

EPIDEMIOLOGY OF CLONORCHIASIS IN NINH BINH PROVINCE, VIETNAM

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Abstract. Clinical and stool examinations for clonorchiasis were carried out in an endemic area, Kim Son District, Ninh Binh Province, Vietnam. Stool examination with the Kato-Katz technic revealed that in 306 residents selected randomly, 42 people (13.7%) were infected with *Clonorchis sinensis*. The rate was biased towards men (23.4%) as opposed to women (1.5%) and increased with age. No children younger than 10 years old were infected, reflecting difference in a chance for acquisition of infection through a habit of eating raw fish. Few clinical abnormalities were found by blood and urine examinations of the patients. Treatment with praziquantel decreased the infection rate to 5.3% at 6 weeks later. Snails, *Melanoides tuberculatus*, collected from ponds around the settlements were infected with cercariae at a rate of 13.3%. Farmed fish (*Hypophthalmichthys molitrix*) in the ponds were infected with metacercariae at rates of 56.4% in small individuals and 100% in large ones. The life cycle of *C. sinensis* is exclusively completed in the ponds and the traditional habit of eating raw fish in summer was thought to be a major route of infection.

INTRODUCTION

Clonorchiasis is caused by the infection with *Clonorchis sinensis* and known to occur in oriental countries including China, south Korea, Japan, Taiwan and north Vietnam (Komiya, 1966: Rim, 1986; Harinasuta *et al.*, 1993). In Vietnam, although distribution of the disease was reported by French workers in an early time of the century (Legar, 1910; Mathis and Legar, 1911; Faust and Khaw, 1927), details had not been published until reported by Kieu *et al.* (1990). The Institute of Malariology, Parasitology and Entomology in Hanoi began active surveys on clonorchiasis in Vietnam in 1976 and has revealed clonorchiasis distributed in 7 provinces in northern Vietnam; Ha Bac, Hai Phong, Ha Tay, Thai Binh, Ninh Binh, Nam Ha and Thanh Hoa provinces, in addition to opisthorchiasis in Phu Yen Province in southern Vietnam. These northern provinces are located in the Red River delta and people there have a habit of eating raw fish together with alcohol intake (Kieu *et al.*, 1990).

A survey was carried out in Ninh Binh Province where the infection rate with *C. sinensis* was known to be high. The survey aimed to clarify parasitological status of the residents by stool examina-

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tion, clinical condition of patients, efficacy of treatment with praziquantel and infections in other hosts such as snails and fish.

MATERIALS AND METHODS

Study site

As a heavily endemic area, Kim Son District in Ninh Binh Province was selected for study site. The survey was carried out in Dong Huong commune where population is approximately 8,000 and most of the residents are living on rice agriculture.

Stool examination

Among the residents 306 people were selected randomly. Stools were collected and examined with the Kato-Katz technic. EPG values were estimated for *C. sinensis* infection.

Clinical examination

Blood, urine and stool were collected from 67 patients with clonorchiasis previously known in Kim Son and 30 persons randomly selected in Hanoi as a control. After serum was separated, GOT, GPT and γ -GTP values were determined.

Antigen for HBs and antibody for HC were also examined by ELISA. Urine was examined by a testing paper (Multisticks, Miles and Sankyo Co Ltd, Tokyo) for urobilinogen, blood, ketone body, glucose, protein and pH. EPG (eggs per gram feces) value of *C. sinensis* was also estimated for the patients by the Kato-Katz technic. The habit of eating raw fish and alcohol intake was asked individually in addition to body condition.

Treatment

The patients were treated with praziquantel with a dose of 25 mg/kg/day for successive 3 days. Blood, urine and stool were again collected and examined 6 weeks after treatment.

Other hosts

Snails (*Melanooides tuberculatus*) were collected from pond, river (canal) and rice field to compare the infection rate in different habitats. The viscera of all snails were examined for cercarial infection under a dissecting microscope. Fish (*Hypophthalmichthys molitrix*) with different sizes were collected from ponds and examined for metacercarial infection using artificial digestion technic with pepsin under acidic condition. The number of metacercariae per fish was determined for large fish. Cats and dogs in the commune were necropsied after over-anesthesia and examined for adult worms.

