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Schistosomiasis

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ABSTRACT Human schistosomiasis is a common blood fluke infection in the tropics and subtropics. The organism requires a specific fresh water snail intermediate as host and this determines its geographical distribution. Humans become infected following water exposure, with rural communities and children having the highest burden of disease. Travellers to areas of high endemicity are at risk of infection as they frequently engage in pursuits that expose them to fresh water. Disease manifestations range from acute hypersensitivity reactions to chronic illness with intestinal, hepatic and bladder disease. Infection can often be asymptomatic and travellers to endemic areas should be screened for schistosomiasis after return. Treatment is highly effective, even in advanced disease, and the diagnosis should be considered in individuals with possible clinical illness who have travelled to or lived in endemic areas.

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EDUCATION

INTRODUCTION

Schistosomiasis is caused by blood dwelling flukes called schistosomes. The worms were first described in 1852 by Theodore Bilharz, hence the illness is also known as bilharzia. Schistosomiasis is a global health problem with over 200 million people infected worldwide and an estimated 200,000 deaths per year. There are three main species of schistosome with world distribution largely reflecting the presence of specific snail hosts. Infection in humans results from fresh water exposure and the illness is characterised by both acute and chronic manifestations.

EPIDEMIOLOGY

Schistosomiasis is a disease of the tropics and subtropics closely associated with communities that reside close to water. In endemic areas the greatest burden of disease occurs in children, with a peak at age eight to 15 years. The intensity of infection then reduces in adults and is thought to represent both behavioural (less water exposure) and immunological (development of immunity) factors. Although the greatest burden of disease is amongst local populations, it is a recognised cause of both acute and chronic disease in travellers to these areas.

LIFE CYCLE AND HUMAN INFECTION

Humans become infected with schistosomiasis after contact with fresh water containing the infectious cercarial larvae. Although most infection results from swimming in freshwater lakes and rivers, it has been described as resulting from showering in fresh water pumped directly from an infected water source. The cercarial larvae penetrate intact skin and migrate into the blood where they are taken to the heart and ultimately the pulmonary vascular bed. Here they migrate through to the left side of the circulation and to the portal vein where they mature and mate. They then migrate to the perivesicular venules (*Schistosoma. haematobium*) or mesenteric circulation where they attach to the vessel wall using two terminal suckers. The female lives in a groove on the male's body and they copulate and the female produces hundreds of eggs per day. The eggs then migrate into the colonic or bladder lumen and are excreted in the faeces or urine of the infected individual. On contact with water the eggs hatch and produce miracidia that infect specific snail hosts. The miracidia multiply asexually inside the snail and produce cercarial larvae that eventually start leaving the snail and infect humans, thus completing the life cycle.

After a human is infected it takes six to eight weeks for the adult worms to develop. This is an important consideration, as the diagnostic techniques used to identify infection rely

TABLE 1 The distribution and chronic manifestations of the three main species of human schistosomiasis

Species Schistosoma	Geographical distribution	Chronic disease
S. mansoni	Sub-Saharan Africa, Middle East, S. America, Carribean	Intestinal and hepatic disease
S. haematobium	North & Sub-Saharan Africa, Middle East, Turkey, India	Renal and bladder disease
S. japonicum	Asia	Intestinal and hepatic disease

upon the identification of eggs or the egg antigen. It is also important to recognise that praziquantel, the main drug used to treat schistosomiasis, only acts upon adult worms and therefore the administration of this prior to the development of adult worms will have little clinical effect.

CLINICAL MANIFESTATIONS OF HUMAN SCHISTOSOMIASIS

Although the majority of individuals infected with schistosomiasis are initially asymptomatic, human schistosomiasis has both acute and chronic manifestations. The acute manifestations, namely cercarial dermatitis and Katayama fever, are thought to be more common in travellers.

Cercarial dermatitis

This is a maculopapular eruption at the site of cercarial entry. It is usually intensely pruritic and occurs 12 to 24 hours after exposure. Occasionally a less intense reaction, often referred to as 'swimmer's itch', can occur. This reaction can last for days and is more common when individuals are exposed to non-mammalian species such as avian schistosomiasis.

