RESEARCH PAPER

# Association Of Mean Platelet Volume And Thrombotic Complications In Type 2 Diabetes Mellitus

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**ABSTRACT**
Type 2 diabetes mellitus (T2DM) is a major global health problem and a leading contributor to cardiovascular and cerebrovascular morbidity and mortality. Chronic hyperglycaemia in diabetes leads to endothelial dysfunction, platelet activation, and a prothrombotic state. Mean Platelet Volume (MPV), a simple and inexpensive hematological parameter, reflects platelet size and activity and may serve as a potential marker for thrombotic complications in patients with T2DM.The objective is to study the association between Mean Platelet Volume and thrombotic complications—namely coronary artery disease (CAD) and cerebrovascular accident (CVA)—in patients with Type 2 diabetes mellitus, and to compare these findings with non-diabetic patients. This hospital-based cross-sectional observational study was conducted at MGM Medical College and Hospital, Aurangabad, from October 2022 to March 2024. A total of 96 patients were enrolled and divided into two groups: 48 diabetic patients (cases) and 48 non-diabetic patients (controls), all of whom had documented thrombotic events (CAD or ischemic CVA). Detailed clinical evaluation, biochemical investigations including fasting and post-prandial blood sugar, HbA1c, and complete hemogram with platelet indices were performed. MPV was analyzed and correlated with thrombotic complications and glycaemic parameters. Statistical analysis was carried out using SPSS version 20. The majority of patients were above 60 years of age, with male predominance. Mean MPV was significantly higher in diabetic patients compared to non-diabetic controls ($p < 0.001$). Raised MPV (>11.5 fL) was more frequently observed in diabetic patients with CAD and CVA. A significant association was found between MPV and fasting blood sugar, post-prandial blood sugar, HbA1c levels, and duration of diabetes. No statistically significant difference was observed between cases and controls with respect to age, BMI, hemoglobin, total leukocyte count, platelet count, ECG, or 2D-echocardiographic findings. Mean Platelet Volume is significantly elevated in patients with Type 2 diabetes mellitus and shows a strong association with thrombotic complications and poor glycaemic control. MPV can be used as a simple, cost-effective, and readily available marker to identify diabetic patients at higher risk of cardiovascular and cerebrovascular events, enabling early intervention and improved clinical outcomes....

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## INTRODUCTION

Diabetes mellitus (DM), characterized by persistent hyperglycemia resulting from inadequate insulin secretion or insulin resistance, has emerged as one of the most significant public health challenges of the 21st century[1]. With over 422 million people globally affected and projections suggesting nearly 98 million cases in India by 2030, the epidemiological burden continues to escalate precipitously[2]. Historically regarded as a disease of affluent nations, diabetes now predominantly affects low- to middle-income countries, where approximately 75% of diabetic individuals reside[3].

The pathophysiology of Type 2 Diabetes Mellitus (T2DM) involves both insulin resistance and progressive β-cell dysfunction. Chronic hyperglycemia triggers multiple pathologic cascades, including non-enzymatic glycation of proteins and lipids, oxidative stress, and chronic inflammation. These metabolic derangements directly impair endothelial function and promote atherosclerotic plaque formation[4]. Consequently, diabetic patients face a two- to four-fold increased risk of cardiovascular events compared to non-diabetic

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populations, with cardiovascular disease accounting for nearly 50% of deaths in this cohort[5].

Platelets play a pivotal role in hemostasis and thrombosis. Mean Platelet Volume (MPV), a measure of platelet size, reflects platelet activity and function. Larger platelets are metabolically and enzymatically more active, possessing denser granules and exhibiting greater procoagulant potential[6]. The relationship between MPV and vascular complications in diabetes remains incompletely understood; elevated MPV may either predispose to thrombotic events or develop consequent to thrombosis. Nevertheless, MPV represents a simple, affordable biomarker that can be readily assessed using automated hematology analyzers available in most clinical settings[7].

**Objectives:**

To study the association between Mean Platelet Volume and thrombotic complications—namely coronary artery disease (CAD) and cerebrovascular accident (CVA)—in patients with Type 2 diabetes mellitus, and to compare these findings with non-diabetic patients.

