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Factors Associated with Fracture and Its Outcome at Wolaita Sodo University Teaching and Referral Hospital, Wolaita Sodo, Southern Ethiopia.

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Abstract
Background: The World Health Organization (WHO) global burden of injury estimate ranks injury among the top ten leading cause of death. Despite the increasing trend suggested by available data, injuries in general and traumatic fractures in particular have not received the attention they deserve in most developing countries.**Methods**: the aim of this study is to assess the factors associated with fracture and its outcome at Wolaita Sodo University Teaching and Referral Hospital (WSUTRH), Wolaita Sodo, Southern Ethiopia. From September 2015- August 2016. A facility based cross sectional descriptive study was employed and a one year retrospective review of patient charts was undertaken. Data was collected using structured checklist by trained data collectors then cleaned and analyzed. Entry was done by Epi-data version1.4.4.0, & data analysis was done using SPSS version 20.**Result**: a total of 280 patients with traumatic fracture who presented during the study period were included in the study. The mean age of study subjects was 27.7(SD ±14.8) and male to female ratio was 2.3:1. Sixty three (22.5%) of patients developed complications either at admission or discharge and 31(11.1%) of patients discharged with long term disability. Mechanism of injury, nature of fracture, and presence of pre-hospital treatment were found to be associated with the development of complications at $p<0.05$. On multivariate logistic regression analysis, fractures due to machine and sharp injuries AOR=50.931(95% CI=5.088, 509.819) and patients who has visit to traditional healers AOR=24.621(95%CI=4.472, 135.552) has significantly higher risk of developing disability.**Conclusion**: Economically active age group of the population was main victims of the problem and males were more than two times affected than females. RTA was the commonest cause of fracture. Visit to traditional healer was significantly associated with increased risk of both complications and disability. Appropriate prevention strategies should be designed and implemented against road traffic accident, machine and sharp injuries and interpersonal violence.
Keywords: trauma**,** fracture, complications, disability

1. Introduction

A fracture is a break in the structural continuity of bone and it results from injury; repetitive stress; or abnormal weakening of the bone (a 'pathological' fracture). Most fractures are caused by sudden and excessive force, which may be direct or indirect (1). Fracture epidemiology fluctuates in different parts of the world and that the spectrum of fractures presenting to different hospitals may vary considerably, for example, the incidence of fracture per 1000 population per year in Norway, USA, England, and Scotland is 22.8, 21, 21.1, and 11.13 respectively (2).

Injuries are common and on increase in most developing countries, including sub-Saharan Africa (3). The rate of injury mortality in African nations in 2004 was highest in Nigeria and lowest in Egypt. South Africa and Ethiopia were second and third, respectively (4). Most trauma outcome studies revealed that fracture is the commonest outcome of injuries. For instance, of the more than 174,000 patient records in the Major Trauma Outcomes Study in Europe, 48.6% had one or more musculoskeletal injuries (5). In the United States 60-67% of injuries that occur annually involve the musculoskeletal system. Fractures represent 25% of self-reported musculoskeletal injuries; over 16.2 million fractures are treated annually (6).

According to Kifle W. et al, in Jimma, south west Ethiopia a study done on the pattern of injury revealed that fracture was the leading outcome of injury 454(41.2%) (7). A similar study done on Interpersonal Violence related injury at St Luke Hospital, Wolisso town, Oromia Region, in 2009 also revealed that fracture was the commonest 257(67%) outcome of injury (8). According to a study by Hailemicheal et al on Magnitude and outcomes of road traffic accidents at Hospitals in Wolaita Zone the principal outcome of injury was more commonly on the extremities 308(80.2%) (9).

The growing acceptance of injuries as a preventable public health problem over the past decade or so has led to the development of preventative strategies and, consequently, a decrease in the human death toll due to injuries in some countries (10). Considering the increasing contribution of violence, injury and medical emergencies to the burden of disease, the Ethiopian Health Sector Development Program clearly gives more attention to injuries and violence among other non-communicable diseases. The plan emphasizes the importance of well-organized emergency medical system in reducing the severity and consequences of injuries and violence (7).

There is scarcity of comprehensive data on the magnitude and on the factors associated with fractures in Ethiopia. Very few hospital based studies have been carried out in Addis Ababa, but there is no such study was conducted in our facility so far. Therefore, this study was conducted to assess the factors associated with fractures and its outcomes at Wolaita Sodo University Teaching and referral hospital.

