Tanzania Journal of Health Research
Volume 25: Number 3, July 2024
https://dx.doi.org/10.4314/thrb.v25i3.8

Blood utilization practice in elective orthopaedic surgeries at Muhimbili Orthopaedic Institute, Dar-es-salaam

Justice M. Mwambashi[1,2], Mohamed Muhamedhussein[1,3*], Billy T. Haonga[1]

[1]Department of Orthopaedics and Traumatology, School of Medicine, Muhimbili University of Health and Allied Sciences, P.O Box 65001, Dar es Salaam, Tanzania
[2] Bukoba Regional referral Hospital, P.O Box 265, Bukoba, Tanzania
[3] Ebrahim haji charitable health center, P.O Box 14861, Dar es Salaam, Tanzania

Abstract

Background: The average blood requirement and its products for a particular elective orthopaedic procedure are usually based on subjective anticipation of blood loss rather than an evidence-based estimate. There are no specific evidence-based guidelines for the appropriate amount of blood products to be ordered for particular procedures. Therefore, this study aimed to fill the knowledge gap in the effectiveness of blood utilization practice. It is expected to add information on formulating a practical institution-based protocol for properly optimizing the use of blood components.

Methods: A hospital-based descriptive study was done at Muhimbili Orthopedic Institute from July 2018 to April 2019, in which patients scheduled for elective orthopaedic surgeries for whom blood was requested were included. Demographic and blood utilization data were collected and analyzed using SPSS version 20. The following indices calculated blood utilization: (i) Crossmatch to transfusion ratio (C/T), (ii) Transfusion probability (%T), (iii) Transfusion index (TI), (iv) Maximum surgical blood ordering schedule (MSBOS).

Results: A total of 286 patients undergoing 27 different types of elective orthopedic surgeries were included in this study. Five hundred and twenty-seven units of blood were cross-matched, of which only 224 units (42.5%) of blood were transfused to 146(51%) patients. The overall crossmatch to transfusion ratio(C/T) calculated was 2.4, the transfusion index (TI) was 0.8 and the transfusion probability (%T) was 51.0%. All these figures were found to be within the optimal range.

Conclusion: This study revealed an adequate overall ratio of C/T, %T, and TI blood utilization that was considerable to significant, except for a few surgeries that showed transfusion above or below acceptable levels. Male patients and patients above 60 years of age had a higher transfusion rate. The highest proportion of blood transfusion was observed in lower limb surgeries. Knee arthroscopy showed the lowest blood transfusion rate, while pelvic and acetabular surgeries showed the highest. There is a need for formulating and practicing institution-based blood ordering policies to guide clinicians regarding blood usage.

Keywords: Blood utilization, Elective orthopedic, Muhimbili Orthopaedic Institute

* **Corresponding Author: Mohamed Muhamedhussein, mohamedshabbir@hotmail.com, +255786762786**

Introduction

Blood utilization is a common practice in elective orthopedic surgical procedures. During these procedures, most surgeons overestimate the anticipated blood requirement. There is subjective anticipation of the average requirement for a particular procedure rather than evidence-based estimates. Belayne et al. (2013) showed that over-ordering with minimal utilization squanders technical time and reagent and imposes extra expenses on patients and institutes.

The World Health Organization (WHO) Global Database on Blood Safety (GDBS) was established in 1998 to address global concerns about the availability, safety, and accessibility of blood for transfusion. The WHO (2017) report shows large differences in the amount of blood collected and transfused worldwide. Countries in the high-income group collected 47% of the global donations, and Countries in the low-income and lower-middle-income groups collected 2% and 22% of the global donations respectively. Annual rates of using blood are 32.0 units per 1,000 population in high-income countries, 12.5 units per 1,000 population in upper-middle-income countries, 5.38 units per 1,000 population in lower-middle-income countries, and 3.4 units per 1,000 population in low-income countries.

Osaro et al (2011) reported globally, approximately 80 million units of blood are donated each year whereas of this total, 2 million units are donated in Sub-Saharan Africa, where the need for blood transfusions is great because of maternal morbidity, malnutrition, and a heavy burden of infectious diseases such as malaria. It is essential that the use of blood and blood products is kept to a minimum and used only when indicated. Kuchhal et al (2016) showed that blood is a precious and scarce resource that should, therefore, be used rationally to avoid misuse and wastage.

