Original Article

Blood transfusion safety: A study of adverse reactions at the blood bank of a tertiary care center

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Abstract

Background: An adverse transfusion reaction (ATR) is an unfavorable reaction to the transfused unit, the severity of which may be different among individuals depending upon the type of reaction and the patient's susceptibility. Transfusion reactions may be immediate or delayed type depending on the onset and immune or nonimmune type depending on the pathogenesis. A study was conducted to study the frequency of various transfusion reactions and the associated morbidity.

Materials and Methods: All ATRs occurring over a period of 3 years at a tertiary care health center were studied in detail according to the institute's protocol.

Results: Of 38,013 units of blood and components that had been issued, 101 (0.2%) cases had an ATR. The most common reaction was allergic - 34/101 (33.6%) followed by febrile - 26/101 (25.7%). Other reactions included transfusion-related acute lung injury in 6/101 (5.9%) cases, and immune reactions were seen in 19/101 (18.8%) cases.

Conclusion: Allergic and febrile reactions are most common and least harmful, but fatal reactions can also occur, and preventive measures must be taken to avoid such reactions.

Key Words: Adverse reactions, blood bank, blood transfusion

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INTRODUCTION

Blood transfusion is a treatment modality which has definite potential benefits and risks which vary among patients. An adverse transfusion reaction (ATR) is an unfavorable reaction to the transfused unit, the severity of which may be different among individuals depending upon the type of reaction and the patient's susceptibility. Transfusion reactions may be immediate or delayed type depending on the onset and immune or nonimmune type depending on the pathogenesis. It cannot be predicted, which patients will have such a response to blood transfusion, so it is important for the clinical and laboratory personnel involved in the procedure to have a knowledge of the types of reaction and steps to be taken in such a case. It is important to identify various adverse reactions so that steps can be taken to minimize such reactions and add safety to the transfusion being carried out. The present study was conducted to study the frequency of various transfusion reactions and the associated morbidity.

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MATERIALS AND METHODS

All ATRs occurring over a period of 3 years at a tertiary care health center in Uttarakhand were studied retrospectively. A transfusion-related adverse reaction was taken as the adverse response in the patient associated with administration of blood or blood components. The units of blood were issued along with a transfusion form to record the details of transfusion including timings, vital parameters, and record of transfusion reaction if any. In case of ATR, the form was to be sent to blood bank along with the blood bag and patient's blood samples-Ethylenediaminetetraacetic acid and plain. These cases were worked up according to a standard protocol which included clerical checks, repeat blood grouping (patient and blood bag), cross-match (major and minor), culture and Coomb's test (direct and indirect). All immunohematology tests-blood groups, cross-matching, and Coomb's test were done using gel cards. The results were recorded, and a report was sent to the ward along with the advice in case further transfusions were needed. Details of all such cases over a period of 3 years were collected and analyzed. The analysis was done using percentages and ratios.

RESULTS

Over a period of 3 years, 38,013 units of blood and components had been supplied, and 101 (0.2%) cases had an ATR. Reactions were seen in patients of all ages and without any significant sex predilection, that is, males - 50/101 (49.5%) and females - 55/101 (54.4%). These reactions were seen in patients from all wards. The reactions were seen mostly with whole blood - 44/101 (43.5%) and packed red blood cells (RBCs) - 49/101 (48.5%). Reactions to fresh frozen plasma were seen in 4/101 (3.9%) and to platelets in 6/101 (5.9%) cases [Table 1]. It was observed that reactions are mostly seen after transfusion of the initial small volume of the component transfused [Table 2]. Common presenting complaints were fever, chills, itching, and rashes followed by dyspnea, palpitations, and others [Table 3]. There was no past history of transfusion reactions in the study group. No delayed complications were reported in this study.

ATR workup of the cases did not reveal a clerical error in any of the cases. Physical examination revealed hemolysis in the posttransfusion sample in 1 case. There was no discrepancy between pretransfusion and posttransfusion samples in blood grouping or cross-matching. Indirect Coomb's test was positive in 3/101 (2.9%) cases, and direct Coomb's test was positive in 16/101 (15.8%) cases.