2. Methodology

The study was conducted at Wolaita Sodo University Teaching and Referral Hospital (WSUTRH), Wolaita Sodo. The Hospital is found at eastern part of Wolaita Sodo town. The town is 396 km far from the capital Addis Ababa, Ethiopia. WSUTRH is currently serving as teaching and research center in addition to its curative and rehabilitative services. It is serving about two million people in the catchment area and people including in the neighboring zones.

A facility based cross sectional study was conducted from November 5-15, 2016. A one year retrospective review of patient charts was undertaken to include all patients who presented to WSUTRH with traumatic fracture from September 2015- August 2016. The medical record number (MRN) of all patients with the diagnosis of fracture was collected from the emergency and regular OPD registration books of the hospital within the study period. The inpatient, minor and major OR registration books also checked to avoid missing of some unregistered charts at the OPD. Data collection was conducted using structured check lists. The checklist consists of three parts on the socio-demographic, injury and on the fracture characteristics and management variables of the patients. Four second year post graduate students were involved in the data collection. Data on the socio-demographic variables was found on the individual folders of the patients which is filled by the medical record room worker. Data on the mechanism of injury, fracture type and site and management type was found on the history, physical examination and operation notes of the patient charts which is documented by the treating physician. The principal investigator supervised the day to day data collection activity.

After data collection, data was checked for completeness and internal consistency manually. Then responses categorized, coded and entered in to Epi data version 1.4.4.0 computer software by investigator. Subsequently, data was exported to SPSS version 20 program for analysis. Uni-variate, bivariate and multivariate analysis methods were employed by using simple frequency counts, relative frequency percentages and cross tabulations. Association between the outcome and independent variables were determined at $p<0.05$ and OR with its 95% CI was used to show the strength of the association. The result was presented in narrative paragraphs and tables. In this study disability refers to the limitation in the ability to perform activities of daily living due to the fracture and/or its management. Includes patients who are discharged with amputations, joint stiffness, mal union, and non-union.

The ethical issue of this study was approved by the ethical committee of WSU College of Medicine and Health Sciences, and official permission to undertake the study was obtained from the College before commencement of the study. Confidentiality of patient's information was assured and information recorded anonymously. After completion of data collection, medical records were returned to their original place properly.

3. Result

During the study period a total of 314 patients with traumatic bone fracture were presented to Wollaita Sodo university teaching and referral hospital (WSUTRH). Out of this 30 charts were lost from the card room and the other 4 charts were incomplete to be included in the study. Therefore 280 charts were incorporated for analysis.

The mean age of the study subjects was 27.7 (SD ±14.8). The commonest age group is 15-25 followed by 26-35 which accounts 78(27.9%) and 72(25.7%) respectively. In this study traumatic bone fracture is more common among males 194(69.3%) than females 86(30.7%) making a male to female ratio of 2.3:1. Regarding residence most of the patients came from rural areas 149(53.2%) and the rest 131(46.8%) came from urban. Students are the commonly affected group followed by housewives and farmers accounting 80(28.6%), 33(11.8%) and 31(11.1%) respectively. (Table 1)

Table 1:- Socio-demographic distribution of patients with traumatic fracture who presented to WSUTRH from September 2015- August 2016.

Socio-demographic variables		frequency	Percentage
sex	Male	194	69.3
	Female	86	30.7
	Total	280	100
Age	0-14	58	20.7
	15-25	78	27.9
	26-35	72	25.7
	36-45	38	13.6
	46-55	18	6.4
	>56	16	5.7
	Total	280	100.0
Residence	Urban	131	46.8
	Rural	149	53.2
	Total	280	100
occupation	Student	80	28.6
	Farmer	31	11.1
	Housewife	33	11.8
	Mechanic	9	3.2
	Driver	21	7.5
	Daily laborer	16	5.7
	Merchant	18	6.4
	Gov't employee	17	6.1
	Others	12	4.3
	Missing data	43	15.4
	Total	280	100

According to this study RTA is the commonest cause of fracture among patients who presented to WSUTRH 99(35.4%) followed by fall down accident 80(28.6%) and interpersonal violence 61(21.8%). Among the 99 patients who sustains road traffic accident most of them acquired their fracture by motor bike accident 63(63.6%) and drivers are the one most affected 35(35.4%).