Katayama fever

This is a more systemic hypersensitivity reaction to the immature parasite as it migrates to the liver. As such it is more common in travellers and tourists than in chronically infected local populations. This typically occurs a few weeks after exposure and is more common in *S. mansoni* and *S. japonicum* infection. Katayama fever presents with rapid onset of fever, malaise, arthralgia, myalgia, cough, and headache. Blood tests will typically show an eosinophilia and chest radiography will often show patchy infiltrates. Although most patients recover spontaneously, Katayama fever can be a serious illness with widespread rash and hepatosplenomegaly.

The diagnosis of Katayama fever requires appropriate history taking to identify epidemiological risk. As this is an acute manifestation of the illness, specific tests for schistosomiasis that rely on identifying eggs will often be negative. The optimum treatment of Katayama fever is unclear but is essentially supportive, with the use of glucocorticoids to improve symptoms due to the hypersensitivity. It is accepted practice to treat with praziquantel, however this should be repeated eight weeks later to ensure clearance of adult worms.

The chronic manifestations result from the chronic inflammatory response to migrating eggs and therefore require higher infectious burdens. They are more common in local populations or travellers with higher worm burden (e.g. frequent travellers or long stayers). Often, chronically infected individuals are asymptomatic until these develop. Typically the chronic manifestations of disease involve the intestines and liver in the case of *S. mansoni* and *S. japonicum* and the renal tract in *S. haematobium*.

Intestinal disease

As the eggs migrate through the bowel wall they stimulate a granulomatous inflammatory response. This leads to ulceration of the intestinal mucosa and occasionally the development of intestinal polyps. Disease is most frequent in the large bowel and can ultimately lead to stricture formation. Individuals have intermittent abdominal pain, loose stool and stools can contain blood. Often it is difficult to differentiate schistosomal intestinal disease from other enteric infections.

Hepatic disease

Hepatic schistosomiasis can present as an inflammatory disease in children associated with hepatomegaly or with fibrosis in adults resulting in portal hypertension. Spillover of eggs into the periportal space in children with heavy infection results in an acute inflammatory illness with massive hepatomegaly. However, in young adults the more chronic inflammatory response leads to collagen deposition and periportal or 'Symmers' fibrosis. This is characterised by portal hypertension and variceal development with maintained hepatocellular function.

Urinary disease

Urinary schistosomiasis results from granulomatous inflammation resulting from the migration of *S. haematobium* eggs into the ureteric and bladder lumen. Microscopic haematuria is common. However, occasionally gross haematuria is reported, often in the terminal portion of the urine. Progressive fibrosis and calcification can lead to ureteric obstruction and hydronephrosis. There is also a reported higher incidence of squamous cell bladder carcinoma in individuals with chronic urinary schistosomiasis.

Other chronic manifestations

The abnormal migration of adult worms, or the embolisation of eggs to the spinal cord and brain, can result in neurological disease. Patients can present with a transverse myelitis or with focal neurology and seizures resulting from a granulomatous brain lesion.

The development of portosystemic collaterals due to portal hypertension allows eggs to enter the pulmonary circulation. The resultant granulomatous reaction at the alveolar bed can result in the development of pulmonary hypertension.

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DIAGNOSIS

The majority of individuals infected with schistosomiasis are asymptomatic. Although non-specific signs of infection can include eosinophilia, microscopic haematuria, and transient chest X-ray infiltrates, the specific diagnosis relies upon the demonstration of eggs or immunologic assays for egg antigen. As adult worms are required to produce eggs, these tests will often be falsely negative in the first eight weeks after infection and therefore travellers thought to be at risk should be investigated at least eight weeks after their last possible exposure. Typically, a number of stool samples will be examined for eggs and if *S. haematobium* infection is possible, either a terminal urine sample or a 24-hour urine collection should be examined. Blood should be taken for egg antigen enzyme-linked immunosorbant assay (ELISA), this can remain positive for many years after treated infection and is only useful in the diagnosis of current infection in those not likely to have been previously exposed. The identification of eggs in stool or urine requires significant egg excretion and can be negative in travellers with light infection. The ELISA is reported to have a sensitivity in excess of 90%.

