PARASITIC ROUNDWORM DISEASE

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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 eggladen 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.
ENTEROBIASIS

1. Maturation in humans: 15–26 days
2. Contaminated hands, food, drink, clothing, dust
3. Caecum and lower ileum
4. Gravid female crawls through anus to oviposit on perianal skin

Autoinfection by scratching: Very frequent
Mature in hours (viable for months)
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.
The Roundworms

In nature, there are many thousands of different species of roundworms collectively referred to as “nematodes”. It has been estimated that there may be as many as a half million species of these worms found or still to be found. If the estimates are correct, then the nematodes are just behind insects as the most diverse group of animals on earth. For example, in just one hand full of dirt, there may be thousands of these worms. All of the roundworms look pretty much the same with the exception of size. If one has seen the common earthworm, then he or she pretty much knows what they look like. They have a simple, worm-like appearance and an internal body cavity referred to as a “pseudocolon”. To the untrained it is often difficult to tell the head from the tail of the worm.

A. lumbricoides, the giant roundworm of man, lives in the small intestine of man as the name suggests. The disease caused by this organism is referred to as Ascariasis. Female worms can reach a length of 1 foot; males are smaller.
Epidemiology

*Ascaris lumbricoides* has a worldwide distribution but the highest incidence is in tropical and subtropical areas especially if there is inadequate sanitation. It is estimated that there are around 650 million to a billion cases throughout the world. That’s about one-quarter of the world’s population! Most cases are in Asia and South America. In the United States, the incidence is the highest in the Southeast due to the warmer temperatures and higher humidity. It is also more prevalent in inner city areas. More than 4 million persons are thought to be infected – most of them being immigrants to this country. There is no relationship to age, gender and ethnic background (other than place of birth or travel). They are, however, more prevalent among children. This may be due to hygiene problems or to the size of the lumen of the small intestine of children which is smaller than in adults and facilitates attachment of the worms.
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 reswallowed to be returned to the small intestine where they grow, mature, and mate. The worms become mature in about 2 months.
ASCARIASIS

[Diagram showing the life cycle of Ascaris lumbricoides, including stages of development, egg fertilization, and fecal output.]
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. There are also drugs that can be used to cause the worms to release and can be used when there is intestinal blockage.
Update

New evidence

Evidence-based guidelines
No new evidence-based guidelines since 1 March 2007.

HTAs (Health Technology Assessments)
No new HTAs since 1 March 2007.

Economic appraisals
No new economic appraisals relevant to England since 1 March 2007.

Systematic reviews and meta-analyses
No new systematic review or meta-analysis since 1 March 2007.
Primary evidence
No new high quality randomized controlled trials since 1 March 2007.

Primary evidence
No new high quality randomized controlled trials since 1 March 2007.

New policies
No new national policies or guidelines since 1 March 2007.

New safety alerts
No new safety alerts since 1 March 2007.

Changes in product availability
No changes in product availability since 1 March 2007.
Roundworm treatment

Which therapy?

• Drug therapy and hygiene measures should be combined to break the cycle of reinfection.
Clinical Knowledge Summaries: Previous version – Roundworm

- Mebendazole is the treatment of choice in adults and children older than 2 years. The dose is 100 mg twice a day for 3 days.

- Piperazine combined with senna (as a powder) is an alternative and is suitable for adults and children older than 3 months. It is given as a single dose.

- Treatment does not usually require repeating if there is no evidence of reinfection after 2–3 weeks.
• For people with epilepsy, neurological disease, or severe renal or hepatic impairment, prescribe mebendazole, as neurotoxic reactions resulting in convulsions have been reported in people with neurological or renal abnormalities.

• If intestinal or biliary obstruction is suspected, piperazine is the drug of choice.

• During pregnancy, it is generally recommended that, whenever possible, treatment is delayed until after the birth. There is no risk of infection to the fetus or to the baby during birth. Neither mebendazole nor piperazine is licensed for use during pregnancy.

• In severe cases of Ascaris infection unresponsive to standard treatment, seek specialist advice.
Prescriptions

Mebendazole

Mebendazole suspension: 100mg twice a day for 3 days

Age from 2 years to 11 years 11 months

- Mebendazole 100mg/5ml oral suspension. Take one 5ml spoonful twice a day for 3 days. Supply 30ml.

- NHS Cost £1.77

- Licensed use: yes
Ancylostoma Duodenale and Necator Americanus
Some Facts....

- Hookworms infect an estimated 1 billion people worldwide, mostly in tropical and sub-tropical climates.
- A. duodenale and N. americanus are the two hookworms that infect humans.
- A. duodenale is found in southern Europe, northern Africa, India, China, the Middle East, and the Americas.
- N. americanus can be found in the southeastern U.S. and Australia.
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.
ANCYLOSTOMIASIS
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.
Transmission

- Filariform juveniles wait in soil or feces and wave back and forth to increase chances of finding a host.
- Filariforms then penetrate the skin (usually hands or feet).
- Children, elderly people and people who work about contaminated soil are at high risk.
Pathogenic Effects

- Asymptomatic until worms have already started multiplying
- Symptoms include:
  - Irritation of skin at site of penetration
  - Iron-deficiency anemia
  - Abdominal pain
  - Diarrhea
  - Loss of appetite
  - Weight loss
  - Tiredness
  - Difficulty breathing
  - Cardiomegaly
  - Irregular heartbeat
  - Extreme cases include stunted growth and mental retardation
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.
Control and Treatment

- Scientist are trying to develop a vaccine
- In some countries, infections aren’t treated because they are so common
- Drugs of choice are Albendazole, Mebendazole, and Pyrantel Pamoate
Prevention

- Wear shoes
- Monitor the disposal of humans' feces
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).
STRONGYLOIDIASIS (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 1 or 2 days has become the medicine of choice. Albendazole given in two courses 10 days apart is also effective. Disseminated disease requires longer treatment.