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Characteristics and Outcomes of Japanese Encephalitis in the Northeast State of India: A Retrospective Case Series Study

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Abstract

Background: Japanese Encephalitis (JE) is a serious public health issue in an Asian region, causing high mortality and disability rates across all age groups.

Objectives: The current study aims to examine the clinical characteristics, laboratory findings, treatment patterns, and discharge outcomes of JE-admitted patients at a tertiary care neurology hospital in the Northeast state of India.

Methods: The medical records of diagnosed JE patients were reviewed retrospectively between January 2021 and December 2022. Demographic and clinical characteristics were analyzed. Characteristics of the disease severity were assessed based on the discharge status: routine discharge, Discharge Against Medical Advice (DAMA), and mortality during the hospital stay.

Results: A total of 28 JE patients were included; their average age was 40.7 (±20.2) years, males predominantly (60.7%), and the majority belonged to the lower socioeconomic level (85.6%). The most common clinical symptom was fever with altered sensorium (89.3%), with involved hyperintensities in the thalamus (25.0%). Twenty-six patients required Neurological Intensive Care Unit (Neuro-ICU) management with tracheostomy-assisted ventilation due to neurological deterioration. Symptomatic treatment was prescribed such as prophylactic antibiotics and osmotic diuretics. JE patients' mortality (25.0%) during a hospital stay due to superadded septic shock and elevated intracranial pressure, 21.4% were routine discharge, and 53.6% underwent DAMA.

Conclusion: The prevalent reasons for JE patient mortality were superadded septic shock, increased intracranial pressure, and disease severity. Fever with altered sensorium and thalamus involvement were major findings. Many patients were DAMA because of their low socioeconomic level, which was a barrier to monitoring the progression of the disease.

Keywords: Flavivirus, Prevention and Control, Prognostic Factors

1. Background

Japanese Encephalitis (JE) is among the most common viral encephalitis in South-Asian countries, including India.[1] Globally, JE patients are estimated at 68,000 yearly, with a mortality rate in severe clinical cases of 20-30%, and survivors of severe cases having long-term neurological sequelae of 30-50%.[2] The JE virus transmission is associated with vertebrate hosts, such as pigs and wading birds via Culex species of mosquitoes.[1,3] The north-eastern region of India, particularly in Assam, has consistently reported the highest number of JE patients since 2011 despite initiating JE immunization programs for children and adults.[4-6] Every year during monsoon, i.e., July through October, Assam has repeated JE epidemics of varying severity.[7]

In the prodromal and encephalitic stages of JE, common symptoms include fever, altered consciousness, headache, hyporeflexia, seizures, abnormal brainstem reflex, and flaccid weakness, which can lead to a serious situation.[8] JE also has profound neurological consequences, and the current population shift from children to adults presents a significant challenge for JE treatment and prevention.[9] Further research needs to be done since symptomatic JE patients have a high rate of morbidity and mortality.[10]

As of now, there is no specific treatment available against JE. So, it is essential to understand the proper clinical symptoms and prognosis of JE patients that can help to better intensive supportive care and avoid neurological sequelae.[11] Owing to insufficient studies on possible treatments for JE and concerns about the potential severity of an illness and its ability to spread rapidly in both endemic and non-endemic areas.

This study tries to explore the pattern and specific

contributing factors associated for JE in north-east states of India in the light of their geographical environmental and social differences. By conducting a thorough analysis of clinical management and discharge status of patients with JE, specially in a tertiary care setting, significant advances can be observed in this region. The insights gained are not only invaluable for healthcare practices but also hold great relevance for research and policymaking for the development of more effective strategies and effectively utilising the resources available, ultimately benefiting both individual patients and the broader public health of the region. Furthermore, the study's findings might serve as template for providing management applicability to similar areas confronting analogous challenges.

There is paucity of literature available for the JE in the north-eastern states of India, and owing to the difference in livelihood, the regional population evidences from studies conducted in other parts cannot be implacable here. In order to bridge this gap, the current study provides a detailed and region-specific analysis of JE. This allows a deeper understanding of the unique epidemiological and clinical facets for deploying effective vaccination campaigns and public health interventions.

