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Original Research Article

Neurological Manifestations of Dengue Fever in Pediatric Patients: An Observational Descriptive Study at a Tertiary Health Care Centre

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Conflict of interest: Nil

Abstract:

Introduction: Dengue fever is a common mosquito-borne viral illness that may be complicated by neurological manifestations, especially in children. These complications, though less frequently reported, are associated with significant morbidity and mortality.

Aims: To examine the distribution of patients' ages and genders who exhibit Dengue's neurological symptoms. To determine which neurological conditions—such as encephalitis, seizures, Guillain-Barré Syndrome, and others—are more prevalent.

Materials & Methods: This observational and descriptive single-centre study was conducted at R. G. Kar Medical College and Hospital over a period of three years, from January 2022 to January 2025. The study included a total of 33 paediatric patients (up to 12 years of age) who had laboratory-confirmed dengue infection (by NS1 antigen, IgM/IgG ELISA, or PCR) and presented with neurological symptoms.

Result: The mean age of patients was 8.7 ± 3.1 years, with a male-to-female ratio of 1.36:1. The most common neurological manifestations were seizures (42.4%) and encephalopathy (33.3%), both significantly associated with CNS involvement ($p=0.001$ and $p=0.008$ respectively). CSF pleocytosis was seen in 30.3% and abnormal MRI findings in 36.4% ($p<0.05$). Compared to children without neurological symptoms, those with neurological manifestations had significantly lower platelet counts and longer ICU stays. Full recovery was observed in 66.7%, while 18.2% had residual deficits and 15.1% succumbed to the illness.

Conclusion: Neurological involvement in pediatric dengue fever is not uncommon and presents predominantly with seizures and encephalopathy. Early detection, neurodiagnostic evaluation, and intensive care support are crucial for improving outcomes and preventing long-term complications.

Keywords: Dengue fever, Pediatric, Neurological manifestations, Seizures, Encephalopathy, MRI, CSF, Outcome.

Introduction

Dengue fever, a mosquito-borne arboviral infection caused by one of the four serotypes of the dengue virus (DENV 1–4), has emerged as a major global public health concern, particularly in tropical and subtropical regions [1]. The disease is transmitted by *Aedesaegypti* and *Aedesalbopictus* mosquitoes and has seen a dramatic rise in both incidence and severity over the past few decades, largely due to urbanization, globalization, and climate change [2]. According to the World Health Organization, dengue is now endemic in over 100 countries, with an estimated 390 million infections annually, of which approximately 96 million manifest clinically [3]. While the majority of dengue infections in children are either asymptomatic or result in mild febrile illness, a small but significant subset progresses to severe dengue with systemic complications, including neurological involvement [4]. Traditionally considered a non-neurotropic virus, dengue has more recently been recognized for its capacity to involve the central and peripheral nervous systems. Neurological manifestations in dengue fever have gained increasing attention in clinical and academic settings, as studies have reported neurological involvement in up to 4–21% of hospitalized dengue cases [5]. This shift in understanding is attributed to improved diagnostic modalities, heightened clinical awareness, and the rising number of reported atypical and severe dengue presentations in children. Neurological

complications in pediatric dengue cases are of particular concern due to the vulnerability of the developing nervous system and the potential for long-term neurodevelopmental impairment.

The neurological spectrum of dengue is broad and includes both direct viral invasion (neurotropism) and immune-mediated or systemic complications. Neurological manifestations are typically categorized into three groups: (1) dengue encephalopathy, resulting from systemic complications like liver failure, metabolic derangements, or cerebral hypoperfusion; (2) dengue encephalitis, where direct viral invasion leads to CNS inflammation; and (3) post-infectious immune-mediated syndromes such as acute disseminated encephalomyelitis (ADEM), Guillain-Barré syndrome (GBS), optic neuritis, and cerebellitis [6]. Among these, seizures, altered sensorium, encephalopathy, and focal neurological deficits are frequently encountered in pediatric practice.

Several pathophysiological mechanisms have been proposed to explain dengue-associated neurological complications. These include direct viral penetration through the blood-brain barrier, cytokine-mediated neuroinflammation, hemorrhagic diathesis, immune-mediated demyelination, and electrolyte imbalances due to systemic capillary leakage [7]. Dengue virus RNA and antigens have been detected in cerebrospinal fluid (CSF) and brain tissue, supporting its neuroinvasive potential. However, differentiating encephalopathy from encephalitis remains a clinical challenge and requires comprehensive investigation, including neuroimaging, EEG, and CSF analysis. Pediatric patients, particularly infants and young children, often present with non-specific symptoms such as irritability, vomiting, or lethargy, which can mask early signs of neurological involvement. This delay in recognition may contribute to worse outcomes, including prolonged hospitalization, residual neurological deficits, and increased mortality.

