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Description of a Male *Gnathostoma spinigerum* Recovered from a Thai Woman with Meningoencephalitis

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Abstract: A coiled nematode, which was removed surgically from a Thai woman, was consulted to the authors in July, 1987. She was known to suffer from meningoencephalitis since she was in Thailand. Numerous eosinophils were detected from her CSF. The worm was 12.3mm long and 0.9mm wide. It had a head bulb beset with eight rows of spines, a cervical constriction, esophagus, cervical sacs, dark intestine and testis. Cuticle of anterior half of the worm was covered with numerous spines. The spines at anterior part was stout and had 3~4 tips, but they became slender, shorter, single tipped and sparser and finally they disappeared posteriorly. Cuticular spines reappeared at tail which had 4 pairs of pedunculated papillae. By above morphological characteristics, the worm was identified as an adult male of *Gnathostoma spinigerum*. The present case is the first authentic case of imported intracranial gnathostomiasis in Korea, although clinical informations of the case were obtained limitedly.

Key words: *Gnathostoma spinigerum*, meningoencephalitis, gnathostomiasis, human infection

INTRODUCTION

Gnathostome is a nematode of superfamily Spiruroidea which inhabits in the stomach wall of cats, dogs or other carnivorous mammals. The genus *Gnathostoma* was founded by Owen in 1836, with the type species of *G. spinigerum*, which was discovered in the stomach wall of a tiger in London (Miyazaki, 1960). The first intermediate host of *Gnathostoma* spp. in fresh water crustacea such as *Cyclops*, and the second intermediate host is a wide spectrum of vertebrates including amphibia, reptilia, fishes and mammals. In carnivorous mammals, the larvae migrate into the peritoneal cavity, liver, muscle or connective tissue where they become almost matured. Thereafter, the worms gather into the stomach wall and make a tumor finally (Miyazaki, 1960).

Human infection of *G. spinigerum* was first reported by Levinsen(1889) from a Thai woman in Bangkok. After the first record, many cases of human gnathostomiasis have been detected in Asian countries which are located between India and Japan, and in Australia. Almost all of the human cases were found to be infected by *G. spinigerum*, but a few were by *G. hispidum* (Beaver *et al.*, 1984).

Man is regarded biologically as the secondary second intermediate host, who is infected by ingestion of larval gnathostomes encysted in other second intermediate hosts. Almost all of the worms removed from human were known as either third stage larvae or as sexually immature adults. Only in rare occasions mature worms in man were recorded in Japan(Miyazaki, 1960).

Human gnathostomiasis is clinically characterized by creeping eruption induced by migrating larvae in subcutaneous tissues. However, the worm is also known to invade the lungs,

the eyes and even the brain (Miyazaki, 1960).

In July, 1987, we were consulted about a worm obtained surgically from a Thai woman. The worm was observed parasitologically and identified as *G. spinigerum*. This is the first record of human gnathostomiasis diagnosed in Korea as far as the literature is concerned. The worm is to be described and the disease will be briefly reviewed.

CASE RECORD

A young woman who suffered from meningoencephalitis was admitted to the US Army Hospital in Seoul, Korea in July, 1987. She was a young Thai woman and a wife of an American military personnel. It was known that she contracted meningoencephalitis when she was in Thailand. Unfortunately, we were able to obtain very little clinical informations on this case because her husband refused to expose her clinical record due to personal reason. He also refused our interview with the patient.

The only clinical finding we know is the appearance of numerous eosinophils in her CSF as written in a consultation sheet to us. Therefore, we have no further informations on some important clinical details; i.e., which kind of neurosurgical procedure was carried out, where the worm was found, how many worms were isolated, what was the nature of histopathological examination on the resected tissue, *etc*. We only received a fixed worm extracted at the surgical table with a very brief clinical record.

