



Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive



Health Protection Surveillance Centre
Lárionad Faire um Chosaint Sláinte



Botulism

An overview of the disease

Updated 22.12.2008



Botulism milestones

- 1793 Human outbreak linked to sausages (Germany)
- 1870 Disease named “botulism” - *botulus* = "sausage" (Latin)
- 1895 Organism isolated
- 1944 Toxin isolated
- 1949 Identification that toxin blocks neuromuscular transmission
- 1973 Animal experiments
- 1980 Therapeutic usage - treatment of strabismus
- 1989 BOTOX (botulinum toxin, therapeutic usage) is approved in the United States for treatment of specific conditions



C. Botulinum

- Worldwide distribution
 - *Clostridium* spores are found in soil
 - High mortality rate unless identified and treated early
- **Epidemiology**

Ireland

- Rare, between 1998-2007 only 1 case notified
- 3 cases in injection drug users reported in 2002 (wound botulism became notifiable 1st Jan 2004)

EU

- UK -6 food borne outbreaks between 1987 and 2005, >130 wound botulism cases between 2000-2007
- Food-borne botulism commoner in Italy, Germany and Baltic States

USA

- ~ 145 cases/year; 15% food borne,, 65% infant botulism,20% wound

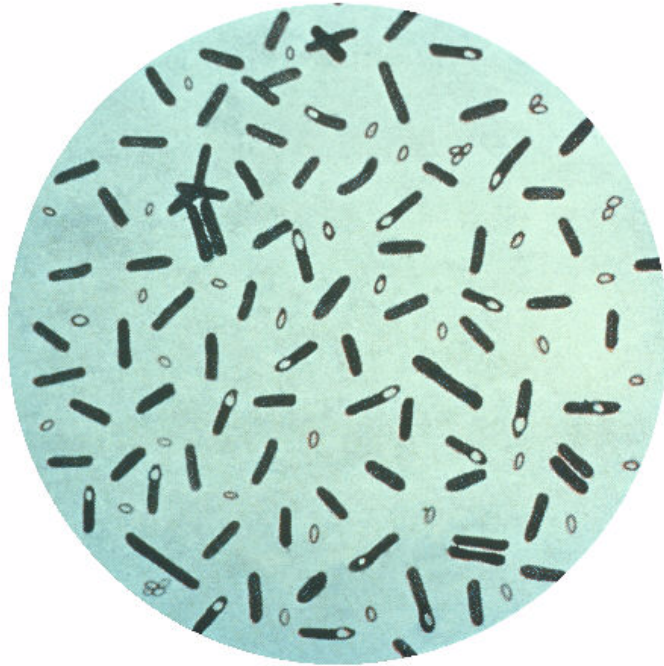


C. Botulinum characteristics

- Nerve toxin produced by the bacterium *Clostridium botulinum*
 - One of the most powerful toxins known to man – tiny infectious dose
- A medical and Public Health emergency
- 7 types of botulism toxin (A-G)
 - Types A, B, E and F cause human illness
- Anaerobic, gram positive, rod-shaped bacteria
- Spores
 - Can remain dormant for 30 years or more
 - Spores resistant to heat and UV light
- Toxin is inactivated by heat
 - Cooking at 80°C for 10 minutes or longer

