

DIPHYLLOBOTHRIASIS LATUM: THE FIRST CHILD CASE REPORT IN TAIWAN

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Diphyllobothriasis latum is an intestinal parasitosis caused by the ingestion of mostly raw fresh-water fish containing plerocercoids of *Diphyllobothrium latum*. We report an 8-year-old boy who came to our hospital with the complaint of a tapeworm hanging from the anus after defecation. The other symptom was mild abdominal cramping for a period of 1 year. The laboratory examination did not reveal anemia or vitamin B₁₂ deficiency. Examination of gravid proglottids with rosette-like central uterus and typically operculated eggs of *D. latum* confirmed the diagnosis. The morphologic characters of proglottids and eggs size are compatible with *D. latum*. The patient had a history of eating uncooked fish for 1 year. Salmonids may be the infection source. He was treated with two doses of praziquantel and passed about 183 cm in length of all proglottids. There is a high prevalence of diphyllobothriasis latum in the northern temperate areas, but it is very rare in children. This patient is the first child case reported in Taiwan.

Key Words: child case, diphyllobothriasis, *Diphyllobothrium latum*, (Kaohsiung J Med Sci 2006;22:346–51)

Diphyllobothriasis, an infection by the broad tapeworm *Diphyllobothrium* sp., is a zoonosis acquired by humans and other mammals [1]. Humans become infected by ingesting the larva (plerocercoids) in raw or insufficiently cooked freshwater fish, including flesh, roe, liver, or other organs of infected fish. Human diphyllobothriasis is known to occur widely in the world. Several species of human diphyllobothriid cestodes have been reported. However, *Diphyllobothrium latum*, *D. pacificum*, and *D. nihonkaiense* are the main pathogens of human cases of diphyllobothriasis [2]. *D. latum* is the longest of the tapeworms that infect humans, measuring 4–15 m in length and 10–20 mm in width, and may contain 3,000–4,000 proglottids [3]. Most cases infected with *D. latum* often show no

clinical symptoms. However, in a proportion of cases, there is transient abdominal discomfort, diarrhea, anorexia, nausea, vomiting, vertigo, weakness, and weight loss. Anemia due to vitamin B₁₂ deficiency has been described in cases of prolonged infection [4].

The infection of *D. latum* in humans is common in regions with cold water lakes, such as Europe [5] and North America [6]. In South America, this infection is common in Chile and Peru [7] and there have been sporadic cases in Argentina and Brazil [8,9]. *D. latum* in Asia has been reported in Japan, Korea, Siberia, and Malaysia [2,10,11]. Two cases among 141 aborigines have been reported in Taiwan [12]. However, no pediatric cases of diphyllobothriasis in Taiwan have been published in the scientific literature. This is the first child case infected with *D. latum* in Taiwan.

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CASE PRESENTATION

An 8-year-old Taiwanese boy had felt unwell for several days. When his mother discovered a white, flat,

noodle-like worm hanging down from his anus after defecation, she tried to pull the worm out but it broke. She and her son brought the worm segment to our hospital. The segment was a strobila (the chain of tapeworm proglottids). The length of the strobila was about 15 cm. *D. latum* infection was confirmed by examination of the gravid proglottids and eggs in the stool. All proglottids were wider than their lengths. An ovoid cirrus sac was observed in the anterior ventral side of each proglottid. The genital pore was located at the posterior end of the cirrus sac. The rosette-form uterus had less than seven uterine loops on both lateral sides (Figures 1 and 2). The eggs were light yellow in color, ellipsoidal with operculate characteristics, and had a small knob in the anti-operculum side (Figure 3). The average size of the 35 eggs in the boy's stool were $65.1 \pm 1.6 \times 45.3 \pm 1.2 \mu\text{m}$ (59.5–72.3 \times 41.6–47.8 μm).

He had suffered from intermittent abdominal cramping for about 1 year, but had not complained about or exhibited diarrhea or constipation. He had eaten "sashimi" (Japanese raw fish including sailfish, tuna, and salmon flesh) about once per month with his father since 1 year ago. This patient had never been abroad. Physical examination showed his height to be 133 cm (1SD–2SD), weight to be 35 kg (>2SD), and body mass index to be 19 (normal range, 15–19.3). We did not find pale conjunctiva or abdominal distention.

The laboratory data revealed the hemoglobin count to be 13.6 g/dL, the red blood cell count to be

$4.82 \times 10^6 / \mu\text{L}$, and mean corpuscular volume to be 83.8 fL. Platelet count was $272 \times 10^3 / \mu\text{L}$ and the white cell count was $5,800 / \text{mm}^3$ (segments 38%; lymphocytes 54%; eosinophils 4%; and atypical lymphocytes 3%). Vitamin B₁₂ level was 862.5 pg/dL (normal range, 200–950 pg/dL). He was treated with the first dose of praziquantel, about 8.5 mg/kg/dose for one dose. Several proglottids were expelled in stool during 5 days after treatment. The length of all expelled proglottids was about 183 cm (Figure 4), but no scolex was found in the stool specimens. The same dose of praziquantel (8.5 mg/kg/dose) was given again 1 week later.

