

Research Article

Investigating an Upsurge of Acute Encephalitis Patients at a Tertiary Hospital in Bogura, Bangladesh

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Abstract

Background: Japanese encephalitis (JE), Nipah virus encephalitis and some other viral encephalitis are endemic in northern districts of Bangladesh. Occasionally upsurge of hospital admission of encephalitis patients are reported in the tertiary care hospitals which needs evaluation. In May 2015, Shahid Ziaur Rahman Medical College Hospital (SZMCH) in Bogura, Bangladesh, reported an increased admission of encephalitis patients. Due to the endemic nature of viral encephalitis in the region, including Japanese encephalitis (JE) and the Nipah virus, the hospital authority reached out to the Institute of Epidemiology, Disease Control and Research (IEDCR). **Objectives:** The investigation was performed to verify whether the event was an outbreak and to identify potential etiologies. **Methods:** A field investigation was conducted from June 2 - 5, 2015 in SZMCH. Hospital admission in Medicine wards from January 2014 to May 2015 were analyzed to determine baseline trends. A suspected encephalitis case was defined as any patient with acute onset of fever and unconsciousness or altered mental status, seizure, or other neurological symptoms. We interviewed the attendants of encephalitis patients admitted from June 3 - 4, 2015. Serum and cerebrospinal fluid (CSF) samples were collected and tested for JE virus IgM antibodies at IEDCR. Clustering and geographic distribution were assessed using an epidemic curve and mapping of cases by district. **Results:** A total of 17 suspected encephalitis cases were identified (mean age 37 years; 70% male; 41% mortality). The rate of encephalitis admissions in May 2015 (5.9/1000 hospital admission in Medicine wards) was not significantly higher than the baseline period (7.1/1000 hospital admission). No spatial or temporal clustering was observed. Four patients met the probable case definition based on CSF findings. Of these, one tested positive for JE IgM antibodies; the rest were seronegative. No epidemiological risk factors for Nipah virus were found. **Conclusion:** We conclude that the encephalitis was sporadic and had no spatial and temporal relation with each other. However, a confirmed JE case reveals ongoing viral encephalitis transmission in northern Bangladesh. We recommend to strengthen hospital-based surveillance, improve diagnostic capacity for rapid detection, confirmation and control of the outbreak.

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Keywords

Encephalitis, Japanese Encephalitis, Hospital-Based Surveillance, Outbreaks, Epidemiologic Investigation, Bangladesh

1. Introduction

Acute viral encephalitis is a neurological emergency and a significant public health problem due to the high case fatality rate and the potential for outbreaks. It remains one of the major public health concerns in tropical and subtropical regions, especially in South and Southeast Asia. Common viral etiologies are Japanese encephalitis virus (JEV), Nipah virus, and herpes simplex virus (HSV). Globally, encephalitis accounts for an estimated 3.5-7.4 cases per 100,000 person-years, with higher incidence reported among children and immunocompromised individuals. [1, 2] Early recognition and accurate etiological diagnosis are critical for treatment, and implementing preventive measures to mitigate outbreak potential.

In Bangladesh, encephalitis is commonly diagnosed clinically, mostly without laboratory confirmation due to limited capacity. Few viral etiologies could be confirmed, such as Japanese encephalitis virus (JEV), Nipah virus, and herpes simplex virus (HSV). [3] Despite surveillance efforts initiated in the early 2000s, the true burden, seasonality, and epidemiologic characteristics of viral encephalitis in Bangladesh remain poorly understood. [4]

Japanese encephalitis (JE) is endemic in different parts of Bangladesh, notably in the northern districts, and has been identified through clinical surveillance and serological testing. [5] Previous studies have shown sporadic outbreaks and serological evidence of Japanese encephalitis virus (JEV) in Bogura, Pabna and Rajshahi district. [6] The Nipah virus, another encephalitic agent endemic in the same districts, has a particular seasonal transmission pattern in Bangladesh, generally linked to the drinking of raw date palm sap or contact with infected animals. [7]

In May 2015, Shahid Ziaur Rahman Medical College Hospital (SZMCH), a tertiary care hospital in Bogura, reported a rise in hospital admissions due to encephalitis. The cases were admitted from Bogura and neighboring districts, and the local health authority sought the assistance of the Institute of Epidemiology, Disease Control and Research (IEDCR) in epidemiological and laboratory investigations. The objective of the investigation was to verify the event to confirm possible clustering, identify etiologic agents, and early detection of an outbreak.

