SPECIAL FEATURES OF ACUTE INFECTION DUE TO *SCHISTOSOMA JAPONICUM* IN URBAN AND RURAL AREAS IN CHINA

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Abstract. The statistical analysis of six indices: sex, age, occupation, time of onset, mode of infection and educational level of acute cases infected by *Schistosoma japonicum* in 1990 and 1994 respectively in Wuhu city was carried out. No significant differences were found in the five indices between 1990 and 1994 in Wuhu city except sex. There were significant differences between the urban and rural areas in all six indices.

INTRODUCTION

Traditionally, schistosomiasis is considered a rural disease in some countries but the endemic of schistosomiasis has migrated or spread into periurban, even urban areas. There are many examples of schistosomiasis endemic in urban areas of large and middle cities such as Sao Paulo in Brazil, Kinshasa in Africa and Wuhan in the center of the China (Mott 1992; Zhang, 1992; WHO, 1993). It is one of the features of urban schistosomiasis that a lot of acute infected cases occur and the distribution of related indices of acute infected cases are markedly different from those in rural areas. Six indices: sex, age, occupation, time of onset, mode of infection and educational level of the acute infected cases in Wuhu city (urban area) in both 1990 and 1994 year, and in Fanchan and Dongzhi counties (rural area) in 1994 and in 2 isolated islands in the center of Yangtze river (rural area) in 1991 ~ 1992 to clarify differences and find reasons emerging the differences in the study. The data collected are used as completely as possible, it is tried to sum some special features of the population of acute infection due to *Schistosoma japonicum* in the urban area.

MATERIALS AND METHODS

Original relevant data provided for analysis and comparison came from the questionnaire administered to acute infected cases of one city and 4 counties in the period 1990-1994 and from the data investigated in this study.

Background epidemiology

The endemic areas which provided data included one city Wuhu, 2 counties Fanchan and Dongzhi and 2 isolated islands, Chenqiaozhou and Jiangxinzhou belonging respectively to Hexian and Dangtu counties. The islands, located in the center of the Yangtze river, are typical endemic areas in the island-subpattern of the marshland-pattern. Dongzhi county, located on the south bank in the upper reaches of the Yangtze river in Anhui, is a mixed endemic area, with the most serious endemicity in mainly marshland-pattern combined with hilly land. Located on the south bank in the lower reaches of the Yangtze river in Anhui, the city of Wuhu was non-endemic in the urban area, but water systems pass freely between the urban and rural endemic areas. Fanchan county, located in the upper reaches of the river near Wuhu city, is also a middle endemic area, mainly in hilly land combined with marshland. Based on the survey, the areas of natural focal infection in 1990 and 1994 are situated in marshlands and river watershed along the Yangtze and Qingyijiang rivers. Schistosomiasis is still endemic in 4 counties, and acute infection occurred mostly in the marshlands, except for a small number of cases inland in Fanchan county.

Analysis of data

The data of 3 groups from 5 administrative areas are respectively listed in Tables 1-6, according to 6 indices: sex, age, occupation, time of onset, mode of infection and educational level of infected cases. The indices were subject to statical analysis to allow of comparison between 1990 and 1994, and between urban and rural areas, using Student's *t* test.

RESULTS

Difference of distribution of sex of the acute infected cases

The distribution of according to sex is shown in Table 1.

Table 1

Distribution of sex of the acute cases.

Areas	Year	Total no. of cases	Male (%)	Female (%)
Wuhu city	1990	110	85 (77.3)	25 (22.7)
Wuhu city	1994	114	103 (90.3)	11 (9.7)
Fanchan county	1994	43	30 (69.7)	13 (30.3)
Dongzhi county	1994	59	45 (76.3)	14 (23.7)
Hexian (Chenqiapzhou)	1991-1992	35	23 (65.7)	12 (34.3)
Dongtu (Jiangxinzhou)	1992	39	25 (64.1)	14 (35.9)

The infected female cases in 1990 were more than those in 1994 in the city of Wuhu, there was significant difference between 1990 and 1994 ($p < 0.01$). No significant difference was observed in sex between the counties Fanchan and Dongzhi and between both islets ($p > 0.05$ all). The infected males in 1994 in Wuhu city were markedly more than in 2 kinds of rural areas (respectively $p < 0.01$ and $p < 0.001$).

Difference of distribution of age of the acute infected cases

The distribution of according to age is given in Table 2.

