**International Journal of Medical and Pharmaceutical Research**
**Website**: https://ijmpr.in/| Print ISSN: 2958-3675 | Online ISSN: 2958-3683
**NLM ID:** 9918523075206676
Volume: 4 Issue:2 (Mar-Apr 2023); Page No: 195-199

**Research Article**

IJMPR



# Role of Platelet Indices in Patients with Thrombocytopenia in Serologically Positive Dengue Patients

**Dr Snehal Eknath Karanjekar[1], Dr Gauri Kelkar[3],Dr Surekha Kadadi[3],Dr Shreya Pawaskar[1] Dr Rashmi Vanjari[4], Dr Shivani Battin[2]**

[1]Junior Resident, Department of Pathology, Ashwini Rural Medical College, Hospital & Research Centre, Kumbhari, Solapur, Maharashtra 413006,India
[2]Assistant Professor, Department of Pathology, Ashwini Rural Medical College, Hospital & Research Center, Kumbhari, Solapur, Maharashtra 413006, India
[3]Associate Professor ,Department of Pathology, Ashwini Rural Medical College, Hospital &Research Centre, Kumbhari, Solapur, Maharashtra 413006 ,India.
[4]Junior Resident ,Department of General Medicine, Ashwini Rural Medical College, Hospital &Research Centre, Kumbhari, Solapur, Maharashtra 413006, India

## ABSTRACT

**Background**: Dengue fever (DENV) is one of the most rapidly spreading mosquito-borne viral diseases in the world. An estimated 50 million infections per year occur across approximately 100 countries. 30 fold increased incidence and geographic expansion with potential for further spread has been noted. Platelet count is a predictive prognostic factor of severe dengue. Besides platelet count, automation in haematology has provided newer parameters i.e., platelet indices like Plateletcrit (PCT), Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), Platelet Large Cell Count (P-LCC) and Platelet Large Cell Ratio (P-LCR). This study aims to analyse the relationship of platelet indices in thrombocytopenic dengue patients thus helping clinicians by providing quick and reliable diagnostic and prognostic findings. **Objective**: To analyse the relationship of platelet indices in thrombocytopenic dengue patients. **Materials and Methods**: A cross sectional, observational study at a tertiary health care centre over a period of 2 years including 113 dengue cases presenting with thrombocytopenia. Thrombocytopenia was graded according to platelet count per ml as Grade 1 (75,000-1,50,000), Grade 2 (50,000-75,000), Grade 3 (25,000-50,000) and Grade 4 (<25,000). **Results**: In this study of 113 cases, maximum cases (46.9%) were seen in 21-30 year age group followed by 11-20 year age group (15.04%). Least number of cases belonged to 61-70 year age group (2.65%). 81 were males and 32 were females. Most common presenting symptom was headache (58.40%). The other symptoms were body ache (46.90%), arthralgia (27.43%) and maculopapular rash(32.74%). A total 50 cases (44.25%) shows grade 2 thrombocytopenia, 31 cases (27.43%) show grade 3 thrombocytopenia and 13 cases (11.50%) show grade 4 . The Mean values of the Platelet indices were as follows: Mean Platelet Volume (MPV)= 6.43 fL which was less than normal limit (8-11 fL); Platelet Distribution Width (PDW) = 19.67% which was greater than normal range of 11-18%;Plateletcrit (PCT) = 0.05which was near the lower limit of laboratory reference range; Platelet Large Cell Count (PLCC) = 35.68 x 103/ul which was lower than normal range 44-140 x 103/ul; Platelet Large Cell Ratio (PLCR) = 32.35 % which was within laboratory reference range of 18-50%.**Conclusion**: In conclusion, significant differences i.e.,Low platelet count, MPV, PCT, PLCC and high PDW, observed in dengue fever with thrombocytopenia can be used as a diagnostic aid with considerable sensitivity for dengue fever in endemic areas.

**Key Words**: *Dengue fever, Platelet indices, Thrombocytopenia*

***Corresponding Author**
Dr Gauri Kelkar
*Associate Professor, Department of Pathology, Ashwini Rural Medical College, Hospital & Research Center, Kumbhari, Solapur, Maharashtra 413006, India*

