VOLUME-7, ISSUE-12, DECEMBER-2018 • PRINT ISSN No 2277 - 8160

Original Research Paper

Medical Science

EFFECT OF PLATELETPHERESIS ON PT AND APTT VALUES IN HEALTHY DONORS.

Dr Mitali Sharma Post Graduate, Department of Blood Transfusion and Immunohaematology, GMC Jammu.

Dr Ankur Malhotra Senior Resident, Department of Medicine, GMC Jammu.

Dr Isha Sunil* Senior Resident, Department of Gynaecology and Obstretics, ASCOMS Jammu.
*Corresponding Author

ABSTRACT

INTRODUCTION: Plateletpheresis is a method used to remove platelet from the body either from random volunteer donors, patient's family members or HLA matched donors. A prospective study was carried out on 57 plateletpheresis donors aged between 18 and 60 years.

MATERIAL AND METHOD: We compared the coagulation parameters before and after plateletpheresis of 57 donors over a period of one year

RESULTS: There were significant changes in blood coagulation parameters but it is within acceptable range.

CONCLUSION: This study showed significant changes in blood coagulation parameters, however changes were within normal range. In conclusion, plateletpheresis is a safe procedure for healthy donors.

KEYWORDS : Platelet; Apheresis; Blood coagulation; Plateletpheresis; Prothrombin Time (PT); Activated Partial Thromboplastin Time (APTT).

INTRODUCTION

The American Association of Blood Banking defined platelet pheresis as a method used to remove platelet from the body either from random volunteer donors, patient's family members or HLA matched donor [3]. This technique is usually used for donation and therapeutic purposes. This technology is based on either filtration or centrifugal systems with combination of either continuous- or intermittent-flow technology [9].

Blood coagulation system involves a biological amplification system with series of enzymes in which a few initiation substances activated by proteolysis of a cascade of circulating precursor proteins to generate the thrombin and converts soluble plasma fibrinogen into fibrin. Effects of the plateletpheresis can be seen when there are the changes on the coagulation and thrombophilia markers after the procedure. Venous thrombosis will develop when there is a vessel wall damage, abnormal blood flow and presence of local activation of coagulation. The thrombi are made up of red blood cells with few platelets which are trapped in an extensive fibrin mesh. The risks of thromboembolism in the general population include increasing age, medical illness, surgery, immobilization, venous stasis or sedentary lifestyle, cigarette smoking, pregnancy, use of oral contraceptives, intensive physical exertion and hypercoagulable states [10].

The prothrombin time (PT), and activated partial thromboplastin time (APTT), are screening tests for hemostasis. The PT is a measure of the integrity of the extrinsic and final common pathways of the procoagulant cascade. The PT represents the time, in seconds, for patient plasma to clot after the addition of calcium and an activator of the extrinsic pathway (thromboplastin). Thus, deficiencies or inhibitors of clotting factors within the extrinsic and final common pathways result in prolongation of the PT. The APTT is a measure of the integrity of the intrinsic and final common pathways of the coagulation cascade. The APTT represents the time, in seconds, for patient plasma to clot after the addition of phospholipid, an intrinsic pathway activator, and calcium. The APTT reagent is called partial thromboplastin because tissue factor is not present in conjunction with the phospholipid as it is in the PT reagent. Thus, deficiencies or inhibitors of clotting factors within the intrinsic and final common pathways result in prolongation of the APTT (6)

Most of the studies being done on plateletpheresis usually focused on the platelet function and the haemostasis [4], [5]. The aim of this study is to determine the effects on platelet and blood coagulation parameters in healthy donors after plateletpheresis.

2. MATERIALS AND METHODS

The study was conducted in The Department of Blood Transfusion and Immunohaematology, Government medical college, Jammu. This is a tertiary care centre attending to needs of people of Jammu and adjoining area of Punjab and Himachal Pradesh. The study was carried out between December 2015 to November 2016.

