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Original Article

Being Children and Delayed Presentation are Main Risk Factors for Developing Complications Following Traditional Bone Setting in Southern Ethiopia: Findings from a Facility Based Study

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Abstract

Background *Traditional bone-setting (TBS) can be associated with many life- and limb-threatening complications. The aim of this study was to explore risk factors for complications among trauma patients who presented to our institution after TBS.*

Methods*: A prospective institutional-based study was conducted from July 2020 to June 2021. Two hundred thirty patients who first visited Traditional Bone Setters and presented to hospital were included. A structured, pre-tested questionnaire was used to collect data by trained healthcare professionals through face-to-face interviews. Binary logistic regression analysis was used to measure the association between independent and dependent variables. The presence of a statistically significant association was declared using a 95% confidence interval (CI) and a P-value less than 0.05.*

Results*: Over two-thirds (62.6%) of the patients suffered a complication requiring presentation to the hospital. In the multivariable logistic regression model, younger age (AOR = 2.43, 95% CI = 1.21, 4.92), longer time interval between initial injury and arrival at the hospital (AOR = 7.40, 95% CI = 3.86, 14.20), and the region where the patients live (AOR = 2.05, 95% CI = 1.06, 3.40) were significantly associated with complications.*

Conclusions*: The magnitude of complications among trauma patients who first visited TBS was unacceptably high. Younger age, delayed presentation, and the region where the patients live were the main risk factors. There is a need for a collaborative effort by stakeholders to increase the safety, affordability, and accessibility of modern musculoskeletal care throughout the country.*

Keywords*: Trauma, Traditional bone setting, Complication, Ethiopia, BOSAD study*
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Introduction

Traditional bone-setting (TBS) is a practice by a non-medically trained practitioners who care for musculoskeletal (MSK) injury without having any formal training. It is deeply rooted in the community and patronized with many individuals living mainly in rural areas where the availability and access for modern orthopedic service is significantly limited (1–4). TBS has been practiced widely all over the world before modern medicine became available (5).

Despite the access and availability of modern orthopedic care, in most African countries including Ethiopia, TBS has been patronized in the community as an effective alternative to modern orthopedic care for MSK injuries (6–11). More than 80% of trauma patients in Sub-Saharan Africa and two-thirds of patients with fractures and dislocations in Nigeria use TBS as a first port of treatment (9,12–14).

TBS practice is associated with many life-and limb-threatening complications. For example, a study done in Nigeria has shown that 41% of patients had a non-union and 24.5% had a mal-union after sustaining a fracture (13,15).

Ethiopia is also one of the countries where TBS practitioners are deeply rooted in the community and result in catastrophic preventable complications, including death and disability. A study done in the southern part of Ethiopia has shown that more than 57% of the patients with a fracture first visited a TBS before presenting to an orthopedic clinic. At that time, most of the patients presented with many complications, including joint stiffness (53%), severe infection, mal-union (9%), limb length discrepancy (6%), and 4.3% gangrene (16).

In Ethiopia, despite the increasing number of orthopedic surgeons and the uplifting availability of modern orthopedic care, the practice of TBS remains popular with many devastating complications (17). These complications vary from country to country, bone setter to bone setter, and method of splinting, either bamboo, wood, or carton with tight rope. Most of the complications are preventable if appropriate application is taken with the responsible stakeholders.

To our knowledge, we haven't seen any nationally organized prospective study in Ethiopia to decrease the rate of amputation and prevent other complications, despite numbers of retrospective study that have been published. To provide valuable information for policymakers, a large multicenter national Bone Setting Associated Disability (BOSAD) study was initiated. Before launching to the national label, a pilot study was conducted to assess the data collection questionnaires, and the nature of the BOSAD study website for competency and validity.

Our hypothesis was patients who visited TBS prior to the modern orthopedic services are at increased risk of developing complications. The objective of this study was to describe the determinants of complication among patients first visited TBS before presenting to Hawassa University Comprehensive Specialized Hospital (HUCSH) for orthopedic care.