Tayara in 2015 showed that very few studies have been conducted on blood ordering and transfusion practices in elective orthopedic surgeries which revealed over-ordering with little utilization. Akoko et al (2015) showed that blood was over-ordered by 76% of the patients who had elective surgical procedures where over 80% of these patients had hemoglobin levels of over 10g/dl.

The preoperative request for blood units is often based on worst-case assumptions. Consequently, if unnecessary blood orders can be reasonably avoided, it will reduce both workload and financial expenditure (Kuchhal et al., 2016). There is a need to minimize the quantity of blood being cross-matched without utilization by assigning each elective orthopedic surgical procedure a task of transfusion (Subramanian et al., 2010).

Currently, there are no specific evidence-based guidelines for the appropriate amount of blood products to be ordered for specific orthopedic surgical procedures. The objectives of this study include assessing blood utilization practices in elective orthopedic surgeries and identifying predictive factors for blood utilization.

This study will highlight the determinants of blood utilization practices in elective orthopedic procedures and provide evidence to support guidelines for standardization of blood utilization practices leading to better patient safety and management of resources.

Methods

A hospital-based descriptive study was done on adults who were scheduled for elective orthopaedic surgeries for whom blood and its products were ordered. Two hundred eighty-six patients (286) who met the inclusion criteria were recruited in the study after signing the informed consent. Demographic data were collected using a standard questionnaire. The data obtained were cleaned, coded, and entered into SPSS Statistics for Windows version 20 software.

Frequencies and percentages were obtained for categorical variables. The blood utilization indices were calculated as follows: A) Crossmatch to transfusion ratio (C/T ratio) was calculated as the number of units cross-matched per number of units transfused. Where the value is < 2.5, this shows

 https://dx.doi.org/10.4314/thrb.v25i3.8

that a significant portion of the cross-matched blood was utilized. B) Transfusion probability (%T) was determined as the number of patients transfused per number of patients cross-matched multiplied by 100 for which a value of 30% indicates the significance of the prepared blood used. C) Transfusion index (TI) was calculated as the number of units transfused per number of patients cross-matched - a value of > 0.5 was considered indicative of significant blood utilization. D) Maximal Surgical Blood Ordering Schedule (MSBOS) was calculated as 1.5 times TI.
Data was analyzed by t-test and the P value of <0.05 was considered statistically significant.

Ethical approval and consent
The institutional review board of the Muhimbili University of Health and Allied Sciences and other relevant bodies gave the ethical approval for this study under reference number DA.287/298/01A. Informed consent was taken from all participants.

Results
There was a total of 286 participants in the study, of whom 183 (64%) were males and 103(36%) were females. About a quarter of the participants were in the age group between 31-40 years (23.8%) whilst those aged above 60 years accounted for 23.1%. The mean age was 38 years with an SD of ± 7yrs. (Table 1). Patients above the age of 60 years had the highest proportion of blood transfusion but this was not statistically significant (p-value of 0.144). Around 2/3rd of all patients who underwent elective orthopedic procedures received at least 1 unit of blood. Males received a higher proportion (63%) of blood transfusion, but this was not statistically significant with a p-value of 0.351. (Table 1)

Table 1: Units of Blood utilization per demographic characteristics of patients

	Blood utilization (Units)		
Age (years)	**Transfused**	**Not transfused**	**Total**
18 – 20	4(33.3)	8(66.7%)	12
21 – 30	32(59.3%)	22(40.7%)	54
31 – 40	33(48.5%)	35(51.5%)	68
41 – 50	14(34.1%)	27(65.9%)	41
51 –60	20(44.4%)	25(55.6%)	45
Above 60	43(65.1%)	23(34.9%)	66
Sex			
Male	92	91	183
Female	54	49	103

