DRACUNCULUS MEDINENSIS

INTRODUCTION

Dracunculus medinensis is a nematode that causes Dracunculiasis. It is also known as the guinea worm disease and is caused by the large female nematode which is the longest nematode infecting humans. The adult female is longer than the male and can grow up to about 1m in length inside the body of the human host. The worm inhabits the cutaneous and subcutaneous tissues of infected individuals.

SCIENTIFIC CLASSIFICATION OF D. *MEDINENSIS*

Kingdom: Animalia

Phylum: Nematoda

Class: Secernentea

Order: Camallanida

Superfamily: Dracunculoidea

Family: Dracunculidae

Genus: Dracunculus

Species: D. medinensis

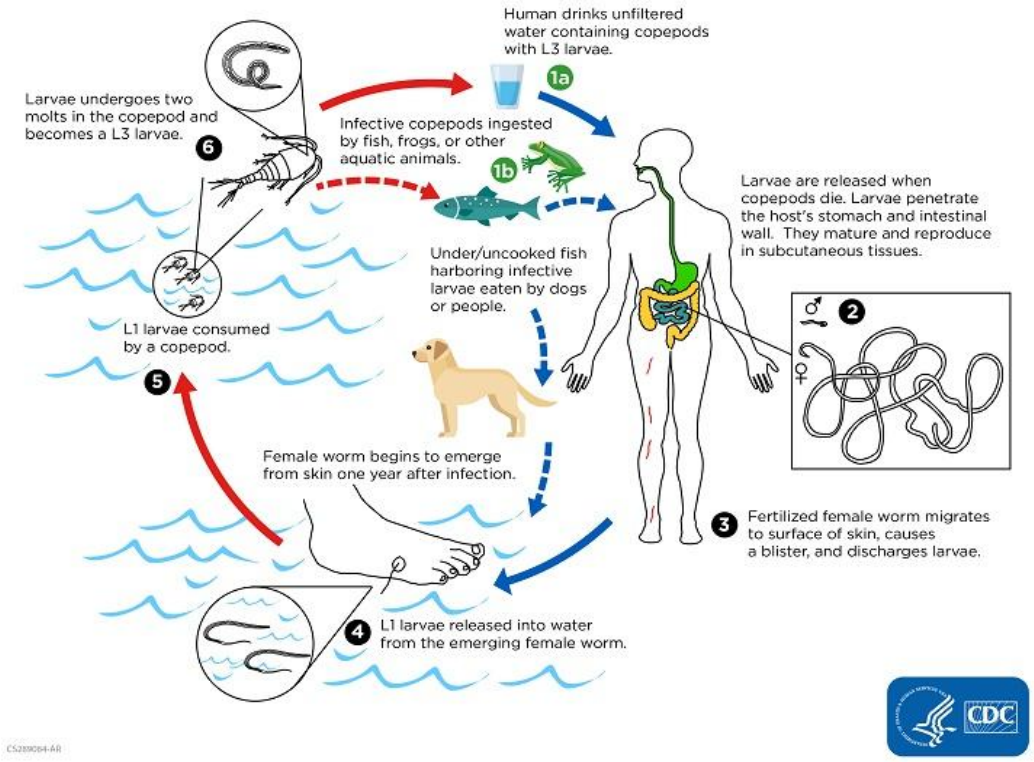
Figure 1: Male and female guinea worm, female longer than male.

Figure 2: copepod

LIFE CYCLE

Humans become infected by drinking unfiltered water containing copepods (small crustaceans) that have been infected with D. medinensis larvae. After ingestion, the copepods die and release the larvae, which then penetrate the host's stomach,

intestinal wall, and enter into the abdominal cavity and retroperitoneal space. After maturing, an adult male worm dies after mating while the female migrates into the subcutaneous tissues towards the surface of the skin. After about a year of infection, the female worm forms a blister on the skin, generally on the distal lower extremity (foot), which breaks open. It can also emerge from other parts of the body like the head, torso, upper extremities, buttocks, and genitalia. The patient then seeks to relieve the local discomfort by placing their foot in water, but when the lesion comes into contact with water, the female worm emerges and releases her larvae. The larvae are then ingested by a copepod, and after two weeks (and two molts) the larvae become infectious. Ingestion of the copepods in drinking water is the last stage that completes the cycle.



Humans become infected by drinking unfiltered water containing copepods (small crustaceans) which are infected with larvae of *D.medinensis* 1. Following ingestion, the copepods die and release the larvae, which penetrate the host stomach and intestinal wall and enter the abdominal cavity and retroperitoneal space 2. After maturation into adults and copulation, the male worms die and the females (length: 70 to 120 cm) migrate in the subcutaneous tissues towards the skin surface 3. Approximately one year after infection, the female worm induces a blister on the skin, generally on the distal lower extremity, which ruptures. When this lesion comes into contact with water, a contact that the patient seeks to relieve the local discomfort, the female worm emerges and releases larvae 4. The larvae

are ingested by a copepod ❺ and after two weeks (and two molts) have developed into infective larvae ❻. Ingestion of the copepods closes the cycle ❶.

PATHOLOGY

Female worms elicit allergic reactions during blister formation as they migrate to the skin, causing an intense burning pain. Such allergic reactions produce rashes, nausea, diarrhea, dizziness, and localized edema. Upon rupture of the blister, allergic reactions subside but skin ulcers form, through which the worm can protrude, the ulcers can be infected by bacteria leading to abscesses. Healing is complete only when the worm is removed.