**Materials and Methods:**

**Study Design and Setting**

This was a cross-sectional observational study conducted at Mahatma Gandhi MissionMedical College & Hospital, Aurangabad, Maharashtra, India, from October 2022 to March 2024. The study was approved by the Institutional Ethics Committee prior to commencement.

**Study Population and Sample Size**

Two groups of equal size were enrolled:

- **Cases (n=48):** Diabetic patients with angiographically proven Coronary Artery
- Disease or imaging-confirmed ischemic Cerebrovascular Accident

**Controls (n=48):** Non-diabetic patients with similar thrombotic complications

Total sample size (n=96) was calculated using the formula:

$$n = \frac{2S^2(Z_1 + Z_2)^2}{(M_1 - M_2)^2} \qquad (1)$$

Where: $S_1$ = 1.0178, $S_2$ = 0.95, $Z_1$ = 2.32635, $Z_2$ = 1.64485, $M_1$ = 10.29, $M_2$ = 9.28, yielding minimum 48 subjects per group.

**Inclusion and Exclusion Criteria**

**Inclusion Criteria:**

- Age >18 years
- Type 2 Diabetes Mellitus diagnosis per American Diabetes Association (2011) guidelines (HbA1c >6.5%, FBS ≥126 mg/dL, or RBS ≥200 mg/dL)

**Exclusion Criteria:**

- Thrombocytopenia (platelet count <100,000/µL)
- End-Stage Renal Disease or CKD Stage 4
- Pregnancy
- Active malignancy
- Ischemic heart disease or CVA on antiplatelet therapy

**Data Collection**

Detailed history and clinical examination were performed for all patients. Patient demographics, occupational details, past medical history, medication history, and addictions were documented.

**Laboratory and Imaging Investigations**

**Blood Investigations:**

- Hemogram with platelet indices (MPV, PDW, P/LCR)
- Fasting Blood Sugar Level (FBSL)
- Post-Prandial Blood Sugar Level (PPBSL)
- Glycosylated Hemoglobin (HbA1c) CK-MB (for CAD patients)

**Cardiac Investigations:**

12-lead standard ECG (50 mm/second)

- 2D Transthoracic Echocardiography
- Coronary Angiography (for CAD cases)
- **Cerebrovascular Investigations:**
- CT Brain or MRI Brain (for CVA cases)

**Statistical Analysis**

Data were compiled in MS Excel 2018 and analyzed using SPSS Version 20. Qualitative data were presented as frequencies and percentages; quantitative data as mean ± standard deviation. Chi-square test was applied for proportions; independent t-tests for continuous variables. Statistical significance was set at $p<0.05$

**Results**

The majority of patients were above 60 years of age, with male predominance. Mean MPV was significantly higher in diabetic patients compared to non-diabetic controls ($p < 0.001$). Raised MPV (>11.5 fL) was more frequently observed in diabetic patients with CAD and CVA. A significant association was found between MPV and fasting blood sugar, post-prandial blood sugar, HbA1c levels, and duration of diabetes. No statistically significant difference was observed between cases and controls with respect to age, BMI, hemoglobin, total leukocyte count, platelet count, ECG, or 2D-echocardiographic findings.

1. **DISTRIBUTION ACCORDING TO AGE**

In our study the maximum number of patients were in the age group of >60 years (60.4%). The mean age for the control group being 58 years for those with coronary artery disease and 63 years for those with cerebrovascular accidents.

Similarly for the cases the mean age group being 66 years for those with coronary artery disease and 62 years for those with cerebrovascular accidents.

2. **DISTRIBUTION ACCORDING TO GENDER**

| **Thrombotic Complication** | **Gender** | **Group** | | **P-Value** |
|---|---|---|---|---|
| | | **Control** | **Cases** | |
| **Coronary Artery Disease (CAD)** | **Female** | 7 | 10 | 0.365 |
| | **Male** | 17 | 14 | |
| **Cerebro-Vascular Accident (CVA)** | **Female** | 8 | 5 | 0.330 |
| | **Male** | 16 | 19 | |
| **Total** | **Female** | 15 | 15 | 1.000 |
| | **Male** | 33 | 33 | |

The above table shows the distribution of cases and controls based on the gender. There are total of 15 females (31.25 % in total) and 33 males(68.75% in total) in controls and cases each.

