GIT Module
2024-2025
Parasitic Infections (2)

Dr. Mohammad Odaibat
Department of Microbiology and Pathology
Faculty of Medicine, Mu'tah University

General Signs and Symptoms of Parasitic Infections

Parasites can live in the intestines for years without causing symptoms. When they do, symptoms include the following:

- Abdominal pain
- Diarrhea
- Nausea or vomiting
- Gas or bloating
- Dysentery (loose stools containing blood and mucus)
- Rash or itching around the rectum or vulva
- Stomach pain or tenderness
- Feeling tired
- Weight loss
- Passing a worm in your stool

Risk Factors

- Living in or visiting an area known to have parasites
- International travel
- Poor sanitation (for both food and water)
- Poor hygiene
- Age. Children and the elderly are more likely to get infected.
- Exposure to child and institutional care centers
- Having a weakened immune system
- HIV or AIDS

Nematodes of medical importance

Intestinal

Small intestine

- With tissue stage:
  - *Ascaris lumbricoides*
  - *Ancylostoma duodenale*
  - *Necator americanus*
  - *Strongyloides stercoralis*
  - *Trichinella spiralis*

Large int.

- Without tissue stage:
  - *Enterobius vermiculars*
  - *Trichuris trichiura*

Tissue & Blood

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Loa loa*
- *Onchocerca volvulus*
- *Dracunculus medinensis*
- *Trichinella spiralis*

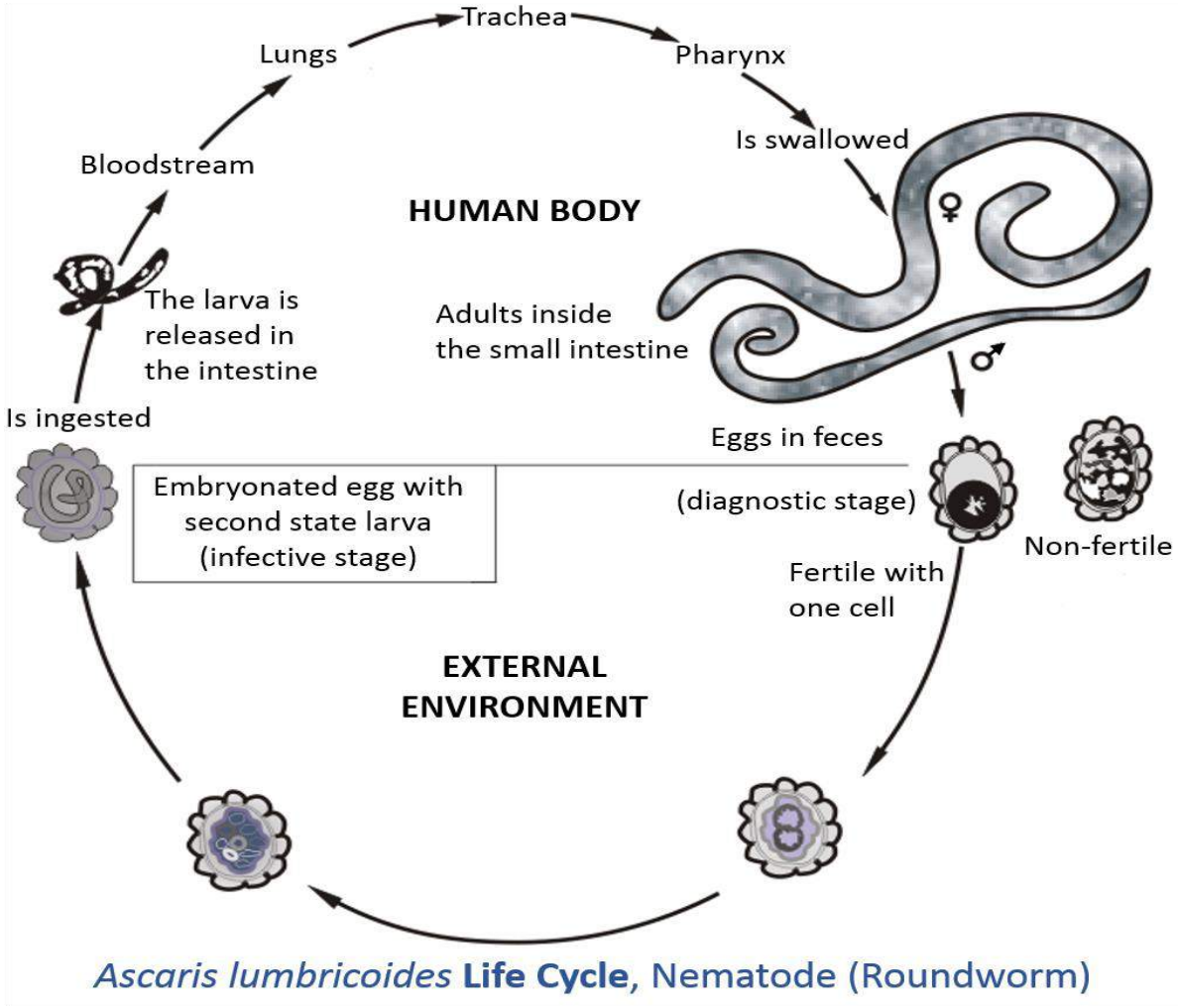
- Larva migrans:
  - *Ancylostoma spp.*
  - *Toxocara spp.*

Ascaris lumbricoides

- **Geographical Distribution:**
  - Cosmopolitans: *A. lumbricoides* is one of the commonest and most wide spread of all human parasites.
- **Habitat:**
  - Adult: In the small intestine.
  - Egg: In the faeces.
- **Morphology:**
  - Adult: colour: pinkish.
  - Male: size: about 15-30 cm with curved tail and two spicules of unequal size.
  - Female: size 20-40 cm , with a straight tail.
- Infective form: Embryonated egg

Ascaris lumbricoides

(Life cycle)



Ascaris lumbricoides **Life Cycle**, Nematode (Roundworm)

Ascaris lumbricoides

Pathogenicity & Clinical Features:

- Ascariasis – infection of *A. lumbricoides.*
- Majority of infections are asymptomatic.
- Clinical disease is largely restricted to individuals with a high worm load.
- Symptoms divided into three groups: those produced by:
  1. Migrating larvae.
  2. Intestinal phase.
  3. Ectopic Ascariasis.

