

Acute Transfusion Reactions (ATRs) in Intensive Care Unit (ICU): A Retrospective Study

RAJESH KUMAR¹, MANVI GUPTA², VARUN GUPTA³, AMARJIT KAUR⁴, SONIA GUPTA⁵

ABSTRACT

Background: Blood transfusion is a frequent and integral part of critical care. Although life saving, it can occasionally be unsafe and result in a spectrum of adverse events. Acute transfusion reactions (ATRs) are probably under diagnosed in critically ill patients due to confusion of the symptoms with the underlying disease.

Aim: To analyze the incidence and spectrum of ATRs occurring in critically ill patients.

Materials and Methods: This was a retrospective review conducted from 1st April 2011 till 31st March 2013. The ATRs related to the administration of blood components in the patients admitted in various Intensive Care Units (ICUs) were recorded, analyzed and classified on the basis of their clinical features and laboratory tests.

Results: During the study period 98651 blood components were issued. Out of these 21971 were issued to various ICUs. A total of 225 transfusion reactions were reported from the various critical care departments during this period. The most frequent were Febrile Non Hemolytic Transfusion Reactions (FNHTR) 136 (60.4%), allergic reactions 70 (31.2%), hemolytic reactions 1(0.4%) and non specific reactions 18 (8%). The incidence of ATRs in our study was found to be 1.09% in adult ICUs and 0.36% in pediatric ICUs.

Conclusions: Blood transfusion is a vital therapeutic procedure with a potential risk to already critical patients. So a strict vigilance has to be kept and each transfusion has to be monitored carefully with prompt recognition and treatment of ATRs. A rational use of these products considering their deleterious effects can decrease transfusion related morbidity and mortality in the critically ill patients.

Keywords: Critically ill, Rational use, Blood components

INTRODUCTION

The need for critical care is expanding as the society ages. Transfusion is a frequently administered therapy among the critically ill patients, to treat a condition leading to significant morbidity or mortality that cannot be prevented or managed effectively by other means [1]. However transfusion is an irreversible event which carries potential benefits as well as risks to the recipient. Any unfavorable event occurring in a patient during or after transfusion of blood and blood components and for which no other reason can be found is labeled as a transfusion reaction. These untoward effects vary from being relatively mild to severe. Improved donor selection and antibody screening has definitely guaranteed a safe blood supply, still a variety of transfusion reactions are encountered. These reactions are mainly non-infectious in nature and may be acute or delayed in onset. Depending on their severity and appropriate clinical response acute reactions can be mild, moderate and severe or life threatening [2].

ATRs occur within 24 hours of transfusion administration, although majority occur during or within four hours of transfusion [2,3]. They can be immunologic reactions and non-immunologic reactions. Acute immunologic reactions are associated with an immune response to antigens on red cells, white cells, platelets or plasma proteins and include acute hemolytic transfusion reaction (AHTR), febrile non hemolytic transfusion reaction (FNHTR), allergic, anaphylactic, transfusion related acute lung injury (TRALI), while non immunologic reactions include transfusion related sepsis, circulatory overload, non immune hemolysis, hypocalcemia and hypothermia [2]. Recent reports estimate that ATRs occur in 0.2-10% of blood transfusions and are responsible for death in approximately 1 per 250,000 units [3,4].

Patients in ICUs are critically ill and it has been estimated that one-third of these patients and 50% of the mechanically ventilated patients receive at least one transfusion [5]. The complex clinical condition of the patients could mask the symptoms of a serious transfusion reaction. Thus complications associated with transfusion of blood and blood products in the ICUs are underdiagnosed and could be associated with significant morbidity and mortality. A rapid recognition and management of the ATRs in critically ill patients is mandatory. The present study was conducted with the aim of determining the characteristics and type of ATRs occurring in ICU patients requiring transfusion.

MATERIALS AND METHODS

This study was conducted in the Department of Immunohaematology and Blood Transfusion, Dayanand Medical College and Hospital, Ludhiana from April 2011 to March 2013. We retrospectively reviewed all the ATRs reported to the department from patients admitted in various ICUs.

An algorithm was already provided in various critical care units, on how to proceed with clinical and laboratory investigations in case of ATRs. A transfusion reaction form was issued along with all the blood products, containing patient's name, age, identification number, name of the ICU, ABO-Rh group of the patient, type of blood product and blood unit registration number. In case of any reaction this form had to be completely filled providing the following information: date and time of starting and stopping the transfusion, when the reaction was noted, patient's pre and post-transfusion vital signs, approximate volume transfused, clinical signs and symptoms. The reaction form along with patients post transfusion blood sample, urine sample and the left over blood product bag

with the attached transfusion set had to be sent back to the blood bank.

