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Original Article

A study on the usage and wastage of blood components in blood bank of B.P. Koirala Institute of Health Sciences, Dharan

Moushami Singh[1], Anju Pradhan[2], Punam Paudyal[2]

[1]*Department of Pathology, Nepal Cancer Hospital and Research Centre, Harisiddhi, Lalitpur, Nepal*
[2]*Department of Pathology, BP Koirala Institute of Health Sciences, Dharan, Nepal*

Keywords:

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ABSTRACT

Background: Human blood till date has no substitute. Transfusion of blood and its components is a lifesaving procedure. Hence, optimum utilization and minimum wastage of blood and its components should be strictly monitored.

Materials and Methods: This is a prospective study conducted on data collected from the blood bank of B.P. Koirala Institute of Health Sciences, Dharan, Nepal for a duration of 1 year from year 2015 to 2016. The sample size was calculated by using systematic random sampling with every third sampling interval sample collection method. The study included usage and wastage of packed red blood cells, platelet concentrate, fresh frozen plasma, and cryoprecipitate including data on the supply of blood components to different departments, age distribution, gender distribution, and distribution of blood components based on blood groups.

Results: A total of 1641 units of blood component were included in the study. A total of 92.9% (1524 units) were used and 7.13% (117 units) were wasted. The renal disorder was the most common cause of blood component utilization. The medicine department utilized the majority of the blood components. The expiry was the most common cause of wastage. Among the wasted blood components, platelet concentrate was the maximum.

Conclusions: Blood components are a life-saving resource. It should be evaluated and analyzed properly for utilization in a justifiable manner. Hospitals should act in accordance so that maximum blood components are utilized in a safe manner and waste is minimized to the least.

Correspondence:
Dr. Moushami Singh, MD
Nepal Cancer Hospital and Research Centre,
Harisiddhi, Lalitpur, Nepal
ORCID ID:0000-0001-8647-3738
Email: moushamisingh123@gmail.com, drmoushamisingh@nch.com.np

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INTRODUCTION

Blood is a precious and irreplaceable body fluid that delivers necessary substances such as oxygen and nutrients to the cells and transports metabolic waste products away from these same cells.[1] The whole blood can be separated into different blood components namely packed red blood cell (pRBC) concentrate, platelet concentrate (PC), fresh frozen plasma (FFP), and cryoprecipitate, the transfusion of which has become an integral part of patient management in modern medicine.[2] It can be a life-saving procedure when given appropriately at the right time in a safe manner.[3] The

first successful transfusion of human blood was done by James Blundell, a British obstetrician in 1818.[4]

Regular audits, discussions with ordering physicians, ward rounds, and computer-based decision-support systems are necessary to reduce inappropriate blood component transfusion and its wastage. In resource-constrained countries like ours, proper use of blood components helps in the maximum utilization of the available resources. It assists in minimizing shortages and avoiding transfusion-related adverse reactions. The causes of inappropriate use of blood and its components should be identified and managed accordingly. Screening of HBsAg and HIV rapid slide test and proper training of staff should be done to avoid transfusion-transmitted diseases and provide safe blood to recipients.[5,6]

Blood components are usually required by accident victims, cancer patients, blood disorder patients, surgery patients especially heart surgery and organ transplants, and in premature, preterm babies. Blood components are discarded due to many reasons, some of them are breakage, expiry, hepatitis and HIV infections, and other causes.[7]

A substitute for human blood is not discovered to date. The demand for blood and its components always outpaces its supply. This emphasizes the importance and proper maximum utilization of blood and its components with minimal wastage.[8]

MATERIALS AND METHODS

This is a prospective study conducted on data collected from the Blood Bank of B.P. Koirala Institute of Health Sciences, Dharan, Nepal for a duration of 1 year from 2015 to 2016. The study included the usage and wastage of pRBC, PC, FFP, and cryoprecipitate. Analysis of indications for usage and wastage of the various blood components was evaluated. The study also included the supply of blood components to different departments, age, and gender distribution regarding blood components utilization, and distribution of blood components based on blood groups. Permission for the study was taken from the Institutional Ethical Review Board, B.P.K.I.H.S before the commencement of the study.

The study included all the blood components used and wasted in the Blood Bank until an expected sample size of 1100 was obtained. The sample size is the number of patients ordering different blood components available at the blood bank. Each number of patients has single or multiple units of blood components utilized or wasted. Systematic random sampling with every third sampling interval was used for sample collection until a total of 1100 was reached.

All the data was entered into Microsoft Excel 2010 spreadsheet and converted into SPSS (Statistical Package for Social Sciences) Version 17 program for statistical analysis. For descriptive statistical analysis, mean, proportion, and percentage were calculated, and tabular and graphical presentation was made.

RESULTS

A total of 1641 units of blood components were included in the study during the one-year study period. Out of 1641 units, 92.9% (1524 units) were used and 7.13% (117 units) were wasted.

