Foodborne Botulism Outbreaks Following Consumption of Home-Canned Bamboo Shoots in Northern Thailand

WITAYA SWADDIWUDHIPONG, M.D.*,
PONGTHEP WONGWATCHARAPAIBOON, M.D.**

Abstract

We report epidemiological investigations of 2 outbreaks of foodborne botulism following consumption of home-canned bamboo shoots in northern Thailand. The first outbreak affecting 4 female and 2 male cases occurred in Mae Sot District, Tak Province, in December 1997. All 6 cases were hospitalized, 4 of whom required mechanical ventilation. All cases experienced neurological features and 4 had gastrointestinal symptoms. One case died, giving a case-fatality rate of 16.7 per cent. A case-control study revealed a significant association ($p < 0.01$) between the disease and consumption of home-canned bamboo shoots purchased from the same foodshop in the village. The second outbreak of a similar clinical syndrome occurred in Thawangpha District, Nan Province, in April 1998. A total of 13 cases were identified, 9 (69.2%) of whom were female. Nine cases (69.2%) were hospitalized, 4 (30.8%) of whom required mechanical ventilation. Two early hospitalized cases died due to ventilatory failure, giving a case-fatality rate of 15.4 per cent. A case-control study indicated that home-canned bamboo shoots prepared by a local foodshop served as the vehicle for the disease transmission. One bamboo shoot specimen from one affected house was positive for botulinum toxin type A by enzyme-linked immunosorbent assay and mouse antitoxin bioassay. Improper home-canning procedures for bamboo shoot preservation were similarly detected in both outbreaks although performed by different merchants. Prompt recognition and treatment of the disease are essential in reducing the fatality rate. Safe home-canning procedures should be widely distributed and instructed to persons who perform bamboo shoot preservation for sale.

Key word : Foodborne Botulism, Home-Canned Food

SWADDIWUDHIPONG W & WONGWATCHARAPAIBOON P
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* Department of Community and Social Medicine, Mae Sot General Hospital, Tak 63110,
** Field Epidemiology Training Programme, Division of Epidemiology, Ministry of Public Health, Nonthaburi 11000, Thailand.

Botulism is a neuroparalytic illness resulting from a potent toxin produced by the anaerobic spore-forming bacterium *Clostridium botulinum*(1). Foodborne botulism, the classical form of botulism in humans, is caused by ingestion of food containing preformed toxin. The disease is rarely reported in most developing countries, including Thailand. We report epidemiological investigations of 2 outbreaks of foodborne botulism following consumption of home-canned bamboo shoots in northern Thailand and emphasize a common failure to recognize the severity of the disease in early cases leading to deaths.

OUTBREAK INVESTIGATION REPORT

Outbreak of suspected foodborne botulism in Tak Province

On 8 December 1997, a 39-year-old woman with clinical symptoms of abdominal cramps, nausea, vomitting, diarrhea, and blurred vision was admitted to Mae Sot General Hospital (310 beds), Tak Province, northern Thailand. Foodborne botulism has not been reported in this province since the establishment of disease surveillance in 1968. One day later in the overcrowded medical ward, she developed slurred speech, dysphagia, and muscle weakness. The diagnosis of suspected botulism was made after she experienced respiratory arrest resulting in death 3 days following admission. Thereafter, 3 other severe cases of similar syndrome were kept under close medical observation in the intensive care unit of the hospital and received supportive therapy including mechanical ventilation as needed. No further cases died in this outbreak.

An epidemiological investigation was carried out to identify additional cases of suspected botulism in the community and to determine the source of disease transmission. A case was defined as a resident of the affected village who had at least 3 of the following features: dry mouth, blurred or double vision, dysphagia, dysarthria, dysphonia, bilateral peripheral muscle weakness, diarrhea, or vomitting in December 1997. In this outbreak, a total of 6 cases were identified, 4 of whom were female. Three cases were children 2-5 years old and the remaining 3 were adults aged 37, 39, and 58 years old. All 6 cases were hospitalized, 4 of whom required mechanical ventilation. All cases experienced neurological features and 4 had gastrointestinal symptoms. Their clinical features included dysphagia (4 cases), bilateral muscle weakness (4 cases), vomitting (4 cases), dry mouth (3 cases), blurred vision (3 cases), ptosis (3 cases), dysarthria (2 cases), dysphonia (2 cases), diarrhea (2 cases), and abdominal cramps (1 case). Electromyography of 1 case who was transferred to one University Hospital revealed an incremental increase in amplitude to rapid repetitive stimulation consistent with botulism. Stool cultures from 2 cases were negative for *C. botulinum*. The first index case died, giving a case-fatality rate of 16.7 per cent.