PARASITOLOGICAL DESCRIPTION

The worm was received under fixation with 10% formalin. It was cylindrical and coiled (Fig. 1). Its length measured 12.3 mm and width 0.9 mm. A head bulb, 202 μm long and 630 μm wide, was protruded anteriorly and a cervical constriction followed (Fig. 2). The head bulb had two labia on anterior end and was beset with spines in eight rows. The spines on head bulb were single pointed and looked like claws of a cat (Fig. 3). The length of the spines measured 11.4~12.5 μm. Anterior half of the worm was covered with numerous cuticular spines, and posterior half was naked. However, many minute spines were found on its posterior end. The size and shape of the spines varied by location. The spines (type A) on the cuticle immediately behind the head bulb were 20.8~21.8μm long and each had a round base and 3 to 4 teeth (Fig. 3). The spines of type B at esophageal level were 37.7~40.0μm in length. They had three toothed tips, with a little larger middle tooth (Fig. 4). The width of the spines was not increased from the round base to the tip. They were laid compactly in numerous transverse rows, and overlaid longitudinally. The spines (type C) following the type B measured 46.6 ~53.5μm long in rather slender shape with 2 to 3 tips (Fig. 5) and their base was linearly connected with each other by transverse cuticular wrinklings. Their distribution became rather sparse. The spines (type D) on the middle of the worm decreased in size of 7.8~ 8.9μm length and had a single tip (Fig. 6). Linear bases of the spines were transversely aligned by circular wrinklings of the cuticle. The spines at anterior part were stout and had 3 to 4 tips but they became slender, shorter and sparser posteriorly. Finally the spines disappeared at the middle coiled portion of the present worm as described in Fig. 1. Only the surface of the worm was found with circular cuticular striations.

As for inner structures, the esophagus was observed 2.4mm long and was connected to intestine. Cervical sacs were found beside anterior half of the esophagus. The intestine was dark and straight to its tail. Testis was identified as a convoluting tubule overlapped with intestine from beginning of intestine to tail(Fig. 1).

Numerous minute cuticular spines were recognized at the posterior end with a Y-shaped

