

Assessment of Hematological and Biochemical Markers in Dengue Fever: A Cross-Sectional Study

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Abstract:

In Pakistan, dengue fever has undergone significant demographic change over the past two decades, and as a result of globalization and climate change, the disease now poses a greater threat to humanity. By comparing the hematological and biochemical parameters in dengue-positive patients, this study seeks to better understand the ongoing endemic dengue fever in Peshawar, Pakistan. The cross-sectional observational study was conducted from November 2022 to January 2023 at Lady Reading Hospital in Peshawar, Khyber Pakhtunkhwa, Pakistan. A sample of 100 patients who tested positive for dengue was gathered and evaluated. Our findings show that those between 25 to 40 years are more likely to get dengue fever. The elevated alanine transaminase levels and significant p-value in the study indicated a link between dengue infection and liver cell damage. The study also discovered an increase in white blood cell count with marginally lower normal hemoglobin levels, which raises the possibility of an underlying immune system reaction or imbalance. Hematological and biochemical parameter means, however, fell within the normal range.

Keywords: Biochemical parameter, Dengue fever, hematological parameter Mosquito-borne disease,

Introduction:

Dengue fever:

Dengue fever is a mosquito-borne disease that significantly impacts the world, as the disease is a growing threat to humanity due to climate change and globalization (1). Dengue fever is the most prevalent mosquito-transmitted viral disease in humans. Dengue virus has four serotypes (DENV1 to DENV4) and can produce clinical illnesses ranging

from dengue fever, a broad-spectrum flu-like syndrome, to dengue hemorrhagic fever and lethal disease. Dengue is an acute, swiftly spreading, dengue fever disease that has a self-limited incubation period of 5-7 days, with myalgia, rash, headache, lymphadenopathy, and leukopenia (2). Dengue has been continuously escalating (a 30-fold increase over the past 50 years) to new areas and re-emerging in areas where it had recently been controlled. At present, dengue is spread to more than 129 countries and cases are increasing steadily over time:

0.51 million in 2000, 2.4 million in 2010, and 4.2 million in 2019. Asia accounts for about 70% of the global burden of dengue disease. A recent study shows that nearly 500 million people in the United States are at risk of contracting dengue. Countries in the world health organization's South-East Asia Region (WHO-SEAR) are severely affected with an estimated 1.3 billion people at risk. According to WHO, about 52% of the global population is at risk of contracting the dengue virus. PAHO (Pan American Health Organization) regional surveillance data on dengue infection reflects this rising trend in the global burden of dengue disease (3). Dengue virus is a member of the genus *Flavivirus* in the *Flaviviridae* family. Dengue virus has a single-stranded positive-sense RNA virus, about 11 kb in length, which encodes a long polyprotein that is synthesized a post-translational and host proteases, yielding three structural proteins (C, prM, and E) and seven nonstructural proteins (NS1, NS2A, NS2B, NS3, NS4A, NS4B, and NS5) (2). Dengue is spread by the of *Aedes* mosquito, mainly in the area where discharge water lines can occur within a few minutes to several weeks depend upon the environment. *Aedes* mosquitoes cause infection mostly during the daytime, but also at night. *Aedes aegypti* can sting several times before completing a single blood meal. The diseases are spread by the breeding and biting habits of *Aedes aegypti* and *Aedes albopictus* that keep them close to human (4). Their preferred hosts are people, and their favorite sites are the ankles and the nape of the neck. This mosquito may be identified by its white patterns on the legs and breast, which resemble lyres. A day before the onset

of a fever illness, a person with dengue viruses in their blood may transmit the viruses to mosquitoes, and the patient can remain to be infectious for the next 6-7 days. This mosquito can spread dengue if it bites another host immediately. Normal dengue viral replication in the mosquito salivary glands takes 8 to 12 days to complete (5).

