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First Case Report of Japanese Encephalitis in Boyolali District, Central Java Province, 2023

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Abstract

Japanese encephalitis virus is the leading cause of immunization-preventable encephalitis in Asia and the Western Pacific. Most people infected with Japanese Encephalitis have no symptoms or only mild symptoms. However, a small percentage of infected people develop inflammation of the brain (encephalitis), with symptoms including headache, fever, disorientation, seizures, weakness, and coma. This bstract aims to provide an overview of the first case of Japanese Encephalitis in Boyolali District. Reports using descriptive methods based on reports of epidemiologic investigation results. The Case is a 5.5-month-old child with symptoms of fever, seizures, liquid diarrhea, decreased consciousness, and high leukocytes. Treatment was symptomatic. The case and the family had a history of traveling outside the area. From the results of environmental observations, mosquito larvae were found in the bathroom and mosquito breeding sites, such as unused fish ponds, used cans and buckets, piles of clothes, humid house temperatures, and piles of garbage behind the house. Positive results were obtained using the Antibody capture ELISA method based on the IgM Japanese Encephalitis examination. After three times of control in the hospital, on April 13, 2024, the case was declared in good condition. In Boyolali District, Culex mosquitoes at risk of transmitting Japanese encephalitis have been found. With this case, the Boyolali District Health Office conducted education related to Japanese Encephalitis, conducted vector surveys, eradicated mosquito nests, and coordinated with related cross-sectors; if similar cases occurred, they were immediately reported for immediate treatment.

Keywords: Boyolali District; First Case; Japanese Encephalitis

Introduction

Japanese encephalitis virus (JEV) is a flavivirus related to dengue, yellow fever, and West Nile viruses, and it is primarily transmitted by mosquitoes, especially Culex tritaeniorhynchus (WHO, 2024). Japanese Encephalitis (JE) mainly affects children and can lead to severe neurological complications, including encephalitis, which can be potentially fatal. The Japanese encephalitis virus is transmitted to humans through the bite of an infected mosquito, particularly the Culex tritaeniorhynchus species, which breeds in areas with abundant water sources such as rice fields. Although a vaccine is available, JE remains a leading cause of viral encephalitis in Asia, contributing significantly to morbidity and mortality, especially in regions with

limited access to healthcare services (Tamgadge et al., 2022).

In this context, we present a case report from Boyolali District, Central Java Province, Indonesia, where a 5-month-old infant was diagnosed with suspected Japanese encephalitis, which was later confirmed as positive through laboratory testing. This case is significant as it represents the first reported instance of Japanese encephalitis in this region, highlighting the need for increased awareness, surveillance, and preventive measures to address the spread of this disease in a non-endemic area. The case underscores the challenges in early diagnosis and management of Japanese encephalitis.

This report details the clinical presentation, diagnostic process, case management, and an epidemiological investigation that revealed significant environmental risk factors, including poor sanitation and mosquito breeding sites near the patient's residence. These findings emphasize the importance of environmental control and community education in preventing Japanese encephalitis cases. The significance of this case lies not only in its rarity but also in its implications for public health strategies in similar areas where Japanese encephalitis may be underreported or misdiagnosed. Lessons from this case can guide future efforts to control and prevent Japanese encephalitis in Boyolali and other at-risk regions.

Methods

This case report utilizes a descriptive method based on the epidemiological investigation conducted in the Boyolali 1 Community Health Center area, Boyolali District, Central Java Province, Indonesia. Data was collected through detailed clinical assessments, laboratory tests, and environmental observations. Clinical data were gathered from hospital medical records, including the patient's symptoms, treatment history, and treatment outcomes. Environmental data were collected through field observations at the patient's residence to identify potential mosquito breeding sites and other risk factors associated with the transmission of Japanese encephalitis.

The diagnosis of Japanese Encephalitis was confirmed by detecting JE-specific IgM antibodies using the Antibody-capture ELISA method. This testing was performed on samples taken from the patient during their hospitalization. A thorough environmental investigation was conducted around the patient’s home. This observation included inspecting water sources such as open water containers, ponds, and drainage systems to identify the presence of mosquito larvae. The condition of the residence, including sanitation practices and potential mosquito breeding sites, was also documented. The data were analyzed descriptively, focusing on the clinical progression of the disease, the treatment administered, and the environmental factors that might have contributed to the transmission of Japanese encephalitis. These findings were used to develop public health intervention recommendations to prevent further JE cases.

