

Pattern of Blood Component Requisition and Utilization in a Tertiary Care Hospital

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INTRODUCTION

Blood transfusion has been used for a long time as an integral part of patient care. The first successful human-to-human transfusion was performed in 1818 by James Blundell¹. Over time, it was discovered that blood transfusion requires specific tests to ensure its safety and effectiveness. As a result, procedures such as blood grouping, cross-matching, and screening for WHO-recommended transfusion-transmissible infections are conducted before transfusion. It is important to note that blood is a unique and limited resource. Although several blood substitutes exist, they often fail to deliver satisfactory outcomes and may even cause toxic effects². So, the demand for blood continues to rise,

ABSTRACT

Introduction: Blood transfusion is an integral part for managing transfusion dependent patients, surgical-gynecological emergencies and many other cases. Symmetry should be maintained between blood component requisition and utilization to ensure the optimization of blood transfusion service. Understanding the trend of proportion between demand and supply of blood component can set prediction for future. Optimum utilization of blood transfusion service will save time and laboratory resources. This study was conducted to evaluate the pattern of requesting and utilizing the blood components in a tertiary care hospital.

Materials & method: It is a retrospective study. It was held in transfusion medicine and clinical hematology department of a tertiary care hospital from July to December 2024. Patient's ID, blood request form and requested unit were kept under record. Simultaneously blood component units delivered for transfusion and units returned or not transfused were also recorded. Data were analyzed for cross match transfusion ratio (CT ratio), transfusion index (TI) and transfusion probability calculation (%T).

Result: Over the six-month period 4,903 units of blood components were crossmatched for 4,454 patients. A total of 3,711 units were transfused to 3,035 patients. In this study C:T ratio was found 1.31, transfusion probability (%T) was 68.19 and transfusion index (TI) was 0.82 overall six months period. Analysis of the result of our study signifies appropriate use of blood units.

Conclusion: Blood transfusion is a life-saving procedure for those with a genuine medical need. So, its use should always be under monitoring to prevent misuse of this valuable resource. Various transfusion indices like C:T ratio, %T and TI can be used as standard tools for ensuring appropriate use of blood. Persistent improvement in good transfusion practice can be achieved by continuous surveillance.

Keywords: Transfusion index, Crossmatch Transfusion ratio, Transfusion probability

both for resuscitation and patient management. In response to this growing need along with the rising costs and potential risks linked to transfusions, research has been undertaken to assess appropriate blood utilization and ordering practices^{3,4}.

It has been noticed that clinicians often tend to over-order blood components, which put pressure on the blood center's supply. Crossmatched units that go unused become unavailable for patients who urgently need them or have valid medical reasons. This situation is concerning, as it reduces the already limited blood stock and shortens the shelf life of these products, leading to the waste of valuable resources⁵. Over-ordering of blood products

also places an additional workload on blood center staff and creates unnecessary financial burdens for patients. This practice leads to the excessive use of laboratory reagents, resources, time, and personnel, ultimately straining the overall efficiency of the blood transfusion services⁶. Hence, it is important to systematically evaluate blood transfusion ordering patterns and identify departments with a high cross-match-to-transfusion (C/T) ratio⁴. The tendency to over-order blood is most commonly observed in patients scheduled for elective surgeries. These preoperative requests are often driven by assumptions of worst-case scenarios or an overestimation of intraoperative and postoperative blood loss, leading to unnecessary demands for multiple units of packed red blood cells (RBCs). The cross-match-to-transfusion (C/T) ratio invented by Boral Henry in 1975, serves as a key quality indicator to assess the appropriateness and efficiency of blood ordering practices within hospital transfusion services^{6,7}. Following this, numerous researchers have utilized the C/T ratio to evaluate blood transfusion practices. The C/T ratio is calculated by dividing the number of packed RBC units crossmatched by the number of units actually transfused. According to the Association for the Advancement of Blood and Biotherapies (AABB), a ratio exceeding 2 suggests over-ordering. Elevated C/T ratios can help pinpoint departments or individual clinicians with inefficient blood-ordering patterns and indicate the potential need for alternative crossmatching strategies⁸. This study aimed to evaluate blood utilization practices by analyzing the C/T ratio, identify departments with elevated ratios, and develop preventive and corrective measures for those areas. The AABB requires blood transfusion services to have a system that ensures appropriate usage of the valuable and scarce resources of the blood center⁸. Regular audits and evaluations of blood ordering and utilization practices should be carried out by the Hospital Transfusion Committee (HTC). The data obtained can be utilized to facilitate discussions during HTC meetings, with participation from all pertinent clinical and administrative departments⁸, thereby improving blood transfusion services and implementing measures that can enhance the services provided by the blood center.

METHODS

This is a retrospective study conducted in transfusion medicine and clinical hematology department of a tertiary care hospital. Data were collected from July 2024 to December 2024 including patients' demographic data, total number of units cross matched, total number of units transfused, total number of patients transfused and total number of patients crossmatched.

Inclusion criteria: patients admitted under medicine and surgery department.

Exclusion criteria: patients who were admitted under gynecology, obstetrics and pediatrics.

