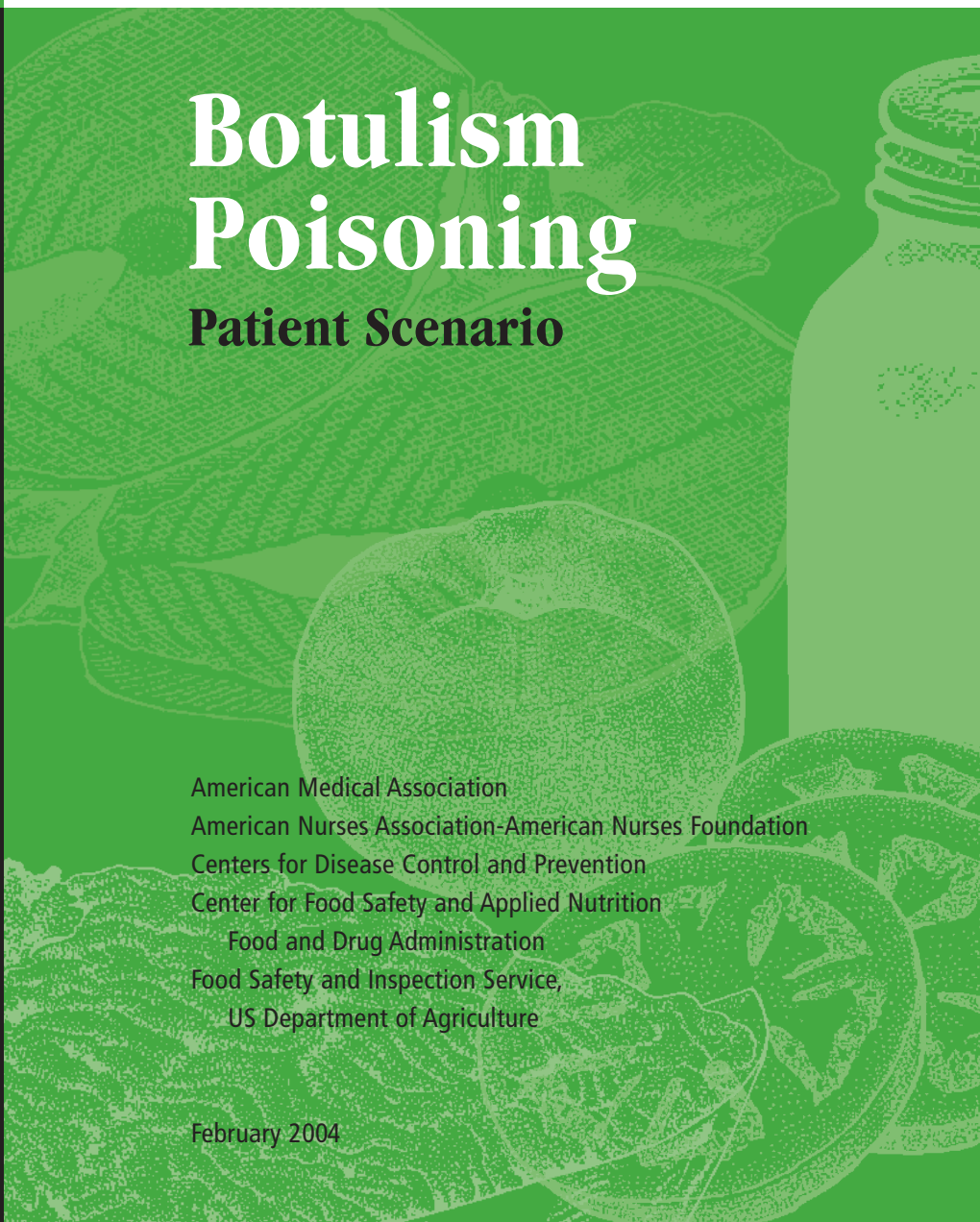
Diagnosis and Management of Foodborne Illnesses

A Primer for Physicians and Other Health Care Professionals



Botulism Poisoning

Patient Scenario

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This learning scenario can be used to reinforce medical management information pertaining to foodborne illnesses, such as that provided from the other booklets of this primer. This case study provides questions that need to be considered when dealing with a potential case of foodborne illness. Answers are provided immediately following the questions to enhance the learning process.

Similar learning scenarios are also available for other foodborne pathogens.

Botulism Poisoning, a Patient Scenario

On Sunday morning at 6am, you receive a call from the wife of a 35-year-old man who awoke complaining of dry mouth and blurred vision. His symptoms rapidly progressed over the next 2 hours to include diplopia, dysphagia, and weakness in his arms. You ask to talk with him directly, but he is having difficulty speaking. He was previously healthy.

You meet them in the local emergency department. On physical examination, he is afebrile with a heart rate of 80 beats per minute, a blood pressure of 120/80 mm Hg, and a respiratory rate of 12 breaths per minute. His pulse oximetry is 98% oxygen saturation. He has a hoarse voice, bilateral ptosis, a weak gag reflex, and bilateral proximal upper extremity weakness. He has no lower extremity weakness. Sensation is intact in all extremities. His mental status is normal.