The study was conducted on all the plateletpheresis, fulfilling the below mentioned criteria:

Donor selection criteria for blood donation included(Saran 2003)- Donor should be in good health, physically fit and mentally alert, age group 18-60 years, weight >45Kg, Haemoglobin >12.5g/dl., Haematocrit >38%, Body temperature was not >37.5 C, The site of venipuncture was free of any skin lesions, pulse was regular and frequency was between 60- 90 beats/min and blood pressure <160 mmHg systolic and <100 mm Hg diastolic

Some other specific donor selection criteria for plateletpheresis included:

1. Platelet count >150x 10^9 cells/L
2. Negative serological marker for HIV 1&2, HBsAg, HCV, VDRL & Malaria
3. In the present study ABO&Rh compatible donors were selected for Plateletpheresis.
4. Minimum 8 weeks interval between whole blood donation and subsequent Plateletpheresis.
5. If it became impossible to return the donor's red cells during Plateletpheresis then atleast 8 weeks were allowed to elapsed before a subsequent Plateletpheresis was done unless the extracorporeal red cell volume was less than 100ml
6. Minimum interval between two Plateletpheresis donation was atleast 48 hrs. a donor was not allowed to undergo the procedure more than 2 times in a week or 24 times in a year

A. Pre-donation activities:

- Written consent for the plateletpheresis procedure by the treating consultant were checked
- Donor questionnaires were filled up and answered by the donors.
- The age and weight of the donors were noted
- Medical examination of the donors was done
- The donors were checked for good venous access in both arms and the arm with better venous access was chosen for the procedure.

- Written Consent of the donors were taken after explaining the procedure to the donors in the language understood by them.
- The sample for PT and APTT was taken in sodium citrate vial in ratio of 1:9.
- Screening for Transfusion Transmitted diseases were done for HIV, HbsAg, VDRL, HCV, Malaria using rapid kits

B. Activities related to Donors;

- The donors were encouraged to drink some water and loosen tight clothing and lie comfortably.

C. Procedure:

- Physical inspection of the apheresis kit was done.
- Expiry of the bag, saline and anticoagulant were checked
- Then loading of kit was done on the machine
- The kits were checked for kinks or wrong install .The machine was then primed.
- Donor phlebotomies were done using standard guideline as written in the SOP

Plateletpheresis were done using COM. TEC, FRESENIUS Kabi apheresis machine using PLT-5d-SN Program with S5L sets which are closed system permitting the storage of platelets for up to 5 days. It is an intermittent flow centrifugation machine and requires one venepuncture site. Acid-citrate-dextrose formula A (ACD-A) was used as anticoagulant during procedures according to the manufacture's recommendations. The procedures were performed under all aseptic conditions. The machine has default ACD rate of 1.2ml/min/L and the ACD: Blood ratio of 1:9 for a donor with haematocrit of 40%.

- Donor monitoring (pulse, respiration, any discofort) was done during the procedure.
- Documentation of the procedure was also done.

D. Post-donation activities include:

- Examination of the vitals e.g. BP, pulse, Respiration.
- Any discomfort to the donor during the procedure was documented
- The post-donation samples were taken from the donors immediately after the procedure as soon as the donors are disconnected from the Apheresis machine.Blood in ratio of 1:9 in sodium citrate vial for PT and APTT.

i) PT was done using R2 Diagnostic Kits using Phosphoplastin RL reagent.

Phosphoplastin RL is intended for use in one-stage prothrombin time (PT) test and PT based haemostasis assays.

ii) APTT – It was done using R2 Diagnostic Kits using Phospholin ES reagent

Phospholin ES APTT reagent is an ellagic acid based reagent with soybean phospholipids, buffers, stabilizers and preservatives. Phospholin ES is intended for use as a activated partial thromboplatin (APTT) time reagent. The APTT test is a qualitative assay used in routine coagulation screening of patient plasma to detect deficiencies in the intrinsic pathway.

After the procedures were complete the bags were kept at room temperature for 1 hour and then were stored in the Platelet Agitator Incubator. Visual check of the products was done before issuance.

STATISTICAL ANALYSIS

All the observations were charted in MS Excel sheet and statistical analysis was done. The data was expressed as mean± SD. The mean pre-donation and post-donation values of the donor coagulation parameters were compared using paired student t test. A p value <0.05 was taken as significant.

RESULTS

A total of 57 plateletpheresis procedures were performed in the above mentioned study period. Plateletpheresis procedures were done on Fresenius Kabi COM.TEC Apheresis machine using closed system apheresis kits. All donors were males in our study and no female underwent plateletpheresis during this period. The mean pulse rate was 75.40± 7.97 beats/min and mean B.P 120.25/79.23± 6.97/5.78mmHg. The mean volume of platelet product was 202.37 ±9.45 ml. Only the donors fulfilling the donor criteria strictly were included in the study.

Maximum no. of donors were in age group of 29-38 years with mean of 35.14 ±8.31 years. Maximum number of donors had weight between 70-79 kgs. No donor had weight less than 60 kgs. The mean weight of the donors was 75.33± 9.81 Kgs.

