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Frequency and types of transfusion reactions in pediatric population: A report from a tertiary care center in Pakistan

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Abstract:

BACKGROUND: A transfusion reaction is an untoward reaction following blood transfusion. It can be immediate or delayed and further sub-classified into immune and nonimmune. The role of physicians and paramedical staff is important in recognition of reaction and notifying transfusion services by sending relevant material for workup.

OBJECTIVE: The aim of the current study is to see frequency and types of transfusion reactions in pediatric population in a tertiary care center. We also assessed the compliance of clinical staff to send the proper transfusion reaction workup in required time.

MATERIALS AND METHODS: This retrospective cross-sectional study was conducted in the section of hematology and transfusion medicine of a tertiary care hospital in Karachi, from January 2020 to December 2021 after the approval from Ethical Review Committee. The data were analyzed using SPSS version 20.

RESULTS: Of the 21,230 units dispensed and transfused, 36 (0.17%) transfusion reactions were noted. Allergic was the most frequent type 21 (58.3%). Red cells accounted for 28 (77.8%) of the reactions. In all cases, reaction forms were completely filled. Blood bags, posttransfusion ethylenediaminetetraacetic acid samples and urine samples in only 8 (22.2%) cases were received at blood bank within 2 h of reaction.

CONCLUSION: Incidence of transfusion reactions was 1 in 590 units transfused. Allergic reactions were most common. No acute hemolytic or septic reaction noted. Practices regarding submission of transfusion reaction form along with required workup to the blood bank need improvement.

Keywords:

Blood transfusion-associated adverse reactions, febrile nonhemolytic transfusion reaction, transfusion-associated allergic reaction

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Introduction

Blood transfusion is a life-saving medical approach, often required to optimize blood counts, stop massive bleeding or it can be given prophylactically before surgeries ultimately improving patient condition.[1] Accompanying the various benefits, blood transfusion also poses serious adverse effects including infectious and noninfectious complications which in some cases may even be fatal. In the past few decades, the risk of infectious complications has been declined owing to effective donor screening, infectious disease testing and pathogen inactivation techniques.[2,3] Despite all the screening methods to ensure safe blood transfusion, the risk of noninfectious reactions is still there.[4]

Blood transfusion is highly practiced around the globe. In developed countries, the most

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common transfusion is observed in elderly age group, which accounts for almost 75% of all transfusions, however in developing countries up to 54% of blood transfusions are given in pediatric patients under 5 years of age.[5] In a study conducted in Northwest Ethiopia, Gelaw *et al*. discovered frequency of transfusion reactions of 5.2%, with allergic reactions being the most prevalent, followed by febrile nonhemolytic transfusion reactions.[6] Same results were observed in a study from Pakistan conducted by Hasan *et al*., which showed allergic transfusion reaction to be the most common.[7]

The data for transfusion reactions in adult age group are readily available; however, it is more limited in the pediatric age group. In 2017, Ghataliya *et al*. conducted a study in the pediatric age group and found that 11.6% (69/594) of patients had transfusion reactions, with platelet concentrate transfusion being the most implicated (14.3%), and the most common reactions being FNHTR and allergic transfusion reactions.[8]

The main aim of the current study is to see frequency and types of transfusion reactions in pediatric population in a tertiary care center. Another aim is to assess the compliance of clinical staff to send the proper transfusion reaction workup in required time. The observations of this study will be used to improve the practices of healthcare professionals to achieve 100% compliance.

Materials and Methods

Study design and setting

This retrospective cross-sectional study was conducted in the section of hematology and transfusion medicine, at a tertiary care hospital in Karachi, after the approval from Ethical Review Committee (2020-3458-10661). Our institute is a 560-bedded tertiary care hospital which consists of many different specialties such as pediatrics, obstetrics, medical, surgical units, as well as it has a day-care setup for outpatient procedures and the institute is also linked to 3 different secondary hospitals in the same city. Hence, blood products are dispensed in these areas whenever required. We reviewed transfusion reactions data (from January 2020 to December 2021), which was already archived in blood bank records. The age group in our study was taken below 18 years and all genders were included.

Evaluation of transfusion reactions

Whenever a transfusion reaction is encountered, a transfusion reaction form is filled by patients' clinician, registered nurse, and then it is sent back to blood bank along with blood and urine samples of patient, and blood bag (with tubing), for further evaluation of the reaction. The clinician and registered nurse fill the first part of form which includes patient location, type of blood component and volume given, time of transfusion, and which clinical actions were taken at the time of reaction. While the other part of form is filled by blood bank technologist and hematology trainee and consultant. Verifying clerical checks and performing the tests, i.e., blood grouping, cross match ± antibody screening, complete blood count, urine DR and culture of blood bag) is the responsibility of technologist. The final part which includes interpretation of clinical findings along with laboratory and radiology workup, and finally assigning type of reaction with recommendations for prevention is done by hematology resident and signed out by consultant hematologist.