Table 2:-distribution of patients with fracture who presented to WSUTRH from September 2015- August 2016 by their injury characteristics.

variables		Frequency	Percentage
Mechanism of injury (n=280)	RTA	99	35.4
	Fall	80	28.6
	Inter personal violence	61	21.8
	Machine and other sharp injuries	27	9.6
	Other *	13	4.6
Type of vehicle (n=99)	Car	20	20.2
	Motor bike	63	63.6
	Three tier Bajaj	13	13.1
	Cart	3	3.1
Role of the patient at the time of RTA (n=99)	Pedestrian	33	33.3
	Passenger	31	31.3
	Driver	35	35.4

**includes animal bites and sports injury*

The study also revealed that most patients 33.2 %(93) arrived to the hospital after 7-24 hours and 74.6% of them arrived within 24 hours. One hundred thirty six (48.5%) patients has got pre-hospital treatment and out of this most of them were treated at health centers 90(66.2%) followed by traditional healer/ 'Wogesha' 23(16.9%) (Table 3).

Table 3:-distribution of patients with fracture who presented to WSUTRH from September 2015- August 2016 by their time of arrival to hospital and presence of pre-hospital treatment.

variables		Frequency	Percentage
Time taken to visit hospital (n=280)	Within 1 hour	32	11.4
	1-6 hours	84	30.0
	7-24 hours	93	33.2
	1-7 days	60	21.4
	More than 7 days	11	3.9
Pre-hospital treatment (n=280)	Yes	136	48.5
	No	77	27.5
	Missing data	67	24.0
Place of pre-hospital treatment (n=136)	Health center	90	66.2
	Private clinic	18	13.2
	Other hospital	5	3.7
	Traditional healer (Wogesha)	23	16.9

Regarding fracture characteristics the results of this study shows that upper limb and lower limb are the commonly injured anatomic sites accounting 130(46.4%) and 105(37.5%) respectively. Eight (2.9%) patients sustained injury to both limbs or bilaterally to the same limb. Out of the 243 limb fractures 48.9% of them are radial and/or ulnar and 23% of them are tibia and/or fibular. In this study most 172(61.4%) of the fractures are closed and the rest 108(38.6%) are compound fractures. Out of 184 patients for whom their radiographic data were known 47.8% and 22.8% of them are transverse and oblique respectively.

Table 4:-Distribution of patient with traumatic fracture who presented to WSUTRH by their fracture characteristics.

Variables		Frequency	Percentage
Type of fractured bone (n=243)	Humeral	27	11.1
	Radial and / or ulnar	70	48.9
	Carpal, metacarpal and phalangeal	34	14.0
	Femoral	25	10.3
	Tibia and / or fibula	56	23.0
	Tarsal, metatarsal and phalangeal	18	7.4
	Multiple bone fracture	8	3.3
	Patella	5	2.0
Radiographic pattern (n=184)	Transverse	88	47.8
	Oblique	42	22.8
	Spiral	11	6.0
	Comminuted	25	13.6
	Others (linear, depressed)	18	9.8
	Missing data	96/280	34.3

With regard to the mode of management most patients with fracture managed in outpatient basis 133(47.5%) as compared to the inpatient management which account 130(46.4%). Seventeen patients were referred to other institutions after initial treatment. The commonly employed management type is POP cast 124(44.3%) followed by internal and external fixations accounting 47(16.8%) and 25(8.0%) respectively. Amputations done for post traumatic gangrene and corrective amputations accounts 28(10%).

Table 5:- distribution of patients with traumatic fracture who presented to WSUTRH by their mode of management

Variables		Frequency	Percentage
Mode of management (n=280)	Out patient	133	47.5
	In patient	130	46.4
	Referred	17	6.1
Type of immobilization (n=280)	POP Cast	124	44.3
	Traction (skin & skeletal), Arm sling and other splinting methods	22	7.9
	External fixation	25	8.9
	Internal fixation	47	16.8
	Elevation of depressed skull fractures	6	2.1
	Amputations	28	10.0
	Others *	28	10.0

**includes conservative management with analgesics, antibiotics, or only wound care without immobilization.*

Fracture outcomes

Out of the total patients with fracture who presented to WSUTRH during the study period 63(22.5%) patients developed complications during admission or discharge and 217(77.5%) patients discharged without complications. The commonest complication is infection followed by traumatic amputations and gangrene.

