

Evaluation of the Clinical Blood Transfusion Practice at a Tertiary Hospital in Kenya

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Abstract

Background: Blood transfusion is an essential component of modern health care. It can restore normal life expectancy and improve quality of life when used appropriately. Adequate blood supply and good clinical practice, which includes appropriate blood use, ensures safe and effective transfusion practice. One of the ways of achieving appropriate blood transfusion is use of blood transfusion guidelines.

Objective: To determine the appropriateness and the associated factors of the clinical indication of blood transfusion at a tertiary hospital.

Methodology: A hospital based medical chart review of 384 patients who were transfused from June 2013 to November 2013 was carried out. Systematic random sampling method was used and data was collected using a data collection form. Data analysis was done using SPSS software version 20. Descriptive statistics, ANOVA, Chi-square and logistic regression were used to analyze the data. A p-value of <0.05 was deemed statistically significant.

Results: The median age of the recipients was 31.5 years (IQR 13, 45.8) and the range was 1 day to 89 years. Females comprised 55.2% of the patients. The proportion of inappropriate transfusion was 49% and the associated factors were pre transfusion hemoglobin ($p < 0.001$), clinical department ($p=0.043$), presenting condition ($p= 0.010$) and the cadre of the prescribing clinician ($p=0.008$).

Conclusion: The proportion of patients who had inappropriate blood transfusion was 49% implying that the adherence to the recommended national guidelines was unsatisfactory.

Keywords: Appropriateness, Guidelines, Clinical indication, Blood Transfusion

1. INTRODUCTION

Blood transfusion is an essential component of modern health care. It can restore normal life expectancy and improve quality of life when used appropriately. According to World Health Organization [1], someone in the world needs blood every second.

The two main elements for safe and effective transfusion are a sufficient supply of safe blood and good clinical practice. Good clinical practice contributes to safe and effective transfusion by ensuring that the right blood and blood product is given to the right patient at the right time, appropriate decision-making about the appropriate use of blood based on assessment of clinical findings and laboratory parameters, and the monitoring of patients for adverse effects of transfusion and their management if they occur [2].

One of the challenges facing blood transfusion practice is inappropriate blood use [3]. This has been attributed, among other reasons, to failure by clinicians to align practice with the recommended guidelines [4]. Studies have demonstrated inappropriate level of blood use ranging from 4-66% [5]. Inappropriate transfusion exposes patients to unnecessary risks, leads to blood wastage and costly health care [2].

Monitoring of blood transfusion practice ensures appropriate blood use and improved access of blood [6]. Use of transfusion guidelines as one of the ways of achieving appropriate blood transfusion, has been shown to decrease blood use and complications. In a study [7], it was shown that use of red cells decreased by 30.1% and 37.1% during year 1 and 2 respectively of

monitoring after introduction of guidelines. This decrease in product use was also accompanied by 28.1% reduction in complications.

In Kenya, the blood transfusion guidelines were developed in the year 2001 by the Kenya National Blood Transfusion Service (KNBTS) (*Guidelines for the appropriate use of blood and blood products*) and were compiled after consultations with hematologists, transfusion medicine experts, prescribers of blood within Kenya, and review of guidelines found in the published literature [8]. The guidelines in its third edition, covers appropriate use of red cells, platelets and fresh frozen plasma in medicine, surgery, obstetrics and pediatrics. In this study, the level of adherence to these guidelines by the clinicians was assessed. The objectives of the study were to determine the proportion and the factors associated of inappropriate clinical indication of blood transfusion at Moi Teaching and Referral Hospital (MTRH). The study specifically focused on the appropriate indication of red cells (packed red cells and whole blood).

2. MATERIALS AND METHODS

2.1. Study Site

The study was carried out at MTRH which is a 900-bed capacity hospital located in Eldoret town, western Kenya. The hospital is an ISO 9001: 2008 certified institution and it serves western Kenya which has a population of about 15 million people, parts of Eastern Uganda and South Sudan.

2.2. Study Design

The study design was a retrospective hospital-based chart review.

2.3. Target and Study Population

The target population was all patients admitted to the hospital and the study population was patients who required a blood transfusion as part of their treatment

2.4. Eligibility Criteria

In-patients admitted into the general wards and were transfused whole blood or packed red blood cells were included in the study.

