

Original Research Article

UTILIZATION OF VARIOUS BLOOD COMPONENT IN TERTIARY HEALTH CARE CENTRE

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ABSTRACT

Background: Blood components play a crucial role in the treatment of various clinical conditions and help mitigate complications associated with whole blood transfusions. Assessing the utilization patterns of blood components, monitoring demand, and implementing effective audit procedures are essential steps in ensuring the optimal utilization of this invaluable resources. The purpose of this study is to evaluate the utilization of various blood components, packed red cell volume, fresh frozen plasma, and platelet concentrate, at a tertiary care centre.

Methods and Materials: In this retrospective cross-sectional study, data regarding the utilization of blood products was collected over the span of one year, from January 2022 to December 2022. This data was obtained from blood centre registers and compiled in Microsoft Excel sheet for subsequent analysis, allowing for the assessment of the utilization patterns of different blood components in various departments.

Results: A total of 2,647 blood units were issued in the study duration. The most frequently used blood product was Packed Red Blood Cells, followed by Fresh Frozen Plasma and Random Donor Platelets. Packed Red Cells were predominantly utilized by Medicine department, closely followed by the Surgery department. Notably, patients with anemia and those undergoing surgery had the highest demand for Packed Red Cells.

Conclusion: Conducting regular audits on the usage of blood components is imperative for every blood bank. These efforts serve multiple purposes, not only partially fulfilling the current demand for blood products but also curbing unnecessary wastage of these vital resources.

Keywords: Blood component, PCV, FFP, RDP, Utilization.

INTRODUCTION

Blood is a life sustaining bodily fluid responsible for transporting vital nutrients and oxygen while aiding in the removal of waste products from essential organs. Blood transfusion is a pivotal procedure in the resuscitation and treatment of various medical conditions. This life-saving practice was originally pioneered by the British obstetrician James Blundell in 1818, with its first successful application in the treatment of post-partum haemorrhage.^[1,2] During the period spanning from the 1950s to the 1960s, a significant breakthrough occurred with the discovery that separating blood components and using them in

clinical practice had distinct advantages over the conventional practice of transfusing whole blood. Despite the remarkable technological advances, there still isn't a 100% substitute for blood and blood components.^[1] According to the World Health Organization, India, as a developing nation, has a considerable need for approximately 13.9 million units of blood. This demand corresponds to about 1% of its vast population, which stands at 1.39 billion. The role of blood components becomes significant in addressing this escalating demand due to a substantial disparity between supply and demand in developing countries.^[3] Human blood is a complex mixture comprising cells, colloids, and crystalloids. This

intricate concoction can be meticulously separated through a process called blood fractionation into distinct blood components, including packed red cells, platelets, fresh frozen plasma, and cryoprecipitate. Each of these blood components serves a unique medical purpose, catering to a variety of healthcare needs.^[4] Consequently, the separation of these components optimizes the utility of a single unit of whole blood, significantly enhancing its effectiveness in addressing a diverse array of medical conditions and requirements.^[4] The packed cell volume primarily consists of red blood cells, making it the most transfused blood component. This packed red cell volume can be obtained by centrifuging whole blood. It plays a vital role in the treatment of various conditions such as acute blood loss, bone marrow failure, and cardiac or respiratory dysfunction.^[5] Previous studies have highlighted that administering packed red cell volume to critically ill patients have the potential to elevate their haemoglobin levels and expedite their recovery.^[6] Once red blood cells are separated from whole blood, the remaining plasma can be effectively utilized to procure fresh frozen plasma (FFP) or platelet for transfusions. These components are essential in treating patients with altered APTT, INR, or bleeding disorders.^[7,8]

Efficient utilization of blood components minimizes the occurrence of complications associated with transfusions and reduces the financial burden on patient. Indeed, the proper use of blood products is vital in maintaining the quality and safety of transfusion services.^[9] Blood component therapy has gained popularity in recent times due to its advantages over whole blood transfusion, including a reduced risk of volume overload in patients. Overuse of blood products can contribute to a shortage of these critical resources.^[10] Currently, there is limited available data on blood products and their utilization in both developing and developed countries. Assessing the utilization patterns of blood components, monitoring demand, and implementing effective audit procedures are essential steps in ensuring the optimal utilization of this invaluable resource.^[10]

The purpose of this study is to evaluate the utilization of various blood components, packed red cell volume, fresh frozen plasma, and platelet concentrate, at a tertiary care centre.

