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Original Research Article

Analysis of Utilization Patterns of Blood and Blood Components in a Tertiary Care Teaching Hospital in Southern India

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Abstract:

Background: Blood transfusion plays a vital role in the management of a wide range of medical and surgical conditions. With the advent of component therapy, the appropriate utilization of blood and blood components has become essential to improve patient outcomes, conserve blood resources, and minimize transfusion-related complications. Regular audits of transfusion practices help assess utilization patterns and promote rational use of blood products.

Objective: To evaluate the utilization pattern of blood and blood components among various clinical departments in a tertiary care teaching hospital.

Materials & Methods: A retrospective record-based study was conducted in the Blood Centre of a tertiary care teaching hospital from January 2021 to December 2024. A total of 5,890 units of blood and blood components issued during the study period were analyzed. Data regarding the utilization of packed red blood cells (PRBCs), fresh frozen plasma (FFP), random donor platelets (RDPs), and whole blood were collected from donor registers, blood requisition forms, blood component preparation records, and blood issue registers. The utilization pattern was evaluated with respect to recipient demographics, clinical indications, and departmental distribution.

Results: PRBCs constituted the most frequently utilized blood component, followed by FFP. Anaemia was the most common indication for PRBC transfusion, while burns followed by thrombocytopenia were the major indications for FFP administration. Female patients received a greater proportion of PRBC transfusions, whereas FFP utilization was higher among male patients. The Department of General Medicine accounted for the highest utilization of both PRBCs and FFP. Most PRBC transfusions were administered to patients aged 21–30 years, while FFP utilization was highest among patients aged 31–40 years.

Conclusion: Packed red blood cells constituted the most frequently utilized blood component, highlighting the continued burden of anaemia and transfusion-dependent conditions in tertiary care settings. The observed utilization patterns emphasize the importance of periodic transfusion audits for promoting evidence-based component therapy, optimizing blood inventory management, and strengthening patient blood management practices.

Keywords: Blood Components, Blood Utilization, Packed Red Blood Cells, Fresh Frozen Plasma.

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Introduction

Blood transfusion is an essential component of modern healthcare and plays a vital role in the management of various medical, surgical, obstetric, and hematological conditions. [1,2] Since no effective substitute for human blood is currently available, the appropriate utilization of blood and blood components remains crucial for patient care. [1] With advances in transfusion medicine, component therapy has largely replaced whole blood transfusion, enabling targeted treatment and optimal utilization of donated blood. [3,4]

Blood component therapy includes packed red blood cells (PRBCs), fresh frozen plasma (FFP), platelet concentrates, and cryoprecipitate.]3] Appropriate use of these components improves therapeutic efficacy while minimizing unnecessary exposure to transfusion-related complications such as transfusion reactions, alloimmunization, circulatory overload, and transfusion-transmitted infections. [5,6] Therefore, adherence to evidence-based transfusion practices is essential. [7]

Regular audits of blood utilization help assess transfusion practices, identify inappropriate usage, reduce wastage, and improve inventory management. [8,9] Such studies provide valuable information regarding departmental requirements and clinical indications for transfusion, thereby assisting in the formulation of institutional transfusion policies and improving patient care. [9,10]

The utilization pattern of blood and blood components varies among hospitals depending on patient demographics, disease burden, and clinical practices. [11,12] Therefore, periodic evaluation of blood usage is necessary to ensure the judicious utilization of this valuable resource. [8] The present study was undertaken to analyze the utilization pattern of blood and blood components in a tertiary care teaching hospital in Southern India over a four-year period and to assess their distribution across various clinical departments and clinical indications for transfusion. [13]

Materials and Methods

This retrospective record-based study was conducted in the Blood Centre of a tertiary care teaching hospital in Southern India over a period of four years, from January 2021 to December 2024. A total of 5,890 units of blood and blood components issued during the study period were included and analyzed. These comprised packed red blood cells (PRBCs), fresh frozen plasma (FFP), random donor platelets (RDPs), and whole blood.

Data regarding blood component utilization were collected from blood requisition forms, donor registers, blood component preparation records, and blood issue registers maintained in the Blood Centre. Information pertaining to recipient demographics, clinical diagnosis, indication for transfusion, requesting department, and type and number of blood components transfused was retrieved and analyzed.

The utilization pattern of blood and blood components was evaluated with respect to age, gender, clinical indication, and departmental distribution. Data were analyzed using descriptive statistics and expressed as frequencies and percentages. Confidentiality of patient information was strictly maintained throughout the study.