3. **: DISTRIBUTION ACCORDING TO LOCALITY OF PATIENTS**

| **Thrombotic Complication** | **Locality** | **Group** | | **P-Value** |
|---|---|---|---|---|
| | | **Control** | **Cases** | |
| **Coronary Artery Disease (CAD)** | **Rural** | 9 | 9 | 1.000 |
| | **Urban** | 15 | 15 | |
| **Cerebro Vascular Accident (CVA)** | **Rural** | 8 | 13 | 0.146 |
| | **Urban** | 16 | 11 | |
| **Total** | **Rural** | 17 | 22 | 0.299 |
| | **Urban** | 31 | 26 | |

The above table shows the distribution of cases and controls based on the locality. Amongst all, 39 patients originated from rural background (40.625%) and 57 patients originating from urban background (59.375%) The result shows that there was no statistically significant difference among the groups based on the locality (p>0.05).

4. **DISTRIBUTION ACCORDING TO OCCUPATION**

Out of 96 patients examined in our study the most common occupation followed was farming (47.91%), following which people were self-employed (20.83), homemakers (18.18) and lastly sedentary occupation. (12.5%).

5. **DISTRIBUTION ACCORDING TO PAST HISTORY OR COMORBIDITIES**

| **Thrombotic Complications** | **Past History** | **Group** | | **P-Value** |
|---|---|---|---|---|
| | | **Control** | **Cases** | |
| **Coronary Artery Disease (CAD)** | **DM** | 0 | 7 | **0.003** |
| | **HTN** | 6 | 0 | |
| | **IHD** | 0 | 1 | |
| | **CVA** | 3 | 1 | |
| | **More than 1** | 0 | 3 | |
| | **NONE** | 15 | 12 | |
| **Cerebro Vascular Accident (CVA)** | **DM** | 0 | 13 | **<0.001** |
| | **HTN** | 8 | 3 | |
| | **IHD** | 0 | 4 | |
| | **CVA** | 0 | 1 | |
| | **More than 1** | 0 | 0 | |
| | **NONE** | 16 | 3 | |
| **Total** | **DM** | 0 | 20 | **<0.001** |
| | **HTN** | 14 | 3 | |
| | **IHD** | 0 | 5 | |
| | **CVA** | 3 | 2 | |
| | **More than 1** | 0 | 3 | |
| | **NONE** | 31 | 15 | |

The above table shows the distribution of cases and controls based on the past history. The result shows that there is statistically significant difference among the groups based on the past history in Coronary Artery Disease, Cerebro Vascular Accident and overall($p<0.05$) with maximum cases having a past history of Diabetes Mellitus (83.33%).

6. **DISTRIBUTION ACCORDING TO DIET**

Majority of patients in cases as well as controls were Non-Vegetarian food consumers. Yet the result shows that there was no statistically significant difference among the groups based on the diet. ($p>0.05$).

7. **DISTRIBUTION ACCORDING TO ADDICTIONS**

| **Thrombotic** | **Addictions** | **Group** | | **P-Value** |
|---|---|---|---|---|
| **Complication** | | **Control** | **Cases** | |
| **Coronary Artery Disease (CAD)** | Alcohol | 5 | 1 | **<0.001** |
| | Tobacco | 7 | 2 | |
| | Bidi Smoker | 10 | 5 | |
| | None | 2 | 14 | |

| | | | | |
|---|---|---|---|---|
| **Cerebro Vascular Accident (CVA)** | Alcohol | 6 | 6 | 0.562 |
| | Tobacco | 6 | 5 | |
| | Bidi Smoker | 7 | 4 | |
| | None | 5 | 9 | |
| **Total** | Alcohol | 11 | 7 | **0.003** |
| | Tobacco | 13 | 7 | |
| | Bidi Smoker | 17 | 9 | |
| | None | 7 | 23 | |

The above table shows the distribution of cases and controls based on the addictions. The result shows that there is statistically significant difference among the groups based on the addictions in coronary artery disease (CAD) and overall group(p<0.05), Whereas the results were statistically non-significant based on the Cerebro Vascular Accident (CVA) group (p>0.05)

