A Cross-Sectional Study of Dengue Virus to Observe Neutrophil-Lymphocyte Ratio as a Predictor of Severity

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Abstract

Background: A viral febrile disease termed as dengue can cause a variety of illnesses, including shock and hemorrhagic disorders. In numerous clinical circumstances, the neutrophil to lymphocyte ratio proved a reliable indicator of stress and morbidity. Our research intends to determine the relationship between NLR, thrombocytopenia, and dengue virus fever symptoms in patients.

Method: In a tertiary care facility, this prospective cross-sectional study is being conducted. In this investigation, 54 patients with a history of a fever higher than 38.5 degrees Celsius and positive results for the NS1 antigen or Dengue IgM were included. From the first day of admission to the time of recovery or discharge, all patients had standard investigations (NS1 antigens, IgM dengue). Patients are clinically followed up on, and CBC was done every day. For this study, the patients were divided into three groups, I - without any haemorrhage, II - with haemorrhage, and III - suffering from shock, based on the signs and occurrence of both haemorrhage and shock.

Results: In study, 32 (59.25%) males and 22 (40.75%) women out of 54 were enrolled. Most patients were between the ages of 18 - 25 years. The study group's average N:L ratio ranged from 0.23 to 2.20 on day 1 to 2.10 (0.1 to 7.8) on day 7. 13 individuals out of 54 exhibited bleeding manifestations, and among them, 6 showed shock symptoms. Despite the patients' lower platelet counts on day 7, NLR does not statistically significantly decrease. There is a statistically significant correlation between bleeding and shock occurring and a decrease in NLR in dengue patients.

Conclusion: In view of this, there was a substantial correlation between the neutrophil to lymphocyte ratio and the severity of dengue fever in adult patients. By monitoring the NLR, we may therefore anticipate the prognosis and the severity of the disease in patients. A lower NLR ratio makes the condition more severe.

Keywords: Dengue Fever, Neutrophil, Lymphocyte, Severity

Introduction

Dengue With symptoms including fever, prostration, headache, myalgia, rash, lymphadenopathy, and leukopenia, dengue is an acute, short-term, self-limiting illness that typically lasts 5-7 days [1,2].

It is brought on by four antigenically related but different types of dengue viruses that are spread through the bite of infected Aedes mosquitoes, particularly Aedes aegypti, Aedes albopictus, and Aedes These viruses are thought to have originated from sylvatic strains in the South-East Asian forests [3].

Clinically, the febrile phase, critical phase, and recovery phase are used to separate patients with dengue virus disease development. WHO classified the severity of the infection into Dengue Fever (DF) and Dengue Hemorrhagic Fever (DHF), with grades I, II, III, and IV [4].

The neutrophil-to-lymphocyte ratio, generally known as the NLR, has exhibited a promising correlation with body stress. The number of neutrophils rises while the number of lymphocytes falls during physiological stress [5].

Following an acute physiologic stress, NLR increases quickly. Due to the immune system's excessive response, the degree of dengue severity is also known to be correlated with the inflammation that develops after a dengue infection [6].

NLR, as a predictive marker for dengue, has not, however, been the subject of any investigations. The purpose of this research is to determine whether NLR can act as a simple indicator of the severity of the disease and the prognosis of dengue fever. This study aims at establishing the relation of NLR on severity of dengue.

Material and Methods

A total of 54 patients were enrolled in the prospective cross-sectional study. By using the mean, standard deviation, percentage, and frequency, the statistical analysis was carried out.

Study Design

A total of 54 patients were admitted to the hospital wards with positive NS1Ag or Dengue IgM findings, and they were chosen using selection approaches when their fever was higher than 38.5 degrees Celsius. From the initial day of enrollment till the moment of recovery or discharge, the enrolled patients were subjected to investigations.

Inclusion criteria

- People over the age of 18 who had a Ns1Ag or IgM diagnosis of dengue were included.
- Patients have fevers that are higher than 38.5 °C

Exclusion criteria

- Individuals below the age of 18 and above 60 were not included.
- Conditions such as hematologic malignancies, immunosuppression, HIV positivity, and known viral pathogen infections were excluded.

Results

54 patients including all comprised the study's sample, with 32 of them (59.25%) men and 22 of them (40.75%) women, for a ratio of 1.3:1. The study group's demographic ranged in age from 18 to 45, with a mean age of 28.54 5.8 years. The maximum age group of patients was 18- 25 years of age as shown in Table 2.

Table 1: Patient's distribution based on Gender

Gender	Frequency (n)	Percentage (%)
Male	32	59.25
Female	22	40.75
Total	54	100

Table 2: Patients distribution based on age group

Age group	Frequency (n)	Percentage (%)
18- 25 years	29	53.70
26-35 years	16	29.62
36-45 years	7	12.9
45- 60 years	2	3.7
Total	54	100

According to the dengue severity grade, as shown in Table 3, there were 31 patients (57.4%) who had hemorrhagic fever grade I, 15 patients (27.7%) who had DHF grade II, and 8 patients (14.9%), who had DHF grade III.

