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Original Research Paper

Pathology

A PROSPECTIVE ANALYTICAL STUDY OF HAEMATOLOGICAL PARAMETERS PRE AND POST DONATION IN PLATELETPHERESIS DONORS IN A TERTIARY CARE HOSPITAL

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ABSTRACT **Background:** Plateletpheresis, or single donor platelet (SDP) collection, is commonly used in transfusion medicine to obtain therapeutic platelet doses from a single donor. While effective, the procedure can transiently alter hematological parameters, necessitating evaluation to ensure donor safety. **Objective:** To assess pre- and post-donation hematological changes in voluntary SDP donors at a tertiary care hospital. **Materials & Methods:** This prospective analytical study included 50 healthy male donors aged 18–50 years with pre-donation platelet counts ≥200 × 10 /L. Blood samples were collected before and immediately after plateletpheresis to measure hemoglobin (Hb), hematocrit (HCT), RBC count, WBC count, platelet count, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), platelet distribution width (PDW), and red cell distribution width (RDW). **Results:** Significant reductions were observed in RBC (5.67 ± 0.45 to 5.55 ± 0.43 ×10 /μL), Hb (15.11 ± 1.27 to 14.94 ± 1.24 g/dL), HCT (46.34 ± 3.02 to 46.20 ± 2.99%), platelet count (5.03 to 2.53 ×10^5/μL), PDW, and RDW ($p < 0.05$). WBC and MCH remained unchanged. Most donors (84%) experienced a mild platelet drop (<10%), and adverse events were minimal. **Conclusion:** Plateletpheresis is safe and well-tolerated, causing minor and predictable hematological changes. Proper donor selection, monitoring, and standardized procedures ensure donor safety and effective platelet collection.

KEYWORDS : Plateletpheresis, Single Donor Platelets (SDP), Hematological Parameters, Donor Safety

INTRODUCTION

Plateletpheresis is a therapeutic apheresis technique in which platelets are selectively collected from a single donor using automated centrifugation or separation systems, while other cellular components are returned to circulation. Modern platforms allow collection of a therapeutic dose (≥3×10^{11}) in a single session, reducing recipient exposure to multiple donors and enhancing transfusion safety [1]. Unlike Random Donor Platelets (RDPs), Single Donor Platelets (SDPs) offer higher yield, improved HLA compatibility, reduced alloimmunization, and lower transfusion-transmitted infection risk, making them preferred for immunocompromised patients and those requiring repeated support [2,3]. Each donation removes 20–30% of circulating platelets, potentially affecting hematological parameters such as platelet count, hemoglobin, hematocrit, and MPV [4]. Indian studies report transient post-donation declines with rapid recovery, emphasizing marrow compensatory mechanisms [5,6]. Given limited data from Southern India, this study aims to assess pre- and post-donation hematological changes in voluntary plateletpheresis donors at a tertiary care center in South India.

OBJECTIVES

1. To evaluate and compare hematological parameters (Hemoglobin, Hematocrit, RBC count, WBC count, Platelet count, MCV, MCH, PDW) before and immediately after plateletpheresis in healthy donors.
2. To assess the safety of plateletpheresis by determining significant hematological changes following the donation procedure.

MATERIALS AND METHODS

Study Design, study setting & Study Duration

A prospective analytical study was undertaken at Blood Bank and the Upgraded Pathology Department of Osmania General Hospital (OGH), Hyderabad to assess hematological changes in voluntary donors before and after plateletpheresis. The study was carried out over a two-year period, beginning from the date of Institutional Ethics Committee (IEC) approval and continuing until completion of data collection.

Study Subjects

The study population included voluntary, healthy individuals who underwent single donor platelet donation at the Blood Bank of Osmania General Hospital. These donors were regularly screened as part of routine blood bank protocol.

Inclusion Criteria

Individuals were eligible for participation if they:

- Were between 18 and 50 years of age
- Weighed ≥50 kg
- Had a pre-donation platelet count ≥200 × 10 /L
- Had adequate antecubital venous access
- Were non-reactive for transfusion-transmissible infections (HIV, HBV, HCV, VDRL, and Malaria)
- Were clinically fit as per standard blood donor selection criteria
- Provided written informed consent in a language they understood

Exclusion Criteria

Donors were excluded if they:

- Were younger than 18 or older than 50 years
- Weighed <50 kg
- Had a platelet count <200 × 10 /L prior to donation
- Tested seroreactive for any TTI
- Had known comorbidities such as hypertension, diabetes, or immunosuppression
- Presented with blood pressure >150/90 mmHg
- Declined consent or were deemed medically unfit

Sample Size

A total of 50 eligible plateletpheresis donors were included by convenience sampling.

