

## Chapter 25. Schistosomiasis

The eradication of schistosomiasis (often referred to as bilharziasis or snail fever) or its elimination by multiple, integrated intervention techniques is beyond the human and financial resources of most endemic countries. However, a reduction in disease or morbidity due to schistosomiasis is now feasible and can be attained within the limited resources of many endemic countries. The simplicity of diagnostic techniques and the safety and ease of administering effective anti-schistosomal drugs such as praziquantel makes disease or morbidity control affordable, particularly if it is integrated with other programmes. Morbidity control should be coupled with transmission control such as sanitation, health education, provision of safe water supplies and snail control.

### THEN AND NOW

In 1948, *Schistosoma japonicum* was recognized as a public health problem in China, Japan and the Philippines. In the late 1960s, *S. mekongi* was found to be endemic in Cambodia, the Lao People's Democratic Republic and in localized sections of the countries bordering the Lower Mekong River. *S. malayensis* was identified among Orang Asli aboriginal tribes in Malaysia. It is probable that small foci of transmission may yet be discovered within the Western Pacific Region but these will have no major public health significance.

### Cambodia

In 1969, officials of the Ministry of Health of Cambodia, together with a WHO consultant, made a general parasitological survey of the inhabitants in Kratie Province and found 40 of 119 persons (33.6%) positive for eggs of schistosomes.<sup>1</sup>

The schistosomiasis control programme was stopped in 1976 due to political turmoil. In 1989, Médecins sans Frontières started a mission in Cambodia. It rehabilitated the Provincial Hospital in Kratie and in collaboration with the Ministry of Health

set up a schistosomiasis control programme. In December 1995, the National Malaria Center was designated as the national referral centre for schistosomiasis control in Cambodia. In high transmission areas of Kratie province mass treatment campaigns reduced prevalence from 60% to less than 20% in 1997.

### China

For centuries, schistosomiasis has caused suffering and premature deaths among people living along the Chang Jiang (Yangtze River) and in other endemic areas. *S. japonicum* eggs were identified in a female corpse from the Western Han Dynasty, 2100 years ago.<sup>2</sup> *S. japonicum* in China was first diagnosed clinically in Changde county, Hunan in 1905.<sup>3</sup>

After the establishment of the People's Republic of China in 1949, a nationwide survey of schistosomiasis was undertaken. In 1950, the known endemic areas were the plains along the Yangtze and Upper Mekong and included the city of Shanghai

<sup>1</sup> Iijima, T. Assignment report of a project in Cambodia, 13 November 1968–8 May 1969 (WPRO 0080, Cambodia), 21 August 1970.

<sup>2</sup> Mao, S.P., and Shao, B.R. Schistosomiasis control in the People's Republic of China. *American Journal of Tropical Medicine & Hygiene*. 31, 1982: 92–99.

<sup>3</sup> *Ibid*; Ross, A.G.P., Li, Y.S., Sleigh, A.C. and McManus, D.P. Schistosomiasis Control in the People's Republic of China. *Parasitology Today*. 13, 1997: 152–155.

and as many as 380 counties in 12 provinces.<sup>4</sup> In 1950, 12 million people were estimated to be infected, out of an exposed population of 100 million in the endemic areas.

Continuous efforts over four decades have led to a 90% reduction in the number of infected persons, compared to 1950. Since the founding of the national control programme in 1955, tens of millions of people have been mobilized to carry out environmental modifications. Health education, scientific research and training, population-based surveys, chemotherapy and mollusciciding have also helped to reduce the prevalence of schistosomiasis.<sup>5</sup> However, schistosomiasis remains a major public health risk in certain areas. A nationwide survey in 1995 estimated that there were 865 084 infected people, mainly in swamp, lake and mountainous areas of Southern China which cover five provinces. In the marshlands and lake regions there has been mounting evidence that schistosomiasis is expanding again due to silting on the banks of the lakes, which have become snail habitats. Added to this is the construction of the Three Gorges Dams that will drastically alter the flow of the Yangtze River. The very large lake to be formed by the dam will be between two areas still endemic for schistosomiasis.

The status of schistosomiasis control in China as of the end of 1997 is presented in Figure 25.1.

## Japan

The disease was first referred to by Fuji, a Japanese physician in 1847. In 1948, only five relatively small foci of transmission were known. In some areas, such as the Chikugo River Basin, prevalence rates of almost 50% were recorded.



