Neglected Epidemiological Point about Pediatric Botulism in the North East of Iran

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Abstract

Background: Botulism is a dangerous disease caused by the toxin of the bacterium Clostridium botulinum. It is necessary to familiarize the treatment staff with this disease from various aspects and check the disease outbreak situation in different regions.

Method: This cross-sectional study utilized available statistics on the number of botulism cases in children aged from one month to 18 years in the Razavi Khorasan region of Iran over the past six years, from 2018 to 2023.

Results: A review of statistics obtained from health centers over the past six years shows the incidence of foodborne botulism in children as follows: a total of 73 clinical cases of foodborne botulism have been recorded in people under the age of 18, several of which the source of contamination has been proven through bioassay testing, and description follows: In 2018, there were 9 cases, all males, in 2019, 22 cases, 50% males, in 2020, 10 cases, 60% males, in 2021, 1 male case; in 2022, 16 cases 40% males, and in 2023, 15 cases, 80% of which were male. The general age range of the patients was from 1 month to 18 years old. The most common sources of the disease were as follows: 19% were canned fish, 12% dairy products kept in an anaerobic environment (some types of yogurts, buttermilk, and local curd), and 8% canned vegetables.

Conclusion: After tuna, dairy products are the second most common source of foodborne botulism; thus, monitoring and ensuring the safety of these products is essential.

Key Words: Botulism, Epidemiology, Pediatric.

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1- INTRODUCTION

Botulism is a serious and potentially life-threatening condition caused by the toxin produced by the bacterium Clostridium botulinum (1). There are several types of this disease, and since it is rarely seen in individuals under the age of 18, its diagnosis can be challenging and often delayed due to its resemblance to other illnesses (2).

This highlights the importance of ensuring that healthcare professionals are well-informed about the disease from various perspectives. It is also crucial to evaluate its outbreak patterns across different regions. Additionally, local health personnel must be familiar with common sources of the disease and develop appropriate preventative strategies accordingly (3).

This cross-sectional study aims to assess the epidemiological patterns of food-borne botulism among children aged 1 month to 18 years in the Khorasan Razavi region of Iran over the past six years, spanning from 2018 to 2023.

2- METHODS

This cross-sectional study utilized data collected at the Health Center, focusing on documented statistics of botulism cases among children aged 1 month to 18 years in the Khorasan Razavi region of Iran.

Between 2018 and 2023, cases of foodborne botulism submitted to the Health Center were analyzed specifically for those that met both clinical and laboratory test criteria. These stringent criteria helped solidify the diagnosis and ensure consistent reporting.

The clinical criteria required patients to present with a range of symptoms characteristic of botulism, including visual disturbances such as blurred vision or double vision (diplopia), difficulty swallowing (dysphagia), facial paralysis, dryness of the mouth, and various central nervous system abnormalities. Additional manifestations included limb muscle weakness, respiratory failure, or gastrointestinal symptoms. Importantly, these cases required a clinical context where botulism could not be conclusively ruled out by the attending physician.

The laboratory criteria focused on confirming the presence of Clostridium botulinum or its neurotoxin through definitive testing. This involved either isolating and identifying C. botulinum organisms from clinical specimens, such as stool or vomitus, or obtaining positive results from serum botulinum toxin assays. Together, these dual sets of criteria provided a robust framework for diagnosing and reporting foodborne botulism cases accurately and comprehensively.

We analyzed the number of children diagnosed with C. botulinum infection between 2018 and 2023, along with their clinical profiles and demographic details.

3- RESULTS

In the review of statistics obtained from health centers in the last 6 years, the incidence of foodborne botulism in children, Over the past 6 years, a total of 73 clinical cases of foodborne botulism have been recorded in people under the age of 18. In several cases, the source of contamination has been proven through bio-assay testing.
Demographic information is provided in Table 1.
The general age range of the patients was from 1 month to 18 years old. in several which the source of contamination has been proven through bio assay testing, and their description follows:
The most common sources of the disease were as follows: 19% were canned fish, 12% dairy products that are kept in an anaerobic environment (some types of yogurts, buttermilk, and local curd), and

8% canned vegetables (home made canned pea,..) (Figure1).

The most common initial symptoms were dysphagia dysphonia and bilateral ptosis. During the last 6 years (study period) in the age group of children with botulism, there was zero mortality and all cases improved with anti-botulinum treatment, respiratory support, etc.

Table-1: Demographic information of patients.

