Original Research Article

Blood Transfusion Request and Utilization: The Trend in a Tertiary Health Care Centre in North Central Nigeria

ABSTRACT

Background: An effective blood transfusion service is anchored on an adequate supply of safe blood and its components as well as its accessibility and appropriate clinical use. There is a contrast in blood supplies and utilization between the high, middle and low-income countries necessitating the formulation of appropriate modalities to ensure judicious use of blood while minimizing wastage.
Aims: This study was aimed at assessing the blood transfusion request trend in our institution and its utilization with the intent of curtailing the wastage of safe blood for transfusion.
Study design: It is a retrospective study.
Place and Duration of Study: Jos University Teaching Hospital Blood Bank from January 2022 to December 2022.
Methodology: Appropriately filled blood transfusion request forms of the Jos University Teaching Hospital compared with the blood bank In-house records from January 2022 to December 2022 were reviewed. Request dates, requesting Department, Unit or Specialty, indications for request, Number of units requested, and number eventually utilized were used to determine blood transfusion indices which are indicative of efficient and significant blood use.
Results: Eight thousand, five hundred forty-eight (8,548) blood transfusion request forms from the blood bank and patients' folders were reviewed and compared with the Blood Bank's in-house records. Requests for blood transfusion for over 460 indications were received from twenty-six (26) departments and units. There was a general Crossmatch: Transfusion ratio (C: T) of 1.7 with a transfusion index (TI) of 1.2 and transfusion probability (TP) of 48.0%.
Conclusion: Transfusion requests were characterized by low utilization across departments and units. This calls for the establishment of a transfusion protocol for the determination of blood volume required for every indication so that this limited commodity will be made available and accessible when needed.

Keywords: Blood transfusion, Request, Trend, Utilization

1. INTRODUCTION

Blood transfusion is a multi-specialist medical procedure that involves the infusion of whole blood or its components from a donor to a recipient. The estimated annual global blood donation is reported to be about 110 million units [1]. Apharesis-derived components which are rarely available in our health care centres' make up 12.4 % of all blood transfusions

while whole blood, a source for several important components in blood transfusion, accounts for 89.5% of all blood transfusions Worldwide [1]. The demand for blood transfusion cuts across departments and units such that no single department or unit can effectively function without this life-giving product. Increasing globalization and sophistication in patient care for haematologic disorders, obstetrics and gynaecology interventions and complications, surgical procedures, and several other medical conditions have created further demands for blood supply.

The average donation rate all across Africa is about 4.3 donations per 1000 population with an abysmal 0.2 donations per 1000 population in Nigeria [2]. Requests for blood transfusions are usually made in anticipation of bleeding that could occur during surgical interventions, blood loss from several other conditions, or as a result of disorders arising from excessive blood cell destruction or due to inability of the bone marrow to produce blood cells to meet up the body's physiologic needs [3]. While requests during surgeries could be subjective, those due to an underlying disorder with evidently low haemoglobin concentration will require prompt supplies.

Several request and cross-match done in anticipation comes with minimal utilization and resultant wastage. It was estimated that in 2013 alone, about 1.8 million blood units were discarded globally [4]. Over the years donations have been grossly insufficient to meet the demand for transfusion, necessitating the need to closely conserve available supplies for judicious use where required.

To the best of our knowledge, no study of this magnitude has been carried out in our facility with the intent of determining blood transfusion requests, usage, and utilization in departments and units of the hospital. This study is aimed at assessing the trend of blood transfusion requests in our institution and subsequent utilization towards identifying areas of wastage so these blood supplies can be appropriately channelled to where it is needed at all times.

2. MATERIAL AND METHODS

2.1 Study Design

This is a hospital-based retrospective study. Completed blood transfusion request forms from the Jos University Teaching Hospital Blood Bank were reviewed from January 2022 to December 2022.

