Schistosomiasis

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Topics

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Schistosomiasis is one of the most important parasitic diseases of humans and is a global public health problem in the developing world.
The disease is caused by trematodes of the genus Schistosoma, which cause periportal fibrosis and liver cirrhosis owing to deposition of eggs in the small portal venules.

Schistosoma mansoni and Schistosoma japonicum lead to liver disease.
Schistosomiasis is known as bilharzia or bilharziosis in many countries, after German physician Theodor Bilharz, who first described the cause of urinary schistosomiasis in 1851.

The first doctor who described the entire disease cycle was Pirajá da Silva in 1908.

It was a common cause of death for Ancient Egyptians in the Greco-Roman Period.
The Pathogen

- **Five major species** of Schistosoma affect humans: *S. mansoni*, *S. haematobium*, *S. japonicum*, *S. intercalatum*, and *S. mekongi*.

- Other *Schistosoma* species that **occasionally** infect humans include *S. bovis*, *S. mattheei*, and some avian schistosomes.
The Pathogen

- These species differ biologically from one another and in their geographic distribution and the type of disease that they produce.
- The schistosomes are digenetic parasitic trematodes. Although they are morphologically distinct, the species of Schistosoma that infect humans share some common factors.
The Pathogen

- The large male (0.6 to 2.2 cm × 2 to 4 mm) has a ventral gynecophoric canal in which the female (1.2 to 2.6 cm × 1 to 2 mm) is held during copulation.
Schistosomiasis occurs mainly in rural agricultural and periurban areas.

Infection with S. mansoni is found in parts of South America, Africa, and the Middle East.

Infection with S. japonicum is found in the Far East, mostly China and the Philippines.

In China, 0.67% of the population may be infected, according to CDC statistical report at 2008.
EPIDEMIOLOGY

- Infection sources
- Mode of transmission
- Susceptible population
Infection sources

- Patients

- reservoir host: animal reservoirs

  cows, pigs (S. japonicum)

  Rodents, monkeys, and baboons have been found infected in nature, but the role of these animals as reservoirs does not seem to be epidemiologically important.
mode of transmission

- 3 links in parasitic epidemiology
  1. The endemicity of schistosomiasis depends on the urban disposal of urine (S. haematobium) and feces (S. mansoni, S. japonicum, S. intercalatum, S. mekongi),
  2. the presence of suitable **snail** hosts
  3. human exposure to cercariae.
The **freshwater snail intermediate hosts** are Biomphalaria spp in Africa and Biomphalaria glabrata (Australorbis) and Tropicarbis in South America and the West Indies.
Susceptible population

Humans are susceptible to the Schistosoma.

- young adults
- Summer and autumn
Schistosoma life cycle

- Adult worms in human vesical or mesenteric veins (6 weeks)
- Egg in urine or stools (5 to 9 weeks)
- Schistosomula, first parasite stage in humans (72 hours)
- Cercaria free-living in fresh water (infective stage) (4 to 7 weeks)
- Miracidium free-living in fresh water (5 to 9 weeks)
- Freshwater snail asexual multiplication (4 to 7 weeks)
Schistosome life cycle
Egg

Snail- intermediate host

cercariae

Schistosoma
Etiology and Life Cycle

- Once deposited in the host, **eggs may stay in the mesenteric vein**, be trapped in the intestines, escape to the intestinal lumen, and **migrate by portal blood to the liver** (S. mansoni, *S. japonicum*).

- The **lifespan** of the worms ranges from **5 to 10 years**.
Humans become infected after **contact with water** that contains the infective stage (cercaria) of schistosomes.

**cercarial dermatitis:** Pruritus is one of the commonest symptoms.
Adult worms release **eggs** in the venules of the mesentery, and the eggs enter the liver through the **portal vein**, where they become lodged in the **terminal branches of the portal venules**.

The lodged eggs cause a **granulomatous inflammation**, and the lesions are healed by **periportal fibrosis**.

**S. japonicum** is more virulent than **S. mansoni** because its infection produces **ten times more** eggs.
Because the **habitat** of S. mansoni, S. japonicum, S. mekongi, and S. intercalatum worms *is the mesenteric blood vessels*, the intestines are involved primarily, and **egg embolism results in secondary involvement of the liver**.

