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Review Article

Opisthorchiasis: An Emerging Foodborne Helminthic Zoonosis of Public Health Significance

Mahendra Pal[1*], Dimitri Ketchakmadze[2], Nino Durglishvili[3]

[1]Narayan Consultancy on Veterinary Public Health and Microbiology, Gujarat, India
[2]Faculty of Chemical Technologies and Metallurgy, Georgian Technical University, Tbilisi, Georgia
[3]Department of Sociology and Social Work, Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia
[4]Department of Parasitology, Tabriz Branch, Islamic Azad University, Tabriz, Iran

Abstract

Opisthorchiasis is an emerging foodborne parasitic zoonosis that has been reported from developing as well as developed nations of the world. Globally, around 80 million people are at risk of acquiring *Opisthorchis* infection. The source of infection is exogenous, and ingestion is considered as the primary mode of transmission. Humans get the infection by consuming raw or undercooked fish. In most cases, the infection remains asymptomatic. However, in affected individuals, the clinical manifestations are manifold. Occasionally, complications including cholangitis, cholecystitis, and cholangiocarcinoma are observed. The people who have the dietary habit of eating raw fish usually get the infection. Certain occupational groups, such as fishermen, agricultural workers, river fleet employees, and forest industry personnel are mainly infected with *Opisthorchis*. The travelers to the endemic regions who consume raw fish are exposed to the infection. Parasitological, immunological, and molecular techniques are employed to confirm the diagnosis of disease. Treatment regimens include oral administration of praziquantel and albendazole. In the absence of therapy, the acute phase transforms into a chronic one that may persist for two decades. Presently, there is no vaccine available against *Opisthorchis* species. Elimination of human host reservoir can be achieved by the examination of stool and treatment of the positive cases. Consumption of thoroughly cooked fish, protection of water bodies, decontamination of sewage, dehelminthization of domestic carnivores, proper washing of hands and kitchen utensils after processing raw fish, and education of the people about the hazards of eating raw or undercooked fish are the practical strategies for the prevention of this emerging zoonotic helminthiasis.

Keywords: Emerging zoonosis, Fish, Foodborne helminth, Opisthorchiasis, Public health

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Introduction

According to the World Health Organization (WHO), zoonoses are defined as diseases and infections that are naturally transmitted between the vertebrate animals and humans (1). Presently, there are more than 300 zoonotic diseases that are caused by viruses, bacteria, fungi, protozoa, helminths, and ectoparasites) and are transmitted through different routes (2-6). Parasitic diseases caused by protozoa, cestode, nematode, trematode, and ectoparasites are significant causes of morbidity and mortality and are reported in both genders, all age groups, urban and rural areas, all seasons, and immunocompetent as well as immunocompromised individuals (2,5,6). There are many foodborne parasitic zoonoses, which include amoebiasis, anisakiasis, balantidiasis, capillariasis, clonorchiasis, cryptosporidiosis, dioctophymiosis , diphyllobothriasis, echinostomiasis, giardiasis, gnathostomiasis, opisthorchiasis, sarcocystosis, toxoplasmosis, and trichinellosis (2,5-7). Among these diseases, opisthorchiasis is an emerging fish-borne helminthic zoonosis of public health significance (2,8,9) and is caused by several species of *Opisthorchis*, such as *O. felineus*, *O. viverrini*, *O. guayaquilensis*, *O. noverca* (2,10-12). *Opisthorchis* is a liver fluke that has the potential to infect the liver, bile duct, and gall bladder in human beings. The parasites are reported from many countries of the world, such as Belarus, Cambodia, China, Ecuador, Germany, India, Italy, Kazakhstan, Laos, Malaysia, the Philippines, Poland, Russia, Siberia, Singapore, Thailand, Turkey, Ukraine, and Vietnam (2,9,11-13).

It is estimated that approximately 80 million people are at risk of getting *Opisthorchis* infection worldwide (8). Currently, around 10 million people in Northeast Thailand and Lao PDR are found to be infected with *Opisthorchis viverrini* (14,15). The prevalence of *O. viverrini* infection may reach up to 90% in highly endemic areas of Thailand (16). The economic losses due to *O. viverrini* in Thailand and Laos were estimated at approximately $120 million

*Corresponding Author: Mahendra Pal, Email: palmahendra2@gmail.com

each year (17). The incidence of infection seems to be higher in rural people as compared to the urban ones (M. Pal, Personal Communication). In this context, Andrews et al (14) reported that *O. viverrini* remains an underestimated parasite in global human health. People who travel to the endemic regions and eat raw or undercooked fish are at risk of acquiring *Opisthorchis* infection (9). The objective of this study is to delineate the growing significance of opisthorchiasis as an emerging foodborne zoonosis of global public health concern.

