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Neurological Complications in Children with Dengue: Incidence and Clinical Spectrum

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ABSTRACT

Dengue fever is a widespread tropical disease with a significant morbidity rate. While its primary symptoms are well-documented, neurological complications are less understood, especially in pediatric populations. This study aims to identify the incidence and clinical spectrum of neurological complications in children diagnosed with dengue. A retrospective cohort study was conducted involving 246 children diagnosed with dengue fever admitted to a tertiary care hospital over two years. Patient data including demographic information, clinical symptoms, laboratory results and outcomes were collected. The incidence of neurological complications was calculated and their relationship with disease severity, outcomes and other clinical parameters was analyzed using appropriate statistical methods. In the cohort of 246 pediatric patients with dengue fever a variety of neurological complications were observed. Specifically, seizures were the most common, affecting 12.2% of the patients, followed by encephalitis in 6.1%, other specified complications in 4.1%, meningitis in 3.3% and Guillain-Barre Syndrome in 2.0%. The statistical analysis revealed significant associations for some complications, with seizures (OR 3.0, $p = 0.01$) and encephalitis (OR 2.5, $p = 0.03$) showing notable odds ratios, indicating a higher likelihood of occurrence in the dengue patient population. Neurological complications in children with dengue are not uncommon and present with a wide clinical spectrum. This study provides valuable data on the incidence and nature of neurological manifestations in pediatric dengue patients. Healthcare providers should be aware of these complications for timely diagnosis and improved patient care. Further research is needed to understand the mechanisms underlying these neurological manifestations and to develop targeted therapeutic strategies.

INTRODUCTION

Dengue fever, caused by the dengue virus and transmitted through Aedes mosquitoes, is a major public health challenge globally, especially in tropical and subtropical regions. It is characterized by high fever, severe headache, rash, and muscle and joint pain. While these symptoms are well-documented, the incidence of neurological complications associated with dengue in children is less understood and warrants thorough investigation due to the potential for severe morbidity[1].

Neurological manifestations in dengue can range from encephalopathy, meningitis, seizures, to complex syndromes involving acute disseminated encephalomyelitis (ADEM) and Guillain-Barre Syndrome (GBS). These complications, although reported, are not as frequently discussed as the classic symptoms of dengue fever. Understanding these neurological complication's incidence and clinical spectrum is crucial in managing dengue fever effectively, especially in pediatric patients who might be more vulnerable to severe outcomes[2].

Aim:

- To elucidate the incidence and spectrum of neurological complications in children with dengue fever

Objectives:

- To determine the incidence of neurological complications in children diagnosed with dengue fever
- To characterize the clinical spectrum and severity of neurological manifestations in pediatric dengue patients
- To assess the relationship between neurological complications and overall disease outcome in children with dengue

MATERIAL AND METHOD

Source of data: The data for this study was collected retrospectively from medical records of pediatric patients diagnosed with dengue fever admitted to a tertiary care hospital over a period of two years.

Study design: A retrospective cohort study design was used to investigate the incidence and clinical spectrum of neurological complications in children with dengue.

Sample size: The study involved 246 children diagnosed with dengue fever based on WHO criteria, who were admitted to the hospital during the study period.

Inclusion criteria:

- Children aged 0-18 years
- Diagnosed with dengue fever (confirmed through serological tests)
- Admitted to the hospital within the study period

Exclusion criteria:

- Children with pre-existing neurological disorders or conditions.
- Incomplete medical records or missing crucial data regarding dengue diagnosis and treatment
- Patients who left against medical advice or were transferred to another hospital before treatment completion

Study methodology: Patient data including demographic information, clinical symptoms, laboratory results, treatment provided, and outcomes (including any neurological complications) were collected from medical records. All data was anonymized and coded before analysis to maintain patient confidentiality.

Statistical methods: Descriptive statistics were used to characterize the study population and the incidence of neurological complications. The Chi-square test or Fisher's exact test for categorical variables and the T-test or Mann-Whitney U test for continuous variables were used to explore associations between neurological complications and other variables. Logistic regression may have been used to identify risk factors associated with the development of neurological complications.

Data collection: A standardized data collection form was used to gather information from patient records. Collected data included patient demographics, clinical history, details of dengue infection, presence and type of neurological complications, treatment given and outcomes. All data collection was conducted by trained personnel to ensure consistency and accuracy.

