International Journal of Research in Medical Sciences
Rahim R et al. Int J Res Med Sci. 2021 May;9(5):1381-1387
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20211873

Original Research Article

Study on acute transfusion related adverse reactions in surgery department

Rejla Rahim[1]*, Sheela Varghese[1], Renu Thambi[1], M. S. Suma[2]

[1]Department of Pathology, Government Medical College, Kottayam, Kerala, India
[2]Department of Transfusion Medicine, Government Medical College, Kottayam, Kerala, India

Received: 11 March 2021
Revised: 12 April 2021
Accepted: 13 April 2021

***Correspondence:**
Dr. Rejla Rahim,
E-mail: rejilaarahim@gmail.com

ABSTRACT

Background: Blood transfusion is a routine life- saving medical intervention which is generally regarded as safe when done appropriately. Without blood transfusion, many medical and surgical conditions like anemia, road traffic accidents, obstetric hemorrhage, cardiothoracic surgeries are nearly impossible to manage. However, this life-saving procedure is often associated with adverse effects ranging from minor chills and rigors to life-threatening anaphylaxis. Incidence of transfusion reactions is estimated at 0.001% -10%. The knowledge about the adverse transfusion reaction (ATRs) will help in early identification, management, and prevention of adverse transfusion reactions.
Methods: Descriptive cross-sectional study done in 1047 patients, admitted and received at least one unit of whole blood and blood components in the surgery department, Government Medical College, Kottayam during the study period. Information regarding the issue of blood component collected from the transfusion medicine department and the details of the reactions were collected from the patients, and the transfusion reaction workups were done in the transfusion medicine department. The collected data was analysed using Microsoft Excel sheets.
Results: The frequency of acute transfusion reaction in this study is 1%. The majority of the reactions were seen with a packed PRBC transfusion. Febrile non-hemolytic transfusion accounted for 54.64% followed by allergic reactions (36.36%) and Transfusion associated cardiac overload (9%).
Conclusions: The frequency of ATR in our study was 1%. Febrile non-hemolytic transfusion (FNHTR) and allergic reactions were common patterns followed by transfusion associated cardiac overload (TACO) seen.

Keywords: Allergic reaction, Febrile non-hemolytic transfusion reaction, Transfusion reaction

INTRODUCTION

Blood transfusion is a routine life- saving medical intervention which is generally regarded as safe when done appropriately. Eight million units of blood are currently needed to meet the total transfusion demands.[1] Blood transfusion reaction refers to an undesirable, unintended, adverse response to the administration of blood, blood components. A transfusion reaction with signs or symptoms presenting during or within 24 hours of transfusion is defined as an acute transfusion reaction. Assessment of transfusion reaction 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 in the transfusion process. This will further encourage the judicial use of blood and blood components.

According to Kumar et al, a study done in AIIMS, Delhi found out that the majority of transfusion reactions

occurred in patients with elective surgery.[2] In our hospital, most of the blood transfusions are occurring in the Cardiothoracic and Nephrology department followed by the Surgery department. Since massive transfusions are more common in nephrology and cardiothoracic patients, so our study was planned to be confined to the Surgery department. Objectives was to describe the frequency of acute whole blood or blood component transfusion related reaction in Surgery department and to assess the patterns of acute transfusion reactions in Surgery department.

METHODS

It was descriptive cross sectional study done from January 2019 to June 2020 in Department of Surgery and Department of Transfusion medicine, Government Medical College, Kottayam.

Study population

All the patient admitted and who received at least one unit of whole blood and blood component in Department of Surgery, at Govt. Medical College, Kottayam during the study period of 18 months.

Sample size, $N = \frac{Z_{1-\alpha/2}{}^2 PQ}{D^2}$

Zα = 1.96 at 95% CI
P = prevalence in previous study
D = precision / allowable error

According to Kapadia et al study 1 acute transfusion reactions observed in surgical cases was 8.4%. So,

P = 8.4%,
Q = 100-8.4
= 91.6

Taking allowable error as 1.68.

Sample size N= $\frac{1.96^2 \times 8.4 \times 91.6}{1.68^2}$

= 1047

Inclusion criteria

All patients admitted and who received at least one unit of whole blood or blood component transfusion in Surgery department.