Methodology

Ethical clearance was obtained from the Institutional Ethics Committee of Osmania Medical College, and written

informed consent was taken from all participants in their vernacular language. Donors underwent standardized pre-donation evaluation, including medical history, physical examination, and transfusion-transmissible infection screening. Venous access was assessed, and the optimal vein selected for apheresis. Plateletpheresis was performed using automated systems, such as the Fresenius COM.TEC, with sterile disposable kits, following manufacturer guidelines and blood bank SOPs. Blood samples were collected immediately before and after the procedure to assess hemoglobin (Hb), hematocrit (HCT), RBC and WBC counts, platelet count, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and platelet distribution width (PDW) using an automated hematology analyzer calibrated per laboratory QC protocols. Donors were monitored for adverse events, including tingling, dizziness, hypotension, citrate reactions, or venipuncture complications, and all symptoms were documented and managed according to standard guidelines.

Study Tools

The study utilized:

- A pretested donor questionnaire for demographic and clinical data
- Standard phlebotomy equipment and plateletpheresis kits
- SDP collection bags
- Automated hematology analyzers for laboratory assessment

Statistical Analysis

Data were entered in Microsoft Excel and analyzed using SPSS version 27.0. Pre- and post-donation hematological parameters were compared using the paired t-test. A p-value <0.05 was considered statistically significant.

Ethical Considerations

IEC approval was obtained prior to commencing the study. Donor confidentiality was maintained throughout. Participation was voluntary, with donors retaining the right to withdraw at any stage without affecting their eligibility for future donations.

RESULTS

This prospective observational study evaluated pre- and post-donation hematological parameters in 50 plateletpheresis donors. The majority of the donors were aged between 21–30 years, with a mean weight of approximately 64.8 ± 7.2 kg. All participants were male, reflecting the common donor pool demographic in the studied institution.

Table 1. Baseline Characteristics Of Plateletpheresis Donors (N = 50)

Parameter	Mean ± SD	Median	Range
Age (years)	31.62 ± 6.27	31.5	20–45
Weight (kg)	69.82 ± 9.15	70.0	52–88

The study population consisted of 50 healthy plateletpheresis donors with a mean age of 31.62 ± 6.27 years, indicating that most donors were young adults, with ages ranging from 20 to 45 years. The average donor weight was 69.82 ± 9.15 kg, reflecting a predominantly well-nourished donor group, with weights spanning from 52 to 88 kg.

Table 2. Comparison Of Hematological Parameters: Pre- vs post-Plateletpheresis

Parameter	Pre-Donation (Mean ± SD)	Post-Donation (Mean ± SD)	p-value
RBC (mill/μL)	5.67 ± 0.45	5.55 ± 0.43	0.0000
WBC (/μL)	7064 ± 1884	7064 ± 1884	-
Hemoglobin (g/dL)	15.11 ± 1.27	14.94 ± 1.24	0.0000
Hematocrit (%)	46.34 ± 3.02	46.20 ± 2.99	0.0000
MCV (fL)	84.98 ± 3.57	84.62 ± 3.51	0.0000
MCH (pg)	27.54 ± 0.00	27.54 ± 0.00	-

Plateletpheresis resulted in a statistically significant reduction in several hematological parameters, including RBC count, hemoglobin, hematocrit, and MCV ($p = 0.0000$ for all), WBC counts showed no change between pre- and post-donation values.

Table 3. Platelet Indices & Red Cell Indices: Pre- Vs Post-donation

Parameter	Pre-Mean	Post Mean	p-value
Platelet Count (lakhs/μL)	5.03	2.53	0.0261
PDW (fL)	11.94	11.34	0.0000
RDW-SD (fL)	39.73	39.59	0.0000
RDW-CV (%)	13.84	13.79	0.0000

A significant decline in platelet count was noted after plateletpheresis, dropping from 5.03 lakhs/μL to 2.53 lakhs/μL ($p = 0.0261$). PDW also decreased significantly (11.94 to 11.34 fL, $p < 0.0001$). RDW-SD and RDW-CV showed minimal but statistically significant reductions ($p < 0.0001$), remaining within normal limits.

