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Adverse transfusion reactions following transfusion of blood and blood products in a tertiary care hospital: A step toward hemovigilance

Mrigen Choudhury[1], Zarika Ahmed[2], Aparna Dutta[3], Adity Sharma[4]

[1]Postgraduate Trainee, [2,3]Associate Professor, [4]Professor and Head, Department of Pathology, Assam Medical College and Hospital, Dibrugarh, Assam, India

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ABSTRACT

Background: Transfusion of blood and blood products is a double-edged sword, so it should be used judiciously. The primary aim of the centralized hemovigilance program is to improve transfusion safety. **Aims and Objectives:** To determine the frequency, distribution, and types of transfusion reactions (TRs) occurring in patients, reported to the blood center in a tertiary care hospital in North East India. **Materials and Methods:** A retrospective study was conducted in State of The Art Model Blood Center, Assam Medical College and Hospital for 1 year from July 2022 to June 2023. Data were collected from TR records as per the hemovigilance reporting format and analyzed. **Results:** During the study, 38,165 blood products were issued. 41 (0.11%) TRs were recorded, out of which 25 (61%) occurred with packed red cell transfusion followed by whole blood transfusion (39%). The most common type was febrile non-hemolytic TR (51.2%) followed by allergic reactions (39%). **Conclusion:** The frequency of adverse TRs was low (0.11%), which may be due to the management of a few cases by the treating clinician itself. Most reactions occurred with packed red blood cells (PRBC) transfusion, the most common type being febrile non-hemolytic TR, which may be due to the presence of leukocytes, inflammatory mediators in leftover plasma during PRBC preparation, which can be standardized by the use of leukoreduced blood products. Hemovigilance will help to strengthen the quality and safety of blood transfusion.

Key words: Adverse transfusion reaction; Allergic reactions; Blood transfusion; Febrile non-hemolytic transfusion reaction; Hemovigilance

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INTRODUCTION

Hemovigilance is a continuous process of data collection as well as analysis of blood transfusion-related adverse reactions to investigate their cause and outcomes, as well as prevent their occurrence or recurrence. It includes the identification, reporting, investigation, and analysis of adverse reactions and events in recipients and blood donors as well as incidents in manufacturing processes and, eventually errors and "near-misses." A hemovigilance system is an integral part of quality management in a blood system, triggering corrective and preventive actions, and for the continual improvement of the quality and safety of blood products and the transfusion process. The primary aim of the hemovigilance program is to increase the safety and quality of blood transfusion.[1,2]

Blood transfusion is a double-edged sword, which should be used judiciously. Although blood transfusion can be life-saving, it can also lead to certain adverse reactions which can be fatal.[2]

An adverse event (AE) that results in a patient during or after a transfusion of blood and blood products and for which no

Address for Correspondence:
Dr. Mrigen Choudhury, Post Graduate Trainee, Department of Pathology, Assam Medical College and Hospital, Dibrugarh - 786 002, Assam, India. **Mobile:** +91-8474839038. **E-mail:** mrigenchoudhury382@gmail.com

Table 1: Comparative studies of adverse transfusion reactions due to blood and blood components

Name of study	WB and PRBC (%)	Platelets (%)	FFP (%)
Kumar et al.[2]	42.8	37.75	19.38
Somagari et al.[3]	93.3	0.94	5.6
Payandeh et al.[8]	45.7	20.3	30.15
Bassi et al.[6]	91	8	1
Present Study (2023)	100	0	0

