

Insight into Clinical Utilization of Blood and Blood Components in A Tertiary Care Hospital

Priya Gupta¹, Veer Karuna², Akansha Gautam³, Deepali Mittal⁴, Abhishake Kumar⁵

¹Associate Professor, Department of Pathology, LLRM Medical College, Meerut, UP, India

²Associate Professor, Department of Pathology, LLRM Medical College, Meerut, UP, India

³Assistant Professor, Department of Pathology, LLRM Medical College, Meerut, UP, India

⁴Associate Professor, Department of Pathology, LLRM Medical College, Meerut, UP, India

⁵Professor, Department of Emergency Medicine, LLRM Medical College, Meerut, UP, India

Received: 27-04-2026 / Revised: 26-05-2026 / Accepted: 28-06-2026

Corresponding Author: Abhishake Kumar

Conflict of interest: Nil

Abstract

Background: Blood and blood components are indispensable therapeutic resources in modern healthcare. As these products are limited and cannot be manufactured artificially, their judicious utilization is essential to ensure patient safety, minimize wastage, and maintain an adequate blood supply. Regular audits of transfusion practices using quality indicators help assess the efficiency of blood utilization.

Objectives: To evaluate the utilization pattern of blood and blood components in a tertiary care teaching hospital and assess transfusion efficiency using the crossmatch-to-transfusion (C/T) ratio.

Materials and Methods: A retrospective observational study was conducted at the Blood Centre, LLRM Medical College and SVBP Hospital, Meerut, over a one-year period (January 2025–December 2025). Data regarding requisition and issue of whole blood, packed red blood cells (PRBC), fresh frozen plasma (FFP), and platelet concentrates (PC) were collected from transfusion records. Department-wise utilization and transfusion indicators, including the C/T ratio, were analyzed.

Results: During the study period, 25,981 units of blood and blood components were requested, of which 20,677 units were issued, resulting in an overall utilization rate of 79.6%. PRBCs constituted the majority of issued components (12,480; 60.4%), followed by FFP (5,467; 26.4%), platelet concentrates (2,636; 12.8%), and whole blood (94; 0.4%). The Emergency Department demonstrated the highest overall utilization (6,680 units; 32.3%), followed by Obstetrics and Gynaecology (4,683 units; 22.7%). PRBC utilization was highest in the Obstetrics and Gynaecology department (29.7%), whereas FFP (46.4%) and platelet concentrates (31.0%) were predominantly utilized in the Emergency Department. Department-wise C/T ratios ranged from 1.1 to 1.6, with an overall mean C/T ratio of 1.26, indicating efficient blood ordering and utilization practices.

Conclusion: Blood component therapy was utilized efficiently in the study institution, with PRBCs being the most frequently transfused component. Emergency and Obstetrics & Gynaecology departments accounted for the greatest demand for transfusion support. The overall C/T ratio of 1.26 reflects appropriate blood ordering practices and highlights the effectiveness of regular transfusion audits in promoting rational blood utilization and minimizing unnecessary cross matching.

Keywords: Blood Utilization, Blood Components, Packed Red Blood Cells, Fresh Frozen Plasma, Platelet Concentrates, Crossmatch-To-Transfusion Ratio, Transfusion Audit, Tertiary Care Hospital.

DOI: 10.25258/ijcpr.18.6.377

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Blood and blood component transfusion comprises of one of the most important therapeutic intervention in medical healthcare for saving a patient's life [1]. It is widely used in various clinical illnesses, including anemia, trauma, obstetric emergencies, and various surgical interventions.

Ensuring the availability of safe and adequate blood and blood components is a crucial responsibility of transfusion services, especially in a tertiary care

centre where requirement of transfusions are vast and extensive [2].

Blood cannot be manufactured through any industrial process. Hence, World Health Organization(WHO) focuses on judicious use of blood and blood products in order to decrease the transfusion-related hazards.

A thorough knowledge of the hazards of blood component therapy among healthcare professionals,

including physicians and intravenous therapists, is essential to ensure patient safety and judicious utilization. [3,4,5]

Although developing countries like India still face challenges of frequent blood shortage due to increased demand and reduced donation, blood is often used inappropriately or unnecessarily, thus exacerbating the problem, leading to a huge gap between demand and supply [5].

Several indicators have been proposed to assess the efficiency of blood utilization. For example, crossmatch to transfusion (C/T) ratio, transfusion probability (%T), and transfusion index (TI). These indicators are used to assess transfusion practices and identify areas of over-usage or under-utilization [2].

