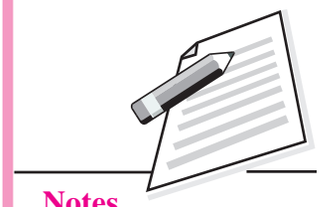


44

HOOK WORM AND STRONGYLOIDES

44.1 INTRODUCTION

Hook worm is the common name given to two nematode worms which possess hook like teeth in their mouth. The two species are Anklyostoma duodenale and Necator americanus. The worm resides in the duodenum and the small intestines.

It attaches to the mucosa of the duodenum and intestines with the help of the hook like teeth. It also sucks blood and also consumes the nutrition of the host and thus causes anaemia and nutritional deficiency.

OBJECTIVES

After reading this lesson, you will be able to:

- describe the morphology & life cycle of hookworm, strongyloides
- explain the pathogenesis of adult worm & strongyloides
- discuss the laboratory diagnosis of hookworm & strongyloides

44.2 MORPHOLOGY

(a) **Adult worm:** The worm measures from 8 to 13mm in length, The female worms are longer than the male worms. The detailed morphological features of the worms are given in the table.

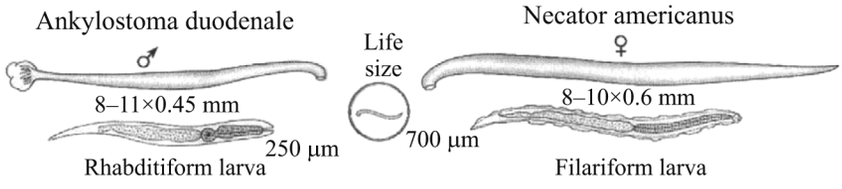
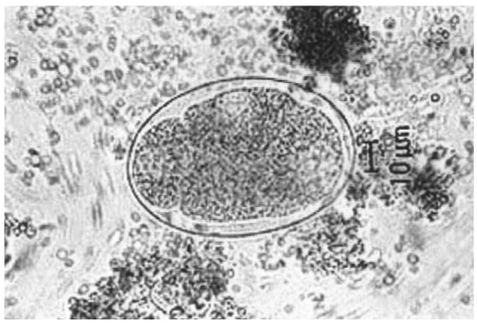


Fig. 44.1

(b) **Ova:** The hook worm are oviparous and the a gravid female after sexual reproduction lays the ova which are passed in the stools. The ova are non bile stained and hence appear colourless on saline preparation. The ova measure 65 µm × 40 µm. The shell encloses a four cell staged segmented ovum also called as the blastomere.



Ova

Rhabditiform Larva

Fig. 44.2

INTEXT QUESTIONS 44.1

1. Common hookworm of man is .....
2. Hookworm live commonly in ..... part of small intestine
3. Male worm has ..... bursa which holds female nematodes during mating
4. ..... is the infective form of the parasite

Differential features of two major species of Hook worm

S No		A duodenale	N americanus
1	Shape	Head bent in same direction as body	Head bent in opposite direction
2	Size	Larger F 10-13 mm F 10-13 mm M 8-11mm	Smaller F 9-11 mm M 5-9mm
3	Oral aperture	4 hook like ventral teeth, 2 knob like dorsal teeth	2 ventral & 2 dorsal cutting plates
4	Copulatory bursa	3 lobes (1 dorsal 2 lat) 13 rays, dorsal ray tripartite	3 lobes (1 dorsal 2 lat) 14 rays, dorsal ray bipartite

Hook worm and Strongyloides			
5	Caudal spine in Female	Present	Absent
6	Vulval opening of the body	Post to middle of body	Ant to middle of body
7	Rate of development	Faster	Slower
8	3rd stage larva	longer	Smaller
9	Pathogenicity	More	less

44.3 LIFE CYCLE

The adult worms are present in the small intestines and after sexual reproduction the gravid female hook worm passes fertilized ova in the stools on to the soil.

