The first discovery of an endemic focus of *Heterophyes nocens* (Heterophyidae) infection in Korea

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**Abstract:** A highly endemic focus of human infection with *Heterophyes nocens* (Heterophyidae) was discovered from a small coastal village of Shinan-gun, Chollanam-do, for the first time in Korea. Fecal examinations by cellophane thick smear and formalin-ether sedimentation techniques revealed 42.9% heterophyid egg positive rate out of 98 inhabitants examined. It was difficult to confirm the species of heterophyids only by eggs. In order to collect the adult flukes, the egg positive cases were treated with 10 mg/kg single dose of praziquantel and purged with magnesium sulfate, and the adult worms were collected from the diarrheic stools. From each of 18 cooperative patients 1 to 1,124 (total 4,730) *H. nocens* worms were recovered, together with a few to large numbers of heterophyids (*Pygidiotopsis sumna*, *Stictodora fuscatum* and/or gymnophallids (*Gymnophalloides seol*). It is speculated that *H. nocens* might be widely distributed along the southwestern coastal areas where the brackish water fish such as the mullets or gobies are popularly eaten raw.

**Key words:** *Heterophyes nocens*, Shinan-gun, epidemiology, prevalence, worm burden, human infection

**INTRODUCTION**

It is well known that human infections with the flukes of the genus *Heterophyes* are chiefly caused by two species, *H. heterophyes* (v. Siebold, 1852) and *H. nocens* (Onji and Nishio, 1916); the former in Egypt and the Middle East (Taraschewski, 1984) and the latter in the Far East such as Japan and Korea (Yokogawa et al., 1965; Seo et al., 1981a; Chai et al., 1984 & 1985).

In Korea, Seo et al. (1980) first confirmed the existence of the life cycle of *H. nocens* in three southern coastal areas (Hadan-dong, Pusan City; Goje Island, Gyongsangnam-do; Yongsanpo, Chollanam-do), by observing the metacercariae encysted in the muscle of mullets, *Mugil cephalus*, and obtaining the adult flukes from experimental animals. Soon after then a case of human infection with *H. nocens* was found from Okku-gun, Chollabuk-do (Seo et al., 1981a). Further cases have been encountered, and so far total 13 cases have been described in the literature (Chai et al., 1984 & 1985; Sohn et al., 1989). However, the cases were found from sporadic areas, and endemic foci of *H. nocens* infection had never been reported. Recently we found out a small coastal village of Shinan-gun, Chollanam-do where human *H. nocens* infection is highly prevalent.

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MATERIALS AND METHODS

1. Fecal examination

During 1989-1990, fecal samples were collected from 98 out of a total of 230 inhabitants residing in a small coastal village on Aphae Island, Shiman-gun, Chollanam-do, and were examined by both cellophane thick smear and formalin-ether sedimentation techniques.

2. Worm collection

After fecal examination, the heterophyd egg positive cases were treated orally with 10 mg/kg single dose of praziquantel and purged with 30 g of magnesium sulfate. After 1 hour, the diarrheic stools were collected and washed several times in tap water. The adult worms of *H. nocens* were collected under a stereo-microscope and fixed with 10% formalin under cover slip pressure. They were stained with Semichon’s acetocarmine and observed. The number of worms collected from each case was counted to assess the individual worm burden.

RESULTS

The overall egg positive rate of intestinal helminths was 71.4%, i.e., 70 positives among 98 inhabitants examined. Trematodes showed the highest prevalence, 61.2%, which included 42.9% (42 inhabitants) positive rate of heterophyids (mostly *Heterophyes nocens*, as confirmed later by adult flukes), 49.0% (48) of *Gymnophalloides soei* (for details refer to Lee et al., 1994), 7.1% (7) of *Clonorchis sinensis*, and 1.0% (1) of *Paragonimus westermani*.

The measurement of individual worm burdens of *H. nocens* was completed in 18 heterophyid egg positive cases who agreed with the praziquantel treatment and purgation. The number of adult flukes recovered from 18 patients ranged from 1 to 1,124 specimens by individual, and 4,730 in total, with an average value per infected person of 263 (Table 1).

The adult specimens (Fig. 1) of *H. nocens* were morphologically compatible with the descriptions given by Onji and Nishio (1916) and Chai et al. (1984 & 1985). The body was dorsoventrally flat, ovoid (Fig. 2), and 0.82-

<table>
<thead>
<tr>
<th>Patient code</th>
<th>Age &amp; Sex</th>
<th>No. of <em>H. nocens</em> recovered</th>
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<tr>
<td>1</td>
<td>65 M</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>58 F</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>55 F</td>
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<td>17</td>
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</tr>
<tr>
<td>18</td>
<td>42 M</td>
<td>1,124</td>
</tr>
</tbody>
</table>

Total 4,730*

*Average No. of worms per case: 263.

1.02 mm in length and 0.52-0.63 mm in width (10 specimens were measured). The genital sucker was 0.15-0.20 mm in size, armed with 49-63 rodlets on its gonotyl (Fig. 3), and located prominently in close vicinity to the ventral sucker. The rodlets were interrupted ventrally near the anteromedian portion of the genital sucker. Eggs from distal uteri were oval, 0.027-0.031 mm in length and 0.016-0.018 mm in width, dark yellowish, operculated, and containing miracidia. They were similar in shape to those of *C. sinensis* but could be differed by a little more slender form and maximum width near the equatorial portion (Fig. 4).