Life Cycle of Parasite

The complex multi-host life cycle of *Opisthorchis* is shown in Figure 1. The parasite has two intermediate hosts, including snails and freshwater fish, and cats, dogs, and humans are definitive (final) hosts. The eggs of the parasites are excreted through the feces of an infected mammal and may enter the water habitat where they are ingested by a freshwater snail, the first intermediate host. The eggs hatch in the alimentary canal of the snail and are called miracidia, which penetrate the intestine and develop into sporocysts. The sporocysts develop into redia and mature into cercariae that leave the snail and penetrate freshwater fish, the second intermediate host. They encyst as metacercariae in the muscles or under the scales of the fish. The infection in the final hosts occurs by ingesting raw or inadequately cooked fish containing metacercariae (9).

Transmission

Humans get the infection following the ingestion of raw or undercooked fish, crabs, or crayfish containing metacercaria of *Opisthorchis*. The consumption of slightly salted fish or sun-dried fish may also result in disease as these methods of food preservation cannot kill the infective stage of the parasite (2). The parasite is transmitted via snails that act as the first intermediate host to freshwater fish, which serves as a second intermediate host, and then to human beings and other fish-eating mammals. Cats, dogs, and other fish-eating mammals serve as reservoirs for *Opisthorchis* and get the infection by eating the fish containing the metacercaria of the parasite (2,9).

Clinical Spectrum

Humans

The patient can present a variety of symptoms, such as indigestion, abdominal pain, nausea, fever, chills, rhinitis, bronchitis, anorexia, diarrhea, or constipation, facial swelling, myalgia, arthralgia, jaundice, hepatomegaly, tachycardia, swollen lymph nodes, enlarged gall