RESULTS

Stool examination

The results are summarized in Table 1. Among 306 people examined, 42 people (13.7%) were infected with *C. sinensis* with mean EPG values of 69.2 ± 272.8 for all and 504.0 ± 573.9 for positive persons. There was a clear difference in the infection rate between sex ($p < 0.001$); women were rather free from *C. sinensis* infection with the rate of 1.5% (2/135), whereas men had a higher rate of 23.4% (40/171). The rate tended to increase with increasing age and no children younger than 10 years old were infected. Infection rates of intestinal nematodes were 79.1% for *Ascaris lumbricoides*, 81.0% for *Trichuris trichiura* and 6.5% for hook-

worm. *Taenia* ova were found only in a man making a total infection rate of 0.3%. There was no exact tendency associated with age or sex for these infections.

Clinical examination

Although many of the patients complained hepato-gastric pain and/or digestive disorder, there was no particular abnormality in liver functions and urine among the patients even before treatment except for γ -GTP (Table 2). No exact relation between the infection and hepatic virus infections was observed. Most of the patients were man (66/67) and all but one of them had the habit of eating raw fish. Although correlation between EPG value and amount of raw fish eaten by individuals was not significant, people who had eaten a large amount of raw fish tended to show higher EPG values. EPG value or alcohol intake had no exact correlations with any of clinical data.

Effect of treatment

Treatment with praziquantel successfully decreased the infection rate to 5.3% among 38 patients re-examined (Table 3). EPG value also decreased from 1,326.7 to 0.97 on average. Clinical data did not change when compared with those before treatment (Table 2).

Infection rates in other hosts

For cercarial infection in snails, the rate was highest (13.3%) in those collected in pond (Table 4). Larger snails tended to have higher infection rate (Table 5). Metacercariae were found in 56.4% of small fish and all of large fish (Table 6). An adult fluke was found from 1 among 3 cats examined and no worm in 3 dogs examined.

DISCUSSION

Helminthic infections in the study site were generally high as reported in Ninh Binh (Kieu *et al*, 1990) and in other provinces (Kim *et al*, 1990, 1992), probably being associated with poor sanitary condition. Clonorchiasis was characterized by

Table 1

Rate of infection with *C. sinensis* among residents with different sexes and ages.

Age	No. examined			No. infected (%)		
	Total	F	M	Total	F	M
< 10	59	29	30	0 (0.0)	0 (0.0)	0 (0.0)
10-19	53	21	32	3 (5.7)	0 (0.0)	3 (9.4)
20-29	30	15	15	5 (16.7)	0 (0.0)	5 (33.3)
30-39	62	30	32	6 (9.7)	0 (0.0)	6 (18.8)
40-49	53	21	32	17 (32.1)	2 (9.5)	9 (46.9)
> 50	45	19	26	11 (24.4)	0 (0.0)	11 (42.3)
Total	306	135	171	42 (13.7)	2 (1.5)	40 (23.4)

Table 2

Clinical examination of patients infected with *C. sinensis*.

	No examined	No. of people (%) abnormal in							
		blood					urine		
		GOT (> 40)	GPT (> 40)	γ -GTP (> 50)	HBs Ag (+)	HC Ab (+)	blood (+)	protein (+)	sugar (+)
Before treatment	67	9 (13.4)	5 (7.5)	12 (17.9)	7 (10.4)	0 (0.0)	10 (14.9)	4 (6.0)	0 (0.0)
After treatment*	38	8 (21.1)	4 (10.5)	2 (5.3)	4 (10.5)	0 (0.0)	7 (18.4)	2 (5.3)	0 (0.0)
Control	30	3 (10.0)	1 (3.3)	0 (0.0)	2 (6.7)	0 (0.0)	1 (3.3)	2 (6.7)	1 (3.3)

* : 6 weeks after treatment with praziquantel (25 mg/kg \times 3 days)

Table 3

Effect of praziquantel on patients infected with *C. sinensis*.

	No. of people		EPG	
	examined	infected (%)	Mean \pm SD	Range
Before treatment	67	67 (100.0)	1,326.7 \pm 3,617.7	19-25,900
After treatment*	38	2 (5.3)	0.97 \pm 4.19	18.5

* : 6 weeks after treatment with praziquantel (25 mg/kg \times 3 days)

Table 4
Infection rates of the snail, *M. tuberculatus*, in different sites.

