기 생 충 학 잡 지 제26권 제1호
The Korean Journal of Parasitology
Vol. 26, No. 1, 55-60, March 1988

A Human Case of *Centrocestus armatus* Infection in Korea

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Abstract: A human case of *Centrocestus armatus* (Heterophyidae) infection was proved by identifying an adult worm collected after treatment with praziquantel in Korea. The case is 42-year old man who resides in a rural area in Sanchung-gun, Kyeongsangnam-do. The case was concomitantly infected with *Clonorchis sinensis* and had the history of eating raw freshwater fishes including *Zacco platypus*, which are known to be the second intermediate host of *C. armatus* in Korea. This is the first report of natural human infection by *C. armatus* in the literature.

Key words: *Centrocestus armatus*, intestinal fluke, Heterophyidae, human infection

INTRODUCTION

Centrocestus armatus, one of the fluke family Heterophyidae, is a minute intestinal trematode of fish-eating birds and mammals. This fluke was first described by Tanabe (1922) from the dog, cat, rabbit, rat and mouse, experimentally fed with cyprinoid fishes harbouring metacercariae in Japan.

The metacercariae were found from more than 20 kinds of freshwater fishes in Far Eastern countries(Komiya, 1965; Lee *et al.*, 1984). As for natural human infection of *Centrocestus* spp., there is only one report on a case infected by *Centrocestus formosanus* var. *kurokawai* (Kurokawa, 1935). However, experimental infection of humans was proven to be successful in *C. armatus* (Tanabe, 1922), *C. formosanus* (Nishigori, 1924) and *C. asadai* (Mishima, 1959) either by identification of eggs in stool or by recovery of worms after drug treatment.

In Korea, freshwater fishes such as *Zacco platypus*, *Rhodeus ocellatus*, *Gobius similis*, *Pseudorasbora parva*, *Pelfeobragrus fulvidraco*, *etc.* were reported to harbour metacercariae of *C. armatus* (Lee *et al.*, 1984), and a brackish water fish, *Tribolodon taczanowskii* was proven to have metacercariae of *C. asadai* (Choi *et al.*, 1964). No reports are available on human infection with *Centrocestus* species in Korea. The present authors collected an adult specimen of *C. armatus* from a man after treatment with praziquantel, and report here as a first report on natural human infection in the literature.

CASE DESCRIPTION

Kim, O.O., 42-year-old man, was residing in a farm village in Sanchung-gun, Kyeongsangnam-do. He said he used to eat raw freshwater fishes such as *Z. platypus*, *Moroco oxycephalus*, *Pseudogobio esocinus* and *Hemibarbus* sp., and recalled he had eaten *Z. platypus* 2~3 weeks before treatment. For several years he experienced episodes of epigastric discomfort, diarrhea and indigestion. The eggs of *Clonorchis sinensis* and of heterophyid flukes were found in fecal examination concomitantly with echi-

nostome eggs in November, 1987. The egg count of *C. sinensis* was 247,800 in E.P.G. (eggs per gram of feces). He was treated with 10mg/kg single dose of praziquantel and purged with magnesium sulfate. Thirty minutes later, one *C. armatus* worm was collected through stereomicroscopy of diarrheal stools, together with 97 *Metagonimus* sp. and 2 juvenile echinostomes. This paper only concerns with *C. armatus*.