Of all elective orthopedic surgeries, 527 units of blood were cross-matched whilst only 224(42.5%) units of blood were transfused. Lower limbs surgeries (such as intramedullary nailing of femur and tibia, angled blade plate and condylar buttress plate for femur & tibia, ankle reconstruction, lower limb amputation) constitute highest proportion of units cross-matched (49.7%) and transfused units of blood (50.9%) followed by arthroplasty surgeries where units of blood cross-matched 112(21.3%) while

https://dx.doi.org/10.4314/thrb.v25i3.8

units transfused 55(24.6%). The lowest transfusions were for arthroscopic knee surgeries (Meniscectomy, Anterior cruciate ligament reconstruction) whereby only 2 patients received blood. The highest proportion (63%) of transfused versus cross-matched units of blood was observed in pelvic and acetabular surgeries followed by arthroplasty (49%) and open reduction and internal fixation of lower limb surgeries (43.5%) whereas the lowest was in arthroscopic knee surgeries. (Figure 1)

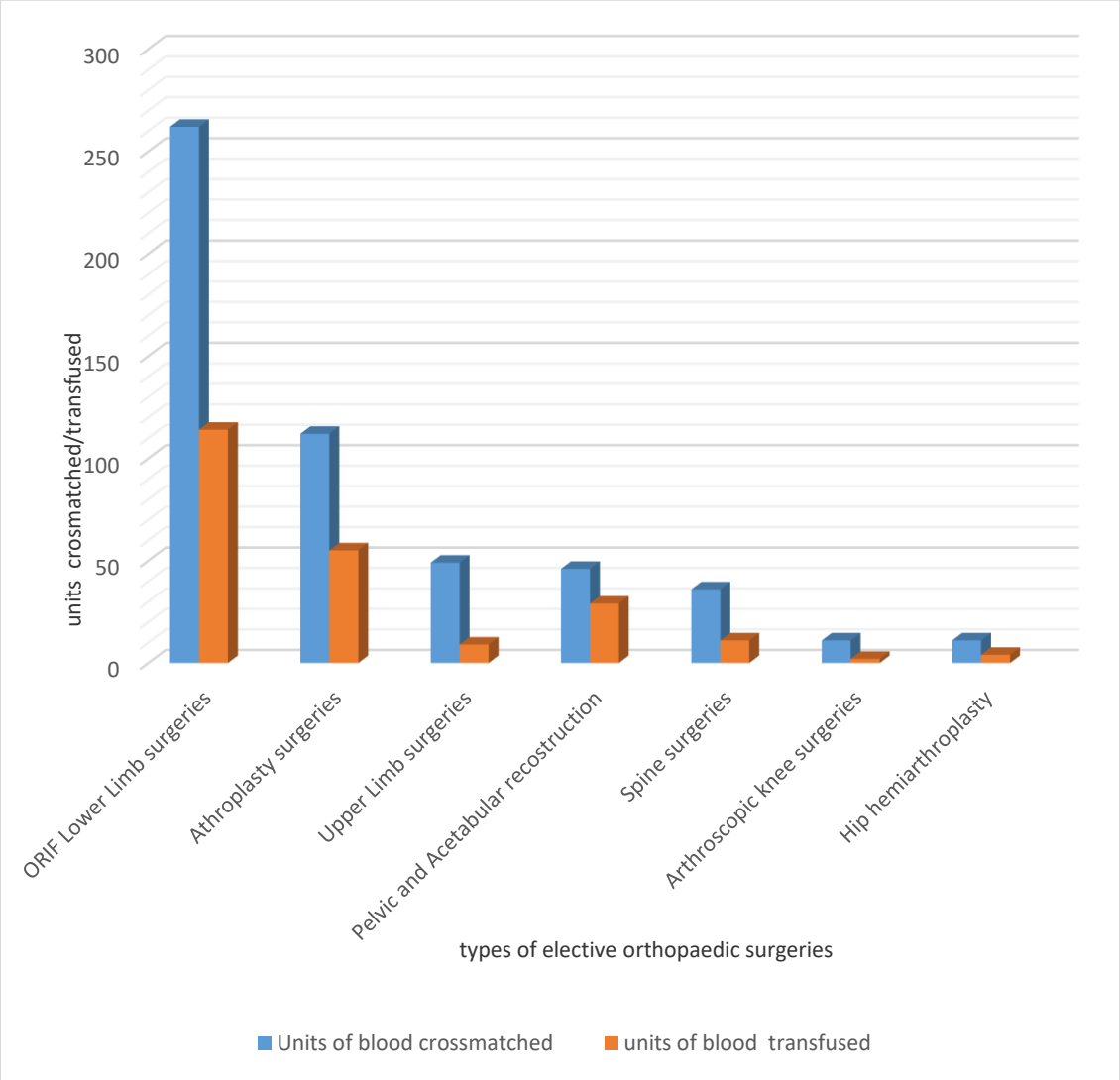

Figure 1: Units of blood cross-matched and transfusion for elective orthopedic surgeries