Exclusion criteria

Ventilator patients, patients in coma or unable to access the transfusion reaction, transfusion reactions reported after 24 hours of transfusion (Delayed reactions) were excluded from the study.

Study procedure

Information regarding the issue of blood components to Surgery department is collected from Transfusion medicine department. Patient history, onset of transfusion and transfusion reactions recorded from case sheets and transfusion reaction reporting form Routine transfusion reaction workups were done. Each unit of blood transfusion can be taken as separate transfusion. Cases with previous history of transfusion or received more than one-unit transfusion is considered as multiple transfusions. Transfusion of each blood product is evaluated and the data obtained is entered in Microsoft excel and statistical analysis done with SPSS software 24.

Information for transfusion reaction workup and evaluation

Checking clerical errors -reconfirming and matching the implicated products, returned blood bag along with transfusion set for visible clots or hemolysis, patients post transfusion sample for hemolysis, compatibility testing (DAT) is repeated on pre and post transfusion sample, blood sample from residual blood bag for sterility testing to the microbiology laboratory, patient with features of jaundice and high coloured urine –URE, LFT and RFT.

Grading of severity of adverse transfusion reaction grade[3]

Table 1: Grading of severity of adverse transfusion reaction grade.

Grade	
Grade I/non severe	Resolves on symptomatic treatments
Grade II/severe	Requires medical or surgical intervention or prolong hospital stay
Grade III/life threatening	Require major intervention
Grade IV/death	Resulting in mortality

International society of blood transfusion criteria for imputability3

Table 2: Imputability criteria.

Definite (certain)	Conclusive evidence beyond reasonable doubt
Probable (likely)	Evidence is clearly in favor
Possible	Evidence is indeterminate
Unlikely	Evidence in favor of other clinical causes
Excluded	Conclusive evidence for causes other than transfusion

RESULTS

The mean age of the present study population is 54 years. The majority belongs to the age group 40-59 years (46.09%). Male patients were predominant (69.18%) in this study compared to females (30.82%). The most frequent blood group transfused was O positive (34.06%), followed by B positive group (25.09%). Least transfused blood group was A negative (12%) and AB negative (25%).

The most common indication for blood and blood component transfusion in the Surgery department was post-surgical causes (67.46%) followed by anemia, and the least common was during surgery. Most of the blood and blood product transfusions were done with a hemoglobin range of 8-10gm/dl. The most frequent blood component transfused was fresh frozen plasma (59%) followed by PRBC (35%), and the least frequent was whole blood (0.66%) transfusion. Most of the blood and blood product transfusions were done with an INR range of 1.1-2.

In 71.87% of cases, the time gap between the issue of blood component and transfusion was within 30min, and in 24.8% cases, it was within 1hour. Only in 0.47% of cases, the time gap between issue and transfusion exceeds 2hours.84.54% of the patients received multiple blood and blood products.

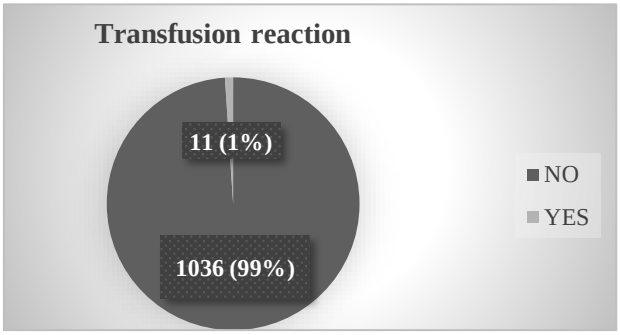

Figure 1: Frequency of transfusion reaction (n=1047).

Out of 1047 patients received transfusion 11 patients (1%) had a transfusion reaction (Figure 1). All transfusion reactions were graded as per ISBT criteria (Table 1). All reactions were of grade 1, non-severe type. In all cases, the imputability levels were assessed as definite (certain). Most of the transfusion reactions (63.64%) were reported within the age range of 41-60 years (Table 2). Most common indication for transfusion among patient who developed transfusion reactions were anemia and the most common cause for total blood and blood component transfusion in the surgery department was post-surgical causes (67.46%).

