Schistosomiasis

Wetlands supporting groups of susceptible animals and freshwater snails

Wildlife ✓
Livestock ✓
Human ✓

Synonyms: Bilharzia, blood flukes, Katayama fever, snail fever, swimmer's itch

KEY FACTS

What is schistosomiasis?

Also known as bilharzia, schistosomiasis is a disease caused by trematode worms which inhabit the blood circulatory system of their host. The worms require freshwater snails as an intermediate host to develop infectious larvae that penetrate the skin of a wide range of animal hosts following contact with infested water bodies. Infected animals pass worm eggs out in their urine or faeces which, if in contact with freshwater, hatch out and infect freshwater snails, producing another larval stage which is infective to the final animal host thus completing the life cycle.

Eighty-five percent of the 207 million people who are infected with schistosomiasis worldwide live in developing African countries. Poor sanitation greatly increases prevalence and severity.

Causal agent

Parasitic flatworms called blood flukes of the genera *Schistosoma* and *Orientobilharzia.* Many domestic farm animals and birds have their own species-specific schistosomes, each with varying impacts on health and subsequent economic importance.

Species affected

Schistosomes have a broad host range encompassing many species of wild animals including waterbirds, however, humans and livestock aremost at risk of clinical disease.

In Africa, cattle, sheep and goats are infected by three species (*S. mattheei*, *S. bovis* and *S. curassoni*). Schistosomes are also prevalent in wild mammals, including: antelope (*S. margrebowiei*), zebra, bushbuck and rodents (*S. rodhaini)* in tropical areas. In addition to humans, *S. mansoni* also infects rodents, baboons and some insectivores.

In Asia, 40 different species of wild and domestic animals are known to be infected by *S. japonicum* including pigs, dogs, cats, rodents, monkeys, oxen and water buffalo (*Bubalus bubalis*). *S. japonicum* also infects humans and animal hosts are likely to act as a reservoir for human infection. *S. indicum* occurs in the Indian subcontinent infecting horses, buffalo, sheep, goats and camels.

Humans are infected by three main species: *Schistosoma haematobium* (Africa)*, S. mansoni* (Africa and South America) and *S. japonicum* (Asia). Locally important species include *S. mekongi* and *S. intercalatum*, which are localised to parts of Cambodia and Laos, and central and west Africa, respectively.

Geographic distribution

- Africa: all freshwater in southern and sub-Saharan Africa, including the great lakes and rivers as well as smaller bodies of water, is considered to present a risk of schistosomiasis transmission. Transmission also occurs in the Nile River valley in Egypt.
- South America: including Brazil, Suriname and Venezuela.
- Caribbean: Antigua, Dominican Republic, Guadeloupe, Martinique, Montserrat, Saint Lucia (lower risk).
- The Middle East: Iran, Iraq, Saudi Arabia, Yemen.

- Southern China.
- South East Asia: Philippines, Laos, Cambodia, central Indonesia, Mekong delta.

Environment

Freshwater, particularly associated with irrigation schemes, reservoirs and water holes. Parasite distribution is dependent on habitats suitable for the snail intermediate host which range from still to slow-moving water.

TRANSMISSION AND SPREAD

Vector(s)

Intermediate hosts include freshwater snails mainly of the genera *Bulinus, Biomphalaria* and *Oncomelania.*

How is the disease transmitted to animals?

Eggs laid by mature flukes in the blood vessels surrounding the gut and the bladder of the host are eventually passed in faeces and urine. When the eggs reach freshwater they hatch into infectious free-living miracidia and infect only suitable snail vectors. Within the snail, the parasite propogates by asexual reproduction and several thousand free-swimming larvae, known as cercariaeare, are released and remain infectious to the final animal host for up to 48 hours.

How does the disease spread between groups of animals?

Eggs shed in the faeces and urine of infected animals and humans contaminate water sources inhabited by snail intermediate hosts, which in turn are shared by different animal groups. Risk of infection is exacerbated by increased host density and by the wide definitive host range of schistosome species. As an example, hosts of *S. japonicum* in Asia include dogs, cats, rodents, pigs, horse, goats, water buffalo, cattle and humans.

