

THE RELATIONSHIP BETWEEN MORBIDITY AND INTENSITY OF *SCHISTOSOMA JAPONICUM* INFECTION OF A COMMUNITY IN JIANGXI PROVINCE, CHINA

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Abstract. Seven hundred and eighty-five individuals from an area endemic for *Schistosoma japonicum* had parasitological and physical examinations done. A morbidity questionnaire was also administered to each participant. Among those with *S. japonicum* infection, there was a significant increase in diarrhea, blood in the stool and weakness during the previous two weeks. The severity of the disease appears to be related to the history of schistosomiasis japonicum and these results give further justification for treatment of the infected individuals and those severe morbidity groups in community based chemotherapy programs designed to reduce morbidity in endemic areas.

INTRODUCTION

In recent years the relationship between intensity of infection and morbidity in schistosomiasis has been demonstrated in variety of studies involving school children, agricultural workers, and entire communities. The most extensive investigations have been performed on schistosomiasis mansoni (Gryseels, 1990; Smith, 1979) and several disease manifestations such as weakness, abdominal pain, diarrhea and hepatosplenomegaly have been attributed to schistosomiasis mansoni. But similar investigations of schistosomiasis japonica are few (Domingo, 1980). This is of importance in that the disease syndromes in schistosomiasis mansoni and japonica, both of which involve the intestines and liver, are similar. As part of a drug intervention program against schistosomiasis in a community in Poyang lake region, Jiangxi Province, China, baseline data on *S. japonica* infection were collected. The infected group was compared with an uninfected group in terms of frequency of symptoms and liver and spleen enlargement. This paper reports on the relationship between intensity of infection and morbidity in terms of gastrointestinal symptoms and liver and spleen enlargement.

MATERIALS AND METHODS

Study area and population

The study village of Sisan is in Duchang District, Jiangxi Province, at the east of Poyang lake, one of the largest lakes in China. It is a typical lake region and transmission of *S. japonica* is very frequently a seasonal phenomenon occurring in spring as water floods and again in autumn as water recedes (Zhang, 1990). Sisan contains 8 natural villages, of which the inhabitants are virtually all employed in farming and fishing. The sanitary conditions are poor, and no piped water is available.

Stool examination

During the survey period (May 1990), each individual was provided with a labeled container. Stool specimens were collected by resident field workers who were familiar with the people and then sent to the field laboratory, where each specimen was processed using the Kato thick smear technic. Smears were prepared in duplicate from each specimen and read by two technicians independently of each other.

A 10% random sample of the slides examined each day was re-examined by a parasitologist as a quality control measure. There was 95% concordance in the readings between the technicians and the parasitologist during the survey.

Medical history

A questionnaire concerning the major gastrointestinal symptoms attributable to *Schistosoma japonicum* infection was designed and pretested before the survey began. Two trained interviewers were conducted on the day of the physical examination, without knowledge of stool results. The questions were asked in a similar manner in the local language. The symptoms asked for were: diarrhea, blood in the stool, weakness, abdominal pain and absence from work or school in the last two weeks.

Physical examination

Individuals were examined in the supine position for liver and spleen enlargement. When the liver was palpated, the maximum distances from the right costal margin in the midclavicular line (MCL) and from the xiphoid in the midsternal line (MSL) to the edge were measured with a centimeter ruler. Spleen size was measured using Hackett's classification (0-5) (Hackett, 1944). Two physicians performed the examinations without knowledge of stool results. The procedures for obtaining measurements and classifications were carefully standardized before the survey began. During the survey, 50% of all participants were selected to record the grade of periportal fibrosis of liver using B ultrasound.

RESULTS

Population

Complete studies, including stool egg counts, physical examinations and medical histories, were performed on 785 of 894 people (87.81%) aged from 3 to 60 years old. The male: female ratio was 0.94 : 1.

