International Journal of Infectious Diseases 83 (2019) 83–85

Contents lists available at ScienceDirect

International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijid

Short Communication

Cholera outbreak by Sea Gypsies in Sabah, Malaysia: A challenge in North Borneo

Muhammad Jikal[a], Tuan Riduan[a], Rosmawati Aarifin[b], Mohammad Saffree Jeffree[c], Kamruddin Ahmed[d,e,*]

[a] Kudat Area Health Office, Kudat, Sabah, Malaysia
[b] Ministry of Health Malaysia, Putrajaya, Malaysia
[c] Department of Community and Family Medicine, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
[d] Borneo Medical and Health Research Centre, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
[e] Department of Pathobiology and Medical Diagnostics, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah

ARTICLE INFO

Article history:
Received 31 December 2018
Received in revised form 31 March 2019
Accepted 8 April 2019
Corresponding Editor: Eskild Petersen, Aarhus, Denmark

Keywords:
Cholera
Kudat
Sabah
Malaysia
Sea Gypsy
Outbreak
Fish

ABSTRACT

Objectives: In this study we investigated an outbreak of *Vibrio cholera* O1 Ogawa serotype, occurred during December 2014 in Kudat district, situated in Sabah state of the Malaysian part of Borneo.
Methods: Active case detection and contact tracing were done at respective localities by house to house survey. Passive case detection was done among acute gastroenteritis patients attended at various health facilities. To determine the source, samples from food, water and environment were taken. A case control study was also done to determine the risk factors.
Results: A total of 44 symptomatic and 34 asymptomatic cases from 19 localities were investigated. 39 cases were detected through passive case detection. Median age of cases was 23 years. All cases belonged to serogroup O1 and Ogawa serotype. The epidemiological investigation of time, place, and person identified that *V. cholerae* cross-transmission might have occurred in two fish markets and the fish-loading port. Circumstantial evidences indicated that cholera was possibly transmitted through contaminated sea foods.
Conclusions: We concluded that the life-style of Sea Gypsies is a challenge in cholera control; therefore vaccination might be an effective way to mitigate cholera in an outbreak prone area like Kudat.

Introduction

The global burden of cholera is 1.4–4.0 million cases annually, with 21,000–143,000 deaths (Ali et al., 2015). Despite considerable public health achievements, cholera is still a challenge in Sabah State of Malaysian Borneo. Kudat is situated in the northern part of Sabah, where cholera has been reported since 2012 (Zin et al., 2015). In addition to a multiethnic population, there are Sea Gypsies who follow a nomadic and seafaring way of life. Despite several outbreaks of cholera in Kudat, only limited epidemiological information is available. Therefore, in this study the epidemiological characteristics, possible source and risk factors of a cholera outbreak in Kudat were determined.

Methodology

Active case detection and contact tracing were done at respective localities by house-to-house survey from January 1 to 31, 2015. Passive case detection was done in patients with diarrhoea that occurred December 20th 2014 onwards attended at various health facilities. Rectal swabs were taken from suspected cases and contacts. Suspected cases were those who presented with acute watery diarrhea with or without vomiting. All clinical and environmental specimens were subjected to culture and serotyping for *V. cholerae.* To determine the source, samples from food, water and environment were taken. An unmatched case-control study was done to determine the risk factors.

Results

In this outbreak, 18 villages, and Kudat town were affected; among the 44 symptomatic cases, 39 were detected through passive case detection. Among 6279 individuals screened for

* Corresponding author at: Borneo Medical and Health Research Centre, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, 88400, Malaysia.
E-mail address: ahmed@ums.edu.my (K. Ahmed).

https://doi.org/10.1016/j.ijid.2019.04.008

cholera, 34 asymptomatic cases were identified. All clinical isolates were *V. cholerae* O1 serotype Ogawa. *V. cholerae* from three environmental samples were O1 El tor, classical Inaba serotype, and non O1/non-O130. The sociodemographic characteristics of cholera cases (Table 1) showed that the majority were fishermen (23.0%) of Ubian ethnicity (23.1%) and resided near the coastal areas. A majority (70.5%) of the cases had a potable water supply, however 52.6% of them had no sanitary toilet (Supplementary Table 1). Epidemic curve showed a sharp rise of cholera cases indicating a common source type outbreak, which later became propagated from person to person (Figure 1). The last onset of cholera was on 25th January 2015.

