Intestinal trematode infections in the villagers in Koje-myon, Kochang-gun, Kyongsangnam-do, Korea

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Abstract: An epidemiological study for the intestinal trematode infection of the villagers was done in Koje-myon, Kochang-gun, Kyongsangnam-do, Korea in March, 1994. Of 116 stool specimens examined, total helminthic ova positive cases were 13 (11.2%) and cumulative ova positive cases 21 (18.1%): Echinostoma hortense 11 cases (9.5%), Metagonimus sp. 6 cases (5.2%), and Clonorchis sinensis 4 cases (3.4%). After the treatment and purgation, variable numbers of E. hortense, 6 to 227 per person, were collected from 7 echinostome egg positive cases, together with M. takahashii in 6 cases. Three adult flukes of E. cinetorhitis were collected from one person and one Stellantchasmus falcatus was recovered from another case. This mountainous village was proved to be one of the endemic foci of echinostomiasis in Korea.

Key words: Echinostoma hortense, Echinostoma cinetorhitis, Stellantchasmus falcatus, Clonorchis sinensis, Metagonimus takahashii, epidemiology, Korea

INTRODUCTION

The study area, Koje-myon is a rural village with a population of 2,024 at the study time. This village was surrounded by Togyusan (Mt.) and located in Kochang-gun, Kyongsangnam-do, Korea. A tributary of Nakdonggang (River) crosses the village, which is not polluted yet. The villagers usually enjoy eating raw fresh water fishes caught in the stream. From their eating habit, it was suspected that villagers could be infected with intestinal trematodes transmitted by freshwater fish. We tried to identify whether there was endemic of any kind of intestinal trematode infection, especially Echinostoma hortense infection. This report also describes rare human cases infected with E. cinetorhitis and Stellantchasmus falcatus.

MATERIALS AND METHODS

A total of 116 stool specimens was collected from villagers residing in Nongsan-ri, Kunghang-ri and Ponggye-ri in Koje-myon, Kochang-gun, Kyongsangnam-do, Korea in early March 1994. The specimens were examined once by formalin ether sedimentation method for the presence of helminth ova at Department of Parasitology, College of Medicine, Hallym University, Chunchon. Clinical data from egg positive persons were recorded. We prescribed praziquantel (Distocide®, Shinpoong Pharmaceutical Co., Seoul, Korea) 10 mg/kg single
dose p.o. to egg positive villagers. One hour after prescription, they intook magnesium sulfate 30-50 g. Loose stools or diarrhea from subjects were collected during day time. Stools were transferred to Department of Parasitology, College of Medicine, Gyeongsang National University, Chinju. They were searched for the presence of worm under a stereomicroscope. Collected worms were wet-mounted and identified for the species differentiation. Number of eggs per gram of feces (EPG) was counted by Stoll’s dilution egg count technique. EPG and worm collection data were analyzed for worm fecundity.

RESULTS

Egg positive rates and clinical data

Of 116 stool specimens examined, a total number of helminthic ova positive was 13 (11.2%) and cumulative ova positive was 21 (18.1%). Ova of Echinostoma hortense 11 (9.5%), Metagonimus sp. 6 (5.2%), and Clinorchis sinensis 4 (3.4%). Size of 50 echinostome eggs from stools of villagers was 115.0-152.5 × 70.0-95.0 μm (mean 132.4 × 81.2 μm). Metagonimus egg positive persons were all concomitantly infected with E. hortense (Table 1). Egg positive rate by age was 25% in the thirties, 35.7% in the forties, 7.3% in the fifties, 8.8% in the sixties and 5.6% in the seventies. All below thirties and above seventies were negative. Egg positive rate in female was 10.6%, and that in male, 12.2%. From 13 egg positive persons, the gastrointestinal symptoms were listed as they complained of: epigastric fullness (53.8%); loose stool or diarrhea(38.5%); constipation(23.1%); epigastric soreness (7.7%); nausea and vomiting (7.7%). One person did not complained of any symptom. Every infected person had a history of eating raw freshwater fishes caught at the stream. The woman who was infected with Stellantchasmus falcatus had a history of eating raw mullet flesh (Mugil cephalus) at the restaurant out of her village 6 months before examination.

Worm recovery and worm fecundity

Ten E. hortense egg positive persons were subjected for the worm recovery. However, three of them failed in defecation due to severe constipation. A total of 452 worms of E. hortense (6-227 worms/person) was collected from 7 persons. We also collected Metagonimus takahashii (8-402 worms/person). 3 Echinostoma cinetorchi and one Stellantchasmus falcatus concomitantly (Table 1). Result of E. hortense EPG was shown in Table 1. From those results, we could calculate the egg per day per worm (EPDPW) of E. hortense when daily stool weight was estimated as 200 g. Mean EPDPW was 3,882.

