

IMPACT MASS CHEMOTHERAPY WITH PRAZIQUANTEL ON SCHISTOSOMIASIS CONTROL IN FANHU VILLAGE, PEOPLE'S REPUBLIC OF CHINA

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Abstract. The paper describes the endemic situation of schistosomiasis japonica in Fanhu village, Poyang Lake region, China and the effect of the strategy of combining annual mass chemotherapy with health education on schistosomiasis control in the community. The results showed that the prevalence of infection with schistosome reduced from 26.0% in 1992 to 10.7% in 1994, the intensity of infection in residents decreased from 1.92 in 1992 to 0.55 in 1994 and the condition of hepatomegaly, splenomegaly and liver fibrosis also improved after chemotherapy in the individuals in the case prospective study. Moreover, the future strategies of schistosomiasis control in this area have been suggested according to the transmission of schistosomiasis in the lake region and the effect of anti-schistosomiasis control indifferent populations.

INTRODUCTION

Schistosomiasis japonicum is a serious health problem in PR of China. In the 1950's more than 10 million individuals were estimated to be infected with *Schistosoma japonicum* (Chen, 1989; Mao, 1986). Over the next decades intensive effort to control schistosomiasis led to a significant reduction in the prevalence of infection and morbidity with *Schistosoma japonicum*.

Recent studies indicate, however, that schistosomiasis is still a serious health problem in lake and marshlands regions in China today, which represent 96.3% of chronic cases, 99.0% of the acute cases and 98.6% of the snail infested areas in national endemic areas. Within these regions, the snail host, *Oncomelania hupensis* is increasing, leading to the expansion of areas endemic for schistosomiasis and increase in the number of cases of acute schistosomiasis (Yuan, 1989).

Poyang Lake region is one of the most serious endemic areas of schistosomiasis japonicum in China. In 1992, 20 thousand individuals were estimated to be infected with *S. japonicum*, 8,000 cases with advanced schistosomiasis, and 1,000 cases with acute schistosomiasis. In addition, 30-50 thousand cases of reinfection occurred every year during recent decades (Zhang *et al*, 1991b).

For exploring the best strategy to control the prevalence and morbidity due to *Schistosoma japonica*, a field site of cooperative study on schistosomiasis control was set up in Fanhu village in 1993 by the Party of Aid for Study of Schistosomiasis in China and Asia (ASSCA) and Jiangxi Provincial Institute of Parasitic Diseases (JPIPD), which was the pilot of chemotherapy of schistosomiasis, set up in 1992 by JPIPD.

MATERIALS AND METHODS

Study site

The study site, Fanhu village, is situated in the south-west of Poyang Lake, Jiangxi Province, which belonged to marshlands of Poyang Lake originally. The Henghu Dike was constructed in 1961 for developing agriculture, and the villagers have resided at the inside of the dike ever since. However, the residents have the chance to contact infested water because they have to go to the outside of the dike for productive and daily living activity such as fishing, bathing, swimming and washing clothes. The total population of Fanhu village in 1992 was 390 with 184 males and 206 female villagers.

The intermediate host snail in the region is

Oncomelania hupensis and their breeding area is the marshlands at the outside of the dike. Transmission of schistosomiasis occurs from April to November, seasonal flooding of the lake occurs in Spring and Summer seasons with almost complete dryness during the winter. Cattle, the major infective resource of schistosomiasis, are grazing in marshlands from the village and significantly contribute to transmission of schistosomiasis.

The study was a longitudinal survey in three consecutive years, including general information in the community, snail investigation and sentry mich test in the marshlands outside the village, questions of medical history, physical examination, stool examination by Kato's method and immunological diagnosis with IHA test for detecting CAAb of *S. japonicum* in individuals aged 3 to 60. All surveys mentioned above were carried out according to the regulation of the "Handbook of Schistosomiasis Control" published by the Department of Endemic Diseases Control, Ministry of Public Health, China.

Ultrasonographic examination was conducted in 1993 and 1994. The examination items and methods recommended by WHO were adopted, such as the size, shape and surface condition of the liver, the status of liver parenchyma, portal vein, periportal thickening, splenomegaly.

Before and after health education, a quantitative survey of contacting infested water in all individuals of the community was made. Local doctors visited the subjects once a week and recorded frequency of exposure to infested water, then calculated the "time/day/person" as the index of water contact.

Control strategy

Since 1992, all investigated individuals were treated with praziquantel at a dose of 40 mg/kg in early spring once every year except for pregnant and lactating women, or anyone who appeared to be seriously ill.

