Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 15s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

A Study To Understand The Significance Of Platelet Indices In Type2 Diabetes Mellitus Patients In A Tertiary Care Hospital

Dr. R. Prathipa[*1], Dr. R. Prathipaa[2], Dr. S. Saranya Bai[3]

[1]Post graduate, Department of Pathology, A.C.S. Medical College & Hospital and Research Institute, Chennai, Tamil Nadu, India.

[2]Associate professor, Department of Pathology, A.C.S. Medical College and Hospital and Research Institute, Chennai, Tamil Nadu, India.

[3]Associate Professor, Department of Pathology, A.C.S. Medical College and Hospital and Research Institute, Chennai, Tamil Nadu, India.

***Corresponding author:**

Dr. R. Prathipa,

Post graduate, Department of Pathology, A.C.S. Medical College & Hospital and Research Institute, Chennai, Tamil Nadu, India.

Email: medicothedoc@gmail.com

Cite this paper as: Dr. R. Prathipa, Dr. R. Prathipaa, Dr. S. Saranya Bai, (2025) A Study To Understand The Significance Of Platelet Indices In Type2 Diabetes Mellitus Patients In A Tertiary Care Hospital. *Journal of Neonatal Surgery*, 14 (15s), 1287-1291.

ABSTRACT

Background: Type 2 Diabetes Mellitus (T2DM) is a global health challenge, affecting millions worldwide. This condition is associated with vascular complications due to endothelial dysfunction and platelet hyperactivity. Platelet indices, such as Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), and Plateletcrit (PCT), have been recognized as potential biomarkers for platelet activity and predictors of vascular risk in T2DM.

Methods: This prospective case-control study was conducted over three months (2024–2025) at the Department of Pathology, ACS Medical College and Hospital. A total of 124 participants were recruited, including 62 T2DM patients and 62 age- and gender-matched non-diabetic controls. Venous blood samples were analyzed for platelet indices and glycemic markers using automated analyzers. Statistical analysis included independent t-tests and Pearson correlation, with a significance threshold of $p < 0.05$.

Results: T2DM patients exhibited significantly higher MPV (10.8 ± 0.9 fL vs. 9.1 ± 0.8 fL, $p < 0.001$), PDW (13.9 ± 1.7 fL vs. 12.5 ± 1.4 fL, $p < 0.01$), and PCT (0.28 ± 0.05% vs. 0.22 ± 0.03%, $p < 0.001$) compared to controls. Glycemic markers (FBS and HbA1c) were also elevated in T2DM patients. Strong positive correlations were observed between HbA1c and MPV ($r = 0.68$, $p < 0.001$) as well as PDW ($r = 0.55$, $p < 0.01$).

Conclusion: Elevated platelet indices in T2DM patients reflect hyperactive platelet function and a prothrombotic state. These indices are strongly associated with poor glycemic control and may serve as cost-effective, accessible biomarkers for identifying patients at risk of vascular complications. Further studies are warranted to validate their clinical utility in diverse populations.

1. INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic condition characterized by persistent hyperglycemia due to impairments in insulin secretion, insulin action, or both. Globally, Type 2 Diabetes Mellitus (T2DM) is the most common form, constituting over 90% of all diabetes cases. This condition represents a significant public health concern due to its widespread prevalence, associated complications, and high morbidity and mortality rates. According to estimates, the global diabetes burden has reached epidemic levels, with over 422 million cases worldwide as of 2014. In India, the prevalence of diabetes among adults is estimated at 8.8%, making it one of the most affected regions globally [1,2].

The complications arising from T2DM include both microvascular and macrovascular issues, such as diabetic retinopathy, nephropathy, neuropathy, coronary artery disease, and stroke. These complications primarily result from sustained hyperglycemia, which induces oxidative stress, advanced glycation end products (AGEs) formation, and endothelial dysfunction. These pathophysiological processes significantly impact vascular integrity and exacerbate thrombotic risks [3-6].

Platelets play a pivotal role in hemostasis and thrombosis, and their hyperactivity in T2DM is a key factor contributing to the condition's vascular complications. In diabetic patients, platelets are not only larger and metabolically more active, but they also exhibit heightened aggregability. These changes lead to an increased release of prothrombotic molecules, such as platelet factor 4, thromboxane A2, serotonin, and glycoproteins, which promote clot formation. Hyperglycemia further aggravates these effects through glycation of platelet proteins and endothelial dysfunction [4,7]. Platelet indices, such as Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW), have emerged as important biomarkers for platelet function and activity. MPV measures the average size of platelets, with larger platelets being more reactive and aggregatory. PDW reflects variability in platelet size, which is often indicative of increased platelet turnover. Elevated MPV and PDW levels have been consistently linked to a prothrombotic state in T2DM and are associated with an increased risk of both microvascular and macrovascular complications [8-10].

