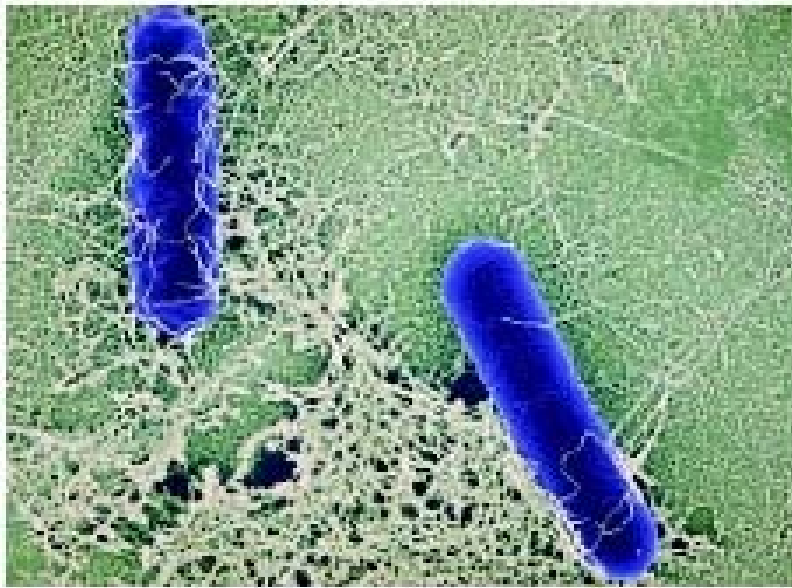


## Clostridium Botulinum and its Health Risks



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HONR: 499B

04/08/08

Introduction: Clostridium Botulinum is a rod shaped gram positive, bacterium that survives as spores in both soil and natural water sources. The bacterium is normally harmless, and remains inactive, until it is ingested by animals or humans. Once the spores are ingested they begin to flourish and produce a potent neuro-toxin. This toxin inhibits action potentials from crossing the axons of nerves, which leads to paralysis. When this happens, the person affected is said to have botulism. Without proper treatment the neurotoxin will spread throughout the body and eventually cause paralysis of the heart and lungs, leading to death. Fortunately, we have an antitoxin to counteract these effects, and related deaths in the United States have dwindled, due to knowledge of the disease, and better methods of supportive therapy. Even so, botulism still poses a health risk, especially to infants, and deems closer investigation. When did we first learn of botulism, what is the prevalence, how can we prevent infection and how is something that poses a health risk being utilized in our health care system? All of these things and more will be discussed in the following pages.

History: One interesting aspect of botulism is the fact that the toxin, which causes the disease, was identified before the actual organism<sup>1</sup>. In the early 1800's Justinius Kerner, a German writer and medical officer identified a toxic substance that had been found in sausage and poorly preserved meat products. He called the substance sausage poison, which was renamed in 1870 by another German as botulism, from the Latin for sausage<sup>1</sup>. The bacterium was finally isolated in 1895 and *Clostridium Botulinum* was identified as the bacteria that caused botulism. Experimentation also yielded a very disturbing fact about the toxin. Gram for gram, botulinum toxin is the most potent poison in the world!

Not only that, but botulism spores are endemic to all areas, and can be found in any backyard, stream or river on American soil. As time passed, the advent of strict food safety regulations and medical knowledge began to diminish the cases of naturally occurring botulism. However, botulism was still studied in a very interesting way, which has benefitted many people infected with botulinum toxin.

In 1978, a retired dress horse from the United States Army was inoculated with an inactivated form of botulism, and began a prestigious career<sup>2</sup>. Throughout his life the horse, First Flight, was inoculated with each successive type of botulism. After his immune system created antibodies against each bacterium, his blood was drawn and his serum saved, so that it could be used to create vaccines against future Botulism infections in humans. Since this project started, First Flight has saved civilians and given peace of mind to those serving in the armed forces. Although First Flight died in 1999, he is still remembered by those who visit the Smithsonian Institution, where his halter and a vial of his blood are displayed, along with his story<sup>2</sup>. More importantly however, First Flight lives on through those who have been, and will be, saved by his services.

Types of Botulism: There are eight types of botulism, which usually present in three different ways. Human botulism is often caused by types A, B, E and F<sup>5</sup>. Types C, D and G have been identified in animal infections<sup>5</sup>. Each type of *Clostridium Botulinum* has its own distinct characteristics that contribute to its infectious nature. However, the validity of reviewing these traits is not within the scope of this paper. Rather, we will look at each presentation of botulism, from greatest to least prevalent, in the hope that this information will be more serviceable to the intended audience of this paper.

Infant Botulism: Infant botulism usually takes place in babies when they are between two and four months old. It was first identified in the 1970's, when people began to have a better understanding of the disease. Since its discovery the incidence of mortality associated with the disease has decreased dramatically. Currently, in the United States, we see about 100 cases a year. But how do babies, who are kept in a relatively clean, safe environment, get a bacterium we normally find in soil or unclean water sources? The answer is, through food. Clostridium spores can lurk in many different places, one of the most common being in honey and other natural foods. Most honey is eaten raw, but even pasteurized or sterilized honey can contain botulism spores. While older children and adults are able to eat honey freely, baby's immune systems are relatively naive and may not view the Clostridium spores as a threat. The spores can then seed, unchallenged, in the digestive tract, activate, and begin making toxins. There is no easy way to determine if honey is contaminated with botulism spores; therefore, the CDC advises that no child under twelve months be given honey <sup>3</sup>.