2.2 Data Collection Method

The Researchers reviewed the completed blood transfusion request forms and extracted request dates, requesting Departments and Units, indications for request, number of units requested, and number eventually utilized. Blood Transfusion utilization indices for each department and unit were calculated using the following equations with their inferences.

i. Cross-match to transfusion ratio (C: T ratio) = Number of units cross-matched/Number of units transfused.
   A ratio of less than 2.5 indicates efficient blood use[5].
ii. Transfusion Index (TI) = Number of units transfused/Number of patients cross-matched.
   TI greater than 0.5 is indicative of significant blood utilization and blood will need to be cross-matched preoperatively [5].
iii. Transfusion Probability (TP %) = Number of Patients transfused/Number of patients cross-matched x 100.
   A transfusion probability of ≥30% is considered significant blood usage[5].

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2.3 Data analysis

Microsoft Excel 2010 and Epi Info Version 7.2.5.0 software were used to analyze the data generated. The results were reported in proportions and percentages, and presented in tables.

3. RESULTS

Eight thousand, five hundred forty-eight (8,548) blood transfusion request forms obtained from the blood bank and patients' folders were reviewed and compared with the Blood Bank's in-house records. Units of blood requested for transfusion ranged from 1 unit to 10 units per request with 2 units accounting for 4668 (54.56%) requests. Three thousand eight hundred forty-four (44.97%) requests made were never utilized, while the highest number of units transfused was 14 units (Table 1). Requests for blood transfusion were received from twenty-six (26) departments and units. The highest number of requests 2000 (23.4%) was received from the Department of Obstetrics and Gynaecology while the least request was from dermatology, a unit in the Department of Internal Medicine. Department of Haematology and the Paediatric haemato-oncology unit of the Department of Paediatrics had requests of 392 (4.6%) and 375 (4.4%) respectively (Table 2).

Seventeen thousand, eight hundred and twenty-four (17,824) units of blood were crossed match for the 8,548 requests we received within the study period but only 10,320 units were transfused. There was a general Crossmatch: Transfusion ratio (C: T) of 1.7 with a transfusion index (TI) of 1.2 and transfusion probability (TP) of 48.0%

Department of Obstetrics and Gynaecology which had the highest blood transfusion request, Department of General Surgery, and the Department of Haematology had a C: T and TIs of 2.5, 1.7, 0.9, and 0.8, 1.2, 2.2 respectively (Table 2).

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Table 1: Blood units per request and blood units transfused (n=8,548)

Variables	Unit(s)	Frequency (n)	Percentage (%)
Number of units requested for transfusion	1	2000	23.40

	2	4668	54.61
	3	1264	14.79
	4	532	6.22
	5	20	0.23
	6	48	0.56
	7	0	0.00
	8	8	0.09
	9	0	0.00
	10	8	0.09
Number of units not transfused/transfused	0	3844	44.97
	1	1988	23.26
	2	1408	16.47
	3	596	6.97
	4	360	4.21
	5	140	1.64
	6	84	0.98
	7	52	0.61
	8	28	0.33
	9	16	0.19
	10	20	0.23
	11	5	0.06
	12	0	0.00
	13	4	0.05
	14	3	0.04

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Table 2: Number of transfusion requests, number of units' cross matched, number of units transfused, C: T ratio, TI and TP by Departments and Units

Department /Units	Number of transfusion	Number of blood units	Number of blood units