Ascaris lumbricoides

Symptoms & Complications

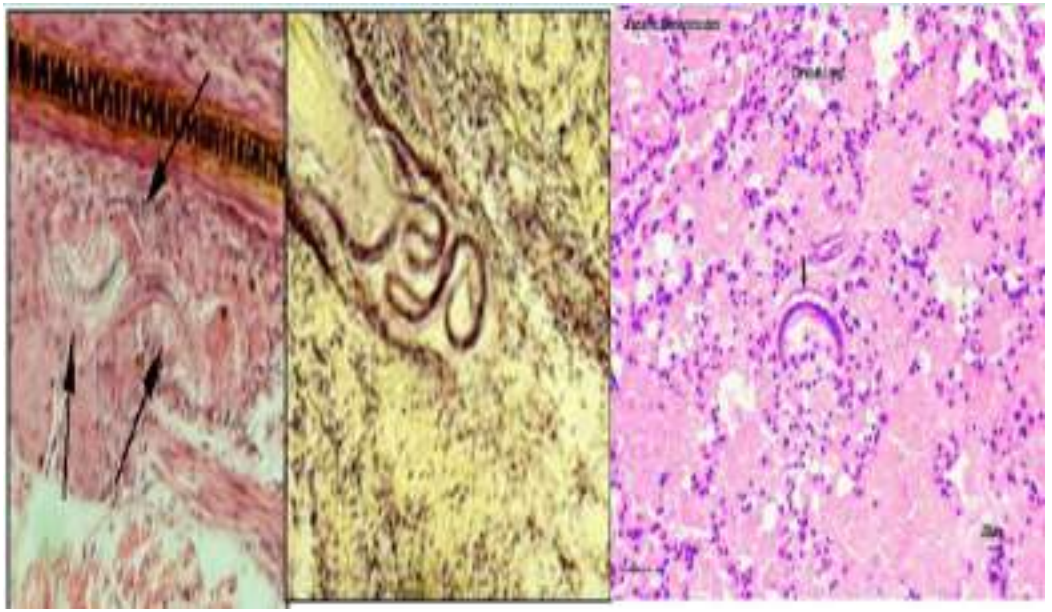
Migrating larvae phase

1- Pneumonia (loeffler's syndrome) – fever, cough, dyspnoea, blood tinged sputum that may contain larva, urticarial rash & eosinophilia

2- Visceral larva migrans – if larvae enter systemic circulation (from pulmonary capillaries) to reach other organs like brain, spinal cord, heart, kidney.

Intestinal phase

Ectopic Ascariasis



Loeffler`s syndrome: Larvae in lung
pnumonia,cough ,bloody sputum

Ascaris lumbricoides

Intestinal phase

- **Light infection ➲ no symptoms**
- **Intestinal symptoms**
  - Colic , abdominal distension , vomiting, diarrhea or constipation, epigastric pain, dyspepsia (due to anti-pepsin & anti- trypsin substances produced by adults that interfere with protein and fat digestion)
- **Malnutrition and underdevelopment of children with heavy infection .**
- **Vit. A deficiency ➲ night blindness**

Ascaris lumbricoides

Ectopic Ascariasis

Due to migration of worm up into the stomach. It may :

- be vomited out,
- pass up through the esophagus at night & comes out through mouth or nose,
- enter larynx to cause asphyxia.
- migrate to other organs and cause **appendicitis,** cholecystitis, biliary colic, cholangitis, pancreatitis

Due to downward migration:

- Obstruction of the appendix ➲ appendicitis.
- Anus ➲ may pass with or without defecation.

Ascaris lumbricoides

3) Complications

(1)

The products of living or dead worm ➲ allergic manifestations (urticaria & asthma) & nervous irritability (insomnia and convulsion).

(2)

Intestinal obstruction

(3)

Perforation of the intestinal wall ➲ peritonitis

Ascaris lumbricoides

Laboratory Diagnosis

- Macroscopic - Direct detection of worm/s in stool or vomit
- Microscopic – direct examination of stool following floatation method: **bile stained eggs.** (eggs may not be seen at least 40 days after infection)
- Blood examination – **eosinophilia**.
- Others:
  - Imaging – large collections of worms in abdomen
  - ultrasonography - to diagnose hepatobiliary or pancreatic ascariasis
  - Serology (Ab detection)

Ascaris lumbricoides

Treatment

- Mebendazole/ Albendazole – drug of choice but contraindicated in pregnancy & heavy infection
- Piperazine citrate - suspected intestinal or biliary obstruction since this drug paralyzes worms to aid expulsion.
- Levamisole

Nematodes of medical importance

Intestinal

Small intestine

- With tissue stage:
  - *Ascaris lumbricoides*
  - *Ancylostoma duodenale*
  - *Necator americanus*
  - *Strongyloides stercoralis*
  - *Trichinella spiralis*

Large int.

