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BLOOD TRANSFUSION PRACTICE IN PATIENTS UNDERGOING THYROIDECTOMY IN IBADAN, NIGERIA
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BLOOD TRANSFUSION PRACTICE IN PATIENTS UNDERGOING THYROIDECTOMY IN IBADAN, NIGERIA

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ABSTRACT

Background: **The demand on the blood bank in sub-Saharan Africa for blood is huge. There is, therefore, a need for more efficient use of this precious material. This study, therefore, was carried out to assess blood transfusion practice for thyroidectomy in a sub-Saharan African country.**

Methods: **A descriptive study of patients who had thyroidectomy over a 12 year-period was carried out. Information on clinical characteristics, blood loss and utilization were obtained prospectively. The blood utilization practice was assessed using Cross-match:Transfusion ratio (C:T), Transfusion probability (%T), and Transfusion index (TI). Maximum Surgical Blood Ordering Schedule (MSBOS) for thyroidectomy was derived.**

Results: **The data of 265 patients aged 11 – 71 years with a mean age of 40.8 ± 12.6 years were analyzed. The surgeons requested for cross-matched blood for 255 patients. Blood cross-match was carried out for 216 (84.7%) patients. The patients had an average pre-operative haematocrit of 37% and median blood loss of 200mls. Cross-match:Transfusion ratio (C:T) was 5.53 with a %T of 17.6% and TI of 0.22. The MSBOS was 0.33.**

Conclusion: **The routine cross-matching of blood is unnecessary for thyroidectomy in our clinical practice. The blood ordering practice for thyroidectomy should, therefore, be streamlined to reduce the cost and burden of the reservation of the units of blood to the transfusion services. The type and screen policy should be considered by the blood bank, surgeons, anaesthetists and the hospital transfusion committee.**

INTRODUCTION

The high cost of blood and transfusion-associated morbidity has led to several studies aimed at reviewing transfusion practices. Transfusion services are expected to introduce changes in practice to improve blood supply and combat safety challenges. Studies have shown that transfusion requirements for surgical patients are often overestimated and blood units reserved for elective surgery may remain unutilized. Most uncomplicated elective surgeries in well-prepared patients can be conducted without blood transfusion. The percentage of patients whose blood were cross-matched and were transfused for general surgical procedures ranged from 5 to 40% [1]. The demand for blood on the existing banked blood in sub-Saharan Africa is huge. There is, therefore, a need for more efficient use of this precious material. Blood cross matched for surgery and not utilized contribute to wastage of resources, blood and time of laboratory personnel [2].

Transfusion of as little as one or two units of Red Blood Cells (RBCs) is significantly associated with increased morbidity and mortality in certain surgical procedures [3]. Minimizing and avoiding unnecessary transfusion is also beneficial to patients. Blood transfusion should be reserved for complicated major surgery and surgical patients with chronic haemopoietic deficiencies. Studies have reported highly variable cross-match: transfusion ratio across elective surgical procedures [4,5]. Though the cross-match: transfusion ratio of 1.03:1 among surgical patients in our practice is close to an ideal and indicative of significant blood usage [4], there is still room for improvement in efficiency of surgeons' blood ordering habits. When blood is ordered and reserved unnecessarily, it could lead to blood inventory shortage and deprive other patients who need it dearly. Blood inventory shortage has been responsible for cancellation and postponement of elective operative procedures in many hospitals [6]. Therefore, auditing of surgeon's transfusion practice in sub Saharan Africa particularly for procedure that require minimum blood transfusion may address the need for a change in practice that will not jeopardize the safety of patients.

Lin suggested that it could be safe to disregard a preoperative blood order for thyroidectomy. However, blood is still being requested for thyroidectomy in our patients [7]. To buttress this, a study from Pakistan on the peri-operative use of blood in patients undergoing thyroidectomy showed that the cross-match to transfusion ratio was 11.88 [8] while a study from America observed that a blood transfusion is required in 0.9% of patients who had thyroidectomy [9]. Haemorrhagic complication has been reported as rare as 0.3% - 1.2% after thyroidectomy [10] [11]. In addition, Rosato et al reported that blood transfusion was necessary in 1% of all cases of haemorrhage (i.e. in 0.12% of all operated thyroids) [11]. This makes thyroidectomy a target to assess and to improve our transfusion practice and maximize available resource. Our hospital does not have a transfusion protocol for surgical patients neither are there any study to determine the blood requirement of patients going for thyroid surgery in our hospital. The objective of this study is to determine the blood ordering and utilization pattern for patients undergoing thyroidectomy. This may enable the development of a blood ordering schedule to streamline the use of blood thereby improve the availability of blood for all patients who need it in the hospital.

