E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.48047/ijprt/16.01.289

Research Article

Adverse Reactions in Donor Plateletpheresis and Their Predictors: A Hospital-Based Study from Central India

Ishika Jain1, Aman Shakya2, Sushant Kumar*3, Ramu Thakur 4, Ashok Yadav5
1Third Year, Junior Resident, Department of Transfusion Medicine, MGM Medical College, Indore
2Post Graduate, Department of Transfusion Medicine, MGM Medical College, Indore
3Senior Resident, Department of Transfusion Medicine, MGM Medical College, Indore
4Associate Professor, Department of Transfusion Medicine, MGM Medical College, Indore
5 Professor and Head, Department of Transfusion Medicine, MGM Medical College, Indore
Corresponding Author
Sushant Kumar
Senior Resident, Department of Transfusion Medicine, MGM Medical College, Indore

Abstract:

Background and Aim:

Plateletpheresis plays an important role in modern transfusion medicine by enabling collection of platelets from a single donor, improving both product quality and transfusion safety. However, the procedure is not completely free of complications and may be associated with adverse reactions in donors, which can influence donor comfort and willingness for repeat donation. This study was conducted to assess the incidence, pattern, and predictors of adverse reactions in donor plateletpheresis at a tertiary care centre in Central India.

Materials and Methods:

This observational study was carried out in the Department of Transfusion Medicine at a tertiary care hospital of central India over a period of 18 months (January 2024 to June 2025). A total of 220 plateletpheresis procedures were included. Donors were selected as per standard eligibility criteria. Relevant demographic, laboratory, and procedural data were recorded. Any adverse events were noted and classified as mild, moderate, or severe. Statistical analysis was performed using SPSS version 20, and multivariate logistic regression was used to identify independent predictors.

Results:

Out of 220 procedures, 40 donors (18.2%) developed adverse events, while 180 (81.8%) had an uneventful donation. The most common reactions were citrate-related (55%), followed by vasovagal episodes (25%). Most reactions were mild in severity (75%), whereas severe reactions were uncommon (5%). On multivariate analysis, young age (<25 years), female gender (AOR 2.45), low body weight (<60 kg) (AOR 2.10), first-time donation (AOR 1.95), prolonged procedure duration (>90 minutes) (AOR 2.75), and low pre-donation platelet count (AOR 2.22) were found to be independent predictors of adverse reactions.

Conclusion:

Plateletpheresis is a safe procedure with a relatively low incidence of mostly mild adverse reactions. Identifying donors at higher risk and addressing modifiable factors during the procedure can further

improve donor safety and enhance the efficiency of plateletpheresis programs.

Keywords: Plateletpheresis, adverse reactions, apheresis donors, citrate toxicity, vasovagal reaction, donor safety, predictors.

Introduction:

Plateletpheresis is a specialized apheresis technique that has become an important part of modern transfusion services. It allows collection of platelets from a single donor, providing a higher yield and reducing exposure of recipients to multiple donors. With the increasing need for platelet transfusions in conditions such as hematological malignancies, chemotherapy-induced thrombocytopenia, and major surgeries, reliance on plateletpheresis has steadily increased compared to conventional whole blood–derived platelet concentrates [1].

Although it offers clear advantages, plateletpheresis is a relatively longer and more technically involved procedure than routine blood donation. Because of this, donors may occasionally experience adverse reactions. Most of these are mild and self-limiting, including citrate-related symptoms, vasovagal episodes, and small hematomas at the puncture site. Rarely, more significant reactions may occur, which can affect donor comfort and discourage repeat donations [2]. Since maintaining a safe and positive donor experience is essential in apheresis practice, minimizing these events is an important goal for transfusion services [3].

The incidence of adverse events during plateletpheresis varies widely across different studies, ranging from 2% to 20%, depending on donor characteristics, apheresis equipment, procedural protocols, and operator expertise [4]. Citrate toxicity, resulting from the anticoagulant used during the procedure, is one of the most commonly reported complications and may manifest as perioral tingling, paresthesia, or muscle cramps [5]. Vasovagal reactions, although less frequent, are also observed and are influenced by factors such as donor anxiety, hydration status, and first-time donation [6].

