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Evaluation of Quality Indicators and Blood Utilisation in the Blood Centre of a Tertiary Care Teaching Hospital – A 1 year study.

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Abstract

Background: The present study was carried out to analyse the rational use of blood and. blood components at our hospital and to evaluate the key performance indicators at our Blood Centre for quality assurance.

Methods: This is a retrospective cross-sectional study carried out in Departments Pathology of a tertiary care hospital in Haryana, India between January – December 2021.

Results: Out of 4261 total number of units cross matched, 3505 (82.25%) units were transfused and the remaining units which were cross matched according to the request but remained un transfused were 756 (17. 74%) units. The overall C/T (cross-match trans fusion) ratio for the hospital was 1.21. The transfusion probability percentage (TP%) and transfusion index (TI) was calculated as 60.95% and 1.13 respectively. The percentage of issue of components was calculated as 88.80%. The seropositivity rate for units screened against the five transfusion transmitted infections during the study period was 0.29%. Total number of voluntary blood donations during the year 2021 were 2696 and the donor deferral rate calculated was 5.41%. The adverse transfusion reaction rate calculated for the year was 0.07%. Adverse donor reaction rate was 1.4%. The wastage rate reported for the whole blood and component units was 1.97%. QC (quality control) failure rate reported in the present study was 12.56 for PRBC (packed red cell), 11.20% for FFP (fresh frozen plasma), 6.34% for platelets. The turnaround time for issue of the cross-match unit, after the receipt of the request from the OPD/IPD/ICU was 120 minutes for the routine and 35 minutes for the emergency cases.

Conclusions: The quality indicators help in adherence to a set of well-defined criteria required for safe blood utilisation and transfusion practices at a Blood Centre. It ensures that process, procedures and products meet a defined criterion. Hence error reporting and correction policy should be in place along with corrective and preventive action. safe and efficacious blood and blood

components are collected, prepared and delivered to the patients.

Keywords: quality assurance, key performance indicators, safe, corrective action

Introduction

The guidelines for the use of blood components mainly aims to: improve the consistency and appropriateness of transfusion practice; promote the integration of quality management systems into transfusion practice; reduce the overall number of transfusion-related complications; increase consumer awareness of the benefits and risks of blood component therapy; and conserve a limited resource [1]. The measurement of the quality indicators helps identify the gaps in performance and the measures that can be taken for providing safe and efficient blood transfusion services like donor selection, preparation, storage and efficient utilisation of blood and its components, serological testing, transfusion of blood products, monitoring of blood transfusion reaction and hemovigilance program.

As blood components are a scarce and expensive resource, inappropriate blood transfusions need to be avoided. Therefore, there is a need for continuous monitoring of blood utilization and auditing the trans fusion practices which serves in identifying key areas of concern in the blood component usage as well as instances of inappropriate component use, wherein corrective actions can be planned. [2] With the growing evidences-based support and the use of restrictive transfusion strategies, patient blood management has emerged as a multidisciplinary approach to optimize the care of patient who may need transfusion. [3]

This study is planned to evaluate the quality indicators for efficient utilisation of transfusion medicine services at our hospital.

Methods

The present study was a retrospective cross-sectional study carried out in the Blood Centre, Department of Pathology of a tertiary care hospital in Haryana, India between January 2021 and December 2022 conducted after obtaining due clearance from Institutional Research Committee and Institutional Ethical Committee.

Inclusion Criteria: All the blood units cross matched for inpatients and blood units issued during the study period.

Exclusion Criteria: Blood/ component requests from outside hospital.

The data collected from the records will include: type of the blood component requested by the clinical depart Ment, infectious agent screening results, trans fusion reaction details, blood bags discarded, total no. of donations donor deferral.