2. Methods

2.1. Investigation Design

We conducted a cross-sectional study to investigate the outbreak. We reviewed previous hospital admission records, interviewed admitted patients, and conducted laboratory investigation. SZMCH is a hospital in Bogura that treats patients from Bogura and the nearby Dinajpur, Joypurhat, Gai-bandha, Sirajgonj, and Pabna districts.

2.2. Study Population

The investigation involved patients who presented at the medicine wards of SZMCH between May 4 and June 3, 2015, and manifested symptoms that were indicative of viral encephalitis. Previous admission records between January 2014 and May 2015 were also reviewed to find out the trends in hospital admission.

2.3. Case Definitions

2.3.1. Suspected Case

Any patient who develops an acute onset of fever and unconsciousness or altered mental status, seizure, or other neurological symptoms altered mental status within the past 30 days.

2.3.2. Probable Case

A suspected case with history of contact with another encephalitis patient or cerebrospinal fluid (CSF) study suggestive of viral encephalitis (either microscopic or biochemical or both).

2.3.3. Confirmed Case

A suspected or probable case with laboratory confirmation (e.g., IgM antibodies to an encephalitic virus or viral RNA detected by PCR).

2.3.4. Cluster

Two or more cases in within two Kilo-meter radius or 30 minutes walking distance who developed symptoms within 21 days.

2.4. Data Collection

We reviewed total hospital admission data at the Medicine

wards and admission of encephalitis case data in those wards from January 2014 to May 2015 for identifying overall trends in encephalitis admissions. We reviewed the records of hospital-admitted encephalitis patients present during the investigation. We conducted face-to-face interviews with suspected cases or their relatives using a standard questionnaire to collect demographic data, medical conditions, and exposure histories from the..

2.5. Data Analysis

We calculated the the rate of admission of encephalitis cases from January 2014 to May 2015. The rate was calculated by the number of encephalitis admissions in a month in the Medicine wards divided by the total number of admitted cases in the same wards and same months and expressed per 1,000 hospital admissions. We compared monthly rates from January to May 2015 with those from January to December 2014 and performed Z-test for two proportions. We set $p < 0.05$ as the level of statistical significance. We also analysed the data of acute encephalitis patients by time, place, and person. We estimated the distance between two cases by the distance from their addresses found in hospital records.

2.6. Laboratory Tests

We collected blood samples and nasal swabs from the acute encephalitis patients admitted to SZMCH and sent them to IEDCR for Japanese encephalitis virus IgM antibody.

2.7. Ethical Considerations

This investigation was conducted during a public health emergency response authorized by the Government of Bangladesh. Ethical standards like informed consent, privacy, and confidentiality were maintained during the field investigation. Face-to-face interviews with the patients and collection of samples were performed with the permission of hospital authorities and patients' caregivers.

3. Results

3.1. Trend Analysis and Outbreak Confirmation

From January to December 2014, SZMCH had a mean of < 7.1 encephalitis cases/ 1,000 admissions in Medicine wards each month, with a peak in November and December, 2014 (Figure 1). The rate of encephalitis admissions in May 2015 (5.9/1000 hospital admission in Medicine wards) was not significantly higher than the mean encephalitis admission rate in 204 ($p > 0.05$) (Figure 1).

