Characterization of Orthopaedic Trauma Patients and the Need for Blood Transfusion at Moi Teaching and Referral Hospital, Eldoret, Kenya

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Abstract

Background: Blood transfusion is required in the management of life threatening orthopaedic trauma hemorrhages. There is great need to categorize trauma patients and match them appropriately with the need for blood transfusion. This will ensure appropriate use of blood and hence save on resources and patent safety.

Objective: To characterize orthopaedic trauma patients and the need for blood transfusion at Moi Teaching and Referral Hospital (MTRH), Eldoret, Kenya.

Methods: Descriptive cross-sectional study conducted at MTRH (March 2019- January 2020) on 132 orthopedic trauma patients who met inclusion criteria. Data (continuous and categorical) collected using interviewer administered structured questionnaire summarized, and presented in prose and table formats.

Results: Males were 101 (76.5%), median age 36 (IQR: 28, 47) years; majority (42; 31.8) were of age group 21- 30 years old; referrals were- 95 (72%), 64 (48.5%) were unskilled workers and 64 (48.5%) had primary school level of education. Injured in road traffic accidents were 105 (79.5%) with 96 (72.8%) having sustained lower extremity fractures while 30 (22.7%) had multiple trauma. Mean Injury Severity Scores was 12.05 (SD: 6.21). Majority of patients had normal vital signs except for increased respiration rate (77; 58.3%). Most patients (94; 71.2%) had pre-transfusion haemoglobin level of 10g/dl or less, and were destined mainly for debridement (58; 43.9%) and Open Reduction and Internal fixation (ORIF) (61; 46.2%). The commonest blood group was O positive. The needs were Packed Red Blood Cells (PRBCs) transfusion in 127 (96.2%) and whole blood in 5 (3.8%).

Conclusion: Most patients were males, injured mostly in road traffic accidents with deranged vital signs and lower extremity fractures. Most were destined for debridement and ORIF, requiring mostly PRBCs.

Recommendations: Orthopaedic Surgeons should have high suspicion index in order to accurately categorize patients and match them with need for blood before surgery.

Keywords: Characterization; Trauma; Sociodemography; Laboratory; Blood Transfusion

Introduction

Trauma in Orthopaedic practice remains a global health problem Conway DJ, et al. [1]. It contributes to higher morbidity, disability and even mortality burden in developing than in developed countries Ayumba BR, et al. [2], Conway DJ, et al. [1], Dolenc AJ, et al. [3], Sisak K, et al. [4]. Majority of trauma victims are males mostly in third and fourth decades who indulge in various unskilled and skilled socioeconomic activities Ayumba BR, et al. [2]. The musculoskeletal injuries are of wide spectrum based on aetiology, mechanisms of injury and regions of the body injured Boughton O, et al. [5]. These injuries are mostly attributed to RTAs and falls among others, with RTAs dominating in developing low- medium income countries Ayumba BR, et al. [2], Boughton O, et al. [5], compared to falls in developed and high income countries Court-Brown CM, et al. [6].

Among the injuries associated with severe blood loss and therefore require blood and blood products transfusion involve the long bones and pelvis Gumm DK, et al. [7], Heetveld M [8], Lee C, et al. [9], Soviero F, et al. [10]. Injury Severity Score has become an important tool in assessing such injured patients Dolenc AJ, et al. [3], Saidi H [11], Verlicchi F, et al. [12]. These patients are mostly found to have deranged vital signs as documented some studies Kipkulei J, et al. [13], Ramenofsky M, et al. [14] and even the laboratory parameters Abbas K, et al. [15], Kipkulei J, et al. [14], and appropriate blood and its products become handy to save lives Gatheru AP, et al. [16], Kenya National Blood Transfusion Service [17], Kopanidis P, et al. [18], Moi Teaching and Referral Hospital [19], Newman C, et al. [20], Shander A, et al. [21], Sisak K, et al. [22], American Society of Anesthesiologists Task Force on Perioperative Blood Management [23], World Health Organization [24], Yudelowitz B, et al. [25]. The purpose of this study is to characterize the trauma patients managed in the Orthopaedics wards of MTRH, Eldoret, Kenya in terms of the sociodemography, clinical features and laboratory parameters.