Schistosoma japonicum infection

S. japonicum eggs were detected in the stools of 325, or 41.40% of 785 individuals included in the

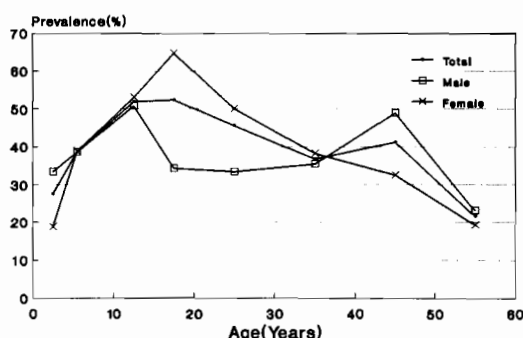


Fig 1—Age-prevalence of *S. japonica* in the study population of Sisan.

study. Fig 1 illustrates the age prevalence of the infection. The peak prevalence for the total population (52.05%) occurred in the 10-20 year age group. There was a decline in prevalence to 36.73% in the 30-40 year age group, gradually rising again to 41.18% in the 40-50 age group and then declining in those 50 years of age or older. Comparing the prevalence between males and females, we found that the peak prevalence was in 10-15 in male and 15-20 in female age groups respectively and then declining in those 20 years of age of older females. There was another prevalence peak in the 45-50 age group, but there was no significant difference of prevalence between males and females at ($p > 0.05$).

Quantitative egg counts were performed on two thick fecal smears from each individual. Statistical analysis by the paired *t*-test showed no significant difference between the readings of the two slides. The population was divided according to intensity of infection as follows: uninfected, 58.60%; lightly infected (1-100 eggs/g), 23.57%; moderately infected (101-400 eggs/g), 9.81%; and heavily infected (> 400 eggs/g), 8.03% (Fig 2).

Medical history

An attempt to assess general physical well-being was made by asking whether individuals felt well enough to carry out their usual activities (work or school) during the past two weeks. The X^2 test showed no significant difference between infected and uninfected individuals nor any relation to intensity of infection. Fifteen and 27% of individuals respectively complained of diarrhea and blood in

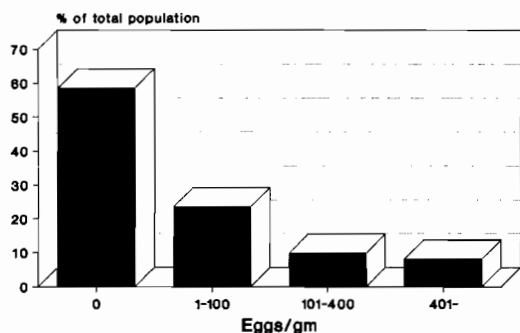


Fig 2—% of the uninfected with those with different intensities of *S. japonica*.

the stool during the previous two weeks. There was a tendency for such symptoms to be reported more frequently by infected individuals and there was also a higher frequency of weakness in the infected (51.69%) than the uninfected (41.96%). A history of abdominal pain in the past two weeks was not related to the presence of infection, nor was a history of respiratory infection (Table 1).

Physical examination

Both hepatomegaly and splenomegaly were common in this population (Table 2). Hepatomegaly in the MCL (≥ 1 cm) and MSL (≥ 3 cm) was observed in 28.03% and 74.78% of the population. X^2 testing showed that there was no difference between infected group and uninfected group at the 5% level. A relationship was observed between schistosomiasis history and MSL.

Using the Hackett classification, splenomegaly equal to or greater than 1 was seen in 22.32% of uninfected population and in 20.63% of the infected population. There was no relationship to presence of infection. But there was a tendency for splenomegaly to occur more frequently in the group which had a history of *S. japonicum* infection (Table 2).

Ultrasound examination

Grade 1 periportal fibrosis was found in 25.00%, grade 2 in 18.56%, and grade 3 in 3.47%. There was no significance of the rate of periportal fibrosis in the infected compared with uninfected groups. However, a relationship was found between periportal fibrosis and schistosomiasis history (Table 3).

DISCUSSION

Morbidity due to schistosomiasis has been a subject of many studies. Kloetzel (1962) was the first to employ egg counts in a population-based morbidity study in Brazil. Since then a number of similar studies have been carried out in different endemic communities. Most such studies have concerned schistosomiasis mansoni infections; the only reports of similar investigations in schistosomiasis japonica were those of Pesigan (1958), Domingo (1980), Mott (1992) and Wiest (1992). The present study, carried out in a rural farming and

Table 1

Percent occurrence of symptoms usually ascribed to chronic schistosomiasis japonica in the population of Sisan in uninfected individuals as compared to those infected.