Statistical analysis

The data in our study were entered and analyzed in IBM SPSS Statistics for Windows, Version 20.0. (Armonk, NY: IBM Corp.) Mean (±standard deviation) was used for quantitative variables while frequencies and percentages were used for categorical variables.

Results

A total of 21,230 units of blood components were dispensed in the time duration of 2 years in which blood components were 64 units whole blood, 7630 units of packed red cells, 8790 units of platelets, 4713 units of plasma products (including cryoprecipitate and FFPS), and 33 units were stem cell products (peripheral and bone marrow). In emergency department 2161 units, in day-care and inpatient 18,768 units while in secondary hospitals 301 units were dispensed.

Out of total 21,230 units of blood products transfused, only 36 (0.17%) transfusion reactions were reported. The median age was 6 years (ranging from 1 month to 18 years).

Total number of blood components transfused and transfusion reactions encountered by the components are shown in Table 1. In our study, the most common transfusion reaction was allergic transfusion reaction, out of 36 reactions 21 were allergic (58.3%), followed by FNHTR 9 (25%), TRALI was reported in 1 (2.8%) patient who had diagnosis of T cell ALL, NOC: 1 (2.8%), unrelated to transfusion 4 (11.1%).

The frequency of signs and symptoms are shown in Table 2. In allergic reaction, the most common symptom was urticarial (55%). In FNHTR, the most common symptom was fever (42.8%) followed by rigors/chills (35%). Only one event of transfusion-associated acute lung injury (TRALI) was reported with signs/symptoms of hypotension, shock, and breathlessness. The entity "Unrelated to transfusion/Not otherwise specified" was given to those reactions which were not associated with blood product transfusion and were

linked to underlying diseases or other reasons and a total of 4 (11.1%) of such events were reported. The most repeated symptom was redness over infusion site 2 (28%).

For all 36 reported reactions, transfusion reaction forms were provided to blood bank. Demographics (including name, age, gender, medical record number, location) were mentioned in all 36 forms along with signs/symptoms and immediate management. The samples received by blood bank along with transfusion reaction form are given in Table 3.

Discussion

Despite all the interventions to ensure safe blood transfusion, a transfusion is always a risk. Transfusion reaction is an unwanted reaction following blood product transfusion. The severity of transfusion reaction varies; it can occur in the form of mild allergic reaction to even anaphylactic or a drop in oxygen saturation resulting from TACO and TRALI leading to higher chances of mortality. Transfusion reaction is divided into immediate and delayed types, depending upon time of onset, and are subclassified into immunological and nonimmunological reactions.[9]

We conducted a 2-year retrospective study in which 21,230 units of blood products were transfused. Out of 21,230 products, only 36 transfusion reactions were reported. The two most common reactions reported in our study were allergic transfusion reactions and febrile nonhemolytic transfusion reactions. Allergic transfusion reaction occurs when donor allergen triggers recipient antibodies to cause reaction. It may occur as milder urticaria, hives or itching, or even life-threatening anaphylactic reaction causing bronchoconstriction, angioedema, or hypotension. Prophylaxis includes antihistamines, and in case of repeated episodes of reactions, there is a need to check for IgA deficiency. Washed blood product is also an option in case of red cell transfusion.[9] On the other hand, febrile nonhemolytic

Table 1: Frequency of different transfusion reactions for all the components transfused

Components	Number of units transfused	Allergic reaction	FNHTR	Acute hemolytic reaction	Transfusion related acute lung injury	Unrelated/not otherwise characterized	Total
Packed red blood cells	7630	16	9	0	1	2	28
Platelets	8790	4	0	0	0	1	5
Plasma products	4713	0	0	0	0	2	2
Whole blood	64	0	0	0	0	0	0
Stem cell products	33	1	0	0	0	0	1
Total	21,230	21	9	0	1	5	36

FNHTR=Febrile nonhemolytic transfusion reaction

Table 2: Sign and symptoms in transfusion reactions

	Allergic, *n* (%)	FNHTR, *n* (%)	TRALI, *n* (%)	Unrelated/NOC, *n* (%)	Total, *n* (%)
Urticaria	15 (55)	0	0	0	15 (29.4)
Pruritis	2 (7.4)	0	0	0	2 (3.9)
Skin rash	2 (7.4)	0	0	0	2 (3.9)
Fever	1 (3.7)	6 (42.8)	0	0	7 (13)
Hypotension	1 (3.7)	2 (14)	1 (33.3)	1 (14)	5 (9.8)
Shock	0	0	1 (33.3)	1 (14)	2 (3.9)
Breathlessness	0	0	1 (33.3)	0	1 (1.96)
Anxiety	2 (7.4)	0	0	0	2 (3.9)
Rigors/chills	2 (7.4)	5 (35)	0	0	7 (13)
Redness	2 (7.4)	0	0	0	2 (3.9)
Backache	0	1 (7)	0	1 (14)	2 (3.9)
Redness over infusion site	0	0	0	2 (28)	2 (3.9)
Pulmonary failure	0	0	0	1 (14)	1 (1.96)
Blue discoloration of lips	0	0	0	1 (14)	1 (1.96)

