Bovine Schistosomiasis: Mini Review

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Abstract

Bovine Schistosomiasis is a chronic debilitating parasitic disease of cattle caused by the species Schistosoma bovis (S. bovis). The parasite encysts mainly in the mesenteric and hepatic veins of the host. The lifecycle of the parasite is entirely dependent on snail hosts. Infections with all major Schistosoma species can be treated with Praziquentel. The most effective way to control cattle Schistosomiasis in endemic areas is to prevent contact between the animals and the parasite by fencing of dangerous marshy water areas, and by supplying clean drinking water. Thus, this mini review focuses on the epidemiology, lifecycle, diagnosis and prevention and control of bovine schistosomiasis.

Keywords

Bovine Schistosomiasis; Epidemiology; Treatment; Prevention; Control

Introduction

Parasitic diseases are a major constraint in animal health and production throughout the tropical and sub tropical countries of the world [1]. Parasitic diseases caused by helminthes, protozoa and arthropods can cause more economic losses than disease caused by bacteria and viruses but their impact however, is not clear to animal owners [2]. Schistosomiasis is a chronic debilitating parasitic disease of both human and animals, and is caused by different species of the genus Schistosoma [3]. Schistosomes are thin elongated fluke, sexually differentiated and primarily parasitize in blood vessels of alimentary tract and bladder [4]. Domestic animals in various tropical areas may be affected with Schistosoma (S. bovis, S.indicus, S.nasalis, S.suis, S.matheei) [5]. Schistosoma japonicum was also reported in human, cats and other mammals in Africa [6]. In human the disease is common in about 75 developing countries and mainly affects people living in rural agricultural and peri-urban areas [7]. The principal clinical signs in the affected host are mainly associated with passage of the spindle eggs through the tissue of the gut lumen. The young parasites cause some damage during migration, but most of the lesions are due to the irritation produced by the eggs of the parasites in the intestine and other organs [5, 8]. Various epidemiological studies were conducted on bovine schistosomiasis in different time periods and localities in Ethiopia. More recently prevalence rates of 28, 33.8, 13.7 and 24.3 were reported in previous studies conducted in Kemmissie [9], Bahir Dar [10], South Gondar [11] and Bahir Dar and its surroundings [12], respectively. This mini review was, therefore, undertaken to compile some literatures available on Bovine Schistosomiasis.
Shchistosomiasis

Definition

Schistosomiasis is a common parasitic infection in cattle and rarely in other domestic animals in Africa and Asia. Although schistosomes may act as important pathogens under rare conditions favoring intensive transmission, most infections in endemic areas are subclinical [13]. Schistosomiasis is a chronic debilitating infection of humans and animals caused by different species of schistosomes and hence the disease is of public health importance. *Schistosoma bovis*, the cause of bovine Schistosomiasis, is one of the major veterinary problems in many Mediterranean and African countries [3].

Morphology of Schistosomes

Blood flukes form five different developmental stages: eggs, miracidia, sporocysts, cercariae and adult worms. Eggs are round to oval in shape, operculate (hinged at one end) and contain a developing embryonic larva (miracidium). Differences in egg morphology can be used to distinguish between *Schistosoma* species means differentiate in their position of spine [14].

Eggs of some species are armed with spine when discharged in the feces (*S.mansoni* and *S.japonicum*) and in urine (*S.hematobium*). The eggs of *Heterobilharzia americana* are rather spherical and possess only a slight bump on one side rather than a spine as seen in *S.hematobium* and *S.mansoni* [5]. Generally the eggs have typical morphological features. Relatively larger, slender (spindle) shaped and have lateral of terminal spine (pointed at both ends) [15].

Miracidia are elliptical free-swimming larval stages (~200µm long) covered with cilia. Sporocysts appear as pleomorphic sac-like bodies which contain developing cercariae. Mature cercariae are elongate free-swimming larval stages (400-600µm long) consisting of a tapering head (with prominent penetration glands) and a forked tail. Adult flukes are elongate tubular worms (10-20mm long), with rudimentary oral and ventral suckers. Males are shorter and stouter than females, and they have a longitudinal cleft (gynecophoral canal or schist) in which the longer slender female lies folded [14].

*Figure 1: Mature Schistosome Worm: Female Lying in the Gynaecophoric Canal of Male*
Life Cycle

Schistosomes have a typical trematode vertebrate-invertebrate lifecycle [16]. Schistosomes live in the mesenteric and hepatic veins of the host (except for S. naesale, which lives in the nasal veins), where they feed on blood and produce eggs with a characteristic terminal or lateral spine [13].

Parasite eggs are released into the environment from infected individuals, hatching on contact with fresh water to release the free-swimming miracidium. Miracidia infect freshwater snails by penetrating the snail’s foot. After infection, close to the site of penetration, the miracidium transforms into a primary (mother) sporocyst [16]. Germ cells within the primary sporocyst will then begin dividing to produce secondary (daughter) sporocysts, which migrate to the snail's hepatopancreas. Once at the hepatopancreas, germ cells within the secondary sporocyst begin to divide again, this time producing thousands of new parasites, known as cercariae, which are the larvae capable of infecting mammals [16].

Cercariae emerge daily from the snail host in a circadian rhythm, dependent on ambient temperature and light. Young cercariae are highly mobile, alternating between vigorous upward movements and sinking to maintain their position in the water. Cercarial activity is particularly stimulated by water turbulence, by shadows and by chemicals found on human skin [17].

Detailed schematic presentation of the life cycle of schistosomiasis is indicated in (Figure 2).

