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ORIGINAL RESEARCH ARTICLE

Pattern and Prevalence of Acute and Delayed Transfusion Reactions Following Blood Component Therapy

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Abstract

Introduction: The blood transfusion procedure is crucial from a therapeutic standpoint but may cause adverse effects to the patients through acute and delayed adverse transfusion reactions (ATRs). It is therefore crucial to maintain constant hemovigilance in order to reduce such occurrences. The objective of this study was to determine the frequency, type, and presentation of these ATRs.

Methods: The study is based on observations made by the researchers in the Department of Transfusion Medicine, L.N. Medical College and Research Center, Indore during the period from July 2025 to March 2026. Information from 160 transfused patients and 520 blood component units is used in the study. Transfusion reactions are classified clinically and biochemically and described.

Results: Of 160 patients who had adverse transfusion reactions, adult patients represented 78.7% and female patients 56.2%. Of 520 units of blood components transfused, packed red blood cells were the highest in percentage (36.5%), and they were responsible for 68.0% of all the reactions. Febrile non-hemolytic transfusion reaction accounted for 40.0% of all the reactions, and allergic reactions 36.0%. Fever accounted for 28.0%, and itching 24.0% of all the reaction.

Conclusion: The study concluded low incidence of mild adverse transfusion reactions, along with FNHTRs and allergic reactions as the most common associated with the PRBC transfusions.

Key words: Adverse Transfusion Reactions, Hemovigilance, Packed Red Blood Cells, Febrile Non-Hemolytic Transfusion Reaction, Blood Component Therapy

1 | INTRODUCTION

Blood transfusion is a significant medical procedure and along with every blood component transfusion, carries a risk for both acute and delayed transfusion reactions. There is also the risk of infection transmitted through the transfusion procedure for the recipient (1). Several major advancements have been taken place in the blood transfusion process, including the separation of the component, to minimize the use of whole blood, the introduction of apheresis technology and the nucleic acid test (2). The introduction of new technologies do not change the incidents of adverse events and the risk of bacterial contamination, alloimmunization, and ABO incompatibility remains with every transfusion (3). Adverse transfusion reactions (ATR) are an adverse events which occurs among patients at the time or after received with the blood or blood components. These reactions can be categorized into acute transfusion reactions which occur within 24 h and delayed transfusion reactions taking place within days to months of transfusion. Also the acute and delayed transfusion

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reactions can be classified into immune-mediated and non-immune-mediated (4). The estimated incidence of acute transfusion reactions ranges from 0.2% to 10%. Among these, the fatal outcome occurs 1 out of 2,50,000 transfusions (5). Common transfusion reactions such as febrile non-haemolytic transfusion reaction (FNHTR), allergic transfusion reaction (ALTR), haemolytic transfusion reaction (HTR), transfusion-related acute lung injury (TRALI), transfusion-associated cardiac overload (TACO), and transfusion-associated sepsis (TAS). The incidence of ATR is largely unknown for the underreporting and inconsistent collection of data as well as systemic barriers, which prevents the surveillance of the system (6). These data inconsistencies compromis safety of the patient, impedes trend analysis and also inhibit the effective implementation with strategic and evidence based preventions. Some of the urban medical centres reported the inadequate active participation effectively in the hemovigilance program India (HvPI). This has created a disjointed national picture, variability exists among the reported rates and the ability for the identification of the risks associated with (7). Because of these deficiencies is essential to strengthen the national haemovigilance system, which enhanced the transfusion procedure, and ensures blood safety in India. Hemovigilance is defined as the set of surveillance procedures of the whole transfusion chain, which reduces the adverse incidents or reactions between the donor and recipient to ensure safe and effective application of the blood components (8). The hemovigilance program was first started in France in 1994 and the program was followed by several countries (9, 10).

2 | METHOD

Research design

The study was a retrospective observational study to evaluate the pattern and the prevalence of the Acute and Delayed Transfusion Reactions which was followed by the blood component therapy. The study was conducted in the Department of Transfusion Medicine at L.N. Medical College and Research Centre, Indore, Madhya Pradesh, India for the period of 9 months. The study was conducted from the July 2025 to March 2026. A total of 160 patients were selected for the transfusion reactions which were followed by the blood or blood component transfusion. Data were collected from the transfusion reaction, patient information and laboratory documents. Verbal and written consent were taken for the study. Predefined inclusion and exclusion criteria were considered.

Inclusion criteria

- Patients of all age and both males and females who had been received with the blood or blood component transfusion were included.
- Patients those who were documented as suspected or confirmed with the transfusion reactions were included.
- Complete clinical information and transfusion reaction were included for the study.

2.1 |

2.1.1 | Exclusion Criteria

- Those who had received transfusions, but not reported with the transfusion reaction.
- Irrelevant or incomplete medical information or missed laboratory investigation reports were excluded.
- Adverse reactions not related blood transfusion were excluded.
- Duplicate records were excluded.

