Complications of Fracture and Dislocation Treatment By Traditional Bone Setters: A Private Practice Experience

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ABSTRACT

Background: Traditional bone setting is common in developing nations. The principles of bone setting, although differing slightly among cultures are similar. The practice is not without its shortcomings as patients who have received prior traditional bonesetters (TBS) care usually present with complications to hospitals. This study seeks to document the complications seen as a result of TBS treatment of fractures and dislocations at a private ortho-trauma centre.

Methods : A prospective study of consecutive patients with fractures and dislocations who had received treatment from traditional bonesetters and were seen and managed afterwards at Rehoboth Specialist Hospital , Port Harcourt from 1st January 2007 to 31st December 2007 .

Results: During the study period, 71 patients were seen, consisting of 38 males and 33 females with a male to female ratio of 1.15:1. Their ages ranged from 4 years to 80 years with an average of 33.75 years. The most frequent age brackets were 20-29 years (32.39%) and 30-39 years (22.53%). Those with secondary and tertiary education constituted 81.69% of the total. More patients first consulted the TBS (63.38%) than orthodox practice (36.62%) after the injury. There were 74 fractures (86.05%) and 12 dislocations (13.95%) with more of the injuries occurring in the lower extremity. The most frequent aetiology was road traffic accidents, mostly motor-cycle related, followed by falls and sports injuries. Those who spent 4 months or more with the TBS before presentation constituted 69%. The most frequent complications were nonunion (36.47%) and malunion (24.71%) and both were associated with shortening in 31.76%. Other complications were chronic joint dislocation, ankylosis, joint stiffness, arthrosis/arthritis, chronic osteomyelitis, Volkmann's ischaemic contracture, osteonecrosis, neuropathy, limb gangrene, delayed union and pressure ulcer. The most frequent intervention was open reduction and internal fixation (60.56%) and most of the patients (78.87%) spent 4 weeks or less in the hospital. There was no mortality in this series.

Conclusion: Complications following treatment of fractures and dislocations by TBS are common. The common complications include non-union, malunion which were both associated with shortening as well as chronic joint dislocation, although the largely avoidable limb gangrene still occurred. There is a need for basic training of TBS for them to be integrated into the primary care system.

Keywords: Traditional bonesetters; Fractures; Dislocations; Complications.

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INTRODUCTION

Traditional bone setting is widespread in developing nations [1 3]. Even in the industrialized nations of the world, the services of bonesetters are also utilized [3 5]. Orthopaedic surgeons have been described as inheritors of tradition [3]. A pioneer orthopaedic surgeon, Hugh Owen Thomas, was from a lineage of bonesetters and learned the art of bone setting from his father[3]. He subsequently took over his father's practice and he also made significant contributions to the development of orthopaedic surgery.

The practice of bone setting may differ between communities but certain characteristics are common to all. The practitioners are uneducated or barely educated [1,4,5-7], and they rely so much on experience [1,4,8-10] and spiritual intuition [1,7,9] . The practice is usually preserved as a family practice [1-4,8,10,11] with the usual scenario being that it is passed from father to son . Training is via apprenticeship [1,2,10,11] and by this , individuals outside the family can acquire their skills . Their records are usually kept by oral tradition [8,11] .

The principles of traditional bonesetting, although differing slightly among cultures, are generally similar. The process entails making a diagnosis, reduction of the fracture by manipulation and massages, fomentation of the site, application of herbal creams with or without scarification, immobilization of the fracture by use of splints and bandaging [2,7,8,10,12-17]. The diagnosis is based on physical assessment and the traditional bonesetter notes such features as swellings , pain , loss of function, tenderness, limb shortening or deformity, presence of a gap between broken fragments, abnormal mobility and crepitation on palpation of the fracture site as features of fractures[2,8,10]. The reduction is carried out closed by traction or manipulation by local pressure and without anaesthesia [8,10] . The fractured part is usually fomented with hot water or heat and massaged with herbal concoction cream [2,8,10,13,14,17] . The scarification is carried out to let out 'bad blood' [8,16] . The traditional splints utilized include wood, bamboo, rattan cane and palm leaf axis [2,8,10 11,13-17]. The splinting materials are knitted into mat-like splint and applied over the fracture site [8,11,17]. Usually the joints above and below the fracture site are not immobilized. The splint is usually applied without a padding and is bandaged tightly most times [8,10,17] . The splints are removed at varying intervals and the part massaged and re-

splinted until there is empirical evidence of union [8,17].

