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# EVALUATION OF PLATELET INDICES IN PATIENTS OF DENGUE OR MALARIA: AN OBSERVATIONAL STUDY

**Pathology**

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## ABSTRACT

**Background:** There are 5 plasmodium parasite species that causes malaria in human out of which P. falciparum and P. vivax is more common in Asia and P. falciparum in African continent. The other rare species are P. malariae, P. ovale and P. knowlesi. [1]. Dengue is endemic in more than 100 countries. [2]. Thrombocytopenia, bleeding and vascular permeability are seen in these infection. Studies have indicated that platelets plays imp role in pathogenesis of clumping of parasitized red blood cells in severe malaria and bleeding in dengue infection. 15. Low platelet count, low plateletcrit and high platelet distribution width may be used as predictor of severity of dengue infection and malaria in PIMSR, Parul university, Vadodara, India4. **Aim And Objective:** To assess the severity of dengue or malaria by evaluation of platelet indices. To evaluate platelet indices like platelet count, Mean platelet volume, plateletcrit and platelet distribution width in patient with dengue or malaria. **Methods:** We enrolled total of 199 patients, comprising 176 with dengue infections and 23 malaria infections case were studied. We evaluated platelet indices during the first day of enrolment in the hospital. **Result:** Platelet Indices, MPV(7.4 – 11.4), PCT( 0.18 - 0.34) and PDW (10-14) values were significantly altered in dengue and malaria infections with platelet count below 20,000 as compared to platelet count more than one lakh. **Conclusion:** Platelet count and platelet indices helps in predicting the severity of dengue or malaria infections and thus aiding in early and timely management which can reduce both morbidity and mortality of the patients.

## KEYWORDS

Platelet indices, Plasmodium falciparum malaria, Plasmodium vivax malaria, Dengue fever.

## INTRODUCTION

Among mosquito borne disease, malaria and dengue caused by parasites and viruses that are transmitted to people via infected anopheles and aedes mosquito respectively. There are 5 plasmodium parasite species that causes malaria in human out of which P. falciparum and P. vivax is more common in Asia and P. falciparum in African continent. The other rare species are P. malariae, P. ovale and P.knowlesi. [1] In 2021, around half of world's population was at risk of malaria. There were about 14 million more patient with malaria in 2020 as compared with 2019. Malarial illness and death due to it was especially seen in children under 5 years, elderly and pregnant women. [1] Dengue is endemic in more than 100 countries, most cases are from south east Asia and western pacific region. [2] Estimates suggest that there are 50 million cases of dengue infection and 5,00,000 cases are of dengue fever in Asian countries. Clinically, Dengue infection can vary from influenza to life threatening. Dengue Hemorrhagic Fever and Dengue Shock Syndrome if left untreated, have a case fatality of 5%. [2] According to NVBDCP INDIA, the number of malaria cases reported in India is 2021 was 4,58,699 and number of death due to it was 88. The number of dengue cases reported in India in 2021 was 57,994 and number of deaths due to it was 85.

Thrombocytopenia, bleeding and vascular permeability are seen in these infection. Studies have indicated that platelets plays imp role in pathogenesis of clumping of parasitized red blood cells in severe malaria and bleeding in dengue infection. 15 Nowadays platelet indices can be easily estimated at a low cost using automated blood cell counters which are biomarkers of platelet activation. [3] Mean platelet volume, normally measured using automated blood analysers, reflects the average size of platelets in circulation. It is meant to show the relationship between platelet synthesis in bone marrow and cell destruction. A normal MPV has a range of 7.5-11.5fl. MPV correlates with platelet function and may be more sensitive than platelet count as a biomarker in variety of diseases. It is also regarded as a useful surrogate marker of platelet activation or reactivity.The newer machines are offering an ever increasing range of modalities for hemogram and platelet analysis. They use different principles such as electrical impedence, optical light scatter, and fluroscent staining for studying blood cells which are giving encouraging results.[5]. PDW is an indicator of volume variability in platelet size and is increased in the presence of platelet anisocytosis[5]. Plateletcrit is the volume occupied by the platelets in the blood as a percentage and calculated according to the formula PCT = platelet count×MPV/10,000. Under physiological conditions, the amount of platelets in the blood is maintained in anequilibrium state by regeneration and elimination.[5] Low platelet count, low plateletcrit and high platelet distribution width may beused as predictor of severity of dengue infection.[4]Previous literature shows that initial platelet indices in malaria and dengue fever showed that only platelet count and plateletcrit were significantly lower. [2]

Mean platelet volume in dengue fever tended to be lower than in malaria. [2] Platelet distribution width increases with decrease in platelet count. [2] Mean platelet volume and plateletcrit decrease with decrease in platelet count. [2] Mean platelet volume can be used as independent predictors of bleeding in patients of dengue. High MPV indicates increased megakaryocytic while low MPV indicates marrow suppression and increased risk of bleeding . Thus, these indicators are useful in assessing severity of disease.

