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EFFECT OF PLATELETPHERESIS ON PLATELET COUNT IN DONORS

Original Research

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ABSTRACT

Background: Platelet transfusion plays a vital role in the management of patients with hematological malignancies, oncological treatments, major surgeries, and organ transplants. Plateletpheresis has become increasingly popular for obtaining single donor platelets (SDP) due to its ability to yield high-quality products. However, the procedure may temporarily alter the donor's hematologic profile, especially platelet count. Monitoring these changes is essential to ensuring donor safety and maintaining sustainable donation practices.

Objective: To determine the mean change in platelet count in healthy donors one hour after undergoing plateletpheresis.

Methods: This quasi-experimental study was conducted in the Blood Bank and Hematology Laboratory at Lahore General Hospital. A total of 60 healthy donors aged 19–45 years, meeting standard eligibility criteria, were included. Venous blood samples (3 mL) were collected under aseptic conditions in K_2EDTA vacutainers before and one hour after the plateletpheresis procedure. Platelet counts were measured using the Nihon Kohden MEK 9100 hematology analyzer. Plateletpheresis was performed using the Fresenius Kabi COM.TEC C5L HemoCare system. Data were analyzed using SPSS version 26.0. A paired sample t-test was applied to evaluate the difference in platelet counts pre- and post-donation, considering $p < 0.05$ as statistically significant.

Results: Among the 60 donors, 59 (98.3%) were male and 1 (1.7%) was female. The mean age was 35.2 ± 10.8 years, and 8 donors (13.3%) were repeat participants. The mean platelet count prior to donation was $289.5 \pm 51.2 \times 10^9$/L, which decreased significantly to $218.0 \pm 48.6 \times 10^9$/L one-hour post-procedure ($p < 0.001$).

Conclusion: Plateletpheresis causes a statistically significant reduction in donor platelet counts shortly after the procedure, emphasizing the need for post-donation monitoring and guidelines to ensure donor safety.

Keywords: Apheresis, Hematological Parameters, Platelet Count, Platelet Donors, Plateletpheresis, Single Donor Platelets, Transfusion.

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INTRODUCTION

Megakaryocytes, the large progenitor cells located within the bone marrow, are responsible for the generation of platelets—anucleate cytoplasmic fragments that play a vital role in hemostasis. These circulating elements have a lifespan of approximately 7 to 10 days, with their levels maintained through a tightly regulated process of thrombopoiesis. Interestingly, platelet count and function exhibit diurnal variations in healthy individuals, with a modest 5% increase in counts observed throughout the day and heightened activation patterns in the morning (1). Functionally, platelets contribute to vascular integrity and coagulation by adhering to disrupted endothelium, primarily through interactions with subendothelial collagen and von Willebrand factor, initiating a cascade that promotes thrombin generation and fibrin deposition (2,3). Thrombocytopenia, defined as a platelet count below 150×10^9/L, is frequently encountered in critically ill patients and is often multifactorial in origin, reflecting the interplay of pre-existing comorbidities and ongoing pathological insults (4). Its presence is consistently associated with adverse clinical outcomes, notably an elevated risk of spontaneous bleeding. In such contexts, platelet transfusion serves as a cornerstone of supportive therapy, complementing efforts to treat the underlying condition. In clinical practice, platelet transfusions are indispensable for managing hematological malignancies, post-surgical bleeding, and transplant-related thrombocytopenia. Apheresis technology has advanced significantly and is now widely adopted for efficient platelet collection. Plateletpheresis, a form of apheresis, enables the selective extraction of platelets and a portion of plasma while reinfusing the donor's red and white blood cells, minimizing donor fatigue and reducing the recipient's exposure to multiple donors (5,6). Typically, one apheresis procedure yields the equivalent of 6 to 8 random donor platelet units, providing a safer and more consistent therapeutic option.

