

## Tissue Parasitic Diseases in Korea

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*Parasitic disease is still important subject in the field of infectious diseases in Korea considering it's number and morbidity. Recently there was conspicuous reduction of parasitic disease in terms of soil-transmitted nematodiasis, but parasitism affecting organs other than intestinal tract is still a considerable problem. This survey covers the parasitic diseases cross-sectioned at a pathology laboratory of a referral hospital, trying to elucidate the significance of its relative frequency and also to describe some histopathological changes made by different parasites.*

*Entire pathological materials of parasitic diseases, that were referred, examined and confirmed at the Department of Pathology, Seoul National University Hospital from 1968 to 1987, were used for the study. There was a total of 594 cases of tissue parasitic diseases. This number accounted for 0.33 per cent of total accessions of surgical pathology. There occurred average 30 cases of tissue parasitic disease each year at this Hospital.*

*Protozoal diseases were consisted of 15 cases of amebiasis, 7 cases of leishmaniasis (imported) and 5 cases of Pneumocystis carinii infections. Among helminthic infections cysticercosis was the most common (425 cases), and was followed by paragonimiasis (35 cases), sparganosis (31 cases), clonorchiasis (32 cases) and ascariasis (16 cases). In addition there were 4 cases of anisakiasis, 2 cases of fascioliasis, 2 cases of echinococcosis (imported) and a case of strongyloidiasis and a case of metagonimiasis respectively.*

*It is emphasized that imported parasitic diseases such as leishmaniasis and hydatid disease become steadily found nowadays. Schistosomiasis is another possible imported disease, but not found in this series. And certain cestodiasis particularly cysticercosis and sparganosis should be the subjects of epidemiologic re-evaluation in view of steady occurrence of their morbidity.*

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**Key Words:** Parasitic disease, cysticercosis, sparganosis, tissue parasitism, ectopic parasitism, protozoal disease, helminthic disease, disease statistics

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*This study was supported in part by Seoul National University Hospital research grant (1987).*

### INTRODUCTION

**Human** tissue is naturally injured in varying extent by endo- or ecto-parasites. However, the extent of the injury is considerably different by species of

parasite, habitats or other factors involving host-parasite relationships. In the clinical situations, the parasitized tissues become available to pathologists when the involved tissue is surgically removed or the parasite is found incidentally in the tissue that was removed for other reasons.

In Korea parasitic diseases have been a major problem in public health. In recent years, however, ascariasis or malaria that used be prevalent are no longer a serious problem. Instead some cestodiasis particularly cysticercosis and sparganosis, a few nematodiasis such as anisakiasis and some imported exotic protozoal diseases became more important in recent years. Particularly cysticercosis involving the central nervous system is recognized as a serious problem after improved discovery by brain computed tomography. Most of diseases regarded recently as important are related to damage of various solid tissue in the body, thus provoking protean clinical manifestations and serious tissue damage sometimes jeopardizing the life.

In this context, this study was undertaken for two reasons. First, by overviewing the patterns of parasitic diseases in Korea as cross-sectioned at a Department of Pathology of a large referral hospital. The relative importance of parasitic diseases and frequency of the respective parasite were tried to reveal out. Second, the important histological reactions provoked by each parasite in human tissue are described. These informations would help diagnostic pathologists to search for and make correct diagnosis when the tissue is evaluated on routine surgical pathological examination.

## MATERIALS AND METHODS

The material used in this study was all the surgical materials that were submitted for histopathological examination during last 20 years, from 1968 to 1987, at the Seoul National University Hospital (SNUH). In addition, consult cases from outside clinics or hospitals to SNUH and selected autopsy cases of Seoul National University Children's Hospital were included.

Parasitic diseases were diagnosed only when the organism was demonstrated in the tissue. When the parasites were markedly degenerated and unclassifiable in terms of genus or species, clinical history, laboratory data including serological test and stool examination were referred. All the cases that disclosed any structure of parasites were included in the material no matter that the particular finding was the major diagnosis of the cases or not. When gross specimen

of parasite was found, the case was regarded as parasitic disease although the section was not seen microscopically. Once a parasite structure was found in a tissue, serial sections were made in most cases to make correct identification possible. Routine hematoxylin and eosin stain was done in most cases, although periodic and Schiff, Masson trichrome and phosphotungstic acid hematoxylin stains were used when necessary. For the cysticercosis we analyzed the tissue response into 3 stages according to the criteria set by Chi & Chi (1978).

## RESULTS

### 1. Overall incidence of parasitic disease

#### 1) Annual incidence at Seoul National University Hospital (Table 1)

An average 30 cases of parasitic disease were accessioned for the histopathological examination at the Department of Pathology. This number represents 0.2 to 0.9 per cent of total accessions of surgical specimens. As shown in Table 1 in the first 10 years of this study (1968-1977), the parasitic disease accounted for approximately 1% of total biopsy material. In the second 10 years (1978-1987) as the number of surgical specimens increased considerably the relative frequency of parasitic disease decreased down to 0.1 to 0.3%. Despite the marked decrease in relative frequency of parasitic disease in recent years, the actual number of cases showed no remarkable change, ranging from 19 to 40. Average 30 cases were encountered every year.

