Medical Referral of Patients with Acute Respiratory Failure: Lessons learned from a Large Outbreak of Botulism in Northern Thailand

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Background: *There was an outbreak of botulism in a district in Nan Province in upper northern Thailand. The outbreak occurred after the villagers took bamboo shoots preserved in a sealed bucket under anaerobic conditions (home-canned bamboo shoots). There were 209 people at risk, of whom 119 (56.9%) were hospitalized. Among the 119 cases, 42 (35.3%) needed ventilators. Of the 42 cases, 25 (59.5%) were transferred to another hospital.*

Objective: *Describe and review transferal processes of the 25 cases and document lessons learned for medical services response from a public health aspect.*

Material and Method: *Review of records and reports.*

Results: *All 25 cases were successfully transferred with no mishaps. The duration of transferal was less than 3 hours.*

Conclusion: *Preparedness of local capacity to cope with botulism outbreak of this scale is important. However, it is also necessary to develop a good system for medical referral of severe cases, to be started early in the course of medical care.*

Keywords: *Lessons learned, Botulism outbreak, Referral*

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Botulism is caused by botulinum toxin, which is produced by *Clostridium botulinum* and taken up by peripheral cholinergic nerve terminals, inhibits acetylcholine release and subsequently causes reversible denervation of muscle fibers. After a non-symptomatic incubation period lasting 12-36 h, non-specific symptoms of nausea, diarrhea, ophthalmoparesis, bulbar palsy, respiratory muscle paralysis, dilated pupils, bradycardia, hypertension, and hyperhidrosis may occur[1,2].

Foodborne botulism in northern Thailand usually occurs in small numbers of people after taking the home-canned bamboo shoots (Fig. 1). During the past 10 years, at least two outbreaks of botulism were reported from northern Thailand. The first outbreak occurred in December 1997, affecting four female and two male cases in Mae Sot District, Tak Province[3]. The second outbreak occurred in April 1998, Thawangpha District, Nan Province[4]. Nine out of 13 cases (69.2%) were hospitalized, four (30.8%) of whom required mechanical ventilation. All cases developed neurological features such as dysphagia, ptosis, generalized weakness and four had gastrointestinal symptoms including abdominal pain, nausea vomiting, and diarrhea. None of the patients associated with that outbreak received treatment with anti-botulinum toxin (anti-BoTN), and two (15.4%) of 13 patients died.

On March 14, 2006, there was an outbreak of botulism in a district in Nan Province in northern Thailand (located 669 km north to Bangkok). The outbreak occurred among villagers who attended a local Buddhist festival in the village. Symptoms occurred among the villagers after they took the bamboo shoots preserved in a sealed bucket under anaerobic conditions (home-canned bamboo shoots). Laboratory investigation of the left-over bamboo shoots identified *Clostridium botulinum*. This event affected 209 people, of whom one hundred and nineteen cases (60%) were

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A B

Fig. 1 A: home-canned bamboo shoots, B: container

hospitalized. In mild cases, they developed gastrointestinal symptoms, mild dysphagia, dysarthria, diarrhea, ptosis, and diplopia bilateral without neuromuscular respiratory failure. However, in severe cases, they developed the symptoms of dysphagia, dysarthria, diarrhea, ptosis, diplopia, and generalized respiratory and muscle weakness. Forty-two cases developed respiratory failure, neuromuscular failure, and autonomic nervous system failure. This group needed ventilators to support their respiratory system.

The severe cases were sent to the Nan Hospital (located 45 km from the center of the outbreak) where they were hospitalized. Nan Hospital is a tertiary-care provincial hospital with 520 beds and has all major medical specialties. The hospital has an intensive care unit (ICU) with 16 beds.

Given the unusually large number of severe cases, the limited number of health personnel who are able to provide ventilator care, as well as a number of mechanical ventilators, the Department of Medical Services was assigned to be the coordinating organization for transferring some of the severe cases from the Nan Hospital to other hospitals in Bangkok.

The objective of the present report was to document and review the medical referral processes as well as the strengths and weaknesses of medical services responses in terms of public health management. The lessons learned from this outbreak could help prepared medical emergency response in the future.