Rates of Encephalitis Patients per 1,000 Patient Admitted in Medicine Ward in Shahid Ziaur Rahman Medical College Hospital (SZMCH), 2014 - 2015

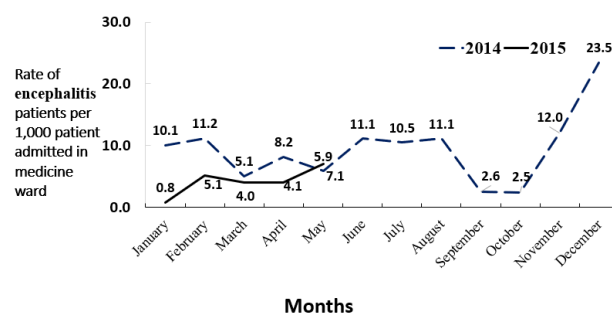


Figure 1. Admission of encephalitis patients per 1,000 patients admitted to the Medicine Wards of SZMCH from January 2014 to May 2015.

3.2. Clinical Features

A total of 17 encephalitis patients were admitted to the medicine ward of SZMCH from May 4 to June 3, 2015. The average age of the patients was 37 years, with an age range of 14 to 58 years. Out of them, 70% (12/17) were male patients. The case fatality rate among the patients admitted was 41% (4/17).

3.3. Temporal and Spatial Distribution

The epidemic curve showed that the cases were admitted sporadically during the study period with no pattern (Figure 2).

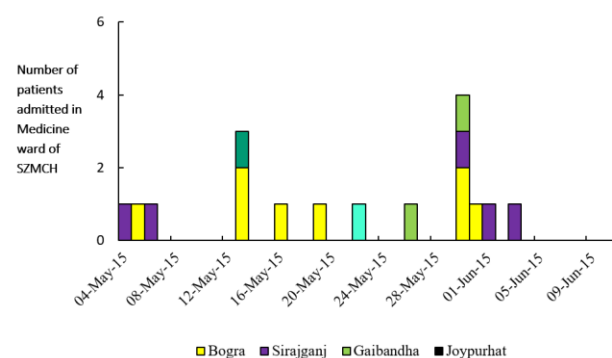


Figure 2. Histogram of Frequency of Admission by District of Encephalitis Patients in Medicine Ward of SZMCH from May 4 to June 10, 2015.

While distributing the locations of the encephalitis patients admitted in May 2015, we found that patients belonged to many nearby districts like Bogura, Dinajpur, Joypurhat, Gaibandha, Sirajgonj, and Pabna. There was no clustering based on patient residence; the cases were scattered in space and time (Figure 3).

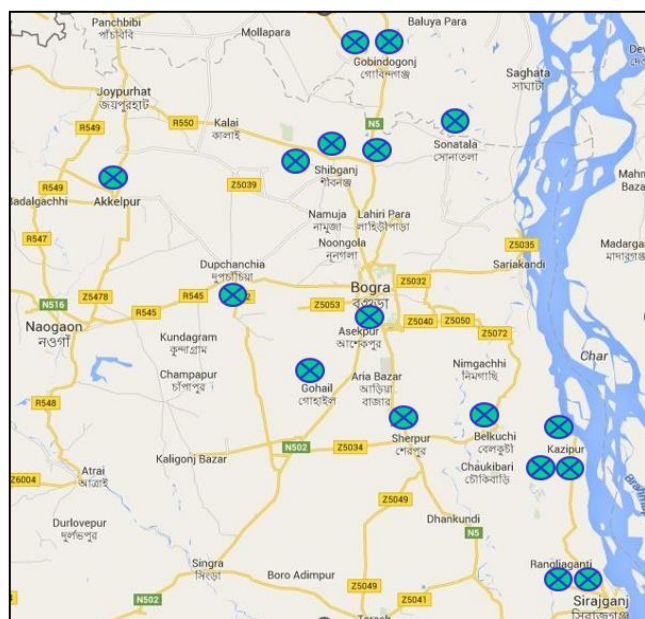


Figure 3. Location of Encephalitis Cases Admitted in Medicine Wards of SZMCH in May, 2015.

