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Mean Platelet Volume in Acute Ischemic Stroke and Its Association with Severity and Prognosis

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Abstract

Background: Mean platelet volume (MPV) is an indicator of platelet size and activity and may reflect the inflammatory and thrombotic processes associated with various disease conditions. Assessment of MPV may provide useful information regarding disease severity and clinical outcomes.

Aim: To evaluate the distribution of mean platelet volume categories and their association with disease outcomes and selected clinical risk factors, including diabetes mellitus, hypertension, and smoking status.

Materials and Methods: This observational study included 102 participants. MPV was categorized as low, normal, or high. The distribution of MPV categories was assessed according to disease outcome at Week 01, diabetic status, hypertension status, and smoking status. Associations between categorical variables were evaluated using the chi-square test, and a p-value of less than 0.05 was considered statistically significant.

Results: Among the 102 participants, 58 (56.9%) had high MPV, 43 (42.2%) had normal MPV, and 1 (1.0%) had low MPV. At Week 01, normal MPV was predominant among participants who improved (91.7%), whereas high MPV was predominant among those whose condition deteriorated (93.5%). Among participants with diabetes, 58.0% had high MPV, compared with 50.0% of non-diabetic participants. High MPV was observed in 59.2% of hypertensive participants and 50.0% of normotensive participants. Similarly, 61.0% of smokers and 54.1% of non-smokers had high MPV. The associations between MPV categories and diabetic status ($p = 0.767$), hypertension status ($p = 0.188$), and smoking status ($p = 0.596$) were not statistically significant.

Conclusion: High MPV was the most common category in the study population and was particularly prevalent among participants whose condition deteriorated at Week 01. However, no statistically significant associations were observed between MPV categories and diabetes mellitus, hypertension, or smoking status. Further studies with larger sample sizes are required to determine the prognostic significance of MPV in predicting disease outcomes.

Keywords: Mean platelet volume, platelet indices, disease outcome, diabetes mellitus, hypertension, smoking, prognosis.

Introduction

Platelets, also known as thrombocytes, are anucleate blood cells that play a vital role in haemostasis, blood coagulation, vascular integrity, and inflammatory responses. In addition to their established role in preventing blood loss, platelets participate in the development of inflammation and thrombosis. Alterations in platelet morphology and function have therefore attracted considerable interest as potential indicators of disease activity, severity, and prognosis [1,2].

Mean platelet volume (MPV) is a routinely measured platelet index obtained from a complete blood count using automated haematology analysers. It represents the average size of circulating platelets and is commonly expressed in femtolitres (fL). Larger platelets are generally considered more metabolically active and may exhibit greater aggregation potential and increased release of prothrombotic mediators. Consequently, MPV has been investigated as a potential marker of platelet activation and a useful, cost-effective parameter in the assessment of various clinical conditions [1–3].

Several studies have explored the relationship between MPV and cardiovascular and inflammatory diseases. Increased MPV has been associated with platelet hyperreactivity, vascular dysfunction, and an increased risk of thrombotic events. However, MPV may vary according to the underlying disease, the intensity of inflammation, and the methods used for blood sample collection and analysis. Therefore, its clinical interpretation requires consideration of the patient's overall condition and the laboratory reference range [2–4].

Diabetes mellitus is a metabolic disorder associated with chronic hyperglycaemia, endothelial dysfunction, and increased platelet activation. These changes contribute to an increased risk of atherosclerosis and thrombotic complications. Previous studies have reported associations between MPV and diabetes-related metabolic and vascular abnormalities, suggesting that MPV may provide additional information about platelet activity in diabetic individuals [5,6]. Hypertension is another important cardiovascular risk factor that contributes to vascular injury and cardiovascular complications. Changes in platelet activation and vascular function may occur in individuals with elevated blood pressure. Research has investigated the association between MPV and hypertension, although the strength and consistency of this relationship vary across populations and study designs [5,7]. Smoking is also associated with endothelial injury, oxidative stress, platelet activation, and an increased tendency towards thrombosis. These effects provide a biological basis for investigating MPV in smokers and non-smokers. Nevertheless, differences in smoking exposure, associated diseases, and other confounding factors may influence the observed relationship between smoking and platelet indices [1,8].

In addition to its association with established cardiovascular risk factors, MPV has been investigated

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as a potential prognostic marker in patients with different acute and chronic diseases. Some studies suggest that platelet indices may be associated with disease progression and clinical outcomes; however, MPV alone cannot reliably predict outcomes in every clinical setting. Differences in study populations, measurement techniques, and MPV cut-off values remain important limitations in translating research findings into routine clinical practice [3,4,9,10].