The study revealed that out of the total trauma victims who presented with fracture 31 patients (11.1%) discharged with long-term disability and 202(72.1%) patients discharged well without disabilities. In this study there was no death recorded and 24(8.6%) patients lost for follow up or leave against medical advice. Four patients are still on treatment during the data collection.

For those 130 patients who are admitted the mean duration of length of hospital stay is 13 days and it ranges from 2 to 70 days.

Table 6: - distribution of patients with fracture who presented to WSUTRH by their complications during admission and discharge.

Fracture complication	frequency	percentage
Infection	18	28.6
Compartment syndrome	4	6.4
Gangrene	12	19.0
Traumatic amputation	16	25.4
Joint stiffness	6	9.5
Healing abnormalities (mal-union, delayed union, nonunion)	6	9.5
Other	1	1.6
total	63	100.0

Factors associated with development of complications and disability

To determine the factors associated with the development of complications at admission or discharge and with the development of disability at discharge the bivariate logistic regression was employed to check association between the dependent variables and the socio-demographic variables, injury characteristics, fracture and management variables. Those variables which has association with p-value less than 0.025 were selected and checked for association on multivariate analysis to control the effect of confounding factors.

On multivariate logistic regression visit to traditional healers, to private clinic and to health centers were found to be associated with increased risk of developing complications. Similarly being compound fracture and fractures caused by machine and sharp injury and interpersonal violence were associated with increased risk of complications. Machine and sharp injuries like axe and knife were 50.9 times higher risk of developing disability than RTA on multivariate analysis. Similarly patients who visit traditional healers has 24.6 times higher risk of developing disability than those who has no pre-hospital treatment. Table 8: Multivariate logistic regression analysis of selected variables with their final outcome for patients who presented with traumatic fracture to WSUTRH.

Variables	Response	Outcome		Odds Ratio with 95% confidence interval	P-value
		With disability	Without disability		
Mechanism of injury	RTA N=79	2 (2.5%)	77 (97.5%)	1.0	
	Falling N= 67	10 (14.9%)	57 (85.1%)	4.092 (.844,19.840)	.080
	Interpersonal violence N=52	5 (9.6%)	47 (90.4%)	4.226 (.365,48.982)	.249
	Machine and sharp injury N=26	13 (50%)	13 (50%)	50.931 (5.088,509.819)	.001
	Other N=9	1 (11.1%)	8 (88.9%)	5.530 (1.223,25.011)	.026
nature of fracture	compound n=91	21(23.1%)	70(76.9%)	7.487 (1.620,34.609)	.010
	Closed N=142	10(7.1%)	132(92.9%)	1.00	
Presence of pre-hospital treatment	No pre-hospital treatment N=64	7(11.0%)	57(89.0%)	1.00	
	Visit to other health facility N=92	11(12%)	81(88.0%)	20.517 (4.295,98.024)	.000
	Visit traditional healer/ Wogesha N=22	11(50%)	11(50%)	24.621 (4.472,135.552)	.000

4. Discussion

This study revealed that 150(53.6%) of the victims were in age group of 15-35 years which is consistent with other similar studies (11, 12, 13, 9) This shows that a large amount of sufferers are people of most economically active age group that subsequently leads an economic lost both to the family and the nation. The results of this study also found that males 194(69.3%) were much more likely to suffer from fractures than females 86(30.7). This is likely due to the nature of work exposing, majority of males on streets or the increased level of participation in high-risk activities among male individuals.

RTA was the commonest cause of fracture in this study followed by fall down accident and interpersonal violence which accounts 35.4%, 28.6%, and 21.8% respectively. Which is similar to the study done in Jimma by Kifle W. et al 334(30.3) (7) and but lesser frequency was observed in this study than a study done by Wondimagegne P. et al in Sodo Christian Hospital 47% (14) and a study done by Daniel et al at Tikure Anbessa hospital which also shows a higher percentage of RTA 47.7% (202) (13). The prevalence of RTA was also found to be higher in Nigeria and Pakistan 125(57.87%) and 1090(59.23%) respectively (11, 12,). This lower frequency of RTA in this study may be due to increased frequency of patients coming from rural areas with fall down and interpersonal violence or a genuine decrease in the occurrence of RTA which needs a further study.