Multiple donor and procedure-related factors have been associated with the risk of adverse events. These include age, sex, body weight, baseline platelet count, volume of blood processed, duration of the procedure, and the type of apheresis system used [7]. Identifying such predictors helps in recognizing donors at higher risk and allows appropriate preventive measures to be taken, thereby improving both safety and efficiency of the procedure [8].

In India, where voluntary repeat donors play a key role in maintaining an adequate platelet supply, reducing adverse events is particularly important. However, data on the incidence and predictors of such reactions from tertiary care centers are still limited.

With this background, the present study was conducted to assess the incidence and pattern of adverse events in donor plateletpheresis and to identify their associated predictors in the tertiary care hospital, with the objective of improving donor safety and optimizing clinical practice.

Materials and Methods:

This hospital-based observational study was carried out in the Department of Transfusion Medicine at a tertiary care

hospital of Central India over a period of one and a half years, from January 2024 to June 2025. Approval was obtained from the Institutional Ethics Committee, and the study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was taken from all donors before enrolment and procedure.

All eligible donors presenting for plateletpheresis during the study period were included in the study. Donors were selected according to the standard guidelines prescribed by the Drugs and Cosmetics Act of India and the National Blood Transfusion Council (NBTC). Inclusion criteria comprised healthy individuals aged 18–60 years, with body weight ≥55 kg, hemoglobin ≥12.5 g/dL, platelet count ≥1.5 lakh/μL, and no history of recent illness, medication intake, or contraindications to apheresis. Donors with a history of chronic medical illness, bleeding disorders, or those unwilling to participate were excluded from the study.

Each donor underwent a routine pre-donation evaluation, which included medical history, physical examination, and basic investigations such as haemoglobin estimation, platelet count, blood pressure, pulse rate, and body weight. Plateletpheresis was performed using automated cell separators (continuous flow systems) as per standard operating procedures. Acid citrate dextrose (ACD-A) was used as the anticoagulant in a fixed ratio with whole blood throughout the procedure.

Donors were monitored continuously during the procedure for any untoward events. Any symptom or sign occurring during or immediately after plateletpheresis was recorded as an adverse event. These were further categorised as mild, moderate, or severe based on standard definitions. Common reactions observed included citrate-related symptoms such as perioral tingling, numbness, and muscle cramps, vasovagal episodes such as dizziness, sweating or syncope, and occasional local complications like hematoma formation.

All relevant information was recorded in a structured proforma, including donor demographics (age, gender), donor status (first-time or repeat donor), baseline laboratory values, procedural details such as duration and volume processed, and any adverse events encountered. Donors who developed reactions were managed immediately as per protocol, which included temporary pausing of the procedure, reassurance, oral or intravenous calcium supplementation when required, and fluid support.

The main outcome of the study was the incidence of adverse events during plateletpheresis. The secondary objective was to identify factors associated with these events. Data were entered into Microsoft Excel and analysed using SPSS version 20. Categorical variables were expressed as frequencies and percentages, while continuous variables were summarised as mean ± standard deviation. Associations between variables and adverse events were evaluated using multivariate logistic regression analysis. A p-value of less than 0.05 was considered statistically significant.

Results:

A total of 220 plateletpheresis procedures were performed during the study period. Table 1 presents the baseline characteristics of the 220 plateletpheresis donors included in the study. The mean age of donors was 28.6 ± 6.4 years, with the majority

belonging to the 18–25 years age group (40.9%), followed closely by 26–35 years (38.6%), while smaller proportions were in the 36–45 years (13.6%) and >45 years (6.8%) age groups, indicating that most donors were young adults. There was a marked male predominance, with 200 donors (90.9%) being male and only 20 (9.1%) female donors. Regarding donor status, 125 donors (56.8%) were repeat donors, while 95 (43.2%) were first-time donors, showing a higher proportion of experienced donors in the study population. In terms of body weight, most donors (73.6%) weighed ≥60 kg, while 26.4% had a weight of <60 kg, with a mean body weight of 64.8 ± 7.5 kg. The mean baseline platelet count of donors was 2.45 ± 0.52 lakh/µL, indicating generally adequate hematological status for plateletpheresis. Overall, the donor population predominantly consisted of young, male, repeat donors with satisfactory body weight and normal baseline platelet counts

.

