



## Outbreak, Surveillance and Investigation Reports

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# Adult Japanese Encephalitis Outbreak Following an Immunization Campaign in Children, Shwe Pyi Tha Village, Sittwe Township, Rakhine State, Myanmar, 2016

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### Abstract

On 31 Aug 2016, one Japanese encephalitis (JE) case was notified from Shwe Pyi Tha Village, Sittwe Township, Rakhine State. The case was the first reported JE case from this village after implementing the single-dose JE vaccination in the area during May 2015. An outbreak investigation was conducted during September-October 2016 to confirm the outbreak and identify possible risk factors. The patient and family members were interviewed. Suspected cases were searched in the family and the village, and the medical records were reviewed. Serum samples were collected and sent for JE antibody, and dengue antigen-antibody testing. Environmental investigation, including entomological study, was conducted. The patient was a 46-year-old male worker. He got fever with headache on 14 Aug 2016. He developed convulsion and was admitted to Sittwe General Hospital with final diagnosis of viral meningitis. He was an alcoholic and usually did not sleep in a mosquito net. Active case finding among 1,758 villagers found 12 feverish villagers, including two suspected cases. Out of 11 serum samples tested, one was positive and two were equivocal for JE antibody testing. Environmental investigation revealed domestic animals, poor drainage and houses without mosquito screens. *Culex tritaeniorhynchus* and *Culex quinquefasciatus* were identified in the village as well. Considering the environmental conditions, Rakhine State should be a high priority area for routine JE immunization program.

**Keywords:** Japanese encephalitis, outbreak, investigation, Rakhine

### Introduction

Japanese encephalitis (JE) is a leading cause of viral encephalitis in Asia, including Myanmar.<sup>1-3</sup> The pathogen is a mosquito-borne *flavivirus*, and transmission is occurred through *Culex* mosquitoes, pigs and water birds.<sup>2,4</sup> Clinical manifestations exhibit in one out of 250 infections.<sup>5</sup> However, the case fatality rate of JE infection can be 30%, and permanent neurological or mental sequelae can occur in 20-30% of survivors.<sup>2,4</sup> In endemic regions, JE

infection is common in rural and agricultural areas.<sup>1,2,4</sup> Although it usually infects children, people in all ages can be infected, especially among people with no immunity.

In 1974, the first JE outbreak in Myanmar was reported from Tachileik, Shan State. During 1979, JE cases were reported from other states and regions.<sup>3</sup> Thus, the hospital-based surveillance for acute encephalitis syndrome (AES) was initiated in limited places during 2007. The AES surveillance was

incorporated into integrated disease surveillance system in 2016.<sup>6</sup> From January to October 2016, 1,552 AES and 377 JE cases were reported from all states and regions.<sup>7</sup>

In Rakhine State, the first JE case was reported in 1979, and outbreaks were detected in four townships during 2007 and 2008.<sup>8</sup> Eight out of total 17 townships in the state had been affected in 2015. Outbreak occurred in agro-based villages with pig husbandry under or near the houses.<sup>8,9</sup> A single dose of JE vaccination was given to 1-14 years old children in some villages including Shwe Pyi Tha Village in May 2015.<sup>8</sup>

On 31 Aug 2016, the Vector Borne Disease Control (VBDC) Team in Rakhine State was notified of a 46-year-old male from Shwe Pyi Tha Village, Sittwe Township. He was the first reported JE case from that village in 2016 and his clinical manifestation was very severe. Thus, the state VBDC team and township health department conducted an investigation in September-October 2016. The objectives were to confirm the outbreak, verify the diagnosis, describe the epidemiological and environmental characteristics, and identify the risk factors associated with the outbreak.

## Methods

The index case and his family were interviewed about the illness, risk behaviors, and travel history and his routines to identify possible source of infection. Medical records of the index case in Sittwe General Hospital were also reviewed. Data on JE and acute encephalitis cases from the affected village and Sittwe Township during January 2010 to October 2016 in Sittwe General Hospital, Special Diseases Control Unit, and Rakhine State VBDC Team were examined as well.