In the liver, the **granulomas** result in perisinusoidal obstruction of portal blood flow, **portal hypertension**, splenomegaly, esophageal varices, and portosystemic collateral circulation.
Liver cell perfusion is not reduced; consequently, **liver function test results remain normal for a long time**. In schistosome-infected populations, the intensity of infection increases during the first 2 decades of life as children accumulate worms and then declines.
Clinical manifestations of schistosomiasis are divided into:

- **schistosome dermatitis**
- **acute** schistosomiasis
- **chronic** schistosomiasis
A pruritic papular rash occurs within 24 hours after the penetration of cercariae and reaches maximal intensity in 2 to 3 days.
CLINICAL MANIFESTATIONS (Acute schistosomiasis)

- **Acute** schistosomiasis occurs usually **20 to 50 days** after primary exposure.
- The clinical syndrome (i.e., *fever, chills, liver and spleen enlargement, and marked eosinophilia*) originally described for *S. japonicum* infection, and still common for this species, is increasingly being diagnosed in Brazil in individuals with *S. mansoni* infection.
CLINICAL MANIFESTATIONS
(Acute schistosomiasis)

- Malaise, diarrhea, weight loss, cough, dyspnea, chest pain, restrictive respiratory insufficiency and pericarditis are important findings in this phase.
CLINICAL MANIFESTATIONS
(Acute schistosomiasis)

- Acute disease is **not** observed in individuals living in **endemic areas** of schistosomiasis because of the downmodulation of the immune response by antigens or idiotypes transferred from mother to child.

- Acute schistosomiasis is becoming a frequent and major clinical problem in **nonimmune individuals** from **urban regions** who are exposed for the first time to a heavy infection in an endemic area.
Abdominal pain, irregular bowel movements and blood in the stool are the main symptoms of intestinal involvement.
Patients may remain asymptomatic until the manifestation of hepatic fibrosis and portal hypertension develops.
Hepatic fibrosis is caused by a granulomatous reaction to Schistosoma eggs that have been carried to the liver.
Hepatic fibrosis is **caused by** a granulomatous reaction to *Schistosoma* **eggs** that have been carried to the liver.
Hematemesis from bleeding esophageal or gastric varices may occur. In such cases, anemia and decreasing levels of serum albumin are observed.
A few patients have severe hepatosplenic disease with decompensated liver disease. Jaundice, ascites, and liver failure are then observed.
In hospitalized adult patients with *S. japonicum* infection, cerebral schistosomiasis occurs in 1.7 to 4.3%.

It may occur as early as 6 weeks after infection.
In *S. haematobium* infection, the main organ system involved is the urinary tract.

The acute granulomatous response to parasite eggs in the early stages causes urinary tract disease, such as urethral ulceration and bladder polyposis.
In chronic disease, usually in older patients, granulomas at the lower end of the ureters obstruct urinary flow and may cause hydroureter and hydronephrosis.

Bladder fibrosis and calcification are also seen in this phase. Up to 70% of infected individuals have hematuria, dysuria, or urinary frequency.
CLINICAL MANIFESTATIONS

- An increased incidence of squamous cell carcinoma of the bladder has been reported in endemic areas of S. haematobium infection, but the mechanism of carcinogenesis is unknown.
- S. haematobium eggs have occasionally been found in the lungs, with subsequent focal pulmonary arteritis and pulmonary hypertension.
DIAGNOSIS

- Blood routine examination
- Liver function test
- Liver ultrasonic
- CT
- Antibodies detection: Several serologic tests for detection of IgM, IgG, and IgA antibodies to Schistosoma antigens are available.
- Examination of feces-the eggs
- Rectum tissue biopsy
- **Ultrasonography** allows determination of the degree of liver fibrosis.
- After S. haematobium infection is diagnosed, assessment of urinary tract disease by ultrasonography is recommended.
Several **serologic tests** for detection of IgM, IgG, and IgA antibodies to Schistosoma antigens are available.

Serologic tests are important in the diagnosis of **acute infection** because the symptoms are not specific and the finding of eggs in stool may reflect chronic infection.