All the reactions were evaluated by the blood bank physician. The requisition form, patient's blood sample and the component bag were cross-checked to rule out clerical errors. The time period between the issue of blood component and the start of transfusion were noted and in case of delay the conditions of storage of the product were inquired. The blood bag and the transfusion set were examined for any clot or discoloration. Plasma in the post reaction blood sample was inspected for evidence of hemolysis. ABO-Rh grouping, re-cross matching and Direct Antiglobulin Test (DAT) of pre and post reaction samples and donor's bag were done. Peripheral blood film of post reaction sample and patient's urine were checked for evidence of hemolysis. Blood bag and the patient's blood sample were sent for culture. In case of a reaction like TRALI, chest X-ray report was cross checked.

Transfusion reactions occurring during or within twenty-four hours of transfusion were evaluated. Based on the clinical features mentioned in the transfusion reaction form and the laboratory reports, these reactions were classified according to the standards and recognized criteria defined by American Association of Blood Banks [2]. The signs and symptoms, for which no direct relationship to the transfusion could be demonstrated, were classified as non-specific reactions.

RESULTS

During the study period a total of 98651 blood components were issued from the department. Out of these 21,971 (22.3%) were transfused to patients admitted in various ICUs. The total number of transfusion reactions reported from various blood components during this period was 225 [Table/Fig-1]. These were observed in age groups from 6-60 years and included 158 (70.22%) males and 67 (29.77%) females.

Blood components were issued to various adult and pediatric critical care units. The number of units transfused and the percentage of reactions reported from these ICU's are shown in [Table/Fig-2].

The various signs and symptoms reported were fever, chills, urticaria, rashes, pruritis, nausea, headache, dyspnoea / tachypnoea, anxiety and sweating. All the reported ATRs were categorized according to investigations and the established criteria. The Spectrum of adverse reactions noted with different blood components is shown in [Table/Fig-3].

DISCUSSION

Studies and trials have been conducted to evaluate the transfusion practices in critical care units [5-6]. ICUs account for a high rate of transfusion, with our study showing a rate of 22.3%. Callera et al., [7], Vincent et al., [8] and Payandeh et al., [9] demonstrated the rate of transfusion in ICUs to be 39.7%, 37% and 18% respectively.

Use of blood components in critically ill patients has been the subject of discussion for many years. In our study 56.9% of the transfused units were packed red cells, 22.7% fresh frozen plasma and 20.4% platelet concentrates. Similarly Rao et al., [10] assessed transfusion practice in 1,247 critically ill patients and showed that 53% were administered red cells, 22% fresh frozen plasma and 16% platelets.

We observed that red cells were most commonly associated with ATRs followed by FFP and platelet concentrates with the rates of 73.8%, 19.1% and 7.1% respectively. Payandeh et al., [9] observed the rates to be 45.7%, 30.5% and 20.3% for red cells, plasma and platelets. However, Grujic et al., [11] and Khalid et al., [12] recorded the reaction rates to be 62.4%, 11.2%, 14.4% and 87.7%, 5.1%, 7.0% for red blood cells, platelets and fresh frozen plasma respectively.

The incidence of ATRs recorded from various adult ICUs in our study

Components	No. of units transfused	No. of reactions (%)
Packed red cells	12491	166 (73.8%)
Fresh Frozen Plasma	4992	43 (19.1%)
Platelet Concentrate	4488	16 (7.1%)
Total	21971	225

[Table/Fig-1]: Number of transfusions and transfusion reactions noted with various components

Department	No. of units transfused	No. of reactions (%)
Emergency ICU*	6591	83 (36.8%)
Medical ICU	5492	64 (28.5%)
Surgical ICU	4394	53 (23.6%)
Cardiac ICU	3295	17 (7.6%)
Pediatric ICU	2199	08 (3.5%)
Total	21971	225

[Table/Fig-2]: Number and percentage of transfusion reactions noted in various Intensive Care Units

* Intensive Care Unit

Type of reaction	Packed red cells	Fresh frozen plasma	Platelet concentrate	Total (%)
FNHTR*	110	16	10	136 (60.4%)
Allergic	42	26	2	70 (31.2%)
Hemolytic reactions	1	0	0	1(0.4%)
Transfusion related sepsis	0	0	0	0
TRALI†	0	0	0	0
Non Specific reactions	13	1	4	18 (8%)
Total	166	43	16	225

[Table/Fig-3]: Distribution of Acute transfusion reactions according to the type of blood components

*Febrile non hemolytic transfusion reaction

†Transfusion related acute lung injury

was 1.09%. Callera et al., [7] and Payandeh et al., [9] recorded low incidences of 0.26% and 0.71% respectively. The ATR incidence in pediatric ICU in our study was 0.36% which was similar to that recorded by Callera et al., [7] (0.15%). However the incidence reported by Ozata et al., [13], Pedrosaa et al., [14] and Gauvin et al., [15] were 9.3%, 4.6% and 1.6% respectively. The highest percentage of ATRs in our study was observed from emergency ICU. The repeated transfusions could lead to alloimmunization against the RBC antigen leading to transfusion reactions in these patients [9]. A strong positive relation exists between transfusion reactions and the number of units transfused [16].