WB: Whole blood, PRBC: Packed red blood cells, FFP: Fresh frozen plasma

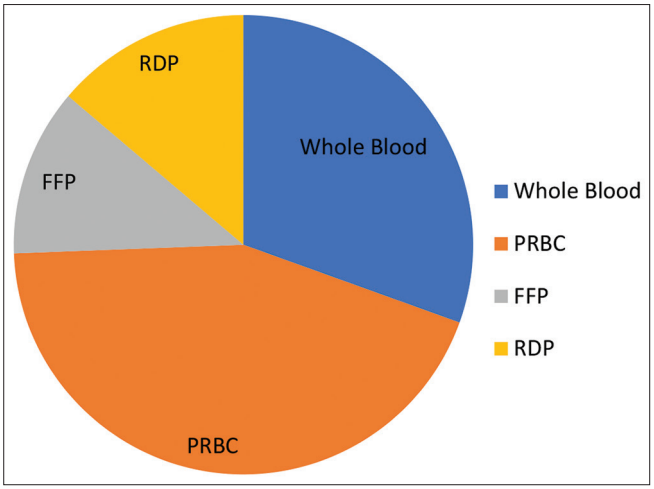

Figure 1: Blood and blood products transfusion

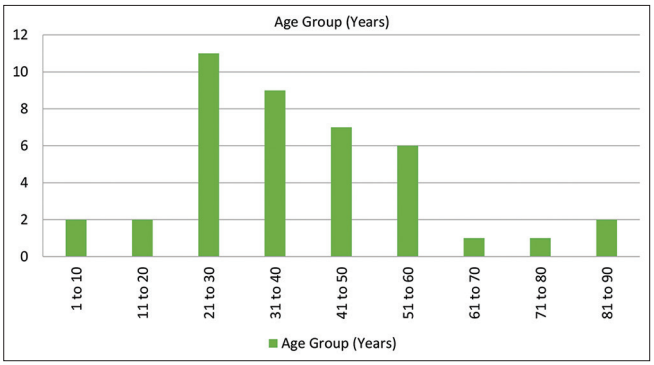

Figure 2: Age group showing adverse reactions

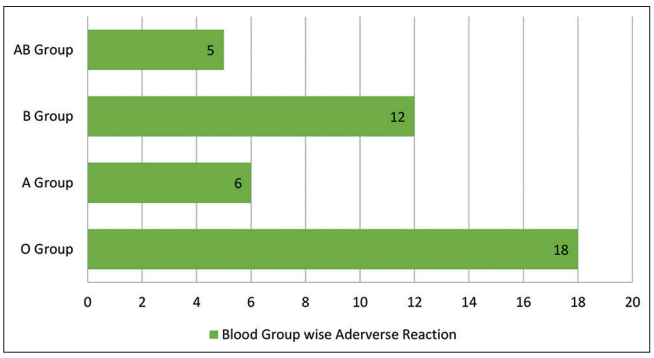

Figure 3: Blood group-wise adverse reactions

other cause can be identified is termed a transfusion reaction (TR). These AEs are mainly non-infectious in nature and may be acute or delayed in onset. Depending on the severity and appropriate clinical response, AEs can be classified as mild, moderate, and severe or life-threatening.[3]

Blood TR may be immune-mediated or non-immune-mediated. Acute immunological events include acute hemolytic TR, febrile non-hemolytic TR (FNHTR), allergic, anaphylactic, and transfusion-related acute lung injury (TRALI). On the other hand, non-immune mediated TR includes transfusion-related sepsis, circulatory overload, non-immune hemolysis, hypocalcemia, hyperkalemia, and hypothermia.[3] The true incidence of TRs is difficult to determine because of the lack of a proper hemovigilance system in the country. About 0.5–3% of all blood transfusions result in some AEs, but most of them are minor without any significant consequence.[2]

The present study was done with the primary objective to determine the frequency, distribution, and types of TRs occurring in patients, reported to the blood center in a tertiary care hospital in North East India.

Aims and objectives

To determine the frequency, distribution and types of transfusion reactions occurring in patients, reported to the blood centre in a tertiary care hospital of North East India.

MATERIALS AND METHODS

A retrospective review of all the TRs that was reported to the blood center at the Assam Medical College and Hospital, Dibrugarh, Assam, over a period of 1 year (from July 2022 to June 2023) was done. Ethical clearance was taken from the Institutional Ethics Committee (H).

All the TRs were clinically assessed by the treating physician and reported to the blood center. On notification, the blood center issued a copy of a pre-designed pro forma in the form of TR report (Annexure 1). This was completed on the ward and reviewed by the responsible physician before being sent back to the blood bank for analysis. The pro forma was used to collect the data regarding the patient's age, identification number, name of the ICU/ward, ABO-Rh group of the patient, type of blood product, blood unit registration number, and the details of the suspected AE. The physician then sent the filled-up TR reporting form to the blood center along with the leftover blood product bag and post-transfusion patient blood and urine samples.

