**Strongyloides stercoralis**

**Objective:** *S. stercoralis* is an important human parasite because of its potential fatal hyperinfection syndrome in immunocompromised persons, as well as recent study shows that chronic alcoholism itself is an important factor that predisposes factor to strongyloidiasis.

- Kingdom: Animalia
- Phylum: Nematoda
- Class: Secernentea
- Order: Rhabditida
- Family: Strongyloidiidae
- Genus: Strongyloides
- Species: *S. stercoralis*

*Strongyloides stercoralis*, also known as the threadworm, is the scientific name of a human parasitic roundworm causing the disease of strongyloidiasis.

**Infectious Agent:**

- *Strongyloidiasis is caused by an intestinal nematode, Strongyloides stercoralis*, which is the smallest pathogenic nematodes, hardly visible to the naked eye, measure 2.4-4.7 mm in length. It is a potentially fatal opportunistic pathogen in immunocompromised hosts.

**Habitat:** is the mucosal epithelium of upper small intestine (s.i.).

**Geographic distribution:**

1. *S. stercoralis* has a very low prevalence in societies where fecal contamination of soil or water is rare. Hence, it is a very rare infection in developed economies, in Iraq also the infestation is rather rare. In developing countries it is less prevalent in urban areas than in rural areas (where sanitation standards are poor). *S. stercoralis* can be found in areas with tropical and subtropical climates.

2. Estimates of global prevalence vary between 3 million and 100 million.

**Mode of Transmission:**

- Filariform larvae found in infected soil in the tropics and subtropics penetrate human skin.
- Person-to-person transmission is rare, but has been documented.

**Risk for Travelers:**

- Travelers who visit endemic areas and have contact with contaminated soil through bare skin are at risk for infection.
Most infections seen in the United States occur in immigrants, refugees, and military veterans who have lived in endemic areas for long periods of time.

Risk for short-term travelers appears to be very low, but can occur.

**Signs and Symptoms:**

- Most infections are asymptomatic.
- **Dermatitis** (with acute infections) is produced by migration of the infective juveniles through the skin (cutaneous infection), migrating larvae in the skin can cause larva currens, a serpiginous urticarial rash.
- The mild to severe symptom of **pneumonia** can occur during migration to air-sacs of **lungs**. (Cases of reproduction in the air-sacs have been observed but they are relatively rare).
- Inflammation of the intestinal **mucosa**.
- **Diarrhea** accompanied by emaciation and exhaustion.
- Immunocompromised individuals, especially those receiving systemic corticosteroids or patients with HTLV-1 infection, are at risk for hyperinfection or disseminated disease, characterized by abdominal pain, diffuse pulmonary infiltrates, and septicemia or meningitis from enteric gram-negative bacilli. Untreated disseminated strongyloidiasis has high mortality.
- Unexplained eosinophilia may be a presenting sign of strongyloidiasis.

**Morphology:**

The different stages of *S. sterocoralis* are:

1. Adult worms
2. Eggs
3. Larvae (rhabditiform larvae and filariform larvae).

**1. Adult worms:** Only female are seen in the intestine. Majority of the female worm are parthenogenetic (i.e., they can produce offspring without being fertilized by the male). Contrary the male worms do exist, which are shorter and broader than the female, while males grow to only about 0.9 mm in length, the females can be anywhere from 2.0 to 2.5 mm. While intestine is present in the posterior 2/3 of the body, the posterior end is pointed. The eggs are arranged antero-posteriorly in a single row of 5-10 eggs in a uterus, the female is ovo-viviparous. **The males are not seen in human infections because they do not invade the intestinal wall and are eliminated from the intestine.** Both genders also possess a tiny buccal capsule, the mouth possess 3 small lips and cylindrical esophagus (without a posterior bulb) is present in anterior part of
the body. In the free-living stage, the esophagus of both sexes are rhabditiform. Males can be distinguished from their female counterparts by two structures: the spicules and gubernaculum.

2. Eggs: The ovum is oval, transparent, thin shelled, about 5-60 μm * 30-35 μm, partially embryonated when discharged in mucosal epithelium. Eggs typically mature into rhabditiform larvae within the intestine. *Strongyloides is the only helminth to secrete larvae (and not eggs)* in feces.