The present study was undertaken to evaluate the distribution of MPV categories—low, normal, and high—and to examine their association with clinical outcomes at Week 01. It also assessed the relationship between MPV categories and selected clinical risk factors, including diabetes mellitus, hypertension, and smoking status. By evaluating these parameters, the study aims to contribute to the understanding of the potential clinical and prognostic significance of MPV and its possible role as an adjunctive laboratory marker in patient assessment.

Materials and Methods

Study Design: Observational study.

Sample Size: 102 participants.

Study Procedure: Clinical and demographic data were collected, including diabetes mellitus, hypertension, smoking status, and clinical outcome at Week 01. Mean platelet volume (MPV) was assessed using haematological reports and classified as low, normal, or high according to the laboratory reference range. The association between MPV categories and selected clinical variables was evaluated using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

Inclusion Criteria

1. Patients included in the study population.
2. Availability of MPV values in the haematological reports.
3. Availability of relevant clinical information, including Week 01 outcome.
4. Availability of data regarding diabetes mellitus, hypertension, and smoking status.

Exclusion Criteria

1. Patients with incomplete or missing MPV data.
2. Patients with incomplete clinical outcome information.
3. Patients with insufficient information regarding the selected risk factors.
4. Duplicate or unusable records

Statistical Analysis

Data were analysed using descriptive statistics and the chi-square test to assess associations between MPV categories and clinical variables. Statistical significance was set at $p < 0.05$.

Results

The distribution of clinical presentations among the study participants revealed that right hemiplegia was the most common presentation, observed in 48 participants (47.1%), followed closely by left hemiplegia in 47 participants (46.1%). Left swaying was reported in 2 participants (2.0%). Other clinical presentations, including left monoplegia, a comatose state, right limb numbness, left-side swaying, and unconsciousness, were observed in 1 participant each (1.0%). Overall, hemiplegia was the predominant clinical presentation, accounting for the vast majority of cases. Right and left hemiplegia together accounted for 95 participants (93.2%), indicating that motor weakness affecting one side of the body was the principal clinical manifestation in the study population.

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Table 1: Distribution of Clinical Presentations (Medical History) of Participants

S. No.	Clinical Presentations	Number (n)	Percentage (%)
1	Right hemiplegia	48	47.1
2	Left hemiplegia	47	46.1
3	Left swaying	2	2.0
4	Left monoplegia	1	1.0
5	Comatose state	1	1.0
6	Right limb numbness	1	1.0
7	Left-side swaying	1	1.0
8	Unconsciousness	1	1.0
Total	All clinical presentations	102	100.0

Table 2: Frequency Distribution of Baseline (Initial) and One-Week Modified Rankin Scale (MRS) Scores

MRS Score	Initial Frequency	Initial Percentage (%)	One-Week Frequency	One-Week Percentage (%)
1	1	1.0	1	1.0
2	2	2.0	1	1.0
3	25	24.5	7	6.9
4	66	64.7	45	44.1
5	8	7.8	43	42.2
6	0	0.0	5	4.9
Total	102	100.0	102	100.0

Table 3: Descriptive Statistics of Baseline (Initial) and One-Week Modified Rankin Scale (MRS) Scores

Descriptive Statistics	Percentile	MRS Initial	MRS at 1 Week
Mean	—	3.76	4.40
Median	—	4.00	4.00
Range	—	4	5
Minimum	—	1	1
Maximum	—	5	6
25th Percentile (Q1)	25	3.00	4.00
50th Percentile (Q2)	50	4.00	4.00

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Descriptive Statistics	Percentile	MRS Initial	MRS at 1 Week
75th Percentile (Q3)	75	4.00	5.00

The descriptive analysis of Modified Rankin Scale (MRS) scores among 102 participants demonstrated an increase in the mean score from 3.76 at baseline to 4.40 after one week. The median score remained unchanged at 4.00 at both assessments. The range increased from 4 at baseline to 5 at the one-week follow-up, with the maximum score increasing from 5 to 6, while the minimum score remained 1. The 25th percentile increased from 3.00 to 4.00, whereas the 75th percentile increased from 4.00 to 5.00.

Overall, the increase in the mean MRS score and the upward shift in percentile values suggest a trend towards greater disability after one week in the study population. However, statistical significance cannot be confirmed from descriptive statistics alone. Although the original text reports a Wilcoxon signed-rank test result of $p < 0.001$, this finding should be retained only if it has been verified using the individual paired MRS scores of the participants.

Table 4: Status of Participants One Week After Initial Assessment

S. No.	Status After One Week	Number (n)	Percentage (%)
1	Deteriorated	46	45.1
2	Improved	24	23.5
3	Remained status quo	32	31.4
Total		102	100.0

Among the 102 participants assessed one week after the initial evaluation, 46 (45.1%) experienced deterioration in their clinical status. In contrast, 24 participants (23.5%) demonstrated improvement, while 32 (31.4%) remained in the same clinical condition as at the initial assessment.