Most common symptom associated with transfusion reaction was fever (54.54%) followed by urticaria (36.36%) and breathlessness (9.1%) (Figure 2). Lab investigations were done to rule out the causes for these symptoms. The results of the workups were correlated with clinical findings, and the final impression was given.

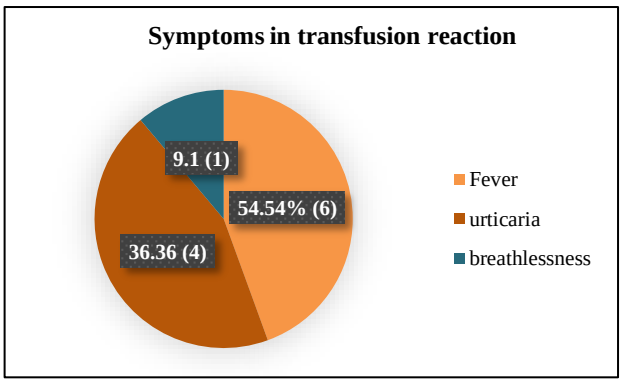

Figure 2: Symptoms in transfusion reaction patients (n=11).

Table 3: Pattern of transfusion reaction.

Reaction	Percentage (N)
Febrile non-hemolytic transfusion reaction	54.64 (6)
Allergic reaction	36.36 (4)
Transfusion associated circulatory overload	9 (1)

The incidence of febrile non-hemolytic transfusion reaction was maximum (54.64%), followed by an allergic reaction (36.36%) (Table 3). Febrile non-hemolytic transfusion reaction is defined as a 1°C temperature rise associated with transfusion and having no medical explanation other than blood/component transfusion. Rigors and other symptoms in the absence of fever are also included as FNHTR. In the present study, it was observed that fever usually came at the end of transfusion with or without chills and did not exceed 101°F. All patients developed FNHTR were managed with the administration of paracetamol.

Table 4: Blood component and frequency of transfusion reaction.

Component	Febrile non hemolytic transfusion reaction	Allergic reaction	Transfusion associated circulatory overload
PRBC (8)	62.5% (5)	25% (2)	12.5% (1)
FFP (3)	33.33% (1)	66.67% (2)	0

Out of the 11-transfusion reaction most reaction was due to transfusion of PRBC (72.7%) followed by FFP (27.3%) and febrile non haemolytic transfusion reaction (62.5%) was the maximum with PRBC. Allergic reactions were more common with FFP (66.67%) (Table 4).

Table 5: Time gap between issue of components and transfusions in transfusion reactions.

Time gap	No reaction	Reaction	Grand total
Within 30 min	746	7	752
30-1 hour	256	4	260
1-2 hour	30	0	30
>2 hours	5	0	5
Grand total	1037	11	1047

Out of the 1047 cases 752 patients received transfusions within 30 minutes of issue of blood product from blood bank. Among these 7 patients developed transfusion reaction. None of the patients developed transfusion reaction after one hour of transfusion of blood product (Table5). In most patients transfusion reactions developed after 25-50 ml of blood transfusion and no persons developed reactions within 10 ml of transfusion.

DISCUSSION

The incidence of transfusion reactions can be only assessed only by clinical reporting of transfusion reaction. This study was done to assess the frequency and pattern of adverse reactions to blood transfusion. Patients were selected from the Surgery department irrespective of age, sex, and diagnosis. In the present study, the frequency of the transfusion reactions was found to be 1% (11/1047) (Figure 1). In a similar study by Sharma et al, the frequency of transfusion reaction was 0.92% (32/3455) (Table7).[4]

ATR workup did not reveal a clerical error in any of the cases. This could be attributed to our institutional policy of checking the patient blood group report and unique patient register number at multiple levels by the technician, doctor, the person issuing the blood unit, and finally by the nursing staff, and the doctor responsible for blood administration. In the present study, number of transfusions exceed the number of patients who received a transfusion.

This was attributed to the requirement of multiple transfusions. Multiple transfusions were also reported in studies done by Kapadia et al, Venkatachalapathy et al and Bhattacharya et al.[4-6] Multiple transfusions were common in patients with anemia, elective surgery and post-surgical causes. Multiple transfusion increases the risk of transfusion reaction.[7] In our study, no such associations were found. Acute transfusion reactions were seen more commonly associated with PRBC and whole blood transfusion (Table 6) followed by FFP transfusions. In our study transfusion reactions RFD associated with PRBC transfusion is found to be 72.7% and no reactions were reported with platelet transfusions.

