

Fish tapeworm infections (diphyllobothriasis) in Canada, particularly British Columbia

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Although the risk of diphyllobothriasis is generally low in Canada, fish tapeworm infections seem to have become more frequent in recent years. This increase is probably a consequence of the growing popularity of raw or inadequately cooked ethnic fish dishes or of a preference for lightly cooked fish, especially salmon. Only freshwater fish become infected with the larvae, but not everyone may realize that salmon can acquire the parasites before they leave their native lakes and rivers for the sea. If fish known to be sources of the tapeworms are to be eaten raw they should first be well frozen or salted to kill the larvae. Physicians should regard fish tapeworm infection as a notifiable disease. In Canada niclosamide, the drug of choice, is available from the manufacturer on a patient-by-patient basis.

Bien que le risque de bothriocéphalose soit généralement faible au Canada, cette infection semble être devenue plus fréquente au cours des dernières années. Cette augmentation découle probablement de la popularité grandissante des plats au poisson cru ou inadéquatement cuit de certaines cuisines ethniques ou d'une préférence pour le poisson peu cuit, surtout le saumon. Seuls les poissons d'eau douce sont porteurs de la larve, mais tous ne se rendent pas compte que le saumon peut être infecté par

ce parasite avant qu'il ait quitté son lac ou rivière d'origine pour atteindre la mer. Tout poisson susceptible d'être porteur de *Diphyllobothrium latum* et destiné à être consommé cru devrait d'abord être bien surgelé ou salé afin de tuer les larves. Les médecins doivent considérer l'infection à *D. latum* comme une maladie à déclaration obligatoire. Au Canada on peut obtenir de la niclosamide, qui est le médicament de choix, auprès du manufacturier après autorisation pour chaque patient.

In Canada and the United States the risk of diphyllobothriasis — infection with fish tapeworms of the genus *Diphyllobothrium* — is generally quite low, for most fish prepared for consumption are only lightly infected and are cooked sufficiently to kill the infective larvae. In both countries, though, the infections seem to have become more frequent. According to the records of the British Columbia Division of Laboratories, the mean annual number of cases known in the province increased from 7.7 in the 1970s to 24 in the first 3 years of the 1980s (D. Proctor: personal communication, 1983). In the United States an apparent increase has been attributed to possible misdiagnosis in the laboratory, where tapeworm eggs are identified, and to the influx of people from southeast Asia, presumably arriving with tapeworm infections.^{1,2} However, the consumption of raw or inadequately cooked salmon has been implicated in both Canada and the United States. The source of British Columbia's first reported case of infection with *D. ursi*, in 1973, was probably salmon in the

form of liver paste.³ A multistate outbreak of diphyllobothriasis in the United States in 1980 was traced to the importation of sockeye salmon from Alaska.⁴ At least 32 people became infected.

The most likely reason for the recent increase in fish tapeworm infections in British Columbia and the United States is the consumption of uncooked salmon. The more efficient shipment of fresh, unprocessed fish, the growing popularity of ethnic raw fish dishes (smoked or marinated) and the growing preference for lightly cooked fish, both in restaurants and in the home, are increasing the risks of human infection. This article reviews the fishes that are sources of infection, as well as the manner of transmission to humans, diagnosis, treatment and means of preventing infection.

Sources of infection

People usually acquire the parasites by eating freshwater fish that are either raw or incompletely cooked and contain the tapeworm larvae, or plerocercoids. Unspecified *Diphyllobothrium* plerocercoids have been reported in 30 fish hosts.⁵ Three of the five species of *Diphyllobothrium* reported in Canadian fishes⁵ are known to infect humans: *D. latum*, the broad fish tapeworm; *D. dendriticum*; and *D. ursi*. In 1983 eight of nine British Columbia patients had *D. ursi*; the ninth had *D. dendriticum*, its identification being based on segments from the hosts (unpublished data, 1983).

Plerocercoids of *D. latum* are found unencysted in the flesh or body cavity of such freshwater fish as northern pike, walleye, sauger

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and yellow perch. Infected fish have been reported in the Northwest Territories, Alberta, Saskatchewan, Manitoba and Ontario.

The larvae of *D. dendriticum* encyst on the viscera or body wall or live unencysted in the liver of rainbow trout, short-jaw cisco, lake trout, Arctic char, Dolly Varden and kokanee. Infected fish have been reported from British Columbia and Ontario,⁵ but the distribution of *D. dendriticum* is probably much wider than that.