The findings indicate that deterioration was the most common outcome, affecting nearly half of the study population. Approximately one-fourth of the participants showed improvement, whereas nearly one-third experienced no change in their clinical status. Overall, these results demonstrate considerable variation in clinical outcomes during the one-week follow-up period, with a greater proportion of participants experiencing deterioration than improvement.

Table 5: Distribution of Diabetes Mellitus (DM) Status Among Participants

S. No.	Diabetes Mellitus Status	Number (n)	Percentage (%)
1	Present	88	86.3
2	Absent	14	13.7
Total		102	100.0

Among the 102 participants included in the study, diabetes mellitus was present in 88 participants (86.3%), whereas 14 participants (13.7%) did not have diabetes mellitus. Thus, the majority of the study participants had diabetes mellitus, accounting for more than four-fifths of the study population.

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These findings indicate a high proportion of diabetes mellitus among the participants. The high frequency of diabetes in this study population may be relevant when interpreting clinical outcomes, as diabetes can be associated with vascular complications and impaired recovery. However, the relationship between diabetes mellitus and clinical outcomes would require further statistical analysis to establish an association.

Graph 1: Distribution of Diabetes Mellitus (DM) Status Among Participants

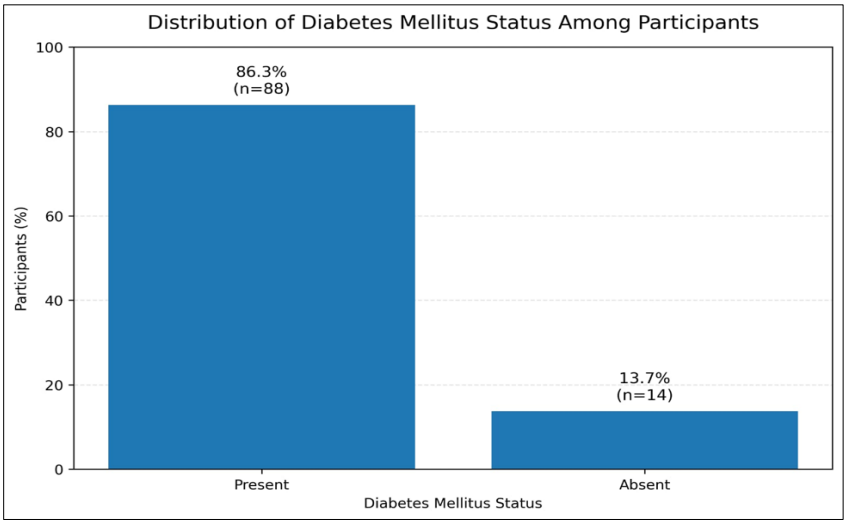


Table 6: Distribution of Hypertension Among Participants

S. No.	Hypertension Status	Number (n)	Percentage (%)
1	Present	76	74.5
2	Absent	26	25.5
Total		102	100.0

Among the 102 participants included in the study, hypertension was present in 76 participants (74.5%), whereas 26 participants (25.5%) did not have hypertension. Thus, nearly three-fourths of the study population had hypertension, indicating that it was a common comorbidity among the participants.

The high proportion of hypertension may be clinically relevant because hypertension is an important risk factor for cerebrovascular diseases and can influence clinical outcomes. However, further statistical analysis would be required to determine whether hypertension was significantly associated with the clinical status or functional outcomes of the participants.

Table 7: Distribution of Dyslipidaemia Among Participants

S. No.	Dyslipidaemia Status	Number (n)	Percentage (%)
1	Present	53	52.0
2	Absent	49	48.0
Total		102	100.0

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Among the 102 participants included in the study, dyslipidaemia was present in 53 participants (52.0%), whereas 49 participants (48.0%) did not have dyslipidaemia. Thus, slightly more than half of the study population had dyslipidaemia, indicating that it was a common comorbidity among the participants. The findings demonstrate a relatively balanced distribution between participants with and without dyslipidaemia, although the proportion with dyslipidaemia was marginally higher. Dyslipidaemia may be clinically relevant because abnormal lipid levels are associated with atherosclerosis and an increased risk of cerebrovascular disease. Further statistical analysis would be required to determine whether dyslipidaemia was associated with clinical deterioration or functional outcomes in the study population.

