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"A Study on Mean Platelet Volume in Patients with Type 2 Diabetes Mellitus and Its Correlation with Albuminuria And Its Prognostic Significance"

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Abstract:
Background : *Diabetes mellitus is a syndrome of altered carbohydrate metabolism characterised by deficiency of endogenous insulin production or defect in insulin secretion or peripheral resistance to insulin action. Mean platelet volume is one of the haematological parameters used to assess platelet function and activity. Large volumes correlates with increased platelet activity, and this in turn is associated with increased vascular complications in diabetes mellitus. Smaller mean platelet volumes on theon the other hand are associated with reduced platelet activity.*
Objectives :*To estimate the mean platelet volume in an uncomplicated type 2diabetes mellitus and to compare with normal controls . To determine the association between mean platelet volume across various levels of albuminuria, thereby relating its association with vascular complications of diabetes, specifically diabetic nephropathy.*
Methods :*A Cross sectional study was done at Institute of internal medicine,Madras medical college and Rajiv Gandhi government general hospital, Chennai from September 2016 to May 2017 in confirmed cases of type 2 diabetes mellitus &Non diabetic controls without coronary artery disease.Atotal of 140 patients which includes 90 diabetics and 50 controls. Healthy subjects who attended routine master health check ups were taken as control group were subjected to detailed history, examinations and investigations as needed and statistical analysis were done using SPSS software 17.0*
Results :*A total number of 140 patients participated in our study that includes 90 (64 %) type 2 diabetes mellitus patients and 50 (36%) age matched healthy controls. Among them 88are females.In our diabetes group, 55 patients(61%) are males and 35 patients(39%) are females. The mean platelet volume was significantly higher (8.8± 0.36) in the diabetes patients when compared to control(7.93± 0.24) group and is statistically significant (p<0.0001) by independent sample t test.The mean MPV in A1 group is (8.45± 0.19) which was lower than A2(8.87± 0.37). both groups were lower than A3 (8.99±0.27). Statistical significance exists between A1and other groups (p <0.0001) , but A2 and A3 does not show any statistical significance by independent t test.*

Keywords *Diabetes mellitus , Glycated hemoglobin , Mean platelet volume*

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I. Introduction

Diabetes mellitus is a syndrome of altered carbohydrate metabolism characterised by deficiency of endogenous insulin production or defect in insulin secretion or peripheral resistance to insulin action.

Mean platelet volume is one of the haematological parameters used to assess platelet function and activity. Large volumes correlates with increased platelet activity, and this in turn is associated with increased vascular complications in diabetes mellitus. Smaller mean platelet volumes on the

other hand are associated with reduced platelet activity. Diabetes mellitus is a heterogeneous group of disorders that have in common the metabolic defect of hyperglycaemia[1].Diabetes prevalence has dramatically increased over the last few decades. The estimated number of cases of diabetes worldwide in2013, is382 million, with a projected increase to 592 million by 2035, according tothe International Diabetes Federation[2]. The three countries with highest prevalence of diabetes in the world are

India, China and US respectively[3].Approximately 80% of all diabetics reside in developing countries, with India and China having the largest contribution[4]. The prevalence of diabetes according to the WHO criteria was 5.6% among the urban areas and 2.7% among rural areas[5]. There are four clinical types[6]

Type 1 – occurs due to destruction of pancreatic ß-cells, usually culminating in complete insulin deficiency.Type 2 – occurs due to insulin resistance and progressive defect in insulin secretion.

Other specific types – genetic defects, disorders of exocrine pancreas, drug-induced . Gestational diabetes mellitus – it is carbohydrate intolerance occurring during pregnancy.Platelets are anucleated, circulating, disc-shaped cells, which are responsible for the initiation of haemostatic mechanisms that repair vascular

endothelial injury. They have four major functions 1. Platelet adherence 2. Activation and secretion 3. Platelet aggregation[7]4. Interaction with coagulation factors. Whenever there is a break in the integrity of vascular endothelial lining, platelets come into contact with the underlying connective tissue matrix, especially collagen fibrils. This activates signalling pathways, which cause the platelet to change shape and secrete thromboxane A2 and ADP, which is turn stimulate neighbouring platelets, producing further activation . When platelets are activated, their distinctive discoid shape is lost, and cytoskeletal rearrangements occurring within the platelets cause it to acquirean irregular morphology. This results in greater thrombotic complications. There may therefore exist, a relationship between mean platelet volume (which is a measure of platelet function), and vascular complications in diabetes. Large mean platelet volume therefore is an indicator of the state of thrombogenesis[8].Platelet hyperactivity is also seen in diabetics, because of dysregulatedsignalling pathways, resulted in greater aggregation and activation, while responding to a given stimulus. Activation of platelets plays an important role in the pathology of diabetes, as it triggers thrombus formation which in turn causes microcapillary embolization, and the relief of mitogenic constrictive and oxidative substances, such as vascular endothelial growth factor and platelet derived growth factor. These in turn result in an acceleration in the progress of local vascular lesions of diabetes[9].Diabetic nephropathy is the most important cause of chronic kidney disease and end stage renal disease. Albuminuria in diabetic individuals is also associated with an increased risk of cardiovascular disease. Usually the diabetic patients with diabetic nephropathy have associated diabetic

retinopathy.In our study we are correlating the mean platelet volume and the albuminuria levels in diabetic patients there by studying role of mean platelet volume in the development of vascular complications specifically diabetic nephropathy. High albuminuria (previously microalbuminuria)is an early indicator of diabetic nephropathy.

