OPEN ACCESS

ORIGINAL ARTICLE

# Trends in mean platelet volume and its relation with platelet count in patients with dengue fever

**Fahad Naim[1], Awais Naeem[1], Asif Nabi[1], Nizamuddin[2*], Irum Mehmood[3], Samiullah[4]**

[1]Department of Medicine, Khyber Teaching Hospital Peshawar Pakistan, [2]Department of Pharmacology, Khyber Medical College Peshawar Pakistan, [3]Department of Medicine, Hayatabad Medical Complex, Peshawar Pakistan, [4]Khushal Medical Center, Peshawar Pakistan

## ABSTRACT

**Background:** Dengue fever is an acute viral illness causes by a Flavivirus, called dengue virus. Worldwide, its affect about 350 million people yearly. It can cause serious complications like dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). This study aims to determine the role of mean platelets volume (MPV) in dengue patients and predict recovery.

**Methods:** This Prospective observational study was conducted during 2021 dengue outbreak, starting from 20th August 2021 till 19th November 2021 at Medicine Unit, Khyber Teaching Hospital (KTH) Peshawar where a total of 276 patients of either gender who remained inpatients for at least 3 days and were afebrile on the day of discharge were enrolled using consecutive sampling technique. Prior ethical approval was taken. MPV was measured on the day of admission and discharge. Data was collected and analyzed using SPSS version 23.

**Results**: In total 276 patients, 180 (65.2%) were males while 96 (34.8%) were females. Result reveals significant differences among hemoglobin value, hematocrit value, platelet count and mean platelet volume with p-values, 0.02, <0.001, 0.009 and <0.001 respectively. The results were also statistically significant at the time of admission and discharge among the three variables with p-value <0.001, <0.001 and 0.003 respectively.

**Conclusion:** Dengue patients need constant monitoring to prevent complications predicts their recovery. This study concludes that MPV can be used as marker for dengue fever to determine the severity and/or improvement of patients.

**Keywords:** Dengue Fever, Mean Platelets Volume, Hematological Markers, Thrombocytopenia

**This article may be cited as:** Naim F, Naeem A, Nabi A, Nizamuddin, Mehmood I, Ullah S. Trends in mean platelet volume and its relation with platelet count in patients with dengue fever. Int J Pathol;22(4):174-9. https://doi.org/10.59736/IJP.22.04.927

**CORRESPONDING AUTHOR**

**Nizamuddin**
Assistant Professor, Department of Pharmacology, Khyber Medical College Peshawar Pakistan
Email: drnizam1122@gmail.com

## Introduction

Dengue fever is an acute viral illness causes by a Flavivirus, Dengue (DENV) (1). It is transmitted by *Aedes aegypti* and *Aedes albopictus* and is one of the most common mosquito-borne viral disease (2, 3). Dengue

fever remains an important public health issue worldwide. It is estimated that about 350 million dengue cases are reported annually throughout the world where more than 20 000 die because of sever disease (4).

Dengue fever can have diverse clinical features varying from asymptomatic to mild illness to life threatening complications like Dengue hemorrhagic fever(5). There are four serologically distinct viruses, called DENV-1, DENV-2, DENV-3, and DENV-4 (6). Infection can be recurrent as there is minimal cross protection. Secondly infection with different virus strain can cause severe immune response which could lead to dengue hemorrhagic fever (DHF) and in its severe form Dengue Shock Syndrome (DSS) (7). This can threaten the patient's life primarily through increased vascular permeability.

Different serological tests are used for diagnosis, severity and predictor of recovery of dengue fever (8). Thrombocytopenia and leucopenia are a common hematological finding in patients with dengue fever on initial blood counts (9). Low platelet count can cause bleeding, although the thrombocytopenia may not correlate with severity of bleeding. In addition to Platelet counts, platelet Indices include mean platelet volume (MPV) & platelet distribution width are used in monitoring of recovery from dengue fever (10). The normal range for MPV is from 9 - 15.5 fl (11).

MPV have been investigated in multiple studies as a prospective platelet activation marker and to assess their role in severity of dengue infection (12). MPV can be used as a marker of platelet production rate, platelet activation where the rising pattern in MPV indicates platelet recovery (13). Relationship of MPV has also been evaluated globally in diagnosis, prognosis and even in predicting bleeding in patients with dengue (14).