No significant difference was found between 1990 and 1994 in Wuhu city ($p > 0.05$); the cases in 1990 and 1994 were more focally distributed in teenagers younger than 15 years old, but the cases in the 25~ and 35~ age groups accounted for 15% and 13.1% respectively. In Fanchan county the infected cases were mostly teenagers younger than 15 years old, and mainly below 35 years old in Dongzhi county. There were significant differences between the 2 counties and the city of Wuhu in 1990 and 1994 respectively ($p < 0.01$ all).

Occupation of the acute infected cases

The distribution of occupation is given in Table 3.

The infected cases were mainly students and workers in the urban area in both 1990 and 1994, between which no significant difference was found ($p > 0.05$). The infected cases in Fanchan county were mainly students, peasants and fishermen, and in Dongzhi county were focally peasants and fishermen. There was a significant difference between the two counties ($p < 0.01$). There were significant differences in the same year (1994) between Wuhu city, and Fanchan and Dongzhi counties, respectively ($p < 0.01$ all).

Distribution of onset time of the acute infected cases

The distribution of onset time is given in Table 4.

In Wuhu city, the peak of clinical onset time of acute infection was in August and September in 1990, but focally in July in 1994. There were significant differences in the urban area between 1990 and 1994 and between the urban area and Fanchan county respectively ($p < 0.01$). The cases were more equally distributed in the 3 months of July, August and September in Fanchan county, and in Dongzhi county they were more focal in August. There were significant differences between the urban area in 1990 and 1994 and Dongzhi county respectively ($p < 0.01$ all).

Distribution of mode of infection of acute infected cases

The distribution of mode of infection is given in Table 5.

Swimming was only one mode of acute infection in the urban area and no significant difference was found between 1990 and 1994 ($p > 0.1$). There were significant differences in the modes of infection between Fanchan and Dongzhi counties ($p < 0.01$). In rural areas, agricultural production as major economic activity is also an important mode of

Table 2

Distribution of age of the acute cases.

Areas	Year	Total no. of cases	Age (years) 1~ (%)	15~ (%)	25~ (%)	35~ (%)	45~ (%)
Wuhu city	1990	110	33 (30.0)	36 (32.7)	17 (15.5)	22 (20.0)	2 (1.8)
Wuhu city	1994	114	31 (27.2)	45 (39.5)	18 (15.8)	15 (13.1)	5 (4.4)
Fanchan county	1994	43	23 (53.5)	8 (18.6)	4 (9.3)	4 (9.3)	4 (9.3)
Dongzhi county	1994	59	23 (39.0)	13 (22.0)	14 (23.7)	5 (8.5)	4 (6.9)

Table 3

Distribution of occupation of the acute cases.

Area	Year	Total no. of cases	Pre-school (%)	Student (%)	Peasant or fisherman (%)	Worker (%)	Other (%)
Wuhu city	1990	110		50 (45.5)		45 (40.9)	15 (13.6)
Wuhu city	1994	114		48 (42.1)		54 (47.4)	12 (10.5)
Fanchan county	1994	43	8 (28.6)	16 (37.2)	19 (44.2)		
Dongzhi county	1994	59		2 (3.4)	50 (84.7)	7 (11.9)	

Table 4

Distribution of onset time of the acute cases.

Areas	Year	Total no. of cases	May (%)	Jun (%)	Jul (%)	Aug (%)	Sep (%)	Oct (%)
Wuhu city	1990	110			1 (0.9)	43 (39.1)	63 (57.3)	3 (2.7)
Wuhu city	1994	114	5 (4.4)	13 (11.4)	80 (70.2)	12 (10.5)	3 (2.6)	1 (0.9)
Fanchan county	1994	43		1 (2.3)	18 (41.9)	13 (30.2)	9 (20.9)	2 (4.7)
Dongzhi county	1994	59		11 (18.7)	10 (16.9)	23 (39.0)	10 (16.9)	5 (8.5)

infection. The 2 islets were similar in mode of infection to the 2 counties. There were significant differences in mode of infection between the urban area and the 4 rural areas ($p < 0.01$).

Distribution of educational level of the acute infected cases

The distribution of educational level is given in Table 6.

No significant difference was found in educational level between 1990 and 1994 in the urban area ($p > 0.05$) and it was markedly higher in the urban area compared with the rural areas (Dongzhi and Chenqiazhou) ($p < 0.01$).

Table 5

Distribution of mode of infection of the acute cases.

