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Neurological Manifestations of Childhood Dengue Fever-Experience in A Tertiary Care Center

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Abstract

Background: ***Dengue fever is a important mosquito-borne illness prevalent in tropical and subtropical regions, posing serious health risks, especially to children. While the common clinical features of dengue, such as high fever, rash, and joint pain, are well-documented, less is known about its neurological manifestations in pediatric patients. These can include a range of symptoms from headaches and seizures to more severe conditions like encephalitis and neuropathy. The complexity of these neurological symptoms often complicates the diagnosis and management of dengue in children.The aim of the study was to evaluate the neurological manifestations of childhood dengue fever and to enhance understanding of the frequency and types of these complications.***

Methodology: ***This observational cross sectional study was conducted in the Dengue unit of the Department of Paediatrics and the Department of Paediatric Neurology at BMU from June 2023 to May 2024. Children age 1 month to 15 years who diagnosed with dengue fever (Dengue NS1 positive) were included in this study, while children had large ascites were excluded. After admission to the dengue unit, each child was assessed clinically through a detailed history and thorough physical examination. All children were also evaluated neurologically***

Results: ***The data suggests that most children aged 5-10 years (61-120 months) 39(40.63%) with a mean age 96.38 ± 52.45 months, particularly males 56(58.3%), residing in urban areas 71(74.0%), and belonging to the middle social class 77(80.2%), may be at higher risk for dengue fever. Fever had 96(100.0%) of subjects, anorexia and vomiting 74(77.1%), and pain 60(62.5%) respectively. More than one fourth (28.1%) subjects had headache followed by encephalopathy 3(3.1%), febrile seizures 2(2.1%), and encephalitis-like features such as lethargy, confusion and coma 2(2.1%) respectively.***

Conclusion: ***Fever remains the most common presenting feature of dengue in children; however, a notable proportion develop neurological manifestations, including headache, encephalopathy, febrile seizures, and encephalitis-like features. Early recognition of these complications is essential for appropriate management and improved outcomes.***

Keywords: Children, Dengue fever, Neurological manifestations.

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Introduction

Dengue fever (DF) is an important mosquito-borne tropical infection

caused by an arbo- virus named dengue virus (DENV). DF is endemic in ≥100 countries with gradually increasing number of reported cases every year (Bentes et al. 2021). Dengue virus infection is most important, rapidly emerged disease in Southeast Asia. Illnesses due to dengue viruses impose enormous morbidity and mortality in this region. In southeast asia, this is a disease predominantly of children and characterized by increased vascular permeability, plasma leakage, hemorrhagic manifestations, and thrombocytopenia (Solomon et al. 2000) .Though central nervous system involvement in dengue infection is relatively unusual, in recent years the number of reported cases of dengue virus neurotropism has been increasing (Samanta et al. 2012). The basic pathogenesis behind central nervous system involvement has been thought to be secondary to fluid extravasation, cerebral edema, hypoperfusion, hemorrhage, hyponatremia, liver failure, and renal failure

(Kankirawatana et al. 2000). The neurological manifestation in dengue virus infection may includes encephalitis, acute disseminated encephalomyelitis, transverse myelitis and Guillain Barre syndrome, (Misra et al. 2006; Soares et al. 2006). Central nervous system (CNS) involvement is considered as expanded dengue syndrome which may occur with or without evidence of fluid leakage. So aim of the study is to evaluate the neurological manifestations of childhood dengue fever and to enhance understanding of the frequency and types of these complications.

Methodology

This observational cross sectional study was conducted in dengue unit of Dept. of Paediatrics and Dept. of Paediatric Neurology, BMU from June 2023 to May 2024. Children age 1 month to 15 years who diagnosed as a case of dengue fever(dengue NS1 positive) were included in this study and children with critically ill, having severe bleeding manifestation or huge ascites were excluded from this study. After admission in dengue unit each children were assessed clinically by taking detailed history, thorough physical examination including general wellbeing, febrile status, temperature pattern, respiration, blood pressure, rash bleeding manifestations, etc. All children were also evaluated neurologically clinically and also by neuroimaging CT scan or MRI of brain which was feasible. Data was collected in pre-designed structured questionnaire. An informed written consent was taken from the parents or the legal guardians of the studied subjects. Statistical analyses of the results were obtained by using window-based computer software devised with Statistical Packages for Social Sciences (SPSS-22).

Results:

Table I shows the distribution of the study subjects according to their socio-demographic characteristics. The data suggests that children aged 5-10 years (61-120 months) 39(40.63%) with a mean age 96.38 ± 52.45 months, particularly males 56(58.3%), residing in urban areas 71(74.0%), and belonging to the middle social class 77(80.2%), may be at higher risk for dengue fever. Here socioeconomic status is classified by social parameters.