Procedure

The study had reviewed all reports of the transfusion reaction which was followed by the blood and blood component. The suspected reaction was assessed on based on the clinical presentation, laboratory findings, and standard criteria for diagnosis. Acute transfusion reactions included febrile non-haemolytic transfusion reaction (FNHTR), allergic transfusion reactions, transfusion-related acute lung injury (TRALI), transfusion-associated circulatory overload (TACO), and transfusion-associated sepsis (TAS) were categorized on based on the established diagnosis. Each of the transfusion reactions was evaluated for imputability grade for the determining the likelihood in relation with the transfusion. The incident of transfusion reactions was estimated

by dividing the total number of transfusion reactions by the total number of transfusion events.

Statistical analysis

Microsoft Excel was used for the data entry, and was analyzed by the use of the descriptive statistics. The frequencies and percentages were used for the categorical variables, while mean ± standard deviation (SD) or median within the range were used for the presentation of the continuous variables. SPSS version 27 was used for statistical analysis.

3 | RESULT

epresented the demographic parameter and the distribution on based on the departments of total 160 patients. 126 patients were adult, while only 34 cases were pediatric patients, those who had indicated ATR were frequently observed among adult patients. 90 patients were female with 70 male patients. The department wise analysis reported the high proportion of ATR cases from the Medicine department 48; 30.0%, which was followed by the Obstetrics and Gynecology as 34; 21.3%, 30; 18.8% of oncology and 29; 18.1% as Surgery. In the Pediatrics department, 11; 6.9% reported few reactions, while 4 cases (2.5%) were observed for the Orthopedics and Emergency Department. These result findings reported that ATR was observed among adult patients those who had received with the transfusions among clinical department.

Table 1. The demographic parameter and distribution on based on department among patients (160)

Variable	n	Percentage (%)
Age Group		
Pediatric (1–18 years)	34	21.3
Adult (20–86 years)	126	78.7
Gender		
Male	70	43.8
Female	90	56.2
Department-wise Distribution		
Medicine	48	30
Obstetrics & Gynecology (OBG)	34	21.3
Surgery	29	18.1
Oncology	30	18.8
Pediatrics	11	6.9
Orthopedics	4	2.5
Emergency	4	2.5
Total	**160**	**100**

Reported the distribution of the blood components which was transfused among the population of the study. Total 520 blood components units were transfused to 160 patients. The largest proportion was Packed Red Blood Cells (PRBCs), with 190 units, which indicated that the most frequent utilised component of blood was the red cell transfusion. 160 units (30.8%) was note for the Random Donor Platelets (RDPs), which was followed by the 154 units (29.6%) of Fresh Frozen Plasma (FFP). Comparatively, the Single Donor Platelets (SDPs) and Cryoprecipitate (CRYO) was observed to be frequent, which contributed to 7 (1.3%) and 9 (1.8%) units. The findings reported that the PRBCtransfusions was prevalent more over the platelet and plasma transfusions, which reported high clinical significance for the red cell replacement therapy.

hows the distribution of clinical signs and symptoms among 25 cases of ATR. The most reported and predominant symptom is fever, which affected 7 patients (28%), which revealed that the most common clinical signs and symptoms was followed by the blood transfusion. The second common man-

Table 2. 2: Distribution of Blood Components Transfused During the Study Period (N = 520 Units)

Blood Component	Units Transfused (n)	Percentage (%)
Packed Red Blood Cells (PRBC)	190	36.5
Random Donor Platelets (RDP)	160	30.8
Fresh Frozen Plasma (FFP)	154	29.6
Single Donor Platelets (SDP)	7	1.3
Cryoprecipitate (CRYO)	9	1.8
Total	520	100

ifestation was Itching which was reported among 6 patients (24%), which was followed by the dyspnoea among 5 patients (20%). 4 patients (16%) were observed with rashes, while the least common manifestation was tachycardia, commonly observed among 3 patients (12%). More than half of the cases reported febrile and allergic manifestations. The findings reported that most of the adverse transfusion reactions were mild to moderate in severity and were detected through clinical signs and symptoms which required evaluation and the management.

Table 3. 3: The distribution of the clinical signs and symptoms among ATR patients (N=25)

Clinical Manifestation	No. of Adverse blood transfusion reaction cases (n)	Percentage (%)
Fever	7	28
Itching	6	24
Dyspnoea	5	20
Rashes	4	16
Tachycardia	3	12
Total	25	100

Reported the distribution of ATR on based on the blood component transfused among 25 cases. PRBCs were related with high number of reactions accounted for 17; 68.0%, which was followed by the 4; 16.0% of the Random Donor Platelets (RDPs), while the Fresh Frozen Plasma (FFP), Single Donor Platelets (SDP), and Cryoprecipitate (CRYO) accounted for 1 or 2 reactions. The most frequently observed reaction was the Febrile Non-Hemolytic Transfusion Reaction (FNHTR) was 10; 40.0%, which was followed by the 9; 36.0% of the allergic reactions. 3 cases (12.0%) reported anaphylactic reactions, Transfusion-Associated Circulatory Overload (TACO), Transfusion-Related Acute Lung Injury (TRALI) and some other reactions were observed for about 4.0% of cases. Haemolytic Transfusion Reactions (HTRs) were observed at the study period. These findings indicated that FNHTR and allergic reactions were predominant and contains adverse events, with the PRBC transfusions accounted for majorly reported reactions.

