Comparison platelet indices in diabetic patients with and without diabetic foot ulcer

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Abstract. Diabetes Mellitus is a group of metabolic disease which incidence increases every year. Some diabetic patients have diabetic foot ulcer as a complication. The occurrence of ulcers in diabetic patients can be caused by the presence of thrombosis due to increased platelet function. Therefore, a cross-sectional study on 40 diabetic patients was performed at RSUP Adam Malik Medan to see whether there were differences in platelet indices between diabetic patients with and without diabetic foot ulcers. Platelet indices were examined and looked for differences in diabetic patients with and without diabetic foot ulcers. Data were analyzed using Chi-Square and Mann-Whitney U test with 95% CI. P-value < 0.05 was considered statistically significant. There were differences in hemostasis function (prothrombin time, thrombin time, INR, aPTT, and fibrinogen) between the two groups with p values of 0.001; 0.004; 0.015; 0.021; 0.009, respectively. From the platelet indices examination, there were differences in the number of platelets, PDW and PCT with p values of 0.041; 0.027; 0.007, respectively, whereas there was no difference for MPV value (p= 0.05). Platelet indices were found to increase in diabetic patients with diabetic foot ulcers indicating more reactive and aggregatable platelet function.

1. Introduction

Diabetes mellitus (diabetic) is a group of metabolic disease which incidence increases steadily every year, from 366 million patients in 2011 to 552 million in 2030.[1] Until now, diabetic foot ulcers is still one of the complications of a diabetic with a high mortality rate (16%), and amputation rate reaches 25%, even 3-year mortality rate after amputation reaches 37%.[2] It may be due to a lack of treatment of thrombosis in diabetic ulcers.

Platelet indices, which consists of platelet count, mean platelet volume (MPV), platelet distribution width (PDW), Plateletcrit (PCT) has become part of the current routine hematological examination. There is a change of morphology and platelet function in diabetic patients resulting in changes in platelet indices.[3] MPV describes the size of platelets associated with the risk of thrombosis. PDW illustrates how platelet and PCT sizes measure total platelet mass in which the increase can also describe the presence of atherosclerosis and thrombosis.[4]

MPV and PDW were known to increase in patients with diabetes [2], but there have not been many studies about these parameters in patients with diabetic foot ulcers. Therefore, this study aims to see if there were differences in platelet indices in diabetic patients with and without diabetic foot ulcers.
It becomes a prediction that diabetic patient will have diabetic foot ulcers complication in order to prevent this complication as early as possible.

2. Methods

In this cross sectional study, 40 patients were enrolled to meet the minimum sample size. We compared the diabetic patient with diabetic foot ulcer as a case of the diabetic patient without diabetic foot ulcers as a control. The inclusion criteria are diabetic patients with diabetic foot ulcers regardless of other comorbidities. The study was at Adam Malik Hospital Medan. All subjects receive a blood test and the differences in blood test result between the case and control group were then observed.

Data were entered and analyzed using SPSS statistical software. Categorical data were in numbers and percentages. Numerical data with normal distribution were in mean ± standard deviation, and if not were in median (minimum-maximum). The level of significance was set at 0.05.

3. Results

Age and laboratory data of the case and control groups were shown in Table 1. There was no significant difference regarding age and sex, while the laboratory results show a significant difference in prothrombin time, thrombin time, INR, aPTT and fibrinogen between the two groups with value were 0.001; 0.004; 0.015; 0.021; 0.009 respectively. (table 1)

Most of the subjects in case group have grade 4 diabetic foot ulcers (50%), 35% have grade 3 and the rest have grade 5 (15%).