Hence, routine evaluation of blood component usage is necessary to estimate the blood utilization pattern in a hospital [1].

The present study was conducted in our hospital to analyze the utilization pattern of whole blood (WB) and its component, including packed RBC (pRBC), fresh frozen plasma (FFP), platelet concentrate (PC).

Material and Methods

The present study was a retrospective study conducted in Blood centre at LLRM Medical College and SVBP Hospital for a period of one year

from January 2025 to December 2025. All the patients admitted in different departments who required blood or blood component transfusions, were included in the study. Data of pRBC, FFP, PC and WB, issued to various departments during one year was recorded, including total number of requisition of components needed by the clinicians. All the details of blood and blood component recipients were studied, including demographic details, ward, unit, clinical diagnosis and indication for transfusion. Data regarding blood utilization was evaluated, including type of blood components given, and occurrence of transfusion reaction if any. Cross match to transfusion (C/T) ratio, was calculated based on number of units cross matched divided by number of units transfused. A ratio of less than equal to 2.5 was regarded as an indicator of efficient utilization of blood and blood components.

Observation

During the study period of one year from 1st January 2025 to 31st December 2025, 25,981 units of blood and blood components were requested by clinicians for 8270 requisition forms received. Request of blood was for patients with different age groups with diverse clinical conditions who needed transfusions. In many instances, request was of more than one unit of blood and blood components, depending on patient's disease and clinical needs. Overall, 20,677 units were issued, resulting in utilization rate of 79.6%. (Table1)

Table 1: Request, Issue and Utilization of Blood and Blood Components

Blood Component	Requested (n)	Issued (n)	Utilization (%)
Whole Blood	145	94	64.8
PRBC (Packed Red Blood Cells)	16,303	12,480	76.6
FFP (Fresh Frozen Plasma)	6,104	5,467	89.6
PC (Platelet Concentrates)	3,429	2,636	76.9
Total	25,981	20,677	79.6

Department-wise data analysis showed that Emergency department accounted for the highest utilization, 6680 units. This was followed by Obstetric and Gynaecology, 4683 units, reflecting

high transfusion requirement associated with obstetric emergencies and postpartum haemorrhage. (Table2)

Table 2: Department wise utilization of blood and blood components(pRBC, FFP,PC and WB)

Department	Total units utilized	%
Emergency	6680	32.3
Obs & Gynae	4683	22.7
Medicine	2879	13.9
Paediatrics	2690	13.0
Surgery	1117	5.4
Ortho	948	4.6
Thalassemia	922	4.5
Super Specialist	669	3.2
TB	89	0.4
Total	20677	100.0

Component-wise and departmental analysis of utilization revealed that packed RBC was mostly utilized in Obstetrics and gynaecology department accounting for 3704 (29.7%) units. This was

followed by FFP, PC, and WB in Emergency department accounting for 2536 units(46.4%), 819 units(31%) and 38 units(40%) respectively. (Table3)

Table 3: Department wise utilization of individual components

Department	PRBC	FFP	PC	Whole Blood
Emergency	3287 (26.3%)	2536 (46.4%)	819 (31%)	38 (40%)
Obs & Gynae	3704 (29.7%)	389 (7.1%)	590 (22.3%)	-
Medicine	1475 (11.8%)	1007 (18.4%)	382 (14.5%)	15 (16%)
Paediatrics	1083 (8.7%)	1010 (18.5%)	568 (21.6%)	29 (31%)
Surgery	735 (5.9%)	281 (5.1%)	89 (3.3%)	12 (13%)
Ortho	778 (6.2%)	92 (1.7%)	78 (3%)	-
Thalassemia	922 (7.3%)	-	-	-
Superspeciality (S/S)	407 (3.2%)	152 (2.8%)	110 (4.1%)	-
Total	12480	5467	2636	94

Evaluation of department-wise utilization of blood and blood components revealed that Emergency department had a lowest CT ratio of 1.1, followed by Obstetrics and gynaecology department and

Thalassemia unit of 1.2 each. All the departments had CT ratio below 2.5, which reflected good transfusion practices.(Table4)

Table 4: Department wise data of units cross matched versus units issued and C/T ratio

Department	Units Cross Matched	Units Issued	C/T Ratio
Emergency	7569	6680	1.1
Obs & Gynae	5568	4683	1.2
Medicine	3846	2879	1.3
Paediatrics	3459	2690	1.3
Surgery	1765	1117	1.6
Ortho	1426	948	1.5
Thalassemia	1136	922	1.2
Super speciality	1080	669	1.6
Tuberculosis	132	89	1.5
Total	25981	20677	1.26

Discussion

Blood is a lifesaving resource and should be used judiciously. It is the major responsibility of transfusion service providers to prevent its misuse so that uninterrupted and adequate supply can be maintained to tackle emergency situations.

