Nematoda (Enterobius & Ascaris)

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Medical Parasitology Ⅱ

Summer Semester

Lecture 2

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Nematoda

Case study

A 6-year-old boy was brought by his mother with **intense perianal itching** for 2 weeks, worse at night, She noticed **tiny white worms** near his anus. **The Scotch tape method** revealed **D-shape eggs** of **Enterobius vermicularis (pinworm)**. He was treated with **mebendazole**, and the family was advised on hygiene measures including handwashing, daily change of underwear, and washing bedding, leading to complete recovery.

Enterobius vermicularis

The name Enterobius vermicularis means a tiny worm living in the intestine (Greek enteron-intestine, bias-life and vermiculus-small worm). The term Oxyuris means "sharp ta il'; a feature of the female worm, from which the name "pinworm" is also derived.

Epidemiology

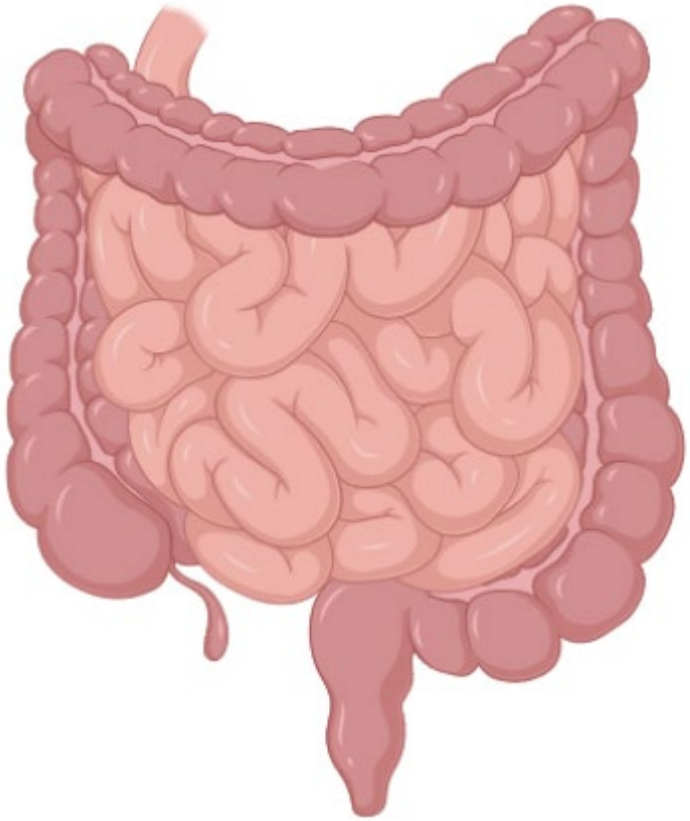
Global distribution: Found worldwide in both temperate and tropical climates; most common helminth infection in developed countries.

Prevalence: Estimated 200–400 million cases globally at any given time.

Age group: Highest incidence in children aged 5–14 years, especially in schools and daycare centers.

Habitat

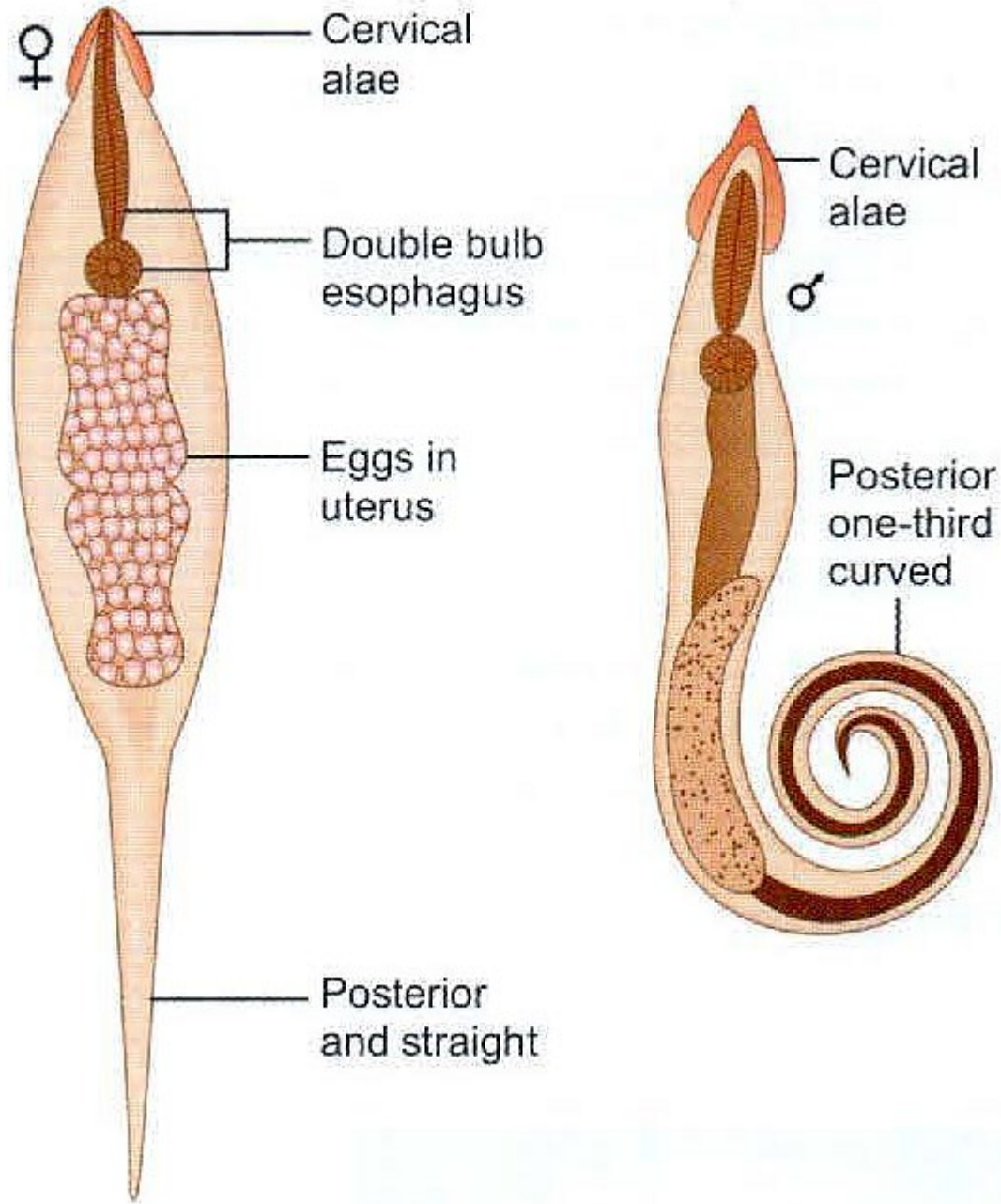
Adult worms are found in the cecum, appendix and adjacent portion of ascending colon.



