CORRELATION OF PLATELET CELL INDICES WITH BLOOD SUGAR LEVELS IN TYPE 2 DIABETES MELLITUS

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ARTICLE INFO	ABSTRACT	ORIGINAL RESEARCH ARTICLE

Background: Type 2 Diabetes has been associated with glucose intolerance, hypertension, dyslipidemia, a procoagulant state and an increase in micro and macrovascular disease. Diabetics are at high risk for coronary artery disease. It has been proposed that the complications are a result of chronic hyperglycemia. The increased platelet activity is emphasized to play a role in the development of vascular complications of this metabolic disorder. Platelet volume, a marker of the platelet function and activation, is measured as mean platelet volume (MPV) by hematology analyzers. Diabetic patients have an increased risk of developing micro- and macrovascular disease, and platelets may be involved as a causative agent with respect to altered platelet morphology and function.

Aims and Objectives: To assess various platelet indices abnormalities in type 2 DM.

Materials and Methods: The present study was a prospective case-control type of study that was conducted in Pravara Rural Hospital, Loni. (PRH) with a sample size of 190 (140 cases and 50 controls).

Results: The MPV in cases was 10.17 ±1.26 fL and in controls was 10.01 ±1.83fL (P<0.001 'S'). The PDW in cases was 11.86 ±2.33fL and in controls was 11.77 ±1.37fL (P<0.001'S'). The PCT in cases was 0.267 ±0.10 % and in controls was 0.231 ±0.01% (P<0.001 'S')

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INTRODUCTION

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. Depending upon the etiology of DM, factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production. The metabolic dysregulation associated with DM causes secondary pathophysiologic changes in

multiple organ systems that impose a tremendous burden on the individual with DM and on the health care system.[1]

Hyperglycemia is a characteristic of diabetes that causes an array of long term systemic complications. They have a considerable impact on the patient as well as society, as the disease typically affects individuals in their most productive years. Generally, the injurious effects of hyperglycemia are separated into macrovascular complications (Coronary Artery Disease, Peripheral Arterial Disease, Stroke) and microvascular complications (Diabetic Retinopathy, Diabetic Nephropathy, Diabetic Neuropathy). [3]

Platelets play an important role in the integrity of normal homeostasis, and platelet indices act as an indicator of its function. Larger platelets have a higher number of dense granules which makes them more potent and thrombogenic. The number and size of granules in platelets do not change during the life span of the platelet. Increased mean platelet volume (MPV) has been associated with metabolic syndrome, stroke, coronary artery disease and diabetes mellitus (DM). A few studies have shown that platelet indices are significantly increased in diabetics as compared to non-diabetic individuals. [5,6]

Platelet parameters have been available in the laboratory routine using blood cell counters for several years. These include MPV, Platelet distribution width (PDW), Plateletcrit (PCT), and platelet large cell ratio (P-LCR). The prothrombotic stage of platelet can be detected early with ease using the newer hematological analyzers through these platelet parameters. [8]

Hence, the present study was conducted with an aim to assess various platelet indices abnormalities in type 2 DM.

MATERIALS AND METHODS

The details of the present study titled, "Correlation of Platelet Cell Indices with Blood Sugar Levels in Type 2 Diabetes Mellitus" are as follows:

Ethical Committee approval:

The study was conducted after the ethical committee approval from the local Ethical Committee of Pravara Institute of Medical Sciences, Loni, Ahmednagar by submitting the synopsis mentioning all the proposed study details and protocols. The corresponding approval letter numbered:

Research Design: Case-Control Study

Duration of the Study: October 2017 to October 2019

Study Setting: The study was conducted in Pravara Rural Hospital, Loni, a tertiary care teaching hospital situated in the rural area of Ahmednagar district.

Sample Size: A total of 190 individuals were included in the study. This included 140 subjects with Type 2 Diabetes Mellitus and 50 age and gender-matched non-diabetic patients.

Sample Size Calculation: Sample size calculation was done with the help of OpenEpi software with the equation given below.

The sample size was 140 at an 80% confidence limit.

Participants: Patients of Type 2 Diabetes Mellitus, either newly diagnosed or previously diagnosed attending Medicine OPD and getting admitted in Medicine wards were taken as cases. Age and gender-matched non-diabetic individuals admitted in Medicine wards were taken as controls. Both these groups of individuals were interviewed, examined, investigated and included in the study.

