

Guide to Life-cycle, Pathology, Symptomatology, and Treatment of Parasites Most Commonly Seen in Refugee Populations

Ancylostoma duodenale and *Necator americanus* (Hookworms)

Hookworm eggs are passed in the stool and then hatch in warm, moist soil, releasing rhabditiform larvae that develop within a few days into filariform larvae. No free-living adult form exists. Filariform larvae invade the skin and migrate through venous blood to the heart and then the lungs, where they penetrate into alveoli and migrate via the trachea into the gastrointestinal system. Once the larvae reach the small intestine, they mature into adults that attach themselves to the duodenal and jejunal mucosa where they suck blood. The worms produce an anticoagulant that causes blood to ooze around the feeding worm, leading to blood in the stool and on-going blood loss. Clinical manifestations are complaints of hunger and nondescript abdominal pain. Severe cases can lead to anemia. Children with significant worm loads may experience growth retardation and lethargy.

Ascaris lumbricoides (Roundworm)

This is the largest intestinal roundworm in humans (8-12 inches in length). Infections are most common in tropical areas with poor sanitation and wherever human feces are used as fertilizer. Nonspecific gastrointestinal symptoms are reported in some patients. If the infection goes untreated, adult worms can live for as long as 12-18 months. ***Patients with multiple parasites including Ascaris should always receive treatment for Ascaris first, due to the risk of migration of the worm in response to noxious stimuli.***

Blastocystis hominis (Protozoan)

Blastocystis is present in many healthy, asymptomatic individuals with stool microscopy showing fewer than three trophozoites per high-powered field. It is often considered non-pathogenic. Infrequently, any of the following symptoms may occur: mild diarrhea (2-4 soft stools per day), abdominal pain, nausea, anorexia, fatigue, bloating, cramps, or alternating diarrhea and constipation. Treatment should be reserved for immunocompromised patients who are symptomatic and in whom no other pathogen or process is found to explain gastrointestinal symptoms.

Clonorchis sinensis (Fluke)

This parasite is commonly known as the oriental liver fluke. Humans get infected by eating uncooked fish containing infectious metacercariae or by ingestion of cysts in drinking water. The parasites live in the distal bile ducts and irritate them by mechanical force and toxic secretions. Depending on the severity of the infection (may be up to thousands of flukes), the liver may become enlarged and tender. The bile ducts gradually thicken, becoming dilated and tortuous. Adenomatous transformation of the biliary epithelium develops. Light infections, however, may produce only mild symptoms or go unrecognized. As additional worms are acquired, indigestion and epigastric discomfort (unrelated to meals), weakness, and weight loss become noticeable. In heavy infections, anemia, liver enlargement, slight jaundice, edema, ascites, and diarrhea also develop. In late stages, tachycardia, palpitations, vertigo, and mental depression may occur.

Entamoeba histolytica (Protozoan)

Entamoeba histolytica occurs in both pathogenic and non-pathogenic strains. Pathogenic strains may penetrate the epithelial tissue of the colon causing ulceration (amoebic dysentery). In some cases, organisms that reach the liver by the portal bloodstream produce abscesses (hepatic amoebiasis). The onset of symptoms of amoebic liver abscesses can be abrupt or insidious. Fever and localized abdominal pain are almost always present. Right shoulder pain usually indicates referred pain from diaphragmatic irritation. The liver is usually tender to palpation. In a fraction of these cases, amoebae may spread to other organs such as the lungs, brain, kidney, or skin, with a high fatality rate.

Giardia lamblia (Protozoan)

This is a flagellate protozoan that exists in trophozoite and cyst form; the cyst form is resistant to drying and other environmental effects and is infectious. Infection is limited to the small intestine and /or biliary tract. It is transmitted through food and water contaminated by sewage, by food handlers with poor hygiene, and through other fecal-oral routes. Infection is more common in children than in adults. Patients with clinical illness may develop acute watery diarrhea with abdominal pain, or they may experience a protracted, intermittent disease, which is characterized by passage of foul-smelling diarrhea or soft stool associated with flatulence, abdominal distention, and anorexia.

Hymenolepis nana (Dwarf tapeworm)

Adults live in the gut lumen of the definitive host. *H. nana* uses the human as both definitive and intermediate host. It is transmitted directly from hand to mouth and, less frequently, by contaminated food or water, and, possibly, by ingestion of insect intermediate hosts. The unhygienic habits of children favor the prevalence of the parasites in the younger age groups. The worm's habitat is the upper two-thirds of the ileum with a life span of several weeks. The ability of *H. nana* to autoinoculate may lead to very heavy worm loads (as many as 2000 worms) and to cramping pain, diarrhea, nausea and vomiting, and headache. Intestinal erosions may occur. In children, heavy *H. nana* infestation may be associated with lack of appetite, abdominal pain with or without diarrhea, anorexia, vomiting, irritability, and, rarely, seizures. These neurologic manifestations have been ascribed to absorption of toxic substances produced by the worms.