- Without tissue stage:
  - *Enterobius vermiculars*
  - *Trichuris trichiura*

Tissue & Blood

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Loa loa*
- *Onchocerca volvulus*
- *Dracunculus medinensis*
- *Trichinella spiralis*

- Larva migrans:
  - *Ancylostoma spp.*
  - *Toxocara spp.*

Enterobius vermicularis (Pin Worm)

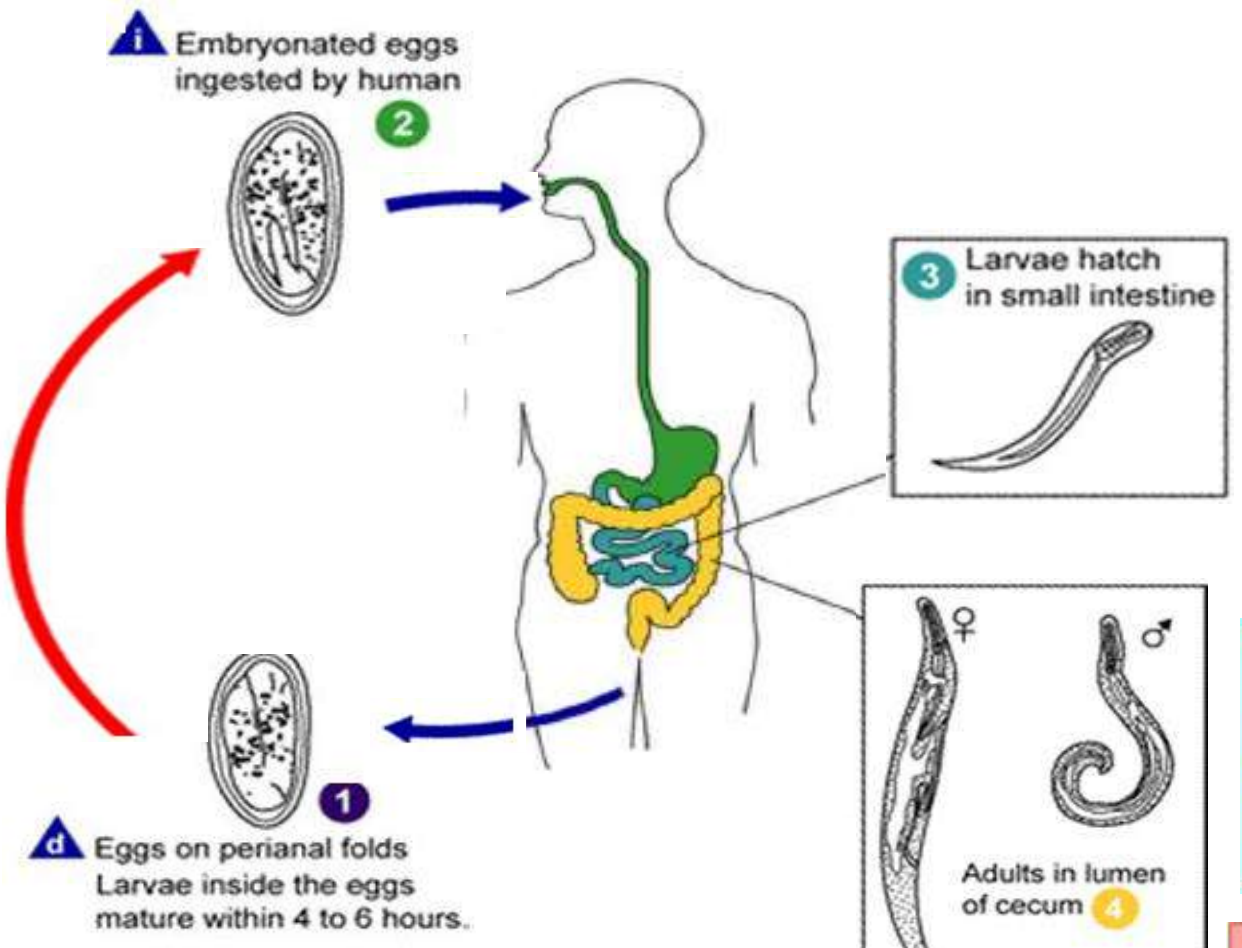
Geographical Distribution:-

- Cosmopolitan more common in temperate and cold climates than in warm climates.

Habitat:

- Adult: small intestine (terminal ileum).
- Gravid female: Caecum and rectum.
- Eggs : In feces or deposited on perianal skin.

Enterobius vermicularis (Life cycle)



The time interval from ingestion of infective eggs to oviposition by the adult females is about one month.

Adult worm in caecum, colon or rectum

Female 8-13mm

Male 2-5mm

•The life span of the adults is about two months.

i = Infective Stage

d = Diagnostic Stage

Enterobius vermicularis (Pathology)

Pathology:

- Its infection rarely causes serious symptoms.
- Due to migration of worm - Perianal, perineal & vaginal itching (**pruritis**) worsens at night.
- Insomnia and restlessness
- **Worms in the appendix can cause appendicitis.**

Prevention and Control:

- Treating all members of a family in which infection has occurred.
- Washing of the anal skin each morning soon after waking.
- Washing of clothing worn at night.

Laboratory Diagnosis:

- Finding eggs from perianal skin using cellulose adhesive tape.
- Finding eggs and adult worms in the faeces.

Nematodes of medical importance

Intestinal

Small intestine

- With tissue stage:
  - *Ascaris lumbricoides*
  - *Ancylostoma duodenale*
  - *Necator americanus*
  - *Strongyloides stercoralis*
  - *Trichinella spiralis*

Large int.