The most common ATRs in our study were FNHTRs 136 (60.4%), allergic reactions 70 (31.2%), non specific reactions 18 (8%). Hemolytic reaction was observed in one patient (0.4%) as a result of ABO incompatibility due to wrong patient sampling. Incidents of incorrect blood component transfusion have also been reported in the literature [17]. No case of TRALI, anaphylaxis and transfusion related sepsis was reported. Khalid et al., [12] also recorded similar results with 41.9% FNHTR, 34.4% allergic reactions, 1.8% hemolytic and 5.1% non-specific reactions.

Red cell (81%) and platelet concentrates (7.3%) were most commonly associated with FNHTR in our study. This was in concordance with Callera et al., [7] who observed 64.2% with packed cells and 25% with platelet transfusion. Febrile reactions result from the interaction of the recipient antibodies with the antigens on donor leucocytes and can be reduced by transfusion of leuco-reduced blood products [18-20]. Commonest reaction noted with fresh frozen plasma by us and the Brazilian study [12] was allergic. Blood components containing larger amounts of plasma are associated with more severe allergic reactions [21].

Blood supply is a limited resource that should not be used indiscriminately. In our institute ICU patients are transfused at hemoglobin level of 8-9gm/dl irrespective of any complication. Normovolemic patients who are not actively bleeding get no benefit from blood transfusions if hemoglobin > 7g/dl [22]. All surgical patients with platelet count below one lakh/ μ l are transfused platelets. However the general consensus recommends a count of 50,000/ μ l for general surgery and 100,000/ μ l for neurosurgery [23-24]. Fresh frozen plasma is given prophylactically in many patients to prevent bleeding. Studies suggest that it should not be given without clinical evidence of coagulopathy [24].

LIMITATIONS

Clinical reporting was the only source of information about incidence of transfusion reactions, thus the accurate figure for transfusion reactions was difficult to obtain.

The data pertaining to whether the reaction was from leuco-reduced or non leuco-reduced blood component was not collected.

CONCLUSION

The data from our institute suggests that transfusion practice in the critical care units is not restrictive and all the components are not leucoreduced. We have to remember that transfusion although necessary and life saving carries the risks of alloimmunization, transfusion reactions and various other transfusion related morbidities, that could pose a vital threat to already critical patients. A high degree of suspicion has to be kept in case of new symptoms or exacerbation of the existing symptoms in a critical patient. Use of only leukocyte depleted components should be in practice. A rational blood use is at least as effective and possibly superior to a liberal transfusion strategy in critically ill patients.

RECOMMENDATIONS

ICU studies based on exclusive use of leucoreduced products are required so that we can determine the rate of reduction of adverse reactions by their use.

Reports from blood transfusion centers regarding practices in critical care units have to be stimulated, so that definite evidence based guidelines can be formed.

Establishing a hemovigilance system with active participation of all, can be a better option to gain understanding of transfusion related events.

ACKNOWLEDGEMENTS

The authors especially thank all the medical and non medical staff of the department and hospital for their sincere work and cordial cooperation with this project.