Table 6: Comparative studies of ATR due to blood and blood components.

Name of the study	WB and PRBC (%)	Platelets (%)	FFP (%)
Present study	72.7	-	27.3
Venkitachalapathy et al[5]	95.83	-	2.08
Bhattacharya et al[6]	82.8	11.4	5.7
Payendeh et al[15]	45.7	20.3	30.51
Kumar et al[2]	42.8	37.75	19.38

FNHTR is the most common adverse effect of blood transfusion. The rate of FNHTR by packed red cells in most studies ranged from 0.5-1%.[8] In our study, the highest percentage of reactions were constituted by FNHTR (54.64%). In a study by Ghataliya et al found out that febrile non-hemolytic transfusion reaction (FNHTR) in surgical patients is 50.8% which is concordant with our study.[1] The frequency of FNHTR with the use of packed red blood cells is 62.5% and FFP is 33.33%. The reaction was common with packed red cells. It is caused by antigen-antibody interaction and the release of cytokines during the storage of blood. The incidence of FNHTR in our case is high because PRBC's were not leuco-depleted. Pre storage leucodepletion significantly reduces the rate of FNHTR. All the subjects developed FNHTR had a fever with chills and an average temperature of 39.3±0.5 °C. The present study correlated well with the study done by Bassi et al, Chowdhury et al, Khalid et al and Bhattacharya et al which also showed the highest incidence of FNHTR in their studies.[6,11-13]

Table 7: Comparison of acute transfusion reactions in different studies.

Features	Rejla et al, Kottayam 2019, (n=1047)	Sharma et al, (Sikkim)[4] 2015 (n=3455)	Kumar et al, AIIMS[2] 2013 (n=3,80658)	Khoyumthem et al, manipur[9] 2018 (n=31,074)	Hatayama et al[10], 2018 (n=18745)
Frequency of ATR	1%	0.92%	0.05%	0.09%	2.60%
MC reaction	FNHTR	Allergic reaction	Allergic reaction	Allergic reaction	Allergic reaction
MC blood component	PRBC	PRBC	PRBC	PRBC	Platelet concentrate
Leucofilters	Absent	Absent	Present	Present	Present

Table 8: Comparative studies of incidence of ATRs.

Name of studies	FNHTR (%)	Allergic reaction (%)	AHTR (%)	Bacterial sepsis (%)	TACO (%)
Present study	54.64	36.36	-	-	9
Chowdhury et al[12]	62.50	25	-	-	-
Khalid et al[13]	41.90	34.40	1.80	0.90	-
Venkitachalapathy et al[5]	43.75	50	-	-	-
Kumar et al[2]	35.70	55.10	2.60	-	0.50
Bhattacharya et al[6]	41	34	8.56	3.80	-

Febrile reactions result from the interaction of the recipient antibodies with the antigens on the donor leucocyte and can be reduced by transfusion of leuko reduced blood products. The frequency of FNHTR in Pahuja et al study is 37.2%, which is lower than other studies where they are using a quadruple bag with internal filters and RBC filters (Table 7).[14] These rates were concordant with the study of Kumar et al.[2]

In RBC transfusion, the rate of FNHTR was found to be 0.4% before leuco depletion and diminished to 0.2% after the introduction of leucodepletion15. Similar results were shown by Michlig et al.[16] The frequency of transfusion reactions is much lower in leuco-reduced transfusion than non-leuco-reduced blood transfusion (Table 7). The most common quoted rate for FNHTR in non-leuco-reduced transfusion is 0.5%-1%. In our case, the frequency of FNHTR is 0.57%. Another study by Uhlmann et al showed the incidence of transfusion reaction is 0.08% in pre-storage leuco-reduced blood.[17]

