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IMPLICATION OF MEAN PLATELET VOLUME AND PLATELET COUNT IN DENGUE PATIENTS

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Abstract

Background: Dengue fever (DF) is a viral infection endemic to many tropical regions, including Southeast Asia, and is characterized by a range of clinical manifestations, from mild febrile illness to severe dengue hemorrhagic fever (DHF). Thrombocytopenia is a common hallmark of dengue, with platelet count and mean platelet volume (MPV) being potential markers for disease prognosis.

Objective: This study aims to evaluate the association between platelet count and MPV in dengue patients to assess their prognostic utility.

Methods: A prospective study was conducted at Vinayaka Mission's Medical College & Hospital, Karaikal, from July 2023 to September 2023, involving 60 confirmed dengue patients. Platelet count and MPV were measured using the Mindray BC 6000 hematology analyzer. Statistical analysis was performed using SPSS 23.0, with ANOVA and

	t-tests used to assess the significance of the association between platelet count and MPV, and p-values < 0.05 considered significant. **Results:** The study included 33 males and 27 females. 85% of cases shows the MPV values between 8-12 and 50% cases had platelet count between 50000-100000. A significant relation was found between MPV and platelet count indicating that as platelet count decreased, MPV increased. **Conclusion:** MPV and platelet count are inversely related in dengue patients. However, platelet count and MPV were not influenced by age. These results highlight the potential of MPV as a prognostic tool in dengue management. Further research is needed to explore its role in predicting disease severity.

[1] INTRODUCTION

Dengue fever (DF) is an endemic viral borne fever transmitted through the mosquito Aedes aegypti. The infection can range from asymptomatic cases to severe manifestations, including organ failure [1]. The global incidence of DF has increased substantially during recent areas with most cases being reported from Southeast Asia regions. India, being part of this region, regularly experience DF/DHF outbreaks and is at increased risk of becoming a major endemic area. The dengue virus belongs to the family Flaviviridae, under the genus Flavivirus and is a spherical shaped single stranded RNA virus. There are different serotypes of dengue virus distinguished by both structural and non-structural proteins [2]. The virus is transmitted to humans through mosquito bites, where it replicates initially in the host dendritic cells and then spread to the lymph nodes and enter the blood stream through monocytes and macrophages, eventually infecting various organs.

The clinical symptoms of DF vary in severity, ranging from mild, flu-like symptoms to life threatening DHF and dengue shock syndrome (DSS), the latter when left untreated can result in a fatality rate of 5%. The dengue progress through three phases: febrile, critical, and recovery [2,3]. During the febrile phase, the patient experiences high spiking temperature, headache, anorexia with tenderness in right hypochondrium and hepatomegaly. The patient with dengue shows abnormal blood tests revealing leucopenia, rising hematocrit and thrombocytopenia and elevation of liver enzymes. Thrombocytopenia, is a key feature of DF which could be caused due to several factors, including bone marrow suppression by the virus, anti-dengue antibody-mediated platelet destruction, peripheral platelet consumption and viral replication in the platelet. Although thrombocytopenia is associated with bleeding but it may not directly correlate with the bleeding manifestations. The critical phase is characterized by increased hematocrit with systemic vascular leak into the peritoneal space, which, if left untreated result in multi-organ failure. The final recovery phase occurs with a halt in vascular leak, and the patient shows and increase in white blood cells and platelets, slowly restoring normal physiological conditions [3].

Recently, novel platelet indices such as mean platelet volume (MPV), platelet distribution width (PDW) have gained attention as potential markers for platelet activation [4,5,6]. Emerging evidence suggests that MPV may serve as an independent predictor of bleeding risk. Understanding the relationship between platelet count, MPV, and bleeding, as well as the severity of disease, holds promise for predicting clinical outcomes and guiding management strategies in patients with various conditions.

[2] MATERIALS AND METHODS

The study is a prospective study conducted in Hematology lab of Department of Pathology, Vinayaka Mission's Medical College & Hospital, Karaikal, for 3 months from July 2023 to September 2023.

Patient population: A total of 60 patients. with NS 1 Antigen, IgM, IgG positivity, experiencing febrile illness, clinically consistent with dengue infection were included in the study. The platelet count and MPV was evaluated for all these cases. All patients exhibited clinical features consistent with dengue fever as per WHO guidelines.

Sample collection: Under aseptic conditions, 2 ml blood was collected from the patients in ethylene diamine tetra acetic acid (EDTA) vials. The samples were evaluated using the Mindray BC 6000 and the platelet indices were observed, which includes platelet count (PC) and mean platelet volume (MPV).

