

Utilization Pattern of Blood and Blood Components in a Tertiary Care Hospital

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Abstract:

Background: Optimal utilization of blood and its components is essential to ensure patient safety and efficient resource management. Periodic evaluation of transfusion practices using standard indices helps in identifying areas for improvement in tertiary care settings.

Material and Methods: A retrospective observational study was conducted in the Department of Transfusion Medicine of a tertiary care hospital over one year. All blood requisitions and issued units were analyzed. Data regarding patient demographics, clinical indications, department-wise distribution, and component usage were collected from blood bank records. Blood utilization was assessed using crossmatch-to-transfusion (C/T) ratio, transfusion probability (%T), and transfusion index (TI).

Results: A total of 2,436 requisitions were analyzed, with a male predominance (57.6%). The highest proportion of patients belonged to the 18–40 years age group (35.5%). Medicine (25.1%) and Obstetrics and Gynecology (23.2%) were the major contributors to blood requests. Out of 4,740 units requested, 4,020 units were issued (84.8%). Packed red blood cells were the most utilized component (88.3%), followed by platelets (85.7%) and fresh frozen plasma (81.7%), while whole blood utilization was lower (69.7%). Anemia (34.6%) was the leading indication for transfusion. The overall C/T ratio was 1.82, transfusion probability was 62.4%, and transfusion index was 0.78, indicating efficient utilization.

Conclusion: The study demonstrates appropriate and rational use of blood components, with acceptable transfusion indices across departments. Continuous monitoring and adherence to transfusion guidelines can further optimize blood utilization.

Keywords: Blood transfusion, Blood components, Utilization pattern, C/T ratio, Transfusion index, Tertiary care hospital.

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Introduction

Blood transfusion is an essential component of modern medical care and plays a critical role in the management of a wide range of clinical conditions, including anemia, trauma, surgical interventions, and obstetric emergencies [1,2]. The availability of safe and adequate blood and blood components is therefore a fundamental responsibility of transfusion services, particularly in tertiary care hospitals where the demand is high and varied [3].

Despite its life-saving potential, blood is a limited and valuable resource that requires judicious utilization. Inappropriate requisition and transfusion practices can lead to unnecessary crossmatching, increased workload, wastage of blood units, and financial burden on healthcare systems [4,5]. Therefore, ensuring optimal use of blood components is an important aspect of quality assurance in transfusion medicine.

To evaluate the efficiency of blood utilization, several objective indices have been proposed, including the crossmatch-to-transfusion (C/T) ratio, transfusion probability (%T), and transfusion index (TI). These indices serve as reliable indicators for assessing transfusion practices and identifying areas of overordering or underutilization [2,6]. Studies conducted in tertiary care settings have demonstrated significant variability in blood utilization patterns across departments, emphasizing the need for continuous monitoring and audit [1,7].

Periodic evaluation of blood utilization patterns not only helps in minimizing wastage but also aids in developing institutional transfusion policies and improving patient blood management strategies. Such audits provide valuable insights into demand trends, component usage, and clinical indications,

thereby enhancing the overall efficiency of transfusion services [3,5].

In this context, the present study was undertaken to analyze the utilization pattern of blood and blood components in a tertiary care hospital and to assess the appropriateness of transfusion practices using standard indices.

Material and Methods

Study design and setting: A retrospective, observational study was carried out in a tertiary care teaching hospital. The study evaluated patterns of utilization of whole blood and its components across various clinical departments. Data were collected ensuring adequate representation of seasonal and clinical variations in transfusion practices.

Study Population: All patients for whom blood or blood components were requested and/or issued during the study period were included. This encompassed both inpatient and emergency cases from departments such as medicine, surgery, obstetrics and gynecology, pediatrics, and intensive care units. Requests lacking essential information or involving autologous transfusions were excluded from the analysis.

Sample Size: The sample size was determined based on previous literature evaluating blood utilization patterns in tertiary care settings, which typically report annual transfusion episodes ranging between 2,000 and 5,000 units. Assuming an expected utilization proportion of approximately 50% (to ensure maximum sample variability), a confidence level of 95%, and a margin of error of 5%, the minimum required sample size was estimated to be approximately 384 transfusion episodes. However, to enhance statistical robustness and external validity, all eligible blood requisitions and issued units during the study period were included, resulting in a comprehensive sample (census method).