#### 2) Frequency of parasitic infections in SNUH material by species

Major parasitic diseases found in tissue were cysticercosis, clonorchiasis, paragonimiasis and sparganosis, etc. Their annual occurrence was indicated in Table 2A & 2B. Cysticercosis accounted for 72.6% of the entire cases of parasitic diseases. Average 25 cases were diagnosed each year at SNUH. Paragonimiasis was the next common disease although the relative incidence was lower than cysticercosis. It accounted for 6.5%. Sparganosis was the third common parasitic disease. There were 32 cases together. It tended to increase in recent years. There was a total of 25 cases of clonorchiasis, thus accounting for 4.17%. Among protozoal infections, amebiasis was the most common. There were 15 cases accounting for 2.4 per cent of the total. There were 7 cases of leishmaniasis, 4 cases of anisakiasis, 2 cases of

fascioliasis and 2 cases of echinococcosis.

### 3) Parasitic diseases subjected to histopathologic study in this study

**Table 1.** Annual incidence of parasitic disease among Surgical Specimens at Seoul National University Hospital

Year	No. of Surgical specimen	No. of Parasitic disease	%
1968	3050	20	0.66
1969	3469	21	0.60
1970	3912	28	0.72
1971	3629	30	0.76
1972	3725	36	0.97
1973	3838	24	0.62
1974	4129	23	0.56
1975	4646	36	0.77
1976	4965	25	0.50
1977	5676	42	0.73
1978	6264	33	0.52
1979	9855	30	0.30
1980	12052	30	0.24
1981	14043	33	0.23
1982	14530	34	0.23
1983	15020	32	0.21
1984	15439	23	0.15
1985	15126	28	0.19
1986	15553	26	0.16
1987	15849	21	0.13
Total	174770	580	0.33

In this study parasitic diseases were classified first into protozoal and helminthic infections. And helminthiasis was further classified into nematodiasis, trematodiasis and cestodiasis. The number of subjected cases for histopathologic review is shown in Table 3.

## HISTOPATHOLOGIC REVIEW OF PARASITIC DISEASES

### 1. Protozoal diseases

#### 1) Amebiasis

Eight of 15 amebiasis cases were detected when endoscopic biopsies were done for abdominal symptoms. Mucous diarrhea was the common manifestation. Cecal amebiasis were seen in surgical specimens that were removed for a malignancy or a granuloma respectively. The liver abscess was found in 4 cases. A case in the tissue of pleural abscess was also recognized.

#### 2) *Pneumocystis carinii* infection (Table 4)

Total five cases of *Pneumocystis carinii* infections was diagnosed in this survey. The lung was the only site of involvement; and the disease was confirmed by demonstrating organisms by methenamine silver stain at postmortem examination. As shown in Table 4 all of the patients were debilitated children. Both lungs were diffusely involved, showing massive consolidation. The alveoli were filled with foamy exudate

**Table 2A.** Annual frequency of common parasitic diseases in tissue found at Seoul National University Hospital (1968-1977)

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Total
Cysticercosis	18	16	21	24	27	20	20	29	13	28	216
Paragonimiasis	1		1	1	2	1	1	3	2	2	14
Clonorchiasis	1	2	2	2	1	1			5	4	18
Sparganosis				2	3		1	1		1	8
Ascariasis		1	4	1	3	1				3	13
Amebiasis						1	1	3	4	3	12
Pneumocystosis											0
Leishmaniasis											0
Anisakiasis											0
Taeniasis									1		1
Enterobiasis										1	1
Trichocephaliasis		2									2
Fascioliasis											0
Echinococcosis											0
Metagonimiasis											0
Strongyloidiasis											0
Total	20	21	28	30	36	24	23	36	25	42	285

**Table 2B.** Annual incidence of common parasitic diseases in tissue found at Seoul National University Hospital (1978-1987)

(1978-1987)	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	Total	Grand total
Cysticercosis	26	26	22	25	26	19	11	25	21	8	209	425
Paragonimiasis	4		4	4	4		2	1	1	1	21	35
Clonorchiasis			1	1	2	3	4		1	2	14	32
Sparganosis	2	2	1	3	1	5	1	1	1	6	23	31
Ascariasis	1					1	1				3	16
Amebiasis			1					1	1		3	15
Pneumocystosis											5	5
Leishmaniasis		1			1	2	2			1	7	7
Anisakiasis						2	1		1		4	4
Taeniasis											0	1
Enterobiasis											0	1
Trichocephaliasis			1								1	3
Fascioliasis		1									2	2
Ecchinococcosis							1				2	2
Metagonimiasis										1	1	1
Strongyloidiasis										1	1	1
Total	33	30	30	33	34	32	23	28	26	21	296	581

