

Effect of Plateletpheresis on Platelet Count and Mean Platelet Volume in Healthy Donors

Naghmana Mazher¹, Nazish Saqlain², Tooba Fateen³

- 1 Associate Professor, Department of Pathology, Fatima Jinnah Medical University, Lahore Pakistan
Manuscript writing, Data collection
- 2 Associate Professor, Department of Pathology, The Children's Hospital & UHS, Lahore Pakistan
Results compilation
- 3 Associate Professor, Department of Pathology, Allama Iqbal Medical College, Lahore Pakistan
Discussion writing

CORRESPONDING AUTHOR

Dr. Naghmana Mazher
Associate Professor, Department of Pathology,
Fatima Jinnah Medical University, Lahore Pakistan
Email: dnm4cf@gmail.com
Submitted for Publication: 30-07-2022
Accepted for Publication 16-12-2022

How to Cite: Mazher N, Saqlain N, Fateen T. Effect of Plateletpheresis on Platelet Count and Mean Platelet Volume in Healthy Donors. APMC 2023;17(1):25-28. DOI: 10.29054/APMC/2023.1148

ABSTRACT

Background: Plateletpheresis is a process by which platelets are extracted from the donor by a device which returns other portions of the blood to the donor. This process yields 8 times more platelets than platelet derived from whole blood. Currently, there are discrepancies in the reports on the extent of the reduction in platelet count after platelet donation by apheresis, and its impact on mean platelet volume (MPV). **Objective:** To Assess the effect of plateletpheresis on platelet count and mean platelet volume after platelet donation. **Study Design:** Cross-sectional study. **Settings:** Department of Hematology University of Children Health, Lahore Pakistan. **Duration:** Six months from January 2022 to June 2022. **Methods:** The procedure of plateletpheresis was done on 30 donors and effect of plateletpheresis procedure on post procedure Platelet count and MPV was observed. **Results:** In this study, 65 donors were included; all were healthy male donors, with mean weight 73.27 ± 11.38 Kg. Among 65 male donors, pre donation platelet levels showed that 12.3% donors had platelet level <200 , 58.5% had platelet levels of 200-350 and remaining 29.2% had platelets level >350 . Regarding pre donation mean platelet volume levels, 46.1% had mean platelet volume levels in the range of 5-8, 30.8% donors had mean volume of 8.1-12 and 23.1% had 12.1-15 mean platelet levels. After 1 hour of donation post platelet levels and mean platelet volume of donors were measured. Changes in platelet count were observed as 18.5% donors had <200 , 49.2% had platelet levels of 200-350 and 32.3% donors had platelet levels of >350 . Mean platelet volume after donation of 36.9% had 5-8, 27.7% donors had mean volume of 8.1-12 and 35.4% had 12.1-15 mean platelet volume levels. Mean pre and post donation platelet levels of donors was 285.7 ± 54.41 and 180.47 ± 45.17 respectively. Mean pre and post donation platelet volume was 8.67 ± 1.43 and 13.60 ± 2.90 respectively. The difference was statistically significant for platelet levels as well as mean platelet volume (p -value <0.001). **Conclusion:** This study concluded that platelet donation by apheresis although reduces both platelet count and MPV in donors, which is detrimental to the purposes of the procedure but decrease in platelet count after plateletpheresis procedure was more significant and there was minor change in MPV which is not significant.

Keywords: Mean platelet volume, Platelet count, Plateletpheresis.

INTRODUCTION

In patients with severe thrombocytopenia, such as those with bone marrow loss, chemotherapy, organ or stem cell transplants, or autoimmune or neurological illnesses, platelet transfusion is the most efficient method of controlling bleeding.^{1,2} Either whole blood donations or apheresis procedures can be used to obtain platelets.³ The use of platelet transfusions by apheresis has expanded during the past five years because it enables blood banks to more effectively meet the rising demand for blood components. For patients who have had several transfusions, are refractory, have alloimmunization, or

both, this method has substituted platelets taken from whole blood, according to studies.^{4,5}

