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Research Article

Platelet Indices: Indicators of Diabetes

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I N F O

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A B S T R A C T

Aim and Objectives: The aim of this study is to study role of platelet indices in with and without diabetes. The objectives included assessing platelet count, mean platelet volume (MPV), platelet distribution width (PDW), and platelet large cell ratio (P-LCR) within these patient categories and to comparing platelet indices among healthy controls and diabetic patients.

Materals and Methods: This prospective case-control study was conducted at Departments of Pathology and Ophthalmology, School of Medical Sciences & Research, Sharda Hospital, Greater Noida. Over one and a half years, 100cases were enrolled, divided into 2 groups: controls and Diabetics .The patients coming to ophthalmology opd for retina checkup, their blood sample was taken. As same vial is used for both estimation of platelet indices and HBA1C, both blood investigations were noted. Inclusion criteria were adult patients with type 2 diabetes. Exclusion criterion was anemia, certain eye conditions, uncontrolled hypertension, cardiovascular issues, renal failure, anti-platelet drug usage, malignancy, and type 1 diabetes were made.

Results: The results revealed significant variations among the groups. In controls, the majority (90%) had MPV below 12, whereas in diabetic patients most (58%) had MPV ranging from 12 to 15. PDW showed similar trends, with 96% of controls having PDW below 17, while 96% of diabetic patients was having as >20 . PLCR percentages ranged within normal limits for controls but shifted towards higher values in diabetic group. Platelet counts were consistent between control and diabetic without Diabetes groups, averaging around 252,000 x10^3/ cumm, while diabetic patients had a slightly lower average count of approximately 242,000 x10^3/cumm .

Conclusion: Thus we conclude that platelet indices are cost effective, easily available, more reliant and more compliant tools which can indicate the progression diabetes. MPV, PDW,PLCR and PLATELET COUNT, can play an important role in Early detection , better diagnosis and prognosis of Diabetes.
Keywords: Mean Platelet Count, Platelet Distribution Width , Platelet Large Cell Ratio, Diabete.

Keywords: Platelet Indices, Diabetes, HBA1C

Introduction

- **Defination and Problem:** Diabetes Mellitus (DM) is a major global health problem.[1] It is a group of metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.[2] Consequential hyperglycemia causes long term vascular complications and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels.[3] Diagnosis of DM was established using American Diabetes Association criterion of fasting blood glucose level of >=126mg/dl or 2hrs post prandial blood glucose >=140 mg/dl on two occasions or random glucose levels of >= 200 mg/dl or HBA1C of>= 5.6. Diabetes is a prothrombotic state. Platelets activity can measure the status of diabetes.[4]
- **Epidemiology:** According to World Health Organization (WHO) the number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014.[5] It is projected that by year 2025, 80.9 million will have diabetes in India.[6] Diabetic patients is one of the most important complications and leads to considerable increase in morbidity.[7] Diabetes is defined as presence of at least 2 microaneurysms and or retinal hemorrhage, Diabetes, the most common retinal vascular disease, is the leading cause of new blindness is DR in adults during the third through sixth decade of life.

Platelet Parameters

Platelet parameters like MPV, PWD, Platelet Rit (PCT), Platelet large cell ratio and platelet count are easily available.[8] and are an important and easily accessible indices done in routine blood test, that reflect the size and activity of platelets.[9]

As DM is considered as a “prothrombotic state”, altered platelet morphology and function has been observed in diabetes in the form of enhanced platelet activity. If microvascular complications like DR are detected at the earlier stages it will be useful in controlling them and protecting the patients from associated adverse events. Platelet volume indices (PVI) such as MPV, PDW, PLCR, PC are cost effective, easily available and more compliant and can be the potential biomarkers for DR.[10]

Platelets release cytokines, thromboxane A2, prostaglandin etc. Their activities increase in Hypercoagulable states and their size increases. My measuring their size one can estimate the progression of chronic conditions like diabetes. Platelet function tests are simple and convenient tools which can be used to detect diabetes and its complications.[11]

Materials and Methods

Source of Data

The study was carried out in the Department of Pathology in collaboration with Ophthalmology Department, School of Medical Sciences & Research, Sharda University and Sharda Hospital, Greater Noida and the ethical approval was taken from the concerned authority. It was a Prospective Case control study and was done for one and a half year from 2019 to 2022 with sample size of 100 cases.

50 normal age and 50 matched controls were also taken having normal blood sugar levels and HbA1C values.

Another 50 patients were selected from the ophthalmology and medicine OPD. The patients who were already diagnosed cases if diabetes, or having random blood sugar of >= 200 mg/dl or according to ADA guidelines were taken. As same vial is used for both HBA1C and platelet indices, that is lavender, a single random sample was taken.

These cases were divided into 2 groups namely controls and diabetics, each comprising of 50 patients each. These patients Blood sample was taken in EDTA vial, also same vial is used for both HBA1C and platelet parameters. The diabetic patients were taken from both medicine and ophthalmology OPD. Controls were selected from random healthy individuals like author itself, teachers and students

Results

Age

Control Group: Out of 50 cases of controls the maximum number of cases (n=11, 22%) were in age groups 50-59years and <30years each; followed by (n=10,20%) cases in 60-69 years age group. The minimum number of cases (n=5, 10%) were noted in </=70 years age group. Table 1. We also calculated average and standard deviation. We found that the. Average age in control group was 47.36 years. Range was about, 20 to 78 years and Standard Deviation for age was 17.4154 years.

