

ORIGINAL ARTICLE

Potential Hematological Predictors Assessing Severity in Patients Presenting with Dengue

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ABSTRACT

Aim: To determine the potential hematological predictors and biochemical markers for assessing severity in patients presenting with dengue

Methods: This descriptive study was conducted at Jinnah Medical College/ District Specialist Naseerullah Babar Memorial Hospital, Peshawar in the duration from March, 2022 to August, 2022 on 150 Dengue NS1 (ICT) positive patients. Hematological and biochemical markers were assessed among severe vs non-severe dengue fever patients. Hematological and biochemical markers were assessed by T-test with $P < 0.05$ as significant.

Results: Hematocrit (%), AST (U/L) and ALT (U/L) levels were higher significantly in the severe dengue patients' vs non-severe dengue fever patients, platelet (mcL) and White blood cells (mcL) were significantly lower in the severe dengue patients' vs non-severe dengue fever patients.

Conclusion: We conclude that Hematocrit (%), platelets count, White blood cells, Alanine transaminase (ALT) (U/L) and Aspartate aminotransferase (AST) (U/L) and are important hematological and biochemical predictors for assessing the severity of dengue.

Keywords: Hematological markers, Biochemical markers, Dengue fever, Severity

INTRODUCTION

Dengue fever and its mosquito vectors have been present in numerous tropical regions across three continents for over 200 years. Due to low risk of exposure, susceptible communities experienced protracted slumps between reported dengue epidemics in the early stages¹. Pathogens and the mosquitoes that spread them had a harder time making it over sea borders².

There are major outbreaks in five out of the six WHO regions^{3,4}. Forty percent of the world's population lives in urban, tropical or subtropical settings, making them vulnerable to dengue virus infections. Every year, there are around one hundred million cases of dengue fever and 500,000 cases of dengue hemorrhagic fever worldwide, with an average case mortality rate of around 5%^{4,5}. Children under the age of 15 account for approximately to 90% of DHF cases⁴. The serotypes responsible for widespread dengue outbreaks have changed⁶. DEN-2 and DEN-3 is the common dengue serotype in Asia⁷.

There is no consensus on what has sparked a global comeback in dengue fever and dengue hemorrhagic fever epidemics. Population increase, unchecked urbanization in tropical and subtropical regions, the spread of Aedes mosquito breeding places, and ineffective mosquito control are all possible causes⁸. Because of these elements, the vectors are more widely dispersed and densely packed. Dengue viruses have been rapidly evolving. Additionally, the less dangerous virus genotypes have been replaced by the more dangerous ones⁹.

Dengue infection can cause a wide range of symptoms, from moderate dengue fever to a life-threatening condition called dengue shock syndrome, marked by severe plasma rupture and bleeding features. The World Health Organization (WHO) recommends several indicators for clinical and laboratory diagnosis of dengue to enable physicians in making a diagnosis and defining the category of dengue infection¹⁰.

Leukopenia is the most notable hematological change, but lymphocytosis (the presence of abnormal lymphocytes) is also common. Thrombocytopenia and an increased hematocrit are hallmarks of DHF. Early screening of dengue is vital for providing the individualized care that guarantees a marked decline in the disease's prevalence^{11,12}.

This is especially important in low-income countries with underdeveloped health care systems. Our study's prime focus is to

identify the hematologic indicators that may be indicative of dengue severity.

MATERIAL AND METHODS

This descriptive research was carried out at Jinnah Medical College/ District Specialist Naseerullah Babar Memorial Hospital, Peshawar in the duration from March, 2022 to August, 2022. We selected 150 using a non-probability method. Dengue NS1 (ICT) positive patients of both sexes and of all ages were included. Patients were not included in our study if they had a history of blood diseases, cancer, or immune-related issues, or if they were unwilling to engage in our study. All the patients were briefed about the study and signed a written consent after ethical approval. Hematological markers and biochemical markers, including hematocrit (%), White blood cell count (mcL), Alanine transaminase (ALT) (U/L), Aspartate aminotransferase (AST) (U/L), and platelet (mcL) count, were determined from sterile blood samples collected from all patients. The information was compiled in a standard proforma.

IBM SPSS version 20 was used to analyze the data.

Quantitative factors, such as gender, were measured in frequencies and percentages, whereas qualitative variables, such as age and biochemical parameters, were measured in terms of means and standard deviations. T-test for independent was used to assess quantitative variables with P value < 0.05 as significant.

