



CONTAMINATED WATER AS A ROUTE OF HELICOBACTER PYLORI TRANSMISSION: REVIEW

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ABSTRACT

The definitive route of Helicobacter pylori transmission is unclear till now. Various studies are conducted to find out the possible route of Helicobacter pylori transmission so that the effective preventive majors can be taken to control the transmission. Many researchers pointed out contaminated water may be the major route for Helicobacter pylori transmission. In developing countries, the infection rate is very high where polluted water, poor socio-economic condition, poor personal hygiene are the major reasons behind it. The main theme of this study is to evaluate the previous data from the different study which suggests that contaminated water as a route of H. pylori transmission.

Keywords: Helicobacter pylori, Route, Transmission, Water, PCR

INTRODUCTION

Helicobacter pylori is a spiral-shaped flagellated, gram-negative microaerophilic bacteria found in the mucosa of the stomach. Barry Marshall and Robin Warren are the Australian scientists first identified it in 1982 in a people suffering from peptic ulcer disease and chronic gastritis [1,2]. *H. pylori* found in the alimentary tract and that penetrates the mucosa of the stomach and causes an ulcer. *Helicobacter pylori* can cause various clinical conditions like gastric ulcer, chronic gastritis, carcinoma of stomach, gastric mucosa-associated lymphoid tissue lymphoma [3,4]. Most of the infected people have no complaints but some people present with complaints of nausea, vomiting, dyspepsia, bloating, belching, pain in epigastrium and black tarry stool.

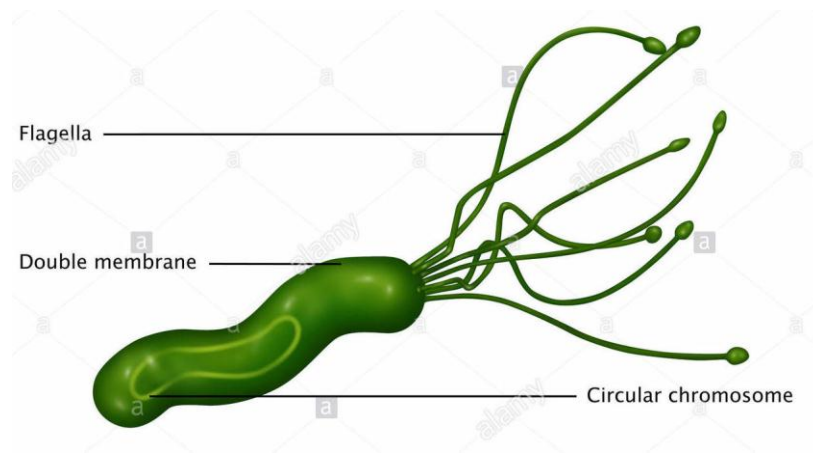


Figure: Structural image of *Helicobacter pylori*

About half of the population in this world is *H. pylori* positive and among them, more are from the developing countries [5]. In developing countries, many places there is lack of availability of the proper drinking water, people are unaware of health and sanitation and low socio-economic condition. Children are more susceptible to get infected and clinical symptoms occur decades after infestation. Many research shows there is the reduction in the infection of *Helicobacter pylori* in the developed countries because of the availability of quality drinking water, healthy socioeconomic status, and awareness about personal hygiene and sanitation. In various studies age, sex, socio-economic status, family size, an area of residence, personal hygiene, smoking, drinking alcohol, eating spicy food, drinking coffee and tea have shown association with *Helicobacter pylori* infection. If the person does not take antimicrobial agent after getting the infection it will persist for lifelong. There are non-invasive and invasive tests available to detect *Helicobacter pylori*. Invasive investigations are endoscopy with biopsy and histopathology, rapid urease test (RUT), culture, fluorescent in-situ hybridization (FISH) and polymerase chain reaction (PCR). Urease breath test, stool antigen test, immunoglobulin G, A and M serology and saliva antibody test are the non-invasive test. Urease breath test is a highly specific and sensitive diagnostic test for *Helicobacter pylori*. Triple and quadruple therapy is the

treatment options of *Helicobacter pylori* infection. Triple therapy includes Proton pump inhibitor, Amoxicillin or Metronidazole, and Clarithromycin, quadruple therapy includes Tetracycline, Metronidazole, Bismuth sulfate and Proton pump inhibitors.

