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An analysis of wastage of blood components in blood bank at tertiary care hospital

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Abstract

Context: Wastage of all blood components, including RBCs, platelets (PLT), and plasma, is an important issue for hospitals worldwide. Waste is not limited to blood products and is present throughout the health care system.1 Studies of systemic waste have examined the importance of workflows in the health care environment.2 and have focused on minimizing operational sources of waste when issuing a variety of medications. In many of these studies, relatively simple interventions resulted in marked reductions in wastage. The present study is designed to analyze the reason for the extent and wastage of whole blood and different blood components. By that we can minimize or prevent the wastage of blood and supply adequate amount of blood components to the patients whenever required for saving the lives.

Aims and Objectives: The basic aim of this study is

- To understand the extent of wastage of different blood components.
- To identify various causes of wastage

Materials and Methods: This is a retrospective and prospective study carried out in A D Gorwala Blood Bank, Shri Krishna Hospital, Karamsad after HREC approval, from 1st January 2015 to 31st December 2015. All the components, like whole blood unit (WBU), Red Cell Concentrate (RCC), Platelet Concentrate (PC), Fresh Frozen Plasma (FFP), Cryoprecipitate (CP), and Cryopoor plasma (CPP) except Single donor platelet (SDP), wasted during this study period due to any reasons were included in the study.

Statistical Analysis: It is an observational study so descriptive statistics is applied.

Results: Age, gender, and blood group wastage of blood components were analysed and it was found that most common wastage was found in male donor between 18 to 30 years of age, in "B" Positive blood group. In this study also reason for wastage of different blood components and components wise wastage reason also analysed. Most common component wasted was platelet concentrate due to short shelf life and due to 1st run reactivity in TTI testing.

Conclusion:

- The most component wasted was platelet concentrate due to its short expiry life followed by TTI (transfusion transmitted infection) reactivity after 1st run of ELISA.
- To avoid wastage of blood components continued training of staff, involved in counseling of donor, phlebotomy and TTI testing along with inventory control regarding the stock position and requirement of different blood group is necessary.
- Regular audit of transfusion of blood component by transfusion committee helps in reduction of blood wastage and also promotes its rational use.

Keywords: RCC, PC, FPP, CP, CPP, SDP, TTI

Introduction

Blood transfusion is an important constituent of health-care delivery system. Millions of lives are saved every year in regular and urgent situations for medical and surgical indications by the accessibility of safe blood transfusion services [1].

To deal with the necessity and supply of blood and blood components, more strict measures should be accessible and pursued for the right utilization of this insufficient reserve [2]. Along with this, a protocol for minimizing the discard of blood should be formed to save energy and human and financial resources in the developing countries. Excessive and inappropriate use of blood products poses a burden on transfusion services. Similarly, with a proper coordination between clinicians and blood bank staff, wastage owing to expiry of blood can be minimized [3].

Wastage of all blood components, including RBCs, platelets (PLT), and plasma, is an important issue for hospitals worldwide. Waste is not limited to blood products and is present throughout the health care system [4]. Studies of systemic waste have examined the importance of workflows in the health care environment [5], and have focused on minimizing operational sources of waste when issuing a variety of medications. In many of these studies, relatively simple interventions resulted in marked reductions in wastage.

The College of American Pathologists (CAP) recommends monitoring the wastage of unexpired blood as it represents a financial loss to the health care system, and more importantly, systemic wastage of blood may reflect a care environment that is out of control, and unsafe for the patient [6].

Excessive and inappropriate use of blood products poses a burden on transfusion services. Similarly with proper coordination between clinicians and blood bank staff wastage due to expiry of blood can be minimized. Preparation of components is also not optimum in resource poor setting in developing countries. This again emphasizes on proper use of available infrastructure, manpower and reduction of wastage [7].

The present study is carried out in the A D Gorwala Blood Bank, Shri Krishna Hospital, Karamsad. It is designed to analyze the reason for the extent and wastage of whole blood and different blood components like, Red Cell Concentrate (RCC), Platelet concentrate (PC), Fresh Frozen Plasma (FFP), and cryoprecipitate (CP). By that we can minimize or prevent the wastage of blood and supply adequate amount of blood components to the patients whenever required for saving the lives.