It is essential to conduct internal audits and education programs to ensure proper selection of blood components and avoiding overuse [1,6,7].

It has been noticed that timely and educational interventions have improved compliance and reduced unnecessary transfusions [6, 8].

The present study was conducted to evaluate the utilization pattern of blood and blood components in our hospital.

A total of 2,5981 blood and blood units were requested for patients admitted in various departments, against which 2,0677 units of blood and blood products including p RBCs, FFP, PC, and whole blood were issued, resulting in utilization rate of 79.6%.

This indicates efficient utilization of blood and its components. Findings are comparable to various studies like Chaudhry et al, who reported utilization rate of 84.8% and Rai et al., who demonstrated a utilization rate of 87.7% . [2, 9].

Among the blood components, PRBC constituted the largest proportion of all components being issued, 60.4%. This was followed by FFP (26.4%), PC (12.8%), and whole blood (0.4%). The requirement of whole blood was least, utilization rate being 64.8%. After the first successful blood transfusion in 1818, whole blood was the standard of transfusion therapy and was extensively used during World War I and II. However, with changing time, it was replaced widely by component therapy [10, 11].

Our findings are in accordance with study by Tripathi et al. and Das and Biswas et al., who also observed that PRBC constituted majority of the blood components being utilized in tertiary care hospitals [9, 12]. These findings are in contrast to study by Giriyan et al. and Gaur et al., who in their

studies found that whole blood was most commonly used blood component [1,13].

Department-wise analysis of utilization of blood and blood products revealed that emergency department had the highest utilization rate, (32.3%), followed by Obstetrics and gynaecology (22.7%), Medicine (13.9%), Paediatrics (13%), Surgery (5.4%), Orthopaedics (4.6%), Thalassemia ward (4.5%), Super specialty block (3.2%).

TB and chest department recorded the lowest utilization rate of 0.4%. (Table 3)

Transfusion of blood and blood products forms a vital cornerstone of treatment of patients admitted in Emergency department, majority of the cases being of trauma, acute haemorrhage, and road traffic accidents. Next major department where utilization rate was high was Obstetrics and gynaecology, reflecting management of severe anaemia and postpartum haemorrhage. Similar trends have been studied by Giriya et al Kondreddy et al and Venkatachalapathy et al where Obstetrics and gynaecology department utilized maximum blood units. [13, 14, 15].

Department-wise analysis of individual blood and blood components revealed that packed RBCs was predominantly utilized in Obstetrics and gynaecology department, (29.7%), followed by FFP in Emergency department, (46.4%). PC were also utilized mainly by Emergency, (31%), and Gynaecology department (22.3%). (Table 3). This shows vital role of blood component in managing bleeding disorders, obstetric haemorrhage, cases of thrombocytopenia, coagulopathies, and critical cases [16].

Cross match to transfusion ratio in various departments varied from 1.1 to 1.6, with a mean of 1.26. This is comparable to the studies conducted by Shrestha et al. (CTR 1.37), Sutrarakar et al. (CTR 1.39), Trisal et al. (CTR 1.4) and Chaudhary et al. (CTR 1.82) [3, 2, 17 18].

CT ratio gives an insight into unused cross-matched units creating an overburden on the hospital. A high CT ratio more than 2.5 is an alarming sign and an indicator of conducting continuing medical education to address the problem of over-ordering of blood units for proper functioning of blood transfusion services [19].

It has been noticed that timely educational intervention have improved compliance and reduced unnecessary transfusions [8,20]

Conclusion

The present study highlights the importance of judicious and productive utilization of blood and blood components in tertiary care centre. There was notable difference in blood product utilization .The

Emergency department had the highest utilization rate closely followed by Obstetrics and Gynaecology department .pRBC was most utilized component followed by FFP, PC and whole blood .The mean CT ratio was 1.26.This further underscores the efficiency of our transfusion practices indicating balanced approach where blood was requested and used efficiently.