## INTRODUCTION:

Dengue fever (DENV) is one of the most rapidly spreading mosquito-borne viral diseases in the world. An estimated 50 million infections per years occur across approximately 100 countries. Incidence has increased 30-fold with increasing geographic expansion and potential for further spread[1]. The primary dengue vector, Aedes aegypti mosquito, has become widely distributed across tropical and subtropical latitudes. Based on the antigenic difference, DENV can be divided into four different serotypes, DENV 1 – 4 [2].The incidence and geographical distribution of dengue infections have significantly increased in the past few decades and a large number of cases remain undiagnosed and underreported. Majority of dengue cases are asymptomatic and cases which are symptomatic are manifested as uncomplicated dengue fever. A very small proportion of the patients progress to dengue haemorrhagic fever (DHF) or dengue shock syndrome (DSS).India reported a total of 110473 dengue cases in the year 2022 with maximum mortality being recorded from the

states of Kerala and Haryana[3]. Majority of DENV infections are characterised by thrombocytopenia and leukopenia. Qualitative and quantitative changes are observed in platelets in DENV infection [4].Platelet count is a predictive factor for prognosis of severe dengue. Automation in haematology has provided newer parameters such as platelet indices apart from platelet count. The various platelet indices are Plateletcrit (PCT), Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), Platelet Large Cell Count (P-LCC) and Platelet Large Cell Ratio (P-LCR).Their reference ranges, based on the laboratories, if are precise and well defined can prove to be significant in the interpretation of results. This can prove to be cost effective and can eliminate expensive dengue workup. The aim of this study is to study the relationship of platelet indices in dengue patients with thrombocytopenia and help the clinicians to diagnose it early, thus eliminating the risks and complications associated with it.

**OBJECTIVE:**

To find out the variation in platelet indices in serologically proven dengue patients with thrombocytopenia.

**MATERIAL AND METHODS**

This is a cross sectional study conducted over a period of 2 years from November 2020 to November 2022 in a rural tertiary health care center. The minimum sample size of 113 was estimated for an anticipated prevalence of thrombocytopenia in 50% in seropositive patients at a relative precision of 10% for 95% confidence level[15]. The platelet parameters were measured bysemi-automated cell counter analyser HORIBA 5 PART (YUMIZEN H550) on venous samples collected in $K_3$ EDTA from patients within 1 hr of venepuncture to prevent artifactual EDTA induced platelet aggregation and swelling. The total platelet count was confirmed on peripheral smear and complete platelet histogram (PCT,MPV,PDW,PLCR and PLCC) were compared with platelet count. The inclusion criteria were all the serologically positive dengue patients with thrombocytopenia and any clinical features. The exclusion criteria include serologically negative dengue patients with similar clinical features and dengue cases with normal platelet count.The statistical analysis was performed using SPSS 21 version, OpenEpi Software Version 2.3. The descriptive statistics were reported using mean $\pm$ SD for age, with frequency and percentage for the categorical variables.

**ETHICAL CONSIDERATION**

Ethical Review Committee gave the approval of Ethical clearance. The data regarding age and sex was noted in predesigned format.

**RESULTS**

In this current study, a total of 113 cases were included. The age of the patients in this study was noted to be between 5 – 63 years (mean age 29.29 years and SD 15.60) (Table 1). Among these, maximum cases were seen in 21-30 year age group contributing 46.9% followed by 11-20 years age group amounting to 15.04%. Least number of cases were seen to be belonging to age group of 61-70 years (2.65%). Among these 81 were males and 32 were females as shown in Table 2.The predominant presenting symptom was observed to be headache seen in 66 patients (58.40%). The other clinical symptoms were body ache in 53 patients (46.90%), arthralgia in 31 cases (27.43%), maculopapular rash in 37 cases (32.74%) as shown in table 3. Patients with bleeding manifestations were not reported while few cases presented with hypotension, malaise and weightloss. A total 50 cases (44.25%) showed Grade 2 Thrombocytopenia, 31 cases (27.43%) showed Grade 3 thrombocytopenia and 13 cases (11.50%) showed grade 4 thrombocytopenia as shown in table 3. Platelet indices of all the cases of this study were analysed and presented in table 4. Mean platelet volume (MPV) was observed 6.43 fL (SD = 1.05) which was less than normal limit 8-11 fL. The mean platelet distribution width (PDW) was found 19.67% which was greater than normal laboratory reference range of 11-18%. The mean plateletcrit (PCT) was found to be 0.05 (SD= 0.01) which was near the lower limit of laboratory reference range. Mean Platelet large cell count (PLCC) was observed to be 35.68 x $10^3$/ul (SD=7.69) which was lower than normal laboratory reference range of 44-140 x $10^3$/ul . Mean Platelet large cell ratio (PLCR) was 32.35 % (SD= 5.87) which was within standard laboratory reference range of 18-50%.