According to one study, leucopenia was observed in (51%) of patients, and low platelet counts were found in (69.5%) of cases. (6). A previous study reveals that total protein (TP) and albumin levels in serum were significantly lower among dengue groups and increased transaminases (ALT 56.5% and AST 70.5%) case with increased levels of urea and creatinine than normal range (7). A further investigation revealed that the pathophysiology of subsequent dengue infections involves cross-reactive T cells and antibodies. (8). There are some vaccines as preventive measures and antiviral agents for the treatment of dengue fever, which are under clinical trials but their results have not yet been reported or approved. Scientific research has been done to find a permanent treatment for dengue fever, but till now, no successful invention has been found so far. Some general treatments for dengue patients can be used through painkillers and fluid replacement; however, specific treatment is needed to control the mortal effect of dengue fever (9). In the treatment of Dengue Shock Syndrome single dose of methylprednisolone showed no mortality benefit in a double-blind, placebo-controlled trial (10). The optimal control of dengue fever will diminish the presence of mosquito larvae around the house environment (11).

One study found that environmental factors such as climate, drainage systems, buildings designed with inaccessible rain gutters, and also poor drainage and plumbing system are the major reservoirs of Aedes habitats (12). The above review shows that a few of them don't enough have a sample size. One study includes only the liver profile. This study aims to correlate the hematological and biochemical parameters in dengue-positive patients to identify the ongoing endemic dengue fever in Peshawar Pakistan.

Method and material:

The study was conducted as cross-sectional observational research in the Pathology Department of LRH KPK Peshawar Pakistan. The study duration was three months, from November 2022 to January 2023. The research aimed to investigate the hematological and biochemical parameters in dengue fever patients. A total of 100 dengue positive patient samples were collected. The 5cc blood sample was collected aseptically according to the recommended method. The hematological tests were performed on MINDRAY 3000 Analyzer, while the biochemical parameters were measured using the chemistry analyzer (Cobas e622 Roch Company). Hematological and biochemical tests were run right away without freezing the sample after the sample was centrifuged and serum was extracted from all the samples. Patients who had dengue fever for at least seven days, had a high fever, had a low platelet count, and were between the ages of 18 and 70 were included in the study. The exclusion criteria were patients with no fever, normal platelet count, liver disease, low

platelets due to other diseases, and patients after two weeks of dengue fever. The data analysis was performed using SPSS version 25.

Result:

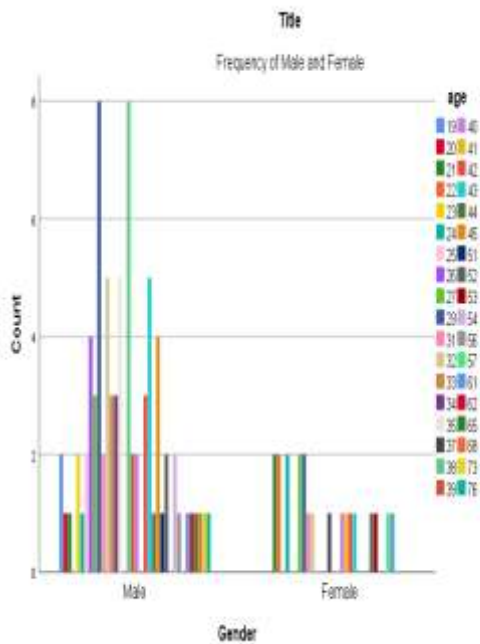
A total of 100 dengue patients were study in which 79(79%) were male and 21(21%) females show in table 1.

