

TWO CONSECUTIVE OUTBREAKS OF FOOD-BORNE CHOLERA ASSOCIATED WITH CONSUMPTION OF CHICKEN RICE IN NORTHWESTERN THAILAND

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Abstract. Hainanese chicken rice (cooked rice mixed with chicken fat and served with sliced chicken and cucumber) is a well-known Chinese dish in Southeast Asian countries. We report two consecutive outbreaks of cholera associated with consumption of chicken rice among attendants of two meetings in northwestern Thailand in April 2010. Active case finding was carried out among persons who attended the meetings and in the community. Environmental investigation was conducted at the implicated food shop and in the affected areas. The first outbreak involved 17 cholera cases (35.4%) among 48 attendants and 16 cases in the community. The onset of symptoms was between April 19 and 23, 2010. People who ate the chicken rice had a higher attack rate of infection than those who did not. All 12 food handlers at the implicated food shop were screened for cholera infection by rectal swab culture; 3 were culture-positive. Although the food shop was closed temporarily following the outbreak, some chicken rice was produced and served at the second meeting and caused 11 more cases (23.4%) among 47 meeting attendants. All cholera isolates obtained from patients and food handlers were *V. cholerae* O1, biotype El Tor, serotype Ogawa, and had similar antibiograms and genetic patterns by pulsed-field gel electrophoresis. The chicken rice which was possibly contaminated by an infected food handler served as the vehicle of transmission. A repeat cholera outbreak caused by the same vehicle can occur when control measures are not adequately followed.

Keywords: cholera outbreak, chicken rice, food-borne, food handler, Thailand

INTRODUCTION

Outbreaks of cholera occur in many parts of the world where water supply, food safety, sanitation and hygiene are

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inadequate (WHO, 2004). In Thailand, El Tor cholera outbreaks have been reported sporadically, particularly along the Thai-Myanmar border (WHO, 2009). On April 21, 2010, two patients with acute severe watery diarrhea, found later to be cholera infection, were admitted to the Mae Sot Hospital, Tak Province, northwestern Thailand. Both lived in different Thai-Myanmar border villages but had attended a computer training course and eaten

lunch in the same place on 5 km from Mae Sot on April 19, 2010. A second cholera outbreak occurred among attendants of a meeting on April 27, 2010, 80 km from Mae Sot. Epidemiological investigations were carried out to determine the source and mode of cholera transmission in these two outbreaks.

MATERIALS AND METHODS

Study area

Mae Sot District, Tak Province shares a 60 km border with Myanmar along the Moei River. Because of widespread poverty and political instability in Myanmar and rapid economic growth in Thailand in recent years, many people have migrated from Myanmar to Thailand seeking work. Most cholera cases in recent years have been in Myanmar migrants (Swaddiwudhipong *et al*, 2008; Tak Provincial Health Office, 2010). Nine cases of cholera were reported in Mae Sot District in 2008 and one in 2009. Mae Sot General Hospital has 317 beds and is the only public hospital in the district.

Collection of data

The first cholera outbreak occurred among persons who attended a computer training course on April 19, 2010. All the attendants were identified and screened for cholera infection by rectal swab culture. A case of cholera was defined as any individual who had bacteriologically confirmed infection. They were asked about their consumption of food and water during the course. All the cholera cases reported consume Hainanese chicken rice (rice cooked with chicken fat and served with sliced chicken and cucumber) purchased from one food shop in the municipality of Mae Sot and served for lunch.

All the food handlers from this food shop were screened for cholera infection

on April 22, 2010 and kept under diarrheal surveillance. Samples of drinking and non-drinking water from the university and the implicated food shop were bacteriologically analysed for the presence of cholera on April 22, 2010. An environmental investigation was conducted at the food shop. Samples of chicken rice, sauce, foodstuffs and environmental swabs from chopping blocks, knives, kitchen utensils, and the inner sides of the refrigerators were cultured for cholera contamination. The implicated food shop was closed on April 23, 2010 when 3 of the 12 food handlers were found to have cholera infection. Sanitary improvement in the kitchen, toilets and environments were recommended. The food shop reopened on May 6, 2010 after all the food handlers had had no *V. cholerae* O1 in their stools and environmental improvement was completed.

On April 30, 2010, a cluster of 8 cases of watery diarrhea, later found to be caused by *V. cholerae* O1, were reported from one community 80 km from the municipality of Mae Sot. Active case finding revealed 14 cases with diarrhea, all of whom reported having attended a meeting and eaten lunch together on April 27, 2010.

