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Foodborne botulism in southwest Romania during the post-communism period 1990—2007

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Summary
Objectives: This study was a retrospective investigation of botulism cases over a period of 18 years following major political and economic changes, addressing the question of whether this disease is still an important health concern in southwest Romania.
Methods: The medical records of botulism cases were used as the source of data. Patients from five southwest Romanian counties were hospitalized at Victor Babes Hospital of Infectious Diseases in Timisoara during the period 1990—2007.
Results: The median annual incidence of botulism cases in southwest Romania decreased from 0.1 per 100 000 persons during 1990—1998, to 0.05 per 100 000 persons during 1999—2007. Most of the cases (18.6%) were diagnosed in 1990, immediately following the communism period. The median age of the patients was 38 years (range 16—73 years); 24 (55.8%) were male; the case fatality rate was 2.3%. A significantly higher incidence rate of 2.7 cases per 100 000 persons occurred in rural areas, even though most of the cases (53.5%) were inhabitants of urban areas. The clinical pattern included: difficulty swallowing (79.1%), double and/or blurred vision (69.8%), dry mouth (60.5%), drooping eyelids (51.2%), vomiting (39.5%), mydriasis (37.2%), constipation (27.9%), abdominal pain (23.3%), and slurred speech (18.6%). All cases were attributed to contaminated food sources, mainly home-prepared traditional pork products.
Conclusions: Although the botulism cases decreased over the study period in southwest Romania, this life-threatening disease continues to be an important concern. A strategy addressing individual behaviors in the home is needed to improve food safety.

Introduction

Botulism is a severe, paralytic illness caused by toxins of the spore-forming, Gram-positive rod *Clostridium botulinum*. Seven immunologically distinct toxins exist, designated A

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Figure 1 Map of Romania depicting the cumulative incidence of botulism events by county of residence, per 100 000 persons, in southwest Romania, 1990—2007. Outbreaks and sporadic cases are counted as one event. Data were derived from a review of the medical records at Victor Babes Hospital of Infectious Diseases in Timisoara. For comparison, the cumulative incidence rate of botulism events for the entire region was 1.4 per 100 000 persons.

through G. Types A, B, and E cause most human illness; type F cases have been reported rarely.[1] Botulinum neurotoxins induce blockage of voluntary motor and autonomic cholinergic neuromuscular junctions, which prevents motor fiber stimulation.[2]

Clinical illness is characterized by cranial nerve dysfunction and symmetric descending flaccid paralysis, which may involve the muscles of respiration leading to death from respiratory failure. Recovery often takes weeks to months.[3] Therapy is based on meticulous intensive care unit support, with mechanical ventilation if needed, and timely administration of equine antitoxin that may arrest the progression of paralysis and decrease the duration of illness.[4]

Foodborne botulism, the most common form, is caused by eating food containing preformed botulinum toxin.[5] Because *C. botulinum* is ubiquitous in the environment, spores routinely contaminate food and survive standard cooking practices that do not exceed 100 °C. *C. botulinum* cells produce botulinum toxin only under particular conditions that include an anaerobic, low-salt, low-acid environment.[6] Home-preserved foods often attain these conditions and, therefore, present a high risk for botulism.

As botulism is a life-threatening condition, a rapid diagnosis is essential. It relies on urgent clinical observation; laboratory analysis may be able to subsequently confirm but not refute a clinical diagnosis.[7] Apart from the ultimate goal of rapid diagnosis and, therefore, saving the patient, every attempt to increase the understanding of the epidemiology of botulism should be made in order to enable the future development of prevention strategies against the disease.[7,8]

Romania is the largest southeast European country (approximately 23 million human inhabitants) and shares borders with Hungary, Serbia, Bulgaria, the Republic of Moldavia, and Ukraine (Figure 1). Timis County, situated at the border with Serbia and Hungary, is the largest of the Romanian counties. Victor Babes Hospital of Infectious Diseases in Timisoara (the capital city of Timis County) is considered as a reference center for patients with foodborne diseases in southwest Romania.