The practice of bone setting is not without its shortcomings. Traditional bonesetters are known in hospital practice for their failures and complications which present to hospitals[17] for remediation. In Nigeria, it is estimated that 80% of fracture morbidities in our hospitals occur as a result of traditional bonesetter's practice [8]. This study therefore seeks to document the complications seen as a result of traditional bonesetters treatment of fractures and dislocations at a private ortho-trauma centre.

PATIENTS AND METHODS

This was a prospective study of consecutive patients with fractures and dislocations who had received treatment from traditional bonesetters and were subsequently seen and managed at Rehoboth Specialist Hospital, Port Harcourt. The hospital is a private ortho-trauma centre in Port Harcourt and is run by an orthopaedic/trauma surgeon. The study was carried out from 1st January 2007 to 31st December 2007.

The socio-demographic data , first consult after injury , distribution of the injuries , aetiology of the injuries ,duration of treatment with the traditional bonesetters , complications , definitive treatment received , duration of hospital stay and mortality were collected and entered into a proforma . Data was analyzed by descriptive statistics and expressed in texts and tables.

RESULTS

During the period of the study, 71 patients with fractures and dislocations who had been treated by traditional bonesetters before presentation were seen. A total of 86 musculoskeletal injuries were seen in these patients. There were 38(53.52%) males and 33(46.48%) females giving a male to female ratio of 1.15:1. Their ages ranged from 4 years to 80 years with an average age of 33.75 years. The age and gender distribution of the patients is shown in Table 1.

Table 1. Age and gender distribution of the patients

	Gender		
Age (Years)	Male n (%)	Female n (%)	Total n (%)
0 9	3 (4.22)	3 (4.22)	6 (8.45)
10 19	1 (1.41)	4 (5.63)	5 (7.04)
20 29	12 (16.90)	11 (15.49)	23 (32.39)
30 39	11 (15.49)	5 (7.04)	16 (22.53)
40 49	5 (7.04)	1 (1.41)	6 (8.45)
50 59	4 (5.63)	4 (5.63)	8 (11.27)
60 69	1 (1.41)	4 (5.63)	5 (7.04)
70 79	1 (1.41)	0 (0)	1 (1.41)
80 89	0 (0)	1 (1.41)	1 (1.41)
	38 (53.52)	33 (46.48)	71 (100)

Figures in parenthesis are percentages

The most frequent age brackets were the 20 29 years and 30 39 years age groups and both constituted approximately 55% of the total number.

When further classified, those aged 0 15 years constituted 12.68%, 16 49 years constituted 66.20% , 50 69 years constituted 18.31% and those 70 years and above constituted 2.82%

There was one patient (1.41%) with no formal education, 12 (16.90%) with primary, 28 (39.44%) with secondary and 30 (42.25%) with tertiary levels of education. Those with secondary and tertiary education constituted 81.69% of the total number of patients. After the injury, 45(63.38%) consulted the traditional bonesetter first while 26 (36.62%) consulted an orthodox practice.

Table 2 shows the distribution of the injury type by the affected extremity, bone/joint and side. There were 74 fractures (86.05%) and 12 dislocations (13.95%). Thirty seven (43.02%) of these injuries occurred in the upper extremity while 49 (56.98%) occurred in the lower extremity. The most frequent fractures in the upper extremity occurred in the humerus [13(15.12%)] followed by the radius [8(9.30%)]. For the humeral fractures, 10 occurred on the right while 3 occurred on left side; 2 of the radial fractures occurred on the right and 3 on the left side. In the lower extremity, the most frequent fractures were in the femur [16(18.60%)] followed by the tibia [15(17.44%)]. For the femoral fractures, 4 occurred on right and 12 on the left side while for the tibial fractures, 6 occurred on the right and 9 on the left side. In the upper extremity , the most frequent dislocation was of the elbow [3(3.49%)] followed by the shoulder(glenohumeral) [2(2.33%)] and in the lower extremity only hip dislocations [3(3.49%)] were seen. For the elbow dislocations, 2 occurred on the right and 1 on the left while the 2 shoulder (glenohumeral) dislocations occurred on the right. All the hip dislocations occurred on the right side.

