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CORRELATION BETWEEN PLATELETS INDICES AND SEVERITY OF DENGUE FEVER

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Abstract

Dengue fever is a significant public health issue in tropical regions such as Pakistan, where recurrent outbreaks cause considerable morbidity and mortality. Early detection of severe cases is critical for improving patient outcomes. Platelet indices, including mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT), and platelet-large cell ratio (PLCR), are potential hematological markers reflecting platelet production and destruction dynamics during infection. This cross-sectional study included 150 laboratory-confirmed dengue patients admitted to Hayatabad Medical Complex, Peshawar, classified according to WHO criteria into dengue fever (DF), dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS). Platelet indices were analyzed using an automated hematology analyzer, and statistical analysis was performed using SPSS version 25. The results showed a significant reduction in platelet count and PCT with increasing disease severity, while PDW and PLCR values were significantly elevated in severe cases ($p < 0.05$). MPV demonstrated a mild decline with disease progression. These findings indicate that platelet indices, particularly PDW, PLCR, and PCT, are significantly associated with dengue severity and can serve as simple, cost-effective, and readily available markers for early prediction of severe disease. Routine assessment of platelet indices may enhance early diagnosis, clinical risk stratification, and timely management of dengue patients, especially in resource-limited healthcare settings.

1. INTRODUCTION

Dengue fever (DF) remains one of the most important arthropod-borne viral infections globally, transmitted primarily by *Aedes aegypti* and *Aedes albopictus* mosquitoes. According to the World Health Organization (WHO), approximately 390 million dengue infections occur each year, with nearly 96 million resulting in clinically apparent disease (1). The disease

manifests across a broad clinical spectrum from mild febrile illness to life-threatening dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) which continue to cause significant morbidity and mortality, particularly in tropical and subtropical regions (2,3).

Early identification of patients at risk of developing severe dengue is crucial for reducing mortality and guiding timely management. The critical phase of dengue infection often begins around defervescence, during which plasma leakage, hemorrhage, and organ impairment can develop abruptly (4). Hematological parameters are among the earliest measurable laboratory markers to change during dengue infection. Thrombocytopenia is a hallmark feature of dengue; however, it is neither specific nor always predictive of disease severity (5). As a result, platelet indices such as mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT), and platelet-large cell ratio (PLCR) have emerged as potential markers of disease progression (6,7).

The dengue virus (DENV) affects platelet dynamics through multiple mechanisms. Direct infection of megakaryocytic progenitors and platelets impairs thrombopoiesis and accelerates platelet destruction (8,9). In addition, immune-mediated mechanisms such as the generation of anti-platelet antibodies, complement activation, and cytokine-mediated bone marrow suppression further exacerbate thrombocytopenia (10). Elevated levels of pro-inflammatory cytokines interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and interferon-gamma (IFN-γ) promote endothelial dysfunction, increase vascular permeability, and enhance peripheral platelet consumption (11).

Platelet indices reflect these dynamic alterations. A low MPV is associated with impaired platelet production, whereas elevated PDW or PLCR values indicate increased platelet destruction and compensatory bone marrow activity (12,13). Similarly, decreased PCT represents overall platelet depletion and is closely associated with disease severity and plasma leakage (14). These indices, routinely generated by automated hematology analyzers, are cost-effective and reproducible parameters that can serve as accessible early warning markers, especially in low-resource settings (15,16).

Although several studies have examined the relationship between platelet indices and dengue severity, their findings remain inconsistent, likely due to variations in viral serotype, disease phase, and demographic characteristics (17,18). Thus, further investigation in diverse populations and clinical settings is needed to validate their prognostic value.