Table 1: Baseline Characteristics of Plateletpheresis Donors (n = 220)

Variable		Value (n or mean ± SD)	Percentage (%)
Age (years), mean ± SD	18–25	90	40.9
	26–35	85	38.6
	36–45	30	13.6
	>45	15	6.8
Gender	Male	200	90.9
	Female	20	9.1
Donor Type	First-time	95	43.2
	Repeat	125	56.8
Weight (kg), (mean ± SD = 64.8 ± 7.5)	<60 kg	58	26.4
	≥60 kg	162	73.6
Platelet count (lakh/µL)		2.45 ± 0.52	----

Table 2 shows the overall incidence of adverse events observed during plateletpheresis among the 220 procedures performed in the study. Out of the total donors, 180 (81.8%) did not experience any adverse event and completed the procedure without complications, while 40 donors (18.2%) developed at least one adverse event during or immediately after plateletpheresis.

Table 2: Incidence of Adverse Events (n = 220)

Outcome	Number (n)	Percentage (%)
No Adverse Event	180	81.8%
Adverse Event	40	18.2%
Total	220	100%

Table 3 describes the distribution of different types of adverse events observed among the 40 donors who developed complications during plateletpheresis. The most common adverse event was citrate-related reactions, seen in 22 donors (55.0%), making it the predominant complication, typically related to the anticoagulant (ACD-A) used during the procedure. Vasovagal reactions were the second most frequent, occurring in 10 donors (25.0%), which are generally associated with donor anxiety, pain, or transient autonomic response during donation. Hematoma formation was observed in 5 donors (12.5%), likely related to venipuncture-related technical factors. The remaining 3 donors (7.5%) experienced other minor complications.

Table 3: Types of Adverse Events Observed (n = 40)

Type of Adverse Event	Number (n)	Percentage (%)
Citrate-related reactions	22	55.0%
Vasovagal reactions	10	25.0%
Hematoma	5	12.5%
Others	3	7.5%
Total	40	100%

Figure 1 shows that most adverse events were mild (75%), presenting with transient and self-limiting symptoms. Moderate reactions (20%) required minimal intervention such as calcium or fluids, while severe reactions (5%) were rare and occasionally led to procedure interruption. Overall, the findings indicate that most complications during plateletpheresis were mild in nature, with severe events being uncommon.

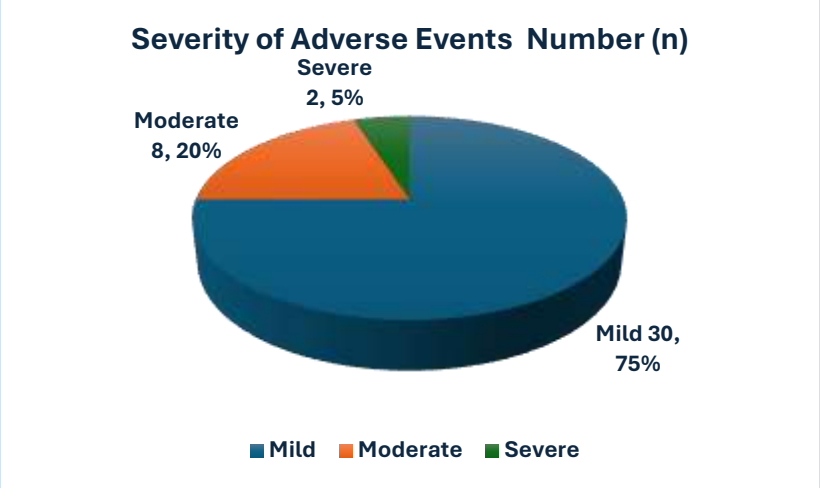

Figure 1: Severity of Adverse Events (n = 40)

