



EFFECTIVE UTILISATION OF BLOOD & BLOOD COMPONENTS – PRESENT SCENARIO IN A TERTIARY CARE TEACHING HOSPITAL – FACT-FINDING ANALYSIS

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ABSTRACT

Introduction: Blood transfusion practices are to be followed very carefully depending upon the availability of blood due to its non-renewable supply and the risks associated with transfusion, etc. A single effective alternative for blood and its components is yet to be found. After a century, we are still dependent on the only available option- the most effective life savior – BLOOD. The present study emphasizes the need for active and periodic blood bank audits and to analyze the effective utilization of each unit of blood collected in the blood bank.

Aim: To evaluate the effective utilization of blood and its components to minimize unwarranted transfusions and wastage of blood products.

Materials and Methods: The present study is a prospective study carried out at Model Blood Centre, Dept. of Pathology, S.V.R.R.Govt. General Hospital, S.V. Medical College, Tirupati, from June 2023 to May 2024. The relevant data of 10088 blood units were collected, from which 9834 units were utilized. The details of the blood units, such as blood groups, components prepared, age and sex of recipients, wards to which disbursed, indications of transfusion, etc., were matched against each parameter and analyzed in the form of proportions and percentages using Microsoft Office Excel 2019 software.

Results: 10088 blood units were prepared and processed, out of which 9834 blood units were utilized, resulting in a utilization rate of 97.4%. Most units were transfused to female recipients, and Packed Red Blood Cells were the most common blood units transfused. The Department of General Medicine demanded the majority of the blood units. However, surgical procedures (elective/emergency) were the most common indications for transfusion. The B-positive blood group was the most common blood group to be transfused in this study.

Conclusion: The study emphasizes the necessity of augmenting blood bank audits to ensure the exalted utilization of blood and blood products. Recent and excellent advancements in blood banking allow for the enhancement of services and the improvement of the prowess of the blood bank staff. An active, practical, and periodic blood bank audit can construct a flawless and clear utilization pattern of blood and blood products.

Keywords: *Audit, blood components, blood units, utilization*

INTRODUCTION

Blood transfusion is one of the most effective and major therapeutic interventions practiced at hospitals. Blood is an elixir *in vivo*, which in turn includes Red Blood Cells (RBC), White Blood Cells (WBC), Platelets, Plasma, i.e., prepared as Fresh Frozen Plasma (FFP), and Other clotting factors. These components aid in oxygenation and protection from microbes with immunological modulation, clotting, and coagulation. Until now, no single effective alternative for blood and its components has been found; even after the advent of index blood transfusion performed in 1818 by James Bundell. After two centuries, the world is still dependent on the only available option, the most effective life savior – BLOOD¹⁻⁹. So, there is a definite need for active blood donation by society and effective utilization of blood with appropriate storage facilities in every blood center. The estimated national clinical demand of 36.3 donations per 1,000 eligible population is closer to the WHO's suggested donation rate of 1-3% of a country's population, which would be sufficient to address the requirement¹⁰. Even though blood is a universal and unique product used worldwide, there are variable trends and considerable variations in utilization patterns by various clinicians, clinical departments/wards, hospitals, and geographical areas. It might be due to other techniques of blood banking, cultural and traditional variations, and different perspectives towards blood donation and blood transfusion. There have been swift and day-to-day advancements in transfusion techniques and the system of blood banking⁵.

Situations of heavy blood demand were made more accessible after the advent of component separation and component therapy, which was introduced in the early 1950s. Component therapy has opened wide corridors in the arena of blood transfusion practices, helping the health care system serve the target population with the appropriate components needed during management and treatment based on indication, etiology, and clinical situation⁷.

Blood transfusion is always challenging and needs meticulous planning and monitoring throughout the chain of events from bleeding to transfusion. Extra efforts must be made to safeguard the recipient from transfusion-transmitted infections and transfusion-induced adverse reactions. Thus, there should be absolute justification for ordering blood from the blood bank. The blood bank staff is still responsible for ascertaining the safety of the available stock of blood units, accurate screening of bled blood units, appropriate storage, careful disbursal, and timely discarding of the expired and TTI-positive blood units. The above chain of events is to be flawlessly followed to ascertain the appropriate utilization of blood and blood products in the blood bank¹¹.

We aim to analyze the effective utilization of each unit of blood collected from the donor, considering the pathway that the blood unit travels: the blood bag is collected from the donor, stored, screened, separated, and prepared as components, stored in different temperatures based on the component prepared, cross matched, disbursed to the recipient, and discarded in the case of expired or screened positive blood.

