Air and Water Borne Diseases

Oryan et al., Air Water Borne Diseases 2015, 4:2
http://dx.doi.org/10.4172/2167-7719.1000e135

Editorial Open Access

# Water as a Potential Transmission Route of Infection with Tapeworms

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**Received date:** May 21, 2015, **Accepted date:** May 23, 2015, **Published date:** May 26, 2015



## Editorial

One of the most important issues related to public health is parasitic diseases. Many diseases are zoonotic, emerging or re-emerging zoonoses, prevalent and difficult to control [1]. Some of these diseases such as leishmaniasis, malaria, Chagas disease and so on are vector-borne causing by pathogens transmitted by arthropods [2-4]. Some others are food- or water-borne so that contaminated food or water may transmit and spread a pathogenic agent or a disease [5]. Water can be considered as a major source of human infection either directly or by indirect contamination via foods or vegetables prepared from contaminated water [6]. Infectious diseases caused by bacteria, viruses and parasites including protozoa, nematodes, trematodes or flukes, cestodes or tapeworms are the main contaminant agents for drinking water that should be eliminated [3]. One category of waterborne diseases includes those caused by the contamination of the drinking water by human or animal feces infected with the etiological agents of such diseases [7]. Helminthiases represent important public health problems with great economic impact in tropical and subtropical countries [1]. Nematodes include ascarids, pinworms, hookworms, strongylids, capillarids, flukes such as schistosomes and liver flukes, and tapeworms like the beef and pork tapeworms and cystic and alveolar hydatid ones are examples of waterborne parasitic diseases [3,5,8]. Waterborne zoonotic helminths may be spread directly from animals to humans or humans to animals through water that is either ingested or that consists of forms with ability of skin penetration [1]. The majority of waterborne diseases of parasitic origin are related to poverty [1,5]). Increase in population throughout the world, poor sanitary conditions, and inability to provide safe drinking water have led to increased importance of water-borne infections particularly those of zoonotic diseases [9]. These risk factors can facilitate disease transmission among animals and humans [9,10]. The waterborne helminthic diseases may be transmitted by fecal-contaminated water (cysticercosis and hydatid disease) or be aquatic snail-mediated (fascioliasis, schistosomiasis and cercarial dermatitis) or copepod-mediated (gnathostomiasis) [1,11].

Two of the important contaminants of water are tapeworms including Taenia and Echinococcus species [1,3,11]. Procine and bovine cysticercosis are serious zoonotic waterborne diseases caused by the larval stages of these tapeworms, metacestodes of *Taenia solium* and *T. saginata* namely *Cysticercus cellulosae* and *C. bovis*, respectively [1,11,12]. Particularly in rural areas with poor public health services, *T. saginata* is more prevalent than *T. solium*. The eggs of *T. saginata* are passed in human excreta and the intermediate hosts such as ruminants may ingest them in drinking water or with contaminated vegetation [1]. These eggs can lead to the formation of many cysts in the muscles of different parts of the body and therefore their condemnation [11]. Natural hosts of the adult stages of Taenia tapeworms are humans, whereas they occasionally may serve as intermediate hosts [1,11]. The eggs are shed in the feces and spread by water and transmission to intermediate hosts, i.e. cattle and pigs, occurs through ingestion of foodstuffs or water contaminated with infective eggs in the pastures fertilized with human sewage [1,5,11]. Many zoonotic parasites use water as a vehicle for transmission to their definitive or intermediate hosts either directly or via aquatic plants or fish-borne parasites. For instance, some animals become infected with Taenia spp. when they consume water source infected with the eggs [3,11]. Ova of *T. saginata* may be distributed in pastures irrigated with contaminated and untreated wastewater and therefore sheep or cattle grazing are at risk of infection [11].

Echinococcosis or hydatidosis is another waterborne disease infecting dogs and other canids as the definitive hosts and also intermediate hosts including ruminants, horses, and human beings in its cystic form [13-16]. The larvae of four species of Echinococcus including *E. granulosus* (cystic hydatid disease), *E. multilocularis* (alveolar hydatid disease), *E. vogeli* and *E. oligarthus* (polycystic hydatid doisease) can infect human beings [12,17]. The cysts are mostly developed in the liver, while they may infect other visceral organs such as the lungs, spleen, as well as kidneys. They can be life-threating due to liver failure, pulmonary edema and eventually anaphylactic shock [1]. This disease is more prevalent in the developing countries due to poor sanitary conditions and close proximity of people to animals [15]. Humans and other intermediate hosts become infected by accidental ingestion of the eggs of Echnicoccus spp. from contaminated soil, foods or water [1,5]. Possible transmission routes of the eggs to humans include eating contaminated uncooked foods from gardens, drinking contaminated water, haling dust containing tapeworm eggs or hands contaminated from fur or soil of infected dogs, cats or foxes while farming or gardening [17]. Fecal contamination of drinking water may occur in areas where dogs have access to drinking water sources [3,5]. Contamination of water system with sufficient quantities of infective larvae or ova can result in outbreaks. However, given the large size of ova and larvae, they would be removed from water systems in many countries by processes such as filtration and sedimentation. Nonetheless, the post-treatment contaminations in water systems with poor or non-strict treatment is possible [3,5,11].

With understanding the life cycle of these parasites, the cycle interruption and prevention of infection and disease can be achievable. Given the numerous cases of waterborne helminthiases due to the presence of helminth infective stages in the water sources, it is likely to prevent the disease transmission by skipping natural surface water [1]. In one study conducted by Yamamoto et al. [18], rearing cattle and pigs and the use of well water were recognized as the significant risk factors for human alveolar echinococcosis. Moreover, the use of tap water significantly decreased the risk of the disease. It was suggested that use of the piped water supply can reduce the risk of

echinococcosis infection. In some areas with open water for public use, there is a threat of parasite contamination that should operate a policy ensuring surveillance with regular monitoring [1].

Given the double effect of zoonotic diseases on animals and their productions and on human health, they must be noticed. Since most waterborne helminthiases result from contamination of water supplies with the infective stages, avoiding natural surface water may stop disease transmission [1,18]. However, this may not be possible in areas where there is no alternative source of safe water. Implementation of on-farm control measures to eliminate the contamination of agriculture water with human feces is a key factor in the control of many zoonotic parasitic infections [11]. Education can be remarkably effective in stopping infection with waterborne parasites and reducing rates of parasite transmission. Young children should be trained to drink only clean water, wash their hand before and after eating. Furthermore, in areas where these waterborne disease are endemic, people should be advised not to contact with suspicious water sources. For provision a safe water supply, treatment of water to reduce pathogens or the use of a clean water source are critical [7]. In endemic areas, deworming can be considered as a valuable tool in helminth control and prevention policies. Unfortunately, public awareness of hydatid disease and cysticercosis is low and unsufficient in most countries and people should be informed and trained about transmission routes of these disease and control and preventive measures.

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