Morphology

Adult worm

- Adult worms are small, white, thread-like with pointed ends, and have a mouth surrounded by three wing-like cervical alae plus a double-bulb esophagus.
- The female (8–13 mm × 0.3–0.5 mm) has a thin pointed tail, vulva in front of the middle third, and when gravid, her body is packed with thousands of eggs. She is oviparous and lives 5–12 weeks.
- The male (2–5 mm × 0.1–0.2 mm) is smaller, with a tightly curved posterior end bearing a copulatory spicule and survives 7–8 weeks.


♀
Cervical alae
Double bulb esophagus
Eggs in uterus
Posterior and straight
Cervical alae
♂
Posterior one-third curved

Morphology

Egg

- The egg is colorless and not bile-stained and D-shaped.
- It has a characteristic shape, being elongated ovoid, flattened on one side and convex on the other (planoconvex), measuring 50-60 µm by 20-30 µm.
- The eggshell is double-layered and relatively thick, though transparent. The outer albuminous layer makes the eggs stick to each other and to clothing and other objects.
- Under cool, moist conditions, the egg remains viable for about 2 weeks.
- A single female worm lays 5,000-17,000 eggs

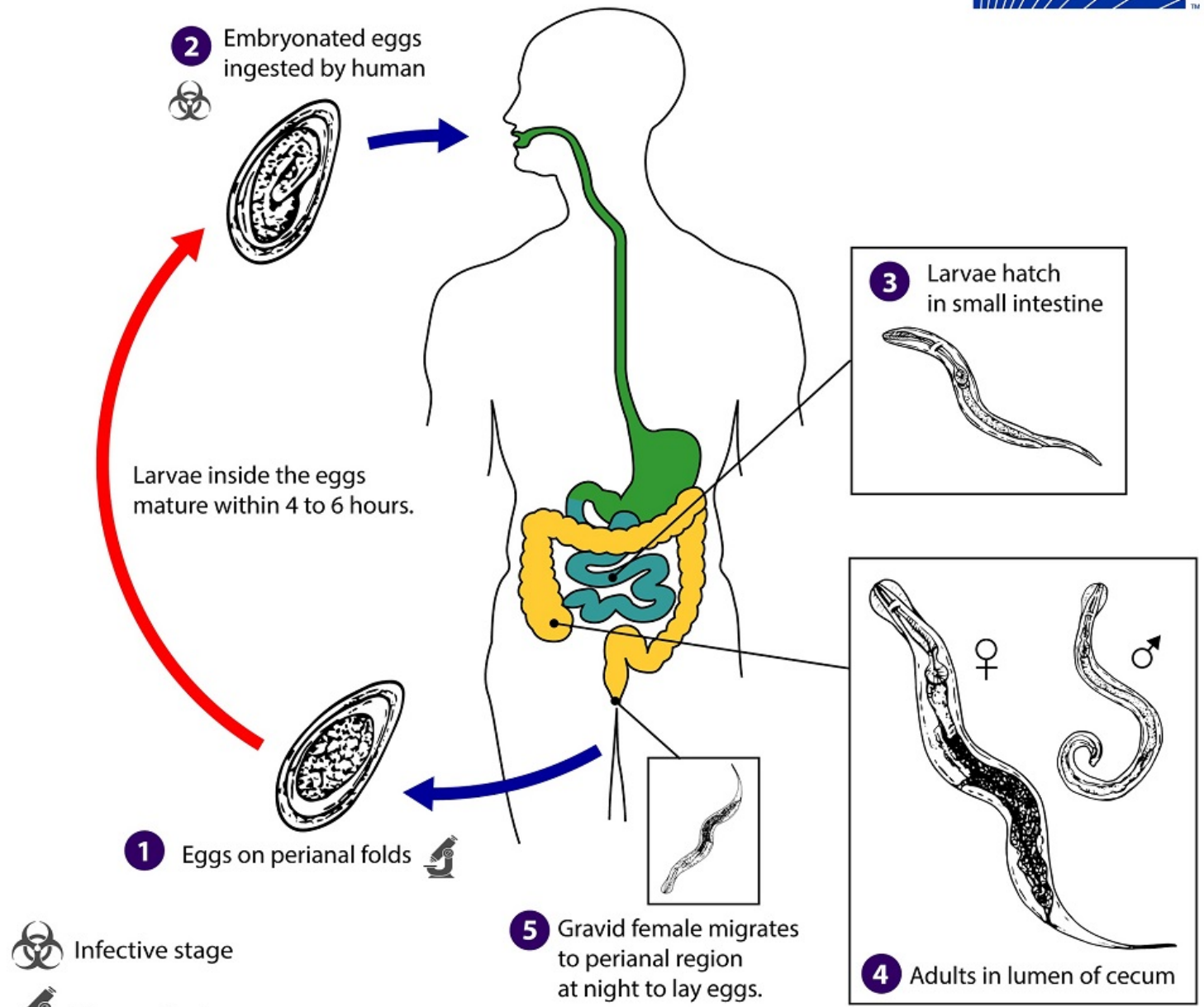
Life Cycle

1. Ingestion of infective eggs via contaminated hands, food, water, or surfaces.
2. Larvae hatch in the small intestine.
3. Adult worms mature and reside in the cecum and appendix.
4. Gravid females migrate to the perianal region at night to lay eggs.
5. Eggs become infective within a few hours in the perianal area.
6. Autoinfection: Eggs from the perianal area are transferred to the mouth via contaminated fingers after scratching, common in children.
7. Retroinfection: Eggs hatch on the perianal skin, and larvae migrate back through the anus to the colon.
8. Indirect transmission can occur via contaminated clothes, bedding, or airborne eggs.

DPDx

Enterobius vermicularis

CDC

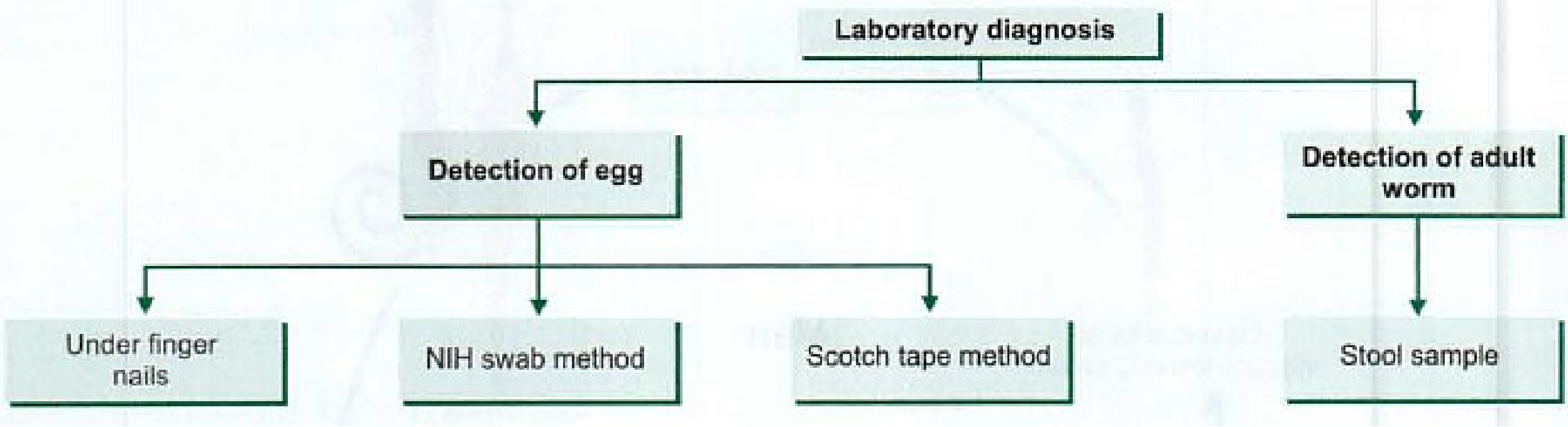


Sign and Symptoms

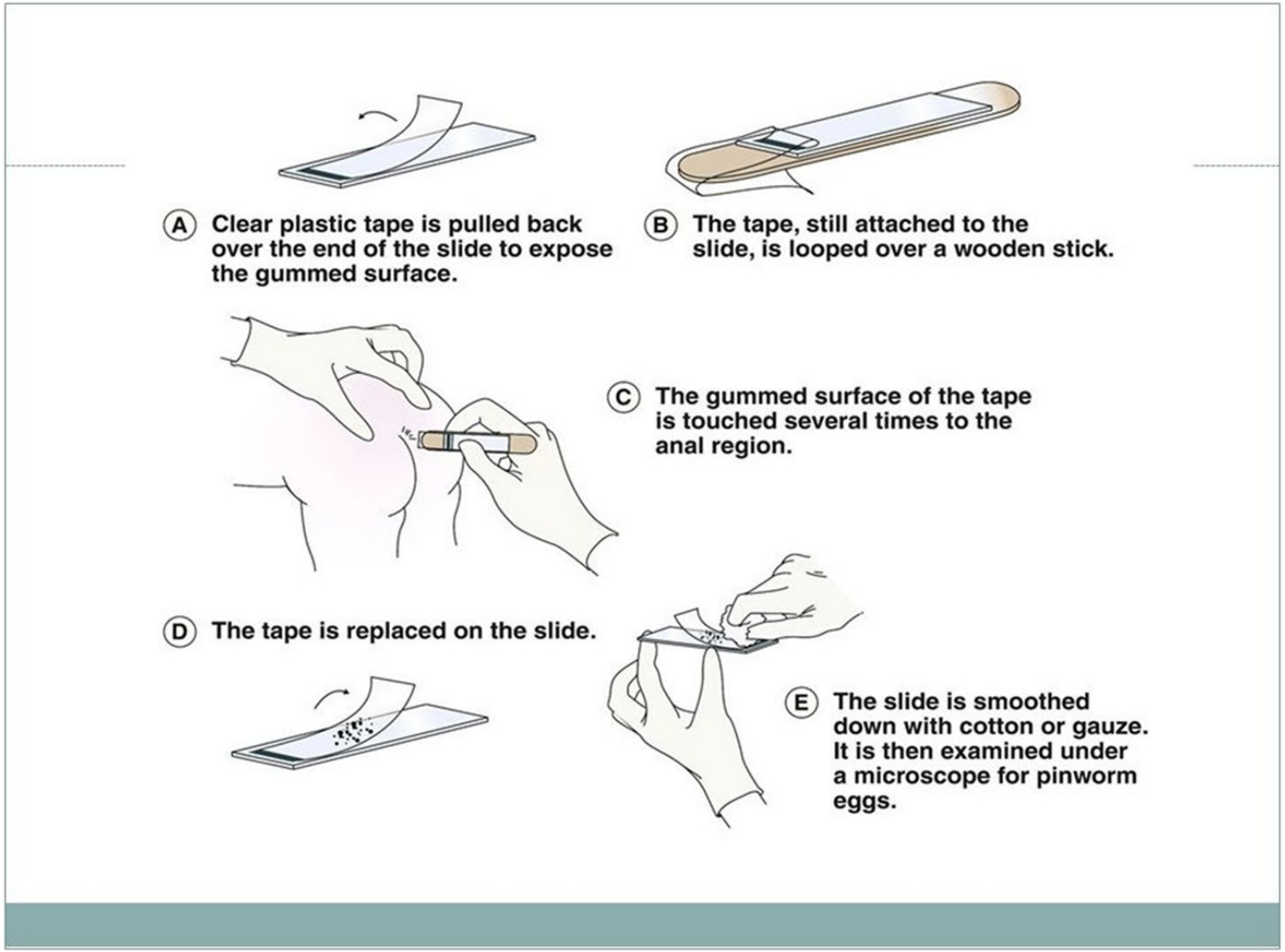
Most people have no symptoms or signs of a pinworm infection. If a person does, it typically itching in the perianal region.