Methods and Materials

Study setting, study design and study period

The study was conducted at HUCSH, Hawassa City, Ethiopia, which is the capital of Sidama Region, located 275 kilometer south of Addis Ababa (capital of Ethiopia). It was an institution-based prospective observational study conducted from July 2020 to June 2021, over one year period, as part of a large multicenter BOSAD study.

Sample size calculation and sampling

The sample size was calculated by Statistical online sample size calculator based on the proportion of severe infection (8.5%) as one of major complication reported from Kumma et al. study in Wolaita Sodo, Ethiopia (16), using anticipated complication rate of 3.6, 95% confidence interval with alpha of 0.05 and 80% power of the study. The final sample size after adding 10% of non-response rate was 230 patients. All patients who came consecutively during the study period were included in the study.

Dependent and Independent Variables

The presence of TBS associated complications was the dependent variable and the rest including sociodemographic variables such as age, sex, marital status, average monthly income, time from first injury to hospital arrival, recent TBS visit, place of residence, and region were independent variables.

Inclusion and exclusion criteria

All Musculoskeletal (MSK) trauma cases who first visited traditional bone setters before seeking orthopedic care from health facilities and presented to HUCSH were included. Patients or guardians who refused to give consent to be included in the study and those at high risk of strangulation during the follow up were excluded.

Operational definition

Complication- was labelled as "yes" or "present" when the patient report or clinically or radiologically diagnosed one of the major complications on the bone, joint, neurovascular, skin, muscle, systemic and other body part after they get treated by TBS practitioner and seek medical attention for the complaint.

Data collection

Data were collected using a structured, pre-tested questionnaire translated into the local language (Amharic) by face-to-face interviews with the patients themselves or their families, and guardians for pediatric patients. Trained BOSAD study data collectors were collecting the data and entered the BOSAD study data collection website at bosadstudy.com which was a password-protected platform developed for this purpose.

Statistical Analysis:

The data was exported into Statistical Package for Social Sciences (SPSS) version 24.0 for cleaning and analysis. Descriptive statistics were used to summarize the data. A binary logistic regression model was employed to identify factors associated with complications. In the multivariable logistic regression model, the magnitude of the association between complications and related factors was estimated using an odds ratio with a 95% Confidence Interval (CI). Finally, the findings were described in words, tables, and figures. A p value < 0.05 was considered the cut-off point to declare a statistically significant association between independent and dependent variables.

Ethical Considerations

The study was conducted after getting ethical approval from Hawassa University, College of Medicine and Health Sciences Institutional Review Board (IRB)

office with reference number of IRB/280/12. Informed and written consent was obtained from each participant before enrolment into the study. The anonymised data was used for the intended purpose only and it was stored in password protected server which is accessed only by the principal investigator

Results

Socio-demographic characteristics of study participants

Overall, 230 MSK trauma patients were included in the study. Most of the patients, 69.6%, lived in urban residence. Nearly one-third (29.1%) of the patients were children less than 15 years-old, with a median (interquartile range (IQR)) of 25 (12 to 40) years. Over two-thirds (63%) of the patients were from Sidama Regional State; 69.6% of them were males; and 70.8% of those in reproductive age groups were married (Table 1).

Injury and complications related characteristics of study participants

Falling down accident was the main mechanism of injury (62.2%), and upper extremity was mostly affected body part (56.5%). The majority, 88.3% of the patients, had fracture with 88.7% closed in nature, whereas the remaining 11.7% were having soft tissue injury only without fracture. Over one in ten patients (12.2%) presented to the hospital with the splint applied by TBS where the most common splint type was tight towel bandaging in 46.6% followed by bamboo in 42.4%. A considerable proportion of patients, 113 (49.1%), had topically applied herbal medication as a treatment remedy.

Over two-thirds (62.6%) of the patients had a complication at presentation to the hospital. The most common complications reported included joint stiffness (30.4%), deformity (21.7%), skin sores and maceration (13.2%), and mal-union (12.6%) (Table 2).