**Table 3.** Parasitic diseases used in this study

1. Protozoal diseases	
Amebiasis	15
Pneumocystosis	5
Leishmaniasis	7
2. Helminthic diseases	
Nematodiasis	
Ascariasis	16
Anisakiasis	4
Trichiuriasis	3
Enterobiasis	1
Strongyloidiasis	1
Trematodiasis	
Paragonimiasis	35
Clonorchiasis	32
Fascioliasis	2
Metagonimiasis	1
Cestodiasis	
Cysticercosis	425
Sparganosis	31
Echinococcosis	2
Taeniasis	1

containing characteristic organisms. Plasma cell infiltration in the interstitium was also noted. Pneumocystis pneumonia associated with AIDS, malignant lymphoma or organ transplantation were not found in this series.

### 3) Leishmaniasis

Six cases of cutaneous leishmaniasis and a case of visceral leishmaniasis were all imported ones from mideast Asia. Illustrative cases were as follows.

Case 1 was a 30 year old man who developed an ulcerating lesion on skin of the right wrist on March, 1983. He stayed in Saudi Arabia as a worker. Skin biopsy showed pseudoepitheliomatous hyperplasia of the epidermis and heavy inflammatory exudate with necrosis. The necrotic center in dermis was composed of eosinophilic amorphous material and nuclear debris. There was a zone of histiocytic collection around which small round cells and eosinophils were infiltrated. Myriads of characteristic amastigotes were seen in and around necrotic areas. The organisms

**Table 4.** Summary of *Pneumocystis carinii* infection

Case	Age	Sex	Involved organ	Associated condition
1	90d	F	Lung	Malnutrition
2	50d	M	Lung	Malnutrition
3	72d	F	Lung	Hyaline membrane disease and CMV
4	95d	F	Lung	CMV and Candidiasis
5	98d	M	Lung	Candidiasis, Malnutrition

\*CMV: cytomegalovirus infection

were also seen outside the cells. A dark spot was seen in one pole, which represented the kinetoplast. The organisms measured 2-4  $\mu\text{m}$  in maximum diameter. This case was successfully treated with Metronidazole and Bactrim. This case was previously reported.

Case 2 was a 27 year old male who came in with skin ulceration in face and the left forearm of 4 months duration. He also stayed Saudi Arabia for one year in 1983. The skin nodules were 3x1.5cm and 1.5x1cm respectively. A skin biopsy showed characteristic necrotizing granulomatous reaction. The organism were most commonly found in the histiocytes around necrotic foci. Overlying epidermis showed marked pseudoepitheliomatous hyperplasia. This case was also treated with Metronidazole.

Case 3 was a case of visceral leishmaniasis. This patient was a 26 year old man who had a history of working as a construction worker in Saudi Arabia for one year in 1980. The diagnosis was made by liver needle biopsy. Amastigotes were seen in Kupffer cells under light microscope, and the characteristic ultrastructural features of the parasite were recognized under the electron microscope. The liver was damaged due to multifocal necrosis and fibrosis. The organisms were easily found by H-E staining as round bodies of 2  $\mu\text{m}$  in diameter. They were clustered or dispersed in necrotic areas. The Kupffer cells were often filled with these organisms. Most inflammatory cells were mononuclears mixed with plasma cells. The patient was successfully treated with Pentostam. This case was previously reported.

## HELMINTHIC DISEASES

### 1. Nematodiasis

Among round worm diseases there were 16 cases of ascariasis, 4 cases of anisakiasis, 4 cases of trichocephaliasis, 2 cases of enterobiasis and one case of strongyloidiasis

#### 1) Ascariasis

*Ascaris* is the rarely the subject of tissue pathology unless it is located extraintestinal sites. Of 16 cases, 11 were biliary ascariasis, 4 were appendiceal ascariasis and the other was a case in whom tangled worms were impacted in the jejunum. All biliary ascariasis showed adult *Ascaris* either fresh or mummified in the common duct (7 cases) or hepatic duct (4 cases). No case of hepatic ascariasis forming abscess or egg granuloma were found. Male worms were found in most biliary ascariasis.

#### 2) Anisakiasis

There were 4 cases of anisakiasis in this series. Illustrative cases were as follows.