Occasionally, invasion of the female genital tract can occur causing inflammation of the vulva and vagina with rare inflammatory reactions occurring in the pelvis or peritoneum. Appendicitis has been associated with pinworm infection in rare cases.

Diagnosis


Laboratory diagnosis
Detection of egg
Detection of adult worm
Under finger nails
NIH swab method
Scotch tape method
Stool sample

Scotch tape method



Treatment

Albendazole (400 mg once) or **Mebendazole** (100 mg once) can be used

Treatment involves two doses of medication with the second dose given two weeks after the first dose. The medications kill worms but cannot kill eggs. The second dose is important to prevent infection by newly hatched adult worms that were not killed by the first treatment because they were still eggs.

Prevention

- Maintenance of personal and community hygiene such as frequent hand washing, finger nail cleaning and regular bathing.
- Frequent washing of night clothes and bed linen.

Ascaris lumbricoides

Introduction

Ascaris lumbricoides has been observed and described from very ancient times, when it was sometimes confused with the earthworm.

Its specific name lumbricoides is derived from its resemblance with earthworm (Lumbricus, meaning earthworm in Latin).

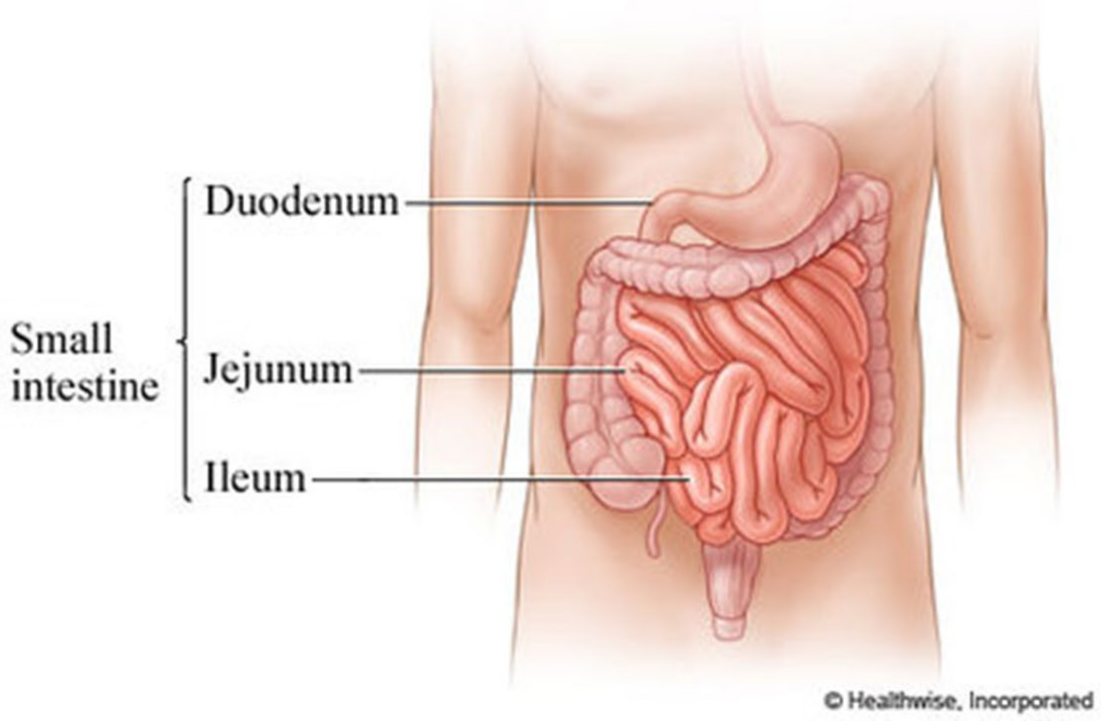
Distribution

It is the most common of human helminths and is distributed worldwide.