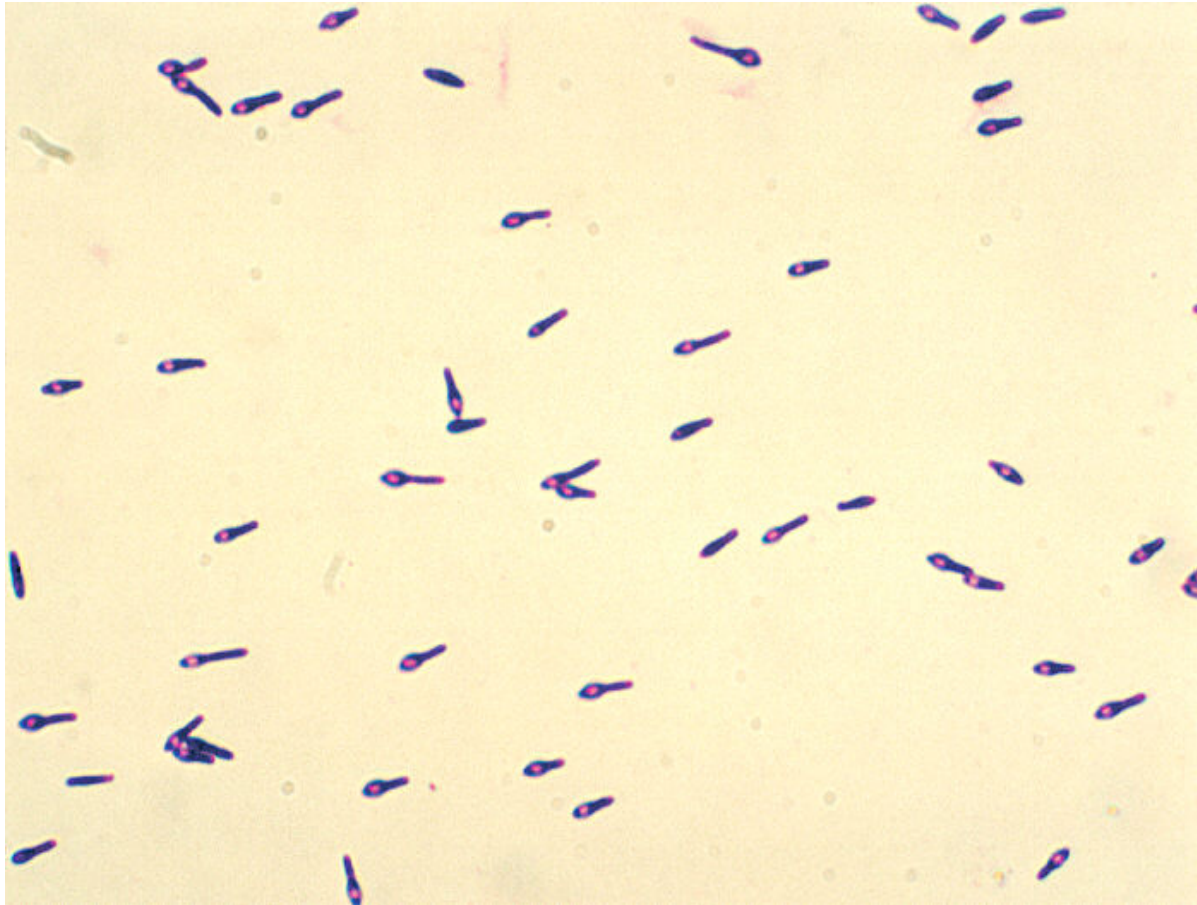


Clostridium botulinum



Photomicrograph of
C. botulinum stained with
Gentian violet.

Picture courtesy of CDC



Photomicrograph of
C. botulinum type A
viewed, Gram stain

Picture courtesy of CDC/ Dr. George Lombard



Botulism food poisoning



These are *Clostridium botulinum* Type E colonies displaying an opaque zone grown on a 48hr egg yolk agar plate; Mag. 1.9X.

Picture courtesy of CDC/ Dr. Holdeman



Botulism food poisoning



These are *Clostridium botulinum* Type A colonies, Strain 2, grown on a 48hr blood agar plate

Picture courtesy of CDC/ Dr. Holdeman



Clostridium botulinum

- 7 types of botulism A through G, based on the antigenic properties of the toxin produced
 - toxins A, B, E and F Humans
 - toxins C and D Birds, mammals
 - toxin G Soil isolate in Argentina, but no disease reported
- Type B predominates in Europe and the US, east of the Rockies. The more severe Type A is commoner west of the Rockies