2. Objectives

The present study aimed to investigate the clinical characteristics, laboratory findings, treatment and discharge patterns of JE patients admitted to a tertiary care hospital.

3. Methods

Retrospective medical records were collected from individuals diagnosed with JE at a tertiary care hospital from January 2021 to December 2022, irrespective of any age or gender restrictions. Records having incomplete information or diagnosed with other forms of neurological co-infections were excluded. Their socio-demographic and clinical information from the medical records were extracted such as age, gender, place of residence, and marital status. Socio-Economic Status (SES) was evaluated using a Modified Kuppuswamy's scale (scale generates a composite score ranging from 3 to 29, derived from the family head's education, occupation, and monthly income).[12] The clinical data includes, symptoms observed upon admission, initial blood routine and biochemical examinations, Cerebrospinal Fluid (CSF) analysis, findings from Magnetic Resonance Imaging (MRI) scans of the brain, as well as treatment modalities.

Furthermore, we also recorded the length of hospitalization, for the Neurological Intensive Care Unit (Neuro-ICU) and the general ward. The Glasgow Coma Scale (GCS) scores of each patient were noted upon admission. This scoring system evaluates three key parameters: best eye response (E), best verbal response (V), and best motor response (M). Scores range from three (indicating the most severe impairment) to 15 (indicating normal neurological function).[13] Patients were classified into three groups based on their discharge status: 1) Routine discharge, 2) Discharge Against Medical Advice (DAMA), and 3) Mortality during their hospital stay.

As this study involved a retrospective chart review, obtaining informed consent from the patients was not acquired. The institutional ethics committee granted a waiver for informed consent. To preserve the subjects' privacy, all data extracted from medical records was de-identified before analysis.

3.1. Statistical Analysis

All data were manually entered and summarized in Microsoft Excel. Categorical data were expressed in frequency and percentage, while continuous data were summarized using mean and their Standard Deviation (SD) or median and their interquartile range (IQR). To identify statistical differences between groups, we applied analysis of variance (ANOVA) for continuous variables and chi-square test for categorical variables. The listwise deletion approach was employed to handle any missing data encountered during the analysis. All calculations were conducted using a p-value level of ≤ 0.05 as the statistical significance threshold. The statistical software IBM SPSS version 29.0 was used for data analysis.

4. Results

The study included 28 patients who had laboratory-confirmed JE. The average age of all patients was 40.7 (±20.2) years, with males (60.7%) outnumbering females. A considerable majority of patients (53.6%) lived in rural areas and were married (71.42%). Moreover, the majority of these patients belonged to the upper lower (53.6%), and lower (25%) socio-economic classes. According to the discharge status, the majority (53.6%) were DAMA, while 25% died during their hospital stay and 21.4% were routine discharge (Table 1).

Patients admitted to the hospital had various symptoms, including fever (89.3%), altered sensorium (50%), cough/ chills and vomiting (21.4%), abnormal body movements (17.8%), headache (14.3%), loss of consciousness (10.7%), neck rigidity and seizure (7.1%), and decreased appetite (3.7%). On admission, the median time for the onset of symptoms were three days (IQR, 1-10). Confusion, stupor, and coma were the predominant manifestations of altered mental status in three patients, and two patients had lower extremity weaknesses that progressed to the upper and lower extremities. Four patients presented with upper motor neuron disorder symptoms, such as an extensor plantar reaction. The median GCS score at the admission of all patients were nine (IQR, 2-15). Patients with DAMA and mortality during hospital stay had a median GCS score of eight (IQR, 2-12), and seven (IQR, 3-12) respectively. The median length of hospital

