Health Matters
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Parasitic Roundworm Diseases

Overview

A parasite is an organism that exists by depending on another organism. Parasites that infect humans are much more widespread than many of us realize. These diseases affect not only poverty-stricken peoples in remote areas of the world, but they also can be important health problems for people throughout the world, including the United States.

As with other parasitic diseases, roundworm infections are more common in warm climates than in cooler, temperate areas. Many roundworm parasitic diseases result from human carelessness and a lack of appropriate personal hygiene and sanitation measures. Thus, the best solution to the problem rests in preventing these infections rather than in curing them.

Roundworms, or nematodes, are a group of invertebrates (animals having no backbone) with long, round bodies. They range in size from those plainly visible to the naked eye to those several hundredths-of-an-inch long and visible only under a microscope. Most roundworm eggs or larvae are found in the soil and can be picked up on the hands and transferred to the mouth or can enter through the skin. With the exception of the roundworm that causes trichinosis, mature adult roundworms eventually end up or live in human intestines and cause a variety of health problems.

Some of the most common parasitic roundworms in humans are

- *Enterobius vermicularis*, the pinworm that causes **enterobiasis**
- *Ascaris lumbricoides*, the large intestinal roundworm that causes **ascariasis**
- *Necator* and *Ancylostoma*, two types of hookworms that cause **ancylostomiasis**
- *Trichuris trichiura*, the whipworm that causes **trichuriasis**
- *Strongyloides stercoralis* that causes **strongyloidiasis**
- *Trichinella spiralis* that causes **trichinosis**

We discuss roundworms that infect human intestines only in this fact sheet.

Pinworm Infection (Enterobiasis)

A pinworm is the most common roundworm parasite in temperate climates-even in areas with high levels of sanitation. In the United States, it is the most common of all parasitic roundworm infections, affecting up to one-third of children in some areas. Because pinworm infection is spread mainly by children, it is found most often in family groups, day-care centers, schools, and camps.

Pinworms are small, threadlike roundworms found primarily in the colon and rectum. The life cycle of the pinworm-egg, larva, and mature worm-takes place inside the human body and requires from 3 to 6 weeks to complete.

How do pinworms get into the body?

Pinworms enter your body when eggs are swallowed. The female pinworm expels thousands of eggs into the environment. Because the eggs are moist and a bit resistant to drying, they may be able to infect someone for several days after being distributed in dust. They can cling to the fingers of children.

Exposure to infective eggs may occur if you are infected and then scratch the contaminated area (the area around the anus where the female worm deposits her eggs), transferring the eggs to your fingertips and from there to your mouth. The eggs may be scattered into the air from bed linen and clothing, and can cling to doorknobs, furniture, tubs and faucets, and even food. Although you may have no symptoms over a long period, episodes of infection may return repeatedly.

Folklore is filled with fantastic descriptions of symptoms and abnormal behavior blamed on pinworm infection. Actually, the symptoms are usually mild and vague. Movement of egg-laden female worms from the anus will often produce itching of the anus or vagina that, in some cases, may become very intense and even interfere with sleep.

Diagnosis

Your health care provider can diagnose pinworm infection by finding the eggs. The most common way to collect the eggs is a rather simple one involving swabbing the anal area with the sticky side of a piece of transparent cellophane tape. The tape is then transferred to a slide where it can be looked at under a microscope.

Prevention

You can prevent becoming infected or reinfected with pinworms by

- Bathing frequently
- Using clean underclothing, night clothes, and bed sheets
- Washing your hands routinely, particularly after using the bathroom

Treatment

Some health care providers believe that treatment is not necessary for pinworm infections that have no symptoms. This is because children usually outgrow the infection. Because of the strong probability that small children will get infected again outside the home, strenuous efforts to eliminate the eggs from the household are of little help.

If your health care provider does prescribe medicine, all members of your household should take it, regardless of whether they have symptoms. Medicines such as mebendazole and pyrantel pamoate (Povan) are the most useful in treating pinworm infections.

To relieve intense itching that often accompanies pinworm infection, your health care provider may prescribe a soothing ointment or cream.