3.4. Interviews of Encephalitis Patients

Six encephalitis patients were present to the Medicine ward of SZMCH from June 3 - 5, 2015, and four met the suspected and probable case definitions. All four had presented with classic symptoms of fever, malaise, body pain, and central nervous system involvement (alteration in mental status or seizures). Two other patients admitted with encephalitis did not meet the case definition—one was subsequently diagnosed with profound electrolyte imbalance, and the other responded to anti-tuberculosis treatment. Interviews with relatives of the four potential cases revealed that they did not consume raw date palm sap or tari (palm wine). One of them mentioned there could have been contact with fruit partially eaten by animals, and another mentioned they did not sleep under mosquito nets. No common sources of infection were identified.

3.5. Lab Results

Serum from these individuals was assayed for Japanese encephalitis virus-specific IgM antibodies at the virology laboratory of IEDCR. One was positive for JE IgM, while the other samples were negative. None of the samples were tested for Nipah virus because they did not meet the criteria of Nipah Encephalitis.

4. Discussions

Although a higher number of encephalitis patients were admitted in May 2015 in SZMCH compared to the same month of the previous year, it was not significantly higher. The cases were also from different districts with no contact

history, suggesting that this was not a localized epidemic. One of the cases was found positive for JE, which confirmed the continued circulation of Japanese Encephalitis virus (JEV) in northern Bangladesh.

Bangladesh has experienced several documented outbreaks of viral encephalitis, most notably due to JEV and Nipah virus, both of which contribute significantly to morbidity and mortality in affected regions. [3, 7] JEV is endemic in the north and northwest districts of Bangladesh, where seasonal upsurges coincide with increased vector abundance during and after the monsoon. [5] In contrast, Nipah virus outbreaks have occurred almost annually since 2001, predominantly in central and western Bangladesh. Most of them were closely associated with the consumption of raw date palm sap contaminated by fruit bats. [8, 9] These outbreaks were often small in size but associated with high case fatality rates and occasional person-to-person transmission. [9] Other viral pathogens—including herpes simplex virus, enteroviruses, and arboviruses such as dengue—have also been implicated in sporadic encephalitis cases, though large-scale outbreaks attributed to these agents were less commonly reported. [7, 9] The recurrence of JEV and Nipah virus outbreaks showed the importance of integrated surveillance systems capable of early detection, laboratory confirmation, and coordinated public health response to mitigate the outbreak potential of encephalitis in Bangladesh. [3, 5]

Japanese encephalitis remains an important but often under-recognized cause of viral encephalitis in Bangladesh. Previous serological surveys and Acute Encephalitis Surveillance (AES) identified the presence of JEV circulation, particularly in the northern and northwestern districts, including areas surrounding Bogura. [4, 5] Although JE cases are typically sporadic, studies have demonstrated seasonal peaks during and after the monsoon months when vector density increases. [6] The single laboratory-confirmed JE case identified in this investigation was consistent with prior findings that could be interpreted as evidence of the endemic nature of the virus rather than evidence of an acute outbreak. [3] A comprehensive sero-survey needs to be conducted to identify true burden of JE and high-risk districts to provide targeted prevention strategies such as vaccination campaigns. [10, 11]

One notable challenge identified during this investigation was the frequent non-diagnosis or incomplete diagnosis of encephalitis cases in Bangladesh. Despite the endemicity of viruses such as JEV and Nipah virus, laboratory confirmation remains limited due to resource constraints and insufficient diagnostic infrastructure at district and sub-district hospitals. [4] Many health facilities rely only on clinical diagnosis and biochemical and microbiological testing of CSF, which cannot distinguish among viral, bacterial, or non-infectious causes. [7] A study evaluating hospital-based surveillance found that a large proportion of encephalitis cases remained undiagnosed, with only a small proportion tested for IgM or viral PCR. [5] This diagnostic gap contributes to underestimation of the true burden of viral encephalitis and delays targeted public health