- Without tissue stage:
  - *Enterobius vermiculars*
  - *Trichuris trichiura*

Tissue & Blood

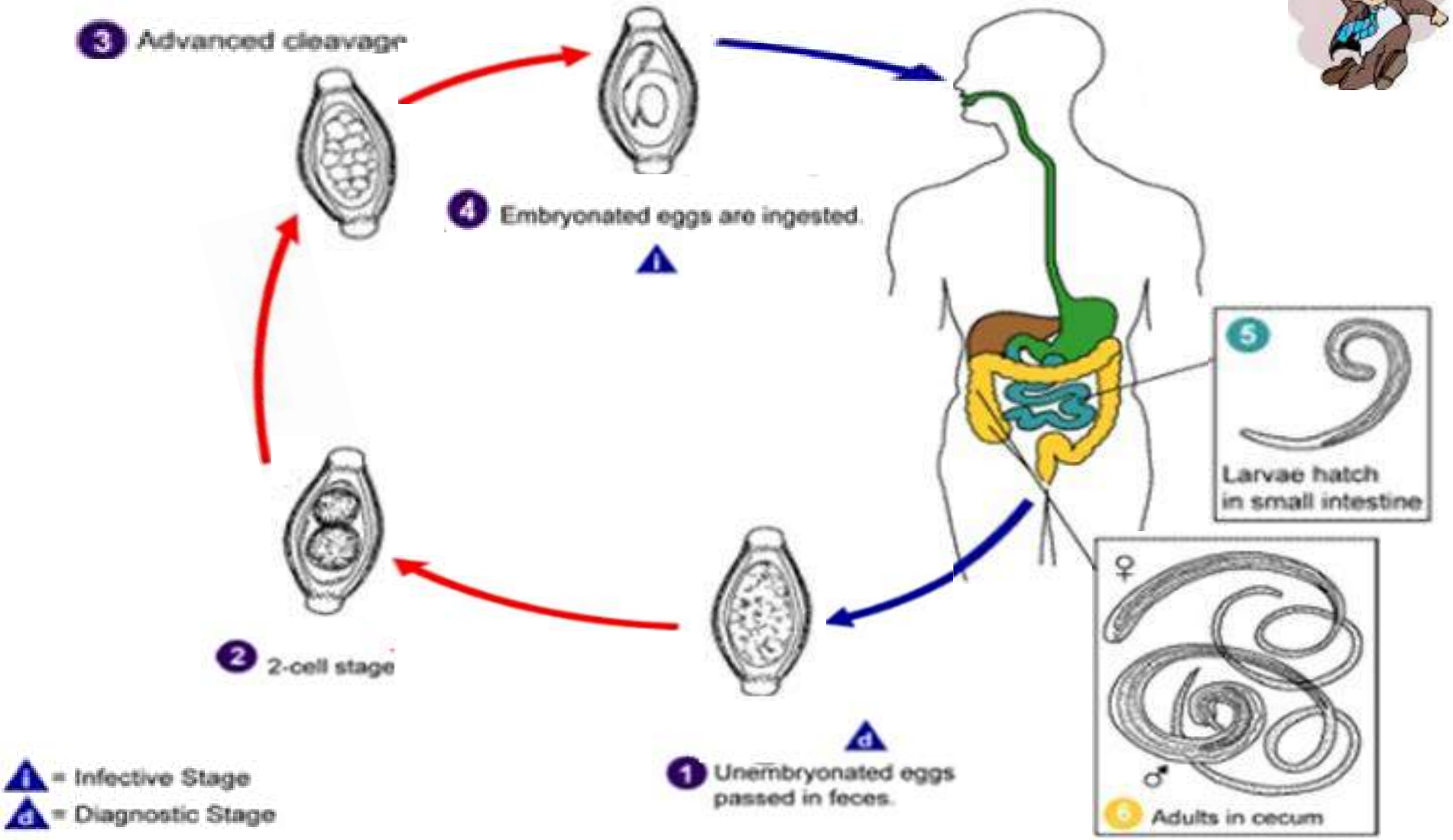
- *Wuchereria bancrofti*
- *Brugia malayi*
- *Loa loa*
- *Onchocerca volvulus*
- *Dracunculus medinensis*
- *Trichinella spiralis*

- Larva migrans:
  - *Ancylostoma spp.*
  - *Toxocara spp.*

Trichuris trichiura (The Whipworm)

Habitat: Adult: large intestine (caecum) and vermiform appendix

- Eggs : In the faeces



Trichuris trichiura (The Whipworm)

Clinical features and Pathology:

- **Infection – Trichuriasis**
- **Symptoms depend on worm burden:**
  - Light infections:- Less than 10 worms – asymptomatic
  - Heavier infections:-
    - Chronic diarrhea
    - Intestinal ulceration with blood and mucus being passed in the feces
    - Iron deficiency anemia
    - Failure to develop at the normal rate.
    - Weight loss
    - Prolapse of the rectum.
- **Laboratory Diagnosis:-**
  - Finding the characteristic eggs in the stool.

Nematodes of medical importance

Intestinal

Small intestine

- With tissue stage:
  - *Ascaris lumbricoides*
  - *Ancylostoma duodenale*
  - *Necator americanus*
  - *Strongyloides stercoralis*
  - *Trichinella spiralis*

Large int.

- Without tissue stage:
  - *Enterobius vermiculars*
  - *Trichuris trichiura*

Tissue & Blood

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Loa loa*
- *Onchocerca volvulus*
- *Dracunculus medinensis*
- *Trichinella spiralis*