In Pakistan, dengue virus infection is very common. Online search does not show any substantial studies to assess the role of MPV in dengue fever recovery in Pakistan. The rationale of our study was to assess the role of MPV in predicting the clinical recovery from dengue fever by comparing MPV at admission and on day of clinical recovery and noting their trend and relationship with clinical course in Pakistani population.

## Methods

This Prospective observational study was conducted during 2021 dengue outbreak, starting from 20th August 2021 till 19th November 2021 at Medicine Unit, Khyber Teaching Hospital (KTH) Peshawar and Khyber Medical College (KMC) Peshawar. After Ethical approval from KMC research ethical committee via letter no. 893/DME/KMC, a total of 276 patients of either gender who remained inpatients for at least 3 days and were afebrile on the day of discharge were enrolled using consecutive sampling technique after obtaining proper consent. The patients were enrolled after their proper consent. Complete blood count on the day of admission and discharge was done and platelets parameters including MPV were recorded. Patients with past history of Hematological disease, patient having malaria fever, patients having chronic liver disease or any other bacterial or viral infection were excluded from the study. Data was analyzed on SPSS version 23. The MPV measured on day of admission was compared with its reading on clinical recovery from Illness. Descriptive statistics was used for describing distribution of variables like age and gender. Means was calculated for Mean platelet volume at time of admission and at time of clinical recovery. Paired T- test was applied to see if there is

any significant difference in both measurements at time of admission and clinical recovery and whether trend in MPV can be used as a marker of recovery from Dengue fever.

## Results

In total 276 patients, 180 (65.2%) were males while 96 (34.8%) were females. Patients were divided into different age groups (12-30 years, 31-45 years, 46-60 years and >60 years) in which the distribution of dengue patients among these groups were 124 (44.9%), 87 (31.5%), 51(18.5%), and 14 (5.1%) respectively. In these patients, 149 (54%) had a hospital stay of 3 days, 84 (30.4%) had 4-5 days while 43 (15.6%) had >5 days in the hospital. All the details are given in table 1.

**Table 1: Demographics of dengue patients**

| Variables | Sub-category | Frequency | Percentage |
|---|---|---|---|
| Gender | Male | 180 | 65.2 |
| | Female | 96 | 34.8 |
| Age | 12-30 years | 124 | 44.9 |
| | 31-45 years | 87 | 31.5 |
| | 46-60 years | 51 | 18.5 |
| | >60 years | 14 | 5.1 |
| Hospital stays | 3 days | 149 | 54 |
| | 4-5 days | 84 | 30.4 |
| | >5 days | 43 | 15.6 |

Gender based differences was done by using independent sample t-test. Result reveals significant differences among hemoglobin value, hematocrit value, platelet count and mean platelet volume with p-values, 0.02, <0.001, 0.009 and <0.001 respectively. However, no differences were observed in white cell count (p-value 0.10). All the details of each variable are shown in table 2.

**Table 2: Gender based differences among study parameters**

| Variables | Gender (mean SD) | | p-value | 95%CI |
|---|---|---|---|---|
| | Male | Female | | |
| Hemoglobin | 14.76 (10.99) | 12.19 (2.34) | 0.02 | 0.32-4.8 |
| White cells | 8.39 (6.0) | 7.04 (7.4) | 0.10 | -0.26-2.9 |
| Hematocrit | 42.04 (6.79) | 35.75 (4.82) | <0.001 | 4.75-7.8 |
| Platelets count | 53616.6 (65783) | 74791.6 (58423) | 0.009 | -36931-5418 |
| Mean platelet volume | 9.83 (1.43) | 9.26 (0.91) | <0.001 | 0.25-0.88 |

The mean difference between platelet count, hematocrit and mean platelet volume at the time of admission and time of discharge were calculated using paired sample t-test. The results were statistically significant at the time of admission and discharge among the three variables with p-value <0.001, <0.001 and 0.003 respectively as summarized in table 3. There is a rising trend seen in platelets count and mean platelets volume.

