

Botulism

1. DISEASE REPORTING

A. Purpose of Reporting and Surveillance

1. To assist in the diagnosis and treatment of potential cases and facilitate prompt administration of antitoxin when indicated.
2. To classify reported cases as foodborne, intestinal (infant or adult), wound or inhalational (implications for a bioterrorist act only) botulism (see §2D).
3. For foodborne botulism, to identify contaminated food(s) and to prevent others from eating it.
4. For foodborne botulism, to identify and assure the proper evaluation and care of other persons who may be at immediate risk of illness because they have already eaten the implicated food.

B. Laboratory And Physician Reporting Requirements

Any suspected botulism case should be reported **immediately, day or night** (within minutes) to local health departments, or, if they are unreachable, to Oregon Health Services.

C. Local Health Department Reporting and Follow-Up Responsibilities

Any suspected case of botulism is a **medical emergency** whereas foodborne or inhalational botulism is a **public-health emergency** and should be investigated as such. Thus, it is critical to determine what kind of illness you are dealing with. See §2D (Modes of Transmission).

1. Report all confirmed, presumptive, and suspect cases (see definitions below) to OHS **within minutes** of initial physician/lab report.
2. Begin follow-up investigation immediately. Use the OHS Botulism Reporting Form. Send a copy of the completed form to the OHS within seven days of initial report.
3. Consult with Communicable Disease Program epidemiologists about the need for botulism antitoxin therapy, and assist with logistic arrangements as necessary.
4. For foodborne botulism, work with the OHS to investigate possible sources, identify other persons who may have been exposed, submit patient and food specimens to the OSPHL, and complete steps to prevent others from eating the suspect food within 24 hours after receiving the case report.

2. THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent and Toxin

Botulism is an intoxication caused by ingestion or other exposure to a toxin produced by the Gram-positive bacillus *Clostridium botulinum*. *C. botulinum* is a spore former, which means that it can survive indefinitely under essentially any environmental conditions—even boiling. Bacterial growth, however, (as opposed to spore survival) occurs only under anaerobic conditions and low acid (generally pH>4). The higher temperatures (>120.5°C/250.5°F) that can be achieved under pressure (e.g., in an autoclave or *properly functioning* home pressure cooker) are sufficient to kill even spores.

The toxin itself is produced as the bacteria are multiplying. There are seven types of botulinum toxin, designated A–G. Types A, B, and E are the most common sources of human disease. F is very rare, and C and D are not known to cause human illness. The toxin is heat-labile, and (in contrast to, say, staphylococcal enterotoxin) can be inactivated by boiling for ten minutes.

B. Description of Illness

Botulism is a neurological disease caused by exposure to botulinum toxin.

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Botulism is characterized by neurologic symptoms that may include dysphagia, dry mouth, diplopia, and dysarthria (the "4 D's"). Blurred or double vision, ptosis (drooping eyelids), and weakness, reflecting a descending, symmetrical flaccid paralysis that starts with the facial muscles and progresses downward are also characteristic symptoms. The patient is usually mentally alert. Neurologic symptoms may be preceded or accompanied by mild GI disturbance such as constipation, vomiting, or diarrhea. The severity of symptoms and the rate of progression are highly variable, depending on dose and other factors. Respiratory distress may ensue if the muscles of breathing are compromised. In severe cases, patients may survive only after months on a ventilator.

The first sign in infants is often constipation, followed by lethargy, listlessness, difficulty feeding (weak or absent sucking response), a weak cry, ptosis, and generalized weakness (the "floppy baby" syndrome).

C. Reservoirs

C. botulinum spores are common in soil and elsewhere in the environment.

D. Modes of Transmission

Epidemiologically, cases fall into one of four categories. Although all types are potentially fatal and demand aggressive medical intervention, only foodborne and inhalational botulism are public-health emergencies.

1. Foodborne Botulism

Foodborne botulism is caused by ingestion of preformed toxin. Typically, implicated foods have been low acid, home-canned foods that had not been heated adequately during canning. In recent years, however, a growing proportion of implicated foods have been "ethnic" delicacies prepared by traditional methods, such as fermented fish heads (among Alaska Natives). Rarely, commercial products are implicated, usually after some breakdown in standard canning procedures has occurred. Examples of implicated foods include:

- home-canned asparagus, beans, and other vegetables (including low-acid tomatoes), usually canned by the water-bath method;
- fish that has been improperly canned, dried, or stored;
- sausage or other prepared meats that are improperly processed (inadequate sodium nitrite) and improperly stored;
- chopped garlic in oil, fried onions, and baked potatoes in foil;
- among Alaska Natives, "traditional" foods including fermented (putrefied) whale blubber, salmon heads, salmon eggs, and other delicacies.