D. ursi larvae encyst on the viscera but can also be found unencysted within the flesh of salmon. Rainbow trout, Dolly Varden, and sockeye and chinook salmon were found to be infected in surveys I made in British Columbia (unpublished data, 1979-83). Though originally described in Alaska, *D. ursi* may exist wherever salmonid fish and bears are found together in the northern hemisphere.

Determining the source of a particular human infection has been complicated by improvements in commercial transportation. The marketing of fresh fish has become so efficient that Pacific salmon can now be enjoyed in Toronto or Montreal within hours of being caught. Similarly, fresh pike from Manitoba is available on the Vancouver market. Consequently, the origin of a fish tapeworm may be difficult to trace, and all the more so if the patient has eaten a variety of fish raw.

Anadromous fish can acquire plerocercoids in their native lakes or rivers before they migrate to the sea. Salmon caught in marine waters can have plerocercoids that are still infective. Reports of *D. latum* in salmon⁵ need to be confirmed because only *D. ursi* was identified after the larvae from sockeye salmon were fed to golden hamsters (unpublished data, 1983).

Transmission to humans

The likelihood of a person becoming the host for a fish tapeworm depends on the frequency with which the uncooked flesh of the source fish is consumed and on the abundance and location of the larvae in the fish. The feeding behaviour of the host fish, the abundance

of the infected plankton or other, smaller fish they ingest, and the presence of definitive hosts, such as bears and fish-eating birds, are key factors in the numbers of the larvae found in food fishes. Larger, older fish will generally have accumulated more tapeworm larvae.

Fisheries crews should be trained to monitor the catches of sport or commercial fishing, and heavily infested fish should be rejected for human consumption because of the greater risks of infection.

The location of the larvae within the fish also influences the risk of infection. Larvae found in the liver or flesh of rainbow trout, pike and salmon are obviously more likely to be eaten than larvae found on the viscera. However, larvae of all tapeworms can excyst and move about so as to contaminate the body cavity, roe or flesh of the fish after capture. The larvae are easily overlooked because they are small (1 to 2 cm long) and may be concealed in the flesh; the cysts are smaller still (4 mm in diameter).

Diagnosis

People may have the following complaints 1 to 3 weeks after having eaten infected fish: abdominal pain, abdominal distension, flatulence, and diarrhea alternating with constipation. However, there may be no symptoms, in which case the infection will go undetected until the person notices portions of the tapeworm that have been expelled with the feces. The whole tapeworm can also be passed from the intestine spontaneously. In a small number of cases of *D. latum* infection in Finland the tapeworms caused serious megaloblastic anemia by absorbing large amounts of vitamin B₁₂ when the patients' capacity to absorb the vitamin was already impaired.⁶ Treatment to remove *D. latum* resulted in rapid resolution of the anemia.

The best known fish tapeworm in Europe and North America is *D. latum*, yet most records of it in fish-eating carnivores and in humans are misidentifications.⁶ The diagnosis of *D. latum* infection has usually been made on the basis of the eggs recovered from stool samples. The size and shape of the

operculated eggs, with their minute terminal knobs, are characteristic for the genus, but comparison of tapeworm eggs obtained from experimental animals and human hosts has shown egg size to be too variable for the identification of species. The problem of reporting *D. latum* on the basis of stool sample analysis has been discussed elsewhere.⁷

The species of *Diphyllobothrium* are most readily distinguished by the shape of the scolex and the length of the neck — parts normally lodged in the intestine of the host. Drug treatment may be necessary to recover the entire tapeworm for identification purposes. Tapeworm segments, as well as eggs, are often passed in the stools of infected persons. These can also be used to identify the species after careful processing, staining and morphologic studies. The shape and size of the ovary, the position of the genital pore, and the relative widths and lengths of the segments appear to be useful features. Morphologic distinctions have recently been made for both larval and adult stages of two of the three species known to infect humans in Europe^{8,9} and Canada.

Treatment

Niclosamide, which is effective in a single dose, is the drug of choice. The formulation has been removed from the Canadian market because of its saccharin content, but it can be obtained quickly by contacting the manufacturer, Miles Laboratories, in Toronto. The company will clear the release of the drug with the health protection branch of the Department of National Health and Welfare on a patient-by-patient basis.