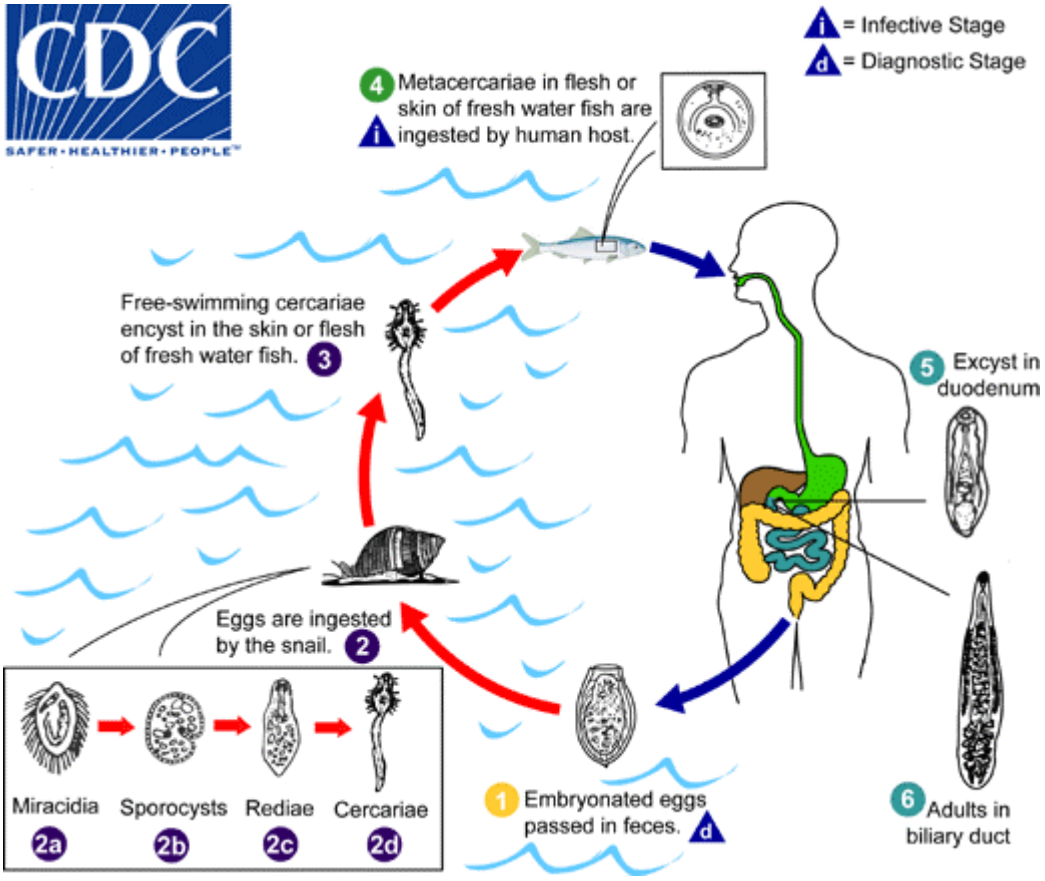

Figure 1. Life Cycle of Opisthorchis (9).

bladder, eosinophilia, weight loss, and skin eruptions (2,9,10,18,19). It is pertinent to mention that *O. viverrini* is found to be associated with cholangiocarcinoma. One study conducted on 103 patients with cholangiocarcinoma in Thailand by Parkin et al (20) revealed that 75% of cases of liver tumor could be attributed to *O. viverrini* infection. However, further comprehensive and systematic studies should be undertaken to conclusively establish the role of *O. viverrini* in cholangiocarcinoma.

Animals

The symptoms in animals include fever, diarrhea, jaundice, and carcinoma in the liver, lung, and lymph nodes (2).

Diagnosis

Clinical signs and symptoms may lead to a tentative diagnosis of opisthorchiasis. Therefore, laboratory testing is needed to establish an unequivocal diagnosis of the disease. Computed tomography (CT) and magnetic resonance imaging (MRI) may be helpful in locating the cysts containing the parasite. The microscopic identification of parasite eggs in stool specimens is a simple and easy method to diagnose the infection. The eggs of *Opisthorchis* should be differentiated from *Clonorchis*. Enzyme-linked immunosorbent assay (ELISA) technique can be useful in serologic diagnosis (2). Recently, Wongratanacheewin et al (22) concluded that polymerase chain reaction (PCR) can detect *O. viverrini* in human stool specimens. Hence, it is suggested that the efficacy of molecular tools to diagnose the disease caused by other species of *Opisthorchis* should also be assessed.

The use of sonography is very helpful in the early detection of carcinoma changes and bile duct cancer caused by *Opisthorchis* (21).

In serological tests, eosinophilia (up to about 40%), increased sedimentation, and sometimes elevated liver enzymes and specific antibodies (IgM, IgG, IgE) can aid in the diagnosis (23).

Treatment

Praziquantel is an anti-parasitic drug that is given orally at the dose of 25 mg/kg three times a day for two days and is considered the remedy of choice (2,21). Another drug named albendazole (10 mg/kg orally once a day for 7 days) is also recommended for treating *Opisthorchis* infection (9).

Prevention and Control

In the absence of a vaccine, measures such as avoiding the consumption of raw or undercooked freshwater fish, cooking the fish (until internal temperature reaches at least 63°C), freezing the fish at -20°C or below for at least 7 days, avoiding feeding raw fish to the carnivores, avoiding the contamination of fish ponds by feces, and sanitary disposal of feces and other waste materials are proved to be effective in preventing the disease (2). It is recommended that pickled, smoked, or slightly salted fish should not be consumed as they may contain infective parasites (2). In addition, health education of people in endemic areas about the hazards of eating raw fish is highly imperative (2). It is pertinent to mention that the improvement of hygienic defecation can be very helpful in the interruption of the transmission cycle (24).

Conclusion

Opisthorchiasis is a widely prevalent emerging fish-borne helminthic zoonosis of public health significance both in tropical as well as temperate areas of the world. The disease is reported in both children and adults living in urban and rural areas. The parasite *Opisthorchis* requires one definitive host and two different intermediate hosts to complete the life cycle. The patient shows a wide variety of clinical symptoms. Complications of the disease are most commonly observed in the chronic stage. Definitive diagnosis is made by detection of eggs of *Opisthorchis* in the stool of the patient. Praziquantel is a safe and effective drug that is widely used for the treatment of opisthorchiasis. It is emphasized that studies should be undertaken on the pathogenesis, risk factors, and epidemiology of opisthorchiasis. Further studies to elucidate the role of *O. viverrini* in liver cancer may be rewarding.

Conflict of Interests

The authors declare that they do not have any conflict of interest.

Ethical Issues

Not applicable.

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Authors' Contribution

All the authors contributed equally. They read the final version and approved it for publication.

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