In the process of platelet pheresis, adverse effects estimated to be fewer than 3% have been observed. Citrate poisoning is one of these, resulting in hypocalcemia, general discomfort, chills, cramping in the abdomen, nausea, vomiting, tremors, perspiration, tachycardia, and hypotension.⁶ Hematomas or thrombosis are a couple of the anticoagulant's other minor side effects. Moreover, occurrences of cardiac arrhythmia, adult respiratory distress syndrome, and

bleeding incidents account for roughly 0.003% to 0.02% of the procedure's fatality rate.⁷

This method yields 8 to 10 times more platelets than pooled platelet donation and recipient is at lower risk of exposing to weak or minor antibodies. (Denise H) The primary hemostatic plug's development and hemostasis maintenance depend on platelets. The main function of platelets in maintaining hemostasis is by the formation of primary hemostatic plug, which it does by getting adhered to the exposed endothelium with the subsequent formation of platelet aggregates at the site of vessel injury and the aggregates are strengthened by facilitating thrombin and fibrin formation.^{8,9} Platelet transfusions are needed either prophylactic or therapeutic. 4-6 units of platelets from a random donor are equivalent to one unit of platelets from a single donor apheresis. *armening - Modern Blood Banking & Transfusion Practices.*

METHODS

30 healthy platelet-apheresis donors were used in a cross-sectional study, and they were chosen according to the following criteria: Age between 18 and 50 years old; weight > 60 kg; hemoglobin > 12.5 gm/dl; platelets count > 200 × 10⁹/L; negative serological screening for HIV, hepatitis B, hepatitis C (HCV), syphilis, and malaria; absence of any sickness; none of them took NSAIDs; and with appropriate venous accesses. This study was conducted at Department of Hematology and transfusion Medicines at university of Child health, Lahore. Procedure details were explained to each donor and informed consent was taken before the procedure.

All donors underwent venipuncture using the ante-cubital vein. Each procedure began and ended with the monitoring of vital signs, and donors were kept under close observation for any negative outcomes. A 21-gauge needle was used to collect 3 ml of venous blood from each donor twice, once during the donor selection process prior to the apheresis operation and once an hour after the procedure was finished, with the least amount of stasis possible. The blood was then put into an EDTA vacutainer. Within 10 minutes of sample collection, all samples were processed for a complete blood count (CBC).

The calibrated hematology analyzer, SYSMEX XN-1000 was used for the platelet count and MPV. Screening was done using ELISA. After 1 hour of donation again sample was collected in EDTA vial and analyzed for the same parameters.

The descriptive analysis was done using SPSS 23.0. Frequency was calculated and difference between mean platelet count and mean platelet volume were analyzed using paired sample t-test.

RESULTS

The study place was at hematology department, University of Child Health, Lahore. In this study 65 donors were included; all were healthy male donors, with mean weight 73.27 ± 11.38 Kg.

Among 65 male donors, pre donation platelet levels showed that 08 (12.3%) donors had platelet level <200, 38 (58.5%) had platelet levels of 200-350 and remaining 29.2% had platelets level >350. Regarding pre donation mean platelet volume levels, 30 (46.1%) had mean platelet volume levels in the range of 5-8, 20 (30.8%) donors had mean volume of 8.1-12 and 15 (23.1%) had 12.1-15 mean platelet levels. After 1 hour of donation post platelet levels and mean platelet volume of donors were measured. Changes in platelet count were observed as 12 (18.5%) donors had <200, 32 (49.2%) had platelet levels of 200-350 and 21 (32.3%) donors had platelet levels of >350. Mean platelet volume after donation of 24 (36.9%) had 5-8, 18 (27.7%) donors had mean volume of 8.1-12 and 23 (35.4%) had 12.1-15 mean platelet volume levels. Table 1

Table 1: Frequency distribution of pre-post platelet count, and Mean Platelet Volume Values (n=65)

Variables	Frequency	Percentage %	
Pre-Platelet	<200	08	12.3%
	200-350	38	58.5%
	>350	19	29.2%
Post Platelet	<200	12	18.5%
	200-350	32	49.2%
	>350	21	32.3%
Pre MPV	5.0-8.0	30	46.1%
	8.1-12.0	20	30.8%
	12.1-15.0	15	23.1%
Post MPV	5.0-8.0	24	36.9%
	8.1-12.0	18	27.7%
	12.1-15.0	23	35.4%