- Larva migrans:
  - *Ancylostoma spp.*
  - *Toxocara spp.*

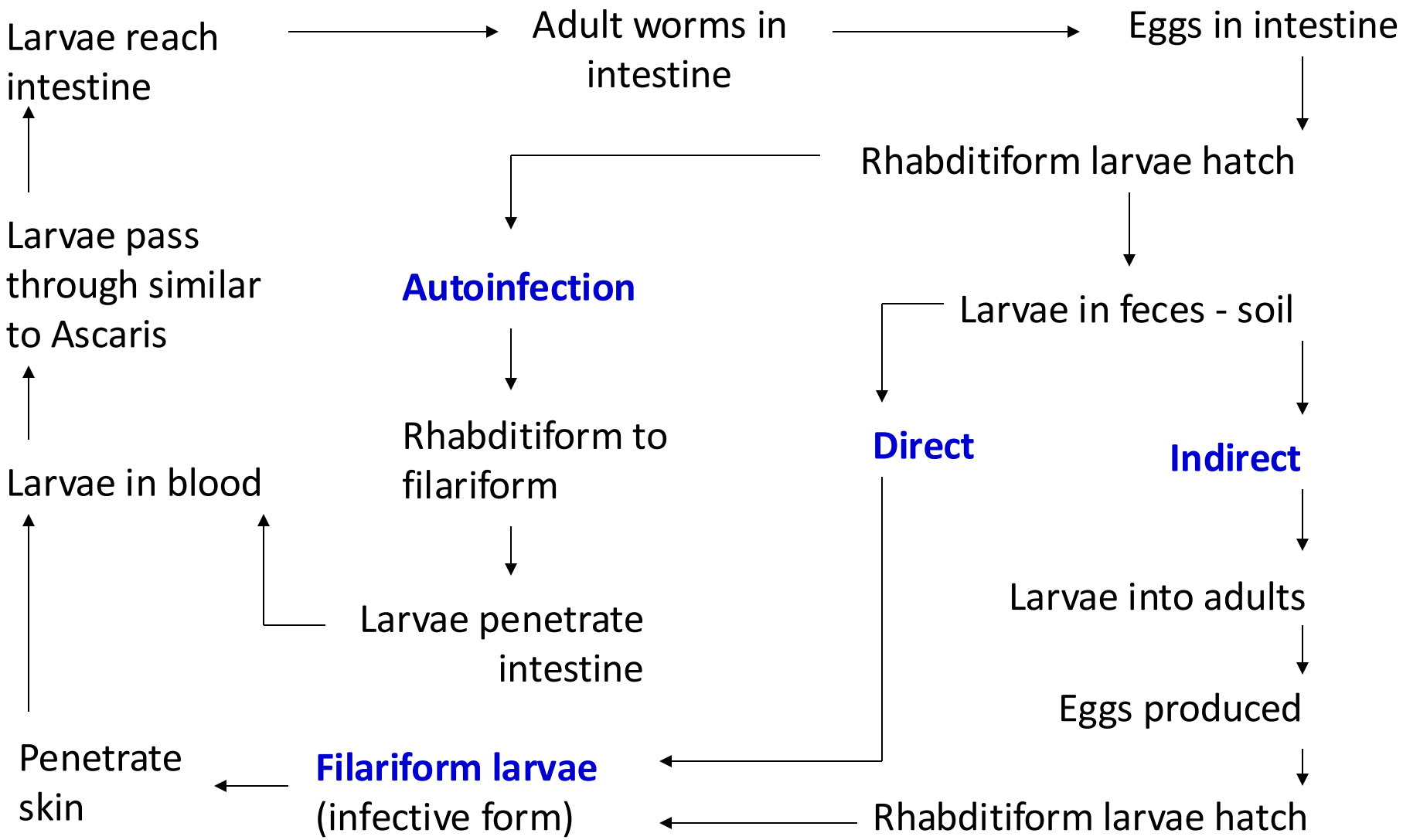
Strongyloides stercoralis (The dwarf thread worm)

Habitat: Has both free living and parasitic generations

- Parasitic Adults**: buried** in the mucosal epithelium of the small intestine of man.
- Rhabditiform larvae: Passed in the faeces and external environment.
- Filariform larvae: soil and water (the infective stage).

Strongyloides stercoralis (The dwarf thread worm)

Life cycle



In the lung, the filariform larvae may develop into free living adult worms (good media due to the presence of oxygen) invade the bronchial epithelium ➲ lays eggs ➲ rhabditiform larvae that may develop again to filariform larvae and repeat the cycle.

Rhabditiform larvae, filariform larvae and adult worm can be detected in the sputum.

Strongyloides stercoralis (The dwarf thread worm)

- **Habitat:** Upper part of the small intestine
- **D.H:** Man
- **R.H:** Dogs and monkeys
- **D.S:** Rhabditiform, filariform larvae and adults
- **Mode of infection:** Skin penetration-autoinfection

Pathogenesis and symptomatology

Disease: Strongyloidiasis

Skin penetration

- **Ground itch**
- **Larva currens** It occurs when the filariform larva penetrates the perianal region with external autoinfection causing linear or tortuous urticarial lesions over the trunk, thigh and buttocks. Go back to blood (autoinfection)

Migratory phase
As *Ancylostoma*

Intestinal phase

- **Nausea, vomiting and profuse watery diarrhea**
- **Epigastric pain and ulceration in the mucosa**
- **Malabsorption**

Disseminated strongyloidiasis

??????
??????

GROUND ITCH: after infection, patients may get a mildly itchy rash that often occurs at the site of larval skin penetration, usually on the feet. This may spread to the buttocks and waist areas.

Hyper infection syndrome and Disseminated stronyloidiasis

In immunocompromised patients the parasite produces massive number of rhabditiform larvae that develop into filariform larvae in the intestinal lumen (autoinfection)➲ Hyperinfection syndrome

Larvae penetrate the intestinal wall ➲ reach the circulation ➲ different organs as brain, lung, liver and kidney (dissiminated strongyloidiasis)

This condition is fatal and death occurs due to:

❶Massive increase of intestinal worm burden ➲ intestinal perforation, peritonitis and paralytic ileus.

❷Invasion of CNS ➲ meningitis& brain abscess.

❸Respiratory failure.

❹Septicaemia due to larval migration from the intestine.

Paralytic ileus occurs when the muscle contractions that move food through your intestines are temporarily paralyzed. It's a functional problem of the muscles and nerves that mimics an intestinal obstruction even when nothing is obstructing them. Food becomes trapped in the intestines, leading to constipation, bloating and gas.

