

To Assess Platelet Indices in Type 2 Diabetic Patients with or Without Complications

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ABSTRACT

Background: The main feature of diabetes mellitus (DM), a complicated metabolic illness with significant global impact, is persistent hyperglycemia brought on by either insulin resistance or deficiency, or both.

Aim: To assess platelet indices in type 2 diabetic patients with or without complications.

Study Design: cross-sectional study.

Methodology: This study was carried at Combine Military Hospital-Multan. Total patients (n=120) were enrolled and were divided into two equal groups with complication and without complication. In addition to providing standard follow-up care, the diabetes follow-up clinic screens all DM patients for diabetes-related complications at the initial visit. Patients were then checked for these issues every six months. The data was entered and analyzed in SPSS 23. Mean \pm SD were given for numeric data i.e., age and platelet indices. The frequency and percent were calculated for categorical data i.e., gender. Independent sample t-test was used to compare the age and platelet indices between the two groups. Chi-square test was used to compare the gender distribution between the two groups. A p-value \leq 0.05 was considered significant.

Results: Independent sample t test revealed that there was no significant difference in mean age between both groups. The results revealed that the mean PDW, MPV, PLCR and PCT levels was significantly higher in patients with complicated diabetes.

Practical implication: This study helped in exploring platelets indices as platelet indices results have notable impact on patient diagnosis and follow-up. With increasing demands and burden of patients in Hospital, new reliable and quick diagnosis is need of hour.

Conclusion: It was concluded that all platelet indices like MPV, PDW, and P-LCR increased significantly in patients with complicated diabetes. However, platelet indices can be used as a simple, low-cost metric to track and gauge the likelihood of problems.

Keywords: Diabetes Mellitus, Hyperglycemia, Platelet Indices, Complications and Hematological Parameters.

INTRODUCTION

The main feature of diabetes mellitus (DM), a complicated metabolic illness with significant global impact, is persistent hyperglycemia brought on by either insulin resistance or deficiency, or both¹. 90% of instances of diabetes worldwide are type 2 diabetes mellitus, which is the most common type².

The prevalence of diabetes mellitus as a global public health issue has been rising quickly. 463 million (8.8%) persons worldwide had diabetes as of 2019, according to estimates from the International Diabetes Federation (IDF). By the end of 2045, the predicted increase in prevalence reaches 700 million (10.9%) people worldwide. According to estimates, 80% of the world's burden of the diabetes epidemic will fall on middle- and low-income nations³.

DM metabolic imbalance brought on by chronic hyperglycemia has long-term effects in a variety of organ systems⁴. These issues reduce the patient's quality of life and have a significant financial impact on them, their loved ones, and the healthcare system. They also account for the bulk of the morbidity and death associated with the condition⁵.

Diabetes mellitus (DM) has been identified as having an enhanced prothrombotic tendency. It has been hypothesized that these increased responsiveness factors into the microvascular problems of diabetes⁶. Measuring variations in either platelet stimulation or the rate of platelet formation, mean platelet volume (MPV) is one of the platelet indicators. Platelet distribution width (PDW), which can be caused by either the ageing of platelets or the uneven demarcation of megakaryocytes, is a measurement of platelet heterogeneity. The third platelet index, or platelet-large cell ratio (P-LCR), measures larger platelets⁷. Only a few studies on diabetic individuals have looked at MPV. There has been evidence connecting an increase in MPV to metabolic syndrome, diabetes, and stroke⁸. Proliferative diabetic retinopathy patients have been demonstrated to have higher MPV levels recently⁹. Because DM's

microvascular complications are a major cause of morbidity and high medical expenses, early detection of their presence would help to reduce adverse occurrences. Platelet indices, which are usually obtained from routine haematological examinations, may therefore provide essential information for the early detection and evaluation of disorders related to diabetes, enabling timely action to be taken at an earlier stage¹⁰.

The objective of the study was to assess platelet indices in type 2 diabetic patients with or without complications.

METHODOLOGY

After IRB permission, this cross-sectional study was carried at Combine Military Hospital-Multan. There were 60 diabetic individuals with complications and 60 diabetic patients without complications out of a total of 120 samples collected from normal hospital patients. In addition to providing standard follow-up care, the diabetes follow-up clinic screens all DM patients for diabetes-related complications at the initial visit. Patients were then checked for these issues every six months.

All patients who had diabetes for less than 10 years and visited the hospitals during the study period were included. However, patients who received blood transfusion, bone marrow inhibitors/antiplatelets, pregnant and had history of blood loss, with low haemoglobin levels were excluded. All baseline parameters were recorded at the time of enrollment. Baseline investigations (CBC, RFTS, URINE R/E), BSL and HbA1c were measured at start and end of study. All patients gave 5ml of blood in EDTA vials and samples were sent into local hospital laboratory for evaluation.