Roundworm Infection (Ascariasis)

The name *Ascaris lumbricoides* reflects the resemblance of this intestinal roundworm to the common earthworm known as *Lumbricus*. Ranging in length from 6 to 13 inches, the female worm may grow to be as thick as a pencil. Ascaris infections are common throughout the

world in both temperate and tropical areas. In areas of poor sanitation, everyone may be harboring the parasite. Amazingly, up to a hundred worms can infect one person.

How is ascariasis spread?

Almost more than any other parasitic disease, human carelessness causes ascaris. Human feces in streets, fields, and yards are a major source of infective eggs in heavily populated areas. The eggs of ascarids do not infect humans when first excreted by the worm. The eggs are very resistant to extremes of temperature and humidity. They usually are transmitted by hand to mouth, although the use of human feces as fertilizer may also permit transmission of infective eggs by food that is grown in the soil and eaten without being thoroughly washed. The eggs require several weeks to develop and become infective.

If you swallow the infective eggs, they pass into your intestine where they hatch into larvae. The larvae then begin their journey through your body. Once through the intestinal wall, they reach your lungs by means of the blood or lymphatic system. In the lungs, they pass through the air sacs, are carried up the bronchial tree with respiratory secretions, and are re-swallowed to be returned to the small intestine where they grow, mature, and mate. The worms become mature in about 2 months.

Pets can transmit these worms to humans

Other species of ascarids such as *Toxocara*, which infect dogs and cats, can, under certain circumstances, be picked up by humans. In dogs and cats, these ascarids have a migratory cycle similar to *A. lumbricoides*. In humans, however, they fail to reach the intestine. Instead they remain active in other body tissue for some time. This state of larval migration is known as visceral larva migrans.

Young puppies and kittens that defecate outdoors contribute most to contamination of soil by eggs that must incubate for some time in the soil. Almost all dogs are infected at birth. Older dogs, however, have usually become immune to the parasite.

Symptoms

A few worms in your intestine may cause no symptoms or may give rise only to vague or intermittent abdominal pain. Heavy infection may cause partial or complete blockage of your intestine resulting in severe abdominal pain, vomiting, restlessness, and disturbed sleep. The heavier or greater the worm infection, the more severe your symptoms are likely to be. Occasionally, the first sign of infection may be the presence of a worm in vomit or in the stool.

Diagnosis

If a large number of larvae invade your lungs at one time, they may cause an illness resembling pneumonia. This stage of the disease precedes the intestinal phase by weeks, and the symptoms are difficult to diagnose. Once mature female worms are present in your intestine, however, a health care provider can diagnose the infection by finding characteristic eggs in the stool.

Treatment

Your health care provider can treat ascariasis successfully with mebendazole, albendazole, or pyrantel pamoate.

Hookworm Disease (Ancylostomiasis)

One of the most common roundworm infections is hookworm. You can pick up hookworms as a result of unsanitary conditions. Hookworm eggs are passed in human feces onto the ground where they develop into infective larvae. When the soil is cool, the larval worms crawl to the nearest moist area and extend their bodies into the air. They remain there-waving their bodies to and fro-until they come into contact with the skin, usually when stepped on by a bare foot, or until they are driven back down by the heat.

Hookworm is widespread in those tropical and subtropical countries in which people defecate on the ground and soil moisture is most favorable. *Necator americanus* is the prevailing species in the southeastern United States.

How hookworms get into your body

You can get hookworms by walking barefoot over contaminated soil. In penetrating the skin, the larvae may cause an allergic reaction. It is from the itchy patch at the place where the larvae entered that the early infection gets its nickname "ground itch." Once larvae have broken through the skin, they enter the bloodstream and are carried to the lungs. (Unlike ascarids, however, hookworms do not usually cause pneumonia.) The larvae migrate from the lungs up the windpipe to be swallowed and carried back down to the intestine.

Pets can transmit these parasites to humans

Some animal hookworms can become accidental parasites of humans in a manner similar to the ascarids. If you are exposed to these animal hookworm larvae, they can penetrate your skin but, like the ascarids, cannot complete their life cycle. This results in these larvae wandering around in the subcutaneous tissue beneath the exposed skin, a condition called cutaneous larva migrans.