Results

Case Report

On December 18, 2023, a 4-month-old baby girl received her Pentavalent-3 vaccination in the morning. However, by the afternoon, she experienced seizures without a fever, leading to her being admitted to Pandan Arang Regional Hospital in Boyolali. She was hospitalized for three days, from December 18 to December 21, 2023. Laboratory results showed a white blood cell count of 12,080, hemoglobin at 10.4, platelets at 542,000, hematocrit at 31, lymphocytes at 44.70%, and neutrophils at 47.50%. After receiving treatment, the patient was discharged in a generally stable condition.

On December 29, 2023, the patient experienced seizures again and was readmitted to Pandan Arang Regional Hospital for five days until January 2, 2024. After this treatment, she was discharged in a stable condition once more. However, on January 18, 2024, the patient suffered from more severe seizures, with three episodes lasting 5 minutes each. The third seizure resulted in a loss of consciousness and a worsening condition, marked by an increase in white blood cells and a body temperature of 38°C. Additionally, the patient experienced watery diarrhea six times. Due to her deteriorating condition, she required intensive care in the PICU at Pandan Arang Regional Hospital. As there was no significant improvement, the patient was subsequently referred to Dr. Sardjito Hospital in Yogyakarta after being hospitalized for eight days at Pandan Arang Regional Hospital.

The patient was admitted to Dr. Sardjito Hospital from January 25 to February 14, 2024. During this period, laboratory tests on January 30, 2024, indicated a decline in several blood parameters: red blood cells at 3.14 million/mm³, hemoglobin at 8.3 g/dL, hematocrit at 25.1%, white blood cells at 11,200/mm³, and platelets at 124,000/mm³. The seizure history revealed that the first seizure occurred at four months of age, lasting approximately 15 minutes. There was also a family history of febrile seizures, with the mother having a history of epilepsy, which may have contributed to the patient's condition.

On February 14, 2024, the patient was discharged but required a nasogastric tube (NGT) for two more weeks. The first follow-up visit on February 19, 2024, showed that the NGT was still in place. By the second follow-up on March 4, 2024, the NGT had been removed, indicating improved patient condition. The third follow-up took place on April 1, 2024.

On January 26, 2024, a specimen was taken from the patient for Japanese Encephalitis (JE) testing and was sent to the Yogyakarta Public Health Laboratory on March 5, 2024. The results, on March 28, 2024, confirmed that the patient was positive for JE-specific IgM antibodies, detected using the Antibody-capture ELISA method. On April 3, 2024, the patient underwent a follow-up examination at Dr. Sardjito Hospital, and although her general condition was good, she still frequently experienced startle reflexes. The history of seizures and epilepsy in the mother served as predisposing factors for the patient's condition.

The patient's home environment was conducive to mosquito breeding, with stagnant water in open buckets and poor sanitation. Mosquito larvae were also discovered around the house. The family reported no

recent travel history, suggesting that the virus transmission likely occurred locally. The patient exhibited typical symptoms of Japanese encephalitis, including fever, recurrent seizures, and decreased consciousness. Laboratory tests showed an increased white blood cell count and signs of inflammation. During treatment, the patient developed muscle stiffness, neck rigidity, and further loss of consciousness. She was treated with anticonvulsants and supportive care. The patient's condition improved after prolonged hospitalization and three follow-up visits, although she continued to display startle reflexes.

The epidemiological investigation of the patient's surroundings identified several environmental risk factors. Open water containers in the bathroom provided potential breeding sites for mosquitoes. Additionally, the area around the patient's home featured piles of garbage, a chicken coop, and stagnant, murky water in a fishless pond. All these factors contributed to a high risk of Japanese encephalitis transmission through infected Culex mosquitoes. Efforts to improve the living environment included community education on mosquito control and vector surveys conducted by local health authorities. In this case, a vector survey was not conducted; however, in cases of mosquito-borne diseases where vector surveys were carried out, Culex mosquitoes were found in Boyolali 1 Community Health Center's service area near the Japanese encephalitis case.

The first reported case of Japanese encephalitis in Boyolali District has prompted an increase in public health efforts, including cross-sector coordination to ensure rapid response if similar cases arise. Moreover, these findings underscore the importance of enhanced surveillance and prevention measures to minimize the risk of Japanese encephalitis transmission in previously non-endemic areas.