Statistical Analysis: SPSS 23 was used to enter and analyse the data. For numerical data, such as age and platelet indices, mean SD were provided. In the case of gender-based categorical data, the frequency and percentage were determined. Age and platelet indices were compared between the two groups using an independent sample t-test. To compare the gender distribution between the two groups, a chi-square test was utilised. A p-value of 0.05 or less was regarded as significant.

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RESULTS

Sixty diabetic individuals with complications and 60 diabetic patients without complications participated in this study. The average age of diabetes patients with difficulties was 52.3 10.4 years, compared to 51.8 9.5 years for diabetic patients without complications as shown in figure-1.

Figure-1: Comparison of mean age between groups

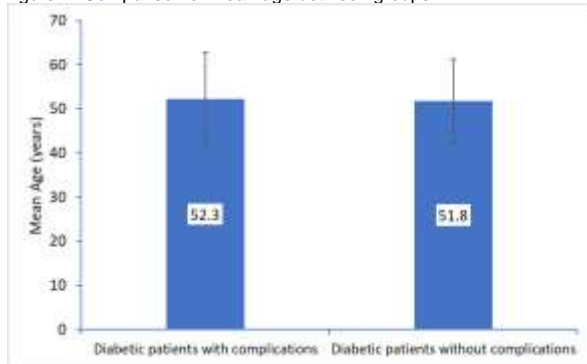


Figure-2: Comparison of Mean PDW between groups

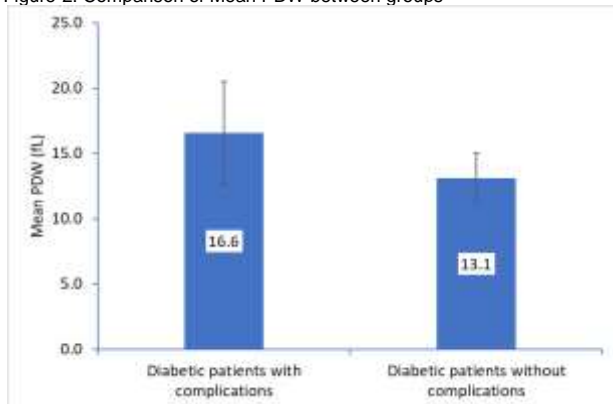
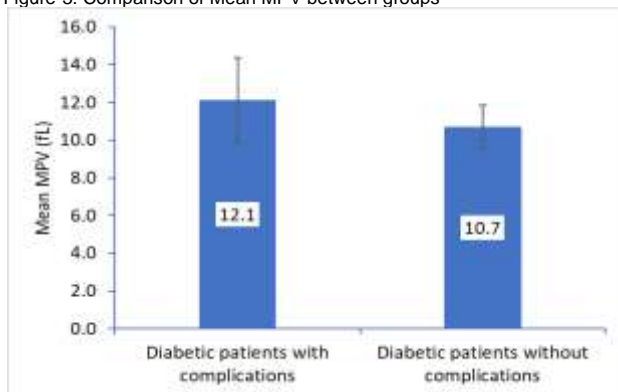


Figure-3: Comparison of Mean MPV between groups



In the group of diabetic patients with complications, there were 33 (55%) males, while in the group of diabetic patients without complications, there were 31 (51.7%) males As Shown In Table-1. The results of the chi square test showed that the gender distribution in the two groups was the same. (p = 0.714)

Table-1: Gender distribution of study participants

Group	Male	Female
Diabetic patients with complication	33 (55.0%)	27(45.0%)
Diabetic patients without complication	31 (51.7%)	29(48.3%)

The findings showed that diabetes patients with complications had considerably higher mean PDW, MPV, PLCR, and PCT levels than diabetic patients without issues as shown in Table-2.

Table-2: Comparison of platelet indices between groups

Platelet indices	Group-A	Group-B	p-value
PDW (fL)	16.6 ± 3.9	13.1 ± 1.9	<0.001*
MPV (fL)	12.1 ± 2.2	10.7 ± 1.2	<0.001*
PLCR (%)	36.5 ± 12.2	31.0 ± 8.5	0.005*
PCT (%)	0.30 ± 0.07	0.22 ± 0.06	<0.001*