Patients who were transfused platelet concentrate or fresh frozen plasma and were admitted in private wings of the hospital were excluded.

2.5. Sample Size

A sample of 384 patient medical charts were studied and this was calculated using the Cochran's formula [9].

$$n = \frac{z^2pq}{d^2}$$

Where:

n - Minimum sample size.

z - Standard normal deviation at desired confidence interval i.e. 1.96 for the 95% confidence interval.

p- Expected prevalence of appropriate blood use and was taken to be 50% because there were no local data on the same based on the national transfusion guidelines among both adult and paediatric patients

q- Expected prevalence of inappropriate blood use (1-p).

d- Accepted error =0.05

2.6. Sampling Procedure

Systematic sampling method was used to sample eligible study subjects who were transfused between June to November 2013. There were 9198 patients who were transfused whole blood and packed red blood cells in the general wards of the hospital in the year 2012 and this translated to 4599 recipients in six months and hence the sampling frame. The k^{th} interval was 12 (4599/384).

2.7. Data Collection

A data collection form was used to collect data from the medical records of those patients who were transfused during the study period and the information was extracted from the clinical notes, laboratory request forms, blood transfusion chart and the nursing notes. The data collected included age, gender, presenting condition, pre-transfusion Hb, blood and blood product transfused and the cadre of clinician who ordered the blood. The International Classification of Diseases (ICD-10) version was used for classification of the presenting conditions requiring transfusion of blood components.

2.8. Data Analysis

The data obtained were analyzed using SPSS software version 20. Data were summarized using frequency tables/proportions, median (IQR), mean and standard deviation. ANOVA was used to compare the mean pre-transfusion Hb between groups. Chi-square test was used to analyze association between the main outcome: inappropriate clinical indication of the transfusion (inappropriate/appropriate) and

patient demographic and clinical variables. Multivariate logistic regression analysis was carried out on all the variables with p value <0.05 in univariate analysis.

2.9. Ethical Considerations

An approval was sought and obtained from Institutional Research and Ethical Committee (IREC) of Moi University and Moi Teaching and Referral Hospital. Permission to carry out the study was also obtained from the hospital administration of MTRH. The patients' medical records were de-identified.

2.10. Criteria for Appropriateness for Blood Use

Appropriate use of blood components was assessed using the guidelines established by the KNTBS [8]. Inappropriate use of a blood product by a particular subject was considered if the guideline was violated.

ADULTS (Blood transfusion is indicated in the following situations)

- I. Acute and perioperative blood loss
 - Blood loss $> 30-40\%$ of rapid blood loss
 - Tachycardia and hypotension not corrected with volume expanders
 - Hb of < 5 g/dl
 - Hb of $5-10$ g/dl and is symptomatic
- II. Pre-operative transfusions
 - Hb <5 g/dl
 - Hb <8 g/dl who lose $>one$ litre of blood during surgery
- III. Chronic anaemia
 - Hb of < 5 g/dl
 - Hb of > 5 g/dl and is symptomatic
- IV. Chronic anemia in pregnancy
 - Pregnancy < 36 weeks
 - Hb < 5 g/dl
 - Hb $5-7$ g/dl with clinical signs of cardiac failure and/or infection
 - Pregnancy > 36 weeks gestation
 - Hb < 6 g/dl
 - Hb $6-8$ g/dl with clinical signs of cardiac failure and/or infection

PAEDIATRICS (Blood transfusion is indicated in the following situations)

- I. Acute blood loss
 - In cases of continued shock or bleeding
- II. Non- hemolytic chronic anemia
 - Hb < 5 g/dl
 - Hb > 5 /dl and symptomatic
- III. Sickle cell disease
 - Aplastic anemia with Hb < 4 g/dl
 - Hyperhemolytic anemia with Hb < 4 g/dl
 - Pre-surgery to raise Hb > 10 g/dl
 - Splenic sequestration

NEONATES (Blood transfusion is indicated in the following situations)

- Hb > 13 g/dl and the baby is < 24 hours or baby needs NICU/ventilation with high O₂ needs
- Hb < 11 g/dl and chronic O₂ dependence; Signs of anemia: unexplained apnea, tachycardia (rate > 160 /min for > 48 hours), poor weight gain (< 10 /kg/day) with adequate fluid intake and environmental temperature and signs of CCF
- Anemia of prematurity with Hb > 8 g/dl with baby requiring O₂ or < 7 g/dl with baby in room air

3. RESULTS

3.1. Demographic Data of the Transfusion Recipients

A total of 384 patient medical records were reviewed. The median age of the patients (IQR) was 31.5(13, 45.8) and the range was 1 day to 89 years. Males comprised 172 (44.8%) and females were 212(55.2%) giving a male: female ratio of 1:1.2.