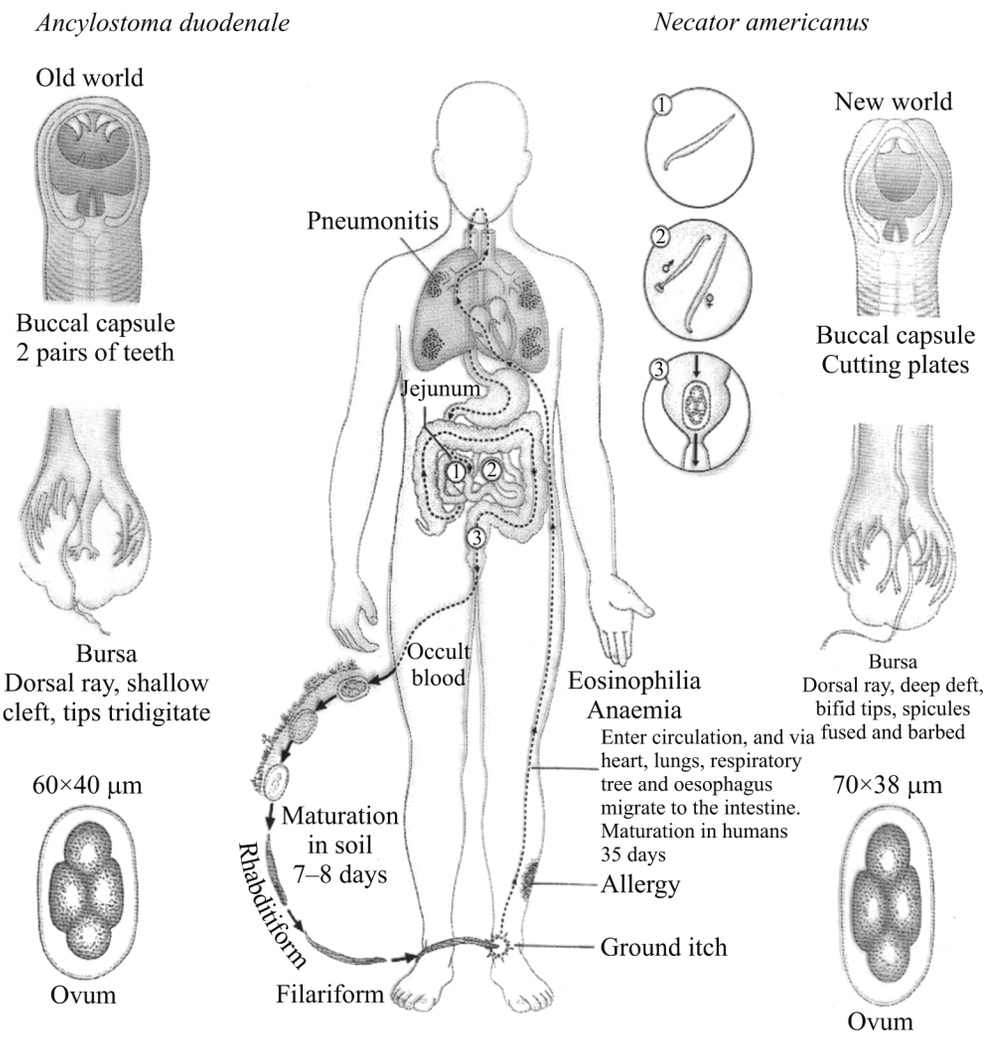


Fig. 44.3

Notes

Development in the soil : The larva matures in the ova within 7-8 days in the soil. The rhabditiform larva comes out of the ova and lives in the soil where further development takes place. The larve develops from rhabditiform larva to filariform larva. The larva survives in the soil in shaded and moist areas. The larva penetrates the skin of people who walk bare foot or work on soil with their hands.

Development in human host

The larva penetrates the skin and reaches the blood circulation. Through the venules and blood circulation it reaches the heart and eventually reaches the lungs.

In the lungs the larva undergoes development from first stage to second stage and then the third stage filariform larva. The larva increases in length and reaches a length of 1500 μm. The larva then moves up on the airway passage from the alveoli to bronchioles. It passes through the bronchi and trachea to reach the pharynx and from there it goes to the esophagus. From the esophagus it travels to the stomach and reaches duodenum and intestines. In the duodenum and intestines the larva develops into the adult stage. The life cycle continues after sexual reproduction and formation of ova. The life span of an adult worm is about one year.

44.4 PATHOGENECITY

Anaemia and nutritional deficiency: The hookworm infestation can cause anaemia due to blood loss as the worm consumes the blood meal in the duodenum and intestines. An adult worm is capable of consuming upto 0.4ml of blood per day. The anaemia is mostly iron deficiency anaemia and it shows a microcytic hypochromic blood picture in the red blood cells on peripheral blood smear examination. Occult gastrointestinal bleeding can also occur. It also causes nutritional deficiency in the hosts.

Itching and skin allergy may follow the worms penetration of the skin

The worm can obstruct small lumen organs like the bile duct, appendix. They may cause appendicitis, pancreatitis, and peritonitis.

44.5 LABORATORY DIAGNOSIS

The demonstration of ova in the stools or detection of adult worm establishes the laboratory diagnosis.

Eosinophilia may be seen the infected hosts.

