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CHOLERA DISEASE'S, CAUSES, SYMPTOMS, TREATMENT AND PREVENTION

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Annotation: *cholera, caused by the bacteria Vibrio cholerae, is rare in the United States and other industrialized nations. Cholera can be life-threatening but it is easily prevented and treated. Travelers, public health, medical professionals, and outbreak responders should be aware of areas with high rates of cholera, know how the disease spreads, and what to do to prevent it.*

Key words: *Vibrio cholerae, Kussmaul breathing (acidosis), tachycardia, hypotension.*

INTRODUCTION

Cholera is a well-known disease caused by intestinal infection with the toxin-producing bacteria Vibrio cholerae. This potentially fatal diarrheal disease results in large volumes of watery stool, causing rapid dehydration that can progress to hypovolemic shock and metabolic acidosis. The case-fatality ratio is up to half in vulnerable groups during outbreaks but can be under 1% if properly treated. Since its endemic origins in Asia, different serotypes of V. cholerae have reached the pandemic level 7 times. Unlike many other infectious diseases, cholera continues to be a worldwide public health concern. Today, cholera persists in regions of the world with unsatisfactory hygienic conditions and regions afflicted by natural disasters and/or humanitarian crises. Research has led to the development of oral rehydration therapy, antibiotic treatment, and new oral vaccines that have saved millions of lives. Toxin-producing strains of V. cholerae cause the disease process. V. cholerae is a highly motile, comma-shaped gram-negative bacteria with a single polar flagellum. It has hundreds of serogroups that include pathogenic and non-pathogenic strains. Until recently, the disease was caused by only 2 of these serotypes, Inaba and Ogawa, and 2 biotypes, classical and

El Tor, of toxigenic serogroup O1. In 1992, serogroup O139, or Bengal, emerged as another epidemic variant of V. cholerae. Recently, there has been an increased recognition for the role that non-O1 and non-O139 serogroups may be playing in diarrheal illness and gastroenteritis.

Cholera is transmitted through contaminated water and/or food especially in vulnerable communities affected by natural disasters, war, and famines. Humans are the only natural host for V. cholerae, and transmission is by the fecal-oral route. However, V. cholerae is also found as a free-living organism in brackish water and can survive in fresh or saltwater, which explains the occasional infections via shellfish. Small intestine colonization is highlighted by V. cholerae's highly effective motility and ease of attachment to the intestinal wall. V. cholerae requires a comparatively high infectious dose (10^8). Cholera toxin is then secreted and eventually endocytosed by the intestinal epithelial cells, altering the electrolyte channels, and resulting in endoluminal fluid loss rich in chloride, bicarbonate, sodium, and potassium. On excretion into the environment, it has been found that the bacteria undergo a period of 24 hours of hyper-infectious activity and are more likely to be transmitted in a human-to-human fashion, explaining the explosive nature of cholera epidemics. Another important pathophysiological feature of V. cholerae is how host susceptibility affects a patient's risk. For example, individuals with blood group O have been found to be more likely to develop severe cholera than other blood types, while individuals previously infected with cholera or vaccinated against it have often been found to gain temporary acquired immunity. Recently, there has been an increase in the number of non-O1 and non-O139 V. cholerae infections presenting as self-limited gastroenteritis after bathing in contaminated recreational waters or ingestion of raw and undercooked seafood. V. cholerae is a comma-shaped, gram-negative rod with a single polar flagellum that is highly motile. It exists in aquatic environments, infects the small intestine, and produces cholera toxins. These bacteria have specialized adherence factors that allow them to attach to the hostile microvilli surface. Once attached, Vibrio export 1 of 2 antigenically related but distinct forms of cholera enterotoxin (CT-1 or CT-2) into the intestinal epithelial cell. The cholera toxin causes adenylate cyclase to be locked on the “on mode,” leading to an excess in cAMP and subsequent hypersecretion of chloride and bicarbonate followed by water. Although this organism has almost 200 serogroups, only O1 and O139 have been found to be responsible for the epidemic disease. Cholera is characterized mainly by profuse painless diarrhea, abdominal discomfort, borborygmi, and vomiting in the absence of fever. Severe cases may present with hypovolemic shock due to the massive volume and electrolyte loss. Although initial diarrhea may include fecal material, the classic diarrhea presentation consists of watery foul-smelling mucous described as "rice-water" stools. The rate of fluid loss (up to 1 liter per hour) and high stool sodium concentrations characterize cholera from other diarrheal diseases. In severe

cases, known as cholera gravis, hypotensive shock can ensue within hours of the first symptoms. If treatment is not started immediately, death rates are reported as high as 70%. Patient presentation with hypovolemic shock may include: decreased urine output, cold, clammy skin, decreased skin turgor, sunken eyes, Kussmaul breathing (acidosis), tachycardia, and hypotension. Electrolyte imbalances can cause muscle cramping and weakness with severe acidosis. Cholera sicca is a variant of the disease when fluid accumulates in the intestinal lumen, followed by circulatory collapse and death before any diarrheal symptoms arise. V. cholerae is mainly diagnosed clinically in the setting of a diarrheal illness outbreak. Various factors differentiate it from other diarrheal diseases. Given the pathophysiology of cholera and its effects on the secretion of chloride via apical channels and inhibition of sodium chloride absorption, laboratory results usually evidence hypokalemia, hypocalcemia, metabolic acidosis, and isonatremic dehydration. In children, severe hypoglycemia may ensue, coupled with altered mental status, seizures, and coma. Otherwise, there are no strict laboratory or radiographic findings required for the diagnosis and/or care of cholera patients.

