기 생 충 학 잡 지 제28권 별 호
The Korean Journal of Parasitology
Vol. 28, Suppl., 123-144, December 1990

Cestode Infections in Korea

Duk-Young Min
Department of Parasitology, College of Medicine,
Hanyang University, Seoul 133-791, Korea

Abstract: Epidemiological surveys concerning cestodes of medical importance in Korea have been sporadically reported by many workers. Among various parasitic infections, cestode infections occur less frequently than other helminthiases, but they often cause serious clinical complications. Cestodes reported so far in Korea belong to the Order Pseudophyllidea or Cyclophyllidea (Subclass Cestoda), *i.e.*, *Diphyllobothrium latum*, *D. yonagoense*, *Spirometra erinacei*, sparganum, *Hymenolepis diminuta*, *H. nana*, *Mesocestoides lineatus*, *Taenia saginata*, *T. solium*, metacestode of *T. solium* (cysticercus), and *Echinococcus granulosus*. The present paper is a brief review of the literature concerning these cestode infections in Korea.

Taeniases by *T. saginata* or *T. solium* are prevalent cestode infections in Korea, and cysticercosis by *T. solium* often reveals serious clinical manifestations. *H. nana* infection is relatively rare, showing 0.22% egg positive rate in a nationwide survey in 1986. Sparganosis by the plerocercoid larva of *Spirometra* is not an uncommon cestode infection in man, and 16 kinds of animal hosts including the snakes and frogs have been reported. *D. latum* infection has been an uncommon intestinal parasitosis, but it tends to increase nowadays. Most of human hydatidosis cases have been recognized as imported ones from outside Korea, but one case was proven indigenous. Other 4 kinds of cestodiases are extremely rare in Korea and only a few cases have been recorded.

Key words: *Diphyllobothrium latum*, *D. yonagoense*, *Spirometra erinacei*, sparganum, *Hymenolepis diminuta*, *H. nana*, *Mesocestoides lineatus*, *Taenia saginata*, *T. solium*, metacestode of *T. solium*, *Echinococcus granulosus*, review

INTRODUCTION

Ever since Mills first described parasitic infections in Korea in 1911, there have been numerous books and articles dealing with parasites found in Korea. Although incidences of parasitic infections have declined drastically over the past years, they are still one of serious medical and socioeconomic problems in Korea.

Although cestode infections occur less often than any other helminthiases, they are still medically important because they often cause serious clinical complications as in sparganosis or cysticercosis. Furthermore, today's frequent intercontinental travel tends to increase the chances of importing parasites from endemic areas. For instance, hydatid disease is now a newly-imported cestode disease from outside Korea.

This paper is a literature review of human cestode infections in Korea reported up to 1989. The literature published in Korea was searched using the data base of the Center for Industrial and Technical Information, Korea Institute for Economics and Technology (1977~1988), and

the Korean Index Medicus (1982~1987), and private paper collections by the present author.

Cestodes reported in Korea are classified as follows:

Class Cestoidea
Subclass Cestoda
Order Pseudophyllidea
Diphyllobothrium latum
Diphyllobothrium yonagoense
Spirometra erinacei
Sparganum
Order Cyclophyllidea
Hymenolepis diminuta
Hymenolepis nana
Mesocestoides sp. (*M. lineatus*)
Taenia saginata
Taenia solium
Echinococcus granulosus

DIPHYLLOBOTHRIUM LATUM INFECTION

Human diphyllobothriasis caused by *Diphyllobothrium latum* has been a relatively uncommon intestinal parasitosis occurring sporadically on the Korean Peninsula.

Since the first report of 2 egg-positive cases (Kojima and Ko) in 1919, a total of 20 egg-positive cases had been reported by the end of 1960s (Hara and Himeno, 1924; Kobayashi, 1925; Brooke *et al.*, 1956; Soh *et al.*, 1961; Chyu *et al.*, 1965), although no adult worm segments had been identified from the egg passers.

After the first description of an adult worm expelled from a patient (Cho *et al.*, 1971), a total of 29 cases of the infection have been proven parasitologically (Min *et al.*, 1975; Jeong *et al.*, 1980; Kim and Lee, 1981 & 1982; Song and Jung, 1983; Joo *et al.*, 1983; Lee *et al.*, 1983 & 1989; Cho *et al.*, 1986; Lee *et al.*, 1987) (Table 1). Twenty-five (85.2%) of the confirmed 29 cases reside in Seoul or its vicinity. However, it is not important to figure out the geographical informations as epidemiological characteristics because the transportation system in Korea for marine fish, the suspected second intermediate host of this parasite, is well-developed. Besides, raw fish is commonly served at any restaurant in Korea. The 4 cases identified from outside Seoul have lived in their local areas for a long time, and they might represent the endemic nature of the infection in those areas; Wando, Koheung, and Ulungdo (Table 1).

This suggests that infection may occur not only in the coastal regions but also in inland. The 29 infected cases ranged in age from 6 to 64 years, and were mainly distributed from teenagers to men of their 40's. In general, Korean men tend to eat raw fish more often than women, and thus the infection occurs more frequently in men (Table 2).

Almost all of the infected cases frequently consumed raw fish such as perch (*Lateolabrax japonicus*), mullet, salmon (*Onchorynchus* sp.), *etc.* Flat fish, sole, squid, and sea eel were also served in assorted dishes in restaurants. It is not known which items have been the most significant sources of this parasite in Korea, although perch, mullet, and salmon seem to be the most suspicious.

Clinical illness was characterized by abdominal pain, indigestion, epigastric discomfort, and diarrhea. In 3 cases, anemia was noted. The rest did not show any clinical symptoms. Those cases were found incidentally by stool examinations during screening surveillances for intestinal parasites or by the discovery of naturally discharged segments of worm during defecation.

The diagnosis of this parasite infection requires careful examination of the eggs, scolices, and proglottids, because the eggs are very similar in shape with those of other diphyllobothriid eggs. For this reason, close and careful observation of proglottids is essential.

Bithionol, niclosamide, and praziquantel (more expensive than others) are very effective in eliminating worms.