A significant body of evidence suggests that these platelet indices are altered in diabetic individuals compared to healthy controls. For instance, in one study, the mean MPV in T2DM patients was 10.41 ± 0.95 fL, significantly higher than 8.89 ± 0.89 fL in non-diabetic individuals ($p < 0.0001$) [6]. Similarly, PDW values were found to be significantly elevated in diabetic groups, reflecting heightened platelet activity. Such findings underline the potential utility of platelet indices as diagnostic and prognostic markers for diabetes-related vascular complications [7].

The increasing prevalence of T2DM and its associated complications underscores the need for effective diagnostic tools that can aid in the early identification of high-risk individuals. While glycemic indices, such as fasting blood sugar (FBS) and glycated hemoglobin (HbA1c), are routinely used to monitor glycemic control, they do not provide direct information about the thrombotic risks posed by altered platelet activity. Platelet indices, on the other hand, offer a cost-effective and readily available alternative that could bridge this gap. A growing body of research highlights the role of platelet indices in predicting diabetic complications. Elevated MPV has been shown to correlate strongly with poor glycemic control and the presence of complications such as diabetic retinopathy, nephropathy, and cardiovascular diseases. For instance, in a study conducted at a tertiary care hospital in India, the mean MPV in diabetic patients with complications was significantly higher compared to those without complications. Similar trends were observed for PDW, with higher values in patients with complications than in those without [7,8].

Moreover, the strong association between elevated platelet indices and glycemic control further reinforces their clinical utility. Poorly controlled diabetes, as indicated by higher HbA1c levels, is consistently associated with increased MPV and PDW values [7]. This suggests that platelet indices could serve as early warning signs for worsening glycemic control and impending complications. Despite these promising findings, the application of platelet indices in routine clinical practice remains limited, particularly in resource-constrained settings. This is due in part to a lack of standardized reference values and insufficient awareness among clinicians about their prognostic significance. By comparing platelet indices between diabetic and non-diabetic individuals, this study seeks to establish their potential role as cost-effective and accessible biomarkers for identifying patients at risk of vascular complications.

Objectives

- To study the platelet indices in patients with Type2 Diabetes Mellitus(T2DM) and in the non-diabetic group.
- To evaluate any association between glycaemic control (HbA1c) and MPV among the diabetic group.

2. MATERIALS AND METHODS

Study Setting and design: The study was conducted in the Department of Pathology at ACS Medical College and Hospital, a tertiary care teaching hospital. This study was a **prospective case-control study** designed to compare platelet indices among Type 2 Diabetes Mellitus (T2DM) patients and non-diabetic controls. The study was conducted over a period of **three months**, with a sample size of 124 participants.

- **62 cases**: Patients diagnosed with T2DM with or without vascular complications.
- **62 controls**: Non-diabetic individuals matched for age and gender.

Inclusion criteria included patients aged between 30–70 years diagnosed with type 2 diabetes mellitus (T2DM), with or without vascular complications, and non-diabetic individuals (controls) without a history of diabetes or vascular disease. Exclusion criteria comprised patients unwilling to provide informed consent, non-diabetic individuals with coronary artery disease or ECG abnormalities, diabetic patients currently on antiplatelet medications such as Aspirin or Clopidogrel, and individuals with a history of smoking, as smoking can independently alter platelet activity and confound the results.

Ethical Considerations: Institutional Ethics Committee approval was obtained (Ethics committee approval no: 1337/2024/IEC/ACSMCH) before initiating the study. All participants provided written informed consent after the purpose and methodology of the study were explained to them. Confidentiality and privacy were maintained throughout the study.

3. METHODOLOGY

Venous blood (10 mL) was collected in EDTA (hematological tests) and plain tubes (biochemical tests), processed within an hour. Hematological tests: RBC, Hematocrit, Hemoglobin, WBC, Platelet count, MPV, PCT, PDW. Biochemical tests: FBS, HbA1c (NGSP-compliant). Automated analyzers (e.g., Nihon Kohden) were used with daily calibration and quality control. Lab technicians were blinded, and SOPs were followed. A structured questionnaire collected demographic/clinical data for systematic analysis.

