

Intestinal human nematodes

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Medically-important nematodes

Type	Disease	Species
Intestinal	Ascariasis	<i>Ascaris lumbricoides</i>
	Trichuriasis	<i>Trichuris trichiura</i>
	Hookworm	<i>Ancylostoma duodenale</i>
		<i>Necator americanus</i>
	Strongyloidiasis	<i>Strongyloides stercoralis</i>
Pin worm	<i>Enterobius vermicularis</i>	
Tissue	Trichinosis	<i>Trichinella spiralis</i>
	Dracunculiasis	<i>Dracunculus medinensis</i>
	Filariasis	<i>Wuchereria bancrofti</i>
		<i>Brugia malayi</i> <i>Brugia timori</i>
Onchocerciasis	<i>Onchocerca volvulus</i>	

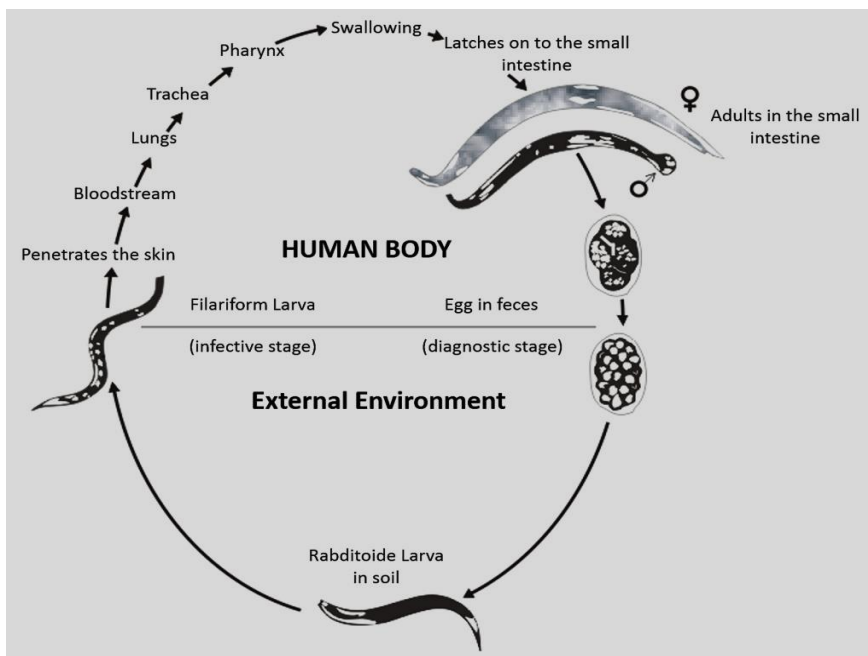
Nematodes (roundworms)

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- All nematodes are elongated, cylindrical, non-segmented organisms, with a smooth cuticle and body cavity containing a digestive tract and reproductive organs.
- Intestinal nematodes are the largest group of human helminths.
- The commonest intestinal nematodes (*Ascaris lumbricoides*, *Ancylostoma duodenale*, *Necator americanus*, and *Trichuris trichiura*) cannot reproduce in humans and are referred to as geohelminths, as their eggs have to develop in the soil.

- The exceptions are *Strongyloides stercoralis* and *Enterobius vermicularis*, which can be transmitted from person to person.
- Prevention of disease is by hygiene measures, including safe drinking water, properly cleaning and cooking food, handwashing, and wearing shoes.

Ancylostomiasis (hookworm)

- Hookworm infections, caused by the human hookworms *Ancylostoma duodenale* and *Necator americanus*, are found worldwide especially in areas with poor sanitation and hygiene (about 25% of the world's population is affected). Hookworm infection is a major contributing factor to anaemia in the tropics.
- Adult worms (about 1 cm long) live in the duodenum and upper jejunum, where they are often found in large numbers attached firmly to the mucosa using the buccal plate, feeding on blood.
- Eggs passed in the faeces develop in warm, moist soil, producing infective filariform larvae. These penetrate directly through the skin of a new host and are carried in the bloodstream to the lungs. definitive home in the upper small intestine. Having crossed into the alveoli, the parasites are expectorated and then swallowed, thus arriving at their



Clinical features

- Cutaneous: allergic dermatitis of the feet at the time of infection (ground's itch).
- Pulmonary: paroxysmal cough, blood-stained sputum.



- GI: vomiting, epigastric pain, diarrhoea.
- Systemic: symptoms of iron deficiency anaemia such as tiredness, malaise, and in severe cases, high output cardiac failure.
- The mental and physical development of children may be retarded in severe infection.



