Original Article

Estimation of platelet distribution width in type 2 diabetic male subjects

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Abstract

The patient with diabetes mellitus (DM) and its complication is increasing in our country and all over the world. Altered platelet morphology and function have been reported in patient with DM. Platelet indices act as a newly emerging and independent risk marker for atherothrombosis and cardiovascular diseases. The present study was carried out to assess Activated Partial Thromboplastin Time in subjects with type 2 diabetes mellitus. It was a cross sectional study and conducted in the Department of Physiology, Dhaka Medical College, Dhaka from July 2013 to June 2014. A total number of 200 adult male subjects were selected with age ranging from 40 to 60 years. Among them, 100 type 2 diabetic subjects were included in the study group (Group B) and 100 healthy subjects were considered as controls (Group A) for comparison. The subjects were selected from BIRDEM, Dhaka and also by personal contact from different areas of Dhaka city on the basis of exclusion and inclusion criteria. Platelet distribution width was estimated in the Department of Hematology BIRDEM, Dhaka. For statistical analysis unpaired Student's 't' test was performed. In this study, platelet distribution width was significantly (P<0.001) increased in the study group than that of control group. From this study, it may be concluded that estimation of platelet distribution width might be beneficial for prediction of future cardiovascular risk in adult diabetic male.

Keyword: Platelet indices, cardiovascular disease, diabetes

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Introduction

Diabetes mellitus is a syndrome of impaired carbohydrate, fat and protein metabolism caused by either lack of insulin secretion or decreased sensitivity of the tissues to insulin.[1] According to WHO, diagnostic criteria of diabetes mellitus are fasting blood glucose ≥7.0 mmol/l, 2 hour after glucose ≥1.11mmol/l and HbA1c ≥6.5%.[2]

Diabetes mellitus is a major global health problem. It is one of the most common non-communicable diseases worldwide. According to International Diabetes Foundation, it is the fourth leading cause of death in most high income countries. Prevalence of diabetes in Bangladesh was found 8.3% in the year of 2011, among them 15.2% in urban and 8.3% in rural population.[3,4]

Patients with DM have increased risk of developing micro and macro vascular diseases.[5] Atherosclerosis is one of the major causes for developing macrovascular complications including coronary heart disease (CHD), stroke and peripheral arterial disease. Cardiovascular disease (CVD) is the leading cause of disability and premature mortality in patients with diabetes.[6] About 80% patients with diabetes may die due to thromboembolism.[7]

Platelets are essential for primary hemostasis and endothelial repair. Platelet size, shape & number are the determinant of platelet function.[8] Altered platelet morphology and function have been reported in patients with DM.[9] Larger platelets are hemostatically more active, younger, aggregate more rapidly with collagen and contain more dense granules and produce large amounts of thromboxane A2. Thus platelets exhibit hyper responsiveness to ADP or collagen induced aggregation.[10,11] During platelet activation, atherosclerotic plaque is formed. The plaque activates the plasma coagulation cascade and converted to a stable clot.12 This leads to vessel obstruction and increases risk of CVD.[6]

Platelet volume is a marker of platelet size and function. Measurement of mean platelet volume (MPV) introduced as a new method for the assessment of platelet activation. Platelet distribution width (PDW) is another specific marker of platelet activation.[13,14] So, platelet indices such as platelet distribution width, mean platelet volume is an important, simple, effortless and cost effective tool that is used for predicting the possibility of impending acute events

like myocardial infarction and cerebrovascular events.[14,15]

Many studies have reported higher platelet distribution width in diabetic patients.[16] The magnitude of this issue in Bangladeshi population is not precisely known as there is less published data available regarding this topic in our country. Therefore, this study was undertaken to asses platelet distribution width which might be beneficial for prediction of future cardiovascular risk in diabetes subjects.

Methods

This cross sectional study was done in the department of Physiology in Dhaka Medical college Dhaka in July 2013 to June 2014. Protocol of this study was approved by Ethical review committee of Dhaka Medical college and Diabetic Association of Bangladesh.

For this study 100 male, age (40-60 years), diabetic subjects were selected from BIRDEM hospital and were included in study group A. These diabetic subjects were selected on the basis of their duration of diabetes more than 3 years, FBG level ≥7.0 mmol/l and HbA1c ≥ 6.5 %. All the study subjects were on oral hypoglycemic drugs. Hundred healthy adult male were considered as control group B for comparison.

Before taking blood, detailed family and medical history were taken. Anthropometric measurement of the subjects was done and blood pressure was measured. All the information's were recorded in a prefixed questionnaire.

With aseptic precaution, 5 ml of venous blood was collected from ante-cubital vein by a disposable plastic syringe from each subject for estimation of hematological and biochemical tests. HbA1c, FBG and platelet distribution width, level were estimated in the laboratory of the Biochemistry and Hematology Department of BIRDEM hospital.