Case 1 was a 23 year old male who was admitted to the Hospital on November, 1979, because of acute abdomen due to known peptic ulcer. Free gas was seen under diaphragm, and laparotomy was done. There was a 2mm perforation in duodenum. During the close observation of the bowel, the surgeon found a mass in the ileum, 10cm from the ileocecal valve. It was elevated on the serosa and looked strawberry. The mass was excised and submitted for histological examination. Microscopically the lesion consisted basically of transmural inflammatory change. Necrotizing granulomatous inflammation around central cavitations that were partly filled with necrotic debris and pus cells. Heavy infiltration of mature eosinophils was another prominent feature. Among serial sections a section of degenerative worm was demonstrated. Many Charcot-Leyden crystals were seen in and around the degenerated cuticular structure measuring 208x118  $\mu\text{m}$  in extents. Beneath 2-7  $\mu\text{m}$  thick cuticle there was a layer of hypodermis. There were two lateral chords protruding deeply into the pseudo-coelomic cavity, which were characteristically Y-shaped. There was a large esophagus, the lumen of which was lined by triradiated cuticle. Based on the size of the sectioned worm, thickness of cuticle, morphology of lateral chords and muscle cells, this worm section was identified as a *Anisakis* larva. This case was previously reported.

#### 3) Strongyloidiasis

A case of strongyloidiasis involving the duodenal mucosa was incidentally found during examination of mucosal biopsy by endoscopy. The patient was a 81 year old male who was suspected for pancreatic carcinoma. The main symptoms were nausea and vomiting of 3 months duration. Microscopically, the worm sections were found in mucosal crypts. The surrounding mucosal villi were edematous and blunted. The lamina propria was heavily infiltrated with a large number of mature eosinophils with small proportion of plasma cells and lymphocytes. The epithelia around the rhabditoid larva were flattened and focally necrotic. Diameter of the worm section measured 40  $\mu\text{m}$  with cuticle and intestine.

#### 4) Enterobiasis

Excluding the lumen dwelling *Enterobius* in appendix, there was one case in which appendix were invaded by *Enterobius vermicularis*. It was definitely

inside the superficial propria mucosae. The worm was surrounded by inflammatory cells including some eosinophils. The worm section showed lateral cuticular crests. No eggs were found inside the worms.

### 5) Trichuriasis

Three cases were found to have *Trichuris trichiura* that involved the mucosa of appendix in the specimens of appendectomy. Clinically two cases showed typical appendicitis symptoms and were operated. The worms were found in the mucosa surrounded by inflammatory exudate. In remaining two cases the worm was found incidentally.

## 2. Trematodiasis

### 1) Paragonimiasis (Table 5)

Out of 39 cases of paragonimiasis 16 cases were involved in lungs and pleura. Most cases showed scattered egg shells embedded in dense fibrotic tissue of the pleura. The lung tissue was involved in 6 cases. An illustrative case is as follows.

A 42 years old male received left lower lobectomy because of bronchochiectasis. He had a 15 year history of hemoptysis. Hemogram showed hemoglobin 11.1gm/dl, hematocrit 33.17% and WBC 3400/mm<sup>3</sup> with 4% eosinophils. Histopathologically moderate bronchiectasis was associated with several cysts in which many eggs of *Paragonimus westermani* and cholesterol clefts were found. No parasite worm was found. Heavy fibrous capsule was formed around egg granulomas.

Ectopic paragonimiasis was diagnosed in remaining 23 cases. Of them, two cases were subcutaneous paragonimiasis. Each involved abdominal subcutis. Juvenile adults were found in heavy inflammatory tissue. Two patients histories would be presented here.

Cases 1 (S80-1612) was a 54 year old female who developed multiple periumbilical subcutaneous nodules. The nodules appeared 2 years, 7 months and 2 months before the admission respectively. The nodules were rubbery hard and movable. However the masses did not disappear spontaneously or move their positions. Diagnosis of pulmonary tuberculosis was made at a local clinic and antituberculous therapy was done for a year, though acid fast bacilli were not demonstrated. Symptoms of night sweat, cough and sputum were not improved. Hemoglobin was 14.9gm/dl, hematocrit 44.2%, WBC 8900/mm<sup>3</sup>, with 16% eosinophils, Stool examination for helminth and protozoa was negative. Skin test for *Paragonimus westermani* was positive. She was treated with bithionol, after which her symptoms and chest x-ray findings improved. Removed subcutaneous nodule measured 2×1×1cm and was thought to be fat necrosis by the surgeon. Microscopically there was heavy eosinophilic infiltration in subcutaneous fat and a central cavity in which parasite section was found. When serially sectioned, tegument with many spines, simple bifurcated intestinal ceca, suckers, a large excretory bladder, etc were demonstrated.

Another patient (S78-294) was a 36 year old female who came to SNUH because of swelling of right flank that appeared recently. The nodule was 1.5cm in size and was not tender. The lesion was removed surgically. The resected mass measured 1.5×1.5×0.4cm and contained a small dark worm measuring 0.3×0.3×0.3cm. This worm was serially sectioned. The worm was characterized by thick tegument with numerous spines, oral and ventral suckers, bifurcated simple intestinal ceca, and large excretory bladder. No sex organs were developed. This parasite was diagnosed to be juvenile *Paragonimus westermani*. Microscopically large foci of necrosis with ragged margin

**Table 5.** Organ of involvement in Paragonimiasis

Organ		No. of case	Total (%)
Abdominal cavity	Mesentery	9	11 (28%)
	Ovary	2	
Thoracic cavity	Pleura	10	16 (41%)
	Lung	6	
Central nervous system	Cerebrum	7	9 (23%)
	Spinal cord	2	
Others	Subcutis	2	3 (7%)
	Scrotum	1	
Total		39	39 (100%)

and contained eosinophilic amorphous debris and numerous Charcot-Leyden crystals.