RESULTS

This study was conducted on 150 patients presenting with dengue fever. The average age recorded was 37.80 ± 11.52 years. According to age distribution 30.67% patients were in the age cluster of 18 to 30 years while majority of the patients were in the age cluster of 31 to 45 years (40%). There were 29.33% patients in the age cluster of 46 to 60 years. According to the gender distribution majority of the patients were male accounting for 56.67% of the patients while 43.33% were females.

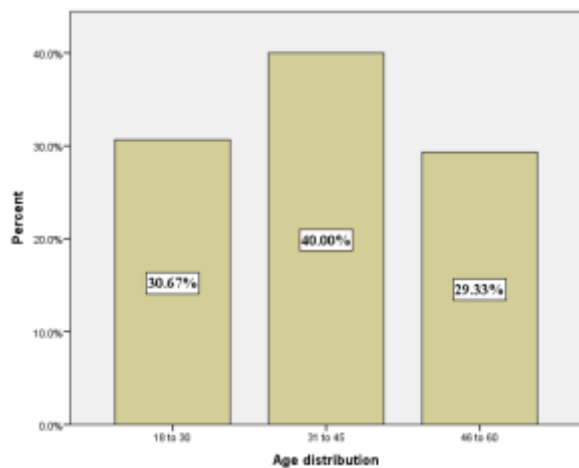
In our study 38.67% patients were presented with severe dengue while 61.33% patients were presented with non-severe dengue.

The hematological markers and biochemical markers such as hematocrit (%), White blood cell count (mcL), Alanine transaminase (ALT) (U/L), Aspartate aminotransferase (AST) (U/L)

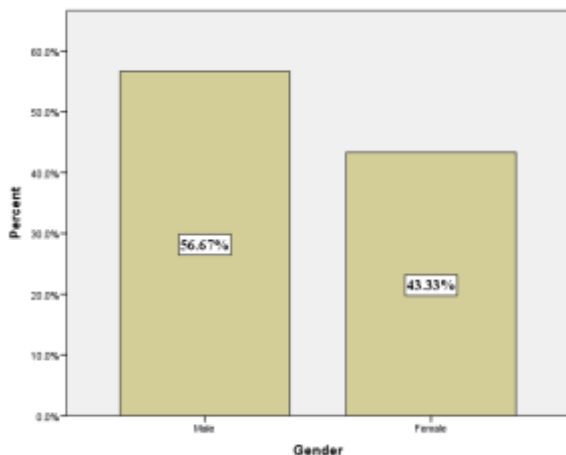
and platelet (mcL) count were compared between severe dengue patients and non-severe dengue patients. Hematocrit (%), Aspartate aminotransferase (AST) (U/L) and Alanine transaminase (ALT) (U/L) were significantly higher in the severe dengue patients as compared to the non-severe dengue patients (49.95±6.72 vs 42.89±3.188 [P = 0.0001], 462.3276±29.80191 vs 212.4348±30.46392 [P = 0.0001], 405.3793±55.71917 vs 128.7174±24.477 [P = 0.0001]) while platelet (mcL) and White blood cells (mcL) were significantly lower in the severe dengue patients as compared to the non-severe dengue patients (58425.57±3595.556 vs 117494.54±4092.231 [P = 0.0001], 3952.50±98.958 vs 4434.74±209.339 [P = 0.0001]).

Table 1: Comparison of hematological markers and biochemical markers between severe and non-severe dengue patients

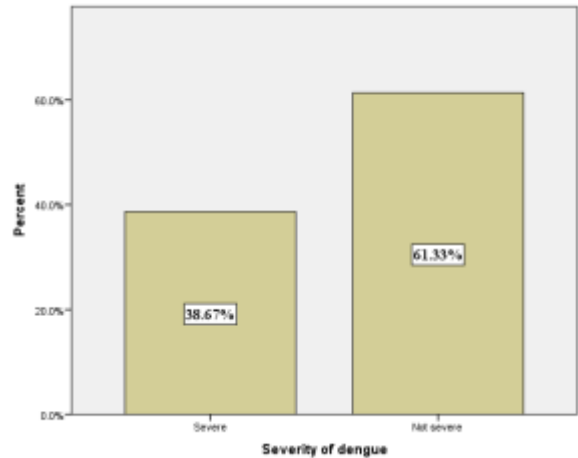
	Severity of dengue				P value
	Severe		Not severe		
	Mean	Std. Deviation	Mean	Std. Deviation	
Hematocrit (%)	49.95	6.724	42.89	3.188	0.0001
Platelet (mcL)	58425.57	3595.556	117494.54	4092.231	0.0001
White blood cells (mcL)	3952.50	98.958	4434.74	209.339	0.0001
Aspartate aminotransferase (AST) (U/L)	462.3276	29.80191	212.4348	30.46392	0.0001
Alanine transaminase (ALT) (U/L)	405.3793	55.71917	128.7174	24.47709	0.0001



