HUMAN INTESTINAL CAPILLARIASIS (CAPILLARIA PHILIPPINENSIS) IN TAIWAN

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Abstract. Capillaria philippinensis was first reported in 1963 in the Philippines. Major outbreaks have occurred in the Philippines and Thailand. This article reviews the known 30 intestinal capillariasis cases in Taiwan from January 1983 to December 2003. The infected cases were diagnosed each year with the exception of 1984 and 2002, making Taiwan a capillaria-prevalent area. Two Taiwanese aboriginal tribes, the Ami and Paiwan, presented a high prevalence. The males and elderly also had a high infection rate. Nine cases were diagnosed by histopathological biopsied specimens. About half of the 30 cases denied having consumed raw or undercooked fish. All cases recovered to health after receiving medication, with no deaths or recurrences.

INTRODUCTION

Only four nematodes of the genus Capillaria are reported to be zoonotic: Capillaria philippinensis, Capillaria hepatica, Capillaria aerophila, and Anthrichosoma cutaneum. However, currently Anthrichosoma cutaneum is not sorted as a Capillaria. Capillaria philippinensis is a parasite of the small intestine and causes a severe enteropathy and at times death in humans. More than 2,000 cases of intestinal capillariasis have been reported from the Philippines and Thailand, with sporadic cases reported from Korea, Japan, Taiwan, India, Iran, Egypt, Italy, the United Arab Emirates, Spain, and the United Kingdom. Small freshwater and brackish-water fish are the source of infection and probably fish-eating birds the reservoir host. Since the first case in Taiwan was reported in 1983, subsequent cases have continued to appear. However, there was no detailed and complete investigation has yet been conducted to study the disease in Taiwan. Geographically, Taiwan is the closest area to the Philippines. It is also a key rest stop on the north-south migratory routes for many fish-feeding migratory birds, which are thought to be the major carriers of Capillaria philippinensis. In addition, there are also more than 200,000 foreign laborers living in Taiwan who originally came from the major epidemic areas in any given year, and it could potentially facilitate the spread of this disease. Therefore, there is an urgent need to understand how this disease progresses in Taiwan.

MATERIALS AND METHODS

Among the cases in this study, we identified and extracted data on 26 infected cases of intestinal capillariasis from medical records of patients from local hospitals throughout Taiwan. The designated code number of 127.5 for capillariasis was used, as it was defined by the International Classification of Diseases 9th Revision Clinical Modification (ICD-9-CM 127.5). Four other cases were provided by parasitologists and pathologists that had not properly been coded as 127.5. In total, we found that as of 31 December 2003, Taiwan had had 30 definitive cases of intestinal capillariasis since 1983. Correct diagnoses were made by five medical centers and five regional hospitals. Among these cases, the correct diagnoses were not made until admitted to the hospitals. The diagnostic tests including stool examinations and biopsy examinations of the duodenum, proximal jejunum, and distal ileum found eggs, larvae, and adults of Capillaria philippinensis. The findings were either confirmed independently by multiple hospitals or confirmed by the Parasitology Department at Taipei Medical University or Kaohsiung Medical University. The latter two academic institutes have supported the identification of Capillaria philippinensis on numerous occasions. The data in the current study exclude the infected foreign workers whose stool examinations were found positive for Capillaria philippinensis in their first physical examination upon arrival in Taiwan.

Since the 30 cases were diagnosed at the 10 medical institutes, crossing various locations in Taiwan and over a span of 21 years, the collection of patient information presented great challenges. This study reviewed all the cases, including analyzing factors such as gender, age, ethnic group, geography, diet, routes of infection, travel history, clinical symptoms, and laboratory results. We also have applied several diagnostic procedures, treatments, and prognoses. The complete data were compared with other countries on disease progression.

RESULTS

To date, there have been 30 cases of Capillaria philippinensis in Taiwan since the first case was found at Kaohsiung Medical University Hospital in July 1983 (Table 1). The gender ratio between male and female was 1.5:1 (18 males:12 females). Patient age ranged from 12 to 76 years, with mean age of 50 years. The geographical distribution is as follows. In the southeastern part of Taiwan, there were 12 cases in Taichung County, 8 in Hualian County, 6 cases in Kaohsiung County, and 1 case in Kaohsiung City. In northern part of Taiwan, there was one case in each city, including Taipei City, Taipei County, and Keelung City (Figure 1).

With regard to their ethic groups, the majority of patients (N = 21) were Taiwanese aboriginals. Seventeen of them were Ami tribesmen and 4 were Paiwan tribesmen. Of the remaining 9 cases, 5 were Minnanese and 4 were Hakkanese.
When examining their dietary history, 14 cases denied having a history of raw fish consumption.

