

Report

Epidemiological, clinical and haematological profile of schistosomiasis in Yemen

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Introduction

Schistosomiasis (bilharziasis) is endemic in Yemen. It has been recognized as a public health problem in the country for the past 2–3 decades. The population of Yemen is about 16 million, of which 2–3 million are estimated to be infected [1]. In certain areas such as Taiz, infection rates as high as 100% have been reported among school-children, with an overall prevalence rate of 64% [1]. Both urinary and intestinal schistosomiasis are known to be endemic in Yemen. Environmental factors and the expansion of agricultural facilities, with the associated improvement in irrigation systems and construction of dams, have generated the optimal environment for the fresh-water snails, *Biomphalaria truncatus* and *B. arabica*, which are the intermediate hosts for *Schistosoma haematobium* and *S. mansoni* respectively [2].

Assessment of the susceptibility of the intermediate host species of snails to local strains of schistosoma in a geographical area is important as it determines the magnitude of the prevailing infection.

This preliminary study was conducted to ascertain the epidemiological, clinical

and haematological features of uncomplicated urinary and intestinal schistosomiasis so as to set guidelines for health workers for detecting these infections, particularly at the primary health care level.

Subjects and methods

An epidemiological survey was conducted during 1992, in which a total of 2902 students of 13 schools in Sana'a governorate, 800 students of 3 schools in Sada'a governorate and 2802 students of 14 schools in Hajja governorate were assessed.

Urine samples were examined by the nucleopore technique and stool samples by the Kato-Katz technique. In addition, 84 proven cases of uncomplicated schistosomiasis, diagnosed either by stool or urine examination at the Schistosomiasis Control Unit of the Central Health Laboratory in Sana'a, were selected at random. The subjects were questioned on the history of symptoms, such as abdominal pain, diarrhoea, bloody stools, haematuria and painful micturition. Basic haematological tests (haemoglobin and total leukocyte count) were estimated using a Coulter counter and

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a differential leukocyte count was carried out by standard manual counting.

For use in the susceptibility study of *B. arabica* snails, *S. mansoni* eggs were obtained from the livers of albino mice previously infected with 170 *S. mansoni* cercariae. For *B. truncatus*, *S. haematobium* eggs were collected from untreated people.

Five freshly hatched miracidia were pipetted into a test tube containing 3 ml dechlorinated tap water. Snails were left under artificial light for at least 5 hours and were then placed in an aquarium containing dechlorinated water. Snails which had been thus exposed were individually examined 3 weeks after infection and re-examined every 3 days to detect cercarial shedding and the infection rate was determined [3].

Results

The mean prevalence of urinary and intestinal schistosomiasis among schoolchildren

were as follows: 10.1% and 18.8% in Sana'a governorate; 52.2% and 7.6% in Hajja governorate; 49.0% and 76.3% in Sada'a governorate respectively (Table 1). The mean prevalence rates of *S. haematobium* among male and female school students in Sana'a governorate were 12.7% and 5.1%, and that of *S. mansoni* were 21.3% and 12.7% respectively (Table 2).

Of the 84 cases of uncomplicated schistosomiasis studied in detail, 60 were infected with *S. mansoni* and 24 with *S. haematobium*. The majority were males (71, 84.5%) and most of the patients (69, 82%) were aged between 10 years and 20 years. Table 3 shows the clinical features and haematological findings of *S. haematobium* and *S. mansoni* infection.

In the 60 cases of intestinal schistosomiasis, the most frequent symptoms were bloody stools (37, 61.7%), followed by diarrhoea (20, 33.3%); 10 (16.7%) cases had non-specific symptoms and 7 (11.7%) were asymptomatic. The average egg count was 95 eggs/g of stool. In 75% of the cases, the

Table 1 Prevalence of intestinal and urinary schistosomiasis among schoolchildren in Yemen

Governorate	No. examined	<i>S. mansoni</i> -infected		<i>S. haematobium</i> -infected	
		No.	%	No.	%
Sana'a	1451	273	18.8	146	10.1
Hajja	1401	106	7.6	732	52.2
Sada'a	400	305	76.3	195	49.0

Table 2 Prevalence of urinary and intestinal schistosomiasis among male and female schoolchildren around Sana'a

Species	Males	Females	Infected males		Infected females	
			No.	%	No.	%
<i>S. haematobium</i>	1100	351	140	12.7	18	5.1
<i>S. mansoni</i>	1035	416	220	21.3	53	12.7

Table 3 Comparison of haematological changes in uncomplicated infections with *S. mansoni* and *S. haematobium*

Test	<i>S. mansoni</i> (n = 60)	Mean	<i>S. haematobium</i> (n = 24)	Mean
Hb (g/dl)	12.3-17.3	15.6	11.8-17.9	13.8
TWBC ($\times 10^9/l$)	3.5-10.5	6.0	3.0-9.5	6.1
Neutrophils (%)	19-71	38	13-56	38
Lymphocytes (%)	22-74	49	38-66	53
Eosinophils (%)	1-26	10	3-21	10
Monocytes (%)	1-15	3	1-8	3
Basophils (%)	0-2	-	0-3	-

Hb = haemoglobin TWBC = total white blood cells

egg count was below 100 eggs/g of stool. The haemoglobin values ranged from 123 g/l to 173 g/l with a mean of 156 g/l. The eosinophil percentage ranged from 1% to 26% with a mean of 10%.