## AIM AND OBJECTIVES

To assess the severity of dengue or malaria by evaluation of platelet indices.

### Rationale and Goal of the study

- To correlate platelet indices with severity of disease in malaria or dengue
- To evaluate utility of platelet parameters as prognostic marker.

### Objective

To evaluate platelet indices like platelet count, Mean platelet volume, plateletcrit and platelet distribution width in patient with dengue or malaria.

## MATERIAL AND METHOD

**Duration Of Study:** 18 months from the approval date.

**Study Site:** Central Clinical Laboratory, Parul Sevashram Hospital, Parul Institute of Medical Science and Research.

**Study Population:** Blood samples of patients, suspected for malaria ordengue received in Central clinical laboratory in first visit.

**Study Design:** Observational type of study

**Data Analysis:** Anova test used for correlating platelet indices in dengue or malaria patient using software SPSS version 27

This study will include patients coming to Parul Sevashram Hospital with clinically suspected patients of dengue and malaria.

Malaria will be confirmed by microscopic method or card method.

Thin and thick smear techniques using giemsa stain method will be used for malaria diagnosis.

Dengue will be confirmed by NS1 antigen antigen or Anti dengue

Immunoglobulin M(IgM) or Anti dengue Immunoglobulin G(IgG) . Platelet indices will be studied in each group. CBC performed using Mindray 6- part (BC6200) fully automatic analyzer.

All the parameters of platelets like platelet count, MPV, PDW, Pct and other complete blood count parameters were studied thoroughly of Malaria positive patients.

## RESULTS

In present study, age group of dengue infection ranged from 2 months-65 years.

Majority of the patients in study were in between age group of 11-20 years (34.09%). In present study, Male gender(60.22%) had more dengue infection than female. 107 cases out of 176 cases amounting to 60.8% had thrombocytopenia in present study. Out of 107 cases of dengue fever, 34 cases(19.2%) had mild thrombocytopenia, 42 cases (23.86%) had moderate thrombocytopenia and 31 cases (17.61%) had severe thrombocytopenia.

**Table 1:comparison Of Platelet Indices With Platelet Count In Dengue Positive Cases**

| Platelet Parameter | Platelet count | N | Mean ±SD | P Value |
|---|---|---|---|---|
| MPV | <20,000 (V,severe) | 9 | 10.32 ±2.16 | <0.005 |
| | 20,000 – 50000 (Severe) | 22 | 12.04 ±2.769 | |
| | 51000 – 100000 (Moderate) | 42 | 11.65 ±2.23 | |
| | 101000- 150000 (Mild) | 34 | 13.76 ±11.89 | |
| | >150000 (Normal) | 69 | 9.97 ±1.28 | |
| PDW | <20,000 (V,severe) | 9 | 14.84 ±3.2 | 0.004 |
| | 20,000 – 50000 (Severe) | 22 | 15.94 ±1.95 | |
| | 51000 – 100000 (Moderate) | 42 | 15.83 ±1.21 | |
| | 101000- 150000 (Mild) | 34 | 15.89 ±1.02 | |
| | >150000 (Normal) | 69 | 14.31 ±2.82 | |
| PCT | <20,000 (V,severe) | 9 | 0.014 ± 0.004 | <0.005 |
| | 20,000 – 50000 (Severe) | 22 | 0.046 ± 0.017 | |
| | 51000 – 100000 (Moderate) | 42 | 0.093 ± 0.036 | |
| | 101000- 150000 (Mild) | 34 | 0.14 ±0.03 | |
| | >150000 (Normal) | 69 | 0.22 ± 0.073 | |

In present study, 110 cases out of 176 dengue positive cases amounting for 62.5% had normal MPV. While 5 cases amounting for 2.8 % had low MPV I.e <7.4 and 61 cases amounting for 34.65% had high MPV i.e >11.5. In present study, 161 cases out of 176 dengue positive cases amounting for 91.47 % had high Pdw i.e>14. While 4 case amounting for 2.27% had normal pdw I.e <10 and 11 cases amounting for 36.25 % had normal Pdw.

