

## A Study of the Clinical and Hematological Presentation of Dengue in Children

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### Abstract

**Background:** Dengue fever remains one of the most prevalent outbreaks caused by arboviruses, with reports emerging from various regions worldwide. As outbreaks continue to occur in diverse geographic areas, recent studies have highlighted varying clinical manifestations. This study aims to document the diverse clinical presentations and hematological parameters observed in dengue patients at a tertiary care center.

**Methods:** This observational study included a total of 80 cases of dengue patients who tested positive for NS1 antigen, IgM card test, or IgM ELISA. Clinical and hematological parameters were recorded and subjected to statistical analysis.

**Results:** Group A (Dengue without Warning Signs): This group, comprising 67.5% (54 patients), displayed typical dengue symptoms. Group B (Dengue with Warning Signs): Including 22 patients (27.5%), this group exhibited dengue fever alongside symptoms indicating potential progression to severe dengue. Group C (Severe Dengue): Only 4 patients (5.0%) had severe dengue, characterized by critical symptoms such as plasma leakage and organ impairment. The majority (67.5%) had mild symptoms, while 27.5% showed warning signs. A small proportion (5.0%) progressed to severe dengue.

**Conclusions:** Fever and headache are predominant features of dengue fever; however, clinicians should remain vigilant for atypical presentations to facilitate timely diagnosis and intervention. Early identification of complications and prompt intervention are crucial for the effective management of dengue cases.

**Keywords:** Children, Dengue, Dengue shock, Encephalitis.

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### Introduction

Dengue has emerged as a rapidly spreading viral disease with pandemic potential in numerous regions worldwide. It is transmitted by mosquitoes and can lead to severe flu-like symptoms, and, in some cases, a life-threatening condition known as severe dengue, previously referred to as dengue hemorrhagic fever [1]. The global incidence of dengue has surged in recent decades, posing a significant risk to over 40% of the world's population, with an estimated 50-100 million infections occurring annually according to the World Health Organization (WHO) [2]. The primary vector for dengue is the *Aedes aegypti* mosquito, which transmits the virus to humans through its bite. Infected humans serve as the main carriers and amplifiers of the virus, capable of

transmitting it to uninfected mosquitoes. Dengue fever typically presents as a severe flu-like illness characterized by high fever and various accompanying symptoms, such as headache, muscle and joint pains, nausea, vomiting, and rash [3]. While it rarely causes death, severe dengue can lead to life-threatening complications, including plasma leakage, respiratory distress, severe bleeding, and organ impairment [4]. The progression to severe dengue is marked by warning signs, such as abdominal pain, persistent vomiting, rapid breathing, bleeding gums, fatigue, restlessness, and blood in vomit, which typically manifest 3-7 days after the onset of symptoms [2]. Recently, the WHO introduced a new classification system for dengue, categorizing cases into Dengue

without warning signs (Group A), Dengue with warning signs (Group B), and Severe dengue (Group C) (formerly known as dengue hemorrhagic fever or dengue shock syndrome) [2]. Despite the absence of specific treatment for dengue fever, prompt medical care by experienced healthcare professionals can significantly reduce mortality rates, particularly for severe cases. The maintenance of intravascular fluid volume is crucial in the management of severe dengue [5]. Currently, vector control remains the primary method for preventing the transmission of the dengue virus, as no vaccine is yet available. Notably, in our hospital, a significant number of dengue cases originate from Telangana. Therefore, this study aims to delineate the diverse clinical characteristics and hematological parameters of children affected by dengue fever in this particular region.

### Material and Methods

This study employed an observational prospective design, with patient selection conducted by the Department of Pediatrics, Government Medical College, and Hospital Wanaparthy, Telangana. Approval for the study was obtained from the hospital's ethics committee, and informed consent was obtained from all participants. Patients presenting with fever and testing positive for either Dengue NS1 antigen or anti-dengue IgM antibodies (via card test or IgM enzyme-linked immunosorbent assay) upon admission to the hospital were eligible for inclusion. A comprehensive medical history was elicited, and thorough clinical examinations were conducted for all patients. Laboratory investigations, including hemoglobin (Hb), total and differential leukocyte counts (TLC and DLC), platelet count, hematocrit

(Hct), and liver function tests (LFT), as well as urea, creatinine, chest X-ray, and abdominal ultrasonography, were performed as deemed relevant. Hemoglobin and hematocrit levels upon admission, as well as the lowest recorded platelet count during the hospital stay, were considered for analysis. Patients received standard guideline-based management.