Material and Method

The authors reviewed the medical care and medical services activities during the botulism outbreak in terms of outbreak and case investigation, medical response in both the local hospital facility and the referral processes including use of antiBoTN and transportation of cases during referral.

Sources of data included records and reports from outbreak investigation from the investigation teams from Nan Province and the Bureau of Epidemiology, medical charts and reports from medical teams in Nan Hospital, Provincial Chief Medical Office in Nan Province and the coordinator team for organizing transferal of the cases.

Results

The clinical symptoms occurred shortly (median duration of onset = 12 hours) after the patients took the pickled bamboo shoots preserved in an anaerobically sealed container. Field teams from the Ministry of Public Health went to the site and started treatment of the patients by administering anti-botulinum toxin (anti-BoTN) on day 4 or day 6 after the onset. The antitoxins were supplied by the US Centers for Disease Control and Prevention[4], the U.K., and Japan. In cases that needed supportive care, the care was provided at Nan Hospital[5,6] (Fig. 2). There was no fatality in this outbreak[7].

Compared to those who received anti-BoTN later, the patients who were treated on day 4 had reduced duration of mechanical ventilation[8].

A medical team was sent from the Department of Medical Services (DMS) to provide support to local medical teams in Nan Hospital. The medical team had assessed the local hospital facilities and suggested to Nan Hospital that it was necessary to consider referral

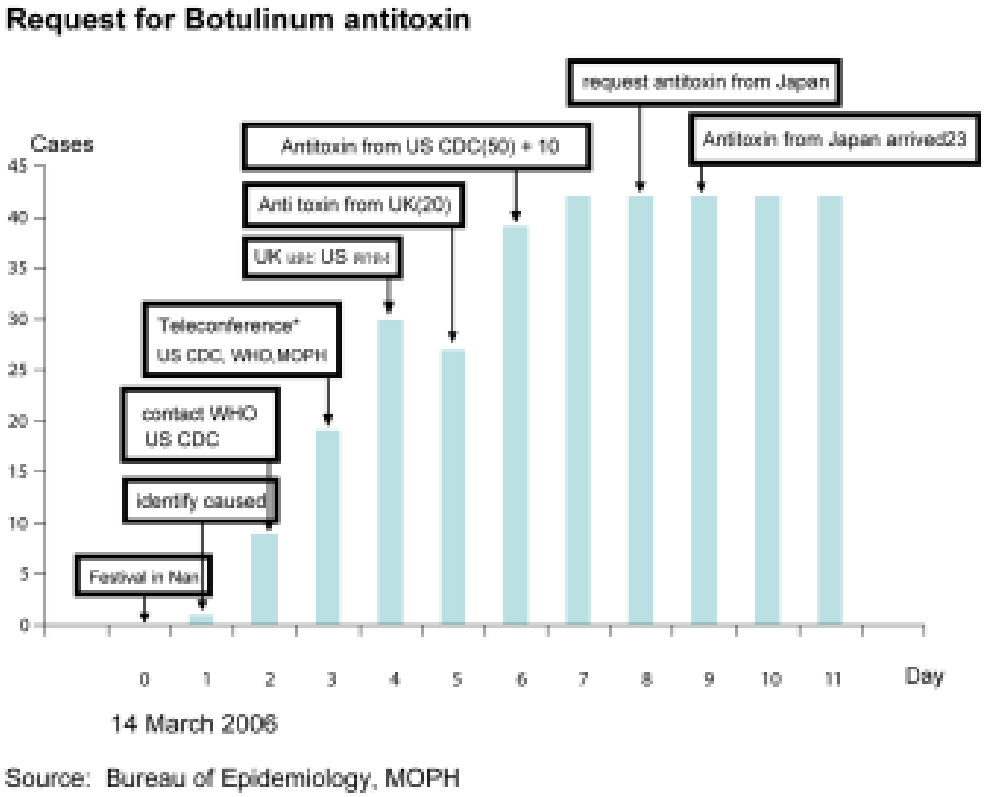

Fig. 2 Source of anti-botulinum toxin and duration of intervention[3,4]

of some severe cases to other hospitals because of limited ICU beds, the existing and anticipated workloads of doctors and nurses, and the limitation of necessary medical equipment. In choosing an appropriate receiving hospital or hospitals, the following factors were taken into consideration, respiratory care facilities including number of ventilators available, distance, transportation route, duration of transferal and appropriate time to transfer.