## Active Case Finding

Active case finding was conducted among family members of the index case and other villagers in Shwe Pyi Tha Village, Sittwe Township, by allocating the investigation teams into four teams by a door-to-door survey.

A suspected case was a person in Shwe Pyi Tha Village, Sittwe Township, who had acute onset of fever and a change in mental status such as confusion, disorientation, coma or inability to talk, and/or new onset of seizures (excluding simple febrile seizures) during August to October 2016. A confirmed case was a suspected case with laboratory confirmation of JE virus immunoglobulin M (IgM) antibody by enzyme-linked immunosorbent assay (ELISA). Serum

samples were taken from suspected cases and sent to the National Health Laboratory for serological analysis of JE virus IgM antibody using an IgM-capture ELISA (JE Detect TM MAC-ELISA test). The serum samples were also tested for dengue NS1 antigen, IgM and immunoglobulin (IgG) testing by the state VBDC.

## Environmental Investigation

Environmental surveys were conducted in Shwe Pyi Tha Village to find out possible environmental factors for disease transmission, including vector breeding sites, animal husbandry and disease occurrence in those animals. Entomological study was carried out at the index case's house and surrounding 10 houses by spray sheet collection. Larva collection was done in nearby water collected areas, ponds and farms.

## Results

### Description of the Index Case

The index case was a 46-year-old male worker, living in Shwe Pyi Tha Village. He was a chronic alcoholic and had no history of similar illness before this episode. He suffered fever with headache on 14 Aug 2016 and took antipyretic drugs by himself. On 15 Aug 2016 evening, he had sensory changes and speech impediments. On the next morning, he got convulsion and became unconscious. The patient was admitted to Sittwe General Hospital on 16 Aug 2016. Although the patient remained unconscious, he was discharged from the hospital on 17 Aug 2016, following the request of the family who thought that he would die.

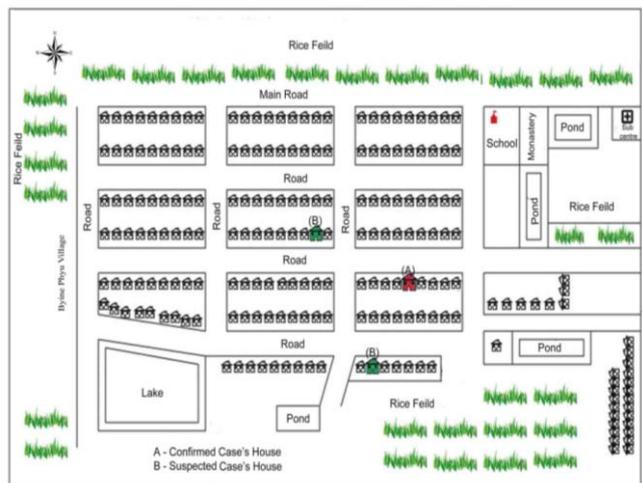
On 18 Aug 2016, the patient was better and admitted to the hospital again on 19 Aug 2016. During the second admission, he had fever (37.8°C) and remained unconscious with no meningeal signs. Complete blood picture showed hemoglobin 11.3 gm%, white blood cells 15,000/cumm, neutrophil 85%, lymphocyte 10%, monocyte 2%, eosinophil 1% and myelocyte 2%, platelets 90,000 per mL and erythrocyte sedimentation rate (ESR) 80 mm/hr. Infection screening showed negative for human immunodeficiency virus (HIV) antibody, hepatitis B virus surface antigen (HBsAg), hepatitis C virus (HCV) antibody and malarial parasites, and normal urine on routine examination. Serum of the patient was sent to the National Health Laboratory for detection of JE antibody. The patient was discharged from the hospital on 27 Aug 2016. Although the patient had good conscious level, could not walk well at the time of discharge. The final diagnosis by the physician was viral meningitis.

