Prof.Dr.Hashim R.Tarish

Second lecture

Hookworm

Soil-transmitted helminthes(Ascaris,hookworm and Trichuris)

Hookworms are intestinal, blood-feeding, parasitic that cause types of infection known as hookworm disease. Hookworm infection is found in many parts of the world, and is common in areas with poor access to adequate water, sanitation, and hygiene.

The two most common types of hookworm that infect humans are *Ancylostoma duodenale* and *Necator americanus*.

Hookworm species that are known to infect domestic cats are *Ancylostoma braziliense* .Dogs are commonly infected by *Ancylostoma caninum*, but may also be infected by *Ancylostoma braziliense*.

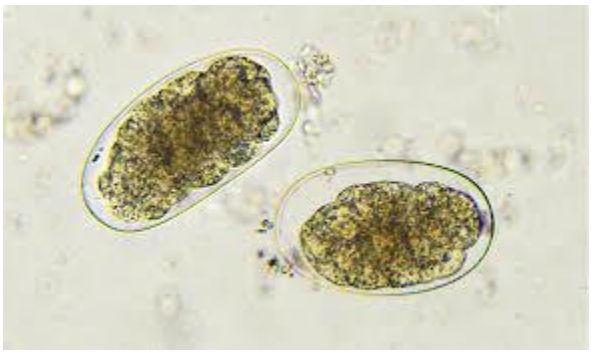
In Asia, *Ancylostoma ceylanicum* is endemic among dogs , cats and infects humans.

Morphology

1-eggs

2-larva (Two types)

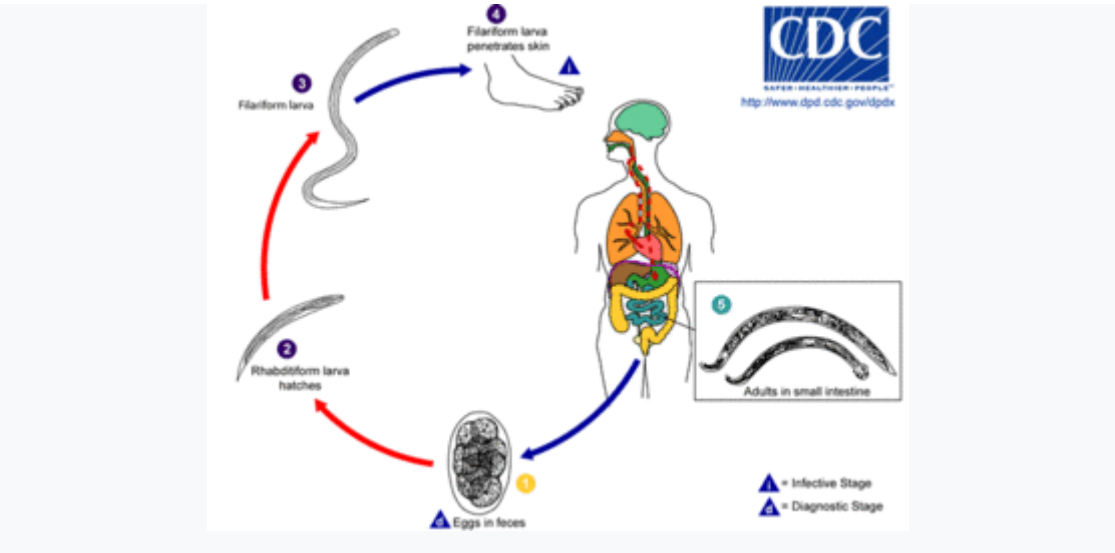
3-adult (male and female)



The two species that commonly infect humans are A.duodenale and N.americanus.

N. americanus is generally smaller than *A. duodenale*, with males usually being 5 to 9 mm long and females about 10 mm long. Instead of the two **pairs of teeth** in *A. duodenale*, *N. americanus* has a pair of **cutting plates** in the buccal capsule. Also, the hook is much more defined in *Necator americanus*.

Life cycle



1-simple type

2-infective stage is the larvae

3-route of infection via skin

4-site of infection is the s.i

The host is infected by the **larvae**, not by the eggs, and the usual route is **through the skin**. Hookworm larvae need warm, moist soil, above 18 °C, in order to hatch. They will die if exposed to direct sunlight or if they become dried out. *Necator* larvae can survive at higher temperatures than *Ancylostoma* larvae.

First-stage larvae (L1) are non-infective, and once hatched in the deposited feces, they feed on soil microorganisms until they

moult into second stage larvae (L2). First- and second-stage larvae are in the rhabditiform stage. After feeding for seven days or so they will moult into third-stage larvae (L3) known as the filariform stage, which is the non-feeding, infective stage. Filariform larvae can survive for up to two weeks. They are extremely motile and will move onto higher ground to improve their chances of finding a host.

N. americanus larvae can only infect through penetrating skin, but *A. duodenale* can also **infect orally**. A common route of passage for the larvae is the skin of barefoot walkers. Once the larvae have entered the host they travel in the circulatory system to the lungs where they leave the venules and enter the alveoli. They then travel up the trachea and are coughed up, swallowed and end up in the small intestine. In the small intestine, the larvae moult into stage four (L4) the adult worm. It takes from five to nine weeks from penetration to maturity in the intestine.

Necator americanus can cause a prolonged infection lasting from one to five years with many worms dying in the first year or two. Some worms though have been recorded as living for fifteen years or more. In comparison, *Ancyclostoma duodenale* worms are short-lived lasting for around six months. However, larvae can remain dormant in tissue stores and be recruited over many years to replace the worms that die.

The worms mate inside the host, in which the females also lay their eggs, to be passed out in the host's feces into the environment to start the cycle again. *N. americanus* can lay between **nine and ten thousand eggs** per day, and *A. duodenale* between **twenty-five and thirty thousand** per day. The eggs of the two species are **indistinguishable.**

Worms need five to seven weeks to reach maturity and symptoms of infection can therefore appear before eggs are to be found in the feces, making the diagnosis of hookworm infection difficult.

Symptoms

1-skin phase -----ground itch or creeping eruption (CLM)

2-lung phase -------Loffler's syndromes

3-intestinal phase : Gastrointestinal symptoms and anemia which causes by :

a-sucking of blood

b- injury and bleeding----anemia(iron def. type)

Diagnosis

Signs and symptoms of hookworm infection vary by host and hookworm species. In humans, the first sign of infection is itching and skin rash. Humans with light infections may show no symptoms, but humans with heavy infections may

have abdominal pain, diarrhea, loss of appetite, weight loss, fatigue and anemia. Children's physical and cognitive growth may be affected. A.duodnale sucks about 0.2 to 0.3 blood /worm/day while N.americanus sucks 0.02 to 0.03 cc/worm/day

The standard method for diagnosing the presence of hookworm is by identifying hookworm eggs in a stool sample using a microscope. Because eggs may be difficult to find in light infections, a concentration procedure is recommended..

Conventional stool examinations, such as the Kato-Katz and formalin-ether concentration technique, are the gold standard for diagnosing Ancylostoma infection by detecting the presence of the eggs and adult worms

CBC

Blood film

Occult test