Table 8: Distribution of Smoking Habits Among Participants

S. No.	Smoking Status	Number (n)	Percentage (%)
1	Present	41	40.2
2	Absent	61	59.8
Total		102	100.0

Among the 102 participants included in the study, 41 (40.2%) were smokers, whereas 61 (59.8%) did not report smoking. Thus, the majority of participants were non-smokers, accounting for 59.8% of the study population, while approximately two-fifths had a history of smoking. Smoking is an important modifiable risk factor for cerebrovascular diseases because it contributes to vascular damage and increases the risk of thrombotic events. The proportion of smokers observed in this study highlights the relevance of assessing smoking habits when evaluating participants with cerebrovascular conditions. However, further statistical analysis would be required to determine whether smoking was significantly associated with clinical deterioration or functional outcomes in this study population.

Table 9: Descriptive Statistics of Clinical and Laboratory Findings Among Participants

Descriptive Statistics	Random Blood Sugar (mg/dL)	Systolic BP (mmHg)	Diastolic BP (mmHg)	Mean Platelet Volume (fL)	Cholesterol (mg/dL)
Mean	203.19	158.41	95.61	11.244	214.07
Standard Deviation	68.726	16.077	7.805	1.2720	30.302
Median	192.00	160.00	100.00	11.800	210.00
Minimum	82	120	70	7.2	152
Maximum	430	190	110	12.9	284
25th Percentile (Q1)	180.00	150.00	90.00	10.775	192.00
50th Percentile (Q2)	192.00	160.00	100.00	11.800	210.00
75th Percentile (Q3)	230.50	170.00	100.00	12.200	230.50

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The descriptive statistics of clinical and laboratory parameters among the study participants are presented in Table 9. The findings provide an overview of the participants' glycaemic status, blood pressure, mean platelet volume, and cholesterol levels.

1. **Random Blood Sugar (RBS):** The mean random blood sugar level was 203.19 ± 68.73 mg/dL, with a median of 192 mg/dL. Values ranged from 82 to 430 mg/dL. The 25th and 75th percentiles were 180 mg/dL and 230.50 mg/dL, respectively. The elevated mean RBS suggests that hyperglycaemia was common in the study population, although individual values varied considerably.
2. **Systolic Blood Pressure (SBP)**: The mean systolic blood pressure was 158.41 ± 16.08 mmHg, with a median of 160 mmHg. The minimum and maximum values were 120 and 190 mmHg, respectively. The interquartile distribution ranged from 150 mmHg at the 25th percentile to 170 mmHg at the 75th percentile. These findings indicate that systolic blood pressure was generally elevated among the participants.
3. **Diastolic Blood Pressure (DBP)**: The mean diastolic blood pressure was 95.61 ± 7.81 mmHg, while the median was 100 mmHg. The recorded values ranged from 70 to 110 mmHg. The 25th percentile was 90 mmHg, and the 75th percentile was 100 mmHg. These results suggest that elevated diastolic blood pressure was also common among the participants.
4. **Mean Platelet Volume (MPV)**: The mean platelet volume was 11.244 ± 1.272 fL, with a median of 11.8 fL. Values ranged from 7.2 to 12.9 fL. The 25th and 75th percentiles were 10.775 and 12.2 fL, respectively. The observed variation indicates differences in platelet volume among participants. MPV may be relevant when evaluating platelet activity and vascular conditions, but its clinical significance should be interpreted alongside other laboratory and clinical findings.
5. **Cholesterol**: The mean cholesterol level was 214.07 ± 30.30 mg/dL, with a median of 210 mg/dL. The minimum value was 152 mg/dL, and the maximum was 284 mg/dL. The 25th percentile was 192 mg/dL, while the 75th percentile was 230.50 mg/dL. These findings suggest that cholesterol levels were elevated in a proportion of participants. However, total cholesterol alone does not provide a complete assessment of lipid status; LDL cholesterol, HDL cholesterol, and triglyceride measurements would provide additional information.

Overall Interpretation

The study population demonstrated elevated average random blood sugar, systolic and diastolic blood pressure, and total cholesterol levels. Mean platelet volume also showed variability across participants. These findings highlight the presence of several potentially important metabolic and vascular risk factors in the study population.

Table 10: Distribution of Age Among Participants According to Disease Status at Week 01

Age (years)	Improved (n = 24) Mean	SD	Remained Status Quo (n = 32) Mean	SD	Deteriorated (n = 46) Mean	SD
Age	66.13	10.816	64.78	9.39	62.98	10.34

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The mean age of participants who improved after one week was 66.13 ± 10.816 years, whereas those who remained in the same clinical condition had a mean age of 64.78 ± 9.39 years. Participants whose clinical condition deteriorated had a mean age of 62.98 ± 10.34 years.