The present study emphasizes the need for an active and periodic blood bank audit, which is being carried out in all the blood banks but in a different pattern. Thus, an active, universally acceptable, and effective auditing system will enhance the prowess of staff in blood banks and help society combat the need for blood not only in our locality but also in our nation and the whole world.

MATERIALS AND METHODS

The present study is a prospective study carried out at Model Blood Centre, Dept. of Pathology, S.V.R.R.Govt. General Hospital, S.V. Medical College, Tirupati. The hospital caters to a bed strength of 1500. The study period was affixed after approval from the Institutional Scientific and Ethics Committee for one year, from June 2023 to May 2024. Approval no: 1555RC/2023 Dt. 23-02-2023 and Lr. No.151/2023. Dt. 22-05-2023 respectively. As per the regulations of the above committees, the confidentiality of data collected from the ledgers and registers of the Model Blood Centre was ensured. The relevant data of 10088 blood units was collected, from which 9834 units were utilized. The details of the blood units – *viz.*, count of - a monthly collection of blood units, respective blood groups of collected units, component separation details, screening-related records, cross matching registers against blood/blood component issue registers, blood bag discarding registers, etc., were thoroughly evaluated to match and quantify the collection and utilization numbers

accordingly. A thorough audit is carried out against each parameter about the number of bags disbursed to the recipients in different wards with different clinical diagnoses and indications for blood transfusion. All the issued units are counted concerning the blood group of the blood unit, age and sex of the recipient, ward to which it has been issued, diagnosis, and indication of the blood transfusion – to ensure appropriate and effective utilization of the blood units. All the calculations are depicted in tabular columns and as graphical representations. The calculations performed were represented in the form of proportions and percentages. The standard version of Microsoft Excel Office 2019 was used for analysis.

RESULTS

In the present study, details of 10088 blood units were derived, out of which 9834 units were effectively utilized. Thus, there has been 97.4% effective utilization of blood units collected, stored, separated, screened, cross matched, issued, and discarded. There has been a minimum of 254 (2.5%) unutilized blood units. Of the total collected units – 3178 (31.50%) were whole blood, and the rest, 6910 (68.5%), were blood component units. Of the total utilized units, 3132 (31.8%) were whole blood units and 6702 (68.1%) comprised component units. The details of component separation units for collected units and utilized units are depicted in *Table. No:1& 2*.

Amongst 254 (2.5%) non-utilized units –2 (0.01%) were positive for Human immunodeficiency virus (HIV); 24 (0.23%) were positive for Hepatitis B; 6 (0.05%) were positive for Hepatitis C, i.e., a total of 32 (0.31%) accounted for transfusion-transmitted infection positive blood units on screening. Rest accounted for - 154 (1.5%) expired blood units, 30 (0.29%) damaged blood units, and 38 (0.37%) insufficiently bled blood units due to donor issues.

The highest number of blood units were transfused to female recipients – 5546 (56.39%) and 4288 (43.60%) are male recipients. A maximum number of blood units were transfused to elderly age group recipients >60 years – 2098 (21.33%), with the least number of units being received and transfused to patients in the age group 11-20 yrs – 194 (1.97%) blood units. Age-wise details of recipients are depicted in *Fig. No: 1*.

The majority of the blood units cumulatively were issued to patients of the General medicine ward/department – 3307 (33.62%) in which a maximum number of component units were Packed Red Blood Cells, 1479 (15.03%), Followed by General Surgery 3082 (31.34%), cumulative blood units. The least number of cumulative blood units were issued to the Casualty/Emergency block – 203 (2.06%).Of which the majority of units were whole blood units, 91 (0.92%). The details of ward-wise issues of whole blood and components are depicted in *Table. No: 3*.

The most common indication that we have come across for blood transfusion in our study was surgical ailment – emergency/elective surgery – 2617 (26.61%) cumulative units recipients with 1587 (16.13%) of whole blood units as demanded. Followed by hematological disorders including anemia, pancytopenia, and others – 2054 (20.88%), with 1459 (14.83%) Packed red blood cell units as the maximum number of component units demanded. The lowest number of units were issued and transfused to patients with cardiovascular accident (or) stroke – 100 (1.01%), and all the above were component units of fresh frozen plasma (FFP). Details of indications and type of blood product transfused are depicted in *Table. No: 4*.

Fig. 2 depicts the distribution of blood units based on groups. The highest number of blood products transfused belonged to the B-positive blood group, 3147 (32%), and the lowest number belonged to the AB-negative blood group, 49 (0.5%).