Investigations

- Stool sample:
ova of hookworm on microscopic examination. fecal occult blood (FOB) may be positive.
- Complete blood count (CBC):
eosinophilia.
- Chest x-ray:
patchy consolidation.

Management

- Albendazole (first choice):
Single oral dose of 400 mg.
- Mebendazole (alternative):
100 mg twice daily for 3 days.

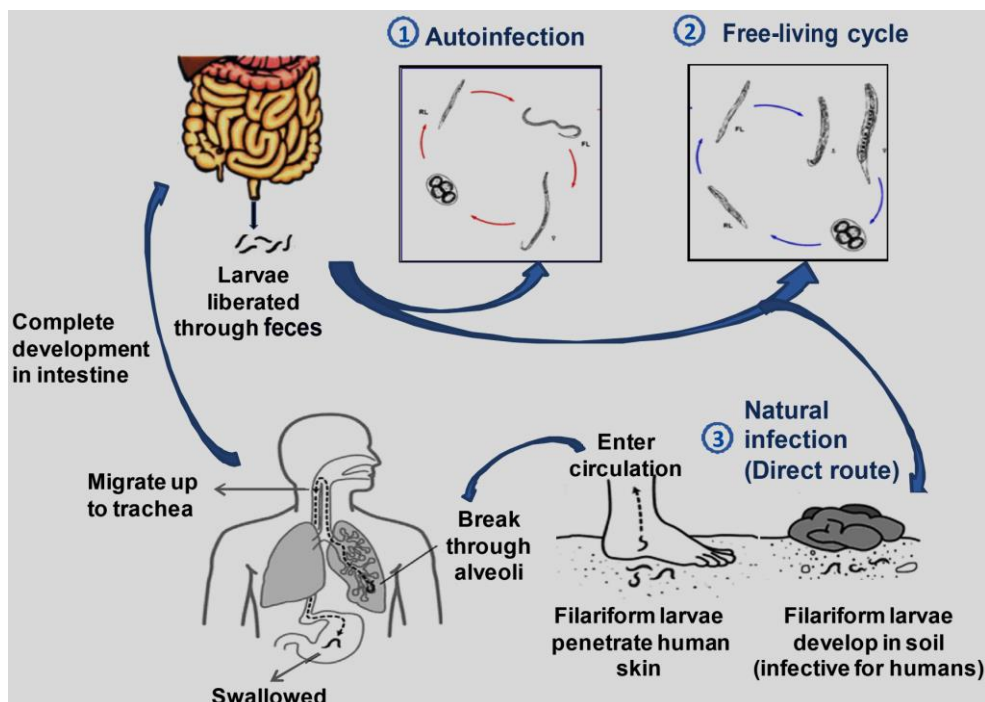
- Oral iron: This is effective in patients who are anaemic and even in patients with features of heart failure. blood transfusion is only rarely needed
- Prevention: wearing shoes and avoiding contact with infected soil in endemic areas.

Prevention

- wearing shoes and avoiding contact with infected soil in endemic areas.

Strongyloidiasis

- *Strongyloides stercoralis* is a small (2 mm long) worm that lives in the small intestine.
- It is found in many parts of the tropics and subtropics, and is especially common in Asia.
- Eggs hatch within the bowel and larvae are found in the stool. Usually, these are non-infective rhabditiform larvae, which require a further period of maturation in the soil before they can infect a new host.
- Sometimes this maturation can occur in the large bowel.
- Infective filariform larvae can therefore penetrate directly through the perianal skin, re-infecting the host. In this way, autoinfection may continue for years or even decades.



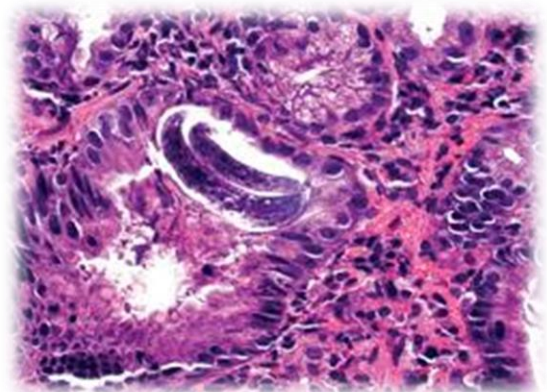
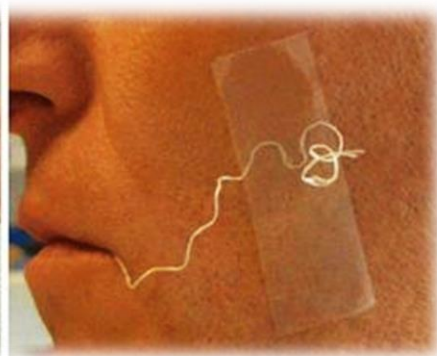
- After skin penetration, the life cycle is similar to that of the hookworm, except that the adult worms may burrow into the intestinal mucosa, causing a local inflammatory response.