The average transfusion indices (CTR, %T, TI, and MSBOS) for elective orthopedic surgeries were 2.4, 51, 0.8, and 1.2 respectively. (Table 2)

The arthroscopic knee surgeries have the highest CT ratio of 5.5, lowest transfusion probability of 22.2%, transfusion index of 0.2, and lowest maximum blood surgical ordering schedule of 0.3, while the lowest CT ratio was observed in Pelvic and Acetabular reconstruction of 1.6 with higher transfusion probability of 89.5% and transfusion index 1.5. The highest maximum blood surgical ordering schedule was observed in the pelvic and acetabula with 2.3.

https://dx.doi.org/10.4314/thrb.v25i3.8

Table 2: Transfusion indices by elective orthopedic surgeries

	Surgery type	Patients (n)	Percent	CTR	%T	TI	MSBOS 1.5 X TI
1.	Lower Limb surgeries	144	50.3	2.3	52.4	0.8	1.2
2.	Arthroplasty surgeries	59	20.6	2.0	62.1	0.9	1.4
3.	Upper Limb surgeries	32	11.2	5.4	19.4	0.3	0.5
4.	Pelvic and Acetabular reconstruction	19	6.6	1.6	89.5	1.5	2.3
5.	Spine surgeries	19	6.6	3.3	35	0.6	0.9
6.	Arthroscopic knee surgeries	7	2.4	5.5	22.2	0.2	0.3
7.	Hip hemiarthroplasty	6	2.1	2.8	50	0.7	1.1
	Total	286	100				

Key: C/T=cross-match to transfusion ratio, %T=Transfusion probability, TI=Transfusion Index, MSBOS= Maximal Surgical Blood Order Schedule

The highest percentage (21%) of the cross-matched blood was for open reduction and internal fixation of the femur and this particular surgery also had the highest percentage of transfused units (20.5%). Total hip arthroplasty patients constituted 12.1% of the cross-matched blood and 16.9% of the transfused. Some procedures including ankle arthrodesis, implant removal, patella tension band wiring open reduction, and internal fixation of the olecranon were not transfused despite a significant number of bloods being cross-matched. (Table 3)

Table 3: Blood cross-matched and transfused patterns for specific orthopedic surgeries

S/NO	Type Of Surgery	Patients (n)	Percent	Cross-matched		Transfused	
				Patients (n)	Units (n)	Patients (n)	Total (units)
1.	ORIF intramedullary nail femur	60	21.0	60	115	31	46
2.	Total hip arthroplasty	31	10.8	31	64	24	38
3.	Total knee arthroplasty	27	9.4	27	48	12	17
4.	Acetabular reconstruction	15	5.2	15	36	15	24
5.	Plating and screw radius/ulnar	13	4.5	13	19	2	4
6.	Exchange intramedullary nail femur	11	3.8	11	19	10	15
7.	Lumbar Discectomy	11	3.8	11	19	5	8
8.	Plating and screw humerus	11	3.8	11	18	2	2
9.	Implant removal intramedullary nail	10	3.5	10	15	1	1
10.	Arthroscopic knee surgeries	10	3.5	10	12	2	2
11.	Sequestrectomy	10	3.5	10	16	5	7
12.	Exchange intramedullary nail tibia	9	3.1	9	14	3	3
13.	Spine decompression & stabilization	9	3.1	9	17	2	3

https://dx.doi.org/10.4314/thrb.v25i3.8

14.	ORIF buttress plate tibia	8	2.8	8	15	3	6
15.	Plate and screw femur	8	2.8	8	15	7	10
16.	Hip hemiarthroplasty	7	2.4	7	13	4	6
17.	ORIF intramedullary nail tibia	7	2.4	7	12	3	5
18.	Distal plate and screw femur	6	2.1	6	14	6	11
19.	ORIF of Olecranon	4	1.4	4	7	0	0
20.	Below knee amputation	3	1.0	3	7	3	6
21.	ORIF Hip screw femur	3	1.0	3	6	2	3
22.	Pelvic reconstruction	3	1.0	3	9	2	4
23.	Ankle Arthrodesis	2	0.7	2	4	0	0
24.	Implant removal	2	0.7	2	3	0	0
25.	Patella tension band wiring	2	0.7	2	3	0	0
26.	Plate and screw ankle	2	0.7	2	4	1	2
27.	SD+External fixation	2	0.7	2	3	1	2
	Total	286	100.0	286	527	146	224