The case-control study comprised 30 cases and 30 controls (Supplementary Table 2). There were 46.7% male and 53.3% female patient with the median age of 37 years. Lack of knowledge about cholera and the presence of pests at home were significant risk factors.

The primary case was a four-month-old Sea Gypsy child admitted to Kudat District Hospital (KDH) on 2nd December with gastroenteritis. Trace back investigation determined that the index case was a two-year-old child from the same community and was also admitted to KDH on 24th December. Both cases were discharged from the hospital before the results of rectal swabs were available.

Discussion

Sea Gypsies are extremely mobile, therefore the patients and their relatives could not be identified despite that considerable efforts were made for contact tracing to determine an epidemiological link between each case. Although primary and index cases were children from the Sea Gypsy community, no direct epidemiological link could be established between them.

The initial infection may have come from the same source and subsequently created a propagated transmission. Through epidemiological investigation of time, place and person, we identified two fish markets and the fish loading port where *V. cholerae* cross-transmission might have occurred. Five days prior to symptoms, three cholera cases bought fish from a hawker, which were supplied by the Sea Gypsies. Fish are considered natural reservoirs of *V. cholerae* and serve as a vehicle for cholera transmission (Hossain et al., 2018).

We found that lack of knowledge about cholera and the presence of pests at home were significant risk factors. However, the median age (37 years) of the cases and controls is much older than that of cholera cases (23 years). This might be the limitation of our case-control study to represent overall cholera outbreak. Although drinking untreated water is a risk factor for cholera, circumstantial evidence showed that this outbreak was probably due to consumption of contaminated fish. Eating raw and undercooked fish are still practiced among Sea Gypsies. Although they live on boats with limited sanitation and clean water, a majority of cholera cases in this study had potable water. In countries with potable water, food would be the main vehicle for cholera outbreaks (Lim, 2001). Transmission of cholera in non-endemic areas is more commonly associated with consumption of foods such as raw or undercooked seafood, imported from cholera-endemic regions (Mandal et al., 2011). Studies suggested that aquatic environmental reservoirs are not the primary source of epidemic cholera; instead, humans play an important role in the long-term spread and maintenance of the pathogen by direct or indirect transmission (Weill et al., 2017). In our study, environmental and outbreak strains were different, indicating a human mediated cholera outbreak by food.

There was no death, and the outbreak was confined within Kudat. The factors influencing the epidemiology and transmission of cholera in Kudat are complex. WHO recommends administering

Table 1
The socio-demographic characteristics of the symptomatic and asymptomatic cholera cases determined in Kudat during the outbreak.

Variable	Details	Symptomatic cases (N = 44)	Asymptomatic cases (N = 34)	Total N = 78	Percentage (%)
Tracing	ACD	5	34	39	50
	PCD	39	0	39	50
Age	<1	0	0	0	0
	1–4	6	7	13	16.7
	5–9	1	7	8	10.3
	10–19	7	9	16	20.5
	20–29	11	2	13	16.7
	30–39	2	3	5	6.4
	40–49	6	5	11	14.1
	50–59	5	0	5	6.4
	>60	6	1	7	8.9
Sex	Male	21	25	46	59
	Female	23	9	32	41
Races	Bajau	6	3	9	11.5
	Ubian	11	7	18	23.1
	Dusun	1	0	1	1.3
	Suluk	1	2	3	3.8
	Sungai	2	1	3	3.8
	Chinese	3	0	3	3.8
	Rungus	13	0	13	16.7
	Others	7	21	28	35.9
Nationality	Malaysian	42	25	67	85.9
	Non Malaysian	2	9	11	14.1
Occupation	Housewife	12	1	13	21.3
	Fisherman	7	7	14	23.0
	Student	6	7	13	21.3
	Farmer	3	0	3	4.9
	Laborer	1	1	2	3.3
	Others	9	7	16	26.2

ACD = active case detection; PCD = passive case detection.