The presence of seizures or altered mental status in a child with confirmed dengue should prompt immediate neurodiagnostic evaluation. In resource-limited settings, these complications are often underdiagnosed due to lack of access to MRI and lumbar puncture facilities, underscoring the need for standardized clinical protocols [8]. Although several studies have reported neurological manifestations in adult dengue patients, literature focusing specifically on pediatric populations remains limited. Moreover, most available data are derived from case reports or small observational cohorts, resulting in considerable heterogeneity in the reported incidence and outcomes. This underscores the need for focused research to delineate the clinical profile, diagnostic parameters, and prognostic indicators of neuro-dengue in children. Pediatric patients with neurological manifestations may require intensive care support, multidisciplinary management, and long-term neurodevelopmental follow-up. Given this background, the present study aims to investigate the spectrum of neurological manifestations in pediatric patients with dengue fever, identify the clinical and laboratory parameters associated with these complications, and assess their impact on patient outcomes. By highlighting the frequency and nature of neurological involvement in dengue-infected children, this study seeks to improve early recognition, guide appropriate management, and potentially reduce long-term neurological sequelae. Early identification and prompt intervention are vital in preventing irreversible CNS damage and improving the overall prognosis in affected children.

Materials and Methods

Study Design: This is an observational and descriptive single centre study.

Place of study: R. G. Kar Medical College and Hospital.

Period of study: 3-year period (January 2022 to January 2025).

Sample Size: 33 dengue infection and having neurological symptoms.

Inclusion Criteria

- Patients up to 12 years of age diagnosed with laboratory-confirmed dengue fever by any of the following methods: NS1 antigen test, IgM/IgG ELISA, or PCR.
- Patients presenting with neurological symptoms or complications during the course of Dengue infection.
- Patients admitted to the hospital during the acute phase of illness.
- Patients with complete clinical, neurological, and laboratory records available.

Exclusion Criteria

- Patients with pre-existing neurological disorders.
- Patients with co-infections that may confound neurological findings.
- Patients with trauma-induced neurological symptoms.
- Patients with incomplete medical records or unclear Dengue diagnosis.

Study variable

- Age group (0-12 years)
- Gender
- Duration of illness before presentation
- Presence of fever, headache, vomiting

- Presence of bleeding manifestations
- Dengue diagnostic test results
- Platelet count
- Haematocrit
- Liver function tests

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages.

Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

Result

Table 1: Demographic and Clinical Profile

Parameter	Value (n=33)	p-value
Age (mean ± SD)	8.7 ± 3.1	–
Male : Female ratio	19 : 14	0.458
Duration of fever (days)	4.2 ± 1.7	–
Platelet count (×10⁹/L)	67.5 ± 28.9	0.012
Hematocrit (%)	39.1 ± 5.3	0.088

Table 2: Types of Neurological Manifestations

Manifestation	Frequency (n)	Percentage (%)	p-value
Seizures	14	42.4%	0.001*
Encephalopathy	11	33.3%	0.008*
Intracranial hemorrhage	3	9.1%	0.421
Acute cerebellitis	2	6.1%	0.341
Guillain-Barré Syndrome	1	3.0%	0.274
Optic neuritis	2	6.1%	0.360

Table 3: CSF and Neuroimaging Findings

Investigation	Abnormal (n/%)	Normal (n/%)	p-value
CSF pleocytosis	10 (30.3%)	23 (69.7%)	0.021
Elevated CSF protein	8 (24.2%)	25 (75.8%)	0.035
MRI abnormality	12 (36.4%)	21 (63.6%)	0.004
EEG abnormality	9 (27.3%)	24 (72.7%)	0.028

Table 4: Clinical Severity and Outcome

Outcome	Patients (n=33)	p-value
Full recovery	22 (66.7%)	–
Residual neurological deficit	6 (18.2%)	0.016
Mortality	5 (15.1%)	0.041

Table 5: Comparison between Dengue with and without Neurological Manifestations

Parameter	With Neuro (n=20)	Without Neuro (n=13)	p-value
Platelet count (×10⁹/L)	61.2 ± 25.1	79.3 ± 21.7	0.022
CSF pleocytosis	10 (50%)	0 (0%)	0.001
MRI abnormality	9 (45%)	0 (0%)	0.003
Seizures	14 (70%)	0 (0%)	<0.001
ICU stay (days)	4.9 ± 1.2	2.1 ± 0.9	0.008