2. Intestinal Botulism

a. Infant

By far the most common form of botulism, infant "bot" occurs when *C. botulinum* spores, ingested in food or soil, germinate in a gut that does not have a mature flora, leading to an intestinal infection. Botulinum toxin is then produced *in situ*. Most cases occur in infants <3 months old (almost always <6 months old). As many as 5% of SIDS cases may be infant bot.

b. Adult

This form of botulism rarely occurs. As with infant botulism, toxin is produced in the colonized intestine of the individual. It occurs in adults with a history of abdominal surgery, gastrointestinal tract abnormalities, Crohns disease or recent treatment with antibiotics.

3. Wound Botulism

Wound botulism results from a local *C. botulinum* infection in devitalized tissue at a wound site, where semi-anaerobic conditions are obtained. As with intestinal bot, the toxin is produced *in situ* and disseminated in the blood. Wound botulism has been rare, but increasingly reported, especially in injectors of "black-tar" heroin.

4. Inhalational Botulism

Inhalational botulism does not occur naturally. There have been only three reported cases in humans world-wide. Studies done with monkeys have shown that the toxin can be absorbed

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through the lung. It is believed that if botulinum toxin were to be used as a bioweapon, it would be by this route.

E. Period of Communicability

Not communicable.

F. Incubation Period

1. Foodborne Botulism

Variable: 12 hours to several days, usually 12–36 hours. A short incubation is associated with more severe disease.

2. Intestinal Botulism

Incubation period is unknown.

3. Wound Botulism

Up to several days.

4. Inhalational Botulism

Thought to be 12–36 hours after inhalation, but may take several days after exposure to low doses of toxin.

G. Treatment

All patients require close monitoring of ventilatory status, and aggressive supportive therapy is required in severe cases. Some patients have recovered completely after months on a ventilator. Additional therapies depend on the type of botulism and are outlined below.

1. Foodborne Botulism

Botulinum antitoxin can halt the progression of symptoms caused by absorbed toxin if given promptly after exposure. **Antitoxin therapy should never be delayed pending laboratory confirmation of the diagnosis.** The trivalent (anti-A, -B, and -E) antitoxin is purified from horse serum, and about 9% of recipients suffer allergic reactions. A skin test is always indicated before administration of antitoxin; the directions are in the antitoxin package insert. If no hypersensitivity reaction to the skin test occurs, the full dose (1 vial) may be given intravenously.

CDC controls the distribution of botulinum antitoxin, which is stocked at U.S. Public Health Service Quarantine Stations throughout the country. (For Oregon, the regional station is at Sea-Tac Airport in Seattle.) Any physician considering antitoxin use must consult first with the Health Services' Communicable Disease staff. After hours, ask that the on-call epidemiologist be paged at 503/731-4030.

2. Intestinal botulism

a. Infants

Most infants do well with supportive care, with or without cathartics or penicillin to try to eliminate intestinal infection by *C. botulinum*; however, they may need weeks of hospitalization and mechanical ventilation. A human-derived hyper-immune globulin (BIG-IV, or "BabyBIG") was approved by the FDA for treatment of infants in October 2003. Though the cost is a substantial \$45,300, its use may be cost-effective. A randomized, double-blind, placebo-controlled trial of BIG-IV found a 3-week reduction in the mean length of hospital stay and a reduction in the mean hospital charges per patient by \$88,600. BabyBIG can be obtained from the California Department of Health Services by calling the 24-hour number at 510-231-7600.

b. Adults

Horse-derived antitoxin is used to treat adult intestinal botulism. More than one dose of antitoxin may be required.

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3. Wound botulism

Debridement of the wound is indicated to remove devascularized tissue that provides the anaerobic conditions required for growth of *C. botulinum*. Antitoxin should be administered as for foodborne botulism (see §2G1 above). Antimicrobial therapy may also be warranted.

3. CASE DEFINITIONS, DIAGNOSIS, AND LABORATORY SERVICES

A. Confirmed Case Definition

Confirmation requires identification of botulinum toxin in serum or stool, and is not always possible. Completion of the tests may take several days to 2 weeks or more. Treatment, including consideration of antitoxin use, should never wait for laboratory confirmation.

B. Presumptive Case Definition

A presumptive case is someone with a compatible illness who has been exposed to the same suspected source as a confirmed case.

C. Suspect Case

Anyone with compatible illness of unknown etiology.