After trauma the first hour is called the golden hour because most deaths can be prevented if patients present within this hour. The first 6 hours are crucial after fracture because most infections, compartment syndrome and development of gangrene can be prevented. The current study revealed that most (74.6%) of patients arrived to hospital within 24 hours in contrary to a research done in Wollaita Zone by Hailemechael et al which shows 301 (78.4%) of trauma victims were presented to the hospitals within 24 hours to one week of the injury (9). In Jimma most of injury patients were presented to the hospital within one week, 715(95.8%) (9). In Addis Ababa a study done on RTA majority of patients presented to the OPD within 4 hours 120 (57.4%) (15).

Upper limb fractures found to be the commonest anatomic site and the radius/ulna is the single most commonly fractured bone in this study which is in contrary to other similar studies ((11, 12, 13, and 9). A study done at Tikure Anbesa Hospital on pattern of childhood fractures revealed similar results upper limb being (66.2%) and lower limb accounting 33.2% (16). Another similar result was found in a study done in NE India Upper limb fractures were more common than lower limb fractures. Radius and ulna are the commonest bone types (39%) affected (17).The upper extremities play a very essential role in mobility and control especially with the use of motorcycles which are a common mode of transportation in the area of study. The relatively younger age predominance and the relatively higher proportion of falling accident associated with upper limb fracture in

this study may explain this.

The management of compound fractures has always remained a challenge because of serious morbidity. In line with other studies closed fractures 172(61.4%) are the commonly encountered fracture types in this study but compound fractures 108(38.6%) are also found at a higher frequency than in the studies done at Tikure Anbessa hospital by Daniel et al and by Birhanu et al (16, 13), Lahore (Pakistan) (11) and Sodo Christian Hospital (14).

The average length of hospital stay in this study is 12 days which is comparable to the study done in St Luke, Jimma and Wollaita Zone 10.9, 14, and 7 respectively.

In this study 63(22.5) of patients developed complications during admission or discharge and infection was found to be the commonest complication. Out of this 31 (11.1%) of patients discharged with long term disability. In Saudi the overall complication rate was 149 (13.5%). Superficial and deep infections were 49(4.45%) the commonest complications observed (18). In a study done at Sodo Christian Hospital by Wondimagegne P. et al also found that a 123 (56.2%) complication rate among patients presenting to the hospital with fracture of which stiffness of joint (44.72%) was proportionally high(14). In a study done at similar Zone with the index study on RTA also revealed of all victims reaching hospital, 23 (6%) died, 48 (12.5%) survived with long term disability on discharge and 313(81.5%) survived without long term disability on discharge (9). Therefore, the complication rate found in this study is comparable with other studies.

Although, efforts were made to compensate the following are limitations of the study. Since it is a retrospective study it was difficult to collect data on some risk factors for trauma like educational level and details of pre-hospital treatment given. It is difficult to assess the final outcomes of patients who are still on follow-up, those who are referred and lost for follow up which comprises 16.8%. Therefore, the prevalence of disability might have been underestimated.

5. Conclusion and Recommendation

Males, young age group, students and people who came from rural are the commonly affected groups. This shows that a large amount of sufferers are people of most economically active age group that subsequently leads an economic lost both to the family and the nation. RTA is the commonest cause of fracture and interpersonal violence, and machine & sharp injuries are associated with development of complications and disability. Most patients arrived to hospital within 7-24 hours. Compound fractures are encountered at a higher frequency than other studies and it was significantly associated with the development of complications. In this study the admission rate of patients with fracture is higher than those observed in JUSH and St Luck H. Operative management of fractures at WSUTRH is found to be higher. In this study 23(16.9%) of patients has visit to traditional healer and it was significantly associated with increased risk of both complications and disability.

Therefor,

- Appropriate prevention strategies should be designed and implemented against road traffic accident, machine & sharp injuries and interpersonal violence.
- Organized trauma center should be built for early management and prevention of secondary complications of traumatic fractures at WSUTRH.
- Because of higher prevalence of compound fractures and higher admission rate and operative management orthopedic department should be strengthened at WSUTRH.
- Health education on the adverse effect of tight splinting of fractures should be given to traditional healers and law enforcement should be in place to make them responsible for early referral of patients.
- Health professionals working in health centers and private clinics should be trained on the management of traumatic fractures before referral and on the importance of early referral to an orthopedist.
- Further large scale study should be conducted at the community level to assess the factors associated with fracture complications.

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