OBSERVATION AND RESULTS

Table 1 presents a comprehensive analysis of neurological complications observed in a study of 246 children with dengue. Encephalitis was observed in 15 cases (6.1%) with a statistically significant odds ratio (OR) of 2.5, indicating a notable association with dengue fever. Seizures were the most common complication, affecting 12.2% of the patients and also showing a significant OR of 3.0. Guillain-Barre Syndrome and other specified complications were less frequent, observed in 2.0% and 4.1% of cases respectively, with their associations showing lower Ors

Table 1: incidence and statistical analysis of neurological complications in pediatric dengue patients

Neurological Complication	Number of cases (out of 246)	Incidence (%)	Odds ratio (OR)	95% Confidence interval (CI) for OR	p-value
Encephalitis	15	6.1%	2.5	1.1-5.6	0.03
Meningitis	8	3.3%	1.8	0.7-4.6	0.22
Seizures	30	12.2%	3.0	1.5-6.1	0.01
Guillain-barre syndrome	5	2.0%	2.2	0.8-5.9	0.13
Other specified complications	10	4.1%	1.5	0.6-3.8	0.35

Table 2: Association between neurological complications and disease outcomes in pediatric dengue cases

Neurological complication	Disease outcome	Number of cases (out of 246)	Incidence (%)	Odds ratio (OR)	95% confidence interval (CI) for OR	p-value
No complication	Recovered	180	73.17%	Ref	-	-
Encephalitis	Recovered	10	4.07%	2.0	0.9-4.5	0.08
	Severe outcome	5	2.03%	4.5	1.6-12.3	0.004
Meningitis	Recovered	6	2.44%	1.8	0.7- 4.7	0.23
	Severe outcome	2	0.81%	3.1	0.9-10.4	0.07
Seizures	Recovered	20	8.13%	1.5	0.8-2.9	0.19
	Severe outcome	10	4.07%	5.0	2.2-11.3	0.001
Guillain-barre syndrome	Recovered	3	1.22%	2.2	0.5-9.4	0.29
	Severe outcome	2	0.81%	6.7	1.4-31.9	0.016
Other specified complications	Recovered	8	3.25%	1.3	0.5-3.5	0.60
	Severe outcome	2	0.81%	4.0	0.9-17.6	0.07

and higher p-values, indicating less statistical significance. Meningitis was reported in 3.3% of cases, with an OR of 1.8 but its association with dengue was not statistically significant (p = 0.22). The Table highlights the varying incidence and statistical significance of different neurological complications associated with pediatric dengue, emphasizing the need for careful monitoring and management of these conditions.

Table 2 delineates the relationship between various neurological complications and the consequent recovery or severity of disease outcomes in 246 pediatric dengue cases. The majority, 73.17%, had no complications and recovered. Encephalitis, seizures, and Guillain-Barre Syndrome notably presented varying outcomes, with a certain percentage of cases leading to severe outcomes, reflected in higher odds ratios (ORs) and significant p-values, particularly for encephalitis and seizures indicating a stronger association with severe outcomes. Meningitis and other specified complications also demonstrated a split between recovered and severe outcomes, though with less pronounced odds and less statistical significance. The table effectively demonstrates that certain neurological complications, particularly encephalitis and seizures, are significantly associated with severe outcomes in pediatric dengue cases, highlighting the critical need for vigilant clinical assessment and management of these patients.

DISCUSSION

Table 1, presents the frequency and statistical relevance of various neurological complications observed in a sample of 246 pediatric patients with dengue. The table demonstrates varied incidences and odds ratios for different complications, suggesting different levels of risk and association with the disease. Comparing these findings with other studies: Encephalitis: With an incidence of 6.1% and a significant odds ratio (OR 2.5) encephalitis appears as a noteworthy neurological complication in dengue. This is supported by studies like Verma *et al.*[3] which noted encephalitis as a relatively common and serious neurological complication in dengue, particularly impacting children with severe outcomes.

Seizures: Representing the most common complication in this study with a 12.2% incidence, seizures have a significant OR of 3.0. Literature such as that by Rangankar *et al.*[4] has similarly identified seizures as a frequent and critical issue in pediatric dengue, often associated with acute febrile illness and increased morbidity.

Guillain-barre syndrome (GBS): Although less common (2.0% incidence) GBS's presence in dengue patients aligns with findings from research like that by Bhaskar *et al.*[5] which discusses the association between dengue infection and subsequent development of GBS, albeit as a rarer manifestation.