II. Objectives

To estimate the mean platelet volume in an uncomplicated type 2 diabetes mellitus and to compare with normal controls. To determine the association between mean platelet volume across various levels of albuminuria, thereby relating its association with vascular complications of diabetes, specifically diabetic nephropathy.

III. Methodology

Study design :
Cross sectional study
Study centre :
Institute of internal medicine
Madras medical college and Rajiv Gandhi government general hospital, Chennai
Study duration :
September 2016 to May 2017 – 9 months
Inclusion criteria :
1. Confirmed cases of type 2 diabetes mellitus
2. Non diabetic controls without coronary artery disease
Exclusion criteria :
1. Patients on antiplatelet drugs such as aspirin and clopidogrel.
2. Patients with abnormal platelet counts (thrombocytosis or thrombocytopenia)
3. Type 1 diabetes mellitus patients
4. Type 2 diabetes mellitus with macrovascular complications
5. Diabetes complicating pregnancy
6. Conditions causing transient urinary albumin excretion such as
infection, heart failure, exercise and uncontrolled hypertension

Sample size :
A total of 140 patients which includes 90 diabetics and 50 controls. Healthy subjects who attended routine master health check ups were taken as control group
Methodology : Patients satisfying above inclusion and exclusion criteria were taken up for study after obtaining consent. Demographic data , history , systemic examination were recorded. Mean platelet volume is measured

by an automatic blood counter using venous blood samples which were taken in a test tube mixed with EDTA and tested within 1 hour of collection. Serum glucose was measured by hexokinase enzymatic method.

CRITERIA FOR DIAGNOSIS OF DIABETES MELLITUS[6]

- Random blood sugar >200 mg/dL, plus symptoms of diabetes
- Fasting blood sugar >126 mg/dL
- HbA1C>6.5%
- 2-hour plasma glucose >200 mg/dL after an oral glucose tolerance test

Albuminuria is measured by early morning urine albumin creatinine ratio.[10]

The diabetic patients are subdivided into three groups based on albuminuria levels

- A1 (<30 mg/gm) - normoalbuminuria
- A2(30-300 mg/gm) - high albuminuria
- A3(>300mg/gm) – very high albuminuria

IV. Results

A total number of 140 patients participated in our study that includes 90 (64 %) type 2 diabetes mellitus patients and 50 (36%) age matched healthy controls. Among them 88 females. They are distributed in age group of 40 to 70 years. The mean age of patients in control group was (52.58±4.26) while in the diabetes group it was (51.93±4.51)The mean platelet volume was significantly higher (8.8± 0.36) in the diabetes patients when compared to control(7.93± 0.24) group and is statistically significant (p<0.0001) by independent sample t test.Mean platelet volume shows a positive correlation (p value – 0.042) with BMI in our study. The correlation coefficient calculated by Pearson correlation coefficient shows only weak correlation (0.215).The mean BMI in control group (26.48±1.36) was also lower than the diabetes group (30.99±2.42) and also statistically significant. The mean fasting blood sugar and post prandial blood sugar in the control group was (89.6± 9.73) and (129.68±9.75) while in the diabetes group it was (171.35± 53.02) and (248.51±84.51) respectively.The mean MPV in A1 group is (8.45± 0.19) which was lower than A2(8.87± 0.37). both groups were lower than A3 (8.99±0.27). Statistical significance exists between A1and other groups (p <0.0001) , but A2 and A3 does not show any statistical significance by independent t test.

	Correlation coefficient	P VALUE
Age	-0.193	0.069
Gender	-0.045	0.677
BMI	0.215	0.042
Duration of DM	-0.049	0.648
Urine albumin creatinine ratio	0.403	**<0.0001**
Serum Creatinine	0.155	0.145
Platelet count	0.228	0.122

PROTEINURIA	MPV		P value
	MEAN	SD	
A1	8.45	0.19	
A2	8.87	0.37	<0.0001
A3	8.99	0.27	<0.0001

	MPV		**P value**
	mean	**SD**	
control	7.93	0.24	<0.0001
DM	8.8	0.36	

V. Conclusion

Mean platelet volume is significantly higher in diabetes mellitus patients than healthy controls. In diabetes mellitus patients, Mean platelet volume is significantly higher in those with high albuminuria (previously microalbuminuria) and very high albuminuria (previously macroalbuminuria) when compared with patients having normoalbuminuria. It suggests platelet may have a role in causing the vascular complications of diabetes particularly diabetic nephropathy. Mean platelet volume is a simple, easy and affordable investigation which predicts the vascular complications arising of diabetes mellitus.

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