

**MALARIA-ASSOCIATED THROMBOCYTOPENIA: A COMPREHENSIVE ANALYSIS OF PLATELET COUNT AND INDICES FOR CLINICAL APPLICATIONS**

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ABSTRACT **Background:** Malaria, a widespread parasitic disease caused by the Plasmodium species, continues to exert a substantial global health burden, particularly in tropical and subtropical regions. Despite advancements in diagnostic and therapeutic approaches, understanding the intricate host-pathogen interactions during malaria remains a pivotal research focus. This paper seeks to provide a comprehensive examination of the relationship between platelet count and platelet indices in the context of malarial infections. **Materials and Methods:** A prospective study in which 107 malaria positive cases were included by peripheral smear examination and Rapid diagnostic test. **Results:** Present study includes 107 patients with malaria from which 72% were males and 28% were females. Maximum number of cases (52.3%) were seen in the age groups between 21-40 years of age. Out of 107 cases, 70 cases (65.4%) were P.Vivax malaria and 37 cases (34.6%) were P.Falciparum malaria. The patient's platelet count ranged from 25,000 to 2,99,000 cells/ cmm, with a mean platelet count of 1,24,607 cells/ cmm. Incidence of Thrombocytopenia was 76% (81 cases) in the study population, out of which mild, moderate and severe thrombocytopenia was seen 35.5% (38 cases) , 34% (36 cases) and 6.5% (7 cases) respectively. All severe cases of thrombocytopenia were seen in P.Falciparum infection. Out of 81 patients with Thrombocytopenia Mean Platelet volume (MPV) was increased in 37 cases (46%) and Platelet distribution width was increased in 31 cases (38%). **Conclusion:** Malaria is usually associated with various degrees of thrombocytopenia. Platelet indices are useful predictors of malaria severity thus enabling the clinicians to establish an effective therapeutic plan to prevent major complications.

KEYWORDS : Thrombocytopenia, Platelet Indices, Malaria, MPV, PDW.

INTRODUCTION:

Malaria, a blood parasitic disease caused by Plasmodium species, continues to pose a significant global health threat. The global incidence of malaria remains a pressing concern, with millions of new cases reported annually, particularly affecting populations in tropical and subtropical regions where the Anopheles mosquito, the primary vector for Plasmodium parasites, thrives. According to the latest World malaria report, there were 249 million cases of malaria in 2022 compared to 244 million cases in 2021. The bulk of mortality is seen in Infants and childrens.¹

Peripheral Blood smear is the Gold standard test for diagnosing malaria.²

Platelets, essential components of the host's immune response, play a crucial role in the pathophysiology of malaria. Studies have consistently reported a decline in platelet count during malarial infections, with thrombocytopenia being a common hematological manifestation. This phenomenon is attributed to multiple factors, including splenic sequestration, immune-mediated destruction, and impaired platelet production.² The severity and duration of thrombocytopenia often correlate with the clinical course of the disease, making platelet count a valuable prognostic indicator in malaria.

In addition to platelet count, platelet indices such as mean platelet volume (MPV) and platelet distribution width (PDW) have gained attention as potential markers of malarial pathogenesis. Changes in MPV, indicative of platelet activation and turnover, have been observed in malaria patients. PDW, reflecting platelet size heterogeneity, may provide insights into the dynamic nature of platelet responses during the course of infection.³

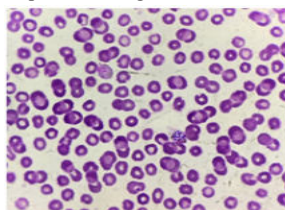


Fig.1A- Trophozoite and Schizont of P.Vivax

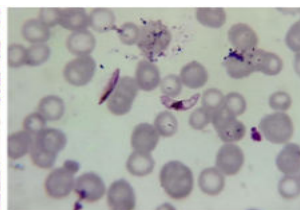


Fig.1B- Gametocytes of P.Falciparum

MATERIALS AND METHODS:

This is a Prospective study in which a total of 107 patients diagnosed to have malaria admitted at medicine wards in Jagjivan Ram Railway Hospital, Mumbai , from October 2022 to December 2023 were included in the study.

