reproductive organs.
- The posterior end of the male is coiled ventrally, while the hind end of the female is straight, blunt, and rounded.
- The worm has a lifespan of 5–10 years.

EGG





- The egg has a characteristic appearance.
- It is brown in color being bile-stained.
- It has a triple shell, the outermost layer of which is stained brown.
- It is barrel-shaped and about 50 µm long and 25 µm wide in the middle, with a projecting mucus plug at each pole containing an unsegmented ovum.
- The plugs are colorless.
- The egg floats in saturated salt solution.
- When freshly passed, the egg contains an unsegmented ovum. At this stage, it is not infective for humans.
- The fertilized female lays about 5,000 eggs per day.

LIFE CYCLE

The entire life cycle can be passed in one host, from the ingested infective egg to the development of the adults and the release of their eggs in feces. But for **transmission of infection** to other hosts and perpetuation of the species, the egg has to **undergo development in the soil** and then **infect another person**.

- **Natural host: Man.**
- No intermediate host is required.
- **Infective form: Embryonated eggs containing Rhabditiform larva.**
- Adult female worm lives in large intestine worm lays eggs which are discharged in feces.
- The egg undergoes development in soil, optimally under warm, moist, shady conditions, when the infective rhabditiform larva develops within the egg in 3–4 weeks.
- At lower temperatures, this may be delayed for 3 months or more .
- These embryonated eggs are infective to man.
- **Mode of Transmission:** Infection occurs in humans (usually male children) when the mature embryonated eggs containing the infective larvae are swallowed in **contaminated food or water**.
- The eggs hatch out in the small intestine releasing the L2 larva, ,which emerges through the pole of the egg, and which migrate to large intestine and molts twice(L3,L4) to transform into mature adults **within 2 to 3 months** and lie **embedded in the cecal wall**, with the thread-like anterior portion piercing the mucosa and the thick posterior end projecting out.
- The female worms following fertilization start laying **unembryonated eggs**, that are **released in feces (diagnostic form).**
- Eggs start appearing in feces usually about **3 months** after infection
- Each female worm can lay 14,000–20,000 eggs per day for 1–3 years.
- **Embryonation**: The eggs passed in the feces become embryonated (i.e. molt twice to produce L2 larvae within the eggshell) in warm (25°C) and moist environment. Embryonated eggs are infective to man and thus the life cycle continues.

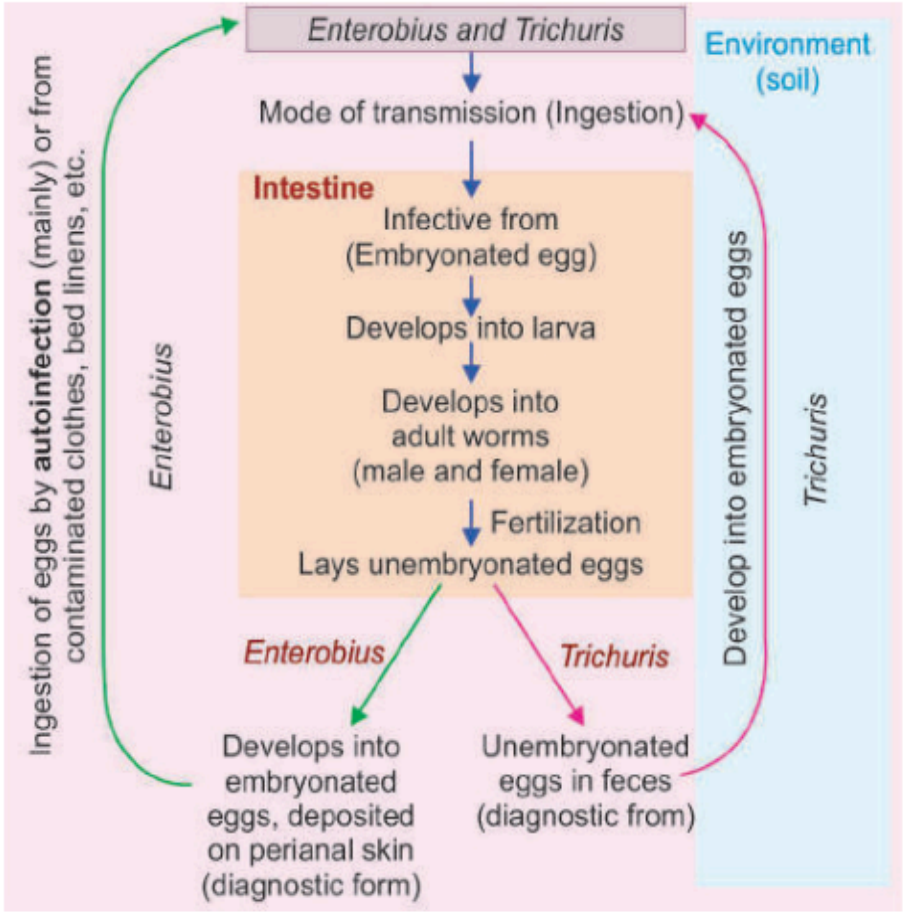


Fig. 46.18: Life cycles of *Trichuris* and *Enterobius*.

