A Common-Source Water-Borne Outbreak of Multidrug-Resistant Typhoid Fever in a Rural Thai Community

WITAYA SWADDIWUDHIPONG, M.D.*,
JIRAPAT KANLAYANAPHOTPORN, M.D.**

Abstract

We report an epidemiological investigation of an explosive water-borne outbreak caused by multidrug-resistant (MDR) *Salmonella* Typhi in a non-endemic community with otherwise good sanitation. Between 31 October and 11 November 1999, 11 cases of typhoid fever occurred in Poppra District, Tak Province. Four cases were children ≤14 years of age and the remaining 7 were adults 15-24 years old. Hemoculture was performed in 10 of the 11 cases, of whom 5 (50.0%) were positive for *Salmonella* Typhi. All the isolates were of Vi phage type E14 which was resistant to chloramphenicol, ampicillin, co-trimoxazole, tetracycline, and streptomycin but sensitive to kanamycin, ofloxacin, ciprofloxacin, and cefotaxime. One confirmed case developed intestinal perforation leading to death. A case-control study revealed a significant association between disease and drinking unboiled spring water. The implication of spring water was supported by the presence of faecal contamination in the spring water source. Rapid identification of the possible transmission source and prompt implementation of control measures curtailed the spread of this outbreak.

Key word : Disease Outbreak, *Salmonella* Typhi, Natural Water Source

SWADDIWUDHIPONG W, & KANLAYANAPHOTPORN J
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Since 1989, outbreaks of typhoid fever caused by multidrug-resistant (MDR) *Salmonella* serotype Typhi (formerly *S. typhi*) have been reported repeatedly in many developing countries, particularly in the Indian subcontinent, Southeast Asia, and Africa[1-11]. In Thailand, the proportion of MDR strains reported by the National Centre for Phage Typing and Drug Resistance in Enterobacteria in-

* 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.

creased from 10.2 per cent in 1994 to 23.4 per cent in 1998, and to 43.1 per cent in 1999 due to some outbreaks of MDR typhoid fever in the country. The common Vi phage types identified in recent years through the national surveillance were those of A, D1, E1, and M1[12]. We report an epidemiological investigation of an explosive water-borne outbreak caused by MDR *Salmonella* Typhi of Vi phage type E14 in a northern Thai community with otherwise good sanitation. The strain of Vi phage type E14 had not been isolated in the country for more than 10 years.

In November of 1999, several cases of typhoid fever were reported from a rural village in Poppra District, Tak Province, 15 km from the Thai-Myanmar border. Typhoid or enteric fever has rarely been reported from this village. Only one case of clinical typhoid fever was reported in February 1999. MDR strains had not been isolated from this area.

MATERIAL AND METHOD

The infected village contained 133 households and 749 inhabitants. Nearly all households (99.3%) had sanitary covered latrines. Piped public water was sufficiently distributed throughout the village. Mae Sot General Hospital (a 310-bed hospital) is a public hospital providing health care services in the area. Medical records of typhoid fever treated in the hospital during the outbreak were reviewed. Active case surveillance was promptly conducted in the infected and nearby villages for early detection and treatment. A suspected case was defined as any individual who, between October and November 1999, had fever for 3 or more days and at least 3 of the following features: abdominal pain, diarrhoea/constipation, nausea/vomitting, malaise/headache, rose spots, or splenomegaly, and who had no other pathogens identified such as malaria. Definite diagnosis was confirmed by a positive blood culture for the organism. *Salmonella* was identified by standard methods. Antibiotic sensitivity was determined by the standardized disc method[13]. *Salmonella* isolates were then submitted to the WHO National Salmonella and Shigella Center, Thailand Ministry of Public Health, for laboratory confirmation and Vi phage typing.

A matched case-control study was conducted to determine the vehicle for the transmission of the disease. Each case except the 5-year-old was matched to 2 neighbourhood controls of the same sex and approximately the same age (±5 years for cases <20 years, ±10 years for cases 20 years and older), who had no clinical typhoid features during the epidemic period and had negative stool culture for *Salmonella* Typhi. Cases and controls were asked about their consumption of food and water in the 3-week period before each case became ill with typhoid fever.