Routes of H. Pylori Transmission:

There are different ways through which *H. pylori* gets transmitted, they are oral-oral, fecal-oral, gastro-oral, vector-borne and iatrogenic. The common ways for *H. pylori* transmission from one person to another person are fecal-oral and oral-oral routes [6,7]. Many researchers have shown that oral-oral transmission is among the family members. If one person in a family is infected there are more chances of infection in other family members [8,9]. Italian and German researchers have found that there is a high chance of infection among uninfected spouses who spend more time with an infected partner [10]. Some researchers also showed that there is the strong chance of vertical transmission to the child from the infected mother [11]. Thomas et al [12] found that isolation and growth of *Helicobacter pylori* in human feces which strongly suggest *Helicobacter pylori* can transmit by the fecal-oral route. The most important reasons behind the fecal-oral transmission of *Helicobacter pylori* may be due to the water contaminated with feces.

Endoscopy is the procedure used to see the upper gastrointestinal structure and to detect the disease conditions. Endoscopy is the reason of the iatrogenic transmission to the patients who underwent endoscopies. The structure of endoscope is so complex that its proper disinfection is difficult which is the main reason behind this transmission [13]. Lin et al [14] thought that medical staff who perform endoscopic examinations are more prone to get an infection. Human beings are the main reservoir of the *H. pylori* and there may be other reservoirs as well, such as cats, monkey, a housefly. Handt et al [15] found *Helicobacter pylori* in cats but there is no adequate previous data of *H.pylori* infection in cats so there is less chances of transmission of *Helicobacter pylori* from cats. Grubel et al [16] suggests that *Helicobacter pylori*-infected houseflies may be the reservoir of bacteria. The houseflies can carry the *H. pylori* from the infected feces to food. Goodman et al [17] found the children who played with sheep in Colombian Andes are positive for *Helicobacter pylori* infection. Dore et al [18] detected positive cases of *H.pylori* infection among the Sardinian shepherders. Although *Helicobacter pylori* infection is a major issue nowadays, the epidemiology of *Helicobacter pylori* infection is still unclear. There is conflicting in various studies in regard to the source, modes of *Helicobacter pylori* transmission and risk factors associated with it. The authors of various studies suggest environmental, geographical and socio-economic condition as risk factors.

Water as a route of H. Pylori Transmission:

Water is regarded as the major source of *Helicobacter pylori* transmission. Various studies had detected that *Helicobacter pylori* found in the river, stream, well water. Klein et al[19] found *H. pylori* is more common in Peruvian children who drink water from the municipal water supply. Lafleur and Vena et al [20]

found the sewage workers are at more risk for gastric carcinoma. Friis et al[21] researched on the risk of H. pylori infection in sewage workers. Goodman and others surveyed in the Colombian Andes they found the risk of H.pylori infection in the children who drink water from streams, bathing and swimming in streams and pools.Nurgalieva reported that drinking water in Kazakhstan was a high risk of H. pylori infection [22]. Shahamat and colleagues found that viable but non-culturable form of H. pylori present in water [23]. Japanese researcher found DNA of H. pylori in a well water in 2001 and the people's are found infected who uses the water from that well for drinking [24]. Azevedo studied about water as a source of Helicobacter pylori transmission in 2005 in which there is mentioned that Helicobacter pylori can be attached to different parts of water pipes or other surfaces in contact. Azevedo also pointed use of water after disinfection, the couple using proper sanitary methods has decreased the rate of Helicobacter pylori transmission in developed countries [25].In India, the research was conducted on occupational health hazard in 2008 which showed the sewage and sanitary workers are highly infected with Helicobacter pylori [26]. This concludes that the exposure of worker with contaminated water is the high risk of infection.Bellack and colleagues suggest that man and animals are the carrier of the bacteria for a long duration and then transfer it to water via feces. Helicobacter pylori then transmitted to the person who consumes the contaminated water [27].