DISCUSSION

Until present, only 13 sporadic cases of human *H. nocens* infection had been reported in Korea (Seo et al., 1981a; Chai et al., 1984 & 1985; Sohn et al., 1989). It is quite unlikely, however, that human infections with *H. nocens* occurred so rarely in spite of the popularity of eating raw brackish water fish such as the
mullet (Mugil cephalus) or goby (Acanthogobius flavimanus) among many people in Korea.

Several reasons seem to be responsible for the rare detection of *H. nocens* infections. The eggs of *H. nocens* are very similar in size and shape to those of *Metagonimus yokogawai* and *C. sinensis* (Lee et al., 1984), both species are better known and more widely distributed in Korea. For the above reasons, the eggs of *H. nocens*, if they appeared at times in human stools, might have been misdiagnosed as those of *M. yokogawai* or *C. sinensis* in routine stool examinations. In fact, the exact diagnosis of *H. nocens* infection is hardly possible unless the adult flukes are recovered from the egg positive patients after anthelmintic treatment and purgation. Moreover, *H. nocens* produce much smaller number of eggs compared with *C. sinensis*, so that the infected cases with *H. nocens* can be frequently false negative in fecal examinations (unpublished observation).

Because of such inconvenience and difficulty in the diagnosis, there have been no field surveys searching for endemic areas of *H. nocens* infection.

This study first confirmed that human *H. nocens* infection should occur not only sporadically but also in group making an endemic focus in Korea. It was of special interest that the endemic area discovered in this study was a small coastal village of Shinan-gun, very close to Mokpo City, since Mokpo area has long time been suspected as an endemic area of *H. nocens* (Asada, 1934; Seo et al., 1980 & 1981b). Asada (1934) mentioned that heterophyid metacercariae (presumably *H. nocens*) were found by H. Kobayashi in 1925 from the mullets collected at Mokpo, although the literature background can not be traced at present. Later, Seo et al. (1980 & 1981b) identified the metacercariae of *H. nocens* encysted in the flesh of the mullets,
M. cephalus, and gobies, A. flavimanus, collected from Mokpo area. The source of human infection with H. nocens in this area is, therefore, suggested to be the mullets and/or gobies.

From this study it is speculated that the distribution of H. nocens infection in Korea might be wider than previously considered. Many seashore villages in southwestern coastal areas where the mullets and gobies are popularly eaten raw might be turned out to be new endemic foci of H. nocens infection in the near future. Hence, much attention should be paid in routine fecal examinations on the inhabitants of seashore villages.

There were debates on the taxonomic validity of H. nocens (Faust and Nishigori, 1926), because of its morphological similarity to H. heterophyes, the type species. But H. nocens has a distinct morphological character of having only 50-60 chitinous rodlets on the gonotyl (Chai et al., 1984) whereas H. heterophyes has 70-85 rodlets (Chai et al., 1986). The difference in the number of rodlets on the gonotyl has been a unique and consistent feature of each species (Taraschewski, 1984; Chai et al., 1984, 1985 & 1986). Once H. nocens was proposed to be called as a subspecies, H. heterophyes nocens (Asada, 1934), which we followed for some time (Seo et al., 1980, 1981a & b; Chai et al., 1984 & 1985), but after then we have regarded it as a distinct species, H. nocens (Chai et al., 1986; Chai and Lee, 1990).

The clinical symptoms due to H. nocens infection are generally known to be mild gastrointestinal troubles (Chai et al., 1985), unless heavily infected. In this study we were told by many of the patients that they experienced repeated episodes of severe gastrointestinal troubles. But as they were co-infected with other kinds of trematodes such as G. seoi (Lee et al., 1994), it seems not appropriate to correlate the symptoms solely with H. nocens infection. To elucidate the clinicopathological characteristics of human H. nocens infection further studies are recommended.

REFERENCES
Seo BS, Heng ST, Chai JY (1981a) Studies on intestinal trematodes in Korea III. Natural human infections of Pygidiosis summa and Heterophyes heterophyes nocens. Seoul J Med
유해이형흡충(Heterophyes nocens)의 우리 나라 첫 유형지 발견 보고

서울대학교 의과대학 기생충학교실 및 통로병연구소

채종일, 남영근, 국진아, 이순형

전라남도 신안군 도서지역의 한 작은 해안 마을에 유해이형흡충(Heterophyes nocens)의 노출이 인접삼례로 유형지임이 우리 나라에서 최초로 확인되었다. 1999년부터 1998년에 걸쳐 마을 주민 230명 중 98명의 농민을 수집하여 셀로판후증도말범 및 포도알린-에테르 정화법을 병행하여 겨사한 바 이형흡충류(heterophyids) 중량이 42명(42.9%)에서 검출되었다. 그러니 농민층으로는 이형흡충류의 종(species)을 진단할 수 있어 농민 객유군들에게 대해 praziquantel 10 mg/kg과 하체를 주어 한 후 겨사한 후 정화법으로부터 복용을 최수하였다. 농민 객유군 42명 중 포도알린-에테르 정화법을 혈액 양자 18명 객유군으로부터 셀로판후증도말범을 쳐도 있었고, 유해이형흡충 중재 1-1.124마리(총 4,730마리)를 수혈할 수 있었다. 객유군들은 대부분 다른 이형흡충류(Pygidioptes summa, Stictodora fuscatus) 및 큰십동흡충류(gymnophallid)는 특히 Gymnophallididae에 중복 검출되어 있었다. 이번 연구 결과로서 미국 농부 보아 유해이형흡충은 중간공주인 농부, 물질성동물 등을 통해 생식하고 있는 우리 나라 남해안 및 서해안의 해안 마을에 널리 분포하고 있을 것으로 추측되었다.
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