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Clinical Characteristics and Hematologic Profile of Children Admitted to a Tertiary Hospital with Dengue Virus Infection: A Cross-sectional Study

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Abstract

Introduction: Dengue is an arboviral disease spread by mosquitoes, predominantly affecting tropical and subtropical regions. In Nepal, dengue cases have highest burden in the Bagmati region, including Kathmandu. Clinically, dengue manifests with asymptomatic to severe infection characterized by systemic symptoms. This study aims to identify the clinical characteristics and hematologic profile of children admitted with dengue fever in a tertiary hospital in Kathmandu.

Methods: A cross-sectional study was carried out at Nepal APF Hospital, a tertiary care facility in Kathmandu, Nepal. Enumerative sampling was used to gather secondary data of 49 children under the age of 18 who were hospitalized with positive dengue tests (NS1 antigen or IgM antibody positive) between September 2022 and November 2024. Dengue was categorized as per the 2009 WHO classification. Descriptive statistics and Kruskal-Wallis test was performed.

Results: Majority of the patients (77.5%) had dengue without warning signs, 20.41% had warning signs and only 2.04% had severe dengue. All the patients had fever when they first arrived. Headache (57.1%), Arthralgia/Myalgia (53.1%), Nausea and Vomiting (24.5%) and Cough (22.4%), were common clinical characteristics. Abdominal pain (p-value <0.05) and epistaxis (p-value <0.05) was significantly associated with severity of dengue infection. There was a sharp rise in incidence of dengue cases in the month of September. Majority of children admitted had Leukopenia (69.4%) and thrombocytopenia (57.1%). 83.7% of children were Non-Structural protein 1 (NS1) positive and 32.7% were IgM positive whereas none were IgG positive.

Conclusion: Fever is the most common sign of a dengue infection. Leucopenia and thrombocytopenia are the most prevalent test findings. Children are especially susceptible to dengue during the monsoon season. It is critical to be aware of these clinical and laboratory markers to diagnose and manage dengue.

Keywords: children; clinical characteristics; dengue virus infection; hematologic profile

Introduction

Dengue Virus (DENV), a flavivirus, is spread by the mosquito vectors Aedes aegypti and Aedes albopictus and is the most quickly spreading mosquito-borne arboviral disease. It is more prevalent in subtropical and tropical regions.[1] In Nepal, Bagmati has been the mostly affected region.[2] Dengue is the leading cause of juvenile morbidity and mortality in Southeast Asia.[3]

World Health Organization (WHO) in 2009 divided dengue into three categories based on laboratory results and clinical manifestations: severe dengue, dengue with warning signs, and dengue without warning signs. A major risk factor for dengue infection is age. Children and the elderly are frequently the groups most affected by dengue's morbidity and mortality.[4] Because of increased microvascular permeability, children are about 15 times

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more likely to die during a secondary DENV-2 infection than adults.[5]

Clinically, the disease may show no symptoms at all or symptoms including fever, headache, hepatomegaly, muscle and joint pain, lymphadenopathy, rash, retro-orbital pain, nausea, and vomiting.[6] White blood cell counts (WBC), absolute neutrophil and absolute monocyte counts, and thrombocytopenia are all more likely to be lower in children with dengue than in children with other febrile illnesses.[7,8] There is seasonal variations in dengue infection with rise in dengue cases in temperate and rainy climate.[9]

Until 2010, dengue was endemic and mostly found in the Terai region; however, in 2016, it was increasingly discovered in the hilly area.[10] Kathmandu is the second top most district being affected by Dengue virus infection with 5919 number of Dengue cases from 2023-2024 A.D.[2] Many studies are found regarding the outbreak of Dengue virus in Nepal[11–15] but only few studies have been conducted in children with Dengue virus infection in Nepal.[16] This study has been conducted to resolve this gap with aim to identify the clinical characteristics and hematologic profile of children with dengue virus infection admitted in a tertiary hospital.