Habitat

Adult worms live in the small intestine (85% in jejunum and 15% in ileum).

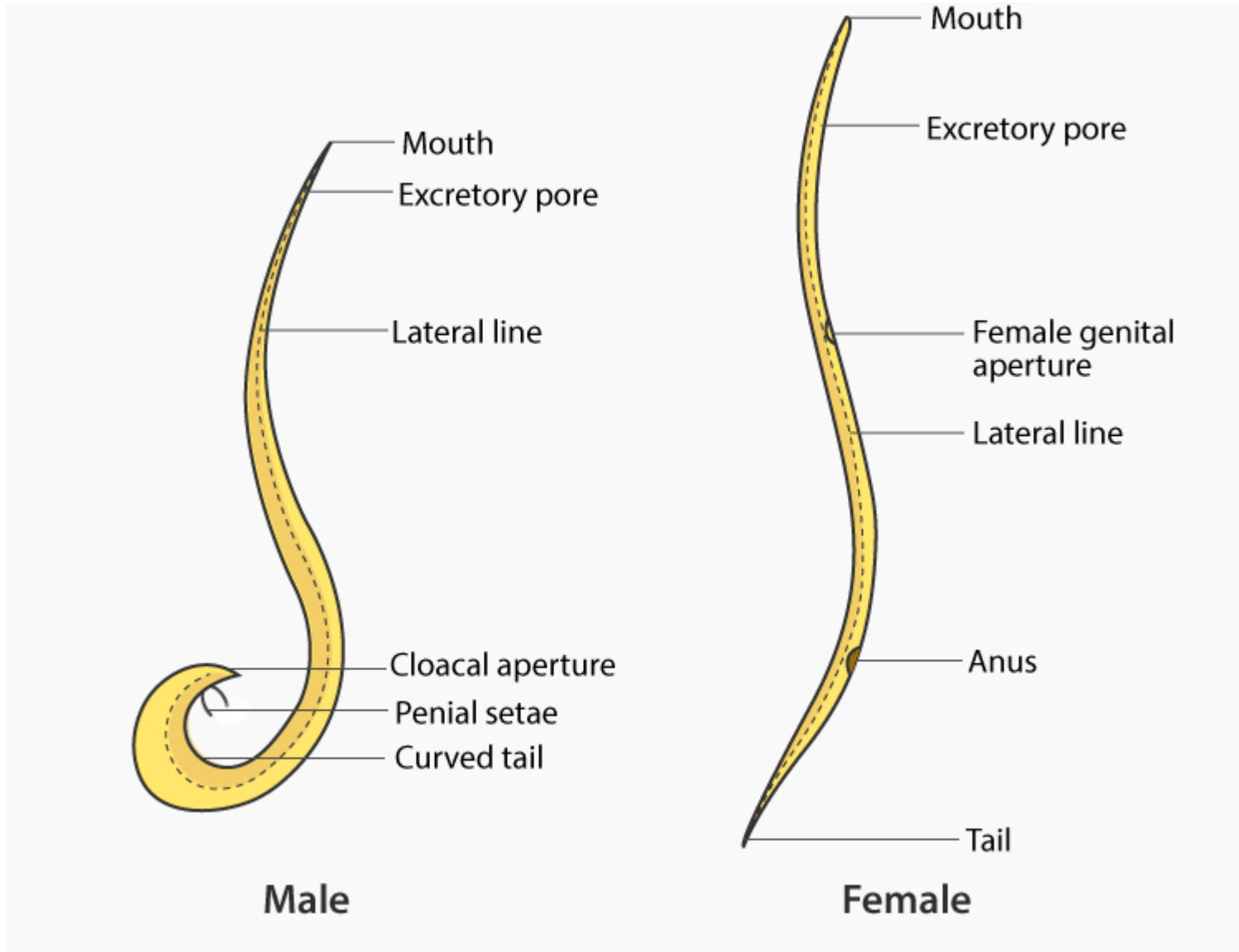
The roundworm, Ascaris lumbricoides is the largest nematode parasite in the human intestine.



Morphology

Adult Worm

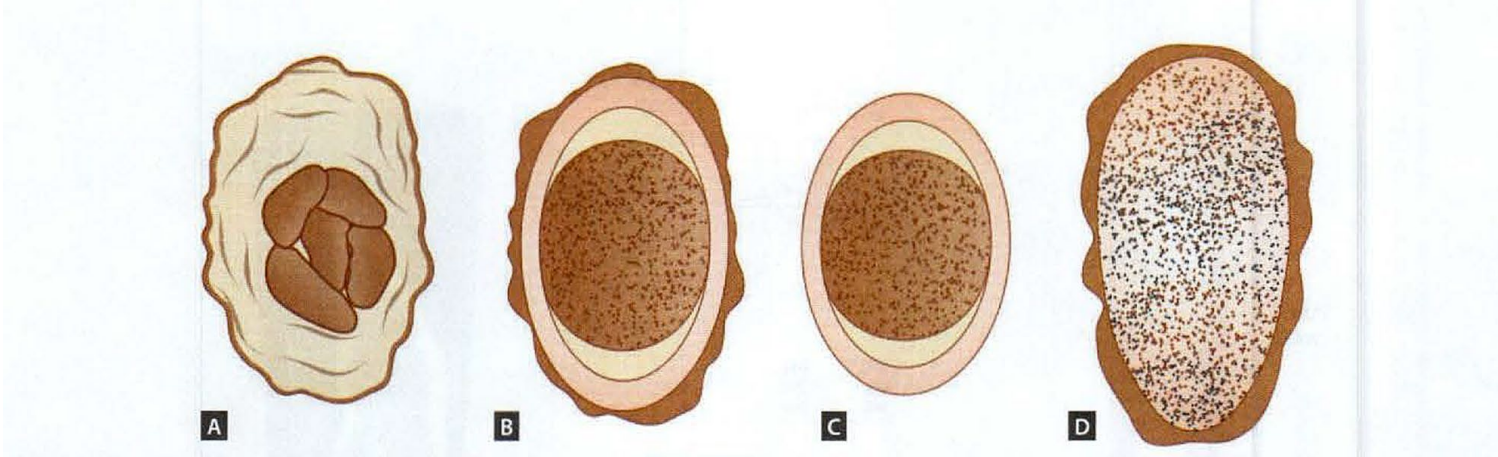
- They are large cylindrical worms, with tapering ends, the anterior end being more pointed than the posterior.
- They are pale pink or flesh colored when freshly passed in stools, but become white outside the body.
- The mouth at the anterior end has three finely toothed lips, one dorsal and two ventrolateral.
- The adult male worm is a little smaller than the female
- A single worm lays up to 200,000 eggs per day. The eggs are passed in feces.