The findings indicate a slight difference in mean age across the three outcome groups, with participants who improved being older on average than those whose condition deteriorated. The standard deviations were relatively similar across the groups, suggesting comparable variability in age. According to the Kruskal–Wallis test, the difference in age among the three groups was not statistically significant (p = 0.599). Therefore, age was not significantly associated with clinical outcomes at the one-week assessment in this study.

Table 11: Distribution of Random Blood Sugar (RBS) Among Participants According to Disease Status at Week 01

Parameter	Improved (n = 24) Mean	SD	Remained Status Quo (n = 32) Mean	SD	Deteriorated (n = 46) Mean	SD
RBS (mg/dL)	167.17	47.482	198.41	62.386	225.30	74.561

The mean random blood sugar (RBS) level among participants who improved after one week was 167.17 ± 47.482 mg/dL. Those who remained in the same clinical condition had a mean RBS level of 198.41 ± 62.386 mg/dL, whereas participants whose condition deteriorated had the highest mean RBS level of 225.30 ± 74.561 mg/dL.

Table 12: Distribution of Systolic Blood Pressure (SBP) Among Participants According to Disease Status at Week 01

Parameter	Improved (n = 24) Mean	SD	Remained Status Quo (n = 32) Mean	SD	Deteriorated (n = 46) Mean	SD
SBP (mmHg)	152.92	15.413	159.69	13.556	160.39	17.631

The mean systolic blood pressure (SBP) among participants who improved after one week was 152.92 ± 15.413 mmHg. Participants who remained in the same clinical condition had a mean SBP of 159.69 ± 13.556 mmHg, whereas those whose condition deteriorated had the highest mean SBP of 160.39 ± 17.631 mmHg. The findings indicate a gradual increase in mean systolic blood pressure across the three outcome groups, with the lowest mean observed among participants who improved and the highest among those whose condition deteriorated. However, the difference in SBP across the groups was not statistically significant according to the Kruskal–Wallis test (p = 0.070). Therefore, this study did not demonstrate a statistically significant association between systolic blood pressure and clinical outcomes at the one-week assessment.

Table 13: Distribution of Diastolic Blood Pressure (DBP) Among Participants According to Disease Status at Week 01

Parameter	Improved (n = 24) Mean	SD	Remained Status Quo (n = 32) Mean	SD	Deteriorated (n = 46) Mean	SD
DBP(mmHg)	93.50	9.422	95.31	6.713	96.91	7.492

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The mean diastolic blood pressure (DBP) among participants who improved after one week was 93.50 ± 9.422 mmHg. Participants who remained in the same clinical condition had a mean DBP of 95.31 ± 6.713 mmHg, whereas those whose condition deteriorated had the highest mean DBP of 96.91 ± 7.492 mmHg

Table 14: Distribution of Mean Platelet Volume (MPV) Among Participants According to Disease Status at Week 01

Parameter	Improved (n = 24) Mean	SD	Remained Status Quo (n = 32) Mean	SD	Deteriorated (n = 46) Mean	SD
MPV (fL)	9.55	1.2083	11.278	0.7657	12.104	0.4397

The mean platelet volume (MPV) among participants who improved after one week was 9.55 ± 1.2083 fL. Those who remained in the same clinical condition had a mean MPV of 11.278 ± 0.7657 fL, whereas participants whose condition deteriorated had the highest mean MPV of 12.104 ± 0.4397 fL.The findings demonstrate a progressive increase in mean MPV across the three outcome groups, with the lowest value observed among participants who improved and the highest among those whose condition deteriorated. The standard deviation was greatest in the improved group and lowest in the deteriorated group, indicating greater variability in MPV among participants who improved.

Table 15: Distribution of Cholesterol Among Participants According to Their Disease Status at Week 01

Parameter	Improved (n = 24) Mean	SD	Remained Status Quo (n = 32) Mean	SD	Deteriorated (n = 46) Mean	SD
Cholesterol (mg/dL)	210.83	30.718	217.88	27.224	213.11	32.421

The mean cholesterol level among participants who improved was 210.83 ± 30.718 mg/dL. Participants whose condition remained unchanged had a mean cholesterol level of 217.88 ± 27.224 mg/dL, while those whose condition deteriorated had a mean cholesterol level of 213.11 ± 32.421 mg/dL. Although the mean cholesterol level was highest among participants whose clinical status remained unchanged, the differences between the three groups were not statistically significant, according to the Kruskal–Wallis test ($p = 0.49$). Since the p-value was greater than 0.05, no statistically significant association was observed between cholesterol levels and disease outcomes at Week 01 in this study population.

