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COMPARISON OF THE EFFECT OF APHERESIS AND RANDOM THROMBOCYTE TRANSFUSIONS ON PLATELET FUNCTIONS OBSERVED BY PFA-200 TEST

RANDOM VE AFEREZ TROMBOSİT TRANSFÜZYONUNUN PFA-200 TESTİYLE TROMBOSİT FONKSİYONLARI ÜZERİNDEKİ ETKİSİNİN KARŞILAŞTIRILMASI

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ÖZ

Giriş: *Transfüzyon etkinliği, transfüzyon sonrası trombosit sayısındaki ve trombosit fonksiyonlarındaki artış ile değerlendirilir.*

Biz de random ve aferez trombosit süspansiyonunun trombosit fonksiyonu üzerine etkilerini PFA-200 ile araştırmayı amaçladık.

Gereç ve Yöntem: *Transfüzyondan sonraki 24 saat içinde ADP/Kollajen ve ADP/Epinefrin ile PFA-200 testi uygulanan hastaların veriler toplandı. Aferez ve random trombosit transfüzyonu alan hastalar iki gruba ayrıldı. Transfüzyon almayan trombositopenili hastalar kontrol grubu olarak tanımlandı.*

Her grup için, transfüzyon sonrası ADP/Kollajen ve ADP/Epinefrin kapanma zamanı değerleri ve trombositopeni mekanizması (kemik iliği baskılanması veya trombosit yıkımı) kaydedildi.

Bulgular: *Random ve aferez transfüzyon alan hastaların kollajen/ADP ve kollajen/Epinefrin değerleri arasında istatistiksel olarak anlamlı bir fark yoktu. Hastalar kemik iliği baskılanması ve trombosit yıkımı olmak üzere 2 alt gruba ayrıldı. Trombosit yıkımı olan gruptaki aferez transfüzyon, random transfüzyon ve kontrol grubunun ortalama Kollajen/ADP değerleri sırasıyla 244.4, 221.0 ve 186.9 saniyeydi. Random transfüzyon alan hastalarda Kollajen/ADP CT değeri anlamlı derecede düşüktü. Kollajen/Epinefrin değerleri arasında anlamlı fark yoktu. Supresyon grubunda, aferez alan hastalar ile random transfüzyon alan hastaların Kollajen/ADP ve Kollajen/Epinefrin değerleri arasında anlamlı fark yoktu.*

Sonuç: *Trombosit yıkımı olan hastalarda, Random trombosit transfüzyonuyla Kollajen/ADP CT değeri daha düşük saptandı.*

SUMMARY

Introduction: *Transfusion efficacy is assessed by an increase in platelet counts and platelet functions after transfusion.*

We aimed to investigate the effects of random and apheresis platelet suspension on platelet function with PFA-200.

Material and Methods: *Data were collected from patients who underwent platelet function test PFA-200 with ADP/Collagen and ADP/Epinephrine within 24 hours after transfusion. Patients were divided into two groups, one receiving apheresis platelet transfusions and receiving random platelet transfusions. Patients with thrombocytopenia received no transfusion were determined as a control group.*

For each group, ADP/Collagen and ADP/Epinephrine closure time (CT) values after transfusion and thrombocytopenia mechanism (bone marrow suppression or platelet destruction) were recorded.

Results: *There was no statistically significant difference between the Collagen/ADP and Collagen/Epinephrine values of patients receiving random and apheresis transfusions. Patients were divided into 2 subgroups as bone marrow suppression and platelet destruction. The mean Collagen/ADP values of apheresis, random transfusion and control group in the destruction group were 244.4, 221.0 and 186.9 seconds, respectively. The level of collagen/ADP in patients receiving random transfusion was significantly lower. There was no significant difference between the collagen/ADP and Collagen/Epinephrine values of patients receiving apheresis and random transfusion in supression group.*

Conclusion: *In patients with platelet destruction, collagen/ADP CT values were found lower with Random platelet transfusion.*

INTRODUCTION

There is currently a growing need for platelet transfusion for the treatment or prophylaxis of bleeding in patients with thrombocytopenia or platelet dysfunction (1). Thrombocytopenia can be caused by many different causes. When differential diagnosis is made, the pathophysiological mechanism provides for ease of diagnosis after exclusion of pseudothrombocytopenia. Thrombocytopenia usually occurs in two forms, namely platelet destruction and loss of production due to bone marrow depression. Hematologic malignancy, aplastic anemia, myelodysplasia and drugs are example for bone marrow supression. Immune thrombocytopenic purpura, disseminated intravascular coagulation, thrombotic thrombocytopenic purpura, hemolitic uremic syndrome and connective tissue diseases are example for thrombocyte destruction (2).