REFERENCES

- [1] Chisakuta A, Lackritz E, McClelland B. Appropriate use of blood and blood products. In *The Clinical Use of Blood*. World Health Organisation. 2001: 7-19.
- [2] Mazzei CA, Popovsky MA, Kopko PM. Noninfectious complications of blood transfusion. In *Technical manual*. American Association of Blood Banks. 16th ed. Maryland. 2008:5-51.
- [3] Callum JL, Pinkerton PH. Transfusion reactions. In *Bloody easy: Blood transfusions, blood alternatives and transfusion reactions. A guide to transfusion medicine*. 2nd ed. Ontario. 2006: 34-65.
- [4] Kuriyan M, Carson JL. Blood transfusion risks in the intensive care unit. *Crit Care Clin*. 2004; 20:237-53.
- [5] Levy MM, Abraham E, Zilberberg M, MacIntyre NR. A descriptive evaluation of transfusion practices in patients receiving mechanical ventilation. *Chest*. 2005; 127: 928-35.
- [6] Hebert PC, Wells G, Blajchman MA, Marshall J, Martin C, Pagliarello G, et al. A multicentre, randomized, controlled clinical trial of transfusion requirements in critical care. Transfusion requirements in critical care investigators, Canadian Critical Care Trials Group. *N Engl J Med*. 1999; 340: 409-17.
- [7] Callera F, Silva CO, Moura AF, Melo DB, Melo CM. Description of acute transfusion reactions in a Brazilian transfusion service. *Bras Hematol Hemoter*. 2004;26(2):78-83.
- [8] Vincent JL, Baron JF, Reinhart K, Gattinoni, Thijs L, Webb A, et al. Anemia and blood transfusion in critically ill patients. *JAMA*. 2002; 288(12): 1499-507.
- [9] Payandeh M, Zare ME, Kansestanil AN. Descriptions of acute transfusion reactions in the teaching hospitals of Kermanshah University of Medical Sciences. *Int J of Hematology Oncology and Stem Cell Research*. 2013; 7(2):11-16.
- [10] Rao MP, Boralessa H, Morgan C, Soni N, Goldhill DR, Brett SJ, et al. North Thames Blood Interest Group. *Anaesthesia*. 2002;57:527-9.
- [11] Grujic J, Gulan Z, Budakov Z. Importance of hemovigilance and reports on transfusion reaction in blood component therapy. *Med Pregl*. 2012;65(1-2): 50-3.
- [12] Khalid S, Usman M, Mohammad K. Acute transfusion reactions encountered in patients at a tertiary care center. *J Pak Med Assoc*. 2010;60(10):832-36
- [13] Ozata N, Demirkol D, Karabocuoğlu M, Citak A, Uçsel R, Uzel N. Acute transfusion reactions in critically ill pediatric patients. *Critical Care*. 2008; 12(Suppl 2): 239.
- [14] Pedrosaa A, Pinto F, Lins L, Deus G. Blood transfusion reactions in children: associated factors. *J Pediatr (Rio J)*. 2013; 89.
- [15] Gauvin F, Lacroix J, Robillard P, Lapointe H, Hume H. Acute transfusion reactions in pediatric intensive care unit. *Transfusion*. 2006; 46: 1899-1908.
- [16] Chowdhury FS, Biswas J, Siddiqui MAE, Hoque MM, Adnan SK. Transfusion reaction among the blood recipient- A study of 120 cases. *J Dhaka Med Coll*. 2008;17(2):67-71.
- [17] Chiaroni J, Legrand D, Dettori I, Ferrera V. Analysis of ABO discrepancies occurring in 35 French hospitals. *Transfusion*. 2004;44:860-4.
- [18] Payne R. The association of febrile transfusion reactions with leuco-agglutinins. *Vox Sang*. 1957; 2: 233-41.
- [19] Lieden G, Hilden JO. Febrile transfusion reactions reduced by use of buffy-coat - poor erythrocyte concentrates. *Vox Sang*. 1982; 43: 263-5.
- [20] Heddle NM, Klama LN, Griffith L, Roberts R, Shukla G, Kelton JG. A prospective study to identify the risk factors associated with acute reactions to platelet and red cell transfusions. *Transfusion*. 1993; 33: 794-97.
- [21] Domen RE, Hoeltge GA. Allergic transfusion reactions. *Arch Pathol Lab Med*. 2003; 127: 316-20.
- [22] Nicholas SW, Mitchell ML. Blood transfusion practice today. *Crit Care Clin*. 2004;20:179-86.
- [23] Netzer G, Dutton RP, Hess JR. Blood transfusion in critical care. *F1000 Med Rep*. 1 (2009).
- [24] Rebullia P. Trigger for platelet transfusion. *Vox Sanguis*. 2000; 78: S179-S82.

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Immunohaematology and Blood Transfusion (IHBT), Dayanand Medical College and Hospital, Ludhiana, Punjab, India.
2. Senior Resident, Department of IHBT, Dayanand Medical College and Hospital, Ludhiana, Punjab, India.
3. Assistant Professor, Department of Surgery, Dayanand Medical College and Hospital, Ludhiana, Punjab, India.
4. Professor and Head, Department of IHBT, Dayanand Medical College and Hospital, Ludhiana, Punjab, India.
5. Assistant Professor, Department of IHBT, Dayanand Medical College and Hospital, Ludhiana, Punjab, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Marvi Gupta,
28-B, Tagore Nagar, Ludhiana, Punjab-141001, India.
Phone: 09888673127, E-mail: guptamanvi81@yahoo.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Sep 27, 2013**
Date of Peer Review: **Dec 19, 2013**
Date of Acceptance: **Dec 25, 2013**
Date of Publishing: **Feb 03, 2014**