On day 1 (92000 to 3,60,000), the study group's mean platelet count was 145,000, and on day 7 (15000 to 306000), it was 89540. On day 1 the mean neutrophil count ranged from 2700 to 8200, while on day 2 it was 3416.8. (1800 – 7120). On days 1 and 7, the median lymphocyte levels were 48.9 (12 to 82) and 41.6 (10 to 80), respectively. On day 1 the study group's mean N:L ratio was 2.10 (0.1 to 7.8), while on day 7 it was 0.92 (0.23 to 2.15) in Table 4.

Table 5 shows the relationship between NLR and the number of patients who had bleeding manifestations and those who had shock-like symptoms. Only one patient had platelet count less than 5000 per mm^3 with both bleeding manifestations and shock.

Table 3: Patients distribution based on DHF severity grade

DHF severity Grade	Frequency (n)	Percentage (%)
Grade I	31	57.4
Grade II	15	27.7
Grade III	8	14.9
Grade IV	0	0
Total	54	100

Table 4: Relationship between platelet count and Neutrophil to Lymphocyte Ratio

Platelet count	NLR Range						
	<=0.400	0.401-0.800	0.801-1.200	1.201-1.600	1.601-2.000	2.001>	Total
<20000	0	1	1	0	0	0	2
20001-50000	0	3	4	7	1	0	15
50001-100000	0	1	2	6	8	1	18
100001-200000	0	2	5	6	2	0	15
>200000	0	0	1	1	0	2	4
Total	0	7	13	20	11	3	54

Chi square test= 45.76, DF= 9, P< 0.001

Table 5: Relation between NLR with bleeding manifestations and shock

NLR	Dengue fever	Bleeding Manifestations	Shock
<0.4	0	0	1
0.4-0.8	5	3	4
0.8-1.2	13	6	1
1.2-1.6	11	3	0
1.6-2.0	5	1	0
>2.0	1	0	0
Total	35	13	6

Chi square test = 22.43, DF = 19, P= 0.36 (NS)

Discussion

Since there are no specific markers that can diagnose dengue fever early, it is difficult to distinguish it from other viruses that are common in our area. This study aims to analyse clinical and epidemiological data, as well as laboratory dynamics, in order to try to uncover biomarkers that are predictive of severity because it is a condition that can progress with serious consequences and even be fatal.

A single-stranded, positive, non-segmented RNA virus from the Flaviviridae family, which causes dengue, is responsible [7]. A person may contract an infection up to four times because immunity to just that serotype is conferred by one serotype infection. The primary source of dengue virus is humans.

Leucopenia is frequently caused by dengue infection. Leucopenia is a sign that the febrile state may deteriorate and the patient will move into the critical stage. The neutrophil and lymphocyte count ratio will change during the critical phase, with the neutrophil count decreasing so that it is less than the lymphocyte count (5000 cells/mm3) [8].

The male to female ratio in these studies is 2:1, according to Vibha, *et al*. [9], Fu Xi Qui, *et al*. [10], Agarwal, *et al*. [11]. This is because males are more likely to contract an infection from a mosquito bite during the daytime hours while they are working outside.

In our investigation, we discovered a statistically significant relationship between the decline in NLR (neutropenia and relative lymphocytosis), which directly correlates with an increase in infection morbidity and mortality, and the severity of dengue virus fever. In their study, Irmayanti *et al*. [12] found a significant correlation between NLCR and dengue infection (p 0.05). The mean NLCR on DHF grade I is 2.19 and DHF grade II is 0.80, demonstrating that the severity of the dengue infection increases with decreasing NLCR, which is consistent with our study. There was a statistically significant difference between NLCR and DF and DHF, according to a second cross-sectional investigation by Kariadi *et al*. [13].

According to MA Koundinya *et al*. [14], there was a significant correlation between NLR and the severity of the disease since, in their study, all but a patient with an NLR of less than 0.9 had bleeding symptoms, and total of 8 shock patients had an NLR of less than 1. A few study, however, also came to the contrary conclusion. However, when used samples from the third and fourth day of fever, whereas most other studies, including our study, analysed the results on the sixth and seventh day of illness. Nusa *et al*. [15] came to the conclusion that there was no significant relationship between NLCR and dengue severity grade (p = 0.63). The amount of inflammation is predicted by the NLR, which can also be used to predict the severity of the inflammation and the prognosis [16].

Conclusion

It is clear from the current study that the neutrophil to lymphocyte ratio and the severity of dengue fever are significantly correlated. The presence of complications like haemorrhage and shock may be well predicted by NLR. The condition becomes more severe when the NLR ratio decreases.

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