Table 1. Summary of 29 *D. latum* infected cases proven by worms in Korea (1971~1989)

Case No.	Author (year)	Age & Sex	Residence	Symptom	History of			Collected worm			Treatment(Dose)
					Natural disch.	Raw fish eating	Remarkable location	Egg (Size, μm)	Scol-ex	Prog-lottid	
1	Cho *et al.*(1971)	50M	Seoul	No	Yes	Yes	—	66.5×41.2	No	Yes	Atabrine (0.9 g)
2	Min *et al.**(1975)	37M	(Seoul)	(No)	(No)	(Yes)	—	?	No	(Yes)	Niclosamide (2.0 g)
3	Jeong *et al.*(1980)	14M	Seoul	Abd.pain	No	Yes(perch)	Pohang	64.3×41.4	No	Yes	Bithionol(?)
4	Kim and Lee(1981)	26F	Seoul	Anemia	No	Yes	Inchon	63.8×43.6	No	Yes	Niclosamide (2.0 g)
5	Kim and Lee(1982)	42M	Seoul	Abd.pain	Yes	Yes	—	?	Yes	Yes	Bithionol(3.0 g)
6	Song and Jung(1983)	48M	Busan	Abd.pain	Yes	Yes(perch)	Busan	?	Yes	Yes	Niclosamide(3.0 g)
7	Lee *et al.*(1983)	10M	Seoul	Abd.pain	No	Yes(perch)	—	64×45	Yes	Yes	Bithionol(40 mg/kg)
8	Lee *et al.*(1983)	48M	Seoul	?	Yes	Yes	—	62×42	No	Yes	Niclosamide(2.0 g)
9	Lee *et al.***(1983)	64M	Wando	No	No	Yes	Wando	67×48	Yes	Yes	Bithionol(40 mg/kg)
10	Lee *et al.*(1983)	53F	Seoul	Abd.pain, vomiting	No	Yes	—	59×41	Yes	Yes	Praziquantel(20 mg/kg)
11	Lee *et al.*(1983)	23M	Seoul	Abd.pain, indigestion	Yes	Yes(perch, mullet)	Koheung	67×45	Yes	Yes	Praziquantel(15 mg/kg)
12	Joo *et al.*(1983)	17M	Seoul	Anemia	?	Yes(salmon)	—	?	No	Yes	Bithionol
13	Joo *et al.*(1983)	17M	Seoul	Anemia	?	Yes	East Sea	?	No	Yes	Bithionol
14	Joo *et al.*(1983)	35M	Seoul	Diarrhea	Yes	Yes(perch, salmon)	—	?	Yes	Yes	Bithionol
15	Joo *et al.*(1983)	6F	Seoul	?	?	Yes	—	?	Yes	Yes	Bithionol
16	Joo *et al.*(1983)	14M	Seoul	?	?	Yes	—	?	Yes	Yes	Bithionol
17	Joo *et al.*(1983)	17F	Seoul	?	?	Yes(salmon)	—	?	Yes	Yes	?
18	Joo *et al.*(1983)	10M	Seoul	?	?	?	—	?	No	Yes	Bithionol
19	Cho *et al.*(1986)	29M	Seoul	Abd.pain	Yes	Yes	—	63×44	No	Yes	?
20	Cho *et al.*(1986)	41M	Seoul	Diarrhea	Yes	Yes	—	62×43	?	Yes	?
21	Lee *et al.*(1987)	13M	Seoul	No	Yes	mullet salmon, perch	—	62×46	Yes	Yes	Praziquantel(13.0 mg/kg)
22	Lee *et al.*(1987)	31M	Seoul	Abd.pain, vomiting	No	perch, mullet	—	61×42	Yes	Yes	Praziquantel(13.6 mg/kg)
23	Lee *et al.*(1989)***	20M	Ulungdo	Fever, myalgia	Yes	Yes	Ulungdo	?	Yes	Yes	Praziquantel(10 mg/kg)
24	Lee *et al.*(1989)	30M	Ulungdo	?	Yes	Yes	Ulungdo	?	No	Yes	Praziquantel(10 mg/kg)
25	Lee *et al.*(1989)	36M	Seoul	?	No	Yes	—	?	No	Yes	Praziquantel(10 mg/kg)
26	Lee *et al.*(1989)	44M	Seoul	?	Yes	Yes	—	?	Yes	Yes	Praziquantel(10 mg/kg)
27	Lee *et al.*(1989)	41M	Seoul	?	Yes	Yes	—	?	Yes	Yes	Praziquantel(10 mg/kg)
28	Lee *et al.*(1989)	25M	Seoul	?	Yes	Yes	—	?	Yes	Yes	Praziquantel(600 mg)
29	Lee *et al.*(1989)	31M	Seoul	Abd.pain, indigeston	Yes	Yes	—	?	?	Yes	?

* Reported by the author and supplementary informations appear in parentheses

** Diagnosed as infection with *Diphyllobothrium yonagoense* after re-examination of expelled segments by Lee *et al.*(1988)

*** Authors measured 7 eggs(61.0~65.3×41.7~46.1 μm) from 3 patients.

Table 2. Age and sex distribution of 29 diphyllobothriases proven by worm in Korea (1971~1989)

Age	Male	Female	Sum
~ 9	0	1	1
10~19	7	1	8
20~29	4	1	5
30~39	6	0	6
40~49	6	0	6
50~59	1	1	2
60~	1*	0	1*
Total	25	4	29

* This case was diagnosed later as infection with *D. yonagoense* after re-examination (Lee *et al.*, 1988).

DIPHYLLOBOTHRIUM YONAGOENSE INFECTION

Only 1 case of infection has been reported by Lee *et al.* (1988). The patient was a 64-year-old fisherman residing in a seaside village of Kogun-myon, Wando-gun, Chollanam-do. During a stool surveillance, diphyllobothriid eggs (64-68×46-49 μm in size) were detected in his stool. A single dose of bithionol, 40 mg/kg, was administered, and then magnesium sulfate was given as laxative. A complete strobila (3.2 m long) was collected from the diarrheal stool and was identified as an adult worm of *D. latum* (Lee *et al.*, 1983). At that time, the patient had no specific clinical symptoms related to this parasite. He had eaten raw marine fish many times near his village.

Upon re-examination of the eggs and segments, the reporters observed the characteristic features of parallel uterine loops, large and thick-walled seminal vesicle, and thick-shelled eggs with deep pits, and concluded that those features were compatible with those of *Diphyllobothrium yonagoense* (Yamane *et al.*, 1981).

This tapeworm was first described by Yamane *et al.* in 1981. The life cycle has not yet been known completely. It is probably maintained in marine intermediate and final hosts. It was suggested that the source of infection was one of the marine fish the patient had consumed.

SPIROMETRA ERINACEI INFECTION

Lee *et al.* (1984) first described 2 cases of human *Spirometra erinacei* infection in Korea. This tapeworm was tentatively named as *D. latum* (Cho *et al.*, 1974) at first. After re-examination of the formalin-fixed proglottids of 2 diphyllobothriid tapeworms recovered from 2 young men (21 and 24 years old) residing in a mountainous village of Kangwon-do, the authors identified the worms as *Spirometra erinacei* based on their morphological characteristics; spiral formed or coiled uteri, separated vaginal opening from the cirrus sac, incorporated seminal vesicle into the cirrus sac, distribution of testes, and one-pointed asymmetrical eggs (53-59×37-42 μm in size).