The result of the workup was correlated with clinical findings, and the final impression was given. It was found that the most common reaction was allergic - 34/101 (33.6%) followed by febrile - 26/101 (25.7%). Transfusion-related acute lung injury (TRALI) was suspected in 6/101 (5.9%) cases. Immune reactions were seen in 19/101 (18.8%) cases [Table 4].

When percentage of cases showing reaction was considered with regard to the number of units transfused it was found that allergic reaction was

Table 1: Number of units that showed adverse reactions

Component	*n* (%)
Whole blood	43 (43.5)
PRBC	48 (47.5)
Platelet concentrate	04 (3.9)
FFP	06 (5.9)
Total	101 (100)

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

Table 2: Blood volume transfused before reaction was noticed

Volume transfused (mL)	*n* (%)
<50	38 (37.6)
51-100	23 (22.8)
101-150	15 (14.8)
151-200	6 (5.9)
201-250	6 (5.9)
251-300	2 (1.9)
301-350	3 (2.9)
Total	101 (100)

Table 3: Symptoms reported among patients having adverse reactions

Symptoms	*n* (%)
Itching	30 (29.7)
Fever	28 (27.7)
Hives	18 (17.8)
Dyspnea	4 (3.9)
Palpitations	1 (0.9)
Sweating	2 (1.9)
Muscle ache	1 (0.9)
Facial swelling	1 (0.9)
Fever + dyspnea + itching	3 (2.9)

Table 4: Causes of ATRs

Diagnosis	*n*	Percentage of reactions	Percentage of transfusions
Allergic reaction	34	33.6	0.08
Febrile reaction	26	25.7	0.06
Immune reaction	19	18.8	0.05
TRALI	6	5.9	0.01
Others	16	15.0	0.04
Total	101		

ATRs: Adverse transfusion reactions, TRALI: Transfusion-related acute lung injury

seen in 8 out of 1000 units, febrile reactions were seen in 6 out of 1000 units, TRALI was seen in 1 out of 1000 units and Immune reactions in 5 out of 1000 units transfused.

DISCUSSION

A very important issue in blood transfusion is whether the blood transfusion is immunohematologically safe. In a study by Arewa *et al*. in Nigeria an overall incidence of transfusion reactions of 8.7% was seen.[1] Williamson *et al*. performed a SHOT analysis and found 52% cases were associated with incorrect blood transfusion, acute lung injury was seen in 8% cases and 15% patients suffered an acute transfusion reaction.[2]

As clerical errors are common causes of adverse reactions,[3] we have a policy of checking the blood group and all numbers at multiple levels by the technician, doctor, person issuing the unit and finally by the nursing staff, and the doctor responsible for blood administration. No clerical error was detected among the adverse reactions in this study.

Some diseases that can cause hemolysis (autoimmune hemolytic anemia, paroxysmal nocturnal hemoglobinuria, G-6-phosphate dehydrogenase deficiency, etc.) can give rise to a transfusion reaction like situation and result in misdiagnosis of immune type of transfusion reaction.[3] Hence a detailed workup of the patient's primary disease is also important.

According to Geiger and Howard, the most common acute adverse reactions to blood component transfusions, febrile nonhemolytic transfusion reactions (FNHTRs), and allergic reactions, are fortunately among the least harmful. The most common bedside approach for the prevention of febrile nonhemolytic and urticarial transfusion reactions is premedication with an antipyretic and an antihistamine, most commonly acetaminophen and diphenhydramine, and at their institution, where most transfusions are administered to pediatric oncology patients, they have observed a rate of 68%.[4] In a study by Sovic *et al*., febrile nonhemolytic and allergic reactions were quite equally represented, 49.5% each and as for other reactions (1%), one transfusion-associated circulatory overload, and one TRALI were recorded.[5]