Figure-4: Comparison of Mean PLCR between groups

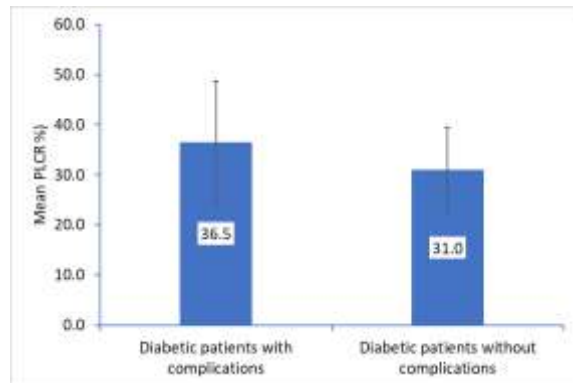
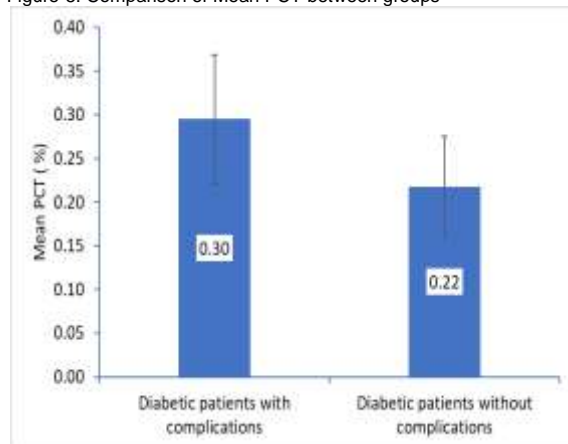


Figure-5: Comparison of Mean PCT between groups



DISCUSSION

Diabetes is a widespread public health issue that puts people at higher risk for both microvascular and macrovascular problems¹¹. Literature review has revealed that with a variety of blood tests, including MPV, have been used as biomarkers for the early diagnosis of diabetic problems. However, biomarkers that indicate an increase in platelet size and reactivity also result in raised MPV, PDW, and P-LCR values as per previous study¹². The increased synthesis of glycoproteins and non-enzymatic glycation of these proteins on the surface of the platelets in a hyperglycemic situation reduces the fluidity of the platelet membrane and results in hyperactive platelets¹³. One of the powerful platelet activators, thromboxane A2, which is produced in greater amounts as a result of increasing plasma glucose concentration, is a factor in the hyperactivity of platelets in diabetic individuals¹⁴.

One previous study showed that vascular problems accelerated mainly due to hyperactive platelets as they are bigger, more active and produce more granules. These factors lead to increased clotting, poor fibrinolysis, and endothelial dysfunction¹⁵. Moreover, these overactive platelets change into a multi-

pseudopodia shape that increases their capacity for adhesion, which might result in vascular problems¹⁶.

Additionally, hyperglycemic conditions and some glucose metabolites force platelets to swell osmotically, increasing their reactivity and possibly shortening their lifespan, which is indicative of the increased release of larger platelets from the bone marrow. The morbidity and mortality of diabetic patients rise as a result of these young, bigger platelets because they are more metabolically and enzymatically active and more likely to develop thrombotic events that cause both macrovascular and microvascular problems¹⁷.

In our project there were 33(55%) males in diabetic patients with complication group and 31 (51.7%) males in diabetic patients without complication group. Our results revealed that mean PDW, MPV, PLCR and PCT levels were significantly higher in patients with complicated diabetes. This was in line with many researches that showed higher platelet indices among complicated diabetic patients^{15,18}.

According to one previous study, average age of presentation with type 2 diabetes mellitus was 53 ± 5.7 years. The mean duration of diabetes was 4.7 ± 2.5 years. MPV, PDW and P-LCR were significantly higher in diabetics compared to non diabetics (11.3 ± 1.0 vs. 9.0 ± 0.6 , 14.2 ± 2.5 vs. 10.7 ± 0.7 fl, 35.0 ± 8.1 vs. $23.0 \pm 2.4\%$). Among the diabetics, MPV, PDW and P-LCR were higher in those with complications as compared to those without complications, which was not statistically significant¹⁹. The higher values of MPV, PDW and P-LCR indicated that they serve as better risk indicator of initial vascular complications in diabetes mellitus patients and can be used as a simple and cost effective tool to assess vascular events^{19,20}. Their findings were similar to our results that revealed higher platelets indices among diabetics having complications like nephropathy, neuropathy and retinopathy.

Limitations of study: This study was only done on a limited population, hence in order to generalise the findings to wider populations, a larger study needs be done. Financial restrictions, a lack of genetic testing, and lengthy follow-ups are some of the constraints.

CONCLUSION

It was concluded that all platelet indices like MPV, PDW, and P-LCR increased significantly in patients with complicated diabetes. However, platelet indices can be used as a simple, low-cost metric to track and gauge the likelihood of problems. This showed that platelet indices can serve as more accurate prognostic indicators for identifying diabetes problems early on.

Authors' Contribution: AM&JZC: Conceptualized the study and formulated the initial draft, **HI&SS:** Contributed to the analysis of data and proofread the draft, **SL&SBZ:** Collected data.