Incidence of allergic reactions varies with literature (Table 8) (25-55.1%).[6,9,13] Incidence of allergic reaction was second highest, constituting 36.36% in our study. Majority of the allergic reactions presented with skin manifestations such as urticarial, rashes and pruritis. In the present study, it was 25% with PRBC and 66.67% with FFP. Allergic reactions can occur in up to 2% of transfusions as a result of recipient IgE and donor antigen interactions triggering the release of histamine and de novo synthesis of leukotrienes and platelet activating factor. The present study correlated well with the literature which also showed highest prevalence of allergic reaction with FFP.[12,15] The higher rate of allergic reaction seen with FFP could probably explained by reaction to plasma proteins like IgA and haptoglobulin.[18]

TACO was seen in one case giving an incidence of 9%. In a study by Popovsky19 incidence of TACO was estimated to be 0.03% in patients transfused with PRBC. Our case was that of a 50-year-old female with a history of carcinoma cervix presented with severe anemia of 4gm/dl. The probable explanation for the development of TACO is due to hyperkinetic circulation. She expired after two days of admission to this hospital. In severe anemia even the slightest increase in blood volume is not tolerated by the heart Therefore, it is necessary to follow AABB recommendations of infusing RBC at the rate of 2-4ml/min.[20] Studies estimating the risks of hypervolemia due to transfusion reported 0.31-0.42/1000 recipients of transfusion.

A study by Ghtaliya et al found out that the risk of transfusion reactions increases with each transfusion and when the transfusion is initiated after 30 min in children. Which was coherence with the WHO recommendation of initiation of transfusion within 30 min.[1] It was not evident in surgical patients in the same study. In our case also so such associations were seen in surgical patients. Most of our patients developed transfusion reactions within 30 minutes of transfusion.

Acute hemolytic reactions were not observed in the present study. This indicated efficient blood grouping and cross-matching practices by our blood bank and lack of administration errors. Transfusion errors generally remain under-reported, primarily due to lack of awareness, and also due to inadequate feedback system. Developing institutional guidelines and having an appropriate adverse event reporting format is crucial. However, there is a need to sensitize all the health personnel involved in the transfusion chain for more thorough reporting. Haemovigilance Programme of India was launched on December 10, 2012. Our department has also enrolled in this program since 2019.[18]

It is important to ensure the appropriate use of blood components. Maintaining a proper transfusion schedule and use of leukocyte depleted component and keeping transfusion minimum and use only when absolutely indicated may make blood transfusion safer. Also, to reduce transfusion reaction blood grouping, cross-matching and screening should be done properly and aseptic precaution should be taken during blood collection, storage and transfusion, and maintenance of storage temperature and environment. The introduction of leukoreduction at our institution could probably reduce the incidence of acute transfusion reaction in general and febrile reactions in particular.

CONCLUSION

The frequency of ATR in our study was 1% (Figure 1). Most of the reactions occurred for patients who received transfusion for anemia. Most common symptom developed during transfusion was fever and urticaria

(Figure 2). All transfusion reaction patients were evaluated for clerical mistakes, hemolytic reactions, and immunological compatibility then categorized into different patterns. Febrile non-hemolytic transfusion (FNHTR) and allergic reactions were common patterns followed by transfusion associated cardiac overload (TACO) seen. The component associated with FNHTR and transfusion-associated cardiac overload were seen with packed RBC transfusions and the component associated with allergic reaction was with FFP (Table 4).

The present institutional hemovigilance data is highly valuable as it facilitates corrective and preventive actions to minimize the potential risks associated with safety and quality in blood processing and transfusion to donors, patients, and staff. Introduction of leucoreduction will be helpful in further reducing the incidence of adverse transfusion reactions especially FNHTR.

Limitations

In our study, the sample size was small compared to most studies conducted in other states. The low sample size causes a lower number of transfusion reactions and a decreased number of representative populations like elder patients/younger participants, which might have an effect on some ATRs like TRALI and TACO.