Rationale

Given the ongoing challenge of predicting dengue severity accurately and at an early stage, there is a pressing need to identify laboratory markers that are reliable, inexpensive, and easily obtainable. Platelet indices, derived from routine complete blood count (CBC) tests, present a promising yet underutilized diagnostic approach. These parameters mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT), and platelet-large cell ratio (PLCR) reflect dynamic changes in platelet production and destruction during dengue infection. Evaluating these indices may provide valuable insights into disease progression and assist clinicians in identifying patients at risk of developing severe dengue. Thus, this study focuses on exploring the correlation between platelet indices and the severity of dengue fever, aiming to enhance early clinical assessment and improve patient management outcomes.

2. Objectives

i. To evaluate the correlation between platelet indices (mean platelet volume, platelet distribution width, plateletcrit, and platelet-large cell ratio) and the severity of dengue fever.

ii. To determine whether platelet indices can serve as early prognostic markers for identifying patients at risk of developing severe dengue infection.

3. MATERIALS AND METHODS

This cross-sectional observational study was conducted from April 2025 to October 2025 at the Department of Pathology, Hayatabad Medical Complex, Peshawar, Pakistan, including 150 patients with laboratory-confirmed dengue infection. Diagnosis was established through positive dengue NS1 antigen and/or dengue-specific IgM antibody tests, and patients were classified according to World Health Organization criteria into dengue fever (DF), dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS).

Patients aged 15 years and above, of either gender, presenting during the acute phase of dengue infection were included. Those with pre-existing hematological disorders, chronic liver disease, other infections affecting platelet counts, or on medications influencing platelet function such as anticoagulants or antiplatelet agents were excluded.

Venous blood samples (2 mL) were collected in EDTA tubes under aseptic conditions, and complete blood counts were performed within two hours using an automated hematology analyzer to prevent in vitro platelet swelling. Platelet indices, including mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT), and platelet-large cell ratio (PLCR), were analyzed and compared across varying clinical severities to assess their correlation with disease progression.

Data were analyzed using SPSS version 25.0. Continuous variables were expressed as mean ± standard deviation, while categorical data were presented as frequencies and percentages. A p-value less than 0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Review Board of Hayatabad Medical Complex, Peshawar, and informed consent was obtained from all participants, with strict maintenance of confidentiality throughout the study.

4. RESULTS

A total of 150 patients with laboratory-confirmed dengue infection were enrolled in the study conducted at Sarhad University, Peshawar. The demographic, clinical, and hematological characteristics of the study participants are presented in the following tables.

4.1. Demographic Characteristics

Among the 150 patients included in this study, 84 (56%) were males and 66 (44%) were females, showing a slight male predominance. The mean age of the study population was 31.8 ± 10.7 years, with the majority of cases (68%) falling between 15 and 35 years of age. This indicates that dengue infection predominantly affected the younger population during the study period.

Table 4.1: Demographic Characteristics of Study Participants (n = 150)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	84	56.0
	Female	66	44.0
Age Groups (years)	15–25	48	32.0
	26–35	54	36.0
	36–45	28	18.7
	>45	20	13.3
Mean Age (years)		31.8 ± 10.7	

4.2. Clinical Profile and Disease Classification

Patients were classified according to the World Health Organization (WHO) criteria into dengue fever (DF), dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS). The majority of patients (54.7%) presented with DF, while 32% had DHF and 13.3% had DSS. The mean duration of illness was 5.6 ± 1.2 days, and the mean hematocrit increased with disease severity, indicating plasma leakage in more severe cases.

Table 4.2: Clinical Profile and Disease Classification (n = 150)

Clinical Parameter	DF (n = 82)	DHF (n = 48)	DSS (n = 20)	Total (n = 150)
Mean Age (years)	30.2 ± 9.8	32.4 ± 10.9	34.6 ± 11.5	31.8 ± 10.7
Gender (M/F)	46/36	28/20	10/10	84/66
Mean Duration of Illness (days)	5.3 ± 1.1	5.8 ± 1.3	6.0 ± 1.2	5.6 ± 1.2
Mean Hematocrit (%)	39.8 ± 4.1	42.3 ± 4.6	44.7 ± 4.9	41.2 ± 4.5

4.3. Platelet Indices and Disease Severity

Analysis of platelet indices revealed a consistent pattern of change with disease severity. The mean platelet count and plateletcrit (PCT) were lowest in patients with dengue shock syndrome, while platelet distribution width (PDW) and platelet-large cell ratio (PLCR) were highest in severe cases, indicating enhanced platelet destruction and bone marrow response. Mean platelet volume (MPV) showed a mild decrease as disease severity increased.

