

# EEK! Clostridium botulinum



## What is Botulism?

It comes from the Latin word, *botulus* (a sausage). In 1820, Justinus Kerner, a small-town German medical officer, gave the first complete description of clinical botulism based on extensive clinical observations of so-called “sausage poisoning.”

- Soil-borne, single-celled bacterium.
- Needs moisture. Hates oxygen (anaerobic).
- If *C. botulinum* senses oxygen:
  - Builds an impenetrable armor shell.
  - Lays dormant until oxygen leaves.
  - It's a spore in this mode.
  - Very patient, can wait 1,000s of years for conditions to improve and still remain viable.
- If *C. botulinum* finds itself back in a comfortable, low-acid, moist, oxygen-free environment:
  - Will reanimate back into vegetative, bacterial form.
  - Grow, reproduce and, for the home canner, produce botulinum toxin.
  - The most potent neurotoxin in the world.
- *C. botulinum* spores cannot be killed by boiling, drying, freezing, radiation or most household cleansers.

## How bad is botulism, really?

- A pint jar of pure botulinum toxin would be enough to kill every man, woman and child in the world. About 1 microgram (0.000001 gram or 1 gram is 1000000 micrograms) is lethal to humans when inhaled.
- Sealing food in a jar, as we do when we water-bath or pressure can food, creates a moist, oxygen-free environment. This is exactly the environment *C. botulinum* spores are looking for to reanimate into their toxin-producing form.

## Why aren't we all dead?

- While botulism poisoning is deadly serious, it's thankfully very rare. Over the last 50 years, the US averaged about 110 reported cases per year.
- Of these, the majority (72%) are *infant botulism*.
  - Occurs when botulinum spores lying dormant in soil or dust, on food or in honey colonize the low-acid digestive tract of an infant, germinate and begin to produce toxin. The digestive tract of people over age of one year is generally too acidic to allow spores to germinate.
- About 25% are *food borne* – home canners concern.
  - Occurs when food contaminated with botulinum toxin is ingested. Most common source is home-canned, low-acid food.
- Few cases (3%) are *wound botulism*.



- Occurs when botulinum spores or bacterium are introduced into deep wounds, grow and produce toxin.
- Most often found among those who inject street drugs (black tar heroin).
- Botulism has occurred after cosmetic use of inappropriate strengths of Botox.
- In 2002, the FDA approve Botox Cosmetic, botulinum A toxin.
- In 2010, the FDA approved intramuscular botulinum toxin injects for treatment of chronic migraine headache.

- Muscle weakness starts in the muscles supplied by the cranial nerves.
- Acts by blocking nerve function, causing paralysis.
- Group of 12 nerves controls
  - Eye movements (double vision, drooping of both eyelids)
  - Facial muscles (chewing, swallowing)
  - Slurred speech
  - Postural hypotension (light headedness)
- Spreads to arms, then legs and feet
- Botulism can result in death due to respiratory failure by paralyzing chest muscles
  - Past 50 years death has fallen from 50% to 7% due to improved supportive care.
- Infant botulism (floppy baby syndrome)
  - Case fatality rate is <1% for hospitalized infants.

## Botulism Control Methods

- Acid Level (stop spore germination)
  - The spores that cause botulism will not germinate in a strongly acid environment.
  - If the spores never germinate, they cannot make the botulism toxin.
  - Food that has a pH of 4.6 or less is considered strongly acid and is safe to can in a water bath canner.
- Temperature (kill spores outright)
  - *C. botulinum* spores that can germinate and then create the botulinum toxin can survive temperatures of 212°F.
  - If you can get them up to 240°F and keep them there long enough, the spores will die.
  - In the US, commercial guidelines for most canned low-acid food require a “botulism cook” at 250°F for 3 minutes, which reduces the chance of a *C. botulinum* spore surviving to one in a trillion.
  - Because home canners cannot be absolutely sure how long it takes for every bit of the internal temperature of a jar of food to reach the necessary temperature, official guidelines for processing time must be followed.
  - Never shorten processing time, ever.

## Treatment

- Early administration of botulinum antitoxin.
- Intensive supportive care, including mechanical breathing assistance.
- Some cases go undiagnosed because of mild symptoms or misdiagnosed as Guillain-Barré syndrome.

## Symptoms

- Botulinum toxin is broken down into 8 neurotoxins (A, B, C [C1, C2], D, E, F and G).
- Human botulism is caused mainly by types A, B, E and F (rare).
- Early symptoms start from 4 hours to 8 days after eating. Usually 18- 36 hours.

## BOTULISM SIGNS AND SYMPTOMS