The statistical analysis was performed using SPSS version 26.0. Descriptive statistics were calculated for demographic and clinical parameters, while inferential analysis was conducted using independent t-tests for continuous variables such as MPV, PCT, PDW, HbA1c, and chi-square tests for categorical variables like gender. A p-value of <0.05 was considered statistically significant. The primary outcomes included the comparison of platelet indices (MPV, PDW, PCT) between T2DM patients and controls, while secondary outcomes focused on correlations between platelet indices, glycemic markers (HbA1c and FBS), and vascular complications.

Results

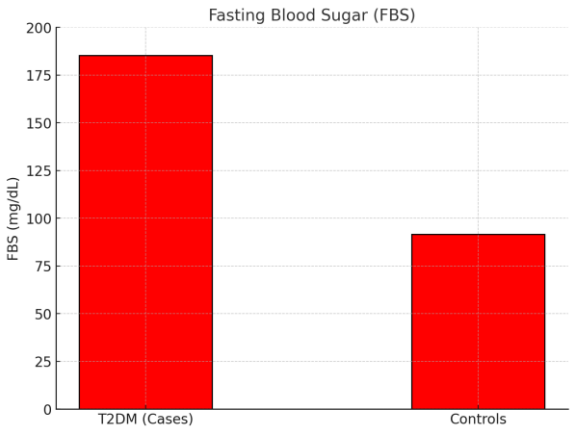
The study included a total of 124 participants, with 62 T2DM patients (cases) and 62 non-diabetic individuals (controls). The mean age of the participants in the case group was 55.3 ± 12.1 years, while the control group had a mean age of 48.6 ± 10.4 years. There was a slight male predominance in the case group, with 57% being male, compared to 52% in the control group (p-value – 0.412).

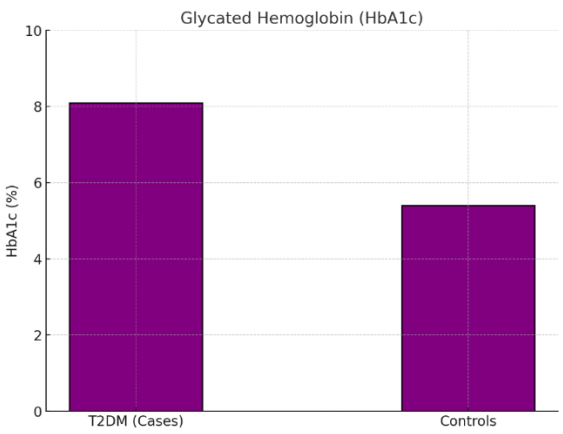
Table 1 shows there were significant differences observed in the platelet indices between T2DM patients and controls. The Mean Platelet Volume (MPV) was significantly higher in T2DM patients (10.8 ± 0.9 fL) compared to controls (9.1 ± 0.8 fL, $p < 0.001$). Platelet Distribution Width (PDW) was also elevated in T2DM cases (13.9 ± 1.7 fL) compared to controls (12.5 ± 1.4 fL, $p < 0.01$). Plateletcrit (PCT) showed a significant difference between the groups, with cases having a mean value of 0.28 ± 0.05 compared to 0.22 ± 0.03 in controls.

Table 1: Hematological Parameters

Parameter	Cases (T2DM, n=62)	Controls (n=62)	p-value
Platelet Count (×10⁹/L)	238 ± 52.3	242 ± 48.7	0.521
MPV (fL)	10.8 ± 0.9	9.1 ± 0.8	**<0.001**
PDW (fL)	13.9 ± 1.7	12.5 ± 1.4	**<0.01**
PCT (%)	0.28 ± 0.05	0.22 ± 0.03	**<0.001**

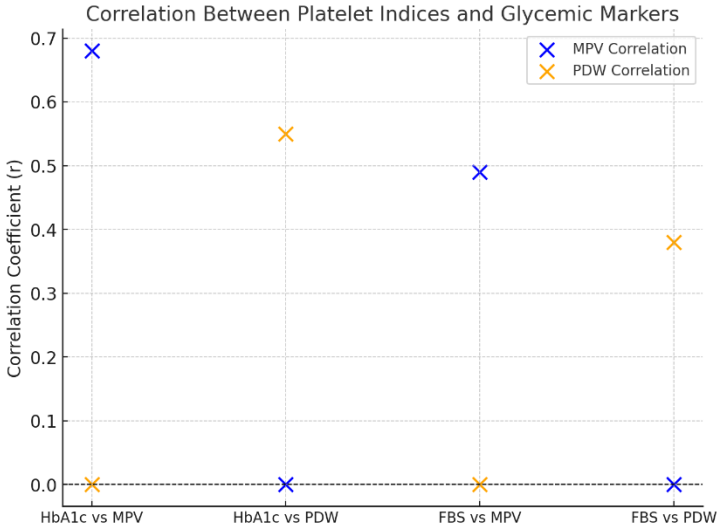
The mean fasting blood sugar (FBS) and glycated hemoglobin (HbA1c) levels were significantly higher in the T2DM group compared to controls. The mean FBS in the T2DM group was 185.4 ± 28.7 mg/dL, compared to 91.6 ± 10.3 mg/dL in the control group ($p < 0.001$). Similarly, HbA1c levels in T2DM cases were markedly elevated (8.1 ± 1.3%) compared to controls (5.4 ± 0.5%, $p < 0.001$) as shown in Figure 1 & Figure 2.