MATERIALS AND METHODS

The study was conducted in an 850-bed hospital located in the South Western part of Nigeria. The hospital has a blood bank

which collects and distributes 7,000 to 8, 000 units of blood per year. The requests for blood transfusion received by the blood bank are processed and the blood samples are cross matched with the available units of blood. Blood order from the surgeon for thyroidectomy is expected to be accompanied by an evidence of previous blood donation by or for the patient. Surgeons usually request for confirmation of availability of cross-matched blood in advance of elective surgery. Pre-transfusion testing performed on the patients' samples include ABO grouping, Rh(D) grouping, and major cross-matching. Full cross match is performed for two hours while a one-hour cross match could be performed when indicated.

The Institutional Review Board of the University of Ibadan and the University College Hospital, Ibadan granted approval for the conduct of the study which is a review of the patients who had thyroidectomy at our hospital between 2002 and 2014. The data of all the patients of the Endocrine and Hepatobiliary Division of Surgery of the Hospital who had thyroidectomy during the period were obtained prospectively. The following information were recorded for each patient: demographic characteristics, the preoperative and postoperative haematocrit (hct), number of blood units requested, number that was cross-matched and the blood donor type which was either allogeneic or autologous. The peri-operative data obtained included the duration of surgery, the blood loss and the number of blood units and/or colloids replaced. Blood loss consists of intra-operative blood loss and the blood drained post-operatively. For each of the blood donor type, the number of units of blood cross-matched and number transfused were recorded. The professional status of surgeon who operated the patients included consultant and senior registrar. The data were analysed using mean and the standard deviation for continuous variables while proportions and percentages were used for categorical variables. The blood utilization practice was assessed using ratio and probability. Chi-square and Kruska Walis test were used for categorical data. The level of significance was $p<0.05$.

The blood utilization practice was assessed using Cross-match: Transfusion ratio (C: T), Transfusion probability (%T), and Transfusion index (TI) using the following equations: [12]

Cross-match to Transfusion ratio (C: T) =

$$\frac{\text{Total number of units cross-matched}}{\text{Number of units transfused}}$$

This ratio should be 1.0 but a ratio of 2.5 and below is considered indicative of effective blood usage.

Transfusion Probability (%T) =

$$\frac{\text{No. of patients transfused}}{\text{No. of patients cross-matched}} \times 100$$

A value of 30 or above is appropriate and considered indicative of significant blood usage.

Transfusion Index (TI) =

$$\frac{\text{No. of units transfused}}{\text{No. of patients cross-matched}}$$

A TI of 0.5 or above is considered indicative of significant blood utilisation.

Maximum Surgical Blood Ordering Schedule (MSBOS) was calculated by Mead's criterion [13].

MSBOS = 1.5 x TI

RESULTS

A total of 265 patients had elective thyroidectomy between 2002 and 2014.

Females constituted 84.9% of the patients. The mean age of the patients was 40.8 ± 12.6 years with a range of 11 – 71 years. The commonest clinical diagnosis was simple multinodular goitre (49.1%) followed by Solitary thyroid nodule (16.2%). Consultant surgeons performed 90.2% of the thyroidectomy and most of the patients (90.6%) had total thyroidectomy (Table 1).