Aims and Objectives

- To understand the extent of wastage of different blood components.
- To identify various causes of wastage

Materials and Methods

This is a retrospective and prospective study carried out in A D Gorwala Blood Bank (NABH accredited), Shri Krishna Hospital, Karamsad after HREC approval, from 1 st January 2015 to 31st December 2015. All the components mentioned in inclusion criteria, wasted during this study period due to any reasons were included in the study.

Inclusion Criteria

All the components including whole blood unit (WBU), RCC, PC, FFP, CP, and CPP discarded or wasted due to TTI Positivity, expired shelf life, hemolysis, broken/leakage units, broken segments, QNS (Quantity Not Sufficient), expired QC bag, lipemia or wasted due to leakage were included in the study.

Exclusion Criteria

Single Donor platelet (SDP) is not included in the study because it is prepared on demand and it is prepared after screening the donor for transfusion transmitted infection so rate of wastage is minimal.

The data were collected by assessing the blood bank information system, by referring the blood bank NABL register and correlation of it is made with hard copy of discard register also. Donor record, TTI record, Component

preparation record and Wastage record is collected.

Selection of blood donor is done by strictly adhering the criteria mentioned in standard operating procedure of donor selection and registration.

Once the donor is selected for blood donation phlebotomy of donor is done by taking strict aseptic precaution as mentioned in standard operating procedure of phlebotomy.

From each unit TTI testing for HIV, HBsAg, HCV, for syphilis and malaria was carried out. TTI testing for HIV, HBsAg, and HCV and for syphilis is done by senior technician of blood bank and verified by consultant of pathology posted in blood bank.

HIV testing is done by fourth generation ELISA technique and for HbsAg and HCV third generation ELISA technique is used, by strictly adhering procedure mentioned in Standard operating procedure In first run if absorbance of any unit falls above or equal to cut off value, that unit is discarded and final interpretation is given after running the same in duplicate in next run.

For syphilis detection of Treponema Pallidum organism was done by Rapid Plasma Reagin (Carbogen) Test by strictly adhering procedure mentioned in Standard operating procedure Any unit found to be positive is discarded.

For detection of malarial parasites, thick blood smears are prepared and Geimsa stain is carried out on it. Reporting of thick smear is done by resident of pathology posted in blood bank. Any unit

found to be positive for p.vivax or p.falciparum parasite is discarded. Standard operating procedure is followed strictly at each level.

Any units discarded due to any reason is entered in the hard copy of discard register of discard and also updated in the NABL register. Consultant posted in blood bank personally verifies each discard and do signature after verification. Each discarded units were sent for autoclaving, Indicator slip of autoclave is preserved for record purpose. After autoclaving all bags were discarded in red bag and sent for incineration.

Observations and Results

During study period, total 6423 blood donations were received from 1st January 2015 to 31st December 2015. Out of which 6270 (97.6%) of units were separated into components and 153 units were not separated into components. From 153 unseparated units, in 118 units quantity of blood was not sufficient and 35 units were utilized as whole blood for neonatal exchange transfusion.

Out of 6423 total blood donations, 1007 wasted in different age, gender and reasons.

Out of 1007 wasted components, 940(93.35%) components were of male donors & 67 (6.65%) components were of female donors.

Out of total 1007 components, 800 (79.3%) components (majority) were from donors with age between 18-38 years and 474 (47%) components (maximum) were from donors with age between 18-28 years.

Out of total 1007 wasted components maximum numbers, 338 (33.57%) wasted components were of blood group "B Positive" and minimum number, 25(2.48%) components were of blood group "AB Negative". This data is matched with the statistical data of different blood groups in community. According to standard text book maximum blood group persons are of "B Positive" blood groups so wastage rate also maximum in "B Positive" blood group.