Symptoms

Diarrhea, particularly if you have never been infected, sometimes starts as the worms mature in your intestines and before eggs appear in the stool. Other signs and symptoms at this stage include vague abdominal pain, intestinal cramps, colic, and nausea.

Scientists have learned that people in good health and on a diet containing adequate iron can tolerate the presence of these worms in small or moderate numbers without having problems. In chronic infections, if the number of parasites becomes great enough, you can develop serious anemia because of blood loss from the worms attaching themselves to the intestine and sucking the blood and tissue juices. When this situation is combined with poor nutritional intake, pregnancy, and/or malaria, the resulting anemia can be severe.

Ancyclostoma canium, an illness caused by a particular species of dog hookworm, has been described in Australia. This worm may almost complete its development in the lower small intestine, but produces a severe inflammatory reaction in the bowel, causing abdominal pain, diarrhea, and an increase in certain white blood cells called eosinophils.

Diagnosis

A laboratory worker will examine your stool specimens to look for and count the number of eggs. If the egg output is large enough-more than 2,000 eggs per gram of stool-your health care provider will assume that the infection may cause anemia and start treating you.

Treatment

Once you have been diagnosed with hookworm disease, your health care provider can prescribe medicines such as mebendazole or albendazole. You might also be given an iron supplement with this treatment.

Whipworm Disease (Trichuriasis)

The name whipworm comes from this parasite's long, very thin, whiplike shape. This parasitic roundworm infection of the large intestine often has no symptoms, but a health care provider usually can diagnose it by examining your stool and finding whipworm eggs. Heavy infections may cause intermittent stomach pain, bloody stools, diarrhea, and weight loss. Fertilized eggs develop outside the body, and an embryonated egg is produced in 3 weeks in a favorable environment; that is, warm, moist, shaded soil.

Although the incidence of whipworm infection is high, its intensity is usually light. In the United States, the infection occurs principally in warm, moist climates, most frequently among children. You can get infected by accidentally eating whipworm eggs on your hands or in food or drink. Severe infections in young children can result in serious disease with bloody diarrhea and a condition called rectal prolapse.

Treatment

Health care providers treat whipworm disease most often with mebendazole or albendazole.

Strongyloidiasis

The parasitic roundworm called *Strongyloides stercoralis* mainly infects humans. This parasite has different types of life cycles. One is direct, similar to that of the hookworm. After a short feeding period and development in the soil, the larvae penetrate human skin, enter the blood stream, and pass through the right side of the heart to the lungs. From the lungs, the adolescent parasites go up the windpipe into the mouth, are swallowed, and reach the upper part of the small intestine where they develop into mature worms.

Under certain conditions, parasites may undergo an indirect life cycle in which free-living mature male and female worms develop in the soil and produce a new generation of large numbers of larvae.

At times, the larvae may develop rapidly into the infective state in the intestine where they penetrate the intestinal lining instead of passing out of the body in the feces, as occurs normally. This modification of the life cycle, called internal autoinfection, explains persistent strongyloidiasis, as long as 40 years in people who have moved to areas where the disease is not generally found. Autoinfection may produce heavy infections and severe disease (also known as disseminated strongyloidiasis), especially in people with reduced immunity such as those receiving corticosteroids or other immunosuppressive drug treatment, or those with acquired immunodeficiency due to human retroviruses (HIV or HTLV-1).

Symptoms

Many *Strongyloides* infections are mild and go unnoticed. Moderate infections may cause a burning pain in your abdomen. You may have nausea and vomiting and alternating diarrhea and constipation. Severe infections result in anemia, weight loss, and chronic diarrhea. Disseminated strongyloidiasis in severely immunocompromised people can cause a variety of

symptoms, including an ARDS-like pneumonia (Acute Respiratory Distress Syndrome).

Diagnosis

Your health care provider can use blood tests to help establish the diagnosis, but those tests are prone to error. You may have to have repeated stool examinations.