What is the possible differential diagnosis for his chief complaint?

Guillain-Barré Syndrome

Myasthenia gravis

Tick paralysis

Cerebral vascular accident

Botulism intoxication

Heavy metal (thallium, arsenic, lead) or organophosphate toxicity

What additional information would assist in the diagnosis?

Has he had a recent flu-like illness?

Has he had a recent gastrointestinal tract illness?

Has he had similar symptoms before?

Is there a family history of hypertension, stroke, or other neurological disorders?

Has he found any ticks on himself or recently been in a tick-infested area?

Had he had any occupational or recreational exposure to heavy metals or organophosphates?

Has he eaten any home-canned foods? What foods has he consumed in the last 72 hours?

Has anyone else in the home been ill?

The patient denies having a flu-like illness within the last month. Neither he nor his family members have had similar symptoms. There is no family history of stroke or other neurological disorders, and he does not have hypertension or hypercholesterolemia. He has not discovered any ticks on himself or in his environment, and he has not been camping, hiking, or in any tick-infested area within the last week. He has had no occupational or recreational exposures to heavy metals or organophosphates. He denies eating any home-canned foods. He cannot remember everything he ate during the last 72 hours, but recalls eating lunch at a coffee shop near his office. He and his wife hosted a barbeque one evening at which they served grilled chicken, vegetables, and homemade ice cream. The night before onset of his symptoms, they ate at their favorite Italian restaurant where they shared a calamari appetizer, had salad prepared by the waiter at the table, and shared an entree of Fettuccine Fra Diablo. They finished the meal with a cappuccino and tiramisu.

How does this information assist with the diagnosis?

Guillain-Barré Syndrome (GBS) is usually preceded by a diarrheal or flu-like illness within 5 days to 3 weeks before onset of symptoms. It characteristically presents with an ascending pattern of muscle weakness; however, the Miller-Fisher variant of GBS may present with a descending pattern of muscle weakness. Myasthenia gravis is characterized by muscle fatigue after exercise, and the symptoms fluctuate over time. Tick-borne paralysis should be ruled out by a thorough examination for a tick; it also usually presents with an ascending pattern of muscle paralysis. Heavy metal poisoning may cause gastrointestinal tract symptoms, alopecia, mental disturbances (irritability, concentration difficulties, and somnolence) and peripheral neuropathy. Organophosphate toxicity causes a cholinergic syndrome. Botulism is a probable diagnosis despite the absence of a history of consumption of home-canned foods; bilateral cranial nerve palsies and a descending pattern of weakness are classic symptoms of botulism. The incubation period for this illness is typically 18 to 36 hours; therefore, it is important to obtain as complete a dietary history as possible for this time period. It is important that the local or state health department be contacted immediately when botulism is suspected.

What diagnostic tests are needed?

Five diagnostic tests may help pinpoint the diagnosis:

1. Electromyelogram (EMG) with rapid repetitive stimulation of the affected area at 20-50 Hertz
2. Tensilon test
3. Lumbar puncture – Cerebrospinal fluid (CSF) protein
4. Computerized tomography (CT) scan of the head
5. Magnetic resonance imaging (MRI)

In cases of botulism intoxication, an EMG of the affected muscles done with rapid repetitive stimulation at 20-50 Hertz will usually demonstrate a potentiated response in muscle action potentials;

whereas in GBS and myasthenia gravis rapid repetitive stimulation yields flat and decremental responses, respectively. Administration of Tensilon (edrophonium) will help confirm the diagnosis of myasthenia gravis by showing improved muscle strength after injection of this compound. CSF protein levels are normal in botulism but are almost always elevated in GBS except early in the course of the illness. A CT scan of the head with and without contrast may help rule out a significant cerebrovascular accident or encephalitis. An MRI may be helpful to distinguish soft tissue abnormalities or midbrain lesions. If the history suggests heavy metal or organophosphate toxicity, special tests including evaluation of hair or blood can be done.

You order the EMG, Tensilon test, CSF studies, and the CT scan of the head. The EMG shows a potentiated muscle action potential with rapid repetitive stimulation at 20 Hertz, consistent with botulism intoxication. The Tensilon test is negative (no improvement with Tensilon) and the CSF protein, glucose, and cell counts are normal. CT scan of the head shows no meningeal enhancement or evidence of intracranial hemorrhage.

What diagnostic test(s) will confirm the diagnosis of botulism?

To confirm the diagnosis of botulism, serum, stool, and any leftover suspect food should be tested for the presence of botulinum toxin. The test is a mouse bioassay. Mice are given injections of dilutions of sera, stool, and food extract followed by injections of monovalent antitoxins A, B, and E and polyvalent antitoxin ABCEF, and observed for signs of botulism and death. Stool and food also can be cultured for the bacterium *Clostridium botulinum,* which produces the toxins.