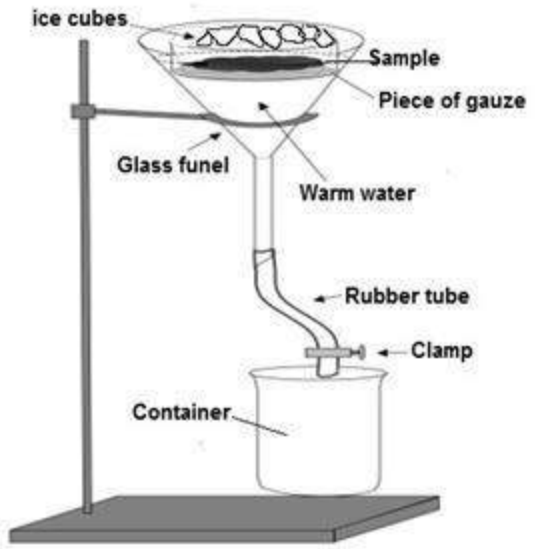
Laboratory diagnosis

Direct methods

- Stool examination for rhabditiform larvae by direct smear and concentration methods as bearman's technique.
- Stool culture to detect free living adults
- Duodenal aspiration or enterotest reveals larvae and adults.
- Sputum examination or culture: during disseminated disease, all stages may be present in lung (rhabditiform larvae, filariform larvae, adults).

Indirect methods

- Eosinophilia (10-40%)
- Serological testes (CFT, IHT, ELISA)

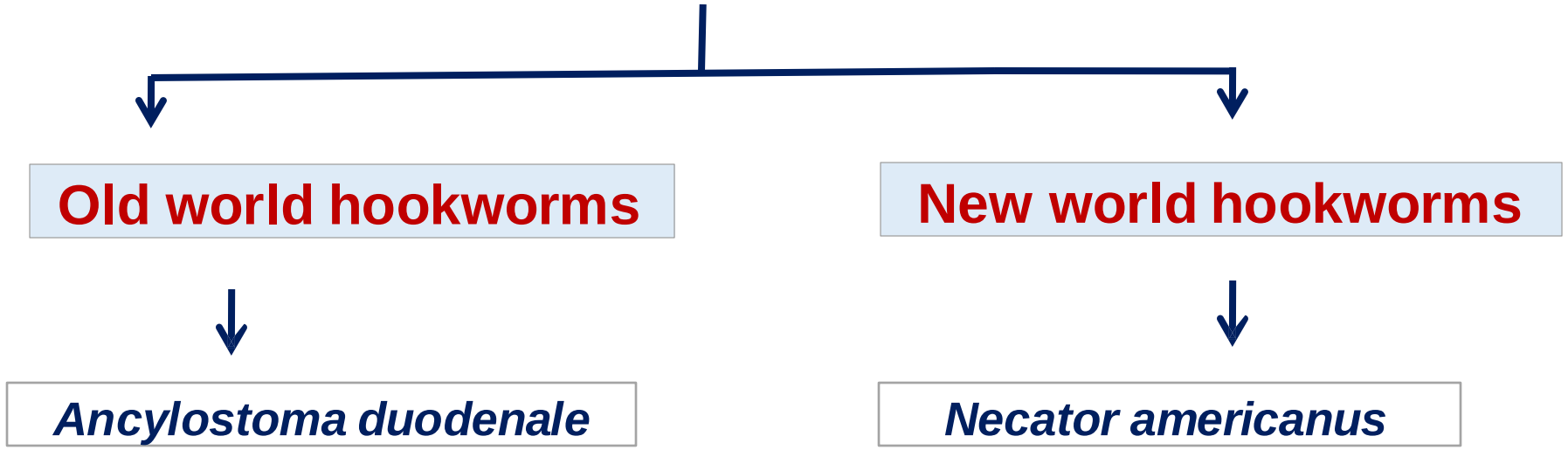


Treatment

- Ivermectin (drug of choice).
- Mebendazale.
- Antihistaminic and antibiotics for cutaneous lesions.

Hookworms

Human Hookworms



Life Cycle of Ancylostoma duodenale

Adult in small intestine

L4 migrate up to the epiglottis

Alveoli (3rd molt → L4)

L4 swallowed to reach GIT undergo 4th molt (L5)

The lungs

The heart

Circulation

Man D.H.

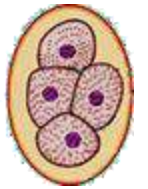
L5 mature to adults

L3 penetrate the skin or ingested and starts migration

Infective stage
Sheathed filariform larva

L3

Female lays Immature eggs passed with stool



Egg Maturation in the soil

Mature

Hatch

Release

L1

1st Molt

L2

2nd Molt

D.Ibrahim

Ancylostoma duodenale

- **Habitat:** Upper part of the small intestine
- **D.H:** Man
- **D.S:** Egg
- **I.S:** Filariform larva
- **Mode of infection:** Penetration of the skin or mucus membrane of the mouth

Pathogenesis and symptomatology

Disease: Ancylostomiasis

Skin penetration
Ground itch

- It is a **cutaneous** lesion produced as a result of penetration of human skin by filariform larva of *A. duodenale*.
- The most common sites are usually **between the toes**, **dorsal surface of the foot** and **inter digital spaces of hands.**
- Characterized by erythema, popular rash, vesicles and pustules with secondary bacterial infection

Migratory phase

- **Verminous pneumonia or Loeffler's syndrome** which is manifested by fever, cough, dyspnea, and hemoptysis with eosinophilia.
- **Eosinophilic granuloma** and abscess formation in different organs when larvae are distributed through the circulation to other organs.