Assessment of the medical team revealed that the Nan Hospital had admitted more than 120 cases of botulism, of whom 42 (34%) needed intubation and ventilators. The hospital has only 16 ICU beds, which were attended by only four medical staff.

From this assessment, the medical team, with concurrence from the Nan Hospital's authority as well as the consent from the patients' relatives, a number of patients with severe respiratory failure were referred to seven hospitals throughout Thailand. They were Maharaj Nakorn Chiang Mai Hospital, Lampang Hospital, Buddhachinaraj Hospital, Phramongkut Army Hospital, Rajavithi Hospital, Siriraj Hospital, Ramathibodi Hospital, Vajira Hospital, and Bhumibol Hospital. These patients were in well-equipped ICUs with attendance of full-time pulmonologists.

The following steps were taken before referring the patients.

1. Patient severity assessment

A. Hemodynamic stability

B. Breathing ability: grade 1 (Vt 0-50 ml), grade 2 (Vt 50-150 ml), grade 3 (Vt > 150 ml)

C. Degree of hypoxemia and complications

2. Means of transportation

o Transportation by car (8 cases, grade 1-2): Lampang (3 cases with one multi-lobar pneumonia case), Chiang Mai (2 cases; one with asthma, and the other with early pneumonia), Phitsanulok (3 cases)

o Transportation by air (17 cases): complete respiratory paralysis (5 cases), whole body paralysis (1 case – a 14 year-old), grade 1-2 (12 cases), heavy smoker with COPD (1 case)

o Remaining at Nan Hospital (17 cases - grade 2-3) with one with hypotension and one with cardiac arrhythmia

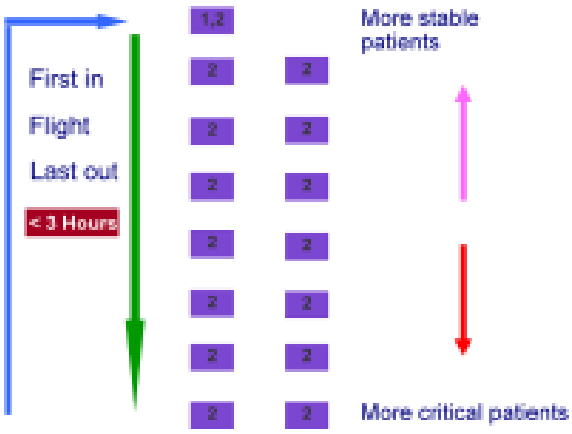

Fig. 3 Sequence of patients move during the mass air transportation

3. Factors to be considered for air transportation

o Good teamwork and co-ordination: doctor – nurse – workers

o Number of O_2 tanks allowance on the plane

o Available equipment on the plane: ventilators, monitors, suction machine

o Available stretchers, O_2 tanks, ambulances

o Patient mobilization, sequence, and timing of transferal with particular attention to the order of the move and the location where the patients will be located on the plane (Fig. 3)

o Well-prepared patient & family members

The medical transfer was carried out on March 23, 2006, which was the 4th-9th days after the patients were hospitalized. Vehicles used for land transportation were provided by Nan Hospital and the air transportation was provided by Royal Thai Air Force. In each case of transferal, a team of one doctor, one nurse, and one paramedic accompanied the patient. In the air transportation from Nan Province to Bangkok where 17 patients were transferred at the same time, a team of 10 doctors, 17 nurses, and 17 paramedics joined the transfer.

The transferal processes were successful without any mishaps. The total duration from the time the patients left the ICUs of the Nan Hospital to the time they were admitted to the ICU of the receiving hospital was less than 3 hours. The patients were successfully referred to the designated hospitals and admitted to the ICUs.

Some patients received early tracheostomy for long-term ventilator care at Nan Hospital. Either at the Nan Hospital or at the receiving hospitals, examination and culture of sputum samples, Gram staining and culture of urine samples, culture of blood samples, and culture of wound samples were performed in all cases. Antibiotic treatment was prescribed based on the evidence from the clinical and laboratory findings (e.g. organisms identified and their susceptibility patterns) by the specialists at each hospital.