Materials and Methods

A hospital based descriptive cross-sectional study of 132 orthopedic trauma patients (March 2019- January 2020) at MTRH after obtaining approval from both IREC (Approval number 0003213) and MTRH CEO (Ref: ELD/MTRH/R&P/10/2/V.2/2010). Cochran formula was used to calculate sample size proportions Cochran WG, et al. [26] in conjunction with a previous study on proportion of patients who received blood transfusion by some team of authors Abbas K, et al. [15], getting 132. Consecutive sampling was done on patients who met the inclusion criteria and then data on sociodemographic, clinical and laboratory features was collected using interviewer administered structured questionnaire (whose contents were adopted from MTRH and Kenyatta National Hospital (KNH) trauma registry). At KNH, several studies have been conducted by several authors Gatheru AP, et al. [16], Gitakah RW [27], Muriithi MP [28], the same applies to MTRH Oeba B [29], Rotich M [30]. Data was then entered into Microsoft and Access 2019 version 16 software package for storage and back up, later exported to R version 3.6.0 R Core Team [31] for analysis. Descriptive analyses were done on sociodemographic data while continuous data was summarized (as mean with standard deviation and median with interquartile range) and categorical (frequency tables and proportions).

Results

Socio-Demographic Characteristics

A total of 132 patients participated in this study. Males were 101 (76.5%) while females were 31 (23.5%); Male: Female ratio 3.3:1. Mean and median ages were 40.35 (SD: 17.90) and 36 (IQR: 28, 47) years respectively. The age range of the patients was 18- 90 years. Most patients, 95 (72.0%) were referrals, 64 (48.5%) were unskilled workers, 64 (48.5%) had primary school level of education and 42 (31.8%) were aged 21 to 30 years. The socio-demographic characteristics are shown in Table 1.

Characteristics	Overall n=132
Sex	
Female	31 (23.5%)
Male	101 (76.5%)
Age Group	
< 20 years	7 (5.3%)
21 to 30 years	42 (31.8%)
31 to 40 years	34 (25.8%)
41 to 50 years	20 (15.2%)

51 to 60 years	8 (6.1%)
61 to70 years	9 (6.8%)
>70 years	12 (9.1%)
Education Level	
College/University	8 (6.1%)
High School	48 (36.4%)
No Formal Education	12 (9.1%)
Primary School	64 (48.5%)
Occupation	
Semi-skilled worker	53 (40.2%)
Skilled worker	10 (7.6%)
Student	5 (3.8%)
Unskilled worker	64 (48.5%)
Referral Status	
Non-Referral	37 (28.0%)
Referral	95 (72.0%)

Table1: Socio-demographic characteristics.

Trauma Characteristics

Most of the patients, 105 (79.5%) had injuries due to road traffic accidents. Gunshot and assault injuries were uncommon. The overall mean and median injury severity score were 12.05 (SD: 6.21) and 10 (IQR: 9, 13) respectively.

Majority of the patients, 62 (47.0%) had isolated femur fractures while 30 (22.7%) had multiple trauma. About half of the patients, 61 (46.2%) underwent open reduction and internal fixation (ORIF) while 58 (43.9%) had debridement primarily. Table 2 describes the trauma characteristics.

Characteristics	Overall n=132
Mechanism of injury	
Assault	5 (3.8%)
Falls	19 (14.4%)
Gunshot	3 (2.3%)
Road Traffic Accidents	105 (79.5%)
Injury Severity Score	
Mean (SD)	12.05 (6.21)
Median (Q1,Q3)	10 (9,13)
Type of injury	
Femur fractures	62 (47.0%)
Fibula fracture	1 (0.8%)
Humerus fracture	1 (0.8%)
Multiple trauma	30 (22.7%)
Pelvis fractures	3 (2.3%)
Spine fracture	1 (0.8%)
Tibia fractures	34 (25.8%)
Surgery	

Amputation	6 (4.5%)
Debridement	58 (43.9%)
External fixation	6 (4.5%)
Grafting	1 (0.8%)
ORIF	61 (46.2%)

Table 2: Trauma characteristics.