In addition to its role in donation, plateletpheresis is occasionally performed for therapeutic cytoreduction in cases of thrombocytosis. The procedure generally takes between 45 and 90 minutes. To uphold donor safety, the World Health Organization recommends a pre-donation platelet count exceeding 150×10^9/L as part of its donor eligibility criteria (7,8). However, despite these safety thresholds, post-procedural drops in platelet count have been documented. Previous studies have noted declines as significant as 112×10^9/L one hour after donation, underscoring the physiological impact of the procedure on the donor (9,10). Given the critical importance of maintaining a sustainable donor pool and ensuring donor well-being, it becomes essential to evaluate post-procedural hematological changes, particularly platelet count fluctuations. The objective of the present study was to determine the mean change in platelet count in healthy donors one hour after undergoing plateletpheresis. Findings from this study aim to refine donor selection and safety guidelines, thereby supporting the long-term viability of platelet donation programs within the community.

METHODS

This quasi-experimental study was conducted in the Blood Bank and Haematology Laboratory of Lahore General Hospital, Lahore, with the objective of evaluating the mean change in platelet count among donors one hour after undergoing plateletpheresis. A total of 60 healthy adult donors, comprising both first-time and repeat donors, were enrolled using a non-probability consecutive sampling technique. The sample size was calculated based on a confidence level of 95%, an expected mean change in platelet count of $25 \pm 8.9 \times 10^9$/L, and an absolute precision (d) of 0.03, as previously documented in the literature (8). Eligibility criteria included male and female donors aged 19 to 45 years, with a body weight of more than 50 kg and a pre-procedural platelet count of at least 150×10^9/L. Donors were excluded if they had any known congenital or acquired hematologic disorders, had undergone plateletpheresis within the past week, or had consumed non-steroidal anti-inflammatory drugs (NSAIDs) or acetylsalicylic acid in the seven days preceding the donation, as these factors may influence platelet function or count (11). Ethical approval was obtained from the Institutional Review Board (IRB) of Lahore General Hospital. Prior to participation, all donors were briefed on the study's objective and methods, and informed written consent was obtained. Demographic details including name, age, gender, and body weight were recorded before the procedure.

For data collection, 3 mL of venous blood was drawn under aseptic conditions into sterile vacutainers containing K2-EDTA (Beckton Dickinson, Franklin Lakes, NJ, USA) immediately before the procedure. Complete blood counts (CBC), including platelet counts, were analyzed using the Nihon Kohden MEK-9100 hematology analyzer. Plateletpheresis was then performed using the Fresenius Kabi

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COM.TEC C5L HemoCare system. One hour after the completion of the procedure, a second venous blood sample of 3 mL was drawn under similar aseptic precautions and processed on the same hematology analyzer. The mean change in platelet count was calculated by subtracting the post-procedure count from the pre-procedure value. Data were analyzed using SPSS version 26.0. Categorical variables, such as gender and donation status (first-time or repeat), were expressed as frequencies and percentages, while continuous variables like age and platelet counts were presented as mean ± standard deviation. A paired sample t-test was applied to assess the statistical significance of the difference in platelet counts before and after the procedure. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 60 healthy donors participated in the study, of which 59 (98.3%) were male and 1 (1.7%) was female. The mean age of the donors was 35.2 ± 10.8 years. Among these, 8 individuals (13.3%) were repeat donors, while the remaining 52 (86.7%) were first-time donors. The mean pre-donation platelet count was 289.5 ± 51.2 ×10⁹/L, whereas the mean post-donation platelet count recorded one hour after the procedure was 218.0 ± 48.6 ×10⁹/L. A paired sample t-test revealed that this decline in platelet count was statistically significant ($p < 0.001$), indicating a meaningful reduction in platelet levels following plateletpheresis. Subgroup analysis provided further insights into platelet count dynamics across different donor categories. Among male donors, the mean platelet count decreased from 280.6 ± 45.9 ×10⁹/L pre-donation to 209.3 ± 46.9 ×10⁹/L post-donation, reflecting a mean reduction of 71.3 ×10⁹/L. The single female donor exhibited a greater absolute decline, with platelet count dropping from 348.0 to 269.0 ×10⁹/L. Repeat donors showed a slightly smaller reduction (296.6 ± 61.9 to 227.4 ± 63.6 ×10⁹/L, mean change: 69.2 ×10⁹/L) compared to first-time donors (295.7 ± 46.3 to 223.6 ± 47.0 ×10⁹/L, mean change: 72.1 ×10⁹/L). Age-based comparison revealed that donors aged 19–30 years experienced a drop from 282.2 ± 58.3 to 209.6 ± 58.0 ×10⁹/L (mean reduction: 72.6 ×10⁹/L), while those aged 31–45 years had a reduction from 292.1 ± 39.7 to 221.4 ± 40.7 ×10⁹/L (mean reduction: 70.7 ×10⁹/L). These findings indicate a relatively uniform pattern of platelet count decline across subgroups, with only minor variations.