All patients, either at the Nan Hospital or at the other receiving hospitals, were successfully treated. Their mean duration of hospitalization was 12 days (range 4-35 days). There were neither fatalities nor serious complications.

Discussion

Forty-two cases (20.1%) of 209 patients in this botulism outbreak required mechanical ventilation, and all of these patients received an infusion of anti-BoTN on either day 4 or day 6 after ingesting contaminated bamboo shoots[8]. There were no reports of death associated with this outbreak. It is estimated that about 122 million Baht was spent to address the needs arising from the outbreak, e.g. anti-BoTn, medical referral, and treatment.

This outbreak was probably the largest outbreak in the world[9-12] and the medical referral of the severe cases in this outbreak is arguably the largest medical transferal done at one time in Thailand. It is estimated that the medical referral costs were 20 million Baht.

The need for medical referral was raised in the early phase of the treatment, although the patients were still being well cared for in the Nan Hospital. It is important not to delay medical transferal to the time that conditions of care deteriorate. This important point should be well appreciated by the local authority, the receiving hospitals, and the patients' relatives. In the author' opinion, both optimal medical care provided at the local hospital and early transferal of some cases to other hospitals explains why there was no mortality in this large and severe outbreak of botulism.

Although the team were successful in saving patients' life the team may need to improve their performance in a number of areas, e.g. preparedness of outbreak of such magnitude, reporting a system to higher authority and other concerned sectors, availability of anti-BoTN, and contact information, especially outside the country where the author could request for a supply of anti-BoTN.

In addition, the team may also need to stockpile antitoxins and other medications for this and other

outbreaks[13], as part of emergency response preparedness in Thailand. Establishing a good network and strengthening collaboration with the World Health Organization and other member states could be an immediate source of assistance during the time of emergency.

This botulism outbreak demonstrated that many patients require more than specific anti-BoTN treatment. A large botulism outbreak like this can easily overwhelm existing health care facilities and capacities. Although it is clear that a readily available supply and rapid administration of anti-BoTN would prevent substantial morbidity in this event, a good medical services system is still needed, especially when the local hospital capacity is exceeded and medical referral is needed.

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การส่งต่อผู้ป่วยที่มีการหายใจล้มเหลวเฉียบพลัน: บทเรียนจากการระบาดครั้งใหญ่ของโรคโบทูลิซึม

สมภพ พันธุโฆษิต

***ภูมิหลัง**: จากรายงานการระบาดของผู้ป่วยโบทูลิซึมที่ จังหวัดน่าน สาเหตุจากการรับประทานหน่อไม้ปี๊บ พบว่ามีผู้ป่วยด้วยโรคโบทูลิซึม จำนวน ทั้งสิ้น 209 ราย ในจำนวนนี้เข้ารับการรักษาในโรงพยาบาล 119 ราย (ร้อยละ 56.9) พบว่าผู้ป่วยในต้องใช้เครื่องช่วยหายใจ 42 ราย (ร้อยละ 35.3) และ ร้อยละ 59.5 (25/42) ต้องส่งต่อไปรักษาที่โรงพยาบาลอื่น*

***วัตถุประสงค์**: เพื่อศึกษาและทบทวนการดำเนินงานในด้านระบบการส่งต่อผู้ป่วยจำนวน 25 ราย เพื่อเป็นบทเรียนในด้านสาธารณสุข*

***วัสดุและวิธีการ**: ทบทวนจากการดำเนินงานและ เวชระเบียนผู้ป่วย*

***ผลการศึกษา** ผู้ป่วยทุกคนที่ได้รับการส่งต่อไปรักษาที่โรงพยาบาลอื่นปลอดภัย ระยะเวลาในการส่งต่อแต่ละรายไม่เกิน 3 ชม.*

***สรุป**: การเตรียมการในการส่งต่อผู้ป่วยในพื้นที่เป็นสิ่งสำคัญและจำเป็น การดำเนินการพัฒนาระบบการส่งต่อผู้ป่วยโดยเฉพาะผู้ป่วยที่มีอาการหนักเป็นสิ่งสำคัญในระบบการดูแลรักษาผู้ป่วย*