PARASITOLOGICAL DESCRIPTION

The acetocarmine stained specimen was observed and measured. Drawing attachment was used for the illustration of worm morphology. Body small, elongated ovoidal in shape, dorso-ventrally flat, and covered with fine spines from anterior to posterior end(Figs. 1 & 2). Body 0.362mm in length and 0.157 mm in width (Table 1). Oral sucker terminal, with two alternating rows of total 42 circumoral spines, anterior spines being larger than posterior ones (Figs. 3 & 4). Prepharynx present. Pharynx well developed and 0.034mm in diameter. Esophagus very short. Intestine dilated, bifurcating in front of ventral sucker and ceca terminated at ovarian level in right side and at level of Mehlis' gland in left side. Ventral sucker in middle of the body, smaller than oral sucker. Testes ellipsoidal, side by side in posterior region of body, with two to three lobules, and right testis slightly larger than the left. Seminal vesicle large, sigmoid and constricted into two parts at its middle portion, lying transversely behind ventral sucker. Prostatic complex prominent. Genital atrium immediately in front of ventral sucker. Ovary elliptical, with smooth margin anterior to right testis, 0.050mm in length and 0.047mm in width. Mehlis' gland opposite to ovary and pre-testicular. Seminal receptacle globular, median and pre-testicular between testes. Uterus serpentine between testes and genital pore in cecal and intercecal area. Intrauterine eggs yellowish brown, oval and attenuated anteriorly, without surface lattice, 4 in number, and measured 0.031~0.033mm in length and 0.015 ~0.020mm in width (Fig. 5). Vitellaria follicular, distributed along extracecal margins from pharyngeal level to post-testicular area and intruded to meet at esophageal and post-bifurcate regions. Common vitelline ducts from each side passing transversely to form ellipsoidal vitelline reservoir between seminal receptacle and posterior sac of seminal vesicle. Excretory bladder X-shaped.

DISCUSSION

In the genus *Centrocestus*, 10 species have been recorded so far; *C. cuspidatus* (Looss, 1896) Looss, 1899, *C. cuspidatus* var. *caninus* Leiper, 1913, *C.*(*Stamnosoma*) *armatus*(Tanabe, 1922) Price, 1932, *C.* (*Stamnosoma*) *formosanus* (Nishigori, 1926) Price, 1932, *C.*(*Stamnosoma*) *nycticoracis* Izumi, 1935, *C. formosanus* var. *kurokawai* Kurokawa, 1935, *C. yokogawai* Kobayasi, 1942, *C. polyspinosus* Kobayasi, 1942 and *C. asadai* Mishima, 1959(cited from Chen, 1942; Yamaguti, 1958; Kobayasi, 1968). The major diagnostic characters were the number of circumoral spines, margin of ovary and testes, presence or absence of latticed design on the egg shell, number and size of eggs in fully mature specimens. The number of circumoral spines is considered to be the most reliable one.

C. cuspidatus var. *caninus* was once regarded as synonym of *C. cuspidatus* by Ransom in 1921 since they were morphologically very similar except different number of circumoral spines (Chen, 1942). On the other hand, the former was considered identical to *C.* (*Stamnosoma*) *formosanus* by Faust and Nishigori (1926). Yamaguti (1958) evaluated *C. cuspidatus* var. *caninus* as a valid species, *C. caninus*, and placed *C.* (*Stamnosoma*) *formosanus* as a synonym of *C. caninus*. However, many researchers has adopted *C. formosanus* to be valid species (Chen, 1942; Komiya, 1965; Premvati and Pande, 1974; Yanohara *et al.*, 1987).

Kobayasi(1968) classified flukes belonging to

Table 1. Comparison of the measurements of *Centrocestus* spp. with the present specimen (unit: mm)

