

Two cases of Metagonimiasis with special reference on the egg laying capacity in the human host

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The *Metagonimus* infection has been known to be present nationwide and endemic in some parts of Korea (Kobayashi, 1928; Seo, 1960), but no known published cases of human metagonimiasis with distinct clinical symptoms and the diagnosis based on the adult worm were reported. And strictly speaking, almost all of the reports on the human infection status of *Metagonimus* spp. in Korea were based on the observations of heterophyidae ova during the stool examinations.

Some of the authors reported the metacercariae of *Moetagonimus* spp. infected in various kinds of fishes from some localities of Korea (Chun, 1960a, b; Choi, 1966; Lee, 1968) and some experimental observations on the *Metagonimus yokogawai* in animals were reported by Kang et al. (1964) in dogs and in mouse by Hong and Seo (1969).

The authors have opportunities to detect two cases of *Metagonimus yokogawai* infection in Korea, one of which was a clinical case with heavy worm burden and the other was an asymptomatic case whose egg discharging rate was closely observed.

Case Presentation

Case 1: The patient D. L., a 21-year-old

Korean male was admitted to the Seoul National University Hospital on February 1968, to evaluate the long-standing diarrhea. He had been ill of mild, continuous diarrhea during recent 6 months which was characterized by loose or watery but never bloody or mucoid. The diarrheal attacks occurred every day 4 to 6 times. The patient has not complained any other associated gastrointestinal symptoms such as abdominal pain or indigestion.

On physical examination, the patient showed on abnormal signs except 2-finger-breadth palpable liver and mild puffy face. The laboratory findings could be summarized as follows: Hb. 15gm%, Hct. 42%, WBC 4,800 with diff. counts; seg. 43%, lymph. 46% and eosino. 11%. E. S. R. was 5/2. protein 6.7gm% (alb. 4.6 gm%), TTT 2.5, Alk. P'tase 2.7 Bodansky unit, bilirubin 0.31 mg%. The chest X-ray showed on remarkable findings including the heart shadow. The E. K. G. finding showed sinus bradycardia (56/min.) without any findings of hypertrophy of ventricles.

The results of stool examination were remarkable. The ova of *A. lumbricoides*, *T. trichiurus*, *Metagonimus yokogawai* and *C. sinensis* and the larvae of *Strongyloides stercoralis* and the cyst of *G. lamblia* were recovered by

direct smears and formalin-ether technique. The E. P. G. of *M. yokogawai* was 67,600 (stool weight 310 gm, consistency 2.5). The size of wheal for the VBS antigen of *C. sinensis* was 9×8 and for *P. westermani* 8×8 mm

The patient agreed that he had been very favor to eat raw fresh-water fishes. From 1961 to 1966 he was interested in taking some kinds of raw fresh-water fishes such as *Cyprinus carpio*, *Carassius auratus* and *Siniperca scherzeri* in vicinities of Seoul and some other ponds in rural countries. On August 1967, he visited Woolsan and enjoyed the raw sweetfish (*Plecoglossus altivelis*) two times which was the season of that sweet and delicious fish in that area.

At first he was treated with piperazine citrate tablets for *Ascaris* infection with negative conversion on 4th day. Atabrine 0.9 gm orally for the *G. lamblia* infection was undertaken with successful results. The watery diarrhea was not so remarkably improved during the 4 days observation after treatment. The result of *M. yokogawai* ova count just before treatment was 71,300(stool weight 320 gm, consistency 2.5). Tetrachlorethylene 3 capsules with magnesium sulfate purge was undertaken, 2 times. The whole amount of diarrheal stool were collected during the next two days to isolate the worms in each time of treatment. The total number of worms isolated was 17,560. The last stool examination showed

the ova of *M. yokogawai* 400, *C. sinensis* 400, and *T. trichiurus* 500 in E. P. G. The patient was treated no more for the parasitic infections. The follow-up observation of this patient during the next 2 months showed a gradual improvement of chronic diarrhea.

Case 2: The patient, J. Y. was 32-year-old Korean male who was an instructor of Seoul national University. He visited the Department of Parasitology to evaluate whether he was infected with any kinds of trematodes on mid-September, 1969. On stool examination the ova of *T. trichiurus* and *M. yokogawai* were recovered. The result of ova count was *M. yokogawai* 800 and *T. trichiurus* 200 by Stoll's dilution egg counting technique.

He recently visited his home-town in an island of South Sea. He spent joyful days for a week and at the farewell party prepared by his hometown friends he must eat some pieces of sweetfish which was the most abundant season of that fish (26th August, 1969). Although he was awful of some kinds of flukes infection, he said he really enjoyed the party.