Description of worms

Echinostoma hortense: Body is elongated, and measures 8.0 mm in length. The head collar is reniform with 27 collar spines including 4 end group spines on each sides. Characteristics of this worm such as 4 end

| Table 1. Trematodes collected from echinostome egg positive villagers |
|------------------------|----------------|------------------|----------------------|
| **Name** | **Age** | **Sex** | **Echinostoma hortense (EPG)** | **Metagonimus takahashii** | **Others** |
| Park, OO | 54 | M | 227 (1,200) | 402 | Echinostoma cinetorchi (3) |
| Park, OO | 49 | M | 6 (350) | 43 |  |
| Poh, OO | 49 | M | 22 (150) | 106 |  |
| Lee, OO | 31 | M | 18 | — | 8 |
| Choi, OO | 47 | F | 18 (250) | 21 |  |
| Kim, OO | 42 | F | 8 (150) | 0 |  |
| Kim, OO | 42 | F | 153 (2,050) | 42 | Stellantchasmus falcatus (1) |
| **Mean** | **65** |  |  |  |  |

a) No. of eggs per gram of feces
group spines, length of eggs (mean 132.4 × 81.2 μm), laterally deviated ovary, and two distict testes (T) at equatorial portion are well agree to the description of *E. hortense* Asada 1926 (Fig. 1).

**Echinostoma cinetorchis:** Adult worm is elongated, dorsoventrally flattened, and measures 10.6 mm in length. The head collar was reniform, and bearing 36 to 38 spines, including six end group spines on each side. This species is characterized by the variation or abnormalities of the testes. Testis single in a worm and none in another 2 worms. Remaining one testis is post-equatorial in position. Ovary ellipsoidal in shape is in median line of the body. Mehlis' gland large and immediately behind ovary (Fig. 2). From these characters, we identified this trematode as *E. cinetorchis* Ando and Ozaki, 1923.

**Metagonimus takahashii:** Body small 1.53 mm long and 0.83 mm wide. Characterisics of this worm such as no posteriormost location of right testis, separated left testis from the right one, distribution of uterine tubule over the left testis and intertesticular junction, vitellaria passing through the posteriormost portion of the body coincide with the *M. takahashii* Suzuki 1930 (Fig. 3).

**Stellantchasmus falcatus:** Body small 0.71 mm long and 0.40 mm wide, pyriform to ovoidal in shape, covered with fine scale-like spines (Fig. 4). Oral sucker subterminal and 0.06 mm in diameter. Ventral sucker small, 0.05 mm in diameter, muscular, displaced right to median line, and armed with minute spines.

**Fig. 1.** *Echinostoma hortense* collected from Park OO (54/M) in Table 1 has laterally deviated ovary, and two distict testes (arrowheads) at equatorial portion. Acetocarmine stained. Bar = 1 mm. **Fig. 2.** One of 3 *Echinostoma cinetorchis* collected from Park OO (54/M) in Table 1 has one reduced testis (arrow) located posteriorly to ovary. Acetocarmine stained. Bar = 1 mm.

**Fig. 3.** *Metagonimus takahashii* collected from Park OO (54/M) in Table 1. No poseteriormost location of right testis (R), separated left testis (L) from the right one, distribution of uterine tubule over the left testis and intertesticular junction, vitellaria passing through the posteriormost portion of the body. Unstained. Bar = 100 μm.
\[ \mu m \] long and 14.7 \[ \mu m \] wide. These morphological characters coincide well with those of \textit{S. falcatus} Onji and Nishio, 1915.

**DISCUSSION**

Egg positive rate at rural area in Kyongsangnam-do, 1992, was recorded as \textit{Ascaris lumbricoides} 0.5%, \textit{Trichuris trichiura} 1.0%, \textit{C. sinensis} 21.6% in nationwide surveys of intestinal helminthiasis (Ministry of Health and Social Affairs, and Korea Association of Health, 1993). In this village, the prevalence of clonorchiasis is much lower than that of Kyongsangnam-do. Echinostomiasis is one of the endemic diseases in Far east and Southeast Asian countries. Of them, \textit{E. revolutum}, \textit{E. echinatum}, \textit{E. malayanum} and \textit{Euparyphium ilocanum} are frequently found in south-east Asia (Huffman and Fried, 1990; Waikagul, 1991). \textit{E. hortense}, \textit{E. cinetorhisis} and \textit{Echinococcus japonicus} infection in human have been recorded in Korea, Japan and China [Chai and Lee, 1990 & 1991; Ujije, 1936; Miyamoto et al., 1983; Zhu et al., 1986]. From 1980, human echinostomiasis had been known to be as the endemic intestinal trematodiases in Korea. Seventy six cases of \textit{E. hortense}, five cases of \textit{E. cinetorhisis}, and one case of \textit{Echinococcus japonicus} infection were already confirmed in Korean (Chai and Lee, 1990). Not only Chongson-gun but also upper reaches of the Namhangang such as Umsong-gun, Yongwol-gun have been known as endemic foci of echinostomiasis (Ahn and Ryang, 1986; Lee et al., 1988; Ryang, 1990; Chai et al., 1993). We add Koje-myon, Kochang-gun as another endemic focus of echinostomiasis in Korea.

