Case Report

Fish tapeworm and sushi

Nancy Craig MD CM CCFP

A variety of parasitic infections might be acquired by ingesting raw or undercooked fin fish (Table 1).1-3 Fish tapeworm, or Diphyllobothrium spp, is acquired by eating raw or undercooked freshwater or anadromous fish (ie, sea fish that spawn in freshwater rivers, such as salmon). Marinated and smoked fish can also transmit the worm.4 While cases in previously endemic areas have decreased, likely because of improved sewage treatment processes, cases have increased in other parts of the developed world,5-9 presumably owing to increased consumption of raw fish.4 The widespread popularity of Japanese sushi (bite-sized pieces of cold cooked rice topped with fish, eggs, or vegetables and wrapped in seaweed) and sashimi (slices of raw fish) is a contributor, but other popular dishes might also be implicated, such as raw salted or marinated fillets (which originate from Baltic and Scandinavian countries), carpaccio (very thin slices of raw fish common in Italy), tartare maison (raw salmon) and poisson du lac façon nordique (in French-speaking Europe), and ceviche (lightly marinated fish in Latin America).4

Case

A 43-year-old woman presented to an Edmonton, Alta, emergency department with acute onset of diarrhea and vomiting, and was diagnosed with gastroenteritis. The acute illness resolved, but the patient came to the clinic 8 weeks later complaining of unresolved diarrhea. She was otherwise in good health. There was no history of travel. A workup was ordered, including the following: complete blood count; vitamin B12 level; liver function and lipase tests; hepatitis A, B, and C screening; tissue transglutaminase test; stool for occult blood; and stool culture and examination for ova and parasites.

However, the following day, before any of the workup was done, the patient passed a 75-cm flat worm. She took it to a laboratory where it was identified as Diphyllobothrium latum species segments. All other tests ordered came back with normal or negative results, except for an indeterminate hepatitis A immunoglobulin G. On review, the patient described herself as a “regular” sushi consumer. She could not recall any other raw fish consumption, and no more detail concerning the type or source of her sushi was obtained. She was treated with 600 mg of praziquantel. Follow-up stool testing for ova and parasites 2 weeks later showed negative results.

Discussion

The eggs of Diphyllobothrium species hatch into embryos (coracidia) after 2 weeks in cool fresh water. These are ingested by copepods (the first intermediate host), where they develop into the first larval stage, or procercoids, over 2 to 3 weeks. When the copepod is eaten by fish, the procercoids migrate into the muscle fibres of the fish where they metamorphose into the second larval stage, or plerocercoids. Raw fish consumption by a definitive host (carnivore mammals such as bears, dogs, or undercooked fin fish) will become more common.

EDITOR’S KEY POINTS

- Diphyllobothriasis is infection of the small intestine by the broad tapeworm Diphyllobothrium spp acquired from eating undercooked or raw fish. With the increasing popularity of sushi and sashimi, it can be expected that diphyllobothriasis will become more common.
- Diphyllobothriasis infections are often asymptomatic and can persist for years.
- Symptoms include fatigue, constipation, diarrhea, vague abdominal discomfort, and less commonly vomiting.
- Check for vitamin B12 deficiency in suspected and proven cases.
- Treatment is a single dose of 10 to 25 mg/kg of praziquantel.

EDITORS’ KEY POINTS

- La diphyllobothriase est une infection de l’intestin grêle causée par le ténia large Diphyllobothrium sp et acquise en mangeant du poisson mal cuit ou cru. Étant donnée la popularité grandissante des sushis et du sashimi, on peut s’attendre à ce que les cas de diphyllobothriase deviennent plus fréquents.
- Les diphyllobothriases sont des infections souvent asymptomatiques et elles peuvent persister pendant des années.
- Parmi les symptômes, on peut mentionner la fatigue, la constipation, la diarrhée, un vague malaise abdominal et, moins souvent, des vomissements.
- Il faut vérifier s’il y a une carence de vitamine B12 chez les cas suspectés et diagnostiqués.
- Le traitement est l’administration d’une seule dose de 10 à 25 mg/kg de praziquantel.
and humans) allows the plerocercoids to attach to the small-intestine wall. There they develop into the mature tapeworm over 3 to 5 weeks. Mature *Diphyllobothrium* spp can grow from 2 m to 15 m in length, the largest known parasite in humans; can live for many years in the host intestine; and can discharge very large numbers of eggs per day, completing the cycle.4,8,10

