Original Research

PATTERN AND FREQUENCY OF BLOOD TRANSFUSION REACTIONS: A THREE-YEAR RETROSPECTIVE STUDY

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ABSTRACT

Background: Transfusion of blood is an important intervention that is regularly carried out in tertiary hospitals. It involves several potential adverse reactions varying from mild allergic reactions to potentially fatal complications. Hence, continuous monitoring and analyzing of these transfusion reactions are crucial to guarantee patient safety and optimize transfusion practices. Recognizing the pattern and occurrence of these transfusion reactions in a tertiary hospital setting is crucial to enhance haemovigilance programs. Consequently, the aim of this study was to identify the pattern and occurrence of transfusion reactions in our GEMS Hospital's in-patients, as documented in our hospital's blood center.

Materials & Methods: This study utilized retrospective observational designs conducted in GEMS Hospital, a tertiary hospital, between January 2023 and December 2025. During the study duration, all transfusion reactions reported to our blood center due to blood and blood products transfusion were identified and analyzed using the institution's standard operation procedure.

Results: Throughout the study duration, a total of 27,319 units of blood and blood components were distributed. There was a total of 78 transfusion reactions, which resulted in an overall rate of 0.29%. The most prevalent transfusion reaction was Febrile Non-Haemolytic Transfusion Reaction, which totaled 37 (47.4%). Allergic reactions accounted for 31 (39.7%), while other reactions were 10 (12.8%).

Conclusion: In this study, the incidence of transfusion reactions was relatively low (0.29%) with the most common transfusion reaction being Febrile Non-Haemolytic Transfusion Reaction followed by allergic reactions.

Keywords: Blood Bank, Hemovigilance, Transfusion Reactions, Febrile Non-Haemolytic Transfusion Reaction (FNHTR).

INTRODUCTION

Blood transfusion is one of the most vital interventions practiced in current medicine that helps treat various medical conditions including anaemia, injuries, obstetric emergencies, hematological disorders, malignancies, and surgery. Nevertheless, blood or blood product transfusions carry the risk of certain side effects despite all progress achieved in screening donors, separating blood components, their storage, and performing tests on the compatibility of blood[1–3].

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Such side effects include mild transfusion reactions such as febrile non-hemolytic transfusion reaction (FNHTR) or allergic reaction, but also serious conditions, for example, transfusion-related acute lung injury (TRALI), transfusion-associated circulatory overload (TACO), anaphylactic reaction, and other conditions[4–5]. It was found out that the most frequent transfusion reactions in India are FNHTR and allergic reactions[6–9].

With the creation of the Hemovigilance Programme of India (HvPI), reporting and monitoring of transfusion reactions have been systematized in the country[10–11]. Nevertheless, there are certain peculiarities in the occurrence of transfusion reactions depending on the institution because of different characteristics such as the structure of patients, transfusion practices, types of components used, etc[12]. Institutional monitoring is critical for improving the situation regarding transfusion reactions.

In this regard, it was decided to conduct the current study in order to investigate the pattern of reactions, their frequency, and their distribution during three years in a tertiary care center compared with Indian literature.

MATERIALS AND METHODS

Study Design

A retrospective observational study was conducted with the objective of identifying the pattern and frequency of transfusion reactions reported in a specified period of time.

Study Setting and Period

This retrospective study was conducted at the Blood Centre of GEMS Hospital, a tertiary care teaching hospital in southern India, by reviewing records over a three-year period from 1st January 2023 to 31st December 2025.

Sample Size and Inclusion Criteria

The sample size involved all blood and blood products used during the study period and all the cases of reported transfusion reactions. Total 27,319 blood products were issued and 78 cases were studied during the study period. All cases with transfusion reaction reports were selected by reviewing the records maintained at the blood bank.

Inclusion criteria

- All patients having transfusion reactions during or after 24 hours of transfusion at study site.
- All transfusion reactions reported to the blood centre during the study period.
- All transfusion reactions due to all types of blood components (whole blood, PRBCs, platelets, FFP and cryoprecipitate).

Exclusion Criteria

- All patients having transfusion reactions outside study site.
- Incomplete documentation/transfusion reaction report.
- Suspected reactions without reporting to the blood bank.

Ethical Approval

The ethical approval of the study was obtained from the Institutional Human Ethics Committee (Registration Number - 02/IEC/GEMS&H/2026). This study being retrospective no ethical issues were faced while collecting the data. Informed consent had already been taken from all patients or attendants before transfusion at study institution.

Methods of Data Collection

The retrospective data of transfusion reactions was collected from the records of transfusion reaction reports, blood bank register books and reports on transfusion reaction investigation forms. The collected data include:

- Patient demography (age, gender, blood group)
- Clinical profile (diagnosis, reason for transfusion, history of transfusion)
- Transfusion related parameters (type of component transfused, volume, duration and rate of transfusion)
- Signs and symptoms of transfusion reaction.
- Laboratory investigation results (haemolysis check, Direct and Indirect Coomb's test and Repeat Grouping and Cross Matching).

All transfusion reactions were studied with respect to standard operating procedure according to hemovigilance guidelines. Clinical clerical checks, visual inspection of blood bags and laboratory investigations were done to classify the transfusion reaction.