In our study, only patients in surgery departments are studied so the generalization of the results to other departments like pediatric and OBG is not possible. In addition to sample size, the small outcome of interest (ATR) might have an effect to predict the association between ATRs and explanatory variables.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Kapadia J, Ghataliya K, Desai M, Mehariya K, Rathod G, Bhatnagar N, et al. Transfusion-related adverse reactions in pediatric and surgical patients at a Tertiary Care Teaching Hospital in India. Asian J Transfusion Sci. 2017;11(2):180.
2. Kumar P, Thapliyal R, Coshic P, Chatterjee K. Retrospective evaluation of adverse transfusion reactions following blood product transfusion from a tertiary care hospital: a preliminary step towards hemovigilance. Asian J Transfusion Sci. 2013;7(2):109.
3. Prakash P, Basavaraj V, Kumar R. Recipient hemovigilance study in a university teaching hospital of South India: an institutional report for the year 2014–2015. Global J Transfusion Med. 2017;2(2):124.
4. Sharma DK, Datta S, Gupta A. Study of acute transfusion reactions in a teaching hospital of Sikkim: a hemovigilance initiative. Indian J Pharmacol. 2015;47(4):370.
5. Venkitachalpathy TS. A prospective audit of blood transfusion reactions in tertiary care hospital for the use of blood and blood components. J Blood Disorders Transfusion. 2013;03(02):55-9.
6. Bhattacharya P, Marwaha N, Dhawan HK, Roy P, Sharma RR. Transfusion-related adverse events at the tertiary care center in North India: An institutional hemovigilance effort. Asian J Transfusion Sci. 2011;5(2):164-70.
7. Lichtiger B, Thornton PE. Hemolytic transfusion reactions in oncology patients: experience in a large cancer center. J Clin Oncol. 1984;2:438-42.
8. Consensus conference. Peri operative red cell transfusion JAMA. 1988;9:260-70.
9. Khoyumthem P, Rachandra K, Goswami S, Lyngdoh L, Sharma A, Singh A. Acute transfusion reactions in a tertiary hospital: a 2-year retrospective study. J Med Society. 2018;32(1):47.
10. Hatayama Y, Matsumoto S, Hamada E, Kojima N, Hara A, Hino N, et al. Analysis of acute transfusion reactions and their occurrence times. Yonago Acta Medica. 2018;61(1):087-090.
11. Bassi R, Aggarwal S, Bhardwaj K, Thakur K. Patterns of adverse transfusion reactions in a tertiary care centre of north India: a step towards hemovigilance. Indian J Hematology Blood Transfusion. 2016;33(2):248-53.
12. Chowdhury F, Biswas J, Siddiqui M, Hoque M, Adnan S. Transfusion reaction among the blood recipient - a study of 120 cases. J Dhaka Med College. 1970;17(2):67-71.
13. Khalid S, Usman M, Khurshid M. Acute transfusion reactions encountered in patients at a tertiary care center. J Pak Med Assoc. 2010;60(10):832-6.
14. Puri V, Pahuja S, Mahajan G, Gupta P, Jain M. Reporting adverse transfusion reactions: A retrospective study from tertiary care hospital from New Delhi, India. Asian J Transfusion Sci. 2017;11(1):6.
15. Payandeh M, Zare ME, Kansestani AN, Pakdel SF, Jahanpour F, Yousefi H, et al. Descriptions of acute transfusion reactions in the teaching hospitals of Kermanshah university of medical sciences Iran. Int J Hematol Oncol Stem Cell Res. 2013;7(2):11-6.
16. Michlig C, Vu DH, Wasserfallen JB, Spahn DR, Schneider P, Tissot JD. Three years haemovigilance in a general university hospital. Transfus Med. 2003;13:63-72.
17. Uhlmann EJ, Isgriggs E, Wallhermfechtel M, Goodnough LT. Prestorage universal WBC reduction of RBC units does not affect the incidence of transfusion reactions. Transfusion. 2001;41:997-1000.
18. Hemovigilance programme of India. Available at https://www.researchgate.net/publication/236115004_Hemovigilance_Program-India. Accessedon 12 January 2020.

19. Popovsky M. A Transfusion related acute lung injury: incidence, pathogenesis and the role of multicomponent apheresis in prevention. Transfus Med Hemother. 2008;35:76-9.
20. Tobian A, Heddle N, Wiegmann T, Carson J. Red blood cell transfusion: 2016 clinical practice guidelines from AABB. Transfusion. 2016;56(10):2627-30.

Cite this article as: Rahim R, Varghese S, Thambi R, Suma MS. Study on acute transfusion related adverse reactions in surgery department. Int J Res Med Sci 2021;9:1381-7.