Wound Botulism

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November 1st, 2016
Objectives

Overview of Botulism

Types of Botulism

Heroin in Alaskan media

Heroin and wound botulism
History

First noted with a case series in 1820s

- hundreds of patients with "sausage poisoning" in a southern German town

1895 in Belgium

- the association was demonstrated between a neuromuscular paralysis and ham infected by a spore-forming bacillus that was isolated from the ham.

Botulus = Latin word for “sausage”
Botulism - *Clostridium botulinum*

A gram positive anaerobic spore-forming bacilli

Neurotoxin enters the bloodstream and paralyzes muscles by irreversibly blocking the release of acetylcholine at peripheral neuromuscular junctions. Affects both autonomic and voluntary motor activities.
**A** Normal Neurotransmitter Release

- Synaptic Vesicle
- SNARE Proteins Form Complex
- Vesicle and Terminal Membranes Fuse
- Neurotransmitter Released
- Muscle Fiber Contracts

**B** Exposure to Botulinum Toxin

- Botulinum Toxin Endocytosed
- Light Chain Cleaves Specific SNARE Proteins
- SNARE Complex Does Not Form
- Membranes Do Not Fuse
- Neurotransmitter Not Released
- Muscle Fiber Paralyzed

Arnon et al., 2001
Botulism

easily isolated from the surfaces of vegetables, fruits, seafood, and exist in soil and marine sediment worldwide

**Heat resistant spores surviving 100°C**, can be destroyed if >120°C for 5 minutes

Germinate in anaerobic environment

pH>4.6

ideal temp 25-37°C (some strain grow in 4°C)
Symptoms

Cranial nerve palsies followed by symmetric descending paralysis.

Neurologic: diplopia, eye dilation, dysphagia, dry mouth

GI: nausea or vomiting

Muscular: weakness, paralysis, fatigue, dyspnea
Types of Botulism

**Foodborne botulism** – Ingestion of food contaminated by **preformed botulinum toxin** (dx: blood assay. Sometimes can find in emesis and stool assay too)

**Infant botulism** – The *ingestion of clostridial spores* that then colonize the host's gastrointestinal (GI) tract and release toxin produced in vivo (dx: stool toxin)

**Wound botulism** – Infection of a *wound* by *Clostridium botulinum* with subsequent in vivo production of neurotoxin
Types of Botulism

**Inhalational botulism** – The form that would occur if aerosolized toxin was released in an act of bioterrorism

**Iatrogenic botulism** – Iatrogenic cases of botulism from patients receiving botox for cosmetic indications. Rare reports.
Treatment

Call State Health Department for the antitoxin (Heptavalent botulinum antitoxin which contains antibodies for 7 toxin types A-G)

- Antitoxin side effects include serum sickness and anaphylaxis
- Patient often continue to progress with neurologic and muscular deterioration after receiving antitoxin

Monitor airway and evaluate for possible intubation. Respiratory failure is the primary cause of death.

Complete resolution of toxin effects usually takes 1-2 months.
Heroin in Alaska

Figure 4. Number of Heroin-Associated Deaths*, by Year — Alaska, 2008–2013 (N=72)

*Represents deaths where heroin was either the underlying and contributory cause of death.
<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Deaths Per Year (Age-Adjusted Rate of Overdose Deaths per 100,000 Pop. Per Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2009</td>
</tr>
<tr>
<td>Prescription Drugs</td>
<td>104 (14.4)</td>
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<tr>
<td>Opioid Pain Relievers</td>
<td>80 (11.2)</td>
</tr>
<tr>
<td>Illicit Drugs</td>
<td>36 (5.1)</td>
</tr>
<tr>
<td>Heroin</td>
<td>7 (1.0)</td>
</tr>
<tr>
<td>Unspecified Drugs</td>
<td>7 (9.0)</td>
</tr>
<tr>
<td>Total Overdose Deaths</td>
<td>131 (17.9)</td>
</tr>
</tbody>
</table>

http://www.epi.alaska.gov/bulletins/docs/b2016_06.pdf
In the news

May 2014 Kodiak: “In a January bust that was their biggest yet, Kodiak police seized 76 grams of black tar heroin and 28 grams of Afghan brown heroin, plus other drugs” http://www.seattletimes.com/nation-world/heroin-invades-rural-alaska/


Alaska Heroin Rush. Drugs Inc. on National Geographic Channel. On Nov 13th at 3am.
Heroin

highly addictive drug processed from morphine, a naturally occurring substance extracted from the seed pod of certain varieties of poppy plants.

“cut” with sugars, starch, powdered milk [White China from Asia/Afghanistan] OR coffee grounds, dirt [Black Tar from Mexico].
Wound Botulism and “Black Tar Heroin”

 Longer incubation period, up to 10 days (where as food botulism incubation 12-36hrs), fever, leukocytosis

 Black tar heroin (tarry consistency, dark-colored), toxin type A or B. inject subcutaneously (“skin popping”) or intramuscularly (“muscling”) -> necrotic myositis, which sets up an ideal environment for bacterial growth.

 Toxin can’t be detected once bind to cell receptors.

 Culture the wound for toxin and bacteria

 Antibiotics recommended for wound botulism -> (PenG or Metronidazole UpToDate recommendations)
Black Tar Heroin: a viscous substance that is gummy and non-water-soluble, requiring additional handling and heating to prepare in an injectable solution.

Cheap heroin. Improper acetylation with acetic acid with lack of fancy lab equipments. Veins from injection often become sclerotic due to additives leading to skin popping.

“cut” with a variety of brown organic materials, which increase its weight for sale. i.e. shoe polish, wood pulp, coffegrounds, and dirt – are believed to be a major source of contamination with Clostridial spores.
Black Tar Heroin

Preparation for injection:

- Dissolve in saliva, lemon juice
- heated to boiling temperature
  - This process likely destroys most bacteria other than Clostridial spores, which have been shown to survive such conditions

From Mexico/Latin America
Wound Botulism and Black Tar Heroin

First noted in 1950s due to contaminated surgical wound, then now more associated with black tar heroin skin popping across England and Scotland for 2000-2009. Overall, 295 infections were reported: 1.45 per 1,000 IVDU in England and 4.01 per 1,000 IVDU in Scotland.

In California from 1993-2007 had 17 recurrent cases (14 patients with 1 recurrence, 3 patients with 2 recurrence.)

Most Common Symptoms: a visible wound, speech difficulty, double vision, respiratory difficulty, and trouble swallowing.

Yuan, 2011. Palmteer 2013
Conclusion

Early recognition of botulism with a thorough patient history

Early access and administration to antitoxin (only works before toxin is endocytosed) - reduce ICU stay

Supportive Care

Can recur if they continue skin popping
Resources