As to their travel histories, three patients had visited Thailand, one patient had traveled to the Philippines, and the other patient was a crewmember of a ship and he had visited many countries including the Philippines and Thailand (Table 1). All cases had developed clinical symptoms of _Capillaria philippinensis_, including intermittent abdominal pain, borborygmi, diarrhea, and weight loss as well as various degrees of painless lower legs edema.

With regard to the laboratory results, the results of complete blood cell examinations revealed that eight cases were anemic (hemoglobin level ≤ 10 mg/dL). Eleven cases had an eosinophil ratio ≥ 5%. The biochemical texts reveals that the albumin levels ranged from 0.5 to 3.0 mg/dL with 19 cases showing values ≤ 2.0 mg/dL and 5 cases showing values ≤ 1.0 mg/dL.

Twenty-one diagnoses were confirmed, based on the presence of _Capillaria philippinensis_ eggs in the feces; whereas nine patients were diagnosed by histopathological findings of eggs, larvae, and adult _Capillaria philippinensis_. Of the latter nine cases, biopsy specimens were obtained by segmental resection of distal ileum in two cases. In other four cases, specimens were obtained by panendoscopic examination, with two taken from the duodenum and the other two taken from the proximal jejunum. In the remaining three cases, specimens were obtained from the distal ileum by colonofibroscopic examination. Of the remaining patient, the stool examination and histologic examination all confirmed a positive result of _Capillaria philippinensis_ infection.

The progression of the disease from symptom commencement to a confirmed diagnosis ranges from 2 weeks to 6 years, with an average of 8.1 months (see Table 1). Of the 30 cases, 8 patients were not diagnosed until more than a year after the onset of symptoms. Hospitals with greater diagnostic experience were Mackay Memorial Hospital–Taitung Branch, Hualian Buddhist Tzu-Chi General Hospital, and Kaohsiung Medical University Hospital, with each having made six to seven correct diagnoses. The first diagnosed case in Taiwan was case no. 1, whereas case no. 5 was the first case published in an English paper.

With regard to the treatments, cases no.1 and no. 6 were prescribed 400 mg/day albendazole for 3 weeks, whereas the other 28 cases were all given 400 mg/day mebendazole for 3-4 weeks. All cases recovered with no deaths or recurrences.

### DISCUSSION

In an attempt to present an overall view of the progression of intestinal capillariasis infection in Taiwan, the 30 cases were arranged chronologically according to the onset time of the disease (Table 1). In the Philippines and Thailand, males tend to be easily infected than females, but the opposite was true in Egypt. Of the 30 infected cases in Taiwan, the gender ratio was 1.5: 1 (18 males to 12 females). The age of infected persons ranged from 12 to 76 years, with mean age of 50 years. Eleven patients were more than 60 years of age. In comparison with other countries, Taiwan had a greater proportion of elderly infection.
Kilawin infection. However, nearly half of the cases were Hakkanese. Minnanese and Hakkanese are two of the major ethnic groups in Taiwan. In comparison with aboriginal tribes who had been residing in Taiwan for more than 400 years, Minnanese and Hakkanese are identified as Taiwanese and they were originally immigrated from Southeastern provinces of China including Fujian, Jiangxi, and Guangdong province in the past 300 years. Generally speaking, Hakkanese resident in the mountainside areas, and their living and dietary habits are different with aboriginal tribes in Taiwan. In this study, the very first case in Taiwan was from Meinong in Kaohsiung County, and the second case in the same location was found 16 years later. Both cases were Hakkanese. They were also the only two cases from a mountainside population.

Geographically, Taiwan is closer to Luzon of the Philippines than any other countries. They are separated only by the Bashi Strait. The distance between Taitung County in Taiwan and Ilocos Norte and Ilocos Sur in the northwestern Luzon of the Philippines is less than 500 km. We found that the first Philippine case of intestinal capillariasis and the very first outbreak in Taiwan were respectively reported. The geographical proximity may potentially allow fish-feeding migratory birds bringing *Capillaria philippinensis* to Taiwan. In Taiwan, *capillaria*-prevalent areas were found to be located in Taitung, Hualien, and Kaohsiung counties, despite single episodes taking place in each of Keelung, Taipei, and Taipei City from northern Taiwan. All three northern patients belonged to the Ami tribe, who had originally lived in Taitung County but had immigrated to the northern cities for the reasons of marriage (the Keelung County case) or work (the Taipei City and Taipei County cases). They often returned to visit their hometowns in Taitung County on a regular basis, so they would have been infected in Taitung County. Thus, northern Taiwan may not be a prevalence area yet. The high-risk groups may include the Ami tribe in Taitung and Hualian counties, the Paiwan tribe in Taitung County, and the Hakkanese in Kaohsiung County.