Among the 1641 units which were used, 999 units (65.6%) were packed red blood cells (pRBC), 308 units (20.2%) were platelet concentrate (PC) and 217 units (14.3%) were fresh frozen plasma (FFP). However, 117 units (7.13%) of blood components were discarded. Platelet concentrate (42.7%) was the most common blood component wasted followed by fresh frozen plasma (29.9%) and packed red blood cells respectively (27.3%) (fig.1).

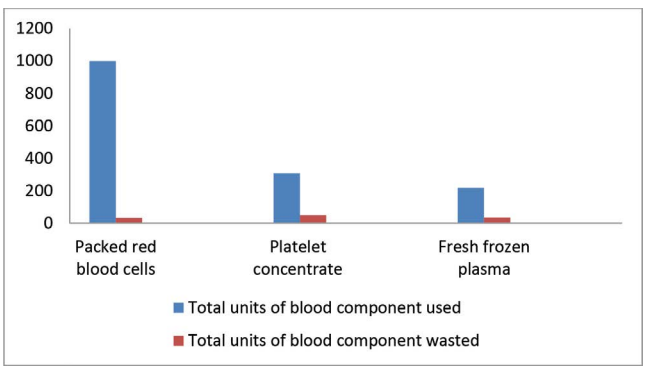

Figure 1: *Comparison of Blood component usage and wastage*

A maximum number of blood components was used by renal disorders patients(25.5%). Hematological conditions required 16.4%, gynecological and infectious causes required 11.9% and 11.0% of blood components respectively. Low birth weight and sepsis resulted in 6.2% usage of blood components. Surgical cases and hepatic disorders required only 4.5% and 4.0% respectively. GI hemorrhage resulted in 5.1% usage of blood components. Cardio-respiratory causes and malignancies required the least number of transfusions with percentages of 2.2% and 1.4% respectively. Other instances of blood component usage accounted for 5.05% of blood components which included poisoning, burns, snake bite, and systemic lupus erythematosus(SLE).

pRBC was required in the maximum number of cases of renal disorder which comprised 361 units whereas the minimum number of blood components was required by patients diagnosed with malignancy (21 units). PC was mostly required for hematological disorders, while it was not required for cardio-respiratory cases. Irrespective of other causes of FFP usage, 48 units of FFP were used for infectious causes followed by low birth weight and sepsis (34 units).

The maximum number of blood components was used in the Medicine department (43.8%) followed by ICU (12.7%).

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There is an equal percentage (11.9%) of usage in the Gynecology and Emergency departments. The departments that utilized the least amount of blood components were Pediatrics (9.1%) and Surgery departments (8.0%) (fig 2).

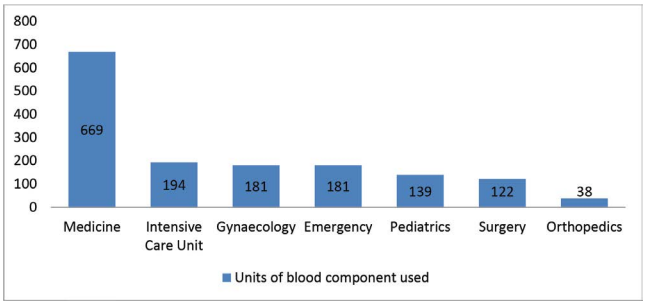

Figure 2: *Supply of blood components to different wards.*

The requirement of blood components in patients over 60 years of age (16.9%) was markedly more than in other age groups. The minimum unit of blood was used in the age group between 1-10 years. There was not much difference in blood component usage between the age groups of 21-50 years. This study has shown that out of 983 patients requiring transfusion, 53.6% were female, and 46.6% comprised males.

The maximum units of A positive (36.7%) followed by O positive (32.0%) blood groups were used in our study. B negative (0.2 %) was the least required blood group. The utilization of blood group B positive and AB positive was 22.4 % and 8.7% respectively (Table 1).

Table 1: Distribution of blood components based on blood groups

Blood Group	pRBC	PC	FFP	Total	Total percent
A+	341	140	78	559	36.68%
O+	333	71	84	488	32.02%
B+	242	63	36	341	22.38%
AB+	82	33	18	133	8.72%
B-	1	1	1	3	0.19%
Total	**999**	**308**	**217**	**1524**	**100.00%**

Expiry is the frequent cause of blood component wastage constituting 80.3%, followed by HBsAg positivity (6.0%), HCV positivity (5.2%), hyperlipidemia (3.4%), HIV positivity (2.6%) and RBC contamination (2.6%).

Expiry of pRBC was 20 units, PC was 43 units and FFP was 24 units. Hyperlipidemia was found only in FFP as the reason for wastage. HCV resulted in wastage of pRBC and PC whereas none of the FFP was wasted due to HCV in our study (Table 2).