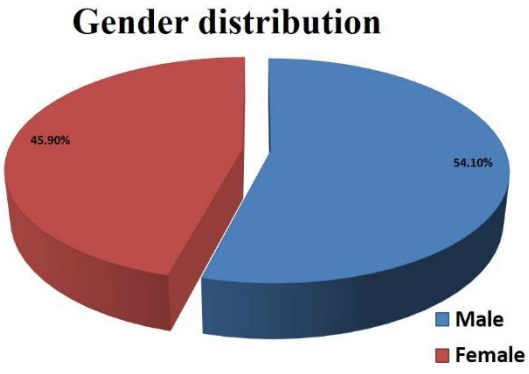
Statistical analysis

Statistical analysis was performed with the SPSS, version 23.0 for Windows statistical software package (SPSS inc., Chicago, USA). Descriptive statistics such as mean, standard deviation (SD), and interquartile range (IQR) were calculated. The significance of the association between MPV and platelet count was analyzed using t-tests, ANOVA and normality test. A p-value of ≤ 0.0001 was considered statistically significant.

Results

In the present study, we evaluated 60 cases of dengue fever and found a relatively even distribution of male (33) and female (27) patients. The age distribution indicates that the majority of the patients were in the 35-44 age group, while the age group between 15-24 years was lowest affected (Figure 1). This could be due to the significant difference in age-related immune functions, underlying health condition, or differing exposure patterns between younger and older population.

(a)



(b)

Age distribution	NO.OF PATIENTS	Percentage
15 – 24	7	11.5%
25 – 34	13	21.3%
35 – 44	16	26.2%
45 – 54	15	24.6%
≥55	10	16.4%
Total	**61**	**100%**

Figure 1: Represents the (a) gender and (b) age distribution of dengue patients.

The platelet counts observed in the study ranged from 20,000 to 196,000. A significant proportion of the patients (50%) presented with platelet counts between 50,000 and 100,000, indicating moderate thrombocytopenia. Meanwhile, 28% of the patients had platelet counts below 50,000, representing severe thrombocytopenia, a common feature in dengue infections (Figure 2 a). Platelet counts below 100,000 are a diagnostic marker for dengue, and patients with counts under 50,000 often require closer monitoring due to the risk of bleeding complications.

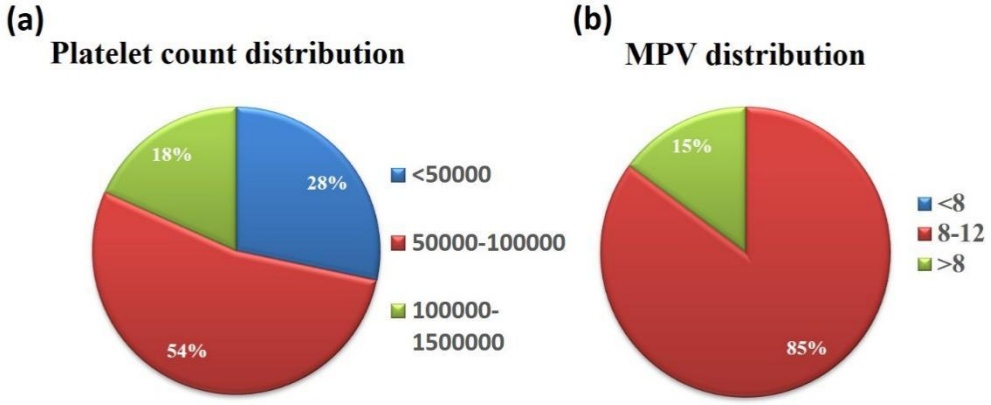


Figure 2: Relation between percentage of patient population and (a) Platelet count and (b) MPV distribution.

Mean platelet volume (MPV), which ranged from 8.8 to 14.10 fL in this cohort, provides additional insights into the bone marrow's response to platelet destruction. The MPV values in this study show that 85.2% of cases had MPV values between 8-12 fL, while 14.8% of patients had MPV values higher than 12 fL (Figure 2 b). This indicates that most dengue patients have moderately elevated MPV, which is associated with increased platelet turnover. Higher MPV values in some patients suggest greater platelet activation or destruction, a common finding in dengue infections where thrombocytopenia is a hallmark [7].

A comparison of MPV values with platelet count revealed a significant inverse relationship between the two parameters (Figure 2,3 a). As platelet count decreases, MPV tends to increase,

indicating that as the body attempts to compensate for low platelet levels, it releases larger, younger platelets into circulation [8,9]. This correlation was statistically confirmed through ANOVA analysis, showing a highly significant p-value of less than 0.0001 (Figure 3b). This supports the hypothesis that MPV can be a useful marker for monitoring platelet activity and destruction in dengue patients.

Table 1: Statistical analysis for (a) MPV with Platelet Count and, (b) MPV categories with Platelet Count.

(a)

Variable	N	Mean	S.D	T value	p value
MPV	61	10.75	1.42	-14.125	0.0001
Platelet Count	61	72098.36	39858.79		

(b)

Variable	N	Mean	S.D	F value	p value
<8	0	0.00	0.00	2.959	0.091
8 – 12	52	75692.31	40867.33		
>12	9	51333.33	26443.33		
Total	61	720998.36	39858.79		

However, no significant correlation was found between platelet count and age, suggesting that the reduction in platelet count and the associated changes in MPV are independent of the patient's age (Figure 4). This finding implies that the changes in platelet dynamics observed in dengue are more likely to be driven by the infection itself rather than patient age.