*An electron microscope photograph of the parasite which causes schistosomiasis*

A national control programme began in 1950.<sup>6</sup> This resulted in drastic reduction of prevalence. By 1973, only 124 cases out of 18 923 inhabitants of endemic areas were positive after examinations of at least five stool specimens by concentration technique.<sup>7</sup> The last case of human schistosomiasis was detected in 1977.

It is doubtful whether there will be any resurgence of schistosomiasis in Japan under the present conditions. The 1973 Expert Committee on Schistosomiasis Control recommended that the experience in Japan be shared among all countries suffering from schistosomiasis.

<sup>4</sup> Mao, S.P. and Shao, B.R. *Op cit*; Ref 2; Ross et al. *Ibid*.

<sup>5</sup> Chen Minggang. *Schistosomiasis control in the People's Republic of China*. Paper presented at SEAR/WPR Biregional Meeting on Prevention and Control of Selected Parasitic Diseases, 13–15 April 1998, Manila, WHO.

<sup>6</sup> Beaver, P.C., Jung, R.C. and Cupp, E.W. *Clinical parasitology*, 9<sup>th</sup> ed. Philadelphia, Lea & Febiger, 1984: 415–448; Tanaka, H. Tsuije, M. Tsutsumi, H. and Minai, M. The present status of schistosomiasis in Japan. *Southeast Asian Journal of Tropical Medicine and Public Health*. 15, 1984: 475–500.

<sup>7</sup> Tanaka et al. *Ibid*.

## **The Lao People's Democratic Republic**

Schistosomiasis was first detected in a Laotian student in Paris, France, who originally came from

Figure 25.1 Status of schistosomiasis control in China as of 1997

Regions	Total no. of endemic counties	No. of counties where schistosomiasis was eradicated	No. of counties where schistosomiasis is under control	No. of counties where schistosomiasis is still endemic
Guangdong	12	12	0	0
Shanghai	9	9	0	0
Fujian	14	14	0	0
Guangxi	19	19	0	0
Zhejiang	53	53	0	0
Hunan	25	5	3	17
Hubei	58	20	4	34
Jiangxi	37	19	7	11
Anhui	41	13	12	16
Jiangsu	56	29	11	16
Sichuan	59	24	17	18
Yunnan	17	10	1	6
<b>Total</b>	<b>400</b>	<b>227</b>	<b>55</b>	<b>118</b>

Source: Office of Endemic Disease Control, Ministry of Health, Institute of Parasitic Diseases, Chinese Academy of Preventive Medicine.

an island near Pakse.<sup>8</sup> A WHO survey in 1961 based on an intradermal test using *S. japonicum* antigen showed a prevalence rate of only 0.2%. Another survey in 1967, with support from the Mekong Committee and WHO, showed that Khong island, south of Pakse, was endemic with a prevalence of 11.9%.

The schistosomiasis control project in Khong island was a major WHO-supported initiative. Schistosomiasis control began in Khong island in

October 1989<sup>9</sup> with active participation of the Institute of Malariology, Parasitology and Entomology in Vientiane. After five rounds of praziquantel treatment between 1989 and 1993, the egg-positive rate was reduced from an average of 30% among schoolchildren in the different villages to 0.4% in 1994.<sup>10</sup> The egg-positive rate among adults

<sup>9</sup> Self, L.S. Mission report to the Lao People's Democratic Republic, malaria and schistosomiasis control. Manila, WHO, 1991.

<sup>10</sup> Kimura, E. WHO Mission Report to the Lao People's Democratic Republic to evaluate treatment of praziquantel for schistosomiasis control. Manila, WHO, 1994.

<sup>8</sup> Sormani, S. Current status of schistosomiasis in Laos, Thailand and Malaysia. *Southeast Asian Journal of Tropical Medicine and Public Health*. 7, 1976 : 149–154.

was very low (0.3%). The long-term objective is to maintain the prevalence at a level of 1% or less,

to supplement chemotherapy with improvements to sanitation and water supply, and to run a health education campaign.

### **Malaysia**

In 1973, *S. malayensis* was identified in an autopsy of an aborigine who died of another cause in Pahang state.<sup>11</sup> In 1975, *S. malayensis* was found at another autopsy. This prompted a review of autopsies of aborigines which resulted in diagnosis of more cases who had resided in Pahang and Perak states. Schistosomiasis is not a public health problem in Malaysia.