To order tests for botulinum toxin and *C. botulinum* culture, the state health department should be contacted. It can provide information about what specimens should be collected and how they should be stored, and will forward the specimens to the state public health laboratory or to the Centers for Disease Control and Prevention (CDC) if the state does not have the capacity to test for botulism.

What treatment is needed?

The most important treatment for botulism is supportive care. The patient's cardiorespiratory status should be monitored continuously in an intensive care unit. His respiratory function as measured by forced vital capacity should be monitored frequently, and he should be placed on assisted ventilation at the first sign of respiratory decompensation. Induced vomiting or gastric lavage are sometimes recommended to eliminate unabsorbed toxin from the stomach. These therapies are only done with a protected airway when the risk of aspiration is low. Cathartic agents or enemas are sometimes recommended to remove unabsorbed toxin from the gastrointestinal tract.

The only pharmacological treatment for botulism is antitoxin. The currently available licensed antitoxins are equine antibodies to toxin; one product has antibodies to toxin types A and B, the most common causes of botulism, and the other product has antibodies to toxin types A, B, and E. Use of the product containing antibodies to type E toxin is reserved for patients at high risk of type E botulism intoxication including those patients who were exposed to botulinum toxin in Alaska, or those who have a history of consumption of preserved fish, fish eggs, seal, walrus, whale, or beaver tail.

Antitoxin is most effective in preventing progression of the illness and shortening the duration of ventilatory failure if administered early (24-48 hours) after the onset of neurologic symptoms. If a diagnosis of botulism intoxication is strongly suspected, antitoxin should be administered promptly and should not be delayed until the diagnosis is confirmed. Hypersensitivity reactions have been reported in up to 9% of patients who receive antitoxin; therefore, skin testing is recommended prior to administration of antitoxin. Antimicrobials have not been of benefit in the treatment of foodborne botulism intoxication.

Botulinum antitoxin is obtained from quarantine stations with permission for release from the CDC and some state health departments; this should be arranged through the state health department. Epidemiologists within the Foodborne and Diarrheal Diseases branch are available 24 hours a day through the CDC; you can contact the on-call epidemiologist at CDC by calling the security desk at 404 639-2888 or at 404 639-2206 during business hours (8:30am – 4:30pm EST).

Should this case be reported to the local health department?

All suspected cases of botulism intoxication should be reported ***immediately*** to the local health department. It will then notify the state health department, which will notify the CDC. In collaboration with state health departments, the CDC will assist with laboratory tests, arrange for treatment with botulinum antitoxin, and notify the Food and Drug Administration (FDA). The FDA is responsible for investigating commercial products possibly contaminated with botulinum toxin and assessing the need for a recall. In the present scenario, the patient denied consuming home-canned foods, suggesting the source of botulinum toxin was a commercial product. A contaminated, widely distributed commercial product could be a potential hazard to many people. State and local health officials with the assistance of the FDA will begin a more thorough investigation, searching for other cases and identifying suspect food exposures.

What was the most likely source of botulism intoxication in this patient? What commercial foods are potential sources of botulism intoxication?

Home-canned foods are responsible for over 90% of all cases of foodborne botulism. However, commercial products have also occasionally been implicated. A product with an anaerobic environment allows for the growth of *C. botulinum* spores and toxin production. The toxins are resistant to digestion by gastric

enzymes. In the present scenario, the salad dressing was contaminated. The patient's wife had the house Dijon on her salad, but the patient had garlic-infused olive oil. The oil created an anaerobic environment, which allowed *C. botulinum* spores that were on the garlic to germinate and produce toxin. The oil was not acidified or refrigerated; these procedures could have prevented *C. botulinum* spore growth and toxin production.

How can botulism be prevented?

C. botulinum spores are highly heat-resistant; commercial and home-canning procedures should be done at the appropriate temperature and pressure to kill these spores. A pressure cooker must be used to can vegetables at home safely because it can reach temperatures above boiling (>212°F or >100°C). Information on safe home-canning procedures is available from local county extension home economists. Botulinum toxin is readily inactivated by heat; nevertheless, the FDA recommends that any food suspected to contain botulinum toxin be destroyed. Proper acidification and refrigeration of commercial products such as herb-infused oils will inhibit spore growth and toxin production.

Growth of *C. botulinum* in food may cause container lids to bulge and cause foods to have a bad odor. Commercial or home-canned food products with bulging lids or a bad odor should not be eaten. However, botulism has also been associated with foods that smell and taste normally; therefore, the smell and taste of food should not be used to determine if it is contaminated.

The patient's serum and stool contained type A botulinum toxin. An investigation by the state and local health department found four other cases of intoxication associated with the garlic-infused oil at the restaurant. Two of the patients had been hospitalized with a diagnosis of stroke, one had been hospitalized with a diagnosis of myasthenia gravis, and one had been hospitalized with an unknown diagnosis. The patient in this scenario required assisted ventilation, but his respiratory muscle function improved after he received antitoxin. He fully recovered within 3 weeks of the onset of his symptoms.