

Causes of Donor Blood Wastage in a Blood Centre from a Tertiary Care Hospital, Tirupati, India: A Cross-sectional Study

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ABSTRACT

Introduction: The transfusion of blood and blood components are an essential therapeutic intervention and at present India's blood requirement is about 9 to 9.5 million units per year. But blood banks in India are able to collect only about 5 to 5.5 million units per year. The causes of donor blood wastage are classified into shelf life expiry, seroreactivity, Quantity Not Sufficient (QNS), broken bags, lipaemic, dispensed but not transfused. Based on previous studies the discarding rate is ranging from 4.3 to 26.6%.

Aim: To evaluate the causes of donor blood wastage in a tertiary care hospital.

Materials and Methods: The present cross-sectional study included all the blood units received in the blood bank of Sri Venkateswara Ramnarayan Ruia Government General Hospital (SVRRGGH) for a period of six months (July 2024 to December

2024). Causes of discarded blood were analysed based on shelf life expiry, serological positivity and QNS. The results were analysed in the form of rates and percentages.

Results: The total number of 3,761 blood units were collected during the study period, of which 347 (10.1%) units of whole blood and its components were discarded during the study period. Shelf life expiry 254 (73%) followed by seroreactivity 60 (17%) units were the two most common causes of discarding the blood and blood components.

Conclusion: Regular screening for Human Immunodeficiency Virus (HIV) and Hepatitis B surface antigen (HBsAg) by rapid tests before bleeding decreases the wastage by deferring the donor. To arrange near expiry blood units in front shelves of refrigerator, regular audit of blood issue and discard by hospital transfusion committee to be done to minimise the wastage.

Keywords: Blood donation, Blood transfusion, Seropositivity, Shelf life expiry

INTRODUCTION

The transfusion of Whole blood and blood components has become an integral part of patient management in modern medicine [1]. Blood transfusion includes transfusion of whole blood and blood components i.e., Packed Red Blood Cells (PRBC), Fresh Frozen Plasma (FFP), platelets and cryoprecipitates [1]. This vital health care resource has no complete substitute to date. Each unit of blood and its components are precious, must be utilised with minimal wasting [2]. India's blood requirement is about 9 to 9.5 million units per year [3]. But blood banks in India are able to collect only about 5 to 5.5 million units per year. Based on previous studies, the discarding rate is ranging from 4.3 to 26.6% [1,2]. The causes of donor blood wastage are classified into shelf life expiry, seroreactivity, QNS, leakage in a bag, lipaemia, haemolysis, clots, icterus etc.,

Several studies are available from western countries on wastage of red cell/whole blood wastage in different blood banks, but there are paucity of data on the degree and nature of wastage of red cell/whole blood units in blood banks in India [4]. Many factors lead to the wastage of blood products such as broken bag, broken seal, expired units, serology positive units, broken cold chain, clotted blood, or miscellaneous reasons, which is most importantly due to lack of proper knowledge, training, and awareness.

The present study aimed to evaluate the causes of donor blood wastage in a tertiary care hospital. Objectives of the study were to estimate the rate of wastage of whole blood and blood components and to find out the reasons for the wastage of whole blood and blood components.

MATERIALS AND METHODS

The present cross-sectional study was conducted for a period of six months after the approval of Institutional Scientific Committee and Institutional Ethics Committee (IEC No. Lr.No. 98/2024) Sri

Venkateswara Ramarayan Ruia Government General Hospital, Tirupati, Andhra Pradesh, India. The whole blood received in the blood bank of tertiary care hospital served as the source of data. Before collecting data all subjects were briefed about the purpose of study and informed written consent was obtained. All investigations done during the study were done free of cost and the study didn't cause any financial burden on patient and on institution. Whole blood received in the blood bank of tertiary care hospital was used in the study.

Inclusion criteria:

- All the blood donations fulfilling the World Health Organisation (WHO) donor selection criteria [5].
- All the blood donations collected within the hospital and in camps.
- Donors who were willing to give written informed consent.

Exclusion criteria:

- Who were not fulfilling the WHO criteria for donor selection [5].
- The blood bags collected from other organisations without proper consent.