44.6 STRONGYLOIDES STERCORALIS

Strongyloides stercoralis, also known as the dwarf thread worm causes strongyloidiases. It is smallest pathogen nematode to cause infection in man. The parasite is unique in having both parasite and freeliving generations.

44.7 GEOGRAPHIC DISRTIBUTION

It is prevalent in tropical regions of Africa, Asia and South America. It is important pathogen in immunocompromised host (HIV).

44.8 HABITAT

The female parasite inhabits the mucosa of the small intestine.

44.9 MORPHOLOGY

Adult worm

The parasitic females are approximately 2mm in length, with blunt-ended tails, and an elongated, straight-sided (filariform) oesophagus, occupying approximately one third of the body length . The ovary is didelphic and opens at the vulva which is positioned approximately two thirds along the body length. The free-living adults stages are approximately 1mm in length, with the female slightly larger than the male. Both sexes have a rhabditiform oesophagus; the free-living female has a didelphic ovary and a vulva at the mid-point of the body .

EGG

The egg measures 50-58µm × 30-34µm .They are thin-shelled , transparent and oval. They contain larva ready to hatch. As soon as the eggs are laid. The rhabditiform larve start hatching and bore their way out of the mucous membrane into the lumen from where they are passed in the faeces.

Life Cycle

The Strongyloides' life cycle is heterogonic - it is more complex than that of most nematodes with its alternation between free-living and parasitic cycles, and its potential for autoinfection and multiplication within the host. The parasitic has a homogenic life cycle, while the free-living has a heterogonic life cycle. The heterogonic life cycle is advantageous to the parasite because it allows reproduction for one or more generations in the absence of a host.

Notes

In the free-living cycle, the rhabditiform larvae passed in the stool can either molt twice and become infective filariform larvae (direct development) or molt four times and become free-living adult males and females that mate and produce eggs from which rhabditiform larvae hatch. In the direct development, L1 (1st-stage larvae) transform into IL (infective larvae) via three molts. The indirect route results first in the development of free-living adults that mate; the female lays eggs, which hatch and then develop into IL. The direct route gives IL faster (3 days) versus the indirect route (7–10 days). However, the indirect route results in an increase in the number of IL produced. Speed of development of IL is traded off for increased numbers. The free-living males and females of S. stercoralis die after one generation; they do not persist in the soil. The latter in turn can either develop into a new generation of free-living adults or develop into infective filariform larvae. The filariform larvae penetrate the human host skin to initiate the parasitic cycle. The infectious larvae penetrate the skin when there is contact with the soil. Some of them enter the superficial veins and ride the blood vessels to the lungs, where they enter the alveoli. They are then coughed up and swallowed into the gut, where they parasitise the intestinal mucosa (duodenum and jejunum). In the small intestine, they molt twice and become adult female worms. The females live threaded in the epithelium of the small intestine and, by parthenogenesis, produce eggs, which yield rhabditiform larvae. Only females will reach reproductive adulthood in the intestine. Female strongyloides reproduce through parthenogenesis. The eggs hatch in the intestine and young larvae are then excreted in the feces. It takes about two weeks to reach egg development from the initial skin penetration. By this process, S. stercoralis can cause both respiratory and gastrointestinal symptoms. The worms also participate in autoinfection, in which the rhabditiform larvae become infective filariform larvae, which can penetrate either the intestinal mucosa (internal autoinfection) or the skin of the perianal area (external autoinfection); in either case, the filariform larvae may follow the previously described route, being carried successively to the lungs, the bronchial tree, the pharynx, and the small intestine where they mature into adults; or they may disseminate widely in the body.

44.10 DISEASES

Many people infected are usually asymptomatic at first. Symptoms include dermatitis: swelling, itching, larva currens, and mild hemorrhage at the site where the skin has been penetrated. If the parasite reaches the lungs, the chest may feel as if it is burning, and wheezing and coughing may result, along with pneumonia-like symptoms (Löffler's syndrome). The intestines could eventually be invaded, leading to burning pain, tissue damage, sepsis, and ulcers. In severe cases, edema may result in obstruction of the intestinal tract as well as loss of peristaltic contractions. Strongyloidiasis in immunocompetent individuals is

usually an indolent disease. However, in immunocompromised individuals, strongyloidiasis can cause a hyperinfective syndrome (also called disseminated strongyloidiasis) due to the reproductive capacity of the parasite inside the host. This hyperinfective syndrome can have a mortality rate of close to 90% if disseminated.