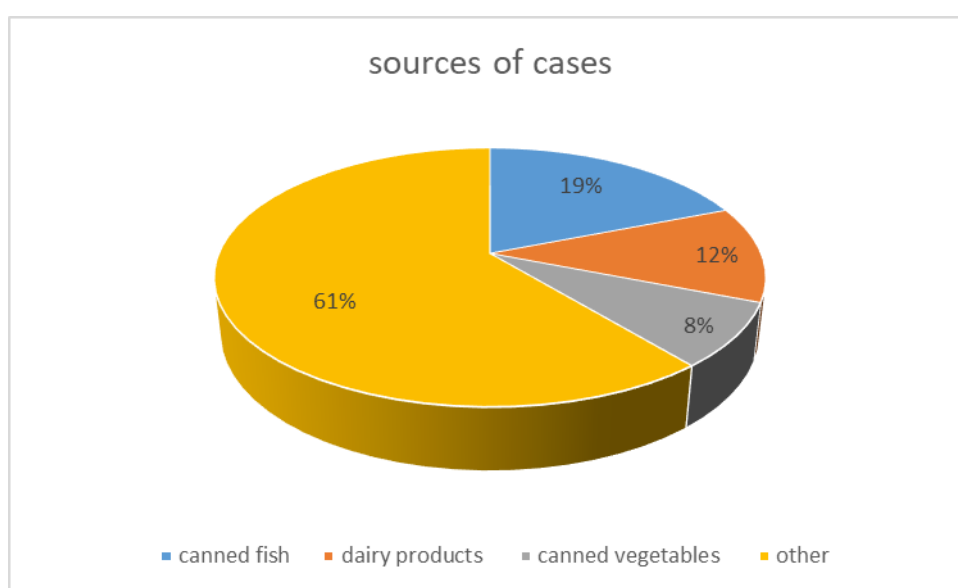| year	2018	2019	2020	2021	2022	2023
Total patient (Number)	9	22	10	1	16	15
Male (%)	100	50	60	100	40	80
Female (%)	0	50	40	0	60	20

Figure-1: Sources of botulism cases.

4- DISCUSSION

Botulism is a severe disease caused by a neurotoxin produced by the bacterium Clostridium botulinum. Botulinum neurotoxin, the toxin produced by Clostridium botulinum, is the most toxic substance known in the world (1-4).

There are four main types of botulism :

1. Foodborne botulism: caused by the production of the toxin in food and its consumption.

2. Infant botulism: caused by spore consumption, colonization of the infant's intestine with Clostridium, and toxin production.

3. Adult intestinal botulism: occurs in adults who have undergone surgery, have intestinal fistula, or have long-term use of drugs that reduce stomach acid, allowing their intestines to be colonized by Clostridium microbes through the same mechanism as in infants.

4. Wound botulism: caused by the colonization of wounds with microbial spores and toxin production (incubation period: 1-2 months) (5,6).

The other two types include those caused by Botox injections (cosmetic applications (7,8)) and inhalation exposure used in

cases of bioterrorism (toxin is used in aerosol form). These are much more dangerous than the other types (9). This article mainly focuses on refers to the epidemiological parameters of foodborne botulism cases in individuals under 18 years of age.

Foodborne botulism: In the last 50 years, 65% of cases have been caused by foods prepared at home. The toxin is mainly produced in food environments with low acidity (pH > 4.5), low salt content (less than 3.5%), and inadequate pressure cooking (e.g., home canning). The alkaline and anaerobic environment facilitates the production of toxins from microbial spores. Clostridium botulinum has about seven types, including Clostridium baratii (producing type F toxin) and Clostridium butyricum (producing type E toxin) (9,10).

Type A and B toxins are more common in meat and vegetables, while type E toxins are more common in seafood and fermented foods. Type C and D toxins cause disease in animals and birds (5,6).

The mechanism of poisoning: This toxin destroys all peripheral acetylcholine synapses but does not affect central synapses (1-4).

Initial symptoms include nausea, vomiting, abdominal pain, diplopia (mainly lateral rectus palsy), cranial nerve involvement, descending flaccid and symmetrical paralysis, constipation, urinary retention, ileus, dry mouth, dysphagia, dysphonia, double mydriasis, ptosis, decreased or absent deep tendon reflexes (DTRs), hypotension, and bradycardia. The manifestations of botulism are similar to those of antidepressant poisoning (2,11,12).

Botulism is also considered in the differential diagnosis of diseases such as Guillain-Barré syndrome, tick bites, bites from certain types of cobras, as well as the effects of some drugs such as

aminoglycosides, diphtheria, tetanus, and myasthenia gravis (13,14).

On the other hand, since it can rapidly disrupt the patient's breathing and through of progressive paralysis, complete familiarity with possible sources of botulism, its symptoms, diagnosis, and immediate treatment is essential (15).

As evident from the sources of the passages, canned foods, including tuna, are among the common sources of botulism, aligning with the findings of this article. In this study, tuna ranks first among the confirmed sources in the children's age group, while local dairy products are identified as the second most common source. In the study area, local people often store ingredients such as condensed yogurt with local buttermilk in airtight containers, which provide an ideal environment for the production of the neurotoxin Clostridium botulinum (16,17).