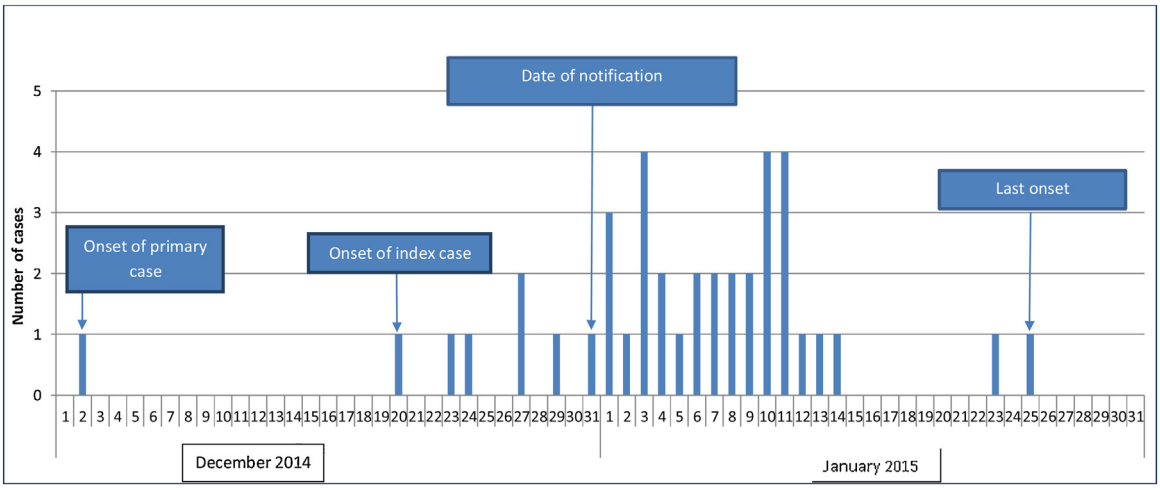

Figure 1. The epidemic curve of cholera outbreak in Kudat during December 2014–January 2015.

killed whole-cell oral cholera vaccines (OCV) in conjunction with control strategies during cholera outbreaks (Organization, 2018). The OCV has been deployed in several outbreaks and was found effective (Ciglenecki et al., 2013; Ivers et al., 2015). In a cholera-prone area like Kudat, vaccinating Sea Gypsies with OCV might be an effective option to control outbreak.

Funding

The study was funded by Launching Grant for Centre of Excellence from Universiti Malaysia Sabah (Number: AM 18006).

Declaration of interest

None.

Ethical approval

All procedures performed were in accordance with the ethical standards of the institutions and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Acknowledgments

The authors would like to thank the Director General of Health Malaysia for the permission to publish this article.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.ijid.2019.04.008.

References

Ali M, Nelson AR, Lopez AL, Sack DA. Updated global burden of cholera in endemic countries. PLoS Negl Trop Dis 2015;9(6)e0003832.
Ciglenecki I, Sakoba K, Luquero FJ, Heile M, Itama C, Mengel M, et al. Feasibility of mass vaccination campaign with oral cholera vaccines in response to an outbreak in Guinea. PLoS Med 2013;10(9)e1001512.
Hossain ZZ, Farhana I, Tulsiani SM, Begum A, Jensen PKM. transmission and toxigenic potential of vibrio cholerae in hilsha fish (*Tenualosa ilisha*) for human consumption in Bangladesh. Front Microbiol 2018;9:222.
Ivers LC, Hilaire IJ, Teng JE, Almazor CP, Jerome JG, Ternier R, et al. Effectiveness of reactive oral cholera vaccination in rural Haiti: a case-control study and bias-indicator analysis. Lancet Glob Health 2015;3(3):e162–8.
Lim VK. Cholera: a re-emerging infection. Med J Malaysia 2001;56(1):1–3.
Mandal S, Mandal MD, Pal NK. Cholera: a great global concern. Asian Pac J Trop Med 2011;4(7):573–80.
Organization WH. Cholera vaccine: WHO position paper, August 2017 — Recommendations. Vaccine 2018;36(24):3418–20.
Weill FX, Domman D, Njamkepo E, Tarr C, Rauzier J, Fawal N, et al. Genomic history of the seventh pandemic of cholera in Africa. Science 2017;358(6364):785–9.
Zin T, Aung TS, Saupin S, Myint T, Naing DKS, Aung MJ, et al. Influencing factors for cholera and diarrhoea: water sanitaion and hygiene in impoverished rural villages of Belarun district, Sabah, Malaysia. Malaysian J Public Health Med 2015;15(1):30–40.