Clinical findings from persons with \textit{E. hortense} infection was variable, and did not well correlate with worm burdens. First human case in Korea with one worm did not complained of any trouble (See et al., 1983). Other cases complained of abdominal pain and diarrhea, tenesmus, easy fatigueability, and dizziness. Fifty nine \textit{E. hortense}-infected villagers in Chongsong-gun, Korea did not complain of specific gastrointestinal symptoms although their degrees of eosinophilia were positively correlated with the worm number.

**Fig. 4.** \textit{Stellantchasmus falcatus} collected from Kim OO, showing well-developed seminal vesicle, two testes (arrowheads) and many uterine eggs. Unstained. Bar = 100 \[ \mu m \]. **Fig. 5.** Magnification of Fig. 2 showing ventrogenital sac (arrowheads) between ventral sucker and distal part of seminal vesicle. Bar = 200 \[ \mu m \].

on its inner rim. Ventrogenital sac slightly submedian to left side and contains gonotyl and male and female genital pores. Seminal vesicle bipartite and located obliquely between the levels of ventral sucker and ovary (Fig. 5). Uterus winding convoluted between ventral sucker and posterior end. Intrauterine eggs yellowish, oval and a little elongated in shape with slightly attenuated anterior end, and 30.8
Their infections were found during the screening of the intestinal helminthiases incidentally. The records from volunteers who ate metacercariae of _E. hortense_ showed generalized weakness, diarrhea, epigastric pain in a case with ten worms. On the other hand, only mild generalized weakness was in the one worm burden case (Seo et al., 1985). Out of four volunteers in Japan who were experimentally infected with metacercariae of _E. hortense_, only one revealed violent diarrhea and abdominal pain from 3rd-4th week post-infection (Miyamoto et al., 1984). The upper small intestine of rats experimentally infected with _E. hortense_ showed a marked destruction of villi (Lee et al., 1990). Those histopathological changes are expected to be seen also in human infection. The explanation of symptomless infection might be as a difference of immunological reaction. In this study, the egg positive villagers complained of gastrointestinal symptoms. However, those non-specific symptoms were believed as endurable conditions for them, since they did not visit the health center with those kinds of problems by themselves.

Egg laying capacity is one of the parameter for the detection of infection through stool examination. Egg laying capacity of _E. hortense_ is fairly variable according to its age in the host. Maximum egg production per worm of _E. hortense_ occurs during the 30-40th day post-infection (Seo et al., 1985). Mean EPDPW was 1,478 in 35 villagers in Chongsong-gun. _E. hortense_ collected in this study were in the form of juvenile or senile worms. Considering flukes in human intestine are not in same age, it is not easy to estimate the correct EPDPW from our data.

Ten human cases of _E. cinetorchis_ infection had been recorded in Korea and Japan from 1930. Some infected cases complained of weight loss, loose stools. The others were found incidentally during stool examination. _E. cinetorchis_ infection of 54 years-old man in this study can be reported here as the 11th case of human infection (Chai and Lee, 1990; Ryang, 1990; Takahashi et al., 1930; Kawahara and Yamamoto, 1933; Moriyama, 1952), and as the 6th case in Korea. Human infection with _S. falcatus_, has been reported from Asia Pacific countries: one in the Philippines (Africa and Garcia, 1935), 2 in Hawaii (Alicata and Schattenberg 1938; Glover and Alicata, 1957), 3 in Japan (Takahashi S, 1929; Kagei et al., 1964), 6 in Thailand (Radomyos et al., 1990) and 4 in Korea (Chai and Lee, 1990). Forty two-year-old woman in this study was the 17th human case of _S. falcatus_ infection as literature concerned.

The loach (_Misgurnus anguillicaudatus_) has been known as most important source of echinostome infections. Further study should be pursued to explain the source of infection in this area. The mullet was known as second intermediate host of _S. falcatus_ in Korea (Chai and Sohn, 1988). From the history of infected woman, the mullet is thought to be a source of infection of _S. falcatus_ infection.

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=국문초록=

경상남도 거창군 고제면 주민들의 장흡측 감염상

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주민들의 장내 기생충 감염상황 조사와 구종을 목적으로 1994년 3월 경상남도 거창군 고제면 주민 116명의 대변을 수거하여 포르말린-에테르 집란법으로 1번 검사하였다. 장흡측 종합 양성자들에 대해 집단검사를 투여하여 증례를 회수하였다. 주민들의 경우 양성율은 11.2%(13예)였으며 간흡측 3.4%(4예), 메타코나무스 5.2%(6예), 호르텐스극구활충 9.5%(11예)였다. 7명의 호르텐스극구활충 양성자를 치료하여 평균 65(6-227)일에서 호르텐스극구활충을 수거하였다. 그중 1예에서 이전에 45(32-55)일에서 호르텐스극구활충을 수거하였다.

상복부 평만감, 우른변, 설사, 변비가 감염자의 주된 위장장 증상이었다. 경남 거창군 고제면을 호르텐스극구활충 유병지로 사용하는 것으로 추정한다. 이 조사의 이전에 45(32-55)일에서 호르텐스극구활충은 국내 제6예, 수세미이 형주종은 국내 제5례이다.

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