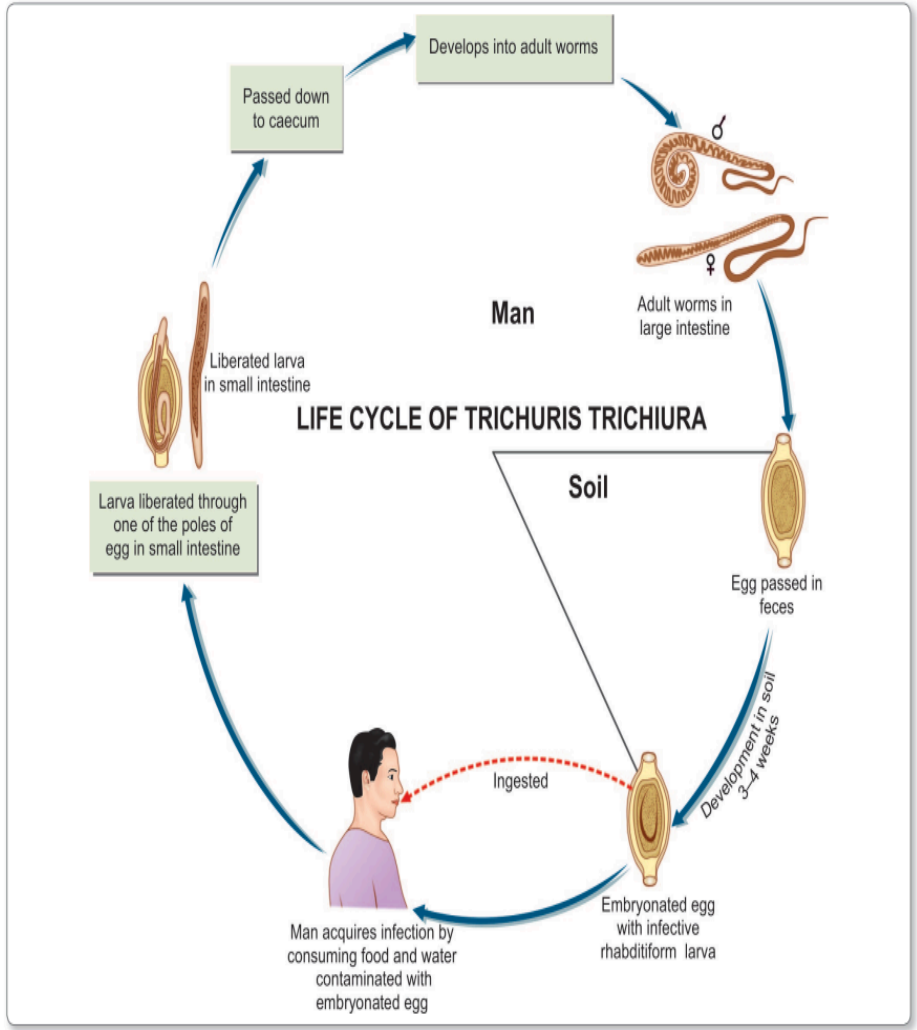


Fig. 16.3: Life cycle of *Trichuris trichiura*

Pathogenicity

- **Incubation period** varies from **70 to 90 days**.

- **Soil serves as a reservoir** for the parasite.
- Most infected individuals are **asymptomatic**, with or without having **eosinophilia.**
- **In people with heavy infections:** Adult female worms get buried in the large intestinal mucosa, that leads to disease due to one of the following causes:

1. **Mechanical distortion**: Leading to **inflamed, edematous, and friable mucosa**
2. **Allergic response by the host:** Large number of **macrophages infiltrate in the lamina propria that produce tumor necrosis factor-α (TNF-α).**

CLINICAL FEATURES

Common manifestations include:

1. **Abdominal pain, anorexia**,et cetera

2. **Trichuris dysentery syndrome**—bloody or mucoid diarrhea resembling inflammatory bowel disease