Motorcycle passengers and riders were almost equal in number with a ratio of 1.06:1 and comprised majority of injured road accidents victims. Notably, motorcycle riders were the youngest [mean age of 30.0 (SD: 7.4) years], mostly males (97.1%) and had a lower mean injury severity score [11.8 (SD: 6.9)] compared to motorcycle passengers as shown in Table 3. Pedestrians involved in motorcycle accidents were older at a mean age of 46.3 (SD: 14.5) years and were mostly males (60.0%). Motor vehicle passengers had the highest mean injury severity score of 15.1 (SD: 10.9). Overall, 80 of 105 (76.2%) patients were afflicted by injuries from motorcycle associated road traffic accidents predominating 25 of 105 (23.8%) patients who sustained trauma from motor vehicle road traffic accidents.

Mechanism of injury n = 105		Mean age	Sex		Mean ISS
			Male	**Female**	
MC Passenger	36	37.3 (17.1)	21 (58.3%)	15 (41.7%)	12.6 (6.3)
MC Pedestrian	10	46.3 (14.5)	6 (60.0%)	4 (40.0%)	12.6 (5.8)
MC Rider	34	30.0 (7.4)	33 (97.1%)	1 (2.9%)	11.8 (6.9)
MV Driver	4	41.0 (12.9)	4 (100.0%)	0 (0.0%)	13.0 (3.8)
MV Passenger	8	37.9 (18.8)	8 (100.0%)	0 (0.0%)	15.1 (10.9)
MV Pedestrian	13	40.6 (13.8)	11 (84.6%)	2 (15.4%)	13.5 (6.7)

Table 3: Road traffic accidents.
MC= Motor Cycle
MV= Motor Vehicle

On average, those who fell from a standing height were older (73.1 (SD: 15.4)) years] compared to those who fell from a significant height (44.8 (SD: 21.3)) years]. However, their mean Injury Severity Score (ISS) was similar as shown in Table 4. Most patients who fell from a significant height, 6 of 8 (75.0%) were males.

Mechanism of injury n = 19		Mean age	Sex		Mean ISS
			Male	**Female**	
Fall (height)	8	44.8 (21.3)	6 (75.0)	2 (25.0)	9
Fall (standing)	11	73.1 (15.4)	6 (54.5)	5 (45.5)	9

Table 4: Falls.

Vital Signs

Pre-transfusion vital signs just before transfusion commencement were recorded. Majority of the patients, 105 of 132 (79.5%) had normal pre-transfusion pulse rate and 115 of 132 (87.1%) had normal systolic blood pressure as shown in Table 5. However, more than half of them, 77 of 132 (58.3%) were found to have increased respiratory rate.

Characteristics	Overall n=132
Pulse Rate	
Bradycardia	1 (0.8%)
Normal	105 (79.5%)
Tachycardia	26 (19.7%)
Respiratory Rate	
Normal	55 (41.7%)
Tachypnoea	77 (58.3%)
Systolic Blood Pressure	
Hypertension	9 (6.8%)
Hypotension	8 (6.1%)
Normal	115 (87.1%)

Table 5: Vital Signs.

Laboratory characteristics

The median (IQR) pre-transfusion haemoglobin (g/dl), haematocrit (%), platelets (10^9/L) were 8.90 (7.98, 10.35), 26.10 (23.15, 30.48) and 330.0 (218.5, 578.0) respectively. Majority of the patients, 78 of 132 (59.1%) had pre-transfusion haemoglobin level in the category of 7 to 10 g/dl. Only 16 of 132 (12.1%) patients had hemoglobin less than 7 g/dl while 38 of 132 (28.8%) had hemoglobin more than 10 g/dl. The commonest blood group among the transfusion recipients was O positive followed by A positive and B positive as shown in Table 6.