He has well understood the situation of this intestinal fluke infection and promised to check the life-span of *M. yokogawai* in human host. He was schedule to check the ova discharging status bimonthly (Table 1). Unfortunately it must be interrupted the life-span observation because he was invited as a fellow by a University in the United States. He was

Table 1. Serial check of egg discharging status of *M. yokogawai* in Case 2.

Date	Months after infection	E. P. G.	Stool weight (gm)	Consistency of stool
Aug. 26th, 1969	Day of infection			
Sep. 15th, 1969	1/2	800	110	1.0
Nov. 1969	3	1,200	85	1.0
Feb. 1970	7	1,800	120	1.0
Apr. 1970	9	2,200	90	1.0
Jun. 1970	11	2,800	95	1.0

treated with 100mg/kg dose of Yomesan orally with magnesium sulfate purge. The stool was collected during the next 2 days and isolated the adult worms of *M. yokogawai* as described below. The total number of worm isolated were 154. One week after the treatment the stool examination was negative for the ova of *M. yokogawai*.

Method of Worm Isolation

Authors tried to isolate this minute intestinal trematodes from the diarrheal stool collected after the chemotherapy during consecutively 2 days. The diarrheal stool collected were immediately emulsified in a container with physiological saline and filtered through the 2 layers of wet gauze (mesh No. 30). The filtrate was examined under dissecting microscope, but always no worms could be recovered from the filtrate. The remaining unfiltered portion was washed with fresh saline repeatedly and meticulously, so as not to let the worms passing through the gauze. The unfiltered remnants and gauze were fixed with 10% formalin and isolated the minute intestinal trematodes under dissecting microscope from the various kinds of stool remnants. The most of the worms collected were isolated in the first day stool and only negligible number of worms were isolated in the second day stool.

Description of the Collected Worms

The figures in plate showed the adult worms collected and the ova discharged from case 1 and 2. The Table 2 and 3 presented the dimensions of ova and adult worms collected from case 1 and 2 respectively.

From the above data, it could be concluded that the worms collected were identified as *Metagonimus yokogawai* (Katsurada, 1912).

Table 2. The result of measurement of discharged ova in each cases (in μ).

	Ova from	
	Case 1	Case 2
Length	29.0±1.4	28.8±1.8
Width	16.7±0.4	17.1±0.9
Opercular width	7.9±0.6	7.7±0.8
Op. width/width (%)	47.4%	45.2%

*50 samples of ova were measured under micrometer in each cases.

Table 3. Results of the measurement of adult worms collected from Case 1 & 2. (in mm.)

	Worms from	
	Case 1	Case 2
Length	0.876	0.975
Width	0.363	0.521
Oral sucker	0.068×0.051	0.080×0.082
Pharynx	0.037×0.044	0.048×0.046
Ventral sucker	0.102×0.092	0.116×0.104
Seminal receptacle	0.140×0.088	0.152×0.100
Seminal vesicle	0.122×0.068	0.141×0.063
Ovary	0.068×0.048	0.068×0.059
Testes (Right)	0.134×0.102	0.152×0.107
(Left)	0.092×0.088	0.152×0.097

Measured from the specimens unstained.

Calculation of Egg Laying Capacity of *Metagonimus yokogawai* from two cases

From the results of egg counting undertaken in case 1 and 2 with the number of worms collected by the above described method, the authors could calculate the egg-laying capacity in human host as showing in

$$\text{Egg-laying capacity} = \frac{\text{E. P. G.} \times \text{Stool weight}}{\text{No. of worms collected}}$$

Table 4. Calculation of the egg-laying capacity of *Metagonimus yokogawai* observed in two cases.

Case No.	Sex & age	Duration from inf. to treatment.	E. P. G. & stool weight			No. of worms collect.	E. P. G. P. W.	E. P. D. P. W.
			before treatment	after treatment	Stool consist.			
1	male 21	6 months	71,300 (320 gm)	400 (280 gm)	2.5	17,560	4.0	1,293
2	male 32	9 months	2,800 (95 gm)	0 (90 gm)	1.0	154	18.2	1,727

1; Stool consistency was followed the criteria of Stoll.

2; E. P. G. P. W. means eggs per gram of feces per worm.

3; E. P. D. P. W. means eggs per day per worm.