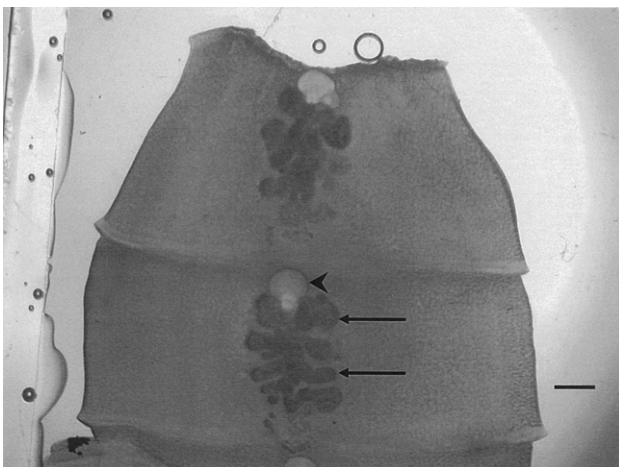


Figure 1. Two proglottids of *Diphyllobothrium latum* from the patient. Note a cirrus sac (arrowhead) and four uterine loops (arrows) in rosette-form. (Scale bar: 1.25 mm)

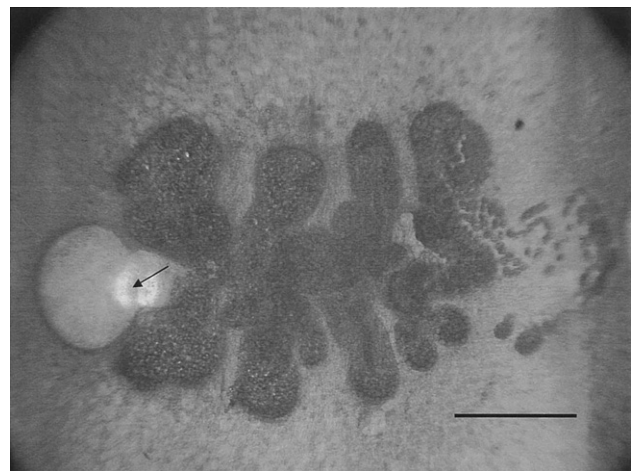


Figure 2. Proglottid of *Diphyllobothrium latum* from the patient. The genital pore (arrow) is located at the posterior edge of the cirrus sac. (Scale bar: 1.25 mm)



Figure 3. Egg of *Diphyllobothrium latum* found in the feces of the patient ($\times 400$). The eggs are ovoid, with an operculum (arrow) at one side and a small knob at the opposite end (arrowhead), and measure $65.1 \pm 1.6 \mu\text{m}$ in length and $45.3 \pm 1.2 \mu\text{m}$ in width. (Scale bar: 28 μm)

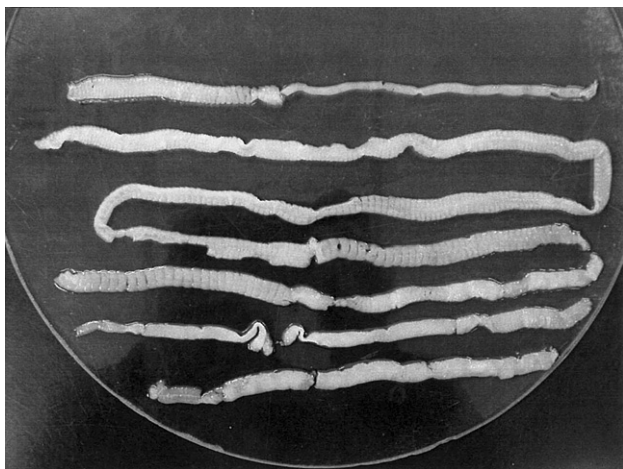


Figure 4. Overview of the strobila of *Diphyllbothrium latum* (about 183 cm), which was found in stool after praziquantel administration.

The stool was continuously checked for 3 months and no ova or proglottids were found.

DISCUSSION

The life cycle of *D. latum* requires two intermediate hosts. Eggs passed in the feces hatch into a small ciliated coracidium in water, which swim about until ingested by copepods and development of the second larval stage (the proceroid) is completed. When a fish ingests these infected freshwater crustaceans, the larvae continue growing in the flesh of the fish, developing to the next stage named plerocercoid. If, in its turn, this fish is ingested by a larger fish, the plerocercoid may be transferred to the larger fish but will not continue to grow in this transport host [3,13]. If a human eats the fish, the plerocercoid larva is not digested but remains in the small intestine and grows to adulthood. Because this disease is caused from eating raw fish, it very rarely occurs in children. However, infections in children have been reported [14–18]. The patient in this report is the first child case infected with *D. latum* in Taiwan. The patient's family did not find proglottids in the stool, and eggs were not found in the stool examination.

Various species of freshwater fish and ones that live in brackish water may be infected with the plerocercoid of *D. latum* [19]. In Europe and northern Asia, the main secondary intermediate hosts of *D. latum* are pike, ruffe, and perch, but salmonids have been and continue to be reported as hosts of this tapeworm

[6,17]. The patient and his family regularly ate sashimi prepared from sailfish, tuna, and salmon flesh in a Japanese restaurant. Because ingestion of raw or undercooked marine fish does not constitute a risk for *D. latum* infection, salmon flesh is the possible source of infection in this child.

