

Botulism

Summary

Botulism is a neuroparalytic disorder characterized by an acute, afebrile, symmetric descending flaccid paralysis. Although rare, botulism is a serious illness caused by a nerve toxin produced by the bacterium *Clostridium botulinum*.

There are six kinds of botulism:

- **Foodborne botulism** can happen by eating foods that have been contaminated with botulinum toxin. Common sources of foodborne botulism are homemade foods that have been improperly canned, preserved, or fermented. Though uncommon, store-bought foods also can be contaminated with botulinum toxin.
- **Wound botulism** can happen if the spores of the bacteria get into a wound and make a toxin. People who inject drugs have a greater chance of getting wound botulism. Wound botulism has also occurred in people after a traumatic injury, such as a motorcycle accident, or surgery.
- **Infant botulism** can happen if the spores of the bacteria get into an infant's intestines. The spores grow and produce the toxin which causes illness.
- **Adult intestinal toxemia** (also known as adult intestinal toxemia) botulism is a very rare kind of botulism that can happen if the spores of the bacteria get into an adult's intestines, grow, and produce the toxin (similar to infant botulism).
- **Iatrogenic botulism** can happen if too much botulinum toxin is injected for cosmetic reasons, such as for wrinkles, or medical reasons, such as for migraine headaches.
- **Inhalational botulism** has recently been described. To date, the only human cases have been the result of inadvertent inhalation of toxin by laboratory workers. However, aerosolization and inhalation of botulinum toxin is considered a possible method for poison delivery in a bioterrorist attack.

All forms of botulism can be fatal and are considered medical emergencies. If you or someone you know has symptoms of botulism, see your doctor or go to the emergency room immediately. Foodborne botulism is a public health emergency because other people could eat a contaminated food.

Signs and symptoms in an adult may include:

- Double vision
- Blurred vision
- Drooping eyelids
- Slurred speech
- Difficulty swallowing
- Dry mouth
- Muscle weakness/descending paralysis
- Difficulty breathing/shortness of breath

Possible signs and symptoms in foodborne illness may also include:

- Abdominal pain
- Nausea
- Vomiting
- Diarrhea

Signs and symptoms in an infant may include:

- Poor feeding
- Diminished suckling and crying ability
- Neck and peripheral weakness (“floppy baby”)
- Constipation
- Respiratory failure

If untreated, illness might progress to cause descending paralysis of respiratory muscles, arms, and legs.

Agent

Botulinum toxin is produced by *Clostridium botulinum*, a gram-positive bacillus which is a spore-forming obligate anaerobe. Botulism occurs after absorption of botulinum toxin into circulation from a mucosal or wound surface. The toxin irreversibly blocks presynaptic release of acetylcholine at the neuromuscular junction causing flaccid paralysis and cranial nerve dysfunction. Botulinum toxin is broken into eight neurotoxins (labeled as types A, B, C [C1, C2], D, E, F, G and, most recently discovered in 2013, H). Human botulism is caused mainly by types A, B, E, and (rarely) F. Types C, D and E cause illness in other mammals, birds and fish. The majority of foodborne cases in the western United States (US) are caused by type A; type B causes the majority of cases in the eastern US; type E causes most cases of foodborne botulism in Canada and Alaska which are associated with native foods; and type F causes rare foodborne cases in the US. *C. botulinum* types A, B and E have been identified in wound botulism cases.

Transmission

Reservoir:

Botulinum spores are ubiquitous in soil and may be recovered from agricultural products, including honey.

Mode of Transmission:

- Foodborne botulism occurs when a person ingests botulinum toxin, which leads to illness within a few hours to days. Outbreaks of foodborne botulism have the potential to be a public health emergency because the contaminated food may be eaten by other people. A frequent source is home-canned foods prepared in an unsafe manner.
- Infant botulism occurs each year in a small number of susceptible infants who harbor *C. botulinum* in their intestinal tract. It occurs when an infant ingests spores of *C. botulinum*, which in turn colonize the intestinal tract and produce toxin.
- Wound botulism is a rare disease that occurs when wounds infected with *C. botulinum* secrete the toxin. Wound botulism has been reported among illicit drug users (especially

those using black tar heroin) from subcutaneous injections contaminated with spores or from cocaine inhaled into a sinus followed by germination, vegetative growth, and toxin production. It has also been seen in cases of traumatic injury, such as motorcycle crashes, and surgeries.