Mouth
Excretory pore
Lateral line
Cloacal aperture
Penial setae
Curved tail
Male
Mouth
Excretory pore
Female genital aperture
Lateral line
Anus
Tail
Female

Egg

- Two types of eggs are passed by the worms: (1) fertilized and (2) unfertilized.

1. The fertilized eggs, laid by females, inseminated by mating with a male, are embryonated and develop into the infective eggs.
2. The unfertilized eggs, are laid by an uninseminated female. These are nonembryonated and cannot become infective

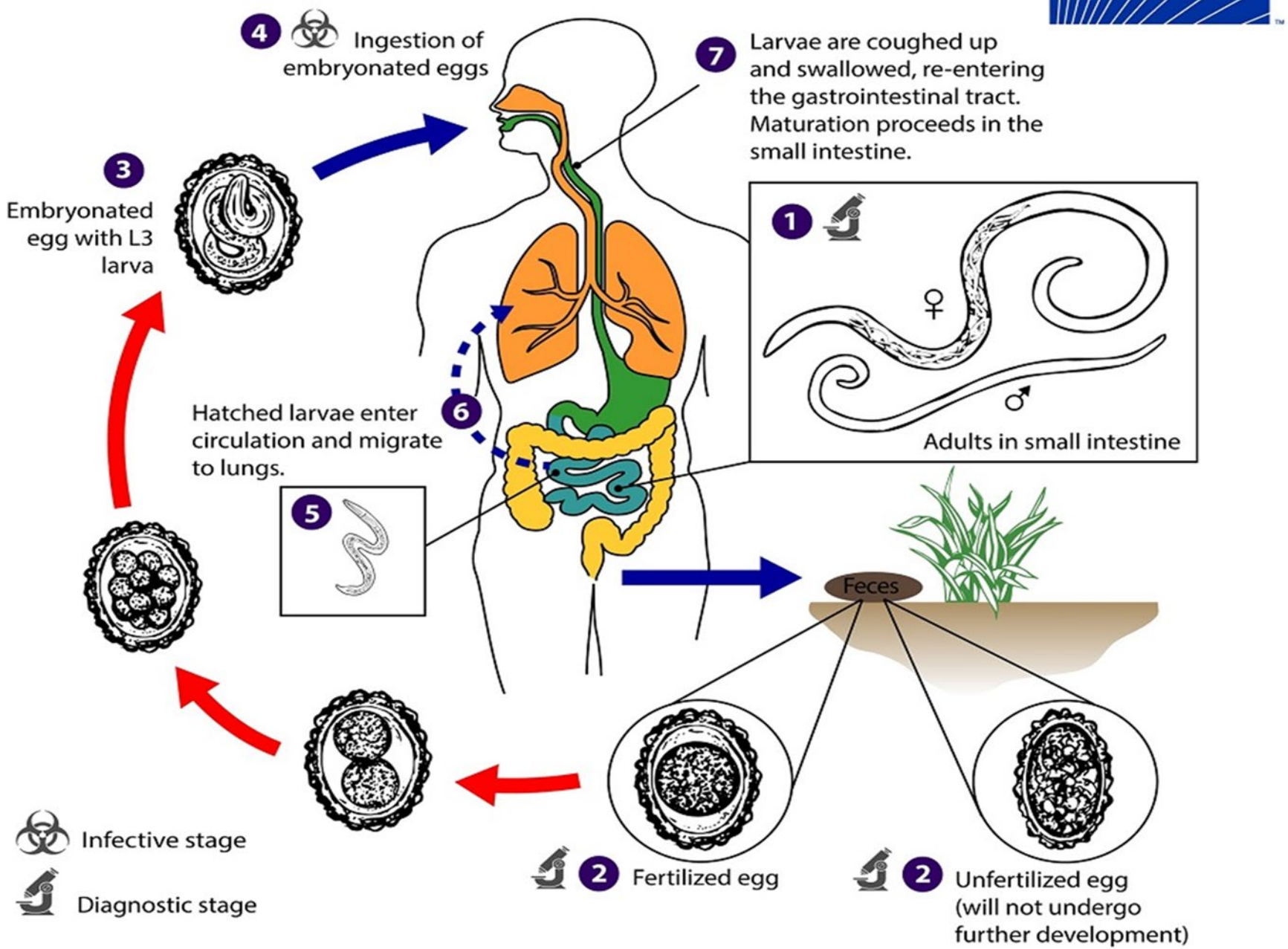


Figs 3A to D: Types of *Ascaris* eggs found in stools. (A) Fertilized egg surface focus, showing outer mamillary coat; (B) Fertilized egg, median focus, showing unsegmented ovum surrounded by three layers of coats; (C) Decorticated fertilized egg, the mamillary coat is absent; and (D) Unfertilized egg, elongated, with atrophic ovum

Life cycle

- Eggs are passed in feces; fertilized eggs become infective after embryonation in soil.
- Infective stage is embryonated eggs containing larvae, ingested through contaminated food, water, or hands.
- Larvae hatch in the small intestine.
- Larvae penetrate intestinal wall, reach liver, heart, and then lungs.
- In the lungs, larvae mature, move up the bronchial tree to throat, and are swallowed.
- Larvae return to the small intestine and develop into adult worms.
- Adults produce eggs that are excreted in feces to continue the cycle.

