

# VIBRIO CHOLERAE

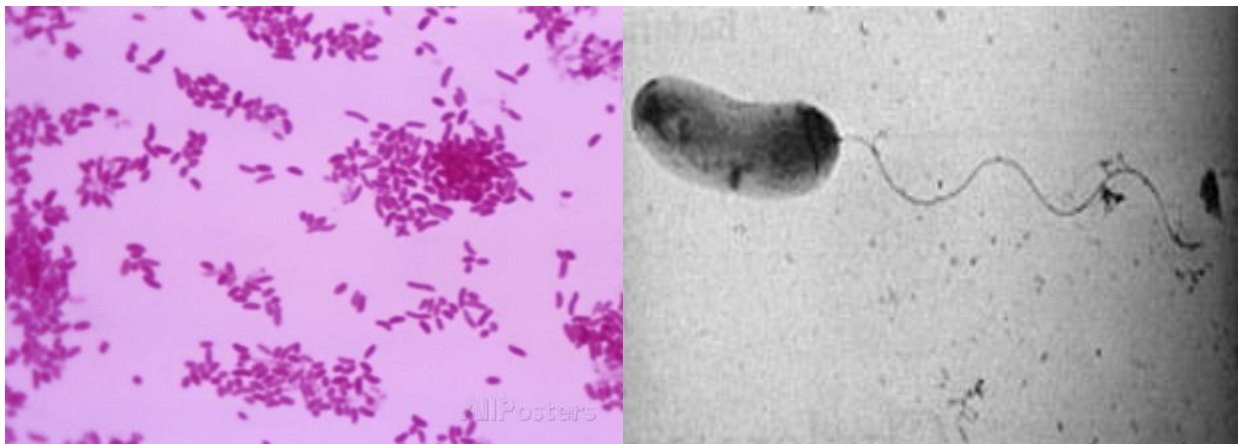
## PATHOGEN SAFETY DATA SHEET - INFECTIOUS SUBSTANCES

### INFECTIOUS AGENT

**NAME:** *Vibrio cholerae*

**SYNONYM OR CROSS REFERENCE:** Cholera

**CHARACTERISTICS:** *Vibrio cholerae* is a gram negative, non-spore forming, curved rod that is oxidase positive. It is very motile and has a single polar flagellum. The bacterium size is 1-3  $\mu\text{m}$  by 0.5-0.8  $\mu\text{m}$ . It is a facultative anaerobe and is part of the *Vibrionaceae* family. Serogroups O1 (classical and El Tor biotypes) and O139 are primarily responsible for cholera outbreaks. Pathogenic serogroups produce cholera toxin (CT) while non pathogenic strains may or may not produce this toxin. Recently, *V. cholerae* serogroup O75 strains possessing the cholera toxin gene were isolated from patients with severe diarrhea, and serogroup O141 has been associated with sporadic cholera-like diarrhea and bloodstream infections in the United States. Some serotypes may serve as a reservoir for the cholera toxin phage genome. Serotypes that do not produce cholera toxin can still cause illness in humans (i.e. enteritis).



*Vibrio cholerae*, gram-stained<sup>1)</sup>

*Vibrio cholerae* with its single polar flagellum<sup>2)</sup>

### HAZARD IDENTIFICATION

**PATHOGENICITY/TOXICITY:** *Vibrio cholerae* can cause syndromes ranging from asymptomatic to cholera gravis. In endemic areas, 75% of cases are asymptomatic, 20% are mild to moderate, and 2-5% are severe forms like cholera gravis. Symptoms include abrupt

onset of watery diarrhea (a grey and cloudy liquid), occasional vomiting and abdominal cramps. Dehydration ensues with symptoms and signs such as thirst, dry mucous membranes, decreased skin turgor, sunken eyes, hypotension, weak or absent radial pulse, tachycardia, tachypnea, hoarse voice, oliguria, cramps, renal failure, seizures, somnolence, coma and death. Death due to dehydration can occur in hours to days in untreated children and the disease is dangerous for pregnant women and their fetuses during late pregnancy as abortion, premature labor and fetal death may occur. In cases of cholera gravis involving severe dehydration, up to 60% of patients can die; however, less than 1% of cases treated with rehydration therapy are fatal. The disease typically lasts from 4-6 days.

**EPIDEMIOLOGY:** In the past 200 years, there have been 8 main cholera pandemics, with the disease being most common in tropical and subtropical areas. Most of the cases are in the Indian subcontinent and Africa. There are several million cases of cholera each year and in endemic areas, these tend to be most common in children aged 2-9 and in women who are of child-bearing age. Epidemics in endemic areas tend to occur during the hot season.

**HOST RANGE:** Humans, water birds, shellfish, fish, and herbivores have been found to contain the infectious agent.

**INFECTIOUS DOSE:** The infectious dose ranges between  $10^3$  and  $10^4$  ingested vibrios. The infectious dose depends on gastric acidity (lower acidity levels reduces the number of vibrios required for infection).

**MODE OF TRANSMISSION:** Cholera is typically spread by consumption of water that is contaminated with infectious feces. Epidemics caused by infectious raw fish and seafood have been reported.

**INCUBATION PERIOD:** The incubation period can range from a few hours to 5 days after infection.

**COMMUNICABILITY:** Symptomatic patients may shed vibrios before clinical signs of illness and up to 2 weeks after, whereas asymptomatic patients typically only shed vibrios for 1 day. A carrier state (where the patient has the infectious agent without any clinical manifestations) can exist for several weeks where vibrios are shed in small and intermittent quantities.