Areas	Year	Total no. of cases	Swimming (%)	Work on river (%)	Fishing (%)	Collecting reed leaf (%)	Cultivating (%)	Other (%)*
Wuhu city	1990	110	110 (100)					
Wuhu city	1994	114	112 (98.24)	2 (1.76)				
Fanchan county	1994	43	28 (65.1)		3 (7.0)	5 (11.6)	7 (16.3)	
Dongzhi county	1994	59	22 (37.2)	3 (5.1)	20 (33.9)		11 (18.7)	3 (5.1)
Hexian (Chenqiaozhou)	1991-1992	35	8 (22.9)		10 (28.6)	6 (17.1)	6 (17.1)	5 (14.3)
Dongtu (Jiang-xinzhou)	1992	39	20 (51.3)		2 (5.1)	5 (12.8)	3 (7.7)	9 (23.1)

* including controlling flood, grazing etc.

Table 6

Distribution of educational level of the acute cases.

Areas	Year	Total no. of cases	Higher than senior middle school (%)	Senior middle school (%)	Junior middle school (%)	Primary school (%)	Illiteracy (%)	Preschool (%)
Wuhu city	1990	110	5 (4.5)	20 (18.2)	57 (51.8)	24 (21.8)	4 (3.7)	
Wuhu city	1994	114	1 (0.9)	35 (30.7)	39 (34.2)	32 (28.1)	7 (6.1)	
Dongzhi county	1994	59		1 (1.7)	19 (32.2)	36 (61.0)	1 (1.7)	2 (3.4)
Hexian (Chenqiaozhou)	1991-1992	35			2 (5.7)	19 (54.3)	12 (34.3)	2 (5.7)

DISCUSSION

In the Yangtze river basin, marshlands on both sides of the river are areas where the population is particularly affected. In urban Wuhu, areas where the population are affected are located in marshlands of the periurban area (1990), in the zone where the Yangtze river and Qingyijiang river converge and in the 1 km region from the mouth of the Yangtze river to the upper reaches along the Qingyijiang river (1994). These regions are all within the urban area. Gently flowing water and level river bed are common peculiarities in these areas which are natural swimming pools and ideal places for passing the summer in a leisurely way for residents.

In 1990, as in 1994, there was the same severe hot and dry summer weather and swimming was a major mode of acute infection in the urban area, but a significant difference of sex distribution in the infected cases between 1990 and 1994 existed. In the periurban area where the population was infected in 1990, because of shortage of tap water and treading the beaten track to bathe and wash in the river, the proportion of females infected was relatively higher. Women and children are at highest risk of infection in periurban areas where natural water bodies are the source of water for domestic and recreational proposes (WHO, 1993).

In 1994, the severe hot summer came earlier, continued longer and swimming was a common

way of passing the summer in a leisurely manner for residents in the urban area, so the proportion of females was lower than that in 1990. In the rural area, acute cases in females accounted, at least, for more than 25%. The difference in contact with water between females and males is decided by ways of life. Because the summer came earlier, the population contact with water came earlier, so the time of onset of the disease came earlier. The special feature of sex distribution in the urban area in 1990 may be considered as a result of urbanization of schistosomiasis (or domestication of natural zoonotic foci). After infected persons entered endemic or non-endemic urban areas, transmission was established and infected migrants contributed directly to spread, aggravation or an increase in transmission. Because swimming is a popular recreational sport, acute cases in the urban area were distributed more equally in different age-groups of the population under 45 years old. And in rural areas, swimming is a mode of play with water mainly for children. All the population in urban areas and teenagers and children in rural areas, have limited immunocompetence due to infection by *Schistosoma japonicum*, which made the difference of age in the infected population between urban and rural areas. No matter in urban or in rural areas, swimming is an important, major risk behavior for becoming infected with schistosomiasis. Studies in Nigeria showed that swimming and playing with water are the major ways in which people, especially children, are infected with schistosomiasis (Ofoezie *et al*, 1991).

Although in the urban area, there were no infected snails to be found in the zone where the population were infected in 1994, 2 infected snails were found in a zone where the population were infected (infected rate 0.05%) in 1990. There are endemic areas of schistosomiasis all around the urban area, because there is no practical way to distinguish infected from non-infected water; all fresh water in schistosomiasis-endemic areas should be considered suspect (Cummings *et al*, 1990). The distribution of the disease follows a pattern related to the complexity of the urban infrastructure. Several variables that are related to different aspects of the population's way of life were strongly associated with the prevalence and intensity of infection (Barreto, 1991). As a consequence of inadequate or short of supplies of water, especially safe water resources, deficient and crude methods of sanitation and lack of safe and popular places for swimming, the outbreak of acute infection occurred in residents in the urban area of Wuhu in 1994.

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