Original Article

Platelet Control in Type 2 Diabetics

Mean Platelet Volume in Diabetic Retinopathy and its Association with Duration of Diabetes and Glycaemic Control in Type 2 Diabetics

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ABSTRACT

Objective: To study the mean platelet volume (MPV) in diabetic retinopathy (DR) with special reference to duration of diabetes and glycaemic control (HbA1c) in type 2 diabetics (DM).

Study Design: Case control study

Place and Duration: This study was carried out at the Department of Medicine, Liaquat University Hospital Jamshoro, from March 2014 to December 2014.

Materials and Methods: 100 subjects; comprising of 50 controls and 50 cases of DR were selected as per criteria and evaluated for study variables. Blood sample were collected in anticoagulant sterilized bottles for analysis of hematoanalyzer. Volunteers were requested to sign the informed consent proforma. *Statistix* 8.1 was used for data analysis. Pearson's correlation (r), student t test and Chi square were used for data analysis. $p \leq 0.05$ was defined significant.

Results: MPV values were found raised in DR subjects compared to controls i.e.; 11.7±3.2 fl versus 9.12±2.1 respectively ($p < 0.0001$). MPV was positively correlated with HbA1c (r=0.740, p-value= 0.0001) and duration of DM (r=0.510, p=0.0001).

Conclusion: The present study reports raised mean platelet volume was diabetic retinopathy which was positively correlated with HbA1c and duration of diabetes.

Key Words: Mean Platelet Volume, HbA1c, Diabetic retinopathy

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INTRODUCTION

International Diabetes Federation (IDF) reported a rise of diabetics from current 285 millions in 2010 to 439 in 2030.[1] Presently, Pakistan occupies sixth position as regards load of diabetics in the country.[2] Diabetic patients (DM) are prone to damage their organs such as retina/eye, brain nerves, renal tissue, heart and vascular system.[3]

Platelet is the smallest blood formed element which plays role in hemostasis. A change in its morphology has been documented in the chronic hyperglycemic states as DM.[4] Mean platelet volume (MPV) is a morphological measure of platelet defined as a measure of average size and function.[4] MPV is determined at the bone marrow and is an indicator of megakaryocytes ploidy. As the megakaryocytes lyses in the bone marrow, it results in the formation of pre- and pro-platelet formation. MPV is a determinator of its dispersion, which is affected by various cytokines such as IL-6, IL-11 and thrombopoietin (TPO).[5]

These cytokines directly or indirectly affect mega-karyocytes ploidy, hence platelet size varies and they may be larger in size and physiologically more reactive.[6] A change in megakaryocyte ploidy, platelet morphology and mean platelet volume has been observed in DM. The MPV is an emerging indicator of microvascular complications in diabetics. A previous study concluded a raised MPV is an independent finding in T2DM.[7] This shows a tendency of thrombogenecity due to platelet with high MPV which are rich in granules. The size and granules content of platelets are independent to any of hormonal control. Changes in platelet don't occur in the peripheral circulation; hence they are indicator of bone marrow functioning in response to platelet utilization in diseases such as T2DM. Hence many studies had worked on the MPV as a risk factor of atheroma, & thrombo-embolic phenomena. Previous study reported MPV is an independent risk factor of cardiac disease, brain ischemia and albuminuria in T2DM.[8] Glycated hemoglobin (A1c) is a established indicator of glucose regulation in DM[8,9] and has been compared with MPV in previous studies.[9,10] However, A1C is costly, while MPV is cost effective and free of bias.[11] Hence, the present study is an investigation into the MPV and A1C in the T2MD subjects. Research was conducted to

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evaluate & analyze MPV in diabetic retinopathy with special reference to duration of diabetes and glycemic control.