Graph 1: Age distribution



Graph 2: Gender distribution



Graph 3: Severity of dengue

DISCUSSION

The mosquito-borne disease dengue can be found in both tropical and sub-tropical areas worldwide. Recent years have seen an uptick in transmission, especially in urban settings, making this an important international public health problem.¹²

The World Health Organization has reported that dengue fever has spread at an alarming rate during the past few decades. It is estimated that between 100 and 400 million new cases of dengue virus infection occur year, with the greatest prevalence in Asia and America. Dengue fever has become endemic in Vietnam, with each year bringing a new wave of cases.¹³

The course of dengue fever typically lasts between 2 and 7 days, and consists of three stages: the feverish stage, the critical stage, and the recovery stage. Shock, major hemorrhage, and organ failure are some of the most communal reasons of mortality. In the clinic, symptoms like patients with dengue have reported a range of symptoms, from fever and rash to myalgia and bleeding, with less common symptoms including nausea, vomiting, abdominal discomfort, and enlarged liver. Most dengue patients can be managed as outpatients and checked for dengue cases with cautionary signals for hospitalization, as per WHO recommendations.¹³ Dengue patients, however, frequently exhibit abnormal progression, especially during the severe stage of the illness. In addition to shock syndrome, other serious diseases, such as severe bleeding and reduced organ function, have been described more often in dengue patients in recent years. Acute kidney damage (AKI) is a growing worry in the already dire scenario of liver failure because it impacts treatment results. Laboratory tests are sometimes the only way to confirm organ failure in dengue patient. Some recent studies have therefore proposed the use of biochemical such as ALT and AST to predict severe or serious dengue patients along with hematocrit and platelet indices.¹⁴

We conducted this study on 150 patients presenting with dengue fever. We found that majority of the patients belonged to the male gender accounting for 56.67% of total patients. In accordance with our findings a study¹⁵ reported that dengue fever is more prevalent in the male population as compared to female population. One of the reasons for this higher prevalence is that the male gender is exposed to open environment for the majority of the time throughout the day.

We selected patients having between age having 18 to 60 years, in which majority of patients were from the age range of 31 to 45 years (40%). Various studies have shown that majority of dengue patients in their study were either less than 40 years of age or between 11 to 40 years.^{16, 17}

In our study we assessed several biochemical markers between severe dengue and non-severe dengue patients. Our research showed that patients with severe dengue had platelets

count < 10000 which is a significant predictor of severe dengue in both acute and chronic stages of the disease. It has been shown in various studies that in severe dengue fever patients the platelets count drops significantly^{16,17}. Many studies have indicated AST and ALT as indications in the prognosis of severe dengue, although the recommendations have been quite diverse^{18, 19}. On day 3 of illness, a predictive indication of early mortality was proposed if either the AST or ALT was greater than 203 U/L¹³. Although another retrospective study suggested AST and ALT cut-off values of 402 U/L and 653 U/L for severe dengue prognosis¹⁸, it did not recommend when examination should take place. Thus, ALT/AST were prognosis indicators for severe dengue; however, these indicators must be stated at the appropriate time and be concerned with threshold scores with prognostic value.

Some blood measures, including hematocrit > 40% or platelet count 50 G/L, have been proposed as indications for the prognosis of severe dengue²⁰. Our research, also showed that the hematocrit measure added predictive value to the severity of dengue. The mean hematocrit value significantly higher in the patients with severe dengue, these findings are also comparable to another study which reported the findings¹⁶.

We also observed that the mean WBC count was significantly lower in the severe dengue patients as compared to the non-severe dengue patients. Studies have suggested that WBC count > 5000 is strong predictor of severe dengue^{21, 22}.

CONCLUSION

From our study we conclude that ALT, AST, hematocrit and white blood cells (WBC) are important predictive biochemical markers for severity of dengue fever. Medical professionals should examine these markers for better management of dengue patients.

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