A strong positive correlation was observed between HbA1c and MPV ($r = 0.68$, $p < 0.001$) as well as between HbA1c and PDW ($r = 0.55$, $p < 0.01$). FBS levels also showed a moderate positive correlation with MPV ($r = 0.49$, $p < 0.05$). These

results suggest that worsening glycemic control is associated with increased platelet activity, as reflected by elevated MPV and PDW levels as shown in Figure 3.



4. DISCUSSION

This study demonstrates the significant role of platelet indices—Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), and Plateletcrit (PCT)—in the pathophysiology of Type 2 Diabetes Mellitus (T2DM). Our findings revealed that these indices are significantly elevated in T2DM patients compared to non-diabetic controls, aligning with previous research suggesting that platelet dysfunction contributes to the development of vascular complications in diabetes (5,11).

MPV, a marker of platelet activation and size, was significantly elevated in T2DM patients compared to controls (10.8 ± 0.9 fL vs. 9.1 ± 0.8 fL; $p < 0.001$). Larger platelets are known to be enzymatically and metabolically more active, releasing higher levels of thromboxane A2 and other prothrombotic factors, thereby predisposing diabetic patients to vascular complications (12,13). PDW, indicative of platelet size variability and heterogeneity, was also significantly elevated in T2DM patients (13.9 ± 1.7 fL vs. 12.5 ± 1.4 fL; $p < 0.01$). This increase reflects enhanced platelet turnover and the presence of immature, larger platelets. Studies by Ahmed et al. and Papanas et al. similarly observed higher PDW in diabetic populations, emphasizing its role in vascular risk assessment (13,14). PCT, which measures the proportion of blood volume occupied by platelets, was significantly higher in T2DM patients than in controls (0.28 ± 0.05% vs. 0.22 ± 0.03%; $p < 0.001$). Elevated PCT further supports the hypothesis that increased platelet reactivity and aggregation play a pivotal role in the pathogenesis of vascular complications in diabetes (15).

A strong positive correlation was observed between MPV and HbA1c ($r = 0.68$, $p < 0.001$), indicating that poor long-term glycemic control exacerbates platelet dysfunction. This finding is consistent with earlier studies reporting significant correlations between MPV and HbA1c in diabetic populations (16,17). Similarly, PDW showed moderate correlations with both HbA1c and FBS, suggesting that it may serve as a marker of hyperglycemia-induced platelet activation. These findings align with studies by Ozder et al. and Bhatta et al., which highlighted the diagnostic utility of platelet indices in assessing glycemic control (16,17).

The elevated MPV, PDW, and PCT levels observed in T2DM patients reinforce their potential as simple, cost-effective biomarkers for identifying individuals at increased risk of vascular complications. These indices, routinely available in complete blood count reports, can be easily integrated into clinical practice to aid in risk stratification and monitoring of diabetic patients (18).

While the findings of this study are significant, certain limitations must be acknowledged. The sample size was relatively small, and the study was conducted at a single tertiary care hospital, limiting the generalizability of the results. Additionally, the cross-sectional nature of the study precludes establishing causal relationships between glycemic markers and platelet indices. Future longitudinal studies are needed to confirm these associations and evaluate the impact of glycemic control on platelet dysfunction. Platelet indices such as MPV, PDW, and PCT are significantly elevated in T2DM patients and strongly correlate with glycemic markers like HbA1c. These indices provide valuable insights into the prothrombotic state associated with diabetes and may serve as early markers for vascular complications. Incorporating these indices into routine clinical practice could enhance the management of diabetes and improve patient outcomes. Future research should focus on validating these findings in larger, more diverse populations and exploring their utility in predicting long-term complications.