The Implant removal of intramedullary nail has the highest CT ratio (15), lowest transfusion probability (10%), transfusion index (0.1) and lowest maximum blood surgical ordering schedule (0.2). On the other end of the spectrum, acetabular surgeries had the lowest CT ratio (0.6), highest transfusion probability (100%), transfusion index (1.6) and highest maximum blood surgical ordering schedule (2.4). (Table 4)

Table 4: Transfusion indices for specific elective orthopaedic surgeries

	Surgery type	Patients(n)	Percent	C:T RATIO	%T	TI	MSBOS 1.5 X TI
1.	ORIF intramedullary nail femur	60	21.0	2.5	51.7	0.8	1.2
2.	Total hip arthroplasty	31	10.8	1.7	77.4	1.2	1.8
3.	Total knee arthroplasty	27	9.4	2.8	44.4	0.6	0.9
4.	Acetabular reconstruction	15	5.2	1.5	100	1.6	2.4
5.	Plating and screw radius/ulnar	13	4.5	4.8	15.4	0.3	0.5
6.	Exchange intramedullary nail femur	11	3.8	1.3	90.9	1.4	2.1
7.	Lumbar Discectomy	11	3.8	2.4	45.5	0.7	1.1
8.	Plating and screw humerus	11	3.8	9	18.2	0.2	0.3
9.	Implant removal intramedullary nail	10	3.5	15	10	0.1	0.2
10.	Arthroscopic knee surgeries	10	3.5	6	20	0.2	0.3
11.	Sequestrectomy	10	3.5	2.3	50	0.7	1.1
12.	Exchange intramedullary nail tibia	9	3.1	4.7	33.3	0.3	0.5
13.	Spine decompression & stabilization	9	3.1	5.7	22.2	0.3	0.5
14.	ORIF buttress plate tibia	8	2.8	2.5	37.5	0.8	1.2
15.	Plate and screw femur	8	2.8	1.5	87.5	1.3	2.0
16.	Hip hemiarthroplasty	7	2.4	2.2	57.2	0.9	1.4
17.	ORIF intramedullary nail tibia	7	2.4	2.4	42.9	0.7	1.1
18.	Distal plate and screw femur	6	2.1	1.3	100	1.8	2.7
19.	ORIF of Olecranon	4	1.4	0	0	0	0
20.	Below knee amputation	3	1.0	1.2	100	2	3
21.	ORIF Hip screw femur	3	1.0	2	66..7	1	1.5
22.	Pelvic reconstruction	3	1.0	2.3	66.7	1.3	2.0
23.	Ankle Arthrodesis	2	0.7	0	0	0	0

https://dx.doi.org/10.4314/thrb.v25i3.8

24.	Implant removal	2	0.7	0	0	0	0
25.	Patella tension band wiring	2	0.7	0	0	0	0
26.	Plate and screw ankle	2	0.7	2	50	1	1.5
27.	SD + External fixation	2	0.7	1.5	50	1	1.5
	Total	286	100.0				

Key: C/T=crossmatch to transfusion ratio, %T=Transfusion probability, TI=Transfusion Index, MSBOS= Maximal Surgical Blood Order Schedule

Discussion

Blood is a vital commodity that is limited in supply, and hence, its distribution and appropriate use is the key to ensure maximum benefit. In our study, 42.5% of the cross-matched units were transfused for elective orthopedic surgery. This was lower compared to studies done in Europe(Rosencher et al., 2003), Pakistan (Waheed et al., 2015), and India (Sonam et al., 2017) which showed 69%, 65.4%, and 57.1% of the cross-matched blood were utilized but higher than those done in Tanzania (Akoko et al., 2015) and Nepal (Karki , 2016) which had usage of 28.2% and 18% respectively.