interventions. [8] The situation is further complicated by the need for timely specimen collection and transport to national laboratories like IEDCR, which is often logistically challenging in resource-limited settings. [7] Strengthening diagnostic capacity at sentinel hospitals—including introduction of rapid serological assays and molecular testing—combined with standardized case definitions and surveillance protocols, is critical to improve case detection, pathogen confirmation, and outbreak preparedness in Bangladesh. [11] At present JE surveillance is being conducted throughout Bangladesh including all Upazilas with the support of WHO. [12]

Other arboviruses like dengue and chikungunya also become endemic in Bangladesh. Studies in Bangladesh showed that dengue and chikungunya usually peak during monsoon season occasionally presented with severe neurological complications. [13] occasionally clinicians don't perform the test of these virus to an encephalitis patients. This diagnostic gap reflects a broader issue in the national health system, where a lack of multiplex PCR or rapid diagnostic tests hampers the identification of emerging or overlapping arboviral infections. [14, 15] Investing in multiplex diagnostic platforms at sentinel sites would enable better pathogen identification in future encephalitis investigations.

The fatality rate of the encephalitis patients in this investigation was higher than usual. Studies in neighboring countries have shown that timely supportive care and access to diagnostics significantly reduce encephalitis-related mortality. [16, 17] In our setting, lack of early diagnosis, absence of standardized case management protocols, and delayed hospital presentation may contributed to the high mortality. Standardized clinical guidelines for early recognition and empiric treatment of viral encephalitis should be developed and disseminated to frontline clinicians, particularly in tertiary hospitals like SZMCH.

The limitations of the investigation was the location of the investigation. The investigation should be performed at the community level. As encephalitis patients commonly presented to hospitals for treatment so the sensitivity of the cases were higher than other disease outbreaks. However, the cases admitted private clinics and national level tertiary case hospitals were not included in the investigation. Another limitation was the samples were tested only for JE IgM. Other suspected viruses, like the herpes simplex virus, enteroviruses, and Epstein-Barr virus, were not tested. Nasal swabs were collected to test for Nipah virus, which could not be done immediately due to logistic shortage and performed later. Record-keeping at SZMCH was not adequate for the early detection of unusual clusters. Moreover, the hospital-based denominator that estimates incidence may not accurately reflect community-level trends and risks. Despite these limitations, the investigation findings showed the importance of ongoing hospital-based encephalitis surveillance in endemic regions of Bangladesh.

5. Conclusion

This investigation found no evidence of an outbreak of acute viral encephalitis in SZMCH in May 2015, based on admission patterns and lack of clustering. The confirmation of JE interpreted persistent transmission of encephalitogenic viruses in northern Bangladesh. Enhanced surveillance, diagnostic capacity, and inter-hospital communication are recommended to early detection and response to future outbreaks of encephalitis.

Abbreviations

CSF	Cerebrospinal Fluid
IgM	Immunoglobulin M
JE	Japanese Encephalitis
JEV	Japanese Encephalitis Virus
PCR	Polymerase Chain Reaction
SZMCH	Shaheed Ziaur Rahman Medical College Hospital
WHO	World Health Organization

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Author Contributions

Mallick Masum Billah: Lead the Field Investigation, Conceptualization, Methodology, Data Collection, Validation, Formal Analysis, Writing - original draft, Writing - review & editing

Quazi Ahmed Zaki: Investigation Team Member, Data collection, Formal Analysis, review & editing.

Sharmin Sultana: Investigation Team Member, Sample Collection, Laboratory Test, Supervision, Writing - review & editing

Syed Muhammad Baqui Billah: Investigation Team Member, Conceptualization, Supervision, Validation, Writing - review & editing

Mahmudur Rahman: Conceptualization, Resources, Supervision, Validation, Writing - review & editing

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Data Availability Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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