The two groups are used as random and apheresis according to the platelet suspension preparation techniques (3). Transfusion efficacy is assessed by an increase in platelet counts and platelet counts after transfusion. However, evaluation of posttransfusion platelet function may be useful in assessing the risk of bleeding (4).

The Platelet Function Analyzer (PFA-100 Dade Behring, Marburg, Germany) can analyze platelet functions more responsively and more reproducibly than the standard bleeding time test. Nowadays it is used as a screening test for platelet functions. PFA-200 is a new version of PFA-100 (5). This system has two disposable cartridges: Collajen/Epinefrine (Col/Epi) ve Collajen/ADP (Col/ADP). In the operating system, the anticoagulant full blood is absorbed through a capillary lumen and passes through the hole on a membrane coated with collagen. The platelets adhere to collagen with vWF as they pass through the hole and are also activated with stimulants. Finally, thrombocyte plug occurs. With the formation of this plug, the hole is closed and the blood flow is cut off. The time between blood absorption and the occlusion of the hole is called the "closure time (CT)" (1) . We aimed to investigate the effects of random and apheresis platelet suspensions on platelet function in patients who underwent platelet function test PFA-200 with ADP / Collagen and ADP / Epinephrine within 24 hours after transfusion in our clinic.

MATERIAL AND METHODS

Data were collected from patients who underwent platelet function test PFA-200 with ADP / Collagen and ADP / Epinephrine within 24 hours after transfusion in Izmir Tepecik Training and Research Hospital Internal Medicine Clinic. Patients were divided into two groups, one receiving apheresis platelet transfusions and the other receiving random platelet transfusions. Other exclusion criteria were being younger than 18 years and having hepatic or renal failure. As a control group, no transfusion, thrombocytopenia patients with platelet function test PFA-200 were screened.

Profilactic platelet transfusion had performed under 20.000/uL in patients with no evidence of bleeding. Also, it had performed in patients with thrombocytopenia. The limit of thrombocytopenia was accepted as 100000 / uL. Hemoglobin level of Apheresis, random and control group was 10.6, 10.8 and 10.0 g/dl, respectively.

For each group, ADP/Collagen and ADP/ Epinephrine CT values after transfusion, and thrombocytopenia mechanism (bone marrow suppression or platelet destruction) were recorded. To compare the posttransfusion platelet counts of the random and apheresis groups with the control group; the number of platelets after 24 hours in the control group was taken as the number of platelets after transfusion.

Statistical Analysis

We used Shapiro-wilk test, T-test, ANOVA, Bonferroni and Dunnett's-T3 test, Mann-Whitney U test, Kruskal Wallis test, Chi-square test and variance analysis in this study. The statistical significance was 0.05.

RESULTS

A total of 112 patients' data were obtained. 32 patients were included in the random transfusion group, 38 patients were in the apheresis transfusion group, and 42 patients were in the control group. The average age of random group was 63.7±19.1, of apheresis group was 55.0±16.6 and of control group was 62.2±17.7.

Platelet counts of patients analyzed were logarithmic. Shapiro-Wilk test showed that the groups were normally distributed. The changes of apheresis and random groups according to the control group were 0.63 and 0.65, (With Bonferroni Test) respectively.

Patients were compared with platelet count before and after transfusion, 2 groups were separated according to thrombocytopenia pathogenesis as bone marrow suppression and thrombocyte disruption. There was no statistically significant difference between platelet counts of both suppression and destruction groups, both before and after transfusion ($p = 0.85$). However, both in the destruction and suppression group the increase in platelet count after transfusion was statistically significant ($p = 0.001$). The relation of the platelet values of the groups is shown in Table 1.

Collagen/ADP and Collagen/Epinephrine values were separately evaluated for each groups as bone marrow suppression and thrombocyte destruction according to the pathogenesis of thrombocytopenia. Analyzes were made logarithmically.

The mean Collagen/ADP values of apheresis, random transfusion and control group in the destruction group were 244.4, 221.0 and 186.9 seconds, respectively. Collagen/ADP values of patients receiving random transfusion were lower and statistically significant ($p=0.044$). There was no significant difference between the Collagen/ ADP values of patients receiving apheresis and random transfusion in the suppression group ($p=0.568$). There was no statistically significant difference between the collagen/epinephrine values of patients receiving random and apheresis transfusion in the destruction and suppression groups ($p=0.191$ and $p=0.110$).