This study aimed to retrospectively investigate the epidemiology, clinical and laboratory diagnosis of botulism cases admitted to Victor Babes Hospital of Infectious Diseases in Timisoara over a period of 18 years (1990—2007) following major political and economic changes, addressing the question of whether botulism is still an important health concern in southwest Romania.

Materials and methods

Data were extracted from the hospital records of 43 patients who were inhabitants of five different counties (Arad, Caras-Severin, Hunedoara, Gorj, Timis) from southwest Romania, hospitalized at Victor Babes Hospital of Infectious Diseases in Timisoara during the period 1990—2007 for botulism.

A patient was considered to have botulism if medical records indicated that this was the final diagnosis. For each patient, a standardized data abstraction form was completed, which included patient demographics, illness history, and clinical characteristics.

Outbreaks were not documented separately in the regional surveillance. To account for clustering of cases from common food sources, an outbreak was defined as two or more patients who were documented in the medical record as being part of an outbreak; who had hospital admission dates no more than three days apart; and who had identical

suspect food sources and town of residence. An event was defined as the occurrence of a sporadic case or an outbreak of botulism. A food was considered the source of an outbreak if it tested positive for botulinum toxin and was eaten by a case-patient, or if the food was not tested, formed part of an epidemiologic investigation that linked a food to a botulism event.

When performed, toxin detection and culture for *C. botulinum* were conducted in a municipal health laboratory according to methods described elsewhere.[9] All clinical specimens for toxin detection were collected before the administration of botulinum antitoxin. The method used for detection and identification of botulinum neurotoxin in serum and food was the mouse toxicity and neutralization bioassay. *C. botulinum* was isolated from the patients' feces. The organisms were recovered from enrichment cultures.

Statistical analysis was performed using SPSS version 15.0 for Windows (SPSS Inc., Chicago, IL, USA).

Results

Although all 43 patients with a diagnosis of botulism originated from five different counties (Arad, Caras-Severin, Hunedoara, Gorj, Timis), they were hospitalized at Victor Babes Hospital of Infectious Diseases in Timisoara, which serves as the regional referral hospital for botulism in southwest Romania.

The median annual incidence of botulism cases in southwest Romania decreased from 0.1 per 100 000 persons (median case count 2) during 1990—1998, to 0.05 per 100 000 persons (median case count 1) during 1999—2007. The incidence was highest in 1990 (0.4 per 100 000 persons) when most of the patients (18.6%) were diagnosed. The median number of cases occurring per year was 1.5 (range 0—8). No cases were reported in 1993, 1995, 2002, 2004, and 2005 (Figure 2).

According to the area of residence, most of the patients lived in Timis County (67.4%; median annual incidence of 0.1 per 100 000 persons).

The median age of patients was 38 years (range 16—73 years). Twenty-four (55.8%) were male. Twenty-three (53.5%) cases occurred in urban areas accounting for an incidence rate of 0.2 patients per 100 000 urban inhabitants. A significantly higher incidence rate of 2.7 cases per 100 000 persons occurred in rural areas of southwest Romania.

Most of the patients were either unemployed (25.6%) or retired (20.9%). The next largest groups were: laborers and people with limited formal education (18.6%), intellectuals and office workers (18.6%), and students (11.63%). For two patients (4.7%) the profession was not specified in the medical records.

The onset of symptoms occurred 36—48 hours after ingestion of the toxin, with a range from a few hours to 4 days. The clinical pattern was mainly characterized by dysphagia (79.1%), double and/or blurred vision (69.8%), dry mouth (60.5%), drooping eyelids (51.2%), vomiting (39.5%), mydriasis (37.2%), constipation (27.9%), abdominal pain (23.3%), and slurred speech (18.6%). One patient (2.3%) died from respiratory failure during hospitalization. The median hospitalization period of patients with botulism was 18 days (range 1—52 days).

Twenty-nine botulism events were identified: eight outbreaks involving 22 persons (median 2.5 persons per outbreak; range 2—5) and 21 sporadic cases. The median number of events occurring per year was 1.5 (range 0—5). Timis County had the highest cumulative incidence rate (Figure 1).