Table 1 Gender wise distribution

Gender	Percent	Valid percent	Cumulative percent
Male	79	39	79
Female	21	10	21
Total	100	50	100

In which dengue fever is common between age group 25-40-year-old shown in the figure 2.

figure 2 Frequency of positive patient



A 100 sample were analysis in which statistics were apply and data was not normally distributed. A non-parametric Friedman two-way analysis of test were applied which p- value less than 0.05. The mean and standard deviation of alanine transaminase and alkaline phosphate is 118.3 ± 46.3 U/L and 255.7 ± 60.5 U/L, serum bilirubin 0.98 ± 0.72 mg/dl, urea 30.6 ± 6.1 mg/dl, creatinine 0.98 ± 0.32 mg/dl .The result show that an association existed in which dengue infect patient have liver cell damaged, which raise the ALT level and p-value show in table

	N	Mean	Std. Deviation	Minimum	Maximum
WBC	100	5919.0	6676.48	2700	52000
HB	100	13.3	1.73	10	19
PLT	100	13559.3	55668.65	13000	39800
Neutro	100	65.9	14.21	37	96
Lymph	100	28.7	8.91	8	50

Table 3 statistic of biochemical parameter

	N	Mean	Std. Deviation	Minimum	Maximum
ALT	100	118.3	46.33	22	268
ALP	100	255.7	60.58	13	389
Bilirubin	100	0.98	0.72	0.5	8.00
Urea	100	30.6	6.11	16	48
Creatinine	100	0.98	0.32	0.1	2.60

The table 4 show that analysis includes 100 samples. The Friedman test's computed chi-square statistic is 381.09 points. There is very strong evidence to reject the null hypothesis that there are no differences between the groups when the asymptotic significance value (p-value), denoted as ".000," is less than 0.001.

Table 4 biochemical test statistic

N	100
Chi-Square	381.09
Asymp. Sig.	.000
Friedman Test	

The mean and standard deviation of white Blood cell $5919.0 \pm 6676.48/\text{ul}$, hemoglobin $13.3 \pm 1.7\text{g/dl}$, platelet $135593.0 \pm 55668.65/\text{mcl}$, Neutrophil $65.9 \pm 14.2\%$, lymphocyte $28.7 \pm 8.9\%$ shown in the table 5. The result show that increases in white blood cell with a few normal hemoglobin levels. The p-value for hematological parameter is less the 0.05

The table 6 show that the Friedman test's computed value of the chi-square statistic is 393.112.

Table 5 hematological test statistic

Test Statistics	
N	100
Chi-Square	393.112
Asymp. Sig.	.000
Friedman Test	

There is very strong evidence to reject the null hypothesis that there are no differences between the groups, as shown by the asymptotic significance value (p-value), which is less than 0.001 (shown as ".000").

Discussion:

In many tropical areas of the world, the dengue virus poses a serious hazard to public health. . In the past thirty years, there has been a significant change in the demographics and clinical characteristics of dengue infections. The dengue epidemic in Pakistan occurred in 2004, when the DV-2 serotype was discovered (13). After then, other investigations from Pakistan and other endemic locations showed DV-1 and DV-2

as the prevalent serotypes(14). The DV-2 and DV-3 genotypes were discovered to be common in Pakistan in 2006 (15). In this cross-sectional observational study, our findings indicate that the groups differ significantly for the variable under study when the Friedman test is applied to several related samples. One of the study showed

that in children

dengue is usually asymptomatic and frequencies of symptoms are influenced by age and sex (16). These results correlate with our study because in our study it is more common in the age group of 16-25 years and less common in children and older age group. The observed change in median age may be explained by adults developing immunity as a result of previous infections as the DV-2 strain has been present in the Pakistani community since 2004(13) (17). In terms of the hematological parameters, the results show that the mean white blood cell count is 5919.0, with a standard deviation of 6676.48. This suggests that there is a high degree of variation in white blood cell counts within the sample population. The mean hemoglobin level is 13.3 g/dL, which falls within the normal range for adult males and females. The mean platelet count is 135593.0, with a standard deviation of 55668.65, which indicates that there is also a high degree of variation in platelet counts within the sample population. The mean neutrophil percentage is 65.9%, which is within the normal range, and the mean lymphocyte percentage is 28.7%, which is also within the normal range. These result

