

Original article:

Early prediction of diabetic nephropathy by Platelet indices in type 2 diabetes mellitus

Dr. Divya P Wangoo*, Dr. Sumit Gulla**

* Senior resident, Department of physiology, North Delhi Municipal Corporation Medical College and Hindu Rao Hospital, Delhi – 110007,

**Senior resident, Department of General Medicine, World College of Medical Sciences & Research & Hospital, Village-Girawar, Jhajjar-Sampla Road, NH-334(B), Jhajjar-124103, Haryana, India

Author for correspondence: Dr. Divya P Wangoo, Department of Physiology, Senior resident, North Delhi Municipal Corporation Medical College and Hindu Rao Hospital, Delhi – 110007 ;E- mail:divya.wangoo@gmail.com

ABSTRACT:

Background: Diabetes Mellitus (DM) is the most prevalent endocrinal disorder distinguished by hyperglycaemia arising from faults in insulin secretion, insulin action or both and is related with remarkable morbidity and mortality. Diabetic nephropathy is a serious microvascular complication which can seriously affect vision in diabetic patients. Platelet indices have close association with development and progression of diabetic nephropathy.

Aim and Objective: Early prediction of diabetic nephropathy by platelet indices in type 2 diabetes mellitus. The objective of this study was to study platelet indices in Type 2 diabetics with and without complications of diabetic nephropathy.

Methods: A cross sectional study was conducted on 75 Type 2 diabetes patients. Detailed clinical history regarding duration, and complications was taken. Platelet indices were obtained using an automated cell counter. Fasting blood glucose, HbA1c were also obtained. Diabetics were further categorized into patients with complications and without complications of diabetic nephropathy.

Results: Platelet indices were significantly ($p=0.001$) higher among patients with nephropathy than without nephropathy.

Conclusion: Platelet indices are significant in microvascular complication diabetic nephropathy in type 2 diabetes patients and can be considered as a predictive marker of diabetic microvascular complication.

Keywords: Diabetic nephropathy, Platelet indices, Type 2 diabetes mellitus

INTRODUCTION

Microvascular complication like diabetic nephropathy eventually determines the mortality of diabetes and is a burden on the health care system. Hyperglycaemia contributes to greater platelet reactivity through direct effect and by promoting glycation of platelet proteins. Platelets in type 2 diabetes mellitus adhere to vascular endothelium and aggregate more readily than those in healthy individuals. Enhanced platelet activity due to abnormal insulin action is emphasized in the development of vascular complications of diabetes mellitus. Elevated MPV level specifies bigger platelets, that are metabolically and enzymatically more active. Higher value of MPV has been shown in diabetic patients in parallel to the microvascular complications such as retinopathy and microalbuminuria.^{1,2} Platelets are important for haemostasis and compression of their function is basic to the understanding of the pathophysiology of vascular disease in diabetes mellitus.³ In recent decades, a growing number of proofs have revealed that platelets are also associated with inflammation. There are three parameters for understanding platelet function and morphology that is Mean Platelet Volume (MPV), Platelet Distribution Width (PDW) and Platelet Large Cell Ratio (P-LCR). MPV and PDW are easily measured platelet

indices, which rise during platelet activation and during platelet activation platelets change their shape from discoid to spherical.⁹ Mean platelet volume (MPV), a structural parameter of platelets is a readily available indicator in routine blood test, could consider the size and activity of platelet.

Insulin is a natural antagonist of platelet hyperactivity as it sensitizes the platelets to PGI₂ and increases the generation of PGI₂ and NO. Therefore, the defect in insulin action in diabetes mellitus produces an environment of disordered platelets conducive to macro vascular and micro vascular events.⁴ Diabetic nephropathy is the leading cause of End Stage Renal Disease (ESRD) accounting for 39% of prevalent kidney failure and also a leading cause of diabetes mellitus related morbidity and mortality.⁵ Evaluation of neutrophil lymphocyte ratio along with all the three platelet indices can predict the occurrence of diabetic microvascular complications at a very early stage so that treatment can be initiated at the earnest leading to better prognosis.