Table 2 . Distribution of injury type by affected extremity, bone/joint and side

			Side		
Extremity	Injury type	Bone/Joint	Left	Right	Total (%)
Upper	Fractures				
		Humerus	3	10	13 (15.12)
		Radius	4	4	8 (9.30)
		Ulna	3	2	5 (5.81)
		Metacarpal	1	0	1 (1.16)
		Clavicle	1	0	1 (1.16)
		Subtotal	12	16	28 (32.56)
Lower		Femur	12	4	16 (18.60)
		Tibia	9	6	15 (17.44)
		Fibula	5	4	9 (10.47)
		Patella	1	1	2 (2.33)
		Ankle	1	2	3 (3.49)
		Calcaneum	1	0	1 (1.16)
		Subtotal	29	17	46 (53.49)
Upper	Dislocations				
		Shoulder (Glenohumeral)	0	2	2 (2.33)
		Acromioclavicular	0	1	1 (1.16)
		Elbow	1	2	3 (3.49)
		Wrist	0	1	1 (1.16)
		PIP	1	0	1 (1.16)
		MCP	0	1	1 (1.16)
		Subtotal	2	7	9 (10.47)
Lower					
		Hip	0	3	3 (3.49)
		Grandtotal	43	43	86 (100)

Figures in Parenthesis are percentages
PIP= Proximal interphalangeal
MCP= Metacarpophalangeal

The aetiology of the injuries is shown in Table 3. The most frequent cause was road traffic accidents [30(42.25%)] followed by falls [22(30.99%)] and sports injuries [7(9.86%)].

Table 3. Aetiology of injuries

Aetiology	Number	Percentage
RTA	30	42.25
Falls	22	30.99
Sports injury	7	9.86
Civil violence	5	7.04
Gunshot injury	3	4.23
Jumped from moving vehicle	1	1.41
Hit finger against an object	1	1.41
Domestic accident (collapsed stool falling on patients leg)	1	1.41
Tree fell on patients knee	1	1.41
	71	100

RTA = Road traffic accidents

Of the road traffic accidents , 18 were motorcycle related ; involved were 2 motorcyclists (drivers) , 12 pillion riders (passengers on motorcycles) , and 4 pedestrians (motor cycle hitting the pedestrian) . Motor vehicle collisions were the cause in 6 patients and these were all passengers. It was pedestrian related in a total of 7 patients ; 4 (already mentioned) involved motorcycles , 2 involved cars hitting the pedestrians ,and in 1 , a trailer hit the pedestrian. Summersaulted vehicles were involved in 3 and all were passengers.

The falls were from the same level in 13 patients and were from a height in 9. Of the 9 who fell from a height, 2 fell from steps, 1 from a table, 3 from trees, 1 from a broken chair, 1 from a roof and 1 from a storey building.

The duration of treatment with the traditional bone setters is shown in Table 4. Those who spent 4 months or more with the bonesetters constituted 69% of the study population.

Table 4 . Duration of treatment with traditional bone setters

Duration (Months)	Number	Percentage
0 1	5	7.04
2 3	17	23.94
4 6	16	22.54
7 12	19	26.76
>12	14	19.72
	71	100

There were 85 complications in these patients. The most frequent complications were nonunion [31(36.47%)] , malunion [21(24.71%)] , chronic joint dislocations [8(9.41%)] , and ankylosis [5(5.88%)] . This is shown in Table 5.

Table 5. Complications in patients

Complications	Number	Percentage
Nonunion	31	36.47
Malunion	21	24.71
Chronic joint dislocation	8	9.41
Ankylosis	5	5.88
Joint stiffness	4	4.71
Arthrosis/Arthritis	3	3.53
Chronic osteomyelitis	3	3.53
Volkmann ischaemic contracture	2	2.35
Osteonecrosis	2	2.35
Neuropathy	2	2.35
Gangrene	2	2.35
Delayed union	1	1.18
Pressure ulcer	1	1.18
	85	100

In the upper extremity, there were 8 nonunions with 2 being associated with shortening. Five of the upper extremity nonunions occurred in the humerus with 2 associated shortening occurring in this bone. There were 2 nonunions in the radius and 1 nonunion in the ulna.
In the lower extremity, there were 23 nonunions with 11 associated with shortening. There were 9 nonunions in the femur, 7 nonunions in the tibia, 3 nonunions in the fibula, 2 nonunions in the patella and 2 nonunions in the ankle. The shortenings occurred in the following frequencies femur (8), tibia (2) and fibula (1).
Malunion in the upper extremity occurred most frequently in the radius (3) followed by the ulna (2) and humerus (2) while in the lower extremity it occurred most frequently in the femur (5) and tibia (3).
The shortening as a result of malunion was found mostly in the radius (2), ulna (2), and humerus (1) in the upper extremity and mostly by the femur (5), tibia (1) and fibula (1) in the lower extremity.
In all, shortening was a consequence of nonunions in 13 fractures and of malunions in 14 fractures. Consequently, shortening occurred in 27 fractures in association with nonunion/malunion thus accounting for 31.76% of the complications.