MATERIAL AND METHODS

In this retrospective cross-sectional study, data regarding the utilization of blood products was collected over the span of one year, from January 2022 to December 2022. This data was obtained from the registers of blood centre of a tertiary care centre. Data of packed cell volume, fresh frozen plasma and platelets concentrates issued to various surgical wards, surgery, gynaecology, orthopaedics,

Otorhinolaryngology as well as non-surgical wards such as medicine, casualty, and the issuance of blood products to other hospitals was collected. The data also included additional variables like gender and the indication for transfusions of various blood components. The compiled data was then entered in Microsoft Excel sheet for subsequent analysis, allowing for the assessment of the utilization patterns of different blood components.

RESULTS

Over the course of one year, from January 2022 to December 2022, a total of 2,647 units of various blood components, Packed Red Cells (PRBC), Fresh Frozen Plasma (FFP), and Random Donor Platelet (RDP), were utilized. On an average, there were 220 units used each month. (Table.1, Figure.1)

Upon analysis, it was evident that out of the 2,647 units, the most frequently utilized blood component was Packed Red Cells (n = 1,702), followed by Fresh Frozen Plasma (FFP) (n = 794) and Random Donor Platelets (RDP) (n = 151).

The highest utilization of Packed Red Cells (PRBC) was observed towards the end of the year. Conversely, the maximum issuance of Fresh Frozen Plasma occurred during the months of September to November. (Table. 1, Figure.1) Utilization of PRBC according to blood group over the span of one year revealed that, A positive was issued the highest number of units 557 in total, while AB negative was the lowest issued units. (n = 13). (Table.2, Figure.2)

The distribution of Packed Red Cells (PRBC) across various wards in the hospital revealed that the Medicine ward was issued the highest proportion, accounting for 30.72% (n = 523) of the total, followed by Surgery, 30.37% (n = 517). (Table.3) The lowest utilization was observed in Otolaryngology at 0.41% (n=7). The most common indication for patients requiring Packed Red Cells (PRBC) was anemia, accounting for 865 units out of this 795 were nutritional anemia, and 70 were Hemolytic anemia. Anemia was followed by Surgery accounted for 45.12 % (n=768) of the indications. (Table.4, Figure.3). Least common indication for PRBC transfusion was pregnancy 1.76% (n=30).

In case of Fresh Frozen Plasma (FFP) (n= 794), deranged coagulation factors was the common indication. Conversely, the least common indication for Fresh Frozen Plasma (FFP) was bleeding, (n= 37) of cases. For Random Donor Platelet (RDP) (n=151), Dengue fever accounted for the most frequent indication and the least common indication was Labour, making up just (n=5) of cases. (Table 5).

In terms of gender distribution, there was no significant difference between male-to-female ratio of 0.9 to 1. Females made up 51.00% of the total population (n = 1350), indicating a relatively minor difference.

Table 1: Month wise Utilization of Blood Product.

Month	PRBC	FFP	RDP	Total
January	112	56	09	177
February	120	58	8	186
March	118	58	12	188
April	109	55	13	177
May	125	59	15	199
June	122	63	11	196
July	129	60	10	199
August	135	66	07	208
September	152	72	13	237
October	180	78	17	275
November	197	82	17	296
December	203	87	19	309
Total	1702	794	151	2647

Table 2. Blood Group wise Utilization of the Packed Red Cells.