Inclusion Criteria:

Study Group: Newly detected individuals with diabetes mellitus as per World Health Organisation criteria or individuals already on treatment with either oral hypoglycemic agents or insulin.

- Age: More than 40 years
- Gender: Both male and female

- Consent: Individuals or their legally accepted representatives giving consent to be a part of this study.
- Control Group: Age and gender-matched non-diabetic individuals admitted to the medical wards.

Exclusion Criteria:

- Patients with nutritional anemia.
- Patients on antiplatelet agents.
- Patients with type 2 diabetes mellitus on anticoagulants.
- Subjects with any diagnosed malignancy.
- Patients with type2 diabetes mellitus with thrombocytosis and peripheral vascular disease.

Language of Interview: Subjects were interviewed according to the proforma Annexure: in the mother tongue of the patient or the language the patient best understands.

Study protocol: Individuals with type 2 diabetes mellitus admitted in the Medicine ward of PRH, Loni were interviewed with a structured proforma.

Informed written Consent: Attached in Annexure: was taken in the mother tongue of the patient and the participants were assured of their confidentiality.

Participants were then interviewed in their mother tongue or the language they best understood (Marathi, Hindi or English).

METHODOLOGY

The following methodology was standardized for the purpose of the study. Platelet Indices: A blood cell count of all the study subjects was achieved by drawing samples aseptically in EDTA bulbs and tested within 1 hour when maintained at room temperature. In case of anticipated delay in testing the samples were cooled in a refrigerator at $8^{o}C$ till processed. Automated cell counter, XN 100 manufactured by Sysmex Corporation, was used which provided with the hemoglobin values along with platelet counts and indices (PCT, PDW and MPV). These values were used to rule out and exclude cases of anemia and pancytopenia.

Blood sugar levels: Venous samples were sent in Fluoride bulbs and were tested within 30 minutes after collection in a fully automated: which is available in the hospital central chemical laboratory.

Test Principle: The machine, The Vitros 5600, uses the colorimetric method without deproteinization. Glucose is determined after enzymatic oxidation in the presence of glucose oxidase. The hydrogen peroxide thus produced reacts, catalyzed by peroxidase, with phenol 4-aminophenazone to form a red-violet quinonimine due as an indicator. The intensity of the final color is directly proportional to the glucose concentration and is measured at 505 nanometres. This assay uses an endpoint method and a single point calibration.

Two samples were sent:

Fasting blood sugar: The morning samples were collected after at least 8 hours of overnight fasting.

Postprandial blood sugar: The samples were collected two hours after dinner and tested.

RESULTS:

Table 1: Comparison of fasting blood sugar levels among both groups:

Blood sugar levels	Diabetic group	Control group	P-value
FBS (mg/dl)	193.6 ±105.28	89.65 ±7.98	<0.001

**Table 2:** Comparison of postprandial blood sugar levels among both groups

Blood sugar levels	Diabetic group	Control group	P-value
PPBS	239.56 ±121.14	111.35 ±22.07	<0.001

Table 3: Comparison of MPV among both groups:

Index	Diabetic group	Control group	P-value
MPV (fl)	10.17 ±1.26	10.01 ±1.83	<0.001
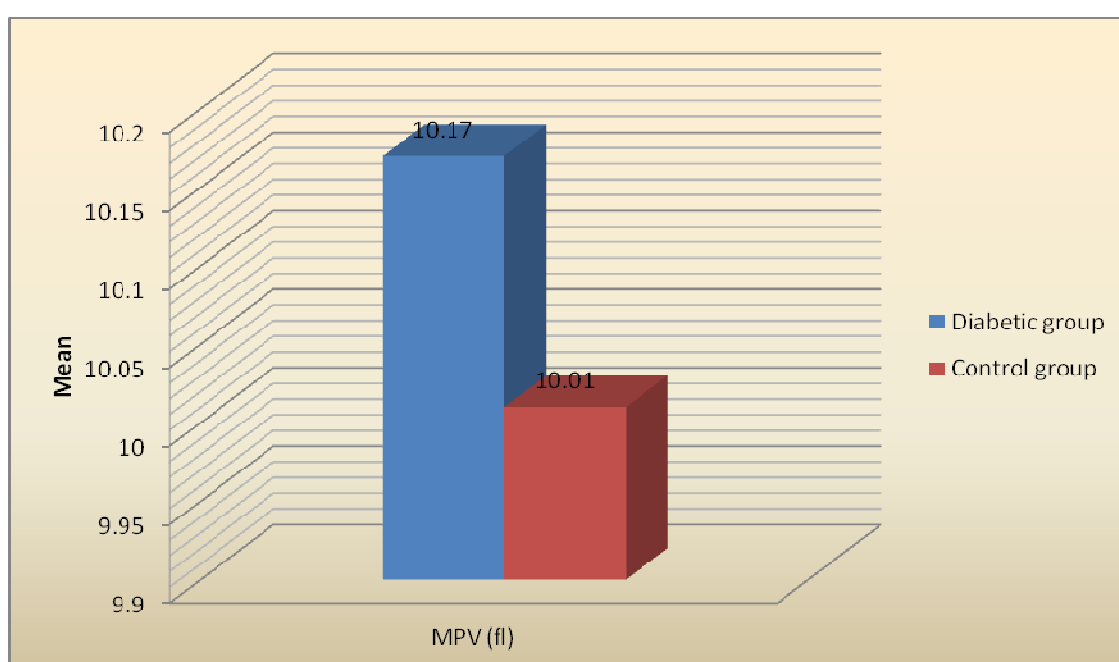
Figure 1: Comparison of MPV of Diabetics and non-diabetics.

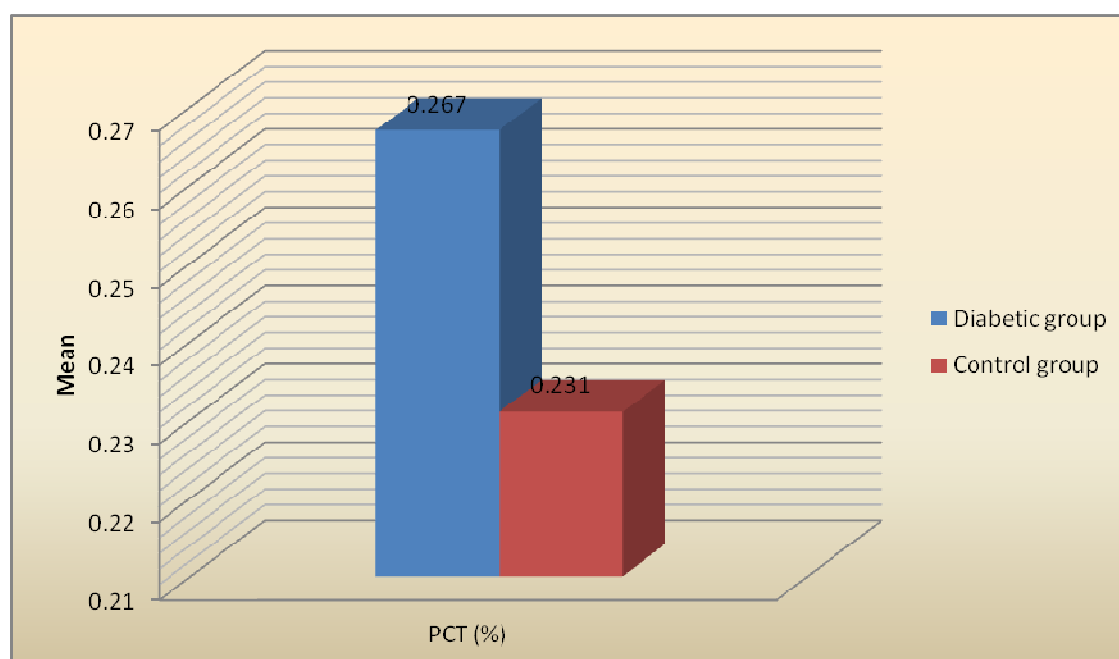**Table 4:** Comparison of Platelet Distribution width among both groups:

Index	Diabetic group	Control group	P-value
Platelet Distribution width (fl)	11.86 ±2.33	11.77 ±1.37	<0.001
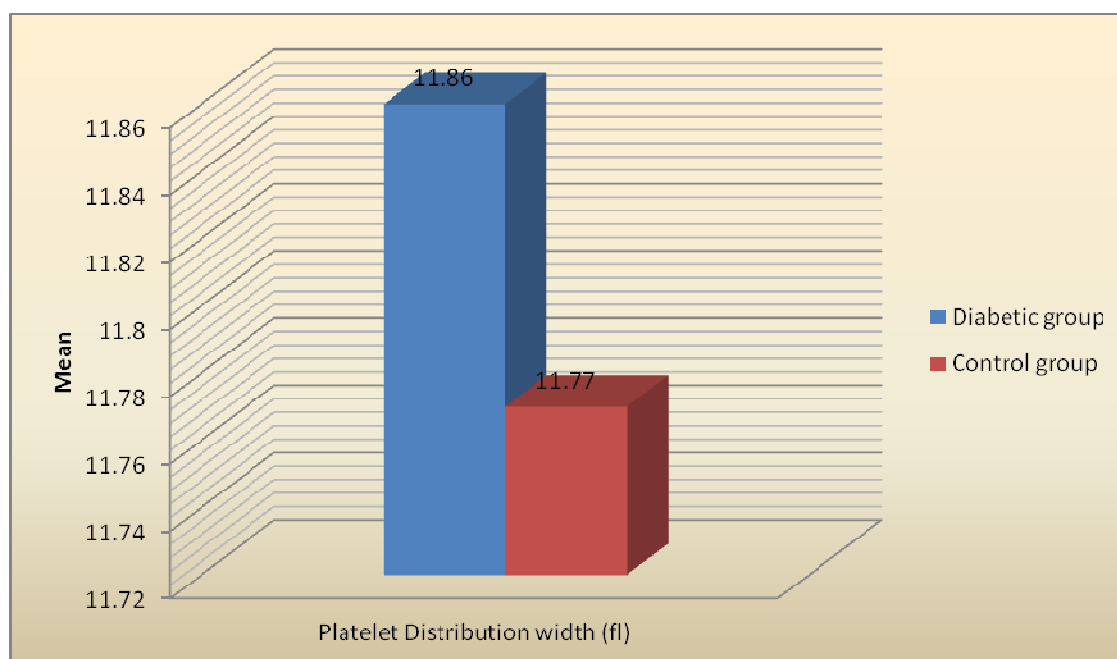
Figure 2: Comparison of PDW in diabetics and non-diabetics.

Table 5: Comparison of PCT among both groups

Index	Diabetic group	Control group	P-value
PCT (%)	0.267 ±0.10	0.231 ±0.01	<0.001

Figure 3: Comparison of PCT in diabetics and non-diabetics.

DISCUSSION:

DM is a prothrombotic state associated with accelerated atherosclerosis and inflammation. Patients with diabetes, particularly those with type 2 DM, have been shown to exhibit increasing platelet reactivity. This has been attributed to both insulin resistance and insulin deficiency. Insulin has been shown to antagonize the effect of platelet agonists like collagen, adenosine diphosphate, epinephrine and platelet-activating factor. Hyperglycemia contributes to heightened platelet reactivity directly as well as through glycation of platelet proteins. In addition, hypertriglyceridemia also increases platelet reactivity. Enhanced platelet aggregation has been implicated in the development of micro- and macrovascular disease in patients with DM.[28] An earlier study has shown higher MPV values in diabetic patients with retinopathy and other vascular complications. Microvascular complications include effects on small vessels, arterioles, and capillary venules. Complications start early in the pathogenesis of DM type 2 and account for morbidity, in the form of retinopathy, neuropathy and nephropathy.[39]

Mean platelet volume (MPV) reflects either change in platelet stimulation or the rate of platelet production. Platelet distribution width (PDW) is a measure of platelet heterogeneity, which in turn may be due to platelet aging or heterogeneous demarcation of megakaryocytes. In earlier studies, MPV was found to be significantly higher in diabetic patients and it was hypothesized that platelets with altered morphology are likely to be associated with increased risk of vascular complications in diabetes. Larger platelets contain more dense granules and hence are more potent and thrombogenic.

The study findings point to significant differences in platelet parameters in patients with T2DM, suggesting the presence of more reactive and aggregatable platelets in individuals. These results suggest that platelet evaluation may be useful in the early detection of long-term complications in diabetic patients, considering that it is a simple and low-cost tool.

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