8. **DISTRIBUTION ACCORDING TO PRIOR DRUG HISTORY**

| **Thrombotic Complications** | **Treatment History** | **Group** | | **P-Value** |
|---|---|---|---|---|
| | | **Control** | **Cases** | |
| **Coronary Artery Disease (CAD)** | OHA | 0 | 5 | **0.026** |
| | INSULIN | 0 | 2 | |
| | ANTI-HTN | 6 | 2 | |
| | MORE THAN 1 | 0 | 0 | |
| | NONE | 18 | 15 | |
| **Cerebro Vascula Accident (CVA)** | OHA | 0 | 8 | **<0.001** |
| | INSULIN | 0 | 4 | |
| | ANTI-HTN | 7 | 3 | |
| | MORE THAN 1 | 0 | 0 | |
| | NONE | 17 | 9 | |
| **Total** | OHA | 0 | 13 | **<0.001** |
| | INSULIN | 0 | 6 | |
| | ANTI-HTN | 13 | 5 | |
| | MORE THAN 1 | 0 | 0 | |
| | NONE | 35 | 24 | |

The above table shows the distribution of cases and controls based on the treatment history. The result shows that there is statistically significant difference among the groups based on the treatment history in Coronary Artery Disease (CAD), Cerebro Vascular Accident (CVA) and overall(p<0.05) with Maximum patients receiving Anti-Hypertensive and OHA

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9. **DISTRIBUTION ACCORDING TO ECG**

| Thrombotic Complication | ECG | Group | | P-Value |
|---|---|---|---|---|
| | | Control | Cases | |
| Coronary Artery Disease (CAD) | STEMI/NSTEMI | 9 | 15 | 0.166 |
| | Left Ventricular Hypertrophy | 1 | 0 | |
| | Normal | 14 | 9 | |
| Cerebro Vascular Accident (CVA) | STEMI/NSTEMI | 0 | 2 | 0.349 |
| | Left Ventricular Hypertrophy | 4 | 4 | |
| | Normal | 20 | 18 | |
| Total | STEMI/NSTEMI | 9 | 17 | 0.185 |
| | Left Ventricular Hypertrophy | 5 | 4 | |
| | Normal | 34 | 27 | |

The above table shows the distribution of cases and controls based on the ECG changes among the patients. The result shows that there was no statistically significant difference among the groups based on the ECG findings (p>0.05)

10. **DISTRIBUTION ACCORDING TO 2DECHO FINDINGS**

| Thrombotic Complication | 2D ECHO | Group | | P-value |
|---|---|---|---|---|
| | | Control | Case | |
| Coronary Artery Disease (CAD) | RWMA | 5 | 8 | 0.256 |
| | Concentric LVH | 2 | 0 | |
| | Normal | 17 | 16 | |
| Cerebro Vascular Accident (CVA) | RWMA | 3 | 2 | 0.355 |
| | Concentric LVH | 3 | 7 | |
| | Normal | 18 | 15 | |
| Total | RWMA | 8 | 10 | 0.671 |
| | Concentric LVH | 5 | 7 | |
| | Normal | 35 | 31 | |

The above table shows the distribution of cases and controls based on the 2D ECHO findings. The result shows that there was no statistically significant difference among the groups based on the 2D ECHO(p>0.05).

11. **DISTRIBUTION ACCORDING TO CAG FINDINGS**

The result shows that there was statistically significant difference among the groups based on the coronary artery disease (CAD) ($p<0.05$). Among 48 patients 24 patients had single vessel disease (50%), 10 patients had double vessel disease (20.83%) and 14 patients had Triple Vessel Disease (29.16%).

12. **DISTRIBUTION ACCORDING TO IMAGING FINDINGS (CT/MRI)**

| **CVA** | **CASES** | **CONTROL** | **S P-Value** |
|---|---|---|---|
| **CT Brain Acute Infarct** | 2 | 3 | |
| **CT Brain Chronic Infarct** | 2 | 0 | |
| **MRI Brain Acute Infarct** | 24 | 24 | 0.0036 |
| **MRI Brain Chronic Infarct** | 0 | 0 | |
| **Acute Infarct in Both** | 2 | 3 | |

The above table shows the distribution of cases and controls based on CEREBRO VASCULAR ACCIDENT (CVA). The result shows that there was statistically significant difference among the groups based on the CEREBRO VASCULAR ACCIDENT (CVA) ($p<0.05$).