![Unembryonated and embryonated ova of S. stercoralis](image)

3. Larvae: Two types of larvae are found: rhabditiform and filariform larvae. The embryonated eggs hatch almost immediately in the mucosa of the intestine to the rhabditiform larvae.

![Larvae](image)

A. Rhabditiform larvae: These are developed directly from gravid females and are found in the lumen of the bowel, are short in length than filariform larvae and sluggishly motile, and have short mouth and double bulb oesophagus. The further course of development could be by either a. internal reinfection or by b. external reinfection or hyperinfection through penetrate the perianal & perineal skin without leaving the host, or c. by may be voided with faeces and undergo development in the soil through direct or indirect cycle.

B. Filariform larvae: These are skin penetrating infective forms of the parasite, which are longer and more slender than the rhabditiform larvae, they have short mouths and cylindrical esophagus. These are develop in three ways: metamorphosed in human bowel from the first batch of rhabditiform larvae, direct development from rhabditiform larvae (in temperate climates), and from a sexual phase of rhabditiform
larvae in the soil giving rise to second rhabditiform larvae and then developed to filariform larvae(in tropical climates).

**The Life Cycle of *S. sterocoralis***: Man is the only host of *S. sterocoralis*, and no I.H. is required and the change of the host is not essential.

- worms have a heterogenetic life cycle which consists of:

  1. A free-living generation is called (**heterogonic life cycle**): The mating take place in the soil and fertilized female lays eggs, which hatch to release the next generation of rhabditiform larvae that either repeat the life cycle or may develop to into filariform larvae which infect man and initiate the parasitic phase.

  2. A parasitic generation which is internal and external autoinfection is called (**homogenic life cycle**). Infection occurs when exposed skin contacts contaminated soil, following skin penetration they are carried by the blood to the lungs, where they exit into the alveoli, travel up the trachea, are swallowed, and mature in the small intestine. If ingested, migration through the lungs is not necessary.

  Filariform larvae rest in the small intestine, mature into adult females. A parasitic females anchor themselves with their mouths to the mucosa of the small intestine or burrow their anterior ends into the submucosa. Reproduction in the host is by parthenogenetic females which lay several dozen eggs each day. Eggs are released into the lumen of the gut or the submucosa where they hatch and juveniles pass into the lumen. These first-stage juveniles are 300-380µm long and are usually passed with the feces. Juveniles develop either to free-living adults or to infective filariform juveniles. Third stage juveniles(filariform larvae) are the infective stage. They are 490-630µm long. This is a resting stage which does not develop further until it penetrates through skin or is ingested.
Clinical Features:
Often asymptomatic yet cause mild to severe abdominal symptoms, but a characteristic sign of strongyloidiasis is larva currens.

- Under certain conditions (e.g., constipation, decreased bowel motility, diverticular disease), the larvae do not exit the host in feces and instead molt into the infective filariform.

Recent studies show that the hyperinfection is associated with a dramatic increase in the number of parasites and the progression to clinical manifest dissemination seems to be related with an increase in the successful rate of molting.
**Laboratory of diagnosis of *S. stercoralis***:

1. Stool examination, only larvae of the parasite can be detected (either rhabditiform or filariform larvae will confirm the presence of this parasite. Repeated stool examinations may be necessary, given the low sensitivity of a single stool examination.  
   a. Direct wet smear examination, by using either (direct saline or iodine smear) is examined for the presence of larvae.  
   b. Formal–ether concentration: this method is more sensitive than the direct smear examination.  
   c. Concentration of larvae by **Baermann's method**, this method depends on the principle of the tendency of strongyloides larvae to migrate from a colder to warmer area, this is the most sensitive method available for diagnosis.

2. Stool culture: using **charcoal culture method**, filariform larvae develop in 5-7 days in positive cases.

3. Duodenal aspiration: using enterotest gelatin capsule (repeated examination is recommended). This is also a very sensitive method.

4. Histopathological examination: biopsy or autopsy specimen.

5. Immunodiagnosis: like **ELISA, RAST** (used for screening from individuals from endemic area who are likely to put on immunosuppressive therapy.)