Table 1. Frequency of dengue fever in various age group

| **Age Groups** | **Frequency** | **Percentage** |
|---|---|---|
| **1-10** | 11 | 9.73 |
| **11-20** | 17 | 15.04 |
| **21-30** | 53 | 46.90 |

| | | |
|---|---|---|
| **31-40** | 2 | 1.76 |
| **41-50** | 16 | 14.15 |
| **51-60** | 11 | 9.73 |
| **61-70** | 3 | 2.65 |
| **Grand Total** | **113** | **100** |

Mean Age = 29.29 years, SD = 15.60

Table 2. Sex distribution of dengue fever in various age groups

| **Age Groups** | **Male** | **Female** | **Total** |
|---|---|---|---|
| **1-10** | 8 | 3 | 11 |
| **11-20** | 12 | 5 | 17 |
| **21-30** | 39 | 14 | 53 |
| **31-40** | 2 | 0 | 2 |
| **41-50** | 11 | 5 | 16 |
| **51-60** | 7 | 4 | 11 |
| **61-70** | 2 | 1 | 3 |
| **Grand Total** | **81** | **32** | **113** |

Table 3. Clinical profile of dengue fever with thrombocytopenia (n=113)

| **Clinical features** | **Number** | **(%)** |
|---|---|---|
| **Headache** | | |
| **Yes** | 66 | 58.40 |
| **No** | 47 | 41.59 |
| **Body ache** | | |
| **Yes** | 53 | 46.90 |
| **No** | 60 | 53.10 |
| **Maculopapular rash** | | |
| **Yes** | 37 | 32.74 |
| **No** | 76 | 67.26 |
| **Arthralgia** | | |
| **Yes** | 31 | 27.43 |
| **No** | 82 | 72.57 |
| **Thrombocytopenia** | | |
| **Grade 1 : 150- 75 x $10^3$/ul** | 19 | 16.81 |

| | | |
|---|---|---|
| **Grade 2 : 50-75 x $10^3$/ul** | 50 | 44.25 |
| **Grade 3 : 25-50 x $10^3$/ul** | 31 | 27.43 |
| **Grade 4 : <25 x $10^3$/ul** | 13 | 11.50 |

Table 4.Clinical profile of dengue fever cases with thrombocytopenia (n=113)

| **Platelet parameters** | | **Frequency** | **Percentage (%)** |
|---|---|---|---|
| **MPV** | | | |
| **Low**<br>**Normal**<br>**High** | (<8fL)<br>(8–11fL)<br>(>11fL) | 95<br>19<br>0 | 84.07<br>16.81<br>0.00 |
| **PDW** | | | |
| **Low**<br>**Normal**<br>**High** | (<11%)<br>(11–18%)<br>(>18%) | 0<br>33<br>80 | 0.00<br>29.20<br>70.80 |
| **PCT** | | | |
| **Low**<br>**Normal**<br>**High** | (<0.15%)<br>(0.15–0.40%)<br>(>0.40%) | 113<br>0<br>0 | 100.00<br>0.00<br>0.00 |
| **P-LCC** | | | |
| **Low**<br>**Normal**<br>**High** | (<44x $10^3$/µl)<br>(44-140 x $10^3$/µl)<br>(>140 x $10^3$/µl) | 92<br>21<br>0 | 81.42<br>18.58<br>0.00 |
| **P-LCR** | | | |
| **Low**<br>**Normal**<br>**High** | (<18%)<br>(18% to 50%)<br>(>50%) | 0<br>113<br>0 | 0.00<br>100.00<br>0.00 |

| | **PLT** | **PCT** | **MPV** | **PDW** | **P-LCC** | **P-LCR** |
|---|---|---|---|---|---|---|
| **Mean** | 57141.59 | 0.05 | 6.43 | 19.67 | 35.68 | 32.35 |
| **SD** | 19851.62 | 0.01 | 1.05 | 3.82 | 7.69 | 5.87 |

## DISCUSSION

Dengue is emerging to be a serious public health issue globally with 50 million dengue infections occurring annually. Increased frequency of epidemics and emergence of dengue fever in new areas is due to expanding geographical distribution of both virus and mosquito vector [5].The major reason behind this is due to climatic changes and non fulfilment of control of the mosquito vector [6]. Multifactorial mechanisms play a major part in pathogenesis of Dengue fever/Dengue haemorrhagic fever which include thrombopathy, coagulopathy and vasculopathy. Thrombopathy includes platelet dysfunction and thrombocytopenia. The factors leading to thrombocytopenia in DF varies from immune response against platelets to its hypoproduction. Decreased production of platelets in bone marrow leading to thrombocytopenia occurs in acute stage of dengue fever. Direct infection of megakaryocytes by dengue virus could lead to increased platelet destruction [7]. Platelet indices can prove to be an early diagnostic tool to predict progression of disease. MPV has been demonstrated to have sufficient sensitivity and specificity to discriminate aplastic anaemia, bone marrow disease, hypoproductive thrombocytopenia and bone marrow metastasis of solid tumour [8,9]. Since platelets are natural source of growth factors like platelet derived growth factor (PDGF) and vascular endothelial growth factor (VEGF), they play major role in inflammation, angiogenesis, repair and regeneration of the tissue [10]. Platelet activation leads to morphological alterations: Activated platelets are larger, spherical in shape and form pseudopodia. Due to this, platelets with increased number and size of pseudopodia will vary in size leading to alteration in PDW [11].