Microbiology

Rectal swab specimens were placed in Cary-Blair transport media and sent to the Mae Sot Hospital within 3 hours of collection for bacteriological identification. All clinical and environmental specimens were enriched using alkaline peptone water (CDC, 1999). Antibiotic sensitivity was determined by the disc diffusion method (CLSI, 2009). The laboratory was certified by the National External Quality Assessment Scheme, Thailand Ministry of Public Health. Cholera isolates were then submitted to the Department of Medical

Sciences, Thailand Ministry of Public Health, for laboratory confirmation. Samples of cholera isolates obtained from the patients in both outbreaks and from the infected food handlers were additionally analyzed by pulsed-field gel electrophoresis (PFGE) for genetic relatedness of isolates (Cameron *et al*, 1994).

Statistical analysis

The Fisher's exact test was used for comparison between proportions. Relative risk was used to measure the strength of association between contracting infection and consumption of the implicated food.

RESULTS

Epidemiological characteristics

The first cholera outbreak occurred among participants of a computer training course on April 19, 2010. Forty-eight participants of the course were identified and contacted regarding diarrheal symptoms and food and water consumption during the course; all were screened for cholera infection by rectal swab culture. Of the 48 attendants, 17 (35.4%) were culture-positive for *V. cholerae* O1, biotype El Tor, serotype Ogawa. Of the 17 cases, 11 (64.7%) had mild diarrhea, 3 (17.6%) had moderate to severe diarrhea, and 3 (17.6%) had an asymptomatic infection. All 17 cholera cases reported consuming Hainanese chicken rice for lunch during the course. The attack rate of infection for people eating the chicken rice was higher than for those who did not (Table 1). All symptomatic cases developed cholera between April 19 and 21, 2010 (Fig 1). The incubation period of the cholera infection in this outbreak ranged from 5 to 55 hours with a median of 28 hours.

During the epidemic, active case finding was carried out in the district.

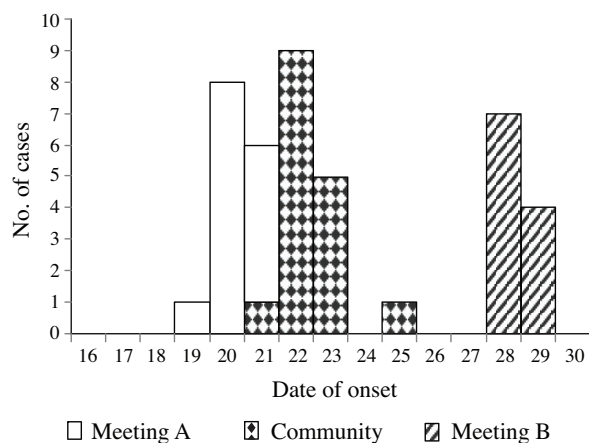


Fig 1—Cases of cholera associated with eating chicken rice at each meeting and in the community, by date of onset, April 2010.

Rectal swab specimens were taken from all persons with diarrhea for bacterial culture. Surveillance detected an additional 16 cases of cholera who reported eating chicken rice from the same food shop during a 5-day period prior to cholera symptoms. Their onset of cholera symptoms was between April 21 and 25, 2010 (Fig 1).

The second outbreak took place among attendants of a meeting in a community, 80 km from the municipality of Mae Sot. The person who conducted the meeting stayed in Mae Sot and telephone ordered 25 boxes of Hainanese chicken rice and 23 boxes of roasted pork rice from the same food shop, without knowing the shop was closed. The food was carried to the meeting in the morning and served for lunch. Seven boxes of fried pork rice purchased locally in the community were also served at the meeting. Forty-seven persons were identified from the list of participants' names and addresses. All were interviewed about diarrheal symptoms and their consumption of food and water during the meeting, and were screened for cholera infection by rectal swab cultures. Of the 47 attendants, 11

Table 1
Distribution of cholera infection, by history of food consumption at two meetings in Mae Sot District, Tak Province, Thailand April 2010.

Meeting	Food exposure	No. attendants	Infected (%)	P-value	Relative risk
A	Chicken rice	42	17 (40.5)	0.08	∞
	Rice with pork curry	6	0 (0.0)		
	Total	48	17 (35.4)		
B	Chicken rice	20	11 (55.0)	<0.01	∞
	Roasted pork rice and fried pork rice	27	0 (0.0)		
	Total	47	11 (23.4)		

(23.4%) had cholera infection of the same biotype, serotype and with the same antibiogram. All the cholera cases had mild to moderate diarrhea and developed cholera symptoms between April 28 and 29, 2010 (Fig 1). People who ate the chicken rice had a higher attack rate of infection than those who did not (Table 1). The incubation period for the cholera infection in this outbreak ranged from 13 to 54 hours with a median of 29 hours.

