ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Mean Platelet Volume: A Cardio-vascular Marker in Type 2 Diabetes Patients.

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ABSTRACT

Diabetes is a complex metabolic syndrome. Countries with highest absolute number of diabetes are India (19million), China (16million) and United States (14million). The prevalence of diabetic microvascular complications is higher in patients with poor glycemic control, longer duration of diabetes mellitus (DM), associated hypertension and obesity. Platelets may be involved in micro/macro vascular complication as a causative agent with respect to altered platelet morphology and function. Platelet volume, a marker of platelet function and activation is measured as Mean Platelet Volume (MPV) by haematology analyzers. We have made an attempt to assess the platelet activity by determining MPV in 100 diabetic patients in comparison with 100 non-diabetic controls. A cross sectional study was carried out in 100 known type 2 diabetic patients and 100 non diabetic healthy subjects. Patients with anemias and who are on antiplatelet therapy were excluded.Blood samples were collected for Complete blood counts (CBC), MPV and Random Blood Sugar (RBS) . CBC including MPV were measured using automated blood cell counter (Sysmex-XP100) and RBS was done by fully automated analyser. Statistical evaluation was performed by using Student's t test. Mean MPV values were 9.42fl in case of diabetic patients that is significantly higher than nondiabetic subjects(mean MPV 8.49fl) with significant P value of 0.00336. Platelets in diabetes mellitus are more active, shown by increased mean platelet volume. MPV can be used as one of the simple and cost-effective tool to assess the risk of cardiovascular complication in diabetes patients.

Keywords: Diabetes mellitus; mean platelet volume; platelet activity; cardiovascular risk.

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ISSN: 0975-8585

INTRODUCTION

Diabetes mellitus is a major global health problem. Countries with highest absolute number of diabetes are India (19million), China (16million) and United States (14million) [1]. Diabetes mellitus is a complex metabolic syndrome characterised by chronic hyperglycemia resulting from defects in insulin secretion secretion, insulin action or both. The diagnosis of diabetes is established according to the ADA criteria [2].

The chronic hyperglycemia and attendant metabolic dysregulation may be associated with secondary damage in multiple organ systems, especially kidneys, eyes, nerves and blood vessels [1]. The prevalence of diabetic microvascular complications is higher in patients with poor glycemic control, longer duration of DM, associated hypertension and obesity leading to increased morbidity and mortality [3].

Platelets play an important role in hemostasis and mean platelet volume (MPV) is an indicator of the average size and activity of platelets and thereby platelet functions [4]. Increased MPV has been documented in patients with metabolic syndrome , stroke and DM [3]. Larger platelets are more thrombogenic and are a risk factor for atherothrombosis. Thus, MPV is an important, simple, and cost effective tool that should be used and explored extensively, for predicting the possibility of impending vascular events [3].

MATERIALS AND METHODS

A cross sectional study was carried out from departments of Medicine and Pathology, at Sri Siddhartha Medical College and Research Centre, Tumkur. Hundred known cases of type 2 diabetes patients were included in the study. Hundred normal healthy individuals were taken as controls. Patients with anaemia and who are on antiplatelet therapy were excluded from the study.

Random Blood samples were collected for CBC including MPV (anticoagulated) and plain blood for RBS. Complete blood counts including MPV were measured using automated blood cell counter (Sysmex-XP100) and Random Blood Sugar was estimated by an automated chemistry analyzer.

Statistical evaluation was performed by using Student's t test. The chi square test was used and p values of < 0.05 were taken as significant.

RESULTS

Among 100 diabetics 61 were males (61%) and 39 were females(39%). Among 100 nondiabetic controls 55 were males(55%) and 45 were females (45%). Mean age of diabetic population was 55.39+ 12.09 and mean age of non-diabetic control was 50.31 + 12.18. Mean duration of diabetes was 6.5+ 6.24 years. Out of 100 diabetic patients 46 had complications such as hypertension, diabetic foot, coronary artery disease, hyperlipidemia, peripheral vascular disease. The mean RBS values were 184.31 + 87.72mg/dl. Mean MPV values were 9.42fl (Table 1) in case of diabetic patients that is significantly higher than non-diabetic subjects(mean MPV 8.49fl) with significant P value 0.00336 ($P < 0.05$).

