Botulinum Toxin as a Biological Weapon
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What is botulinum toxin?
Botulinum toxin is a nerve toxin produced by the soil bacterium *Clostridium botulinum*. It is "the most poisonous substance known". The American Medical Association states the lethal inhalation dose is approximately 0.7-0.9 µg.

Why is botulinum toxin considered a bioweapons threat?
Botulinum toxin is extremely potent, easy to manufacture and transport, as well as being colorless, odorless, and tasteless when in solution. In addition, affected persons require protracted care. Furthermore, several states are known to have produced botulinum toxin as a biological weapon. For example, the Soviet Union and Iraq produced botulinum toxin as a weapon. Finally, the Japanese cult Aum Shinrikyo tried to use botulinum toxin as a weapon in the early 1990s.

What is the mode of action of botulinum toxin?
Botulinum toxin is a nerve poison. It blocks acetylcholine release in motor neurons, and thereby causes muscle paralysis. Affected persons die from respiratory failure.

Is there a naturally occurring illness caused by botulinum toxin?
Yes, botulinum toxin causes botulism. There are three kinds of botulism; foodborne, infant, and wound. Each type is caused by the bacterium *Clostridium botulinum.*

How could botulinum toxin be used as a bioweapon?
Botulinum toxin could be released as an aerosol or as a food-borne contaminent. To generate aerosols for inhalation, Iraq produced both missiles and bombs filled with botulinum toxin. The Japanese cult Aum Shinrikyo used aerosol-generating equipment during its attacks. However, it's unlikely botulinum toxin would be used to contaminate municipal water supplies because it would require large amounts of toxin, and standard water treatments inactivate the toxin anyway.

How would we know if botulinum toxin has been deliberately released?
According to the American Medical Association, the following features would indicate a deliberate release of botulinum toxin:

- Outbreak of cases of paralysis characteristic of botulinum toxin (i.e., flaccid paralysis with bulbar palsies)
- Outbreak of an unusual or rare botulinum toxin type (for example toxin type G has never caused a foodborne botulism)
- Outbreak within a common geographic area, but without a common dietary exposure
- Multiple simultaneous outbreaks with no common source

Can the botulinum toxin be transmitted person-to-person?
No. In addition, the toxin does not penetrate intact skin. Rather, it enters via the gut, lungs, or a wound.

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Does the botulinum toxin remain active once sprayed into the environment?
Yes and its decay depends on the atmospheric conditions and the particle size of the aerosol. Substantial inactivation could take as long as 2 days.

What are the symptoms of botulinum toxin?
"Patients with botulism typically present with difficulty seeing, speaking, and or swallowing." By the third day following inhalational botulism, patients will have mucus in the throat, difficulty swallowing, and dizziness. By the fourth day patients will have difficulty moving their eyes, mild dilation of the pupils, indistinct speech, an unsteady gait, and extreme weakness.

How soon do exposed people fall ill?
The onset and severity of symptoms depends on the rate and amount of exposure. For foodborne exposures, cases typically present in 12-72 hours. Onset following inhalational exposure is unknown.

How is botulism diagnosed?
Diagnosis requires specialized laboratory tests. Several rapid diagnostic tests have been developed.

What preventive measures are available for botulinum toxin?
According to the Johns Hopkins University Center for Civilian Biodefense Strategey (2002), "An investigational botulinum toxoid is used to provide immunity for laboratory workers. It has been used to provide immunity against botulinum toxin over the past 30 years. However, supply of the toxoid is limited, and use of it would eliminate possible beneficial uses of toxoid for medical purposes. The toxoid induces immunity over several months and so would not be effective for rapid, post-exposure prophylaxis.

Existing technologies could produce large reserves of human antibody against the botulinum toxin. Administration of such a therapy could provide immunity of up to a month or greater and obviate the need for rationing the equine antitoxin. The development of such a human antibody reserve would require sufficient resources be dedicated to this problem."

How is botulism treated?
Per the AMA's advice, therapy for botulism consists of supportive care and treatment with an antitoxin (passive immunization with equine antitoxin). Even so, "the paralysis of botulism can persist for weeks to months with concurrent requirements for fluid and nutritional support, assisted ventilation, and treatment of complications." Recovery follows the growth of new axon twigs to reinnervate the paralyzed muscles.

References:
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