Study Procedure

The donors were screened based on WHO criteria which include donor name, age, gender, marital status, previous status of blood donation and type of blood donation. Blood drawing was done under medical supervision. Blood grouping, typing, and various immunological screening methods were performed on all donated samples for HIV, HBsAg, Hepatitis C Virus (HCV) (By ELISA), Syphilis (By VDRL rapid tests), Malaria (By SD BIOLINE Malaria antigen p. f/p. v rapid diagnostic card test or RDT). Blood bags which are negative for screening tests were stored under proper temperature regulations. The date of bleeding and date of expiry was noted on the

blood bags and in the blood bag registers. Component preparation was done according to the requirement of components. Whole blood/blood components were issued after proper cross matching. The number of expired bags were noted. Percentages and rates of expired bags were calculated.

Wastage rate was calculated by using the following formula [6]:

Wastage rate in % = $\frac{\text{Number of blood units discarded}}{\text{Number of blood units issued by donation}} \times 100$

Discarded blood was assessed based on type of blood group. Rate of blood wastage of present study was calculated and compared with various studies. Also causes of discarded blood were analysed based on shelf life expiry, serological positivity and QNS in comparison with other studies.

STATISTICAL ANALYSIS

The collected data was entered in MS excel spreadsheet. All categorical variables were represented in the form of rates and percentages.

RESULTS

The total number of 3,761 blood units was collected during the study period, of which majority were voluntary blood donations 3,709 (98.6%) [Table/Fig-1]. Among total blood collections, 3414 (89.9%) were issued and 347 (10.1%) were discarded. In the present study 2,133 units (56.7%) were utilised whole blood while the remaining 1,628 units (43.2%) were proceeded into different blood components.

Type of Donation	A+ve	A-ve	B+ve	B-ve	O+ve	O-ve	AB+ve	AB-ve	Total
Voluntary	662	42	1194	68	1,444	88	204	7	3,709 (98.6%)
Replacement	15	-	15	1	21	-	-	-	52 (1.4%)
Total	677	42	1,209	69	1,465	88	204	7	3,761

[Table/Fig-1]: Distribution of donated blood according to type of donation.

Majority of blood donations 254 (73%) were discarded due to shelf life expiry, of which more number of platelets 153 (44%) were discarded due to their short shelf life expiry [Table/Fig-2]. Among the seropositivity wastage of 60 blood units (17%), majority of blood donations 28 (8%) were discarded due to HBsAg followed by HIV and VDRL positivity [Table/Fig-3]. Among the blood group types, majority of discarded blood units 119 (34%) are O-positive blood group [Table/Fig-4]. The rate of wastage of present study was 10.1% (calculated by using formula [6] - Wastage rate in % = $\frac{\text{Number of blood units discarded}}{\text{Number of blood units issued by donation}} \times 100$).

Components	Shelf life expiry	Seroreactivity	QNS	Total
Whole blood	57	10	33	100
PRBC	24	25	-	49
FFP	20	25	-	45
Platelets	153	-	-	153
Cryoprecipitates	-	-	-	-
Total	254 (73%)	60 (17%)	33 (10%)	347

[Table/Fig-2]: Distribution of discarded whole blood/blood components according to the cause.

QNS: Quantity not sufficient; PRBC: Platelet rich blood cells; FFP: Fresh frozen plasma

Seropositivity	Total blood and components	Percentage (%)
HIV	2	0.6%
HbsAg	28	8%
HCV	1	0.3%
VDRL	2	0.6%

[Table/Fig-3]: Distribution of % of seropositive cases.

Blood group	Shelf life expiry	Seroreactivity	Quantity Not Sufficient (QNS)	Total
A+ve	50	13	8	71 (2.07%)
A-ve	18	-	-	18 (0.52%)
B+ve	68	15	9	92 (2.69%)
B-ve	10	2	2	14 (0.41%)
O+ve	81	26	12	119 (3.48%)
O-ve	7	-	-	7 (0.20%)
AB+ve	11	4	2	17 (0.49%)
AB-ve	9	-	-	9 (0.26%)
Total	254	60	33	347 (10.1%)

[Table/Fig-4]: Distribution of discarded blood according to the blood group type.

blood units discarded / Number of blood units issued by donation x100).

