



Clostridium botulinum

Education

CDC/MMWR

NIH/PubMed

1. Name of the organism:
Clostridium botulinum

Clostridium botulinum is an anaerobic, [Gram-positive](#), spore-forming rod that produces a potent [neurotoxin](#). The [spores](#) are heat-resistant and can survive in foods that are incorrectly or minimally processed. Seven types (A, B, C, D, E, F and G) of [botulism](#) are recognized, based on the antigenic specificity of the toxin produced by each strain. Types A, B, E and F cause human botulism. Types C and D cause most cases of botulism in animals. Animals most commonly affected are wild fowl and poultry, cattle, horses and some species of fish. Although type G has been isolated from soil in Argentina, no outbreaks involving it have been recognized.

Foodborne botulism (as distinct from wound botulism and infant botulism) is a severe type of food poisoning caused by the ingestion of foods containing the potent neurotoxin formed during growth of the organism. The toxin is heat labile and can be destroyed if heated at 80°C for 10 minutes or longer. The incidence of the disease is low, but the disease is of considerable concern because of its high mortality rate if not treated immediately and properly. Most of the 10 to 30 outbreaks that are reported annually in the United States are associated with inadequately processed, home-canned foods, but occasionally commercially produced foods have been involved in outbreaks. Sausages, meat products, canned vegetables and seafood products have been the most frequent vehicles for human botulism.

The organism and its spores are widely distributed in nature. They occur in both cultivated and forest soils, bottom sediments of streams, lakes, and coastal waters, and in the intestinal tracts of fish and mammals, and in the gills and viscera of crabs and other shellfish.

2. Name of the Disease:

Four types of botulism are recognized: foodborne, infant, wound, and a form of botulism whose classification is as yet undetermined. Certain foods have been reported as sources of spores in cases of infant botulism and the undetermined category; wound botulism is not related to foods.

Foodborne botulism is the name of the disease (actually a foodborne

intoxication) caused by the consumption of foods containing the neurotoxin produced by *C. botulinum*.

Infant botulism, first recognized in 1976, affects infants under 12 months of age. This type of botulism is caused by the ingestion of *C. botulinum* spores which colonize and produce toxin in the intestinal tract of infants (intestinal toxemia botulism). Of the various potential environmental sources such as soil, cistern water, dust and foods, honey is the one dietary reservoir of *C. botulinum* spores thus far definitively linked to infant botulism by both laboratory and epidemiologic studies. The number of confirmed infant botulism cases has increased significantly as a result of greater awareness by health officials since its recognition in 1976. It is now internationally recognized, with cases being reported in more countries.

Wound botulism is the rarest form of botulism. The illness results when *C. botulinum* by itself or with other microorganisms infects a wound and produces toxins which reach other parts of the body via the blood stream. Foods are not involved in this type of botulism.

Undetermined category of botulism involves adult cases in which a specific food or wound source cannot be identified. It has been suggested that some cases of botulism assigned to this category might result from intestinal colonization in adults, with in vivo production of toxin. Reports in the medical literature suggest the existence of a form of botulism similar to infant botulism, but occurring in adults. In these cases, the patients had surgical alterations of the gastrointestinal tract and/or antibiotic therapy. It is proposed that these procedures may have altered the normal gut flora and allowed *C. botulinum* to colonize the intestinal tract.

3. Nature of the Disease:

Infective dose -- a very small amount (a few nanograms) of toxin can cause illness.

Onset of symptoms in foodborne botulism is usually 18 to 36 hours after ingestion of the food containing the toxin, although cases have varied from 4 hours to 8 days. Early signs of intoxication consist of marked lassitude, weakness and vertigo, usually followed by double vision and progressive difficulty in speaking and swallowing. Difficulty in breathing, weakness of other muscles, abdominal distention, and constipation may also be common symptoms.

Clinical symptoms of infant botulism consist of constipation that occurs after a period of normal development. This is followed by poor feeding, lethargy, weakness, pooled oral secretions, and wail or altered cry. Loss of head control is striking. Recommended treatment

is primarily supportive care. Antimicrobial therapy is not recommended. Infant botulism is diagnosed by demonstrating botulinal toxins and the organism in the infants' stools.

4. Diagnosis of Human Illness:

Although botulism can be diagnosed by clinical symptoms alone, differentiation from other diseases may be difficult. The most direct and effective way to confirm the clinical diagnosis of botulism in the laboratory is to demonstrate the presence of toxin in the serum or feces of the patient or in the food which the patient consumed. Currently, the most sensitive and widely used method for detecting toxin is the mouse neutralization test. This test takes 48 hours. Culturing of specimens takes 5-7 days.

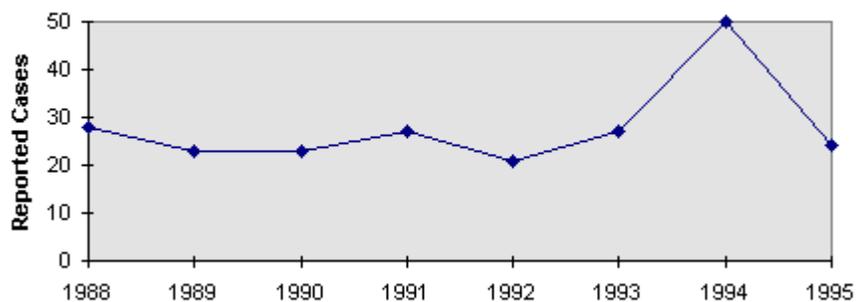
5. Associated Foods:

The types of foods involved in botulism vary according to food preservation and eating habits in different regions. Any food that is conducive to outgrowth and toxin production, that when processed allows spore survival, and is not subsequently heated before consumption can be associated with botulism. Almost any type of food that is not very acidic (pH above 4.6) can support growth and toxin production by *C. botulinum*. Botulinal toxin has been demonstrated in a considerable variety of foods, such as canned corn, peppers, green beans, soups, beets, asparagus, mushrooms, ripe olives, spinach, tuna fish, chicken and chicken livers and liver pate, and luncheon meats, ham, sausage, stuffed eggplant, lobster, and smoked and salted fish.