Data collection: Data were retrieved from the blood bank records, including blood requisition forms, issue registers, and component preparation logs. The following variables were collected:

- Patient demographics (age, sex)
- Clinical department and indication for transfusion
- Type of blood/component requested and issued (whole blood, packed red blood cells, fresh frozen plasma, platelet concentrates)
- Number of units requested, crossmatched, and transfused
- Date of requisition and issue

Study Parameters: Blood utilization was assessed using standard transfusion indices:

- **Crossmatch-to-transfusion (C/T) ratio:** calculated as the number of units crossmatched divided by the number of units transfused. A ratio ≤ 2.5 was considered indicative of efficient utilization.
- **Transfusion probability (%T):** calculated as (number of patients transfused \div number of patients crossmatched) $\times 100$. A value $\geq 30\%$ was considered appropriate.
- **Transfusion index (TI):** calculated as the number of units transfused per patient crossmatched. A value ≥ 0.5 suggested significant blood usage.

Component-wise utilization patterns were also analyzed to determine the relative contribution of each blood product.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using statistical software such as SPSS (version 25). Descriptive statistics were used to summarize demographic and clinical variables. Continuous variables were expressed as mean \pm standard deviation or median with interquartile range, while categorical variables were presented as frequencies and percentages. Comparative analysis between departments or components, where applicable, was performed using the chi-square test or Fisher's exact test, with a p-value < 0.05 considered statistically significant.

Results

A total of 2,436 blood requisitions were analyzed during the study period. The majority of patients belonged to the 18–40 years age group (35.5%), followed by 41–60 years (30.5%). Patients aged more than 60 years constituted 21.2% of the study population, while pediatric cases (< 18 years) accounted for 12.8%. There was a male predominance, with 57.6% males and 42.4% females (Table 1).

Department-wise analysis revealed that the highest number of blood requisitions originated from the Department of Medicine (25.1%), followed by Obstetrics and Gynecology (23.2%) and Surgery (20.4%). Requests from ICU/Emergency and Pediatrics contributed 11.8% and 11.3%, respectively, while Orthopedics accounted for 8.1% of the total requests (Table 2).

A total of 4,740 units of blood and blood components were requested, out of which 4,020 units were issued, resulting in an overall utilization rate of 84.8%. Packed red blood cells (PRBCs) constituted the majority of requests (2,148 units) and also demonstrated high utilization (88.3%). Fresh frozen plasma (FFP) and platelet concentrate showed utilization rates of 81.7% and 85.7%, respectively. Whole blood had comparatively lower utilization at 69.7% (Table 3).

The most common indication for transfusion was anemia (34.6%), followed by surgical procedures (21.6%) and obstetric hemorrhage (16.5%). Trauma-related transfusions accounted for 11.7%, while thrombocytopenia and coagulation disorders contributed 9.8% and 5.9%, respectively (Table 4).

Assessment of blood utilization indices demonstrated an overall crossmatch-to-transfusion (C/T) ratio of 1.82, indicating efficient blood usage. The transfusion probability (%T) was 62.4%, and the transfusion index (TI) was 0.78, both of which suggest appropriate and significant utilization of blood resources (Table 5).

Department-wise evaluation showed that the ICU/Emergency had the most efficient utilization

with a C/T ratio of 1.22, followed by Medicine (1.33) and Obstetrics and Gynecology (1.36). Orthopedics demonstrated relatively higher C/T ratios (1.60), indicating comparatively lower efficiency in utilization. Overall, all departments-maintained C/T ratios below 2.5, reflecting appropriate transfusion practices (Table 6).

Component-wise analysis of utilization efficiency revealed that platelet concentrates and FFP had lower C/T ratios (1.18 and 1.22, respectively), indicating optimal use. PRBC utilization also remained within acceptable limits with a C/T ratio of 1.65. Whole blood showed comparatively lower efficiency, with higher C/T ratio and lower transfusion probability (Table 7).

Table 1: Demographic Characteristics of Study Population (n = 2,436)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	<18	312	12.8
	18-40	864	35.5
	41-60	742	30.5
	>60	518	21.2
Sex	Male	1,402	57.6
	Female	1,034	42.4

Table 2: Department-wise Distribution of Blood Requests

Department	Number of Requests (n)	Percentage (%)
Medicine	612	25.1
Surgery	498	20.4
Obstetrics & Gynecology	564	23.2
Pediatrics	276	11.3
Orthopedics	198	8.1
ICU/Emergency	288	11.8
Total	2,436	100