Ascaris lumbricoides



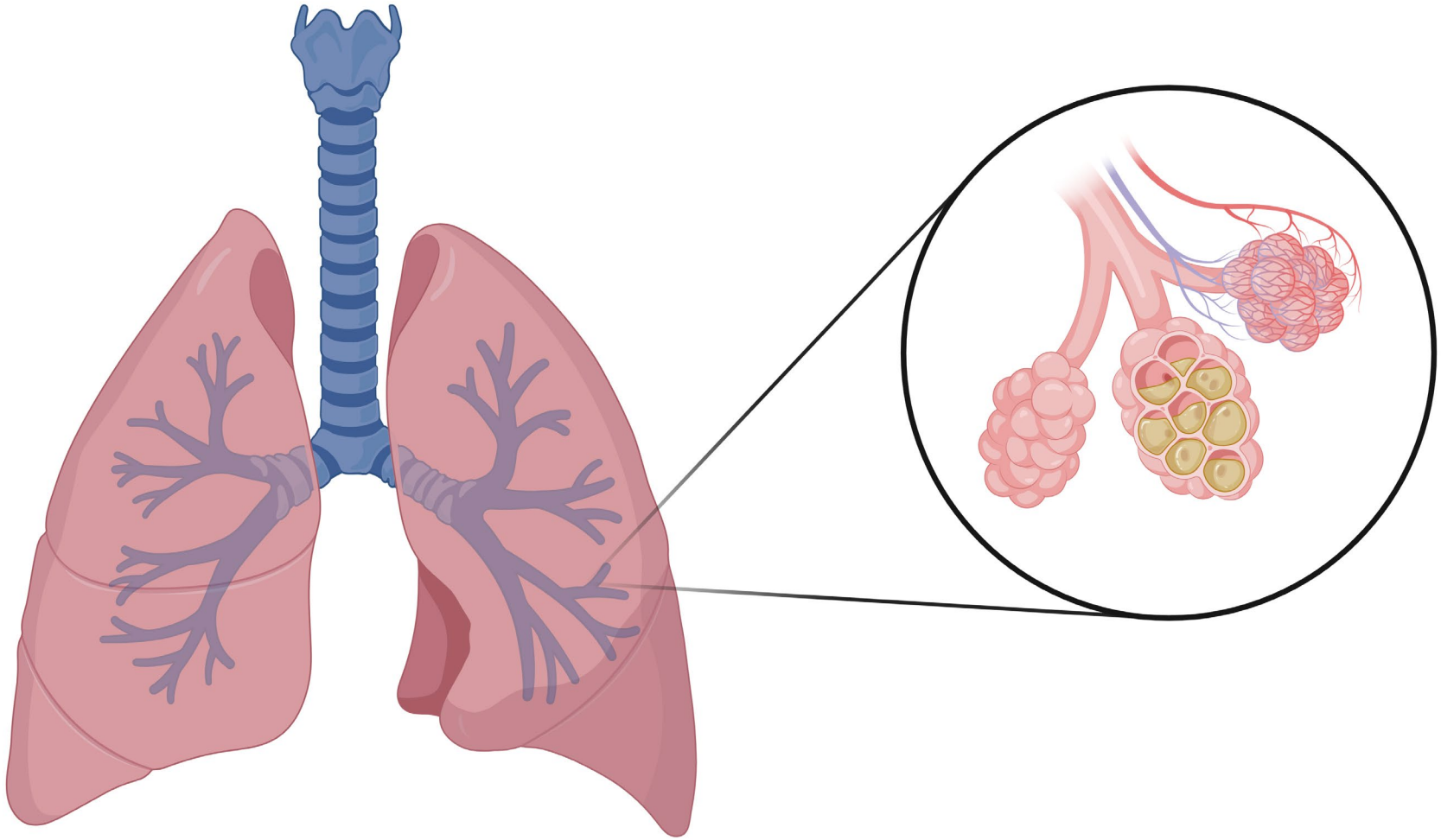
Sign and symptoms

Disease caused by Ascaris lumbricoides is called as ascariasis. Clinical manifestations in ascariasis can be caused either

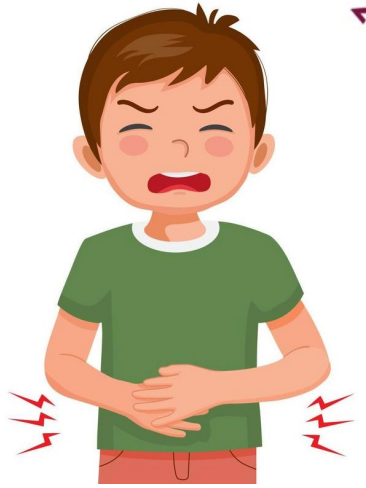
by the migrating larvae or by the adult worms.

- the initial exposure to larvae is usually asymptomatic, except when the larval load is very heavy it will lead to **Ascaris Pneumonia**.

