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Original Research Article

A cross-sectional study to assess difference of mean platelet volume among diabetics (case) and non-diabetics (control) in Western Rajasthan

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Abstract

Background: Diabetic patients have an increased risk of developing micro- vascular and macro vascular disease, and platelets may be involved as a causative agent with respect to altered platelet morphology and function. Aim of our study was to determine if platelets were activated in diabetes and to see if there was a difference in MPV in diabetics and non-diabetics.

Methodology: A cross sectional study had been conducted to study the impact of HBA1C on mean platelet volume in Type 2 diabetic patients in western Rajasthanattending the Medicine Outdoor and indoor at M.D.M. Hospital Jodhpur.

Conclusion: Platelets in Diabetes Mellitus become more reactive and agreeable and their Mean Platelet Volume (MPV) is increased. Increase in platelet size may be the one factor responsible for microvascular complication in Diabetes Mellitus. Hence, MPV could be a useful prognostic marker of micro vascular complications.

Keywords: Mean platelet volume, diabetics, cross sectional study

Introduction

Diabetes mellitus (DM) is a leading medical problem throughout the world. Diabetes causes long-term systemic complications that have considerable impact on the patient as well as society, as the disease typically affects individuals in their most productive years[1, 2]. Prevalence of diabetes is increasing throughout the world. In addition, this increase appears to be greater in developing countries[3, 4]. The etiology of this increase involves changes in diet, with higher fat intake, sedentary lifestyle changes, and decreased physical activity.

The increased platelet activity may play a role in the development of vascular complications of this metabolic disorder[5, 6]. The mean platelet volume (MPV) is an indicator of the average size and activity of platelets. Larger platelets are younger and exhibit greater activity. The increased platelet activity is emphasized to play a role in the development of vascular complications of this metabolic disorder[7, 8].

Methodology

Study design: A cross sectional study was conducted to study the impact of HBA1C on mean platelet volume and its with microvascular complication (retinopathy, neuropathy,

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nephropathy) in Type 2 diabetic patientsin western Rajasthan attending the Medicine Outdoor and indoor at M.D.M. Hospital Jodhpur.

Sample size: Sample size was calculated at alpha error 0.05 and study power 90% was calculated using the below formula for difference in two independent sample mean-

$$N = \frac{2\times(Z_{1-\alpha_2} + Z_{1-\beta})^2 \times \sigma^2}{d^2}$$

Where,
N = Sample size
$(Z_{1-\alpha_2})$ = Standard normal deviate for Type 1 error (taken as 1.96 for 95% confidence interval).
$Z_{1-\beta}$ = Standard normal deviate for Type 2 error (taken as 1.28 for 90% study power).
σ = pooled standard deviation of mean platelet volume (taken as 2fl as per reference article).
d= minimum expected significant difference in diabetic patient and control group (taken as 1fl as per reference article)[9].
Sample size was calculated to be a minimum of 84 subjects in each group. Considering 10% attrition, sample size was enhanced and rounded of to 100 in each group.

Duration of study: 8 months.

Inclusion criteria

1. All known cases of Diabetes Mellitus Type 2 diagnosed according to ADA criteria for case group.
2. Normal healthy person attendant of indoor or outdoor patients those not have any disease.

Exclusion criteria

1. Abnormal platelet count (<1.5lac or >4.5lac).
2. Use of drugs affecting platelet function (aspirin, warfarin, ticagrelor, clopidogrel, or heparin.) and statin therapy.
3. Pregnant females.
4. Patients with known case of rheumatoid arthritis and SLE, Recent infection, Anemia (male Hb <12gm/dl and female Hb <10gm/dl, Type 1 DM and malignancy.

Methodology
The study included both control group and case group. All individuals were > 30 years of age. A verbal consent taken from all individuals entering in to the study. A written consent will be taking from all the individuals who undergo for height, weight, BMI was calculated by using formula of Weight (kg)/Height[2] (meter). Fasting blood glucose level and post prandial blood glucose level was detected by glucose oxidase method. Complete blood count done by collecting 2ml. blood sample in EDTA vial and process in SYSMEX 5 part auto analyzer and HbA1C testing had done by collecting 2ml of blood in EDTA vial and process by using high performance liquid chromatography of normal healthy individuals (control group) who attended OPD or attendants of indoor or outdoor patient and following all sampling criteria. A written consent was taken from all diabetic patients who underwent for height, weight, BMI, fasting blood glucose level, complete blood count and HbA1C testing of case group who attended OPD or indoor patients and following all sampling criteria[10].

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Result and Observations

Table 1

Gender	Case		Control	
	N	%	N	%
Male	57	57.00	60	60.00
Female	43	43.00	40	40.00
Total	100	100.00	100	100.00
Age (yrs)	**Case**		**Control**	
	N	%	N	%
31-40	5	5.00	14	14.00
41-50	23	23.00	27	27.00
51-60	32	32.00	21	21.00
>60	40	40.00	38	38.00
Total	100	100.00	100	100.00
Mean+SD	57.77+11.69		56.44+13.88	
t & p value	0.897, 0.370			

This table show that most of the study subject in control group are in>60 years age group (38%) followed by 41-50 years age group and in case group most of study subject are also in>60 years age group(40%) followed by 51-60 years age group. Above table show that most of study subject in both case and control group are male 57% and 60% respectively.