3.2. Pre-Transfusion Hb

The mean pre-transfusion Hb for all the recipients was 7.8 (SD 2.9). The mean pre-transfusion Hb according to the age, gender, clinical department and presenting condition of the recipients is as shown in table 1. There was a statistically significant difference of the mean pre-transfusion Hb between those who had appropriate transfusion and those who had inappropriate transfusion ($p<0.001$).

Table1. The mean pre-transfusion Hb according to the age, gender, clinical department and presenting condition of the recipients

	N	Mean pre-transfusion Hb±SD	F	p value
Age groups (years)				
0-4yrs	54	10.2±2.9	7.396	<0.001
5-14yrs	52	7.9±3.3		
15-24yrs	31	7.3±2.7		
25-34yrs	78	7.6±2.5		
35-44yrs	71	7.1±2.8		
45-54yrs	41	7.0±2.6		
55-64yrs	22	8.4±2.4		
65+	34	7.4±2.6		
Total		7.8±2.9		
Gender				
Male	169	8.2±2.9	4.297	0.039
Female	211	7.6±2.9		
Total	380	7.8±2.9		
Clinical Department				
Medical	109	6.3±2.1	23.054	< 0.001
Surgical	117	8.7±2.7		
Reproductive health	75	7.3±2.6		
Child health	79	9.1±3.4		
Total	380	7.8±2.9		
Presenting Condition				
Infectious and parasitic	43	6.1±1.9	18.609	<0.001
Neoplasms	88	8.1±2.8		
Diseases of blood	31	6.3±2.4		
Endocrine, nutritional and metabolic disorders	12	6.6±1.9		
Digestive system diseases	28	7.9±3.2		
Genitourinary disorders	36	6.1±2.1		
Pregnancy related	45	7.4±2.6		
Perinatal conditions	27	12.0±2.1		
Injuries	43	9.0±2.5		
Others	27	8.9±2.4		
Total	380	7.8±2.9		
Appropriateness of Transfusion				
Appropriate	196	6.2±2.2	216.871	<0.001
Inappropriate	184	9.6±2.4		
Total	380	7.8±2.9		

3.3. Appropriateness of Blood Transfusion and the associated Factors

The overall proportion of inappropriate blood use was 49% for all the departments. The factors found to be significantly associated with

inappropriate blood transfusion were the pre-transfusion Hb (p< 0.001), clinical department (p=0.043), presenting condition (p=0.01) and the cadre of prescriber of the transfusion (p = 0.008) (table 2 and table 3).

Table2. Association between inappropriate blood transfusion and patient demographic and clinical variables

Variable	Inappropriate transfusion		Statistic (χ ²)	p value
	Yes, n(%)	No, n(%)		
Age(years)				
0-4yrs	32(59)	22(41)	4.148	0.763
5-14yrs	24(46)	28(54)		
15-24yrs	16(52)	15(48)		
25-34yrs	35(45)	43(55)		
35-44yrs	32(45)	39(55)		
45-54yrs	19(46)	22(54)		
55-64yrs	13(57)	10(43)		
65+	17(50)	17(50)		
Sex				

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Male	92(53)	80(47)	2.558	0.110
Female	96(45)	116(55)		
Clinical Department				
Medical	45(40)	67(60)	8.706	0.043
Surgical	68(58)	50(42)		
Reproductive health	32(43)	43(57)		
Child health	43(54)	37(46)		
Presenting Condition				
Infectious and parasitic(A00-B99)	22(50)	22(50)	22.683	0.010
Neoplasms (C00-D49)	50(56)	39(44)		
Diseases of blood (D50-D89)	12(39)	19(61)		
Diseases of digestive system (K00-K93)	15(54)	13(46)		
Endocrine, nutritional & metabolic	7(54)	6(46)		
Genitourinary diseases (N00-N99)	7(20)	28(80)		
Pregnancy related conditions (O00-099)	18(39)	28(61)		
Conditions of perinatal period (P00-P99)	15(56)	12(44)		
Injuries (S00-T98)	23(52)	21(48)		
Other chapters	19(70)	8(30)		
Cadre of Clinician				
Consultant	15(32)	31(68)	13.905	0.008
Registrar	66(44)	84(56)		
Medical officer	15(47)	17(53)		
Medical intern	71(57)	54(43)		
Clinical officer	21(68)	10(32)		