Table 1: Analysis of Wastage of Different Blood Components

No.	Types of components	Components prepared (NO)	Wastage of components (NO)	% of wastage of components (%)
1.	RCC	6270	312	4.97%
2.	FFP	5974	204	3.41%
3.	PC	2428	481	19.81%
4.	CP	283	10	3.53%
	Total components	14955	1007	

From 6270 whole blood units, 14955 blood components were prepared. Out of which 1007 (6.7%) components were wasted. The most common components wasted were PC (19.81%), followed by RCC (4.97%), minimum number of components wasted were FFP (3.41%).

Table 2: Analysis of Reasons for Wastage of Blood Components

No.	Reasons of wastage	Number of wastage	% of wastage
1.	Shelf life Expired	474	47.07%
2.	Leakage/Breakage	113	11.22%
3.	QC (Quality Control)	47	4.66%
4.	QNS	118	11.71%
5.	TTI Positivity	221	21.94%
6.	Hemolysis / Contamination	9	0.89%
7.	Mother bag expired	24	2.38%
8.	Other	1	0.09%
		1007	100.00%

The most common reason for discard of the components was expired shelf life. Total 474 (47.07%) components were wasted due to expired shelf life. The second common reasons for wastage of components were positivity for transfusion transmitted infection in first run of ELISA testing. It is the policy of blood bank to discard the components which came to be positive for TTI in first test run of ELISA; final result was given after second time running the same tests in duplicate. Total 221 (21.94%) of components were wasted due to this reason. The third common reasons for wastage of components were breakage or leakage of bag and sufficient quantity of blood not collected. Total 118 (11.71%) and 113 (11.22%) components were wasted due to QNS and leakage or breakage of bags respectively.

Table 3: Analysis of Wastage due to Positivity for Transfusion Transmitted Infection

No.	Total Wastage	Wastage due to Positivity after 1st ELISA Run	Final TTI Negative result	Final TTI positive result
1.	1007	221	137	84

Above data of positivity was, wastage of blood components due to the result came positive in first run of ELISA testing for transfusion transmitted infection and comparison of actual positivity after 2nd ELISA test run in duplicate. In 2nd run of ELISA if both duplicate test give positive results then final result is declared as positive for specific transfusion transmitted infection. The reason may be due to carry forward of positive samples, inadequate washing steps or technical inaccuracy.

5. Discussion

In this study in a period of 1-year total 1007 (6.7%) components were wasted out of 14955 prepared components. Total 6423 units were collected in study period, out of which 3595 (55.97%) units were collected

from in house blood donors in the blood bank and 2828 (44.02%) units were collected from outdoor voluntary blood donation camp. From 3595(55.97%) in house blood donations, 8334 (55.72%) components were prepared and from 2828 (44.02%) out door voluntary blood donations, 6621(44.27%) components were prepared. The above data of pre-sent study are comparable with the study conducted by Patil P et.al.⁸ In his study out of 14026 blood donation s, 8131 (57.98%) units were collected from in house blood donors and 5894(42.02%) units were collected in outdoor blood donation camp.

In present study out of 6423 total blood donors, 6145 (95.67%) were male donors and 278 (4.3%) were female donors. The blood donor data of this study are comparable with the study conducted by Bobde *et al.*^[9], Patil P *et al.*^[8], Chavan SK¹⁰ and Lakum *et al.*^[11] In their study out of 31143 blood donation 29125 (93.5%) were male donors and 2018(6.5%) were female donors, out of 14026 blood donations, 13557 (96.66%) were male donors and 469 (3.34%) were female donors, out of 15337 blood donation 15089(98.4%) were male donors and 248(1.61%) were female donors, out of 15084 blood donation 14797 (98.10%) were male donors and 287 (1.90%) were female donors respectively.

