

A Cross Sectional Analytical Study of Platelet Indices on Type 2 Diabetes Mellitus

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Abstract

Background: Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia and associated microvascular and macrovascular complications. Platelets play an important role not only in hemostasis but also in thrombosis and vascular pathology. Platelet indices such as Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), and Platelet Large Cell Ratio (P-LCR) reflect platelet size and activity and may serve as markers for thrombotic risk in diabetic patients.

Aim: To evaluate and correlate platelet indices with glycemic status in patients with Type 2 Diabetes Mellitus.

Material and Method: A cross-sectional analytical study was conducted over a period of six months (June–November 2023) at SBKS Medical Institute and Research Centre, Piparia, Vadodara. The study included 130 participants, comprising 65 patients with type 2 diabetes mellitus (Group A) and 65 age- and sex-matched non-diabetic controls (Group B). Platelet indices (MPV, PDW, and P-LCR) and glycemic parameters including HbA1c, fasting blood sugar (FBS), random blood sugar (RBS), and post-prandial blood sugar (PPBS) were analyzed and compared between groups.

Results: The study demonstrated significantly higher platelet indices in diabetic patients compared to non-diabetic controls. Mean MPV, PDW, and P-LCR values were elevated in diabetics (12.1 fl, 14.02 fl, and 35.1%) compared with controls (9.5 fl, 10.4 fl, and 23.7%) with statistically significant p-values. Furthermore, diabetic patients with complications showed higher platelet indices than those without complications. Increased platelet indices were also associated with poor glycemic control and higher HbA1c levels.

Conclusion: Platelet indices such as MPV, PDW, and P-LCR are significantly increased in patients with Type 2 Diabetes Mellitus and correlate with glycemic status and diabetic complications. These indices may serve as simple, cost-effective laboratory markers for early detection and monitoring of thrombotic risk and vascular complications in diabetic patients.

Keywords: Type 2 diabetes mellitus, Platelet indices, Mean platelet volume, Platelet distribution width, Platelet large cell ratio, Glycemic control.

Introduction

Platelets are hematological cells derived from the cytoplasm of megakaryocytes in bone marrow.

Besides hemostasis platelets are involved in physiologic and pathologic processes such as thrombosis,

inflammatory, immune responses, vascular integrity and wound healing.

Diabetes mellitus is a complex disease characterized by chronic hyperglycemia, metabolic abnormalities, and long-term macro and microvascular complications involving the blood vessels, eyes, kidneys, nerves. According to WHO, India will be the country with the maximum number of diabetics in the world by 2030. **In 2014**, 40.9 million people were affected with diabetes in India and the projected estimate for the year **2030** is 80 million.

The enhanced platelet morphology and function in diabetic condition contribute to prothrombotic diseased state.

Mean platelet volume (MPV) is an indicator of average size and activity of the platelets and is reported to be high in diabetes mellitus and is considered as a risk factor for heart disease.

Normal range: 7.5 – 11.5 fl.

Similarly **platelet distribution width (PDW)** is an indicator of variation in platelet size which may be a sign of active platelet release.

Normal range: 9 – 14 fl.

Platelet large cell ratio (P - LCR) is directly related to PDW and MPV.

This implies the need for studying **PLATELET INDICES IN TYPE 2 DIABETES MELLITUS** in the Dhiraj General Hospital, Piparia, Vadodara.

The enhanced platelet morphology and function in Diabetic condition contribute to prothrombotic diseased state.

Aim and Objectives

Aim:

To correlate platelet indices with glycemic status in type-2 Diabetes Mellitus (DM) patients.

Objectives:

To compare mean blood sugar level and platelet indices among diabetics and non-diabetics. To correlate platelet indices with blood sugar parameters among the diabetic group.

To compare platelet indices among the diabetic cases in subgroups based on HbA1c level

To compare platelet indices among the diabetics with and without complications.

Particulars	Details
Type of Study	A Cross-sectional analytical study
Period of Study	06 months- June 2023 to November 2023
Place of Study	SBKS MI & RC
Sample Size	65 cases each in Group A and Group B respectively
Inclusion Criteria	<ul style="list-style-type: none"> Type 2 Diabetics admitted as indoor patients. All type-2 diabetics will be grouped as Group A and will be compared with equal number of randomly selected sex-matched non-diabetics controls (Group B).
Exclusion Criteria	<ul style="list-style-type: none"> Subjects on antiplatelet drugs such as aspirin and clopidogrel. Subjects with any diagnosed malignancy Patients who are not willing to give consent. Patients with hemoglobin less than 9 gm%.

METHODOLOGY

Results

For study- Total of 65 diabetic patients (42 males, 23 females) and 65 controls (36 males, 29 females) were selected.

- Maximum number of diabetic males - Age group of 41–60 years.
- Comparison of platelet indices was made in cases and controls.

Comparison of platelet volume indices in diabetics with complications, without complications and non – diabetics

(Table - 1)

Group	n	MPV (fl)	PDW (fl)	P-LCR (%)
		Mean ± SD	Mean ± SD	Mean ± SD
DM with complication	17	11.6±0.4	13.4±1.3	35.6±2.1
DM without complication	48	10.4±1.3	11.8±3.3	27.8±10.8
Normal	65	9.5±0.8	10.4±1.3	23.7±4.9
P value (2 tailed)		0.00015	0.0114	0.0043

Our study suggested that MPV, PDW and P – LCR were statistically significantly increased in diabetic patients with complications than diabetics without complications than nondiabetic group.