This study showed that male patients were found to have a higher proportion of blood transfusion, however, this was not statistically significant. Some other studies (Soleimanha et al., 2016; Giriyan et al., 2017, Chalya et al., 2016 and Jumpotpong et al, 2015) have also shown that males were more likely to be transfused in elective orthopedic surgery whilst others including Belayneh et al (2013), Giriyan et al (2017) and Mwambungu et al (2015) showed that females were more likely to receive blood. Higher transfusion proportion was observed among the patients aged above 60 years, but again this was not found to be statistically significant.

The overall CT ratio was 2.4, which indicates significant blood utilization. Similar findings were observed in a study done in Nigeria by Adegboye et al. (2018), with an overall CT ratio of 2.3. The average transfusion indices in this study (%T, TI and MSBOS) for elective orthopedic surgeries were 51, 0.8 and 1.2 respectively. These values are indicative of significant blood usage. This was in contrast to studies done at Muhimbili National Hospital (Akoko et al., 2015), Bugando Medical center (Chalya et al., 2016) and another hospital in India (Sonam et al., 2017) which had CTR >2.5. Jumpotpong et al (2015) and Mwambungu et al (2015) showed T% of 22% and 26.1% respectively. (18,19) Published articles (8,11) Soleimanha et al (2016) and Waheed et al (2017) have shown TI of >0.5 whilst studies done by Adegboye et al (2018) have shown the reverse is true. It is possible that the disparity was due to different surgical practice at different centers and the guidelines for crossmatch for elective orthopedic procedures or different intraoperative techniques to minimize blood loss such as using tourniquet.

About 2/3rd (63%) of pelvic and acetabular surgeries and almost half (49%) of arthroplasty surgeries required blood transfusion whilst less than 1/5th (18.2%) of arthroscopic knee surgeries required blood and its products. Similar findings were found in studies done by Basnet et al. (2009), Tayara et al. (2015), Soleimanha et al. (2016) and Adegboye et al. (2018). Pelvic and acetabular surgeries are extensive and require soft tissue dissection, and have been known to have significant blood loss leading to higher proportion of blood needed for transfusion. Reasons for Pelvic and acetabular surgeries to have the highest proportion of transfusion can be because these are major orthopaedic surgeries involving extensive cutting of soft tissues and bone, hence leading to extensive blood loss, which needs a transfusion.

Despite optimal overall transfusion probability reported in this study, five types of elective orthopedic surgeries had inefficient blood utilization. These include fixation of radius and ulna, fixation of the humerus, implant removal of intramedullary nail, arthroscopic knee surgeries, and spine decompression (T% 10-22%). Adegboye, in 2016, observed five procedures have a low TI of < 0.5,

including fixation of radius and ulna, spine decompression surgery, total knee replacement, tibiofibular fracture and ankle fracture. These differences in blood utilization can be explained by the generalization of similar blood ordering in different orthopaedic procedures by a surgical team, which usually explains the provision of safety measures in the event of excessive unexpected blood loss during surgery.

Conclusion

This study assessed blood utilization in elective orthopedic procedures and at Muhimbili Orthopedic Institute. It showed an overall adequate (42.5%) blood utilization. Knee arthroscopy showed the lowest blood transfusion rate, while pelvic and acetabular surgeries showed the highest transfusion rate. A few categories of elective orthopedic surgeries showed transfusion indices above /below accepted levels. Therefore, the overall blood utilization was significant.

All patients going for elective orthopedic surgery should have their blood type checked. There are certain types of orthopaedic surgeries, such as pelvic and acetabular which have a high likelihood of transfusion being required. Hence, blood can be cross-matched, whilst others, such as knee arthroscopy, have shown a very low probability of transfusion, so cross-matching should not be routinely done unless clinically advised on an individual basis. There is a need for formulating and practicing institution-based blood ordering policies to guide clinicians regarding blood usage as there is an inadequate guideline.

List of abbreviations

C/T:	Crossmatch to transfusion ratio
GDBS:	Global Database on Blood Safety
MSBOS:	Maximum surgical blood ordering schedule
ORIF:	Open reduction and internal fixation
SD:	Surgical debridement
%T:	Transfusion probability
TI:	Transfusion index
WHO:	World Health Organization

Availability of data and materials: Available upon request from the corresponding author
Competing interests: The authors declare no conflicts of interest
Funding: This was self-funded by the authors

Author's contributions

Justice Mwambashi contributed to the research concept, wrote the proposal, collected data, and analyzed and wrote the manuscript. Mohamed Muhamedhussein contributed to the proposal, literature review, analyzing the data, writing up the discussion, and editing the manuscript. Billy Haonga contributed to developing the research concept, analyzing the data, and editing the manuscript.