Moreover, 58 (25.2%) patients visited a traditional bone setter after visiting health facilities as a first encounter. The main reasons for going back to traditional bone setting from the heath facilities included family or peer pressure in 24 (41.4%) patients, lack of organized care in the health facilities in 15 (25.9%), lack of timely admission or long waiting list 3 (5.2%), fi-

Table 1. Socio-demographic characteristics of study participants included in the study from July 2020 to June 2021

Variables (n=230)		Frequency	Percent
Place of residence			
	Urban	160	69.6
	Rural	70	30.4
Age group in years			
	0-14	67	29.1
	15-64	152	66.1
	65 and above	11	4.8
Sex			
	Male	160	69.6
	Female	70	30.4
Region			
	Sidama	145	63.0
	Oromia	72	31.3
	SNNPR	11	4.8
	Somali	2	0.9
Marital status (n=161)			
	Single	47	29.2
	Married	114	70.8
Educational status of patients			
	No formal education	44	19.1
	Primary school	108	47.0
	Secondary school	35	15.2
	Diploma and above	43	18.7

nancial reason to be treated in a health facility 11 (19.0%), and others 5 (8.5%).

Factors associated with complications among trauma patients

In the multivariable logistic regression model, younger age less than 15 years-old (AOR 2.43, 95% CI 1.21,

Table 2. Injury and complications related characteristics of study participants from July 2020 to June 2021

Variables		Frequency	Percent
Mechanism of injury (n=230)			
	Road traffic accident	46	20.0
	Falling accident	143	62.2
	Fight/assault	34	14.8
	Others	7	3.0
Specific area involved (n=230)			
	Upper extremity	130	56.5
	Lower extremity	85	37.0
	Pelvic and hip area	15	6.5
Type of Injury (n=230)			
	Soft tissue only without fracture	27	11.7
	Closed fracture	176	76.5
	Open fracture	27	11.7
Fracture Nature (n=203)			
	Closed	180	88.7
	Open	23	11.3
Splinted at presentation (n=230)			
	Yes	28	12.2
	No	202	87.8
Herbal Medication use			
	Yes	113	49.1
	No	117	50.9
Presence of Complication at presentation			
	Yes	144	62.6
	No	86	37.4
Type of complications (n=299) [1]			
	Skin Sore and maceration	39	13.2
	Chronic Osteomyelitis and septicaemia	22	7.4
	Malunion	37	12.4
	Non union	13	4.3
	Joint Stiffness	91	30.4
	Deformity	65	21.7
	Missed compartment syndrome and Volkman's Ischemic Contracture	9	3
	Gangrene	7	2.3
	Amputation	7	2.3
	Others[2]	9	3.0

[1]There is more than one report of complication per patient, a total of 299 complications are reported from 144 patients.

[2]Includes nerve palsy, septic joint, and muscle atrophy

Table 3. Determinants of complication among study participants from July 2020 to June 2021

Variables	Complication		COR (95% CI)	AOR (95% CI)	P-value
	Yes	No			
Region					
Sidama	80	65	1.00	1.00	
Others	64	21	2.48(1.37, 4.47)	2.05(1.06, 3.40)	0.033
Time from injury to hospital arrival					
<22.5 months	49	66	1.00	1.00	
>22.5 months	95	20	6.40(3.49, 11.75)	7.40(3.86,14.20)	<0.001
Patient's age in years					
<15	47	20	1.60(0.87, 2.94)	2.43 (1.21, 4.92)	
≥15	97	66	1.00	1.00	0.013

Discussion

Our study presented the bone-setting related complications among MSK trauma patients who first visited TBS before coming to health facilities. The study showed that 63% of the trauma patients who visited TBS had complications at presentation to the hospital. This complication rate is slightly higher than the rate of complications reported from Kumma et al. done 10 years back from Wolaita Sodo, Ethiopia which was 56.91% (16), but slightly lower than Memon et al. prospective report from Pakistan which report complication rate of 79.3% (19). This shows that even though the number of orthopedic surgeons and modern health facilities increasing in Ethiopia, TBS practice is still significantly high, and complications are being seen in the southern part of the country. The high rate of complications in our study are due to the technique utilized by the bone setters like tight bandaging and bamboo splinting, which hinder the blood circulation and cause skin sore, maceration, gangrene, and joint stiffness with mal- or non-united fractures due to inadequate stabilization at the fracture.

