

A Family Outbreak of Foodborne Botulism Following Consumption of Home-Canned Doogh in Hamadan, West of Iran

Seyyed Hamid Hashemi¹; Mojgan Mamani¹; Fatemeh Torkaman Asadi^{2,3,*}; Afshin Fayyazi⁴

¹Brucellosis Research Center, Department of Infectious Diseases, Hamadan University of Medical Sciences, Hamadan, IR Iran

²Department of Infectious Diseases, Hamadan University of Medical Sciences, Hamadan, IR Iran

³Blood transfusion research center, high institute for research and education in transfusion medicine, Hamadan, IR Iran

⁴Department of Pediatrics, Hamadan University of Medical Sciences, Hamadan, IR Iran

*Corresponding author: Fatemeh Torkaman Asadi, Department of Infectious Diseases, Hamadan University of Medical Sciences, Hamadan, IR Iran. Tel: +98-8138274192, Fax: +98-8138276010, E-mail: dr.torkamanasadi@yahoo.com

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Background: Food-borne botulism is one of the potentially fatal forms of food poisoning, usually caused by ingestion of home-canned vegetables, fruits and fish products.

Objectives: The aim of this study was to report an outbreak of botulism due to homemade doogh in Hamadan, Iran.

Patients and Methods: During an outbreak, 10 members of a family referred to the hospital because of food poisoning. All patients had a history of consumption of doogh, a traditional drink. After careful physical examination, all of them were hospitalized. Botulism was suspected in all patients except for the first patient.

Results: The first patient was a 76-year-old man who died after 12 hours of admission due to respiratory distress. Nine subsequent patients were diagnosed as botulism with the following symptoms: diplopia (90%), dizziness (70%), nausea and vomiting (80%), ptosis (60%), symmetric weakness of extremities (60%), dysarthria (30%), chest discomfort (30%), mydriasis (20%), dysphasia (20%) and dry mouth (20%). All of the nine patients received botulinum antitoxin and improved during 5-15 days of hospitalization.

Conclusions: Immediate diagnosis based on careful history and physical examination are essential for management of botulism. People should be notified about proper food handling and preparation of traditional homemade foods.

Keywords: Botulism; *Clostridium Botulinum*; Outbreaks

1. Background

Botulism results from intoxication with protein neurotoxins elaborated by *Clostridium botulinum*. The toxins predominantly affect peripheral neuromuscular junction and autonomic synapses, and primarily manifest as weakness. Botulinum toxins are designated as types A to G based on antigenic differences. Types A, B, E and F produce human disease (1). The hardy spores survive environmental conditions and ordinary cooking procedures. Toxin production, however, requires spore germination, which occurs only with a rare confluence of circumstances; an anaerobic atmosphere, a pH of > 4.5, low salt and sugar concentrations and temperatures of 4-120°C (2). *C. botulinum* spores are found throughout the world in soil samples and marine sediments. These spores are able to tolerate 100°C for several hours, because boiling renders solutions more anaerobic, it may actually favor the growth of *C. botulinum*. Proper preparation of food in a pressure cooker would kill spores (1). In contrast with the spore, botulinum toxins are temperature sensitive, and all toxins are inactivated by heating to 85°C for five minutes (3). Foodborne botulism is most frequently recognized in outbreaks. Home-canned vegetables, fruits

and fish products are the most common sources of toxin. In some cultures, such as Alaskan Natives, preferred food preparation practices involving fish fermentation commonly lead to botulism. In China, homemade fermented beans are the leading cause. Commercial foods and restaurants are occasional sources (1, 4, 5) In Iran, several outbreaks of botulism have been reported in the last decade from northern regions (provinces) near the Caspian Sea coast. The most common sources were fish products (6, 7).

2. Objectives

The aim of this study was to report the first outbreak of botulism due to homemade doogh in Hamadan, west of Iran.