MATERIAL AND METHODS

This study was conducted in Department of Medicine, SGT Medical College, SGT University, Gurugram, Haryana, India. 75 patients in the age group 35 years to 70 years were selected for the study. Platelet indices was studied in the cases and was correlated with diabetic nephropathy. Laboratory results in these patients were analyzed & frequency of abnormal results was evaluated. Consent was taken from the patients prior to involving them in the study on a consent form. Correct procedure of the test was well explained to all the patients. After taking permission from the ethical committee of SGT medical college and university and written consent of patients, a cross-sectional study was carried out in the medicine department of SGT hospital. Inclusion criteria was FBG level \geq 126 mg/dL, HbA1c level \geq 6.5%, RBS \geq 200 mg/dL with symptoms of diabetes. Exclusion criteria was females with Hb% $<$ 10g% & males with Hb% less than 12 g%, pregnant women, patients on antiplatelet drugs like aspirin or having malignancy, chronic heart disease. Blood sample was taken under all aseptic precautions from the ante-cubital vein by a clean puncture avoiding bubbles and froth. About 2 ml of blood sample was collected in EDTA, fluoride bulb, and plain bulb each. Complete hemogram was performed by using automatic blood counter (Sysmex XN-550, USA) from EDTA bulb. Platelet indices was determined.

Statistical analysis

The data collected was entered into the M-S excel sheet and SPSS. The results were analysed using software Statistical Software Package of Social Sciences (SPSS) 16.0 version (Chicago, Inc., USA). The results were presented in percentages and mean \pm SD. The Unpaired t-test was used to compare continuous variables. P value $<$ 0.05 was considered significant and p value $<$ 0.01 was considered as very significant.

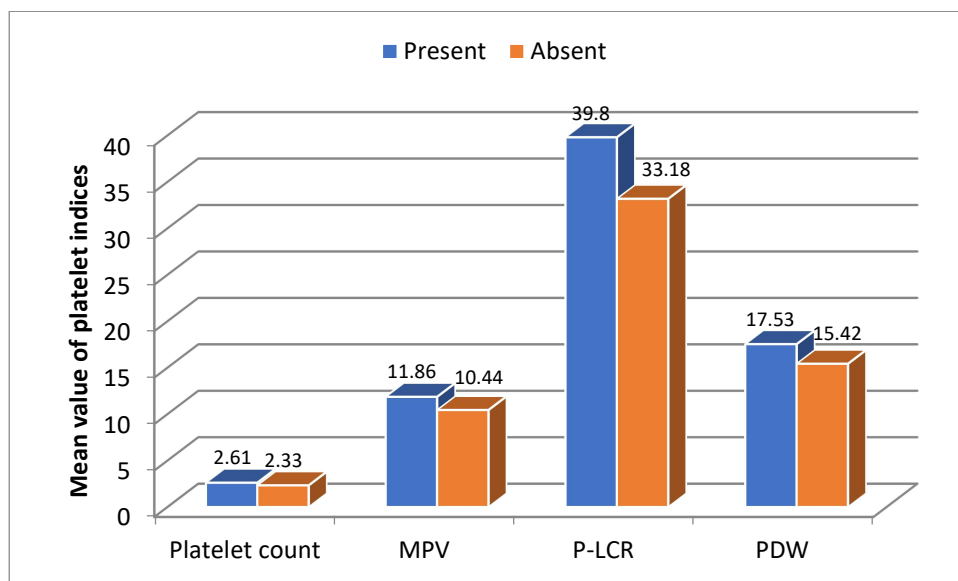
RESULTS

Table-1: Comparison of platelet indices between with & without nephropathy

Platelet indices	Nephropathy		p-value ¹
	Present	Absent	
Platelet count	2.61 \pm 0.558	2.33 \pm 0.69	0.34
MPV	11.86 \pm 1.08	10.44 \pm 1.11	0.001*
P-LCR	39.80 \pm 6.46	33.18 \pm 6.31	0.001*
PDW	17.53 \pm 2.76	15.42 \pm 2.54	0.003*

¹Unpaired t-test, *Significant

Table-1 & Fig. 1 shows the comparison of platelet indices with between with and without nephropathy. Platelet indices were significantly ($p<0.01$) higher among patients with nephropathy than without nephropathy except platelet count.



Nephropathy

Figure 1: Comparison of platelet indices between with & without nephropathy.