The patient had no previous history of similar illness or travel to other places before the illness. However, he usually drank alcohol every evening in the village and came back home in the late evening. He did not sleep under a mosquito net while his family members usually did.

### Active Case Finding

Active case search was conducted among family contacts and people in Shwe Pyi Tha Village. There were total five family members (one adult male, three adult females and one 8-year-old boy). Only the boy had fever with no neurological features on the same day as the patient. The boy had received one dose of live attenuated JE vaccine in 2015.

Active case search was also conducted among 1,758 persons in the village. Total 12 cases, including the index case, had fever with onset between 1 Aug 2016 and 7 Oct 2016. Of these 11 cases, five cases were from nearby houses. Three were admitted to the hospital and among them, two met the case definition of JE suspected case. One of the two suspected cases was a 9-year-old girl with fever and disorientation, and the other one was a 1-year-old boy with fever and convulsion. Both of them did not get JE vaccination in 2015. The houses of the two suspected cases were close to that of the index case (Figure 1).



**Figure 1. Location of confirmed (in red) and suspected JE cases' houses (in green) in Shwe Pyi Tha Village, Sittwe Township, Rakhine State, Myanmar, 2016**

### Laboratory Findings

Seven serum samples from the index case, his 8-year-old son, one suspected JE case and four cases with fever were sent to the National Health Laboratory for JE IgM antibody testing by ELISA and also tested for dengue NS1 antigen and IgM/IgG testing at the state VBDC. All samples were negative for dengue infection. Only the index case had positive JE IgM

antibody. His 8-year-old son and one from nearby house had equivocal JE IgM antibody. The remaining four (one suspected JE case and three cases with fever) had negative results.

### Environmental Study

Shwe Pyi Tha Village is situated in peri-urban area of Sittwe Township. There were 348 households with total population of 1,758 in 2016. The major economy of the village was fishery. Some villagers were farmers and some were workers in Sittwe Township. There were huge rice fields near the village. There were no pig farms. However, domestic breeding of animals such as pigs, cattle and chickens were found in most of the households. During the investigation, there were total 45 pigs, 25 cattle and 321 chickens in the village. No history of diseases in animals was reported in the village. There was a pig in the index case's house and also in the nearby house. Water supply was from four ponds in the village. The water drainage system was not good with a lot of ditches and ground pools near the index case's house and within the village. Most of the houses in the village, including the index case's house, were made of dry leaves or wood without mosquito screens (Figure 2).



**Figure 2. Environmental condition in Shwe Pyi Tha Village with JE confirmed case, Sittwe Township, Rakhine State, Myanmar, 2016**

Entomological study was carried out at the index case's house and surrounding 10 houses by spray sheet collection. One *Culex tritaeniorhynchus*, eight females and two males of *Culex quinquefasciatus* were detected. Unfortunately, JE virus detection was not carried out in these mosquitoes. Larva collection was done in water collected from swamps, ponds and farms. However, no larva was found.

### AES and JE cases in Shwe Pyi Tha Village

One JE case (16 years old boy) was reported from this village in 2010. Two acute encephalitis cases were reported during 2015 and one of whom was JE IgM positive. Both cases were under one year old. One

dose of live attenuated JE vaccine was given to 292 children aged 1-15 years in the village during May 2015 and vaccine coverage was 61.5%. In 2016, there was also one adult JE case reported from a nearby village.

### AES and JE cases in Sittwe Township

During 2010, one AES case was confirmed to have JE in Sittwe Township. There were six AES cases in 2014 and 13 AES cases in 2015. Among them, two JE cases were confirmed in each year. As of 10 Oct 2016, there were total 17 AES cases and seven JE confirmed cases (Table 1). Up to 2015, all cases were less than 14 years and in 2016, three out of seven cases were more than 14 years.