Table 16: Gender Distribution Among Participants According to Their Disease Outcome at Week 01

Disease Outcome	Female (Number)	Female (%)	Male (Number)	Male (%)	Total
Improved	11	45.8	13	54.2	24
Remained status quo	15	46.9	17	53.1	32
Deteriorated	20	43.5	26	56.5	46
Total	46	45.1	56	54.9	102

Among the 24 participants who showed improvement at Week 01, 11 (45.8%) were female and 13 (54.2%) were male. Among the 32 participants whose clinical status remained unchanged, 15 (46.9%) were female and 17 (53.1%) were male. Of the 46 participants whose condition deteriorated, 20 (43.5%) were female and 26 (56.5%) were male

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Table 17: Distribution of Diabetic Status Among Participants According to Their Disease Outcome at Week 01

Disease Outcome	Diabetic (Number)	Diabetic (%)	Non-diabetic (Number)	Non-diabetic (%)	Total
Improved	18	75.0	6	25.0	24
Remained status quo	30	93.8	2	6.3	32
Deteriorated	40	87.0	6	13.0	46
Total	88	86.3	14	13.7	102

Among the 24 participants who improved at Week 01, 18 (75.0%) were diabetic, while 6 (25.0%) were non-diabetic. Among the 32 participants whose clinical status remained unchanged, 30 (93.8%) were diabetic and 2 (6.3%) were non-diabetic. Of the 46 participants whose condition deteriorated, 40 (87.0%) were diabetic, whereas 6 (13.0%) were non-diabetic. Overall, 88 (86.3%) participants were diabetic, while 14 (13.7%) were non-diabetic. The proportion of diabetic participants was highest in the group whose clinical status remained unchanged (93.8%), followed by the deteriorated group (87.0%) and the improved group (75.0%).

Table 18: Distribution of Hypertension Status Among Participants According to Their Disease Outcome at Week 01

Disease Outcome	Hypertensive (Number)	Hypertensive (%)	Normotensive (Number)	Normotensive (%)	Total
Improved	14	58.3	10	41.7	24
Remained status quo	28	87.5	4	12.5	32
Deteriorated	34	73.9	12	26.1	46
Total	76	74.5	26	25.5	102

Among the 24 participants who improved at Week 01, 14 (58.3%) were hypertensive, while 10 (41.7%) were normotensive. Among the 32 participants whose clinical status remained unchanged, 28 (87.5%) were hypertensive and 4 (12.5%) were normotensive. Of the 46 participants whose condition deteriorated, 34 (73.9%) were hypertensive, whereas 12 (26.1%) were normotensive. Overall, 76 (74.5%) participants were hypertensive, while 26 (25.5%) were normotensive. The proportion of hypertension was highest among participants whose clinical status remained unchanged (87.5%), followed by those whose condition deteriorated (73.9%) and those who improved (58.3%).The Chi-square test (χ^2 = 6.158, df = 2, p = 0.046) indicated a statistically significant association between hypertension status and disease outcome at Week 01, as the p-value was less than 0.05. These findings suggest that hypertension status was associated with differences in clinical outcomes in the study population. However, this association does not establish a causal relationship.

Table 19: Distribution of Dyslipidemia Status Among Participants According to Disease Outcome at Week 01

Disease Outcome	Dyslipidemia Present, n	Percentage (%)	Dyslipidemia Absent, n	Percentage (%)	Total
Improved	9	37.5	15	62.5	24
Remained status quo	17	53.1	15	46.9	32
Deteriorated	27	58.7	19	41.3	46

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Disease Outcome	Dyslipidemia Present, n	Percentage (%)	Dyslipidemia Absent, n	Percentage (%)	Total
Total	53	52.0	49	48.0	102

Statistical analysis: Chi-square = 2.864; df = 2; p = 0.239.

Among the 24 participants who improved, 9 (37.5%) had dyslipidemia, whereas 15 (62.5%) did not. Among the 32 participants whose condition remained unchanged, 17 (53.1%) had dyslipidemia and 15 (46.9%) did not. Of the 46 participants whose condition deteriorated, 27 (58.7%) had dyslipidemia, while 19 (41.3%) did not.Overall, dyslipidemia was present in 53 (52.0%) participants and absent in 49 (48.0%). The proportion of participants with dyslipidemia was higher in the deteriorated group (58.7%) than in the improved group (37.5%).

The chi-square test revealed no statistically significant association between dyslipidemia status and disease outcome (χ^2 = 2.864, df = 2, p = 0.239). Since the p-value was greater than 0.05, the observed differences were not statistically significant. Therefore, this study did not demonstrate a significant association between dyslipidemia status and disease outcomes at Week 01.

Table 20: Distribution of Smoking Status Among Participants According to Disease Outcome at Week 01

Disease Outcome	Smoker, n	Percentage (%)	Non-smoker, n	Percentage (%)	Total
Improved	9	37.5	15	62.5	24
Remained status quo	14	43.8	18	56.3	32
Deteriorated	18	39.1	28	60.9	46
Total	41	40.2	61	59.8	102

Statistical analysis: Chi-square = 0.262; df = 2; p = 0.877.