A repeat ABO/Rh blood grouping and typing, repeat compatibility testing, and screening for irregular antibodies

Table 2: Comparative study of the incidence of adverse transfusion reactions

Name of study	Allergic reaction (%)	Anaphylactoid reaction (%)	FNHTR (%)	AHTR (%)	Hypotensive reaction (%)	TACO (%)	TRALI (%)	Other (%)	Frequency (%)
Kumar et al.[2]	55.1	5.1	35.7	2.6	-	0.5	0.5	0.5	0.05
Bassi et al.[6]	24	-	73	1	1	-	-	1	0.39
Sharma et al.[5]	65.6	3.12	28.1	-	-	-	-	3.18	0.92
Saha et al.[7]	49.2	1	25.37	3	5.22	4	3	1.49	0.14
Payandeh et al.[8]	49.2	-	37.2	-	6.8	-	-	6.8	0.95
Bhattacharya et al.[9]	34	3.8	41	8.56	-	-	0.95	3.8	-
Present study (2023)	39	-	51.2	-	-	-	2.4	7.3	0.11

FNHTR: Febrile non-hemolytic transfusion reaction, TACO: Transfusion-associated circulatory overload, TRALI: Transfusion-related acute lung injury

were done and were compared with the pre-transfusion sample. In case of a suspected hemolytic TR - Direct antiglobulin test, qualitative and quantitative estimation of plasma hemoglobin %, serum bilirubin, and peripheral blood smear examination for the presence of spherocytes and schistocytes. The turn-around time of transportation of the unit from the blood bank to bedside, storage conditions, delayed start of transfusion (>30 min), or prolonged transfusion (>4 h), any evidence of thermal, oncotic, or osmotic injury was checked by checking the unit for hemolysis to rule out pseudo-hemolytic TRs.

The remaining bag was sent for blood culture in suspected cases of bacterial sepsis, and the results were correlated with the patient's culture reports.

The AEs were considered to be acute if the particular event was observed within 60 min after the transfusion, considered to be subacute if the particular event results within 1–24 h from the time of transfusion and considered to be latent if the reactions take 2 or more days to become apparent.[3]

After ruling out other potential causes, clinical symptoms such as fever, chills, and rashes were the only basis used to diagnose allergic, FNHTR, and anaphylactoid reactions. The lack of systemic symptoms such as bronchospasm and hypotension allowed allergic reactions to be distinguished from anaphylactoid reactions.[1]

FNHTR was defined as a body temperature rise of 1°C or more, with or without chills and rigor occurring in association with transfusion and without any other explanation.[1]

Patients with bilateral infiltrates on a chest X-ray who experienced acute respiratory distress within 6 h were diagnosed with TRALI, which was distinguished from transfusion-associated circulatory overload based on the patient's blood pressure, volume status, and response to diuretics.

An isolated drop in systolic or diastolic blood pressure of more than 30 mmHg within an hour of transfusion and systolic blood pressure of <80 mmHg were considered hypotensive reactions.[1]

The causality of the TRs was graded using a standard score system, which was given by the World Health Organization.[4]

- Grade 1 (non-severe): Concerned reactions without immediate or long-term morbidity
- Grade 2 (severe): Reactions with long-term morbidity
- Grade 3 (life-threatening): Direct life-threatening reactions
- Grade 4 (death): Death of the recipient from the blood transfusion.

RESULTS

A total of 38,165 units of blood and blood components were transfused from July 2022 to June 2023. Among these blood and blood component transfusion packed red blood cells (PRBC) transfusion was found to be 43.9% (16765), whole blood (WB) 30.5% (11637), fresh frozen plasma 13.8% (5250), and platelet concentrate found to be 11.8% (4513) (Figure 1). Out of 38165 transfusions of blood and blood products, a total of 41 (0.11%) adverse TRs were reported during the study, of which 21 (51.2%) were seen in females and 20 (48.8%) were seen in males. Maximum adverse reactions were reported in adults; 39 (95.1%) and only 2 (4.9%) in children. Of all the TRs that were reported, 25 (61%) occurred with PRBC, and 16 (39%) were reported with WB. The age of recipients ranges from 6 years to 85 years with a mean age of 39 years. Maximum TRs were seen in the age group of 21–31 years – 11 (26.8%) followed by 31–40 years – 7 (17%) (Figure 2). Among the adverse TRs Group-O accounts for 18 (43.9%), Group-A 6 (14.6%), Group-B 12 (29.3%), and Group-AB accounts for 5 (12.2%) (Figure 3). The categorization of TRs according to ward, where the TRs occurred are depicted in Figure 4. Maximum reported in the medicine ward; 14 (34.1%). Among the adverse TRs, FNHTR was the most frequently encountered TR; 21 (51.2%), followed by allergic reaction; 16 (39%). 2 (4.9%) patients presented with headache, body ache, and chest pain, 1 (2.4%) patient show hypersensitivity reaction and 1 (2.4%) presented with breathlessness and crepitation TRALI (Figure 5). Out of 21 allergic reactions, the common clinical signs and symptoms were rash in 18 (85.7%), pruritus in 8 (38.1%), and urticaria in 7 (33.3%). Not a