- Adult intestinal colonization (also called adult intestinal toxemia) is an even rarer type of botulism. It involves intestinal colonization in a person older than one year of age. In the small number of these cases, most patients had a history of gastrointestinal surgery or illness, such as inflammatory bowel disease, which might have predisposed them to enteric colonization. No other specific risk factors have been identified.
- Iatrogenic botulism occurs after an overdose of injected botulinum toxin for cosmetic or medical purposes
- Inhalational botulism occurs from the inadvertent inhalation of toxin by laboratory workers.

Period of communicability:

Not transmitted person to person.

Clinical Disease

Incubation Period:

- **Foodborne botulism:** usually 12 to 48 hours after eating contaminated food, but can occur as early as 6 hours or as late as 8 days.
- **Wound botulism:** 4 to 14 days between time of injury, injection, or inhalation and onset of signs and symptoms.

Infant botulism: estimated at 3 to 30 days from exposure to spore-containing food.

Illness:

Cranial nerve palsies always occur in botulism.

Foodborne botulism is characterized by acute bilateral cranial nerve dysfunction and descending weakness or paralysis. Early signs and symptoms can include: ptosis (drooping eyelids), double vision, blurred vision, dry mouth, dysarthria (difficulty in articulating words), dysphonia (difficulty talking, muffled speech), and dysphagia (difficulty swallowing, eventually aspiration). Symmetrical voluntary muscle weakness progresses from difficulty with head control to weakness of upper extremities then lower extremities. Cognitive function is normal despite fatigue and apparent lethargy. Fever is absent unless secondary infections develop.

Wound botulism develops into a similar clinical picture after the organism contaminates a wound, although these patients may have little evidence of acute wound infection.

Infant botulism typically presents with constipation, lethargy, difficulty feeding and swallowing, ptosis, loss of head control, and muscle weakness. Prolonged paralysis and intubation frequently lead to secondary infections. When death occurs, it is primarily due to respiratory failure.

Laboratory Diagnosis

Initial diagnosis of botulism should be based on clinical signs and symptoms. Treatment should not wait for laboratory confirmation. Laboratory confirmation is done by demonstrating the presence of botulinum toxin in serum, stool, or food, or by culturing *C. botulinum*, *C. butyricum*, or *C. baratii* from stool, a wound, or food.

Other tests and laboratory studies to help with clinical diagnosis include:

- Routine lab tests (CBC, electrolytes, LFTs, urinalysis): Generally not helpful in diagnosis as these tests show no characteristic abnormalities.
- Cerebrospinal fluid (CSF) studies: Essentially normal, although occasionally a borderline elevation in protein level may be seen.
- Tensilon test: A normal test helps to differentiate botulism from myasthenia gravis; borderline positive tests can occur in botulism.
- CTs and MRIs: Normal CTs and MRIs help to rule out cerebrovascular accident (CVA.)

Persons with suspected botulism should have serum and stool collected for analysis. (Because the toxin may enter the blood stream through the eye or via small breaks in the skin, caution is warranted during specimen collection.)

- A mouse neutralization bioassay confirms botulism by isolating the botulism toxin. Toxin may be identified in serum, stool, vomitus, gastric aspirate, and suspected foods.
- *C. botulinum* may be grown on selective media from samples of stool, wound exudates or foods. Note that the specimens for toxin analysis should be refrigerated, but samples for cultured *C. botulinum* should not be refrigerated.
- Because intestinal carriage is rare, identifying the organism or its toxin in vomitus, gastric fluid, or stool is strongly suggestive of the diagnosis.
- Isolation of the organism from food without toxin is insufficient grounds for the diagnosis.

Treatment

Treatment of botulism should begin based on clinical suspicion before definitive laboratory test results are available.

Intravenous botulinum antitoxin should be administered as soon as possible, but after collection of serum and other specimens for testing, to all patients with suspected botulism.

- **Foodborne and wound botulism:** Equine trivalent (types A, B, E) and bivalent (types A and B) antitoxin can be made available 24/7/365 by contacting the Epidemiology and Response Division at 505-827-0006 and the CDC Emergency Operation Center at 770-488-7100. Because the antitoxin is of equine origin, testing for hypersensitivity and desensitization may be necessary. For wound botulism, in addition to antitoxin, the wound should be debrided, and appropriate antibiotics administered.
- **Infant botulism:** Infants should be given an investigational human botulinum immunoglobulin available from the California Department of Health Services. To obtain BabyBIG® for a patient with suspected infant botulism, the patient's physician must first contact the Infant Botulism Treatment and Prevention Program (IBTPP) on-call physician at 510-231-7600 to review the indications for such treatment. Inquiring physicians may obtain a checklist that outlines the necessary steps the IBTPP must take to release BabyBIG® to a hospital at www.infantbotulism.org/home.php.
- Equine botulinum antitoxin **should not** be used for infant botulism due to the risk of sensitization and anaphylaxis.