References

1. Gaur DS, Negi G, Chauhan N, et al. Utilization of blood and components in a tertiary care hospital. *Indian J Hematol Blood Transfus.* 2009;25:91-95. doi:10.1007/s12288-009-0027-1.
2. Chaudhary A. Utilization pattern of blood and blood components in a tertiary care hospital. *Int J Curr Pharm Res.* 2026;18(3):Article 129.
3. Sutrarakar SK, Chaurasia S, Rajpoot PS, Shambhavi, Agrawal P, Tripathi L, 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.
4. Chandrasekar M, Balakrishnan V, Ponnaiyan A, Ramachandran T. Audit of clinical use of blood products in a tertiary care hospital. *J Hematol Allied Sci.* 2021;1(1):22-27. doi:10.25259/JHAS_5_2021.
5. Ishore K, Nandy P, Mukherjee T. Pattern of utilization and indications of use of blood and blood products in a tertiary care hospital of West Bengal. *J Compr Health.* 2024;12:56-59. doi:10.25259/JCH_8_2023.
6. Shander A, Hardy JF, Ozawa S, et al. A global definition of patient blood management. *Anesth Analg.* 2022;135(3):476-488.
7. World Health Organization. Guidance on implementing patient blood management to improve global blood health status. Geneva: World Health Organization; 2021.
8. Carson JL, Guyatt G, Heddle NM, et al. Clinical practice guidelines from the AABB: Red blood cell transfusion thresholds and storage. *JAMA.* 2016;316(19):2025-2035.
9. Rai J, Behera NK, Gupta MK, Vemuri P, Kendre BD, Dixit H, et al. Blood component utilization and discard patterns in Telangana, India: A three-year retrospective study. *Cureus.* 2025;17(12):e99846. doi:10.7759/cureus.99846.
10. Learoyd P. The history of blood transfusion prior to the 20th century—Part 2. *Transfus Med.* 2012;22:372-376.
11. Bloch EM, Jacobs JW, Sachais BS, Ziman A, Cushing M, Cap AP, et al. Revisiting whole blood transfusion for the massively bleeding patient: The origins of resistance to change.

- Transfusion. 2024;64(2):345-353. doi:10.1111/trf.17705.
12. Manna N, Bhattacharya P, Mukherjee R, Das S. An observational study on utilization of blood and blood components in a tertiary care hospital of Kolkata, West Bengal. *Natl J Physiol Pharm Pharmacol*. 2022;12(8):1306-1310.
 13. Giriyan SS, Chethana HD, Sindhushree N, Agarwal A, Nirala NK, Bajpai R. Study of utilisation of blood and blood components in a tertiary care hospital. *J Blood Lymph*. 2017;7(2):1-3.
 14. Kondreddy S. A study of utilisation of blood and components in a tertiary care teaching hospital in South India. *Int J Med Public Health*. 2025;15(4):1786-1789.
 15. Venkatachalapathy TS, Subhashish D. A prospective audit of blood transfusion requests in RL Jalappa Hospital and Research Centre for blood and blood components. *J Blood Lymph*. 2012;2:106.
 16. Morale A, Kulkarni A, Ghodake S, Ramteke R, Mankar J, Godaria H. Utilisation of blood and blood components in a tertiary care hospital. *J Popul Ther Clin Pharmacol*. 2025;32(2):923-928. doi:10.53555/65kyas25.
 17. Shrestha AN, Aryal BB, Poudel A, Chhetri P, Poudel S, Adhikari A, et al. Blood transfusion practices in a tertiary care hospital in Nepal. *J Pathol Nepal*. 2020;10(2):1728-1732. doi:10.3126/jpn.v10i2.30424.
 18. Trisal M, Rana S, Khetrapal S, Jetley S, Mohroo RN, Jairajpuri Z. Blood utilisation practices and quality indicators at a tertiary care hospital in South Delhi: A retrospective study. *Natl J Lab Med*. 2020;9(2):PO01-PO03.
 19. Joon V, Robins RDL, Haran AH, SK I, James S. Evaluating the crossmatch-to-transfusion ratio as a tool for analyzing and optimizing blood bank resource utilization: A retrospective observational study. *Cureus*. 2024;16(9):e69862. doi:10.7759/cureus.69862.
 20. Abelow A, Gafter-Gvili A, Tadmor B, Lahav M, Shepshelovich D. Educational interventions encouraging appropriate use of blood transfusions. *Vox Sang*. 2017;112(2):150-155. doi:10.1111/vox.12493.