Sr. No	Blood Group	Utilized PRBC
1	A Rh Positive	552
2	A Rh Negative	014
3	B Rh Positive	481
4	B Rh Negative	016
5	AB Rh Positive	140
6	AB Rh Negative	013
7	O Rh Positive	466
8	O Rh Negative	020
Total		1702

Table 3. Department wise distribution of various blood component

Sr.no	Wards	PRBCS	FFP	RDP
1	Medicine	523	171	26
2	Surgery	517	92	-
3	Gynecology	302	402	74
4	Pediatrics	121	57	35
5	Orthopedics	115	10	-
7	Otolaryngology	7	01	-
8	Other hospitals	117	61	16
Total		1702	794	151

Table 4. Indications for Packed Red Cells utilization.

Sr.no	Indications	PRBC	%
1	Nutritional deficiency anemia	795	46.8%
2	Hemolytic anemia	70	4.11%
3	Surgery	768	45.12%
4	RTA	39	2.29%
5	Pregnancy	30	1.76%
Total		1702	

Table. 5 Indications for issue of Fresh Frozen Plasma and Random donor platelet.

Sr.no	Various Indication	FFP	RDP
1	Deranged coagulation parameters	332	
2	Surgery	250	39
3	Trauma	110	42
4	Sepsis	65	
5	Bleeding	37	
6	Dengue		57
7	Anemia		8
8	Labour		5
TOTAL		794	151

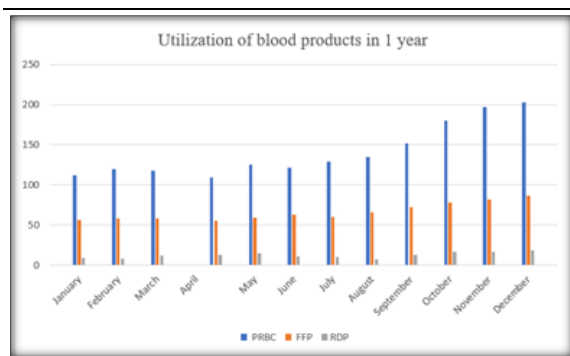


Figure 1. Comparison of monthly distribution of various blood component over the span of one year. (PRBC – XPacked Red Cell, FFP – Fresh Frozen Plasma, RDP-Random Donor Platelet.)

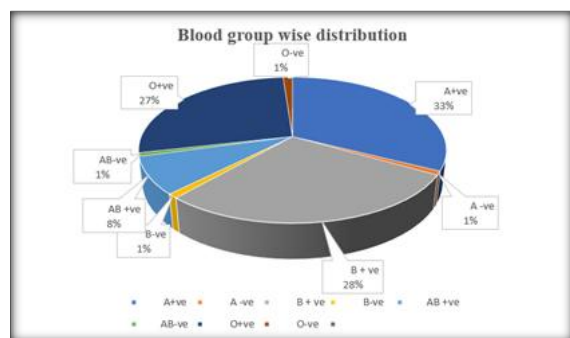


Figure 2. Utilization of the Packed Red Cells According to Blood Group

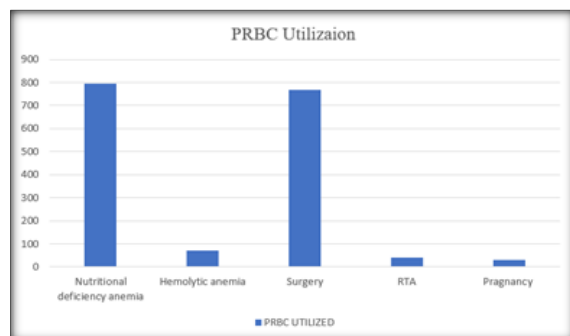


Figure 3. Indications for Packed Red Cells utilization.