The association of collagen/ADP and Collagen/ Epinephrine values with pathogenesis and transfusion groups were shown in Table 2

Table 1. Relationship of Platelet Counts and Transfusion Groups According to Pathogenesis

Transfusion/ Platelet Count	Category	N	Average (/uL)	Standard Deviation	p value
Before	Destruction	38	32000.0	28778.7	0.85
	Supression	74	33256.7	29001.2	
After	Destruction	38	57368.4	23903.4	0.85
	Supression	74	63121.6	32316.9	
p value	Destruction				0.001*
	Supression				0.001*

*p<0.05

Table 2. Relation of transfusion groups with PFA-200

PFA-200/Transfusion			N	Average (sec)	p value
Collagen/ ADP (second)	Random	Destruction	6	221.0±18.7	*0.044
		Supression	26	218.9±80.2	0.568
		Total	32	219.3±72.4	0.630
	Apheresis	Destruction	18	244.4±43.3	*0.044
		Supression	20	222.5±49.2	0.568
		Total	38	232.8±47.2	0.630
	Control	Destruction	13	186.9±85.8	*0.044
		Supression	28	241.8±73.1	0.568
		Total	41	224.4±80.5	0.630
	Total	Destruction	37	220.4±63.9	*0.044
		Supression	74	228.5±70.1	0.568
		Total	111	225.8±67.9	0.630
Collagen/ Ephinefrine (second)	Random	Destruction	6	216.6±36.2	0.191
		Supression	26	200.0±67.6	0.110
		Total	32	203.1±62.8	0.210
	Apheresis	Destruction	18	233.6±37.7	0.191
		Supression	20	212.1±53.6	0.110
		Total	38	222.3±47.4	0.210
	Control	Destruction	13	193.4±66.1	0.191
		Supression	28	244.5±67.0	0.110
		Total	41	229.0±69.0	0.210
	Total	Destruction	37	218.8±49.4	0.191
		Supression	74	218.3±65.6	0.110
		Total	111	218.5±60.5	0.210

*p<0.05

DISCUSSION

In the presence of thrombocytopenia there may be an increased risk of bleeding by impaired platelet function. The collagen / epinephrine and collagen / ADP closure time studies performed with the PFA-100 and PFA-200 platelet function analyzer are now fast, easy and sensitive platelet function tests as an alternative to the bleeding time test. In a study by Mohamed E. Salama et al, closure time was studied with PFA-100 after platelet transfusion. With transfusion, a mean decrease of 40 seconds was detected at closure time. Therefore, closure time evaluation after platelet transfusion may be beneficial in terms of clinical outcome and cost-effectiveness (6). We

aimed to compare the effect of random and apheresis platelet transfusions on platelet function by closure time measurements after transfusion.

In our study, the change of the number of platelets of the random group compared to the control group was statistically significant (p = 0.036) in the analysis of the patients who received apheresis and random transfusion by removing the effect of platelet count before transfusion. The change in the apheresis group was not statistically significant (p = 0.563). Heddle and colleagues compared the number of platelets at 1 hour post transfusion with apheresis platelet suspension increased more than random suspension (7). The difference in our study was thought to be due to the use of 24-hour platelet values in patients and the presence of patients with immuno-platelet destruction in the evaluated patients. For this reason, patients were divided into groups as destruction and bone marrow supression, and re-evaluation was performed.

The increase in platelet count after transfusion in the destruction and suppression groups was statistically significant (p <0.001). There was no statistically significant difference between platelet counts of suppression and destruction groups before and after transfusion (p = 0.85). There was no statistically significant difference in the levels of Collagen / ADP and Collagen / Epinephrine after transfusion in patients receiving random and apheresis transfusions compared to the control group.

When Collagen / ADP and Collagen / Epinephrine values were separately evaluated after 2 groups according to the pathogenesis of thrombocytopenia.; Collagen / ADP values of patients receiving random transfusion were lower in the destruction group and statistically significant. Although there was no significant difference in collagen / ADP and collagen / epinephrine values in the other groups except for collagen / ADP in the destruction group, the closure times of both random and apheresis transfusion patients were longer than the control group. This was thought to be attributable to the higher mean baseline platelet count of the control group. Because the closure time is longer as the platelet count decreases.

CONCLUSION

Since the PFA-200 test can evaluate platelet function more responsively and reproducibly than bleeding time, platelet function tests have begun to be used as a screening test. In patients with platelet destruction, collagen / ADP CT values were found lower with Random platelet transfusion. To understand whether this finding has any clinical significance, large series and prospective studies are needed.

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Sorumlu yazar

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