	request	cross-matched	transfused	C:T ratio	TI	TP(%)
Accident and Emergency	203	534	328	1.6	1.6	38.0
Cardiothoracic Surgery	263	696	464	1.5	1.8	37.8
Cardiology	141	385	301	1.3	2.1	36.6
Dermatology	4	8	8	1.0	2.0	50.0
Endocrinology	128	324	212	1.5	1.7	39.5
Oto-rhino-laryngology	138	246	38	6.5	0.3	56.1
Emergency Paediatric Unit	294	334	302	1.1	1.0	88.0
Gastroenterology	205	526	343	1.5	1.7	39.0
Haematology	392	766	850	0.9	2.2	51.2
Infectious disease	164	414	280	1.5	1.7	39.6
Maxillo Facial Surgery	182	332	98	3.4	0.5	54.8
Nephrology	420	1040	852	1.2	2.0	40.4
Neurology	100	244	172	1.4	1.7	41.0
Neuro-surgery	569	1480	504	2.9	0.9	38.5
Obstetrics &Gynaecology	2000	4123	1641	2.5	0.8	48.5
Oncology (Adult)	89	151	150	1.0	1.7	58.9
Orthopaedic Surgery	674	1438	620	2.3	0.9	46.9
Paediatric (General)	125	153	185	0.8	1.5	81.7
Plastic Surgery	300	608	348	1.8	1.2	49.3
Paediatric Haemato-oncology	375	488	502	1.0	1.3	76.8
Paediatric Surgery	256	369	146	2.5	0.6	69.4
Pulmonology	46	128	96	1.3	2.1	35.9
Rheumatology	82	170	124	1.4	1.5	48.2
Special Care Baby Unit	276	292	287	1.0	1.0	94.5
Surgery (General)	835	1904	1041	1.8	1.3	43.9
Urology	287	635	428	1.5	1.5	45.2
	8,548	**17,824**	**10,320**	**1.7**	**1.2**	**48.0**

C: T- Crossmatch: Transfusion, TI- Transfusion Index, TP- Transfusion Probability

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4. DISCUSSION

The first recorded successful blood transfusion occurred in 1665 in England when Doctor Richard Lower successfully kept a dog alive by transfusing it with blood from other dogs. By 1818, a British Obstetrician James Blundell successfully transfused human blood to a patient with postpartum haemorrhage marking the advent of human-to-human blood transfusion [6]. Little wonder that Obstetrics and Gynaecology continue to be one of the medical disciplines known to have a high demand for blood as demonstrated in this study. The first recorded blood transfusion in Africa was by an Arab physician in Egypt in 1242 and was later carried out in well-resourced medical centres' in Uganda, Kenya, and Senegal [7]. Humans realized how essential blood is from the ancient period hence the tag "*Vital force and essence of life*", however, it has become practically impossible to meet the world's safe blood transfusion demand despite efforts spanning decades of policies after policies [8]. Through well-formulated and supported policies, the World Health Organization earmarked the year 2012 as the year for Nigeria and other Sub-Saharan African Countries to meet their demands for safe blood as well as sustain its availability [9, 10]. World Health Organization further recommended that the minimum blood donation by any given population should be 1% of that population but till date, more than 70 countries globally have a blood donation rate of less than 1% [11]. Africa was only able to achieve 40% of that minimum requirement of blood donation in 2006 while Nigeria achieved only 33.3% [11]. These reports demonstrated the fact that this essential gift of life is grossly in short supply globally more so in the middle- and low income countries, Nigeria inclusive.