are correlate with other review in which a progressive decrease in granulocyte count, i-e, neutrophils leading to huge decrease in leukocyte count, leukopenia being the most commonly reported finding (18). Relative lymphocytosis with cumulative atypical lymphocytosis is typically found in the febrile phase or in the recovery phase, the possible reason of neutropenia is apoptosis of neutrophils caused by the virus infection cumulative severity of dengue viral fever and NLR associates directly with the increased illness and death ratio of infection(19). Thrombocyte minimum value in our study is 13000 and maximum value is 398000, while one of the studies seen platelet counts of patients is 81.67 and SD is 92.5 which was below normal range of platelets. The pathophysiology of thrombocytopenia comprises bone marrow suppression and acute phase and direct invasion of megakaryocytes by virus thus causing their obliteration, related with bleeding indicator and third space fluid accumulation(20).

Mean values for alanine transaminase, alkaline phosphatase, serum bilirubin, urea, and creatinine are all within the normal range. However, there is some degree of variability within each parameter, as evidenced by the standard deviation values. Alanine transaminase (ALT) is an enzyme that is primarily found in the liver, and elevated levels can indicate liver damage or disease. The mean ALT value of 118.3 in this analysis is within the normal range, but some individuals in the sample population may have elevated levels. Alkaline phosphatase (ALP) is an enzyme that is found in many tissues throughout the body, but elevated levels are often associated with liver or bone

disease. The mean ALP value of 255.7 in this analysis is within the normal range, but again, some individuals in the sample population may have elevated levels. Serum bilirubin is a waste product that is produced when red blood cells break down. Elevated levels can indicate liver or bile duct disease. The mean serum bilirubin value of 0.98 in this analysis is within the normal range, but there is some degree of variability within the sample population. Urea and creatinine are both waste products that are produced by the body and eliminated through the kidneys. Elevated levels can indicate kidney disease or dysfunction. The mean values for both urea and creatinine in this analysis are within the normal range, but again, there is some degree of variability within the sample population we also absorbed the kidney function test In Dengue patient the minimum value of urea 16 g /dl and maximum value 48 g/dl. the minimum value of creatinine is 0.10 g/dl while maximum value is 2.60 g/dl (21).According to our study Neutrophil minimum value is 37 and maximum value 96 while minimum value of lymphocyte is 8 and maximum value is 50 correlating this NL ratio to the previous one study which accomplish a NLR as follow ,the mean neutrophil count was 5531.2 (2700 to 8,200) on day 1 and 3416.8 (1800 – 7120). The mean values of lymphocyte were 48.9 (12 to 82) and 41.6 (10 to 80) correspondingly on day 1 and day 7. The mean N:L ratio of the study group was 2.12 (0.1 to 8.2) on day 1 and 0.95 (0.23 to 2.20) on day 7. Out of 100 patients, 26 patients had bleeding indices and in them 8 had signs of shock (22).

Conclusion:

The finding of this study is white blood cell count, hemoglobin, and platelet count sample mean values were all within the normal range for hematological parameters. Neutrophil and

lymphocyte counts, however, had slightly higher and lower average levels, respectively. This implies that the sample population may be experiencing an underlying immune system reaction or imbalance. Alanine transaminase, alkaline phosphatase, serum bilirubin, urea, and creatinine sample mean values were all within the normal range for these biochemical markers. Yet, the Friedman test's significant difference finding suggests that there may be substantial differences in these parameters between the groups being compared. More research is required to pinpoint the precise causes of these variations and ascertain the consequences for general health and illness risk.

Limitation:

The limitation of this study is that samples size is relatively small, consisting of only 100 individuals. The study was carried out on a particular group thus it might not be

indicative of other populations that have different demographic or health features. Any confounding variables including drug usage, lifestyle choices, or medical history were not examined in the research. These variables could skew the findings and prevent us from reaching reliable conclusions.

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