### **The Philippines**

*S. japonicum* was first reported in the Philippines in 1906.<sup>12</sup> In 1908, Garrison examined 4100 prisoners in Manila prison and found 16 cases of schistosomiasis<sup>13</sup>. Six of these were from Samar, five from Leyte and four from Mindoro. These three provinces were later determined to be endemic areas for schistosomiasis.

Selective and mass chemotherapy, depending on the level of prevalence, was made the principal control measure in the Philippines. Prevalence in the endemic areas averaged 10% in the early 1980s. However, chemotherapy was backed up by provision of safe water supplies, health education and snail control. Thus the prevalence among the population at risk of 7.4% in 1986 had been reduced to 4.5% in 1997. The year to year reduction is shown in Figure 25.2. At present, it is estimated that there are 209 000 schistosomiasis cases out of a total at-risk

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<sup>11</sup> Sormani, S. *Op Cit* Ref 8.

<sup>12</sup> Wolley, P.G. The occurrence of *Schistosoma japonicum* in the Philippine Island. *Philippine Journal of Science*, 1, 1906: 93–96.

<sup>13</sup> Garrison, P.E. The prevalence and distribution of animal parasites of man in the Philippine Islands with considerations of possible influence upon the public health. *Philippine Journal of Science*. 3, 1908: 191–210.

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population of 5.1 million in 183 municipalities of the 24 endemic provinces.<sup>14</sup>

## WHO ACTIVITIES

### Significant WHO activities and campaign

By direct technical collaboration with endemic Member States, and by stimulating collaboration and cooperation among endemic countries and areas, WHO has provided considerable support for schistosomiasis control. The experience of some endemic countries (e.g. the Lao People's Democratic Republic) indicates that very significant prevalence reductions can be attained by mass chemotherapy within a short period. With additional emphasis on basic sanitation, control of reservoir hosts, provision of safe water supply, snail control and health education, appreciable reductions can be attained.

Since 1953, WHO has periodically convened meetings of international experts on various aspects of schistosomiasis. For example, the first Expert Committee on Bilharziasis in 1952 dealt with standard procedures for surveys of bilharziasis. Another expert committee in 1964 reviewed control programmes and discussed their objectives, methods of control and factors affecting design, choice of methods of control and techniques for measuring progress of control programmes. The committee observed that control can be subdivided into disease control with the human population as the target and transmission control of the biological cycle. Both are essential to the concept of total control of schistosomiasis. In the 1984 meeting, the Expert Committee developed a strategy for the control of morbidity due to schistosomiasis by chemotherapy.

Two WHO scientific working groups in 1959 and 1964 collaborated in the standardization of drug evaluation procedures used in experimental chemotherapy and in clinical trials. Scientific working groups have subsequently evaluated antischistosomal drugs such as praziquantel.

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<sup>14</sup> Ducusin, B. *Schistosomiasis control in the Philippines*. Paper presented at SEAR/WPR Biregional Meeting on Prevention and Control of Selected Parasitic Diseases, 13–15 April 1998, Manila, WHO.

Figure 25.2 Prevalence of schistosomiasis among the population at risk in the Philippines (1986–1997)

Year	No. examined	No. +	Prevalence (%)
1986	458 291	34 150	7.4
1987	683 918	44 925	6.6
1988	423 708	26 953	6.4
1989	468 355	35 197	7.5
1990	528 359	34 611	6.6
1991	1 317 933	79 500	6.0
1992	1 326 283	55 896	4.2
1993	1 402 216	54 648	3.9
1994	771 970	40 446	5.2
1995	267 346	12 091	4.5
1996	374 262	15 293	4.1
1997	404 811	18 301	4.5

The Philippine schistosomiasis control programme from 1953 to 1960 studied the epidemiology, biology of the parasite and its intermediate snail host, *Oncomelania hupensis quadrasi*, and demonstrated that this snail can be controlled by ecological or environmental modifications, such as drainage, filling of wet areas, cleaning of banks, cementing of sides of canals, and streamlining of banks of streams and doing more intensive rice cultivation.

An important biregional meeting involving the South-East Asia and Western Pacific Regions was held in April 1998 in Manila. The meeting emphasized that two drugs (praziquantel and albendazole or mebendazole) can be jointly administered to control schistosomiasis and soil-transmitted nematodes such as roundworm, pinworm and hookworm. An indispensable activity of WHO, particularly for less-developed endemic nations such as Cambodia and the Lao People's Democratic Republic, is the provision of trained personnel to initiate epidemiological surveys to establish endemicity and to plan, implement and evaluate control measures.