Table 4.3: Platelet Indices Across Different Severity Groups of Dengue (n = 150)

Platelet Parameter	DF (n = 82) Mean ± SD	DHF (n = 48) Mean ± SD	DSS (n = 20) Mean ± SD
Platelet count ($\times 10^9$/L)	112.4 ± 36.8	72.6 ± 28.4	45.3 ± 18.7
Mean Platelet Volume (MPV, fL)	9.4 ± 1.2	8.8 ± 1.1	8.2 ± 0.9
Platelet Distribution Width (PDW, %)	13.7 ± 2.1	15.3 ± 2.5	16.4 ± 2.8
Plateletcrit (PCT, %)	0.18 ± 0.07	0.11 ± 0.05	0.07 ± 0.03
Platelet Large Cell Ratio (PLCR, %)	22.3 ± 5.2	25.6 ± 6.1	27.8 ± 6.7

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Summary of Findings

The results demonstrate that platelet indices vary consistently with disease severity. Patients with severe dengue (DHF and DSS) showed pronounced thrombocytopenia, lower PCT, and higher PDW and PLCR compared with those with mild dengue fever. These findings suggest that routine assessment of platelet indices may provide early indicators for disease severity and prognosis in dengue infection.

5. DISCUSSION

The present study evaluated the correlation between platelet indices and the severity of dengue infection among patients admitted to Sarhad University, Peshawar. Our findings demonstrated a clear trend of declining platelet count, mean platelet volume (MPV), and plateletcrit (PCT) with increasing disease severity, while platelet distribution width (PDW) and platelet-large cell ratio (PLCR) showed a progressive rise in severe cases. These results suggest that platelet indices reflect dynamic changes in thrombopoiesis and platelet destruction during the course of dengue infection and may serve as useful indicators for assessing disease progression.

The decline in platelet count observed with increasing disease severity aligns with well-established evidence that thrombocytopenia is a hallmark of dengue infection. Thrombocytopenia results from both bone marrow suppression and peripheral destruction of platelets (19,20). However, platelet count alone is often insufficient to predict severe dengue, as the nadir may occur late in the illness (21). Therefore, platelet indices, which provide qualitative information on platelet morphology and kinetics, are gaining interest as potential early prognostic markers.

In this study, MPV was lower among patients with severe dengue (DHF and DSS) compared to those

with non-severe disease. Similar findings were reported by Hossain et al. (2023) in Bangladesh, who observed significantly lower MPV values in severe dengue, suggesting impaired platelet production due to megakaryocytic suppression (22). Conversely, Sujatha et al. (2022) found elevated MPV in severe cases, attributing this to early compensatory bone marrow activity (23). These variations highlight that MPV may fluctuate depending on the phase of illness and the balance between platelet destruction and regeneration.

The increase in PDW and PLCR observed among severe dengue cases in our study is consistent with findings by Reddy et al. (2023) and Hasan et al. (2022), who reported that higher PDW and PLCR values reflect platelet anisocytosis secondary to peripheral destruction and increased turnover (24,25). Elevated PDW may indicate simultaneous platelet destruction and release of immature, larger platelets into circulation a hallmark of reactive thrombopoiesis during dengue infection (26).

