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Comparative Study of Mean Platelet Volume (Mpv) in Type 2 Diabetes Patients with and without Foot Ulcers

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Abstract

Diabetes is a major health issue with multiple micros vascular and macro vascular complications. 15-18% of the diabetics suffer from foot ulcers (DFU) during the course of the disease. MPV is a biomarker of platelet activation and increased function. Increase in MPV implies release of highly active platelets with an increased chromogenic activity and an increased risk of atherosclerosis.

Aim

Aim of the study was to compare MPV values of diabetic patients with and without foot ulcers and to study the relation of MPV with diabetic foot ulcers

Type of Study and Place of Study

The study was a prospective randomized study with selective sampling conducted at Kempegowda Institute of Medical Sciences, Bangalore for a period of 1 year from October 2018 to October 2019.

Materials and Methods

We collected MPV values of 150 patients with type 2 diabetes having non gangrenous DFU and compared them with MPV values of 150 type 2 diabetes patients without DFU after matching both the groups for age and sex. The following criteria were used for diagnosing diabetic foot ulcer: presence of systemic signs of infection, purulent discharge from the wound, and minimum two local signs of inflammation (erythema, warmth, edema, tenderness and induration).

Results

Patients with DFU had an increased MPV value when compared to patients without DFU.

Conclusion

The underlying pro-inflammatory conditions causing diabetic foot ulcers have an influence on platelet volume. High MPV can be used as a biomarker for increased platelet activity resulting in more chromogenic episodes contributing to the formation of diabetic foot ulcers.

Introduction

Diabetes is a major health issue with multiple micros vascular and macro vascular complications. 15-18% of the diabetics suffer from foot ulcers (DFU) during the course of the disease [1]. Diabetic foot ulcers are one of the main causes for prolonged hospital stay and morbidity in patients with diabetes [2]. Diabetic foot ulcers are caused by many factors which directly or indirectly influence the disease; they are; polyneuropathy, ischemia, increased blood sugar levels, loss of proprioception, AV malformations etc. [3]. Mean Platelet Volume (MPV) is a predictive biomarker of increased platelet activity and function. It implies that increase in MPV results in production larger platelets which are immature and which contain pro-thrombotic and pro-inflammatory substances, increased number of alpha-granules and their subsequent release, resulting in thrombosis [4, 5]. MPV is known to increase with blood sugar levels in patients without a good glycemic control [6]. Aim of the study was to compare MPV values of diabetic patients with and without foot ulcers and to study the relation of MPV with diabetic foot ulcers.

Material and Methods

The study was conducted at Kempegowda Institute of Medical Sciences, Bangalore, for a time period of 1 year from October 2018 to October 2019 after obtaining clearance from the ethical committee. Written informed consent of the patients was taken.

We collected MPV values of 150 patients with type 2 diabetes having non gangrenous DFU and compared them with MPV values of 150 type 2 diabetes patients without DFU after matching both the groups for age and sex.

The following criteria were used for diagnosing diabetic foot ulcer: presence of systemic signs of infection, purulent discharge from the wound, and minimum two local signs of inflammation (erythema, warmth, edema, tenderness and induration).

Patients with anemia, no diabetics, patients with coronary artery disease, pregnant, patients on antiplatelet drugs such as aspirin and clopidogrel , patients with malignancy , gangrenous DFU (Wagner class 4 and 5), subjects with active infection except for DFU and subjects with Peripheral artery disease involving in large vessels were not included in the study.

2cc of Blood was drawn under strict aseptic precautions into an EDTA tube. MPV was calculated using automated blood counter

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system.

Statistical analysis was done using SPSS software version 20. The KS test was used for values of distribution. ANOVA and Mann-Whitney U test were used for comparing variables between groups with a normal distribution and groups with abnormal distribution respectively. Correlation analysis was done using Pearson correlation factor. P value of less than 0.05 was considered statistically significant.

Results

The Results obtained in both the groups were as follows (Table 1).

Characteristics	Diabetics without Foot Ulcers (n=150)	Diabetics with Foot Ulcers (n=150)	P –value (<0.05)
Age	53 +/- 2.8	56.1 +/- 11.3	NS
Gender (male/female)	75/75	80/70	NS
BMI (Kg/m^2)	26.7 +/- 2.3	28 +/- 2.9	NS
SBP(mmhg)	120 +/- 8	123 +/- 15	NS
DBP(mmhg)	75 +/- 4	75 +/- 11	NS
Creatinine (mmhg)	0.9 +/- 0.1	0.9 +/- 0.1	NS
Fasting plasma glucose	115 +/- 7	300 +/- 168	<0.001
WBC ($*10^3$)	8.3 +/- 2	9.1 +/-2.7	0.002
Hemoglobin (g/dL)	14 +/- 1.5	13.3 +/- 1.9	0.002
Platelets ($*10^3$)	288.1 +/- 68.7	295.9 +/- 110	NS
MPV (fL)	9.9 +/- 1.97	11.3 +/- 1.96	<0.001

Table 1: Mean platelet volume levels of patients with and without diabetic foot ulcers.

Factors such as Age, body mass index, gender, and blood pressures were not statistically significant in our study and did not have much of in influence on development of foot ulcers. However, fasting plasma glucose was on a higher side in patients with diabetic foot ulcers with a statistically significant p value of less than 0.001. Total WBC count was higher in patients with foot ulcers with a statistically significant p value of 0.002. However, hemoglobin levels did not show much of significance in contributing to the development of foot ulcers in our study [8].

Mean Platelet Volume levels were seen to be high in patients with diabetic foot ulcers when compared to the other group. P value of this variable was less than 0.001 which implied that it was statistically significant in our study.

Discussion

Diabetic foot ulcer is one of the major complications of the disease with prolonged hospitalization and high morbidity and mortality [2, 7]. Diabetic foot ulcers are caused by involvement of multiple factors like polyneuropathy, ischemia and increased blood sugar levels, loss of proprioception, AV malformations and superadded infections [3]. Both macro vascular and micro vascular components are involved in contributing to the formation of foot ulcers and also affecting wound healing [3]. MPV denotes the dimension of platelets. Increased MPV implies that the platelets are large and immature with increased activity. They have increased number of alpha granules, adhesion molecules, release more thromboxane A2 and have a greater potential for thrombosis [9]. MPV can thus be used as an indicator of increased platelet activity [5]. Elevated MPV levels have been reported in many pro inflammatory conditions including diabetes [10, 11]. Furthermore, several studies have shown that increased MPV is also a risk factor for IHD, CVA, juvenile SLE, fibromyalgia and angiopathic complications in diabetes [11, 13-15].

Conclusion

Diabetic foot ulcers are a result of multifactorial involvement. All of these factors influence the volume of platelets. Therefore mean platelet volume can be used as a biomarker of highly reactive platelets with higher potential for thrombosis.

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