- Antimicrobial therapy **is not indicated** in infant botulism, as lysis of luminal bacteria could release more toxin.

Patients with suspected or confirmed botulism should have immediate access to intensive care for meticulous supportive care, including intubation and ventilation when indicated.

Surveillance

Foodborne:

Laboratory criteria - Detection of botulinum toxin in serum, stool, or patient's food or isolation of *Clostridium botulinum* from stool.

Confirmed – a clinically compatible case that is laboratory confirmed or that occurs among persons who ate the same food as persons who have laboratory confirmed botulism.

Probable - a clinically compatible case with an epidemiologic link (e.g., ingestion of a home canned food within the previous 48 hours.)

Wound:

Laboratory criteria - Detection of botulinum toxin in serum or isolation of *Clostridium botulinum* from wound.

Confirmed – a clinically compatible case that is laboratory confirmed in a person with no exposure to contaminated food and who has a history of a fresh, contaminated wound or a history of injection drug use during the two weeks prior to symptom onset.

Probable - a clinically compatible case in a person with no exposure to contaminated food and who has a history of a fresh, contaminated wound or a history of injection drug use during the two weeks prior to symptom onset.

Infant:

Laboratory criteria - Detection of botulinum toxin in serum or stool or isolation of *Clostridium botulinum* from stool.

Confirmed – a clinically compatible case that is laboratory confirmed occurring in a child <1-year-old.

Reporting:

Report all suspected or confirmed cases of botulism immediately to the Epidemiology and Response Division (ERD) at 505-827-0006. Information needed includes: patient's name, age, sex, race, ethnicity, home address, home phone number, occupation, and health care provider. ERD will collect clinical and laboratory information, assist in the shipment of antitoxin for treatment, and arrange for specimen testing at CDC. Information should also be entered into NM-EDSS per established procedures.

Case Investigation:

- **Foodborne botulism** – use the Foodborne Surveillance Investigation Form to complete the investigation. Information should also be entered into NM-EDSS per established procedures.
- **Wound botulism** – use the General Infectious Disease Investigation Form to complete the investigation. Information should be entered into NM-EDSS per established procedures.

- **Infant botulism** – Complete the CDC Infant Botulism Form 52.73 and send to Epidemiology and Response Division, P.O. Box 26110, Santa Fe, New Mexico, 87502-6110 or fax to 505-827-0013. Information should be entered into NM-EDSS per established procedures.

Control Measures

1. Case management
 - 1.1. Isolation: None required.
 - 1.2. Prophylaxis: Not applicable.
2. Contact management
 - 2.1. Isolation: None required.
 - 2.2. Prophylaxis: Persons who have eaten the same food implicated in a case of botulism should receive catharsis to remove toxin from the intestine or stomach. They should remain under surveillance for at least one week after exposure. The decision to provide presumptive treatment with antitoxin to an asymptomatic exposed individual, needs to be weighed carefully against the risks for adverse reactions and sensitization to horse serum.
3. Prevention
 - 3.1. Canning of food requires careful attention to adequate control of pH (for food not subject to pressure sterilization), temperature, and time in order to destroy spores.
 - 3.2. Honey should not be given to children younger than 12 months of age.
 - 3.3. Immunization: Not applicable.
4. Outbreak
 - 4.1. Report of a single suspected case of botulism requires an immediate response to confirm the index case, facilitate prompt treatment, investigate the source of toxin, and identify additional cases or persons at risk. Infant and wound botulism cases are sporadic. Foodborne and other intestinal botulism cases may occur in protracted outbreaks from commercially distributed food products or from extended use of contaminated foods by restaurants.

Management of Botulism in Child Care Centers

Refer to recommendations above.

References

American Academy of Pediatrics. In: Kimberlin, DW, et al eds. Red Book: 2018 Report of the Committee on Infectious Diseases. 31st ed. Itasca, IL: American Academy of Pediatrics; 2018.

Arnon, SS. et al. Botulinum Toxin as a Biological Weapon Medical and Public Health Management JAMA, February 28, 2001—Vol 285, No. 8.

CDC. Botulism. <https://www.cdc.gov/botulism/health-professional.html>

Heymann, DL, ed. Control of Communicable Diseases Manual. 19th edition. Washington, DC: American Public Health Association; 2008.

See Botulism Fact Sheets.