MPV=Mean Platelet Volume

Mean pre and post donation platelet levels of donors was 285.7 ± 54.41 and 180.47 ± 45.17 respectively. Mean pre and post donation platelet volume was 8.67 ± 1.43 and 13.60 ± 2.90 respectively. The difference was statistically significant for platelet levels as well as mean platelet volume (p-value<0.001). Table 2

Table 2: Mean Comparison of Platelet count and Mean Platelet Volume (n=65)

Variables	Pre-donation	Post-donation	P-value
Platelet Count	285.7 ± 54.41	180.47 ± 45.17	<0.001
Mean Platelet Volume	8.67 ± 1.43	13.60 ± 2.90	<0.001

DISCUSSION

In our study the platelet count was significantly reduced after plateletpheresis procedure, while the MPV was increased slightly which is comparable with the study conducted by Altuntas *et al*, Tendulkar and Rajaddhyaksha Das *et al.*,¹⁰ Suresh *et al.*⁹ and Garg It means that this is the safe procedure and the platelet count returns to normal within few days and MPV count is not so significant.

About 36% of the healthy donors who had a pre-donation platelet count of less than $200 \times 10^9/L$ were found to have post-donation thrombocytopenia, according to Das and his collaborators. A drop in platelet count and an increase in MPV were also documented by Suresh and his coworkers. However, Sachdeva and his team discovered a minimal rise in the MPV and a 30.7% drop in post-donation platelet count.

Between 1980 and 2018, a meta-analysis study on the impact of plateletpheresis on platelet count and mean platelet volume was published. On 31 December 2019 Scopus, Science direct Med-line Pubmed, Scielo databases were searched from inception. Most studies were published in India and United States. Seven studies were done on 1176 donors to check the MPV and Twenty-five studies were done on 3769 donors to analyze the platelet count. Both the variables were reduced after the procedure. The decrease in platelet count was 14.3×10 (95% CI 11.4 to 17.1×10 /ul). The MPV decreased was 1.43fL (95% CI 0.3 to 2.5 fL). This analysis shows that the reduction after two weeks of donation is not significant in platelet count.¹¹ During the period of 2013-2014 in the Department of transfusion medicine a prospective Observational study was done. The study was done on fifty donors and platelet count was measured before donation and at 30 min and post donation after 7 and 14 days. Recovery of the platelet count was assessed over a two-week period. 30% of donors in group III (donors with platelet counts >2.75 lacs/l to 3.5 lacs/l) of the donors had results that were significantly examined ($p < 2.2$ lacs/l to 2.75 lacs/l). By the day 7 platelet count recovered in most patients.¹³ A retrospective study was performed at department of hematology and Transfusion medicine unit, s, University Sains Malaysia, Kubang Kerian 16150, Malaysia by Wan Haslindawani Wan Mahmood, Nor Suhaila Mat Rifin, Salfarina Iberahim, Long Tuan Mastazamin, Ripaah Mustafa. The study was performed on 76 donors and effect of platelet count and mean platelet volume was measured platelet count post donation is 193.4×10 /L and MPV post donation is 9.7fL. After the gift, the values drastically dropped. As a result of platelet donation by apheresis, donors' platelet counts and MPV decrease, which is counterproductive to the procedure's goals.^{14,15} This emphasises the necessity for

follow-up studies to assess additional factors including donation frequency and intervals.¹⁶⁻¹⁸

CONCLUSION

This study found that although platelet donation by apheresis lowers donors' MPV and platelet counts, which is counterproductive to the procedure's goals, the decrease in platelet count following plateletpheresis was more significant, and the change in MPV was only slight and not statistically significant.

LIMITATIONS

Amid the need of increased demand for plateletpheresis, donor safety must be ensured. Failing to do so can be detrimental to blood supply chain, hence stringent programs for post donation screening of plateletpheresis donors need to be established.

SUGGESTIONS / RECOMMENDATIONS

There is need for subsequent studies to evaluate variables, such as donation frequency and donation intervals, should be considered to evaluate if the reported decrease is easily compensated, without adverse consequences for donors, or if modifications in donor selection criteria are required.

CONFLICT OF INTEREST / DISCLOSURE

There are no conflicts of interest.

ACKNOWLEDGEMENTS

The authors would like to thank all the plateletpheresis donors for participating in this study.