Statistical Analysis

Collected data was recorded using Microsoft Excel and analysed using descriptive statistics. For categorical variables, frequencies and percentages were reported. Incidence of transfusion reactions was determined as number of reactions/number of components issued.

RESULTS

Table 1: Distribution of Total Components Used

S.No	Components	No.of Issues	Percentage
1	Whole Blood	868	3.18 %
2	Packed Red Cells	15805	57.85 %
3	Fresh Frozen Plasma	5009	18.34 %
4	Platelets	5563	20.36 %
5	Cryo Precipitate	74	0.27 %
	TOTAL	27319	100 %

Over the study duration, which is from January 2023 to December 2025, the number of blood units issued was 27,319. The largest number of blood components issued were packed red blood cells (PRBC) amounting to 15,805 (57.85%) while the second and third most frequent blood components issued were platelets, fresh frozen plasma, whole blood, and cryoprecipitate.

There were 78 cases of transfusion reactions reported resulting to 0.29% of reactions overall.

Table 2: Distribution of Transfusion Reactions Gender wise

Year	Male	Female	Total with Percentage
2023	05	07	12 (15.38%)

2024	17	18	35 (44.87 %)
2025	15	16	31(39.74 %)
TOTAL	37	41	78 (100%)

The highest number of reactions was observed in 2024 (35; 44.87%), followed by 2025 (31; 39.74%) and 2023 (12; 15.38%).Females (41; 52.56%) experienced slightly more reactions than males (37; 47.44%).

Table 3: Distribution of Transfusion Reactions Age Wise

Age inYears	Total with Percentage
<20	07 (8.97%)
21 - 30	10 (12.82%)
31 - 40	07 (8.97%)
41 - 50	08 (10.25%)
51 - 60	17(21.79%)
61 - 70	17(21.79%)
71 – 80	06(7.69%)
>80	06(7.69%)
TOTAL	78 (100%)

The majority of reactions occurred in patients aged 51–60 years (17; 21.79%) and 61–70 years (17; 21.79%), accounting for 43.58% of total reactions. Fewer reactions were noted in patients below 20 years (8.97%) and above 80 years (7.69%).

Table 4: Distribution of Transfusion Reactions Blood Group Wise with Year

Blood Group	2023	2024	2025	Total with Percentage
Group A	02	14	08	24 (30.77%)
Group B	04	04	09	17 (21.79%)
Group AB	01	02	04	07 (8.97%)
Group O	05	15	10	30 (38.46%)
Total	12	35	31	78 (100%)

Blood group O (30; 38.46%) showed the highest number of reactions, followed by Group A (24; 30.77%), Group B (17; 21.79%), and Group AB (7; 8.97%).

Table 5: Distribution of Transfusion Reactions Types

Type of Reaction	Percentage
Febrile Non Haemolytic Transfusion Reaction	37 (47.43%)
Allergic Transfusion Reaction	31 (39.74%)
Transfusion Associated Dyspnoea (TAD)	06 (7.69%)
Transfusion Related Acute Lung Injury (TRALI)	01 (1.28%)
Transfusion Associated Circulatory Over Load (TACO)	01 (1.28%)
Transfusion Associated Hypotension	01 (1.28%)
Anaphylaxis	01 (1.28%)
Total	78 (100%)

The most common transfusion reaction was Febrile Non-Haemolytic Transfusion Reaction (FNHTR) (37; 47.43%), followed by Allergic Transfusion Reaction (31; 39.74%).
Less common reactions included:

- Transfusion Associated Dyspnoea (TAD) – 6 (7.69%)
- TRALI – 1 (1.28%)
- TACO – 1 (1.28%)
- Hypotension – 1 (1.28%)
- Anaphylaxis – 1 (1.28%)

Table 6: Relative Frequency of Transfusion Reactions

Type of Reaction	Whole Blood	PRBC	PC	FFP	Cryo Precipitate	TOTAL

Febrile Non Haemolytic Transfusion Reaction	0	32	04	01	0	37
Allergic Transfusion Reaction	0	28	02	01	0	31
Transfusion Associated Dyspnoea (TAD)	0	05	01	0	0	06
Transfusion Related Acute Lung Injury (TRALI)	0	01	0	0	0	01
Transfusion Associated Circulatory Over Load (TACO)	0	01	0	0	0	01
Transfusion Associated Hypotension	0	01	0	0	0	01
Anaphylaxis	0	01	0	0	0	01
Total	0	69	07	02	0	78

Analysis of component-wise distribution revealed that the majority of transfusion reactions were associated with Packed Red Blood Cells (PRBCs) (69 out of 78; 88.46%). Platelet concentrates accounted for 7 reactions (8.97%), while Fresh Frozen Plasma (FFP) was associated with 2 reactions (2.56%). No transfusion reactions were reported with Whole Blood or Cryoprecipitate during the study period.

Among PRBC-related reactions, Febrile Non-Haemolytic Transfusion Reactions (32 cases) and Allergic Reactions (28 cases) were the most frequently observed. Platelet transfusions were mainly associated with FNHTR (4 cases) and allergic reactions (2 cases), while FFP transfusions accounted for 1 case each of FNHTR and allergic reaction.