Health education for schistosomiasis control began from February 1993. Various health education methods such as TV video, slides, pictures, broadcast, reading materials, slogans, warning board and others were adopted to spread knowledge about schistosomiasis, including life history of schistosomiasis, infection place, infection way, suscepti-

ble season, preventive measure, symptoms, harm to health and the method of treatment. Moreover, lectures about the importance of schistosomiasis control and methods for preventing infection were held.

Statistical analysis

All data were input in computer to set up database using Epi-info V 5.0 software. Data analysis was conducted by adopting Epi-info and SAS/PC procedures.

RESULTS

Endemic situation

The results of an initial survey in 1992 showed that Fanhu village was a serious endemic area of schistosomiasis, the residents' positive rate of stool examination and immunological examination with IHA test were 26.0% and 65.5% respectively. 50.1% of the individuals interviewed contacted infested water frequently. 69.9% of the individuals interviewed had a history of infection with schistosomiasis and the mean treated times was 2.9 (maximum was 13). There were 10 persons who died of schistosomiasis during the last five years.

Effect of prevalence control

In results of longitudinal stool examination in the residents are given in Table 1. The positive rate of stool examination reduced from 26.0% in 1992 to 10.7% in 1994 and the intensity of infection (geometric mean of EPG in population) decreased from 1.92 in 1992 to 0.55 in 1994.

There were significant changes in prevalence of schistosomiasis in various populations groups: school children, female inhabitants and male inhabitants during the period from 1992 to 1994. In school children, the prevalence reduced from 22.9% in 1992 to 2.3% in 1994 ($p < 0.01$); in the female population, it fell from 20.0% in 1992 to 5.8% in 1994 ($p < 0.01$); and in the male population, it fell from 32.4% in 1992 to 26.1% in 1994; the detailed results are shown in Fig 1-3.

The results of immunological examination with IHA test are given in Table 2. The results also

Table 1

Longitudinal survey on prevalence of *S. japonicum* in Fanhu village from 1992 to 1994.

Year	No. of exam	Positive No. rate (%)	Intensity of infection (EPG)
1992	235	61 26.0	1.92
1993	263	27 7.4	0.31
1994	290	31 10.7	0.55

$X^2 = 30.80, p < 0.001$

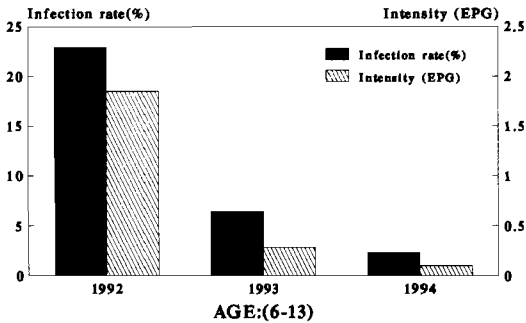


Fig 1—The changes on prevalence of infection with *S. japonicum* in school children.

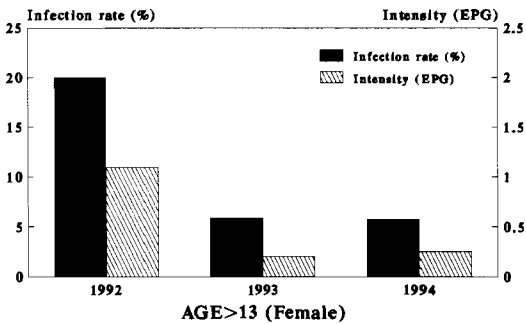


Fig 2—The changes on prevalence of infection with *S. japonicum* in female.

showed that the endemic situation of schistosomiasis in the community has been controlled after mass chemotherapy.

Comparing the results of stool examination and IHA test in the same individuals who accepted both surveys mentioned above, the sensitivity of IHA test reached 92.9% in 1993 and 96.4% in 1994 (Table 3).

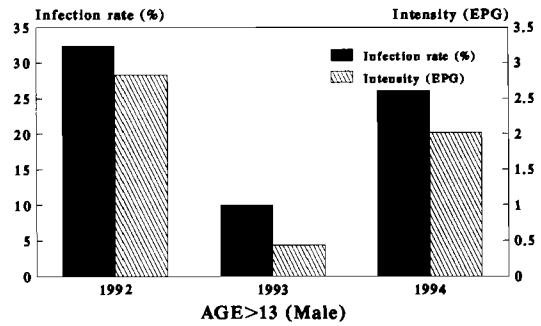


Fig 3—The changes on prevalence of infection with *S. japonicum* in male.

Table 2

Longitudinal survey on IHA test in residents of Fanhu village.