Discussion

The clinical manifestations caused by the infection with Heterophyidae were still controversial portion in medical parasitology. And that of *Matagonimus* were rarely investigated and the most of them were reported by the Japanese workers. Dr. Africa et al. (1935) examined the autopsy cases with deep interest on the visceral complications of heterophidiasis and detected the ova from the cardiac muscles. Nakayama(1937) divided the gastrointestinal troubles caused by *Metagonimus* into the acute and chronic stages and summarized typical symptoms of cases. About half of the clinical cases complained the diarrhea and some other symptoms such as abdominal pain, gastrointestinal dysfunction, low-grade fever and fitlike gastric cramp etc. Koga (1938) reported one case suffering from diarrhea and general malaise and two cases of diarrhea accompanied with abdominal pain caused by *Metagonimus* infection. Nagayoshi(1949) recorded a Japanese who were infected as much as 30,462 of *Metagonimus yokogawai* obtained by the use of anthelmintics who complained of chronic diarrhea and general malaise.

Zaitu(1958) observed the parasitised cases in an endemic area of Japan with *Metagonimus yokogawai* and *Heterophyes* caused by eating *Mugil cephalus*, and summarized the

symptoms. In adults, abdominal pain(26%) was the most frequent presenting symptom and general malaise, nausea, diarrhea accompanied by soft stool, epigastric fullness etc. were appeared. In children, abdominal pain (33%) was the most frequent, and autointoxication, anorexia, vomiting, diarrhea etc. were followed.

The case 1, observed in this report, was admitted to the hospital with the chief complaints of chronic diarrhea lasting past 6 months. The results of routine laboratory examination were in normal ranges except that of stool examination. This case was infected with *Ascaris lumbricoides*, *T. trichiurus*, *Strongyloides stercoralis*, *Giardia lamblia*, *C. sinensis* and *Metagonimus yokogawai*. He was treated with piperazine citrate and atabrine to eradicate the *G. lamblia* and *A. lumbricoides* prior to the application of tetrachlorethylene. Two courses of tertachlorethylene applied in this patient eradicated the *Metagonimus yokogawai* in vast majority (E. P. G. from 71,300 to 400).

The authors would like to postulate that the symptoms in this case was chiefly caused by the infection of *M. yokogawai*, although some other kinds of parasites were present concomittantly, because of following reasons: 1) The coincidence between the duration of present illness and the lenth from intake of second

intermediate host of *Metagonimus* to the time of admission. The patient had enjoyed the sweetfishes on August 1967 and admitted on Feb. 1968 and he said he had been ill of diarrhea during the last 6 months. 2) The giardial dysentery usually affects children and only rarely affects adults. The manifestation of giardial infection is usually characterized by steatorrhea. 3) The ova of *C. sinensis*, *A. lumbricoides* and *T. trichiurus* and the larvae of *S. stercoralis* were scantily observed to cause any remarkable symptoms independently. These kinds of parasites with the *G. lamblia* would be played some roles in aggravating the symptoms in this case.

Because of the puffy face of the patient at the time of admission, E. K. G. and chest X-ray film were carefully evaluated whether this patient had any heart troubles of any causes. But no positive findings to support this idea were found.

The case 2, whose worm burden of *M. yokogawai* was relatively low ingrade, showed no clinical symptoms during the observed periods. Because of the minute size of this intestinal fluke, it must be necessary relatively large number of worms to cause any clinical symptoms.

As for the collection methods of minute intestinal trematodes such as *Metagonimus* spp., only limited kinds of technique were available. Most authors could find out the adult worms from the autopsy table, from the experimentally infected animals by the scraping the intestinal mucosa of suspected region or macroscopic sedimentation technique after treatment. The present authors used a simple method of isolating the worms from infected individuals after chemotherapy. The main differences from the sedimentation technique was the repeated washing of the unfiltered

stool remnants containing the minute intestinal trematodes. With the experiences, it revealed superior results to the simple macroscopic sedimentation technique in aspects of freshness of the collected worms, missing probability of the expelled worms and difficulties in examination of concentrated samples. The two layers of wet gauze (mesh No. 30 or more) will be sufficient to prevent the passage through the meshes of the gauze. When the patients are regularly treated with magnesium sulfate purge after use of adequate chemotherapeutics and immediate handling of stool specimen, a relatively fresh specimens could be obtained for the morphological observations. The majority of the worms were passed out in the first day of chemotherapy and only the negligible number compared with the total number obtained were isolated on the second day.

From the data of two cases of infection whose egg discharging status was relatively well observed and worm burdens were precisely counted, authors could obtain the eggs per day per worm (E. P. D. P. W.) of *M. yokogawai*. Kagei et Kihata (1970) in Japan have observed on the egg discharging status in three asymptomatic cases and presented E. P. G. P. F. as 1.9, 1.2 and 0.5 respectively, after treatment with kamala.