13. **DISTRIBUTION ACCORDING TO AGE, BMI, HB AND TLC**

| | | | AGE | BMI | HB | TLC |
|---|---|---|---|---|---|---|
| Control | CAD | Mean | 58.75 | 26.529167 | 13.466667 | 9902.38 |
| | | SD | 13.898 | 5.3526490 | 1.6525781 | 4833.522 |
| | CVA | Mean | 63.42 | 25.487500 | 12.266667 | 9667.75 |
| | | SD | 11.283 | 4.8793542 | 2.2149034 | 3740.817 |
| | TOTAL | Mean | 61.08 | 26.008333 | 12.866667 | 9785.06 |
| | | SD | 12.743 | 5.0939611 | 2.0260362 | 4277.261 |
| Cases | CAD | Mean | 66.08 | 25.733333 | 12.358333 | 9856.42 |
| | | SD | 13.253 | 4.4181116 | 2.2078746 | 3404.876 |
| | CVA | Mean | 62.33 | 24.895833 | 12.912500 | 11396.38 |
| | | SD | 13.802 | 4.5736941 | 2.4076531 | 4438.250 |
| | TOTAL | Mean | 64.21 | 25.314583 | 12.635417 | 10626.40 |
| | | SD | 13.519 | 4.4685658 | 2.3023105 | 3989.764 |
| Total | CAD | Mean | 62.42 | 26.131250 | 12.912500 | 9879.40 |
| | | SD | 13.936 | 4.8718102 | 2.0088766 | 4136.027 |
| | CVA | Mean | 62.88 | 25.191667 | 12.589583 | 10532.06 |
| | | SD | 12.483 | 4.6879580 | 2.3116946 | 4153.360 |
| | TOTAL | Mean | 62.65 | 25.661458 | 12.751042 | 10205.73 |
| | | SD | 13.11 | 4.7789312 | 2.1602629 | 4135.861 |

| | | | | |
|---|---|---|---|---|
| P-VALUE | 0.247 | 0.480 | 0.603 | 0.322 |

The above table shows the mean and standard deviation of control and cases with respect to their Age BMI, Hemoglobin and TLC. The result shows that there was statistically no significant difference among the cases and control based on the age, BMI, Hb and TLC (p>0.05)

14. **DISTRIBUTION ACCORDING TO OTHER HEMOGRAM PARAMETERS**

| | | | MCV | MCH | MCHC | PLATLET COUNT | MPV |
|---|---|---|---|---|---|---|---|
| Control | Coronary Artery Disease (CAD) | Mean | 90.325000 | 28.908 | 31.787500 | 270291.67 | 8.495833 |
| | | SD | 10.199584 | 3.7821 | 1.4374835 | 89044.434 | 1.8250620 |
| | Cerebro Vascular Accident (CVA) | Mean | 86.820833 | 40.575 | 32.816667 | 248500.00 | 9.512500 |
| | | SD | 7.0796696 | 55.9854 | 1.9811430 | 112591.99 | 2.0409530 |
| | TOTAL | Mean | 88.572917 | 34.742 | 32.302083 | 259395.83 | 9.004167 |
| | | SD | 8.8640738 | 39.6937 | 1.7895072 | 101019.64 | 1.9830085 |
| Cases | Coronary Artery Disease (CAD) | Mean | 85.429167 | 28.404 | 33.283333 | 243833.33 | 10.935000 |
| | | SD | 8.6724691 | 3.5696 | 5.1567319 | 65683.475 | 1.3175636 |
| | Cerebro Vascular Accident (CVA) | Mean | 84.737500 | 28.954 | 32.831667 | 274708.33 | 10.474583 |
| | | SD | 8.1963837 | 3.4397 | 2.0111594 | 95655.396 | 1.7519504 |
| | TOTAL | Mean | 85.083333 | 28.679 | 33.057500 | 259270.83 | 10.704792 |
| | | SD | 8.3548517 | 3.4789 | 3.8787224 | 82657.648 | 1.5510175 |
| Total | Coronary Artery Disease (CAD) | Mean | 87.877083 | 28.656 | 32.535417 | 257062.50 | 9.715417 |
| | | SD | 9.6868246 | 3.6470 | 3.8204093 | 78549.999 | 1.9996350 |
| | Cerebro Vascular Accident (CVA) | Mean | 85.779167 | 34.765 | 32.824167 | 261604.17 | 9.993542 |
| | | SD | 7.6492792 | 39.6750 | 1.9748718 | 104195.14 | 1.9433909 |
| | TOTAL | Mean | 86.828125 | 31.710 | 32.679792 | 259333.33 | 9.854479 |
| | | SD | 8.7454614 | 28.1918 | 3.0284552 | 91809.375 | 1.9662842 |
| P-Value | | | 0.050 | 0.295 | 0.224 | 0.995 | <0.001 |