A case-control study was conducted to determine the vehicle for the transmission of the disease. Each case was matched to 2 neighbourhood controls who were approximately the same age ($\pm$5 years for children, $\pm$10 years for adults), the same sex, and who had neither neurological nor gastrointestinal features during the epidemic period. Cases (or their relatives) and controls were asked about their consumption of food in the 8-day period before each case became ill with the disease. The only significant difference between cases and controls was a history of consumption of home-canned bamboo shoots purchased from the same foodshop in the village. All 6 cases (100.0%) had eaten the bamboo shoots without reheating them compared to 1 (8.3%) of the 12 controls ($P < 0.01$, odds ratio undetermined). The interval between consumption of bamboo shoots and onset of illness was 10 hours to 4 days with a median of 2 days. The shortest incubation period was reported in the fatal case.

Four samples of the implicated bamboo shoots were sent to the Regional Medical Science Center for laboratory diagnosis. *Clostridium* sp. was isolated from 2 samples of bamboo shoots collected from one affected house and the foodshop. The pH of bamboo shoot samples ranged between 5.4 and 5.7. Unfortunately, identification of botulinum toxin could not be performed due to lack of laboratory resources in the country. Despite no laboratory confirmation for the toxin, the suspected diagnosis of foodborne botulism outbreak was made by clinical manifestations of the cases including electromyography, history of exposure to the home-canned food, the incubation period, and detection of a similar syndrome among persons having eaten the implicated food. Our case-control study indicated that bamboo shoots served as the vehicle for the transmission of the disease.

Laboratory-confirmed outbreak of foodborne botulism in Nan Province

In April 1998, an outbreak of a similar clinical syndrome occurred in Thawangpha District, Nan Province, northern Thailand. Foodborne botulism has not been reported from this area since 1968. An epidemiological investigation discovered a total of 13 cases of whom 9 (69.2%) were female. Their ages ranged between 38 and 68 years with a median of 44 years. All 13 cases had neurological symptoms; common features included dysphagia (84.6%), dry mouth (61.5%), vomitting (53.8%), dysphonia (53.8%), diarrhea (38.5%), symmetrical weakness (30.8%), dysarthria (30.8%), and ptosis (23.1%). Nine cases (69.2%) were hospitalized, 4 (30.8%) of whom required mechanical ventilation. Electromyography of 2 cases who were transferred to Siriraj University Hospital showed an incremental response to rapid repetitive stimulation consistent with botulism. Stool cultures from these 2 cases were negative for *C. botulinum*. Two early hospitalized cases died due to ventilatory failure, giving a case-fatality rate of 15.4 per cent.

A case-control study revealed a significant association between the disease and consumption of home-canned bamboo shoots prepared by a local foodshop. All 13 cases (100.0%) had consumed bamboo shoots compared to 4 (6.1%) of the 66 controls ($P < 0.01$, odds ratio undetermined). The interval between consumption of bamboo shoots and onset of illness was 6 hours to 6 days with a median of 2 days. The incubation period in both fatal cases was about 12 hours. Six specimens of the implicated bamboo shoots were sent to the Army Medical Research Institute for Infectious Disease in Fort Detrick, Maryland, USA, for laboratory diagnosis. All were negative for *C. botulinum* but one specimen from one affected house was positive for botulinum toxin type A by enzyme-linked immunosorbent assay and mouse antitoxin bioassay. The pH of 2 bamboo shoot specimens examined at the Regional Medical Science Center was 5.3 and 5.7. Details of this investigation are reported elsewhere[2].

Home-canning procedures for bamboo shoot preservation were nearly similar in both outbreaks although performed by different merchants. Bamboo shoots picked in the forest were cleaned, peeled off, and boiled in a 20-litre iron container for about 45-60 minutes. The container was sealed with a lid while the shoots were boiling. The canned bamboo shoots were stored at ambient temperature for sale later when fresh bamboo shoots were scarce.

DISCUSSION

In general, the shorter incubation period, the more severe the disease and the higher the case-fatality rate[1]. Moreover, early deaths from botulism frequently result from a failure to recognize the severity of the disease[3-5]. Findings from these outbreaks suggest that early cases who may have severe disease are likely to be misdiagnosed and/or treated without close medical observation possibly because physicians are unfamiliar with the disease and because clinical features can be mistaken for other more common diseases. It is therefore essential that physicians recognize botulism as early in its course as possible and provide supportive care with close medical monitoring. Typical clinical features, history of exposure to home-canned foods, and findings of similar illness among those having shared the suspected food may be helpful for the diagnosis of foodborne botulism. Isolation of *C. botulinum* from stool specimens will support the diagnosis of botulism but stool cultures often yield low positive results[1,5]. Laboratory detection of botulinum toxin in clinical specimens and incriminated foods, if made available in the country, will provide confirmatory evidence for botulism. However, since the results of culture and toxicity testing are often long delayed, the diagnosis leading to early treatment should be made primarily on history and physical findings. Immediate search for other possible cases and rapid identification of the possible transmission source to prevent additional cases are essential components of control measures.