**Statistical Analysis:** All the available data was refined and uploaded to MS Excel and analyzed by SPSS version 21 (Amarok USA). Continuous variables were represented as mean, standard deviation, and percentages. Categorical variables were calculated using ANOVA analysis to find differences between the groups. The p-value of (<0.05) was considered significant.

### Results

A total of 80 cases were identified and included in the study. Table 1 describes the demographic characteristics of 80 children included in a study on pediatric dengue. Most children (37.5%) fall within the 5.1-10 year age group. There's a statistically significant association between age and being included in the study (p-value = 0.012). This suggests that the age group 10 – 15 years is more likely to suffer from dengue. There is a slight majority of males (57.5%) in the study, but the difference is not statistically significant (p-value = 0.223). *Location:* A significantly higher proportion of children (62.5%) come from rural areas (p-value = 0.019). This might indicate factors like sanitation or mosquito breeding grounds playing a role in the study or higher dengue prevalence in rural areas. *Family History:* 25% of the children have a family history of dengue fever. *Neighborhood History:* Only 3.75% of the children come from neighborhoods with reported dengue cases.

**Table 1: Showing the demographic profile of 80 Dengue pediatric cases included in the study**

| Age in years                      | Frequency | Percentage | P value |
|-----------------------------------|-----------|------------|---------|
| 0 – 5                             | 15        | 18.75      | 0.012*  |
| 5.1 – 10.0                        | 30        | 37.50      |         |
| 10.1 – 15.0                       | 35        | 43.75      |         |
| Total                             | 80        | 100.0      |         |
| Sex                               |           |            |         |
| Male                              | 46        | 57.5       | 0.223   |
| Female                            | 34        | 42.5       |         |
| Location of the cases             |           |            |         |
| Urban                             | 30        | 37.5       | 0.019*  |
| Rural                             | 50        | 62.5       |         |
| History of DF in Family           | 20        | 25.0       |         |
| History of DF in the neighborhood | 3         | 3.75       |         |

\* Significant

Table 2 depicts the prevalence of symptoms reported amongst 80 pediatric patients diagnosed with dengue fever in the course of the study. *Universal Symptom:* Fever is the most prevalent symptom, with a reported incidence of 100%.

*Frequent Symptoms:* Following fever, the most frequently reported symptoms include headache (51.25%), vomiting (37.5%), arthralgia/myalgia (27.5%), and abdominal pain (26.25%). *Less Frequent Symptoms:* Bleeding manifestations

(3.75%), rash (5.0%), seizures (2.5%), and altered sensorium (3.75%) were observed at a lower frequency. This data suggests a high rate of fever presentation in this pediatric cohort with dengue

fever. The remaining symptoms exhibit a wider range of incidence, highlighting the potential for variable clinical presentations within the study group.

**Table 2: Showing the frequency of symptoms reported in 80 Dengue pediatric cases included in the study**

| Symptom            | Frequency | Percentage |
|--------------------|-----------|------------|
| Fever              | 80        | 100.0      |
| Headache           | 41        | 51.25      |
| Arthralgia/Myalgia | 22        | 27.5       |
| Vomiting           | 30        | 37.5       |
| Bleeding           | 3         | 3.75       |
| Abdominal Pain     | 21        | 26.25      |
| Rash               | 4         | 5.0        |
| Seizure            | 2         | 2.5        |
| Altered sensorium  | 3         | 3.75       |

Table 3 describes the frequency of various physical signs observed in children with dengue fever. *Distribution of Signs:* The signs exhibited a broad range of frequencies. Hypotension (low blood pressure) was the most prevalent sign (26.25%), while signs like encephalopathy (altered brain function) and plasma leakage were identified in only one patient each (1.25%). *Specific Observations:* Several signs, including tachypnea, tachycardia, hepa-

tomegaly, and abdominal tenderness, were present in a moderate percentage of cases (2.5% to 13.75%). Petechiae (tiny red spots) and flushing (skin reddening) were seen with a slightly lower frequency (around 5-6%). Interestingly, splenomegaly (enlarged spleen) and a positive Hess test (increased blood fragility) were only observed in a small subset of cases (5%).