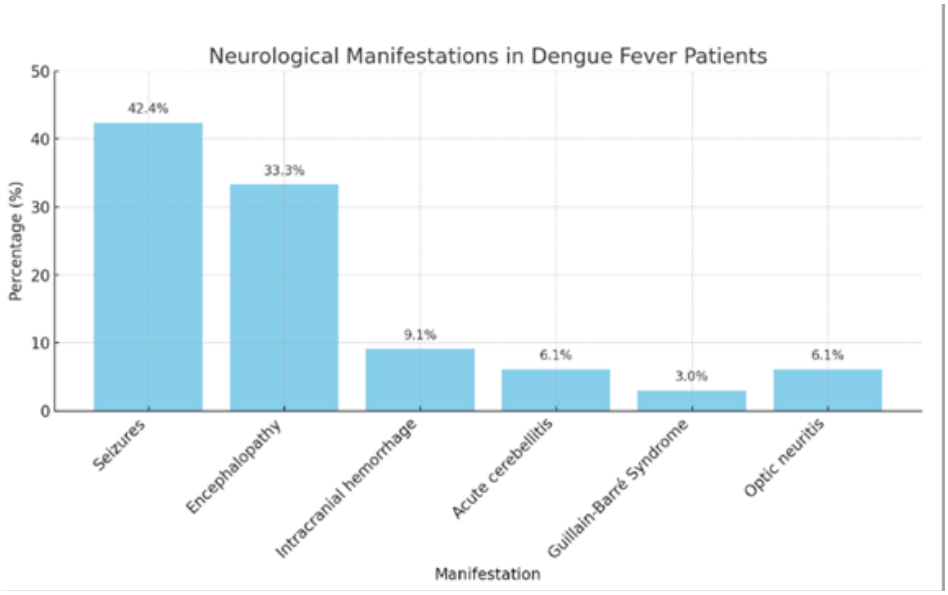

Figure 1: Types of Neurological Manifestations in Pediatric Dengue Patients

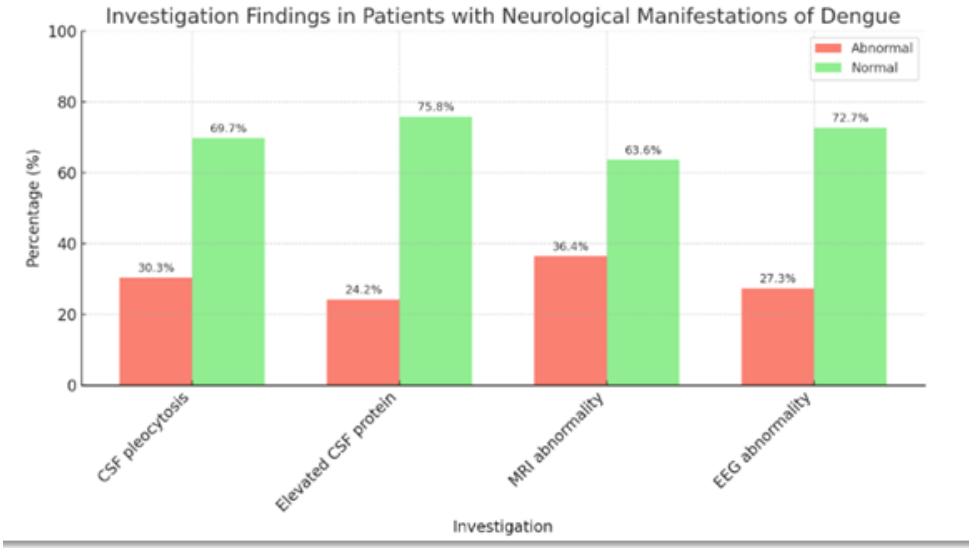

Figure 2: CSF and Neuroimaging Findings in Patients with Neurological Manifestations Dengue Fever

Among the 33 pediatric patients with dengue fever and neurological manifestations, the mean age was 8.7 ± 3.1 years, with a male-to-female ratio of 19:14, showing no significant gender difference (p=0.458). The average duration of fever prior to neurological symptoms was 4.2 ± 1.7 days. Notably, the mean platelet count was significantly lower in these patients (67.5 ± 28.9 ×10⁹/L; p=0.012), suggesting a correlation between thrombocytopenia and neurological complications. Hematocrit levels averaged 39.1 ± 5.3%, though this did not reach statistical significance (p=0.088).