TREATMENT

Any individual with evidence of infection should be treated. Adult worms can live for many years and it is often difficult to distinguish between active and previous infection. The drug of choice is praziquantel given at a dose of 40 mg/kg (*S. mansoni* and *S. haematobium*) or 60 mg/kg (*S. japonicum*) in two divided doses. Praziquantel leads to the dislodgement of adult worms with resultant reduction in egg burden. Treatment with praziquantel is reported to produce improvement even in those who already have manifestations of chronic disease. As it only works on adult worms, treatment should be given at least eight weeks after exposure or treatment should be repeated in individuals treated early due to Katayama fever. Praziquantel is a well-tolerated drug with rare adverse effects. Efficacy is difficult to measure but in endemic areas cure rates in excess of 85% are reported.

PREVENTION

In areas of high prevalence, prevention strategies incorporate public health measures to improve sewage management and mass treatment programmes. Travellers to endemic areas should be warned against fresh water exposure; however, this can often be difficult to avoid. There is no evidence for the efficacy of brisk towelling after water exposure or the use of mosquito repellents to prevent infection. Travellers should not take praziquantel soon after exposure as it will have no effect on the developing worms. Travellers should be warned about the risks of acquiring infection and offered screening with serology and stool and urine microscopy eight weeks after return home. Those with evidence of infection should then be treated with praziquantel.

HIGHLIGHTS

- Potential exposure to schistosomiasis results from fresh water exposure.
- The only effective measure of protecting yourself from schistosomiasis is avoidance of fresh water exposure.
- The illness can be asymptomatic therefore travellers need to be warned of the risk and encouraged to be tested upon return.
- The tests for schistosomiasis rely on the detection of eggs or egg antigen. Therefore sufficient time should be allowed (6–8 weeks) after last potential exposure before testing.
- Praziquantel, the drug of choice for schistosomiasis, is effective and associated with few adverse effects.

Further reading

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SELF-ASSESSMENT QUESTIONS

1. A 23-year-old man returned two weeks ago from a six-month trip to Malawi. During his stay he had frequent visits to Lake Malawi, which included swimming in the lake. He presents with fever, myalgia, headache and urticaria. You are concerned about the risk of Katayama fever. What should you do?

A. Commence symptomatic treatment for Katayama fever and collect blood, urine and stool for schistosomiasis. Treat with praziquantel if these tests are positive.
B. Treat symptomatically and discharge.
C. Exclude other tropical infection particularly malaria. Commence prednisolone and treat with praziquantel if no other cause found. Repeat stool and urine microscopy with schistosomiasis eight weeks later and further praziquantel if any of these are positive.
D. Treat with praziquantel and discharge.
E. Exclude other tropical infection particularly malaria. Commence prednisolone and treat with praziquantel if no other cause found.

2. A 46-year-old Kenyan man presents with ascites and haematemisis. He has lived in the UK for two years and has noticed increasing abdominal girth over the last one year. He drinks 'moderate' amounts of alcohol only and serology for hepatitis B and C are negative. His prothrombin time is normal. What investigations would you perform to diagnose schistosomiasis?

A. Examine three stool samples only.
B. Examine three stool samples, a 24-hour urine collection and do schistosomiasis enzyme linked immunosorbent assay (ELISA).
C. Examine three stool samples and do schistosomiasis ELISA.
D. Do schistosomiasis ELISA only.
E. Examine a 24-hour urine collection and do schistosomiasis ELISA.

3. A 22-year-old medical student attends clinic prior to travel to Uganda. He intends to go white water rafting and has heard about schistosomiasis. What advice would you give him?

A. Use a diethyl-meta-toluamide (DEET) containing mosquito repellent prior to rafting and towel himself briskly after getting out of the water.
B. Do not go white water rafting.
C. There is no risk due to the fast flowing water.
D. Return to clinic eight weeks after return for schistosomiasis screening.
E. Local eradication programmes have been successful so there is no risk.

This paper was originally published as part of the Tropical Medicine module in the RCPE Online Continuing Medical Education Programme. Online CME, including the anwers to these questions, is available to Fellows and Members at: http://www.rcpe.ac.uk

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