Comparison of blood sugar level in diabetics with complications, without complications and non – diabetics (Table - 2)

Group	n	FBS (mg/dl)	RBS (mg/dl)	PPBS (mg/dl)
		Mean ± SD	Mean ± SD	Mean ± SD
DM with complication	17	210.8±75.97	264.2±132.8	339±90
DM without complication	48	152.1±55.07	233.7±83.8	259.5±82.5
Non-diabetics (control)	65	79.7±6.5	84.2±18.08	120.4±4.08
P value (2 tailed)		0.0219	0.2839	0.0435

Our study reinforced the fact that poor glycemic control and raised FBS and PPBS blood sugar level causes increased risk of diabetic complications. However, no statistically significant difference was observed in RBS among all the three study groups.

Comparison of mean of blood sugar and platelet indices among diabetics cases and non – diabetics controls (Table - 3)

Parameters	Diabetic (n=65) Mean ± SD	Non-diabetic (n=65) Mean ± SD	P value (2 tailed)
HbA1C (%)	9.8±1.62	5.5±0.6	0.001
FBS (mg/dl)	171.7±70.5	79.7±6.5	0.004
RBS(mg/dl)	241.7±97.3	84.2±18.08	0.004
PPBS(mg/dl)	270.4±85.7	120.4±4.07	0.001

MPV(fl)	12.1±1.3	9.5±0.7	0.002
PDW(fl)	14.02±3.08	10.4±1.3	0.002
P-LCR (%)	35.1±9.9	23.7±4.9	0.003

Our study observed significant higher value of MPV, PDW and P – LCR with higher value of blood glucose parameters in diabetic patient compared to the nondiabetics.

Comparison of diabetics cases in group A1 and group A2.

- In our study, Diabetic cases were observed having higher HbA1c level (mean HbA1c >6.5%) when we wanted to divide into two groups after baseline evaluation according to their HbA1c level in group A1 (mean HbA1c <6.5%) and group A2 (mean HbA1c level >6.5%).
- Our study also observed that mean of MPV, PDW and P-LCR was higher in diabetics with HbA1c level >6.

Comparison of mean of blood sugar and platelet indices among diabetics cases with complications, without complications and non – diabetics (Table - 4)

Parameters	Diabetic cases (n=65) Mean ± SD	DM with complication (n=17) Mean ± SD	DM without complication (n=48) Mean ± SD	Non-diabetic Control (n=65) Mean ± SD
HbA1C (%)	9.8±1.62	10.2±1.6	9.8±2.09	5.5±0.6
FBS (mg/dl)	171.7±70.5	210.8±75.97	152.1±55.07	79.7±6.5
RBS(mg/dl)	241.7±97.3	264.2±132.8	233.7±83.8	84.2±18.08
PPBS(mg/dl)	270.4±85.7	339±90	259.5±82.5	120.4±4.07
MPV(fl)	12.1±1.3	11.6±0.4	10.4±1.3	9.5±0.7
PDW(fl)	14.02±3.08	13.4±1.3	11.8±3.3	10.4±1.3
P-LCR (%)	35.1±9.9	35.6±.2.1	27.8±10.8	23.7±4.9

Our study observed significant higher value of MPV, PDW and P – LCR with higher value of blood glucose parameters in diabetic patient with complications than without complications than nondiabetics.

Discussion

Comparison of MPV with other indices (Table - 5)

Publication	Cases	MPV(fl)	Controls	MPV(fl)	P value
Present study (2023)	65	12.1	65	9.5	0.002
Walinjkar, et al. (2019) ¹⁴	125	11.32	125	8.56	0.0001
Shilpi study et al. (2018) ¹³	280	11.3	280	9	<0.05
Kodiatte et al. (2012) ¹⁵	300	8.29	300	7.47	<0.001
Jindal et al. (2011) ¹⁶	75	12.08	50	11.42	<0.05

Comparison of PDW with other indices (Table - 6)

Publication	Cases	PDW(fl)	Controls	PDW(fl)	P value
Present study (2023)	65	14.02	65	10.4	0.002
Walinjkar, et al. (2019) ¹⁴	125	15.57	125	11.69	0.0001
Shilpi study et al. (2018) ¹³	280	14.2	280	10.7	0.003
Jindal et al. (2011) ¹⁶	75	17.25	50	15.349	0.002

Comparison of P - LCR with other indices

(Table - 7)

Publication	Cases	P-LCR (%)	Controls	P-LCR (%)	P value
Present study (2023)	65	35.1	65	23.7	0.003
Walinjkar, et al. (2019) ¹⁴	125	43	125	34	0.0001
Shilpi study et al. (2018) ¹³	280	35	280	23	0.002
Jindal et al. (2011) ¹⁶	5	42.31	50	36.93	0.004

Conclusion

- Our study suggest that increased platelet volume indices contributes to the prothrombotic state in diabetes mellitus.
- Because larger platelets are hemostatically more active, its presence probably is a risk factor for developing diabetic vascular complications.
- This implies that raised MPV, PDW and P-LCR can be considered as biomarkers for early detection of impending diabetic complications.

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