Clinical features

- Cutaneous: “ground itch” (as in hookworm infection), larva currens (linear urticarial weals on buttocks and abdomen).
- Pulmonary: Löeffler’s syndrome (respiratory symptoms, pulmonary infiltration on CXR, and peripheral eosinophilia).
- GI: colicky abdominal pain, diarrhoea, passage of mucus, nausea, vomiting, weight loss, malabsorption, and protein-losing enteropathy.
- Systemic (hyperinfection syndrome): massive larval invasion with autoinfection in immunocompromised patients; severe, abdominal pain, ileus, and shock; cough, wheeze and dyspnoea; meningoencephalitis (coma).; Gram-negative sepsis.

Investigations

- Stool sample:
motile larvae seen on microscopic examination especially after a period of incubation.
- Jejunal aspirate (endoscopy)/string test (cheaper)
- Blood:
eosinophilia on CBC
Serology (ELISA)



Management

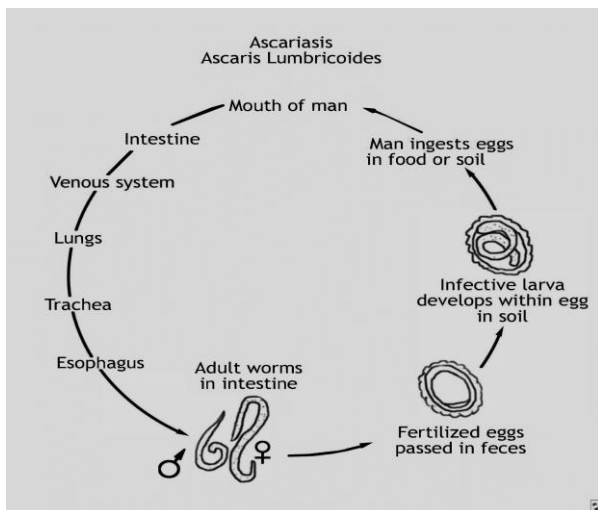
- Ivermectin (first choice):
A course of two doses of ivermectin (200 µg/kg), administered on successive days, is effective.
In *Strongyloides* hyperinfection syndrome, treatment is continued for 5–7 days.
- Albendazole (alternative):
Given orally in a dose of 15 mg/kg body weight twice daily for 3 days. A second course may be required.

Prevention

wearing shoes and avoiding contact with infected soil in endemic areas.

Ascariasis (roundworm infection)

- Ascariasis is the commonest helminthic infection of humans. It is caused by *A. lumbricoides* (roundworm) and is found worldwide, most commonly in the tropics.
- The adult worms (pale yellow, 20-35cm in length) live in the small intestine and have a lifespan of 10– 24



months. Each female produces up to 200 000 ova/ day, which pass out in the faeces.

- When ingested in stool-contaminated food, the eggs hatch in the small intestine, penetrate the intestinal wall, migrate through the venous system to the lungs where they break into the alveoli, migrate up the bronchial tree, before they are swallowed and develop into mature worms in the intestine.



Clinical features

- Most infected patients are asymptomatic.
- Clinical features depend on the site and intensity of infection.
- Pulmonary: during larval migration through the lungs (Löeffler's syndrome)
- GI: abdominal pain, small bowel obstruction (about 35% of all cases in the tropics), intussusception, volvulus, haemorrhagic infarction and perforation.
- Biliopancreatic: abdominal pain, cholangitis, pancreatitis, and obstructive jaundice.