Table 2: Comparison of blood component wastage and its various reasons

Reason for wastage	pRBC	PC	FFP	Total
Expiry	20	43	24	87
RBC contamination	0	2	1	3
Lipemia	0	0	4	4
HIV	1	0	2	3
HCV	5	1	0	6
HbsAg	1	4	2	7
VDRL	5	0	2	7
Total	**32**	**50**	**35**	**117**

DISCUSSION

A total of 1641 units of blood components were included in our study of which blood component usage was greater (92.9%) than wastage (7.7%) which is consistent with a study carried out by Singhal et al.[1] Outof 1524 units of blood components used, the total of 999 units (65.6%) of packed red blood cells (pRBC) was utilized followed by 308 units (20.2%) of platelet concentrate (PC) and 217 units (14.3%) of fresh frozen plasma (FFP). This was in agreement with the study conducted by Shilpa et al., in a tertiary hospital in India where 38.0% of pRBC, 35.0% of PC, and 24.0% of FFP were used.[9] In a survey carried out by Garg et al.,[10] and Geibler et al.,[11] FFP was utilized more than PC. This finding is in contrast to this study where increased units of PC were utilized as compared to FFP. In a study done in South Kerala, FFP was utilized more than PC which was attributed to the inappropriate FFP transfusion and increased prevalence of Dengue fever leading to hypoproteinemia.[12]

In the present study, blood component transfusion was mostly carried out for renal disorders (25.5%) which were mostly for dialysis which is similar to a study done by Gaur et al.,[13] in a tertiary care hospital. In contrast, there were only 0.4% of blood component requests for dialysis patients in the Nukem blood bank during the study period of 12 years as whole blood was utilized for patients undergoing dialysis instead of blood components.[1]

The requirement of blood components in patients over 60 years of age (16.9%) was markedly more than in other age groups. The minimum units of blood were used in the age group between 1-10 years. In comparison to the study carried out by Ambroise et al., the utilization of blood products in patients aged over 60 years was markedly less compared to the younger age groups.[13]

In our study, females (53.6%) utilized more blood components than males (46.6%). Post-partum hemorrhage and pre-operative correction of anemia is the reason for the increase in blood component transfusion in females (73.8%) in a study done by Das et al.,[14] and males required increased units of blood component transfusion such as PC and FFP due to infectious and parasitic causes in a study conducted

by Ambroise et al.[13] This difference in result may be due to increased incidence of anemia in female patients with decreased hemoglobin concentration.

Out of the many departments in BPKIHS, the Medicine department utilized the majority of the blood component in this study comprising 43.9%. This might be due to the increased number of dialysis patients admitted to the Medicine department. Similarly, Alcantara et al.[15] also found that a maximum number of blood components was utilized in the Medicine department comprising 54.2%. However, in research done by Arewa et al.[6] in Nigeria, the Pediatrics department was the most common department requiring 33.3% of the blood component.

In this study, the most common blood group requested for transfusion was A positive (36.7%) and the least common was B negative (0.2%) of the total transfusion requirement. This finding is discordant when compared to the study carried out in a hospital in Karnataka where the majority of the blood group transfused was B positive and the rarest was AB positive. [7] However, in our study, there was the absence of a request for blood group AB negative. Similarly in a study done by Venkatachalapathyet al. AB negative blood group was requested by only 0.1% of patients whereas O positive was required by a majority of the patients comprising 35.0%.[14]

The maximum number of blood component wastage was due to expiry(80.3%) which was in agreement with the study conducted by Far et al.[16] In contrast, RBC contamination resulted in the majority(40%) of blood wastage in a study of Morish et al.[17] whereas it was the least common cause for wastage in our study accounting for 2.6%.

In our study, PC scored the highest wastage rate (42.7%) compared to other blood components. This was mostly due to non-utilization. The other causes of wastage were due to lipemia and seropositivity. This was comparable to the study done by Singhal et al.[1] in which the platelet concentrate (54.5%) was mostly discarded due to non-utilization.

The discarded percentage for fresh frozen plasma was 29.9% which was again mainly due to expiry. This finding is similar to the study conducted by Kumar et al.[18]. However, in a study conducted by Bobde et al.[19], the rate of discard of fresh frozen plasma was 7.6% but the majority was discarded due to leakage followed by seropositivity. Only 0.16 % was discarded due to expiry. In contrast, leakage was the prime cause of wastage of FFP in a study carried out at Nukem Blood Bank.[1]

Packed red blood cells were the least wasted component at the rate of 27.3% in this study. The wastage occurred due to expiry and this was in agreement with the study done by Roy et al.[20] whereas seropositivity led to the wastage of most packed red blood cells in a survey performed by Kumar et al.[18] and Bobde et al.[19]

Morish et al. studied that the total percentage of discarded whole blood and its components was 2.3 %. According to their study, platelet concentrate recorded the highest discard rate (6%) because of non-utilization and RBC contamination (40%). Other causes included leakage and lipemia.[18]

CONCLUSIONS

This study reflects on the trend of usage and wastage of blood components in the Blood Bank of BPKIHS. The majority of blood components were utilized for anemia while expiry was the most common cause for wastage. The observation of this study is similar to the results of many other similar studies. However, in order to improve the standards of blood transfusion practices, strict protocols should be implemented for rational utilization of blood components and to minimize its wastage. Most of the PC were wasted due to short shelf life and non-utilization. Hence, the preparation of PC only on demand can help to significantly reduce its wastage.

Conflict of Interests: None

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