Most reported complications from this study were joint stiffness accounting 30.4% followed by deformity (21.7%), soft tissue complications (13.2%) and malunion (12.7%). In our study, the rate of amputation after TBS practice was reported to be 2.3%. Even though the frequency of complications are different, the type of complications reported in our study are almost similar with other studies reported from different parts of resource limited countries where modern orthopedic services are less developed or inexistence (13,16,19–21). This again prove that there are a lot of similarities of technical problem from the bone setter splint which should be improved to at least decrease the frequency of preventable complications.

In contrast to prior studies entered solely on the perspective of bone setters, our investigation aimed to uncover potential gaps within health facilities that might drive patients to seek treatment from traditional bone setters. Our findings revealed that 58 (25.2%) patients initially sought care from a traditional bone setter despite the availability of health facilities. The primary reasons for patients returning to TBS after visiting health facilities were diverse including 24 (41.4%) due to familial or peer pressure, 11 (19.0%) because of financial constraints associated with health facility treatments, 15 (25.9%) due to perceived lack of organized care within health facilities, 3 (5.2%) faced challenges related to timely admission or lengthy waiting lists, and 5 (8.5%) cited other reasons. We contend that the 25% of patients who initially sought care from health facilities but later returned to traditional bone setters, subsequently representing to health facilities with complications, represent missed opportunities. This underscores the pressing need for health institutions to enhance the competence of healthcare professionals in diagnosing and treating MSK injuries. Moreover, there is a crucial need to provide safe and affordable services accessible to all patients, promote community awareness about available healthcare options, and strive towards creating more favorable and organized care environments within health facilities. Addressing these issues is imperative to mitigate the trend of patients resorting to traditional bone setters despite initial contact with health facilities and subsequent complications.

In our study, we observed a significant association between younger age less than 15 years-old (AOR 2.43, 95% CI

1.21,4.92) with occurrence of complications. This pediatric population often relies on families or guardians to make treatment decisions and consequently, they may be taken to TBS without their consent about their treatment and leading to complications. This vulnerable segment of the population necessitates legal protection to mitigate the risk of complications arising from treatments decided upon without their informed decision. Safeguarding their rights in healthcare decision-making is crucial to minimize the occurrence of complications and ensure their wellbeing. Similarly, longer time between initial injury and arrival at the hospital (AOR 7.40, 95% CI 3.86, 14.20), and the region where the patients lived (AOR 2.05, 95% CI 1.06, 3.40) were significantly associated with the presence of complications. These all entail that the modern health facilities need to work towards delivering safe, affordable and accessible musculoskeletal care for the needy patients, so that the complications from TBS practice will be significantly reduced.

The limitation of this study is its nature of being facility -based where it will present the significantly injured or complicated cases and it may miss patients who perceived as they successfully get treatment from TBS and return to their activities which need community-based study to address this issue. Our study is also a single institution-based study which is difficult to generalize to the whole nation and it would have been good to make it multicenter in order to have the overall picture of the problem throughout the country. The strength of this study includes being prospective, data collected with the website developed to enhance the quality of data.

Conclusion

The magnitude of complications among MSK trauma patients who first visited TBS practice was significantly high despite the increased number of modern health facilities and orthopedic services throughout the country. The risk factors for complications were younger age, delayed presentation to the hospital, and the region where the patients lived. The Ministry of Health, Non-governmental organizations, healthcare professionals, and other stakeholders need to work hard to deliver safe, affordable, and accessible musculoskeletal care throughout the country to minimize TBS associated complications.

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Conflict of Interest

The authors declare that there is no conflict of interest about this publication.

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