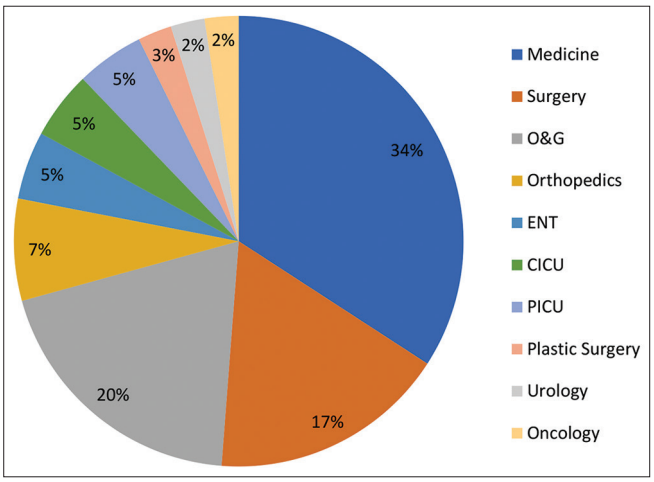

Figure 4: Ward-wise adverse reactions

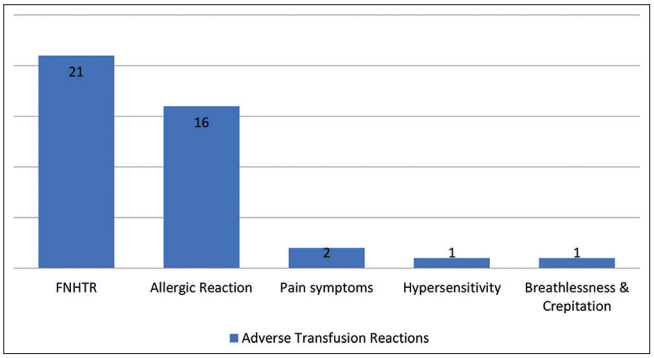

Figure 5: Adverse transfusion reactions

single case of bacterial contamination was reported. Of the 41 patients who had experienced adverse TRs, all the patients recovered. There were no permanent disability and no deaths following the adverse TR.

DISCUSSION

The first mandatory reporting system for hemovigilance was introduced in France in 1993, whereas the first voluntary reporting system was introduced in the United Kingdom (UK) in 1996. The hemovigilance program was launched in India in December 2012 as a crucial component of the pharmacovigilance program.[3] Hemovigilance is now acknowledged on a global scale as an essential part of quality control in blood programs. The goal of an optimal hemovigilance system is to identify, compile, and evaluate unanticipated or undesired transfusion effects.[5]

In the present study, information about various adverse TRs was collected from cases reported to our blood center. These were then evaluated based on the clinical history and laboratory work-up using the TR reporting form. In the present study, the frequency of adverse TRs was found to be 0.11% (41 out of 38,165). In a similar study by Somagari et al., at Gauhati Medical College and Hospital, the incidence of adverse TR was 0.208% (106 reactions out of 51,000 units of blood and blood component transfused).[3] The frequency of adverse TRs was not determined by counting the actual number of recipients who were transfused, primarily because some patients required multiple transfusions and a very small percentage of the blood products that were distributed might have been wasted or not returned to the blood bank and disposed of. Even the total number of adverse reactions may not be the actual indicator mainly because of underreporting and few cases managed by the treating clinician itself.