In the 24 cases of urinary schistosomiasis, the most common symptom was haematuria, (15, 62.5%), followed by painful micturation (8, 33.3%); 2 (8.3%) cases had non-specific symptoms and 2 (8.3%) were asymptomatic. The haemoglobin values ranged from 118 g/l to 179 g/l with a mean of 138 g/l. The eosinophil percentage ranged from 3% to 21% with a mean of 10%.

Of the 21 cases of hepatosplenic schistosomiasis, 17 were males. The average haemoglobin value was 115 g/l, and the average egg count was 206/g of stool, and in 70% of the cases the egg count was above 100/g of stool.

The susceptibility study of the intermediate host snails *B. arabica* and *B. truncatus* to infection with local strains of schistosomes revealed, in the case of *B. arabica*, that snails started shedding cercariae in the fifth week after infection. The infection rate was high with 70 snails shedding

cercariae from a total of 72 snails (97.2%). Of the 55 *B. truncatus* snails, 54 (98.2%) were infected and started shedding cercariae in the sixth week after infection.

Discussion

Although the presence of schistosomiasis in Yemen has been well documented, few epidemiological studies have been carried out. All members of the genus *Biomphalaria* are potential intermediate hosts of *S. mansoni*, but not all species and races of *Biomphalaria* are regularly susceptible to all strains of the parasite and in some cases they may be completely resistant [4,5]. We found that *B. arabica* and *B. truncatus* were highly susceptible to infection with local Yemeni strains of *S. mansoni* and *S. haematobium*, respectively under laboratory conditions.

The school survey in the three governorates clearly shows the vulnerability of schoolchildren to both intestinal and urinary schistosomiasis. The infectivity rate ranged from 10.1% to as high as 76.3%. *S. mansoni* was more prevalent than *S. hae-*

matobium, which is similar to the findings of Hazaa et al. [6] and Farag [4].

Our results indicate the need for periodic urine and stool examination as a part of the school health programme in areas where schistosomiasis is endemic. We found that schistosomiasis was most common in the age group 10–20 years and in males, which concurs with earlier studies [4,7].

A useful method of reducing schistosomiasis is case-finding by standard and effective diagnosis and treatment, especially in rural areas where medical manpower is lacking. The most common clinical symptoms in uncomplicated schistosomiasis caused by *S. mansoni* were bloody stools (61.7% of the cases) and abdominal pain and/or diarrhoea (50% of the cases). In *S. haematobium* infection, haematuria was seen in 62.5% of the cases and painful micturition in 33.3%. Such findings have often been reported [5,8].

We found that in uncomplicated schistosomiasis, anaemia was not a feature but mild eosinophilia was present in the majority of our patients, findings which have been documented elsewhere [8]. However, anaemia has been found with *S. mansoni* infection when there are associated complications, such as hepatosplenomegaly [9,10]. All our patients with hepatosplenomegaly had mild to moderate anaemia, a finding in agreement with other studies [11]. In *S. haematobium* infection, iron deficiency develops as a result of chronic blood loss late in the course of the disease. In the majority of the uncomplicated cases in this study, the total leukocyte counts were normal and the average leukocyte count was $6 \times 10^9/l$.

In two cases of *S. mansoni* infection and one case of *S. haematobium* infection, there was leukopenia. Mild neutropenia appears to be a feature of schistosomiasis as shown

in our study, where in 50% of the cases there was mild neutropenia with an average percentage differential count of 36%. Neutropenia has often been demonstrated in hepatosplenic schistosomiasis [11]. Eosinophilia is a common haematological finding in schistosomiasis. Marked leukocytosis with absolute eosinophilia is a feature of acute schistosomiasis [12]. Moderate eosinophilia occurs in the active disease but eosinophilia is not always present as seen in our study where in 55.8% of the cases, the eosinophil counts were within the normal range and similar to those of all our cases of uncomplicated schistosomiasis.

Recommendations

1. The strategy to control schistosomiasis should be based on curative and preventive approaches.

Curative

- a) mass treatment for schoolchildren should be carried out if the prevalence of schistosomiasis is more than 30%.
- b) selective population chemotherapy involving screening of the whole population through urine and stool analysis once a year should be conducted, and positive cases should be treated with praziquantel and examined after 3 months of treatment.

Preventive

- a) snail control with niclosamide should be carried out by treating all water sources and snail habitats and conducting proper post-treatment surveys to treat reinfested habitats.
- b) selective mollusciciding should be applied in areas where people are in close contact with the water sources.

2. Support from the international community should be sought in order to implement the control programme and strengthen the research unit.
3. The government should establish a committee for schistosomiasis control and earmark more funds in order to implement the plan of action of the

project, and provide the necessary manpower and facilities.

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