It is well-known that the E. P. G. of a helminth in a final host may be variable as the condition of host were changed. Those conditions of host include the stool consistency, stool weight etc. So it is more reasonable to calculate the E. P. D. rather than E. P. G. in describing the egg-laying capacity of worm in a specific host. In our cases, the E. P. D. P. W. from case 1 was 1,293 and from case 2 was 1,727 (average 1,505). This value has the limited meaning because the E. P. D. P. W. of

M. yokogawai, 1,585 was derived from two human cases whose durations of infection were within 1 year.

Considering the minute size of this intestinal trematodes, the egg-laying capacity per day, about 1,500 might be a supprisingly high value and must be evaluated to ascertain further in the future.

Summary

Two cases of human infection of *Metagonimus yokogawai* proven with adult worm in Korea were presented with special reference on the egg-laying capacity of the worm in the human host observed in these cases.

1) The case 1 who had the history of intake of raw sweetfish(*Plecoglossus altivelis*) were suffered from mild but chronic diarrhea for 6 months exactly after the intake. was treated with 2 courses of tetrachlorethylene incompletely but successfully. The total number of adult worm collected from this case was 17,560.

The case 2 who was infected in low grade, was showed no symptoms since the infection with *Metagonimus yokogawai*. He was treated with Yomesan completely.

2) The above two cases were evaluated on the egg-laying status of *Metagonimus yokogawai* and collected the whole of the worms expelled after treatment. From the E. P. G., stool weight and consistency at each time of stool examination and the number of worms collected in each cases, the authors could obtained the number, 1,505 as a E. P. D. P. W. (Eggs per day per worm) of *Metagonimus yokogawai* in human host within one year of infection.

3) The morphological observation on the collected adult worms from the cases were briefly recorded.

<국문초록>

성충진단에 의한 요꼬가와 흡충증 (Metagonimiasis)

— 2예보고 및 인체숙주에서의 산란능력 —

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한국 내에서의 요꼬가와흡충의 존재는 과거 주민에 대한 대변검사시 이형흡충과 충난의 발견, 제이중간 숙주 내의 피낭유충발견 및 동물실험결과 등으로 수차에 걸쳐 확인된바 있다. 그러나 요꼬가와흡충(*Metagonimus yokogawai*)의 성충을 기초로한 인체기생이나 임상증에 관한 보고는 아직 없었다.

저자들은 서울대학교 의과대학 부속병원에 입원하였던 임상증에 1예 및 무증상의 경감염에 1예에서 성충을 얻어 요꼬가와흡충을 진단하고 그 2예에서 인체내에서의 요꼬가와흡충의 산란능력을 검토한바 흥미있는 결과를 얻어 보고하는 바이다.

1) 제1예는 21세의 남자로서 1967년 8월 울산에서 은어를 회로 먹은 후로 계속되는 만성설사로 인하여 입원하였다.

입원당시의 소견으로 약간의 안면부종과 2회지정도의 간종대 이외에는 별무소견이 었고 검사소견은 호산구증가(11%) 이외에는 특기 소견이 없었다. 본예는 요꼬가와흡충 이외에도 회충, 편충, 분선충, 간흡충 및 지알디아 램부리아가 감염되어 있었다.

Tetrachlorethylene 3감을 2회 투약하여 요꼬가와흡충란 E. P. G. 71,300에서 400으로 격감시킨 후 치료를 종결하였다.

이에 얻은 대변에서 총 17,560마리의 요꼬가와흡충을 얻었다.

2) 제2예는 32세의 남자로서 1969년 8월 남해의 한섬에서 감염되었다. 1970년 6월 E. P. G. 2800일때 Yomesan 100 mg/kg 로 치료하여 154마리의 요꼬가와흡충을 얻었다. 본예에서는 감염이후 임상증상이 나타나지 않았다.

3) 이상 2예에서 요꼬가와흡충의 산란능력을 계산한바, 제1예에서의 요꼬가와흡충 1마리당 1일 산란량은 1,293 제2예에서는 1,727로 계산되어 평균 1,505의값을 얻었다.

4) 투약후의 총체분리방법에 대하여 기술하였다.

5) 분리된 총체 및 충란을 계측, 동정(同定)하였다.
위의 소견은 우리나라에 있어 성충종별 진단에 의한 최초의 요꼬가와 흡충예를 보고한 것이라 하겠다.

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Explanation of plates

Fig. 1 & 2. Adult worm of *Metagonimus yokogawai* from case 1. Note the ventral sucker.

Fig. 3. Ova of *Metagonimus yokogawai* from case 1.

Fig. 4. Adult worm from case 2. This worm was the maximum in size among the collected worms.

Fig. 5. Adult worm from case 2. This was the minimum.

Fig. 6 & 7. Ova from case 2.

> 서 병 설 의 사 진 부 도 <