Items		*C. armatus* (Tanabe, 1922)	*C. formosanus* (Nishigori, 1924)	*C. formosanus* var. *kurokawai* (Kurokawa, 1935)	Present specimen
Body	length	0.350~0.630	0.289~0.389	0.350~0.515	0.362
	width	0.182~0.284	0.187~0.238	0.175~0.225	0.157
No. of circumoral spines		44	32	38~40	42
Oral sucker	length	0.056~0.074	0.050	0.048~0.055	0.045
	width	0.061~0.076	0.047	0.050~0.055	0.051
Prepharynx	length	0.016~0.031	—	—	0.006
Pharynx	length	0.037~0.054	0.040~0.047	0.037~0.040	0.035
	width	0.028~0.047	0.020~0.035	0.025~0.027	0.034
Esophagus	length	0.018~0.033	—	—	0.005
Ventral sucker	length	0.049~0.061	0.035~0.042	0.045~0.052	0.032
	width	0.054~0.069	0.038~0.054	0.046~0.053	0.038
Seminal vesicle	length	0.220~0.367	—	—	0.075
	width	0.037~0.059	—	—	0.085
Ovary	length	0.059~0.074	0.037~0.042	0.037~0.055	0.050
	width	0.086~0.103	0.050~0.062	0.055~0.065	0.047
Seminal receptacle	length	0.049~0.091	0.042~0.062	0.045~0.062	0.017
	width	0.061~0.105	0.050~0.060	0.042~0.063	0.021
Testis (right)	length	0.092~0.137	0.037~0.057	0.045~0.050	0.044
	width	0.047~0.074	0.077~0.100	0.060~0.075	0.059
Testis (left)	length	0.081~0.115	0.035~0.055	0.048~0.052	0.034
	width	0.037~0.074	0.055~0.100	0.060~0.075	0.050
Egg	length	0.028~0.032	0.033~0.035	0.033~0.040	0.031~0.033
	width	0.016~0.017	0.017~0.020	0.017~0.021	0.015~0.020

genus *Centrocestus* into 4 groups on the basis of the number of circumoral spines. He named *C. yokogawai* for those having 26, 28 or 30 circumoral spines, and *C. polyspinosus* for the group having 50, 52, 56, 58 or 60 spines. He also suggested that *C. armatus* should be named to flukes having 42, 44, 46 or 48 circumoral spines, and *C. formosanus* to those having 32, 34, 36, 38 or 40 spines. In this regard, it is suggested that *C. asadai* (Mishima, 1959), though it takes brackish water fishes as second intermediate host, be placed in *C. formosanus*. The present specimen has 42 circumoral spines, which is compatible to *C. armatus*. All other morphology is not different from *C. armatus* (Table 1).

Kurokawa(1935) obtained flukes belonging to genus *Centrocestus* after chemotherapy of a Japanese native. The flukes were differentiated from *C. armatus* or *C. formosanus* by the number of circumoral spines and number of intrauterine eggs. However, the eggs had latticed design on their shell surface, and were similar to that of *C. formosanus*. He considered that the flukes were close to *C. formosanus* and recorded as a natural human infection of *C. formosanus* var. *kurokawai*. Later, Yamaguti (1958) classified this fluke into a distinct species, *C. kurokawai*(Kurokawa, 1935). In this context, the present case is the first natural human infection of *C. armatus* so far as literatures are concerned.

As for the second intermediate host of *C. armatus* in Korea, several freshwater fishes such as *Z. platypus* and *R. ocellatus* are known to harbour the metacercariae(Lee *et al.*, 1984). The present authors experienced that *Z. platypus*, caught at a stream nearby the hamlet where the present case was residing, was heavily infected with the metacercariae of *C.*

armatus (unpublished observation). It is highly suspected that the source of infection is the freshwater fishes he had eaten.

The eggs of *C. armatus* closely resemble those of *Clonorchis sinensis*, hence, researchers will find difficulty in differentiating them in fecal examinations. It is highly expected that the eggs be misinterpreted not only as those of *C. sinensis* but also as other heterophyids such as *Metagonimus yokogawai*. Small amount of egg production per worm seems to be a factor for that human infection of *C. armatus* had not been detected, in spite that freshwater fishes are preferably eaten raw in many countries where the presence of metacercariae has been proven. It is expected that, if more scrutiny in fecal examination is paid on the eggs of heterophyids and *C. sinensis*, human infection cases by *C. armatus* would be increasingly detected.