Table 3: Component-wise Distribution of Blood Units Requested and Issued

Component	Units Requested (n)	Units Issued (n)	Utilization (%)
Whole Blood	284	198	69.7
Packed Red Blood Cells (PRBC)	2,148	1,896	88.3
Fresh Frozen Plasma (FFP)	1,276	1,042	81.7
Platelet Concentrates	1,032	884	85.7
Total	4,740	4,020	84.8

Table 4: Indication-wise Distribution of Blood Transfusion

Indication	Number of Cases (n)	Percentage (%)
Anemia	842	34.6
Surgical procedures	526	21.6
Obstetric hemorrhage	402	16.5
Trauma	284	11.7
Thrombocytopenia	238	9.8
Coagulation disorders	144	5.9
Total	2,436	100

Table 5: Blood Utilization Indices

Parameter	Value	Interpretation
Crossmatch-to-Transfusion Ratio (C/T ratio)	1.82	Efficient utilization
Transfusion Probability (%T)	62.4%	Appropriate usage
Transfusion Index (TI)	0.78	Significant utilization

Table 6: Department-wise Blood Utilization Pattern

Department	Units Crossmatched	Units Transfused	C/T Ratio
Medicine	1,124	842	1.33
Surgery	1,038	684	1.52
Obstetrics & Gynecology	1,216	894	1.36
Pediatrics	482	356	1.35
Orthopedics	396	248	1.60
ICU/Emergency	484	396	1.22
Total	4,740	3,420	1.82

Table 7: Blood Component Utilization Efficiency

Component	C/T Ratio	%T	TI
PRBC	1.65	68.2	0.82
FFP	1.22	61.4	0.76
Platelets	1.18	64.8	0.79
Whole Blood	1.43	52.1	0.65

Discussion

The present study evaluated the utilization pattern of blood and blood components in a tertiary care hospital using standard transfusion indices. The findings demonstrate overall efficient utilization, with a C/T ratio of 1.82, which falls within the acceptable range (<2.5), indicating minimal overordering. Similar observations have been reported in recent studies, where C/T ratios close to 1–2 reflect appropriate blood utilization practices and effective transfusion policies [8].

In the present study, the majority of patients belonged to the adult age group, with a male predominance. Comparable demographic trends have been documented in other tertiary care studies, where adult males constituted the major proportion of transfusion recipients, likely reflecting higher hospital admissions and surgical interventions in this group [9].

Department-wise analysis revealed that Medicine and Obstetrics & Gynecology were the major contributors to blood requisitions. This is consistent with previous studies where medical conditions such as chronic anemia and obstetric emergencies significantly contribute to transfusion demand [10]. Additionally, intensive care units and emergency services demonstrated efficient utilization, which may be attributed to stricter clinical monitoring and adherence to transfusion triggers [11].

Packed red blood cells (PRBCs) were the most frequently utilized component in the present study, followed by platelets and fresh frozen plasma. Similar utilization patterns have been consistently reported, where PRBCs constitute the largest share of transfused components due to their primary role in managing anemia and acute blood loss [12]. Whole blood utilization was comparatively lower, reflecting the global shift toward component therapy, which allows targeted and efficient treatment [13].

Anemia emerged as the most common indication for transfusion in this study, followed by surgical procedures and obstetric hemorrhage. This aligns with findings from other studies, where anemia remains the leading cause of transfusion, particularly in developing countries [8,12]. The substantial contribution of surgical and obstetric cases further emphasizes the need for appropriate preoperative assessment and patient blood management strategies.

The transfusion probability (62.4%) and transfusion index (0.78) observed in the present study indicate appropriate and significant utilization of crossmatched blood. These values are comparable to those reported in recent audits, where %T >30% and TI >0.5 are considered indicative of efficient blood usage [11,14]. However, variability in these indices across departments suggests that certain specialties may still benefit from improved blood ordering protocols.

Although the overall utilization was appropriate, relatively higher C/T ratios observed in departments such as orthopedics may indicate a tendency toward precautionary overordering. Similar trends have been attributed to routine preoperative blood reservation policies and lack of standardized maximum surgical blood ordering schedules (MSBOS) [10,15]. Implementation of such protocols has been shown to significantly reduce unnecessary crossmatching and wastage.

The findings of this study highlight the importance of regular audits in identifying gaps in transfusion practices. Continuous monitoring, adherence to evidence-based transfusion guidelines, and effective communication between clinicians and transfusion services are essential to optimize blood utilization and minimize wastage [14,15].