Table 4 presents the results of multivariate logistic regression analysis identifying independent predictors of adverse reactions among plateletpheresis donors. After adjusting for confounding factors, several variables were found to be significantly associated with increased odds of adverse events. Donors aged <25 years had 1.82 times higher odds of developing adverse reactions (AOR 1.82; 95% CI: 1.05–3.16; p = 0.032). Female donors were at significantly higher risk, with 2.45 times increased odds compared to males (AOR 2.45; 95% CI: 1.28–4.68; p = 0.006). Similarly, donors with body weight <60 kg had 2.10 times higher risk (AOR 2.10; 95% CI: 1.20–3.68; p = 0.009). First-time donors were also more prone to adverse events, with nearly twice the risk compared to repeat donors (AOR 1.95; p = 0.018). A strong association was observed with procedure duration >90 minutes, which showed the highest risk (AOR 2.75; 95% CI: 1.50–5.05; p = 0.001), indicating that longer procedures significantly increase adverse event rates. Donors with low pre-donation platelet count also had higher odds of reactions (AOR 2.22; 95% CI: 1.18–4.18; p = 0.013).

Table 4: Predictors of Adverse Reactions among Plateletpheresis Donors (Multivariate Logistic Regression Analysis)

Variable	Adjusted Odds Ratio (AOR)	95% Confidence Interval (CI)	p-value
Age (<25 years)	1.82	1.05 – 3.16	**0.032**
Female Gender	2.45	1.28 – 4.68	**0.006**
Body Weight (<60 kg)	2.10	1.20 – 3.68	**0.009**
First-time Donor	1.95	1.12 – 3.40	**0.018**
Procedure Duration (>90 min)	2.75	1.50 – 5.05	**0.001**
Volume Processed (>3 L)	1.68	0.95 – 2.98	0.074
Low Pre-donation Platelet Count	2.22	1.18 – 4.18	**0.013**

Discussion:

The present study assessed the incidence and predictors of adverse reactions among plateletpheresis donors in a tertiary care centre. The overall rate of adverse events was 18.2%, which falls within the range

reported in previous studies (approximately 4% to 20%). This variation across studies is likely related to differences in donor selection criteria, procedural techniques, and the type of apheresis equipment used [9,10]. In our study, most reactions were mild and resolved on their own, while severe reactions were uncommon. This supports the general view that plateletpheresis is a safe procedure when performed with appropriate monitoring and precautions.

Citrate-related symptoms were the most frequently observed adverse events, followed by vasovagal reactions. This is in line with existing literature, where citrate toxicity is consistently reported as the leading complication due to calcium binding by acid citrate dextrose during the procedure [9,11]. Vasovagal episodes also remain relevant and are often linked to factors such as anxiety, hydration status, and whether the donor is donating for the first time [12,13].

On multivariate analysis, several factors emerged as independent predictors of adverse reactions, including younger age, female gender, low body weight, first-time donation status, prolonged procedure duration, and lower pre-donation platelet count. These findings are broadly consistent with previous reports. Female donors and those with low body weight have been shown to have a higher tendency for both citrate-related symptoms and vasovagal reactions, possibly due to lower blood volume and greater physiological sensitivity to extracorporeal circulation [13,14,15,16].

Among all variables, prolonged procedure duration (>90 minutes) was the most important predictor of adverse events. This finding is supported by earlier studies, which suggest that longer exposure to citrate and extracorporeal circulation increases the likelihood of citrate toxicity [11,17]. First-time donors also had almost twice the risk of adverse reactions compared to repeat donors, which highlights the protective effect of prior donation experience and physiological adaptation over time [10,18].

Although higher processed blood volume (>3 L) was associated with increased odds of adverse events, it did not reach statistical significance. This suggests that donor-related factors and procedure duration may have a stronger influence on adverse outcomes than volume alone [19].

Overall, the results emphasize the importance of careful donor selection and individualized procedural planning. Donors who are young, female, of low body weight, first-time donors, or those with lower platelet counts should be considered higher risk. In such cases, preventive measures such as adequate hydration, calcium supplementation, and optimization of procedure duration may help reduce the incidence of adverse events.

The strength of this study lies in its adequate sample size and the use of multivariate analysis to identify independent predictors. However, being a single-centre study, the findings may have limited generalizability. In addition, factors such as machine-specific settings and operator variability were not separately evaluated.