Symptoms in the last 2 weeks	Uninfected (%) (460*)	Infected (%) (325*)	X^2	p
Ability to work	4.75	2.15	2.56	0.11
Diarrhea	10.65	20.62	14.23	0
Bloody in the stool	16.74	41.85	59.46	0
Feeling weak	41.96	51.69	6.88	0.01
Abdominal pain	24.78	29.85	2.23	0.14
Resp infection	16.52	16.62	0	1.00

* Number of individuals examined

Table 2

Percent occurrence of hepatomegaly and splenomegaly in the population of Sisan in the uninfected and no schistosomiasis history individuals compared to groups infected and with schistosomiasis history.

Occurrence of	<i>S. japonica</i> infection		<i>S. japonica</i> history	
	No (460)*	Yes (325)*	No (495)*	Yes (399)*
Hepatomegaly MCL (≥ 1 cm)	25.87	31.08	29.07	28.69
Hepatomegaly MSL (≥ 3 cm)	73.04	77.23	67.92	79.60*
Splenomegaly (≥ 1 cm)	22.32	20.63	16.32	26.43*

* Number of individuals examined; *p < 0.01

Table 3

Occurrence of periportal fibrosis in the population of Sisan in the uninfected and no schistosomiasis history as compared to groups with infected and schistosomiasis history.

Grade of periportal fibrosis	<i>S. japonica</i> infection		<i>S. japonica</i> history	
	No	Yes	No	Yes
0	146	68	160	89
I	64	37	15	100
II	42	33	9	67
III	13	1	2	13
p > 0.05		p < 0.01		

fishing population on the shore of Poyang lake region, an area where schistosomiasis is endemic, attempted to measure the impact of *S. japonicum* on the health of that population.

The age-prevalence curves in Sisan showed a high infection rate of 52.05% in the 10-20 age group. The peak prevalence for males and females occurred in 10-15 and 15-20 age groups respectively and males rising to a second peak in 40-50 age group. The largest proportion of those infected had light infections (56.92%), 23.69% had moderate infections and 19.38% had heavy infections. This is consistent with the dispersed distribution of schistosome infections as seen in all but the most heavily infected populations (Smith, 1979; Warren,

1974). Studies in experimental animals have repeatedly shown that egg output by *S. japonicum* is 10 times that of *S. mansoni* (Moore, 1967). The high mean egg counts of 363 eggs/g feces in the infected population of Sisan suggests high worm burdens.

As repeated statements that chronic schistosomiasis japonica is associated with weakness, diarrhea and blood in the stool (Warren, 1978), the present study revealed that in comparison with an uninfected control group in the same community there was increased incidence of diarrhea, weakness and bloody stools in the infected group. This is consistent with the results for schistosomiasis mansoni obtained with similar methodology in

Burundi (Gryseels, 1988), Ethiopia (Hiatt, 1976), Brazil (Guimaraes, 1985), Uganda (Ongom, 1972), Zambian (Sukwa, 1986), and it is suggested that these symptoms can be regarded as indicators of schistosomiasis japonica infection. However, contrary to the findings of some studies (Smith, 1979; Macario, 1985), the study did not reveal any relationship between abdominal pain and presence of infection.

On physical examination in Sisan there was high prevalence of hepatomegaly and splenomegaly in the population but there were no significant changes with either the presence or absence of infection. But, hepatomegaly in MSL, splenomegaly and periportal fibrosis of the liver correlated with a history of schistosomiasis japonica, which is consistent with the result obtained by Mott (1992). Although some factors such as HBV infection can affect hepatosplenomegaly, it is indicated that past parenteral infection has a role in the high rate of hepatomegaly in MSL, splenomegaly and periportal fibrosis of the liver.

Schistosomiasis japonica is currently endemic in 7 provinces in China and it is estimated that 1.35 million persons are infected and 44 million persons are exposed to infection (Yuan, 1992). The expert panel convened by WHO to review schistosomiasis control stated that reduction and prevention of morbidity were the primary objectives (WHO, 1985). In light of the severity of morbidity indicated by the results of this study and other effects of schistosomiasis reviewed by Yuan (1992), urgent action such as mass chemotherapy is necessary to reduce the prevalence of *S. japonica* in endemic areas and further studies need to be carried out to determine the longterm implications of such high morbidity levels on the population and their productive capacity.

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