H. Pylori Detection:

There are various diagnostic tests for the detection of Helicobacter pylori from the samples. It is difficult to differentiate naked DNA from the dead and living cells by using polymerase chain reaction (PCR). Lu et al found municipal wastewater canal was infected with Helicobacter pylori on the US- Mexico border for the first time in 2002 by the culturable method [28].The canal was contaminated with sewage. Besides this study, there were various studies conducted but the researcher has not succeeded to culture Helicobacter pylori from the drinking water. H. pylori convert into a viable but non-culturable state (VBNC) quickly in water due to low nutrient and hyperosmotic condition of water and environment [29]. VBNC state of Helicobacter pylori was isolated by fluorescent in situ hybridization (FISH) in 2004 by Rowan. The relationship of VBNC state of Helicobacter pylori and the transmission of infection is still unclear.Moreno et al.[30] detect that Helicobacter pylori can survive in the VBNC state.

Handwerker et al.1995[31] first detect Helicobacter pylori from water by using PCR amplification of samples obtained from Colombia. Later on, PCR assays were done various times to test H. pylori in water. In united states, Helicobacter pylori from ground and well water have been tested using fluorescent antibody-tetrazolium reduction (FACTC) microscopy and PCR was done to confirm.Moreno et al.2003 PCR and FISH were used as a rapid and sensitive method to detect Helicobacter pylori in environmental samples[32]. Nayak and Rose et al.[33] found that quantitative polymerase chain reaction (qPCR) as the rapid, specific and sensitive method to detect Helicobacter pylori in sewage.

There have been various reports that say the *Helicobacter pylori* can survive for the long duration in water. West et al [34] found *H. pylori* remain alive for 11-14 days in culture when it is suspended in distilled water, 16 days in saline and 3-7 days in artificial seawater. Rolle-Kampczyk et al. [35] suggested a relationship between *Helicobacter pylori* infection and drinking water from contaminated well. DNA of *Helicobacter pylori* was detected in the drinking water sample in Japan (Sasaki et al.1999), Mexico (Mazari-Hiriart et al.2001) and Peru (Hulten et al.1996), from water delivery tanker in the Canadian Arctic (Mc Keown et al. 1999) and from drinking water storage pots in the Gambia (Bunn et al.2002) [36,37,38,39,40]. Till now the viability of *Helicobacter pylori* in the environment is not clear and what affects its viability is also unknown.

Disinfection:

Chlorine is used to disinfect drinking water but different studies shown water disinfection process by chlorine is less effective in case of *Helicobacter pylori*. Baker et al.(2002) discovered that *Helicobacter pylori* were resistant to the low level of chlorine as compared to *Campylobacter jejuni* and *E.coli* [41]. The chlorine inhibits the activity of *Helicobacter pylori* but it fails to kill the pathogens from drinking water which survives in a VBNC state. Moreno et al.[30] suggest that viable but non-culturable form of *Helicobacter pylori* which is resistant to the disinfectant may transmit to the consumer but are undetected by culture methods. Xia et al.[42] suggest that boiling of water at 30degree centigrade was effective to kill various strains of bacteria.

Prevention:

On the basis of various research, the risk factor associated with *Helicobacter pylori* and routes of transmission of it were known. Now the effective preventive measures can be taken to control the *Helicobacter pylori* infection. By public awareness about the personal hygiene, sanitation, proper disposal of sewage, wash the hands properly before eating, boil the water before drinking may minimize the rate of infection. In recent studies, there is decreasing the rate of the *Helicobacter pylori* infection in developing countries due to increased public awareness about the personal hygiene and sanitation.

CONCLUSIONS

In this review article, we tried to show contaminated water as a possible source of transmission of *Helicobacter pylori* on the basis of various researches and discussion methods of detection of *Helicobacter pylori*, how to disinfect it and some preventive measures to decreases the prevalence rate of *Helicobacter pylori*. The Culture of water samples for *Helicobacter pylori* have been unsuccessful so still, we have no proper evidence for transmission by this route. More study should be conducted in transmission routes of *Helicobacter pylori* infection and emphasis should be given on *Helicobacter pylori*-specific diagnostic tools to

detect the bacteria and decrease the prevalence.

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