Table 4. Frequency Of Platelet Drop & Donor Adverse Events (n=50)

A. Platelet Drop Frequency Categories

Platelet Drop Category	Number of Donors (n)	Percentage (%)
>50% Drop	4	8%
30–50% Drop	0	0%
10–30% Drop	4	8%
<10% Drop	42	84%

Most donors (84%) experienced <10% platelet drop, and only 8% had a >50% decline, indicating that significant reductions were uncommon.

B. Donor Adverse Events

Type of Reaction	Number of Donors
No Reaction	42
Citrate Toxicity (Mild)	5
Vasovagal Episode	2
Local Hematoma	1

Adverse events were minimal, with 42 donors reporting no reactions; mild citrate toxicity was the most frequent event (5 cases), followed by rare vasovagal episodes (2) and a single local hematoma.

Hb and HCT are strongly correlated ($r = 0.75$), as expected. HCT correlates negatively with PDW and RDW-CV, indicating an inverse relationship with platelet variability. Correlation with MCH and MCV supports integrated erythrocyte indices. Reveals meaningful biological relationships between red cell and platelet parameters, supporting internal consistency.

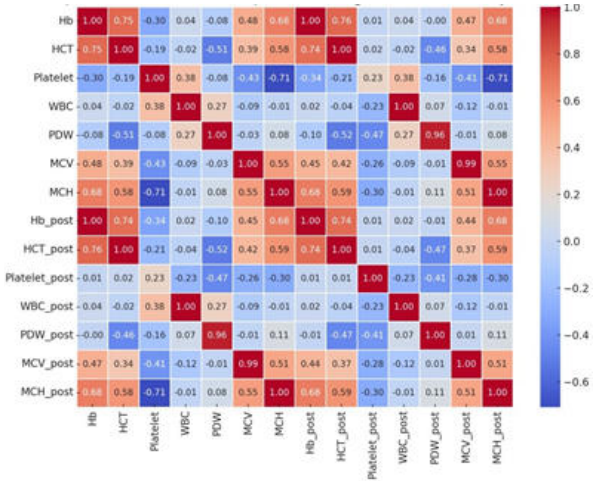

Figure 1: Correlations between hematological parameters pre- and post-procedure.

DISCUSSION

The present study evaluated hematological changes associated with plateletpheresis among healthy donors, demonstrating measurable but clinically acceptable alterations post-donation. Statistically significant reductions were observed in RBC indices, including RBC count, hemoglobin, hematocrit, and MCV; however, all values remained within normal physiological limits without causing symptomatic anemia. Similar findings reported by Sharma et al. (2024) attribute these changes to transient hemodilution, minor extracorporeal loss, and mild cellular trauma from centrifugation during apheresis [7].

A post-procedural decline in platelet count was noted, reflecting the expected removal of 20–30% of circulating platelets during SDP collection. Most donors (84%) experienced only a mild platelet drop of <10%, highlighting stable platelet homeostasis. These changes stayed above safety thresholds, requiring no intervention, consistent with thrombopoietin-driven compensatory megakaryopoiesis.

Platelet indices showed significant changes, notably a reduction in platelet distribution width (PDW), indicating a temporary shift toward a more uniform platelet population. This may result from selective removal of larger or more active platelets or early replenishment by smaller marrow-derived platelets, as described by Umar et al. (2025) and Bassi et al. [8,9,10]. Mean platelet volume (MPV) remained unchanged, likely due to pre-analytical variability or analyzer calibration differences.

White blood cell counts remained stable, confirming preservation of leukocyte integrity and supporting immunological safety, in line with Sharma et al. (2024) [7]. Adverse events were minimal; 84% of donors had no reactions, while mild citrate toxicity, occasional vasovagal episodes, and a single local hematoma were self-limiting. These findings reaffirm that plateletpheresis is safe, well-tolerated, and associated with predictable, minor hematological changes when performed under standardized protocols.

CONCLUSION

Plateletpheresis causes statistically significant but clinically minor reductions in RBC indices, hemoglobin, hematocrit, and platelet counts, with most donors remaining within safe ranges. PDW decreases post-donation, reflecting early marrow compensation, while MPV and WBC counts remain stable. Adverse events are minimal and self-limiting, with no serious complications. These results confirm that plateletpheresis is safe and well-tolerated, and that careful donor selection and monitoring ensure both donor safety and effective platelet collection.

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