

## Experimental human infection with Asian *Taenia saginata* metacestodes obtained from naturally infected Korean domestic pigs\*

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**Abstract:** The infectivity of metacestodes of Asian *Taenia saginata*, now tentatively called *Taenia saginata taiwanensis*, in human host was confirmed. The metacestodes used in experimental infection were collected from the livers of naturally infected domestic pigs at an abattoir in Cheongju City, Korea. The first gravid proglottid was spontaneously discharged 76 days after infection. Two worms were recovered two years later by chemotherapy. The scolex was unarmed. The number of main uterine branches, varying from 16 to 21, was similar to that of classical *Taenia saginata*. The liver of pigs was confirmed to be an infection source of Asian *T. saginata* in Korea.

**Key words:** Asian *Taenia saginata*, experimental human infection, naturally infected metacestodes in domestic pigs, Korea

### INTRODUCTION

Asian *Taenia saginata*, morphologically similar to *T. saginata*, is a cestode that provides an important clue for understanding an epidemiological enigma of human taeniasis in many Asian countries, including Korea.

Park and Chyu(1963) in Korea; Huang *et al.* (1966) in Taiwan; Harinasuta and Charoenlarp (1971) in Thailand; Kosin(1972) in Indonesia; and Arambulo *et al.*(1976) in the Philippines have raised questions about the source of human *Taenia saginata* infection in Asian countries mainly because of the irrelevance between eating habit of the local people and resulting species of *Taenia* infections. These puzzling relations

began to be solved by Fan *et al.* (1986) who recognized the liver of pigs as a source of the so-called *T. saginata* in these countries.

Eom and Rim(1992), in a recent survey, reported that the livers of 1.01% of 25,358 domestic pigs in Korea were infected with Asian *Taenia saginata* metacestodes. Of those infected, live metacestodes were found in 0.01% of the pigs and the authors suggested that domestic pigs may well be an infection source of Asian *T. saginata*.

We have undertaken this study to confirm the suggestion by experimental infection in a volunteer.

### MATERIALS AND METHODS

Asian *T. saginata* metacestodes were collected from naturally infected domestic pigs at an abattoir in Cheongju City (Eom and Rim, 1992),

\* This paper was supported by NON DIRECTED RESEARCH FUND, Korea Research Foundation, 1989.

A Korean male volunteer who was not previously infected with any species of *Taenia*, was inoculated per os with five metacestodes. He was treated two years later with 2 g of niclosamide. Scolex and discharged gravid proglottids were observed by light microscopy after fixing and acetocarmine staining.

## RESULTS

The first gravid proglottid was discharged spontaneously 76 days after infection.

One of the two recovered worms which were collected by niclosamide treatment, was fixed in 10% formalin. This entire worm with a scolex measured 330 cm in total length and had approximately 700 proglottids (Fig. 1). The scolex measured 0.81 mm in width. Four simple suckers measured 0.24~0.29 mm in maximum diameter. The number of main uterine branches was 18.3 (n=18) in a range of 16 to 21 (Fig. 2). Eggs with a hexacanth embryo in the embryophore measured  $35.7 \mu\text{m}$  (33.8~40.0) by  $34.4 \mu\text{m}$  (33.5~37.5) (n=50) (Fig. 3).

## DISCUSSION

Asian *Taenia saginata*, now tentatively called *T. saginata taiwanensis*, is a cyclo-zoonotic parasite which needs intermediate animal hosts. Fan *et al.* (1986) had found wild boars and Lanyu pigs as possible intermediate hosts for this tapeworm. The liver of those animals was noticed especially as an infection source of Asian *T. saginata*. In Korea, however, wild boars are unusual and the Lanyu pigs are non-existent. In such situations, Eom and Rim (1992) reported natural infections of Asian *T. saginata* metacestodes in the livers of Korean domestic pigs. The present study, using the metacestodes obtained from naturally infected domestic pigs, confirms that domestic pigs are intermediate hosts for this parasite and the liver of pigs can be a source of human infection.