Millions of people from different backgrounds experience one form of bleeding or the other in addition to obstetrics haemorrhages, and anaemia caused by hundreds of benign and malignant disorders in adult and paediatric patients. This therefore calls for judicious utilization of this life-giving commodity to tackle the innumerable dire consequences associated with its scarcity. Obstetrics and Gynaecology (O&G) accounted for the highest transfusion request received in our center and this is supported by several other reports in Nigeria and other Countries of the World [12-14].]. A report by Arzani *et al* [15] among pregnant women in Southeast Iran showed comparable transfusion indices with our findings from Obstetrics and Gynaecology, however it is worthy of note that while we considered both Obstetrics and Gynaecology, theirs was only among pregnant women. Contrary to the predominance of O&G in blood transfusion requests in our study, Ibijola *et al* [16] in Ado-Ekiti, Nigeria reported the predominance of requests from the Department of Paediatrics and this was attributed to haemolysis with resultant anaemia due to malaria infestation. While it is true that more request was received from O&G in our center, our findings demonstrated that less than half of the blood cross-matched were transfused. Several of these requests were made in anticipation of intra or post-operative bleeding while others arise from the relative estimation of blood requirement for a procedure or a patient presenting with anaemia. There are several scientific methods of calculating blood requirement for patients based on packed cell volume (PCV) or haemoglobin (Hb) concentration at presentation relative to the desired blood level, patient weight in kilogram, and blood volume per kilogram body weight, but many health care personnel transfuse with the notion of 1 unit of blood increases PCV by 3% or haemoglobin (Hb) concentration by 10 gram per litre when this actually applies to red cell concentrate transfusion in an adult with 70-75 kilogram body weight [17,18].This leads to overestimation and wastage of blood or underestimation of patients' blood requirements sometimes. This finding affirms the need for appropriate blood transfusion requests in quantity and component with the intent of maximizing utilization while minimizing wastage. A look at the individual statistics of the different departments and units captured in our study showed that a significant number of these departments and units rarely utilize half of the blood cross-matched based on several requests. However, worthy of note is the fact that the department and unit involved in managing haematologic disorders in adults and children as well as the paediatric emergency unit of the institution exceeded the number of units initially requested when compared with their transfusion rates. This may be linked to the fact that most patients in these categories present with clinically and laboratory verifiable anaemia of varying degrees requiring instant blood transfusion. The surgical unit of Otorhinolaryngology had the lowest transfusion rate probably due to the predominant surgical procedures they are known to perform or their surgical precision which are not associated with significant blood loss. The general blood transfusion indices of the cross match: transfusion ratio (C: T), Transfusion index (TI), and transfusion probability (TP) determined in our study indicated significant blood usage and utilization. This cuts across all the departments and units identified to have requested blood for transfusion within the study period except for two surgical departments of Otorhinolaryngology and Neurosurgery despite having a significant transfusion probability. These slight differences may not be unconnected with the long-term surgical practice of blood grouping and cross-matching ahead of surgical procedures in anticipation and for prevention of complications that could occur in case of excessive bleeding during the surgery. The indices recorded in our study are slightly higher but within the range of significant blood usage and utilization when compared to what was reported in studies from Calabar in Southern Nigeria and Sagamu in the South West region of Nigeria [19-20. Higher indices were observed in Nepal, India indicating a very significant blood usage with minimal wastage when compared to our finding [21].

There were over 460 indications for blood transfusion requests in our study cutting across the departments and units considered. Blood transfusion requests as assessed from this study indicated the fact that several requests are made in anticipation without quantifying the exert volume required resulting in keeping units of blood that may not be used or minimal

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quantity are utilized in comparison to what was requested. Scientific methods to determine blood volumes based on deficits incurred or anticipated are not utilized. Hospital transfusion committees could employ the use of schedules like the maximum surgical blood order schedule (MSBOS) using Mead's criterion where MSBOS= 1.5 x transfusion index or the Patient Specific Blood Ordering System (PSBOS) [22, 23]. These schedules and systems can aid the maintenance of inventory, adequate blood usage, and utilization with a resultant reduction in blood wastage thereby cutting the cost and manpower required for blood safety. Blood transfusion indices by departments and units were used in our study, however, individual indications or yearly assessments can be carried out and these indices are determined for the same purpose as reported in several studies [24-26].

5. CONCLUSION

Availability of blood and its components remains an integral part of any viable health care system but despite the glaring benefits of this product and the fact that our blood donation bases have continued to dwindle, blood transfusion requests are made without scientific quantification of volume required. This results in the unavailability of blood where required with resultant blood wastage.

6. RECOMMENDATION

A robust system for improving blood utilization to curb blood wastage and channel excesses to where it is needed must be part of our health system planning. Health personnel working in surgical departments and units should be trained and encouraged to implore scientific methods of determining their patients' blood requirements during surgeries. Bloodless techniques and blood salvage during surgeries should also be encouraged.

ETHICAL APPROVAL

Ethical approval was obtained from the Jos University Teaching Hospital Health Research Ethics Committee.

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