Death of the adult worms in joints can lead to arthritis and paralysis in the spinal cord.

INTERESTING FEATURES OF THE PARASITE THAT MAKE IT VERY DIFFICULT TO MANAGE

As the female grows inside the body, the host remains unaware of its presence. The worms prevent pain by secreting opiates and dodge the immune system by coating themselves with human proteins. The pain and burning sensation it causes when the blister ruptures causes the victim to go to search for cool water to relieve the burning where the female can release larvae.

The annual cycle maximizes the chances of the larvae finding stagnant water where the copepods can be infected. There is no vaccine to prevent the disease, no drug to treat it and no protective immunity after infection to prevent re-infection. Therefore the only way to deal with this infection is to prevent the disease from spreading. The main effects of the disease are on the productivity of the infected people. Children infected cannot go to school and adults infected are so weakened and in pain that they cannot take part in farming and other productive activities leading to an increased financial burden.

TREATMENT

The traditional technique which involves winding the worm out on a stick has been a treatment used successfully for centuries but proves to be a very painful method. An alternative method is done by surgically removing the worm. The surgical procedure

Figure 5: A worm being rolled out from a patient

Figure 4: The worm finds its way out upon rupture of the blister

is only successful if the entire worm is near the surface of the skin.

PREVENTIVE MEASURES TAKEN

Only humans are infected by the guinea worm, and the larvae die within months if no one swallows the copepods carrying them. So stop human infections and the worm disappears. There are two simple ways of preventing infection:

• Stop infected people from contaminating the water supplies with the larvae.

• Drink boiled and filtered water.

Clean drinking water alone helped eradicate guinea worm from many countries over the past century. Then, in 1986, the World Health Organization declared guinea worm eradication an official goal.

Making of wells and bore holes would be the ideal method to make sure that clean water is supplied but these methods have proved to be expensive therefore cheaper and effective measures have been employed to deal with the situation.

THE SUCCESSFUL MEASURES THAT HAVE BEEN TAKEN SO FAR INCLUDE:

• Filters for household water stores.

• Use of pesticides to kill the copepods and.

• Containment areas for infected people to go to when the worm appears. This prevents infected individuals from contaminating water supplies. Now there are many containment centers in Africa staffed by local volunteers trained to remove worms using the tiring method of winding them gently around a stick.

TREATMENTS

There is no vaccine or medicine to treat or prevent Guinea worm disease. Untreated cases can lead to secondary infections, disability and amputations. Once a Guinea worm begins emerging, the first step is to do a controlled submersion of the affected area in a bucket of water. This causes the worm to discharge many of its larvae, making it less infectious. The water is then discarded on the ground far away from any water source. Submersion results in subjective relief of the burning sensation and makes subsequent extraction of the worm easier. To extract the worm, a person must wrap the live worm around a piece of gauze or a stick. The process may take several weeks. Gently massaging the area around the blister can help loosen the worm. This is nearly the same treatment that is noted in the famous ancient Egyptian medical text, the Ebers papyrus from c. 1550 BC. Some people have said that

extracting a Guinea worm feels like the afflicted area is on fire. However, if the infection is identified before an ulcer forms, the worm can also be surgically removed by a trained doctor in a medical facility.

SUMMARY

Feature	Characteristic
Mode of infection/ Port of entry	Oral, contaminated water
Source of infection	Infected *Cyclops, MESOCYCLOPS LEUEKARTI* (a fresh water crustacean)
Infective stage	*Cyclops* containing **third instar larva**
Digestion of *Cyclops* and migration of the 3rd instar larva in the body of definitive host	*Cyclops* is digested by host's gastric juices in the stomach. Under the influence of digestive juices the larvae become active and penetrate the gut wall migrate through the host's intestinal wall into the deeper connective tissue/retroperitoneal connective tissue attain maturity in 3 – 4 months
Site of localization	Subcutaneous tissues of exposed parts, like, legs, back, arms, and ankles
Pathogenic stage	Adult female *Dracunculus*
Incubation period	8-12 months

- Dracunculus medinensis is a somatic nematode which requires two hosts to complete its life cycle.
- Definitive host: Human and an Intermediate host: Cyclops.
- It is a viviparous parasite.
- Infective stage is the Cyclops containing the third instar rhabditiform larva.
- Humans get the infection by drinking contaminated water containing the infected Cyclops.
- Larva are digested out of the Cyclops by the acidic juices of the stomach.
- The larva migrates through the intestinal wall and reach the retro-peritoneal connective tissue where they grow and attain maturity.
- The male Dracunculus resides in the retroperitoneal connective tissues and dies shortly after copulation.
- Female Dracunculus is the largest nematode and is found in the subcutaneous tissues in the legs, arms and back.

- Causes Dracunculiasis.
- Clinical manifestations are because of the female emergence through the skin.
- Its body fluid is toxic and blister appears as the female worm makes an attempt to pierce the skin in order to discharge the embryos.
- Secondary bacterial infection is quite common in persons infected with Dracunculus.
- Dracunculiasis is a water borne disease.
- Safe drinking water, not allowing infected persons from entering water bodies like ponds, step wells etc. and removal of Cyclops from the water bodies can help in prevention of the disease.