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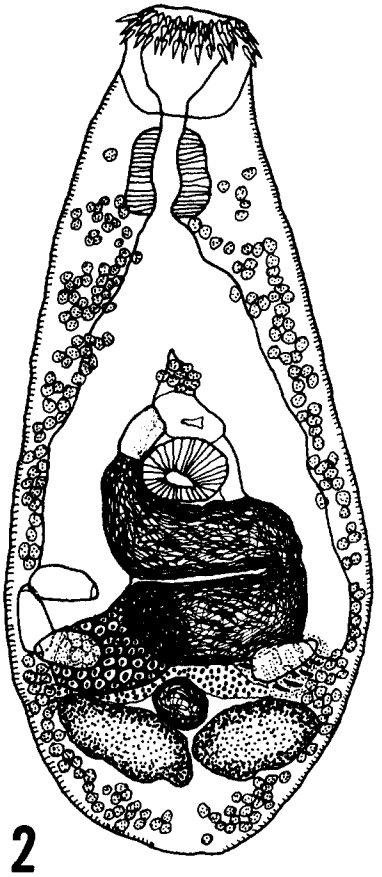

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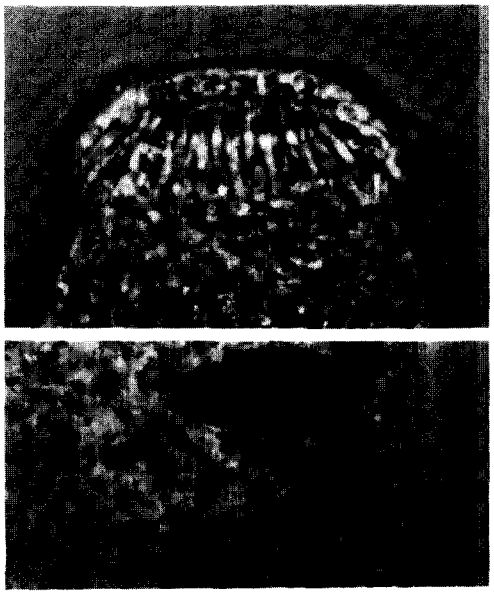

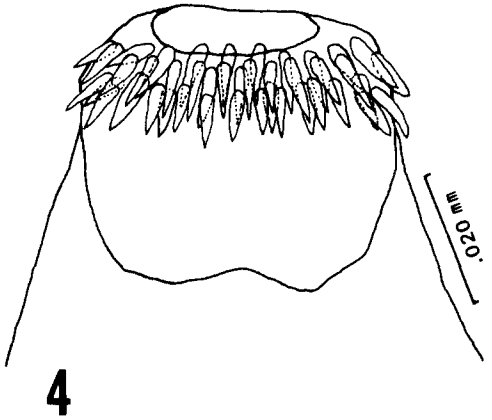

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=국문초록=

*Ceutrocestus armatus*의 인체 감염 1례

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이형흡충류의 하나인 *Centrocestus armatus*의 인체감염 1례가 praziquantel 투여후 성충을 수집, 동정함으로써 확인되었다. 환자는 42세 남자로 경남 산청군에 거주하였으며 상복부 통증, 설사, 소화불량 등을 호소하였다. 환자는 간흡충, 이형흡충류 및 극구흡충 충란 양성이었다. 장흡충류 치료를 위하여 praziquantel 10mg/kg를 투여하였고 $MgSO_4$으로 설사를 유도하고 설사변을 입체해부현미경으로 검사한 바 *C. armatus* 성충 1마리와 극구흡충 유충 2마리가 수집되었다. 환자는 피라미 등 민물고기를 자주 생식하였다 하며 치료 2~3주 전에도 피라미를 회로 먹었다고 한다. 따라서 피라미를 비롯한 민물고기가 *C. armatus*의 감염원이 되었을 것으로 추측되었다.

EXPLANATIONS FOR FIGURES

Fig. 1. Adult worm of *C. armatus* collected from a man.
Fig. 2. Drawing of Fig. 1.
Fig. 3. Dorsal view of oral sucker showing the alternating rows of circumoral spines (unstained).
Fig. 4. Drawing of circumoral spines on outer surface of the oral sucker.
Fig. 5. Intrauterine eggs (scale: 0.020mm).