**Table 3: Variable difference at time of admission and discharge**

| Variable | Value at time of admission Mean (SD) | Value at time of discharge Mean (SD) | p-value | 95%CI |
|---|---|---|---|---|
| Platelet count | 60981 (64015) | 133418 (17102) | <0.001 | -9346-5141 |
| Hematocrit | 39.85 (6.86) | 38.22 (6.31) | <0.001 | 0.88-2.38 |
| Mean platelet volume | 9.63 (1.30) | 9.96 (1.34) | 0.003 | -0.54-0.11 |

## Discussion

Dengue is a common public health problem in developing world. Patients usually experience significant morbidity due to dengue viral infection. Dangerous

complications like dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). As there is no direct acting antiviral drug against dengue virus, only supportive therapy is given. In dengue fever, the role of hematological markers plays significant role in the recovery and hospital stay of the patients. In over study, patients MPV was progressively and significantly improved near recovery with a p-value of <0.003.

The relationship of MPV with patients' recovery was studied in Colombia by Diana Marcela Martínez-et all, on the mean platelet volume as a predictor of platelet count recovery in dengue patients. It was established that there is significant recovery in those patients who progressively increased MPV (i.e., 13.58fl and above) (15). Similar findings were also reported by Arora et al, who reported MPV as additional marker for severity of dengue fever (16).

In another observational retrospective clinical study, which was conducted by Pattnaik SS et all, Kalinga Institute of Medical Sciences (KIMS), Bhubaneswar, India, finding mean platelet volume (MPV) and platelet count in the recovery of dengue patients, found correlation between MPV and platelet on day one was r= -0.22, p=0.011, on day three was r= -0.32, p=0.0001, and on day five was r= -0.30, p= 0.0004, all the values were statistically significant. It was concluded that progressively increased MPV show less platelets breakdown and rapid recovery (17).

In another study conducted in Colombia by Sanz AM et all, titled as "Could Mean Platelet Volume Predict Platelet Count Recovery in Dengue Virus Infection?", it was found that in a total of 54 patients who were analyzed, the median of the highest MPV was 11.25 fl. MPV was progressively increased from day first with the recovery in progress. It was concluded that MPV increase can be useful marker to predict the recovery of the patients from the disease (18). However, there are certain studies who does not report any correlation between MPV and severity and outcome in dengue patients (19). MPV can be served as a good predictor marker for severity and improvement in dengue fever. Improvement is MPV subsequently reflect the improvement of patient. Thus along with other markers like platelets, MPV can also be used as marker for dengue fever.

## Conclusion

Dengue patients need constant monitoring to prevent complications predicts their recovery. Monitoring of MPV and other hematological parameters are really important in to predict patients' recovery. Progressively increased MPV show bone marrow functionality and recovery from dengue fever.

**Conflict of Interest:** Nil

**Funding source:** Nil

## References

1. Murugesan A, Manoharan M. Dengue virus. Emerging and reemerging viral pathogens: Elsevier; 2020. p. 281-359.
2. Näslund J, Ahlm C, Islam K, Evander M, Bucht G, Lwande OW. Emerging mosquito-borne viruses linked to Aedes aegypti and Aedes albopictus: global status and preventive strategies. Vector-Borne and Zoonotic Diseases. 2021;21(10):731-46.
3. Batool A, Anwar B, Rasul A, Khalid S, Asif N, Shah H. Clinicopathological Features of Dengue Fever–a Single Center