Cerebrospinal paragonimiasis was encountered in 9 cases. Seven of them involved cerebrum. In locally resected brain, worm sections have never been seen. The lesion showed central cavitory necrosis often filled with yellowish white necrotic debris, reminiscent of caseous material. Surrounding tissue showed gliosis, some fibrosis, and inflammatory cellular infiltration. In these pathologic lesions, random sections of *Paragonimus westermani* eggs were seen in clusters or scatteredly. The temporal lobe was most frequently involved; and subcortical white matter was also frequent site. Radiologically the lesion may be appeared as an abscess. Sometimes patients presented symptoms of obstructive hydrocephalus. The lesion in spinal cord was found in 2 instances. Characteristic egg granulomas were seen in parenchyme of the spinal cord.

A case of scrotal paragonimiasis was seen in 56 years old man who had a small mass in the right scrotal sac for 1 year. It grew to be hen egg size. On operation the mass was 7×7×4cm and contained an intact adult of *Paragonimus westermani* with surrounding egg granulomas. In center of the mass necrosis reminiscent of caseation was found. Out of 39 cases, 2 systemic paragonimiasis were found in whom involving lung, subcutis, omentum and pelvic organs were involved concomitantly. This case was previously reported.

## 2) Clonorchiasis (Table 6)

In this series there were 32 cases of clonorchiasis. In 5 cases worm or eggs involved the liver proper. In remaining 27 cases, adult *Clonorchis sinensis* or their eggs were found in extra-hepatic loci such as gallbladder or bile ducts. When the liver proper was involved, characteristic periductal fibrosis, many egg granulomas in liver parenchyme and adenomatous hyperplasia of the bile duct epithelium were major findings. Goblet cell metaplasia was also prominent. Associated conditions are tabulated.

## 3) Fascioliasis

We experienced 2 cases of fascioliasis in this series; one case was the ectopic intestinal fascioliasis and the other was the gallbladder fascioliasis.

The first case was a 19 year old female who was admitted to SNUH because of colicky abdominal pain and a palpable abdominal mass. After colon X-ray study she was operated under the diagnosis of colonic lymphoma. A markedly thickened terminal ileum

was found and a modified hemicolectomy was done. Cut sections of the thickened bowel wall showed tunnel-like channels and impacted parasitic structure. This worm measured 3 mm and was surrounded by inflammatory exudate as well as necrotic debris. A large number of eosinophils was seen together with numerous Charcot-Leyden crystals. Because a few yellowish white specks were seen on the liver surface at the time of operation, a wedge biopsy of the liver was done. This revealed large foci of coagulative necrosis surrounded by a heavy infiltration of eosinophils and fibroblasts. Innumerable Charcot-Leyden crystals were also seen in the liver. The worm seen in the terminal ileum was serially sectioned. Syncytial tegument carried many spines with rounded tip that were fairly compact in distribution. Beneath tegument, well developed muscle layers and many subtegumental cells were seen. Because of its general parenchymatous feature and its tegumental and branched intestine the fluke was finally identified as juvenile form of species. This case was described previously.

The second case was a 59 year old housewife, resident of Kangwon-Do, who had episodic abdominal pain for the last 3 years. She was operated under a diagnosis of cholelithiasis. Upon opening the gallbladder a large dark flat worm was expelled from the gallbladder. The common duct was slightly dilated but no stone was found. Pathologic examination of the gallbladder showed no stone. Microscopically there was thickening of the wall and infiltration of chronic inflammatory cells in the mucosa and the muscularis. Eosinophils were prominent. No parasitic eggs were seen. Parasitologic examination was made utilizing 160 serial sections of the specimen. The worm was 1.6cm long and 0.8cm wide. The syncytial tegument had many compact spines with rounded tips. The proximal intestine showed relatively simple branching. As it went posteriorly it was highly branched. The den-

Table 6. Associated diseases of clonorchiasis

Disease	Number
Chronic cholecystitis	13
(with cholelithiasis)	(8)
Cholangiohepatitis	10
Intrahepatic stone	2
Liver abcess with	
adenocarcinoma of gallbladder	1
Cholangiocarcinoma	1
Angiosarcoma	1
Unknown	4
Total	32

dritic ovary was located just anterior to the anterior testis. Well developed follicular vitellaria were located along both lateral walls of the body from anterior to the posterior end. Intricately coiled uterus contained many ovoid light brown yellow operculate eggs. This case was also reported.