Year	No. of exam	Positive No. rate (%)	GMRP
1993	232	152 65.5	11.86
1994	235	133 56.0	7.44

$X^2 = 3.91, p < 0.05$

Table 3

Comparison on the results of stool exam and IHA test in residents of Fanhu village.

	IHA test			IHA test	
	+	-		+	-
Stool+	13	1	Stool+	27	1
Exam-	133	76	Exam-	70	74

Sensitivity of IHA test = 92.86 (1993)

Sensitivity of IHA test = 96.43 (1994)

Effect of morbidity control

158 cases were analyzed in the prospective study for assessing the effect of morbidity control, they suffered from hepatomegaly or splenomegaly or liver fibrosis due to schistosomiasis determined by ultrasound examination in 1993 and repeated examination in 1994.

The results were as follows: among 32 cases with hepatomegaly (SLL \geq 70mm, SLL = size of left lobe of liver), 11 cases (34.4%) didn't have a change on the size of the liver after chemotherapy; 16 cases (50.0%) decreased from 1993 to 1994 and 5 cases (15.6%) enlarged from 1993 to 1994. Table 4 gives the results in detail.

There were no changes in spleen size in 18 cases (21.4%) among 84 cases with splenomegaly (LS \geq 100 mm, LS = length of spleen), 42 cases (50.0%) decreased in spleen size from 1993 to 1994 and 24 cases (28.6%) enlarged after treatment. The results are given in Table 5.

In 67 cases the liver parenchyma was abnormal in 1993; after mass chemotherapy, 22 cases (32.8%) improved and in 11 cases (16.4%) the condition was worse than pretreatment, in 34 cases liver fibrosis had not changed within two years. The results are given in Table 6.

Table 4

The changes of hepatomegaly in the community from 1993 to 1994.

SLL (mm) 1993	SLL (mm), 1994			
	< 70	70-	80-	90-
70-	13	7	2	2
80-	1	1	3	1
90-	1	0	0	1

Table 5

The changes of splenomegaly in the community from 1993 to 1994.

SLL (mm) 1993	SLL (mm), 1994			
	< 100	100-	110-	120-
100-	20	9	11	8
110-	6	5	4	5
120-	5	1	5	5

The changes of frequency of contacting infested water

After health education on schistosomiasis had

Table 6

The changes of liver fibrosis grade in the community from 1993 to 1994.

1993	1994			
	0	I	II	III
I	15	13	9	0
II	3	4	11	2
III	0	0	0	10

been implemented since 1993, there were significant differences in the change of frequency of contacting infested water in school children and the female population, but not the male population of the community. In school children (aged 6-13), the main ways of contacting infested water were swimming, playing and fishing outside the dike; by performing health education, the frequency of exposure in the flood season decreased from 0.234 (time/day/person) 1992 to 0.0037 in 1993 ($p < 0.001$). Fig 4 shows the exposure conditions in detail.

In female persons (aged 13-60), the main style of exposure was washing clothes and utensils, their frequency of exposure decreased from 0.098 (time/day/person) to 0.070 (Fig 5).

In male persons, the main activity of contacting infested water was fishing, the frequency of exposure was not significantly different before and after health education (Fig 6).

Impact of transmission control

The results of snail investigation outside of the dike showed that the strategy of mass chemotherapy

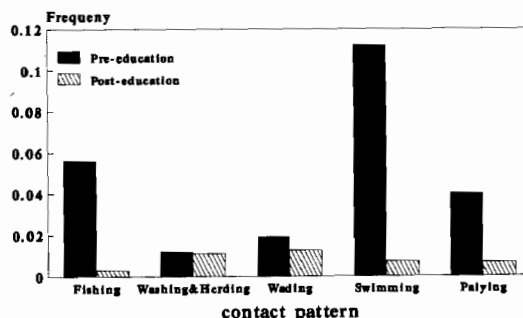


Fig 4-Frequency of water contact in school children.

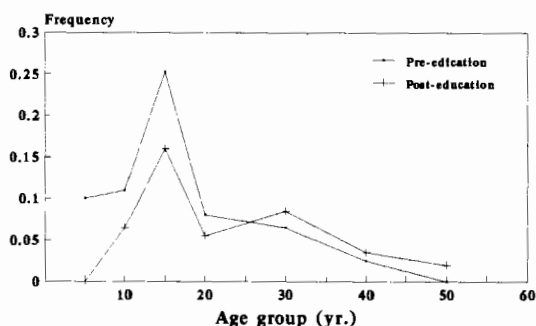


Fig 5—The changes of frequency of water contact in female.