| Table 1. Characteristics of the subjects. |
|------------------------------------------|
| Sex                                      |
| Male, n(%)                               | 13 (56.5) | 10 (43.5) | 0.337 |
| Female, n(%)                             | 7 (41.2)  | 10 (58.8) |         |
| Hemoglobin (mg/dL)                       | 10.7 ± 1.66 | 13.06 ± 1.74 | <0.001 c |
| Leucocyte/mm³                              | 13,930 (1,800-39,920) | 8,915 (6,310-19,600) | 0.013 c |
| Urem³                                    | 31 (11-103) | 29 (11-90) | 0.284 |
| Creatinin³                               | 1.16 (0.37-1.94) | 0.97 (0.59-1.96) | 0.675 |
| SGOT³                                    | 26 (11-59) | 20 (15-50) | 0.136 |
| SGPT³                                    | 22.35 ± 12.31 | 23.10 ± 6.81 | 0.813 |
| Albumin³                                 | 2.64 ± 0.79 | 3.45 ± 0.53 | 0.001 c |
| HDL³                                     | 33.75 ± 8.25 | 42.70 ± 10.56 | 0.005 c |
| Prothrombin time³                        | 14.2 (10-18.8) | 12.3 (10-17.2) | <0.001 c |
| aPTT³                                    | 30.55 (25.5-36.2) | 26.2 (12.4-34.4) | 0.017 c |
| ThrombinTime³                            | 19.6 (13.6-35.2) | 14.95 (10-28) | 0.004 c |
| INR³                                     | 1.04 (0.69-1.57) | 0.89 (0.76-1.76) | 0.015 c |
| Fibrinogen³                              | 425 (100-900) | 267 (186-501) | 0.009 c |

| Table 2. Comparisons of platelet indices between diabetic patients with and without foot ulcers. |
|------------------------------------------|
| Laboratory                               |
| Platelet count                           | 303350 ± 110211 | 381200 ± 122559 | 0.041 |
| PDW³                                     | 11.93 ± 2.19 | 10.52 ± 1.65 | 0.027 |
| MPV³                                     | 10.38 ± 1.13 | 9.73 ± 0.87 | 0.050 |
| PCT³                                     | 0.29 (0.16-0.66) | 0.43 (0.18-0.52) | 0.007 |

From the indices platelet examination, differences were in the number of platelets, PDW and PCT with p values of 0.041; 0.027; 0.007. (table 2)


4. Discussion
This study showed that there was no significant difference between the two groups except regarding hemostasis parameters which are aPTT, PT, TT, and INR. In the diabetic group with ulcers, the hemostasis function tends to be prolonged which means the blood had morehypercoagulation.

In this study, platelet counts were higher in the diabetic foot ulcers group. Other studies—show different results regarding the number of Platelets in patients with adiabetic. Swaminathan et al. found higher mean platelet count in diabetic group than non-diabetic although not significantly different.[5] The other study by Demirtunc et al showed a significant difference in platelet count between patients with and without diabetic.[6]

The elevated MPV levels in diabetic patients with foot ulcers have been reported by Gunes et al.[7] In contrast, we found no differences in MPV levels between diabetic patients with and without foot ulcers. It is similar to the study results by Ozkan et al. which showed no significant change in MPV value in diabetic ulcers patients and that MPV cannot be diabetic foot ulcer markers.[8]

High MPV values can be an interpretation of large platelet size. Large platelets become more hyperreactive resulting in a prothrombotic factor. This platelet has more alpha granules, expressing increased adhesion molecules, producing more thromboxane A2 and showing greater thrombogenic potential when compared with small platelets.[6,9]

In this study, we found differences in PDW and PCT values which are significantly higher in diabetic foot ulcers patients. In a study by Alahdas et al. diabetic patients with complications showed an increase in MPV, PDW, and PCT versus uncomplicated diabetic patients. MPV and PDW often associated with macrovascular complications whereas MPV and platelet count associated with microvascular complications. Elevation in MPV and PDW level indicating more reactive and aggregatable platelets that can explain the incidence of complications of diabetes.[9]

The limitation of this study is the lack of data of controlled diabetic and duration of adiabetic. The Swaminathan et al. study showed that MPV level in diabetic patients associated with poor glycemic control and duration of a diabetic.[6] Also, no other comorbid matching experienced by the patient in which comorbidity may also affect the platelet indices such as infection.

5. Conclusion
There was an increase in platelet count, PDW and PCT levels in diabetic patients with diabetic foot ulcers compared to diabetic patients without diabetic foot ulcers. It indicates that platelet function becomes more reactive and aggregatable.

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*Independent t-test
*Mann Whitney U test
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