Our study indicated that home-canned bamboo shoots served as the common vehicle for the transmission of the disease in both outbreaks. Bamboo shoots picked in the forest might be contaminated with *C. botulinum* spores which are ubiquitous and commonly found in soil. The spores are highly heat-resistant and the organisms generally do not grow in an acid environment (pH < 4.6)[1]. Inadequate heating for killing the highly heat-resistant spores during canning, the anaerobic condition in the container, and lack of acidifier might allow the sprores to germinate and elaborate toxin in this

food. Since canning of bamboo shoots for sale has been increasingly processed at home in many rural areas in recent years following the economic crisis in the country, safe food preservation techniques should be widely distributed and instructed to these people. Home-canned foods, particularly vegetables, are responsible for most outbreaks of foodborne botulism[1,4]. Health education to the public about the disease and the importance of heating the home-canned foods before consumption can reduce the risk of botulism intoxication since the toxin can be destroyed by boiling.

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การระบาดของโบทูลิสม จากการรับประทานหน่อไม้อัดปี๊บ

วิทยา สวัสดิวุฒิพงศ์, พ.บ., พงศ์เทพ วงศ์วัชรไพบูลย์, พ.บ.***

รายงานนี้ได้นำเสนอผลการสอบสวนการระบาดของโรค botulism 2 ครั้ง จากการรับประทานหน่อไม้อัดปี๊บ ในภาคเหนือของประเทศ โดยครั้งแรกเกิดในอำเภอแม่สอด จังหวัดตาก ในเดือนธันวาคม 2540 ซึ่งพบผู้ป่วยรวม 6 ราย เป็นหญิง 4 ราย และชาย 2 ราย ผู้ป่วยทุกรายมีอาการทางระบบประสาท และ 4 ราย มีอาการทางระบบทางเดินอาหารร่วมด้วย ผู้ป่วย 4 รายจำเป็นต้องใช้เครื่องช่วยหายใจระหว่างการรักษา มีผู้ป่วยเสียชีวิต 1 ราย คิดเป็นอัตราป่วยตายร้อยละ 16.7 จากการศึกษา case-control study พบความสัมพันธ์อย่างมีนัยสำคัญทางสถิติ ระหว่างการเป็นโรคและการรับประทานหน่อไม้อัดปี๊บที่ผู้ป่วยซื้อจากแม่ค้าคนเดียวกันในหมู่บ้าน การระบาดครั้งที่ 2 ซึ่งพบผู้ป่วยมีลักษณะทางคลินิกคล้ายคลึงกับครั้งแรก เกิดในอำเภอท่าวังผา จังหวัดน่าน ในเดือนเมษายน 2541 การระบาดครั้งนี้มีผู้ป่วยรวม 13 ราย เป็นหญิง 9 ราย (ร้อยละ 69.2) และชาย 4 ราย (ร้อยละ 30.8) ผู้ป่วย 4 ราย (ร้อยละ 30.8) จำเป็นต้องใช้เครื่องช่วยหายใจระหว่างการรักษา มีผู้เสียชีวิต 2 ราย คิดเป็นอัตราป่วยตายร้อยละ 15.4 จากการศึกษา case-control study ก็พบว่าการรับประทานหน่อไม้อัดปี๊บที่ผู้ป่วยซื้อจากแม่ค้าคนเดียวกันในหมู่บ้าน น่าจะเป็นสาเหตุของโรค จากการตรวจวิเคราะห์ตัวอย่างหน่อไม้ที่สงสัย พบ botulinum toxin type A ในตัวอย่างที่เก็บจากบ้านผู้ป่วยรายหนึ่ง จากการศึกษากรรมวิธีในการผลิตหน่อไม้อัดปี๊บ ซึ่งคล้ายกันในผู้ผลิตขายทั้ง 2 รายนี้ พบว่าไม่เพียงพอในการฆ่าสปอร์ของเชื้อโรคนี้ การศึกษานี้แสดงให้เห็นถึงความสำคัญของการวินิจฉัยโรคและการดูแลรักษาผู้ป่วยให้ได้โดยเร็ว ซึ่งจะมีส่วนช่วยลดการเสียชีวิตของผู้ป่วย การให้ความรู้ที่ถูกต้องในการผลิตหน่อไม้อัดปี๊บแก่ผู้ผลิตขาย น่าจะมีส่วนช่วยป้องกันการเกิดโรคได้

คำสำคัญ : อาหารเป็นพิษโบทูลิสม, อาหารบรรจุกระป๋อง

วิทยา สวัสดิวุฒิพงศ์, พงศ์เทพ วงศ์วัชรไพบูลย์
จดหมายเหตุทางแพทย์ ฯ 2543; 83: 1021-1025

* กลุ่มงานเวชกรรมสังคม, โรงพยาบาลแม่สอด, ตาก 63110

** โครงการฝึกอบรมแพทย์ประจำบ้านสาขาเวชศาสตร์ป้องกัน, แขนงระบาดวิทยา, กองระบาดวิทยา, กระทรวงสาธารณสุข, นนทบุรี 11000