The following key quality indicators will be calculated during the 2-year study period: TTI% (transfusion transmitted infections), Adverse Transfusion Reaction Rate %, Wastage Rate %, Turnaround Time (TAT) of Blood Issues, Component QC failures (for each component), Adverse Donor Reaction Rate %, Donor Deferral Rate %, % of Components Issued, Cross-match transfusion ratio, Transfusion probability, Transfusion index

Statistical Analysis of the Data Obtained

Data from clinical records will be analyzed using SPSS version 27 (IBM Corp., Armonk, NY, USA). Categorical data will be presented as frequency and percentage. A C/T ratio of 2.5 or below, Transfusion probability of ≥30% and TI of more than 0.5 is considered indicative of efficient blood utilization as conceptualized by Boral et al [4] and Mead et al [5].

Results

The age of the patients who underwent blood and component transfusion in the study varied between 20

years to 78 years with a M:F ratio of 1.8± 1.0. The age of paediatric patients for blood transfusion varied between 3 years to 12 years.

The common indication for the whole blood transfusion was road traffic accident and trauma patients as our set up is a tertiary care trauma Centre. The common indications for transfusion of packed red cells was severe anaemia, thalassemia, patients on hemodialysis, elective surgeries, malignancies. Fresh frozen plasma was mainly requested for patients with chronic liver diseases, disseminated intravascular coagulation, burns patients. The demand for platelets (RDP/SDP) were requested mainly for severe thrombocytopenia, dengue positive patients, aplastic anaemia, patients on chemotherapy, thrombocytopenia in antenatal patients in 3rd trimester. (Table.1.)

Out of 4261 total number of units cross matched, 3505 (82.25%) units were transfused and the remaining units which were cross matched according to the request but remained untransfused were 756 (17.74%) units. A total of 3159 patients were cross matched out of which 2434 (77.05%) patients were transfused.

The overall C/T ratio for the hospital was 1.21. The TP% and TI was calculated as 60.95% and 1.13 respectively. (Table.2.)

The total number of components and whole blood requested during the study period from January – December 2021 were 500(11.73%) whole blood, 2145 (50.34%) packed red blood cells, 997 (23.39%) fresh frozen plasma , 384 (9.01%) random donor platelets and 235(5.51%) single donor platelets.

The number of components and whole blood issued during the study period from January – December 2021 were 380 (10.84%) whole blood, 1879(53.60%) packed red blood cells, 736 (20.99%) fresh frozen plasma, 282(8.04%) random donor platelets and 228(6.50%) single donor platelets.

Total number of whole blood and components requested were 4261 out of which 3505 were issued. The rest of the units were taken back in the inventory as per the blood bank policy of the institute.

The percentage of issue of components was calculated as 88.80%. (fig.1,2,3)

The total number of blood grouping and rh typing done during the study period was 8994 out of which 39 % was reported B positive, 35% O positive, 12 % A positive, 5 % AB positive, 2% B negative, 4% O negative, A negative 2%, 1% AB negative.

The seropositivity rate for units screened against the five transfusion transmitted infections during the study period was 0.29% out of which 1 donor tested positive for HIV, 6 tested positive for HCV, 1 donor tested positive for HBsAg. There were no tests positive for syphilis and malarial parasite.

Total number of voluntary blood donations during the year 2021 were 2696 and the donor deferral rate calculated was 5.41%. The common reasons found for the donor deferral during our study period were patients with history of hyper tension, diabetes mellitus, underweight, history of anti- epileptic drugs and statins. No donor reaction was reported during the study period.

There were 3 cases of transfusion reaction reported to the blood bank during the study period and the adverse transfusion reaction rate calculated for the year was 0.07%.

Quality control on 1% of the components prepared during a month was done and QC failure rate reported was 12.56 for PRBC, 11.20% for FFP, 6.34% for platelets. The PRBCs were checked for volume, hematocrit and sterility. Fresh frozen plasma was tested for volume, stable coagulation factors, factor VIII and

fibrinogen. The platelets were checked for volume. platelet count, pH, RBC contamination.

The wastage rate reported for the whole blood and component units was 1.97%.