Table 2: Statistical analysis using ANOVA for comparing age distribution with (a) platelet count, (b) MPV values.

(a)

Variable	N	Mean platelet count	S.D platelet count	F value	p value
15 - 24	7	92142.85	56634.58	1.327	0.271
25 – 34	13	74076.92	40495.80		
35 – 44	16	80125.00	39805.98		
45 – 54	15	65200.00	37121.81		
≥55	10	53000.00	23767.39		
Total	61	72098.36	39858.79		

(b)

Variable	N	Mean MPV	S.D MPV	F value	p value
15 - 24	7	10.46	1.69	0.369	0.830
25 – 34	13	10.84	1.31		
35 – 44	16	10.48	1.27		
45 – 54	15	11.02	1.78		
≥55	10	10.90	1.18		
Total	61	10.75	1.43		

[3] DISCUSSION

The present study carried out a comprehensive evaluation of MPV and platelet count of 60 dengue-positive patients. These findings provide insights into the clinical manifestations with respect to platelet count emphasizing the prognostic value of MPV in dengue fever. The even distribution of cases between males (33) and females (27) indicates that dengue fever affects both genders similarly in this population. The age distribution showed that middle-aged adults (35-44 years) were the most affected group.

Thrombocytopenia is a hallmark of dengue infection, with nearly half of the patients in this study showing platelet counts below 100,000 cells/μL. Among the dengue patients, significant differences were observed in their platelet levels and MPV. The higher MPV observed in patients with lower platelet counts suggests increased platelet turnover, which could be indicative of heightened bone marrow activity in response to platelet destruction caused by the dengue virus [4]. The finding that MPV increases as platelet counts decrease supports the hypothesis that the body compensates for low platelet levels by releasing larger, immature platelets. This correlation, which was confirmed statistically with a highly significant p-value (<0.0001), underscores the potential of MPV as a surrogate marker for platelet destruction and disease severity in dengue patients. However, no significant difference was observed between the average MPV values at the time of minimal platelet counts and at discharge in dengue cases except in dengue hemorrhagic fever cases [12].

The variation in clinical and hematological presentations highlights the complexity of dengue fever. While most patients exhibited significant thrombocytopenia, the majority of patients had platelet levels that did not require immediate transfusion or intensive intervention. Nonetheless, the subset of patients with critically low platelet counts underscores the need for vigilant monitoring, particularly in endemic areas where dengue outbreaks can strain healthcare resources.

Mean age of presentation observed in this study was 37years which is similar to a study done by Deshwal et al., were the mean age was 35 years [10]. However, few other reported mean age less than what we have observed. which was more than the previously reported studies [4, 11]. Interestingly, no significant correlation was observed between platelet count and age, suggesting that thrombocytopenia and changes in MPV are largely independent of the patient's age. Despite the significant association between platelet count and MPV, no significant difference was observed between MPV and the severity of the disease. The results highlight the importance of monitoring platelet indices, especially in regions endemic to dengue fever. Early identification of patients with low platelet counts and high MPV may help in providing close monitoring and assistance to patients [10-12].

[4] CONCLUSION

In conclusion, this study demonstrates the importance of MPV and platelet count as important markers in dengue fever management, with lower platelet counts and elevated MPV indicating more severe thrombocytopenia [4]. While thrombocytopenia is well-established as a marker of disease severity, MPV offers additional insights into platelet turnover and bone marrow activity. MPV is predictor of platelet count recovery in dengue and hence the prognosis of the disease but not to assess the severity of the disease. MPV can be used as tool to assess platelet count which is one the important prognostic indicator of Dengue and hence it is easily available and cost effective tool.

[5] LIMITATIONS

The size of the sample was very small. The study was completely conducted on senior citizens.

[6] RECOMMENDATIONS

Needs to conduct in Tai-chi exercise to assess the physical problems in old age people.Comparison research may be done to discover changes in adults and old age Recommend to do this study as qualitative research.

[7] AUTHOR(S) CONTRIBUTION

Dr. Zealous Mary comprehended and conducted the study, as well as evaluated and interpreted the results. Dr. Vathana wrote and updated the main manuscript. All authors read and approved the final version of the manuscript.

[8] ACKNOWLEDGEMENT

Individuals/resources participated in the work are acknowledged properly to the best of the knowledge..

[9] SOURCES OF FUNDING

The authors received no financial aid to support the study.

[10] ETHICS & PLAGIARISM POLICY

The author(s) declare that all author(s) have taken care for plagiarism, copyright, and ethical matters. Journal and editors are not liable for issues related to aforesaid matters.

[11] CONFLICT OF INTEREST

The authors declared that no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

[12] PROTECTION OF RESEARCH PARTICIPANTS

This study do not involve any such criteria or condition.

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