Table 2

Variables	Case		Control		P value
	Mean	SD	Mean	SD	
Heart Rate	78.38	5.10	76.75	5.24	0.026
Weight	76.42	8.53	67.35	6.75	<0.0001
Height	169.50	6.72	167.41	8.36	0.052
BMI	26.51	2.24	24.00	1.28	<0.0001
Hemoglobin	14.26	0.68	14.05	0.75	0.045
WBC	6617.10	1150.27	7013.40	1130.17	0.014
Platelet	3.26	0.65	3.18	0.69	0.382
Mean platelet volume	11.07	0.89	8.70	0.60	<0.0001
Fasting blood sugar	153.98	30.77	83.66	7.01	<0.0001
HbA1C	8.44	1.75	5.51	0.30	<0.0001

Above table show comparisons of data between case and control group.

Table 3

Duration ofDM (yrs)	HbA1C (%)			
	≤7.5		>7.5	
	N	%	N	%
≤5	30	60.00	19	38.00
6-10	20	40.00	24	48.00
>10	0	0.00	7	14.00
Total	50	100.00	50	100.00

Chi square 9.833, P value 0.007 (S)

Above table illustrates that most of the patients in case group A (HbA1c ≤7.5) had DM since less than 5 years duration (60%) while in case group B (HbA1c > 7.5)most of patients had DM since 6-10 years (48%).

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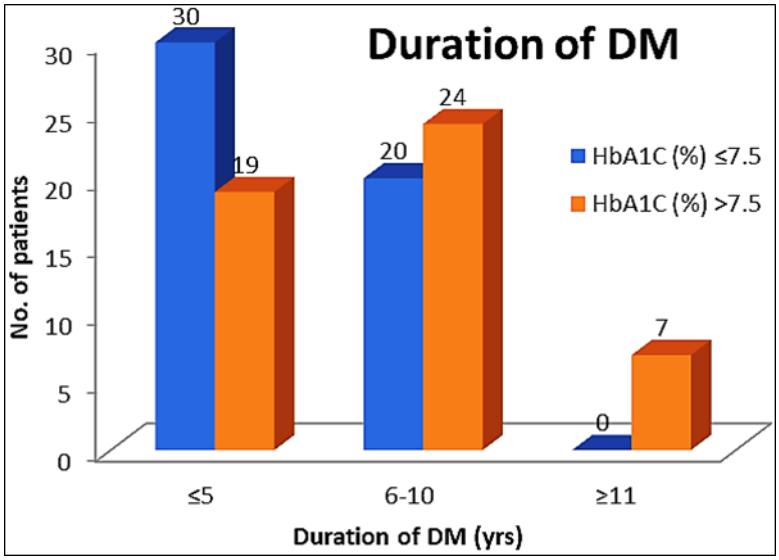
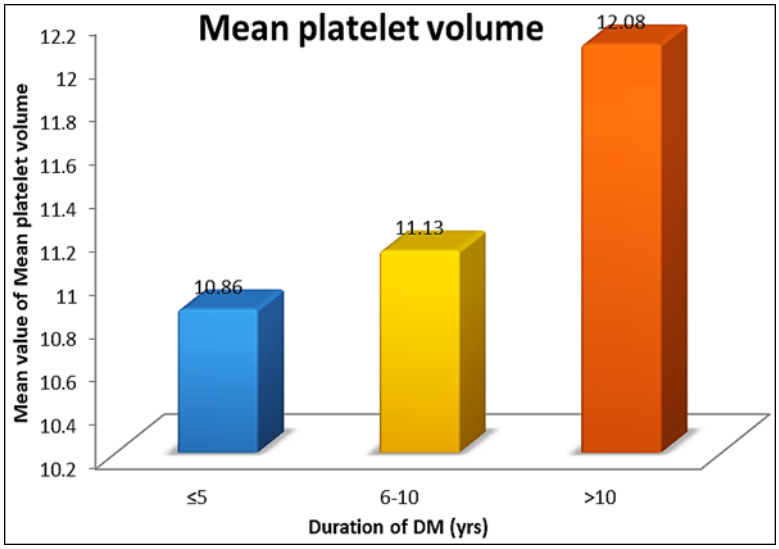


Table 4

Duration of DM (yrs)	Mean platelet volume			p value
	No. of patients	Percentage	Mean+SD	
≤5	49	49.00	10.86+0.81	0.002
6-10	44	44.00	11.13+0.91	
>10	7	7.00	12.08+0.42	
Total	100	100.00	-	-

Above table suggest significant positive correlation with duration of diabetes and Mean Platelet Volumep value 0.002.