D. Services Available at the Oregon State Public Health Laboratory

The OSPHL will test serum and feces from a suspected case of foodborne botulism, as well as check any suspected food items, for the presence of toxin. Suspected commercial sources may be referred to the FDA for testing. The toxin test is a mouse bioassay, and is consequently expensive, time-consuming, and tough on the mice (twelve mice will give their lives in a single test).

Send as much stool as possible. (This may be difficult, because patients are often constipated.) A *minimum* of 15 ml of stool and 5 ml (preferably 15 ml) of serum are required for a proper examination. Specimens should be collected as early in the course of illness as possible. Send as much suspected food as possible. For suspected infant botulism, stool, not serum, is the specimen of choice. All specimens must be kept refrigerated (*not frozen*) during storage and transport (please use cold packs). Specimens must be properly packaged using guidelines for shipping and packaging of diagnostic specimens. Be sure to use absorbent material around the primary container. Use the Bacteriology/Parasitology form (#75).

4. ROUTINE CASE INVESTIGATION

The nature of follow-up depends on whether it is foodborne, intestinal (infant or adult), wound, or inhalational. No botulism investigation is "routine."

A. Foodborne Botulism

1. Identify Source of Intoxication

Interview the case and others who may be able to provide pertinent information about foods eaten. A home visit is strongly recommended when home-canned foods are implicated, or if the source is not readily apparent.

- a. Identify all home-canned foods eaten during the week prior to onset of symptoms. The most suspect foods are those that were eaten less than two days before onset, those that are low in acid (vegetables, fish, and meat), and those that were not eaten by other persons who remain well. (Keep in mind, however, that some cases may develop symptoms several days after the index case.) Identify and collect all remaining jars of the home-canned foods.
- b. Identify all commercially canned foods eaten during the week prior to onset of illness. For implicated foods, determine the brand, manufacturer, package size, lot number, and place and date of purchase (see §5B).
- c. Identify all sausage and other preserved meats eaten during the week prior to onset of illness. Meat products that have not been adequately refrigerated should also be suspected as a source.
- d. Identify all preserved fish eaten during the week before onset of symptoms.
- e. Identify all items stored in oil (e.g. onions, garlic) or foil (e.g. baked potatoes)

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2. Identify Potentially Exposed Persons

- a. Obtain the name, address, and telephone number of every person who may have eaten the suspected food item.
- b. Obtain the name, address, and telephone number of every person who may have the suspect home-processed food in his or her possession.
- c. When a commercial product is implicated, see §5B.

B. Intestinal Botulism (Infant Botulism)

No epidemiological follow-up is required. Provide education and counseling as needed.

C. Wound Botulism and Intestinal (Adult) Botulism

Once foodborne illness is ruled out, no public health follow-up is required.

D. Inhalational Botulism

1. Identify Source of Intoxications

Interview the case and others who may be able to provide pertinent information about possible exposures. Ask about public events recently attended.

2. Identify Potentially Exposed Persons

Obtain the name, address and telephone number of every person who may have been exposed.

5. CONTROLLING FURTHER SPREAD (FOODBORNE BOTULISM ONLY)

A. Home-Canned Food Implicated

1. If reachable within six hours of exposure, other persons who have eaten implicated food should be purged and given gastric lavage to remove any unabsorbed toxin. They should be monitored for signs of botulism at least twice daily for three days, and instructed to seek medical care immediately should symptoms develop.
2. Samples of any implicated home-canned food should be sent to the OSPHL for testing, and the remainder destroyed. To avoid endangering trash haulers or others, these foods should be boiled for 10 minutes before discarding. Any containers should be likewise boiled.
3. The person who prepared the home-canned food should be thoroughly instructed in proper canning techniques. The OSU Extension Service is a good resource for canning information (800/354-7319). Their website is <http://oregonstate.edu/dept/ehe/preserve/>

B. Commercial Products Implicated

When a commercial product is implicated as the source of intoxication, the Communicable Disease Program should be notified immediately. They will coordinate follow-up with relevant outside agencies (FDA, USDA, CDC, etc.).

MANAGING SPECIAL SITUATIONS

Clostridium botulinum toxin has been classified as a possible agent of bioterrorism because it is phenomenally potent and lethal (considered the most toxic compound, by weight, known). It is also easy to produce and transport, and affected individuals often need extensive and prolonged intensive care. It is believed that aerosol dissemination on food or in air would be the most likely mode of spread.

Aerosol dissemination could produce many cases in a geographic area. Therefore, inhalational botulism produced by an act of bioterror, should be considered for any clusters of botulism where food cannot be implicated. Call the Communicable Disease Section of Oregon Health Services immediately, day (503/731-4024) or night (503/731-4030).