DISCUSSION

Currently, well-established clinical guidelines dictate that transfusion therapy should only be administered for clearly defined indications, with a preference for using blood components instead of whole blood. The optimal utilization of blood components, characterized by high quality and minimal wastage, constitutes a crucial objective in blood component utilization.^[10,11]

2647 units in all were issued in the current trial following extensive cross-matching and screening. Packed Red Blood Cells (PRBCs), used in 1702 cases, were the most commonly used blood component. FFP (fresh frozen plasma) was used in 794 cases, and donor platelets (RDP) were used in 794 cases. These results are consistent with research by Anshoo et al.^[12] and Hulwan et al.^[11] which

indicated that packed red blood cells (PRBC) were most frequently used, followed by frozen fresh plasma (FFP) and random donor platelets (RDP).

Our ongoing study exhibits a notable correlation with the research conducted by Sharma R et al.^[11] revealing a pattern of diminished unit supply at the onset of the year, followed by a surge towards the year's conclusion. In our particular case, this trend can be attributed to the increased availability of blood bag stock during this timeframe. It's important to note that, in contrast to our findings, the study by Dushyant Gaur et al.^[13] reported a peak in the middle of the year, followed by a decline as the year progressed.

A positive blood group (n = 552) was issued the most frequently in our study, whereas AB negative blood group (n = 13) was issued the least frequently. These results coincide with the research that Sharma et al.^[12] undertook.

When it came to departmental utilization, the Medicine department used PRBC units at the highest rate (30.72%; n = 523), closely followed by the Surgery department (30.37%; n = 517). These results are consistent with a study conducted by Alcantara et al.^[14] which also found that the Medicine department used PRBC units at the highest rate. In the research of Venkatachalapathy et al. and Subhash et al., the gynaecology department issued the greatest amount of Packed red cell PRBC units.^[15]

In our study, the primary indication for Packed red cell (PRBC) transfusion was anemia (51%), with most patients having nutritional deficiency anemia 46.8%. This consistent with the findings of Sharma et al.^[11] and Dushyant Gaur et al.^[13]

Disordered coagulation factors have been identified as the predominant cause of infection, constituting approximately 70% of cases requiring Fresh Frozen Plasma (FFP), mirroring the findings of a study conducted by Gaur DS et al.^[13] Patients with deranged coagulation factors often require FFP to correct or support their coagulation profiles.

Dengue was the most common indication for about 80% of Random donor platelets (RDP) issued in our study, which closely concordance with the findings of Ambrose et al.'s study.^[17] India has a vast and densely populated territory. This, coupled with the high incidence of dengue, results in a substantial number of cases where platelets are required, contributing to the statistic.^[18]

In our study, females required a higher number of blood component units than males, which is consistent with the studies conducted by Venkatachalapathy et al. and Subhash et al.^[15] Contrary to the studies by Mathew et al.^[16] our study found that females received more blood transfusion units than males.

It is noteworthy that the Food and Drug Administration categorizes whole blood and its components as drugs, given their therapeutic benefits for patients.^[1] The current standard in blood centres is to process various blood components from donated whole blood units and subsequently provide patients

with only the specific components they require, abiding complication. Developing nations have grappled with the persistent challenge of ensuring a sufficient and secure supply of blood and its derivatives, particularly in cases of limited voluntary donors, inadequate storage facilities, and instances of improper practices in blood procurement and utilization.^[19]

CONCLUSION

This study offers valuable insights into the utilization of blood components within a tertiary care centre, providing a comprehensive understanding of usage patterns. Among these components, Packed Red Blood Cells (PRBCs) emerged as the most frequently utilized product, followed by Fresh Frozen Plasma (FFP) and Random Donor Platelets (RDP).

The primary indication for PRBCs was anemia, with surgery representing a significant common usage. For Fresh Frozen Plasma (FFP), the primary indication was related to deranged coagulation factors, while Dengue fever stood out as the most prevalent reason for Random Donor Platelets (RDP) transfusions.

Conducting regular audits on the usage of blood components is imperative for every blood bank. These efforts serve multiple purposes, not only partially fulfilling the current demand for blood products but also curbing unnecessary wastage of these vital resources. By doing so, blood banks contribute to reducing the financial burden on healthcare systems.

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