All study subjects were identified positive for malaria parasite by peripheral smear examination with conventional microscopy and by Rapid diagnostic tests (Bioline malaria antigen P.f HRP-II for P.falciparum and p-LDH for P.Vivax).

Platelet counts were done on a fully automated quantitative analyzer (5 part differential cell counter, SYSMEX XN-1000). Baseline platelet counts were done on the day of presentation. Repeat Platelet counts were done in subjects daily for 6 days from admission until normal or near normal values were reached.

Patients with thrombocytopenia were divided into three categories.

1. Mild thrombocytopenia < 150000 to > 100000 cells/ cmm.
2. Moderate thrombocytopenia < 100000 to > 50000 cells/ cmm.
3. Severe thrombocytopenia < 50000 cells/ cmm.

Reference ranges for Platelet indices were taken to be 7.2 - 11.7 for MPV and 9.2 - 16.7 for PDW Respectively. Data collected were entered into Microsoft Excel Spreadsheet for Analysis.

RESULTS:

Table 1 shows the overall distribution of the individuals based on age and sex. There were 77 male (72%) and 30 female (28%) individuals in the studied population. The age range was between 2 - 73 years. Maximum number of cases (52.3%) were seen in the age groups between 21-40 years of age.

Out of 107 cases, 70 cases (65.4%) were P.Vivax malaria and 37 cases (34.6%) were P.Falciparum malaria. (Case distribution of malaria is given in Fig.2)

The patient's platelet count ranged from 25,000 to 2,99,000 cells/ cmm, with a mean of 1,24,607 cells/ cmm.

Incidence of Thrombocytopenia was 76% (81 cases) in the study

population, out of which mild, moderate and severe thrombocytopenia was seen 35.5% (38 cases), 34% (36 cases) and 6.5% (7 cases) respectively (Table 2).

(Fig 3 shows the platelet count in P.Vivax and P.Falciparum cases).

Platelet counts were done daily for 6 days from the date of admission. On Day one 81 (100%), on day two 76 (93%), on day three 39 (48%), on day four 18 (22%) Patients had low platelet counts.

Out of 81 patients with Thrombocytopenia Mean Platelet volume (MPV) was increased in 37 cases (46%) and Platelet distribution width was increased in 31 cases (38%). The patient's Mean Hospital stay was 3.8 days. Patients with increased MPV and thrombocytopenia had an increased mean hospital stay of 4.70 days compared to Patients with Normal MPV and thrombocytopenia which is 3.02 days.

Table 3 shows the Platelet counts on admission and at discharge. Patients with Falciparum malaria were found to have lower counts than patients with vivax malaria. All patients made a full recovery and were discharged home in a stable condition. Platelet counts improved significantly in all the malarial patients. By discharge, No patients had severe thrombocytopenia, 3 patients had moderate thrombocytopenia and 13 had mild thrombocytopenia.

Once Treatment was started patients with P.Falciparum took longer days to recover from thrombocytopenia compared to P.Vivax positive individuals.

TABLE 1 : AGE AND SEX DISTRIBUTION OF CASES :

Age groups (Years)	Male (No. of Cases) & Percentage	Female (No. of Cases) & Percentage	Total (No. of Cases)
0-20	9	2	11 (10.2%)
21-40	43	13	56 (52.3%)
41-60	16	14	30 (28%)
61-80	9	1	10 (9.5%)
Total	77 (72%)	30 (28%)	107 (100%)

TABLE 2 : INCIDENCE OF DEGREE OF THROMBOCYTOPENIA IN STUDY POPULATION :

Degree of Thrombocytopenia (Platelet counts in Lac/ μ l)	No. of Cases	Percentage
Mild (1.0 to <1.5)	38	35.5%
Moderate (0.5 to 1.0)	36	34%
Severe (< 0.5)	7	6.5%
Total	81	76%

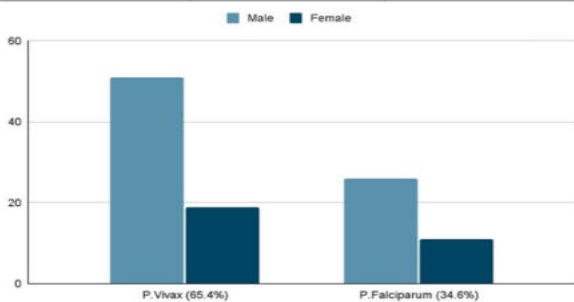


Fig 2 : Case Distribution of Malaria

TABLE 3 : PLATELET COUNTS ON ADMISSION AND AT DISCHARGE:

	On Admission		On Discharge	
	Vivax Malaria	Falciparum Malaria	Vivax Malaria	Falciparum Malaria
Severe Thrombocytopenia (<50,000 cells /cmm)	0	7	0	0
Moderate Thrombocytopenia (50,000 - 1,00,000 cells /cmm)	19	17	0	3
Mild Thrombocytopenia (1,00,000 - 1,50,000 cells /cmm)	27	11	3	13
No Thrombocytopenia (>1,50,000 cells/cmm)	24	2	67	21

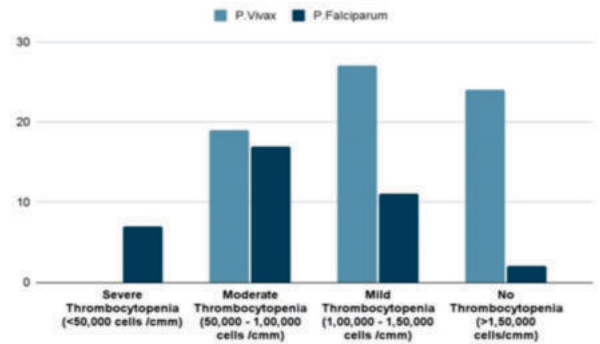


Fig 3 : Platelet Count in Vivax and Falciparum Cases

DISCUSSION:

Acute febrile illness (AFI) poses a diagnostic challenge due to the myriad of potential infectious causes, among which malaria is a prominent contributor, especially in regions where the disease is endemic. Thrombocytopenia is a well-documented feature in various forms of malaria caused by Plasmodium species. The prevalence and severity of thrombocytopenia often correlate with the species of Plasmodium involved, the degree of parasitemia, and the immune response of the host.⁴

Several mechanisms contribute to the development of thrombocytopenia in malaria. Splenic sequestration, where infected red blood cells and platelets accumulate in the spleen, is a key factor. Immune-mediated destruction of platelets, often triggered by the release of malarial antigens, further exacerbates thrombocytopenia. Additionally, impaired platelet production in the bone marrow due to the direct effects of the parasite or secondary to inflammation plays a role.⁵

Severe thrombocytopenia is a recognized complication in individuals infected with Plasmodium falciparum and is associated with an increased risk of bleeding complications.⁶ In Present study Mild thrombocytopenia was seen commonly associated with P.vivax as compared to P.Falciparum, Moderate thrombocytopenia was seen in both P.Vivax and P.Falciparum, Severe thrombocytopenia was commonly seen in P.falciparum compared to P.Vivax.

Thrombocytopenia is rarely accompanied by clinical bleeding. Platelet counts can fall below 25,000 cells/ cmm, but this is uncommon. Platelet count rises rapidly with recovery along with initiation of Anti-malarial treatment.

Platelet indices - MPV and PDW are the two most hematological predictors of P.falciparum and P.vivax malaria infection. MPV is a measure of the average size of platelets and PDW reflects the variation in platelet size. Altered MPV and PDW values may serve as potential prognostic indicators, with certain patterns associated with disease severity. However, their clinical utility should be considered in conjunction with other clinical and laboratory parameters.⁸

In normal individuals, MPV has been found to be inversely correlated with Platelets when measured by impedance technology. Immature platelet fraction is also raised in case of severe malaria and it is significantly useful than MPV.⁹

In general, platelet transfusion is not routinely recommended for individuals with mild to moderate malaria and uncomplicated thrombocytopenia. It is often transient and self-limiting.¹⁰

CONCLUSION:

Malaria is usually associated with various degrees of thrombocytopenia. Severe thrombocytopenia can occur in P.vivax infections although it is more common in P.Falciparum infections. Platelet indices are useful predictors of malaria severity thus enabling the clinicians to establish an effective therapeutic plan to prevent major complications.

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