How is the disease transmitted to humans?

In contaminated freshwater bodies, infective schistosome cercariae penetrate the skin. Schistosome infections are maintained by a range of mammals, however, field transmission is increased when water sources such as dams and irrigation ditches are shared with infected human populations (*e.g. S. mansoni* in Africa). Herein lies the potential for a human settlement with poor sanitation to significantly impact on the health of surrounding livestock and wildlife.

Human population displacement and refugee movements can introduce the disease to new areas (*e.g.* Somalia and Djibouti).

Schistosomes which only infect domesticated ruminants (*e.g. S. mattheei*, *S. bovis*, *S. curassoni*) or waterbirds (*e.g. Heterobilharzia americana*, *Orientobilharzia turkestanica*, and *O. turkenstanicum*) may be present in water bodies near human settlements. The infective cercariae of these non-human species can penetrate the skin of humans but rarely develop further. A condition known as 'swimmer's itch' may develop from these infections.

IDENTIFICATION AND RESPONSE

Field signs

In ruminants symptoms may include haemorrhagic enteritis, anaemia and emaciation due to mechanical damage of blood vessels by the spiked eggs of schistosomes. Severely affected animals usually die within a month or two of infection. Older cattle may develop immunity in areas where the disease is endemic.

In humans, there are no symptoms when first infected. Skin irritation or a rash may develop after a few days. After 1-2 months, fever, chills, cough and muscle aches may occur. Intestinal schistosomiasis can result in abdominal pain, diahorroea and blood in the stool. Urogenital schistosomiasis is associated with blood in the urine.

The infectious larval stages of some 'animal' *Schistosoma spp*. in either tropical or temperate countries may penetrate the skin of humans and cause an allergic reaction known as 'swimmers itch'. 'Swimmers itch' may develop in approximately one third of those infected, however, the larval worms die in the skin and cannot migrate or mature in infected humans.

Recommended action if suspected

Contact and seek assistance from human and animal health professionals immediately if there is suspected infection in people and/or livestock. The disease is not notifiable.

Diagnosis

Diagnosis is based on identification of characteristic schistosome eggs by microscopic examination of faeces and urine samples, or biopsy specimens. Serological tests may be sensitive and specific but do not provide information about the size of worm burden or clinical status.

PREVENTION AND CONTROL IN WETLANDS

Environment

Adult schistosomes have a high degree of fecundity as the infective cercariae are sensitive to dessication and have an average life span of 48 hours. In areas where mammalian host density is low, this high fecundity enables the parasite to maintain a low level population without causing disease in humans or livestock. In environments where water sources supporting populations of susceptible snails are contaminated with high levels of infected human and livestock excreta, rates of transmission will also rise along with the probability and severity of disease.

Control measures should therefore focus on **preventing contamination of water sources** through improved sanitation, as well as public health education, large scale medical treatment of infected individuals [► **Humans**], ring-fencing contaminated water bodies and reducing snail populations.

Reduce snail populations
► **Section 3.4.3. Vector control - snail control**

Strategies should be implemented with specific knowledge of the ecology of the causative snail. Water impoundments of all shapes and sizes (*e.g.* irrigation systems, lakes and dams) provide fertile breeding grounds and good habitat for freshwater snails and encourage close and frequent contact between people and infected water. The following habitat alterations may help reduce snail populations.

Alter flow rate and water levels to disturb snail habitats and their food sources:

- Include V-shaped banks in irrigation channels.
- Remove vegetation/silt in channels to avoid a drop in velocity which may lead to further vegetation growth and good habitat for snails. Note that personnel involved in the manual removal of vegetation are increasing their exposure to snails. Frequent removal may be needed.
- Flow rate should only be addressed with knowledge of the ecology of the snail in question *e.g.* for *Biomphalaria* and *Bulinus* flows greater than 0.3 m/sec would suffice but most snails can withstand flows up to 0.5 m/sec.

- Borrow-pits, small pools and ponds serving no special purpose (for humans, wildlife or livestock) may be drained to eliminate breeding sites.

