

The Pattern of Hematological Abnormalities in NS1 Positive Dengue Patients: A Study in a Tertiary Care Hospital in Bangladesh

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Abstract:

Background: Dengue fever, caused by a mosquito-borne arbovirus, is characterized by painful febrile symptoms. Hematological abnormalities are frequently observed, especially in patients testing positive for NS1 antigen. NS1 antigen, a protein generated by the dengue virus during acute infection, is detectable in the blood of infected individuals. This study aimed to assess the pattern of hematological abnormalities in NS1-positive dengue patients. **Methods:** This prospective cross-sectional study was conducted in the Department of Medicine, Comilla Medical College, Cumilla, Bangladesh from July 2022 to June 2023. A total of 137 dengue patients who tested positive for NS1 were included as study subjects, selected through purposive sampling. Data processing and analysis were conducted using Office tools. **Results:** In this study, among our total participants, the

mean \pm SD hemoglobin was 13.2 \pm 1.8 g/dl, hematocrit was 39.4 \pm 5.4%, leucocyte count was 7.7 \pm 5.8 x10⁹/L, neutrophil count was 5.5 \pm 1.3 x10⁹/L, and lymphocyte count was 3.7 \pm 1.2 x10⁹/L, all of which were within normal ranges. However, the mean \pm SD platelet level was found to be 98.1 \pm 58.1 x10⁹/L, which was abnormally lower. **Conclusion:** Among NS1-positive dengue patients, hematological assessment reveals normal levels of hemoglobin, hematocrit, leucocytes, neutrophils, and lymphocytes. Although the mean hematocrit value is typically normal, a significant number of cases show values either higher or lower than the normal range. However, platelet levels are notably lower.

Keywords: Hematological abnormalities, NS1 positive dengue, Hemoglobin, Platelet, Headache, Arthralgia

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Introduction:

Dengue poses a significant public health threat globally, affecting approximately 2.5 billion people in over 100 countries.¹ The World Health Organization estimates around 50 million cases of dengue infection worldwide each year.² Transmitted by mosquitoes, dengue is classified as an arthropod-borne viral disease.³ The dengue virus belongs to the Flaviviridae family and comprises four antigenic types: dengue 1, 2, 3, and 4. The primary vector responsible for transmission is *Aedes aegypti*, known to bite during the daytime.⁴ Typical symptoms include fever, headache, myalgia, arthralgia, and minor hemorrhagic manifestations.⁵ Dengue fever presents with nonspecific symptoms and signs, necessitating laboratory confirmation of dengue infection. Individuals with a history of previous dengue infection are at risk of severe complications, including hypotensive shock and marked thrombocytopenia leading to spontaneous bleeding, such as epistaxis and gastrointestinal hemorrhage.⁶ Infections with any of the dengue virus strains can manifest with a wide range of symptoms, ranging from mild fever to life-threatening hemorrhage and shock.⁷ Timely and accurate diagnosis is crucial for optimal patient management and the efficient allocation of hospital

resources, including staff, beds, and equipment⁸ The laboratory-testing for dengue includes non-specific tests such as complete blood count, as well as definitive tests like dengue serology and NS1 antigen test.⁹ Variations in test results may occur due to factors such as the epidemiological aspects of the disease, the testing kit used, and the method employed.¹⁰ Throughout the course of the disease, various hematological and biochemical changes occur, which are dependent on the clinical presentation.¹¹ The clinical features of dengue infection may resemble those of other infections, and serological tests, although definitive, can be costly and may not be available in many hospitals.¹² Understanding the clinical features and interpreting laboratory findings, including hematological and biochemical parameters, are crucial for guiding therapy and assessing the prognosis of dengue fever. Common hematological and biochemical abnormalities observed include thrombocytopenia, anemia, leukopenia, as well as elevated levels of AST and ALT.¹³ The objective of this study was to assess the pattern of hematological abnormalities in NS1-positive dengue patients.