In present study, 118 cases out of 176 dengue positive cases amounting for 67.04 % had low pct. While 55 case amounting for 31.25% had normal pct I.e <0.18 and 3 cases amounting for 1.74% had high Pct cases amounting for 1.74% had high Pct i.e >0.35. Most patients showed normal MPV, with a considerable proportion exhibiting elevated MPV and PDW, indicating increased platelet turnover. PCT was low in the majority, reflecting reduced total platelet mass. NS1 antigen positivity was the most frequent serological finding. Platelet indices (MPV, PDW, PCT) demonstrated statistically significant correlation with platelet count, underscoring their diagnostic value in assessing thrombocytopenia severity.

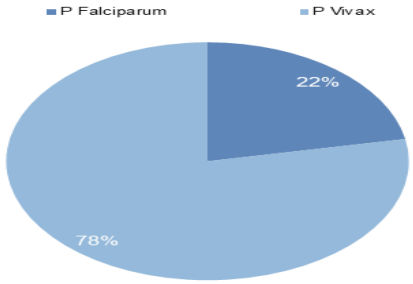


**Chart 1:** Pie Chart Showing Species Wise Distribution Of Cases Of Malaria

In Present study, total 78.26% cases were positive for P. Vivax Malaria and 21.74% cases were positive for P. Falciparum, with a male predominance in both species.

**Table 2 : Comparison Of Platelet Indices With Platelet Count In Malaria Positive Cases**

| Platelet Parameter | Platelet count | N | Mean ±SD | P Value |
|---|---|---|---|---|
| MPV | <20,000 (V,severe) | 2 | 6.35 ±0.21 | <0.005 |
| | 20,000 – 50000 (Severe) | 1 | 14.3 ±0 | |
| | 51000 – 100000 (Moderate) | 7 | 10.02 ±1.62 | |
| | 101000- 150000 (Mild) | 4 | 9.5 ±0.73 | |
| | >150000 (Normal) | 9 | 9.68 ±0.81 | |
| PDW | <20,000 (V,severe) | 2 | 16.9 ±0.423 | <0.004 |
| | 20,000 – 50000 (Severe) | 1 | 18 ±0 | |
| | 51000 – 100000 (Moderate) | 7 | 16.92 ±0.615 | |
| | 101000- 150000 (Mild) | 4 | 16.3 ±0.15 | |
| | >150000 (Normal) | 9 | 12.02 ±3.5 | |
| PCT | <20,000 (V,severe) | 2 | 0.04 ± 0.05 | <0.005 |
| | 20,000 – 50000 (Severe) | 1 | 0.4 ± 0 | |
| | 51000 – 100000 (Moderate) | 7 | 0.10 ± 0.019 | |
| | 101000- 150000 (Mild) | 4 | 0.13 ±0.04 | |
| | >150000 (Normal) | 9 | 0.22 ± 0.063 | |

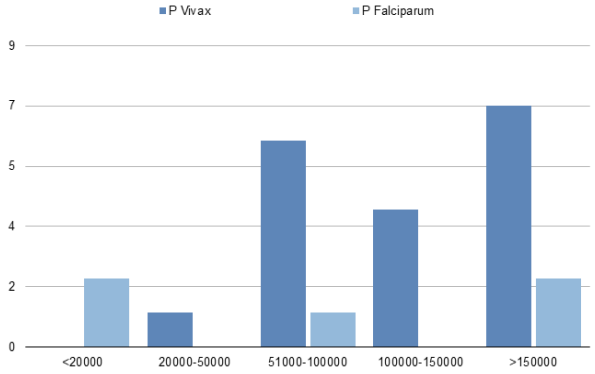


**Chart 2:** Bar graph showing distribution of malaria cases according to Platelet Count

P. falciparum infection showed a higher tendency for very severe thrombocytopenia, whereas P. vivax cases commonly presented with normal to mildly reduced platelet counts. MPV was mostly normal in P. vivax but frequently low in P. falciparum, suggesting suppressed platelet production. PDW was elevated in the majority of both groups, while PCT was predominantly low, especially in P. falciparum patients. Platelet indices showed significant association with platelet count, indicating their usefulness in evaluating platelet kinetics and disease severity.