Future multicentre studies with larger datasets would be useful to validate these findings and to develop a more structured risk stratification model for improving the safety of plateletpheresis procedures.

Conclusion:

The present study shows that plateletpheresis is generally a safe procedure, with an overall adverse event rate of 18.2%. Most of these reactions were mild in nature and settled without any specific intervention. Citrate-related symptoms were the most frequently observed, followed by vasovagal episodes, while severe complications were uncommon. On multivariate analysis, young age, female gender, low body weight, first-time donation, longer procedure duration, and lower pre-donation platelet count were found to be independent predictors of adverse reactions. These results underline the need for proper donor selection and thorough pre-donation evaluation before proceeding with plateletpheresis. Attention to modifiable procedural factors is equally important. In donors identified as high risk, simple preventive measures such as adequate hydration, calcium supplementation, and avoiding unnecessarily prolonged procedures can help reduce the likelihood of adverse events. Overall, careful planning and monitoring can improve both donor safety and the smooth functioning of plateletpheresis services.

Source of Funding: NIL
Conflict of Interest: None

References:

1. McLeod BC. Apheresis: principles and practice. 3rd ed. Bethesda: AABB Press; 2010.
2. Vassallo RR. New paradigms in the management of adverse reactions to blood donation. Transfus Med Rev. 2007;21(1):13–24.
3. Newman BH. Donor reactions and injuries from whole blood donation. Transfus Med Rev. 1997;11(1):64–75.
4. Desai PD, Pandya AN. Adverse events in platelet apheresis donors: A study from a tertiary care hospital. Asian J Transfus Sci. 2014;8(2):132–5.
5. Bolan CD, Greer SE, Cecco SA, Oblitas JM, Rehak NN, Leitman SF. Comprehensive analysis of citrate effects during plateletpheresis. Transfusion. 2001;41(9):1165–71.
6. Wiltbank TB, Giordano GF, Kamel H, Tomasulo P, Custer B. Faint and prefaint reactions in whole blood donors: An analysis of predonation measurements and their predictive value. Transfusion. 2008;48(9):1799–808.
7. Singh B, Kaur P, Marwaha N. Adverse donor reactions during plateletpheresis in a tertiary care center. Asian J Transfus Sci. 2015;9(2):146–50.
8. Makar Y, Siddiqui S, Atif M, et al. Frequency and predictors of adverse reactions in platelet apheresis donors. J Coll Physicians Surg Pak. 2017;27(12):743–6.
9. McLeod BC. Apheresis: Principles and Practice. 3rd ed. Bethesda: AABB Press; 2010.
10. Newman BH. Donor reactions and injuries from whole blood donation. Transfus Med Rev. 1997;11(1):64–75.
11. Bolan CD, Greer SE, Cecco SA, et al. Comprehensive analysis of citrate effects during plateletpheresis. Transfusion. 2001;41(9):1165–71.
12. Wiltbank TB, Giordano GF, Kamel H, et al. Faint and prefaint reactions in whole blood donors. Transfusion. 2008;48(9):1799–808.
13. Vassallo RR. Management of adverse reactions to blood donation. Transfus Med Rev. 2007;21(1):13–24.

14. Desai PD, Pandya AN. Adverse events in platelet apheresis donors. Asian J Transfus Sci. 2014;8(2):132–5.
15. Singh B, Kaur P, Marwaha N. Adverse donor reactions during plateletpheresis. Asian J Transfus Sci. 2015;9(2):146–50.
16. Makar Y, Siddiqui S, Atif M, et al. Frequency and predictors of adverse reactions in platelet apheresis donors. J Coll Physicians Surg Pak. 2017;27(12):743–6.
17. Murphy MF, et al. Donor safety in apheresis procedures: a review. Vox Sang. 2013;105(3):191–202.
18. Katz L, et al. Predictors of vasovagal reactions in blood donors. Transfusion. 2015;55(4):789–98.
19. Goodnough LT, Shander A. Apheresis platelet donation: donor safety considerations. Blood Transfus. 2012;10(1):19–25.