ISSN: 0975-8585

Table 1: Comparison of various parameters between diabetics and non-diabetics patients

Characteristic	Diabetics (100)	Non-diabetics (100)	p-value
Age (yrs)	55.39+12.09	50.31±12.183	0.9413
Males (%)	61	55	
Females (%)	39	45	
Mean duration of diabetes	6.5±6.24	-	-
Complication (%)	46	-	-
RBS	184±87.72	107.59±17.752	<0.001
MPV(fl)	9.419±0.98	8.487±0.724	0.00336

DISCUSSION

The diagnosis of diabetes is established according to the ADA criteria:

- A random glucose concentration > 200 mg/dL
- A fasting glucose concentration > 126 mg/dL
- An abnormal oral glucose tolerance test , in which the glucose concentration is greater than 200 mg/Dl, 2 hours after a standard carbohydrate load [2].

Platelet abnormalities have been implicated in the etiology of cardiovascular events among patients with diabetes . Chronic hyperglycemia, characteristic of diabetes, affects many physiological functions related to haemostasis [5].

Platelet hyper reactivity and increased baseline activation in diabetic patients is multifactorial. It is associated with biochemical factors such as hyperglycemia and hyperlipidemia, insulin resistence, an inflammatory and oxidant state and also with increased expression of glycoprotein receptors and growth factors. Hyperglycemia can increase platelet reactivity by inducing non enzymatic glycation of proteins on the surface of platelet, by osmotic effect of glucose [6] and activation of protein kinase C. Platelet function is directly regulated by insulin via a functional insulin receptors found on human platelets. Platelets from patients with diabetes express more surface P-selectin and glycoprotein IIb/IIIa receptors and are more sensitive to agonist stimulation than platelets from non-diabetic patients. Platelet activation triggering thrombus formation and causing microcapillary embolization with the release of constrictive, oxidative, and mitogenic substances such as PDGF and VEGF that accelerate progression of local vascular lesions [1].

Platelets may be involved in micro/macro vascular complication as a causative agent with respect to altered platelet morphology and function. Increased platelet activity is emphasized to play a role in development of vascular complications of this metabolic disorder.

A number of mechanisms for increased cardiovascular risk in diabetes has been proposed including increased tendency towards intracoronary thrombus formation, increased platelet reactivity and worsened endothelial dysfunction. There is increased platelet turnover , ultimately leading to enhanced platelet adhesion and aggregation, increased expression of platelet surface expression molecules and receptors as well as disturbances in calcium homeostasis. There is also increased release of proaggregatory

adhesion molecules such as Thromboxane A2, from arachidonic acid and synthesis and secretion of antiaggregatory agents such prostacyclins and nitric oxide are reduced. Thus platelet dysfunction leads to development of thrombotic disorders and vascular complications of diabetes mellitus. [5].

MPV is an indicator of average size and activity of platelets [7]. Larger platelets are younger, more reactive and aggregable. Hence, they contain denser granules, secrete more serotonin and β-thromboglobulin, and produce more thromboxane A2 than smaller platelets. Increase MPV is now emerging as an independent risk factor for thromboembolism, stroke and myocardial infarction in diabetes mellitus [8].
A study by Zuberi B et.al was the first study from Pakistan who reported that increase MPV in diabetic and impaired fasting glucose (IFG) patients, with respect to non- diabetic patients. They have showed a significant stepwise increase in MPV from a non- diabetic population to IFG, and further to a diabetic population. Increased MPV has also been documented in gestational diabetes mellitus, congestive cardiac failure and coronary artery ectasia [3].

Thomas Alex Kodiatte et.al documented that MPV was significantly higher in diabetics than non – diabetics which was similar to present study [1].

Binita Shah et.al conducted a large study to examine MPV with diabetes and they concluded that MPV is higher in diabetic population and in particular in those with poor glycemic control [6].

As it is an observational and cross- sectional study, there are some limitations regarding the correlation between MPV and diabetes in the available and the present studies. MPV value was evaluated at one point in time. More follow-up and large prospective studies correlating vascular complications of diabetes with MPV are required to establish a definite relationship between the two. However, MPV can still be used as a risk marker in type 2 diabetes since it is a simple and cost effective method.

CONCLUSION

Platelets in diabetes mellitus are more active, shown by increased mean platelet volume. The increased platelet size may be one factor in the increased risk of atherosclerosis associated with DM and vascular complications. Hence MPV would be a useful prognostic marker of cardiovascular complications in type 2 diabetes. MPV can be a simple and cost-effective tool to assess the risk of cardiovascular complication in type 2 diabetes patients.

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