Cholera

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Etiologic Agent and General Characteristics
The etiologic agent for cholera is *Vibrio cholerae*. (1) Vibrios are gram-negative rods, are sensitive to acid, and are facultative anaerobes (6). They move by a single flagellum and are considered highly motile. The structure of the cell surface lipopolysaccharide O antigen is the main method of classification for cholera. There are over 200 serotypes, only three of which cause virulence: Inaba, Ogawa, and Hikojima (2). These serotypes contain either O1 or 0139 serotype antigens. The major virulence factors are toxin-coregulated pilus (TCP) and cholera toxin (CT) (3). Additionally, there are two biotypes, classical and El Tor, which evolved independently.

Transmission
Cholera is transmitted by vehicle transmission. It is spread through water that has been contaminated with the feces of a person or animal infected with *V. cholerae*. This is generally seen in areas with poor sanitation. Cholera can also be spread by foodborne transmission from raw shellfish living in warm, coastal regions. Raw or undercooked shellfish from the Gulf of Mexico are essentially the only cause of cholera for people living in the United States. (1)

Reservoirs
The main reservoir for cholera is water, which is a nonliving reservoir. *V. cholerae* is part of the normal flora in brackish water (water with a salt level between fresh water and seawater), and is seen in algal blooms (4). People and animals (specifically shellfish) are also reservoirs for cholera. Humans are the only animal in which *V. cholerae* grows. It lives in the small intestine of humans. (2). *V. cholerae* exists in a “viable but not culturalable state” in shellfish, algae, and plankton (2). Today, it is found most often in developing countries that have inadequate sewage infrastructure.

Signs And Symptoms
The vast majority of the time, the symptoms of cholera are hard to distinguish from diarrhea caused by many other possibilities. The bacteria will be present in an infected person’s feces for 7-14 days, however (4). Around 1 in 10 cases display the characteristic signs and symptoms of cholera. They are extreme diarrhea, nausea and vomiting, and dehydration. With diarrhea, the infected person may lose as much as liter of fluid an hour. The diarrhea from cholera has a pale, milky appearance, and for this reason, diarrhea from cholera is generally called “rice-water stool.” Nausea and vomiting may last for several hours at a time. Dehydration causes electrolyte imbalance, which can lead to muscle spasms and shock, specifically hypovolemic shock.
Signs and symptoms for cholera dehydration also include irritability, lethargy, sunken eyes, dry mouth, extreme thirst, dry and shriveled skin, little or no urine output, low blood pressure, and an irregular heartbeat (5).

**Key Tests For Identification**
The main test for identification for *V. cholerae* is serologic identification, searching for the presence of O1 serotype antigens (6). This can be shown by using an agglutination test. Most serotypes of cholera that do not cause epidemic or pandemic outbreaks also do not produce cholera toxin (6). *V. cholerae* samples are generally taken from stool samples of infected persons. The stool will have the appearance of “rice-water stool.” It will have a white, pasty layer similar to water after it has been used to boil rice. The stool will also have a fishy odor.
The above tests are quick methods for identification, which is important since cholera can turn deadly very rapidly. Another test is noting whether the serotype produces cholera toxin. Only the three pathogenic serotypes will (6).

**Historical Information**
The word cholera comes from the Greek ‘khole’ meaning ‘illness from bile (9).’ The first notable reports specifically referencing cholera come from John Snow of London, England, and Filippo Pacini of Florence, Italy. Both reports come from 1854. Pacini was the first to identify *V. cholera* as the etiologic agent of cholera, though his discovery was not widely known until Robert Koch publicized his own independent research in 1884. John Snow did not discover the cause of cholera, but he did impart knowledge on how to stop a local outbreak (9).
There have been seven epidemic outbreaks of cholera since 1817. The first six outbreaks were caused by the classical O1 biotype. The seventh outbreak was caused by the El Tor O1 biotype (2).

**Virulence Factors**
Cholera, once inside a human, lives in the small intestine. An adherence factor is needed to remain in the small intestine, though a specific adherence factor has not yet been defined (7). The motility of vibrios (the single flagellum) is also considered a virulence factor (7).

**Control/Treatment**
Anyone thought to be suffering from cholera should be treated with oral rehydration solution (ORS), which contains salts, sugar, and electrolytes. It is dissolved in water and administered orally (1). Antibiotics such as tetracycline, which is effective against many vibrios, will reduce the period of infection. Rehydration is the key to overcoming cholera, though (7).

**Prevention/Vaccines**
Cholera is a disease spread primarily by poor sanitation. The best way to combat cholera is to improve waste management, water treatment, and food preparation (5).
Currently, there are two vaccines for cholera available. One is Dukoral, which is World Health Organization (WHO) prequalified, and the other is ShanChol, which is licensed in India and is awaiting WHO approval (1). The vaccines are both administered orally, two times (six weeks apart). Their effectiveness lasts for about two years (5). The vaccines may take several weeks for their benefits to begin taking shape in a person, so vaccination “should not replace standard prevention and control measures” (1).

**Local Outbreaks**

Cholera is not a major concern in the United States, or in most developed countries. In 2012, there were 245,393 cases reported across 48 countries, with 3,034 deaths. That year, the United States reported 18 incidents, with 0 deaths (8).

**Global Outbreaks**

There have been seven cholera pandemics since 1817 (2). The first originated in India; the India-Pakistan subcontinent is typically the point of origin for major cholera outbreaks (2). Cholera spread to Europe and the Western Hemisphere for the first time during the second pandemic, which began in 1829 and also originated in India (8). The seventh and most recent pandemic began in 1961 in Indonesia, and spread as far as Latin America. Recently, an outbreak of cholera occurred in Haiti in 2010. By 2013, their government reported that 657,117 cases of cholera and 8,096 deaths have occurred since the outbreak began (8). Cholera also infected Cuba in July of 2012, causing 417 cases of illness and 3 deaths. It has since been eliminated from Cuba (8). Mexico also reported 159 cases of cholera in 2013 (8). Outbreaks are far more likely to happen in developing countries. Recent outbreaks have occurred in Sierra Leone, the Democratic Republic of Congo, Pakistan, and Zimbabwe (8).

**Bibliography**