WHO has also helped some countries to obtain external funding for control measures. For example, WHO collaboration with China in operational research, epidemiology, evaluation and training was helpful for China in obtaining a US\$ 71 million World Bank loan to finance its control programme, based mainly on health education and chemotherapy, from 1992 to 1998. WHO has also helped the Philippines make bulk purchases of praziquantel.

### Training, information exchange

WHO-supported activities in the field of training and information exchange have included support from the Special Programme for Research and Training in Tropical Diseases (TDR) since 1978, joint meetings with the South-East Asia Region of WHO and the holding of technical workshops.

Four collaborating research centres have been designated in the Region. They are: the Department



*Destroying the water-snail in its favourite shallow water environment is essential to schistosomiasis control*

of Medical Biology, Institute of Basic Medical Sciences, University of Tsukuba, Japan, (WHO collaborating centre for chemical control and laboratory culture of amphibious snails host of *S. japonicum*); the Hunan Institute of Parasitic Diseases, Hunan, China, (WHO collaborating centre for research and control on schistosomiasis in lake regions); the Institute of Parasitic Disease of the Chinese Academy of Preventive Medicine in Shanghai, China, (WHO collaborating centre for malaria, schistosomiasis and filariasis); and the Department of Parasitology, College of Public Health, Manila, the Philippines, (WHO collaborating centre for research on schistosomiasis).

## ACHIEVEMENTS

In Cambodia schistosomiasis is partially controlled; surveys and surveillance are being expanded. Combined chemotherapy for schistosomiasis and helminth control is taking place.

China has been relatively successful, considering the magnitude of the schistosomiasis problem when the national control programme started in 1950. As of 1997, five of the original twelve endemic provinces in 1950 have eradicated schistosomiasis. Of the 400 endemic counties, schistosomiasis has been eradicated in 227. Only 118 counties (28%) are still endemic.<sup>15</sup>

<sup>15</sup> Chen Minggang. *Op cit*, Ref 5.

The reduction of schistosomiasis prevalence in the Lao People's Democratic Republic to less than 1% in Khong island and other parts of Khong District has been a major achievement. The control programme has been extended to all other endemic areas of Champassak Province.

Japan eradicated schistosomiasis in 1977.

In Malaysia, *S. malayensis* does not pose a major public health problem.

In the Philippines, the results of schistosomiasis control show an encouraging trend, with prevalence among the population at risk dropping from 7.4% in 1986 to 6.6% in 1990 and 4.5% in 1997.<sup>16</sup>

## UNDERACHIEVEMENTS

Cambodia and the Lao People's Democratic Republic (which both started their schistosomiasis control programmes only a few years ago) still need to ensure that all possible endemic areas are identified.

More resources will be required for schistosomiasis to be eliminated from all of the endemic counties of China.

Domestic animals, especially cows and pigs, play an important role in the transmission of

<sup>16</sup> Ducusin, B. *Op cit*, Ref 14.

schistosomiasis in China. As a consequence, schistosomiasis is still endemic in parts of the country, especially in the Dongting Lake Region.<sup>17</sup>

Of the 24 endemic provinces in the Philippines, prevalence of schistosomiasis exceeds 4% in nine provinces. In four of these provinces prevalence ranges from 8.9% to 18.91%.

There have been recent reports of natural and laboratory-induced praziquantel resistance in schistosomes.

## **FUTURE**

WHO will continue to support national schistosomiasis control programmes. In the Philippines, the devolution of health services to the local governments will help control services to reach currently unprotected populations.

More emphasis will be given to supplementing chemotherapy with basic sanitation, safe water supply, health education that is culturally acceptable and snail control. This will enhance the prevention of a number of other communicable diseases as well as reduce water contact.

Current drugs now available for schistosomiasis are adequate for morbidity control, but experience with other infectious diseases suggests that drug resistance may develop. This may have already happened with regard to praziquantel. WHO will therefore encourage development of new drugs.

Trained personnel form the backbone of any schistosomiasis control programme. More attention and effort by WHO and the concerned Member States will be given to organization and undertaking of intensive training courses for different levels of personnel.

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<sup>17</sup> Ross, Li, Sleigh and Mc Manus. *Op cit*, Ref 3.