Study. International Journal of Pathology. 2020:53-7.
4. Muhammad U, Ahmad M, Abbas S, Arif MZE, Jan M, Sarwar MF, et al. Dengue virus: epidemiology, clinical aspects, diagnosis, prevention and management of disease in Pakistan. CABI Reviews. 2023(2023).
5. Biswas P, Ganguly S, Debnath B. Dengue fever: stages, complication, diagnosis, and prevention strategies. Asian J Pharm Clin Res. 2021;14(5):3-11.
6. Bello SOT, Tapsoba ASA, Zoure AA, Bassole YJR, Bado P, Kouta OF, et al. Molecular Characterization of the Four Serotypes (DENV-1, DENV-2, DENV-3 and DENV-4) of Dengue Virus Circulating in Ouagadougou, Burkina Faso. Open Journal of Epidemiology. 2024;14(4):565-78.
7. Huy NT, Van Giang T, Thuy DHD, Kikuchi M, Hien TT, Zamora J, et al. Factors associated with dengue shock syndrome: a systematic review and meta-analysis. PLoS neglected tropical diseases. 2013;7(9):e2412.
8. Muller DA, Depelsenaire AC, Young PR. Clinical and laboratory diagnosis of dengue virus infection. The Journal of infectious diseases. 2017;215(suppl_2):S89-S95.
9. Castilho BM, Silva MT, Freitas AR, Fulone I, Lopes LC. Factors associated with thrombocytopenia in patients with dengue fever: a retrospective cohort study. BMJ open. 2020;10(9):e035120.
10. Kantharaj A. Role of red cell and platelet indices as a predictive tool for transfusions in dengue. Global Journal of Transfusion Medicine. 2018;3(2):103-8.
11. Fei Y, Wang X, Zhang H, Huang M, Chen X, Zhang C. Reference intervals of systemic immune-inflammation index, neutrophil to lymphocyte ratio, platelet to lymphocyte ratio, mean platelet volume to platelet ratio, mean platelet volume and red blood cell distribution width-standard deviation in healthy Han adults in Wuhan region in central China. Scandinavian Journal of Clinical and Laboratory Investigation. 2020;80(6):500-7.
12. MUFTI MZ, YOUSAFZAI YM, HAROON MZ, ALI R, KHAN SQ, JAVED H. Relationship of Hematological Indices with the Outcome of Dengue Infection. Pakistan Journal of Medical & Health Sciences. 2024;18(8):18-.
13. Handtke S, Thiele T. Large and small platelets—(When) do they differ? Journal of Thrombosis and Haemostasis. 2020;18(6):1256-67.
14. Zeb S, Qaisar O, Babar N, Sardar A, Bilal M, Shuaib SL. Significance of platelets and its indices in patients with dengue fever. Pakistan Journal of Medical & Health Sciences. 2023;17(02):475-.
15. Martínez-Ruíz DM, Tovar-Rios DA, Valencia-Orozco A, Florez-Elvira LJ, Agudelo OL, Parra-Lara LG, et al. Mean platelet volume as a predictor of platelet count recovery in dengue patients. Transactions of The Royal Society of Tropical Medicine and Hygiene. 2022;116(9):798-806.
16. Arora S, Gupta M, Tahlan A, Gupta S, Jesrani G. Role of mean platelet volume and platelet distribution width in assessing the severity of dengue fever: An observational study. Journal of Dr YSR University of Health Sciences. 2022;11(4):328-32.
17. Pattnaik SS, Patil U, Aggarwal L, Patro S, Mishra P, Mohanty A. Exploring Mean Platelet Volume and Platelet Count Recovery in Dengue Patients: Findings

From an Observational Retrospective Clinical Study. Cureus. 2024;16(7).
18. Sanz AM, Martinez DM, Valencia A, Flórez L, Tovar D, Parra CM, et al., editors. 2309. Could Mean Platelet Volume Predict Platelet Count Recovery in Dengue Virus Infection? Open Forum Infectious Diseases; 2019.
19. Sharma K, Yadav A. Association of mean platelet volume with severity, serology & treatment outcome in dengue fever: prognostic utility. Journal of clinical and diagnostic research: JCDR. 2015;9(11):EC01



| HISTORY | |
|---|---|
| Date received: | 20-11-2024 |
| Date sent for review: | 20-11-2024 |
| Date received reviewers comments: | 22-11-2024 |
| Date received revised manuscript: | 24-12-2024 |
| Date accepted: | 25-12-2024 |

| CONTRIBUTION OF AUTHORS | |
|---|---|
| **AUTHOR** | **CONTRIBUTION** |
| Fahad Naim | AB |
| Awais Naeem | AB |
| Asif Nabi | B |
| Nizamuddin | AC |
| Irum Mehmood | BC |
| Samiullah | BC |

**KEY FOR CONTRIBUTION OF AUTHORS:**

A. Conception/Study/Designing/Planning
B. Active Participation in Active Methodology
C. Interpretation/ Analysis and Discussion