Investigations

- Stool:
 - ova seen on microscopic exam
 - Sometimes macroscopic adult worms seen

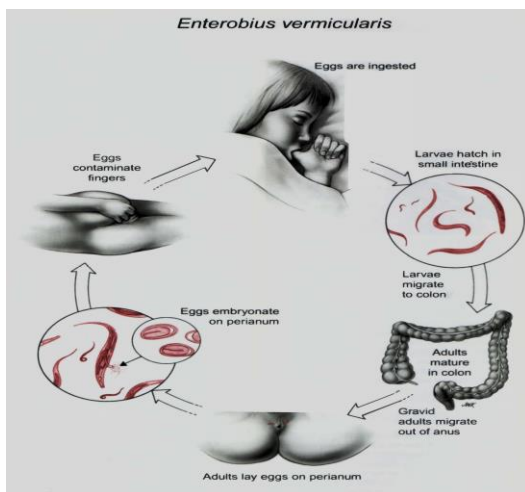
- CBC:
eosinophilia
- Radiology:
Barium study, sometimes incidentally.

Management

- Albendazole (400mg single dose) or mebendazole (100mg bid for 3 days or 500mg single dose) are the treatments of choice.
- Alternative agents include ivermectin, nitazoxanide, piperazine citrate, and levamisole.
- Endoscopic or surgical intervention may be required for biliary/ intestinal obstruction.
- Prevention by whole community chemotherapy programmes have been used to reduce *Ascaris* infection. Alternatively, schoolchildren can be targeted to lower the prevalence of ascariasis in the community.

Enterobiasis (pinworm, threadworm)

- *E. vermicularis* is a small (2–12 mm) worm, which is common throughout the world. Larval development takes place mainly in the small intestine and adult worms are normally found in the colon.
- The gravid female deposits eggs around the anus, causing intense itching, especially at night.
- The eggs do not require a maturation period in soil, and infection is often directly transmitted from anus to mouth via the hands.
- Eggs may also be deposited on clothing and bed linen, and are subsequently either ingested or inhaled.



Clinical features

- Most infected patients are asymptomatic.
- Perianal/ perineal pruritus and disturbed sleep are the commonest symptoms.
- Adult worms may be seen moving on the buttocks or in the stool.

Investigations

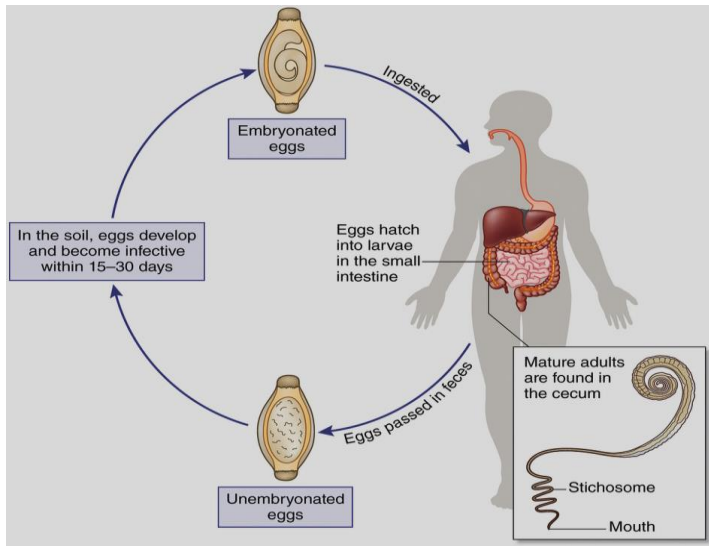
- Ova collected on a strip of adhesive tape applied in the morning to the perianal skin and examined microscopically on a slide.
- A perianal swab, moistened with saline, is an alternative sampling method.
- All family members of an affected individual should be screened for infection.

Management

- Single dose of mebendazole 100 mg, albendazole 400 mg or piperazine 4 g. Dosing should be repeated at 2 weeks to prevent autoreinfection.
- If infection is recurrent, all family members should be treated.
- Prevention is by general hygienic measures such as laundering of bedclothes, keeping nails short and clean.

Trichuris trichiura (whipworm)

- Infections with whipworm are common all over the world under unhygienic conditions.
- Infection is contracted by the ingestion of earth or food contaminated with ova which have become infective after lying for 3 weeks or more in moist soil.
- The adult worm is 3–5 cm long and has a coiled anterior end resembling a whip. Whipworms inhabit the caecum, lower ileum, appendix, colon and anal canal.
- There are usually no symptoms, but intense infections in children may cause persistent diarrhoea or rectal prolapse, and growth retardation.



Investigations and Management

- **Diagnosis:**
lemon-shaped ova on stool microscopic examination
- **Treatment:**
Albendazole 400 mg daily for 3 days, OR
Mebendazole 100 mg twice daily for 3 days
Heavy infections require therapy for 5-7 days.