Samples of various types of drinking and non-drinking water from the infected village, communal waters and some selected foods were bacteriologically analysed for the presence of *Salmonella* contamination. All food handlers and their household members were screened for *Salmonella* organisms by stool cultures on 10-12 November 1999 and then kept under disease surveillance.

RESULTS

In this outbreak, a total of 11 suspected cases were identified, 7 (63.6%) were female. Four cases were children ≤14 years of age and the remaining 7 were adults 15-24 years old. Their onset of illness was between 31 October and 11 November 1999. Their clinical features included fever (100.0%), malaise (100.0%), headache (90.9%), nausea (63.6%), diarrhea (45.5%), abdominal pain (27.3%), constipation (27.3%), and splenomegaly (9.1%). In 2 households there were 2 and 3 cases respectively. Intrafamilial spread was unlikely since both cases in one household had onset of clinical features on the same date and in the other household the following 2 cases developed clinical symptoms 5 days after the first case. Hemoculture was performed in 10 of the 11 suspected cases, of whom 5 (50.0%) were positive for *Salmonella* Typhi. All the isolates were of Vi phage type E14 which was resistant to chloramphenicol, ampicillin, co-trimoxazole, tetracycline, and streptomycin but sensitive to kanamycin, ofloxacin, ciprofloxacin, and cefotaxime. Ciprofloxacin (for adult cases) or cefotaxime (for children) was the principal drug used for treatment of the cases. One 16-year-old case suffered a relapse of culture-confirmed infection about 4 weeks after initial treatment, giving a relapse rate of 9.1 per cent. One adult confirmed case who migrated for work to another province and did not receive any appropriate treatment developed intestinal perforation leading to death.

Ten cases and 20 matched controls were interviewed about their consumption of food and water in the 3-week period before each case contracted infection. The only significant difference be-

tween cases and controls was a history of drinking unboiled spring water. All the 10 cases (100.0%) had drunk unboiled spring water compared to 7 (35.0%) of the 20 controls ($p<0.01$, odds ratio 13/0). Of the 10 cases in the case-control study, 5 were bacteriologically confirmed. The matched analysis of these 5 triplets also revealed an increased risk of infection associated with drinking unboiled spring water ($p< 0.05$, odds ratio 7/0).

A survey of households indicated that about one-third of the households preferred to drink spring water, whereas, the remaining used piped water, rain water, commercially-bottled water, or water from wells as their major drinking source. All the cases in the study had drunk spring water. Samples of various types of water were bacteriologically-analysed for the presence of *Salmonella* Typhi and/or faecal contamination on 10 November 1999. Only water samples from the spring of both the communal source (2 samples) and the infected households (2 samples) revealed faecal coliform contamination. However, *Salmonella* organisms could not be cultured from these water samples.

In this village, 62 family contacts in the infected households, 70 food handlers and their household members were screened for *Salmonella* infection by stool cultures on 10-12 November 1999 and none were culture-positve. The investigations did not determine an increased risk of infection associated with any food or food shop that might be related to any food handler.

People in the infected village were educated about the disease, its transmission, and the importance of using safe water for drinking, including boiling the spring water. Sanitary improvement of the spring water was made by construction of a cement covering with a tap. One additional case of confirmed typhoid fever with onset on 24 November 1999 was detected by intensive surveillance during the following 3 months.

DISCUSSION

The explosive nature of this outbreak suggested a common-source exposure for epidemic spread. This case-control study revealed a significant association between contracting infection and drinking unboiled spring water. The implication of spring water was supported by the presence of faecal contamination in the spring water source.

Tak Province is located at the Thai-Myanmar border. A large number of Myanmar citizens stay illegally to work in Tak Province, particularly in border regions. In late October 1999, they were forced to move from the Thai communities according to the national policy to reduce illegal migrant workers. Some of them escaped and temporarily hid in rural Thai villages, including this infected village. Meanwhile, there was a typhoid fever outbreak caused by strains of similar antibiograms and Vi phage type among Myanmar migrants in the refugee camp in the area[12,14]. The authors expected that the spring water might be contaminated with *Salmonella* Typhi from an infected person(s) from Myanmar and/or contaminated fomites. However, it was not possible to determine precisely how the water was contaminated.