Intestinal phase

- **Nausea, vomiting, diarrhea** and abdominal pain
- **Anaemia** (microcytic hypochromic) due to blood suction by worms and bleeding at the attachment sites (worm release anticoagulant) that may lead to anemic heart failure
- **Hypoproteinemia and nutritional deficiency** that leads to growth retardation

Laboratory diagnosis

Fresh stool examination for egg detection by different methods:

- **Direct smear.**
- **Concentration methods**

Blood examination for anaemia

Treatment

Albendazole

Supportive treatment:

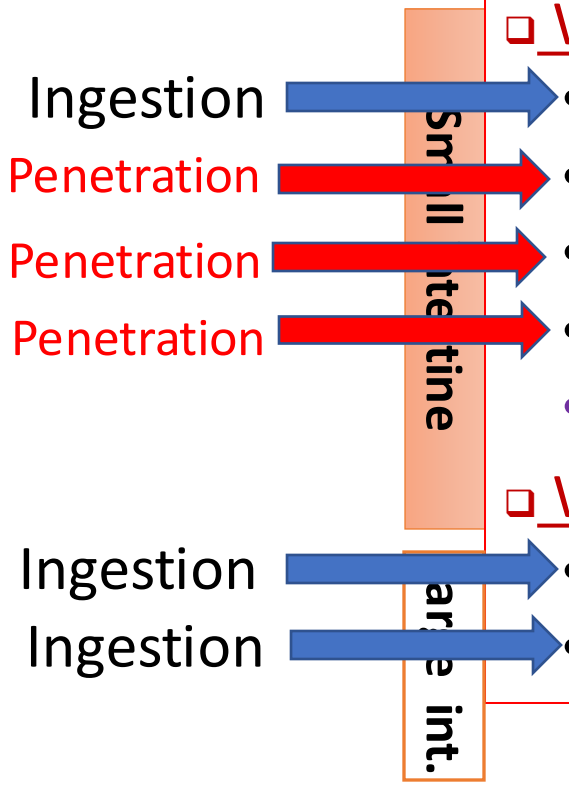
-High protein diet.

-Vitamins & iron.

In severe anaemia, blood transfusion may be needed

Nematodes of medical importance

Intestinal



- With tissue stage:
  - *Ascaris lumbricoides*
  - *Ancylostoma duodenale*
  - *Necator americanus*
  - *Strongyloides stercoralis*
  - *Trichinella spiralis*
- Without tissue stage:
  - *Enterobius vermiculars*
  - *Trichuris trichiura*

Tissue & Blood

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Loa loa*
- *Onchocerca volvulus*
- *Dracunculus medinensis*
- *Trichinella spiralis*

Larva migrans:

- *Ancylostoma spp.*
- *Toxocara spp.*

Infection. Bacteria? Virus? Parasites?

Normal White Blood Cell Distribution

White blood cell line	*Normal percentage of total leukocyte count*
Neutrophils	40 to 60
Lymphocytes	20 to 40
Monocytes	2 to 8
Eosinophils	1 to 4
Basophils	0.5 to 1

WBC count = 4000-1000 cell /µl Blood

Neutrophils ↑ In Bacterial infections

Lymphocytes ↑ In Viral Infections

Eosinophils ↑ In Parasitic infections, Asthma, Allergies

Basophils ↑ In Parasitic infections

Infection. Bacteria? Virus? Parasites?

Normal White Blood Cell Distribution

White blood cell line	*Normal percentage of total leukocyte count*
Neutrophils	40 to 60
Lymphocytes	20 to 40
Monocytes	2 to 8
Eosinophils	1 to 4
Basophils	0.5 to 1

WBCs ↑ Neutrophils ↑ Acute Bacterial infections

WBCs ↑ Lymphocytes ↑ Acute Viral Infections

WBCs ↓ Neutrophils ↑ Chronic Bacterial infections

WBCs ↓ Lymphocytes ↑ Chronic Viral infections

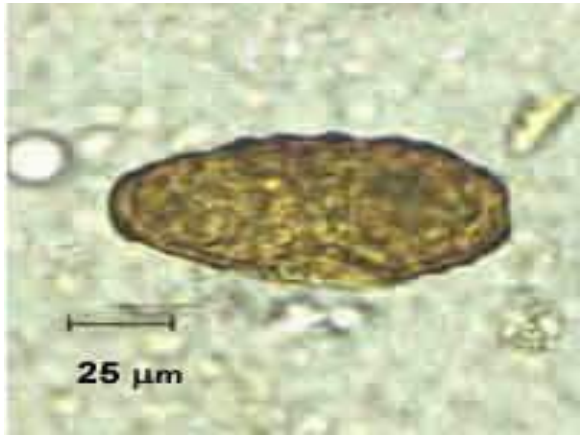
Monocytes and Eosinophils ↑ In Parasitic infections

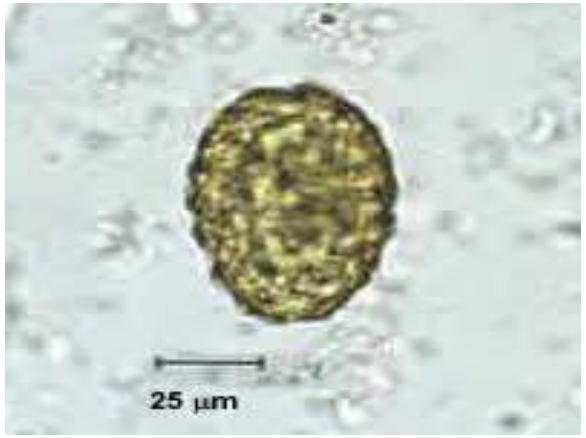
Case Studies

Case 1

A 3-year-old girl was seen in a small rural clinics with complaints of abdominal pain and upset stomach. A local laboratory performed a routine stool examination and observed the objects shown in the images. The laboratory suspected the objects were artifacts. A portion of the stool concentrate was sent to a reference laboratory for confirmation that parasite cysts or eggs were not present.

What is your diagnosis?