All isolates obtained from the patients during both outbreaks were *V. cholerae* O1, biotype El Tor, serotype Ogawa. They were all sensitive to ampicillin, chloramphenicol and norfloxacin and resistant to tetracycline and trimethoprim-sulphamethoxazole. Norfloxacin was the principal drug used for treatment of the cases and all recovered uneventfully. There were no deaths.

Source of infection

The epidemiologic findings implicate the Hainanese chicken rice from one food shop as the transmission source for cholera infection. All 12 food handlers at this food shop were screened for cholera infection on April 22, 2010; 3 were positive for *V. cholerae* O1 of the same biotype, serotype and with the same antibiograms.

One case (symptomatic) was the Thai owner and two (one symptomatic and one asymptomatic) were Myanmar employees who had worked at this food shop for three months. They had moderate diarrhea with onset between April 20 and April 22, 2010. Both Myanmar cases reported their relatives from Myanmar had come to visit and had meals with them during the Songkran festival (Thai and Myanmar traditional New Year, April 13-15). However, both denied diarrheal symptoms among their relatives during the visit. Follow-up rectal swabs were taken from the 3 infected food handlers first on April 25, 2010, 3 days after initiation of antimicrobial treatment and 2 remained positive for *V. cholerae* O1. All were culture-negative on April 29, 2010. The cholera isolates from the patients in both outbreaks and from the infected food handlers were analyzed by PFGE and all showed similar patterns.

Food handlers would cook rice and boil chicken in the early morning for sale throughout the day. There are two common types of sauce (thick dark soy sauce and yellow soybean paste mixed with garlic, ginger and chilli) which are packed in small plastic bags for taking away. The

cooked rice was warmed throughout the day. Of the three infected food handlers, the Thai patient packed the chicken rice in the foam boxes and the two Myanmar patients boiled the chicken, packed the sauce in bags and served the clients.

Unhygienic food handling was observed in the food shop. The food handlers did not wear gloves while preparing food, including slicing the chicken and the cucumbers. The boiled chicken was kept in containers without covers which could be exposed to flies. Two different bags of sauce were placed on the chicken rice within the foam box for taking away. And cooked food, bags of sauce and raw food were kept together in the same refrigerators without separation. The kitchen and toilets were not clean and flies were observed in the food shop. During investigation, *V. cholerae* O1 was not isolated from the samples of chicken rice, sauce, foodstuff or environmental swabs.

All the infected clients in both outbreaks drank commercially bottled water during the meetings. The food shop used piped public water and well water. None of the drinking and non-drinking water samples collected from the food shop or at the affected areas were positive for *V. cholerae* O1.

Control measures

Control measures included: 1). active case finding at the affected areas; 2). instructions for improved food handling and sanitation at the implicated food shop; 3). screening food handlers at the food shop and treatment of infected food handlers; and 4). health education of infected families, food handlers and people in the community. No additional cases associated with this food shop were detected by diarrheal surveillance during the following three months.

DISCUSSION

The patterns of these two outbreaks suggested a common exposure source. The following epidemiological findings implicate the Hainanese chicken rice as the vehicle of cholera transmission. The clustering of cases in each outbreak occurred among people who reported consumption of the chicken rice. In both incidents, people who ate the chicken rice had a higher attack rate of infection than those who did not. Three food handlers in the implicated food shop were found to have cholera infection. Cholera isolates obtained from patients in both outbreaks and infected food handlers had similar biotypes, serotypes, antibiograms and PFGE patterns.

Vibrio cholerae can survive easily and multiply rapidly in a variety of foods, such as cooked rice, chicken, sea food and milk (Felsenfield, 1965; Pesigan *et al*, 1967; Kolvin and Roberts, 1982; Wu *et al*, 2002). Recent studies in both developing and developed countries have shown an association between cholera infection and consumption of cooked or uncooked food contaminated with cholera organisms (CDC, 2004, 2006, 2009; Forssman *et al*, 2007; Swaddiwudhipong *et al*, 2008, 2010). The incriminated chicken rice might have been contaminated directly from an infected food handler, through cholera-containing foodstuff or by flies. Compared with boiled chicken, the cooked rice was less likely to be contaminated after cooking since it was kept warm in the cooking pot with a fitting lid and normally had no contact with the food handler's hands. After the chicken was boiled, it could have been contaminated by an infect food handler during transporting, slicing or through contaminated packs of sauce, which were placed on the food in the

foam box. Moist foods, such as cooked rice and chicken, contaminated after cooking and kept at room temperature for several hours, can provide a good environment for the growth of *V. cholerae* (WHO, 2004). The implication of the contaminated chicken rice as the vehicle for disease transmission indicates the importance of hygienic food handling for safe food products. This study also documents a second cholera outbreak caused by the same vehicle of transmission can occur when control measures are not adequately followed.

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