Spirometra erinacei is a tapeworm the adults of which occur in the intestine of cats, dogs or other carnivores. Its plerocercoid larvae, spargana, can naturally infect wide spectrum of animals such as amphibia, reptiles, birds, and mammals including man as second intermediate hosts. The final host is infected by ingestion of spargana. Usual human infections occur when the plerocercoid or procercoid larvae are introduced and are found as sparganosis (Faust *et al.*, 1929). In these 2 rare cases, the adult worms were recovered after treatment with atabrine (500 mg) and by purgation. The patients had episodes of intermittent abdominal pain or epigastric discomfort. They did not have any experience of eating raw brackish or marine fish which are known intermediate hosts of *D. latum*, but consumed raw flesh of snakes and freshwater fish. The authors strongly suggested that the snake was the source of infection. In Korea the snake is the most important transport host of the spargana of *S. erinacei* (Cho *et al.*, 1973 & 1975; Kim, 1983).

SPARGANOSIS

Human sparganosis caused by *Sparganum mansoni*, the larval plerocercoid worm of the genus *Spirometra*, is not uncommon in Korea. Human sparganosis involving the leg of a Korean farmer was first discovered by Uemura in 1917 in Korea and described by Doi and Boku(1924). In 1925, Kobayashi reported 3 human cases of sparganosis including Uemura's case and 2 other cases. Reports of more cases of sparganosis followed (Shin, 1933; Seo *et al.*, 1964; Lee, 1970; Min, 1973; Cho *et al.*, 1975; Kim, *et al.*, 1981).

Since Kobayashi(1925) described the human infections caused by sparganum, many other researchers began to focus on the increasing number of cases of sparganosis in Korea (Table 3). In 1975, Cho *et al.* reviewed 63 cases of sparganosis recorded up to 1974, and the present author found 56 more cases between 1975 and 1989. In the present paper, 119 cases were subjected to an epidemiologic analysis.

According to Cho *et al.* (1975), the cases were found mostly in Seoul, Kyongsangbuk-do, and Pusan and its vicinity. Meanwhile, 19 out of 26 cases, of which residences were confirmed, resided in Seoul, Kyonggi-do and Kangwon-do. It was suggested that these areas were the main endemic foci of sparganosis in Korea (Table 4).

The age and sex distribution of the 56 new cases were worthwhile to note. Disease incidence was highest in men of 20-49 years of age. This distribution was very similar to the observation of Cho *et al.* (1975). Sex distribution of 119 cases was extremely dominant in the male (Table 5), and sex distribution is very significant in sparganosis. That's mainly due to much more chances are met by those aged males than females.

Among the 119 cases, sparganum was most frequently found in the abdomen (28.4%), and next urogenital organs, extremities, central nervous system, chest, orbital region, neck, and oral cavity, in descending order (Table 6). Interestingly, intracranial sparganosis (13 cases) increased remarkably between 1975 and 1989 compared with those reported before 1975. Among the 13 cases, 8 were confirmed by detection of worms and remaining 5 were diag-

Table 3. Decennial distribution of human sparganosis in Korea

Periods*	No. of cases
1924～1933	9
1933～1943	8
1944～1953	0
1954～1963	12
1964～1974	34
1975～1984	27
1985～1989	29
Total	119

* Quoted from Cho *et al.* (1975) for 1924～1974

Table 4. Geographical distribution of 26 sparganosis(1975～1989)

Area	No. of cases
Seoul and Kyonggi-do	8
Kangwon-do	11
Pusan and Kyongsangnam-do	2
Kyongsangbuk-do	2
Taejeon and Choongchungnam-do	2
Choongchungbuk-do	1
Total	26

Table 5. Age and sex distribution of 119 sparganosis in Korea

Present Author (1975～1989)				Cho *et al.*(1975)			
Age/Sex	M	F	T	Age/Sex	M	F	T
0～ 9	1	0	1	Preschool age(0～6)	1	3	4*
10～19	3	1	4	Childhood and adolescence (7～18)	5	0	5
20～29	10	2	12	Young adult (19～29)	8	3	11
30～39	10	4	14	Adult (30～49)	26	8	34
40～49	10	1	11				
50～59	5	1	6	Over 50	9	0	9
60～69	6	1	7				
70～	0	1	1				
Sum	45	11	56	Sum	49	14	63

Total: 119 (Male 94, Female 25)

Table 6. Location of spargana found in 119 Korean cases (~1989)

Location	Cho *et al.* (~1975) No. of cases(63)	Present author (~1989) No. of cases(56)	Total	Reporter(1976~1989)
CNS	2	14	16	
Spinal	2	1		Park *et al.* (1983)
Intracranial	0	13		Kim *et al.* (1981)
				Hong *et al.* (1985), Youm *et al.*(1987)
				Lee *et al.* (1987)
				Hahn *et al.* (1988)
Orbital	6	5	11	
Eyelid	2	1		Chang and Choi (1980)
Subconjunctiva	3	4		Choi *et al.* (1979), Kim *et al.* (1979),
				Shin *et al.* (1980), Kim and Kim (1980)
Unknown	1			
Oral	1	0	1	
Retropharyngeal	1			
Neck	1	0	1	
Chest	10	4	14	
Chest wall	9	2		Lee *et al.* (1978), Loh *et al.* (1988)
Breast		2		Jung *et al.* (1981), Nha *et al.* (1987)
Pleural cavity	1			
Abdominal	25	13	38	
Abdoimnal wall	20	6		Kim *et al.* (1976), Kim *et al.* (1980),
				Sim *et al.* (1982), Shin (1985),
				Kim *et al.* (1989)
Abdominal cavity	5	4		Min *et al.*(1976), Lee *et al.*(1978),
				Sim *et al.*(1982), Kim *et al.* (1989)
Retroperitoneum		3		Seo *et al.*(1982), Kim *et al.*(1989)
				Kim *et al.*(1989)
Extremity	13	11	24	
Lower extremity	10	6		Byun *et al.*(1982), Chang *et al.*(1982)
				Kim *et al.*(1989)
Inguinal	3	5		Chang *et al.*(1982), Choi(1984),
				Cho *et al.*(1985), Park *et al.*(1986),
				Kim *et al.*(1989)
Urogenital	17	13	30	
Urinary tract	3			
External genitalia	14	10		Kim and Park(1980), Kim *et al.*(1980)
				Lim *et al.*(1980), Ahn *et al.*(1981),
				Lim *et al.*(1982), Lee *et al.*(1983),
				Soh *et al.*(1983), Jo *et al.*(1984),
				Park *et al.*(1986), Kim *et al.*(1989)
Epididymis		3		Lee *et al.*(1982), Whang *et al.*(1987),
				Kim *et al.*(1989)
Total	75	60	*135	

* Exceeds the total number of cases due to multiple infection.

nosed with clinical manifestations, CT findings and both of serum and cerebrospinal fluid examination using ELISA. Increasing diagnoses of cerebral sparganosis are closely attributed to the introduction of CT, MRI, development of microsurgery, advanced serology, and of course, by improvement in economic status.