**Symptoms and investigations**  
*Diphyllobothrium* infections are often asymptomatic. When symptoms occur, they are often mild and vague, including fatigue, constipation, and poorly defined abdominal discomfort. Laboratory investigations tend to present normal results, but might show low vitamin B12 levels or frank pernicious anemia (if the worm has attached in the proximal small intestine, it can compete for vitamin B12 absorption).4 Often the first awareness of infection might be passing segments of the tapeworm in the stool,5-7 as the patient in this report did, whose diarrhea might have been due to an unrelated illness. Diagnosis is made by identification of ova or sometimes worm segments in the stool (Figures 1 and 2).

**Treatment**  
Treatment is usually 10 to 25 mg/kg of praziquantel given as a single dose.4 Stool culture for ova should be negative a week after treatment; occasionally a second dose might be needed.6 While treatment is generally completed in a single dose, segments might continue to be evacuated over a prolonged period, which can be distressing to patients and their families. If vitamin B12 levels are low, they generally return to normal ranges within a period of several months.4 While praziquantel is not officially indicated for this use in Canada, it is the accepted treatment in the literature. Niclosamide, 2 g as a single dose, is another accepted treatment, but it is not available in Canada.

**Prevention**  
Prevention can be accomplished on a population level by good sewage treatment plants interrupting the cycle at the point where eggs are discharged back into the water, when humans are the definitive host. This is the likely reason for the decline of diphyllobothriasis in previously endemic areas such as Scandinavia4 and coastal areas of Japan.7

On an individual level, consumers should be aware of the risks of diphyllobothriasis with consuming uncooked
case Report

Fish. Sushi and sashimi are now available not just in restaurants, but also in the deli sections of many grocery stores. Marketers should consider affixing labels to the packaging, assuring consumers that proper preparations have been completed to minimize risks of fish tapeworm. Those who prepare fish should be aware that cooking at a temperature of only 55°C for 5 minutes will kill the larvae; freezing to -20°C for 7 days, or flash freezing to -35°C for 15 hours, as long as the flesh is less than 15 cm thick, effectively kills the larvae also. Sushi and sashimi chefs should use only fish frozen in this way. While these freezing protocols are the standards required by public health regulations, they are not easy for public health inspectors to verify.

Relevance

With the increasing popularity and availability of sushi in restaurants and grocery stores, one might expect to see an increase in the number of cases of diphyllobothriasis such as this one. Ching described a substantial increase