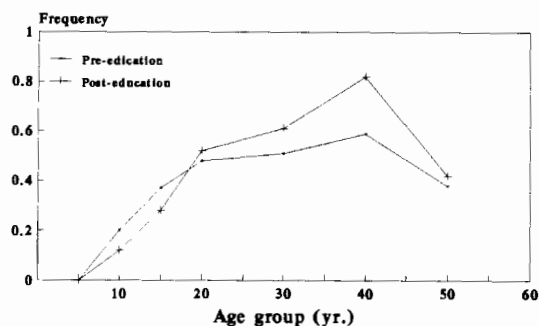


Fig 6—The changes of frequency of water contact in male.

with health education could not control the transmission of schistosomiasis in the community (Table 7).

DISCUSSION

The objective of the present study was to determine the impact of annual mass chemotherapy with praziquantel on infection status and morbidity due to schistosomiasis japonica in a community in Poyang Lake, Jiangxi Province, in China. Our data

Table 7

Snail investigation in marshlands outside of Henghu Dike.

Year	No. of Survey point	Snail density (/0.11m ²)	Infected snail density (/0.11m ²)
1992	544	0.20	0.0036
1993	613	0.41	0.0079
1994	450	0.62	0.0067

demonstrate that the achievement of schistosomiasis control has been obtained by intensive effort by the cooperative study group organized by Dr Hidenori Murakami, the chairman of ASSCA; the prevalence of infection in the community decreased from 26.0% to 10.7% during a three-year period. The most noteworthy change in infection status was found in younger individuals and female persons while little impact on the prevalence of infection was seen in male persons. This observation is important since recent studies suggest that schistosomiasis has a significant negative impact on growth and development and potentially on cognition in children (Mcgarvey *et al*, 1992, 1993; Kimura, *et al*, 1992). The case prospective study of hepatomegaly, splenomegaly and liver fibrosis showed that the status of signs due to schistosome infection also gave significant improvement after treatment. According to above results we realized that chemotherapy is a very important strategy of schistosomiasis control in the lake region in China today.

According to Wu Zhongdao's research in 1991, the reinfection rate of schistosomiasis in Sisan village, Poyang Lake was 54.0% during the next year of post-treatment; in this study, the reinfection rate of schistosomiasis was estimated to be 10%-15% every year in the community. In view of the difficulty of controlling transmission of schistosomiasis due to the vast snail infested area and the serious reinfection of schistosomiasis in the lake region mentioned above, "morbidity control" including prevalence control has to be selected as the objective of schistosomiasis control in these areas in recent years.

There were two peaks of cercaria density of *Schistosoma japonicum* on surface of the water in flood season in Poyang Lake region, the first peak was in Spring (from April to June) and the second one was in Autumn (from September to November). The period from November to next April belonged to the non-susceptible season of schistosomiasis (Zhang *et al*, 1991a). According to the results mentioned above, the chemotherapy season in the lake region had better to be moved from early Spring (March) to end of Autumn (November), so that the individuals posttreatment will have no reinfection until next April and the effect of morbidity control will be promoted significantly in the community, otherwise, if the chemotherapy is arranged in Spring such as in this project, some

individuals who accept the treatment will get reinfection of schistosomiasis immediately after chemotherapy and become the carriers of schistosomes the whole year and the impact of morbidity control will be reduced significantly.

In this study, the reinfection rate of *Schistosomiasis japonicum* was very low in school children and female persons through the strategies of combining annual mass chemotherapy with health education. For getting the best cost-effectiveness from schistosomiasis control, it seems not necessary to implement mass treatment in these individuals. In view of the high sensitivity of the IHA test, the selective chemotherapy with screening method of IHA test once every year in above persons will be suitable, the cost-effectiveness will be better than mass chemotherapy, but in male persons, the reinfection rate of schistosomiasis was very high during the next two years after mass chemotherapy and it was estimated to be 15-30% every year. So the strategy of mass chemotherapy has to be adjusted from once every year to twice every years in these individuals for getting the better effect of morbidity control, and the first time of chemotherapy should be selected in August and the second time in November or December.

Health education was a very important measure to consolidate the achievement of chemotherapy in the population, especially in school children and female persons because some activities of contacting infested water outside of the dike such as swimming, playing and washing clothes and utensils can be avoided by health education. In male persons in the community, the main activity of contacting water was fishing and it is difficult to avoid, so the impact of health education was not so good to these individuals and it will be necessary to implement mass chemotherapy twice every year.

ACKNOWLEDGEMENTS

The authors are grateful for the support of ASSCA in providing the ultrasound machines and the funds in this study and Henghu Hospital in providing the laboratory for testing CAB of *Schistosoma japonicum*. We are also indebted the staff of ASSCA, Shanghai Medical University and JPIPD for work in the field site.

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