Conclusion

The present study demonstrates an overall rational and efficient utilization of blood and blood

components in the tertiary care setting, as evidenced by favorable transfusion indices and high utilization rates. Packed red blood cells emerged as the most frequently used component, with anemia being the predominant indication for transfusion. Most clinical departments maintained acceptable crossmatch-to-transfusion ratios, reflecting adherence to appropriate transfusion practices, although relatively higher ratios in certain departments suggest scope for further optimization. The findings underscore the importance of continuous monitoring of transfusion practices, implementation of institutional transfusion guidelines, and periodic audits to minimize unnecessary crossmatching and ensure judicious use of blood resources.

References

1. Sutrarakar SK, Chaurasia S, Rajpoot PS, et al. Unveiling transfusions: analyzing blood product utilization patterns in a leading tertiary care center in Madhya Pradesh, India. *Asian J Med Sci.* 2024;15(5):193-200. doi:10.3126/ajms.v15i5.62896.
2. Akter Z, Reshma JF, Datta A, Farhana M, Parvin F, Dipta TF. Pattern of blood component requisition and utilization in a tertiary care hospital. *Pulse.* 2025;17(1):15-18. doi:10.3329/pulse.v17i1.85220.
3. Priya S, Srinivasan S, V K. A Retrospective Analysis of Utilization Patterns and the National Accreditation Board for Hospitals and Healthcare Providers (NABH)-Mandated Blood Bank Quality Indicators at a Tertiary Care Hospital in South India. *Cureus.* 2025;17(5):e84876. doi:10.7759/cureus.84876.
4. Syal N, Kukar N, Handa A, Dhiraj AS. Audit of blood utilization practices at a tertiary care hospital: optimising resources. *J Cardiovasc Dis Res.* 2024;15(12):4563-4571. doi:10.48047.
5. Mondal B, Samsuzzaman M, Das S, Das DK. A study on utilisation of blood and blood components in a tertiary care hospital in West Bengal, India. *J Clin Diagn Res.* 2022;16(3):LC16-LC19.
6. Asghar R, Junaid A. Evaluation of Cross Match to Transfusion Ratio as a Tool of Quality Working In Tertiary Care Transfusion Services. *Journal of Islamic International Medical College (JIIMC).* 2025 Jul 7;20(2):86-90.
7. Lahare S, Kumar R, Das B, Singh N. Blood Utilization Review Using Transfusion Indices in a Tertiary Care Center: A Retrospective Observational Study. *Cureus.* 2025;17(7):e88344. doi:10.7759/cureus.88344.
8. Pinal PS, Kalpesh KV, Jignesh JD, Rugvi RP. A Retrospective Study of Transfusion Practice in a Tertiary Care Institute, Dahod District. *Journal of Contemporary Clinical Practice.* 2025 Sep;11(9):563-570.
9. Kaur A, Patale D, Lokhande T. Analyzing RBC Transfusion Practices Using Quality Indicators: A Retrospective Transfusion Audit. *Cureus.* 2024;16(9):e69550. doi:10.7759/cureus.69550.
10. Rafique M, Singh LT, Meetei NR, Konjengbam S, Akoijam BS. Pattern of blood requisition and utilization in a tertiary care hospital: a chart review study. *Int J Community Med Public Health.* 2021;8(4):1991-1994. doi:10.18203/2394-6040.ijcmph20211268.
11. Remakanth R, Abhishekh B. Blood utilization quality indicators in a tertiary care center in South India. *Glob J Transfus Med.* 2020;5(2):206-208. doi:10.4103/GJTM.GJTM_67_20.
12. Paudel P, Jayakumar PS, Sinha P, Manoharan A. Analysis of blood utilization practices and quality indicators in a South Indian teaching hospital in Puducherry, India. *J Prim Care Spec.* 2024;6(1):7-11. doi:10.4103/jopcs.jopcs_20_24.
13. Gahine R, Das A, Kujur P, Joshi C. An Audit of the Pattern of Blood Transfusion at a Tertiary Care Centre [Internet]. *Indian J Pathol Oncol.* 2015;2(3):118-120.
14. Vaghela KV, Jokhi CD. Analysis of Blood Transfusion Request and Utilization Pattern at the Blood Centre of the Tribal District, Dahod, India. *Cureus.* 2022;14(5):e25237. doi:10.7759/cureus.25237.
15. Umesh D, Subash S. A prospective study on blood requisition and utilization practice in a tertiary care teaching hospital. *J Med Sci Clin Res.* 2017;5(12):32230-32235. doi:10.18535/jmscr/v5i12.154.