Table 1. Characteristics of Japanese Encephalitis Patients

Characteristics	Total (n = 28)	DAMA (n = 15)	Routine (n = 6)	Mortality (n = 7)	*P*-value
Age in years, mean ± SD	40.7±20.2	45.5±17.3	27.8±20.7	41.6±26.6	0.195
Gender (%)					0.127
Male	17 (60.7)	11 (73.3)	4 (66.6)	2 (28.6)	
Female	11 (39.3)	4 (26.6)	2 (33.3)	5 (71.4)	
Place of residence (%)					0.692
Rural	15 (53.6)	8 (53.3)	4 (66.6)	3 (42.8)	
Urban	13 (46.4)	7 (46.6)	2 (33.3)	4 (57.2)	
Marital status (%)					
Single	8 (28.6)	4 (26.6)	3 (50.0)	1 (14.3)	0.354
Married	20 (71.4)	11 (73.3)	3 (50.0)	6 (85.7)	
Socioeconomic class (%)					0.120
Upper	3 (10.7)	2 (13.3)	0 (0)	1 (14.3)	
Upper middle	1 (3.6)	0 (0)	1 (16.7)	0 (0)	
Lower middle	2 (7.2)	0 (0)	1 (16.7)	1 (14.3)	
Upper lower	15 (53.6)	8 (53.3)	4 (66.6)	3 (42.8)	
Lower	7 (25.0)	5 (33.3)	0 (0)	2 (28.5)	
Symptoms (%)					
Fever	25 (89.3)	15 (100)	5 (83.3)	5 (71.4)	0.113
Headache	4 (14.3)	3 (20.0)	1 (16.6)	0 (0)	0.451
Vomiting	6 (21.4)	4 (26.6)	1 (16.6)	1 (14.2)	0.764
Cough/chills	6 (21.4)	5 (33.3)	1 (16.6)	0 (0)	0.197
Decreased appetite	1 (3.57)	0 (0)	1 (16.6)	0 (0)	0.149
Neck rigidity	2 (7.1)	1 (6.6)	1 (16.6)	0 (0)	0.506
Altered sensorium	14 (50)	7 (46.6)	2 (33.3)	5 (71.4)	0.364
Abnormal body movements	5 (17.8)	3 (20.)	1 (16.6)	1 (14.2)	0.945
Seizure	2 (7.1)	0 (0)	1 (16.6)	1 (14.2)	0.285
Loss of consciousness	3 (10.7)	2(13.3)	0 (0)	1 (14.2)	0.631
Neurological sequelae	1 (3.6)	1 (6.6)	0 (0)	0 (0)	0.149
GCS score at admission (IQR)	9 (2-15)	8 (2-12)	10 (9-15)	7 (3-12)	0.158
Length of stay, days (IQR)					
Length of stay in neuro ICU	3.5 (0-27)	3 (1-18)	4.5 (0-11)	6 (2-27)	0.131
Total length of stay in hospital	4 (1-27)	3 (1-18)	5.5 (3-11)	6 (2-27)	0.414

*Significant at *P*<0.05 level.
DAMA: Discharge against medical advice; GCS: Glasgow coma scale; IQR: Interquartile range; Neuro ICU: Neurological intensive care unit; SD: Standard deviation

stay was four days (IQR, 1-27). No statistically significant differences were observed between the characteristics and outcome groups (Table 1). In the medical records, there was no information about the patients with JE's vaccination history.

The majority of patients had leucocytosis, neutrophilia, and lymphocytosis, but there were no significant differences in the levels between the outcome groups. However, compared to the routinely discharge and DAMA, the median haemoglobin level in the mortality group was much lower at 9.1 gm/dl (IQR, 8.2-11). Haemoglobin levels and outcome groups were statistically significantly correlated (*P*<0.002). All outcome groups had higher levels of total proteins, Serum Glutamic-Oxaloacetic Transaminase (SGOT), Serum Glutamate Pyruvate Transaminase (SGPT), and sodium. Albumin level was significantly lower in the mortality group (*P*<0.03), while the SGOT level was significantly higher in the routinely discharge group (*P*<0.041). The mortality group showed higher CSF protein levels, but the difference was not statistically significant. According to the results of the MRI scans, hyperintensities were involved in the thalamus (25%), temporal lobe (21.4%), midbrain (10.7%), basal ganglia (7.2%), meningeal enhancement and the lentiform nucleus in 3.6% of patients. There were no statistically significant differences between MRI brain findings and the outcome groups (Table 2).