Table 1
Socio-demographic and Clinical Characteristics

Patient characteristics	Frequency	Percent
SEX		
Male	40	15.1
Female	225	84.9
MARITAL STATUS		
Single	58	21.9
Married	198	74.7
Widowed	9	3.4
CLINICAL DIAGNOSIS		
Simple Solitary Nodular	43	16.2
Simple Multi Nodular	130	49.1
Toxic Diffuse	36	13.6
Simple Diffuse	24	9.1
Toxic Multinodular	10	3.8
Malignant	22	8.1
TYPE OF OPERATION		
Lobectomy	5	1.9
Lobectomy and Isthmusectomy	4	1.5
Lobectomy, Isthmusectomy and Partial Contralateral Lobectomy	5	1.9
Subtotal Thyroidectomy	11	4.2
Total Thyroidectomy	240	90.6
PROFESSIONAL STATUS OF SURGEON		
Consultant	239	90.2
Senior Registrar	26	9.8

Request to the blood bank for transfusion was made for 255 patients. Out of the 255 patients, blood cross-match was carried out for 216 (84.7%) patients. Blood was not cross-matched for 39 (15.3%) of the patients. Of the 216 patients who had blood cross-matched, only 38 (17.6%) were transfused with blood. The 38 patients who were transfused received 47 units of the cross-matched blood, of which 22 (65.8%) units were transfused intra-operatively, 13 (34.2%) units were transfused post-operatively while 2 (5.3%) had blood both intra and post operatively and 1 (2.6%) had blood transfusion both pre-operatively and intra-operatively. Out of the 38 patients who had blood transfused, 12 (31.6%) had autologous blood transfusion, 25 (65.8%) had allogeneic blood while 1 (2.6%) had both autologous and allogeneic blood transfused. None of the patients who did not have blood cross-matched was transfused.

Before the operation, the mean hct of all the patients was 37.6 ± 4.0% with a range of 24% - 48%. The average duration of surgery was 3.78 hours with a range of 1.5 hours - 9.0 hrs. The maximum blood loss in this group of patients was 1.5L with a median of 0.2L blood loss. The mean post-operative hct of all the patients was 35.8 ± 4.4% with a range of 16% - 52%.

The patient who had the highest blood loss (1.5L) and units of blood (3 units) had a preoperative anaemia hct of 30% and postoperative hct of 35%. The patient had thyroidectomy due to a malignant thyroid disease. The transfused patients had a statistically significant higher estimated blood loss (mean rank = 118. 4 ml) than non-transfused patients (mean rank = 89.04ml) (p=0.004). There were no statistically significant differences in the duration of surgery and the preoperative hct for patients who had blood transfusion and those who did not have blood transfusion, p=0.2 and 0.5 respectively. The patients who had blood transfused had significantly lower postoperative hct (table 2).

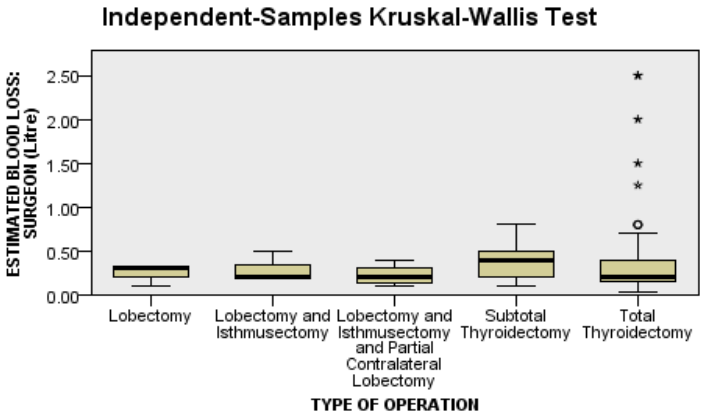
Table 2

Relationship of the haematocrit (hct) of patients to transfusion

	Blood Transfusion				**95% CI for Mean Difference**		**P-value**
Haematocrit (hct) in relation to operation	**Yes Mean (SD)**		**No Mean (SD)**				
Pre-operative hct	36.97	(4.8)	37.38	(3.8)	-1.05	1.87	0.58
Post-operative hct	34.15	(5.9)	39.6	(3.9)	0.26	3.52	0.02

There was a significant difference in pre-operative and post-operative hct of patients who had blood transfused (p = 0.001). There was no statistically significant association between blood transfusion and age, gender, clinical diagnosis and professional status of the surgeon. There was a statistically significant association between blood transfusion and type of operation. Some 18.2% of patients operated by consultants were transfused compared to 11.1 % of patients operated by surgeons less than the consultant level. Six patients had lobectomy or lobectomy and isthmusectomy, 3 (50%) of the patients were transfused with blood while nine patients had subtotal thyroidectomy, 4 (44.4%) were transfused with blood. Of 196 patients who had total thyroidectomy, 15.8% were transfused with blood (p=0.028). The Kruskal-Wallis test was applied to detect any difference in means of estimated blood loss among the types of operation. There was no statistically significant difference in the volume of estimated blood loss among the types of operation (Figure 1).