The turnaround time for issue of the cross match unit , after the receipt of the request from the OPD/IPD/ICU was 120 minutes for the routine and 35 minutes for the emergency cases.

Discussion

Quality assurance in blood banking is necessary to ensure availability of a sufficient supply of blood, blood components of high quality with maximum efficacy and minimum risk to both donors and patients. The present study was carried out to evaluate the effectiveness of blood transfusion practices at our hospital and scope for improvisation of blood utilisation based on the calculation of various quality indicators as per the NABH guidelines. Different studies (table.no.3) have reported C/T ratio <2.5 comparable to our study. C:T ratio >2.5 means that less number of cross matched units are transfused and over ordering of the blood products as a precautionary / standby measure for the elective procedures. The TI varies between different studies with lowest being 0.77 [6] and highest 1.22[7]. The value of transfusion probability shows wide variation between 42.5% [2][3]- 97.2% [8]. The cut off criteria taken is >30% which indicates efficient blood utilisation practices. TI > 0.5% is the cut off Present study has a C/T ratio, TI and T% as 1.21, 1.13 and 60.95% respectively and meets the standard guidelines for efficient blood utilisation practices. Devi et al [8] reported significant blood utilisation practices at their Centre with a C/T ratio of 1.02, TI 0.97 and T% 97.2%.

The percentage of components issued in the present study was 89.13% with whole blood as 10.84%. whereas Bharti et al[13] reported components issue rate 99.67% and whole blood 0.33% of the total collection. Varshney et al [12] reported percentage of components issued 98.18% Kaur et al 99.75%.[9]. The seropositivity rate for units screened against the five transfusion transmitted infections as recommended by WHO in the present study was 0.29% out of which seropositivity was highest for HCV .Study by Nikhil et al [14] observed seroprevalence of 1.87% ; with most common HIV, followed by Hepatitis B. The TTI prevalence was 0.6% and 0.6% as reported by Fernandes H et al[15] and Hariharan A et al., [16]. Zulfikar A et al 0.82% [25]and Varshney L et al., reported TTI to be 0.93% [12] with HBsAg to be more sero-prevalent followed by HIV. In the study done by Fernandes et al [15] TTI prevalence was 0.6% ,study by Zulfikar et al [25]showed prevalence to be 0.82%. Bharati et al [13] reported TTI% in their study as 1.4 % with seroprevalence of HBsAg ,HCV ,HIV as 0.14%, 0.79% and 0.4% respectively.

Adverse transfusion reaction rate found in present study was 0.07%. Varshney et al reported it as 0.16%. [12]. Similar findings were reported by Bhattacharya et al [26] as 0.18%. Chakravarty et al [27] 0.16% and Bharti et al as 0.15% [13]. The most common blood component implicated in in causing adverse transfusion reactions was packed red cells in majority of the studies. The most common causes of transfusion reactions reported in our setting were allergic reactions like urticaria, itching, fever, chills. The other cause could be febrile non hemolytic transfusion reaction with symptoms of chills, rigors, increased respiratory rate, anxiety, headache and variation in blood pressure readings. Our set up uses gel card technology for cross matching which has brought a dynamic change in our transfusion practices and made it possible to ensure rapid and safe blood components available to our patients. Also to reduce the rate of transfusion reactions if certain ground rules can be

followed before and during transfusion would help reduce the rate of transfusion reactions like checking the vital parameters of the patients pre transfusion should be mandatory, ensure proper transport and storage conditions of various components, monitoring the rate of transfusion, special precautions in patients undergoing regular transfusions (thalassemia, cancer patients). Our blood center maintains the documentation of all the transfusion reaction forms received with empty bags along with detailed workup of the adverse transfusion reactions according to our institutional policy. Our institution is also enrolled in National Hemovigilance program which helps to identify trends in adverse reactions and events, target areas for improvement in regular transfusion practice, stimulates research, provides an early warning of new complications and to improve safety of transfusion for patients.