The consequence of autoinfection is that the autoinfective larvae can carry gut bacteria back into the body. About 50% of people with hyperinfection present with bacterial disease due to enteric bacteria. Also, a unique effect of autoinfective larvae is larva currens due to the rapid migration of the larvae through the skin. Larva currens appears as a red line that appears, moves rapidly (>5 centimetres (2.0 in)/day), and then quickly disappears. It is pathogonomic for autoinfective larvae and can be used as a diagnostic criterion for strongyloidiasis due to S. stercoralis.

44.11 LABORAORY DIAGNOSIS

Parasitic diagnosis – definitive diagnosis is made by identification of the larvae in the stool

Specimen – stool is the specimen of choice. Urine and sputum are collected in disseminated infections.

Method of examination includes

1. Stool microscopy
2. Stool culture
3. Enterotest

Stool microscopy- only larva are demonstrated in stool. No eggs are seen. Formalin – ether or Zinc floatation methods are employed to concentrate strongyloides larvae in the stool

Stool culture

It is important in suscepected cases of strongyloidiasis not confirmed either by direct smear or concentration. Stool can be cultures by a) Harada-Mori filter paper method, b) Baermann funnel method using charcoal, and c) the agar plate method

Enterotest

The rhabditiform larvae may also be demonstrated in the intestinal fluid aspirated by duodenal intubation and string test (enterotest).

Notes

Immunodiagnosis

Serodiagnosis – ELISA, IHA AND IFA are useful in the clinical evaluation and diagnosis of the cases.

INTEXT QUESTIONS 44.2

1. ..... technique is used for stool microscopy
2. ..... method is used for stool culture
3. Strongyloides stercoralis is also known as .....
4. The female parasite inhabits ..... of human body
5. ..... life cycle allows reproduction in the absence of host
6. Strongyloides enter human through .....
7. Strongyloides causes ..... syndrome in human
8. ....., ... methods are commonly used in identifying parasites in stool microscopy
9. ....., ... & ..... methods are carried out in stool culture

44.12 TREATMENT

Ideally, prevention, by improved sanitation (proper disposal of feces), practicing good hygiene (washing of hands), etc., is used before any drug regimen is administered.

Thiabendazole 25mg/kg twice a day for 2 or 3 days can be used for the treatment of strongyloides. Ivermectin has also been reported to be effective in the treatment of chronic strongyloidiasis.

INTEXT QUESTIONS 44.3

1. Which of the following stages of *Ancylostoma duodenale* is infective to human beings?

   (a) Rhabditiform larva (b) Filariform larva

   (c) Eggs (d) Adult worm

2. Habitat of Hookworm larva is

   (a) Small intestine (b) Large intestine

   (c) Liver (d) Heart

3. Which of the following nematodes is ovoviviparous ?

   (a) Ascaris lumbricoides (b) Drancunculus medinesis

   (c) Strongyloides sterocoralis (d) Trichncella spiralis

4. Disseminated systemic infection in AIDS patients is seen with

   (a) Ancylostoma duodenale (b) Dracunculus medinensis

   (c) Strongyloides stercoralis (d) Trichenella spiralis

WHAT HAVE YOU LEARNT

Hookworm

- Hookworms cause intestinal infections.
- Hookworm larvae found on the soil have the ability to penetrate human skin, thereby starting the infection process.
- Light infections are asymptomatic while heavy infections can produce a variety of abdominal complaints.
- Treatment is relatively easy with appropriate drugs.
- There is no vaccine.

Strongyloides stercoralis

- It causes intestinal infection
- The adult parasitic stage lives in tunnels in the mucosa of the small intestine
- Many people infected are usually asymptomatic at first. Symptoms include dermatitis: swelling, itching, larva currens, and mild hemorrhage at the site where the skin has been penetrated
- Albendazole and mebedazole is used for treatment

TERMINAL QUESTIONS

1. Discuss the morphology and pathogenecity of Hook worm.
2. Discuss the life cycle of Hook worm.

Notes

3. Draw a labeled diagram of ova of Hook worm.
4. Enumerate the differentiating feature between Ankylostoma dudenale and Necator americanus.
5. Descibe life cycle and clinical manifestation of hook worm and strongyloides stercoralis?
6. Write laboratory diagnosis of hook worm and strongyloides stercoralis?

ANSWERS TO INTEXT QUESTIONS

44.1

1. Anklyostoma duodenale
2. Duodenum
3. Corpulatory
4. Filariform larva

44.2

1. Wet mount
2. Harada Mori
3. Dwarf thread worm
4. Mucosa of small intestine
5. Heterogonic
6. Skin
7. Loffler's
8. Formalin-ether & Zinc floatation
9. Harada –Mori filter paper, Baermann funnel & agar plate

44.3

1. Filariform larva
2. Small intestine
3. Strongyloides sterocoralis
4. Strongyloides stercoralis