3. **Iron deficiency anemia**—occurs as a **result of blood loss** (around 0.005 mL is lost per worm per day)(contrast it with anemia due to blood ingestion seen in Hookworm)

4. **Recurrent rectal prolapse**—occurs due to heavy worm load in the rectum

5. **Malnutrition** leading to **growth retardation and impaired cognitive function**—due to the release of anti-inflammatory cytokines induced by Trichuris species

6. mechanical blockage of the appendiceal lumen by masses of whipworms may cause **acute appendicitis.**

LABORATORY DIAGNOSIS

Stool Examination

Stool examination is carried out either by direct wet mount or following concentration of the stool, which reveals **characteristic barrel-shaped eggs with mucus plug at both poles** and occasionally adult worm.

Single stool specimen is sufficient for diagnosis of symptomatic cases as the level of egg output is usually high.

The degree of infection can be assessed by egg counts.

Less than 10 eggs per smear in direct stool preparation is considered **light infection** and **more than 50 per smear** as **heavy infection**

Light infection is not considered to cause clinical disease.

Sigmoidoscopy

Sigmoidoscopy is useful as **worms are found in the rectal mucosa** in whipworm diarrhea and dysentery.

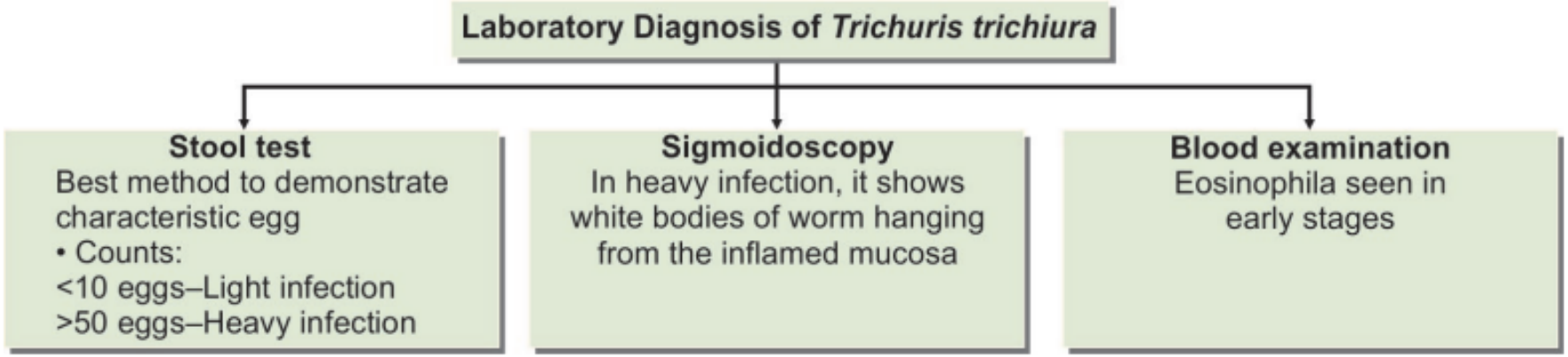
Charcot-Leyden crystals are usually abundant in stools of patients with whipworm dysentery.

In heavy infection, sigmoidoscopy may show white bodies of worm hanging from the inflamed mucosa, the so called **coconut cake rectum.**

Blood Examination

Peripheral blood eosinophilia (<15%)

Increased Serum IgE levels



Flowchart 16.1: Laboratory diagnosis of *Trichuris trichiura*

TREATMENT AND PROPHYLAXIS

RATIONALE FOR THERAPEUTIC USE

1. Albendazole and mebendazole have an **inhibitory effect on tubulin polymerization** which results in the **loss of cytoplasmic microtubules**.(Mebendazole is slightly more effective and hence is 1st CHOICE DRUG).

2. Ivermectin **binds with high affinity to the glutamate-gated chloride channel** which occurs in invertebrate nerve and muscle cells, causing an **increase in permeability of cell membrane to chloride ions with hyperpolarization of the nerve and muscle cells**. The hyperpolarization leads to

TREATMENT — **Trichuriasis**

- Mebendazole (500 mg once) or albendazole (400 mg daily for three doses) is safe and moderately effective for treatment, with cure rates of 70–90%
- Ivermectin (200 mg/kg daily for three doses) is also safe but is less effective.

PREVENTION AND PROPHYLAXIS

Trichuriasis can be prevented by

1.Proper disposal of feces and Improved Personal Hygiene.