Figure 1: A boxplot of estimated blood loss versus the type of operation



Total N	173
Test Statistic	1.903
Degrees of Freedom	4
Asymptotic Sig. (2-sided test)	.754

1. The test statistic is adjusted for ties.
2. Multiple comparisons are not performed because the overall test does not show significant differences across samples.

However, patients who had Subtotal Thyroidectomy had the highest mean estimated blood loss (0.37 ± 0.23L). The total number of units of blood cross-matched was 260, out of which 47 units were utilized (Table 3).

Table 3

Blood transfusion indices for patients who had elective thyroidectomy between 2002 and 2014

Blood transfusion indices	**Values**
Total number of units' cross-matched	260
No. of units transfused	47
No. of patients transfused	38
No. of patients cross-matched	216
Cross-match to Transfusion ratio (C: T ratio)	5.53
Transfusion Probability (%)	17.6%
Transfusion Index (TI)	0.22
MSBOS	0.33

The blood cross-matched and requirement of patients who had thyroidectomy is as shown in Table 3. The ratio of the number of transfused units to the number of patients transfused is 1.24.

DISCUSSION

Studies to predict blood transfusion requirement of patients going for surgery in an institution may not necessarily apply to another institution. Variability in techniques and staff skills may affect findings and change over time, affecting the utilization of blood therefore, the evaluation of blood utilization in patients who had thyroidectomy was conducted to improve the current practice in our hospital. This study showed that 17.6% of 216 patients who had blood cross matched and available for surgery was transfused with blood. This proportion of patient transfused in this study is higher than the 2.5% from another study in a different institution from the same country suggesting a variation in blood usage for patients undergoing thyroid surgery even in the same country [14]. The age and gender of the patients is similar in both studies. Total thyroidectomy was the commonest surgery carried out in our patients. The number of patients who received blood transfusion for total thyroidectomy was less than those who had thyroid lobectomies a lesser procedure [15]. There was no statistically significant difference between estimated blood loss and the type of thyroidectomy performed. The amount of blood loss in our patients is more than the amount reported in other studies in developed countries [15]. It is interesting to note that that the patients who had subtotal thyroidectomy had the highest mean estimated blood loss (370 ± 230ml). The estimated amount of blood loss observed by Kpolugbo et al among patients in Benin, Nigeria who had subtotal thyroidectomy was similar (334.3 ± 168 ml) [14].

The probability of transfusion in patients for whom cross-matched blood was available was 17.6% indicating that there was no significant use of the blood. The low %T corroborates findings by other authors [7, 12]. The transfusion index is higher than 0.02 and 0.11 reported for thyroidectomy performed in Tanzania and Saudi Arabia respectively [16, 12]. The need for only 47 units of blood out of the 260 units of blood reserved for surgery in a blood bank that could not attend to all requests is an issue of concern. The implication of the cross-match status is that the units of blood are not available for dire emergencies and while these units are in reserve, there are possibilities that some surgeries with higher %T were cancelled due to unavailability of blood. Blood ordering practice for thyroidectomy should be reviewed to reduce the cost and burden of the reservation of the units of blood.