Seroconversion occurs within 4 to 8 weeks of infection but cannot distinguish active infection from a history of exposure.
Quantification of circulating antigens in serum and urine is an alternative for the diagnosis of schistosome infection.

However, the sensitivity of the method decreases in patients with light infection (<100 eggs per gram of feces).
Basis for DIAGNOSIS

- History of epidemiology: infested water contact
- Clinical manifestation
- Laboratory tests
- Differentiation diagnosis
A definitive diagnosis of schistosomiasis can be made only by finding schistosome eggs in feces, urine, or a biopsy specimen, usually from the rectum. Schistosomal eggs typically have lateral or terminal spines and are easy to detect on microscopic examination of feces or on a rectal biopsy.
A **history** of contact with contaminated water and appropriate clinical manifestations are important steps in establishing the diagnosis.

Because schistosome **eggs** may be few, concentration by **sedimentation** should be performed.
- Rectal biopsy may be used for those with light infection.

- In patients with chronic S. mansoni and S. japonicum infection and liver disease, the diagnosis is sometimes made by documentation of eggs in liver specimens.
DIAGNOSIS

- *S. mekongi* and *S. intercalatum* infection is diagnosed by examination of the stool for eggs.
- Urine examination for *S. haematobium* eggs can be performed by direct or concentration methods.
- Samples should be obtained at midday, when excretion of eggs is maximal.
- Rectal biopsy may be performed in patients with light infection and negative urine results.
Chemotherapy is by far the major method for control and cure of schistosomiasis.

Three compounds are in use metrifonate, oxamniquine, and praziquantel, and all three are included in the World Health Organization’s list of essential drugs.
Praziquantel

- a pyrazinoisoquinoline derivative, is the drug of choice for the treatment of schistosomiasis for **four** reasons:
  - high efficacy against all schistosome species and against cestodes,
  - lack of serious short-term and long-term side effects,
  - administration as a single oral dose
  - competitive cost is cheap.
The standard recommended treatment consists of a single dose of praziquantel, 40 mg/kg, for *S. mansoni*, *S. haematobium*, and *S. intercalatum* infection.

In *S. japonicum* infection, a total dose of 60 mg/kg is recommended, split into two or three doses in a single day.

*S. mekongi* may require two treatments at 60 mg/kg body weight.
With these dosages of praziquantel, recorded cure rates are 75 to 85% for *S. haematobium*, 63 to 85% for *S. mansoni*, 80 to 90% for *S. japonicum*, 89% for *S. intercalatum*, and 60 to 80% for double infections with *S. mansoni* and *S. haematobium*. 
The most common side effects observed with praziquantel or oxamniquine are related to the gastrointestinal tract: abdominal pain or discomfort, nausea, vomiting, anorexia, and diarrhea.
TREATMENT

- These symptoms can be observed in up to 50% of patients but are usually well tolerated.
- Other side effects are related to the central nervous system (e.g., headache, dizziness, drowsiness) and the skin (e.g., pruritus, eruptions) or may be nonspecific (e.g., fever, fatigue).
In general, the cumulative experience from a large number of studies allows the conclusion that praziquantel is an extremely well tolerated drug that requires minimal medical supervision and is therefore particularly suitable for mass chemotherapy programs.
TREATMENT

Although a reduction in the intensity of infection and morbidity has been documented after mass chemotherapy, provision of clean water, use of molluscicides (kill the snail), and adequate sanitation should also be implemented to control the disease.
The mortality rate is 0.05% for severe S. mansoni infection and 1.8% for severe S. japonicum infection.

**Bleeding** from esophageal varices is the most serious complication.

Chronic infection can lead to hepatocellular carcinoma.
Schistosomiasis occurs mainly in rural agricultural and periurban areas in the developing world.

Five major species of Schistosoma affect humans.

The intermediate hosts is snail.

Eggs, causing the portal hypertension and liver fibrosis, is very important in pathobiology and diagnosis.
Rectal biopsy may be used for those with **light infection**.

Metrifonate, oxamniquine, and praziquantel are included in the WHO’s list of essential drugs.

Praziquantel is well tolerated and effective for **different clinical forms** of schistosomiasis.
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