Categories of Botulism

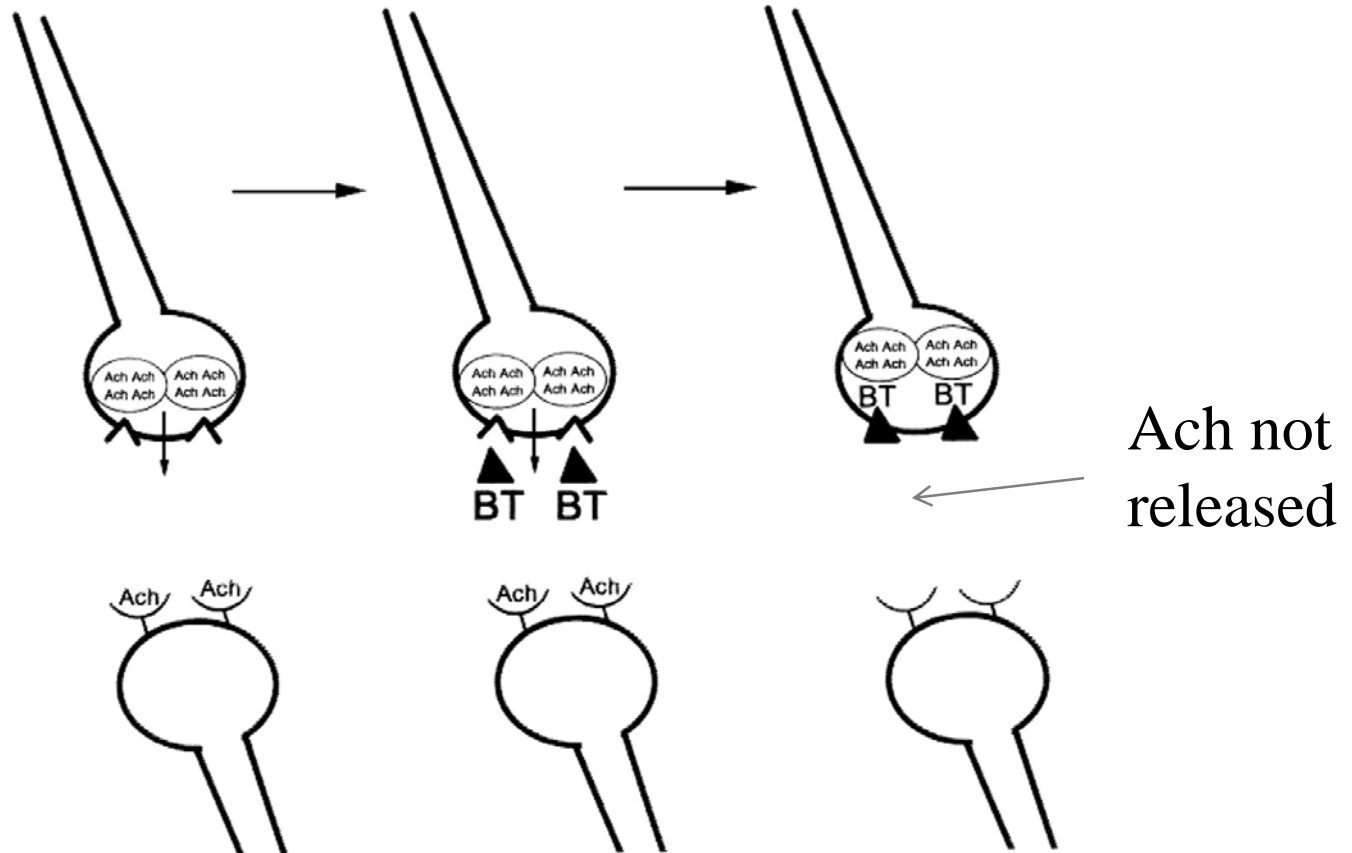
- **Food borne botulism**
 - foods containing botulism toxin
- **Intestinal botulism (infant and child/adult)**
 - Ingested spores of *C. botulinum* germinate and produce toxin in intestines
 - Uncommon in adults
- **Wound botulism**
 - *C. botulinum* spores germinate in the wound and release toxin
- **Inhalation botulism**
 - Aerosolised toxin is inhaled
 - Usually does not occur naturally (has been reported in cocaine users)
 - Potential for use as a bioterrorist agent



Botulism – development and progression of disease

- Suspected Botulism is a medical emergency
- Incubation period
 - food borne: 4 hours-8 days
 - wound: 4-14 days
 - Shorter incubation period associated with higher ingested dose and more severe disease
- Toxin enters bloodstream
 - Binds to peripheral cholinergic nerve endings
 - Inhibits release of acetylcholine, preventing muscles from contracting
- Symmetrical, descending paralysis
 - begins with cranial nerves , progresses peripherally

Schematic representation of the action of botulinum toxin (BT) on a neuromuscular junction





Symptoms

Motor loss cranial → peripheral + cholinergic effects

Gastrointestinal*

- Nausea
- Diarrhoea (early)
- Constipation (late)
- Abdominal cramps
- Vomiting

**for food borne illness*

Neurologic

- Blurred/double vision
- Difficulty swallowing, dry mouth
- Muscle weakness
- Drooping eyelids
- Slurred speech
- Difficulty breathing

Miscellaneous

- Fatigue
- Sore throat
- dizziness



Physical findings*

- Ptosis
- Extra-ocular muscle weakness
- Facial nerve dysfunction
- Hypoactive gag reflex
- Tongue weakness
- Pupils fixed or dilated
- Extremity weakness
 - Symmetric
 - Proximal to distal
 - Descending pattern
- Nystagmus
- Hypoactive deep tendon reflexes

**adapted from Hughes et al. Ann Intern Med 1981;95:442-5*



Botulism – clinical course (cont.)