Table 3. Multivariate analysis of the factors associated with inappropriate blood transfusion: (inappropriate: no=0, yes=1)

Variable	Inappropriate blood use		uOR(95%CI)	pvalue	aOR(95%CI)	p value
	Yes, n (%)	No, n (%)				
Clinical Department						
Medical	46(40)	67(60)	Reference category			
Surgical	68(58)	50(42)	1.995(1.179-3.377)	0.010	1.521(0.761-3.040)	0.236
Reproductive	32(43)	43(57)	1.170(0.647-2.115)	0.604	1.426(0.588-3.456)	0.432
Child health	43(54)	37(46)	1.730(0.969-3.089)	0.064	1.590(0.768-3.294)	0.212
Presenting Condition						
Infectious	22(50)	22(50)	Reference category			
Neoplasms	50(56)	39(44)	1.282(0.621-2.645)	0.501	1.255(0.565-2.787)	0.577
Disorders of blood	12(39)	19(61)	0.632(0.248-1.606)	0.335	0.683(0.257-1.819)	0.446
Digestive disorders	15(54)	13(46)	1.167(0.338-4.033)	0.808	1.217(0.337-4.388)	0.764
Metabolic& nutritional diseases	7(54)	6(46)	1.154(0.447-2.981)	0.768	1.038(0.378-2.848)	0.943
Genitourinary diseases	7(20)	28(80)	0.286(0.107-0.764)	0.013	0.259(0.091-0.734)	0.011
Pregnancy related	18(39)	28(61)	0.607(0.261-1.412)	0.247	0.485(0.149-1.585)	0.132
Perinatal conditions	15(56)	12(44)	1.250(0.478-3.271)	0.649	1.194(0.396-3.601)	0.753
Injuries	23(52)	21(48)	1.095(0.474-2.527)	0.831	0.725(0.254-2.068)	0.548
Others	19(70)	8(30)	2.375(0.860-6.558)	0.095	2.103(0.698-6.338)	0.187
Cadre of Clinician						
Consultant	15(32)	31(68)	1.624(0.810-3.256)	0.172	1.547(0.740-3.236)	0.247
Registrar	66(44)	84(56)	1.824(0.721-4.615)	0.205	2.575(0.943-7.029)	0.065
Medical officer	15(47)	17(53)	Reference category			
Medical intern	71(57)	54(43)	2.717(1.335-5.531)	0.006	2.621(1.246-5.511)	0.011
Clinical officer	21(68)	10(32)	4.340(1.640-11.485)	0.003	5.375(1.916-15.098)	0.001

uOR- Unadjusted Odds Ratio

aOR- Adjusted Odds Ratio

4. DISCUSSION

The proportion of inappropriate blood use in the study was 49% and it falls within the range of results reported in other studies of 4% to 66%

[5, 10, 11, 12, 13, 14, 15]. The variation in results reported from different studies could be due to different study time periods, study designs, study population, practice guidelines and the specific appropriateness criteria applied

[5]. The high prevalence of inappropriate blood use in our study indicates that the transfusions were unnecessary and could have impacted negatively on the availability of the scarce resource and also exposed recipients to avoidable risks.

The factors associated with inappropriate transfusion in the study were the pre-transfusion Hb ($p < 0.001$), clinical department ($p = 0.043$), presenting condition ($p = 0.010$) the cadre of the prescribing clinician ($p = 0.008$). Other studies have had mixed findings [10, 13] and this could be because of the differences in study setting, study design and the criteria used to evaluate the appropriateness of blood use. However, these findings are similar to the findings by Barr et al [13] where age, pre-transfusion Hb, comorbidity and presenting condition were found to be associated with inappropriate blood transfusion.