Table 3: Comparison of Wastage of Blood Components

Name of study	Components prepared	Components wastage	% of wastage
Suresh <i>et al.</i> ^[11]	24847	1747	7%
Bobde <i>et al.</i> ^[9]	19545	1610	8.2%
Presented study	14955	1007	6.7%

In present study out of 14955 prepared blood components, 1007 (6.7%) components were wasted. This was comparable with the study conducted by Suresh *et al.*^[11] and Bobde *et al.*^[9], in their study average wastage rate was 7% and 8.23% respectively. In study by Bobde V *et al.* comparatively wastage was higher than present study.

In present study out of 14955 prepared, blood components, 312 (4.97%) RCC were wasted due to different reasons. This was comparable with the study conducted by Patil P *et al.*^[8], Suresh *et al.*^[11] and the study conducted by European centers¹² from 2000 to 2002, in their study wastage rate of RCC was 6.7%, 3.8% and 4.5% respectively.

In present study out of 14955 prepared blood components, 204 (3.41%) FFP were wasted due to different reasons. This was comparable with the study conducted by Suresh *et al.*^[11] and Novis *et al.*^[13] USA. In their study wastage rate of FFP was 3.3% and 2% to 2.5% respectively.

In present study out of 14955 prepared blood components, 481 (19.8%) PC were wasted due to different reasons. This was comparable with the study conducted by Suresh *et al.*^[11], Shinghal *et al.*^[14] and Bobde *et al.*^[9]. In their study wastage rate of PC was 16.6%, 16.92%, and 26.2% respectively.

Tables 4: Comparison of Wastage of Components due to Expired Shelf Life

Name of study	Components wasted due to bag expired	% of Wasted
Shinghal <i>et al.</i> ^[14]	596	45.46%
Sharma <i>et al.</i> ^[2]	930	54.5%
Bobde <i>et al.</i> ^[9]	829	51.4%
Present study	522	51.83%

In present study out of 1007 wasted components, 522 (51.83%) components were wasted due to expired shelf life of the components or expired shelf life of mother bag in case of pediatric unit preparation. It was comparable with the study conducted by Shinghal *et al.* ^[14], Sharma N *et al.* ^[2] and Bobde *et al.* ^[9]. In their study wastage rate due to same reason was 45.46%, 54.5% and 51.4% respectively.

Table 5: Comparison of Wastage of Components due to Leakage or Breakage

Name of study	Components wasted due to Leakage or Breakage	% of Wastage
Shinghal <i>et al.</i> ^[14]	181	13.80%
Suresh <i>et al.</i> ^[11]	112	8.4%
Present study	113	11.22%

Table 6: Comparison of Wastage of Components due to TTI Positivity

Name of study	Components wasted due to TTI Positivity	% of wastage
Shinghal <i>et al.</i> ^[14]	182	13.88%
Sharma <i>et al.</i> ^[2]	341	20.0%
Present study	221	21.94%

In present study out of 1007 wasted components, 221 (21.94%) components were wasted due to positive reactivity for TTI in 1st run of ELISA testing. It was comparable with the study conducted by Shinghal *et al.* ^[14] and Sharma N *et al.* ^[2] in their study wastage rate due to same reason was 13.88% and 20.0% respectively.

Conclusions

Wastage of blood components will continue to be an issue at all blood banks. Our study revealed that the wastage rate of blood components was 6.7%. The most common component wasted were platelet concentrate PC (19.81%), due to short expired shelf life.

Different reasons of wastage observed in study are, quantity of blood collected was not sufficient, expired shelf life, expired of mother bag in case of pediatric bag preparation, positivity for TTI after 1st run of ELISA testing, hemolysis, RBC contamination, utilization for QC purpose and received back of component after dispatch from blood bank. Second common reason for wastage was TTI positivity after 1st run of ELISA testing. Other most common reason for wastage of component was quantity of blood is not sufficient (QNS). To avoid wastage of blood components continued training of staff, involved in counseling of donor, phlebotomy and TTI testing is needed. Inventory control in blood bank regarding the stock position and requirement of different blood group is necessary. Avoid bleeding of negative blood group donor and rare blood group donor, help in prevention of wastage due to outdating. Regular audit of transfusion of blood component by transfusion committee helps in reduction of blood wastage and also promotes its rational use.

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