3. Patients and Methods

During an outbreak, from 27 to 31 August 2013, all patients with gastrointestinal symptoms, respiratory discomfort or descending paralysis after consumption of homemade doogh in a family dinner referred to Sina Hos-

pital, Hamadan, Iran, were hospitalized. Doogh is a popular refreshing drink in Iran and adjacent countries made with yogurt, water and salt. It is generally served chilled or over ice. Except for the first case, botulism was suspected as the primary diagnosis for all patients. A probable case was defined as a patient who met the clinical criteria for botulism (a sign of bilateral cranial nerve neuropathy including diplopia, blurred vision, dysphasia, bulbar paralysis, and/or peripheral symmetrical muscle weakness). All probable cases received a trivalent botulism antitoxin. Specimens of serum, gastric contents and stool were obtained from all patients. In addition, samples of all consumed foods were obtained and sent to the Reference Laboratory, Pasteur Institute, Tehran, for detection of *C. botulinum* toxins. For each patient, required information including demographic and clinical characteristics, data on length of hospitalization and outcome of disease were recorded in a questionnaire.

4. Results

Ten patients including 5 men and 5 women with the mean age of 32.3 (range: 5-76) years were admitted. The first case was the grandfather of the family who admitted in ICU because of respiratory discomfort. Acute re-

spiratory distress with unknown cause was diagnosed for him. Diagnosis of botulism was not suspected until the disease worsened and the patient died after 12 hours due to respiratory failure. Other nine patients referred to the hospital during 12 to 48 hours after the first case. After careful history of consumed food and physical examination, a clinical diagnosis of food-borne botulism was considered in all patients. Table 1 shows demographic and clinical characteristics of 10 patients involved in the outbreak. Onset of symptoms were as follows; diplopia (90%), dizziness (70%), nausea and vomiting (80%), ptosis (60%), symmetric muscle weakness of extremities (60%), dysarthria (30%), chest discomfort (30%), mydriasis (20%), nistagmus (20%), dysphasia (20%) and dry mouth (20%). All patients except for the first case received a trivalent botulism antitoxin. Only a 14-year-old female (case 5) needed mechanical ventilation and intubated for eight days. All nine patients recovered during 5-15 days of hospitalization. The gastric juice samples of two patients, stool sample of one patient and samples of consumed doogh had positive results for type A botulinum toxin. Doogh had been prepared in home by traditional home-canned yogurt and stored in room temperature for several days.

Table 1. Demographic and Clinical Characteristics of 10 Patients With Botulism

Variables	Patients									
	1	2	3	4	5	6	7	8	9	10
Age, y	5	7	11	12	14	38	52	53	55	76
Gender	M	F	M	F	F	F	M	F	M	M
Incubation Period, d	2	3	2	2	2	2	3	2	2	1
Diplopia	+	+	+	+	+	+	+	+	-	+
Dysphagia	-	-	+	-	+	-	-	-	-	-
Dry mouth	-	-	+	-	+	-	-	-	-	-
Dysarthria	-	-	+	-	+	-	-	-	-	+
Ptosis	-	-	+	-	+	-	+	+	+	+
Dizziness	+	+	-	+	+	-	+	+	-	+
Chest discomfort	-	-	-	-	+	+	-	-	-	+
Nistagmus	-	+	-	-	+	-	-	-	-	-
Dilated pupils	-	-	+	-	+	-	-	-	-	+
Nausea and vomiting	+	+	+	-	+	-	+	+	+	+
Autonomic dysfunction	-	-	-	-	-	-	-	-	-	+
Motor paralysis of upper extremities	-	-	+	-	+	+	+	+	-	+
Motor paralysis of lower extremities	-	-	+	-	+	+	+	+	-	+
Duration of admission, day	5	5	13	5	15	7	8	7	10	1/2
Outcome	I ^a	I	I	I	I	I	I	I	I	D ^b

^a Improvement.

^b Death.