Among the 24 participants who improved, 9 (37.5%) were smokers, whereas 15 (62.5%) were non-smokers. Among the 32 participants whose condition remained unchanged, 14 (43.8%) were smokers and 18 (56.3%) were non-smokers. Of the 46 participants whose condition deteriorated, 18 (39.1%) were smokers, while 28 (60.9%) were non-smokers.

Overall, 41 (40.2%) participants were smokers and 61 (59.8%) were non-smokers. The proportion of smokers was highest in the group whose condition remained unchanged (43.8%), followed by the deteriorated group (39.1%) and the improved group (37.5%).

The chi-square test revealed no statistically significant association between smoking status and disease outcome (χ^2 = 0.262, df = 2, p = 0.877). Since the p-value was greater than 0.05, the observed differences between the groups were not statistically significant.

Table 21: CT Scan Findings Among Study Participants (n = 102)

S. No.	CT Scan Findings	Number (n)	Percentage (%)
1	Left cerebellar infarct	3	2.9
2	Right middle cerebral artery (MCA) infarct	47	46.1

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S. No.	CT Scan Findings	Number (n)	Percentage (%)
3	Left middle cerebral artery (MCA) infarct	49	48.0
4	Left thalamic infarct	1	1.0
5	Multiple infarcts	1	1.0
6	Right frontotemporal infarct	1	1.0
Total		102	100.0

CT scan findings among the 102 study participants revealed that left middle cerebral artery (MCA) infarction was the most common finding, observed in 49 participants (48.0%), followed by right MCA infarction in 47 participants (46.1%). Left cerebellar infarction was observed in 3 participants (2.9%). Left thalamic infarction, multiple infarcts, and right frontotemporal infarction were each reported in 1 participant (1.0%)

Table 22: Distribution of Mean Platelet Volume (MPV) Categories Among Participants According to Disease Outcome at Week 01

Disease Outcome	Low MPV, n	Percentage (%)	Normal MPV, n	Percentage (%)	High MPV, n	Percentage (%)	Total
Improved	1	4.2	22	91.7	1	4.2	24
Remained status quo	0	0.0	18	56.3	14	43.8	32
Deteriorated	0	0.0	3	6.5	43	93.5	46
Total	1	1.0	43	42.2	58	56.9	102

The distribution of mean platelet volume (MPV) categories varied considerably according to disease outcome at Week 01. Among the 24 participants who improved, 22 (91.7%) had normal MPV, while 1 (4.2%) had low MPV and 1 (4.2%) had high MPV. In the group of 32 participants whose condition remained unchanged, 18 (56.3%) had normal MPV and 14 (43.8%) had high MPV. None had low MPV.

Table 23: Distribution of Mean Platelet Volume (MPV) Category According to Diabetic Status

Diabetic Status	Low MPV: Number	Percentage	Normal MPV: Number	Percentage	High MPV: Number	Percentage
Diabetic (n = 88)	1	1.1%	36	40.9%	51	58.0%
Non-diabetic (n = 14)	0	0.0%	7	50.0%	7	50.0%
Total (n = 102)	1	1.0%	43	42.2%	58	56.9%

Among diabetic participants, 1.1% had low mean platelet volume (MPV), 40.9% had normal MPV, and 58.0% had high MPV. Among non-diabetic participants, none had low MPV, while 50.0% had normal MPV and 50.0% had high MPV.

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Overall, high MPV was the most common category, accounting for 56.9% of the study participants, followed by normal MPV (42.2%) and low MPV (1.0%).

Table 24: Distribution of Mean Platelet Volume (MPV) Categories According to Hypertension Status

Hypertension Status	Low MPV, n (%)	Normal MPV, n (%)	High MPV, n (%)
Hypertensive (n = 76)	0 (0.0%)	31 (40.8%)	45 (59.2%)
Normotensive (n = 26)	1 (3.8%)	12 (46.2%)	13 (50.0%)

High MPV was observed in 59.2% of hypertensive and 50.0% of normotensive participants, with no statistically significant association between MPV categories and hypertension status ($\chi^2 = 3.344$, df = 2, p = 0.188).