DISCUSSION

Blood transfusion practices are to be tailored very carefully depending upon the availability of blood due to its non-renewable supply, risks associated with transfusion, etc. Unless there is a definite need for blood transfusion, the process can be postponed, or an alternative can be considered for therapeutic intervention. However, in most instances, the pros of transfusion outweigh the cons. Thus, blood transfusion is still considered one of the most powerful, life-saving interventions in the field of medicine².

Among the 10088 units collected, 9834 units were efficiently utilized, accounting for 97.4% of the effective utilization rate in our study. A similar survey by Bimal Mondal et al.¹² showed a

78.95% utilization rate. The difference in rate can be attributable to different transfusion-related policies in various hospitals and variable hospital and clinician-related blood transfusion policies.

The present study found that the majority of recipients of blood products were female (56.39%), which is similar to the observations made by the studies conducted by Mathew AS et al.,¹ (52.13%), and Joshi et al.,⁵ (54.6%).

Our study observed that the elderly (aged > 60 years) were the highest recipient of blood product units – 21.33%. This is a contrast observation with other studies where the majority of recipients belonged to younger age groups, as reported in research works of Moses Ambroise et al.,⁴ Priyanka Bansod et al.,¹³ D Singh Gaur et al.,²

Most of our transfusions were PRBC component units, accounting for 42.89%. This observation is similar to the findings in the study performed by Priyanka Bansod et al.,¹³ (47.15%). The above findings also correlate with similar studies conducted by Anshoo et al.,¹⁴ Venkatachalapathy & Subhashish³. However, in contrast to the present study, Moses Ambroise et al.,⁴ observed that Fresh Frozen Plasma and Platelets occupy the top chart in the list of components issued from the blood bank to the recipients.

In the present study, most blood units were issued cumulatively to the General Medicine ward/department at 33.62%, PRBC was the most common blood component unit issued, and that too was to the General Medicine ward/department at 15.03%. Identical findings were observed in the research study performed by Alcantara et al.,⁶ Whereas contrast opposite findings were observed by Giriyan et al.,⁹ Venkatachalapathy & Subhashish³. Their research observed that the Obstetrics and Gynecology (OBG) department has the maximum demand for blood transfusions. This contrast finding might be attributed to our study because a separate blood bank is being maintained in the OBG block under a separate license and operating policies, which does not come under the purview of our Model Blood Center. So, the demand will only be catered by the existing blood center in the OBG block. Thus, General Medicine and General Surgery departments and wards share a maximum number of transfusions in the present study. After looking into different studies, it has been observed that there is no uniform demand for blood and blood products in other workplaces and hospitals. This might be due to different policies and therapeutic or treatment or management patterns in various places.

The common indication for blood transfusion in the present study happens to be a surgical procedure (elective/emergency), which is a similar finding in a study conducted by Giriyan et al.,⁹. In a study carried out by Priyanka Bansod et al.,¹³ Arewa et al.,¹⁵ Anemia—Hematological disorders are common indications for blood transfusion. However, Hematological disorders occupy second place in the present study.

The most common blood group amongst the total cumulative transfusions was found to be B-Positive - 32%, and the last one was AB Negative – 0.5%. Similar findings were recorded in a study carried out by Priyanka Bansod et al.,¹³ Giri et al.,¹⁶ Bimal Mondal et al.,¹² In a similar study performed by us previously, we reported O Positive as the commonest group and AB Negative as the least common blood group, which has partially correlated with our present findings.¹⁷

There is a varied pattern of utilization of blood and blood products due to different etiological factors and transfusion-related regulations, policies, etc. Firm and deeper analysis will provide a definite platform for appropriate transfusion services without any wastage of blood and blood products.

CONCLUSION

The present study emphasizes the necessity of augmentation of blood bank audits to ensure exalted utilization of blood and blood products. Not only is the utilization being challenged, but the services of the blood bank also depend mainly on internal quality control monitoring, which is a factor governed by blood bank audits. The recent and excellent advancements in blood banking techniques, screening methods, component separation techniques, temperature control mechanisms, etc., give an extra edge to thinking and formulating the prospects and plans to maintain necessary stock in blood banks at any given time with enhanced facilities. Based on the findings in the audit – a strong pathway can be created for effective and appropriate utilization of blood products with respect to blood groups to be stocked up, component units to be prepared, reserving blood to needful departments and wards, and blood units to be issued depending upon firm indication for transfusion.