5. CONCLUSION

This study highlights the significant elevation of platelet indices—Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), and Plateletcrit (PCT)—in patients with Type 2 Diabetes Mellitus (T2DM) compared to non-diabetic controls. The

findings underscore the critical role of platelet activation and dysfunction in the pathophysiology of T2DM and its associated vascular complications. Furthermore, the strong positive correlation between platelet indices and glycemic markers, such as HbA1c and fasting blood sugar (FBS), establishes these indices as reliable markers of poor glycemic control and predictors of thrombotic risk. Platelet indices are cost-effective, routinely available, and easily integrated into clinical practice, making them valuable tools for early detection of patients at higher risk of vascular events. Their inclusion in regular monitoring protocols for T2DM patients can facilitate early interventions, ultimately reducing morbidity and mortality associated with diabetes-related complications. Despite these promising findings, the study emphasizes the need for further research to validate the clinical utility of these indices across larger, more diverse populations. Longitudinal studies investigating the causal relationship between glycemic control and platelet dysfunction, as well as the impact of therapeutic interventions on platelet indices, will strengthen the evidence base for their routine clinical use. In conclusion, platelet indices provide significant insight into the hypercoagulable state in T2DM and have the potential to improve risk stratification and management of diabetic complications. Their routine application could represent a transformative step in optimizing care for patients with T2DM.

REFERENCES

[1] Spandana T, Yerragolla S, Swaroopa MJ, Shalini C. Role of platelet indices in Type 2 Diabetes Mellitus in a tertiary care hospital. J Clin Diagn Res. 2022;12(4):222-31.

[2] Ahluwalia RS, Jagtap SV, Borade DS, Khawale R, Billawaria S. Association of platelet indices with diabetic complications: a cross-sectional study. J Clin Diagn Res. 2024;18(2):EG01-05.

[3] Saboor M, Ilyas MS. Platelet structural, functional and metabolic alterations in diabetes mellitus. Pak J Physiol. 2012;8(2):40-3.

[4] Demirtas L, Akbas E, Timuroglu A, et al. Association of hematological indices with diabetes and its complications. Int J Clin Exp Med. 2015;8(7):11420-7.

[5] Kodiatte TA, Manikyam UK, Rao UK, et al. Mean platelet volume in Type 2 Diabetes Mellitus. J Lab Physicians. 2012;4(1):5-9.

[6] International Diabetes Federation. IDF Diabetes Atlas. 6th ed. Brussels: IDF; 2013.

[7] Dalamaga M, Karmaniolas K, Lekka A, et al. Platelet markers correlate with glycemic indices in diabetic patients. Dis Markers. 2010;29(1):55-61.

[8] Hekimsoy Z, Payzin B, Ornek T, Kandogan G. Mean platelet volume in Type 2 diabetic patients. J Diabetes Complications. 2004;18(3):173-6.

[9] Zuberi BF, Akhtar N, Afsar S. Comparison of mean platelet volume in patients with diabetes mellitus. Singapore Med J. 2008;49(2):114-6.

[10] Subashini S, Siva G, Anandraj V. Platelet indices and microvascular complications in Type 2 DM. Int J Recent Sci Res. 2020;11(3):37915-9.

[11] Dayal A, Kothari S, Shah R, Patel S. Mean platelet volume in diabetes mellitus Type II. Ann Pathol Lab Med. 2016;3:1-5.

[12] Ahmed S. To assess mean platelet volume in type II diabetes mellitus patients. Int J Adv Res Med. 2019;1(1):1-6.

[13] Papanas N, Symeonidis G, Maltezos E, et al. Mean platelet volume in patients with Type 2 diabetes mellitus. Platelets. 2004;15(7):475-8.

[14] Rajin A. Evaluation of platelet count and mean platelet volume in Type 2 Diabetes Mellitus. Pan Afr Med J. 2017;18:1-5.

[15] Hekimsoy Z, Payzin B, Ornek T. Mean platelet volume in Type 2 diabetic patients. J Diabetes Complications. 2004;18(3):173-6.

[16] Bhatta S, Singh S, Gautam S, et al. Mean platelet volume and platelet count in T2DM. J Nepal Health Res Counc. 2019;16(41):392-5.

[17] Ozder A, Eker H. Investigation of MPV in T2DM and impaired fasting glucose. Int J Clin Exp Med. 2014;7(8):2292-7.

[18] Li Z, Wang J, Han X, et al. Association of MPV with incident T2DM risk. Diabetol Metab Syndr. 2018;10:1-10.