Acknowledgements

We want to thank the entire orthopaedics and trauma department of Muhimbili Orthopedic Institute, especially the head of the department, Dr Joseph Mwanga.

REFERENCES

Adegboye, M., Kadir, D. (2018). Maximum surgical blood ordering schedule for common orthopedic surgical procedures in a tertiary hospital in North Central Nigeria. *J Orthop Trauma Surg Relat*, 13(1):6–9.

Akoko, L., Torg, J. (2015). Blood utilization in elective surgery in a tertiary hospital in Dar es salaam, Tanzania. *Tanzan J Health Res*, 17(4):1–8.

Basnet, R., Lamichhane, D., Sharma, V. (2009). A Study of blood Requisition and transfusion Practice in Surgery at bir Hospital. *Postgrad Med J NAMS*, 9(2).

Belayneh, T., Messele, G., Abdissa, Z., Tegene, B. (2013). Blood requisition and utilization practice in surgical patients at university of gondar hospital, northwest ethiopia. *Journal of blood transfusion*. p. 5.

Chalya, P., Mbunda, F., Mabula, J., Massinde, A., Kihunrwa, A., Gilyoma, J. (2016). Blood transfusion practice in surgery at Bugando Medical Centre in northwestern Tanzania. *Tanzan J Health Res*, 18(1):1–9.

Giriyan, S., Chetana, H., Sindhushree, N. (2017). Study of Utilization of Blood and Blood Components in a Tertiary Care Hospital. *J Blood Lymph*, 7:69:2–4.

Jumpotpong, W., Lewsirirat, S., Piyapromdee, U. (2015). Blood Utilization for Elective Orthopaedic Surgeries at Maharat Nakhon Ratchasima Hospital. *Thai J Orthop Surg*, 39 No.1-2:

Karki, O. (2016). Blood Requisition and Utilization Practice in Surgical Patients in a Teaching Hospital, Western Nepal. *Kathmandu Univ Med J,* 14(53):27–30.

Kuchhal, A., Negi, G., Gaur, D. (2016). Blood utilization practices in elective surgical patients in a Tertiary Care Hospital of Uttarakhand. *Glob J Transfus Med*, 1(2):51–6.

Mwambungu, A., Siulapwa, N. (2015). Analysis of Blood Cross-match Ordering Practice in Surgical Patients at Ndola Central Hospital. *Int J Healthc Sci*, 3,1:278-28.

Osaro, E., Charles, A. (2011). The challenges of meeting the blood transfusion requirements in Sub-Saharan Africa : the need for the development of alternatives to allogenic blood. *J Blood Med*, 7–21.

Rosencher, Nadia. (2003). Orthopedic Surgery Transfusion Hemoglobin European Overview (OSTHEO) study: blood management in elective knee and hip arthroplasty in Europe. *Transfusion*, 43(April):459–69.

Soleimanha, M., Haghighi, M., Mirbolook, A. (2016). A Survey on Transfusion Status in Orthopedic Surgery at a Trauma Center. *Arch Bone Jt Surg*, 4(1):70–4.

Sonam, K., Care, H. (2017). Proposed maximum surgical blood ordering schedule for common orthopedic surgeries in a Tertiary. *J Orthop Allied Sci*, 5:21–6.

Subramanian, A., Rangarajan, K. (2010). Reviewing the blood ordering schedule for elective orthopedic surgeries at a level one trauma care center. *J Emergencies, Trauma, Shock*, 3:225-30.

Tayara, B., Al-Faraidy, M. (2015) Blood utilization in orthopedic and trauma practice. *Int J Appl Basic Med Res*, 5(2):111.

Waheed, U., Muneeba, A., Wazee, A., Sultan, S. (2017). Evaluation of blood requisition and utilization practices at a tertiary care hospital blood bank in Islamabad, Pakistan. *Glob J Transfus Med*, 2:113-7.

WHO(2017). Global status report on blood safety and availability 2016. Geneva,Switzerland.