## DISSEMINATION

**RESERVOIR:** Humans are a reservoir for the disease as are animals around aquatic environments. The bacterium has been found in birds and herbivores surrounding freshwater lakes and rivers as well as in algae, copepods (zooplankton), crustaceans and insects.

**ZOONOSIS:** None

**VECTORS:** None

## STABILITY AND VIABILITY

**DRUG SUSCEPTIBILITY:** Susceptible to antibiotics. Tetracycline has been the drug of choice, although resistance to this antibiotic is becoming more common. Ciproflaxin, doxycycline and co-trimoxazole can also be used.

**DRUG RESISTANCE:** Resistance has been shown to nalidixic acid, furazolidone, and co-trimoxazole, *V. cholerae* O1 Inaba isolates have been found to be multi-antibiotic resistant, when increasing resistance to ciprofloxacin.

**SUSCEPTIBILITY TO DISINFECTANTS:** Susceptible to 2-5% phenol, 1% sodium hypochlorite, 4% formaldehyde, 2% glutaraldehyde, 70% ethanol, 70% propanol, 2% per acetic acid, 3-6% hydrogen peroxide, and 0.16% iodine.

**PHYSICAL INACTIVATION:** *Vibrio cholerae* is sensitive to cold (loss of viability after a cold shock at 0°C).

**SURVIVAL OUTSIDE HOST:** Cholera can survive in well water for  $7.5 \pm 1.9$  days and the El Tor biotype can survive  $19.3 \pm 5.1$  days. The bacterium can survive in a wide variety of foods and drinks for 1-14 days at room temperature and 1-35 days in an ice box. It has also been found on vomits at room temperature for 1-7 days.

## FIRST AID / MEDICAL

**SURVEILLANCE:** Monitor for symptoms. Confirm diagnosis by dark field microscopy of a wet mount of fresh stool, polymerase chain reaction (PCR) or enzyme-linked immunosorbent assay (ELISA).

**FIRST AID/TREATMENT:** Fluid replacement, electrolyte replacement and base *i.v.* fluid replacement followed by the WHO's oral rehydration solution (Na<sup>+</sup> 90 mmol/L, K<sup>+</sup> 20 mmol/L, Cl<sup>-</sup> 80 mmol/L, citrate (10 mmol/L and glucose 110 mmol/L) is the recommended treatment for dehydration. Administering an antibiotic like ciproflaxin, doxycycline or co-trimoxazole reduces the duration of the illness.

**IMMUNIZATION:** Routine vaccination for laboratory workers and travelers is not recommended. Traditional parenteral inactivated vaccine strains are available though not recommended for widespread use as they only provide protection for 3-6 months. Oral vaccines that provide protection for several years (up to 3) are available but their efficacy in endemic areas has not been confirmed.

**PROPHYLAXIS:** Chemoprophylaxis with antibiotics has not been shown to be effective. Proper hygiene, sanitary measures, water treatment and careful food preparation are the best prophylactic measures in endemic areas.

# LABORATORY HAZARDS

**LABORATORY-ACQUIRED INFECTIONS:** Cases of laboratory-acquired infections with deaths have been reported. The deaths were associated with mouth pipetting, contact with infectious feces and contaminated laboratory laundry.

**SOURCES/SPECIMENS:** Feces and naturally or experimentally infected animals are the main specimens which contain the infectious agent.

**PRIMARY HAZARDS:** The primary hazards when working with this agent are ingestion and accidental parenteral inoculation. The risk of aerosol exposure is not known.

**SPECIAL HAZARDS:** The risk of infection is higher in people who don't have gastric acid (i.e. due to gastrectomy or achlorhydria).

# EXPOSURE CONTROLS / PERSONAL PROTECTION

**RISK GROUP CLASSIFICATION:** Risk group 2.

**CONTAINMENT REQUIREMENTS:** Containment Level 2 facilities, equipment, and operational practices for work involving infectious or potentially infectious materials, animals, or cultures.

**PROTECTIVE CLOTHING:** Lab coat. Gloves when direct skin contact with infected materials or animals is unavoidable. Eye protection must be used where there is a known or potential risk to splashes.

**OTHER PRECAUTIONS:** All procedures that may produce aerosols, or involve high concentrations or large volumes should be conducted in a biological safety cabinet (BSC). The use of needles, syringes, and other sharp objects should be strictly limited. Additional precautions should be considered with work involving animals or large scale activities.

# HANDLING AND STORAGE

**SPILLS:** Allow aerosols to settle and, wearing protective clothing, gently cover spill with paper towels and apply appropriate disinfectant, starting at the perimeter and working towards the centre. Allow sufficient contact time before clean up (30 min).

**DISPOSAL:** All wastes should be decontaminated before disposal either by steam sterilization, incineration or chemical disinfection.

**STORAGE:** The infectious agent should be stored in a sealed and identified container.

## REFERENCE

Pathogen Safety Data Sheet (PSDS) for *Vibrio cholerae* has been modified from the ones produced by the Public Health Agency of Canada as educational and informational resources for laboratory personnel working with infectious substances.

- 1) Picture from [www.allposters.com](http://www.allposters.com)
- 2) Picture from [microbewiki.kenyon.edu](http://microbewiki.kenyon.edu)