Foodborne Botulism in the Republic of Georgia: Implications for Preparedness Planning

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(See the article by Varma et al. on pages 357–62)

In this issue of Clinical Infectious Diseases, Varma et al. [1] present data from nearly a quarter century of foodborne botulism cases in the Republic of Georgia [1]. The results may provide Georgia with a cost-saving alternative to the management of botulism cases and may offer guidance for those who are preparing plans for mass numbers of casualties due to botulinum intoxication.

The authors reviewed the individual medical records of >700 patients with botulism during 1980–2002 to determine the initial clinical presentation and the eventual outcome of the disease. They then used classification and regression tree analysis (CART) to determine predictors for survival and death. The incubation period, symptoms at presentation, clinical management, and mortality rate were all similar to what might be expected of foodborne botulism cases in the United States. Trivalent botulinum antitoxin was given to 88% of patients, and 13% required mechanical ventilation. Fifty-four patients (8%) died during the course of treatment for botulism, which is similar to the 7% case fatality rate reported in the United States from 1980 through 1996 [2]. These similarities are reassuring, when considering application of these findings elsewhere. However, as noted by Varma et al. [1], the clinical prediction rules developed from these data should ideally be validated in other populations.

CART is a multivariable method that has been used to develop clinical decision rules to separate patients according to risk groups. For example, CART analysis has been used to predict stroke outcomes and the likelihood of acute myocardial infarction and for triage of pediatric trauma victims, but it has not been used commonly in infectious diseases or public health settings [3–5]. CART analysis yields a decision tree that is based on clinically recognizable parameters, which is an advantage over some logistic regression models [5]. Also, the data are not assumed to be normally distributed, and, thus, CART can use data from skewed distributions without transformations. In this study, the large number of clinical parameters associated with death dictated the need for a multivariable analysis, and CART provided a useful solution.

Varma et al. [1] determined that characteristics at the time of initial presentation were 100% predictive of survival for patients without shortness of breath, vomiting, or facial weakness. This age-adjusted analysis included only those self-reported signs and physical examination findings recorded at admission to the hospital. Missing from this CART analysis were aspects of clinical management for hospitalized patients with botulism (i.e., receipt of antitoxin and need for mechanical ventilation), laboratory parameters, and the past medical history. For the clinician, interpretation of data collected from retrospective studies can be challenging. Retrospective studies that attempt to assess clinical-management decisions are subject to a variety of problems, because key parameters may be inconsistently reported, clinical decisions must be categorized on the basis of interpretations of incomplete information, and referral bias may inflate the apparent prevalence of rare or serious conditions. By choosing to correlate the patient’s initial clinical presentation with illness outcome, the authors avoided these hazards.

This analysis will be most useful for persons who may be faced with triage decisions involving large numbers of potential botulism cases. In such a situation, the absence of shortness of breath, vomiting, and facial weakness could be used to identify a subset of patients for whom transport to a higher level of care might be deferred or delayed. In contrast, the classic diagnostic pentad for botulism (nausea...
and vomiting; dysphagia; diplopia; dry mouth; and fixed, dilated pupils) was found in only 2% of patients and would have limited usefulness in the triage process. Use of the signs and symptoms at initial presentation to the hospital to predict death was more problematic in this study. The syndrome most predictive of death (shortness of breath, impaired gag reflex, and no diarrhea) identified only 33% of those who died. As a result, this symptom triad would not be an acceptable single measurement for patients needing a higher level of care. By itself, shortness of breath at presentation was observed in 50 (93%) of 54 patients who died. Thus, these data could inform the development of triage guidelines for a large botulism outbreak, depending on the number of suspected cases and the local resources for ventilatory support or patient transportation.

In the United States, we have limited experience with botulism outbreaks involving >20 cases [6–9]. However, we are preparing for the possibility of a massive botulism outbreak, either naturally occurring or because of bioterrorism. Botulinum toxin used as a weapon of bioterrorism would most likely be distributed via contamination of food or as an aerosol (with inhalation into the respiratory tract) [10]. Because some of the symptoms of naturally acquired foodborne botulism, such as vomiting and diarrhea, may be due to bacterial metabolites in the food, an intentional attack of foodborne botulism using purified toxin would probably result in fewer gastrointestinal symptoms [10]. Limited data are available on human illness from aerosol-based botulinum toxin, but the clinical syndrome would likely be recognizable as botulism [10]. Successful management of a large number of botulism cases would probably depend on several key factors. On a broad scale, such factors would include improved early diagnosis, presence of adequate supplies of antitoxin, and availability of essential supportive care equipment (such as ventilators), plus a coordinated medical system and response plan to assess and treat these patients. A rapid epidemiologic investigation would also be essential to determine the likely source of the exposure, so that further cases could be averted. Large-scale responses should be coordinated through the local emergency response system by means of an Incident Command System (ICS) or similar coordination structure, such that simultaneous responses of medical, public health, law enforcement, public communication, and government personnel can be achieved. The ICS system is also helpful for the efficient incorporation of outside assets into the local response and for the coordination of events that involve multiple jurisdictions.

Botulinum toxin is one of the high-priority, biological agents that threatens US public health–based terrorism-preparedness efforts. Other high-priority agents include Bacillus anthracis, variola major virus, Francisella tularensis, Yersinia pestis, Filoviridae, and Arenaviridae [11]. Preparations specific to botulism have included development of educational and training materials, such as those found at http://www.bt.cdc.gov/agent/botulism/index.asp, to improve recognition and reporting of potential botulism cases. In addition, neurologic symptoms have been included as a syndrome in surveillance systems for bioterrorism syndromes, further increasing the chances of early recognition of a larger-scale botulism-based bioterrorism event. The diagnosis of botulism can now be confirmed in many state public health laboratories across the United States that are part of the National Bioterrorism Laboratory Response Network [12]. Federal efforts are underway to supplement national stores of botulinum antitoxin and ventilators to make available the treatment resources that would be required to treat large numbers of botulism cases. Mass casualty–management planning at the federal, state, and local level to coordinate medical care personnel is also ongoing. The response to terrorism begins at the local level. Therefore, clinicians and hospitals should become an active part of training and planning efforts in their communities. A bioterrorism event resulting in a large number of botulism cases would impose a substantial strain on the medical resources of the community. The inclusion of these medical care delivery resources in planning efforts is essential to optimize the capacity of local response. The article by Varma et al. [1] identifies issues that are critical for those preparations.

Acknowledgment


References

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