In developing countries, typhoid infection is essentially acquired by consumption of food or water contaminated with human excreta that contains *Salmonella* Typhi. The most important strategy for reducing the incidence of infection in those areas is provision of safe water supplies and sanitary disposal of human excreta[15,16]. This outbreak indicated that although safe public water could be sufficiently supplied throughout the community, a waterborne outbreak could occur since some inhabitants might continue to drink other unsafe water. In line with the provision of a safe public water supply, health education is required for modification of risk behaviour in the community. Effective surveillance of infection will provide early detection of the outbreak. Rapid identification of possible transmission sources and prompt implementation of control measures can terminate spread of infection.

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การระบาดของไข้ไทฟอยด์ดื้อยาต้านเชื้อหลายขนาน จากการดื่มน้ำพุ

วิทยา สวัสดิวุฒิพงศ์, พ.บ., จิรภัทร กัลยาณพจน์พร, พ.บ.***

รายงานนี้ได้นำเสนอผลการสอบสวนการระบาดของไข้ไทฟอยด์ที่ดื้อยาต้านเชื้อหลายขนาน ในหมู่บ้านแห่งหนึ่งของอำเภอพบพระ ซึ่งเป็นอำเภอชายแดนไทย – พม่าของจังหวัดตาก หมู่บ้านนี้มีระบบน้ำประปา และเกือบทุกครัวเรือนมีส้วมที่ถูกสุขลักษณะใช้ จากการสอบสวนพบผู้ป่วยรวม 11 ราย มีวันเริ่มป่วยอยู่ระหว่าง 31 ตุลาคม ถึง 11 พฤศจิกายน 2542 เป็นเด็กอายุ ≤ 14 ปี 4 ราย และผู้ใหญ่ 7 ราย มีผู้เสียชีวิต 1 ราย คิดเป็นอัตราป่วยตายร้อยละ 9.1 จากการเพาะเชื้อจากเลือดผู้ป่วย 10 ราย พบเชื้อ *Salmonella* Typhi 5 ราย (ร้อยละ 50.0) ซึ่งดื้อต่อยาคลอแรมเฟนิคอล แอมพิซิลิน โค–ไตรม็อกซาโซล เตตร้าไซคลิน และสเตร็ปโตมัยซิน เชื้อทั้งหมดเป็น Vi phage type E14 ซึ่งไม่เคยพบในประเทศไทยมาหลายปี จากการศึกษา case – control study พบความสัมพันธ์อย่างมีนัยสำคัญทางสถิติระหว่างการเป็นโรค และการดื่มน้ำพุที่ไม่ต้ม ซึ่งจากการตรวจน้ำพุระหว่างการสอบสวนโรคพบว่ามีการปนเปื้อนอุจจาระ การศึกษานี้แสดงให้เห็นว่า ถึงแม้จะมีระบบน้ำประปาที่สะอาดอย่างทั่วถึง การระบาดของโรคที่ติดต่อทางน้ำก็สามารถเกิดขึ้นได้ เนื่องจากประชาชนบางกลุ่มยังนิยมดื่มน้ำตามธรรมชาติที่อาจมีการปนเปื้อนเชื้อได้ การสอบสวนโรคเพื่อหาแหล่งแพร่โรคให้ได้โดยเร็ว ร่วมกับมาตรการควบคุมป้องกันโรคจะมีส่วนช่วยให้การระบาดของโรคสงบได้ในเวลารวดเร็ว

คำสำคัญ : การระบาดของโรค, ไข้ไทฟอยด์, แหล่งน้ำดื่ม

วิทยา สวัสดิวุฒิพงศ์, จิรภัทร กัลยาณพจน์พร
จดหมายเหตุทางแพทย์ ฯ 2544; 84: 1513–1517

* กลุ่มงานเวชกรรมสังคม, โรงพยาบาลแม่สอด, ตาก 63110

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