The possible sources of infection were eating raw snakes and/or frogs, drinking untreated water, and eating other kinds of raw flesh, even though one case had a history of dropping frog muscle emulsion on his eyes (Shin and Koh, 1958). As shown in Table 7, the most important route of infection was eating raw snake(59.8%), followed by drinking untreated water(14.7%). Eating raw flesh of frogs or other animals was also not uncommon.

It was found that most patients had consumed raw snakes and/or raw frogs for their nutritional and medical value. A few, however, ate raw snake as a delicacy or cordial food. Sparganosis also occurred among soldiers. They had eaten many kinds of raw fleshes of wild animals during the survival training(Cho *et al.*, 1974).

Weinstein *et al.*(1954) documented the importance of snakes as a source of infection based on information from 3 cases interned at a prisoner-of-war compound at 'Koje-do' in Korea during the fall of 1951. All 3 patients presented a history of having consumed raw snake, in the vicinity of the prison compound. The snake was proven to be the source of infection by inducing experimental infections in guinea pigs

Table 7. History of eating raw flesh of snakes, frogs and others, and drinking untreated water in 90 verified sparganosis patients in Korea

Probable source of infection	Cho *et al.* (1975) 45 cases*	Present author (1975~1989) 45 cases*	Sum(%)
Drinking untreated water	10	5	15 (14.7)
Dropping frog muscle emulsion on eyes	1	0	1 (1.0)
Eating raw frogs	6	7	13 (12.7)
Eating raw snakes	30	31	61 (59.8)
Eating other kinds of raw flesh	9	3	12 (11.8)
Total	56	46	102 (100.0)

* Most patients had many experiences of eating various kinds of flesh.

Table 8. Natural intermediate hosts of sparganum in Korea since 1925

Amphibia	
Rana nigromaculata	Honda(1938), Kim *et al.*(1967), Kim & Shin(1975), Kim(1983)
Reptilia	
Elaphe schrenkii	Kobayashi(1925), Honda(1938)
Elaphe dione	Honda(1938), Cho *et al.*(1973)
Elaphe rufodorsata	Chang and Seong(1966), Cho *et al.*(1973)
Rhabdophis(=*Natrix*) *tigrina lateralis*	Kobayashi(1925), Cho *et al.*(1973)
Dinodon rufozonatum rufozonatum	Weinstein *et al.*(1954), Seo *et al.*(1964), Cho *et al.*(1973)
Zamenis spinalis	Cho *et al.*(1973)
Agkistrodon halys	Kobayashi(1925), Honda(1938), Cho *et al.*(1973)
Mammalia	
Lutreola sibiricus	Kobayashi(1925)
Charronia flavigula koreana	*Ibid*
Nyctereutes koreensis	*Ibid*
Vulpes vulpes	*Ibid*
Vulpes lupus	*Ibid*
Erinaceus amurensis koreens	Kobayashi(1928), Iwata(1932)
Sus scrofa domesticus	Jang(1964)
Aves	
Gallus species	Kim and Kim(1973)

with plerocercoids obtained from a *Dinodon rufozonatum* caught in the vicinity of the prison compound. Seven species of the snake, *Elaphe schrenkii*, *E. rufodorsata*, *E. dione*, *Dinodon rufozonatum rufozonatum*, *Natrix tigrina lateralis*, *Zamenis spinalis*, and *Agkistrodon halys*, were proven as the intermediate host of *Sparganum mansoni*. Cho *et al.* (1973) examined 75 terrestrial snakes (7 species) caught in the vicinity of Wonju City, Kangwon-do, where human sparganosis was common, and found that all kinds of snakes were infected with spargana except *E. schrenkii*. The infection with sparganum has also been reported from various vertebrates in Korea (Table 8).

Frogs might also be a common source of infection. Shin and Koh (1958) reported a case of child who had a history of dropping frog muscle emulsion on his diseased eye, and Im *et al.* (1974) also found a sparganosis patient who ate raw frogs. Kim *et al.* (1967) examined 348 frogs (*Rana nigromaculata*) caught from Kupo and Haman, Kyongsangnam-do; Chongpyong and Nungkock, Kyonggi-do, and Naju, Chollanam-do, and found that 61 (71.5%) had plerocercoid infections. The highest incidence (30.2%) was found in a mountainous district of Chongpyong. Kim and Shin (1975) reported that 39 (3.9%) out of 1,101 *R. nigromaculata* caught at the Chungnam area were naturally infected. In 1983, Kim examined 602 *R. nigromaculata*, 11 *R. rugosa*, and 13 *Bombina orientalis* and found only 4.1% of infection in *R. nigrcmaculata*. sparganum in infected frogs were mainly distributed in the thighs and hind legs (Table 9).

Drinking untreated natural water was a common practice in rural and mountainous areas in Korea. All the cases of sparganosis in women and children consumed neither raw snake nor raw frog, and it is assumed that untreated cold water containing cyclops infected with procercoids played a role as the source of their infection. Based on the reports of Shin *et al.* (1980), a 40-year-old patient with subconjunc-

Table 9. Distribution of sparganum in infected frogs

Region	Kim, *et al.* (1967)	Kim & Shin (1975)	Kim (1983)
Thigh & leg	96.7	82.6	95.0
Head	0.6	1.5	0
Trunk	2.0	13.0	5.0
Body cavity	0.6	1.5	0

* Numbers represent the percent (%).

Table 10. Intracranial sparganosis proven by worm in Korea

Age & Sex	Clinical manifestations and duration	History of eating raw snake/frog	CT findings	Remark	Reporter (year)
17 M	seizure (?)	snake+ frog+	ring form enhancement in left frontal area	living worm	Kim *et al.* (1981)
40 M	focal seizure in right extremities (18 months)	snake+	linear enhancement in left frontoparietal area	living worm	Youm *et al.* (1987)
34 M	generalized seizure (5 years)	snake+	2 nodules on left frontal lobe low density, ventricular dilatation	degenerated worm	Lee *et al.* (1987)
53 M	right hemiparesis, seizure (2 years)	snake+	enhacing nodules, ventricular dilatation	degenerated worm	Lee *et al.* (1987)
34 M	seizure and hemiparesis (5 years)	snake+	round low density at left frontal lobe, ventricular dilatation	surgically confirmed	Chang *et al.* (1987)
25 F	focal seizure (3 years)	—	multiple low densities at right temporal lobe & frontal lobe	surgically confirmed	Chang *et al.* (1987)
28 M	seizure (8 years), hemiparesis (2 months)	uncertain	high enhanced at right frontal & posterior temporal lobe	surgically confirmed	Chang *et al.* (1987)
54 M	hemiparesis, seizure (13 years)	uncertain	enhancing round lesion	surgically confirmed	Han *et al.* (1988)

tival sparganosis had a noticeable history of washing his eyes with water at a stream in the mountains and the infection subsequently occurred.

The incubation period for sparganosis varied because consumption times of snakes or frogs could not be pinpointed, as well as other individual factors. Shim *et al.* (1982) observed a very short incubation period in a 22-year-old male who ate raw snake flesh 10 days prior to admission. On the other hand, another patient spent 20 years asymptomatically (Park *et al.* 1986).

