

Hookworm (Intestinal)

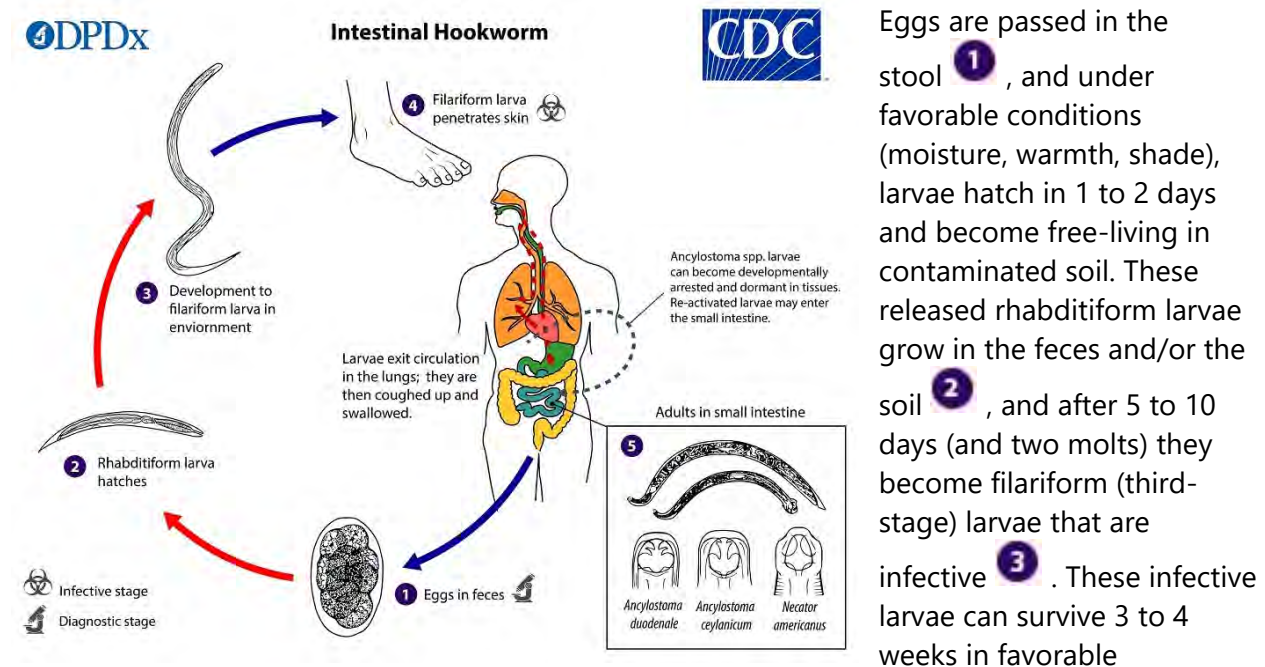
[*Ancylostoma duodenale*][*Ancylostoma ceylanicum*][*Necator americanus*]

Causal Agents

Intestinal hookworm disease in humans is caused by *Ancylostoma duodenale*, *A. ceylanicum*, and *Necator americanus*. Classically, *A. duodenale* and *N. americanus* have been considered the two primary intestinal hookworm species in the United States.

Another group of hookworms infecting animals can penetrate the human skin causing cutaneous larva migrans (*A. braziliense*, *A. caninum*, *Uncinaria stenocephala*). Other than *A. caninum* noted above, these parasites do not develop further after their larvae penetrate human skin.

Life Cycle



Eggs are passed in the stool **1**, and under favorable conditions (moisture, warmth, shade), larvae hatch in 1 to 2 days and become free-living in contaminated soil. These released rhabditiform larvae grow in the feces and/or the soil **2**, and after 5 to 10 days (and two molts) they become filariform (third-stage) larvae that are infective **3**. These infective larvae can survive 3 to 4 weeks in favorable environmental conditions. On contact with the human host, typically bare feet, the larvae penetrate the skin and are carried through the blood vessels to the heart and then to the lungs. They penetrate into the pulmonary alveoli, ascend the bronchial tree to the pharynx, and are swallowed **4**. The larvae reach the jejunum of the small intestine, where they reside and mature into adults. Adult worms live in the lumen of the small intestine, typically the distal jejunum, where they attach to the intestinal wall with resultant blood loss by the host **5**. Most adult worms are eliminated in 1 to 2 years, but the longevity may reach several years. Some *A. duodenale* larvae, following penetration of the host skin, can become dormant (hypobiosis in the intestine or muscle). These larvae are capable of re-activating and establishing intestinal infections. In addition, infection by *A. duodenale* may occur by the oral and transmammary route. *A. ceylanicum* and *A. caninum* infections may be acquired by oral ingestion. *A. caninum*-associated eosinophilic enteritis is believed to result following oral

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ingestion of larvae, not percutaneous infection. *N. americanus* does not appear to be infective via the oral or transmammary route.

Hosts

Humans are the principal host.

Geographic Distribution

Hookworm species have a worldwide distribution, mostly in areas with moist, warm climates where larvae can survive in the environment. Both *Necator americanus* and *Ancylostoma duodenale* are found in the Americas. Only *N. americanus* is found in south India and predominates in the Americas.

Clinical Presentation

Intestinal hookworm infections are commonly asymptomatic. Attachment of the hookworms to the intestinal wall may stimulate abdominal pain, nausea, and anorexia. Iron deficiency anemia caused by blood loss at the site of intestinal attachment of adult worms may occur especially in heavy infections. Occult blood in the stool may also be seen in heavy infections. In severe cases, protein malnutrition from chronic plasma protein loss has been reported.

Other clinical manifestations of hookworm infection include an urticarial dermal reaction ("ground itch") associated with filariform (L3) larvae penetration, and respiratory involvement including eosinophilic pneumonia may be observed may occur during larval pulmonary migration. A second urticarial rash may subsequently develop during pulmonary migration. Patients have reported vague gastrointestinal disturbances and eosinophilia (sometimes referred to as Wakana syndrome) following peroral infection.

Prevention

The most important ways to help prevent this parasitic disease is to teach children and others the importance of washing hands correctly with soap and running warm water, particularly after using the toilet and before eating. Disposing of human and animal feces appropriately and avoiding walking barefoot outdoors will improve one's chances to avoid infection.

Photos:



Adapted from Source: <https://www.cdc.gov/dpdx/hookworm/index.html>