Plateletcrit (PCT), which represents the total platelet mass, showed a significant decline in severe dengue in our cohort. Patel et al. (2022) and Kumar et al. (2023) similarly reported lower PCT in patients with dengue hemorrhagic fever and shock syndrome, suggesting that reduced PCT is a reliable marker of overall platelet depletion and plasma leakage (27,28). Given that PCT and PDW are automatically generated by most hematology analyzers, they could serve as simple and cost-effective adjuncts in clinical risk assessment.

From a pathophysiologic standpoint, dengue virus (DENV) directly infects megakaryocytes, impairing platelet production while promoting immune-mediated destruction. Elevated cytokines such as interleukin-6 and tumor necrosis factor-alpha contribute to bone marrow suppression and vascular permeability (29). These mechanisms explain the observed alterations in platelet indices across different severity grades.

Clinically, these findings underscore the potential of platelet indices as early indicators of disease severity. Their routine assessment can complement clinical and serological parameters, aiding in timely identification of patients at risk for complications, particularly in resource-limited settings where advanced biomarkers are unavailable.

However, this study has certain limitations. Being a single-center cross-sectional study with a six-month duration, temporal variations in dengue serotypes and infection patterns were not fully captured. Additionally, serial measurements of platelet indices during disease progression could provide more robust insights into their predictive value. Future multicenter studies with larger sample sizes and longitudinal follow-up are recommended to validate these findings and establish standardized cut-off values for clinical use.

CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

The present study demonstrated that platelet indices, particularly platelet count, plateletcrit (PCT), platelet distribution width (PDW), and platelet-large cell ratio (PLCR), show significant variation with the severity of dengue infection. Patients with severe dengue (dengue hemorrhagic fever and dengue shock syndrome) exhibited marked thrombocytopenia, lower PCT, and higher PDW and PLCR values compared to those with mild disease. These findings suggest that routine assessment of platelet indices can provide valuable, early indicators of disease progression, supporting clinicians in timely risk stratification and management of dengue patients.

Given that platelet indices are readily available from automated hematology analyzers, their inclusion in routine diagnostic interpretation could enhance the early identification of high-risk patients, especially in resource-limited settings.

6.2 RECOMMENDATION

1. Platelet indices should be routinely evaluated in all dengue cases to aid in early prediction of disease severity and clinical outcomes.
2. Future multicenter studies with larger cohorts and serial monitoring of platelet indices are recommended to validate

these findings and establish standardized reference ranges for clinical application.

References

World Health Organization. Dengue and severe dengue. Geneva: WHO; 2024. Available from: https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue

1.Wilder-Smith A, Ooi EE, Horstick O, Wills B. Dengue. The Lancet [Internet]. 2019 Jan;393(10169):350–63. Available from: http://dx.doi.org/10.1016/s0140-6736(18)32560-1

Bhatt S, Gething PW, Brady OJ, Messina JP, Farlow AW, Moyes CL, Drake JM, Brownstein JS, Hoen AG, Sankoh O, Myers MF. The global distribution and burden of dengue. Nature. 2013 Apr 25;496(7446):504-7.

Simmons CP, Farrar JJ, van Vinh Chau N, Wills B. Dengue. New England Journal of Medicine [Internet]. 2012 Apr 12;366(15):1423–32. Available from: http://dx.doi.org/10.1056/nejmra1102165

Wiwanitkit S, Wiwanitkit V. Dengue and swine flu: An existed co-infection in clinical practice. Annals of Tropical Medicine and Public Health [Internet]. 2013;6(1):140. Available from: http://dx.doi.org/10.4103/1755-6783.115199

de Andrade Vieira Alves F, Nunes PC, Arruda LV, Salomão NG, Rabelo K. The Innate Immune Response in DENV-and CHIKV-Infected Placentas and the consequences for the fetuses: a Minireview. Viruses. 2023 Sep 6;15(9):1885.

Khatri B, et al. Utility of platelet indices in predicting the severity of dengue infection. BMC Infect Dis. 2023;23(1):890.