DISCUSSION

Diabetes mellitus is a worldwide health problem characterized by persistent hyperglycaemia that can cause both acute and chronic complications and subsequently imposes an enormous burden on the individual as well as the healthcare system. Hyperglycaemia in diabetes causes creation of glycated proteins that damages the cells in various ways, including impaired cellular function, and subsequently causes the creation of inflammatory cytokines like C-Reactive Protein, TNF-alpha, Interleukin-6, etc. This inflammation contributes to development of microvascular complications like diabetic nephropathy. Platelet indices is an inexpensive and easily available marker to evaluate the inflammatory status in these patients and can predict complications like diabetic nephropathy at an early stage.

Age distribution of the cases ranged from 35-70 years with mean age of 51.41 ± 10.64 . Maximum patients were in the age group 40 to 50 years while minimum number of patients were in the age group 35-40 years. The morphologic and functional forms of platelets, which are related to enhanced platelet activity, were found to be increased in patients with DM⁶. Statistically significant correlation of MPV with microvascular complication diabetic nephropathy was found in our study. Similarly, high values were also seen in the studies done by Dindar et al.⁷ and Ates et al.⁸ Association of elevated MPV with prediabetes, diabetes and vascular diabetic complications are stated in the literature^{9, 10-15}.

Conclusion:

Platelet indices was significantly ($p<0.01$) higher among patients with nephropathy than without nephropathy in our study.

REFERENCES

1. Papanas N, Symeonidis G, Maltezos E, Mavridis G, Karavegeli E, Vosnakidis T, et al. Mean platelet volume in patients with type 2 diabetes mellitus. *Platelets* 2004;15:475-8.
2. Hekimsoy Z, Payzin b, Ornek T, Kandogan G. Mean platelet volume in type 2 diabetic patients. *J Diab Comp* 2004;18:173-6
3. Jagroop I, Clatworthy I, Lewin J, Mikhailidis DP. Shape change in human platelets: measurement with a channelyzer and visualization by electron microscopy. *Platelets* 2000;11:28-32
4. Vinik A, Erbas T, Park TS, Nolan R, Pittenger G. Platelet dysfunction in type 2 diabetes. *Diab Care* 2001;24:1476-85.
5. Bethesda M. US renal data system. The National Institute of Diabetes and Digestive and Kidney Diseases. 2015 Available from www.usrds.org/2015/view.
6. Ferroni P, Basili S, Falco A, Davi G. Platelet activation in type 2 diabetes mellitus. *J Thromb Haemost* 2004;2:1282-91.
7. Dindar 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;62:519-23.
8. Ate O, Kiki I, Bilen H, Kelep M, Kocer I, Kulacoolu DN. Association of Mean Platelet Volume With The Degree of Retinopathy in Patients with Diabetes Mellitus. *Eur J Gen Med* 2009;6:99-102.
9. Jabeen F, Fawwad A, Rizvi HA, Alvi F. Role of platelet indices, glycemic control and hs-CRP in pathogenesis of vascular complications in type-2 diabetic patients. *Pak J Med Sci* 2013; 29:152-6.
10. Zuberi BF, Akhtar N, Afsar S. Comparison of mean platelet volume in patients with diabetes mellitus, impaired fasting glucose and non-diabetic subjects. *Singapore Med J* 2008;49:114-16.
11. 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.
12. Tavil Y, Sen N, Yazici H, Turfan M, Hizal F, Cengel A, et al. Coronary heart disease is associated with mean platelet volume in type 2 diabetic patients. *Platelets* 2010;21:368-72.
13. Xiao W, Huang Y, Dong J, Zhang X, Hu J. Relationship between platelet volume indices with macrovascular and peripheral neuropathy complications in type 2 diabetic patients. *J Diabetes* 2014;6:298-303.
14. Lippi G, Salvagno GL, Nouvenne A, Meschi T, Borghi L, Targher G. The mean platelet volume is significantly associated with higher glycosylated hemoglobin in a large population of unselected outpatients. *Prim Care Diab* 2015; 9:226-30.
15. Bekler A, Ozkan MT, Tenekecioglu E, Gazi E, Yener AU, Temiz A, et al. Increased platelet distribution width is associated with severity of coronary artery disease in patients with acute coronary syndrome. *Angiology* 2014; 66:638-43.