Methods

A cross-sectional study was conducted in a tertiary care hospital named Nepal APF Hospital, Kathmandu, Nepal. Secondary data of total 49 children below 18 years of age admitted with positive dengue test (NS1 antigen or IgM antibody positive) and recorded in medical record section of Nepal APF Hospital was collected retrospectively from September 2022 to November 2024.Total enumerative sampling technique was used and as none of the sample had incomplete demographic, hematologic and clinical data recorded in medical record section, none of the sample were excluded in the study. Ethical approval was taken from IRC of Nepal APF Hospital (Ref No.: NAPFH-024/2024). Data regarding demographic characteristics (age, sex, ethnicity and area of residence), clinical symptoms, hospi tal stay, season of admission, type of diagnostic test (dengue IgM and NS1 RDTs) and hematologic profile was obtained in an excel sheet. Record file of all included patients were reviewed for validity of the data collected. Admitted pediatric patients were divided into three clinical groups based on their clinical characteristics: severe dengue, dengue with warning signs and dengue without warning signs, as per the 2009 WHO classification.[17] Thrombocytopenia refers to a platelet count below 150,000 cells/mm^3. Leucopenia refers to a total white blood cell count below 4,500 cells/mm3.[17] The clinical profile and haematological profiles were compared and examined after the classification.

Data was checked for completeness and then entered using Epidata version 3.1. SPSS version 20 was used for data analysis. Data was analyzed using descriptive statistics like mean, standard deviation and percentage. Inferential statistical tests such as 'Kruskal-Wallis' test was used to determine the association between severity of Dengue with Clinical characteristics and Hematological profile. P value was set at 5% level of significance and 95% confidence interval.

Results

Among 49 pediatric patients, majority (77.55%) were diagnosed as dengue without warning signs, 20.41% as dengue with warning signs and only 2.04% were diagnosed as severe dengue. Most of the affected children (55.1%) were of age ≥14 years with mean age of 13.06 ± 4.12 years ranging from 2 years to 18 years of age. There were more male children (61.2%) admitted with a dengue virus infection than female children. Most of the pediatric patients admitted were Brahmin/Chhetri (61.2%) followed by Janajati (32.7%). Majority of children (75.5%) were from inside Kathmandu valley (Table 1).

During admission, all of the pediatric Dengue patients presented with symptom of fever (100%) followed by Headache (57.1%), Arthralgia /Myalgia (53.1%), Nausea and Vomiting (24.5%), Cough (22.4%), Retro-Orbital pain (10.2%), Epistaxis (8.16%), Abdominal pain (6.12%), Rashes (4.1%) and other symptoms like chest pain, diarrhea (8.16%). Majority of children stayed in hospital for ≤ 4 days (65.3%) with minimum hospital stay of 1 day and maximum of 8 days. Most of the children with dengue viral infection (83.7%) were Non-Structural protein 1 (NS1) antigen positive and 32.7% were IgM positive whereas none of the children were IgG positive. But severe dengue case has only IgM positive and NS1 antigen negative. Cent percent of the children were discharged from hospital after medical management. Clinical characteristic of abdominal pain (p-value <0.05) and epistaxis (p-value <0.05) was significantly associated with the severity of dengue virus infection (Table 2).

The incidence of children admitted with Dengue viral infection started low in May (2 cases) with slight increase in August (3 cases). There was a sharp rise in incidence in September with cases increasing tenfold from 2 to 20. Cases then declined in October to 14 cases. In November, there were eight cases, continuing the declining trend. Cases drop to two by December, the same number as in May (Fig 1).

Regarding hematologic profile, majority of children admitted with dengue viral infection (69.4%) had Leukopenia and more than half the children admitted had thrombocytopenia (57.1%). There was no significant association of WBC and Platelet Count with severity of dengue. (Table 3)

Table 1: Socio-demographic Characteristics of Children

Socio-demographic Characteristics of Children				
n=49				
Characteristics	**Dengue without warning signs n(%)**	**Dengue with warning signs n(%)**	**Severe dengue n(%)**	**Total n (%)**
Age (in completed years)				
< 14 years	16(32.7)	6(12.2)	0(0.0)	22(44.9)
≥14 years	22(44.9)	4(8.2)	1(2.0)	27(55.1)
Total	38(77.6)	10(20.4)	1(2.0)	49(100)
Mean age:13.06 years ± 4.120 SD, Q1:10.5,Q3:16.5 Min:2, Max:18				
Sex				
Male	23(46.9)	7(14.3)	0(0.0)	30(61.2)
Female	15(30.6)	3(6.1)	1(2.0)	19(38.8)
Total	38(77.6)	10(20.4)	1(2.0)	49(100)
Ethnicity				
Dalit	0(0.0)	1(2.0)	0(0.0)	1(2.0)
Janajati	13(26.5)	2(4.1)	1(2.0)	16(32.7)
Brahmin/Chhetri	23(46.9)	7(14.3)	0(0.0)	30(61.2)
Others	2(4.1)	0(0.0)	0(0.0)	2(4.1)
Total	38(77.6)	10(20.4)	1(2.0)	49(100)
Area of residence				
Inside Kathmandu Valley	26(53.1)	10(20.4)	1(2.0)	37(75.5)
Outside Kathmandu Valley	12(24.5)	0(0.0)	0(0.0)	12(24.5)
Total	38(77.6)	10(20.4)	1(2.0)	49(100)