Sridharan A, Chen Q, Tang KF, Ooi EE, Hibberd ML, Chen J. Inhibition of Megakaryocyte Development in the Bone Marrow Underlies Dengue Virus-Induced Thrombocytopenia in Humanized Mice. Journal of Virology [Internet]. 2013 Nov;87(21):11648–58. Available from: http://dx.doi.org/10.1128/jvi.01156-13

St. John AL, Rathore APS. Adaptive immune responses to primary and secondary dengue virus infections. Nature Reviews Immunology [Internet]. 2019 Jan 24;19(4):218–30. Available from: http://dx.doi.org/10.1038/s41577-019-0123-x

Malavige GN, Ogg GS. Pathogenesis of vascular leak in dengue virus infection. Immunology [Internet]. 2017 May 24;151(3):261–9. Available from: http://dx.doi.org/10.1111/imm.12748

St. John AL, Rathore APS. Adaptive immune responses to primary and secondary dengue virus infections. Nature Reviews Immunology [Internet]. 2019 Jan 24;19(4):218–30. Available from: http://dx.doi.org/10.1038/s41577-019-0123-x

Ahmed S, et al. Mean platelet volume and platelet distribution width as markers of severity in dengue fever. *J Clin Diagn Res*. 2021;15(5):OC09–OC12.

Parameswaran K, et al. Evaluation of platelet indices in dengue: Correlation with disease severity. *Transfus Apher Sci*. 2024;63(2):103747.

Senanayake S, et al. Platelet indices and dengue severity: A hospital-based study. *PLoS Negl Trop Dis*. 2023;17(4):e0011247.

Sharma A, et al. Platelet indices as prognostic markers in dengue infection. *Int J Hematol Oncol Stem Cell Res*. 2022;16(3):177–184.

Mohan A, et al. Dynamic changes in hematological parameters and their prognostic value in dengue infection. *Front Med*. 2025;12:1456823.

Suresh S, et al. Platelet indices as early predictors of severity in dengue: A systematic review and meta-analysis. *Front Trop Dis*. 2024;5:1387712.

Jain H, et al. Platelet indices in dengue infection: Correlation with disease outcome. *BMC Hematol*. 2024;24(1):115.

World Health Organization. Dengue: Guidelines for Diagnosis, Treatment, Prevention and Control. Geneva: WHO; 2023.

Guo C, et al. Global epidemiology of dengue outbreaks. *Lancet Infect Dis*. 2022;22(9):e208–e219.

Srichaikul T, et al. Hematologic changes in dengue hemorrhagic fever. *Southeast Asian J Trop Med Public Health*. 2022;53(1):12–20.

Hossain MJ, et al. Platelet indices as predictors of severity in dengue fever: A cross-sectional study from Bangladesh. *BMC Infect Dis*. 2023;23(1):674.

Sujatha R, et al. Diagnostic utility of mean platelet volume in assessing severity of dengue infection. *Int J Res Med Sci*. 2022;10(6):1283–1288.

Reddy S, et al. Evaluation of platelet indices as early markers in dengue infection. *J Clin Diagn Res*. 2023;17(4):OC05–OC09.

Hasan N, et al. Role of platelet distribution width and plateletcrit in assessing severity of dengue fever. *Cureus*. 2022;14(8):e28391.

De Azeredo EL, et al. Pathogenesis of thrombocytopenia in dengue: Multifactorial mechanisms. *Front Immunol*. 2023;14:1162542.

Patel J, et al. Clinical relevance of plateletcrit and platelet indices in dengue infection severity. *J Lab Physicians*. 2022;14(3):249–254.

Kumar V, et al. Plateletcrit as a prognostic marker in dengue fever: A tertiary care study. *Asian Pac J Trop Med*. 2023;16(2):78–83.

Krishnasamy V, et al. Dengue virus infects human megakaryocytes and alters platelet function. *Nat Commun*. 2022;13(1):4501.

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