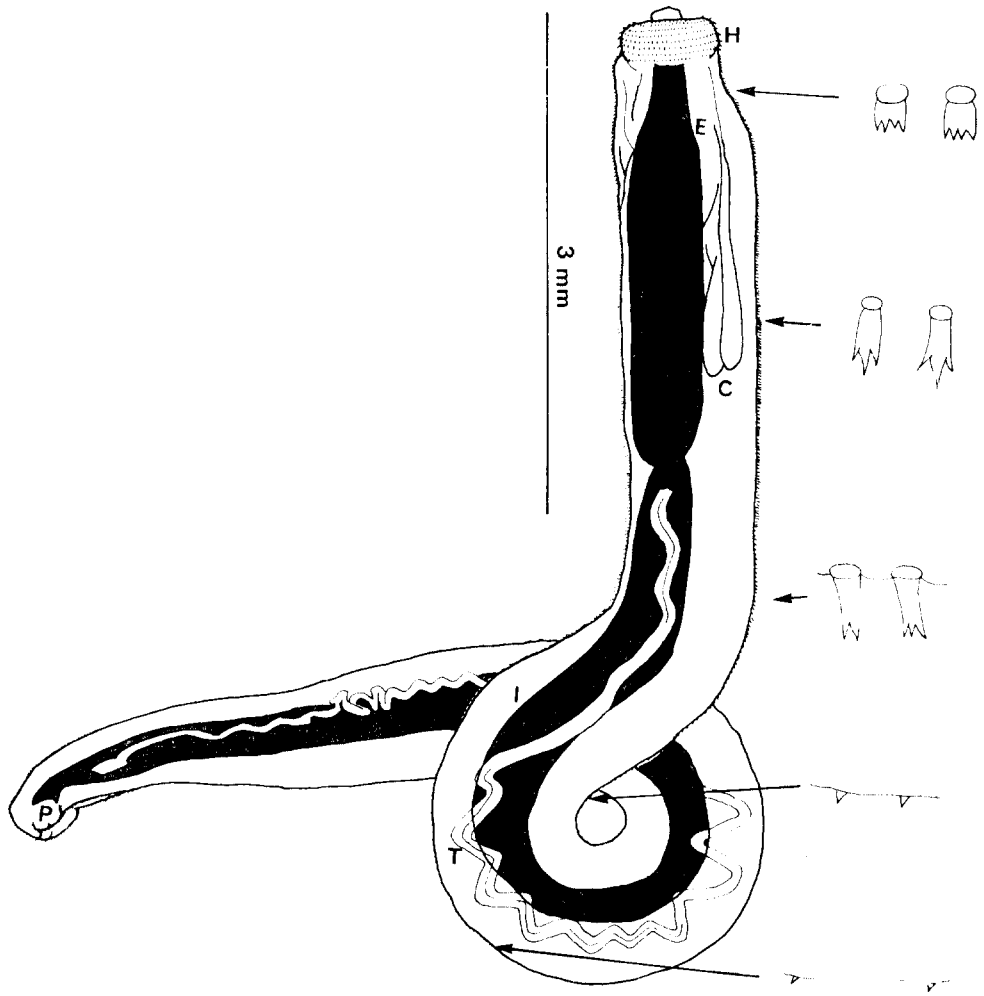

Fig. 1. Drawing of whole worm of *Gnathostom spinigerum* with enlarged spines by location (H: Head bulb, E: Esophagus, C: Cervical sacs, I: Intestine, T: Testis, P: Caudal papillae).

aspinous area at ventral surface around the cloaca. There were 4 pairs of large pedunculated papillae bilaterally at the tail (Fig. 7).

DISCUSSION

Human gnathostomiasis is caused mainly by *G. spinigerum*, and in a few instances by *G. hispidum*(Beaver *et al.*, 1984) although several species have been described in the genus *Gnathostoma*. In speciation of the gnathostomes, the morphological features of cuticular spines are very important. Distribution and shape of the spines are different by the species, and the spines vary in size, shape and number by stage of the worm. The spines on head bulb are at 4 rows in larval stage of all species of *Gnathostoma*. At adult stage, the number increased to 8 rows in *G. spinigerum* and to 12 rows in *G. hispidum*.

The worm from the present case is male and 12.3mm long. By length, the present worm can be regarded as an adult worm (Beaver *et al.*, 1984). Also testis and ejaculatory duct are found as convoluting tubules. It has cephalic spines in 8 rows which also means adult stage.

The spines of body are distributed on the cuticle of anterior half and near the tail. Therefore, the species; *G. doloresi*, *G. hispidum*, *G. procyonis*, are excluded because these species are covered with cuticular spines all over the body in adult stage. The species with cuticular spines on anterior half of body are *G. spinigerum*, *G. nipponicum* and *G. americanum*. By Miyazaki (1960), *G. spinigerum* and *G. nipponicum* are distinguishable by caudal spines and the shape of cuticular spines. The tail of female *G. nipponicum* is aspinous, but that of male is spinous. In tail of a male worm, distribution of papillae is similar between the two species, however, there is no Y shaped aspinous area around cloaca in *G. nipponicum*. The aspinous area of Y-shape in tail of the present worm was compatible with that of *G. spinigerum*. The shape of three-teethed spines in Figs. 1 & 4 is more characteristic. In the spines of *G. spinigerum*, middle tooth is slightly longer than two laterals and the width is even from base to teeth. Contrary to these, the spines of *G. nipponicum* have a long and convex middle tooth and become wider at the teeth part than at the base. The present worm was compatible with *G. spinigerum* in morphology of the spines and that of tail. *G. americanum* is written easily distinguishable by two caps of eggs, however, we have no eggs. At this point, *G. americanum* should be ruled out by locality because the present case was infected in Thailand where *G. spinigerum* has been highly prevalent while *G. americanum* was recorded in Brazil. Conclusively the worm was identified as an adult male of *G. spinigerum*.

The present case suffered from meningoencephalitis and numerous eosinophils were detected in her CSF. Therefore, it can be supposed that such symptoms as headache, nausea, vomiting, drowsiness and stiff neck were foundable although clinical records of the case were insufficient. Also migratory facial edema might be observable as Miyazaki (1960) described. The patient must have been a case of intracranial gnathostomiasis, and also other localizing neurological signs might be expected. It might be also possible that the neurosurgical procedure might pick out more worms because clinical manifastations of the case looked severe.

