

Evaluation of Hematological Parameters in Dengue Patients of Peshawar

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ABSTRACT

Background: Dengue fever is caused by a virus called Dengue virus. A positive sense RNA virus belongs to *flaviviridae* family having four serotypes. The word "Dengue" is derived from Swahili language which means seizure-like cramps. Human-to-human transmission is through vector (Mosquito) *Aedes aegypti* and *Aedes albopictus*. Dengue virus was discovered in 1779 in Batavia. Dengue fever is differentiated into Dengue Fever, Dengue hemorrhagic fever, and Dengue shock syndrome.

Material and Methods: Dengue-suspected patients were screened for Dengue virus. Among these 120 were found positive for dengue virus. All the patients were screened using the NS1 strip method. A complete blood count test was performed for all the dengue-positive patients for evaluation of hematological changes. Data were entered in Microsoft Excel 2020, and further analyzed through SPSS-22.

Results: Among the dengue suspected patients 120 were found positive for dengue virus infection. Out of 120 patients 76(63%) were male and 44(36%) were female. 68% of the patients were in the middle age group (16-40 years), 7.5% of patients were lower age group (1-15 years) and 24.1% of patients were in the old age group (41-70 years). CBC results showed variation in hematological parameters. 41% of patients were found with low platelet count while in 73% of patients, WBC count was decreased below the normal range. A small portion of the patients showed low hemoglobin levels. Neutrophil levels also decreased in more than 70% of patients. In a few cases, the hematocrit level was out of range.

Conclusion: The study was conducted for the evaluation of hematological changes that occurred in patients infected by dengue. According to our study on dengue viral infection, a total of 120 patients were included of which 76(63%) were males and 44(36%) were females. Male frequency was higher than females affected by dengue fever. The median age group in our study was most affected by dengue fever. Platelet counts were low in 41% of infected patients, WBC levels were decreased than normal ranges in 73% and neutrophil levels were also affected which shows similarities with previous studies.

Keywords: Dengue fever. CBC Test. NS1. Dengue hemorrhagic fever. Dengue Shock Syndrome.

HOW TO CITE: Khanzada AB, Ejaz D, Ullah N. Evaluation of Hematological Parameters in Dengue Patients of Peshawar. National Journal of Life and Health Sciences. 2023 Dec; 2(1), 23-26.

DOI: <https://doi.org/10.62746/njlhs.v2n1.14>

Date of Submission: 25/03/2023

Date of Revision: 16/05/2023

Date of Acceptance: 19/06/2023

INTRODUCTION

Dengue fever is a viral infection caused by a virus called Dengue virus (DENV) through mosquitoes. Dengue virus is transmitted from one human to another through a vector called Aedes (Mosquito).¹ According to World Health Organization (WHO) in more than 100 countries 2.5 billion individuals are at high risk of Dengue Infection.² Annually estimation of 50 to 100 million individuals having dengue is reported.³

Dengue fever is characterized by the following signs and symptoms such as myalgia, headache, bone aches, high fever, retro-orbital pain, arthralgia, and hemorrhagic manifestation.⁴ Dengue fever is a disease caused by the transmission of a virus through mosquito bites. In 1997 the WHO classified dengue fever into three types, 1) Fever (Undifferentiated), 2) Dengue Fever (DF), and 3) Dengue Hemorrhagic Fever (DHF).⁵ DHF is further classified into four grades. Out of these grades, Grade III and Grade IV are called Dengue Shock Syndrome (DSS). Diagnostic tools used for dengue fever are IgM detection and NS1 antigen using ELISA. Leukopenia is the most common hematological change

observed.³ Dengue fever is a type of fever characterized by specific signs and symptoms such as high fever, weakness, body aches, headache, etc. Dengue fever is diagnosed by different serological procedures. The most often hematological changes caused by dengue fever are thrombocytopenia and leukopenia.⁶ In DHF high-grade fever with hemorrhagic phenomenon resulted in hepatomegaly and sometimes circulatory failure. In severe cases, it is called Dengue Shock Syndrome (DSS) which can lead to death.⁷