Twenty-six JE patients in the Neuro-ICU received tracheal intubation/tracheostomy-assisted ventilation. All JE patients received both prophylactic symptomatic and supportive care. A total of 17 different antibiotics were prescribed of which Ceftriaxone (82.1%) was the most frequently prescribed antibiotic. Antiviral (Acyclovir) was prescribed to 25% of the patients. Sodium valproate was the most often administered anticonvulsant (42.9%), followed by Levetiracetam (35.7%), Phenytoin (7.2%), and Lacosamide (3.5%) (based on seizure types) (Table 3).

Proton pump inhibitors (Pantoprazole, 82.7%), Histamine -2 blocker (Ranitidine, 25.0%), and antiemetics (Ondansetron, 39.3%) were given to patients. Paracetamol was the most commonly used Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) (67.9%) and Aspirin was prescribed to one patient. Dexamethasone was prescribed to 46.4% of patients, whereas Budesonide nebulizers were administered to 14.3%. Mannitol was the most commonly administered osmotic diuretic (21.4%) and Amlodipine was the most often prescribed antihypertensive drug (21.4%), followed by Telmisartan, Labetalol, and Cilnidipine. Diphenhydramine -HCl was administered to 10.7% patients and 21.4% patients were given a hepatoprotective (Ursodeoxycholic Acid). One patient was given a first-generation (typical) antipsychotic medicine, such as Haloperidol, and two patients were given a benzodiazepine, such as Midazolam, as an anti-anxiety medication. Nutritional supplements were prescribed to 53.2% of patients (Table 3).

Table 2. Laboratory Parameters of Japanese Encephalitis Patients

Parameters	Total (n = 28)	DAMA (n = 15)	Routine (n = 6)	Mortality (n = 7)	*P-value*
Blood routine examination, median (IQR)					
Total count (cells/cmm)	14000 (4400-63900)	13500 (7900-63900)	14465 (10420-31680)	14430 (4400-20900)	0.715
Neutrophils (%)	82.5 (60-95)	81.5 (61-91)	83(60-91)	85(68-95)	0.688
Lymphocytes (%)	10.5 (3-34)	9 (1-34)	12(6-30)	11(3-17)	0.571
Eosinophils (%)	1 (0-7)	1 (1-7)	1(1-3)	1(0-3)	0.707
Monocytes (%)	6.5 (0-15)	6.5 (0-11)	7(1-9)	2(0-15)	0.864
Haemoglobin (g/dl)	11 (7.6-13.8)	12.2 (10.3-13.8)	11.1 (7.6-12.9)	9.1 (8.2-11)	0.002*
Platelet count (lac/cmm)	1.5 (0.8-2.5)	1.5 (0.85-2.23)	1.8 (1.6-2.56)	1.5 (1.27-1.68)	0.166
Blood biochemical examination, median (IQR)					
Total protein (gm/dl)	7.3 (4.8-8.3)	7.3 (5.2-8.3)	7.5 (7.4-7.8)	6.5 (4.8-7.2)	0.057
Albumin (gm/dl)	3.2 (1.7-3.7)	3.2 (2-3.7)	3.3 (3-3.5)	2.75 (1.7-3.2)	0.030*
Alkaline phosphate (IU/L)	66 (46-168)	68 (46-100)	62 (51-126)	60 (25-168)	0.886
SGOT (IU/L)	50.5 (19-138)	71 (28-138)	45.5 (19-86)	38 (30-53)	0.041*
SGPT (IU/L)	46 (15-304)	46 (21-304)	63.5 (21-135)	24.5 (15-46)	0.275
Urea (mg/dl)	34 (16-87)	33 (20-84)	38 (16-87)	35 (27-58)	0.748
Creatinine (mg/dl)	1.1 (0.6-2.3)	1.3 (0.7-1.9)	1.15 (0.6-2.3)	0.85 (0.60-1.90)	0.498
Na^+ (mmol/L)	141.5 (126-180)	143 (126-180)	139.5 (132-147)	142.5 (135-171)	0.469
K^+(mmol/L)	3.7 (3-4.4)	3.7 (3-4.4)	3.85 (3.5-4.1)	4.05 (2.9-5.8)	0.239
Ca^{+2} (mg/dl)	8 (6-8.9)	8 (6-8.9)	8.2 (8.1-8.5)	7.7 (7.3-7.9)	0.538
Mg^{+2} (mg/dl)	2.3 (1.7-3.4)	2.5 (1.7-2.8)	2.3 (2-3.4)	2.2 (1.9-2.3)	0.520
TSH (mIU/L)	0.55 (0.09-4.76)	0.51 (0.09-3.5)	1.57(1.1-2.0)	2.53 (0.3-4.7)	0.419
CSF analysis, median (IQR)					
CSF WBC (cells/cmm)	70 (5-250)	70 (10-210)	91 (30-200)	55 (5-250)	0.220
CSF protein (mg/dL)	97.05 (45.2-359.6)	99.1 (73.4-359.6)	56 (45.2-70)	190 (81-295.5)	0.400
CSF sugar (mg/dl)	78.5 (53-178)	78 (53-178)	73.5 (54-114)	87 (71-110)	0.457
MRI brain findings (%)					
Thalamus	7 (25.0)	4 (26.6)	3 (50.0)	1 (14.3)	0.354
Midbrain	3 (10.7)	2 (13.3)	1 (16.6)	1 (14.3)	0.981
Basal ganglia	2 (7.2)	1 (6.6)	1 (16.6)	0 (0)	0.149
Temporal lobe	6 (21.4)	3 (20.0)	2 (33.3)	1 (14.3)	0.692
Meningeal enhancement	1 (3.6)	1 (6.6)	0 (0)	0 (0)	0.638
Lentiform nucleus	1 (3.6)	1 (6.6)	0 (0)	0 (0)	0.149