Table 2: Association of Severity of Dengue and Clinical Characteristics of Children

Association of Severity of Dengue and Clinical Characteristics of Children					
n=49					
Characteristics	**Dengue without warning signs n (%)**	**Dengue with warning signs n (%)**	**Severe dengue n (%)**	**Total n (%)**	**p-value**
Clinical Features					
Fever	38(77.6)	10(20.4)	1(2.0)	49(100)	-
Headache	23(46.9)	5(10.2)	0(0.0)	28(57.1)	0.423
Arthralgia/Myalgia	22(44.9)	4(8.2)	0(0.0)	26(53.1)	0.338
Nausea and Vomiting	7(14.3)	5(10.2)	0(0.0)	12(24.5)	0.100
Cough	8(16.3)	3(6.1)	0(0.0)	11(22.4)	0.719
Retro-Orbital pain	5(10.2)	0(0.0)	0(0.0)	5(10.2)	0.447
Epistaxis	0(0.0)	4(8.2)	0(0.0)	4(8.2)	<0.001
Abdominal pain	0(0.0)	2(4.1)	1(2.0)	3(6.1)	<0.001
Rashes	2(4.1)	0(0.0)	0(0.0)	2(4.1)	0.739
Others	4(8.2)	2(4.1)	0(0.0)	4(8.2)	0.669
Total	38(77.6)	10(20.4)	1(2.0)	49(100)	
Total hospital stay					
≤ 4 days	16(32.7)	4(8.2)	0(0.0)	32(65.3)	0.698
>4 days	22(44.9)	6(12.2)	1(2.0)	17(34.7)	
Total	38(77.6)	10(20.4)	1(2.0)	49(100)	
Median:14 days, Q1:3, Q3:5 Min:1, Max:8					
Type of Diagnostic Test					
NS1 positive	32(65.3)	9(18.4)	0(0.0)	41(83.7)	0.066
IgM positive	13(26.5)	2(4.1)	1(2.0)	16(32.7)	0.243
IgG positive	0(0.0)	0(0.0)	0(0.0)	0(0.0)	-
Outcome of management					
Discharge	38(77.6)	10(20.4)	1(2.0)	49(100)	-

Table 3: Association of Severity of Dengue and Hematologic Profile of Pediatric Patients

Association of Severity of Dengue and Hematologic Profile of Pediatric Patients					
n=49					
Characteristics	**Dengue without warning signs n (%)**	**Dengue with warning signs n (%)**	**Severe dengue n (%)**	**Total n (%)**	**p-value**
WBC					
Leukopenia	27(55.1)	6(12.2)	1(2.0)	34(69.4)	0.636
Normal WBC count	11(22.4)	4(8.2)	0(0.0)	15(30.6)	
Median:3300, Q1:2800, Q3:4400, Min:1200, Max:8200					
Platelet					
Thrombocytopenia	20(40.8)	7(14.3)	1(2.0)	28(57.1)	0.419
Normal	18(36.7)	3(6.1)	0(0.0)	21(42.9)	
Median:140000, Q1:122500, Q3:165500, Min:60,000, Max:321,000					

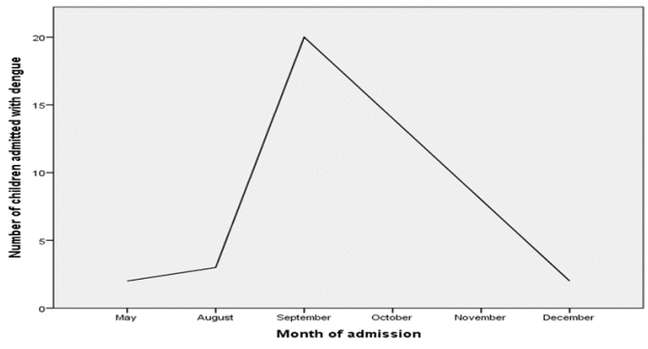

Figure 1: Seasonal Variation in Incidence of Dengue Viral Infection among Children Admitted with Dengue

Discussion

In the present study of 49 children admitted with dengue viral infection, the clinical and hematologic profiles provide important information about the disease presentation and severity patterns in pediatric population.