The mean post-donation PT showed a mean of 13.79 ±0.79secs where as the pre-donation PT recorded was 13.28± 0.78 secs and therefore, it was observed that rise in PT was significant (p<0.001) with a change of 3.77%

The increase in APTT was found to be 4.89% as compared to pre-donation values. The mean post-donation APTT showed a mean of 32.61± 2.28 secs where as the pre-donation APTT recorded was 30.82 ±1.96 secs

TABLE 1 COMPARISON OF PRE AND POST-DONATION MEAN, UPPER LIMITS AND LOWER LIMITS

PARAMETER	PRE-DONATION			POST-DONATION		
	Mean	Upper limit	Lower limit	Mean	Upper limit	Lower limit
PROTHROMBIN TIME (in secs)	13.28	15	12	13.79	16.1	12
ACTIVATED PARTIAL THROMBOPLASTIN TIME(in secs)	30.82	36.2	28	32.61	38.2	29

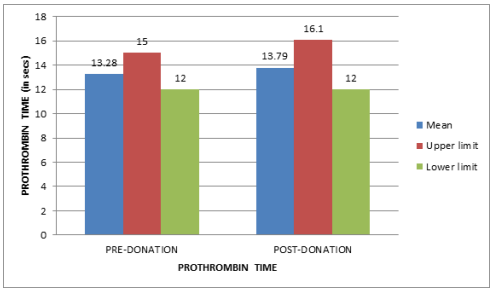

FIG-1 Comparison between pre and post-donation mean and range PT values

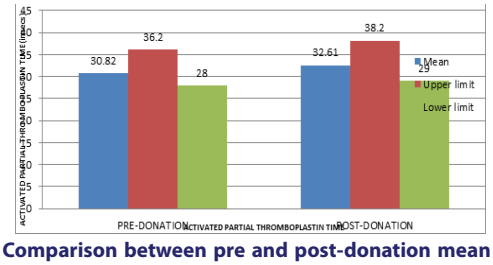

FIG-2 Comparison between pre and post-donation mean and range of APTT values

TABLE-2 POST-DONATION CHANGES IN DONOR PARAMETERS

Variables	Pre-donation Value (mean ±sd)	Post-donation Value (mean ±sd)	Change (%)	Statistical Significance
Prothrombin Time (in Secs)	13.28± 0.78	13.79 ±0.79	3.77	<0.001 t= 3.42
Activated Partial Thromboplastin Time(in Secs)	30.82 ±1.96	32.61± 2.28	4.89	<0.001 t= 4.5

4. DISCUSSION

Post-donation changes in donor PT

Two coagulation parameters were also studied in our study-Prothrombin Time (PT) & Activated Partial Thromboplastn Time (APTT)

The change in pre and post plateletpheresis Prothrombin Time (PT) was also analyzed in our study. The mean pre-donation PT value in our study was found to be 13.28±0.78 secs and the mean post-donation PT was 13.79±.79 secs . We found that that post-donation PT showed A significant decrease in almost all the procedures ($p<0.001$). The mean decrease in the post-donation PT in our study was 3.77%.range of post-donation PT was 11.9 to 16.1secs.

Nadiah AKS et al (2013) recorded that the prothrombin time (PT) was significantly prolonged ($p<0.01$) after plateletpheresis but it was still within the normal range. The pre-d0nation mean PT was 9.15 ± 0.22 and post-donation PT was found to be 9.27 ± 0.31. It was postulated that there was prolonged PT/APTT after apheresis procedure, probably due to citrate from ACD-A solution. However it does not lead to systemic anticoagulation since it has a short in vivo half-life[10].

Beyan et al. (2005) studied effect of cell separator on coagulation in plateletpheresis donors. They compared the values obtained before and they found prolonged in PT. The mean pre-donation PT was found to be 1.14±0.11 secs and post-donation mean PT was 1.28±0.26 secs. The p value was 0.0028. Hence, the pre and post –donation difference was significant. In this study it was stated that citrate in anticoagulant ACD-A transiently binds ionized calcium and if sufficient ionized calcium is bound, there is minimal activation of platelets; however centrifugation and exposure to plastics also activates platelets and monocytes. This could lead to slight activation of the coagulation and/or fibrinolytic system which could explain change in PT.The differences in these tests were not high enough to cause any clinically significant bleeding episodes or thrombosis was observed[2]. Akay et al (2007) studied platelet function, coagulation and fibrinolytic system parameters in 20 healthy volunteer platelet apheresis donors. Platelet apheresis procedures were performed with the Fresenius AS-TEC 204 in this study. The prothrombin time (PT) was found prolonged[1].