MATERIALS AND METHODS

Case control study was conducted at the Department of Medicine, Liaquat University Hospital Jamshoro, from March 2014 to December 2014. 100 subjects; comprising of 50 controls (Group I) and 50 cases of DR (Group II) were selected as per criteria and evaluated for study variables. Diagnosed cases of age >25 but <70 years having DR of any stage/grade were included. Diabetics with renal failure, chronic systemic diseases, urinary tract infections, and anti-platelet or anti-coagulant therapy were excluded. Blood sample were collected in anticoagulant sterilized bottles for analysis of hematoanalyzer. MPV was defined as an average size of platelet (range 8–12 fl).[5] Systolic blood pressure - ≥140 mmHg and/or diastolic blood pressure - ≥90 mmHg were defined as "Systemic hypertension".[12] DM was defined by American Diabetes Association criteria.[3] Study was approved by Ethics review committee. Volunteers were requested to sign the informed consent proforma. *Statistix* 8.1 was used for data analysis. Pearson's correlation (r), student t test and Chi square were used for data analysis. p≤0.05 was defined significant.

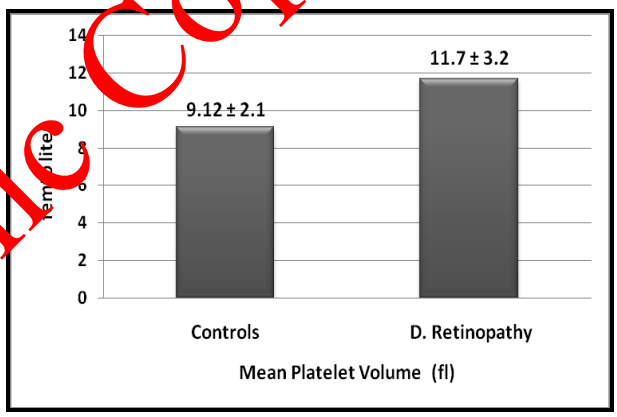
RESULTS

Demographic characteristics of study population are shown in table I. Mean ± SD age noted in controls and cases was 47 ± 10.15 and 49 ± 9.50 (p ≥ 0.83) respectively as shown in table 1. Hypertension was noted in 31 (62%) of DR patients. Systolic BP in controls and cases was noted as 127.86 ± 9.29 and 168.1± 18.15 mmHg respectively while diastolic BP was noted as 65.7 ± 10.9, and 88.1± 18.5 mmHg respectively.

Male population predominated in present study. Random blood sugar and glycated hemoglobin A (HbA1c) revealed a poor glycaemic control (p=0.0001). HbA1c was noted as 9.3±3.12% in DR subjects which indicates a bad glycaemic controls.

The platelet counts in controls and diabetic groups were similar in groups I and II (p=0.06) (Table I). Age, gender and BMI showed no correlation with platelet counts as indicated by (r=0.12, p=0.067), (r=0.13, p=0.61) and (r=0.18, p=0.91) respectively. Platelets showed –ver correlation with MPV (r= –0.6, p=0.4), A1c (r= –0.22, p=0.001) and duration of hyperglycemia (r= –0.1, p=0.2).

High MPV values were found in DR subjects compared to controls (Table. I). MPV was raised in DR subjects, i.e.; 11.7±3.2 fl versus 9.12±2.1 in controls (p <0.0001) (Table I). MPV showed +ve correlation to HbA1c (r=0.74, p-value= 0.0001) and duration of DM (r=0.510, p=0.0001) and correlation was not observed with age and gender.



Graph No.1:. Bar graph showing MPV in controls and D. Retinopathy study subjects

Table No.I. Demographic characteristics of study population (n=100)

	Group I (Controls) (n=50)	Group II (D.Retinopathy) (n=50)	p-value
Age	47±10.15	49±9.50	0.83
Male	34 (68%)	35 (70%)	0.75
Female	16 (42%)	15 (30%)	0.91
BMI (kg/m^2)	26.5±7.8	27.7±9.5	0.043
Duration of DM	-	15.7±3.5	-
Hypertension	12 (24%)	31 (62%)	0.0001
Random blood glucose (mg/dl)	132±23.5	289±45.9	0.0001
HbA1c	5.4±1.3	9.3±3.12	0.0001
Microalbuminuria	0 (0%)	49 (98%)	0.0001
WBC (/µL)	7900±3.10	7700±2.90	0.061
RBC (x10^9/µL)	4.23±1.1	4.92±2.1	0.023
Platelet (x10^9/µL)	3.53±1.1	3.02±2.1	0.06
MPV (fl)*	9.12±2.1	11.7±3.2	0.0001
*femto-liter			