Treatment

Thiabendazole (Mintezol) given twice daily for 2 or 3 days is the one of the treatments health experts recommend. Ivermectin given in a single dose for 1or 2 days has become the medicine of choice. Albendazole given in two courses 10 days apart is also effective. Disseminated disease requires longer treatment.

Trichinosis

Trichinosis is an infection caused by the larvae of a most versatile roundworm, *Trichinella spiralis*. This parasite can infect virtually every meat-eating mammal. Unlike the other parasitic roundworm diseases that we have discussed, trichinosis is not an intestinal infection in the usual sense. It is the migration of *T. spiralis* larvae through the body and their encystment (becoming enclosed in a capsule) in muscle tissue that creates serious problems. The parasite is especially common in rats and in swine that feed on uncooked garbage. The disease occurs in humans when they eat undercooked infected pork.

Although trichinosis is sometimes found in cities, it is much more common in rural areas, particularly in the hog-raising areas of the United States. Because many states have adopted laws requiring that all garbage fed to hogs be sterilized, fewer people get trichinosis. Human cases have also been associated with eating undercooked home-made sausage that contains pork or horse meat, as well as eating walrus or bear meat.

Typically, the life cycle of the parasite begins when a person or an animal eats contaminated meat containing larvae. Digestive juices from the stomach dissolve the capsule-like cyst and release the parasites. The larvae then penetrate into the intestine where they mature and mate. Female worms then pass larvae into the blood stream where they make their way through the capillaries (tiny blood vessels) into the muscle fibers. Once in the muscle fibers, they encyst again and begin a sometimes long life.

Symptoms

The average case of trichinosis is not severe and produces no noticeable discomfort. It can produce symptoms that are frequently overlooked or ignored-a slight stomachache and achy muscles and joints. Invasion by a large number of parasites, however, produces symptoms that mimic food poisoning followed by severe "muscular rheumatism."

Diagnosis

Although your health care provider may suspect that you have trichinosis on the basis of clinical signs, it is usually diagnosed one or two ways.

- A blood test that shows an increase in the number of eosinophils, a type of white blood cell
- Microscopic examination of muscle tissue to look for the larvae

Treatment

Your health care provider can prescribe medicine only to relieve your symptoms. There is no treatment for the infection. If your health care provider diagnoses infection while you are still having digestive symptoms, standard antiparasite medicines can be used to dislodge some of the worms. Once encystment of the parasite has begun, treatment is for any symptoms. Your chances of recovery are good.

Albendazole may help you if treatment is begun very early, during the incubation state. Corticosteroids can relieve the inflammatory reaction during the larval migration state, and you should take them with albendazole. Steroids could, however, prolong the intestinal phase of the infection.

Prevention

Health experts have known all the basic facts necessary for preventing trichinosis in humans for years. You can kill the parasites by cooking (allowing all parts of the meat to reach at least 150 degrees Fahrenheit) or freezing (16 degrees Fahrenheit for 36 hours). Irradiation can also kill them. Smoking, pickling, and other methods of processing or preserving meats do not kill the parasites.

Research

Researchers at the National Institute of Allergy and Infectious (NIAID) diseases are conducting basic and clinical research on the prevention, control, and treatment of a variety of parasitic diseases, including some caused by parasitic roundworms. NIAID scientists are trying to determine the factors that allow *Strongyloides stercoralis* roundworms to infect humans and cause disease. The findings from this research may help scientists develop a skin test to diagnose stronglyloidiasis.

More Information

National Library of Medicine
MedlinePlus
8600 Rockville Pike
Bethesda, MD 20894
1-888-FIND-NLM (1-888-346-3656) or 301-594-5983
http://medlineplus.gov

Centers for Disease Control and Prevention
National Center for Infectious Diseases
Division of Parasitic Diseases
1600 Clifton Road, NE
Atlanta, GA 30333
1-800-311-3435 or 404-639-3534
http://www.cdc.gov/ncidod/dpd

U.S. Department of Agriculture
Food Safety and Inspection Service
1-888-MPHotline (1-888-674-6854) (Meat and Poultry Hotline)
http://www.fsis.usda.gov

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