Conflict of interest: None

Funding: None

REFERENCES

- Petersmann, A., Nauck, M., Müller-Wieland, D., Kerner, W., Müller, U. A., Landgraf, R & Heinemann, L. (2018). Definition, classification and diagnosis of diabetes mellitus. *Experimental and clinical endocrinology & diabetes*, 126(07), 406-410.
- Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., ... & IDF Diabetes Atlas Committee. (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas. *Diabetes research and clinical practice*, 157, 107843.
- ATLAS, I. (2019). 2017: <http://www.diabetesatlas.org>. Accessed on Feb 10th.
- American Diabetes Association. (2009). Diagnosis and classification of diabetes mellitus. *Diabetes care*, 32(Suppl 1), S62.
- Buch, A., Kaur, S., Nair, R., & Jain, A. (2017). Platelet volume indices as predictive biomarkers for diabetic complications in Type 2 diabetic patients. *Journal of laboratory physicians*, 9(02), 084-088.
- Koltai, K., Feher, G., Kesmarky, G., Keszthelyi, Z., Czopf, L., & Toth, K. (2006). The effect of blood glucose levels on hemorheological parameters, platelet activation and aggregation in oral glucose tolerance tests. *Clinical hemorheology and microcirculation*, 35(4), 517-525.
- Borkatay, S., Jain, R., Gupta, R., Singh, S., Krishan, G., Gupta, K., & Kudesia, M. (2009). Role of platelet volume indices in the differential diagnosis of thrombocytopenia: a simple and inexpensive method. *Hematology*, 14(3), 182-186.
- Tavil, Y., Sen, N., Yazıcı, H. U., Hızal, F., Abacı, A., & Cengel, A. (2007). Mean platelet volume in patients with metabolic syndrome and its relationship with coronary artery disease. *Thrombosis research*, 120(2), 245-250.
- Ateş, O., Kiki, I., Bilen, H., Keleş, M., Koçer, I., Kulaçoğlu, D. N., & Baykal, O. (2009). Association of mean platelet volume with the degree of retinopathy in patients with diabetes mellitus. *Eur J Gen Med*, 6(2), 99-102.
- Dwivedi, T., & DavangeRi, R. (2018). Variation of Platelet Indices among Patients with Diabetes Mellitus Attending Tertiary Care Hospital. *Journal of Clinical & Diagnostic Research*, 12(11).
- Dindar, S., Cinemre, H., Sengul, E., & Annakkaya, A. N. (2013). Mean platelet volume is associated with glycaemic control and retinopathy in patients with type 2 diabetes mellitus. *West Indian Med J*, 62(6), 519-523.
- Buch, A., Kaur, S., Nair, R., & Jain, A. (2017). Platelet volume indices as predictive biomarkers for diabetic complications in Type 2 diabetic patients. *Journal of laboratory physicians*, 9(02), 084-088.
- Ji, S., Zhang, J., Fan, X., Wang, X., Ning, X., Zhang, B., ... & Yan, H. (2019). The relationship between mean platelet volume and diabetic retinopathy: a systematic review and meta-analysis. *Diabetology & metabolic syndrome*, 11, 1-8.
- Saboor, M., & Ilyas, S. (2012). Platelets structural, functional and metabolic alterations in diabetes mellitus. *Pakistan Journal of Physiology*, 8(2), 40-43.
- Dwivedi, T., & DavangeRi, R. (2018). Variation of Platelet Indices among Patients with Diabetes Mellitus Attending Tertiary Care Hospital. *Journal of Clinical & Diagnostic Research*, 12(11).
- Goyal, P., Mahajan, S., & Parmar, C. (2020). Evaluation of platelet function in subjects with type-2 diabetes mellitus: A case control study. *National Journal of Physiology, Pharmacy and Pharmacology*, 10(8), 667-667.
- Jaman, S., Rezwani, S., Alam, S., Islam, R., Husna, A. U., & Sayeed, A. (2017). Association of mean platelet volume and platelet distribution width with HbA1c. *J Endocrinol Diab*, 4(4), 1-6.
- Desai, K. N., & Lakum, N. R. (2018). An Evaluation Study of Platelet Volume Indices (PVI) in type-2 diabetes mellitus and its micro and macro vascular complications. *Ann Pathol Lab Med*, 5(5), 480-483.
- Shilpi K, Potekar RM. A study of platelet indices in type 2 diabetes mellitus patients. *Indian Journal of Hematology and Blood Transfusion*. 2018;34:115-20.
- Walinjkar RS, Khadse S, Kumar S, Bawankule S, Acharya S. Platelet indices as a predictor of microvascular complications in type 2 diabetes. *Indian journal of endocrinology and metabolism*. 2019 Mar;23(2):206.