The source of human gnathostomiasis is ingestion of the larvae in the first or second intermediate host. The most important infection source is the raw fish. The fishvorous fish, *Ophicephalus striatus* is regarded as a major source in Thailand, in addition *Clarias batrachus*, *Monopterus albus*, *Glossogobius giurus* and *Therapon argenteus* are known in southeast Asian countries or in Japan (Beaver *et al.*, 1984). However, we had no information on the infection source of the present case.

The present case can be regarded as a case of intracranial gnathostomiasis imported from Thailand. The autochthonous infection of *Gnathostoma* in definitive host or human has not been recorded yet in Korea. Only the third stage larva was detected from a *Channa argus* in Kimhae (Kim, 1973). However, its enzootic prevalence may be possible in Korea because this country is located in the middle of its distribution area between mainland China and Japan. Human gnathostomiasis is also expected when the habitual consumption of the raw fish is considered. Especially *Channa argus* is one of the favourite fishes. The loach is regarded as an important source of human infection in Japan, but the loaches from Taegu were examined negative for gnathostome larvae (Koga *et al.*, 1985). Detection of autochthonous infection of *Gnathostoma* in Korea should be a theme of further study.

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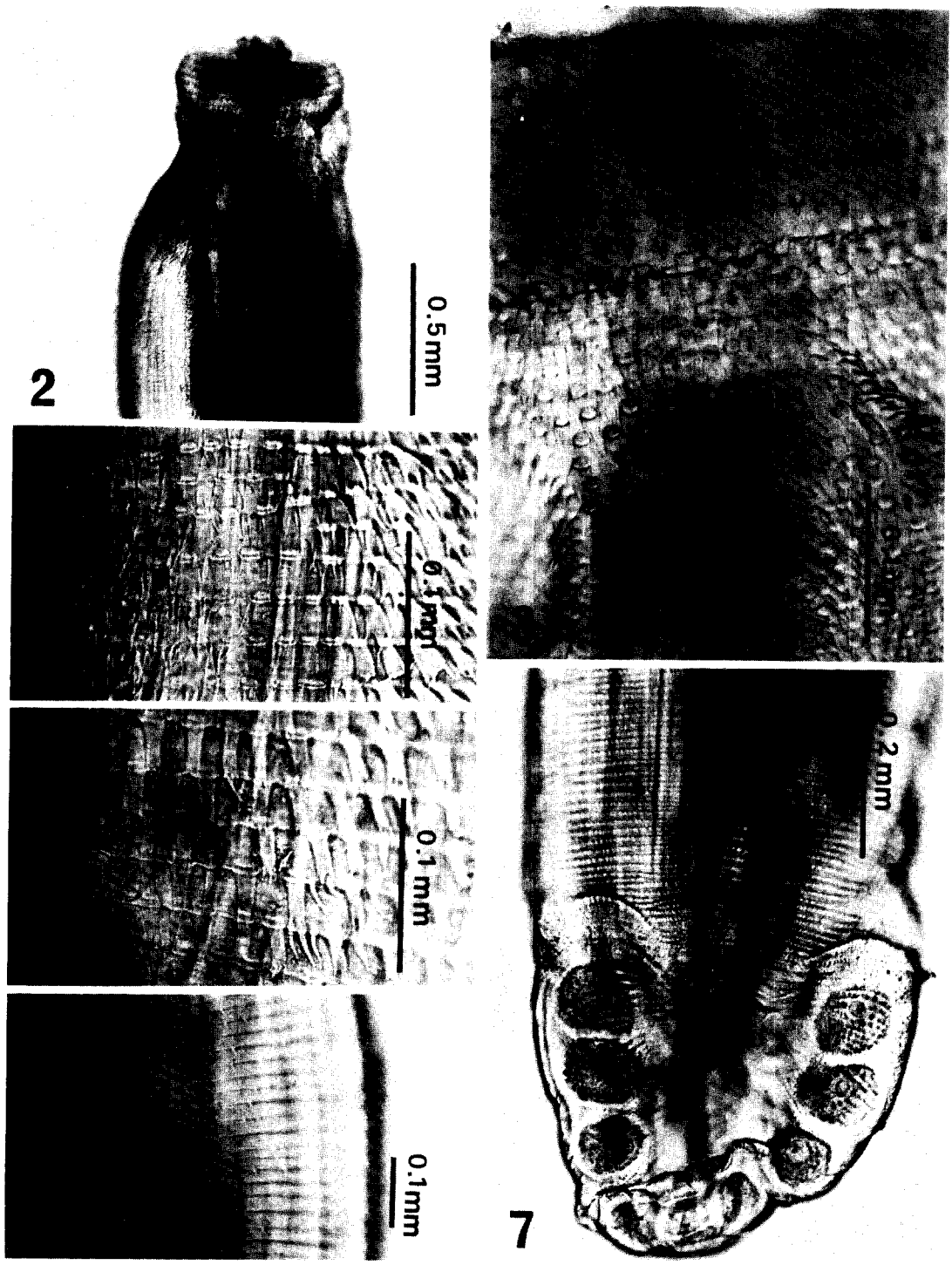
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=국문초록=