In this study, the maximum number of dengue cases were of age ≥14 years with mean age of 13.06 ± 4.12 years. This aligns with the finding in India where maximum dengue cases were of age 13-18 years.[18] The finding is also similar to finding in Mexico which stated an increasing trend of severe dengue for children above 10 years.[19] This may be explained by the fact that older kids independently go outside home and are to be bitten by mosquitoes. The finding is contradictory to the finding of other studies where the mean age of the dengue patient was <14 years.[3,4,8,16,20,21] Male children (61.2%) were more affected with dengue virus infection than female children which was similar to other studies.[4,22] This may be due to more outdoor game played by male child than female and thus been bitten by mosquito. Contradictory finding was seen in Nepal were ratio of male and female children affected with dengue was 1:1.[15]

The majority of pediatric patients children (77.55%) were diagnosed with dengue without warning signs, while 20.41% had dengue with warning signs, and only 2.04% presented with severe dengue. This finding is in line with earlier study in Nepal where majority of pediatric dengue patients were admitted due to dengue without warning signs while severe dengue was comparatively uncommon.[11,16,22] The finding is in contrast with several studies in India where majority of the patients had Dengue with warning signs.[3,4]

Fever was the most common clinical characteristic seen in all dengue patients along with other symptoms like headache, arthralgia/myalgia, nausea and vomiting, cough, retro-orbital pain, epistaxis, abdominal pain and rashes which is supported by other studies.[3,4,11,16,23] Clinical characteristic of abdominal pain (p-value <0.001) and epistaxis (p-value <0.001) was significantly associated with the severity of dengue virus infection. So, children with fever, abdominal pain and epistaxis should be ruled out for dengue viral infections and closely monitor for severity of dengue.

Most of the children with dengue viral infection (83.7%) were Non-Structural protein 1 (NS1) antigen positive and 32.7% were IgM positive whereas none of the children were IgG positive. A positive result for NS1 antigen indicates that the test has a good sensitivity for early illness diagnosis as in other studies conducted in Nepal.[16,23] But severe dengue case has only IgM positive and NS1 antigen negative. There was a sharp rise in incidence of dengue cases in September with cases declining through October to November majority with hospital stay for ≤ 4 days. Severe dengue case had hospital stay for more than 4 days. Similar trend in seasonal variation was seen in other studies where cases peaked in September and declined afterwards.[18,21,23] This can be explained by the fact that mosquitoes breed best during the monsoon and post monsoon seasons.

Thrombocytopenia as a hallmark hematologic finding

was observed in 57.1% of cases in our study. Similar thrombocytopenia was observed as 88.6%[8], 88%[3], 67.5%[16] in other studies which are similar or higher when compared to our study. Inconsistent result was seen in study where thrombocytopenia was seen in lesser cases as 40.48%[22], 26.4%[4] than in our study. Similarly, majority of children admitted with dengue viral infection 69.4% had Leukopenia but other studies showed Leukopenia in lesser cases than ours as 64.68%[22], 40%[3], 38.1%[8], 35.1%[16], 11.8%[4], 11%[23]. Both Leukopenia and Thrombocytopenia was observed in severe dengue case. But there was no significant association of WBC and Platelet Count with severity of dengue. Clashing findings were in studies where Leukopenia and thrombocytopenia was significantly associated with severity of dengue.[4,22,23] This may be due to single case of severe dengue seen in our study. All of the admitted pediatric dengue cases were discharged from hospital after treatment. This indicates prompt diagnosis and management of dengue cases in the tertiary care center.

Limitations

As the sample size was small and there was only a single case of severe dengue in our study, the findings may not generalize the exact status in general population.

Conclusion

Clinical characteristic of febrile illness is the most typical sign of a dengue infection. Hematologic profile of Leucopenia and thrombocytopenia are the most prevalent test findings. It is critical to be aware of these clinical and laboratory markers in order to diagnose dengue infections quickly, assess their severity, and manage them overall. Children are especially susceptible to contracting dengue during the monsoon season.

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