Table 1. Parasitic infections acquired by ingesting raw fish

<table>
<thead>
<tr>
<th>Category</th>
<th>Genus, Species</th>
<th>Sources</th>
<th>Symptoms</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nematodes</td>
<td>Anisakis simplex</td>
<td>Raw or undercooked fish or squid</td>
<td>Acute (1-2 h after ingestion, maybe up to 14 d): sudden, severe, episodic epigastric distress, sometimes nausea and vomiting</td>
<td>Ultrasound: might show small-bowel dilatation; thread-like gastric filling defects</td>
<td>Spontaneous recovery; occasional endoscopic removal of worms</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Chronic: diarrhea, urticaria, occasional coughing up of larvae, intestinal pseudo-obstruction</td>
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<tr>
<td>Trematodes (liver flukes)</td>
<td>Clonorchis sinensis</td>
<td>Korea, China, Taiwan, Vietnam, and Japan; raw or undercooked fish</td>
<td>Acute (within 1 wk of ingestion): fever, chills, tender hepatomegaly</td>
<td>Stool for ova</td>
<td>Praziquantel</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Chronic: asymptomatic; occasional cholangitis or pancreatitis</td>
<td></td>
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<tr>
<td>Echinostoma</td>
<td>southeast and east Asia; raw or undercooked fish</td>
<td>Gastroenteritis, anemia, headaches, dizziness, stomach pain, diarrhea, anorexia, eosinophilia</td>
<td>Stool for ova</td>
<td>Mebendazole, albendazole, or praziquantel</td>
<td></td>
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<tr>
<td>Trematodes (intestinal flukes)</td>
<td>Metorchis conjunctus</td>
<td>Raw white sucker fish (case report in Quebec)</td>
<td>1-15 d incubation; abdominal pain, fever, diarrhea, headache, nausea</td>
<td>Stool for ova or serology</td>
<td>Praziquantel or spontaneous resolution</td>
</tr>
<tr>
<td></td>
<td>Heterophyes spp</td>
<td>Middle East, Asia; raw, marinated, or undercooked fish</td>
<td>Abdominal pain, diarrhea</td>
<td>Stool for ova</td>
<td>Praziquantel</td>
</tr>
<tr>
<td></td>
<td>Metagonimus spp</td>
<td>Middle East, Asia; raw, marinated, or undercooked fish</td>
<td>Abdominal pain, diarrhea</td>
<td>Stool for ova</td>
<td>Praziquantel</td>
</tr>
<tr>
<td></td>
<td>Nanophyetus salmincola</td>
<td>North America; raw, undercooked, or smoked fish</td>
<td>Diarrhea, abdominal pain, nausea and vomiting, fatigue, weight loss</td>
<td>Stool for ova</td>
<td>Spontaneous resolution or antiparasitic agents</td>
</tr>
<tr>
<td>Cestodes</td>
<td>Diphyllobothrium latum</td>
<td>Raw, undercooked, or marinated fish</td>
<td>Abdominal pain, diarrhea, eosinophilia, occasional B12 deficiency</td>
<td>Stool for ova or passage of proglottids</td>
<td>Praziquantel or niclosamide*</td>
</tr>
<tr>
<td>Protozoa</td>
<td>Giardia lamblia</td>
<td>North America; home-canned salmon; China, koi pla (ie, fish soup), using uncooked freshwater fish</td>
<td>Nausea, chills, fever, epigastric pain, foul-smelling diarrhea (might be mucous-mixed, bloody)</td>
<td>Trophozoites or cysts in stool</td>
<td>Metronidazole</td>
</tr>
</tbody>
</table>

*Praziquantel is indicated in Canada for the treatment of Schistosoma and some liver flukes, but not specifically for fish tapeworm. It is recognized as a treatment for Diphyllobothrium spp elsewhere, as is niclosamide. Niclosamide is not available in Canada.

Data from Butt et al,1 van Voorthuis and Weller,2 and Eastburn et al.3

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**Figure 1.** *Diphyllobothrium latum* ova wet mount
in the number of cases in British Columbia between the 1970s and the early 1980s, attributed to increasing consumption of uncooked salmon. A MEDLINE search using the terms *diphyllobothriasis* and *sushi* revealed a number of case reports from a variety of places around the world, only 3 of which had North American connections. In all cases, raw or undercooked fish were consumed, often salmon species, but sometimes perch, char, or pike. Sushi and sashimi restaurants were specifically implicated in some reports. Additional cases are likely occurring but are not being reported in the literature. Primary care physicians should keep the possibility in mind.

**Conclusion**

Given the current popularity of sushi and sashimi in North America, and the rarity of case reports of diphyllobothriasis in North American literature, one might speculate that there is generally good compliance with proper freezing of fish for these products. However, in cases of vague abdominal complaints or unexplained low vitamin B12 levels, it might be worth asking patients about types of fish consumed, particularly bearing in mind the popularity of sushi and sashimi, and it might be worth checking the stool for *Diphyllobothrium* ova.

**References**


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**Figure 2. Diphyllobothrium latum proglottids**

Photo credit: D.M. Raymondo MLT CLS(M)