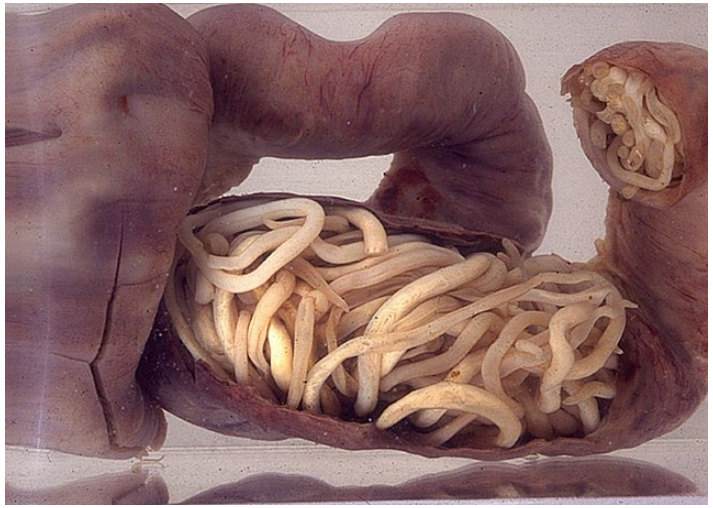
Pneumonia



Sign and symptoms

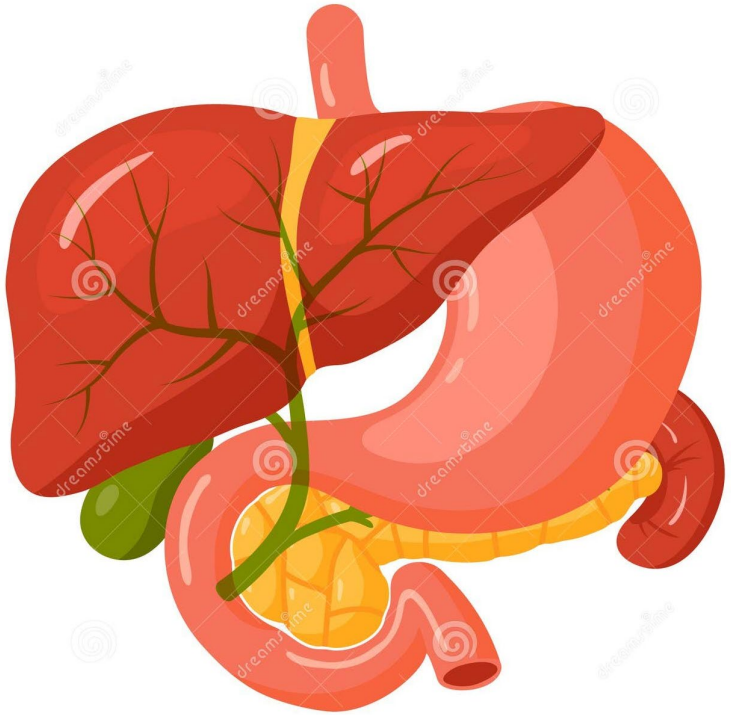


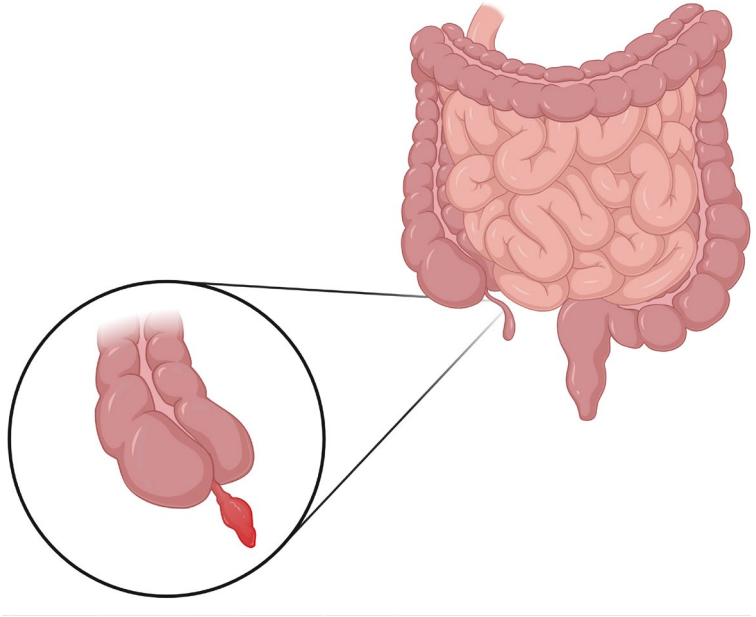
- Although heavy infections in children may cause stunted growth via malnutrition
- adult worms usually cause no acute symptoms.
- High worm burdens may cause abdominal pain and intestinal obstruction and potentially perforation in very high intensity infections.



Sign and symptoms

- Migrating adult worms may cause symptomatic occlusion of the biliary tract, pancreatitis appendicitis, or nasopharyngeal expulsion, particularly in infections involving a single female worm.





Laboratory diagnosis

Detection of Parasite

- The adult worm can occasionally be detected in stool or sputum of patient by naked eye.
- In the early stages of infection, when migrating larvae, the diagnosis may be made by demonstrating the larvae in sputum,
- Definitive diagnosis of ascariasis is made by demonstration of eggs in feces.

Treatment

- Drugs for ascariasis: Albendazole (400 mg once), Mebendazole (100 mg twice daily for 3 days or 500 mg once).
- Partial obstruction: Manage with Nasogastric suction, IV fluids.
- Complete obstruction: Needs immediate surgery.

References

- Paniker, C. K. J. & Ghosh, S. 2021. *Paniker's textbook of medical parasitology,* New Delhi, Jaypee Brothers Medical Publishers.
- https://www.cdc.gov/pinworm/hcp/clinical-overview/index.html