Severe reactions such as TRALI, TACO, hypotension, and anaphylaxis were rare and were observed exclusively with PRBC transfusions (1 case each).

Table 7: Distribution of Transfusion Reactions Department Wise

Department	**TOTAL**
Medicine	38
Surgery	09
Obstetrics	07
Gynaec	03
Pediatrics	03
Ortho	11
Nephrology	03
Cardiology	04
TOTAL	78

Department-wise analysis showed that the highest number of transfusion reactions was reported from the Department of Medicine (38; 48.72%), accounting for nearly half of all reactions. This was followed by Orthopaedics (11; 14.10%), Surgery (9; 11.54%), and Obstetrics (7; 8.97%).

Fewer reactions were observed in Cardiology (4; 5.13%), Gynaecology (3; 3.85%), Paediatrics (3; 3.85%), and Nephrology (3; 3.85%).

The higher frequency of reactions in the Department of Medicine may be attributed to the larger number of transfusions administered to patients with chronic anaemia, haematological disorders, and other medical conditions requiring repeated transfusions.

DISCUSSION

The prevalence of transfusion reactions in the present study was found to be 0.29%, which is comparable with those reported from other Indian tertiary care hospitals ranging between 0.18% to 0.60%[1–4]. The variability in prevalence could be due to different practices followed in haemovigilance reporting, clinician awareness levels, and institutional protocols. The under-reporting of minor reactions in some studies has been highlighted previously as a limitation.[5]

As per the findings in other Indian centres, the most common transfusion reaction in our study was FNHTR, accounting for 47.43% of adverse events. In keeping with previous reports, Kaur et al.[6], Banerjee et al.[7], and Malik et al.[8] had similar findings in terms of the predominance of FNHTR in their cohort, accounting for around 40-55% of adverse reactions. FNHTR is believed to be caused by cytokine formation during blood storage and the immune reaction to donor leukocytes. Since the practice of leukoreduction is limited among many Indian centers, FNHTR remains predominant.

Among the remaining reactions, the most common was allergic reactions, accounting for 39.74%.

Allergic reactions have been observed in 30-45% of cases in previous studies conducted by Kumar et al.[2] and Patel et al.[9]. Usually, allergic reactions are minor in nature and involve a hypersensitive reaction to plasma proteins.

Of the total reactions in the current study, 7.69% were identified as TAD. The national hematovigilance surveillance data collected by HvPI show that about 2-6% of adverse reactions are related to respiratory complications, which include TAD[10],[11]. Agnihotri et al.[12] also reported respiratory reactions in a few patients. The slightly higher percentage in our case could be attributed to better clinical diagnosis and documentation of the same. Correct differentiation of TAD from TRALI and TACO is crucial.

Among the rare but severe reactions like TRALI, TACO, hypotension, and anaphylactic shock, all four reactions accounted for only 1.28% each. As seen in earlier studies conducted by Keshari et al.[13] and Gupta et al.[14], the incidence of severe transfusion reactions was relatively low. However, these adverse reactions should not be overlooked, as they can lead to serious consequences.[15]

A component-wise analysis demonstrated that 88.46% of all reactions were associated with Packed Red Blood Cells (PRBC), followed by platelets and FFP. Similarly, Patel et al.[9] and Raut et al.[16] have reported similar findings, which could be because of the higher utilization rate of PRBC for anemia-related problems.

Based on age-wise distribution, the reaction rate was higher among individuals in the age group of 51–70 years. This finding was in accordance with the reports provided by Sinha et al.[17] and Verma et al.[18]. The requirement for frequent blood transfusions in this age group due to underlying disorders is likely to be the cause of this phenomenon.

Department-wise distribution reflected the maximum number of reactions reported from the Department of Medicine, followed by Orthopaedics and Surgery. Similar results were found by Jain et al.[19] and Kabra et al.[20], wherein medical patients who require frequent transfusions formed the bulk of the reaction cases.

In summary, the results of the current study were in accordance with other national and institutional findings from India. Implementation of improved hemovigilance mechanisms, increased awareness among clinicians, proper documentation, and implementation of preventive strategies such as leukoreduction could further enhance transfusion safety in tertiary care settings.

CONCLUSION

Response to Objectives:

Transfusion reactions occurred at an overall low frequency (0.29%) with FNHTR forming the majority of reactions followed by allergic reactions. All reactions were mostly mild in nature whereas severe reactions were infrequent. PRBCs were responsible for maximum reactions while patients belonging to 51-70 years were at a high risk of transfusion reactions as were medical patients.

Practical Implications:

The current transfusion procedures are safe and efficient. However, since there are a large number of FNHTR reactions that take place, there is an urgent need for preventive actions to be undertaken by patients who frequently undergo blood transfusions.

Recommendations:

- Implement strict haemovigilance policies and reporting mechanisms
- Conduct regular training sessions for early identification and handling of reactions
- Conduct leukoreduction in high-risk patients
- Adequately follow guidelines and protocols during transfusion

Declaration:

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