Several species of *Diphyllbothrium* have been found to infect humans. As previously mentioned, *D. latum*, *D. pacificum*, and *D. nihonkaiense* are the main pathogens [2]. *D. pacificum* is distributed in South America and *D. nihonkaiense* in Japan [2,10,20]. *D. latum* is almost worldwide in distribution, occurring in northern temperate and subtropical areas of the world where pickled or insufficiently cooked freshwater fish are prominent in the diet [10,13]. In Taiwan, *D. latum* infections were recorded in two aborigines [12], and *D. latum* infection was reported in 1% each of 96 stray dogs and 95 stray cats in Taipei in 1999 [10]. Thus, when this current case came to our hospital, we considered *D. latum* infection because of the historical human case records and geographical distribution of this parasite. However, definitive diagnosis should be established following a laboratory examination.

Finding an operculated egg with a small knob in the anti-operculum side is the most accurate diagnostic method for diphyllbothriasis latum patients. However, the eggs of most diphyllbothriid parasites have the same characteristics. The size of the eggs among three popular species of *Diphyllbothrium* sp., and infection in humans differ from each other. According to Baer et al [21], the eggs of *D. pacificum* are 40–60 μm in length and 36–40 μm in width. The egg size of *D. nihonkaiense* and *D. latum* are 56.5–65.6 \times 38.4–46.4 μm and 58–76 \times 40–51 μm , respectively [10, 22]. The eggs in the stool of this patient are bigger than those of *D. pacificum*; they are more similar in size to those of *D. latum*.

The broadest tapeworm of *Diphyllbothrium* sp. in Asia is *D. latum* and *D. nihonkaiense*. Although Yamane et al [23] clarified the morphologic differences of gravid proglottids between both species of *Diphyllbothrium*, they still had practical difficulty in recognizing their specific identity. It is well known that the genital pore of *D. nihonkaiense* is located posteriorly to the center in the cirrus sac, and the uterus of *D. nihonkaiense* has 7–8 loops on both of the lateral sides [22]. However, *D. latum* has 3–6 uterine loops on each side of the uterus, and its genital pore is located near the posterior edge of the cirrus sac [24]. Thus, the

morphologic characteristics of gravid proglottids from this patient are more similar to those of *D. latum*.

Even though most cases of *D. latum* infection are asymptomatic, manifestations may include transient abdominal discomfort, diarrhea, vomiting, weakness, and weight loss. Occasionally, infection can cause acute abdominal pain and intestinal obstruction; very rarely cholangitis or cholecystitis may even be produced by migrating proglottids [11]. If the worm attaches to the proximal portion of the jejunum, clinical vitamin B₁₂ deficiency develops in a small percentage of those parasitized patients [19]. Tapeworm anemia occurs in about one of 50 infected people; the disease results primarily from vitamin B₁₂ deficiency [25]. Megaloblastic anemia caused by *D. latum* infection has been reported in children as young as 9 years old [18]. Fortunately, our patient presented only nonspecific symptoms of this infection. Pernicious anemia due to vitamin B₁₂ deficiency did not occur during infection.

Praziquantel is highly effective against intestinal tapeworms in low doses; treatment with 5–10 mg/kg yields 99–100% cure rates in patients with *D. latum* [26]. The drug on schistosomes causes spastic paralysis of the parasite musculature [27]. As the worms are seldom passed spontaneously after administration of this drug, a saline purge may be given 1–2 hours later to expel them in a more or less intact condition [25]. The reason for administering two doses of praziquantel to our patient was because we could not determine whether the whole worm had passed. An earlier report has also described intraduodenal amidotrizoic acid (gastrografin) injection as being able to remove this worm [28]. Fish that has been thoroughly cooked, brine-cured, or frozen at –10°C for 24–48 hours is safe for consumption [13]. Although Taiwan is in the subtropical area, more and more people have an interest in eating raw fish (especially salmon). Doctors should be made aware of the possibility of this infection.

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廣節裂頭條蟲感染： 台灣第一例兒童病例報告

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廣節裂頭條蟲感染是一種腸道的寄生蟲感染，常是食入含有廣節裂頭條蟲的全尾幼蟲的生淡水魚肉而感染。我們報告一個八歲大的男孩主訴在排便時發現蟲體。其他症狀包括將近一年的輕微腹痛。實驗室檢查並無發現貧血或維他命 B₁₂ 的缺乏。確定診斷是由觀察生殖節片中有與廣節裂頭條蟲特徵相符的玫瑰花瓣形狀的子宮及典型的卵蓋和蟲卵大小。此病人在近一年中有食用未煮熟魚肉的經歷，其感染源可能為鮭魚。我們使用 praziquantel 治療這病人，治療後他排出約 183 公分的蟲體。廣節裂頭條蟲感染通常流行在北方高緯度的地方。這病人是台灣第一例的小兒病例報告。

關鍵詞：兒童病例，廣節裂頭條蟲症，廣節裂頭條蟲

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