

Dracunculiasis

COMMON NAMES

Guinea worm, Medina worm, pharaoh worm

BACKGROUND

Dracunculiasis follows ingestion of freshwater contaminated with copepods (water fleas) that contain the parasitic nematode *Dracunculiasis medinensis*. The affliction is ancient. It has been identified in a 3,000-year-old mummy and is believed to be described in the Old Testament as the “fiery serpent” responsible for torturing the Hebrews during their exodus from Egypt. Mortality is generally low, but secondary bacterial infections may be life-threatening due to lack of access to health care in most endemic areas. Associated painful and infected ulcers can substantially impair mobility and incapacitate patients for weeks or months.

The presence of Guinea worm disease in a community usually indicates extreme poverty and the absence or inadequacy of safe drinking water. The health status and livelihoods of entire villages may be negatively affected if children are prevented from attending school and adults from tending their fields or livestock.

Once prevalent in 20 nations in Africa, the Middle East, and Asia, Guinea worm disease affected approximately 3.5 million people when eradication efforts began in 1986. The Global Dracunculiasis Eradication Campaign (led largely by The Carter Center, founded by former US President Jimmy Carter and his wife, Rosalynn) has dramatically reduced the number of cases to fewer than 5,000 reported in 2008. Only 6 endemic countries remain: Sudan, Ghana, Mali, Ethiopia, Nigeria, and Niger.

PATHOPHYSIOLOGY

Transmission occurs by accidental consumption of tiny *Cyclops* copepods, often found in stagnant pond water, that have ingested *D medinensis* larvae. Though stomach digestive juices kill the copepods, the larvae of the Guinea worm survive and penetrate the stomach or small intestinal wall, migrating to the subcutaneous tissue of the abdomen and thorax. During the next 2 to 3 months, these larvae develop into adult worms and mate. The male worms die shortly after copulation



Blue indicates areas of high risk.

while females continue to mature and burrow into connective tissue and along long bones. Approximately a year following initial infection, female worms emerge through the dermal surface. Dependent regions including the foot and lower leg are the most common exit points, although any part of the body can be involved. Often multiple worms can appear at the same time—as many as 40 or more have been documented to emerge simultaneously. A blister forms at the site of egress, and the associated burning sensation elicited by worm penetration is relieved by soaking the affected limb.

Submerging the affected body part in water triggers gravid females to release hundreds of thousands of microscopic larvae, a particularly unfortunate occurrence when released in a community water source. These larvae are then ingested by copepods, completing the life cycle. There is no acquired immunity to Guinea worm, so simple prevention techniques such as water filtration and health education are required to avoid repeated infections.

CLINICAL PRESENTATION

Symptoms from migrating adult parasites are rare but may include an urticarial rash, fever, nausea, vomiting, diarrhea, and dizziness. Worms emerge over a period of weeks and produce intensely painful edema, blistering, and ulceration. Baseline health and nutritional status play important roles in determining the rate and success of ulcer healing. The process may be prolonged and, in many cases, is complicated by secondary bacterial infection, abscess formation, septic arthritis, sepsis, or tetanus. Joint infection may result in deformities and limb contractures. The mean length of disability is

10 weeks, although some patients experience continuing pain for an additional 12 to 18 months.

DIAGNOSIS

Guinea worms are diagnosed clinically as they approach dermal tissue and form a painful papule, which subsequently enlarges and ruptures to expose the adult worm. Immersion of affected body parts in water can lead to a characteristic “white cloud,” representing release of larvae.

TREATMENT AND PREVENTION

At present, no medications are available to treat or prevent dracunculiasis. Pain is addressed symptomatically with analgesics, although these are rarely available in the remote areas where the disease remains endemic. Antibiotics are critical for management of superinfections. Affected limbs should be kept clean, disinfected, and bandaged. Emerging worms are easily torn if pulled with force. Instead, extrusion is facilitated by curling worms around a small stick and manually winding them several centimeters daily. This method, which is painful and can take up to a month, has been practiced for centuries. Some scholars suggest that this traditional treatment for Guinea worm is the basis for the caduceus and staff of the Aesculapius symbol of medicine.

Dracunculiasis eradication strategies are focused on behavior modification and health education. Nylon water filters or specially designed filtration straws effectively strain copepods. Affected individuals are encouraged not to soak their affected limbs in areas where water is used for public consumption. Vectors are targeted through treatment of water sources with the safe larvicide temephos and the construction of boreholes or deep wells.

A number of favorable disease features render Guinea worm a promising candidate for eradication: seasonality is marked, assisting the timing and effectiveness of surveillance and control interventions; human carrier states are limited to the 1-year incubation period and no animal reservoir exists; the intermediate host is contained (not mobile, such as mosquito vectors); the diagnosis is relatively

easy and worm protrusion is required for transmission; and the methods for controlling transmission are not complex. The Global Dracunculiasis Eradication Campaign, working in partnership with endemic countries, hopes that disease elimination will be achieved within the next several years. Guinea worm will be the first parasitic disease to be eradicated in human history.



IMAGE 1

This tell-tale blister, which forms up to a year following infection, is the first sign of Guinea worm disease. During the next 24 to 48 hours, the blister will burst and the worm will emerge. Even though a burning sensation often results, patients should be instructed not to cool the wound by placing it in a community water source. *Courtesy: The Carter Center.*

**IMAGE 2**

A threadlike, whitish guinea worm burns a hole from inside and breaks through the skin. Dracunculiasis derives its name from the Latin term for “affliction with little dragons.” *Courtesy: The Carter Center/Louise Gubb.*



IMAGE 3A, 3B

A local health worker removes a guinea worm from the foot of a 9-year-old patient in Ghana (Image 3A). A guinea worm case containment center was established to assist with management of a disease outbreak. Traditionally, extraction is achieved by wrapping the worm on a small stick or moist bandage and slowly winding (Image 3B). The process is painful and frequently takes weeks. Worms may be 1-m long. *Courtesy: The Carter Center/Louise Gubb.*

**IMAGE 4**

Ulceration and secondary bacterial infection constitute alarming complications of dracunculiasis. *Courtesy: Kirsten Johnson.*

**IMAGE 5**

Women and children gather and filter water from their community water source. Filtering drinking water is highly effective for reducing guinea worm disease, especially when coupled with other health education strategies. *Courtesy: The Carter Center/Louise Gubb.*