In an unadjusted logistic regression analysis, patients admitted to the surgical ward were more likely to have an inappropriate transfusion (reference category = medical ward) (OR 2.025; 95% CI, 1.197-3.424) ($p = 0.01$). Though this association became statistically insignificant after adjusted logistic regression, patients admitted to the surgical ward were 1.5 times more likely to have an inappropriate transfusion compared to those admitted to the medical ward. This finding compares to those from other studies [10, 14, 16]. Similar findings have been reported on associations between inappropriate transfusion and elective and emergency transfusions in obstetrics, gynaecology and urology departments compared with other departments [13, 17]. However, in a review by International Consensus Conference on Transfusion Outcomes (ICCTO), there was no difference in inappropriate transfusion among hospital setting (ward type) [18].

The level of inappropriate blood use varied with the presenting conditions of the patients. Using infectious and parasitic conditions as the reference category, patients with genitourinary disorders were least likely to have inappropriate transfusion (OR, 0.233; 95% CI, 0.80-0.677). This finding differs from that by Barr et al. [13] where patients with urologic and gynaecologic conditions were found to have high level of inappropriate transfusion with OR, 1.51; 95% CI, 1.04-2.20 and OR, 1.50; 95% CI, 1.17-1.93 respectively. The patients in the Barr et al study tended to have high mean pretransfusion Hb levels (8.1 and 8.2 g/dL ($p < 0.001$), whereas,

the ones in this study tended to have lower mean pretransfusion Hb levels, 6.1g/dL ($p < 0.001$). In the review by International Consensus Conference on Transfusion Outcomes (ICCTO), red blood cell transfusion was most often rated appropriate (81%) in scenarios featuring patients with hemoglobin (Hb) level 7.9 g/dL or less while red blood cell transfusion was rated inappropriate in all scenarios featuring patients with Hb level 10 g/dL or more and in 71.3% of scenarios featuring patients with Hb level 8 to 9.9 g/dL [18].

There was an association between appropriateness of blood use and the prescribing clinician and this finding concurs with that of other studies [13, 18]. The level of inappropriate transfusions appeared to be higher among the patients in whom transfusion was prescribed by clinical officers (68%; OR 4.340, 95% CI, 1.640-11.487) and medical interns (57%, 2.717, 95% CI, 1.335-5.531) compared to other cadres of clinicians; consultant (32%), registrar (44%) and medical officer (47%). This finding differs from the study by Barr et al [13] where higher proportion (31%) of the inappropriate transfusion was by a consultant compared to other grades even though firm conclusions on the actual level of inappropriate prescribing by clinician grade could not be drawn because of missing data on information regarding prescriber grade in 13% (197/1474) of cases. The different levels of appropriate use of blood among the various cadres of clinicians might be attributed to varying level of knowledge about appropriate use of blood among clinicians [4]. This postulation is supported by a South African study where it was established that the knowledge of appropriate blood product use varied with the clinician rank. In the study, the means for correctly answered questions on knowledge of appropriate blood product use from 32 questions were 14.82 (4.49), 15.65 (4.03), 17.0 (4.34) and 20.09 (3.67) for interns, medical officers, registrars and consultants respectively [19].

Study Limitations

One of the limitations of this study is that it was a retrospective chart review whereby important factors pertinent to the transfusion decision, such as the actual decision maker, the ability to tolerate anaemia, the clinician's education experience and personality, et cetera could not be readily captured. Such missing information may have contributed to the variance of some

findings between our study and other studies. Another limitation is that the study was based on a single hospital and therefore, the findings may not be generalizable. Furthermore, since the study was undertaken in 2013, research and practice in this area may have moved on.

5. CONCLUSION

The proportion of inappropriate blood transfusion was 49%, implying that the adherence to the transfusion guidelines was unsatisfactory. This finding may indicate that blood was being used unnecessarily and that patients may have also been exposed to avoidable transfusion associated risks. The factors associated with inappropriate blood transfusion were pre-transfusion haemoglobin, the clinical department, the presenting condition and the cadre of the prescribing clinician. The clinicians and nursing staff involved in blood transfusion need to be trained by way of continuing medical education on the importance of appropriate clinical use of blood and adherence to guidelines. In additions, the hospital needs to adopt the strategies of clinical audit to monitor the usage of blood and adherence to the national transfusion guidelines.

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