In general, diagnosis of sparganosis is made after surgical removal and confirmation. In neurosparganosis, diagnosis is much more difficult. Recent advances in the radiologic field, however, made the diagnosis more easy. CT scans reveal characteristic features. According to a report by Chang *et al.* (1987b), CT from 12 cases of cerebral sparganosis showed following features; (a) unilateral involvement, (b) extensive or multifocal low density with ventricular dilatation and localized cortical atrophy, (c) nodular or irregular enhancement with spotty calcification, and (d) change in location of enhancing nodules on sequential scans (Table 10). Serologic tests have also been available in recent years (Kim *et al.*, 1984; Choi *et al.*, 1988). Choi *et al.* (1988) demonstrated that antigenic fractions in 29 and 36 kDa were the strongest reactive proteins and most frequently reacted with specific antibody (IgG) in sparganosis sera, even though cross-reaction was observed with cysticercosis.

INFECTION OF *MESOCESTOIDES* SPECIES

This tapeworm infection is rare worldwidely, and only 2 cases have been reported in Korea by Choi *et al.* (1967) and Kim *et al.* (1988).

According to the first report by Choi *et al.* (1967), a 45-year-old male patient visited a hospital with chief complaints of intermittent indigestion and abdominal distention for 1 year. He had eaten raw snake flesh several times 1 year before. The laboratory findings were almost normal except for increased peripheral eosinophils up to 14%. The patient expelled 3 worms, 85, 117.5, and 136 cm long after treatment with atabrine. The irregular ovoid eggs were $24\sim27\times31\sim34$ μm in size and contained an actively moving hexacanth larva in the non-operculated egg shell. The scolex had 4 distinct suckers but not rostellum. The mature proglottid revealed numerous testes branching bilaterally and an ovary with yolk glands in central part. The spiral uterus opened up to the uterine pore. Spherically distended uterine capsules contained many eggs and were very characteristic. With these results and a history of consuming raw snake flesh, they diagnosed the case as *Mesocestoides* infection.

In another case reported by Kim *et al.* (1988), the adult worm was identified and named as *Mesocestoides lineatus*. The patient, a 45-year-old male living in Cheju-do, visited a clinic because of abdominal pain after meals, dizziness, and loss of appetite. He experienced discharge of sesame-shaped segments in his stool. Over 30 worms were recovered after treatment with niclosamide. The eggs were irregular and ovoid in shape, and $28.2\sim31.7\times20.1\sim24.1$ μm in size. They contained well-developed hexacanth larvae. In gravid proglottids, the characteristic parauterine organ was located at the lower part on the midline. Thus this case was diagnosed as an infection with *M. lineatus*.

This parasitic infection has been reported in mammals or birds of prey. The larval stages of this genus are found in the body cavity and tissues of reptiles, birds, and small mammals (Beaver *et al.*, 1984). In Korea, the case reported by Choi *et al.* (1967) had several experiences of eating raw snake flesh, and another case reported by Kim *et al.* (1988) frequently consumed raw viscera of chickens and pigs. Judging from those experiences or eating habits, it is presumed that the snake, chicken and/or pig may play an etiologic role as the intermediate or paratenic hosts in Korea, although any objective evidence has not yet been demonstrated.

TAENIASES

Taeniases caused by *Taenia saginata* or *T. solium* occurs throughout the world and are commonly found in Korea. Choi(1926) reported a case(0.3%) of *Taenia* egg-positive in the Seoul area. Soh *et al.*(1961) found that 0.5% of 14,682 stools examined were egg-positive. Seo *et al.*(1969) and Kim *et al.*(1971) reported a positive rate of 0.7% and 0.3% by nationwide studies. On the other hand, Lee *et al.*(1966) and Cho *et al.*(1967) reported 4.0% and 16.4 ~38.0% rate of infection among inhabitants or schoolchildren by individual interview or questionnaire in Chollabuk-do and Cheju-do respectively. The results from the above studies indicated that taeniasis was nationwidely distributed but more prevalent in Cheju-do than on the mainland. According to serial reports by MHSA and KAH(1971, 1976, 1981 & 1986), the egg positive rates decreased gradually from 1.8% to 0.27% in stool examination. Min *et al.*(1986) and Hong(1986) found none from outpatients in Seoul but 0.3% from military persons. However, the positive rates of inhabitants in remote islands and Cheju-do were quite different from the results in the mainland. Goo *et al.*(1988) screened 1,011 stool specimens of inhabitants on a remote island, Yondo, Chollanam-do, which lies between Cheju-do and the mainland, and reported 5.8%, and Soh *et al.*(1988) also reported 7.0% of infection in Cheju-do. Compared with those of the nationwide studies of MHSA and KAH(1971, 1976, 1981 & 1986), the results of Goo *et al.*(1988) and Soh *et al.*(1988) were still high(Table 11).

Taeniasis by age showed a higher occurrence in the older age groups, and males were more prevalent than females. The highest rate of infection was observed in 20 to 49 years of age(Soh *et al.*, 1971; *Lee et al.*, 1966). This particular age distribution might be related to eating habits. In general, older-aged males rather than females are fond of eating raw pork and beef as appetizers with alcoholic beverages. Thus the infection

Table 11. Review on the incidence of *Taenia* spp., *Hymenolepis nana* and *H. diminuta* in Korea

Reporter	Year	No. of cases examined	Positive rate(%)			Locality
			Taenia sp.	*H. nana*	*H. diminuta*	
Choi	1926	334	0.3	—	—	Seoul(outpatients)
Soh *et al.*	1961	14,682	0.5*	0.22*	—	Seoul(outpatients)
		3,615	3.6**			
Lee *et al.*	1966	803	4.0**			Chollabuk-do
Cho *et al.*	1967	577	38.0**			Cheju-do(inhabitants)
		1,631	16.4**			Cheju-do(students)
Seo *et al.*	1969	40,581	0.7	0.2***	0.03	Nationwide
Kim *et al.*	1971	2,250	0.3	0.7	0	Nationwide
MHSA &	1971	24,887	1.8	0	0	Nationwide
KAH. ****	1976	27,178	0.72	0.57	0	Nationwide
	1981	35,018	1.1	0.43	0.01	Nationwide
	1986	43,590	0.27	0.22	0.005	Nationwide
Min *et al.*	1986	5,251	0	0.02	0	Seoul(outpatients)
Hong	1986	2,643	0.3	0.2	0.04	Military persons
Koo *et al.*	1988	1,011	5.8	0.4	0	Chollanam-do(Yondo)
Soh *et al.*	1988	1,102	7.0**			Cheju-do

* This includes 30 cases(0.22%) of *H. nana* positives.

** Results obtained by the interview or questionnaire on expelling segment in stool

*** Among 75 cases(0.2%), 12 cases(0.03%) of *H. diminuta* egg-positives were included.

**** The Ministry of Health and Social Affairs, Republic of Korea, and The Korea Association of Health

occurred much more in males.