5. Discussion

Food-borne botulism is a relatively rare, but potentially fatal disease. Most cases are sporadic or small outbreaks. Worldwide, the highest incidence rate is reported from the Republic of Georgia and Armenia, where home-canning practices are the most common risk factors of botulism (2). In Iran, several outbreaks have been reported during the last two decades. Most outbreaks occurred in rural population in northern and western regions. Fish products, traditional cheese and whey and home-canned vegetables were the most common sources (6-8). Our report was a rare outbreak of botulism related to the consumption of homemade doogh. Doogh is a current Persian yogurt-drink made by adding salt and water to yogurt. It may be prepared in unsafe conditions in rural area. In this outbreak, *C. botulinum* type A was the responsible organism. Other reports from Iran indicated type E toxin as the causative agent and in a lesser proportion, type A and B were the responsible toxins (6). In a survey of 131 samples of Iranian traditional foods, *C. botulinum* toxins were detected in 6.36% of salted fish and 3.51% of cheese samples. Type E botulinum was the most prevalent toxin in salted fish and type A in cheese (9). Moreover, in a review of laboratory-confirmed outbreaks of foodborne botulism in Iran from 2004 to 2010, *C. botulinum* type E was the most common cause. Seafood was the most implicated food for type E and locally made cheese for type A botulism. Most of cases were reported from Golestan, Gilan, Tehran and Hamadan provinces (10). Indeed, a unique outbreak was reported from Tehran, in which, 11 members of a family developed type E botulism following ingestion of traditional soup (11). In the last two decades, several hundred outbreaks of foodborne botulism have been reported worldwide. Most outbreaks were reported from Poland (12, 13), China (14), the United States (15), the United Kingdom (16), France (17), Italy (18), Argentina (19), Canada (20), Japan (21) and Thailand (22). A close association has been shown between the frequency and type of botulism outbreaks and environmental conditions. *C. botulinum* type E is a common cause of botulism in colder regions of the northern hemisphere. These outbreaks are mostly associated with fish and aquatic animals. Types A and B *C. botulinum* are usually responsible for outbreaks in more temperate and tropical climate, with one type often predominating over the other (23). Most outbreaks of foodborne botulism in South America have been reported from Argentina, where type A *C. botulinum* was the most prevalent isolate (19). Home-canned fruits and vegetables have caused most outbreaks. Moreover, *C. botulinum* type A was a common cause of botulism in China. Most outbreaks were due to fermented soybean (23, 24). In the Middle East, besides Iran, most outbreaks have been reported from Turkey. An outbreak of type A botulism was associated with eating condensed yoghurt (25). Other sources of outbreaks in Turkey were home-canned mushrooms

(26), green beans and unprocessed black olives (27). Despite the paucity of information about the situation of botulism in Arab countries, frequent reports of major foodborne outbreaks with different microorganisms indicate that food safety in these developing countries remains a public health concern, and foodborne botulism may be a potential hazard in these countries (28, 29). In this outbreak, all cases presented with symptoms of symmetric cranial nerve palsies including diplopia, dysarthria and/or dysphasia. All cases were recovered except for the first case, who was misdiagnosed as acute respiratory distress syndrome. As we know, botulism is a severe disease, which can be fatal in 5-10% of cases (3, 16). Death is often due to respiratory failure before receiving anti-toxin as in our first case. Distinctive clinical syndrome of botulism consists of the onset of symptoms of symmetric cranial nerve palsies including diplopia, dysarthria, ptosis and/or dysphagia followed by symmetric descending flaccid paralysis, which may progress to respiratory arrest. The frequency of presenting manifestations and outcome of botulism in our report is in accordance with those reported in the literature (1-3, 11). The type of toxin may affect the severity of disease. Toxin type A produces the most severe syndrome, with the greatest proportion of patients requiring mechanical ventilation. Toxin type B appears to cause milder disease than type A. Toxin type E, most often produces a syndrome of variable severity (2). None of these differences is diagnostic for the toxin type. Unlike the abovementioned differences, most cases in this outbreak of type A botulism presented as milder disease. Report of this outbreak gives some lessons to us. First, clinicians must be aware about the symptoms of botulism. Immediate clinical diagnosis of botulism based on careful history and physical examination, and immediate administration of botulinum anti-toxin based on clinical suspicion are essential for the management of botulism. Second, because consumption of traditional homemade and home-canned foods is common in rural and suburban community in our country, people should be notified about proper food handling and preparation.

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