Site	No. of snails	
	examined	positive(%)
Pond	173	23 (13.3)
River	82	6 (7.3)
Rice field	302	10 (3.3)
Total	557	39 (7.0)

Table 5
Infection rates of the snail, *M. tuberculatus*, in different size classes.

Size class (mm)	No. of snails	
	examined	positive(%)
≥ 25	52	11 (21.2)
20-24	53	7 (13.2)
< 20	68	5 (7.4)
Total	173	23 (13.3)

Table 6
Infection rates of *H. molitrix* with different size classes.

Size class	Weight (g)	No. of fish	
		examined	positive (%)
Small	≈ 100	101	57 (56.4)
Large	≈ 200	25	25 (100.0)

the feature of biased infection to men and adults associated with the habit of eating raw fish together with alcohol intake as also described by Kieu *et al* (1990). No infection in children younger than 10 years old strongly supported the correlation between the infection and the habit, since the people begin to take alcoholic drink, and so raw fish, from this age. The tendency has been also observed in Korea (Rim, 1986) and China (Fang, 1994). On the other hand, 2 women in the random group and 3 men

in the patient group who have had no history of eating raw fish were also infected. This suggested that infection can occur through ways other than direct intake of raw fish including improperly cooked fish and contaminated food with metacercariae.

Clinical examination of patients did not show any particular clinical abnormalities such as those in liver function when compared to the control group. Alcohol intake may affect the functions more than the infection, although no clear relation was observed. The low level of clinical abnormality may have also related to the lower severity of infection in the patients. Severely affected patients have been sent to hospitals in large cities such as Hanoi. Most patients with moderate or lighter infection are known to show little clinical abnormalities such as liver functions and the condition varies depending on various factors (Rim, 1986). Although the treatment with praziquantel dramatically decreased infection level from 100% to 5.3%, the clinical functions did not change after the treatment. These imply that the clinical disorder is caused by long-term infection and chronic lesions.

Infection rates in snails and fish clearly showed importance of farming system of fish in pond near settlements. The life cycle of *C. sinensis* is completed in the pond through feeding contaminated stool to fish, condition fitted to snail growing, high density of snails and fish infected and importantly the habit of eating raw fish. Domestic cats and dogs may play an important role as reservoir hosts. As the first intermediate host of *C. sinensis*, *Parafossarulus manchouricus* is most known in various endemic areas such as Korea, Japan, and Taiwan (Komiya, 1966; Rim, 1986; Chung and Soh, 1991; Chen, 1992). Although this species is also distributed in the study area, density and infection rate are lower than *M. tuberculatus* (unpublished data) and no *P. manchouricus* was found in the present study. Thus *M. tuberculatus* is more important species in this area as the first intermediate host of *C. sinensis*. Various species of cyprinoid fish are known to serve as the second intermediate host of *C. sinensis* (Komiya, 1966; Rim, 1986). *H. molitrix* has been reported as one of them in Guangdong, China (Ishii, 1929; Fang, 1994). This fish is raised in the pond around settlements for a food resource. Young fish are introduced in spring and fed sewage containing contaminated stool. In summer residents eat grown fish in raw salad dish called "goi ca" together with alcoholic drink, having a belief that eating raw fish

cools their body down in hot season. By this season miracidia hatched from the eggs infect snails and cercariae emerged from the snails attach to the fish and encyst as metacercariae. Then humans become infected by eating infected fish. Thus the life cycle of *C. sinensis* completes every year exclusively in and around the pond.

The traditional habit of eating raw fish is also known in southern area of China such as Guangdong (Fang, 1994) having probably the same origin and sharing the infection. Since the traditional habit is difficult to change, other mean(s) should be considered to control the infection. Although treatment with praziquantel is highly effective, risk of reinfection remains if the people keep the habit of eating raw fish. Exclusiveness of the life cycle to the pond may have an advantage for control of the disease. Modification of structure of the pond to prevent snail growth may have a priority. The financial problem, however, makes it difficult. To avoid feeding contaminated stool to fish may also have some value, though the presence of reservoir hosts can maintain the cycle. In this connection improvement of sewage system may be inevitable.

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