Post-donation changes in donor APTT

The change in pre and post plateletpheresis Activated Partial Thromboplastn Time (APTT) was also analyzed in our study. The mean pre-donation APTT value in our study was found to be 30.82±1.96 secs and the mean post-donation APTT was 32.61±2.28 secs. We found that that post-donation APTT showed a significant decrease in almost all the procedures ($p<0.001$). The mean decrease in the post-donation PT in our study was 4.89%.Range of post-donation APTT was 29-37.8 secs.

Nadiah AKS et al (2013) the prothrombin time (PT) and activated partial thrombin time (APTT) was significantly prolonged (p value<0.01) after plateletpheresis but they were still within the normal range. The pre-donation APTT was 28.97 ± 2.89secs and post-donation APTT was 29.77 ± 2.81secs with the range of 24.10–35.50secs. . It was postulated that there was prolonged PT/APTT after apheresis procedure, probably due to citrate from ACD-A solution[10].

Beyan et al. (2005) reported unaffected APTT after plateletapheresis. The mean pre-donation T was found to be 32.97±3.90 secs and post-donation mean APTT was 35.26±7.17secs. The p value was >0.05. Hence, the pre and post –donation difference was not significant. They also stated that there was no correlation between the amount of ACD-A solution used and the magnitude of deviation in PT and APTT[2]. Akay et al (2007) reported that the pre and post-donation activated partial thromboplastin time was unaffected by plateletpheresis[1].

CONCLUSION

This study showed significant changes in blood coagulation parameters, however changes were within normal range. Reduction in blood coagulation parameters are compensated by humoral mechanism. With new technology of cell separator, the procedure will be terminated when there is technical or mechanical errors hence risk of hypercoagulable state from extracorporal hemostasis can be reduced therefore reduce the risk of thrombosis. In conclusion, plateletpheresis is a safe procedure for healthy donors.

REFERENCES

1. Akay, OM, Akin, E, Mutlu, F & Gulbas, Z. The effects of plateletpheresis on donor platelet function and coagulation. Trans Apher Sci 2007; 3:113-14
2. Beyan C, Kaptan K, Savasci S, Irfan A, Ozturk Y & Okmen B. Platelet apheresis affects prothrombin time and plasminogen dlevels in healthy donors. Transfus Apher Sci. 2005; 33(1):47-50
3. Brecher ME, AABB Technical Manual Maryland AABB's Premier Publication (2005)
4. Buyukkagnici DI, Ilhan O, Kavas GO, et al.Effects of plasma nitric oxide levels on platelet activation in single donor apheresis and random donor concentrates Transfus Apheres Sci, 36 (1) (2007), pp. 73-78
5. Gutensohn K, Geidel K, Brockmann M,et al.Binding of activated platelets to WBCs in vivo after transfusion Transfusion, 42 (10) (2002), pp. 1373-1380
6. Kamal AH, Tefferi A, Pruth R. How to Interpret and Pursue an Abnormal Prothrombin Time, Activated Partial Thromboplastin Time, and Bleeding Time in Adults. Mayo Clin Proc 2007; 82(7): 864–873.
7. Klein .H, Anstee DJ, Mollisons blood transfusion in clinical medicine Blackwell Publishing, Massachussetts (2005) 114–162
8. McLeod BC, Price TH, Owen H, Ciavarella D, Sniecinski I, Randels MJ & Smith JW. Frequency of immediate adverse effects associated with apheresis donation. Transfusion. 1998; 38(10): 938-43
9. Murphy MF, Pamphilon DH Practical transfusion medicine Willey-Blackwell, Oxford (2009)p. 421–429
10. Nadiah AKS, Asiah MN, Syimah ATN et al. Effects of plateletpheresis on blood coagulation parameters in healthy donors at National Blood Centre, Kuala Lumpur, Malaysia. Trans Apher Sci. 2013; 49: 507–10
11. Robinson EAE,Hazard of apheresis and the U.K. approach to guidelines Transfusion Sc, 11 (3-4) (1990), pp. 305-308
12. Silvestro G.D, Marson P, Russo G.E, et al.National survey of apheresis activity in Italy (2000)Transfus Apheres Sci, 30 (1) (2004), pp. 61-71
13. Stegmayr B.G, Ivanovich P, Korach JM, et al.World apheresis association-world apheresis registry Transfus Apher Sci, 32 (2005), pp. 205-207