**Table 1. Number of acute encephalitis syndrome (AES) and Japanese encephalitis (JE) cases in Shwe Pyi Tha Village, Sittwe Township, Rakhine State, Myanmar, 1979-2016**

Year	AES	JE	% of JE in AES
1979	1	1	100.0
2007	1	1	100.0
2010	1	1	100.0
2014	6	2	33.3
2015	13	2	15.4
2016	17	7	41.2

## Discussion

The index case in this outbreak was an adult male aged 46 years old with history of chronic alcohol use. The patient had fever and neurological manifestations, with laboratory confirmation of JE virus IgM antibody. Alcoholic abuse, which generally weakens the immune system<sup>10</sup> and not using the mosquito net might increase risk of infection in this patient.

His 8-year-old son who had received one dose of live attenuated JE vaccine in the previous year had only fever and equivocal serological analysis for JE IgM antibody. The clinical manifestations of the boy did not meet the JE case definition. Two suspected JE cases were found during active case finding.

JE is predominantly, although not exclusively, a rural disease. JE virus is transmitted primarily by *Culex* mosquitoes, and circulates in an enzootic cycle in pigs and water birds, which serve as amplifying hosts.<sup>2,4</sup> The most important vector is *Culex tritaeniorhynchus* which breeds in flooded rice fields and water pools. Living in close proximity to rice fields and family or

neighbor ownership of pigs were significant risk factors for JE.<sup>11</sup> In this outbreak investigation, huge rice fields, ponds and families with pig ownerships found in the area were environmental conditions favorable for JE spread. *Culex tritaeniorhynchus* (main vector of JE transmission) and *Culex quinquefasciatus* (competent vector) were also detected in the affected area.

Due to the animal reservoirs, although JE virus cannot be eliminated, the disease can potentially be controlled by universal human JE vaccination in endemic areas.<sup>1,4,5</sup> Immunization is the most effective JE prevention strategy in reducing JE morbidity and mortality, and had shown to be cost-effective in studies carried by several countries.<sup>12</sup> The World Health Organization recommends that JE vaccine should be incorporated into immunization programs in all areas with high disease burden.<sup>1</sup> The most effective immunization strategy is an one-time campaign in locally defined target population, followed by incorporation of JE vaccine into the routine childhood immunization program.<sup>1,4,5</sup>

JE has been endemic in most townships of Rakhine State and reported cases increase by year.<sup>7,8</sup> There was a big JE outbreak in Rakhine State in 2014 and there were total 23 cases from nine townships.<sup>9</sup> There were also 52 JE cases in 2016 from 10 townships.<sup>8</sup> Environmental conditions are favorable for breeding of vectors and disease transmission. Rakhine State should therefore be a high priority area for routine JE immunization program.

## Prevention and Control Measures

Health education about JE cause, clinical manifestations, mode of transmission, importance of early treatment, environmental sanitation and animal husbandry was provided to the villagers. Malathion fogging was done in the index case's house and nearby 31 houses. One dose of live attenuated JE vaccine was given to 253 children aged 1-15 years old who had no previous JE vaccination in September 2016.

## Limitations

Cerebrospinal fluid sample of the index case was not tested for JE antibody. One suspected JE patient refused to test JE and thus, the information could not be obtained. JE virus detection was not carried out in the collected vectors or domestic animals. JE immunity level of the community was not measured.

## Conclusions and Recommendations

An investigation confirmed JE infection in an adult male with a history of chronic alcohol use and lived in

a village of Sittwe Township, Rakhine State. Two suspected JE cases were found during the active case search. Vectors of JE transmission were also detected in the affected area. Routine JE immunization program is essential and was needed to initiate at earliest. Children should be the priority for JE immunization. However, serological survey of JE immunity level in adults in high-risk areas should be conducted and used for considering JE vaccination in adults.

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### Suggested Citation

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