FNHTR=Febrile nonhemolytic transfusion reaction, TRALI=Transfusion associated acute lung injury, NOC=Not otherwise characterized

Table 3: Samples received with transfusion reaction forms

	Blood bag along with tubing, *n* (%)	Urine sample, *n* (%)	EDTA sample, *n* (%)
Received within 2 h	8 (22.2)	8 (22.2)	8 (22.2)
Received after 1 h	24 (66.6)	17 (47.2)	28 (77.7)
Not received	4 (11.1)	11 (30.5)	0

EDTA=Ethylenediaminetetraacetic acid

transfusion reaction's symptoms are increase in body temperature of >38°C, chills, nausea, vomiting. Prestorage leucodepletion of blood products is the mainstay of prevention.[10] Hemovigilance has significant role in this aspect, as it is foremost that patient be given blood product transfusions when clinically indicated.[11]

A study conducted by Oakley *et al*. in 2015 compared the incidence of transfusion reactions in pediatric and adult age group, i.e., 6.2 transfusion reactions per thousand transfusions were observed in pediatric population (age <21) and 2.4 reactions per 1000 transfusions within the adult population.[12] In 2020, Kohorst *et al*. conducted a study in US on transfusion reactions in pediatric hematology oncology patients which revealed 2.04% incidence of transfusion reactions. The incidence of adverse reactions was more associated with platelet transfusions and the most transfusion reactions were FNHTR (61.4%).[13] The totally reversed results were found in our study, i.e., the most common reaction was allergic transfusion reaction and higher incidence of adverse reactions was associated with packed red cell transfusion.

Acute hemolytic transfusion reactions occur due to clerical error, i.e., wrong blood transfusion and patient presents with backache, fever, hemoglobinuria, disseminated intravascular coagulation, hypotension, and shock with positive direct antiglobulin and signs of hemolysis.[13] Propitiously, in our study, there was no event of acute hemolytic transfusion reaction, which is an indicator of strict hemovigilance practices in our center.

Transfusion transmitted infections involve both acute as well as chronic reactions. Fortunately, due to strict hemovigilance system, no such reaction was reported. On the other hand, Borhany *et al*. conducted a study in 2011, on transfusion transmitted infections in hemophilic patients which showed prevalence of 51.4% for hepatitis C virus, 1.73% for hepatitis B virus, and zero for HIV in total of 173 multitransfused male hemophiliac patients.[14]

In our study, only one TRALI was encountered, i.e., in a 17-year-old male patient with diagnosis of T cell acute lymphoblastic leukemia. Packed red cell was transfused, after 100 ml of blood transfusion, patient developed breathlessness, hypotension, and 1C rise in body temperature. Oxygen saturation dropped from 97% to 88%. TRALI was labeled based on patient symptoms and radiographic findings. A study of Pakistan conducted by Jamil *et al*. (2015) on pediatric intensive care unit patients showed incidence of TRALI to be 0.19% (19/100,000 per blood product transfused).[15]

Besides allergic, FNHTR and TRALI, five other adverse events were encountered in our study, four of them were categorized "Unrelated to transfusion," i.e., the cause was secondary to the underlying disease. Two of them developed redness over infusion site, one developed backache and anxiety and one patient was known case of tetralogy of Fallot who had cyanosis. The transfusion was stopped and reported to our blood bank. Out of 36 adverse events, one was mentioned as "not otherwise characterized" in which the patient developed hypotension, and tachycardia only and the root cause could not be established.

We also found that all transfusion reaction forms submitted to blood bank were completely filled by the clinical team. A study in Pakistan reported 95% compliance.[7] Only 66.6%, 77.7%, and 47.2% of the forms along with blood bag, posttransfusion blood sample, and urine sample, respectively, were received in the blood bank within 1 h of transfusion reaction. This calls for the need to create awareness in clinical areas to submit complete workup within the assigned time. Another hospital in Pakistan, in their clinical audit, observed lesser rates of compliance in submitting the workup to the blood bank, that too with cutoff time of 2 h as compared to 1 h in our hospital.[7] We aimed to use the findings of this study to improve the practices of healthcare professionals to achieve 100% compliance for reporting transfusion reaction to blood bank.

There were certain limitations in the current study. Since delayed transfusion reactions are not reported in our blood bank, such cases are under reported. No transfusion-transmitted infection was reported which may be due to lack of recipient follow-up.

Conclusion

Frequency of transfusion reactions was 1 in 590 units transfused. Allergic reactions were the most common type. No acute hemolytic or septic reaction noted. There was good compliance with sending completely filled form. However, practice of submitting required samples to the blood bank need improvement.

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Conflicts of interest
There are no conflicts of interest.

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