*Significant at $P<0.05$ level.

Ca^{+2}: Calcium; cells/cmm: cells per cubic millimetre; CSF: Cerebrospinal fluid; DAMA: Discharged against medical advice; g/dl: gram per decilitre; IQR: Interquartile range; IU/L: International units per litre K^+: Potassium; Lac/cmm: lakh/cubic millimetre; mg/dl: milligram per decilitre; mmol/L: millimoles per litre; mIU/L: milli-international units per litre; MRI: Magnetic resonance imaging; Mg^{+2}: Magnesium; Na^+: Sodium; SD: Standard deviation; SGOT: Serum glutamic-oxaloacetic transaminase; SGPT: Serum glutamic pyruvic transaminase; TSH: Thyroid stimulating hormone; WBC: White blood cells

5. Discussion

JE poses a significant public health concern, particularly in low-income nations including India.[4] JE patient's morbidity and mortality depend on various factors, including disease severity at presentation, in-hospital care quality (facilities and clinicians' skills), length of stay, and socioeconomic and demographic status of the patients.[10]

Gender preponderance is observed in JE infection as males are more exposed to the vector than females.[14] The current study depicted a similar pattern of gender distribution. However, the results were contradicted in studies primarily conducted in underprivileged regions of Bengal and Jharkhand. Within these areas, women have to spend more time in agricultural lands and fields rendering them more susceptible to vector bites.[15, 16] Previous studies showed that the JE burden was most pronounced, approximately 60% within the age group under 20-25 years.[17,18] Current studies showed a shift in peak prevalence toward the adult and geriatric populations. This divergence may have implications for vaccination programs at the community level in these regions.

Rural areas experienced a significant infection burden due to their proximity to irrigated rice fields and pig-rearing sites, which offer an ideal breeding environment for the vector responsible for JE transmission.[19] Prior studies had emphasized the cross-regional transmission from rural to urban areas, as the epicentre still remains in rural regions.[17,20] Our study's findings align with previously published data, emphasized that the majority of JE patients were rural residents, with some cases in urban areas close to rural environments. This information is crucial in the formulation of block-level policies for