Discussion

Japanese Encephalitis is a significant cause of morbidity and mortality in Asia and has become a public health problem worldwide (Kasarla et al., n.d.). Due to international travel, rapid urbanization, and climate change, the virus is rapidly spreading worldwide. Due to the lack of effective antiviral drugs, accurate diagnosis and prevention with active immunization and vector control should be the top priority to reduce the disease burden. Effective, effective, safe, and readily available drugs are the need of the hour to control mortality in endemic areas (Chen et al., 2022).

This first reported case of Japanese Encephalitis (JE) in Boyolali District provides valuable insights into the challenges of diagnosing and managing the disease in non-endemic areas. Although JE is known as one of the leading causes of encephalitis that can be prevented through vaccination in Asia (Connor & Bunn, 2017), this case reveals that regions previously considered low-risk can also become sites of disease transmission, particularly if environmental conditions favor the breeding of mosquito vectors. The densely populated residential area, along with swamps, bushes, dirty stagnant water, human activity at night, and the habit of littering, creates a potential environment for the breeding of Culex mosquitoes (Rahmayanti et al., 2017). Clinically, this case illustrates how challenging it is to diagnose Japanese encephalitis, especially in

the early stages of the disease. The symptoms exhibited by the patient, such as seizures, fever, decreased consciousness, and diarrhea, are general and could be caused by various other infectious diseases. Most people infected with the JE virus are asymptomatic or show non-specific symptoms resembling the flu. The signs and symptoms of encephalitis usually appear between 4-14 days after a mosquito bite (incubation period), with the primary symptoms being sudden high fever, changes in mental status, gastrointestinal symptoms, headaches, and gradual changes in speech and gait. In children, the initial symptoms usually include fever, irritability, vomiting, diarrhea, and seizures (IDAI, 2018).

In this case, the diagnosis of Japanese encephalitis was confirmed through specific IgM testing using the Antibody-capture ELISA method, the gold standard for detecting acute Japanese encephalitis infection (Garjito et al., 2018). This method is crucial as it allows for an accurate diagnosis, essential for initiating appropriate treatment and identifying cases in an epidemiological context. According to the World Health Organization recommendation, the laboratory-confirmed JE cases met both clinical criteria for acute encephalitis syndrome (AES) and laboratory criteria for JE. Clinically, AES refers to the acute onset of fever and at least one of altered mental status and newly developed seizures. Laboratory confirmation of JEV infection requires one of the following: 1) the presence of JEV-specific IgM antibody in serum or cerebrospinal fluid (CSF) samples in the absence of IgM to other flaviviruses; 2) the detection of a more than 4-fold increase in JEV-neutralizing antibody between acute and convalescent stages (Sunwoo et al., 2017).

The epidemiological investigation conducted in the patient's residential area revealed significant risk factors contributing to the transmission of Japanese encephalitis. The discovery of open water containers, stagnant water in neglected ponds, and poor environmental conditions such as garbage piles and chicken coops all provided breeding grounds for Culex mosquitoes, the primary vector responsible for Japanese encephalitis. Unhygienic environments and poor sanitation directly contribute to the increase in mosquito populations and, consequently, the risk of Japanese encephalitis transmission (Liu, 2018).

Preventive measures include vaccination, covering the skin with clothing, using topical insect repellents, maintaining good sanitation, and avoiding prolonged outdoor activities when mosquito vectors are active are essential. Vector control programs involving community participation are necessary to curb JE transmission, and educating the public about the importance of environmental cleanliness has proven effective in reducing JE incidence (Sewgobind et al., 2022). However, the success of these programs heavily depends on active community participation and support from local governments. Therefore, the interventions conducted in Boyolali, which involved education on vector control and vector surveys, are crucial steps in preventing the further spread of this disease.

