

Dengue Shock Syndrome Case Management and Investigation in Chiang Saen District Hospital, Chiang Rai Province: A case study

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ABSTRACT

An early case of dengue shock syndrome (DSS) was treated and further investigated by a surveillance and rapid response team (SRRT) of Chiang Saen Hospital, Chiang Rai, Thailand. A DSS patient was admitted to the hospital and indicated the need for immediate investigation. The ultimate goal of the study was to understand the effectiveness of case management and identify an effective mechanism for dengue fever (DF) prevention and control in a community. Specific procedures to assess case management and perform standard disease investigations in a community were applied, and information was collected from several sources, such as medical records, laboratory results, and information obtained from interviews with key informants in the community. The surveillance and rapid response team (SRRT), which consisted of public health professionals, medical doctors, nurses, etc., performed disease investigations in the community. A Thai female aged 56 years who was working as a merchant and who lived in San Thon Pao Village, Yo Nok Sub-District, Chiang Saen District Chiang Rai Province, had a high fever on June 16, 2019 and received treatment on June 18, 2019 at the hospital. After completion of the medical investigation, she was diagnosed with DSS, which was the first case in this area in many years and indicated the need for further investigation. The SRRT prepared for further public health actions to respond to the disease properly and started community work on June 20, 2019; the public health actions included mass media education, screening for more cases in the community, and cooperation of people in the community. Finally, an additional 9 cases of DF were detected, the disease was controlled, and no more cases were reported in this area. DSS requires effective medical care, particularly in the critical period, and a rapid response with effective measures, including strong collaboration with people in the community, is key to the success of controlling a disease, and this method could be applied to other severe diseases.

Keywords: Dengue fever, Dengue shock syndrome, Case management, Investigation, surveillance and rapid response team (SRRT)

Introduction

Dengue fever (DF) has been recognized as a public health challenge, particularly in tropical countries [1]. Dengue is a mosquito-borne virus that is frequently reported in the rainy season, especially in Southeast Asian countries [2]. The virus has four serotypes (dengue virus (DENV)-1, -2, -3, and -4) and presents similar clinical features among infected persons, but DF presents a wide spectrum of clinical features from an absence of symptoms to severe manifestations, such as shock syndrome [3]. Infection with one serotype of DENV stimulates life-long

immunity to that serotype but not to other serotypes [4]. Symptomatic dengue virus infections are grouped into three categories: undifferentiated fever, DF, and dengue hemorrhagic fever (DHF) [5]. DHF is classified into four severity grades, with grades 3 and 4 being defined as dengue shock syndrome (DSS) [2]. All cases of DHF or DSS need to be cared for properly and intensively by medical staff. DHF is a severe and potentially life-threatening condition [2]. While DSS is a dangerous complication of dengue infection and is associated with high mortality [6], if the condition is detected early and the patient is cared for properly, the

fatality rate is below 1.0% [1].

The World Health Organization (WHO) estimated that 100-400 million cases of DF occurred globally, and most of the severe cases were reported in countries in Asian and Latin America [1]. The Ministry of Public Health in Thailand reported more than 82,00 cases of DF in 2019. The largest proportion of cases was reported among people aged 5-14 years, followed by 15-34 years. The cases peaked between July and August 2019, and the northern region of Thailand reported the highest number of cases of DF from 2018-2019 [7]. In 2018, 103 deaths caused by DHF and DSS were reported, and those who were older had a greater chance of death than those who were younger, especially those who had underlying diseases such as obesity, hypertension, asthma, etc. [8]. In 2018, there were 1,933 cases of DF in Chiang Rai Province, and Chiang Saen District was identified as one of the high-risk areas for DF in Chiang Rai Province due to having a high population density, having long border areas with Myanmar and the Republic of Lao, and people living in poverty and with poor education levels [9]. To respond to DF, including DHF and DSS, the availability of a team to rapidly implement prevention and control measures is important [10]. Environmental management is another factor to reduce the epidemic potential of the disease [11].

The objectives of this study were to understand effective case management, particularly effective care in febrile (dehydration and high fever may cause neurological disturbances and febrile seizures in young children) and critical phases (shock from plasma leakage, severe hemorrhage, and organ impairment) [2], and identify the associated community factors.

Method

The DSS patient was cared for, and a field investigation was conducted in Chiang Saen District, Chiang Rai Province between June 19th and July 31st 2019, by collaborating with the district surveillance and rapid response team (SRRT). The team consisted of an epidemiologist from the Chiang Saen District Public Health Office, a medical doctor and a nurse from Chiang Saen Hospital, a public health professional from Yo Nok Health Promoting Hospital and village health volunteers (VHVs). The investigation aimed to understand the effectiveness of DSS case management, to identify additional DHF cases in the villages and to identify effective prevention and control measures that reduce potential risk factors for the disease at the community level. The World Health Organization (WHO) criteria were used for probable case identification, which require at least two of the following signs: severe headache, pain behind the eyes, muscle and joint pain, nausea, vomiting, swollen glands, and rash. People with high fever, fatigue, and headache were excluded. The definition of severe dengue required one of the following criteria to be met: a) plasma leakage that may lead to shock (dengue shock), b) fluid

accumulation with or without respiratory distress, c) severe bleeding and/or d) severe organ impairment. Moreover, severe dengue can present with severe abdominal pain, persistent vomiting, rapid breathing, bleeding gums, fatigue, restlessness and blood in vomit [1].