#### 4) Metagonimiasis

A case of metagonimiasis involving small intestine was found incidentally during examination of ileal specimen that was resected for malignant histiocytosis. A 40 year old male was admitted to the hospital for the lower abdominal mass and general malaise. Stool examination for parasitic ova was not done. He underwent exploratory laparotomy and was found to have an ulcerating tumor masses in lower ileum. This mass was removed, and submitted entirely to pathology laboratory. Grossly the lesion of malignant histiocytosis involved the entire thickness of the ileum and surface ulcerations were also seen. The remaining ileal mucosa was unremarkable with its well preserved transverse folds and occasional lymphoid follicles. A few worms could be harvested when the fragmented mucosa was scrutinized.

Microscopically the worms were seen cut in various planes and impacted in the Lieberkuehn's crypts of mucosal villi. The worm was usually cut oval or ellipsoid and measured 40-45×20-25  $\mu$ m. The suckers were seen and the oral sucker was usually directing the tips of the crypts. The worm had spiny tegument, well developed tortuous uterus containing numerous mature ova, testis, seminal vesicle and receptacle, and intestinal loops. The ileal mucosa around the worms was infiltrated with some eosinophils, many plasma cells and some lymphocytes. The crypt epithelia were flattened and focally necrotic by the presence of the worms. The villi were slightly edematous often being blunt. But intervillous adhesion was not seen. There was depletion of goblet cells in the crypts harboring the worms.

### 3. Cestodiasis

#### 1) Cysticercosis (table 7,8,9,10)

Since the cysticercosis was analyzed and published (Chi & Chi, 1978) previously for the cases encountered from 1968 to 1976. These data are excluded from this analysis.

The distribution of cysticercosis by involved organ or tissue was subcutis and skeletal muscle in 76%, central nervous system in 15%, breast in 6%, eyeball in 2%, etc. By involvement site the trunk was the most

common, accounting for 40%. Next common sites were head and neck (19%), upper extremity (18%) and central nervous system (17%). Neurocysticercosis could again be classified into various site as seen in Table 9. The fourth ventricle was the most common site. The ventricular system was involved in 35%, and cerebral hemispheres in 45%, cerebellum in 75% and meninges and spinal cord in 16%.

**Table 7.** Involved organ of cysticercosis

Organ of involvement	Cases	Percent
Subcutis and skeletal muscle	204	76
Central nervous system	40	15
Breast	15	6
Eye ball	6	2
Thyroid	1	0.3
Parotid	1	0.3
Total	267	100

**Table 8.** Involved site of cysticercosis

Site of involvement	Cases	Percent
Central nervous system	40	15
Eye ball	6	2.2
Head and neck	50	19
Upper extremity	48	18
Trunk	107	40
Lower extremity	16	6
Total	267	100

The relationship between duration of illness and histological stage of cysticercus infection was analyzed. As shown in Table 10 stage 1 was often seen in cases who had relatively short history of illness. Findings of stage 2 were seen in a wide range of duration, ranging from 2 months to 2 years. But the majority was between 3 months to 1 year. Stage 3 was seen in cases who had fairly long history of subcutaneous nodule, although some of stage 3 cases had 1-2 months history of revealing stage 3 findings.

We attempted to correlate the tissue response i.e., staging of the lesion to the viability of the parasite. Histological criteria of parasite degeneration or death consisted of poor stainability, eosinophilic amorphous exudate in subtegumental area, calcification and inflammatory cell infiltration in worm parenchyme and eosinophilic homogenization. There was a definite correlation between viability of the parasite and host response. Active viable worm provoked active inflammatory response whereas inactive or dead parasite

**Table 9.** Involved site of cysticercosis in central nervous system

Site of involvement			Cases	Subtotal (%)
Nervous Parenchymal	Cerebrum	Frontal lobe	5	21 (49)
		Temporal lobe	5	
		Parietal lobe	6	
		Occipital lobe	2	
	Cerebellum	3		
Ventricular system		lateral ventricle	1	13 (35)
		Third ventricle	1	
		Fourth ventricle	11	
Subarachnoid space		Cysterna magna	3	6 (16)
		Cisterna, unknown	1	
		Arachnoid membrane	2	
Total				40 (100)

did not provoke any significant degree of active inflammatory cellular reaction to the adjacent tissue. And the surrounding tissue tended to surround the dead worm to form acellular collagenous capsule in later stage.

## 2) Sparganosis (Table 11)

A total of 31 cases of sparganosis was encountered. The trunk was involved in 17 cases. Two cases involved subcutis of thigh. One case involved the tongue and the other are case involved mesentery. The histological characteristics of this parasite were described elsewhere (Chi et al., 1980)

A case of intramural sparganosis of jejunum was found in a 48 year old man who came in with symptoms acute intestinal obstruction. Exploratory laparotomy revealed a mild constriction of distal jejunum which was resected segmentally. Microscopically a round mass section of degenerated sparganum was seen in the submucosa with typical tissue reaction and extensive edema. The tissue reaction was basically granulomatous, consisting of layers of inner palisading histiocytes and outer mononuclear cell infiltration. Many calcospherules were seen within the degenerated worm. Eosinophils infiltration was scanty. This case was previously reported.

