Recognizing Roundworms

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There are a multitude of parasites which can affect humans. Intestinal roundworms, as a group, encompass such varieties of parasites as the pinworm (*Enterobius vermicularis*), the whipworm (*Trichuris trichiura*), the old-world hookworm (*Ancylostoma duodenale*) and the new-world hookworm (*Necator americanus*); however, it is *Ascaris lumbricoides*, that is known as the roundworm of humans and therefore is our **Bug of the Month**.

What is the roundworm of humans?

Attaining lengths of up to 40 cm, *Ascaris lumbricoides* (*A. lumbricoides*) is the largest intestinal nematode parasite of humans. It has a wide geographic distribution, which includes tropical and subtropical regions as well as other humid areas, such as the rural southeastern US. Its body is smooth, cylindrical and has tapered ends.

How is A. lumbricoides transmitted?

Transmission of the roundworm infection occurs through the fecal-oral route with ingestion of the ova from fecally-contaminated materials such as:

- soil,
- water,
- food and
- suboptimally cleaned hands.

Children living in poverty-stricken rural areas are the most frequently affected due to their tendency for hand-to-mouth carriage of fecal material. Most frequently, transmission takes place through soil contaminated with feces due either to the use of night soil (human feces) as fertilizer, or to the inadequacy of sanitary facilities. *A. lumbricoides* eggs born on vegetables transported from endemic areas can result in infection, though this is an infrequent occurrence.

What is the lifecycle?

Following several weeks of maturation in the soil, *A. lumbricoides* eggs become infective and can remain so for years because of their exceptional resistance to environmental stressors. After ingestion, the larvae hatch in the intestine and invade the bowel mucosa to enter the circulatory system where they migrate to the lung parenchyma, breaking into the alveoli. The larvae then ascend the bronchial tree and are swallowed to allow reentry into the small intestine. The larvae now develop into adult worms, mate and produce eggs.

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This process, from initial infection to egg production, requires approximately two to three months. The mature adult worms live for one to two years in the lumen of the small intestine, each female producing up to a remarkable quarter-of-a-million eggs per day that are passed with the feces!

What are the clinical features of roundworm of humans?

Patients may acquire an annoying nonproductive cough and burning substernal discomfort approximately nine to 12 days after ingesting *A. lumbricoides* ova coinciding with the lung phase of larval migration. This substernal discomfort is usually exacerbated by coughing or deep inspiration. Less common symptoms of *A. lumbricoides* infection include dyspnea and blood-tinged sputum. Fever may be reported with temperatures occasionally exceeding 38.5°C (101.3°F). During this symptomatic phase, eosinophilia develops and subsides slowly over the subsequent weeks. Round or oval infiltrates that are a few millimeters to several centimeters in size (nodules or masses) may be seen on chest x-rays which may reveal evidence of eosinophilic pneumonitis (Löffler's syndrome). With serial radiologic studies, these infiltrates may appear transient and intermittent and clear after several weeks. Seasonal pneumonitis, with eosinophilia, may be seen in previously-infected and sensitized hosts in areas where there is seasonal transmission of the parasite.

Adult worms in the small intestine typically cause no symptoms for individuals with established infections. However,

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children in particular are more susceptible to heavy infections in which a large bolus of entangled worms can cause a painful small-bowel obstruction. These worm-ball obstructions can be further complicated by perforation, intussusception, or volvulus. The migration of single worms into aberrant sites may also cause disease. For example, the biliary tree may become obstructed by a large worm, resulting in:

- biliary colic,
- cholecystitis,
- cholangitis,
- pancreatitis, or (rarely)
- intrahepatic abscesses.

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Adult worms that migrate up the esophagus can be expelled by causing fits of coughing. Intestinal and biliary ascariasis is a leading cause of surgical acute abdomen in highly endemic areas—even rivaling acute appendicitis!

How are infections diagnosed?

The microscopic detection in fecal samples of *A. lumbricoides* eggs (65 µm by 45 µm), with their characteristic mamilla, or nipple-like projections, can be diagnostic for most cases of ascariasis. Diagnosis of ascariasis can also be made when a patient presents after the expulsion of an adult worm which is identifiable by its large size and smooth cream-coloured surface. Worm expulsion occasionally occurs in the stool or through the mouth or nose. Ocassionally diagnosis is made by detection of larvae in the sputum or gastric aspirates during the early transpulmonary migratory phase, when eosinophilic pneumonitis occurs, before diagnostic eggs appear in the stool. In established infections, eosinophilia decreases to minimal levels after featuring prominently during the early larval stage. Contrast studies of the GI tract may allow the large adult worms to be visualized (often accidentally). In patients with intestinal obstruction, masses of worms, in gas-filled loops of bowel, may be revealed by a plain abdominal film. The use of ultrasound and endoscopic retrograde cholangiopancreatography (ERCP) can detect pancreaticobiliary worms. ERCP has also been used for the extraction of biliary *A. lumbricoides*.

How is ascariasis treated?

In order to prevent potentially serious complications, *ascariasis* should always be treated. Pharmacotherapy includes one dose of albendazole (400 mg), which is available on compassionate release from the Special Access Programme Therapeutic Product Directorate, Health Canada, or one dose of mebendazole (500 mg). During pregnancy, these benzimidazoles are contraindicated; however, one dose of pyrantel pamoate (11 mg/kg, maximum 1 g), is safe for pregnant women. Uncommon side-effects of these agents include mild diarrhea and abdominal pain. In situations where there is a large parasite load, nasogastric suction should be used to manage partial intestinal obstruction and piperazine should be administered through the nasogastric tube. Complete intestinal obstruction and its severe complications require immediate surgical intervention.

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