Inclusion Criteria

1. All voluntary and replacement blood donors fulfilling donor selection criteria prescribed by the National Blood Transfusion Council (NBTC), National AIDS Control Organisation (NACO), and Ministry of Health and Family Welfare (MoHFW), Government of India.
2. All blood units and blood components prepared and issued by the Blood Centre during the study period.
3. All recipients who received blood or blood component transfusion during the study period.

Exclusion Criteria

1. Blood donors who did not meet the standard donor eligibility criteria.
2. Blood and blood components discarded due to expiry, contamination, leakage, seroreactivity, or other quality-related causes.
3. Cases with incomplete records or untraceable indications for transfusion.
4. Blood units reserved but not transfused.

Results

A total of 5,890 units of blood and blood components were issued during the four-year study period from January 2021 to December 2024. Packed red blood cells (PRBCs) constituted the most frequently utilized blood component, followed by fresh frozen plasma (FFP), random donor platelets (RDPs), and whole blood.

The annual distribution of blood component utilization demonstrated that PRBCs accounted for the majority of transfusions throughout the study period. The highest utilization of PRBCs and FFP was observed in the year 2024. Random donor platelets (RDPs) and whole blood were issued only occasionally and were utilized according to specific clinical requirements.

Gender-wise analysis revealed that PRBC utilization was higher among female recipients, whereas FFP utilization was higher among male recipients. The utilization of RDPs was comparable between both genders.

Age-wise distribution showed that the highest number of PRBC transfusions was administered to patients in the 21–30 years age group, while FFP utilization was highest among patients aged 31–40 years. Utilization of platelet concentrates and whole blood was comparatively low across all age groups.

Department-wise analysis demonstrated that the Department of General Medicine was the largest consumer of blood and blood components, followed by the Department of General surgery. FFP utilization was also highest in the Department of General Medicine.

Analysis of clinical indications revealed that anaemia was the most common indication for PRBC transfusion, followed by preoperative and postoperative blood loss. Burns followed by Thrombocytopenia were the leading indications for FFP transfusion. Random donor platelets were predominantly utilized in patients with

thrombocytopenia, while whole blood was mainly used for exchange transfusion.

Table 1: Blood & blood components issued in the span of 4 years of study period (January 2021 to December 2024)

Component Issued	2021	Percentage (%)	2022	Percentage (%)	2023	Percentage (%)	2024	Percentage (%)
1.Whole Blood	00	00	01	0.016	00	00	02	0.033
2. PRBC	530	8.998	1204	20.441	1335	22.672	1714	29.100
3.FFP	61	1.035	313	5.314	339	5.755	367	6.230
4.RDP	00	00	17	0.288	00	00	07	0.118

Percentages are calculated with respect to the total blood and blood components issued during the study period (n = 5890)

Table 2: Gender wise distribution of issued blood & blood components issued in the span of 4 years of study period (January 2021 to December 2024)

Component Issued	Males	Percentage (%)	Females	Percentage (%)
1.PRBC	2179	36.994	2604	44.210
2.FFP	673	11.426	407	6.915
3.RDP	12	0.203	12	0.203
4.Whole Blood	02	0.033	01	0.016

Table 3: Age – wise distribution of various blood & blood components issued in the span of 4 years of study period (January 2021 to December 2024)

Component Issued	Age – wise distribution of recipients with Percentage (%)
1.PRBC	0 – 10 years – 229 (3.887) 11 – 20 years – 416 (7.062) 21 – 30 years – 893 (15.164) 31 – 40 years – 807 (13.704) 41 – 50 years – 802 (13.616) 51 – 60 years – 590 (10.016) 61 – 70 years – 698 (11.850) 71 – 80 years – 295 (5.008) 81 – 90 years - 52 (0.882) 90 – 100 years – 01 (0.016)
2. FFP	0 – 10 years – 47 (0.797) 11 – 20 years – 44 (0.747) 21 – 30 years – 134(2.275) 31 – 40 years – 314 (5.204) 41 – 50 years - 264(4.482) 51 – 60 years – 197(3.344) 61 – 70 years – 54 (0.916) 71 – 80 years – 20 (0.339) 81 – 90 years - 06 (0.101) 90 – 100 years – 00 (00)
3. RDP	0 – 10 years – 01 (0.001) 11 – 20 years – 01 (0.001) 21 – 30 years – 01 (0.001) 31 – 40 years – 02 (0.033) 41 – 50 years - 10 (0.169) 51 – 60 years – 09 (0.152)
4. Whole Blood	21 – 30 years – 01 (0.016) 41 – 50 years - 02 (0.033)