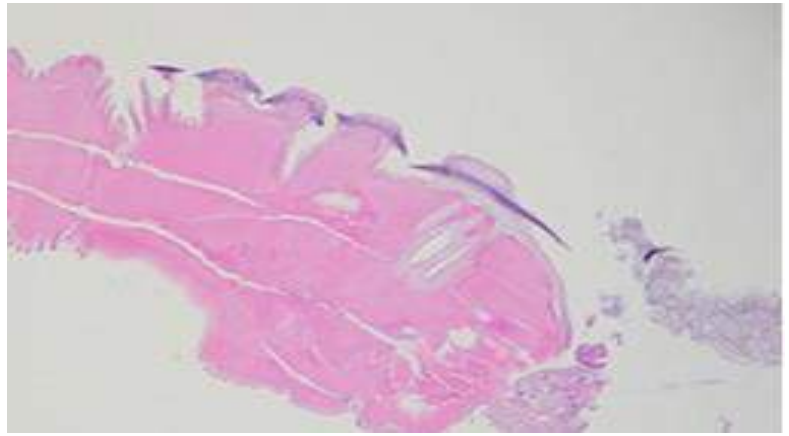


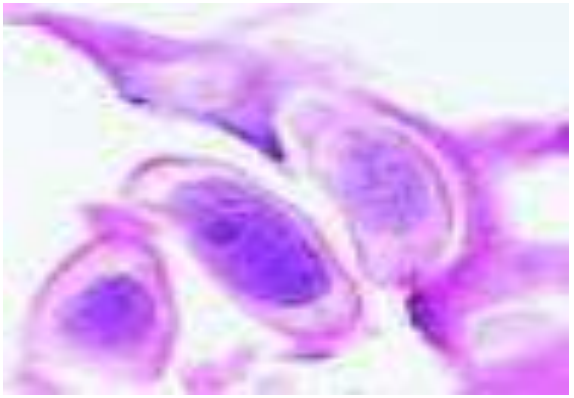


Case Studies

Case 2

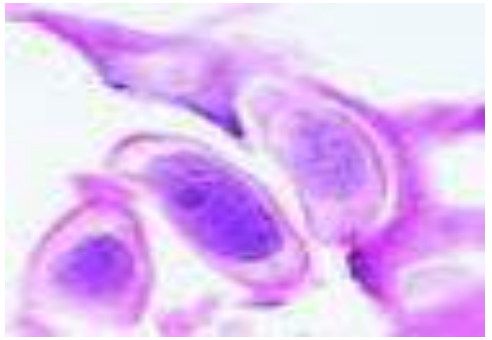
- A 69-year-old male was undergoing a routine colonoscopy performed as a screen for colorectal cancer. The patient was asymptomatic and a stool ova and parasite examination (O & P) performed prior to the procedure was negative. However, the gastroenterologist recovered a worm from the ascending colon during the procedure and sent it to the pathology laboratory for identification. Figures show what was observed on hematoxylin and eosin (H & E) stained slides. Eggs seen inside the worm measured 50 x 25 micrometers on average.
- What is your diagnosis?
- Based on what morphologic features.





Case Studies

Case 2 ●



Case Studies

Case 3

- A 45 year old male was referred to the gastroenterology clinic with complaints of epigastric pain, diarrhea and unintentional weight loss over the past couple of weeks. Travel history was significant for a recent mission trip to rural areas of the Philippines. About a month after his return, he developed epigastric pain and clinically significant diarrhea, with anywhere from 2-8 bowel movements per day. Testing for blood counts, hepatitis and HIV was performed and stool was collected for culture and ova & parasite exam (O&P). He also underwent a colonoscopy with multiple biopsies.

Case Studies

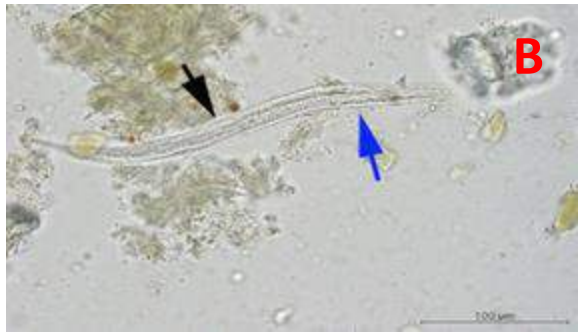
Case 4

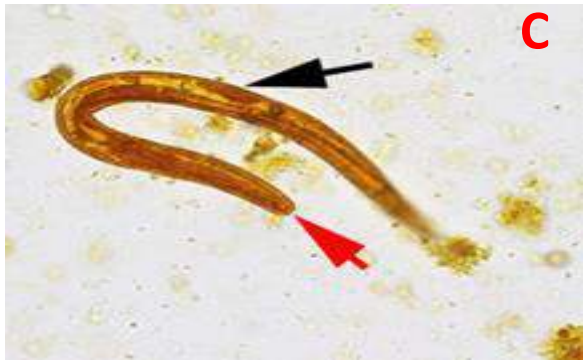
- A 50-year-old female from Canada presented to a health care provider with abdominal pain, diarrhea, and peripheral eosinophilia. A stool specimen was collected in sodium acetate-acetic acid-formalin (SAF) and a formalin-ethyl acetate (FEA) concentration was performed. \
- Figures A-C show what was observed microscopically on a wet mount; Figure C stained with iodine.
- What is your diagnosis? Based on what criteria?

Case Studies

Case 4.....

- This was a case of strongyloidiasis caused by S. stercoralis. Diagnostic morphologic features shown in the images included:
- a prominent genital primordium (black arrow, Figures B and C).
- a short buccal canal (red arrow, Figure C).
- a rhabditoid esophagus (blue arrow, Figure B).
- The morphologic features were consistent with first-stage rhabditiform (L1) larvae which is the stage usually found in stool.





Case Studies

Case 5

A 54-year-old male was admitted because of having suffered from progressive watery diarrhea for 12 days. He had no history of diabetes mellitus, hypertension, heart disease, organ transplantation, or malignancy. After admission, he still complained of diarrhea despite medical treatment. The laboratory examination showed leukocytosis with eosinophilia and a stool examination by the concentration method was negative four times. When a sigmoidoscopy was performed as a part of an explorative survey, a single protruding mass consisting if a moving adult hookworm was found. The fifth stool examination by the concentration method identified hookworm ova. The patient was treated with oral mebendazole 100 mg twice a day for 3 days. The diarrhea and eosinophilia subsided after this treatment.