

## EPSILON TOXIN OF CLOSTRIDIUM PERFRINGENS

### Bioterrorism Agent Profiles for Health Care Workers

**Causative Agent:** *Clostridium perfringens* is a Gram positive, anaerobic, toxin producing spore-forming rod that is commonly found in normal intestinal bacteria. It is a cause of wound infections and food poisoning in humans. *C. perfringens* spores are ubiquitous in the environment. When the spores are injected or inoculated into a wound, bacteria grow and produce toxins.

Epsilon toxin is one of the toxins of type B and type D strains of *C. perfringens*. Epsilon toxin has been suggested as a potential biological weapon. Epsilon toxin damages cell walls and causes potassium and fluid leakage from cells.

**Routes of Exposure:** *C. perfringens* usually causes infections in humans by contamination of food, or by inoculation into an open wound. Exposure to epsilon toxin could be spread by aerosolization or by adding it to food or water.

**Infective Dose & Infectivity:** *C. perfringens* is normal flora in the human intestinal tract. However, when large numbers of *C. perfringens* grow in inadequately stored food, or when it contaminates an open wound, clinical symptoms develop.

**Incubation Period:** The incubation period for gastrointestinal symptoms after oral ingestion of *C. perfringens* is usually 10-12 hours, with a range of 6-24 hours. The incubation period of epsilon toxin after respiratory or oral exposure is not known.

**Clinical Effects:** *C. perfringens* gastroenteritis can include diarrhea, nausea, severe abdominal cramps and bloating for 1-2 days. Vomiting and fever are not usually seen. Wound contamination can result in clostridial myonecrosis (gas gangrene), or clostridial cellulitis.

Type B and D strains, the strains that produce epsilon toxin, do not usually infect humans. *C. perfringens* type B causes severe gastroenteritis in young calves, foals, lambs and piglets. Type D causes enterotoxemia in sheep and goats. Intravenous injection of epsilon toxin animals has resulted in pulmonary edema and neurologic symptoms.

The symptoms in humans from intentional exposure to epsilon toxin is not known. Extrapolating from animal experiments, pulmonary edema, neurologic symptoms, or gastroenteritis could be seen.

**Lethality:** Death from naturally occurring *C. perfringens* infection is very rare. It is not known how lethal epsilon toxin would be as a bioterrorism agent.

**Transmissibility:** *C. perfringens* is ubiquitous in the environment. Transmission to humans is usually from environmental exposure rather than person-to-person spread. Toxins (such as epsilon toxin) are usually not transmitted from person to person.

**Primary contaminations & Methods of Dissemination:** In a bioterrorist attack, *C. perfringens* could be used to contaminate food or water supplies. Epsilon toxin could be spread in food, water, or by aerosolization.

**Secondary Contamination & Persistence of organism:** Since *C. perfringens* is so ubiquitous in the environment yet only causes disease in specific settings, secondary contamination would not be expected to be a problem. *C. perfringens* spores can survive in soil for long periods of time.

**Decontamination & Isolation:**

*Patients* – Standard precautions should be practiced. Specific isolation procedures are not indicated.

*Equipment, clothing & other objects* – Methods of decontamination for the epsilon toxin have not been published. Proteins are usually denatured by heat.

**Laboratory testing:** *C. perfringens* can be isolated from standard bacterial wound and stool cultures. Epsilon toxin can be detected by various assays including enzyme-linked immunosorbent assays (ELISA).

**Therapeutic Treatment:** Penicillin is the drug of choice for *C. perfringens* gastroenteritis and wound infection. Treatment for toxin exposure would likely be supportive.

**Prophylactic Treatment:** There is no vaccine available to protect against *C. perfringens* food poisoning or wound infection. There is no preventive measure against epsilon toxin used as a bioterrorism agent.

**Differential Diagnosis:** The differential diagnosis includes other recognized forms of food poisoning as well as aerosolized toxins and poisons.

**References:**

Chin J. Control of Communicable Diseases Manual, Seventeenth Edition, American Public Health Association; 2000.

Center for Food Safety and Applied Nutrition. Foodborne Pathogenic Microorganisms and Natural Toxins Handbook, U.S. Food and Drug Administration  
<http://vm.cfsan.fda.gov/~mow/intro.html>

Center for Food Security and Public Health. Epsilon toxin of *Clostridium perfringens*, Iowa State University College of Veterinary Medicine  
<http://www.scav.org/Epsilon-toxin%20Fact%20Sheet.htm>

For more information call (602) 364-3289

## Frequently Asked Questions About Clostridium Perfringens

### **What is *Clostridium perfringens*?**

*Clostridium perfringens* are spore-forming bacteria that can be found in soil, feces, and the intestines of healthy people and animals. *Clostridium perfringens* are also often found in raw meat and poultry. The bacteria often cause food poisoning, but can also infect wounds.

### **How is *Clostridium perfringens* spread?**

Eating foods that are served after improper storage can lead to infection. After cooking, small numbers of the organism may still be present. These can grow and produce toxin when the temperature is kept between 70° and 140° F. and air and moisture levels are right. For example, this can occur when foods that are cooked in large quantities are then held at room temperature for a prolonged period of time. *Clostridium perfringens* food poisoning is more common with meat products and gravies. The bacteria can be found in uncooked meat and poultry. It can also be transferred to food from stool bacteria if proper hand washing is not practiced.

### **What illness does *Clostridium perfringens* cause?**

*Clostridium perfringens* most often causes food poisoning that results in sudden, watery diarrhea and abdominal pain. Usually there is no fever and no vomiting. On very rare occasions *Clostridium perfringens* can cause a more severe infection that causes the intestinal tissue to die and results in an infection of the blood. Wounds that become contaminated with *Clostridium perfringens* can result in tissue decay.

### **How is *Clostridium perfringens* infection diagnosed?**

*Clostridium perfringens* is initially diagnosed based on symptoms. Laboratory confirmation is made by finding high concentrations of *Clostridium perfringens* in food or stools.

### **How is the illness treated?**

Usually no treatment is needed, other than taking steps to prevent or treat dehydration.

### **What can be done to prevent *Clostridium perfringens* infection?**

Be sure to wash your hands before preparing or serving foods and after handling raw meat or poultry. Meat and poultry based foods should be cooked thoroughly. *Clostridium perfringens* grows best between 45° and 140° F., so it is best to keep hot foods hot (above 140° F.) and cold foods cold (below 40° F.). If you have a large portion of food leftover, divide it into smaller portions not over three inches deep to refrigerate so it cools quickly. Foods should be refrigerated immediately and not left at room temperature to cool. Prepared food should not be left unrefrigerated for more than two hours. Reheat foods to at least that 165° F.

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