Confirmatory diagnosis of V. cholerae today consists of isolation of the bacteria in stool cultures, polymerase chain reaction (PCR), and rapid tests. Nonetheless, given the morbidity and mortality associated with the disease, treatment is never to be delayed for diagnostic testing given adequate diagnosis can be achieved clinically. Stool culture remains the gold standard for the detection of V. cholerae and susceptibilities using selective media. Nonetheless, this technique is inadequate for rapid diagnosis. On the other hand, rapid diagnostic tests (RDTs) have commanded greater attention for their ease of use in the field setting and being inexpensive, leading to the potential for epidemic-preventive surveillance. Most RDTs are set to follow the principles of dipstick tests by applying a characteristic component of the cholera bacteria on a surface and binding it with specific reagents to produce a visible change. Given the importance placed by the World Health Organization (WHO) on faster, easier, and less expensive diagnostic tests, new RDTs are developed periodically. Recently, enriched RDTs have even been shown to have diagnostic performance equivalent to cultures. On the downside, recent outbreaks like the post-earthquake Haiti event have presented the disadvantages of having too many diagnostic RDTs with significant variations, rendering them suboptimal as point-of-care tests but useful for outbreak response and surveillance.

Cholera is an infectious disease that causes severe watery diarrhea, which can lead to dehydration and even death if untreated. It is caused by eating food or drinking water contaminated with a bacterium called Vibrio cholerae. Cholera was prevalent in the U.S. in the 1800s, before modern water and sewage treatment systems eliminated its spread by contaminated water. Only about 10 cases of cholera are reported each year in the U.S. and half of these are acquired abroad. Rarely, contaminated seafood has caused cholera outbreaks in the U.S. However, cholera outbreaks are still a serious problem in other parts

of the world. The World Health Organization reports that there are 1.3 million to 4 million cases each year. The disease is most common in places with poor sanitation, crowding, war, and famine. Common locations include parts of Africa, south Asia, and Latin America. If you are traveling to one of those areas, knowing the following cholera facts can help protect you and your family.

Cholera Causes

Vibrio cholerae, the bacterium that causes cholera, is usually found in food or water contaminated by feces from a person with the infection. Common sources include:

- Municipal water supplies
- Ice made from municipal water
- Foods and drinks sold by street vendors
- Vegetables grown with water containing human wastes
- Raw or undercooked fish and seafood caught in waters polluted with sewage

When a person consumes the contaminated food or water, the bacteria release a toxin in the intestines that produces severe diarrhea. It is not likely you will catch cholera just from casual contact with an infected person.

Cholera Symptoms

Symptoms of cholera can begin as soon as a few hours or as long as five days after infection. Often, symptoms are mild. But sometimes they are very serious. About one in 20 people infected have severe watery diarrhea accompanied by vomiting, which can quickly lead to dehydration. Although many infected people may have minimal or no symptoms, they can still contribute to spread of the infection.

Signs and symptoms of dehydration include:

- Rapid heart rate
- Loss of skin elasticity (the ability to return to original position quickly if pinched)
- Dry mucous membranes, including the inside of the mouth, throat, nose, and eyelids
- Low blood pressure
- Thirst
- Muscle cramps

If not treated, dehydration can lead to shock and death in a matter of hours.

Cholera Treatment and Prevention

There is a vaccine for cholera. Both the CDC and the World Health Organization have specific guidelines for who should be given this vaccine.

You can protect yourself and your family by using only water that has been boiled, water that has been chemically disinfected, or bottled water. Be sure to use bottled, boiled, or chemically disinfected water for the following purposes

- Drinking
- Preparing food or drinks

- Making ice
- Brushing your teeth
- Washing your face and hands
- Washing dishes and utensils that you use to eat or prepare food
- Washing fruits and vegetables

To disinfect your own water, boil it for one minute (or 3 minutes at higher elevations) or filter it and use a commercial chemical disinfectant. You should also avoid raw foods, including the following:

- Unpeeled fruits and vegetables
- Unpasteurized milk and milk products
- Raw or undercooked meat or shellfish
- Fish caught in tropical reefs, which may be contaminated

If you develop severe, watery diarrhea and vomiting -- particularly after eating raw shellfish or traveling to a country where cholera is epidemic -- seek medical help immediately. Cholera is highly treatable, but because dehydration can happen quickly, it's important to get cholera treatment right away.

Conlusion, hydration is the mainstay of treatment for cholera. Depending on how severe the diarrhea is, treatment will consist of oral or intravenous solutions to replace lost fluids. Antibiotics, which kill the bacteria, are not part of emergency treatment for mild cases. But they can reduce the duration of diarrhea by half and also reduce the excretion of the bacteria, thus helping to prevent the spread of the disease.

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