Prevention of infection

Thorough cooking kills any larvae present in food, but the public's taste for lightly cooked or even raw fish appears to be growing, especially with regard to ethnic dishes, such as sashimi, sushi, lox and gravlax. There are no federal or provincial regulations concerning the consumption of raw fish. However, fish that is to be served in this way can be rendered free of infective larvae by either freezing or salting. Fishes

should be frozen at -18°C for at least 24 hours, and longer if they are larger than average. Since not all freezers are as cold as they need to be for this purpose, longer freezing times are recommended: a temperature of -10°C , for instance, maintained for 72 hours, would also be effective.¹ Under only refrigerated (5°C) or chilled (0.5°C) conditions tapeworm larvae can remain infective for at least 6 days. Salting fish with a 10% to 20% solution will also kill the larvae, but 1 or 2 hours must be allowed for the salt solution to reach plerocercoids deep in the meat of the fish.

Fish that is to be used raw should be kept frozen until it is needed, thawed at refrigerated temperatures, and washed with fresh water to avoid bacterial contamination.¹⁰

The public needs to be informed about the risk of infection with tapeworms when raw fish, including salmon caught in salt water, is consumed. People should appreciate the fact that, unless first frozen or salted, the fish in some dishes may contain infective larvae. Canadian physicians should consider diphylobothriasis in their patients and should notify health officials when it is diagnosed.

References

1. BARCLAY WR: Diphylobothriasis. *JAMA* 1981; 246: 2483
2. DOOLEY JR: Diphylobothriasis in Americans and Asians [C]. *JAMA* 1982; 247: 2230-2231
3. MARGOLIS L, RAUSCH RL, ROBERTSON E: *Diphylobothrium ursi* from man in British Columbia — first report of this tapeworm in Canada. *Can J Public Health* 1973; 64: 588-589
4. JURANEK DD: Parasitic diseases related to changing life styles [abstr]. *Mol Biochem Parasitol [Suppl]* 1982; suppl: 548
5. MARGOLIS L, ARTHUR R: Synopsis of the parasites of fishes in Canada. *Bull Fish Res Board Can* 1979; 199: 270
6. SCHMIDT GD, ROBERTS LS: *Foundations of Parasitology*, 2nd ed, Mosby, Toronto, 1981
7. CURTIS MA: Problems in reporting *Diphylobothrium latum* (fish tapeworm) in Canada on the basis of stool sample analysis. *Can Dis Wkly Rep* 1980; 6: 49-50
8. ANDERSEN K: A marine *Diphylobothrium* plerocercoid (Cestoda, Pseudophyllidea) from blue whiting (*Micromestius poutasson*). *Z Parasitenkd* 1977; 52: 289-296
9. Idem: Studies on the helminth fauna of Norway. XXXIV: The morphological stability of *Diphylobothrium* Cobbold. A comparison of adult *D. dendriticum* (Nitzsch), *D. latum* (L.) and *D. ditremum* (Creplin) developed in different hosts. *Norw J Zool* 1973; 23: 45-53
10. MCGINNIS JA: Raw seafood can be a hazardous food. *J Environ Health* 1983; 45: 182-185

NEW BOOKS OF INTEREST

This list is an acknowledgement of the books received that we intend to send out for review.

HANDBOOK OF GERIATRIC DRUG THERAPY FOR HEALTH CARE PROFESSIONALS. Edward D. Sumner. 208 pp. Lea & Febiger, Philadelphia, 1983. \$17.50, paperbound. ISBN 0-8121-0904-X

ILLUSTRATED TEXTBOOK OF GYNAECOLOGY. Eric V. Mackay, Norman A. Beischer, Lloyd W. Cox and Carl Wood. 496 pp. Illust. W.B. Saunders Company, Toronto, 1983. \$39.50, paperbound. ISBN 0-03-900240-3; ISBN 0-03-900241-1 (hardcover)

PREVENTION OF CORONARY HEART DISEASE. Practical Management of the Risk Factors. Norman M. Kaplan and Jeremiah Stamler. 219 pp. Illust. W.B. Saunders Company, Toronto, 1983. \$46.20. ISBN 0-7216-5277-8

THE PRITIKIN PROMISE. 28 Days to a Longer, Healthier Life. Nathan Pritikin. 432 pp. Illust. Musson Book Company, Don Mills, Ont., 1983. \$24.95. ISBN 0-671-49477-3


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