Discussion

The prevalence of diabetic microvascular complications is higher in people with poor glycemic control, longer duration of diabetes[4]. Mean Platelet Volume (MPV) can use as simple economical test in the monitoring of DM and thereby help in reducing the morbidity and mortality. Type 2 DM characterized mainly by impaired insulin secretion and increased tissue insulin resistance. Sustained hyperglycemialeads to a series of interrelated event that can cause evident endothelial dysfunction and vascular lesions in diabetic complications[2, 3]. Hyperglycemia can increase platelet reactivity by inducing nonenzymatic glycation of proteins on the surface of the platelet, by the osmotic effect of glucose and activation of protein kinase C.

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All these can produce a pro-coagulant effect and cause thrombotic vascular complications. This suggests a relationship between the platelet function especially MPV and diabetic vascular complications thus indicating changes in MPV reflect the state of thrombogenesis.
In our study, the mean platelet count is near similar in both case group A and B and mean platelet count not statistically different in between case and control group that was in contrast to Aclan Ozder and Manoj Saluja study which show higher platelet count in patient with poor glycemic control (high HBA1C). Hence, the platelet count could be dependent on several variables, that is mean platelet survival, platelet production rate and turnover rate in DM. Increased platelet activity results in pathogenesis of micro vascular complication. Many clinical trial results from the Diabetes Control and Complications Trial (DCCT) and epidemiological data from the Wisconsin Epidemiological Study of Diabetic Retinopathy(WESDR) of have emphasized the strong relationship of glycemic control and development and progression of diabetic microvascular complication[11].

Summary

The present study was aimed to assess impact of HBA1C on mean platelet volume and its association with mean platelet volume. In our present study, most of study subject of case group were in more than 60 years age group (40%) followed by 51-60years age group (32%).While most of study subject of control group were in more than 60 years age group (38%) followed by 41-50 years age group(27%). In our study most of the patients have duration of Diabetes less than 5years (49%) followed by 6-10years (44%) and only 7% patients had Diabetes for more than 10 years. In our study case group divided on the basis of HBA1C level in two groups as Group A (HBA1C level ≤7.5) and Group B (HBA1C level >7.5). Mean HBA1C level in group A is 7.11% and in group B is 9.76%. Mean platelet volume in case group is 11.07± 0.89fL and in control group it is 8.70± 0.60fL respectively. Mean platelet volume in case group A and B is 10.44± 0.71fL and 11.71± 0.52fL with p value <0.0001 which is significant.

Conclusion

Platelets in Diabetes Mellitus become more reactive and agreeable and their Mean Platelet Volume (MPV) is increased. Increase in platelet size may be the one factor responsible for microvascular complication in Diabetes Mellitus. Hence, MPV could be a useful prognostic marker of micro vascular complications. We also found that increase in HbA1c concentration is directly proportional to increased MPV, thus poor glycemic control causes increase in MPV which result in more chance of developing micro vascular complication. However, the increased MPV as the cause or the end result of micro vascular complications needs to be further explored. Hence, we propose that MPV can be used as simple and cost-effective tool to monitor the progression and control of Diabetes Mellitus and its associated micro vascular complications.

References

1. World health organization August 2011. Sicree R, King H Global prevalence of diabetes, estimated for the year 2000 and projection for 2030, Diabetes care. 2004;27:1047-47.
2. Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications. Part 1: Diagnosis and Classification of Diabetes Mellitus (WHO/NCD/NCS/99.2). Geneva: World Health Organization, 1999.
3. American Diabetes Association. Diagnosis and classification of diabetes mellitus.2011;34(1):s62-9.
4. GBD 2013 Risk Factors Collaborators. Global, regionaland national comparative risk assessment of 79 behavioural, environmental and occupationaland metabolic risks or clusters of risks in 188 countries, 1990-2013:A systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2015;386(10010):2287-323.
5. Vazquez G, Duval S, Jacobs DR Jr, Silventoinen K. Comparison of body mass index, waist circumference and waist/hip ratio in predicting incident diabetes: a meta-analysis.

ISSN 2515-8260 Volume 09, Issue 04, 2022

Epidemiologic Reviews. 2007;29:115-28.
6. Ramachandran A, Ma RC, Snehalatha C. Diabetes in Asia. Lancet. 2010;375:(9712)408-418.
7. Demirtunc R,Duman D,Basar M,Teomate M,Garip T. The relationship between glycemic control and platelet activity in type 2 diabetes mellitus. J Diabetes Complications. 2009;23:89-94.
8. Hekimsoy Z, Payzinb B,Ornek T,Kandogan G. Mean platelets volume in type 2 diabetic patients. J Diabetic complications. 2004;18:173-6.
9. Gansevoort RT, Verhave JC, Hillege HL, Burgerhof JG, Bakker SJ, De Zeeuw D, De Jong PE. For the PREVEND Study Group: The validity of screening based on spot morning urine samples to detect subjects with microalbuminuria in the general population. Kidney Int Suppl. 2005;94:S28-35.
10. Benson WE, Tasman W, Duane TD. Diabetes mellitus and the eye.Duane's Clinical Ophthalmology, 1994, 3.
11. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. N Engl. J Med. 1993;329:977-98.