Table 1: Demographic Characteristics of Donors (n = 60)

Variable	Category	Frequency (n)	Percentage (%)	Mean ± SD
Gender	Male	59	98.3%	
	Female	1	1.7%	
Age (years)				35.2 ± 10.8
Donor Type	First-time	52	86.7%	
	Repeat	8	13.3%	

Table 2: Mean Comparison of Platelet count pre and post donation (n=60)

Variable	Pre-donation	Post-donation	p-value
Platelet Count	289.5 ± 51.2	218.0 ± 48.6	< 0.001*

Table 3: Stratified Platelet Count Analysis

Category		Pre-donation	Post-donation	Mean Change (×10⁹/L)
Gender	Male	280.6 ± 45.9	209.3 ± 46.9	71.3
	Female	348.0 ± 0.0	269.0 ± 0.0	79.0
Donor Type	Repeat	296.6 ± 61.9	227.4 ± 63.6	69.2
	First-time	295.7 ± 46.3	223.6 ± 47.0	72.1
Age Group	19–30 years	282.2 ± 58.3	209.6 ± 58.0	72.6
	31–45 years	292.1 ± 39.7	221.4 ± 40.7	70.7

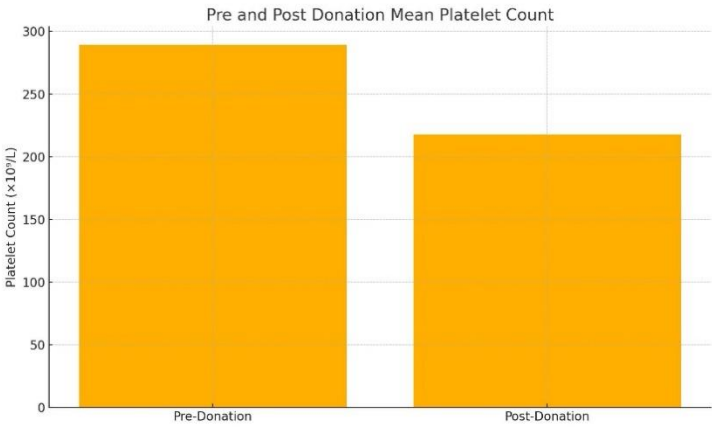

Figure 1 Pre and Post Donation Mean Platelet Count

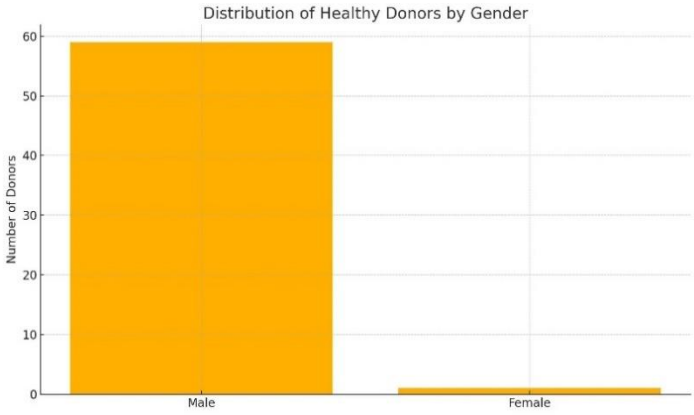

Figure 2 Distribution of Healthy Doners by Gender

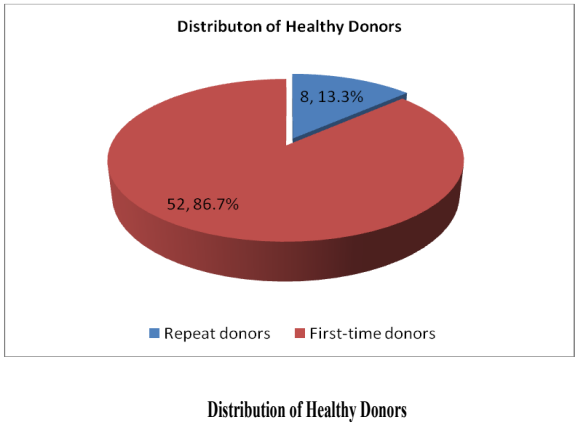

Figure 3 Distribution of Healthy Doners

DISCUSSION

Technological advancements in blood component separation have enabled the collection of higher doses of platelets from fewer donors through automated cell separators. These high-yield plateletpheresis techniques offer substantial benefits for transfusion medicine by enhancing platelet availability. However, they also raise significant concerns regarding donor hematologic safety. With plateletpheresis now routinely practiced in blood banks of many resource-limited countries, monitoring the physiological impacts of this procedure on donors has become increasingly critical. Platelet yield, an indicator of the quality of single donor platelets (SDP), directly affects post-transfusion platelet recovery in recipients. Consequently, donor-centered research is essential to maintain a safe and sustainable donation pool. In the present study, the donor population was predominantly male (98.3%), with most being first-time donors (86.7%), consistent with observations reported in similar settings where male predominance and recruitment of new donors were frequently noted (12-14). The study design, sampling method, and inclusion criteria largely aligned with previously published research (15,16), ensuring methodological consistency and comparability. The mean pre-donation platelet count was $289.5 \pm 51.2 \times 10^9$/L, which decreased significantly to $218.0 \pm 48.6 \times 10^9$/L one hour after the procedure, a statistically significant decline ($p < 0.001$). This finding closely mirrors prior studies where pre-donation counts ranged around $285.7 \pm 54.41 \times 10^9$/L and dropped to approximately $180.47 \pm 45.17 \times 10^9$/L post-donation, reinforcing the reproducibility of this hematologic response (17,18).