Characteristics	Overall n=132
Haemoglobin (g/dl)	
Median (IQR)	8.90 (7.98, 10.35)
Haematocrit (%)	
Median (IQR)	26.10 (23.15, 30.48)
Platelets (109/L)	
Median (IQR)	330.0 (218.5, 578.0)
Haemoglobin Category (g/dl)	
<7	16 (12.1%)
7 – 10	78 (59.1%)
>10	38 (28.8%)
Patient Blood Group	
A-	1 (0.8%)
A+	44 (33.3%)
AB-	1 (0.8%)
AB+	2 (1.5%)
B-	2 (1.5%)
B+	20 (15.2%)
O-	2 (1.5%)
O+	60 (45.5%)

Table 6: Laboratory characteristics.

Discussion

Socio-Demographic and Clinical Characteristics

Socio-Demographic Characteristics: A male predominance was observed with males being about three and half times the females. This concurs with findings by a team of authors Ayumba BR, et al. [2] in their study among patients with post-traumatic exposed bones where they found that majority of patients were males. Ostensibly, males are more Abbas K, et al. [15] exposed and vulnerable to musculoskeletal trauma owing to their propensity for outdoor bread winning and social activities. The mean and median ages were 40.35 (SD: 17.90) and 36 (IQR: 28, 47) years respectively with majority in their third and fourth decades of life. This concurs with findings by some authors Ayumba BR, et al. [2], Dolenc AJ, et al. [3], Sisak K, et al. [4]. This is the age at which most people are socio-economically active. Injury prevention initiatives should place more focus and effort on this age group. Most patients were referrals and had primary school level of education in concurrence with findings by a team of authors Ayumba BR, et al. [2]. Further, majority of the patients were found to be unskilled (no formal job training).The high rate of referrals concurs with MTRH status as the apex of the healthcare delivery system in Western Kenya region, parts of Eastern Uganda and Southern Sudan catchment areas whose population is about 24 million people. No formal job training drives people to informal occupations for income generation. The relatively lower rate of literacy (48.5% primary school level graduates) and salaried employment could explain exposure to more injury prone occupations and activities. In this study, socio-demographic characteristics did not have significant association with appropriate blood transfusion. This concurs with other studies where basic demographics such as age Saidi H [11], Sisak K, et al. [4] and gender Abbas K, et al. [15] were shown not to influence transfusion.

Trauma Characteristics: Most patients were injured due to road traffic accidents with mean and median injury severity cores of 12.05 (SD: 6.21) and 10 (IQR: 9, 13) respectively. In low and middle income countries, road traffic victims represent a large proportion of trauma burden Boughton O, et al. [5]. This is in contrast with findings documented by a team of authors Court-Brown CM, et al. [6] from a study in Royal Infirmary of Edinburgh, Scotland where road traffic accidents accounted for 4.7% of injuries. The lower prevalence of road traffic accidents in developed nations Court- Brown CM, et al. [6] is probably attributable to better infrastructure, adherence and enforcement of traffic laws. Almost half of the patients had isolated femur fractures and one quarter presented with tibia fractures only while a fifth sustained multiple injuries. This shows a higher proportion of lower limb compared to upper limb injury admissions. Seemingly, lower limb injuries render victims immobile hence need for direct admissions unlike those with upper limb injuries who are mostly booked into orthopaedic outpatient clinics. Patients with femur, tibia, acetabular, unstable pelvic among other lower limb fractures are usually admitted for operative treatment at the earliest opportunity to enable early mobilization and restoration of pre-injury limb functions. About half of the patients (46.2%) underwent open reduction and internal fixation (ORIF) while 43.9% had debridement primarily. However, in the study as with other trauma characteristics, type of surgical intervention was not significantly associated with appropriate blood transfusion in concurrence with finding by some author Saidi H [11].