REFERENCES

1. Aslan D. Harris Platelet Syndrome in Patients of Non-Indian Origin. *Journal of Pediatric Hematology/Oncology*. 2016;38(8):e326-e8.
2. Amanat ST, Shakoor HA, Raza M, Khan N, Rauf A. Clinical indications and adverse reactions of platelet apheresis. *J Coll Physicians Surg Pak*. 2015;25(6):403-6.
3. Harmening DM. *Modern blood banking & transfusion practices*: FA Davis; 2018.*
4. Landžo E, Petrović J, Karin M, Tomić I, Pravdić D. Influence of the type of plateletpheresis on the value of corpuscular elements in the blood donors. *Psychiatria Danubina*. 2017;29(suppl. 4):117-22.
5. Thokala RP, Radhakrishnan K, Anandan A, Panicker VK. Recovery of platelet count among apheresis platelet donors. *Journal of clinical and diagnostic research: JCDR*. 2016;10(12):EC01.
6. Gite V, Dhakane M. Analysis of pre-and post-donation haematological values in plateletpheresis donors. *Apollo Medicine*. 2015;12(2):123-5.
7. Moog R. Feasibility and safety of triple dose platelet collection by apheresis. *Journal of Clinical Apheresis: The Official Journal of the American Society for Apheresis*. 2009;24(6):238-40.
8. Naina HV, Harris S. Platelet and red blood cell indices in Harris platelet syndrome. *Platelets*. 2010;21(4):303-6.
9. Suresh B, Arun R, Yashovardhan A, Deepthi K, Sreedhar Babu K, Jothibai D. Changes in pre-and post-donation haematological parameters in plateletpheresis donors. *J Clin Sci Res*. 2014;3:85-9.

10. Tendulkar A, Rajadhyaksha SB. Comparison of plateletpheresis on three continuous flow cell separators. *Asian J Transfus Sci.* 2009 Jul;3(2):73-7.
11. Gil-Betancur A, Mantilla-Gutierrez CY, Cardona-Arias JA. Effect of plateletpheresis on total platelet count and mean platelet volume: A meta-analysis. *Journal of Evidence-Based Medicine.* 2020;13(3):206-14.
12. Joergensen MK, Bathum L. Reference intervals for mean platelet volume and immature platelet fraction determined on a sysmex XE5000 hematology analyzer. *Scandinavian journal of clinical and laboratory investigation.* 2016;76(2):172-6.
13. Maluf CB, Barreto SM, Vidigal PG. Standardization and reference intervals of platelet volume indices: Insight from the Brazilian longitudinal study of adult health (ELSA-BRASIL). *Platelets.* 2015;26(5):413-20.
14. Pabbi S, Tiwari AK, Aggarwal G, Sharma G, Marik A, Luthra AS, Upadhyay AP, Singh MK. Reference interval of platelet counts and other platelet indices in apparently healthy blood donors in North India according to Clinical and Laboratory Standards Institute guidelines: Need to redefine the platelet count cutoffs for repeat plateletpheresis donation? *Asian J Transfus Sci.* 2022 Jul-Dec;16(2):245-250.
15. Syal, Neha Kukar, Neetu Arora, Harkiran Kaur, Arunpreet Handa, Anjali Maharishi, R. N. Assessment of pre and post donation changes in hematological parameters and serum calcium and magnesium levels in plateletpheresis donors. *Journal of Family Medicine and Primary Care* 11(4):p 1489-1492, April 2022.
16. Chopra S, Kaur P, Bedi RK, Kaur G. Effect of double dose plateletpheresis on target yield and donor platelet recovery [published online ahead of print, 2021 Jun 18]. *Hematol Transfus Cell Ther.* 2021;S2531-1379(21)00083-3.
17. Patel J, Nishal A, Pandya A, Patel P, Wadhwani S. Factors influencing yield of platelet aphaeresis using continuous flow cell separator. *Int J Med Sci Public Health* 2013; 2:323-326.
18. Kumawat V, Goyal M, Marimuthu P. Analysis of Donor Safety in High Yield Plateletpheresis Procedures: An Experience from Tertiary Care Hospital in South India. *Indian J Hematol Blood Transfus.* 2020;36(3):542-549.