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CONFLICTS OF INTEREST: None**REFERENCES**

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Figure No. 1: Blood components issued under various age groups

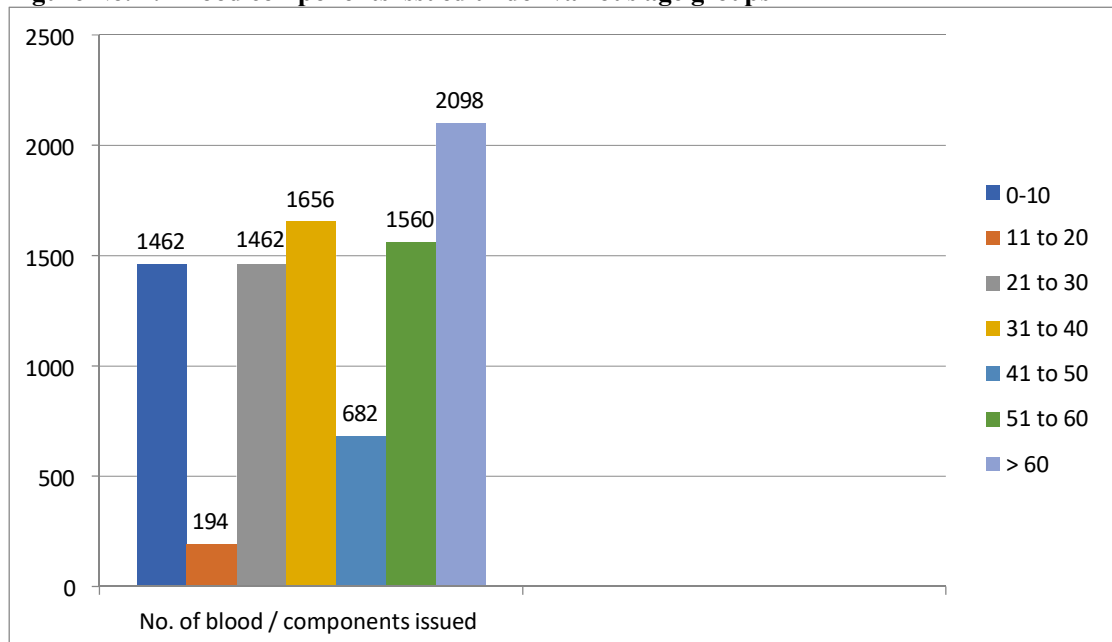


Figure No. 2: Number of blood components issued depending upon Blood group

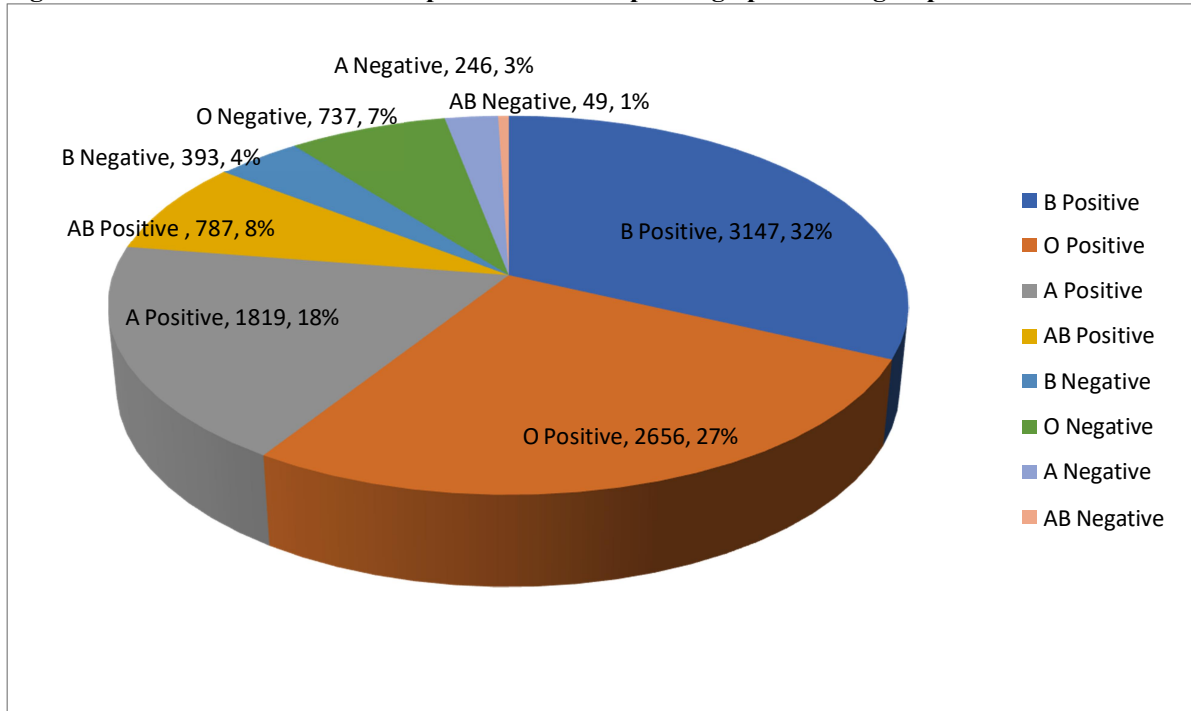


Table No. 1: Total number of Blood units Collected and Processed.

	Whole blood (%)	Packed Red Blood Cells PRBC (%)	Fresh Frozen Plasma FFP (%)	Platelets (%)	Total (%)
Collected, separated, and processed blood units	3178 (31.50)	4342 (43.04)	2114 (20.95)	454 (4.50)	10088 (100)

Table No. 2: Total number of Blood units processed and issued.

	Whole blood (%)	Packed Red Blood Cells PRBC (%)	Fresh Frozen Plasma FFP (%)	Platelets (%)	Total (%)
Processed, separated, and issued to recipients	3132 (31.8)	4218 (42.89)	2056 (20.90)	428 (4.35)	9834 (100)

Table No. 3: Blood/components issued to different wards and departments.

Sl.no	Ward/Department	Whole Blood (WB) (%)	Packed Red Blood Cells (PRBC) (%)	Fresh Frozen Plasma (FFP) (%)	Platelets (%)	Total (%)
1.	General Medicine	778 (7.91)	1479 (15.03)	840 (8.54)	210 (2.13)	3307 (33.62)
2.	General Surgery	1512 (15.37)	1073 (10.91)	445 (94.52)	52 (0.52)	3082 (31.34)
3.	Pediatric	90 (0.91)	1181 (12.00)	549 (0.55)	66 (0.67)	1886 (19.17)
4.	Orthopedics	467 (4.74)	360 (3.66)	39 (0.39)	14 (0.14)	880 (8.94)