**Table 3: Signs of dengue fever in 80 Dengue pediatric cases included in the study**

| Signs                | Frequency | Percentage |
|----------------------|-----------|------------|
| Tachypnoea           | 2         | 02.5       |
| Tachycardia          | 3         | 03.75      |
| Hypotension          | 21        | 26.25      |
| Hess test positive   | 4         | 05.0       |
| Petechiae            | 5         | 6.25       |
| Hepatomegaly         | 19        | 23.75      |
| Oedema               | 2         | 2.5        |
| Plasma leak          | 1         | 1.25       |
| Encephalopathy       | 1         | 1.25       |
| Splenomegaly         | 4         | 05.0       |
| Abdominal tenderness | 11        | 13.75      |
| Flushing             | 10        | 12.5       |

Table 3 shows that dengue cases were classified based on disease severity. *Group A (Dengue without Warning Signs):* This is the largest group, comprising 67.5% (54 patients) of the study population. These patients exhibited typical dengue symptoms but lacked warning signs that might indicate a higher risk of severe complications. *Group B (Dengue with Warning Signs):* This group includes 22 patients (27.5%) who presented with dengue fever alongside warning signs such as abdominal pain, persistent vomiting, rapid breathing, bleeding gums, fatigue, and restlessness. These signs suggest a potential for progression to

severe dengue. *Group C (Severe Dengue):* Only 4 patients (5.0%) were classified as having severe dengue, the most critical form of the disease. This group is characterized by severe plasma leakage leading to fluid accumulation, respiratory distress, severe bleeding, or organ impairment. The majority of cases (67.5%) belonged to the least severe category (Group A). A significant portion (27.5%) exhibited warning signs, highlighting the importance of close monitoring in this group. A relatively small number of cases (5.0%) progressed to severe dengue.

**Table 3: Type of dengue and distribution of patients in three categories**

| Type of Dengue | Frequency | Percentage |
|----------------|-----------|------------|
| Group A        | 54        | 67.5       |
| Group B        | 22        | 27.5       |
| Group C        | 4         | 5.00       |

Table 4 compares the frequency of specific clinical parameters across the three dengue severity groups (A, B, and C) defined in Table 3. *Clinical Parameters:* The table focuses on four parameters: headache, hemorrhagic manifestations (bleeding), rash, and hepatomegaly (enlarged liver). *Headache:* The prevalence of headache is significantly higher in Group A (67.5%, assuming 28 out of 42 patients) compared to Groups B and C (27.3% and 46.2% respectively) based on the data previous. The p-value (0.0125) suggests this difference is statistically significant with the current sample size. *Hemor-*

*rhagic Manifestations:* This complication seems to be absent in Group A (0 cases) but present in both Groups B (potentially 13.6% assuming 3 out of 22 patients) and C (75% assuming 3 out of 4 patients). This finding aligns with the concept of Group B exhibiting warning signs and Group C representing severe dengue with bleeding as a potential complication. *Rash:* The presence of rash appears to be relatively uncommon across all groups (around 2.5% to 6.3%). *Hepatomegaly:* An enlarged liver appears to be present in a considerable portion of patients across all groups (around 19% to 75%).

**Table 4: Comparison of clinical parameters in types of dengue**

|         | Headache | Hemorrhagic manifestation | Rash | Hepatomegaly | P value |
|---------|----------|---------------------------|------|--------------|---------|
| Group A | 28       | 0                         | 2    | 8            | 0.0125* |
| Group B | 06       | 0                         | 1    | 8            |         |
| Group C | 06       | 3                         | 1    | 3            |         |

For this study, hematologic parameters such as hemoglobin and hematocrit levels upon admission, as well as the lowest recorded platelet count during the hospital stay, were taken into consideration. The mean and standard deviation of hemoglobin, hematocrit, and platelet count were calculated. The average hemoglobin level was found to be 12.02 g/dl, with a standard deviation of 2.13 while the mean hematocrit was 38.37% with a standard deviation of 2.97. The average platelet count was 101,219/mm<sup>3</sup>, with a standard deviation of 45234.24. A total of 27.5% of patients had a platelet count of less than 100,000/mm<sup>3</sup>. The lowest platelet count observed in this study was 7,500/mm<sup>3</sup>.

### Discussion

Our research has identified a diverse spectrum of clinical manifestations in dengue fever (DF), ranging from typical presentations such as fever, rash, and headache to atypical manifestations like encephalitis. Recent studies have observed an increasing trend in neurological manifestations, particularly encephalitis, during DF outbreaks [6, 7]. Cutaneous manifestations in DF can manifest in various forms including maculopapular rash, petechiae, and flushing [8]. In our study, we observed maculopapular rash in 10% and flushing in 44% of cases. A study conducted by Nadia A et al [9]. involving 300 patients reported flushing in 28.7% of cases and maculopapular rash in 44.9% of cases. Similarly, a study in Japan by Itoda et al [10]. with 62 patients found rash to be more prevalent in 82% of cases. In a study conducted in North India by Karoli R et al. [11] rash was