Table 4. Distribution of Types of Adverse Transfusion Reactions According to Blood Components (N = 25)

Type of Transfusion Reaction	PRBC	RDP	FFP	SDP	CRYO	Total
Allergic Reaction	4	1	2	1	1	9
Febrile Non-Hemolytic Transfusion Reaction (FNHTR)	9	1	–	–	–	10
Anaphylactic Reaction	2	1	–	–	–	3
Transfusion-Associated Circulatory Overload (TACO)	1	–	–	–	–	1
Transfusion-Related Acute Lung Injury (TRALI)	–	1	–	–	–	1
Hemolytic Transfusion Reaction (HTR)	–	–	–	–	–	0
Others	1	–	–	–	–	1
Total	17	4	2	1	1	25

4 | DISCUSSION

The blood components of the patients in ICU were evaluated and analyse to determine the incidents of the acute transfusion reactions by the active surveillance procedure. The overall rate of transfusion reaction was 1.8%, along with the 0.4%, which was detected through passive reporting, while 1.4% was identified by the active surveillance, indicating substantial underreporting. The most predominant reaction was the Transfusion-associated circulatory overload (TACO), which was followed by the acute haemolytic transfusion reaction (AHTR). Leukodepleted packed red blood cells were implicated. The study analysed the demographical parameter of patients, transfusion related factors, clinical symptoms and laboratory and radiological outcomes, severity of the reaction and imputability by the use of the ISBT hemovigilance criteria (11). The study by Bassi et al., 2017, analysed the transfused blood component units and had detected 100 adverse transfusion reactions (ATRs), with the overall rate of incidence was 0.40%. Parameters analysed include the patient demographics, type of the transfused component, clinical signs and symptoms, laboratory investigations (ABO/Rh typing, DAT/IAT, blood cultures, haemolysis markers, renal and liver function tests, time of reaction and the clinical utility. The most common was the Febrile non-haemolytic transfusion reactions (FNHTRs) which was followed by the 24% of allergic reactions while the acute haemolytic reactions, bacterial sepsis, and ACE inhibitor-associated hypotension accounted to be as 1%. 76% of all reaction was caused by the Packed red blood cells, which emphasized the significance of the leukoreduction, standard form of reporting and strengthened the haemovigilance to ensure the safety of the transfusion (12). The study by the Krishnamurthy et al., 2020, reported 0.95% of adverse transfusion reactions. Similar parameters were observed including the demographical feature of patients, blood groups, component of transfusion, time of reaction, laboratory investigation including the ABO/Rh typing, repeat cross match, direct Coombs test, plasma haemoglobin, urine analysis, liver and renal function tests, peripheral smear and classification of the reactions. The most frequent was the Febrile non-haemolytic transfusion reactions, which was followed by 21% of allergic reactions, 8% hypotension and 2% of acute haemolytic reactions. Most of the reactions were related with the packed red blood cells, while the whole blood was observed with high relative risk. No delayed reactions or transfusion-related death was observed. The study reported leukodepletion, haemovigilance and measures to ensure safety of transfusion (13). The blood and blood component transfusion was analysed for the determination of the frequency and pattern acute transfusion reactions (ATRs). Some of the parameters were evaluated which include the number and type of blood components, incidence of ATRs, clinical presentation, and laboratory investigations which required for the classification of reactions. The total 77 ATRs were observed, with the overall rate of incidence of 0.21%. The most common was the Febrile non-hemolytic transfusion reactions (FNHTRs), which was followed by the allergic reactions (37.66%) and the 2.59% of the anaphylactic reactions. The findings highlighted that most of the reactions were mild and supported the continuous haemovigilance, prompt reporting and staff training for more transfusion safety and patient care (14).

5 | CONCLUSION

The study concluded that the incidence of adverse transfusion reactions (ATRs) among 160 transfused patients in a tertiary care hospital. The highest proportion of ATRs among adult (78.7%) and female patients (56.2%) was recorded. The Medicine department was the main source of ATRs (30.0%). The total number of reported ATRs was 25 with fever (28%) being the leading clinical presentation, followed by itching (24%) and dyspnea (20%), suggesting that febrile and allergic manifestations of ATRs were the major presenting conditions. The total number of blood component units was 520 with the highest percentage belonging to Packed Red Blood Cells (PRBCs) (36.5%). The highest number of adverse reactions (68.0%) was associated with PRBC transfusions. Febrile Non-Hemolytic Transfusion Reactions (FNHTRs) (40.0%) were the most common types of ATRs, while allergic reactions accounted for 36.0%. There were no hemolytic transfusion reactions. Most ATRs were mild to moderate.

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