Step of investigation

The investigation was initiated by confirming the occurrence of DSS based on medical records, including asking the doctor who handled the case. The laboratory information was also confirmed according to the WHO guidelines. Then, the epidemic activity of the disease was confirmed by comparing data from three years prior, and no DSS was reported in the area. Additional information was obtained from the patient and her relatives regarding the travel history of the patient. Possible risk factors and potentially vulnerable or at-risk populations were also identified.

A case definition was developed and understood among the SRRT team. The roles of the SRRT were elucidated, including the flowchart of the authority and all relevant mechanisms, including the major channels of communication. Hypotheses were developed before field investigation. A cross-sectional design was used to test the hypotheses. Family members and selected community members were interviewed. Quality of sanitation and environmental factors were also assessed.

Results

A total of 34 cases of DF were reported through the surveillance system of Chiang Saen Hospital between January 1st, 2019 and July 15th, 2019 (morbidity rate 87.74 cases per 100,000 people).

A case profile:

A 56-year-old female who lived in village No 6, San Thon Pao Village, Yo Nok Sub-District, Chiang Saen District, Chiang Rai Province visited a doctor at Chiang Saen Hospital with high fever, headache and fatigue on June 18, 2019. Her symptoms began on 16 June 2019. A doctor performed an overall assessment including past and present illness history for her and her family members. She had been fully physically assessed, including both routine and dengue-specific laboratory identifications. Finally, she was preliminarily diagnosed with dengue fever (DF) and treated. However, based on her clinical features, she was not admitted and was asked to follow-up the next day (on June 19, 2019).

Early in the day on June 19, 2019, the patient met a doctor again and was admitted to the inpatient care unit because her clinical signs worsened, particularly fever and headache. On June 20, 2019, the patient presented signs of shock because plasma was leaking out of the cells. On June 21, 2019, a large area of red spots presented on her arms and whole body. On June 22, 2019, she went into shock and was cared for in the

intensive care unit (ICU). On June 23, 2019, the patient's signs improved, and the fever decreased. On June 24, 2019, the patient had largely improved, with no fever or usual symptoms. On 25 June 2019, the patient was discharged from the hospital and was further cared for at home.

According to the patient's illness history and physical examination, the patient had high fever, headache, eye pain, bone or joint pain, red rash, and shock, and the tourniquet test was positive, which was a clinical manifestation of dengue fever. The following are the comparisons of the clinical signs and symptoms with those in the World Health Organization (WHO) guidelines.

Table 1 Clinical characteristic of dengue fever patients

Symptoms	Yes	No	WHO
			definition [12]
Fever and acute fever	✓		++++
Headache	✓		++++
Vomiting		✓	++
Eye pain	✓		+
Bone and joints pain	✓		
Rash	✓		+
Internal organs bleeding		✓	+
Liver failure		✓	+
Shock	✓		+
Tourniquet test	positive		++

Laboratory results

Several biomarkers were detected from the first day to the last day for monitoring and case management (Table 2).

Community works;

In the villages, several tasks were performed during the investigation. Two major teams were grouped in the SRRT. In the first group, two staff members looked for probable cases in the village to identify the cases of DF and DHF. Finally, 9 cases met the criteria of probable cases. The second group worked on a) identifying and destroying egg-laying habitats, b) emptying and cleaning water storage containers, c) encouraging people to use long-sleeved shirts in the daytime to reduce bites from mosquitoes, d) providing mass media education on DF disease and proper methods to control and prevent DF at the family and community levels, e) spraying with chemicals to kill adult mosquitoes, and f) performing active larval surveillance in households.

Conclusion

Dengue fever is a critical and threatening health problem, even in very remote areas. Most patients need to be cared for carefully by the medical team. Even in remote and small hospitals in Thailand, medical staff should be able to handle DHF cases properly and effectively. This reflects the quality of the health care and health care system. The formation of an SRRT is challenging in the health system, especially in health resource-limited areas. Under these conditions, timing is important to stop the spread of the disease. Regular training and meeting in teams, including a concrete structure of the team or organization, leads to the optimal effective prevention and control of a disease in certain areas. Communication is found to play a critical role in all steps while working in the field. Finally, the cooperation of people in the community and collaboration among the relevant agencies and organization to integrate all resources to address the problem are also identified as keys to success in the context of the disease investigation.

Table 2 Laboratory result

No	Date	WHO DHF Criteria					Temp.
		WBC ($<5,000$ cell/mm ³)	Platelet ($<100,000$ cell/mm ³)	Hct (increase 10%-20% from original date)	IgM	IgG	
1	June 18, 2019	1,940	135,000	36.6	-	-	35.7
2	June 19, 2019	2,750	109,000	38.8	Neg.	Pos.	38.2
3	June 20, 2019	2,170	51,000	36.1	-	-	38.3
4	June 21, 2019	3,160	34,000	35.4	-	-	37.8
5	June 22, 2019	3,450	25,000	35.1	-	-	37.3
6	June 23, 2019	3,760	29,000	34.5	-	-	37.3
7	June 24, 2019	3,830	84,000	34.5	-	-	37.1

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