Table 4: Department – wise distribution of various blood & blood components issued in the span of 4 years of study period (January 2021 to December 2024)

Component	Department with number of units issued with Percentage (%)
1. PRBC	Medicine – 1822 (30.933) OBG – 1774 (30.118) Surgery – 453 (7.691) Orthopaedics – 451 (7.657) Paediatrics – 237 (4.023) ENT – 20 (0.339) OMFS – 02 (0.033) Pulmonology – 23 (0.390) Oncology – 01 (0.016)
2. FFP	Medicine – 512 (8.692) OBG – 41 (0.696) Surgery – 470 (7.981) Orthopaedics – 10 (0.169) Paediatrics – 41 (0.696) ENT – 02 (0.033) Pulmonology – 04 (0.069)
3.RDP	Medicine – 16 (0.271) Surgery – 8 (0.136)
4. Whole Blood	Medicine – 02 (0.033) Orthopaedics – 01 (0.016)

Table 5: Distribution of various blood & blood components issued according to clinical diagnosis in the span of 4 years of study period (January 2021 to December 2024)

Component issued	Clinical Diagnosis with Percentage (%)
1. PRBC	Anaemia – 3463 (58.794) Prior to Surgical procedure – 1124 (19.08) Post-operative bleeding – 77 (1.307) Intra operative bleeding – 23 (0.400) Thalassemia – 11 (0.186) Sickle Cell Anaemia – 02 (0.033) Chronic Kidney disease – 26 (0.441) Pancytopenia – 45 (0.764) Disseminated Intravascular Coagulation (DIC) – 02 (0.033) Dialysis – 04 (0.067) Diffuse Chronic Liver Disease – 05 (0.084) Hereditary Spherocytosis - 01 (0.016)
2. FFP	Sepsis – 112 (1.901) Hypovolemia – 30 (0.509) Hypoalbuminemia – 24 (0.407) Burns – 303 (5.144) Active Bleeding – 99 (1.680) Altered Coagulation Profile – 215 (3.650) Thrombocytopenia – 240 (4.081) Haemodialysis – 03 (0.05) Surgery – 02 (0.033) Anaemia – 51 (0.865) Haemophilia – 01 (0.016)
3. RDP	Thrombocytopenia – 17 (0.169) Anaemia – 07 (0.118)
4. Whole Blood	Exchange Transfusion – 03 (0.05)

Discussion

Blood transfusion is an integral component of modern healthcare and plays a vital role in the management of various medical, surgical, obstetric, and hematological conditions. Regular evaluation of blood utilization practices is essential to ensure the judicious use of blood and blood components, minimize wastage, and optimize inventory management in blood centres.

In the present study, packed red blood cells {PRBCs= 4783 (81.205%)} were the most frequently utilized blood component, followed by fresh frozen plasma {FFP=1080(18.336%)}, random donor platelets {RDPs=24(0.407%)} and whole blood {03(0.050)}. Similar findings have been reported by Gaur et al., Mondal et al., Sharma et al., and Muleta et al., who observed that PRBCs constituted the major proportion of blood component utilization in tertiary care hospitals [1,8,10]. The predominance of PRBC utilization may be attributed to the high prevalence of anemia, perioperative blood loss, and medical conditions requiring red cell replacement therapy.

Anaemia was the most common indication for PRBC transfusion in the present study [3463 (58.794%)]. Similar observations have been reported by Kumar et al., Hanumanthaiah et al., and other investigators, who identified anemia as the leading indication for blood transfusion. [7, 12] The high burden of nutritional anemia, chronic diseases, obstetric conditions, and perioperative requirements in developing countries may explain the increased demand for PRBCs.

The Department of General Medicine accounted for the highest utilization of PRBCs [1822 (30.933%)] followed by the Department of Obstetrics and Gynaecology [1774 (30.118%)]. The department of General medicine also accounted for highest use of FFP units [512 (8.692%)] followed by General surgery [470 (7.981%)]. Comparable findings have been documented in previous studies, where medical and obstetric patients constituted the major recipients of transfusion support. [2,8,10] This may be due to the large patient load, frequent occurrence of anemia, chronic illnesses, coagulation abnormalities, and obstetric emergencies encountered in these departments.