Table 3. Medications Prescribed of Japanese Encephalitis Patients

Prescribed Medications		n = 28 (%)
Antibiotics	Ceftriaxone	23 (82.1)
	Meropenem	6 (21.4)
	Linezolid	6 (21.4)
	Ampicillin	5 (17.8)
	Vancomycin	3 (10.7)
	Piperacillin + tazobactam	3 (10.7)
	Rifaximin	2 (7.2)
	Piperacillin	2 (7.2)
	Colistin	1 (3.5)
	Cefpodoxmine proxetil	1 (3.5)
	Sulfamethoxazole + Trimethoprim	1 (3.5)
	Nitrofurantoin	1 (3.5)
	Cefuroxime	1 (3.5)
	Ornidazole	1 (3.5)
	Azithromycin	1 (3.5)
	Ofloxacin	1 (3.5)
Antiviral	Acyclovir	7 (25)
Anticonvulsants	Sodium valproate	12 (42.9)
	Levetiracetam	10 (35.7)
	Phenytoin	2 (7.2)
	Lacosamide	1 (3.5)
PPIs	Pantoprazole	24 (85.7)
Histamine 2 blocker	Ranitidine	7 (25.0)
Anti-emetics	Ondansetron	11 (39.3)
NSAIDs	Paracetamol	19 (67.9)
	Aspirin	1 (3.5)
Osmotic laxative	Lactulose	4 (14.3)
Corticosteroids	Dexamethasone	13 (46.4)
	Budesonide	4 (14.3)
Diuretics	Mannitol	6 (21.4)
	Furosemide	4 (14.3)
Antihypertensives	Amlodipine	6 (21.4)
	Telmisartan	3 (10.7)
	Labetalol	1 (3.5)
	Cilnidipine	1 (3.5)
Anti-platelets	Clopidogrel	1 (3.5)
Hepatoprotective	Ursodeoxycholic acid	6 (21.4)
Antihyperlipidemic	Atorvastatin	1 (3.5)
Haematinics	Ferrous ascorbate	1 (3.5)
Bronchodilators	Levosalbutamol	4 (14.2)
	Orciprenaline	2 (7.2)
Mucolytics	Diphenhydramine HCl	3 (10.7)
Sedatives	Phenobarbitone	1 (3.5)
Antipsychotics	Haloperidol	1 (3.5)
Anti-anxiety	Midazolam	2 (7.2)
Nutritional supplements	Multivitamins	5 (17.8)
	Thiamine	3 (10.7)
	Potassium Chloride	3 (10.7)
	Calcium + Vitamin D3	1 (3.5)
	Taurine + Acetylcysteine	1 (3.5)
	Pyridoxine	1 (3.5)
	L-carnitine +Tocopherol	1 (3.5)

HCl: Hydrochloric acid; NSAIDs: Non-steroidal anti-inflammatory drugs; PPIs: Proton pump inhibitors

mapping JE vectors in urban areas, aiming to devise effective preventive measures and curb the spread of the disease.

Socioeconomic status remains a critical parameter in the evaluation of tropical infections. Earlier studies indicated that a significant proportion of JE patients belonged to the low-income group.[20] The current study's results demonstrated no deviation from this trend, revealing that a substantial number of patients in the low-income category opted for DAMA due to an inability to bear the financial burden of hospitalization. However, studies published in other regions revealed that DAMA was not observed among low socioeconomic status patients.[15] In addition, the lower mortality rate might be the reason behind this discrepancy which may also be attributed to demographic variabilities within the East Indian population.

The clinical manifestations of JE are characterized by fever, altered sensorium, and other co-morbidities like gastrointestinal disturbances.[21] Our study revealed that high fever was a prominent morbidity in approximately 90% of the cases. Clinically, patients with JE infection exhibit elevated levels of proteins, serum SGOT, SGPT, and sodium.[14, 22] Our study demonstrated distinct variability among the three groups under investigation. Specifically, the albumin levels were significantly lower in the mortality group, while the SGOT levels were notably higher in the routinely discharge group. Paediatric and adult mortality for patients with JE following hospital discharge was 21.4%, which is notably higher than in Nepal and China (6-8%). However, this difference might be attributed to a shorter study duration (6-12 months) in current study compared to earlier studies with study periods which ranged from five to 20 years.[23,24]

Leucocytosis, neutrophilia, and lymphocytosis was prevalent among the majority of JE patients.[25,26] Our

results align with prior studies, indicate the inherent characteristics of this disease . A striking finding in our study was the significant correlation between haemoglobin levels and outcomes, which has not extensively been reported in the existing literature.[27,28] This observation has clinical significance, suggesting haemoglobin as a potential prognostic indicator for these conditions.