Vaccination is a highly effective preventive measure against Japanese encephalitis (Quan et al., 2020), and vaccines against Japanese encephalitis (JE) have been available for decades. Most JE-endemic countries have vaccination programs for their at-risk populations (Vannice et al., 2021). In Indonesia, the implementation of JE immunization has not yet been carried out across all provinces and is still limited to

specific regions, such as Yogyakarta and Bali. The JE immunization program is planned to be implemented nationwide in 2024. WHO recommends integrating JE vaccination into national immunization programs in all areas where the disease has become a public health problem. The GAVI alliance financially supported this vaccination program. In 2016, half of the 24 countries with endemic JE had a national immunization program (Amicizia et al., 2018). The expanded vaccination program can significantly reduce the incidence of Japanese encephalitis in high-risk areas. Therefore, this case emphasizes the need for vaccination to prevent the occurrence of this disease, especially with environmental changes that may increase the mosquito vector population. However, since the virus is maintained in animal reservoirs, non-immune individuals remain at risk of infection (Mapangdol et al., 2024).

Surveillance is a crucial component in controlling and preventing diseases, including Japanese Encephalitis (JE), as it provides the necessary information for preventive actions, program evaluation, and the development of effective health policies (Heffelfinger et al., 2017). Japanese Encephalitis (JE) surveillance in Indonesia reveals significant challenges, including diagnostic uncertainty and limitations in confirmatory testing, which are mainly centralized in Jakarta. Delays in analysis results and the lack of local capacity for diagnosis indicate the need for strengthening the surveillance system to monitor the impact of JE, particularly following the implementation of vaccination (Kosen et al., 2022).

This case indicates the possibility of similar cases occurring in the future if rapid and appropriate preventive measures are not taken. This case has important implications for public health strategies in areas considered low risk for Japanese encephalitis but may experience an increase in incidence due to environmental changes or urbanization. Robust epidemiological surveillance and a quick response to new cases are crucial to prevent the further spread of this disease. Additionally, public education about the risks of Japanese encephalitis and the importance of environmental control is vital in reducing the risk of transmission. This report also highlights the need for further research to understand the transmission patterns of Japanese encephalitis in areas previously considered low-risk and to develop more effective prevention strategies.

Conclusion

The first Japanese Encephalitis (JE) case report in Boyolali District significantly contributes to our understanding of the disease's distribution, which was previously thought to be confined to some endemic regions. This case highlights the importance of robust surveillance and rapid public health responses in areas that may not have been previously identified as high-risk. By utilizing accurate laboratory diagnostic methods such as the Antibody-capture ELISA, we can ensure precise diagnosis and enable swift and effective treatment. The identification of significant environmental risk factors, such as poor sanitation and the presence of open water containers, demonstrates the crucial role that environmental conditions play in the spread of Japanese encephalitis. This finding reinforces the importance of interventions focused on improving sanitation

and vector control to prevent future outbreaks of the disease. Overall, this study has expanded our scientific knowledge by showing that Japanese encephalitis can emerge in new areas not previously recognized as high-risk, particularly under environmental conditions that support the proliferation of mosquito vectors. These findings emphasize the need not only to target endemic areas in prevention efforts but also to consider the potential spread to non-endemic regions.

The recommendations include strengthening epidemiological surveillance and early detection in at-risk non-endemic areas, with an effective detection system to quickly identify Japanese encephalitis cases. Additionally, environmental improvement and vector control through intensive mosquito breeding eradication programs (PSN) and public education on environmental cleanliness should be prioritized, including improvements in sanitation infrastructure and water management. Japanese encephalitis vaccination should be expanded to at-risk areas, including non-endemic regions that support disease transmission. Further research is needed to understand the mechanisms of spread in non-endemic areas, as well as the impact of climate change and urbanization on vector distribution and transmission risk.

This study has several limitations that need to be acknowledged. First, as a single case report, these findings cannot be generalized to the entire population or a broader region. Second, there is a limitation due to the lack of vector survey data in the area where the case occurred. Therefore, further research with larger samples and more comprehensive data is necessary to strengthen these findings and develop broader recommendations. By addressing these limitations, it is hoped that future studies can provide more complete insights and contribute to efforts to control and prevent the spread of Japanese Encephalitis..

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Author Contribution and Competing Interest

1. Ms. Fadhlun: Served as the lead author of this research, responsible for the study design, field data collection, data analysis, and manuscript preparation.
2. Mr. Teguh Tri Kuncoro: Coordinated with the Boyolali District Health Office and provided valuable input in the interpretation of the research findings.
3. Dr. Riris Andono Ahmad: Provided academic supervision and guidance throughout the research process

and played a role in revising and refining the manuscript for publication.

4. Ms. Anissa Arum Kartika Dewi: Field investigations, collected data related to environmental factors, and discussion of the research findings.

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