Soh *et al.* (1988) demonstrated the correlation between eating habits and disease patterns of the infected cases in Cheju-do. Among a total number of 58 infected cases, 42(72%) had the eating habits of raw meat and/or viscera of pigs or cattle (Table 12). Raw pork was eaten more frequently than raw beef. Han (1969) examined 976 pigs at a slaughterhouse and found that 7.4% were positive for cysticerci. In 1982, Kim studied the body parts of pigs consumed raw among 956 inhabitants on Cheju Island. The most frequent organ eaten was the liver (33%) and then the stomach (12%), fetus (10%), uterus (7%), brain (7%), intestine (7%), pancreas (6%), kidney (5%), meat (3%), heart (4%), spleen (2%), and others (5%). Cysticercosis was more prevalent in pigs than in cattle (Kim, 1985). According to the meat-eating habits of the inhabitants and prevalence of cysticercosis in pigs on Cheju Island, it is suggested that the causative species of taeniasis was *T. solium*. However, most of the adult worms recovered from the infected human cases were *T. saginata*. Cho *et al.* (1967) recovered 105 adult tapeworms with scolices from the stools of infected persons and also found that *T. saginata* was 87%, *T. solium* 10%, and unclassified 3%. Kang *et al.* (1965) also showed similar results from a study of 376 adult tapeworms (*T. saginata* 87%, *T. solium* 7.2%, unclassified 5.9%). Recently Soh *et al.* (1988) examined the adult worms from 72 infected cases and also found some indistinguishable worms from 12 cases. Of the 12 cases, 9 ate raw meat of pigs and cattle, and 3 ate raw pork only. In other words, 3 patients who ate raw pork excreted *T. saginata* only. The results by Kang *et al.* (1965), Cho *et al.* (1967) and Soh *et al.* (1988) revealed the epidemiological paradox and raised the possibility of the existence of *T. saginata*-like tapeworm on Cheju Island. Fan (1988 a,b) conducted several field surveys on Cheju Island as well as experimental studies in the laboratory, in order to clarify the epidemiological paradox and reported that *T. saginata*-like tapeworm was morphologically identical to *T. saginata*. However, the worms were recovered from the cases having consumed raw pork only. The experimental infections had occurred in pigs, cattle, goats and monkeys, and the pig was a more suitable intermediate host than the cattle. The cysticerci of *T. saginata*-like tapeworm were located only in the liver and were smaller than those of classical *T. saginata* or *T. solium* (Fan, 1988b). From these results, the *T. saginata*-like tapeworm on Cheju Island was proposed as a new species of the genus *Taenia* just like the Taiwan *Taenia* (Fan, 1988b). However, despite several evidences by Fan (1988a) and Soh (1988), the finding still needs confirmation, and if a *Taenia*-like tapeworm exists, a parasitological study should be carried out.

Table 12. Eating habits and species of *Taenia* in 58 cases from Cheju-do, Korea (Soh *et al.*, 1988)

Eating habit (raw meat/viscera)	No.	%
Pigs and cattle	42(9)*	72
Pigs only	1(13)*	19
Cattle only	5	9
Total	58(12)*	100

* Number in parenthesis indicates the cases infected with *T. saginata*-like tapeworm.

For the treatment of human taeniasis, various drugs including extract of male fern (*Aspidium oleoresin*), atabrine, bithionol, niclosamide, organic tin compounds, praziquantel, and albendazole have been used, and torreya nuts and some herbs were also administered as folk remedies (Soh *et al.*, 1963 & 1976; Seo *et al.*, 1964; Rim *et al.*, 1979, 1979 & 1985; Min *et al.*, 1984; Eom *et al.*, 1988) (Table 13). Out of them, praziquantel is the most effective and convenient drug so far. A single dose of 5 or 10 mg/kg of body weight is sufficient and shows almost 100% cure rate. Untoward side effects included mild nausea, abdominal discomfort and dizziness all of which disappear quickly without any special care. It is the drug of choice for the treatment of *Taenia* infections as well as other cestode

Table 13. Effect of anthelmintics in the treatment of taeniasis

Reporter(Year)	Drug	Dosage	No. of cases examined	Cure rate (%)	Adverse effects
Seo *et al.*(1964)	Bithionol	50 mg/kg	10	≒100	slight gastric problem
Soh *et al.*(1976)	Niclosamide	1,000 mg(2 tablets)	33	93.9	headache, abdominal discomfort
Rim *et al.*(1979)	Praziquantel	5 mg/kg	26	96.2	abdominal pain
		10 mg/kg	27	100	loose stool, diarrhea
Min *et al.*(1984)	Praziquantel	8 mg/kg×2	32	100	temporary nausea
		10 mg/kg	33	97	epigastric pain
Rim *et al.*(1985)	Albendazole	2×400 mg×3	10	80	slight abdominal discomfort,
		3×400 mg×3	14	92.9	vertigo

infections of man and domestic animals.

CYSTICERCOSIS

Cysticercosis in humans is a disease infected by a bladder worm, *Cysticercus cellulosae*. It is widely distributed in Korea. It is referred to *Cysticercus cellulosae* as a metacestode of *T. solium* in intermediate hosts. Since the description of a subcutaneous cysticercosis from a Korean by Nakao *et al.*(1937), a lot of cases have been reported. When the intermediate host including humans ingest embryonated eggs originated from external sources or from the ruptured gravid proglottid in the intestinal lumen of the patient infected with *T. solium*, the eggs hatch and penetrate the intestinal wall. Hatched embryos can spread to any tissue of the body via the blood or lymphatic circulation, and clinical manifestations of cysticercosis reflect the organs involved.

Cysts involve various organs and tissues, and multiple locations are not uncommon. Infections in the subcutis and skeletal muscle (Yeo, 1953; Park, 1957; Lee and Lee, 1960; Koo *et al.*, 1960; Kang and Rim, 1971), oral cavity and lip (Cha *et al.*, 1982; Yang *et al.*, 1984), scrotum (Rim *et al.*, 1982), pelvic cavity (Lee H.S. *et al.*, 1984), eye (Son, 1958; Son *et al.*, 1967; Juhng, 1971; Chung, 1973; Kim *et al.*, 1985), spinal cord (Chu *et al.*, 1967; Lee *et al.*, 1976; Moon *et al.*, 1984), brain (Koo *et al.*, 1960; Choi, 1968; Hwang *et al.*, 1970; Shim, *et al.*, 1971; Hong *et al.*, 1978; Yoon *et al.*, 1984; Yang *et al.*, 1984; Shin *et al.*, 1988), *etc.*, were found in Korea. Chi *et al.*(1988) found 425 accumulated cases from a single general hospital, Seoul National University Hospital, from 1968 to 1987.