Table 1.Distribution of controls according to age

Age group (years)	No of controls (n)	Percentage (%)
< 30	11	22
30-39	07	14
40-49	06	12
50-59	11	22
60-69	10	20
>/=70	05	10

Case Group

Distribution of patients with Diabetes according to age, we calculated age diversification of the group. We calculated that average/mean age for diabetic patients was 58.54 years and the range was 40- 78 years. Table 2

Table 2.Distribution of cases according to age

Age group	No of cases	Percentage (%)
< 30	00	0

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30-39	00	0
40-49	06	12
50-59	24	48
60-69	10	20
>/=70	10	20

HBA1C

We calculated average, range & Std. deviation & frequency of HBA1C for both the groups.

Control- Average/ mean HBA1C was 5.6 in control group and range was 5 to 6.5, and std deviation was 0.432. Figure 1

Diabetes patients -Average 10.07, Range was 5.1- 15 and Std. deviation was 2.12. Figure 2

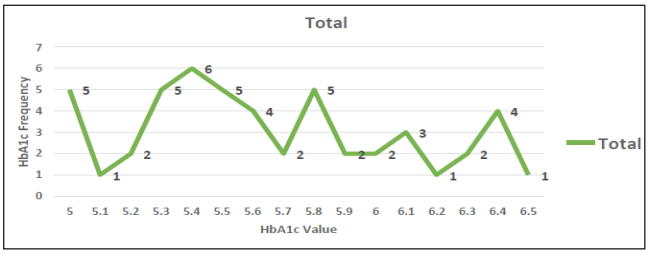

Figure 1.Distribution of cases according to HbA1C in controls

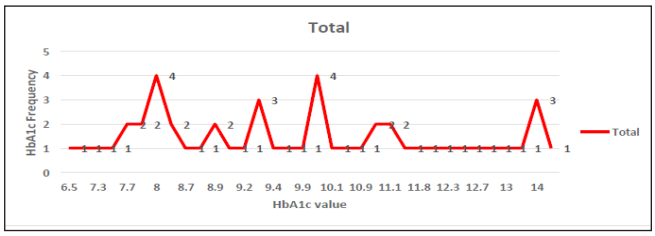

Figure 2.Distribution of cases according to HbA1C in Diabetic patients

T-Test

According to t test we can see there is significant difference between MPV, P-LCR and PDW. And in platelet count there no statistically significant difference between control and diabetic patients. Table 3

Anova

According to ANOVA table the p value among the variables (factor wise) is 0.0001 it is less than 0.05 then we can see there is significant difference between the factors MPV, P-LCR and PDW between the groups of control and Diabetic patients.

p value- The smaller the p value, the stronger the evidence that you should reject null hypothesis. p value of <0.05 is statistically significant.

Discussion

In our study, it was found that the age of the cases with diabetes ranged from 25-75 years (mean 54.4 ±11.012. The age of controls ranged from 20-78 years (mean 47.3 ±17.4 years). The study by Jee et al in South Korea showed the similar age group in cases with Diabetes with the mean age group of 58.0 +/- 11.6 years.

In the present study in the diabetics the HbA1C ranged from (5.1 -15.0 %) with (8.5± 2.07) while with mean HbA1c of 10.07. However, in controls it was (5.0-6.5 %) with (5.6± 0.43%). In another by Sadhana S et al it was reported that there were (69%) of diabetics patients had Hba1c of > 8%. The findings were concurrent with our study.[5] It is due to the fact that diabetes progresses with poor glycemic control.

It was found that in our study, MPV was significantly higher in diabetics (16.26 +/- 4.89 fl) as compared to the healthy controls (11.75 +/- 1.97 fl) (p value=0.0001). Few independent studies show concordant results with the findings of our study. A study by Thomas Alex Kodiatte,

Table 3.T-test for Control and Diabetes Mellitus

Control			Diabetes Mellitus				Significance
	Mean	SD	Mean	SD	t value	P- Value	Significant/ Non Significant
MPV	10.806	1.02	12.752	1.972	6.1978	<0.0001	Extremely statistically significant
Platelet count	252.74	87.069	252.68	77.24	0.0036	0.9971	Not Significant
P-LCR	30.632	8.325	40.812	8.843	5.9179	<0.0001	Extremely statistically significant
PDW	13.308	2.384	18.252	4.343	7.0564	<0.0001	Extremely statistically significant

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Udaya Kumar Manikyam et al, showed MPV of 11.31 in Diabetes patients and 9.91 in controls with p value <0.001.[10] In a similar study conducted by Citrik, MPV was higher in diabetes group 8.05 fl than controls having MPV of 7.74 fl, p value of <0.01.[5]

In a meta-analysis by Ji S et al showed higher MPV in diabetic group than non-diabetic group.[5,7] Another study by Zuberi BF et al it was reported that the MPV in the diabetic group was 9.34 fl and controls was 8.63 fl was statistically significant (p<0.01).[6] Mukund W. Pujari et al showed MPV was significantly higher in diabetics as compared to controls was 9+/-0.9 fl and 8.08 +/-0.45 fl with p value <0.0001.[2]

Similarly, in the study by Hekinsoy et al it was found MPV was significantly higher and were significantly lower in diabetics compared to age and sex-matched non-diabetic healthy controls.[3]

Tanima Dwivedi et al noted that platelet-large cell ratio (PLCR) was 24.6±6.77, 36.9±6.80 in patients controls and with diabetics (p <0.001).[6] Minle Wu et al P-LCR was positively correlated with HbA1c levels (p < 0.01). The results these independent studies were consistent with results of our study.[9]

Conclusion

The study concludes that MPV, PDW, and PLCR could potentially serve as cost-effective, easily available, and better compliant and can serve as novel biomarkers for assessing the progression of diabetes. These platelet indices could help in assessing the risk if diabetes and stages of diabetes. Many Platelet targeting drugs can also be developed for better treatment of DR. However, further studies are necessary to validate these findings and establish their clinical utility.

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