Moreover, another investigation involving 76 donors found that platelet count decreased to 193.4×10^9/L post-donation, with a concurrent drop in mean platelet volume (MPV) to 9.7 fL—further supporting the observation that plateletpheresis significantly impacts donor platelet indices (19,20). Although these changes are typically transient, their recurrence with repeated procedures raises valid concerns about donor eligibility, recovery intervals, and long-term hematologic health. The current study substantiated that even a single

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plateletpheresis session leads to a notable decline in platelet count, affirming the necessity of establishing standardized post-donation recovery protocols (21). While the results are in agreement with existing literature and affirm the safety of the procedure within defined parameters, several limitations were identified. The study was conducted at a single center, limiting generalizability to wider populations. Furthermore, donor follow-up was not incorporated, restricting insight into the duration of recovery and the potential cumulative impact of repeated donations. Financial constraints also precluded the assessment of additional hematological parameters such as MPV, which could have offered more nuanced understanding of platelet quality changes. Importantly, no correlation was explored between donation intervals and platelet recovery, which remains an area of critical interest for optimizing donor scheduling and retention strategies. Despite these limitations, the study contributes valuable local data regarding the immediate hematologic effects of plateletpheresis and reinforces the importance of donor monitoring. Future research should incorporate longitudinal follow-up, multicenter participation, and expanded hematologic profiling to better understand donor recovery patterns and inform evidence-based guidelines for safe apheresis practices.

CONCLUSION

The study concluded that platelet donation through apheresis leads to a noticeable reduction in donor platelet counts, highlighting an essential consideration for donor safety. This decline, although expected, underscores the physiological impact of the procedure and raises the importance of carefully monitoring donor parameters. The findings contribute to the broader understanding of post-donation hematologic changes and emphasize the need for future investigations to explore the influence of donation frequency and intervals. Such efforts would support the development of more comprehensive guidelines aimed at safeguarding donors while maintaining the efficiency and sustainability of plateletpheresis programs.

AUTHOR CONTRIBUTION

Author	Contribution
Sara Ambreen*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Ayesha Saleem	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Sidra Rasool	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Nazish Saqlain	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Ambareen Hamid	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Umbreen Imtiaz	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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