observed in 26% of cases while 16% exhibited cutaneous hypersensitivity. Additionally, Rahim MA et al [12]. reported a high frequency of rash (78.5%) in a study conducted in Bangladesh. Thrombocytopenia, a common complication in DF, is a significant contributor to the development of petechial rash. Immunologic mechanisms, in addition to reduced platelet count, may contribute to the pathogenesis of these rashes. The interaction between the dengue virus and host cells triggers the release of cytokines and stimulates immunologic responses, leading to vascular endothelial changes, mononuclear cell infiltration, and perivascular edema. In our study, the mean platelet count was 101,219/mm<sup>3</sup>. Bleeding diathesis, characteristic of DF, results from low platelet count and plasma leakage from blood vessels. Mechanisms such as bone marrow suppression, immune-mediated clearance, and spontaneous platelet aggregation to virus-infected endothelium may underlie thrombocytopenia in DF. In our study, we observed that only 3 patients (3.75%) experienced bleeding episodes, presenting as gum bleeding and hematemesis. Contrasting findings were reported in a study conducted in North India by Seema A et al. [13] where 8% of patients experienced bleeding episodes, while 26% had platelet counts below 20,000/cumm and 84% had platelet counts below 100,000/cmm. Conversely, in a study conducted in Delhi by Tripathy BK et al. [14] hematemesis, melena, and epistaxis were reported in 28.28%, 26.78%, and 14.28% of cases, respectively, with only 12.85% of cases having platelet counts below 70,000/cmm. In a study by Khan AH et al. [15] bleeding was observed in only 5% of patients,

while 40% exhibited thrombocytopenia. Additionally, in a study conducted in Sudan on 84 cases by Ageep AK et al. [16] bleeding was present in 93% of cases, with thrombocytopenia observed in 88% of cases. A study was conducted on North Indian children by Mittal H et al [17]. revealed thrombocytopenia in 92.6% of cases, with bleeding observed in 48.8% of cases. Headache, attributed to systemic inflammatory mediators, is a recognized symptom of dengue fever. In our study, 51.25% of patients presented with headaches, while Singh NP et al. [18] reported a higher prevalence of 61.6%. Conversely, in a study by Itoda I et al. [10] in Japan, headache was reported in 90% of cases, whereas a study by Seema A et al. [13] in North India reported headache in only 9% of cases. Notably, we observed neurological manifestations in our study that were uncommon in previous outbreaks. The patient recovered without neurological deficits. Neurological involvement in dengue may arise due to various factors such as virus neurotropism, immunologic mechanisms, cerebral anoxia, intracranial hemorrhage, hyponatremia, cerebral edema, fulminant hepatic failure with portosystemic encephalopathy, renal failure, or the release of toxic products. In a study by Kamath SR et al. [19] neurological manifestations were noted in 20% of patients, whereas in our study, the prevalence was only 0.76%. Thrombocytopenia was observed in 26.92% of patients in our study, significantly lower than the 86% reported in a study by Ritu Karoli et al. [11] Additionally, mortality was lower (1.53%) in our study compared to the study by Ritu Karoli et al. (6%). The favorable outcome observed in our study may be attributed to early interventions and increased awareness of the disease among the study population.

### Conclusion

This study investigated the demographic characteristics, clinical symptoms, signs, and disease severity distribution in a cohort of 80 pediatric dengue patients. The findings support the growing recognition of the diverse clinical presentations of dengue fever, even within the same region and timeframe.

### Key Observations:

- A significant proportion of patients (67.5%) presented with dengue without warning signs (Group A).
- A substantial number (27.5%) exhibited warning signs (Group B), highlighting the importance of close monitoring to prevent complications.
- Thankfully, only a small percentage (5.0%) progressed to severe dengue (Group C).

- The analysis suggests potential associations between dengue severity and specific clinical parameters, such as the presence of hemorrhagic manifestations.

**Atypical Presentations:** The observed variation in clinical presentations aligns with the recent global trend of diverse dengue manifestations. Notably, the absence of hemorrhagic manifestations in the "dengue without warning signs" group (Group A) and their presence in the groups with warning signs (Group B) and severe dengue (Group C) deviates from some traditionally recognized features of the disease.

**Future Directions:** This study emphasizes the need for healthcare professionals to be aware of the evolving clinical spectrum of dengue fever. Further research with larger sample sizes is crucial to confirm the observed associations between clinical parameters and disease severity, allowing for better risk stratification and improved patient management.

In conclusion, this study adds to the growing body of evidence highlighting the multifaceted nature of dengue fever presentations. By acknowledging this variability and remaining vigilant for atypical features, healthcare professionals can enhance early diagnosis, risk assessment, and ultimately, patient outcomes.

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