The above table shows the mean and standard deviation of control and cases with further sub-division under CAD and CVA. The result shows that there was statistically non-significant difference among the cases and control based on the MCV, MCH, MCHC and platelet count (p>0.05), whereas the mean difference was statistically significant among the groups based on the MPV (p<0.05) with greater mean of cases as compared to controls.

15. **DISTRIBUTION ACCORDING TO BLOOD SUGAR LEVELS, HbA1C AND CKMB**

| | | | FBSL | PPBSL | HBA1C | CPKMB |
|---|---|---|---|---|---|---|
| Control | Coronary Artery Disease (Cad) | Mean | 105.83 | 137.71 | 5.57 | 206.23 |
| | | SD | 12.853 | 20.890 | .0699 | 87/5 |
| | Cerebro Vascular Accident (Cva) | Mean | 94.92 | 124.38 | 5.43 | |
| | | SD | 13.736 | 25.313 | .0685 | |
| | TOTAL | Mean | 100.37 | 131.04 | 5.50 | 206.230 |
| | | SD | 14.269 | 23.927 | 0.688 | 87.51 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Cases | Coronary Artery Disease (Cad) | Mean | 167.88 | 223.17 | 8.76 | 38.96 |
| | | SD | 25.589 | 37.950 | 1.620 | 43.41 |
| | Cerebro Vascular Accident (Cva) | Mean | 174.17 | 224.33 | 7.57 | |
| | | SD | 38.183 | 61.065 | 1.865 | |
| | TOTAL | Mean | 171.02 | 223.75 | 8.17 | 38.96 |
| | | SD | 32.311 | 50.298 | 1.828 | 43.41 |
| Total | Coronary Artery Disease (Cad) | Mean | 136.85 | 180.44 | 7.17 | 122.59 |
| | | SD | 37.203 | 52.754 | 2.027 | 618.75 |
| | Cerebro Vascular Accident (Cva) | Mean | 134.54 | 174.35 | 6.50 | |
| | | SD | 49.085 | 68.479 | 1.7610 | |
| | TOTAL | MEAN | 135.70 | 177.40 | 6.83 | 122.595 |
| | | SD | 43.337 | 60.879 | 1.918 | 618.75 |
| P-Value | | | <0.001 | <0.001 | <0.001 | 0.355 |

The above table shows the mean and standard deviation of control and cases with further sub- division under CORONARY ARTERY DISEASE (CAD)/ CEREBRO VASCULAR ACCIDENT (CVA). The result shows that there was statistically significant difference among the cases and control based on the FBSL, PPBSL, HBA1C($p<0.05$) with more mean of cases as compared to controls, whereas the mean difference was statistically non-significant among the groups based on the CPKMB ($p>0.05$)

16. **DISTRIBUTION ACCORDING TO BMI**

| Group | BMI(kg/m2) | | | | | | P-Value |
|---|---|---|---|---|---|---|---|
| | <18.5 | 18.5-24.9 | 25.0-29.9 | 30.0-34.9 | 35.0-39.9 | >40.0 | |
| Control | 3 | 19 | 15 | 11 | 0 | 0 | 0.807 |
| Cases | 5 | 18 | 16 | 9 | 0 | 0 | |

The above table shows the frequency distribution of cases and controls based on the BMI category. The result shows that there is equal distribution among the category and hence the results are statistically non-significant ($p>0.05$).

17. **DISTRIBUTION ACCORDING TO HBA1C**

| Group | HbA1C(gm %) | | | P-Value |
|---|---|---|---|---|
| | <5.7 | 5.7-6.5 | >6.5 | |
| Control | 30 | 15 | 3 | <0.001 |
| Cases | 2 | 6 | 40 | |

The above table shows the frequency distribution of cases and controls based on the HbA1C category. The result shows that there is equal distribution among the category and hence the results are statistically non-significant ($p>0.05$).