Figure 2: Life Cycle of Schistosomes [18]
**Epidemiology**

It is almost similar to fasciolagigantica and *Paramphistomes*. Schistosoma required water for hatching of the eggs. Eggs can hatch in slightly acidic pH. Shedding of cercariae is temperaturerependependent. Long time is required for development of schistosoma in snail high high rainfall is good predisposing factor for occurrence of these parasites [19]. Epidemiological studies on bovine schistosomiasis are suggestive of the endemicity of the disease particularly in areas with large permanent water bodies and marshy pastureareas. In Ethiopia, the optimum range for distribution of *S.mansoni* has been reported as 1500 to 2000 meter above sea level (masl) [20].

**Pathogenesis**

Schistosomiasis (or bilharziasis) is unusual amongst helminth diseases for two reasons: much of the pathogenesis is due to the eggs (rather than larvae or adults); and most of the pathology is caused by host immune responses (delayed-type hypersensitivity and granulomatous reactions) [7]. The course of infection is often divided into three phases: migratory, acute and chronic. The migratory phase occurs when cercariae penetrate and migrate through the skin. This is often asymptomatic, but in sensitized patients, it may cause transient dermatis (‘swimmers itch’), and occasionally pulmonary lesions and pneumonitis [7].

Eggs released into the bloodstream by adult worms can invade local tissues, where they release toxins and enzymes and provoke a TH-2-mediated immune response [21]. Inflammation and granuloma formation occurs around deposited eggs, which can lead to fibrosis and scarring of affected tissues, if the burden of eggs is heavy [22]. Eggs tend to either penetrate the bowel (adjacent to the mesenteric vessels in which the adult worms are residing) or travel via the portal venous system to the liver. In the bowel, granulomatous inflammation around the invading eggs can result in intestinal schistosomiasis characterized by ulceration and scarring [23].

The migration of the eggs may cause mechanical damage and lesions. Moreover schistosoma eggs trapped in the tissue elicit granulomatous reaction that is mounted to destruct the eggs. These granulomas consist of several cell types, mainly eosinophils, macrophages and lymphocytes. In the chronic stages of the disease the pathology is associated with collagen deposition and fibrosis, resulting in organ damage and dysfunction (Koqulan and Lucely, 2005).

**Clinical sign**

In cattle the clinical sign exhibited emaciation marked diarrhea, mixed with blood or mucous, dehydration pale of mucous membrane, marked weight loss, decreased production, rough hair coat, anemia, hypoalbuminemia, hyperglobulinemia and severe eosinophilia that develop after the onset of egg excretion. Severely affected animals deteriorate rapidly and usually die within a few months of infection, while those less heavily infected develop chronic disease with growth retardation [13].

Hemorrhagic enteritis, anemia and emaciation which develop after the onset of eggs excretion, are major clinical signs associated with the intestinal and hepatic form schistosomosis in ruminants severely affected animals deteriorate rapidly and usually die within a few months of infection [25].

**Diagnosis**

Examination of stool and/or urine for ova is the primary methods of diagnosis for suspected schistosome infections. The choice of sample to diagnose schistosomiasis depends on the species of parasite likely causing the infection. Adult stages of *S. mansoni*, *S. japonicum*, *S. mekongi*, and *S. intercalatum* reside in the mesenteric venous plexus of infected hosts and eggs are shed in feces; *S. haematobium* adult worms are found in the venous plexus of the lower urinary tract and eggs are shed in urine [26].

In general when schistosomiasis is suspected, diagnosis is best confirmed by detailed post mortem examination, which reveal lesion and if mesentery is stretched the presence of typical lesion in the skin that come in contact with pond, lake, and stream or ocean water containing infective cercaria from the snail intermediate hosts. Fecal examination is most useful in early infection, because egg production decline as infection progresses. Eggs don’t have an operculum and most are spindling shaped [5].

**Treatment**

Infections with all major *Schistosoma* species can be treated with praziquantel. The timing of treatment is important since praziquantel is most effective against the adult worm and requires the presence of a mature antibody response to the parasite [26].

Over the years, different drugs with known schistosomocidal but also toxic effects such as antimonials,
trichlorphon or nequvon have been tested against visceral schistosoma infection in cattle [27].

**Control and Prevention**

The most effective way to control cattle schistosomiasis in endemic areas is to prevent contact between the animals and the parasite by fencing of dangerous waters and supplying clean water. Unfortunately, this is not always possible in parts of the world where nomadic conditions of management prevail. Other methods of control include destruction of the snail intermediate host population at transmission sites, either by chemical or biological methods, or their removal by mechanical barriers or snail traps [13].

In humans, the most effective way of controlling Schistosomosis are the provision of sanitary facilities and the provision of piped water since, it reduces human contact with contaminated water [28].

**Conclusions**

Bovine Schistosomosis is one of the endemic diseases that deserve serious attention in the future although there has been little recognition of its veterinary significance, cattle Schistosomosis does cause significant loss throughout the world. This is due to the nature of the disease, which usually occurs at sub-clinical level with long term effect on animal growth and productivity and increase susceptibility to other parasitic or bacterial infection. It is, therefore, important to obtain more information on natural schistosome’s infection in cattle in general, and on the evaluation of the host–parasite relationship under condition of challenge in particular. Available means in snail control and disease monitoring could be implemented as a short term activity. Indigenous knowledge deserves investigation in this regard. The native Ethiopian plant *Phytolancia dodecandora*, locally known as “Endod” which is considered as potent molluscicide for the control of human Schistosomosis, could also be effectively used against intermediate host of *S. bovis*.

**References**