Overall, platelet indices (MPV, PDW, PCT) showed consistent and significant variations in both dengue and malaria and can serve as supportive markers for early assessment of severity and platelet dynamics.

## DISCUSSION

Dengue fever remains a major public health problem in tropical regions such as India [6]. Globally, an estimated 50–100 million infections occur annually, with more than 500,000 cases progressing to severe forms like DHF and DSS [7]. Thrombocytopenia is a key severity marker as per WHO guidelines [8], resulting from reduced bone marrow production and increased peripheral destruction of platelets [9]. Early platelet activation and apoptosis—evidenced by increased P-selectin expression and apoptotic markers such as caspases and phosphatidylserine (PS)—further contribute to platelet decline [10,11]. Complement activation, particularly C3 involvement and C5b-9 deposition on platelets, has also been implicated in accelerated platelet clearance [12-14].

The present study showed a male-to-female ratio of 1.51:1, similar to findings by Meena CK et al. from Rajasthan (1.7:1) [21] and Shekar GC et al. from Warangal (1.13:1) [15]. Higher male prevalence is likely linked to greater outdoor exposure.

Thrombocytopenia was found in 60.78% of dengue cases, lower than

rates reported in Rajasthan (90%) [21], Jamnagar (79%) [16], and Bengaluru (85.9%) [17]. This supports its role as a major indicator of dengue severity.

Previous studies (Navya et al. [22]; Nehera RH et al. [18]) reported predominantly low MPV values due to marrow suppression. In contrast, the present study showed mainly normal (62.5%) and high MPV (34.65%), suggesting platelet regeneration. High PDW observed in this study aligns with findings from Navya et al. and Nehera et al., indicating increased platelet size variability due to activation or destruction commonly seen in dengue.The mean PCT in this study (0.146 ±0.0737) showed no significant difference ($p < 0.005$) when compared with values reported by Nehera RH et al. (0.048 ±0.0259; $p < 0.016$) [18], reinforcing PCT as an important parameter for assessing disease severity.

Twenty-three malaria-positive cases were recorded. Species distribution showed 78.26% Plasmodium vivax and 21.74% P. falciparum, comparable to findings from Smita & Harish Chandra (69.8% P. vivax, 27.5% P. falciparum) [23] and Palat P. & Vijapura T. (69% P. vivax, 31% P. falciparum) [24]. No mixed infections were detected. Regional patterns indicate P. vivax predominance with higher relapse potential.

Thrombocytopenia (<1.5 lakh/cumm) occurred in 61.1% of P. vivax and 60% of P. falciparum cases. These findings are consistent with earlier studies, including those by P. Jivani & B. Panchal (87.30% P. vivax, 97.29% P. falciparum) [25] and Survey KM et al. (74.54% P. vivax, 66.66% P. falciparum) [4]. Most cases showed moderate thrombocytopenia. Mean MPV (9.67 fL), PDW (14.94), and PCT (0.093) in the present study matched values reported by Haftu Asmerom et al. (MPV 9.6, PDW 19.2, PCT 0.13) [93]. Low MPV (<7.4 fL) may indicate P. falciparum infection, whereas normal or elevated MPV is more characteristic of P. vivax. High PDW, common across both species, reflects active platelet turnover. PCT was low in 61.11% of P. vivax and 80% of P. falciparum cases, suggesting greater platelet mass reduction in P. falciparum infections. Combined assessment of platelet count, MPV, PDW, and PCT may aid in differentiating disease severity between species.

## CONCLUSION

Observational study was conducted in central clinical laboratory, PIMSR for a period of 18 months.

Study included 176 dengue positive cases and 23 malaria positive cases. In this study, platelet indices (MPV, PDW, and PCT) were evaluated in dengue and malaria infections to assess their role in predicting disease severity and improving early and timely management.

In dengue positive cases M:F ratio is 1.51:1. In dengue positive cases, thrombocytopenia was present in 60.8% of the cases, with the mean MPV 11.38fl, mean PDW 15.22 and mean pct 0.14 ml/L. A significant p value of <0.005 was observed in all the three platelet indices which shows statistical significance.

In malaria positive cases, M : F is ratio 2.60:1. In malaria positive cases, thrombocytopenia was present in 60 % of the cases, with the mean MPV 9.67 l, mean PDW 14.94 and mean pct 0.146 ml/L. A significant p value of <0.005 was observed in all the three platelet indices which shows statistical significance.

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