DISCUSSION

Diabetic vasculopathies are grave complications of long standing T2DM. Diabetic vasculopathies are associated with increased morbidity and mortality and are caused by level of glycemic control.[13] Previous studies had reported raised MPV occurrence in the MD as an indicator of microvascular and macrovascular complications.[14-16] Present study found and reports MPV raised in subjects, the findings are consistent to previous report.[14] MPV is considered a marker of platelet reactivity and larger platelets are more reactive and cause vascular damage. [17] Possible mechanism of platelet dysfunction DM are; osmotic injury and glucose mediated structural and functional impairments.[18]

Observations of current study are similar to as above. A few of previous study could not evidence association of MPV and A1C. [19-21]

A study[24] showed correlation of MPV and DM duration while others could not prove[22, 25] It may be concluded by observed findings that the MPV is dependently associated with DM & DR as has been cited.[13,14,16,26] In present study, MPV in DR was raised compared to normal control. MPV showed a positive correlation with glycaemic status and duration of DM. A previous study[20] has reported that MPV was corrected once A1C was controlled. Raised MPV is an important finding because of (i) it suggests a role of MPV in DR and (ii) the potential role of platelets in the pathophysiology of micro vascular complications. Platelet consumption also occurs in diabetics is inversely associated with raised MPV to meet the haemostatic demands[27]; this finding is confirmed in present study. Systemic hypertension was not proved to having any correlation with MPV in present study and is consistent to a previous study,[28] while others had shown strong association.[29] Raised MPV in diabetic retinopathy is a valuable findings of present study similar to cited.[24,25] It is proposed that the platelet may be targeted by drugs to overcome the notorious complication; the diabetic retinopathy.

In conclusion, the present study reports raised MPV in DR in type 2 diabetics who are associated with glycaemic controls and duration of diabetes. The present study has some limitations as of small sample size and various other risk factors which are not studied simultaneously. However, the findings are of clinical importance and future studies are recommended to establish the cause effect relationship.

CONCLUSION

The present study reports that the mean platelet volume is raised in diabetic retinopathy and is positively correlated with duration of diabetes mellitus and glycaemic control.

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Rodriguez DL, Castelao AM, Gorriz JL, de Alvaro F, Gonzalez JFN. Pathophysiological role and therapeutic implications of inflammation in diabetic nephropathy. World J Diabet 2012;3 (1): 7-18.
2. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabet care 2004;27 (5):1047-53.
3. American Diabetes Association. Standards of medical care in diabetes. Diabet care 2012;35 (Suppl 1):S11-S63.
4. Shahid SM, Nawab SZ, Shaikh R, Mahboob T. Glycemic control, dyslipidemias and endothelial dysfunction in co-existed diabetes, hypertension and nephropathy. Pak J Phrama Soci 2012;1: 123-29.
5. Kaito K, Otsuka T, Usui N, Yoshida M, Tanno J, Kurihar E. Platelet size deviation width, platelet large cell ratio, and mean platelet volume have sufficient sensitivity and specificity in the diagnosis of immune thrombocytopenia. Br J Hematol 2004; 128:698-702.
6. Kodiatte TA, Kanikyam UK, Rao SB, Jadadish TM, Reddy M, Lingaiah HKM, et al. Mean platelet volume in type 2 diabetes mellitus. J Lab Physicians 2012;1:5-9.
7. Buttarello M, Plebani M. Automated Blood Cell Counts: State of the Art. Am J Clin Pathol 2008; 130:104-16.
8. Yngen M. Platelet hyperreactivity in Diabetes mellitus: Business Briefing: European Cardiol 2005.
9. Hekimsoy ZI, Payzin B, Ornek T, and Kandog ANG. Mean platelet volume in type 2 diabetic patients. J Diabet Complic 2004;18:173–76.
10. Papanas N, Symeonidis G, Maltezos E. Mean platelet volume in patients with type 2 diabetes mellitus. Platelets 2004;15:475–78.
11. Beyan C, Kaptan K, Irfan A. Platelet count, mean platelet volume, platelet distribution width, and plateletcrit do not correlate with optical platelet aggregation responses in healthy volunteers. J Thrombo and Thrombolysis 2006;22:161–64.
12. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL. The National High Blood Pressure Education Program Coordinating Committee: The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. The Joint National Committee 7 Report. J Am Med Assoc 2003:289:2560-72.