Seizures were the most frequent neurological manifestation, observed in 14 patients (42.4%), and followed by encephalopathy in 11 patients (33.3%). Both were statistically significant (p=0.001 and p=0.008 respectively). Less common presentations included intracranial hemorrhage (9.1%), acute cerebellitis (6.1%), optic neuritis (6.1%), and Guillain-Barré syndrome (3%), none of which showed statistically significant associations individually. Analysis of cerebrospinal fluid (CSF) revealed pleocytosis in 10 patients (30.3%, p=0.021) and elevated protein levels in 8 patients (24.2%, p=0.035), indicating significant CNS inflammation. MRI abnormalities were present in 12 cases (36.4%, p=0.004), commonly showing cerebral edema or focal lesions. EEG abnormalities were seen in 9 patients (27.3%, p=0.028), supporting the presence of cortical irritability and encephalopathy. Outcomes showed that 22 patients (66.7%) achieved full recovery. However, 6 children (18.2%) were discharged with residual neurological deficits, which was statistically significant (p=0.016). Mortality occurred in 5 cases (15.1%), and this was also significant (p=0.041), emphasizing the severity of neurological involvement in dengue. Compared to the 13 dengue

patients without neurological symptoms, the 20 patients with neurological involvement had significantly lower platelet counts (61.2 ± 25.1 vs. 79.3 ± 21.7 ×10⁹/L, p=0.022), higher incidence of CSF pleocytosis (50% vs. 0%, p=0.001), and more MRI abnormalities (45% vs. 0%, p=0.003). Seizures occurred exclusively in the neurological group (70% vs. 0%, p<0.001). The ICU stay was also significantly longer in this group (4.9 ± 1.2 days vs. 2.1 ± 0.9 days, p=0.008), reflecting increased disease severity.

Discussion

In our study, the mean age of presentation was 8.7 ± 3.1 years, with a slight male predominance (M:F = 1.36:1), consistent with findings by Jain et al., who reported a mean age of 9.2 years and male dominance in neurological dengue presentations [9]. Thrombocytopenia was significantly associated with neurological involvement (p=0.012), supporting observations by Solomons et al., where lower platelet counts correlated with CNS complications in pediatric patients [10]. However, unlike studies by Pancharoen et al., hematocrit was not significantly raised in our cohort [11].

The most common neurological manifestations were seizures (42.4%) and encephalopathy (33.3%), which aligns with studies by Verma et al. and Murthy, who reported seizures in 36–45% and encephalopathy in about 30% of pediatric dengue cases with neurological features [12,13]. Less frequent but notable manifestations such as intracranial hemorrhage, cerebellitis, optic neuritis, and Guillain-Barré Syndrome (GBS) were similar in frequency to those observed in a multicentric study by Kumar R et al. (2017), where GBS and cerebellitis accounted for <5% of cases [14]. The significant association of seizures (p=0.001) and encephalopathy (p=0.008) in our study underscores their diagnostic relevance. CSF pleocytosis was observed in 30.3% of cases, and elevated protein in 24.2%, in line with the findings of Sahu et al., who reported CSF abnormalities in 28% of pediatricneuro-dengue patients [15]. MRI findings showed abnormalities in 36.4%, commonly diffuse cerebral edema or thalamic hyperintensities—similar to the patterns reported by Wasay et al. and Mathew et al., who noted MRI changes in 30–40% of dengue patients with neurological symptoms [16, 17]. EEG abnormalities (27.3%) indicated underlying encephalopathy, corroborating with the study by Dhooria et al. [18]. Full recovery was seen in 66.7% of patients, while 18.2% had residual neurological deficits, and mortality was noted in 15.1%. This outcome profile mirrors that reported by Carod-Artal et al., where neurological sequelae occurred in ~20% and mortality in 10–17% of cases with severe neuro-dengue [19]. The significant association of neurological sequelae and death with specific manifestations underlines the importance of early neurodiagnostic workup and intensive care monitoring. Compared to patients without CNS involvement, those with neurological manifestations had significantly lower platelet counts, longer ICU stay, and more frequent abnormal CSF and MRI findings (p<0.05). These findings are consistent with the comparative analysis by Kumar J et al., who found that neuro-dengue patients had more severe hematological and imaging abnormalities and higher morbidity [20]. Seizures were exclusive to the neurological group (70%), reinforcing the diagnostic importance of seizure onset in pediatric dengue.

Conclusion

We conclude that, Neurological manifestations in pediatric dengue fever, though less common, represent a serious complication associated with significant morbidity and mortality. In our study of 33 children, seizures and encephalopathy were the predominant presentations, frequently accompanied by abnormal CSF profiles, neuroimaging findings, and prolonged ICU stays. Thrombocytopenia and MRI changes were significantly associated with neurological involvement.

Despite supportive management, a substantial number of patients experienced residual deficits or fatal outcomes. These findings underscore the importance of early recognition, neurodiagnostic evaluation, and intensive care in pediatric dengue cases presenting with neurological symptoms. Prompt intervention may improve prognosis and reduce long-term complications.

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