Table-I

Distributions of the study subjects by socio-demographic characteristics (n=96)

Socio-demographic characteristics	Number	Percentage
Age (in month)		
<12	3	3.13
12-60	25	26.04
61-120	39	40.63
>120	29	30.21
Mean±SD	96.38	±52.45
Sex		
Male	56	58.3
Female	40	41.7
Residence		
Urban	71	74.0
Rural	25	26.0
Socioeconomic status		
Upper	7	7.3
Middle	77	80.2
Lower	12	12.5

Table II

Distributions of the study subjects by clinical features (n=96)

Clinical Features	Number	Percentage
Fever	96	100.0
Anorexia, Vomiting	74	77.1
Pain in body	60	62.5
Shock	15	15.6
Bleeding manifestations	13	13.5
Rash	7	7.3
Loose motion	4	4.2
Cough	2	2.1

Table II shows the clinical features of the study subjects. The data suggests that the most prevalent clinical features in children with neurological manifestations of dengue are fever 96(100.0%), anorexia and vomiting 74(77.1%), and pain in body 60(62.5%). Although less common, the presence of shock 15(15.6%) and bleeding manifestations 13(13.5%) signifies the potential for severe and life-threatening complications, warranting immediate medical attention. Rash 7(7.3%), loose motion

4(4.2%), and cough 2(2.1%) are less frequently observed but should still be considered in the differential diagnosis and management of dengue in children.

Table-III

Distributions of the study subjects by neurological manifestations (n=96)

Neurological manifestations	Number	Percentage
Headache	27	28.1
Encephalopathy (Lethargy, Confusion, Coma)	5	5.2
Febrile Seizures	2	2.1

Table III shows the neurological manifestations, the data suggests that headache 27(28.1%) is the most prevalent neurological manifestation among children with dengue fever, making it a key symptom to monitor for potential neurological complications. While their less common features encephalopathy 5(5.2%) and febrile seizures 2(2.1%).

Discussion:

Neurological problems in children have been linked more and more to dengue fever, a virus spread by mosquitoes. A variety of clinical symptoms can result from the dengue virus's invasion of the central nervous system (CNS). Encephalitis, encephalopathy, Guillain-Barré syndrome, and ADEM are common neurological symptoms (Trivedi & Chakravarty, 2022).Particularly neurotropic, the DENV2 and DENV3 serotypes can cause serious neurological consequences such seizures, altered mental status, and localised neurological impairments (Priyal et al., 2022).The enlarged dengue syndrome, which includes multisystem involvement and notable neurological consequences, has been brought to light by recent investigations (Chauhan et al., 2022). The pathophysiology includes immune-mediated damage, direct viral invasion, and the phenomena of antibody-dependent enhancement, which causes coagulopathy and plasma leakage (Trivedi & Chakravarty, 2022).

According to Singh et al. (2021), there is a notable impact on paediatric health due to the reported incidence of neurological sequelae, which ranges from 4.3% to 13%. To manage these serious consequences, early detection and intervention are essential. Dengue encephalitis and associated CNS problems can be diagnosed using advanced imaging techniques like magnetic resonance imaging (MRI), which allows for prompt treatment and a better prognosis (Priyal et al., 2022).

Understanding the effects of dengue fever and treating its consequences depend heavily on the age distribution of infected children. According to the data, children between the ages of 5 and 10 years (61-120 months) account for 40.63% of dengue cases, with a mean age of 96.38 ± 52.45 months. This result is in line with recent research showing that dengue fever peaks in this age range (Salgado et al., 2023).Gender disparities in the disease's prevalence are significant when considering the neurological symptoms of childhood dengue fever. According to the data, the incidence is higher in men (58.3%) than in women (41.07%). This male preponderance is in line with earlier research showing that men are more susceptible to and severely affected by dengue fever (Yue et al., 2022). Behavioural and biological variables could be the cause of this gender gap. Males, especially young boys, are more likely to contract dengue because they are frequently exposed to outdoor settings where Aedes mosquitoes flourish. Furthermore, some research indicates that immunological responses may be impacted by hormonal variations, with testosterone possibly weakening the immune response to infections (Sarker et al., 2021; Forsblom et al., 2021).

Dengue fever is more likely to spread in urban areas for a number of reasons. Aedes mosquitoes, the main dengue vectors, proliferate due in large part to high population density, poor waste management, and improper water storage techniques. Compared to 26.0% in rural areas, 74.0% of dengue cases have been documented in urban areas. These findings are consistent with the greater incidence of dengue in urban areas, since urbanisation intensifies variables that promote mosquito breeding. Additionally, the likelihood of disease spread is higher in metropolitan areas due to increased mobility and interactions. Mosquitoes have more opportunity to discover and infect human hosts in urban environments due to their larger population densities (Cho et al., 2022).

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Mosquitoes thrive in urban areas due to poor sanitation and stagnant water sources (Adnyana & Surya, 2023).