5.	Obstetrics & Gynecology	194 (1.97)	53 (0.53)	152 (1.54)	77 (0.78)	476 (4.84)
6.	Casualty	91 (0.92)	72 (0.73)	31 (0.31)	9 (0.09)	203 (2.06)
	Total	3132 (31.80)	4218 (42.89)	2056 (20.90)	428 (4.35)	9834 (100)

Table No. 4: Blood / Components issued based on indication for transfusion & diagnosis.

Sl.no	Diagnosis	Whole Blood (WB) (%)	Packed Red Blood Cells (PRBC) (%)	Fresh Frozen Plasma (FFP) (%)	Platelets (%)	Total (%)
1.	Surgical emergency / elective surgeries	1587 (16.13)	585 (5.94)	445 (4.52)	-	2617 (26.61)
2.	Hematological disorders (Anemia / Pancytopenia/Leukemias etc.,)	295 (2.99)	1459 (14.83)	300 (3.05)	-	2054 (20.88)
3.	Injuries (Road Traffic Accidents / Fractures and other injuries)	487 (4.95)	360 (3.66)	60 (0.61)	-	907 (9.22)
4.	Low birth weight / Neonatal Jaundice	90 (0.91)	780 (7.93)	159 (1.61)	-	1029(10.46)
5.	Chronic Liver Disease	97 (0.98)	382 (3.88)	400 (4.06)	-	879 (8.93)
6.	Thrombocytopenia	-	-	-	428 (4.35)	428 (4.35)
7.	Pre-term / Small for Gestational Age / Birth Asphyxia	-	-	390 (3.96)	-	390 (3.96)

8.	Lower Segment Cesarean Section (LSCS) / Labour / Hysterectomy etc.,	194 (1.97)	53 (0.53)	152 (1.54)	-	399 (40.57)
9.	Diabetes / Diabetic foot	220 (2.23)	92 (0.93)	-	-	312 (3.17)
10.	Poisoning	91 (0.92)	117 (1.89)	100 (1.01)	-	312 (3.13)
11.	Thalassemia	-	195 (1.98)	-	-	195 (1.98)
12.	Tuberculosis	26 (0.26)	175 (1.77)	15 (0.15)	-	216 (2.19)
13.	CVA / Stroke	-	-	100 (1.01)	-	100 (1.01)
	Total	3087 (31.39)	4198 (42.68)	2121 (21.56)	428 (4.35)	9834 (100)