All botulism events were suspected or confirmed to be foodborne. The most commonly implicated food was home-prepared traditional pork products (ham, bacon, blood pudding, mosaic salami, sausage), accounting for 27 (93.1%) events. Other implicated food was commercially canned fish (6.9%).

Botulism events varied markedly by season; most occurred in the summer (48.3%) or winter (27.6%), compared to spring (24.1%). No events were registered in the autumn. The proportion of events attributable to home-prepared traditional pork products was two times greater in the summer (51.9%) than in the spring (25.9%) or winter (22.2%).

A specimen from either a patient or food was collected in 10 (34.5%) botulism events. Of events tested, nine (90%), involving 23 persons, had either botulinum toxin B or *C. botulinum* identified as follows: 14 persons had botulinum toxin B detected in serum, three had botulinum toxin B detected in food, and six had *C. botulinum* isolated from stool. In one event (one patient) the toxin could not be

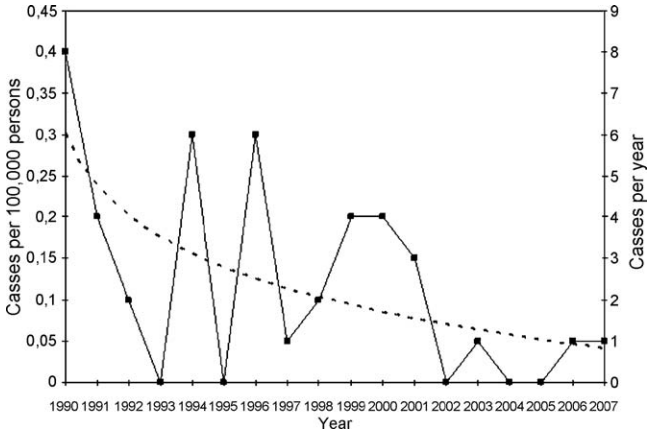

Figure 2 Number of botulism cases and cases per 100 000 persons in southwest Romania during the period 1990—2007. There has been a constant decrease in the total number of botulism cases during the aforementioned period (dotted trend-line).

detected in stool. Home-prepared traditional pork products were implicated in all these events.

All cases were treated with antitoxin, and 42 (97.7%) made a complete recovery.

Discussion

This report provides a review of the medical records of patients with botulism from southwest Romania who were hospitalized at Victor Babes Hospital of Infectious Diseases in Timisoara during an 18-year period (1990–2007) following major political and economic changes.

Few countries report botulism incidence. Of those that do, the highest reported rate is from Georgia with a median annual incidence of 0.9 per 100 000 during 1991–2002.[10] Russia reported 501 cases in 1998, an incidence of 0.3 per 100 000.[11] In 2001, the incidence in the USA was 0.01 per 100 000, although the rate in the state of Alaska was 1.6 per 100 000.[12] Poland has historically reported high rates of botulism, but as economic conditions and food production improved in the 1990s, the incidence of botulism declined dramatically from 0.9 per 100 000 in 1990 to 0.1 per 100 000 in 2005.[13,14] In the European Union, all the rates are $<$0.1 per 100 000.[13,15]

The Romanian Revolution of December 1989 overthrew the communist regime. The median annual incidence of botulism cases for Romania was 0.05 per 100 000 persons during 1980–1989. It increased to 0.06 per 100 000 persons during 1990–1998, and 0.09 per 100 000 persons during 1999–2006.[13,16] It is assumed that the increased incidence of botulism cases during the early post-communism period 1990–1998 as compared to the communism period 1980–1989 may be explained only by poverty, the main reminiscence of the communism period, which drove more persons to conserve food. A lack of reliable energy sources and cooking supplies made food preservation practices riskier, and food shortage forced people to rely on preserved food for a larger proportion of their diet. Why the rate of botulism increased during 1999–2006 remains unclear. It may not only be because of the privatization of previously state-run farms and canning factories, where control of the technological process became less strict, but also the increased poverty rate in some regions of Romania.