The wastage rate in the present study reported for the whole blood and component units was 1.97% and the common accountable factors were – under collection , seropositivity of the donor unit , bag leakage and expired units. Varshney et al [12] reported the mean wastage rate as 12.9% with 2.05% for whole blood, 3.19% for packed red blood cells, 16.11% for platelets and 1.52% for fresh frozen plasma. [12].

Mukherjee G et al.[28] and Hariharan A et al., [13] [16] reported wastage rate of 13.5% and 15.93%.Bharti et al [13] reported wastage rate in their centre as 12.09% with 43.97% for whole blood, 1.67% for packed red blood cells, 43.37% for platelets , 5.91% for fresh frozen plasma and 26.3% for cryoprecipitates and 0% for single donor platelets. The most common component that was reported to be wasted in our study like other studies was platelet concentrates due to short expiry or seropositivity.

With context to donor deferral rate, present study showed a donor deferral rate of 5.41%. Other studies reported 9.3% by Varshney et al [12], John et al [17] reported 5.12%, Rehman et al [18] reported 12.4%, Agnihotri et al [19] 11.6%, Bharti et al 11.5% [13]. The common reasons found for donor deferral in various studies were low haemoglobin levels, medication history (hyper tension, diabetes mellitus, epilepsy, chemo therapy). Other causes included history of jaundice, malaria, dengue or typhoid, dental procedures and live virus vaccination, permanent tattoo, skin allergy, history of travel to endemic areas, history of past donation less than 3 months. Donor counselling would be helpful to retain the temporary deferrals. Adverse donor reaction rate was found to be 1.15% by Varshney et al. [12], 2.03% by Abhishek et al [20], 0.93% Kumar et al [21], Bharti et al [13] showed 1.59%. Our study had adverse donor reaction rate as 1.4 % comparable to other studies. Various reasons cited for the adverse donor reaction rates in the majority of the studies comprised of vasovagal nature.

TAT for routine cases in the present study was 120 minutes for routine and 35 minutes for emergency cases. In the study by Nikhil et al [14] it was 140.9 minutes , 153 minutes in the study done by Gupta A and Gupta C [22] Varshney L et al.[12] was 135.8 minutes.

Quality control in the blood and blood components is done according to the National guidelines set by the government of India as 1% of component shall be tested for Quality Control out of which 75% shall match the acceptable ranges [23,24]. QC failure rate in the study by Varshney et al[15][12] was 10.67% for packed red blood cells, 8.22% for platelets, 8.63% for fresh frozen plasma and 11.30% for saline washed packed cells. Bharti et al [13] showed component quality failure rate of 15.5% in PRBC, 18.18% FFP , 11.57% in PC and 0% in Whole blood, SDP and CP. QC failure rate reported in the present study was 12.56 for PRBC , 11.20% for FFP ,

6.34% for platelets. The root cause analysis to reduce the rate of QC failure at a blood centre can be periodic equipment maintenance , re- calibration and retesting of control materials. Hence QC for equipments , reagents and techniques should be done periodically according to the institutional policy. Use of precision thermometers , graphic recorders for various equipments being used in blood centre should be monitored on a daily basis by a trained technical staff of blood centre. Regular training of blood bank technical staff is mandatory for quality assurance program to be effective.

Conclusion

Quality management in blood transfusion helps develop a system for quality control of the blood supply chain from blood collection to the transfusion of the patient. The Cross-match Transfusion ratio, transfusion probability and transfusion index demonstrated a significant blood utilization at our hospital. Quality indicators enable continuous improvement of blood transfusion services by implementation of root cause analysis, corrective and preventive measures.