## 3) Echinococcosis

Two cases of echinococcosis were seen in this period. In both cases the liver was involved. And both cases were once workers in Saudi Arabia.

Case 1 was 32 year old male who came to the hospital because of epigastric discomfort of 3 months duration. The removed mass was of 10×10×9cm in size and was a unilocular type.

**Table 10.** Duration of illness according to the histological stages in cysticercosis

Duration stage	Early	Intermediate	Late
less than 1 month	10	3	2
1-6 months	9	25	28
7-12 months	4	17	10
1-2 years		20	17
2-3 years	1	6	9
3-4 years		1	3
4-5 years	1	1	3
more than 6 years	2	3	9
unknown	4	12	18
Total	31(14%)	88(40%)	99(45%)

**Table 11.** Involved organ of sparganosis

Organ of involvement	Cases
Trunk	
subcutis	15
skeletal muscle	2
Breast	2
Extremities	2
Neck	2
Thigh subcutis	2
Tongue	2
Jejunum	1
Scrotum	1
Brain	2
Total	31

Case 2 was a 39 year old male who was operated for a large liver cyst. Characteristic brood capsule was recovered. Histologically numerous protoscolices were found too.

**Table 12.** Human fascioliasis reported in Korea

Case	Age	Sex	Location	Diagnosis	Authors
1	42	F	Common bile duct	Adult worm	Cho et al, 1976
2	19	F	Colon	Worm in intestinal wall	Lee et al, 1982
3	4	M	—	Egg in stool	Oh et al, 1984
4	27	F	Cecum	Worm in intestinal wall	Park et al, 1984
5	48	F	Gallbladder	Egg from gallbladder wall	Hong et al, 1986
6	59	F	Gallbladder	Adult worm	Chi et al, 1986

#### 4) Taeniasis

There was a case of ectopic biliary taeniasis. A 77 year old man was brought to the emergency room of SNUH on April 1981, because of acute abdominal pain and fever. The pain attack began suddenly on the early morning of the day of admission. Exploratory laparotomy was done under the impression of appendicitis rupture. The appendix was normal and the abdominal cavity was free of exudate. In the process of exploration, an extremely distended gallbladder was found. The common bile duct and cystic duct were also dilated. Cholecystectomy was done. A 15cm long tape worm was extracted from the common duct. When the gallbladder was opened. A 176cm long strobila of a tape worm were found. The scolex was 1.52mm in diameter and had 4 distinct suckers, devoid of hooklets or rostellum. The worm was identified as *Taenia saginata*. The gallbladder was grossly inflamed showing dusky serosa with fibrinous exudate. The mucosa was almost totally sloughed and was covered by inflammatory exudate. Microscopically multiple patches of ulcers and acute inflammatory cells were prominent, often reaching into outer zone of muscularis and serosa. Mixed with neutrophils a small number of eosinophil was present. There was no evidence of chronic cholecystitis. Ther regional lymph nodes showed features of acute lymphadenitis showing numerous neutrophils mixed with eosinophils. It was later disclosed that this patient used to eat uncooked beef when drinking. This case was reported.

## DISCUSSION

Histopathological identification of certain parasitic diseases can provide another view in understanding general prevalence of parasitic diseases in a certain country. Since most surgical specimens are sent to pathology laboratory of hospitals, surgical pathologists can meet otherwise unapproachable patterns of parasitic disease. Especially in cases of tissue invading parasites, biopsy specimens can overview relative importance of the inflicted parasites. Another aspect to

be mentioned is that in host-parasite relations, parasitic infection does not necessarily mean the parasitic disease. It is very difficult to define precisely the relations between infection and disease. But in surgical pathology, this may be related with whether the lesion was main or incidental finding of the patients.

In interpreting relative frequency of tissue invading parasites it should be emphasized that there are many social and medical factors affecting the frequency of parasitic diseases. Actual changes in incidence because of cultural and faunal changes, progresses in diagnostic and therapeutic principles of parasitic diseases and attitude changes of patients against otherwise tolerable conditions, etc are all the factors. For example, development and wide use of brain CT facilitate the differentiation of cerebral cysticercosis from other neurologic conditions. This may make the incidence of disease in pathologic laboratory to be increased temporarily although the incidence is actually not changed. Another example is development of endoscopic retrograde cholangiopancreatography. This may reduce the number of surgery in biliary ascariasis.