Blood units utilization indices were calculated by following equations:

C:T ratio: total number of units crossmatched / total number of units transfused⁹

Transfusion probability (%T): Total number of patients transfused / total number of patients crossmatched $\times 100$ ¹⁰

Transfusion index (TI): number of units transfused / number of patients crossmatched⁹.

A lower C:T ratio below 2 generally indicates efficient utilization of blood. Higher than 2 of C:T ratio indicates over-ordering. A higher percentage of Transfusion probability (%T) is determinant of better utilization and higher index of TI suggests efficient use of crossmatched units.

Collected data were analyzed for demographical analysis, C:T ratio, TI and %T.

RESULTS

A total of 4,903 units and 4,454 patients were cross-matched for 3,711 units of transfusion to 3,035 patients. Table 1 showed the distribution of utilized blood and its components in departments of medicine and surgery. A total of 1,585 (42.7%) units were issued for the patients admitted in the Departments of Medicine and 2,126 (57.3%) units for patients admitted in department of surgery. 711 (48.83%) of PRBC units were issued for medicine department and 1,022 (62.81%) of whole blood units were issued for surgery department.(Table-1)

Table 1: Distribution of utilized blood and its components in various departments of medicine and surgery

Department	Whole blood units	PRBC units	FFP units	Platelet units RDP/SDP
Medicine 1585 (42.7%)	605 (37.19%)	711 (48.83%)	190 (35.85%)	79 (80.61%)
Surgery 2126 (57.3%)	1022 (62.81%)	745 (51.17%)	340 (64.15%)	19 (19.39%)
Total 3711 (100%)	1627 (100%)	1456 (100%)	530 (100%)	98 (100%)

Table 2: month wise distribution of units crossmatched and units transfused scenario.

Months	No. of units crossmatched	No. of units transfused	No. of patients transfused	No. patients cross matched
July	850	620	550	780
August	740	580	480	680
September	850	620	510	800
October	860	640	500	830
November	790	610	445	650
December	813	641	550	714
Total	4,903	3,711	3,035	4,454

Table 3: Distribution of C:T ratio, transfusion probability (%T) and transfusion index (TI) of six months

Months	C:T ratio	%T	TI
July	1.37	70.5	0.79
August	1.27	70.5	0.80
September	1.37	63.75	0.78
October	1.34	60.0	0.77
November	1.29	68.46	0.93
December	1.26	75.96	0.88
Mean	1.31	68.195	0.825

Overall C:T ratio was found 1.31, transfusion probability (%T) 68.19 which is a measure of appropriateness of blood utilization. and overall transfusion index (TI) was 0.82 over those six months indicating significant use of blood.

DISCUSSION

Blood and its components are important in treating patients, but they are in limited supply and can carry risks like infections and reactions. The way blood is used and how transfusions are done can vary widely between hospitals and countries. In our study majority of the units issued were PRBC (48.83%) for department of medicine while in surgery department, most of the issued units were whole blood (62.81%) and FFP (64.15%). Platelets were mostly issued for medicine department (80.61%). A study conducted by Mondal B et al., showed that PRBC was the most issued component which is similar to our study⁷. Numerous quality indicators in transfusion medicine have been identified as per WHO such as C:T ratio, T% and TI to monitor the gross over-ordering of blood^{11,12}.

The C:T ratio is often used as a measure of the effectiveness of blood ordering practice. It should be ideally 1.0 and C:T ratio >2.0 means that 50% of the cross matched units are transfused¹³. In this study, the C:T ratio was 1.31 overall six months which is very similar to other studies^{7,14,15}. It was found much lower than other developing countries like Iran (3.71)¹⁶. The need for a blood transfusion depends on each patient's condition and the decision of their doctor. However, high C:T ratios are often caused by a lack of clinical audits, clear blood ordering guidelines, and poor communication between clinicians and the doctors of Blood Transfusion Department¹⁷.

Another component of our study was to determine the transfusion index (TI). A value of 0.5 or more signifies efficient blood usage and appropriateness of number of units transfused⁴. In our study TI was estimated to be 0.825 overall six months period which indicates significant use of blood units. These findings also correspond to study done by Waheed S et al., where the it was 0.99¹⁸. Another study by Mondal B et al, overall TI was 0.92, which is very much similar to our study⁷. TI was found lower by yadzi et al (0.31)¹⁶.

Another index measured in this study was transfusion probability. Mead JH et al. first studied the transfusion probability denoted as %T¹⁹. In this

study %T was found 68.195% which signifying the appropriateness of number of units cross matched. Another study done by Mondal B et al found the overall %T 67.52% which corresponds with this study⁷. Quader A et al. found higher %T (94.41) in their study¹⁵.

Therefore, developing a blood ordering policy and monitoring the use of blood by various measures can ensure appropriate use of blood.

Limitations of our study is that gynecological and pediatric patients were not included and duration of the study was short.

CONCLUSION

Using a proper blood ordering schedule can help lower patient costs and improve how the blood bank manages its supply. This makes sure that blood is available for those who truly need it. Every hospital should have a blood transfusion committee to create guidelines for using blood, reducing waste, and doing regular checks. Based on our results, we can say that our hospital is following good practices for ordering and using blood.

CONFLICT OF INTEREST

Nothing to declare.

ETHICAL CONSIDERATION

This study was conducted after approval from the ethical review committee. Confidentiality of this study participants was strictly maintained.

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