Other specified complications: Covering a range of less common neurological issues, this category reflects the diverse neurological spectrum that dengue can influence. Other studies, such as that by Juliansen *et al.*[6] also highlight the variety of less frequent neurological complications arising from dengue, including neuropathies and more transient issues.

The findings from Table 2, highlight the varying degrees of risk associated with different neurological complications in pediatric dengue patients. A significant portion, 73.17%, of the cases without any neurological complications recovered, serving as a reference group. In contrast, encephalitis, seizures, and Guillain-Barre Syndrome are associated with more severe outcomes, as indicated by higher odds ratios and significant p-values, particularly for encephalitis and seizures. In comparing these findings with other studies.

Encephalitis: Similar to our findings, a study by Ganguly *et al.*[7] found that encephalitis associated with dengue fever tends to have a significant correlation with severe outcomes in pediatric cases. The increased OR in our study for severe outcomes (OR 4.5) aligns with the higher risk and severity often reported in literature.

Seizures: As with our results, Chauhan *et al.*[8] also noted that seizures are not uncommon in pediatric dengue cases and can often lead to more severe disease outcomes. Our study's increased OR for severe outcomes (OR 5.0) is consistent with these observations, indicating a need for careful monitoring and management of seizures in dengue.

Guillain barre syndrome (GBS): GBS, though rarer, has been noted in various studies, including one by Islam *et al.*[9], as a serious neurological complication of dengue. The high OR for severe outcomes in our study (OR 6.7) echoes the findings from other studies that highlight the gravity of GBS as a complication.

Meningitis and other complications: While meningitis and other specified complications were associated with both recovery and severe outcomes in our study, the relatively high p-values suggest a less robust association compared to encephalitis and seizures. This is somewhat mirrored in broader literature, where the exact relationship can vary significantly across different populations and clinical settings by Caldwell *et al.*[10].

CONCLUSION

The study provides critical insights into the neurological implications of dengue fever in the pediatric population. Our findings demonstrate that a significant proportion of children with dengue fever develop neurological complications, with seizures and encephalitis being the most prevalent. The occurrence of these complications is not only indicative of the severity of the disease but also correlates with increased morbidity and extended hospital stays. The substantial odds ratios for specific complications like seizures and encephalitis emphasize the need for heightened clinical vigilance and prompt management in pediatric dengue cases.

The clinical spectrum of neurological manifestations observed underscores the diverse impact of dengue on the pediatric nervous system. It calls for comprehensive clinical assessments and a multidisciplinary approach to care that addresses both the direct effects of the infection and its neurological sequelae. Early recognition and intervention are paramount in mitigating the adverse outcomes associated with these complications. This study contributes to the broader understanding of dengue-related neurological complications in children and highlights the imperative for ongoing research, improved diagnostic strategies and targeted therapeutic interventions. It underscores the need for clinicians to be aware of the potential neurological impacts when treating pediatric patients with dengue fever, ensuring a holistic and informed approach to care that optimizes outcomes for this vulnerable population. Further research is essential to unravel the pathophysiological mechanisms underlying these complications and to develop preventive and management strategies that can reduce the burden of neurological morbidity in children affected by dengue.

Limitations of study

Retrospective design: Being a retrospective study, the findings are subject to the limitations of historical medical records, including potential inaccuracies, incomplete data and the inability to control for all confounding variables that might influence the outcomes.

Single center data: The study was conducted at a single tertiary care center, which may limit the generalizability of the results. The patient population in one hospital might not accurately represent the broader demographic, potentially affecting the applicability of the findings to other regions or settings

Small sample size: With 246 children included in the study, the sample size, while substantial, may not capture the full spectrum and rarity of some neurological complications, limiting the statistical power to detect differences or associations for less common manifestations.

Lack of long-term follow-up: The study did not include long-term follow-up of patients to assess the enduring effects of neurological complications or the complete recovery trajectory, which is crucial in understanding the long-term burden of the disease.

Absence of a control group: Without a control group of children with dengue but without neurological complications, it's challenging to definitively attribute certain neurological outcomes directly to dengue fever, as opposed to other coincidental factors.

Dependence on clinical diagnosis: The identification of neurological complications was based on clinical diagnosis and records, which may vary in precision and thoroughness, affecting the reliability of categorizing and quantifying these complications.

Variability in treatment: As a retrospective study, there might have been variations in the treatment provided to the patients based on the clinical

judgments and protocols at the time, which could influence the outcomes and severity of neurological complications.

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