The results by Chi and Chi(1978) showed that the prevalent ages were 21 to 40 years old, and there was no sex predominance (Table 14). On the other hand, taeniasis was more prevalent among ages 41 to 60 years (Lee *et al.*, 1966; Cho *et al.*, 1967; Soh *et al.*, 1988), although *T. solium* infection was less than that of *T. saginata* based on the identification of the expelled worms in the results. These ambiguous results between the higher prevalence in ages 21 to 40 of cysticercosis and higher prevalence in ages 41 to 60 of taeniasis raise an interesting consideration from an epidemiological point of view.

Table 14. Age and sex distribution of cysticercosis*

Age(year)	Sex		Total(%)
	Male	Female	
Under 10	5	4	9 (3.5)
11~20	18	20	38 (14.7)
21~30	32	36	68 (26.4)
31~40	34	43	77 (29.8)
41~50	16	24	40 (15.5)
51~60	9	9	18 (7.0)
61~70	1	1	2 (0.8)
Unknown			6 (2.3)
Total	115	137	258(100.0)

* Quoted from Chi and Chi(1978)

Table 15. Involved organs of cysticercosis*

Organs	Cases(%)
Subcutis and skeletal muscle	204(76)
Central nervous system	40(15)
Breast	15 (6)
Eyeball	6 (2)
Thyroid	1(0.3)
Parotid	1(0.3)
Total	267(100)

* Quoted from Chi *et al.*(1988)

Table 16. Distribution of subcutaneous cysticercoid nodules*

Site	No. of nodules(%)
Head and neck	20 (9.3)
Trunk	121 (56.6)
Upper extremity	57 (26.6)
Lower extremity	16 (7.5)
Total	214(100.0)

* Nodules were examined from 10 cases of cysticercosis (Lee *et al.*, 1966).

Table 17. Age and sex distribution of cerebral cysticercosis

Age(years)	No. of cases		
	Male	Female	Total(%)
Under 10	2	—	2 (2.1)
11~20	4	4	8 (8.5)
21~30	4	6	10(10.7)
31~40	18	7	25(28.7)
41~50	22	9	31(32.9)
51~60	7	5	12(12.8)
61~70	4	1	5 (5.3)
Over 71	1	—	1 (1.1)
Total	62	32	94(100)

* Quoted from Yoon *et al.*(1984)

The commonly involved organs were the subcutis and skeletal muscle(76%), and the next was the central nervous system(15%), breast (6%), eyeball(2%), thyroid(0.3%), and parotid gland(0.3%) (Chi *et al.*, 1988) (Table 15).

Lee *et al.*(1966) had also found similar results in Chollabuk-do. Two-hundred fourteen subcutaneous nodules were distributed mainly in the trunk(56.6%) and upper extremities (26.6%) (Table 16).

The symptoms and signs varied according to the site of involvement and number of cysts. Generally, involvement of the brain, spinal cord and eye reveals serious clinical manifestations.

Cysticercosis in the central nervous system (CNS) was a hardly manageable disease due to the difficulty of diagnosis and treatment before the introduction of computed tomography(CT) in the middle of the 1970s (Yoon *et al.*, 1984; Kim *et al.*, 1988). However, various advanced tools such as magnetic resonance imaging(MRI) (Chang *et al.*, 1987a) and the effective therapeutic drug, praziquantel, are now available. With these benefits, cerebral cysticercosis has been easily detected and managed conveniently even though complete cure has not been successful in some instances.

In cerebral cysticercosis, the infection occurred most frequently in ages 20 to 50 years and the males predominated (Yoon *et al.*, 1984; Yang *et al.*, 1984) (Table 17).

In the classification of cerebral cysticercosis by CT, the major type was parenchymal, and the next was ventricular type. The meningeal and mixed types were fewer than the other 2 types (Table 18). According to studies by Yoon *et al.*(1984), Yang *et al.*(1984), and Shin *et al.* (1988), the most common clinical manifestations on admission were symptoms due to increased intracranial pressure, and the next were seizure, and focal neurologic deficit. In laboratory findings, eosinophilia was observed in 31(33%) cases out of 94 (Yoon *et al.*, 1984) and 16(31%) cases

Table 18. Classification of cerebral cysticercosis by CT

Type	Yoon *et al.* (1984)	Yang *et al.* (1984)	Shin *et al.* (1988)	Total(%)
Ventricular	27	10	13	50(32.1)
Parenchymal	34	21	18	63(40.4)
Meningeal	4	5	4	13 (8.3)
Mixed	7	3	17	27(17.3)
No definite findings	3			3 (1.9)
Total	75	39	52	156(100.0)

out of 52 (Shin *et al.*, 1988) in peripheral blood examination. In cerebrospinal fluid examination, 33% (Yoon *et al.*, 1984) and 35% (Shin *et al.*, 1988) of the cases showed an increase in protein. On examination, subcutaneous nodules were detected in 44 (44.7%) out of 94 examined (Yoon *et al.*, 1984) and 22 (56.4%) out of 39 examined (Yang *et al.*, 1984). Accordingly, in cerebral cysticercosis the subcutaneous nodule occurred coincidentally.

Besides radiological trials for the diagnosis of cerebral cysticercosis, extensive immunological studies were carried out by Cho and his colleagues in recent years. Cho *et al.* (1986) initiated the efforts on application of enzyme-linked immunosorbent assay (ELISA) for the diagnosis of neurocysticercosis and reported 90.1% of sensitivity and 88.5% of specificity using cystic fluid antigen and both serum and cerebrospinal fluid by micro-ELISA. Choi *et al.* (1986) prepared the saline extracted antigen of cystic fluid, bladder wall, scolex and whole worm, and found that the band C protein from cystic fluid was more specific than others. Kim, B.W. *et al.* (1986) measured specific IgE and IgM antibodies in sera from neurocysticercosis patients with micro-ELISA and found the specific elevation of IgE antibody but non-significant IgM levels. Kim, S.I. *et al.* (1986) purified cystic fluid antigen using monoclonal antibody and found that affinity-purified antigen had a higher specificity but lower sensitivity in cysticercosis. Likewise, Joo *et al.* (1987) and Kim and Yang (1988) also reported on the purification of antigen. Joo *et al.* (1987) demonstrated a species-specific protein profile (63 kDa) from the original cystic fluid. Based on these results, the ELISA technique has improved remarkably. However, despite the worthy advances by previous workers, purification of specific antigens is needed to minimize the cross-reactivity with tissue-invasive parasitic diseases such as sparganosis, paragonimiasis, clonorchiasis, *etc.*

For the treatment of cysticercosis cellulosae, surgical removal was the only way before the introduction of praziquantel, a derivative of isoquinolin. Rim *et al.* (1980 & 1982) reported the effects of praziquantel in dermal and cerebral cysticercosis. By the administration of 3×25 mg/kg/day orally for 3 to 7 consecutive days, most of the subcutaneous cysticerci disappeared within 3 to 6 months after administration. In cerebral cysticercosis, initial doses of the above and second consecutive doses of the drug 6 months after the initial administration showed no epileptic seizure in 7 out of 9 cases. The present author also experienced the effectiveness of praziquantel in cerebral cysticercosis with the same doses (personal collection). Among 15 patients treated, 9 improved 1 year after the last administration (Table 19). Praziquantel is very effective not only in subcutaneous cysticercosis but also in cerebral cysticercosis (Jeong *et al.*, 1986; Yi *et al.*, 1986; Wang *et al.*, 1986). During the course of medication or in subsequent days after medication, untoward side effects such as headache, nausea, skin rash, itching sensation and dizziness were observed. Probably the side effects were derived from the hypersensitivity reactions of the host to the cystic fluid and could be managed with dexamethason in practice.

