



Hookworm

Ancylostoma duodenale and *Necator americanus* (hookworms) are similar to roundworms in their worldwide distribution and are common among immigrants from Asia and sub-Saharan Africa. Infection occurs through direct penetration of the skin by the larvae, which travel through the lymphatics and the bloodstream to the lungs and are then swallowed. Infected individuals may be asymptomatic, or they may develop pruritic dermatitis at the site of entry. As with the roundworm, pulmonary infiltrates can occur during the migration phase; this is known as Loeffler's syndrome. Chronic iron deficiency anemia associated with heavy hookworm infection can be severe and debilitating. Eosinophilia is common. The diagnosis is made by stool examination for ova and parasites (E-Fig. 103-8). The treatment is mebendazole.

Helminth Infections Common in Travelers and Immigrants

Strongyloidosis

Strongyloides stercoralis is a helminthic parasite that is found worldwide, although more commonly in the tropics. Infection occurs from contact with contaminated soil; the larva penetrates the skin, migrates to the lungs, and is then swallowed by the individual. The infection is usually asymptomatic, but infection can persist into the chronic phase decades later. Those with symptoms usually have gastrointestinal complaints of bloating, diarrhea, and abdominal pain. Eosinophilia is a common finding in these individuals. In immunocompromised individuals, a hyperinfection syndrome with dissemination of the organism can occur. Hyperinfection syndrome has a higher mortality rate and occurs usually in immigrants who become immunosuppressed as a result of chemotherapy, use of steroids, or illness. Diagnosis is made by stool examination (approximately 30% to 50% sensitivity) (E-Fig. 103-9) or by serology but does not distinguish between chronic and acute disease. Treatment is with ivermectin for 2 days; in the setting of hyperinfection, a longer course is required.

Schistosomiasis

Schistosomiasis is found throughout the tropics and the developing world. Also known as blood flukes, schistosomes use freshwater mollusks as their intermediate host and penetrate the skin of individuals, leading to infection. The three major species are: *Schistosoma mansoni* (Africa, Middle East, South America), *Schistosoma haematobium* (Africa, Middle East), and *Schistosoma japonicum* (China, Philippines, and Southeast Asia). Acute infection can manifest with dermatitis, although most cases are asymptomatic. Chronic infection develops from the immune response to egg deposition. *S. haematobium* can lead to urinary obstruction or hematuria, whereas *S. mansoni* and *S. japonicum* can lead to hepatosplenomegaly, hepatic fibrosis, obstruction of portal blood flow, and varices. *S. japonicum* can infect the central nervous system causing ring enhancing lesions and seizures. Diagnosis is by examination of stool or urine for schistosome eggs in individuals from endemic areas, who have a high egg burden; among travelers, in whom the egg burden is usually low, serology is used for diagnosis. The treatment of choice is praziquantel.

Lymphatic Filariasis (Elephantiasis)

Wuchereria bancrofti and *Brugia malayi* are found throughout the tropics; they are lymph-dwelling filariae that cause elephantiasis. The presentation can vary from acute lymphadenitis, to asymptomatic microfilaremia, filarial fevers, or tropical pulmonary eosinophilia. Lymphadenitis can involve both upper and lower extremities with both of these filarial species, but scrotal involvement only occurs with *W. bancrofti*. The diagnosis is made by examination of a peripheral blood smear for microfilariae obtained between 10 PM and 4 AM because these organisms are nocturnally periodic.

Diethylcarbamazine is used for lymphatic filariasis to eradicate the microfilariae and the adult worms. However, the management of chronic lymphatic obstruction remains a challenge because it is not fully reversible and requires supportive therapy.

Loa loa (Eyeworm)

Loiasis is caused by the eyeworm (*Loa loa*) and is found in West and Central Africa. Presentation can vary and may include pruritus, subcutaneous swellings, joint manifestations, or neurologic symptoms. In the rarest presentation, the adult worm can be seen in the anterior chamber of the individual's eye. Diagnosis is confirmed by the presence of microfilariae in blood samples or isolation of the adult worm. Treatment is as for lymphatic filariasis, with diethylcarbamazine.

River Blindness

Onchocerca volvulus infection mostly occurs in regions of West and Central Africa but also in South and Central America. Pruritic dermatitis is the most common presentation; but involvement of the eye is the most serious presentation. Ocular involvement occurs in endemic areas in individuals with heavy worm burden. The complications can begin with conjunctivitis and photophobia. Corneal involvement with the microfilariae causes an inflammatory reaction leading to sclerosing keratitis and blindness. River blindness is the most common cause of blindness in Africa. The diagnosis is made by examination of skin snips for microfilariae. Ivermectin is the drug of choice; an initial single dose is followed by a repeat dose at 3 or 6 months to suppress any further microfilariae.

Clonorchiasis

Clonorchis sinensis is the Chinese liver fluke. This is an important infection to consider in Asian immigrants who have symptoms consistent with biliary tract disease, including right upper quadrant pain, anorexia, and weight loss. Though the disease is uncommon, untreated infections can lead to cholangiocarcinoma. Treatment is curative with praziquantel in 85% of cases.

Cysticercosis

Cysticercosis is caused by the pork tapeworm, *Taenia solium*. Individuals report new-onset seizures or headaches. Head computed tomographic (CT) scans show ring-enhancing lesions. The diagnosis is usually based on the history and imaging findings, and confirmation can be made by immunoblot assay. Treatment depends on the site of infection and symptoms. It may include antiparasitic treatment, antiseizure medications, and surgical removal. The antiparasitic drug of choice is praziquantel.