Additionally, canned vegetables are also mentioned, particularly in cases involving the consumption of homemade compotes of peas and corn prepared in this region.

One limitation of our study was the inability to directly identify the botulinum toxin. Furthermore, our data were sourced from the Khorasan Razavi Province Health Center, where clinical information about the patients was limited.

5- CONCLUSION

After tuna, dairy products are the second most common cause of foodborne botulism in individuals under 18 years of age in the study area. Therefore, special attention and monitoring of the preparation of these products are essential.

To mitigate the risk of botulism in children, several preventive measures can be implemented:

1. Education: Raising awareness about the dangers of improperly canned foods and

the importance of adhering to safe canning practices.

2. Food Safety Practices: Promoting the consumption of pasteurized dairy products and properly cooked or canned foods.

3. Regular Monitoring: Conducting routine inspections and monitoring of local food sources, especially those that are less regulated.

4. Community Outreach: Collaborating with local health departments to organize workshops on food safety and botulism prevention.

6- REFERENCES

1. Chen BC, Huang YC, Huang SH, Yu PC, Wang BL, Lin FH, et al. Epidemiology and risk factors for notifiable Clostridium botulinum infections in Taiwan from 2003 to 2020. Medicine. 2022 Oct 21;101(42):e31198.

2. Equiza J, Campo-Caballero D, Rodríguez-Antigüedad J, Iruzubieta P, Vinagre-Aragón A, Echeverria J, et al. Management of an outbreak of botulism with benign clinical presentation. Journal of Clinical Neuroscience. 2021 Jun 1;88:159-62.

3. Rao AK. Clinical guidelines for diagnosis and treatment of botulism, 2021. MMWR. Recommendations and Reports. 2021;70.

4. Lonati D, Schicchi A, Crevani M, Buscaglia E, Scaravaggi G, Maida F, et al. Foodborne botulism: clinical diagnosis and medical treatment. Toxins. 2020 Aug 7;12(8):509.

5. Barash JR, Arnon SS. A novel strain of Clostridium botulinum that produces type B and type H botulinum toxins. The Journal of infectious diseases. 2014 Jan 15;209(2):183-91.

6. Khorasan MR, Rahbar M, Bialvaei AZ, Gouya MM, Shahcheraghi F, Eshrati B. Prevalence, risk factors, and epidemiology of food-borne botulism in Iran. Journal of epidemiology and global health. 2020 Dec;10(4):288-92.

7. Eser F, Hasanoğlu İ, Kayaaslan B, Kalem A, Bilen Ş, Orhan G, et al. Iatrogenic botulism cases after gastric and axillary application of botulinum toxin and review of literature. Journal of Infection in Developing Countries. 2024;18(3).

8. Oner OG, Gudek HC, Cetin OE, Demir S. Iatrogenic botulism: a case treated with botulinum antitoxin. Clinical Neuropharmacology. 2023 Mar 1;46(2):82-4.

9. Rao AK, Lin NH, Jackson KA, Mody RK, Griffin PM. Clinical characteristics and ancillary test results among patients with botulism—United States, 2002–2015. Clinical Infectious Diseases. 2018 Jan 1;66(suppl_1):S4-10.

10. Lee K. The World Health Organization (WHO). Routledge; 2008 Aug 21.

11. Panditrao MV, Dabritz HA, Kazerouni NN, Damus KH, Meissinger JK, Arnon SS. Descriptive epidemiology of infant botulism in California: the first 40 years. The Journal of Pediatrics. 2020 Dec 1;227:247-57.

12. Rebagliati V, Philippi R, Tornese M, Paiva A, Rossi L, Troncoso A. Food-borne botulism in Argentina. The journal of infection in developing countries. 2009 May 1;3(04):250-4.

13. Swink JM, Gilsenan WF. Clostridial diseases (botulism and tetanus). Veterinary Clinics: Equine Practice. 2022 Aug 1;38(2):269-82.

14. Raja SM. Lambert-Eaton myasthenic syndrome and botulism. CONTINUUM: Lifelong Learning in Neurology. 2022 Dec 1;28(6):1596-614.

15. Castro C, Morais JM, Correia AL, Almeida R, Soares S. A Challenging Case: Botulism in a Toddler. Cureus. 2023 Dec;15(12).

16. Lindström M, Myllykoski J, Sivelä S, Korkeala H. Clostridium botulinum in cattle and dairy products. Critical reviews in food science and nutrition. 2010 Mar 19;50(4):281-304.

17. Bertilsson J, Lingvall P, Gyllenswärd M. Factors affecting the contamination of bulk milk with clostridia spores.