6. Frequency:

The incidence of the disease is low, but the mortality rate is high if not treated immediately and properly. There are generally between 10 to 30 outbreaks a year in the United States. Some cases of botulism may go undiagnosed because symptoms are transient or mild, or misdiagnosed as Guillain-Barre syndrome.

**Reported Cases Foodborne Botulism,
United States 1988-1995**



Summary of Notifiable Diseases, United States MMWR 44(53): 1996 October 25

7. The Usual Course of

Botulinum toxin causes flaccid paralysis by blocking motor nerve

Disease and Complications:

terminals at the myoneural junction. The flaccid paralysis progresses symmetrically downward, usually starting with the eyes and face, to the throat, chest and extremities. When the diaphragm and chest muscles become fully involved, respiration is inhibited and death from asphyxia results. Recommended treatment for foodborne botulism includes early administration of botulinal antitoxin (available from CDC) and intensive supportive care (including mechanical breathing assistance).

8. Target Populations:

All people are believed to be susceptible to the foodborne intoxication.

9. Food Analysis:

Since botulism is foodborne and results from ingestion of the toxin of *C. botulinum*, determination of the source of an outbreak is based on detection and identification of toxin in the food involved. The most widely accepted method is the injection of extracts of the food into passively immunized mice (mouse neutralization test). The test takes 48 hours. This analysis is followed by culturing all suspect food in an enrichment medium for the detection and isolation of the causative organism. This test takes 7 days.

10. Selected Outbreaks:

Two separate outbreaks of botulism have occurred involving commercially canned salmon. Restaurant foods such as sauteed onions, chopped bottled garlic, potato salad made from baked potatoes and baked potatoes themselves have been responsible for a number of outbreaks. Also, smoked fish, both hot and cold-smoke (e.g., Kapchunka) have caused outbreaks of type E botulism.

In October and November, 1987, 8 cases of type E botulism occurred, 2 in New York City and 6 in Israel. All 8 patients had consumed Kapchunka, an unviscerated, dry-salted, air-dried, whole whitefish. The product was made in New York City and some of it was transported by individuals to Israel. All 8 patients with botulism developed symptoms within 36 hours of consuming the Kapchunka. One female died, 2 required breathing assistance, 3 were treated therapeutically with antitoxin, and 3 recovered spontaneously. The Kapchunka involved in this outbreak contained high levels of type E botulinal toxin despite salt levels that exceeded those sufficient to inhibit *C. botulinum* type E outgrowth. One possible explanation was that the fish contained low salt levels when air-dried at room temperature, became toxic, and then were re-brined. Regulations were published to prohibit the processing, distribution and sale of Kapchunka and Kapchunka-type products in the United States.

A bottled chopped garlic-in-oil mix was responsible for three cases of botulism in Kingston, N.Y. Two men and a woman were hospitalized

with botulism after consuming a chopped garlic-in-oil mix that had been used in a spread for garlic bread. The bottled chopped garlic relied solely on refrigeration to ensure safety and did not contain any additional antibotulinal additives or barriers. The FDA has ordered companies to stop making the product and to withdraw from the market any garlic-in-oil mix which does not include microbial inhibitors or acidifying agents and does not require refrigeration for safety.

Since botulism is a life-threatening disease, FDA always initiates a [Class I recall](#).

January 1992

An incident of foodborne botulism in Oklahoma is reported in [MMWR 44\(11\):1995 Mar 24](#).

A botulism type B outbreak in Italy associated with eggplant in oil is reported in [MMWR 44\(2\):1995 Jan 20](#).

The botulism outbreak associated with salted fish mentioned above is reported in greater detail in [MMWR 36\(49\):1987 Dec 18](#).

For more information on recent outbreaks see the [Morbidity and Mortality Weekly Reports](#) from CDC.

11. Education:

The December 1995 issue of "FDA Consumer" has an article titled [Botulism Toxin: a Poison That Can Heal](#) which discusses Botulism toxin with an emphasis on its medical uses.

12. Other Resources:

[FDA Warns Against Consuming Certain Italian Mascarpone Cream Cheese Because of Potential Serious Botulism Risk \(Sept. 9, 1996\)](#)

A [Loci index for genome *Clostridium botulinum*](#) is available from GenBank.

CDC/MMWR

The CDC/MMWR link will provide a list of Morbidity and Mortality Weekly Reports at CDC relating to this organism or toxin. The date shown is the date the item was posted on the Web, not the date of the MMWR. The summary statement shown are the initial words of the overall document. The specific article of interest may be just one article or item within the overall report.

NIH/PubMed

The NIH/PubMed button at the top of the page will provide a list of research abstracts contained in the National Library of Medicine's MEDLINE database for this organism or toxin.

mow@cfsan.fda.gov
January 1992 with periodic updates

[Bad Bug Book](#) | [Home](#)

Hypertext last updated by mow/j3b/xxz 2000-MAR-08