Table 19. Treatment of cerebral cysticercosis with praziquantel

Reporter	Year	Dosage	No. of cases examined	Adverse effects
Rim *et al.*	1980	3 × 25 mg/kg × 3; (6 months later) 3 × 25 mg/kg × 4	8	headache, nausea, vomiting
Rim *et al.*	1982	3 × 25 mg/kg × 3, 4 or 7; (6 months later) 3 × 25 mg/kg × 4	15	headache, vomiting, ICP ↑, fever, epileptic seizure, focal seizure
Min (personal)	(1983~1985)	3 × 25 mg/kg × 5 or 2 × 25 mg/kg × 10; (2 months or 6 months later) 3 × 25 mg/kg × 5	15	skin rash, itching sensation, epigastric soreness, nausea, vomiting, headache, dizziness

HYMENOLEPIS NANA AND *H. DIMINUTA* INFECTIONS

According to a considerable number of reports on intestinal parasites in Korea, *Hymenolepis nana* infection was relatively rare until recently (Table 11).

Soh *et al.* (1961) screened 14,682 samples and detected 32 cases (0.22%). Of the 32 cases, 88% were children younger than 10 years old. Seo *et al.* (1969) also reported a higher prevalence in the younger age groups. Recently the Ministry of Health and Social Affairs (MHSA) and the Korea Association of Health (KAH) (1986) reported 0.22% positive rate in a nationwide survey. The prevalence was highest in younger ages in rural areas (0.32%) than those in urban areas (0.16%). In 1988, Goo *et al.* reported 0.4% of egg-positives in rural areas, and Min *et al.* (1986) reported only 0.02% in Seoul.

H. diminuta infection is extremely rare in Korea. Since the first description of 3 egg-positive cases (Chyu *et al.*, 1964), there were about 20 egg-positive cases, but only 1 case has been confirmed by demonstration of the worm so far (Lee *et al.*, 1965; Lee and Lee, 1966; Seo *et al.*, 1969; MHSA & KAH, 1981 & 1986; Hong, 1986). Lee and Lee (1966) described 3 adult worms (200~600 mm × 3.5~4.0 mm) expelled from a 10-year-old boy.

HYDATID DISEASE

In Korea, this parasitic disease caused by *Echinococcus granulosus* has been considered to be an imported one until a report by Chung *et al.* (1983), although infections among livestocks had been sporadically reported (Jang and Oh, 1974; Seo *et al.*, 1975; Lee, 1975).

Since the first description of human hydatid infection by Chung *et al.* (1983), 10 proven cases were recorded in the literature (Park *et al.*, 1985; Lee *et al.*, 1986; Kim *et al.*, 1986; Im *et al.*, 1987; Jeon *et al.*, 1988; Kwon *et al.*, 1988; Huh *et al.*, 1988; Suh *et al.*, 1989) (Table 20). The patients were mostly males (9/10) and aged from 26 to 49 years. On comprehensive examinations by ultrasonography, computed tomography, and radioisotope scan, the cysts were easily found and diagnosed. The cysts removed surgically were unilocular cysts located in the lung (7 cases) and liver (3 cases). Of the 7 cases involving the lung, 3 patients complained of chest pain and dyspnea. The other 4 asymptomatic cases were detected during a regular health check. In 3 cases involving the liver, the chief complaints were epigastric discom-

Table 20. Review of hydatid disease reported in Korea

Reporter (year)	Age & Sex	Location of cyst	Symptoms & Signs	History of foreign travel
Chung *et al.* (1983)	27F	Lung	Chest pain	No
	25M	Lung	Chest pain, dyspnea	Kuwait
Park *et al.* (1985)	31M	Lung	Mass on X-ray	Middle East
Lee *et al.* (1986)	30M	Lung	Chest pain	Middle East
Kim *et al.* (1986)	32M	Liver	Epigastric discomfort	Saudi Arabia
Im *et al.* (1987)	49M	Lung	Mass on X-ray	Saudi Arabia
Jeon *et al.* (1988)	39M	Liver	Epigastric discomfort, general malaise	Saudi Arabia
Kwon *et al.* (1988)	26M	Lung	Mass on X-ray	Libiya
Huh *et al.* (1988)	39M	Liver	General malaise, liver enlargement	Saudi Arabia
Suh *et al.* (1989)	(31M)*	(Lung)	(Mass on X-ray)	(Middle East)
	44M	Lung	Mass on X-ray	Saudi Arabia

* This case is the same as reported by Park *et al.* (1985). The reporters reviewed this case together with another new one.

fort(2), general malaise(2), and liver enlargement(1) due to compression by the cyst. Among 10 cases, 9 traveled to the Middle East and/or African countries which had been known endemic regions. They stayed there at least 1 year as laborers or employees of overseas branches of Korean companies.

The infection occurred during foreign travel in endemic regions, but they were normal on regular health checks before departure from Korea. On the other hand, indigenous infection also occurred in a Korean woman in Seoul (Chung *et al.*, 1983). The patient, a 27-year-old housewife, had never been outside of Korea. She spent most of her lifetime in a rural district of Chollanam-do until moving to Seoul 3 years prior to the onset of the disease. This finding presents strong evidence for the fact that this human parasitic infection can occur indigenously in Korea and that the disease is not an imported one only, even though the route of infection is still obscure(Min, 1987).

Echinococcus granulosus is a zoonotic parasite and widely distributed in temperate and subtropical countries, especially in sheep- or cattle-raising countries. The final hosts are dogs and other canines. When the eggs are swallowed by various livestocks or man, cysts develop in various organs of the hosts. Thus livestock and man play a role as intermediate hosts in the life cycle. In Korea, hydatid cysts were found in swine(Jang and Oh, 1974), cattle on Cheju-do (Seo *et al.*, 1975), and in imported sheep from Australia(Lee, 1975). However, the mode of infection is still unknown in this country.

Diagnosis of hydatid cyst can easily be made with a plain X-ray film and recently developed tools that demonstrate the characteristic space-occupying density of the cyst. Additional serologic tests such as enzyme-linked immunosorbent assay(ELISA) have been developed(Ryu *et al.*, 1989), and the results reveal significant differences between hydatid disease and healthy controls. In all of the cases, the cysts were removed surgically.

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