18. **DISTRIBUTION ACCORDING TO MPV**

| Group | MPV | | P-Value |
|---|---|---|---|
| | <11.5 | >11.5 | |

| | | | |
|---|---|---|---|
| Control | 42 | 6 | 0.015 |
| Cases | 32 | 16 | |

The above table shows the frequency distribution of cases and controls based on the MPV category. MPV >11.5 is raised and 7.5 to 11.5 fl is normal. The result shows that the results are statistically significant ($p<0.05$).

19. **DISTRIBUTION ACCORDING TO MPV AND HbA1C**

| MPV(fl) | HbA1C(%) | | | P-VALUE |
|---|---|---|---|---|
| | <5.7 | 5.7-6.5 | >6.5 | |
| <11.5 | 27 | 19 | 28 | 0.037 |
| >11.5 | 5 | 2 | 15 | |

The above table shows the frequency distribution of MPV values based on the HbA1c category. The result shows that the results are statistically significant ($p<0.05$).

20. **DISTRIBUTION ACCORDING TO DURATION OF TYPE 2 DIABETES MELLITUS**

We found that out of 48 cases patient with diabetes, less than 5 years were 35 and 13 patients had diabetes more than 5 years.

Hence 72.29 % had been newly detected and with duration of less than 5 years and the rest 27.1 contributing to more than 5 years of duration

Discussion

Pathophysiologic Basis

The elevated Mean Platelet Volume observed in diabetic patients reflects enhanced platelet reactivity and dysfunction characteristic of diabetes mellitus. Chronic hyperglycemia induces multiple molecular abnormalities affecting platelet biology: increased intracellular calcium, enhanced thrombin generation, upregulation of glycoprotein receptors, and augmented adhesion molecule expression[8]. These changes render larger, more metabolically active platelets preferentially vulnerable to activation.

The "bigger is badder" hypothesis proposes that increased MPV predisposes to thrombosis through enhanced platelet aggregation and increased procoagulant activity[9]. Alternatively, elevated MPV may represent a reactive phenomenon—rapid bone marrow production of immature, larger reticulated platelets in response to consumption during ongoing thrombotic events[10].

MPV as a Biomarker for Risk Strati cation

Our findings align with prior studies demonstrating MPV as an independent predictor of cardiovascular events. Kodiatte et al. (2012) similarly reported significantly higher MPV in diabetics with vascular complications compared to uncomplicated diabetics[11]. Brahmbhatt et al. (2022) demonstrated that elevated MPV was associated with poor glycemic control, prolonged diabetes duration, and increased vascular complication risk[12].

The correlation between MPV, HbA1c, and fasting glucose ($p<0.05$) suggests that improving glycemic control may favorably modulate platelet function, potentially reducing MPV mediated thrombotic risk. This hypothesis requires prospective validation in intervention studies examining the effects of glycemic control on serial MPV measurements.

Clinical Implications for Resource-Limited Settings

In developing nations like India, where 422 million individuals suffer from diabetes, cost effective screening tools are essential. Mean Platelet Volume offers several advantages: (1) Readily available through automated hematology analyzers present in most hospitals, (2) Minimal additional cost when obtained during routine complete blood counts, (3) Noninvasive with rapid turnaround time, and (4) Actionable—guiding intensi cation of preventive measures and antiplatelet therapy in high-risk individuals[13].

The identi cation of patients with both elevated HbA1c (>6.5%) and elevated MPV (>11.5 fL) might warrant more aggressive cardiovascular risk factor modi cation, including dual antiplatelet therapy, intensive lipid management, and early coronary screening in asymptomatic high-risk individuals.

Limitations and Future Directions

Our cross-sectional design precludes establishment of causality. The selected cohort included only patients with already-manifest thrombotic complications; prospective cohort studies following asymptomatic diabetic patients would elucidate whether elevated MPV predicts future vascular events. Additional studies examining the temporal relationship between glycemic control improvement and MPV reduction are warranted.

**CONCLUSIONS**

Mean Platelet Volume is significantly elevated in patients with Type 2 diabetes mellitus and shows a strong association with thrombotic complications and poor glycaemic control.

MPV can be used as a simple, cost-effective, and readily available marker to identify diabetic patients at higher risk of cardiovascular and cerebrovascular events, enabling early intervention and improved clinical outcomes

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