In this study, we found that MPV, Platelet count, PCT and PLCC were lower in dengue fever patients while PDW levels were higher. We have found that MPV, PCT and PLCC was significantly lower and PDW level was significantly

higher in the dengue fever, suggesting that decreased MPV and increased PDW levels predict dengue fever. Ntiaos et al have shown a combination of MPV and PDW to P-LCR[12]. Bashir et al. observed low MPV and low platelet count in dengue cases compared to controls [13]. Nehara et al also demonstrated low platelet count, low MPV, low PCT and high PDW in dengue cases [14]. Majority of the patients in the above studies have thrombocytopenia. In the present cross sectional study, all dengue cases with thrombocytopenia were included and we ventured to assess variations in platelet parameters which showed similar correlation of disease with the platelet indices when compared to other studies.

## CONCLUSION

In conclusion, significant differences were observed in the MPV, PDW, PLCC,PCT and platelet count in dengue fever with thrombocytopenia. Low platelet count, Low MPV, PCT, PLCC and high PDW can be used as probable indicators for dengue fever in endemic area. Low MPV < 8fL, low PCT< 0.1% and high PDW > 18fL shows considerable sensitivity for dengue fever.

**Conflict of Interest**: Nil

## REFERENCES


1. Mackenzie, J. S., Gubler, D. J., & Petersen, L. R. (2004). Emerging flaviviruses: the spread and resurgence of Japanese encephalitis, West Nile and dengue viruses. Nature medicine, 10(Suppl 12), S98-S109.
2. Chuang, Y. C., Lin, Y. S., Liu, C. C., Liu, H. S., Liao, S. H., Shi, M. D., ... & Yeh, T. M. (2013). Factors contributing to the disturbance of coagulation and fibrinolysis in dengue virus infection. Journal of the Formosan Medical Association, 112(1), 12-17.
3. NVBDCP National Vector Borne Disease Control Programme.[cited 2022 ].
4. Martina BEE, Koraka P, Osterhaus ADME (2009) Dengue viruspathogenesis: an integrated view. Clin Microbiol Rev22:564–581
5. Gratz NG: Lessons of Aedes aegypti control in Thailand. Medical andVeterinary Entomology 1993;7:1-10.
6. Gubler DJ. Aedes aegypti and Aedes aegypti-borne disease controlin the 1990s: top down or bottomup. Charles Franklin Craig Lecture. American Journal of Tropical Medicine and Hygiene 1989;40:571-57
7. Bashir AB, Saeed OK, Mohammed BA, Ageep AK. Thrombocytopenia and bleeding menifestation among patients with Dengue virus Infection in Port sudan, Red Sea State of Sudan. J.Infect. Dis. Immun. . 2015 April; 7(2) :13
8. Babu E, Basu D. Platelet large cell ratio in the differential diagnosis of abnormal platelet counts. Indian J Pathol Microbiol. 2004; 47 (2):202 – 5 .
9. Kaito K, Otsubo H, Usui N et al. Platelet size deviation width, platelet large cell ratio, and mean platelet volume have sufficient sensitivity and specificity in the diagnosis of immune thrombocytopenia. Br Haematol. 2005; 128: 698 – 702.
10. Cabar FR, Fettback PB, Pereira P, Zugaib M. Serum markers in the diagnosis of tubal pregnancy. Clinics. 2008;63:701–708
11. Vagdatli E, Gounari E, Lazaridou E, Katsibourlia E, Tsikopoulou F, Labrianou I. Platelet distribution width: a simple, practical and specific marker of activation of coagulation. HIPPOKRATIA. 2010; 14 (1): 28-32
12. Ntaios G, Papadopoulos A, Chatzinikolaou A et al. Increased value of mean platelet volume and platelet size deviation width may provide a safe positive diagnosis of idiopathic thrombocytopenic purpura. Acta Haematologica. 2008; 119:173 – 177
13. Bashir AB, Saeed OK, Mohammed BA, Ageep AK (2015) Roleof platelet indices in patients with dengue infection in Red SeaState, Sudan. Int J Sci Res 4:1573–1576
14. Nehara HR, Meena SL, Parmar S, Gupta BK (2016) Evaluationof platelet indices in patients with dengue infections. Int J Sci Res5(7).
15. Chatterjee N, Mukhopadhyay M, Ghosh S, Mondol M, Das C, Patar K (2014) An observational study of dengue fever in a tertiary care hospital of eastern India. J Assoc Physicians India 62:224–227