Methodology:

This was a prospective cross-sectional study that was conducted in the Department of Medicine, Comilla Medical College, Cumilla, Bangladesh from July 2022 to June 2023. The study comprised 137 dengue patients who tested positive for NS1 antigen, selected through purposive sampling. All the selected cases with confirmed dengue fever were enrolled in a structured protocol that included pertinent hematological investigations. The diagnosis of dengue fever was made based on the WHO criteria. Written consent was obtained from all participants before data collection. According to the inclusion criteria of this study, NS1-positive dengue patients of any age and gender presenting with clinical signs and symptoms of dengue fever and admitted to the mentioned hospital were included. Patients with previously known blood disorders were excluded based on the exclusion criteria. Properly written consent was obtained from all participants before data collection. Demographic and clinical information of the participants was recorded, and data were processed and analyzed using MS Office tools.

Result:

Among our total participants, the majority (75%) were from the ≤ 18 years age group. Additionally, 13%, 7%, and 5% of cases were from the 19-30, 31-40, and >40 years age groups, respectively. More than half of the

patients (61%) were male, while the remaining patients (39%) were female. The majority of our patients presented with a headache (84%), generalized pain (66%), and vomiting (53%). Additionally, 47%, 32%, 30%, 27%, and 22% of cases reported arthralgia, pain in eye movement, depression, diarrhea, and prostration, respectively. Among our total participants, in analyzing the hematological parameters, the mean \pm SD hemoglobin (13.2 ± 1.8 g/dl), hematocrit ($39.4 \pm 5.4\%$), leucocyte ($7.7 \pm 5.8 \times 10^9/L$), neutrophil ($5.5 \pm 1.3 \times 10^9/L$) and lymphocyte ($3.7 \pm 1.2 \times 10^9/L$) levels were found normal. However, the mean \pm SD platelet level was found $98.1 \pm 58.1 \times 10^9/L$ which was abnormally lower. Biochemical analysis revealed elevated levels of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) in 20% and 23% of total cases, respectively. Serum creatinine was elevated in 2% of cases. In our study, examination findings revealed that the majority of cases (91.2%) exhibited lymphadenopathy, followed by a rash (25.5%), pleural effusion (14.6%), tachycardia (12.4%), ascites (10.9%), petechiae (9.5%), and positive tourniquet test (6.6%). The mean temperature was $100.66^\circ F (\pm 1.7)$, systolic blood pressure was 112.01 mmHg (± 13.13), and diastolic blood pressure was 79.1 mmHg (± 10.02).

Table-I: Age distribution of participants

Age (Years)	Number	%
≤ 18	103	75%
19-30	18	13%
31-40	9	7%
>40	7	5%
Total	137	100%

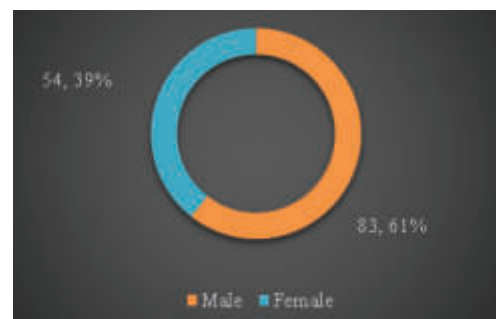


Figure-1: Gender distribution

Table-II: Presenting complaints

Complaints	Number	%
Headache	115	84%
Generalized pain	91	66%
Vomiting	72	53%
Arthralgia	65	47%

Pain in eye movement	44	32%
Depression	41	30%
Diarrhea	37	27%
Prostration	30	22%
Hyperesthesia	26	19%
Scleral injection	21	15%
Pharyngitis	19	14%
Backache	8	6%
GI bleeding	7	5%
Epistaxis	6	4%
Vaginal bleeding	3	2%

Table-III: Hematological parameters

Variables	Mean ±SD	Status
Hemoglobin (g/dl)	13.2±1.8	Normal [14]
Hematocrit (%)	39.4±5.4	Normal [14]
Platelet (nx10 ⁹ /L)	98.1±58.1	ABN [15]
Leucocyte (nx10 ⁹ /L)	7.7±5.8	Normal [16]
Neutrophil (nx10 ⁹ /L)	5.5±1.3	Normal [17]
Lymphocyte (nx10 ⁹ /L)	3.7±1.2	Normal [18]

