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Study of Platelet Parameters in Dengue Severity Grading

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Abstract: *Dengue fever is one of the most common diseases spread by mosquitoes around the world. It can range from a mild illness with fever to serious conditions like dengue hemorrhagic fever and shock. Predicting how severe a case might become early on is important for better treatment. Certain blood markers, like platelet count, mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT), have been studied as possible signs of how the disease is progressing. But it's still unclear how well they can predict severity. This study looks at the relationship between these platelet markers and the severity of dengue, following the WHO 2009 classification. Patients with dengue were grouped into mild, moderate, and severe categories. Their platelet markers were checked when they first arrived and compared to their level of disease severity. The results showed that severe cases had lower platelet counts, higher MPV and PDW, and changes in PCT. MPV and PDW were found to be especially good at predicting severity. These findings suggest that platelet markers can be quick and affordable tools to help predict how severe a case might be and how risky it is, supporting doctors and lab tests in making better decisions..*

Keywords: Dengue, Platelet count, Mean platelet volume, Platelet distribution width, Dengue severity, Biomarkers

I. INTRODUCTION

Dengue is a virus that spreads through mosquitoes and is a major health issue in over 100 countries.
In the past ten years, there has been an increase in the number of dengue cases worldwide, including recent outbreaks in Asia, Latin America, and Africa. According to the World Health Organization, about 390 million dengue infections happen every year, with around 96 million showing symptoms. The symptoms can range from mild fever to more serious conditions like dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS), which can lead to serious illness and death.
Platelets are important for blood clotting, and in severe dengue, they tend to decrease or not function properly.
Measures like MPV, PDW, and PCT, which show how platelets are made and how active they are, give clues about these changes. Studies suggest that these markers change in severe cases and may help predict if a person is likely to develop DHF or DSS. However, there is not a clear agreement on how useful these markers are for determining disease severity early on. This study aims to look closely at how platelet markers relate to the severity of dengue, support better prediction in clinics, and follow the updated WHO 2009 guidelines for grading dengue.

II. METHODOLOGY

Study Design

- This study was a cross-sectional analysis carried out from June 2024 to May 2025 at the Hematology Department in LTMG Hospital.
- Permission from the Institutional Review Board was obtained, and each patient gave written consent, following the Declaration of Helsinki.

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Patient Selection

- Participants were included if they were aged 12 years or older and had a confirmed dengue diagnosis based on WHO guidelines, with positive NS1 antigen or serological IgM/IgG results.
- Patients were excluded if they had pre-existing blood disorders, were taking medicines that affect platelet counts, or had co-infections like malaria or chikungunya.

Severity Classification

Patients were classified according to the WHO 2009 criteria:
- Mild dengue: Fever with or without mild bleeding, and stable blood pressure
- Moderate dengue: Warning signs like abdominal pain, vomiting, bleeding, or enlarged liver
- Severe dengue: Severe plasma leakage causing shock, major bleeding, or serious organ damage

III. DATA COLLECTION & ANALYSIS

Blood samples were taken within 24 hours of hospital admission.
Platelet markers—count, MPV, PDW, and PCT—were tested using the Sysmex XN automated blood analyzer.
Demographic, clinical, and lab data were gathered.
Statistical analysis was done with SPSS 28.0. Continuous data were given as mean ± SD, and categorical data as counts and percentages. ANOVA, Kruskal-Wallis, and post hoc tests were used to compare groups. Receiver operating characteristic (ROC) curves were used to evaluate how well the markers could predict severe dengue. A result was considered significant if the p-value was less than 0.05.

IV. RESULTS

Baseline Characteristics

A total of 382 patients met inclusion criteria, with 178 (46.6%) mild, 142 (37.2%) moderate, and 62 (16.2%) severe dengue cases. Age ranged from 13 to 68 years (mean 34.5 years); 57% were male.

Platelet Parameter Trends

Severity	Platelet Count (x10^3/µL)	MPV (fL)	PDW (%)	PCT (%)
Mild	101 ± 12.5	8.2 ± 1.4	12.1 ± 2.0	0.18 ± 0.03
Moderate	82 ± 14.8	9.4 ± 1.6	14.3 ± 2.2	0.14 ± 0.02
Severe	51 ± 9.7	10.8 ± 1.9	16.5 ± 2.8	0.09 ± 0.01

Statistically significant differences were found between groups for all indices ($p < 0.001$)

Predictive Value

ROC analysis for severe dengue:
MPV: AUC = 0.82, cutoff >10.2 fL (sensitivity 81%, specificity 78%)
PDW: AUC = 0.85, cutoff >15.0% (sensitivity 82%, specificity 80%)
Platelet count: AUC = 0.79, cutoff <60,000/µL (sensitivity 74%, specificity 71%)
PCT: AUC = 0.76, cutoff <0.12% (sensitivity 72%, specificity 70%)

Other Findings

Presence of warning signs (vomiting, hematocrit rise, abdominal pain) correlated strongly with higher PDW and MPV. Severe hepatic involvement and elevated AST/ALT were seen in 24% of severe dengue cases.

IV. DISCUSSION

Pathophysiology

Dengue virus-induced thrombocytopenia results from bone marrow suppression, direct megakaryocyte infection, immune-mediated destruction, and peripheral platelet consumption. Platelet activation markers, reflected in MPV and PDW, rise as a compensatory mechanism in response to acute thrombocytopenia Higher MPV and PDW in severe dengue indicate active platelet turnover and heterogeneity, supporting the hypothesis that severe cases face greater

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platelet consumption and destruction via immune-mediated pathways. Conversely, declining PCT reflects overall platelet biomass reduction.

Comparison with Prior Studies

Recent meta-analyses and cross-sectional studies from 2024–2025 corroborate our findings, establishing MPV and PDW as early predictors of severity. Some literature suggests additional predictive value for immature platelet fraction (IPF), although routine assay availability remains limited.

The use of platelet indices as adjuncts to clinical scoring models (such as warning signs and laboratory markers) enables early risk assessment, particularly in resource-limited settings where rapid serology or imaging may be unavailable.

Clinical Implications

Routine hemogram-derived platelet parameters, especially MPV and PDW, can guide monitoring frequency, admission thresholds, and escalation of care for dengue patients. Incorporating these parameters into severity grading may improve early detection of high-risk patients and inform resource allocation during outbreaks.

V. CONCLUSION

This study confirms that platelet parameters, notably MPV and PDW, are significantly altered in severe dengue and serve as reliable predictors of disease progression. Early identification of severe cases using simple platelet indices can enhance triage, clinical management, and potentially reduce morbidity and mortality. Integration of these indices into standard dengue severity grading protocols is recommended.

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