2. Avoiding consumption of unwashed fruits and vegetables.

3. Treatment of infected persons.

4.Improved Nutrition with Dietary Iron

SET INDUCTION

A 55 year old man was admitted for **epigastric discomfort and intermittent diarrhea** for the past 1 month. The stool examination revealed—***barrel shaped eggs with bipolar prominences***. Blood investigations shows **mild eosinophilia**. He was found to have a **small, white worm within the ileocecal valve** with relatively normal colonic mucosa during colonoscopy.

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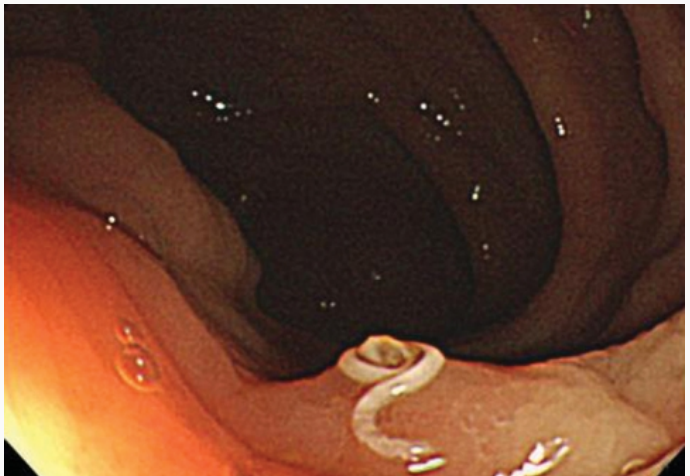

DESCRIBE BRIEFLY THE LIFE CYCLE OF TRICHURIS TRICHIURA

TREATMENT OF TRICHURIASIS

SHORT NOTE ON TRICHURIASIS

SHORT NOTE ON EGG OF TRICHURIS TRICHIURA

Key points of *Trichuris trichiura*

- Adult *Trichuris* worm lives in large intestine.
- It resembles a whip. Anterior $3/5^{th}$ is thin and posterior $2/5^{th}$ is thick and stout, apperaring as handle of a whip.
- Egg is triple-shelled, barrel-shaped with a mucus plug at each pole. It is bile-stained and contains an unsegmented ovum. The egg floats in saturated salt solution.
- **Natural host:** Man is the only host. No intermediate host.
- **Infective form:** Embryonated egg containing rhabditiform larva that develops in soil.
- **Clinical features:** Light infection is asymptomatic. In heavy infection, worm may give rise to acute appendicitis, abdominal pain, mucous diarrhea, anemia, prolapse of rectum, and weight loss.
- **Diagnosis:** Finding of characteristic eggs in stool and sigmoidoscopy may show worms hanging from the rectal mucosa.
- **Treatment:** Mebendazole or albendazole.

POSSIBLE 1 MARK QUESTIONS

1.NAME 2 NEMATODES WHICH INFEST THE LARGE INTESTINE.

2.NAME 2 HELMINTHS WHICH DO NOT REQUIRE AN INTERMEDIATE HOST.

3.NAME 2 PARASITES WITH BILE STAINED EGGS.

4.NAME 2 PARASITES WITH A DIRECT LIFE CYCLE.

5.NAME 2 PARASITES LEADING TO BLOODY DIARRHOEA

6.NAME 2 HELMINTHS WHOSE EGGS FLOAT IN SATURATED SALT SOLUTION.

7.NAME 2 MICROORGANISMS CAUSING IRON DEFICIENCY ANEMIA.

1. Which of the following resides in caecum
   a. Trichuris trichiura
   b. Ascaris lumbricoides
   c. Strongyloides
   d. Ancylostoma
2. The common name for Trichuris is
   a. Roundworm
   b. Hookworm
   c. Whipworm
   d. Seatworm
3. Heavy infection of Trichuris is characterized by
   a. <10 eggs in stool
   b. >10 eggs in stool
   c. <50 eggs in stool
   d. >50 eggs in stool
4. All of the following statements about Trichuris are correct except
   a. It resides in large intestine of man
   b. Eggs of Trichuris float in saturated salt solution
   c. Eggs of Trichuris do not float in saturated salt solution
   d. Embryonated eggs containing rhabditiform larvae are infective to man

Answer

1. a 2. c 3. d 4. c

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1.ESSENTIALS OF MEDICAL MICROBIOLOGY by APURBA S SHASTRY,3rd EDITION

2. Paniker ’s Textbook of Medical Parasitology ,7TH EDITION

3.WHO ROADMAP TO ELIMINATE NEGLECTED TROPICAL DISEASES (2021-2030)