After selection of the subjects, the nature, purpose and benefit of the study were explained to each subject in details. They were encouraged for voluntary participation. They were also allowed to withdraw from the study whenever they feel like. Informed written consent was taken from the participants.

All the parameters were expressed as mean ± SD (standard deviation). Statistical analysis was done by unpaired Student's 't' test and Pearson's correlation coefficient (r) test. P value < 0.05 was accepted as level of significance. Statistical analyses were performed by using a computer based statistical program SPSS (Statistical package for social science) Version 19.

Results

A total number of 200 adult male subjects were selected for this study. Among them, 100 subjects were adult male with type 2 diabetes and an equal number of healthy subjects with same age range were selected as control for comparison. The mean (± SD) age of the study group and control group was 54.72 ± 5.73 and 53.58 ± 4.75 years respectively. The mean (±SD) height of the study group and control group was165.79 ± 6.73 and 158.82±4.36 cm respectively. The mean (±SD) weight of the study group and control group was 63.46±7.21 and 61.43±7.20 kg respectively. The mean (±SD) systolic blood pressure was 108.05±10.20 and 110.65±7.02 mm Hg in study group and control respectively. All the values were within normal range. The mean (±SD) diastolic blood pressure was 62.80±4.40 and 65.95±6.34 mm Hg in study group and control respectively. All the values were within normal range. (Table-I)

Table-I : General characteristics of subjects of both groups (n = 200).

P arameters	Healthy adult male (n=100)	Type 2 diabetic adult male(n=100)
Age (years)	53.58±4.75 (44 - 61)	54.72±5.73 (43 - 60
Weight(kg)	61.43±7.20 (43.0 - 170.0)	63.46±7.21 (48.0 - 79.0)
Height(cm)	158.82±4.36 (152 - 171)	165.79±6.73 (151 - 181)
BMI (kg/m^2)	23.13±2.26 (18.19 - 32.0)	23.15±2.96 (18.37 - 32.89)
SBP (mmHg)	110.65±7.02 (100 - 125)	108.05±10.20 (90 - 170)
DBP (mmHg)	65.95±6.34 (60 - 80)	62.80±4.40 (50 - 70)

The mean (±SD) FBG level was 4.83±0.59 and 11.64±1.95 mmol/L in group A and B respectively. In this study, the mean (±SD) FBG level was significantly (p<0.001) higher in group B in comparison to that of group A. The mean (±SD) HbA1C level was 4.55±0.70 and 10.83±2.28 in group A and B respectively. In this study, the mean (± SD) HbA1C level was significantly (p<0.001) higher in group B than that of group A. (Figure-1)
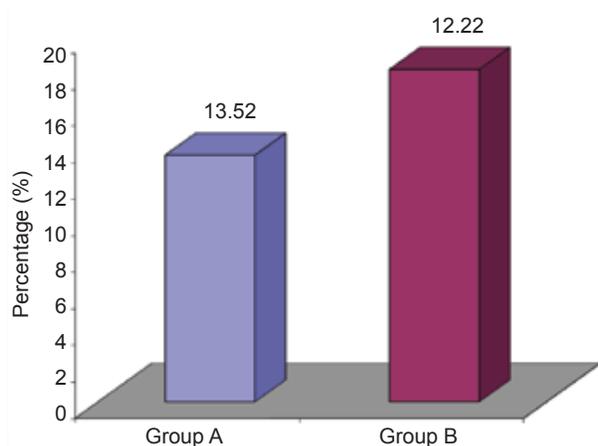
Figure-1: *Mean fasting blood glucose level in both groups (n = 200)*

The mean (± SD) PDW was 13.52±0.98 and 18.22±1.53% in group A and B respectively.The mean (± SD) PDW in group B was higher than that of group A which was statistically significant (p < 0.001). (Table-II)

Table-II : Platelet distribution width (PDW) in both groups (n = 200)

Groups	PDW (%)	P value
A (n=100)	13.52±0.98	<0.001
B (n=100)	18.22±1.53	<0.001

Discussion

In the present study, mean PDW was significantly (p < 0.001) higher in study group than control. Similar type of observations was found by some researchers.[17,18,19] There are some postulated mechanisms suggested by various researchers of different countries which may imply the possible mechanism regarding these changes in the present study. Plasma glucose concentration directly enhances the activation of arachidonic acid pathway leads to increased Thromboxane A2 formation. This thromboxane A2 is one of the potent platelet activators and contributes to hyperactivity of platelet in diabetic patients.[20]

In the diabetic platelets, there is increased mobilization of Ca^{2+} from intracellular storage pools. These intracellular Ca^{2+} responsible for platelet degranulation and causes platelet activation. Vascular NO activity is reduced in diabetes, leading to impaired endothelium-dependent

vasodilatation and increased platelet aggregation. These platelet activation causes increase PDW in diabetic subjects and act as a risk factor for future cardiovascular disease.[21,22] In the present study, it may be concluded that increased platelet distribution width in type 2 diabetes mellitus.

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