The introduction of evidence-based transfusion guidelines and strategies for improved blood utilisation has been shown to be cost-effective and safe. While the blood ordering efficiency of the surgeons as indicated by the Cross-match to Transfusion ratio (C: T ratio) of 5.53 is much lower than 17.5 and 11.88 and for thyroidectomy in Pakistan and Saudi Arabia [8, 12], it is higher than the allowable ratio of 2.5. This suggests that blood utilization by surgeons is less than the demand placed on the blood bank; thereby requiring intervention. Over-ordering of blood for elective surgery more than the actual and the anticipated need has been well documented by many authors and could encourage over-transfusion. Surgical blood ordering strategies are influenced by the skill of the surgeon, the turnaround times of pre-transfusion tests and blood issuance, the efficiency of the transportation of blood units, and blood inventory [14]. Other factors outlined include differing opinions on the threshold level of haemoglobin below which a patient needs

blood transfusion, differences in surgical and anaesthetic techniques, variation in types of case, preoperative anaemia, and lack of availability of transfusion protocols. The finding of %T, TI (an index of blood requirement for a procedure) of 0.22 was used to obtain a MSBOS of 0.3. This suggests that the routine cross-matching of blood is unnecessary for thyroidectomy cases as practice in developed country [17]. The potential severity of haemorrhage can be assessed by the ratio of number of transfused units to number of patients transfused [17]. An average of 1.2 units of blood was required for each patient that was transfused

Since 90% of the operations were performed by highly skilled professionals and these patients had a median blood loss of 200mls with average pre-operative haematocrit of 37%, it might be safe to group and screen. Full cross-match need not be done except a clinically significant alloantibody is identified in the patient's serum. Should the patient urgently need blood during surgery, the blood bank is notified, and ABO-Rh compatible blood is selected based on the patient's "group-and screen" result. As a further check on ABO compatibility, the patient's serum is "cross-matched" with donor red cells so that compatible blood is provided for the patient within minutes of receiving a request. Evaluation of the risk of abbreviating the major cross-match in urgent situations by issuing blood after an “immediate spin” phase in patients whose red blood cells have been typed and whose serums have been screened for unexpected antibodies showed low level of risk [18]. In view of the unpredictable blood inventory level and turnaround time for pre-transfusion time of our transfusion service, the transfusion service must ensure the availability of group compatible blood to reduce anxiety of non-provision of blood in case of emergency. This ensures blood cross-match is carried out for only patients who really need it and allows for efficient use of laboratory scientist time.

The MSOBS generated from this study spanning over 10 years could reliably be adopted to improve bloodstock management and reduce wastage. There should be an agreement between the blood bank, surgeons and hospital transfusion committee on this MSBOS. MSBOS is an evidence-based policy to make request for blood from the blood bank that is safe for patients and saves blood bank costs as well as makes it acceptable to surgeons. The MSOBS for thyroidectomy of 0.33 suggests that blood requirement is 0 to 1 unit. Any operation that requires 0 or 1 unit of red cells per patient transfused can be safely managed with a preoperative Group and Screen as opposed to a cross-match test. Screen assures that uncross-matched ABO +Rh (D) type-specific blood may be transfused with a high degree of safety (99.99%) and the blood unit is not removed from the general inventory [17]. A substitute for the type and screen is "half-hour cross-match". Both surgeons and anaesthetists reduced their demands for blood when a half hour cross-match was immediately available [17]. The implementation will require an effective collaboration among surgeons, anaesthetists and the blood bank.

The post-transfusion haematocrit of 34% for transfused patients suggests a generous use of blood for the patients. However, there was a significant difference in the pre and post-transfusion haematocrit of the patients. This study did not assess the haemodynamic status of the patients and patient's tolerance to blood loss in the patients, which are factors that could influence decision to transfuse at any target PCV. Since there are various indications for thyroid surgery which could also affect the haemodynamic status of patients ranging from symptomatic thyroid masses or goitres to a diagnosis of

thyroid cancer and medically refractory hyperthyroidism, appropriate use of blood may be difficult to determine. Assessment of the haemodynamic status could assist in determining the threshold level of haemoglobin below which these patients need blood transfusion.

CONCLUSION

In view of the low probability of transfusion and high Cross-match: Transfusion ratio for patients with good pre-operative haematocrit, a group and screen or half-hour cross-matching of blood for patients scheduled for thyroidectomy in our clinical practice was recommended. This might improve the blood stock level, reduce the number of cancelled surgery and result in efficient use of laboratory scientist time. The MSBOS generated based on the knowledge of actual transfusion frequencies and requirements for over 12 years in patients suggest that blood requirement is zero to one unit.

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