Schistosoma species (Fluke)

Schistosomiasis encompasses three distinct phases of clinical manifestations and on a worldwide scale is one of the most common causes of hematuria. Individuals exposed to various *Schistosoma* sp. trematodes will initially produce a pruritic papular dermatitis after penetration of the skin by cercariae. With non-human pathogen species, this is referred to as "swimmer 's itch", and can be contracted from fresh and salt water. Human pathogenic species include the following: *S. mansoni*, *S. japonicum*, *S. haematobium*, *S. mekongi*, and *S. intercalatum*. These species rely on the presence of a fresh water snail as intermediate host and have various geographic distributions. *S. mansoni* is found mainly in tropical Africa, Latin America, the Caribbean, and the Arabian peninsula. *S. haematobium* is found mainly in Africa and the eastern

Mediterranean area. *S. mekongi* and *japonicum*, as their names reflect, are found mainly in the Mekong River delta and in parts of China, the Philippines, and Indonesia, respectively.

After skin penetration, the organism migrates through the blood stream via the lungs before ultimately lodging in the venous plexus draining the bladder (*haematobium*) or the colon.

After four to six weeks, an acute illness (characterized by fever, malaise, cough, rash, abdominal pain, nausea, diarrhea, lymphadenopathy, and eosinophilia) ensues and is termed "Katayama Fever." With heavy gastrointestinal infections, bloody diarrhea and tender hepatomegaly may occur. Chronic disease reflects the worm burden and fibrosis with inflammation at the sites of deposited eggs. Infected individuals may be asymptomatic with light infestations. Heavy colon involvement may cause chronic bloody, mucoid diarrhea, abdominal pain, hepatosplenomegaly, ascites, and esophageal varices (due to portal hypertension). Bladder symptoms related to inflammation and fibrosis may include dysuria, terminal hematuria (microscopic or gross), secondary UTIs, and pelvic pain.

Infections by *S. mansoni* and other species affecting the GI tract are diagnosed by microscopy of concentrated stool specimens to look for eggs. Infections by *S. haematobium* are diagnosed by microscopy of filtered urine. Egg excretion peaks at 12-3 PM. Mucosal biopsies may be necessary for diagnosis, and serologic testing is available at the Centers for Disease Control and Prevention.

Strongyloides stercorarius (Roundworm)

S. stercorarius is usually excreted in the stool as a rhabditiform larva. The rhabditiform larva molts into an infective filariform larva (about 700 Φ m) after a couple of days in the soil. The filariform larvae may penetrate the human skin and migrate in the same manner as the hookworms. When larvae reach the upper part of the small intestine, they develop into adults. The rhabditiform larvae also may develop into sexually mature free-living males and females in the soil. This indirect cycle appears to be associated with the optimal environmental conditions for a free-living existence in tropical countries. Autoinfection and maintenance of the disease may occur (despite movement of the host from an endemic area) when rhabditiform larvae develop into filariform larvae in the gut lumen.

Most patients with strongyloidiasis are asymptomatic. A heavy worm load can lead to epigastric pain, weakness, malaise, and watery diarrhea, perhaps due to an absorptive defect. Upper gastrointestinal radiographic studies may show duodenal and jejunal mucosal edema. Ulceration and even intestinal perforation may occur. The hyper-infection syndrome can be an overwhelming systemic disease and is often fatal. Extensive migration of larvae can lead to derangement of multiple organs, secondary bacterial abscesses in the liver and other organs, and development of adult worms in the bronchial tree. Strongyloidiasis can be diagnosed by demonstrating larval forms in the stool or parasites in duodenal aspirates or biopsies and is suggested by blood tests that show hyper-eosinophilia of greater than 30% without obvious clinical correlation.

Trichuris trichiura (Whipworm)

The embryonic development of *Trichuris* takes place outside the host. An unhatched, infectious first stage larva is produced in three weeks in a warm, moist, and shaded soil environment. When the egg is ingested by humans, the activated larva escapes from the weakened eggshell in

the upper small intestine and penetrates an intestinal villus. *Trichuris* lives primarily in the human cecum, but is also found in the appendix and lower ileum. Clinical manifestations are usually absent in light infections; in heavy or chronic infections, abdominal pain and tenderness, frequent blood-streaked diarrheal stools, nausea and vomiting, weight loss, and anemia may occur.

Adapted from: Massachusetts Department of Public Health, Refugee Health Assessment, "A Guide for Health Care Clinicians"