 infection includes bacterial cystitis, tuberculosis, urinary stones, and malignancy.

TREATMENT SCHISTOSOMIASIS

Treatment of schistosomiasis depends on the stage of infection and the clinical presentation. Other than topical dermatologic applications for relief of itching, no specific treatment is indicated for cercarial dermatitis caused by avian schistosomes. Therapy for acute schistosomiasis or Katayama syndrome needs to be adjusted appropriately for each case. Although antischistosomal chemotherapy may be used, it does not have a significant impact on maturing worms. In severe acute schistosomiasis, management in an acute-care setting is necessary, with supportive measures and consideration of glucocorticoid treatment to reduce inflammation. Once the acute critical phase is over, specific chemotherapy is indicated for parasite elimination. For all individuals with established infection, treatment to eradicate the parasite should be administered. The drug of choice is praziquantel, which—depending on the infecting species **(Table 259-2)**—is administered PO as a total of 40 or 60 mg/kg in two or three doses over a single day. Praziquantel treatment results in parasitologic cure in ~85% of cases and reduces egg counts by >90%. Efficacy rates among children <5 years old have been reported to be lower. These children are more likely to need re-treatment to effect a cure. Few side effects have been encountered, and those that do develop usually do not interfere with completion of treatment. Dependence on a single chemotherapeutic agent has raised the possibility of development of resistance in schistosomes; to date, such resistance does not seem to be clinically significant. The effect of antischistosomal treatment on disease manifestations varies by stage. Early hepatomegaly and bladder lesions are known to resolve after chemotherapy, but the late established manifestations, such as fibrosis, do not recede. Additional management modalities are needed for individuals with other manifestations, such as hepatocellular failure or recurrent hematemesis. The use of these interventions is guided by general medical and surgical principles.

PREVENTION AND CONTROL

Transmission of schistosomiasis is dependent on human behavior. Because the geographic distribution of infections in endemic regions of the world is not clearly demarcated, it is prudent for travelers to endemic areas to avoid contact with *all* freshwater bodies, irrespective of the speed of water flow or unsubstantiated claims of safety. Some topical agents, when applied to the skin, may inhibit cercarial penetration, but none is currently available. If exposure occurs, a follow-up visit with a health care provider is strongly recommended. Prevention of infection in inhabitants of endemic areas is a significant challenge. Residents of these regions use freshwater bodies for sanitary, domestic, recreational, and agricultural purposes. Several control measures have been used, including application of molluscicides, provision of sanitary water and sewage disposal, chemotherapy, and health education to effect behavioral change in terms of water-contact activities. Current recommendations to countries endemic for schistosomiasis emphasize the use of multiple approaches. With the advent of an oral, safe, and effective broad-spectrum antischistosomal agent (praziquantel), chemotherapy has been most successful in reducing the intensity of infection and reversing disease. The duration of this positive impact depends on the transmission dynamics of the parasite in any specific endemic region. The ultimate goal of research on prevention and control is the development of a vaccine. Although there are a few promising leads, this goal probably is not within reach during the next decade.

TABLE 259-2 DRUG THERAPY FOR HUMAN TREMATODE INFECTIONS

Infection	Drug of Choice	Adult Dose and Duration
Blood Flukes		
S. mansoni, S. intercalatum, S. haematobium	Praziquantel	20 mg/kg, 2 doses in 1 day
S. japonicum, S. mekongi	Praziquantel	20 mg/kg, 3 doses in 1 day
Biliary (Hepatic) Flukes		
Clonorchis sinensis, Opisthorchis viverrini, O. felineus	Praziquantel	25 mg/kg, 3 doses in 1 day
Fasciola hepatica, F. gigantica	Triclabendazole	10 mg/kg once
Intestinal Flukes		
Fasciolopsis buski, Heterophyes heterophyes	Praziquantel[a]	25 mg/kg, 3 doses in 1 day
Lung Flukes		
Paragonimus westermani	Praziquantel[a]	25 mg/kg, 3 doses per day for 2 days

[a]Not approved by the U.S. Food and Drug Administration for this indication.

LIVER (BILIARY) FLUKES

Several species of biliary fluke infecting humans are particularly common in Southeast Asia and Russia. Other species are transmitted in Europe, Africa, and the Americas. On the basis of their migratory pathway in humans, these infections may be divided into the *Clonorchis* and *Fasciola* groups (Table 259-1).

CLONORCHIASIS AND OPISTHORCHIASIS

Infection with *Clonorchis sinensis*, the Chinese or oriental fluke, is endemic among fish-eating mammals in Southeast Asia. Humans are an incidental host; the prevalence of human infection is highest in China, Vietnam, and Korea. Infection with *Opisthorchis viverrini* and *O. felineus* is zoonotic in cats and dogs. Transmission to humans occurs occasionally, particularly in Thailand (*O. viverrini*) and in Southeast Asia and eastern Europe (*O. felineus*). Data on the exact geographic distribution of these infectious agents in human populations are rudimentary.

Infection with any of these three species is established by ingestion of raw or inadequately cooked freshwater fish harboring metacercariae. These organisms excyst in the duodenum, releasing larvae that travel through the ampulla of Vater and mature into adult worms in bile canaliculi. Mature flukes are flat and elongated, measuring 1–2 cm in length. The hermaphroditic worms reproduce by releasing small operculated eggs, which pass with bile into the intestines and are voided with stools. The life cycle is completed in the environment in specific freshwater snails (the first intermediate host) along with later encystment of snail-derived cercariae as infectious metacercariae in freshwater fish.

Except for late sequelae, the exact clinical syndromes caused by clonorchiasis and opisthorchiasis are not well defined. Because most infected individuals harbor a low worm burden, many are minimally symptomatic. Moderate to heavy infection may be associated with vague right-upper-quadrant pain. In contrast, chronic or repeated infection is associated with manifestations such as cholangitis, cholangiohepatitis, and biliary obstruction. Cholangiocarcinoma is epidemiologically related to *C. sinensis* infection in China and to *O. viverrini* infection in northeastern Thailand. This association has resulted in classification of these infectious agents as human carcinogens.

FASCIOLIASIS

Infections with *Fasciola hepatica* and *F. gigantica* are worldwide zoonoses that are particularly endemic in sheep-raising countries. Human cases have been reported in South America, Europe, Africa, and Australia. Recent estimates indicate a worldwide prevalence of 17 million cases. High endemicity has been reported in certain areas of Peru and Bolivia. In most endemic areas the predominant species is *F. hepatica*, but in Asia and Africa a varying degree of overlap with *F. gigantica* has been observed.

Humans acquire fascioliasis by ingestion of metacercariae attached to certain aquatic plants, such as watercress, water caltrop, and water chestnuts. Infection may also be acquired by consumption of contaminated