In our investigation, CSF abnormalities were observed in all patients with elevated WBCs, sugar, and protein levels. The mortality group showed increased CSF protein levels, but the difference was not statistically significant. A published case series reported a correlation between CSF protein levels and clinical neurological symptoms, suggesting that abnormalities in intrathecal protein synthesis or blood-brain barrier properties might contribute to a poor outcome.[14,15,29]

The present study revealed that MRI brain findings showed abnormalities in 71.5% of patients and the major involvement regions were thalamus. Previous research showed that neuroimaging with NCCT brain scans revealed abnormalities in 30% to 35% of patients, while MRI brain scans identified abnormalities in over 90% of cases. Inpatient fatality rates ranged from 20% to 30%, and survivors often experienced long-term sequelae.[15,30-32] A systemic review reported that thalamic lesions were the most common MRI abnormality in JE (74%), although this result may be skewed as it included dengue patients.[33] Our study indicated a median length of stay in hospital of four days (IQR, 1-27) and a case fatality rate of 28%, with a median GCS score of seven (IQR, 3-12). These findings align with prior studies reported an average hospital stay of 9.6 (± 4.7) days.[15] In contrast, previous studies found a longer average length of stay (16 days), and reported a lower-case fatality rate of 8.8% with a mean recovery period of 7 days. [21,34]

It is believed that there is no specific treatment for JE.[10] In our study, most patients underwent tracheal intubation or tracheostomy-assisted ventilation supportive care, which played a crucial role in reducing mortality risks. Findings also indicated that personalized nutritional supplements contributed to better outcomes.[10]

While the present study has yielded valuable insights, it is essential to acknowledge its limitations. The research was confined to a single centre, reducing its generalizability towards a broader population. Also, the retrospective study design posed challenges in acquiring crucial data, such as vaccination history, neuroimaging findings, and patient follow-ups. Furthermore, the inherent limitations of a case series study make it difficult establishing causality or a clear disease-outcome connection. To address these constraints, a larger multicentre study with a prospective design is suggested. Despite these limitations, the study successfully identified a significant number of JE patients in the adult and elderly population. Its strength lies in furnishing comprehensive data on the characteristics and outcomes of this specific demographic, offering a foundation for future research hypotheses.

6. Conclusion

This study concluded that the most common reason for patient mortality is due to superadded sepsis, septic shock, and elevated intracranial pressure. Additionally, patients with a low GCS on admission and neurological decline were found to have poor prognoses and fatal outcomes. Fever with altered sensorium and thalamus involvement were also significant findings in this study. The high rate of patients with DAMA due to poor economic status is concerning and underscores the need for better communication as well as education for patients and their families regarding the severity of the JE disease and the importance of completing treatment.

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Author Contributions

KU conceptualized the study. MN, RK and KU formulated the methodology. RK and MN had done data collection. MN, RK and KU extracted and analysed the data. RK and MN drafted the manuscript. RK and KU critically evaluated and revised the manuscript. All authors read and approved the manuscript.

Research Highlights

What Is Already Known?

Prior studies have established that JE caused by the Japanese Encephalitis Virus (JEV) is primarily transmitted through the Culex mosquito vector. The virus primarily affects the brain, leading to symptoms such as fever, headache, altered mental status, seizures, and sometimes death. Vaccination campaigns have been implemented in various parts of India to control the spread of the disease. Additionally, there have been reports of variations in disease presentation and outcomes across different geographical regions.

What Does This Study Add?

This study aims to fill a gap in the existing literature by providing a detailed analysis of the characteristics and outcomes of Japanese encephalitis specifically in the Northeastern state of India. By focusing on this region, the study will shed light on the unique epidemiological and clinical aspects of JE in a geographically distinct area. Additionally, this study will contribute to a better understanding of the effectiveness of vaccination efforts and public health interventions in reducing the burden of JE in the Northeastern state.

Conflict of Interest Disclosures

All authors declared that they have no conflict of interest.

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