There are several factors responsible for the dengue epidemic such as waste management, water management, urbanization, population growth, and control management of dengue patients.⁸ In 2010 WHO reported dengue fever as one of the 17 neglected tropical diseases. After monsoon, the dengue fever cases peak as it has a seasonal pattern.⁹ In primary infection, IgM increases within 4 to 5 days after the onset of fever. IgM can be detected up to six months while in secondary infection IgM level is low as compared to the level of IgM in primary infection. In most of the cases, viral infection occurs in cells of monocyte-macrophages.¹⁰ Platelets and

vascular endothelium are targeted. In DHF patients, antigen-antibody complexes have been detected on the surface of the platelets, resulting in platelet destruction. Diagnostic tests are performed for the detection of dengue virus. IgM antibodies are detected after 3 -5 days by onset of illness while IgG can be detected at the end of the first week.¹¹ Serological tests like the Hemagglutination Test, Complement Fixation Test (CFT), Neutralization Test, and ELISA can be performed.¹² Detection of NS1 gene product can also help in the diagnosis of dengue fever. RT-PCR is used for viral nucleic acid detection.¹³

Early and accurate diagnosis of dengue fever can help in the proper management of the patients and optimization of the resources. In dengue fever, different hematological and biochemical changes occur therefore during the diagnostic process all the hematological and biochemical parameters are checked that can help in the therapeutics and prognosis of the dengue fever.¹⁴ Other changes that occurred are a raise in blood sodium and calcium, serum creatinine, and urea level.¹⁵ There is a strong association between severe dengue infections and hematological complications such as thrombocytopenia, plasma leakage, and bleeding tendency.¹⁶ In laboratory features of dengue, thrombocytopenia could be the most important one to monitor the dengue infection in patients. Thrombocytopenia can describe the severity of dengue infection, especially in DHF and DSS.¹⁷ The progression of the infection in patients can be predicted with the help of platelet count. According to WHO criteria, an individual could be suspected of dengue infection if having a fever for more than three days, has a history of traveling to dengue endemic areas, and low platelet/WBC count.¹⁸ Molecular diagnostic tests can be done for confirmation. Early recognition factors are very helpful in the provision of awareness among the community and reduction in morbidity rate of dengue infection.¹⁹ This study aimed to evaluate the hematological parameters in Dengue patients.

MATERIALS AND METHODS

The study design is a Comparative cross-section study. The study was conducted at Razi Institute of Medical Sciences Peshawar and different public and private sector laboratories of Peshawar. This study was conducted from July 2022 to October 2020. The patients who tested positive for dengue were part of this investigation. Patients who tested negative for dengue were excluded from this investigation. 120 participants in all were involved in this trial by using Yamane's Formula as directed;

$$\begin{aligned} \text{Sample size: } n &= N/1 + N(e)^2 \\ &= 170/1 + 170(0.0025) \\ &= 120 \end{aligned}$$

The patient's skin was cleansed using an antiseptic wipe and an elastic band or tourniquet was placed around the upper arm to help in vein swelling with

blood. A syringe needle was inserted in the vein and blood was collected in the sterilized syringe. The tourniquet was removed and the area was covered with a bandage to stop bleeding. The blood was collected in a vial, labeled, and sent to a laboratory for further procedure as soon as possible.

In the Dengue NS 1 Ag test, the sample well (S) is filled with three drops (about 100µl) of serum or plasma blood. A positive case of dengue was indicated by the emergence of a single-color line after 15 to 20 minutes. A negative result is displayed when the result window's side has two colored lines, the T band and the C line.

Nonconductive particles suspended in an electrolyte create detectable variations in electrical resistance, which are used in the Beckman Coulter method of particle size and counting. A tiny hole is simultaneously crossed by an electric current and a suspension of blood cells. Suspended particles go across the sensing zone, a tiny gap (aperture) between electrodes. Every particle shifts its volume of electrolyte in the sensing zone. The volume of the particle is related to the height of each voltage pulse used by Beckman Coulter to quantify the displaced volume. The amount of suspension that is pulled through the aperture is for a precise, repeatable volume. At many thousand counts per second, Beckman Coulter measures the size of individual particles. The density, color, and form of the particles have no bearing on this technique. A quantitative, automated differential cell counter designed for in vitro diagnostic applications is the MAXM. These parameters are measured in whole blood by the MAXM.

Microsoft Excel 2020 was used to enter the data, and SPSS-22 (Statistical Package for Social Sciences) was used for further analysis. Tables and graphs were used to display the data.

RESULTS

A total number of 120 patients were included in this study. Dengue-suspected patients were screened, and out of these 120 patients were found positive for dengue. Among 120 patients, 76 were male and 44 were female (Figure 01).