Expose snail habitat:

- Remove littoral vegetation from the sides of canals feeding irrigation projects to expose snail habitat. Heavy rain can also cause removal.
- Thought should be given to downstream conditions and the potential for the liberated snails to recolonise new habitat.
- Where possible dry out littoral zones to strand snail populations, however take into account the specific ecology and the resilience of the target species.

Chemical control:

- Use of molluscicides may cause environmental damage and should be avoided. Use should be targeted rather than wide-spread. Applications are usually restricted to places frequently used by people for swimming, bathing *etc.*

Biological control of intermediate snail hosts using larger, more voracious aquatic snails which do not harbour schistosome infection and out-compete local snails, has also been successful but should only be used after expert consultation due to their effects on local biodiversity.

Livestock

Prevention of contamination of wetland habitat with livestock excreta should be the main priority. This is especially important for schistosome species such as *S. japonicum* which parasitises wild animal, livestock and human hosts.

To reduce the risk of infection, **susceptible livestock should be removed** from wetlands and replaced with non-susceptible species (or by farm machinery if the purpose of livestock is mechanical management).

Agricultural run-off must be prevented from contaminating water bodies.

Infected and susceptible livestock should be treated with **flukicides** such as praziquantel. However, re-infection may occur quickly if the source of contamination is left uncontrolled.

Wildlife

High density populations of susceptible wildlife increase the potential for disease transmission. Interaction between livestock and wildlife should be prevented wherever possible and **supplementary feeding** of wild animals close to water sources should also be avoided.

Humans

The following practices may help reduce the likelihood of infection in humans:

- Avoiding contact with snail-infested waters and using water supplied from covered pipes or pit-wells.
- Avoiding swimming, wading, washing or bathing in water suspected of infestation. It is safest to consider all freshwater bodies in endemic areas as potential transmission sites if sites are otherwise unidentified.
- For agricultural workers at constant risk of infection, periodic examination and treatment may be the most feasible approach to disease control.

- Ensuring good sanitary practices. A clean water supply and improved sanitation (including for people onboard boats) must be provided to stop human excrement entering wetlands.

Treat infected individuals
Anthelmintics such as praziquantel and oxamniquine (for *S. mansoni*) are effective treatments for schistosomiasis. If the local economic situation allows, consider mass treatment programmes for non-infected individuals following episodes of flooding. It is important that anthelmintic treatment be applied in conjunction with sanitation improvements to prevent widespread re-infection and subsequent cycles of treatment/re-infection thus increasing the potential for drug resistance to develop. Schistosomes contain cross-reacting antigens and vaccine development programmes are currently in progress. Frequent exposure of humans to schistosomes of domesticated animals can impart a degree of immunity to disease-causing species.

Public health education
Many countries and regions may lack funds for public education especially to isolated human settlements. However, an informed public are able to make personal decisions over their contact and use of standing water and thus reduce the risk of infection to themselves and their livestock.

IMPORTANCE

Effect on wildlife

In general this disease has a subclinical impact on wildlife. Problems may arise in areas where wildlife mixes with high density livestock and/or human populations.

Effect on livestock

An estimated 165 million animals are infected in Africa and Asia. In these regions most infections are subclinical but, depending on the schistosome species, can still cause serious morbidity and mortality (*e.g. S. japonicum* in Asian cattle and goats). ► **Economic importance**

Effect on humans

Because of considerable economic and health impacts, schistosomiasis is considered the second most important parasitic disease after malaria. Worldwide, 207 million people are infected with schistosomiasis and it is especially important because of its prevalence in children and capacity to hinder growth and learning. Chronic schistosomiasis is debilitating and can affect people’s abilty to work. In sub-Saharan Africa over 200,000 people die of the disease every year. ► **Economic importance**

Economic importance

Farmers suffer significant economic losses due to schistosome burdens in livestock, productivity is reduced whilst susceptibilty to other environmental stresses is increased (particularly *S. bovis* in African cattle and *S. mattheei* in sheep). Similarly, schistosomiasis impacts on economic development in developing countries by reducing the productivity of human workforces. Eradication programmes including widespread administration of praziquantel and implementation of improved sanitation are costly and beyond the means of many developing nations.

FURTHER INFORMATION

Useful publications and websites

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