Whereas the statistics for botulism cases for the whole of Romania are worrisome, the situation in southwest Romania is improving; the highest incidence of botulism cases was reported in 1990 (0.4 per 100 000 persons) with a decrease to 0.13 per 100 000 persons during 1991–1998. Finally, the median annual incidence decreased to 0.05 per 100 000 persons during 1999–2007 (Figure 2), demonstrating an improvement in botulism-related healthcare policies and the awareness of people in this region of Romania. The low incidence in this part of the country makes the authors suspect that inhabitants do not conserve food as frequently or may have developed safer techniques.

The geographical differences in the cumulative incidence of botulism events by county of residence (Figure 1) could be partly explained by the fact that patients with mild symptoms fail to seek care, or patients with severe illness die before receiving medical attention. Therefore, these rates may be underestimated.

In southwest Romania, dependence on home-prepared traditional pork products is based on culinary preferences, social factors and, sometimes, inadequate awareness of attendant risks. The preserved pork had often been home slaughtered in the winter, bottled, and stored at room temperature for several months before consumption. In several cases, the pork had been refrigerated prior to consumption; it has previously been demonstrated that *C. botulinum* group II (neurotoxin types B, E, and F) has the ability to multiply at refrigeration temperatures.[17] Therefore, it is not surprising that seven events (25.9%) occurred in the spring when people usually consume refrigerated pork.

Changing practices will be difficult because the intervention needs to be home-based and must account for the various forces that compel persons to eat improperly preserved food. Dependence on home-preserved traditional pork products is likely to prevail in persons on low incomes, and most of the patients in this study were either unemployed (25.6%) or retired (20.9%), people for whom the commercially available pork products were prohibitively expensive. The general ratios of 8.3% unemployed and 24.3% retired people in southwest Romania could explain the high percentage of botulism patients from these social categories.[18–29]

The large number of cases (53.5%; two outbreaks and 18 isolated cases) that occurred in urban areas is the result of demographic distribution, as 64.9% of the southwest Romanian population live in urban regions. A real insight is made by comparing the incidence rates of 0.2 cases per 100 000 persons in urban areas with 2.7 cases per 100 000 persons in rural areas. All patients from urban areas except for two, who consumed commercially canned fish, had bought their own pigs that were raised and slaughtered by their relatives or friends in the countryside. Therefore the real source of infection was in rural areas where backyard pigs are usually slaughtered at home. As the pork is usually slaughtered in the winter, the large number of cases (14 isolated cases) that occurred in the summer is of particular interest. There are two explanations: (1) eight patients slaughtered another pig in June–July as the winter provisions of pork had been finished; (2) six cases received some sausages as gifts in July–August.

This study has several limitations. The medical records reviewed in this study included 23 (53.5%) laboratory-confirmed cases (nine events: eight outbreaks and one sporadic case), but a separate analysis of the clinical features of botulism patients lead the authors to believe that misclassification was unlikely for the other 20 cases (20 events involving 20 sporadic cases). No patients were reported to be injection drug users, the leading risk factor for wound botulism.[30]

Among the 20 cases that were not laboratory-confirmed, one did not have the toxin detected in stool, maybe as a result of toxin concentration below the detection limit or toxin degradation during transit. In some outbreaks, concentrations of toxin below the detection level occur in 30–40% of patients.[31] Owing to delays in investigating the remaining 19 patients, appropriate samples were not collected sufficiently early (within 3 days) to confirm the clinical diagnosis. It has been shown that toxin is present in serum or feces in $>$50% of cases within one day of onset

but <25% after three days; *C. botulinum* is present in the feces of >70% of cases within two days and 40% after 10 days.[4]

The decision to treat was always based on clinical observation, case history, and physical findings, and 97.7% of the cases recovered completely after antitoxin administration within one to four days after onset of symptoms.

Foodborne botulism, although rare, remains a public health emergency because of its severity and epidemic potential.[32,33] All suspected cases of botulism should be reported to the public health authorities immediately. Home-preserved pork products account for most of the cases in southwest Romania. As the incidence of botulism cases has decreased during the past years in the southwest, but has increased over the country as a whole, the first priority should be the identification of the areas responsible for the high incidence. Moreover, botulism may be prevented by identifying culinary, cultural, and social factors that keep the incidence low in this part of the country, and then translating these findings into a public health message for high-incidence regions.

Conflict of interest: No conflict of interest to declare.

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