수막뇌염을 동반한 泰國人 有棘顎口蟲症 1例

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서울에 있는 미군 병원에서 시행한 신경외과 수술에서 검출 의뢰된 충체를 有棘顎口蟲으로 同定하여, 국내에서 충체로 확인된 첫 증례로 보고한다.

환자는 젊은 태국인 여성으로 태국에 체재할 때부터 수막뇌염 증세를 앓았고, 뇌척수액에서는 수많은 호산구를 검출하였다.

둥글게 말려서 고정된 충체는 길이가 12.3mm, 폭이 0.9mm이고 앞쪽 끝에 큰 head bulb가 있었다. 이 기관의 표피에는 고양이 발톱모양의 皮棘이 8줄로 배열되어 있었다. 충체 前半部의 표피에는 수많은 皮棘이 가로로 열지어 있는데 head bulb 가까이에서는 둥근 기저부와 4분지의 끝이 있는 굵은 皮棘이 분포하나 점차 뒤쪽으로 3분지되고 2분지되면서 가늘고 길어지는 皮棘으로 이행되었다. 중간부에서는 짧고 작은 가시모양의 皮棘이 관찰되고 그 수도 크게 감소하였고 後半部에서는 皮棘이 관찰되지 않았다.

길이 12.4mm의 식도와 두 개의 食道線(cervical sacs)이 있고, 腸이 식도에서 항문까지 곧게 이어져 있었다. 腸은 검고 불투명하며, 심하게 굴곡하는 고환과 겹쳐지서 관찰되었다.

뒤 끝에서는 작은 皮棘이 다시 나타나서 가로로 배열하였고 항문 주위에 Y형으로 皮棘이 없는 부분이 있었다. 끝의 腹面·양쪽에 네 쌍의 큰 감각유두((pedunculated papillae)가 배열하였다.

이상의 소견은 *Gnathostoma spinigerum* 성충 수컷의 형태와 일치하였다. 따라서 이 증례는 태국에서 감염되어 국내로 유입된 수막뇌염이 유발된 有棘顎口蟲 症例로서, 국내에서는 처음으로 기록되는 것이라 하겠다.

EXPLANATIONS FOR FIGURES

Fig. 2. Anterior end of *G. spinigerum* with a head bulb and lips.
Fig. 3. Cuticular spines on head bulb and neck (type A), ×400.
Fig. 4. Cuticular spines (type B) at esophagus level, ×400.
Fig. 5. Cuticular spines (type C) at intestinal level showing two toothed tips, ×400.
Fig. 6. Minute single-tipped spines (type D) at mid-portion of body, ×200.
Fig. 7. Tail of male *G. spinigerum* showing minute cuticular spines and four pairs of pedunculated papillae, ×100.