DISCUSSION

Blood transfusion is a potential lifesaving procedure. Wastage of blood and blood components is an alarming issue. Proper blood management at blood bank will reduce the wastage. The present study was carried out to get an insight into the causes for discard of blood units. The various reasons for discard of blood are shelf life expiry, seroreactivity, QNS, haemolytic sample, leakage of blood bags, clots, discolouration of blood. Comparison of reasons for discarding whole blood in various studies with present study is shown in [Table/Fig-5] [1-4].

Overall discard rate 347 (10.1%) was observed in the present. It was little higher as compared to studies done by Bashir F et al., (8.87%), Kora SA et al., (4.48%), Jariwala K et al., (6.59%) and it was little lower as compared to studies done by Hayer SS and Gotekar RR (26.6%) [1]. In the present study, shelf life expiry (73%) is the most common cause for discard followed by seroreactivity (17%) and QNS (10%). But the study done by Kora SA et al., [3], seroreactivity is the most common cause of discard of blood units. The shelf life of platelets is only 5 days, Packed Red Blood Cells (PRBC) 35 days, whole blood 35 days, Fresh Frozen Plasma (FFP) one year [7]. So, due to short shelf life expiry of platelets their wastage rate was high (44%) in the present study similar to study conducted in north Karnataka by Kulkarni KR et al., (45.03%) and by Hessah A et al., (52.67%) [8,9]. Providing a small fraction of a bag of blood for paediatric patients leading to outdating of rest of the bag is also an important component of outdating. Its wastage is minimised by optimal preparation according to the clinical requirement and regular screening of blood units, blood bank to arrange the blood units of near expiry in front shelves of refrigerators as per the component storage temperature guidelines [7] and not to bleed rare blood groups.

In the present study, the discard rate of seropositivity was 17%, of which HBsAg was the most common transfusion transmitted infection of discard blood units, like in study done by Mandal R and Modal K (2.93%) and Suresh B et al., (49%) [10,11]. Its wastage minimised by screening by rapid slide tests before phlebotomy procedure. Discard rate of seropositivity showing HBsAg > HIV = Malaria > HCV > VDRL. Causes for QNS are phlebotomy failure like collapse of veins, uneasiness, vomiting, haematoma formation, fainting during donation. Such bags are not suitable for transfusion due to mismatch between amount of blood collected and anticoagulant used in the bag. In the present study, the discard rate due to QNS was only 10%. These are prevented by selection of proper health donors, adequate training of phlebotomy staff. O-positive was the predominant blood group type discarded in our study similar to Simon K et al., [12] study. This is because of lack of awareness about compatible blood transfusions. O positive unit can be transfused to all the positive blood groups.

Study	No. of units collected	No. of units discarded	Reasons for discarding			
			Shelf life expiry	Seroreactivity	QNS	Others
Hayer SS and Gotekar RR [1]	2,210 (6 months)	511 (26.6%)	235 (13.8%)	161 (9.47%)	01 (0.05%)	120 (7.06%)
Bashir F et al., [2]	9,308 (15 months)	2,128 (8.87%)	945 (44.4%)	687 (32.3%)	98 (4.6%)	398 (18.7%)
Kora SA et al., [3]	6129 (2 years)	263 (4.48%)	38 (0.64%)	220 (3.75%)	5 (0.08%)	-
Jariwala K et al., [4]	1,70,431 (5 years)	10,541 (6.59%)	6,777 (4.23%)	1441 (0.9%)	964 (0.6%)	1359 (0.84%)
Present study	3,761 (6 months)	347 (10.1%)	254 (73%)	60 (17%)	33 (10%)	-

[Table/Fig-5]: Comparison of reasons for discarding whole blood in various studies with present study [1,2,3,4].

Limitation(s)

The current study had some limitations. This study did not count the blood wastage from the hospital, like in cases of blood never administered to the patient because the patient expired before the blood transfusion, no refrigeration system within the wards to store the blood temporarily or because of malfunctioning cannulae system. Present study done for short period of time (6 months) compared to other studies. Overall this study improves the proper blood management by regular audit, training of blood bank staff and decreases the unnecessary blood wastage.

CONCLUSION(S)

Wastage is minimised by proper utilisation of blood and blood components along with education and training of blood bank staff. Screening of HBsAg and HIV by rapid slide tests before bleeding. Not to bleed rare blood groups. To follow-up type and screen protocol. Regular audit by hospital transfusion committee will help minimise the wastage.

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