Wound Botulism: Is caused when botulism spores are somehow injected into the body or contaminate a wound. *Clostridium botulinum* is prevalent in soil and water sources, and can potentially be picked up during camping, sports or even playing outside. More recently, scientists have discovered a growing number of botulism cases in people who inject illegal drugs, specifically, heroine <sup>6</sup>. It has been hypothesized that the heroine these people use is contaminated with botulinum spores <sup>6</sup>. The person using the needle is then inoculated with botulism spores, which are able to flourish in an already suppressed

immune environment. The best preventatives for wound botulism therefore, are common sense. People should be mindful of their surroundings and keep any open wounds clean and covered with a bandage, especially when outside. Recreational drug use is never advisable, and the chance of acquiring wound botulism is one of many dangers that should deter people from participating in such activities.

**Food Borne Botulism:** Food borne botulism is usually caused by ingesting foods that contain either botulism spores or botulism toxin. It is often observed when home canned goods are not properly prepared; however, commercially prepared foods have also been known to contain botulism spores or toxin. Symptoms of food borne botulism usually appear 12-36 hours after eating contaminated food <sup>4</sup>. Symptoms may include slurred speech, blurred vision, dry mouth and muscle weakness, among other neurologic abnormalities. People who suspect they may have botulism toxicity should seek medical attention immediately, as the neurotoxin has the ability to interfere with pulmonary function.

**Diagnosis and Treatment:** The diagnosis of all types of botulism is based on neurologic signs. The classic symptoms of botulism include double vision, blurred vision, drooping eyelids, slurred speech, difficulty swallowing, dry mouth, and muscle weakness. Infants with botulism appear lethargic, feed poorly, are constipated, and have a weak cry and poor muscle tone <sup>3</sup>. Treatment involves administering antitoxin and supportive care, especially if the patient goes into respiratory distress. If treatment is not administered quickly, total paralysis is likely to occur. In these instances the patient is often placed on

a ventilator and given antitoxin simultaneously. The antitoxin will prevent further paralysis, and the ventilator allows respiration as the body begins to return to its normal state. Usually however, recovery from a bout of total botulism paralysis will take several months. Therefore, it is imperative to practice food safety, and be aware of possible instances of botulism toxicity.

Medical Uses of Botulism Toxin: Botox is the trade name for botulinum toxin A.

Like all botulinum toxins, type A prevents acetylcholine from binding to the receptors on nerve endings, which causes paralysis. Although this can have potentially life threatening effects if introduced into a healthy body, in the hands of physicians it can be used to help relieve certain conditions.

The most popular use of Botox today is for elective, cosmetic reasons. Botox can be used to temporarily paralyze facial muscles, which reduces the appearance of lines and wrinkles. It has become an increasingly popular procedure among aging women, who view Botox injections as a way to retain their youthful good looks<sup>10</sup>.

A more valid use of Botox perhaps, is the use to relieve a number of neuromuscular problems and conditions. Doctors in France have used botulinum toxin to prevent muscle spasms in children with cerebral palsy after they undergo surgical procedures. Random spasms have a negative impact on post operative pain, as well as the emotional comfort of the patients<sup>7</sup>. Studies have shown that injecting patients with botulinum toxin before operations reduces the duration of post operative pain, and improves the comfort of patients<sup>7</sup>. Botulinum toxin has also been used to help improve speech in people who suffer from stuttering. Injections of botulinum toxin into the larynx have been mildly

successful in reducing stuttering and improving fluency in adult patients<sup>8</sup>. Many other conditions have been treated with botulinum toxin, and there is ongoing research into how the toxin can be used to help heal, instead of harm, people.

Avoiding Illness: Botulism is a highly variable disease, which can present in several forms. To prevent botulism from becoming problematic, there are several simple guidelines to keep in mind. Infants should not be given honey until they are around a year old<sup>1</sup>. Wounds should be cleaned and covered to prevent infection, and any use of illegal drugs should cease immediately. Finally, any home canning should be done in accordance with the regulations set out in the USDA Home Canning Guide, and when shopping, always choose cans which do not appear to have any unusual bulges or characteristics. These guidelines, will not only prevent botulism from becoming problematic, but will also prevent other infections and health problems from occurring.

Further Information:

- The CDC Web Page for Botulism<sup>1</sup>:  
[http://www.cdc.gov/ncidod/dbmd/diseaseinfo/botulism\\_g.htm](http://www.cdc.gov/ncidod/dbmd/diseaseinfo/botulism_g.htm)
- MedicineNet.com, a good source for general information<sup>9</sup>:  
<http://www.medicinenet.com/botulism/article.htm>
- An explanation about Botox and how it works<sup>10</sup>:  
<http://health.howstuffworks.com/botox.htm>
- USDA Home Canning Guide<sup>11</sup>:  
[http://www.uga.edu/nchfp/publications/publications\\_usda.html](http://www.uga.edu/nchfp/publications/publications_usda.html)

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11. National Center for Home Food Preservation. USDA Publications Web site.

Available at: [http://www.uga.edu/nchfp/publications/publications\\_usda.html](http://www.uga.edu/nchfp/publications/publications_usda.html).

Accessed February 9, 2008.