Integrated public health initiatives, such as better urban design, community education, and increased access to healthcare, are necessary to address these problems .According to recent studies, the middle social class accounts for 80.2% of childhood dengue fever cases, followed by the lower social class at 12.5% and the upper social class at 7.3%. There are a number of reasons why dengue fever seems to disproportionately impact the middle class. Due to inadequate sanitation and waste management, middle-class households frequently live in urban or peri-urban regions where mosquitoes grow extensively.

Furthermore, compared to wealthier areas, middle-class neighbourhoods may not receive as regular vector control measures, making these populations more vulnerable. In Pleiku city, Gia Lai province, a study by Vu et al. (2023) highlighted the correlation between high population density, climate, and dengue hemorrhagic fever prevalence. In densely populated locations, the study suggested stepping up surveillance and control efforts, especially during the rainy season when dengue outbreaks are more frequent.Higher exposure to mosquitoes that spread dengue is a result of this economic disparity (Rini et al., 2023). Vector control initiatives are frequently less concentrated in middle-class neighbourhoods. Due to inadequate waste management and water storage methods, middle-class families often reside in densely populated metropolitan regions with an abundance of mosquito breeding grounds (Urmi et al., 2023).

in contrast to wealthy regions, which may result in more mosquitoes and higher rates of transmission (Zhang et al., 2023). Due to these circumstances, children from middle-class families are more likely to contract dengue fever, which calls for specific public health measures to reduce this risk.

Examining the clinical characteristics seen in afflicted children is essential when discussing childhood dengue fever. According to a recent study, the most common symptoms of dengue in children were pain (62.5%), anorexia and vomiting (77.1%), and fever (100%). According to its pathophysiology of systemic viral infection and immunological response, fever is a common symptom that frequently appears first in dengue (Trivedi & Chakravarty, 2022).

The clinical picture might be complicated by anorexia and vomiting, which are often prevalent and can worsen electrolyte imbalance and dehydration. The systemic aspect of the viral infection and its inflammatory response are reflected in pain, which includes headache, myalgia, and retro-orbital pain. Comparatively, similar results have been reported by other investigations, suggesting that these clinical characteristics are not only common but also crucial in predicting catastrophic outcomes. Even though they are less frequent, shock (15.6%) and bleeding symptoms (13.5%) indicate serious, potentially fatal issues that need to be treated right away.

These results align with the severe multisystem involvement of the enlarged dengue syndrome (Chauhan et al., 2022). Although they are less common, rash (7.3%), loose motion (4.2%), and cough (2.1%) should nevertheless be taken into account when diagnosing and treating dengue in children since they can aggravate the clinical situation and conceal more serious symptoms.By identifying these clinical characteristics, medical professionals can better diagnose and treat dengue fever in children, improving their prognosis. Effective management of these patients requires timely clinical evaluation and sophisticated imaging methods (Priyal et al., 2022; Prommalikit et al., 2021).

The most common neurological symptom among children with dengue fever, according to the current study, is headache (28.1%). This result emphasises how crucial it is to keep an eye on headaches as a major sign of possible neurological issues. This finding is supported by empirical research, which highlights headache as a common and important neurological symptom of dengue fever (Stovner et al., 2022[SR]).

Healthcare professionals should be on the lookout for less frequent but serious neurological symptoms including encephalopathy, which includes lethargy, disorientation, coma (5.2%), and febrile seizures (2.1%), even though headaches are the most prevalent symptom. In order to minimise further problems and enhance outcomes for paediatric dengue patients, these severe manifestations necessitate prompt medical treatment (Trivedi & Chakravarty, 2022).

Encephalopathy is a serious illness that can cause serious morbidity if left untreated. It is characterised by altered

mental status and cognitive dysfunction. The clinical picture is further complicated by febrile seizures, which usually occur during the acute phase of the infection and require prompt management. Similar neurological symptoms have been reported in other research, which emphasises the need for increased awareness and timely treatment. Sawires and associates (2022[S])

shown that encephalopathy and headache were serious neurological side effects of dengue that required thorough clinical assessment and prompt treatment. In order to diagnose and treat these disorders and improve the prognosis and outcomes for children who are affected, advanced imaging techniques and comprehensive clinical assessment are essential (Gan et al., 2021). To lessen the impact of the disease on this susceptible age group, comprehensive management techniques, such as early diagnosis and prompt care, are essential (Sarker et al., 2021).

Limitation

The study's small sample size of 96 cases limits generalizability. Being conducted at a single center, it may not represent national trends. The cross sectional design may introduce bias, short follow-up periods overlook long-term outcomes, and incomplete data affects accuracy.

Conclusions

Most of the participants were aged between 5 and 10 years and were predominantly male. Headache was the primary neurological manifestation followed by encephalopathy and febrile seizures in this study.

Conflict of interest: None

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