Fresh frozen plasma was the second most commonly utilized blood component in the present study1080[(18.336%)]. The major indications for FFP transfusion were burns [303 (5.144%)] followed by thrombocytopenia [240 (4.081%)] and other causes. Similar utilization patterns have been reported in previous blood utilization audits. [8,11] Appropriate use of FFP is important because unnecessary transfusion may increase the risk of transfusion-related complications without providing significant clinical benefit.

Gender-wise analysis revealed a higher utilization of PRBCs among female recipients [2604(44.210%)]. This finding may be attributed to the increased prevalence of anemia among women of reproductive age, obstetric hemorrhage, and gynecological disorders. Higher utilization of FFP [673(11.426%)] among male recipients may reflect the greater prevalence of trauma, surgical conditions, and liver-related disorders requiring plasma support.

The highest utilization of PRBCs was observed among recipients aged 21–30 years [893 (15.164%)], whereas FFP utilization was greatest in the 31–40-year age group [314 (5.204%)], reflecting increased transfusion requirements in the economically productive segment of the population. These findings highlight the substantial transfusion requirements among economically productive age groups and emphasize the need for adequate blood inventory management.

The utilization of RDP and whole blood was comparatively low in the present study. This observation reflects the growing preference for component therapy over whole blood transfusion. Component therapy enables targeted treatment, improves clinical outcomes, and allows a single donated unit of blood to benefit multiple patients. [3,6]

Periodic audits of blood utilization are essential for identifying transfusion trends, evaluating adherence to transfusion guidelines, and minimizing inappropriate transfusion practices. Implementation of evidence-based transfusion policies, clinician education programs, and regular review of blood requisition practices can significantly improve the rational utilization of blood and blood components.

The findings of the present study provide valuable information regarding the utilization pattern of blood and blood components in a tertiary care teaching hospital and may assist in strengthening transfusion practices, optimizing blood inventory management, and improving overall patient care.

Table 6: Comparison of Present Study with Previous Studies

Study	Study Setting	Most Utilized Blood Component	Major Observation
Gaur et al.[1]	Tertiary care hospital, India	PRBC	PRBCs constituted the major component utilized
Kumar et al.[7]	Tertiary care hospital, Eastern India	PRBC	Anaemia was a common indication for transfusion
Mondal et al.[8]	Tertiary care hospital, West Bengal	PRBC	PRBCs were the most frequently utilized component
Sharma et al.[9]	Tertiary care hospital, India	PRBC	Majority of transfusions involved PRBCs
Muleta et al.[10]	Tertiary care hospital, Ethiopia	PRBC	PRBCs accounted for the largest proportion of blood utilization
Present Study	Tertiary care teaching hospital, Southern India	PRBC	PRBCs were the most frequently utilized component, followed by FFP

The findings of the present study are comparable with those reported by Gaur et al., Kumar et al., Mondal et al., Sharma et al., and Muleta et al., all of whom observed that PRBCs constituted the most frequently utilized blood component in tertiary care hospitals. [1, 7-10]

Conclusion

Blood is a precious and irreplaceable therapeutic resource, and its optimal utilization remains a cornerstone of modern transfusion medicine. The present four-year audit involving 5,890 blood and blood component transfusions provides a comprehensive overview of transfusion practices in a tertiary care teaching hospital in Southern India. Packed red blood cells emerged as the most frequently utilized component, with anaemia representing the predominant indication for transfusion, underscoring the persistent burden of transfusion-requiring disorders in clinical practice.

The study highlights the growing preference for component therapy and demonstrates how systematic evaluation of utilization patterns can identify departmental requirements, guide inventory planning, and support rational transfusion practices. Regular blood utilization audits serve not only as quality assurance tools but also as important instruments for improving patient safety, minimizing unnecessary transfusions, and maximizing the benefit derived from every donated unit of blood.

The findings of the present study reinforce the need for continuous monitoring of transfusion practices and provide valuable evidence for developing institutional transfusion policies, strengthening patient blood management programs, and enhancing the overall quality of transfusion services in resource-constrained healthcare settings.

Limitation of the Study

The present study was conducted at a single tertiary care teaching hospital and, therefore, may not be representative of the entire population. Multicentric studies involving larger sample sizes are recommended to provide a more comprehensive understanding of blood and blood component utilization patterns and transfusion practices.

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Conflict of Interest: The authors declare no conflict of interest.

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