Case no. 10 began to show clinical symptoms of borborygmi, abdominal pains, and watery diarrhea 2 months after a trip to Thailand, so he would have been infected in Thailand. Case no. 11 was the member of a ship crew who had traveled to many countries including the Philippines and Thailand, so the place where he had contracted with the disease is still unknown. Both cases might have been infected outside of Taiwan.

Accordingly, all cases had shown clinical symptoms of transient abdominal crampy pain, borborygmi, diarrhea, and weight loss. Some patients were found having various degrees of painless lower leg edema. Among the seven cases with chronic infection lasting more than 1 year, four cases had shown symptoms of diarrhea and constipation, which were difficult to diagnose differentially. When a diagnosis was finally made, five cases already showed clinical symptoms of septic shock. The finding of hypoalbuminemia was of significance.

In the literature, the majority of the patients had a history of consuming raw or uncooked fishes, and this is a crucial factor of intestinal *Capillaria* infection. However, nearly half of the Taiwanese patients (14 of 30 cases) denied having consumed any raw or uncooked fishes. We propose that the raw fish might have been infected outside of Taiwan.

Unfortunately, we could not verify the number of cases that resulted from consuming *Chou-Bao*, due to a lack of information from patient records. It is noted that the transmission of *Capillaria philippinensis* in the Philippines is considered to be related to a traditional dish named *Kinilaw* (or *Kilawin*), which is primarily made of raw pilchard fish. Due to the fact that the Taiwanese cases have been sporadic, it has been difficult to study the route of transmission. Hwang examined fish from fish markets in Kaohsiung and Taitung but found no presence of *Capillaria philippinensis*.5

Drondo and others16 found that a diagnosis of intestinal capillariasis in the nonepidemic areas is more likely to be delayed, so they emphasized that clinicians in those areas should remain highly alert for any sign of disease outbreak.
Reports of delayed diagnoses for more than a year have been found in Japan, Korea, Egypt, and India. Among the 30 Taiwanese cases, 8 patients were not confirmed with infection until 1 year later. It is noticeable that five of 8 delayed cases were among the first 8 cases. The physicians and medical technologists in clinical practice should be more trained in diagnosing this disease.

The simplest way to diagnose intestinal capillariasis is by stool examination. Capillaria are closely related to Trichuris and Trichinella species. The eggs of Trichuris trichiura (average size, 50 × 22 μm) and C. philippinensis (average size, 36 × 19 to 45 × 21 μm) are similar although differentiable, and some individuals can be infected with both parasites. If eggs, larvae, or adult Capillaria philippinensis are not found in the stool samples, a panendoscopic examination or surgical operation is then required to obtain biopsy specimens for a histopathological examination. Four Taiwanese cases were diagnosed based on histopathological findings of biopsy specimens from the duodenum (two cases) and proximal jejunum (two cases) of patients by panendoscopic examination. Kang and Wongsawasdi and colleagues had cases definitively diagnosed based on histopathological findings on panendoscopic jejunal biopsy specimens. By the same procedure, two Taiwanese cases were diagnosed based on duodenal biopsy specimens and another two Taiwanese cases were diagnosed based on jejunal biopsy specimens. In Mukai and others, and Hong and others, definitive diagnoses were made based on colonofiberoscopic ileal biopsy. Three Taiwanese cases were also diagnosed by the same procedure. Lee and others reported definitive diagnoses based on histopathological findings from diagnostic surgical exploration. El-Dib addressed that one Egyptian case was found by abdominal laparoscopy for diagnostic purposes. For cases no. 2 and no. 7 in Taiwan, a definitive diagnosis was made by histopathological findings after showing clinical symptoms of peritonitis, and it was complicated with septic shock (case no. 2) and intestinal obstruction (case no. 7). Consequently, they had to undergo surgery for distal ileum removal.

Our study reveals some crucial results. The diagnosis of intestinal capillariasis is commonly delayed, and it may sometimes require biopsy examinations. The areas where Capillaria philippinensis has spread, the number of afflicted countries, and the infected cases may far exceed what we know so far. Taiwan has become a capillaria-prevalent area after the Philippines, Thailand, and Egypt, with infections mainly occurring in the aboriginal population in eastern Taiwan. The fact that the Taiwanese aboriginal tribes are closely related to the Philippines aboriginals in origin might play a role in the high infection rate. Future research focusing on the routes of transmission of Capillaria philippinensis in Taiwan will be necessary.

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References