Overall, motorcycle associated injuries (76.2%) comprised majority of road traffic accidents. This contrasts findings in studies by some authors Ayumba BR, et al. [2], Saidi H [11] where motorcycle related accidents had a contribution of 16.5% and 22.6% respectively. The predominance of motorcycle associated injuries in this study could be attributed to upsurge of motorcycle usage due to need for convenient mobility in widespread parts of Kenya. Perhaps there is need for a tailored regulation of the rapidly expanding motorcycle sector. Falls (14.4%) were the second leading cause of injuries in this study. This concurs with findings from studies by some teams of authors Ayumba BR, et al. [2], Boughton O, et al. [5]. However, it contrasts findings by some team of authors Court- Brown CM, et al. [6] where falls from standing height were the commonest cause of injury accounting for 62.5% of all fractures in their study at Royal Infirmary of Edinburgh, Scotland. Falls from a standing height tend to be more prevalent among older people and are the most frequent cause of fragility fractures owing to age and gender related endocrine, musculoskeletal and neurologic changes. Also, these people are more exposed to environmental and medical risk factors.

Vital Signs: Majority of the patients had normal pre-transfusion pulse and systolic blood pressure. This concurs well with the findings is a study by a team of some authors Abbas K, et al. [15] carried out among transfused orthopaedic trauma patients at Aga Khan University Hospital, Karachi, Pakistan. The team of authors in study at MTRH found out a proportion of patients (58.3%) with increased respiratory rate which is a contrast with the 1.6% in a study by the aforementioned team of authors. Raised respiratory rate in trauma is often related to pain, anxiety or airway and / or ventilatory compromise as documented by another team of authors Ramenofsky M, et al. [14]. Acute blood loss initially leads to tachycardia then hypotension later on as more blood (31- 40% of total body blood volume) is lost Ramenofsky M, et al. [14]. The deranges signs, expected major bleeding and injury patterns point to the need for early transfusion Sisak K, et al. [22].

Laboratory Characteristics: In this study, the proportion of patients with pre-transfusion hemoglobin less than 7 g/dl concurred with the findings in another study Abbas K, et al. [15] at 12.1% compared to 14.3%. However, in the categories of 7 to 10 g/dl and more than 10 g/dl, this study findings contrast those of aforementioned team of authors Abbas K, et al. [15] in a study at 59.1% versus 79.4% and 28.8% versus 6.3% respectively. The discordant results are likely explained by the heterogeneity of the populations studied. The commonest blood group was O positive (45.5%) followed by A positive (33.3%) and B positive (15.2%). This concurs with findings by a team of authors Kipkulei J, et al. [13] in their study on demographic and clinical profiles of blood transfusion recipients at a teaching and referral hospital in Kenya where the commonest blood groups were O positive (49.5%) followed by A positive (28.9%) then B positive at (13.3%). Information about local patient blood groups helps in predicting routine transfusion needs.

Conclusions

1. Most patients were males, transfused with packed red blood cells and majority of injuries sustained were due to road traffic accidents.
2. The proportion adherent to the institutional transfusion guidelines was low at 16.7%. Pre-transfusion haemoglobin and haematocrit levels were the factors associated with adherence to guidelines.
3. Few and mild blood transfusion reactions were noted in 11.4% of patients. There was no association between transfusion reactions and adherence to guidelines.

Recommendations

Based on results and the stated objectives, the following recommendations are proposed:
1. Moi Teaching and Referral Hospital Transfusion Committee to sensitize and encourage adherence to blood transfusion guidelines among clinicians in orthopaedic trauma units by increasing awareness.
2. Need for a high index of suspicion among clinicians and nurses for the diagnosis of blood transfusion reactions and cautions to minimize these reactions be put in place.
A study among clinicians to assess their knowledge about blood transfusion and their experiences on transfusion practices in orthopaedic trauma units at MTRH.

Acknowledgement

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