Allergic reactions also called urticarial reactions are common anaphylactic and anaphylactoid reactions occur immediately and are more severe. Histamine and Leukotrienes are the mediators of these reactions, and common signs and symptoms include redness, itching, and hives. Usual prevention strategies are premedication or plasma deficient blood components. In our study, it was seen in 34 patients. Bhattacharya *et al*. found these in 36 patients in their study and common symptoms were rash and pruritus.[6]

Febrile reactions usually occur in about 1% of transfusions.[3] It is defined as a 1°C temperature rise associated with transfusion and having no medical explanation other than blood/component transfusion. Leuco reduced components were indicated for their prevention. Bhattacharya *et al*. found FNHTR in 41% of cases and fever, chills, and rigors were the main presenting symptoms. In our study, it was found in 26 cases. In the study by Arewa *et al*. in Nigeria an overall incidence febrile reactions was 65% of all.[1]

Immune hemolytic reactions occur very soon after the transfusion of incompatible RBCs which are rapidly destroyed. Prompt diagnosis and treatment are essential. They are usually caused by non-ABO antibodies symptoms are nonspecific, and patient care involves preventive and supportive measures. We found evidence of immune-mediated reactions in 19 cases.

Bacterial sepsis, although rare, can be fatal, and most are caused by Yersinia enterocolitica. The reactions are commonly caused by endotoxins. Treatment is supportive with broad spectrum antibiotics. There may be contamination during sample collection, component preparation, or thawing. Williamson *et al*. performed a SHOT analysis and found bacterial incidents involved contamination with *Serratia liquefaciens*, *Escherichia coli*, *Bacillus cereus* and *Staphylococcus aureus*.[2] Jadhav *et al*. found that posttransfusion endotoxemia was the most frequent mode of death in their series and the bacteria isolated were *Citrobacter*, Klebsiella and *E. coli*.[7]

TRALI presents like adult respiratory distress syndrome. Anti-leucocyte antibodies are thought to result in leukocyte emboli which aggregate in lung capillaries. There are hypoxia and resulting chills, cough, fever, and dyspnea. It is a diagnosis of exclusion after ruling out heart failure, volume overload, bacterial sepsis, and myocardial infarction. Hirayama has found that "heparin binding protein" is a potential final effector molecule that induces NHTRs including TRALI and that basophil activation test might be useful in transfusion medicine.[8]

Other transfusion reactions that may occur include circulatory overload, mistransfusion, posttransfusion purpura, transfusion-associated graft-versus-host disease. There is a slightly more risk of adverse reactions

in high-risk groups such as multiparous females and multitransfused patients[9] but this was not seen in our series of patients. DHTR is very infrequently reported which could be due to nonrecognition clinically because of nonspecific features, which get hidden among symptoms of the main disease. Some minor reactions are even overlooked and not reported as has been suggested in other studies as well.[10] It is, therefore, recommended to advocate careful evaluation of adverse reactions by nursing staff, clinicians, and transfusionists to ensure patient safety. Another article by Harvey *et al*. recommends such interventions to ensure patient safety.[11] In a study by Kumar *et al*., out of the total 196 adverse reactions reported under the hemovigilance system, the most common type of reaction observed was allergic 55.1% (n = 108), followed by FNHTR 35.7% (n = 70), and other less frequently observed reactions were anaphylactoid reactions 5.1% (n = 10), acute nonimmune HTRs 2.6% (n = 5), circulatory overload 0.5% (n = 1), TRALI 0.5% (n = 1), and delayed HTRs 0.5% (n = 1).[12]

The present study was limited in the numbers of reactions studied, and bigger studies from more centers are needed to generalize the causes for the general public. It is, therefore, recommended for all centers to report the reactions reported at their centers so that larger amounts of data can be studied and analyzed.

CONCLUSION

The most common acute adverse reactions to blood/component transfusions include FNHTRs and allergic reactions. These are the least harmful, but fatal reactions can also occur and preventive measures must be taken to avoid such reactions.

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Conflicts of interest
There are no conflicts of interest.

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