Having the above facts in mind we analyzed our data on tissue parasites found in this study. In that respect, pathologists should be aware of various parasitic diseases and their tissue pathology either indigenous or imported. Spectrum of pathological changes provoked by parasite is fairly broad that one is apt to miss the diagnosis unless constant interest and willingness to consult the suspicious cases to experts are provided.

In Korea, there has been relatively good cooperation and collaboration between pathologists and parasitologists for making the final identification of various tissue parasitic diseases. Accordingly, many reports on hitherto unexperienced or rare conditions of parasitic diseases in Korea, became available in literature. The fact that at least 30 cases of tissue parasitic diseases occur every year in a University Hospital signifies the importance of parasitic infection in this country.

An important issue in parasitic diseases in Korea is that we started to encounter imported tropical parasitic diseases. Since 1975, almost a million Korean workers had experiences of employment in middle East, especially in oil-producing countries. Therefore, endemic leishmaniasis and echinococcosis in those countries have been contracted to Korean workers. Since first imported cutaneous leishmaniasis was found in Korean workers by Yoo et al in 1978, a total of 18 cases had been recorded up to 1985 (Yun et al, 1985). Urinary schistosomiasis cases were reported by Min et al 1982 in Korean workers who were in Yemen. Imported visceral leishmaniasis was also described by Chi et al (1983). Imported tropical diseases is not entirely new to Koreans. For example Heu (1952) reported 3 cases of Kala-azar from individuals returned from Northern China. Many malaria patients were experienced during Korean participation in Vietnam War in 1960s. Anyway, recent increase in overseas tourism to tropical countries together with overseas workmanship make it necessary pay attention to tropical diseases.

Along with recent decrease in soil-transmitted nematodiasis in Korea, relatively rare tissue nematodiasis began to receive attention. In Korea, where the raw consumption of marine fish is popular, the occurrence of human anisakiasis has long been speculated. The first case of aberrant parasitism in pharynx has been recorded in 1971 by Kim et al. In 1980, we reported the second case of anisakiasis (case 1 in this series) involving ileum of a young man, that was incidentally found during an operation of perforated peptic ulcer. Many infected cases will be noticed because endoscopic examination for the patients coming in "acute abdomen" becomes popular also in Korea.

Among other nematodiasis strongyloidiasis is seldom described in tissue specimen in Korea although many cases were reported in the literature including cases of fatal outcome (Poltera, 1974). Appendiceal enterobiasis and trichuriasis were incidental in 4 out of 6 cases in this series. However, it is well known that *Enterobius* can migrate extraintestinally to form necrotic granulomas (Chandrasoma and Mendis, 1977).

Although more than 1300 cases of human fascioliasis were reported from various parts of the world (Yoshida et al, 1974), a total of 6 cases has been reported in Korea, including two cases described here (Table 12). Three of them were biliary fascioliasis (Cho et al, 1976, Hong et al, 1986, Chi et al, 1986) and the other two cases were ectopic fascioliasis for-

ming necrotizing granulomas in the intestinal walls (Lee et al, 1982; Park et al, 1984). The remaining one case was diagnosed by egg morphology (Oh et al, 1984). In Japan, more than 18 cases of human fascioliasis were reported (Yoshida et al, 1974). The lesion seen in the liver in case 1 in this series is most likely caused by the migrating *Fasciola*. Since there is similarity in histological findings around the necrotic center of the liver during migrating phase of experimental paragonimiasis (Chi et al, 1982), the hepatic lesion could be interpreted as the process of penetration into the liver, thus hepatic fascioliasis.

The pathological features of cysticercosis were different by different involving sites and different stage of infection. In this study we confirmed our previous observation on the histological stages of cysticercosis based on the tissue reaction of host and worm morphology (Chi & Chi 1978). Therefore one could reasonably be sure that host tissue reacts rather actively and acutely when the cysticercus worm reaches and initiates the lesion. And this initial reaction appears to be non-encapsulating allergic type inflammation harboring many eosinophils. This tissue response becomes stabilized by a progressive formation of fibrous capsule and establishment of "sequestered" bladder worm inside the tissue. Since cysticercosis has constituted a vast majority of tissue parasitosis in Korea, the progress of its annual incidence deserves keen observation. So far, the incidence of the disease could not be said to decrease. Because neurologic symptoms may be manifested by dying worms up to 30 years, the incidence of neurocysticercosis is expected to continuously high in Korea during next score of years.

The pathology of sparganosis is fairly characteristic and is easily differentiated from cysticercosis. The histological characteristics have been previously described (Chi et al, 1980) and present series was not different from the previous cases. Recently neurosparganosis becomes gradually increased reporting 12 cases in 3 years in this country (Chang et al, 1987). Occurrence of human sparganosis is related with snake/frog eating in Korea and other oriental countries. Even if the traditional habit is stopped at this moment, the unexpected discovery of the worm at surgical table will continue for a certain period because the cestode larva can live up to 20 years in a human tissue (Cho, 1983).

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