Table 25: Distribution of Mean Platelet Volume (MPV) Categories According to Smoking Status

Smoking Status	Low MPV, n (%)	Normal MPV, n (%)	High MPV, n (%)
Smoker (n = 41)	0 (0.0%)	16 (39.0%)	25 (61.0%)
Non-smoker (n = 61)	1 (1.6%)	27 (44.3%)	33 (54.1%)

High MPV was observed in 61.0% of smokers and 54.1% of non-smokers, with no statistically significant association between MPV category and smoking status ($\chi^2 = 1.036$, df = 2, p = 0.596)

Discussion

The present study evaluated the distribution of mean platelet volume (MPV) categories and their association with clinical outcomes at Week 01, diabetes mellitus, hypertension, and smoking status among 102 participants. The findings showed that high MPV was the most common category, observed in 58 participants (56.9%), followed by normal MPV in 43 (42.2%) and low MPV in 1 (1.0%). These findings indicate that elevated MPV was common in the study population and support further investigation of its possible clinical significance.

MPV is a routinely available haematological parameter that reflects average platelet size and may provide indirect information about platelet activity. Larger platelets are generally considered more metabolically active and may contribute to thrombotic and inflammatory processes [1–4,11–13]. Previous research has investigated platelet activation in cardiovascular and inflammatory conditions, supporting the biological rationale for evaluating MPV as a potential adjunctive clinical marker. However, an elevated MPV value alone cannot establish the presence or severity of a particular disease.

An important observation in the present study was the distribution of MPV according to clinical outcome at Week 01. Among participants who improved, 91.7% had normal MPV, whereas 93.5% of participants whose condition deteriorated had high MPV. This pattern suggests a possible association between elevated MPV and an unfavourable short-term clinical outcome. Previous studies have explored the prognostic significance of platelet indices in cardiovascular disease and other clinical conditions [3,9,10,14–16]. Nevertheless, the present findings should be interpreted cautiously because statistical significance for the association between MPV and Week 01 outcome has not been provided. Therefore, the observed pattern does not independently establish MPV as a predictor of deterioration.

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Regarding diabetes mellitus, high MPV was observed in 58.0% of diabetic participants, compared with 50.0% of non-diabetic participants. Previous studies have reported increased MPV in individuals with type 2 diabetes and have investigated its relationship with glycaemic control and diabetic vascular complications[5,6,17,18]. Hyperglycaemia and associated metabolic abnormalities may contribute to platelet activation and vascular dysfunction. However, the association between MPV category and diabetic status in the present study was not statistically significant (p = 0.767). This result indicates that the observed difference may reflect random variation and that a relationship cannot be confirmed from the available data.

Similarly, high MPV was found in 59.2% of hypertensive participants and 50.0% of normotensive participants. Hypertension is associated with vascular dysfunction and an increased risk of cardiovascular complications, and platelet indices have been investigated in relation to these processes [5,7,11,12]. However, the association between MPV categories and hypertension in the present study was not statistically significant (p = 0.188). Although the proportion of participants with high MPV was greater among those with hypertension, this finding should be considered descriptive rather than conclusive evidence of an association.

With respect to smoking status, high MPV was observed in 61.0% of smokers and 54.1% of non-smokers. Smoking can promote oxidative stress, endothelial injury, and platelet activation, providing a biological basis for investigating its relationship with MPV [8,11,13]. However, the association between smoking status and MPV categories was not statistically significant in the present study (p = 0.596). Differences in smoking exposure, sample size, underlying clinical conditions, and other confounding factors may influence the results. Further research involving larger populations and more detailed assessment of smoking exposure may help clarify this relationship.

The findings should also be interpreted in light of the methodological limitations of MPV measurement. MPV can be affected by the haematology analyser, anticoagulant used, and interval between blood collection and analysis [11,12]. In addition, categorising MPV as low, normal, or high may result in loss of information compared with analysing MPV as a continuous variable. The relatively small sample size and the very small number of participants in the low-MPV category may also limit the statistical power of comparisons.

Overall, the present study demonstrates that high MPV was the predominant category among the 102 participants and was particularly common among those whose clinical condition deteriorated at Week 01. However, no statistically significant associations were identified between MPV categories and diabetes mellitus, hypertension, or smoking status. These findings suggest that MPV may warrant further evaluation as an adjunctive haematological parameter, but larger prospective studies with standardised measurement procedures and appropriate adjustment for confounding factors are needed before firm conclusions can be drawn about its prognostic value.

Conclusion

The study found that high mean platelet volume (MPV) was present in 56.9% of participants and was more common among those whose clinical condition deteriorated at Week 01. However, no statistically significant associations were observed between MPV

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categories and diabetes mellitus, hypertension, or smoking status. Further studies with larger sample sizes are needed to establish the prognostic significance of MPV in predicting clinical outcomes.

Limitations

The study was limited by its small sample size (102 participants) and short follow-up period of one week, which may limit the generalizability of the findings. MPV measurements may vary with laboratory methods, and potential confounding factors were not adjusted for through multivariable analysis.

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