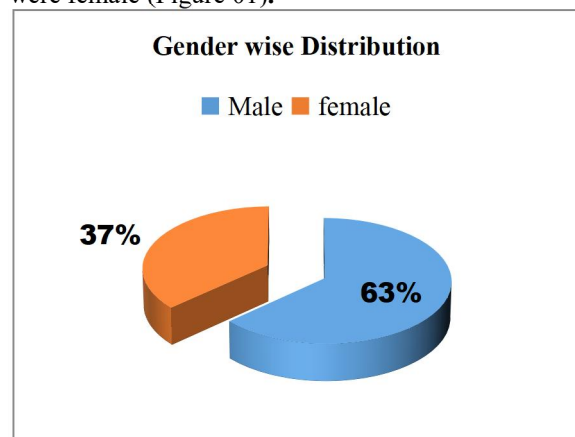


Figure 1: Graphical representation of gender-wise distribution of dengue-positive patients.

All the dengue-positive patients were distributed in different age groups. In group A, 07(5.8%) were male and 02(1.6%) were female, in group B 48(40%) were male and 34(28.3%) were female while in group C 21(17.5%) were male and 08(6.6%) were female (Table 1).

Table 1: Age-wise distribution of dengue-positive patients.

Age group	Male	Female	Total
Group A (1-15 yrs.)	07	02	09
Group B (16 – 40 yrs.)	48	34	82
Group C (41 – 70 yrs.)	21	08	29

Hematological parameters were evaluated for all the dengue-positive patients. According to findings platelet count was decreased in 49(41%) patients while WBCs count was decreased in 88(73%) patients. Hb level was decreased in 27(22.5%) male patients and 14(12%) female patients while hematocrit level was decreased in 07(5.8%) male patients and 03(2.5%) female patients. Neutrophils level was decreased in 86(71.66%) patients while lymphocyte level was decreased in 30(25%) patients (Table 2).

Table 2: Hematological changes in dengue-positive patients.

Hematological Test		No. of patients	Normal value
Platelet count	<150000	71	150000 – 450000/cumm
	≥150000	49	
WBC count	<4000	32	4000 – 10500/cumm
	≥4000	88	
Hemoglobin	Male ≤13	27	M 13-16, F 12-15
	Female ≤12	14	
Hematocrit %	Male >46	07	M 38-46, F 35-44
	Female >44	03	
Neutrophils	< 1500	86	1500 – 8000
	≥ 1500	34	
Lymphocytes	≤ 2900	90	2900 – 8000
	>2900	30	

DISCUSSION

Hundreds of Dengue suspected patients were screened for Dengue infection, out of these 120 individuals were found positive for dengue infection. They were further screened for complete blood count test (CBC Test). There were 120 patients total, 44 women and 76 men. Group 1 consisted of patients

aged 1 to 15 years, Group 2 of patients aged 16 to 40 years, and Group 3 of patients aged 41 to 70 years.

According to this study, several hundreds of participants were included in this study. After screening for dengue virus 120 participants were found dengue positive. Based on gender 63.33% of the dengue-positive patients were male while 36.66% of the dengue-positive patients were female. In contrast to this study, 76.5% of the participants were male while 23.5% of the participants were female.³ Another study revealed that out of 82 dengue-positive patients, 63% were male while 37% of the patients were females.²⁰

The study revealed that among all the dengue-positive patients 59.1% showed a platelet count <150,000/cumm and 41% of patients showed a platelet count ≥150,000/cumm while according to Preeti *et. al.*, 2018, 87% of the dengue positive patients showed platelet count <150,000/cumm that showed similarities in results.²¹ A study conducted showed that 42.68% of the dengue-positive patients had platelet count less than 150,000/cumm.²⁰

The current study evaluated the hematocrit level in all dengue-positive patients. Results showed 7.5% of the total patients with raised hematocrit levels. In contrast to this, a study conducted revealed that among all the dengue-positive patients 6% of them have raised hematocrit levels.³ Another study revealed 15% of the dengue patients have raised hematocrit levels.²²

According to this survey neutrophil and lymphocyte levels were evaluated. Neutrophilia and lymphocytosis were seen in 34% and 30% of cases respectively out of total dengue-positive patients while another study conducted revealed that there is neutrophilia in 14% of the total cases while lymphocytosis in 40% out of total cases.^{3, 22}

CONCLUSION

This study shows that dengue viral infection has a great impact on the hematological profile of a host. The study reveals that in most of the dengue-positive cases hematological parameters such as platelet count, hemoglobin level, neutrophil count, lymphocyte count, etc, are altered and in a great portion of the patients the level of these parameters crossed the normal ranges.

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