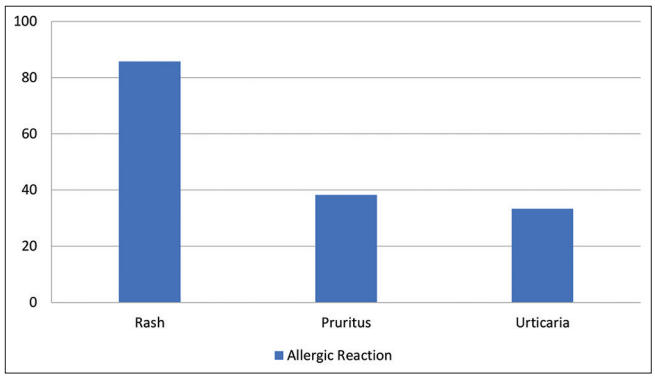

Figure 6: Signs and symptoms of allergic reaction

In our study, it was found that there was a female preponderance of 51.2%, similar to a study done by Sharma et al.[5] (59.4). The most commonly affected people were in the age group of 21–30 years, which is similar to a study done by Somagari et al.[3] Among the adverse reactions reported, blood group O accounted for the maximum number of cases (43.9%) which is in concordance with a study done by Somagari et al.[3]

Among the transfusions of WB and PRBC, WB transfusion accounted for all the cases in our study. This is in concordance with almost all the studies done previously.

Transfusion with PRBC was most commonly associated with adverse reactions (61%) followed by WB transfusion (39%) in our study. This fashion was in accordance with Sharma et al.,[5] and Somagari et al.,[3] studies. Table 1 showing comparative studies of adverse transfusion reactions due to blood and blood components.

Major ATR in our study was FNHTR (51.2%) which is similar to other studies done by Bassi et al.,[6] (73%). However, in some studies, the most common ATR was found to be an allergic reaction as a study done by Sharma et al.[5] Table 2 showing comparative study of incidence of adverse transfusion reaction.

There were no rigorous or life-threatening AEs discovered during the study's duration, and all of the reported AEs in this investigation were determined to be Grade 1 (non-severe) types.

Limitations of the study

(1) Adverse reactions might be underreported due to treating clinician handled a small number of cases by itself.
(2) Findings may not be easily extrapolated to other healthcare settings or regions with different practices.
(3) A retrospective design might limit the ability to establish causation or fully understand the circumstances leading to adverse reactions.

CONCLUSION

The advantages and disadvantages of the various blood product transfusion practices used worldwide are not well supported by high-quality research. Understanding the different kinds of blood TRs will be beneficial for both managing and identifying them early on as well as for taking the necessary precautions to avoid them. It is challenging to ascertain the actual frequency of these reactions due to the absence of a suitable and stringent hemovigilance system across the nation. Newer immunohematological techniques for identifying antibodies and the increased use of leuko-reduced blood products have led to a decrease in the incidence of FNHTRs, platelet refractoriness, and cytomegalovirus transmission.

In our study, adverse TRs were low (0.11%), which might be because the treating clinician handled a small number of cases by itself. The majority of these were PRBC transfusion-related reactions, the most prevalent of which is the febrile non-hemolytic TR, which may be brought on by leukocytes, which act as inflammatory mediators in leftover plasma during PRBC preparation. Leukoreduced blood products can be used to standardize these reactions. Hemovigilance will contribute to improving the standard, quality, and safety of blood transfusions.

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Authors' Contributions:
MC- Definition of intellectual content, literature survey, prepared the first draft of the manuscript, implementation of the study protocol, data collection, data analysis, statistical analysis and interpretation, preparation of figures, manuscript preparation, and submission of the article; **ZA-** Concept, design, clinical protocol, manuscript preparation, statistical analysis and interpretation, editing, and manuscript revision; **AD-** Design of study, clinical protocol, manuscript preparation, editing, and manuscript revision; **AS-** Concept, design, and manuscript revision.

Work attributed to:
State of The Art Model Blood Center and Department of Pathology, Assam Medical College and Hospital, Dibrugarh, Assam, India.

Orcid ID:
Mrigen Choudhury - https://orcid.org/0009-0006-6621-4871
Zarika Ahmed - https://orcid.org/0000-0001-9896-2379
Aparna Dutta - https://orcid.org/0009-0000-7436-3128
Adity Sharma - https://orcid.org/0000-0002-4740-4251

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