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Legend Tables

Table 1: shows quality indicators for blood utilization

Month	No. of units cross matched	No of patients cross matched	No of units transfused	No of patients transfused	Cross match - transfusion ratio (C/T)	Transfusion probability (T%)	Transfusion index (TI)
Jan	359	316	312	232	1.15	64.62	0.98
Feb	332	311	268	223	1.23	67.16	0.86
Mar	332	358	276	205	1.20	61.74	0.77
Apr	294	247	232	210	1.26	71.42	0.94
May	226	156	173	138	1.31	61.06	1.10
Jun	258	209	206	187	1.25	72.48	0.98
Jul	354	338	286	185	1.23	52.25	0.84
Aug	311	245	247	192	1.13	61.73	1.01
Sept	337	258	283	214	1.19	63.50	1.09
Oct	592	293	510	274	1.16	36.10	1.74
Nov	525	249	435	229	1.21	52.19	1.75
Dec	341	179	275	145	1.24	67.15	1.53
	4261	3159	3505	2434	1.21	60.95	1.13

Table 2: shows department wise utilization of blood components.

Department	Cross match -transfusion ratio (C/T)	Transfusion probability (T%)	Transfusion index (TI)
General surgery	1.16	66.45	0.93
Neurosurgery	1.23	53.24	0.90
Orthopaedics	1.21	61.33	1.42
General medicine	1.19	68.90	1.38
Obstetrics&Gynaecology	1.24	65.23	1.41
Paediatrics	1.23	50.56	0.82
	1.21	60.95	1.14

Table 3: Quality indicators in various studies

Study	C/T ratio	TI	T%
Devi KM et al (6)[8]	1.02	0.97	97.2
Kaur Det al (7)[9]	1.57	0.79	79.0
Tadesse B et al (8)[6]	2.3	0.77	47.0
Trisal et al [9][10]	1.4	1.2	68.3

Yasmeen et al [26][11]	1.2	0.88	88.8
Mangawa et al [27][7]	1.34	1.22	83.07
Kour et al [2][3]	1.92	0.6	42.5
Present study	1.21	1.13	60.95

Figure 1: no.of whole blood & blood components requested.

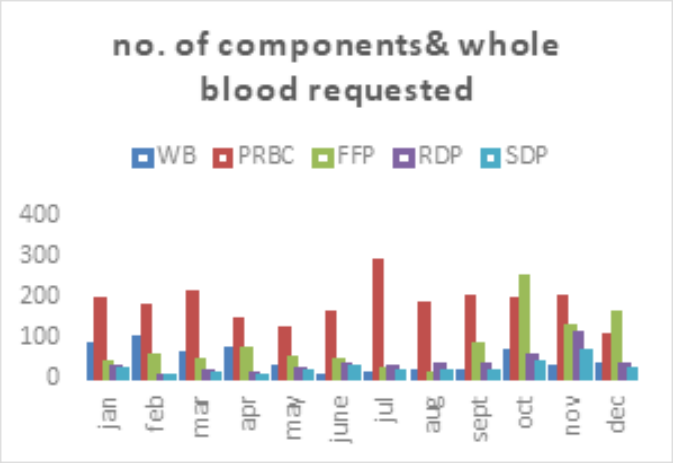

Figure 2**:** no of whole blood & components requested

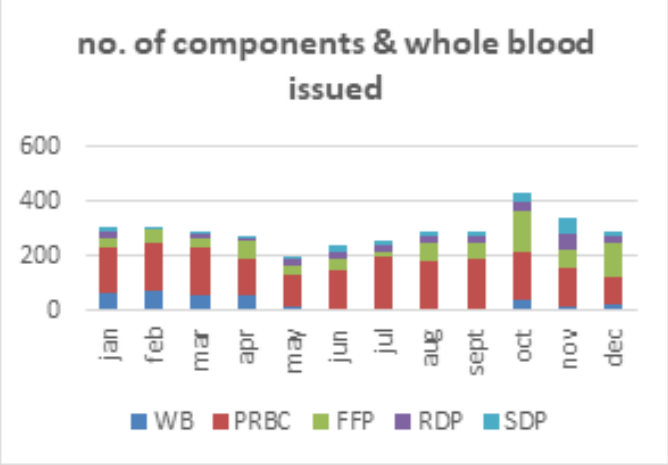

Figure 3: comparison of number of whole blood and components requested & issued