The taxonomic status of Asian *T. saginata* found in many Asian countries, however, remains

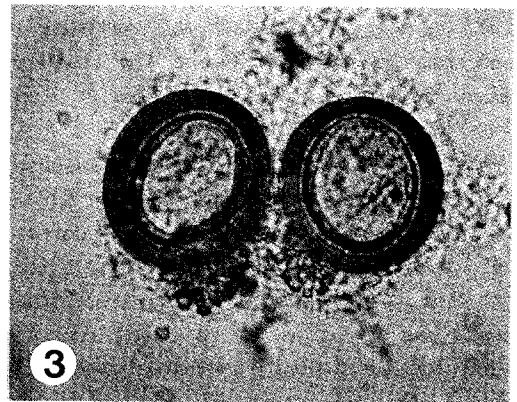
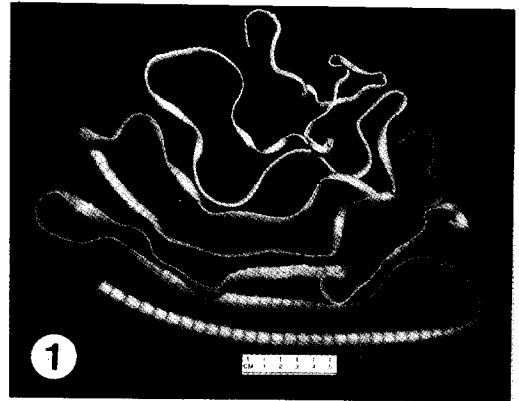


Fig. 1. Asian *Taenia saginata* recovered from a man infected with metacestodes obtained from a naturally infected pig.

Fig. 2. Gravid proglottid, unpressed and fixed.

Fig. 3. Eggs with hexacanth embryo and thick shell.

unclear especially since the morphology of the adult parasite is so similar to classical *T. saginata* (Fan *et al.*, 1986; Fan, 1988; Cross, 1987; Cross and Murrell, 1991).

Of the methods for diagnosing tapeworms, uterine branch counting in gravid proglottids has been considered the most simple and useful. The recorded number of uterine branches in *T. saginata* varies: Faust(1929) and Noble and Noble(1961) reported more than 15; du Noyer and Baer(1928) reported 18-25; Brumpt(1949) reported 15-30 and Abuladze(1964) reported 18-32. Uterine branches in our study of Asian *T. saginata*, 16-21 were within the range of 9-32 of Fan *et al.*(1988). This number is undifferentiable from that of classical *T. saginata* as 15-32. The shape and size of the eggs were also very similar to those of *T. saginata*. Although they cannot be a key for taxonomy, worm lengths of Asian *T. saginata* according to Liu *et al.*(1965) in Taiwan are 75 to 540 cm. Our specimen fell within this range. The morphology of adult worm will be described elsewhere.

The Korean habit of eating the raw viscera of pigs, varying from 19.2% to 52.3% (Park and Chyu, 1993; Kang *et al.*, 1965; Kim, 1982), has traditionally been considered insignificant because that muscle alone was believed to be the source of human taeniasis; but now the fact that most people eat livers explains the disproportionately high ratio of unarmed tapeworms to armed tapeworms (approximately 5 : 1).

This study leads us to believe that the Asian *T. saginata* metacestodes in Korean domestic pigs can be one of the infection source of human taenia tapeworm which has been, hitherto, identified as *Taenia saginata*.

#### ACKNOWLEDGEMENT

We thank Professor Seung-Yull Cho, Department of Parasitology, College of Medicine, Chung-Ang University for valuable discussions. We also acknowledge the help of Mr. Dae-Eui Hong and Jung-Tae Kim, students in the College of Medicine, Chungbuk National University.

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＝국문초록＝

## 돼지 肝에 自然感染된 *Asian Taenia saginata* 囊尾蟲의 人體感染 實驗

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*Asian Taenia saginata* 囊尾蟲에 의한 人體 감염이 성립된다는 것을 실험적으로 확인하였다. 감염에 사용한 5 개의 낭미충은 우리나라 돼지간에 자연감염되었던 것으로 청주 소재 도축장에서 얻은 것이었다. 감염 후 제 76 일에 활발한 운동성을 가진 수태편질이 자연배출되었다. 2년 후 치료하여 두마리의 성충을 회수하였다. 두견에는 小鉤가 없었고 수태편질의 자궁축지수는 16~21 개 이었으며 다른 부분은 형태학상으로 무구조충과 유사하였다.

돼지 肝을 날로 먹으면 우리나라에서 *Asian Taenia saginata*에 감염될 수 있다는 것을 실험적으로 증명하였다.

[기생충학잡지, 30(1):21-24, 1992년 3월]