13. Demirtunc R, Duman D, Basar M, Bilgi M, Teomete M, Garip T. The relationship between glycemic control and platelet activity in type 2 diabetes mellitus. J Diab Compl 2009; 23: 89−94.
14. Dinar S, Cinemre H, Sengul E, Annakkaya AN. Mean Platelet Volume is associated with Glycaemic Control and Retinopathy in Patients with Type 2 Diabetes Mellitus. West Indian Med J 2013; 62 (6): 519-23.
15. Chu SG, Becker RC, Berger PB, Bhatt DL, Eikelboom JW, Konkle B, et al. Mean platelet volume as a predictor of cardiovascular risk: a systematic review and meta-analysis. J Thromb Haemost 2010; 8: 148−56.
16. Khoharo HK, Nizamani GS, Shaikh D. Mean Platelet Volume in Type 2 Diabetes Mellitus. Elixir Int`l J 2014; 25017-20.
17. Chu SG, Becker RC, Berger PB, Bhatt DL, Eikelboom JW, Konkle B, et al. Mean platelet volume as a predictor of cardiovascular risk: a systematic review and meta-analysis. J Thromb Haemost 2010;8:148−56.
18. Martyn CN, Matthews DM, Popp-Snijders C, Tucker J, Ewing DJ, Clarke BF. Effects of sorbinil treatment on erythrocytes and platelets of persons with diabetes. Diabetes Care 1986; 9: 36−9.
19. Dalamaga M, Karmaniolas K, Lekka A, Antonakos G, Thrasyvoulides A, Papadavid E, et al. Platelet markers correlate with glycemic indices in diabetic, but not diabetic-myelodysplastic patients with normal platelet count. Dis Markers 2010;29: 55−61.
20. Demirtunc R, Duman D, Basar M, Bilgi M, Teomete M, Garip T. The relationship between glycemic control and platelet activity in type 2 diabetes mellitus. J Diabetes Complications 2009; 23: 89−94.
21. Unubol M, Ayhan M, Guney E. The relationship between mean platelet volume with micro albuminuria and glycemic control in patients with type II diabetes mellitus. Platelets 2012;23:475–80.
22. Sharpe PC, Trinick T. Mean platelet volume in diabetes mellitus. Q J Med 1993;86:739−42.
23. Hekimsoy Z, Payzin B, Ornek T, Kandoğan G. Mean platelet volume in Type 2 diabetic patients. J Diabetes Complications 2004;18:173−6.
24. Bavbek N, Kargili A, Kaftan O, Karakurt F, Kosar A, Akcay A. Elevated concentrations of soluble adhesion molecules and large platelets in diabetic patients: are they markers of vascular disease and diabetic nephropathy? Clin Appl Thromb Hemost 2007;13: 391−7.
25. Stratton IM, Adler AI, Neil HA, Matthews DR, Manley SE, Cull CA, et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. BMJ 2000;321: 405−12.
26. Boos CJ, Beevers GD, Lip GY. Assessment of platelet activation indices using the ADVIATM 120 amongst 'high-risk' patients with hypertension. Ann Med 2007; 39: 72−8.
27. Dalamaga M, Karmaniolas K, Lekka A, Antonakos G, Thrasyvoulides A, Papadavid E, et al. Platelet markers correlate with glycemic indices in diabetic, but not diabetic-myelodysplastic patients with normal platelet count. Dis Markers 2010;29: 55−61.
28. Gasparyan AY, Ayvazyan L, Mikhailidis DP, Kitas GD. Mean platelet volume: a link between thrombosis and inflammation? Curr Pharm Des 2011;17:47−58.
29. Zhong ZL, Han M, Chen S. Risk factors associated with retinal neovascularization of diabetic retinopathy in type 2 diabetes mellitus. Int J Ophthalmol 2011;4:182-5.