ABN: Abnormal

Table-IV: Biochemical parameters

Variables	Number	%
Raised ALT	28	20%
Raised AST	31	23%
Raised serum creatinine	3	2%

ALT: Alanine aminotransferase, AST: Aspartate aminotransferase

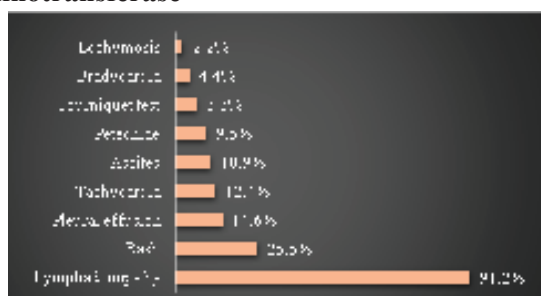


Figure-2: Examination findings

Discussion:

The majority (75%) of our participants belonged to the ≤18 years age group. Furthermore, 13%, 7%, and 5% of cases were from the 19-30, 31-40, and >40 years age groups, respectively. Similar findings were observed in another study.¹⁹ In this study, 61% of the patients were male, with the remaining 39% being female. This aligns with findings from a study in Saudi Arabia, where the number of male patients infected with

dengue fever outnumbered females.²⁰ The majority of our patients experienced headache (84%), generalized pain (66%), and vomiting (53%). Additionally, 47%, 32%, 30%, 27%, and 22% reported arthralgia, pain in eye movement, depression, diarrhea, and prostration, respectively. In another study,²¹ fever (96.5%), headache (40.6%), gastrointestinal symptoms (30%), nausea or vomiting (23.1%), myalgia (19.0%), rash (4.6%), and bleeding (3.2%) were identified as the most common symptoms. Among our total participants, hematological parameters were analyzed, revealing normal mean values for hemoglobin (13.2±1.8 g/dl), hematocrit (39.4±5.4%), leucocyte count (7.7±5.8 x10⁹/L), neutrophil count (5.5±1.3 x10⁹/L), and lymphocyte count (3.7±1.2 x10⁹/L). However, the mean platelet level was abnormally lower at 98.1±58.1x10⁹/L. Another study highlighted thrombocytopenia²² as the most significant laboratory abnormality observed in dengue patients. A Bangladeshi study²³ reported that among cases with platelet counts ≤20,000, 37.9% exhibited petechiae, 34.4% experienced hematemesis, and 27.5% presented with melena. They also noted that among all NS1-positive patients, the platelet count was less than 150 x 10⁹/L in 30.43% (n=49) of cases and less than 100 x 10⁹/L in 49.69% (n=80) of patients. In another recent study,²⁴ it was found that the proportion of patients with a platelet count >100,000/cumm was 26%, 22%, and 35% on baseline, day 3, and day 5, respectively. Conversely, the proportion of those with a platelet count <20,000/cumm was 16%, 10%, and 6% on baseline, day 3, and day 5, respectively. In this study, according to the biochemical parameters, elevated levels of ALT, AST, and serum creatinine were observed in 20%, 23%, and 2% of cases, respectively. In a study by Ferede et al.,²⁵ AST elevation was found in 45.1% of cases, while ALT elevation was found in 17.6% of cases. The findings from this study could be beneficial for guiding future research in similar areas.

Conclusion:

Among NS1-positive dengue patients, hematological assessment typically reveals normal levels of hemoglobin, hematocrit, leucocytes, neutrophils, and lymphocytes. Although the mean hematocrit value is generally within the normal range, a significant number of cases exhibit values that are either higher or lower than normal. Notably, platelet levels are significantly lower, which is a hallmark of dengue infection. This thrombocytopenia is crucial for diagnosis and monitoring, as it can indicate disease severity and the potential for bleeding complications. These hematological patterns help guide clinical management and intervention strategies for dengue patients.

Limitation of the study:

The single-center approach, small sample size, and short duration of this study may limit the generalizability of findings to the entire country. Therefore, caution is advised when extrapolating the results, as they may not accurately depict the broader scenario across the entire country.

Conflict of interest: None declared.

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