- Respiratory muscle involvement
 - many cases require mechanical ventilation when voluntary and involuntary muscles (diaphragm) affected
 - Sudden deterioration may occur
- Complications
 - related to prolonged ventilator support, secondary bacterial infection and prolonged paralysis/weakness
 - Death

Infant botulism



Picture courtesy of CDC



Botulism Differential Diagnoses

Requires high index of suspicion*

- Guillain-Barré syndrome
- Myasthenia gravis
- Stroke
- Lambert-Eaton syndrome
- Intoxication with organophosphates, atropine, carbon monoxide, opiates, alcohol
- Paralytic fish poisoning

***Differs from other causes of flaccid paralysis:**

- Cranial nerve palsies are disproportionately more profound than peripheral weakness/hypotonia
- Absence of sensory nerve damage



Possible Case of Botulism – Action

- Suspected Botulism is a Public Health emergency
- Immediate notification
 - Call local HSE Department of Public Health immediately if a case of botulism is suspected
- Laboratory confirmation
 - Obtain serum sample for toxin testing
 - Isolation of *C. botulinum* from wound
- Treat with anti-toxin
- Full epidemiological investigation
 - Enhanced surveillance undertake and investigation



Botulism Clinical Treatment

- Antitoxin supply and administration
 - Contact Medical officer, Cherry Orchard Hospital; Tel:01 620 6000 who authorises delivery of anti-toxin
 - Anti-toxin administration should NOT BE DELAYED pending microbiology/toxin testing results
 - Turnaround times for reliable negative results can be up to one week
 - Hospital pharmacy should be informed of request
- Elimination
 - Induced vomiting, high enemas (food borne)
 - Antibiotics for wound botulism, debridement if needed
- Supportive Care
 - Mechanical ventilation, parenteral nutrition, rehabilitation



Botulism Antitoxin

- Antitoxin
 - Can be procured from HSE
 - Authorised by Medical Officer, Cherry Orchard Hospital
 - Stored and distributed through National Cold Chain, National Immunisation Office (NIO) when stocks available
 - Emergency stock available from Novartis Germany on named patient basis within 24 hours of request
 - Unlicensed product
 - For use on named patient basis
 - For treatment of most common forms of botulism
 - Product data sheet available at www.immunisation.ie/en/VaccineOrderingandStorage/



Botulism Antitoxin (cont.)

- Does not reverse current paralysis, but may limit progression and prevent nerve damage if administered early
- Hypersensitivity to antitoxin
 - 9% of people experience some hypersensitivity to equine anti-toxin



Botulism Infection Control

- Botulism cannot be transmitted person-to-person
- Standard precautions should be taken when caring for botulism patients



Botulism Laboratory Procedures

- Toxin neutralization mouse bioassay
 - serum, stool, gastric aspirate, suspect foods
- Isolation of *C. botulinum* or toxin
 - Faeces (food borne or intestinal), wound, tissue



Wound botulism

- Avoid use of illegal drugs
- If using drugs
 - is your supply safe? Is your equipment sterile?
- Promptly seek medical care for infected wounds
- Seek medical attention if develop any of signs or symptoms of botulism



Food borne botulism

- Typically low acid content e.g.
 - Canned green beans, spinach, mushrooms, and beets;
 - Fish, including canned tuna, fermented, smoked and salted fish;
 - Meat products, especially ham but also chicken and sausage
- Also
 - Chopped garlic in oil, tomatoes, carrot juice, improperly handled baked potatoes



Preventing food borne botulism

- Follow strict hygienic procedures to reduce contamination of foods
- Refrigerate oils infused with garlic/ herbs
- Baked potatoes (wrapped in aluminum foil) should be kept hot until served or refrigerated
- Boil canned food for 10 minutes before eating
- Don't give honey to children less than 12 months of age



Botulism Vaccine

- Not available in Ireland- concerns about its effectiveness and adverse event profile
- In the U.S.
 - a toxoid vaccine (antigen types A, B, C, D, and E) is available for laboratory workers at high risk of exposure



Documented outbreaks

- Food borne
 - Canned soups - USA, 1971
 - Chili Sauce - USA, 2007
 - Fermented foods - Eskimo population (frequent)
 - Yoghurt - Turkey, 2005
 - Carrot juice - USA, 2006
 - Bamboo shoots - Thailand, 2006



Documented outbreaks (cont.)

- Wound botulism
 - Outbreaks in Germany (2005), UK (2004), Ireland (2002. 2008), U.S.A.
 - Mainly injection drug users (heroin)



References

- WHO. Botulism.
<http://www.who.int/mediacentre/factsheets/fs270/en/>
- Centers for Disease Control (CDC)
 - <http://emergency.cdc.gov/agent/botulism/factsheet.asp>
- Botulism in the United States: A clinical and epidemiologic review. Shapiro RL, Hatheway C, Swerdlow DL. *Ann Intern Med* 1998;129:221-8.
- Botulism - Minnesota Department of health.
www.health.state.mn.us/divs/idepc/diseases/botulism/botslides.ppt
- Hughes JM, Blumenthal JR, Merson MH, Lombard GL, Dowell VR Jr, Gangarosa EJ. Clinical features of types A and B food-borne botulism. *Ann Intern Med* 1981;95:442-5