Figure 1 shows nonunion of femoral fracture with shortening and Figure 2 shows malunion of femoral fracture with shortening from traditional bone setters practice seen in this study.

The ankylosis was bony in 1 and fibrous in 4.
The neuropathy involved the radial nerve in 1 and the common peroneal nerve in another. There were 2 patients with limb gangrene. Figure 3 shows limb gangrene in one of them.
The definitive treatment received by the patients is shown in Table 6. The most frequent intervention was open reduction and internal fixation (60.56%), followed by manipulation under anaesthesia (9.86%) and open reduction (8.45%). Sequestrectomies, arthroplasties, amputations and tendon transfers were also carried out.

Table 7 shows the type and duration of hospital stay for the patients. Most of the patients (78.87%) spent 0-4 weeks in the hospital.
There was no mortality in this series.

Table 6 . Definitive treatment received

Treatment	Number	Percentage of patients
ORIF	43	60.56
MUA	7	9.86
Open reduction	6	8.45
Casting	3	4.23
Sequestrectomy	3	4.23
Soft tissue release	3	4.23
Physiotherapy	2	2.82
Hemiarthroplasty	2	2.82
Total hip replacement	2	2.82
Amputation	2	2.82
Curtis arthroplasty	1	1.41
Corrective osteotomy	1	1.41
Tendon transfer	1	1.41
Total knee replacement	1	1.41

ORIF = Open reduction and internal fixation
MUA = Manipulation under anaesthesia

Table 7 . Type and duration of hospital stay

Type	Duration	Number	Percentage
Outpatient		2	2.82
Inpatient	d 4 weeks	56	78.87
	5-8 weeks	9	12.68
	9-12 weeks	2	2.82
	13-16 weeks	1	1.41
	>16 weeks	1	1.41
		71	100

Figure 1 - Plain radiograph of femoral nonunion from TBS treatment

Figure 2 - Plain radiograph of femoral malunion from TBS treatment

Figure 3 - Right leg gangrene from TBS Treatment

DISCUSSION

This study has shown that complications are common with traditional bonesetter's treatment of fractures and dislocations. The most common complications are nonunion and malunion and these are commonly associated with shortening.

In the present series, there was a slight male preponderance with a male to female ratio of 1.15:1 . Dada and colleagues [18] reported a male to female ratio of 1.3:1 , OlaOlorun et al [19] reported a ratio of 2:1 , Ikpeme et al [7] and Solagberu [20] reported a ratio of 2.1:1 ,while Ogunlusi and colleagues [11] reported a ratio of 2.6:1. However, Memon et al [12] ,Nwadiaro and colleagues [21] and Alonge et al [22] all had a ratio of 3.1:1 . On another hand , the average age reported by Solagberu [20] was 28 years and that by Dada et al [18] was 29.49 years while the average age reported by Ogunlusi et al [11] was 38.4 years and the median age in the series by OlaOlorun and colleagues [19] was 36 years . In our series ,the average age was 33.75 years . The young in the

society and especially males are active and are thus prone to trauma which is one of the leading causes of morbidity and mortality in those under 40 years of age [23].

Those who had attained secondary and tertiary levels of education in the present series were in the majority (81.69%). As reported by others [7,18], those with at least secondary education made up 65% or more of their series. This implies that the utilization of the traditional bonesetter for fracture and dislocation treatment cuts across all educational strata and includes well educated people.

Most of the injuries in our series occurred in the lower extremity. For fractures, it frequently involved the femur (18.60%) and the tibia (17.44%) while in the upper extremity, the humerus (15.12%) and the radius (9.30%) were most affected. The dislocations in the upper extremity occurred mostly in the elbow (3.49%) and in the lower extremity; the hip (3.49%) was affected. In the series by Ogunlusi et al [11], the most frequent fractures were those of the femur (24.3%) and the tibia (24.3%) in the lower extremity and both radius and ulna (15.2%) in the upper extremity followed by the humerus (12.1%). The dislocations they noticed were in the hip, elbow and wrist. Similarly, in the series by OlaOlorun and colleagues [19], the femur was most frequently fractured followed by the tibia and humerus. In the report by Dada et al [18], their most frequent fractures were in the humerus (29%) with almost half being supracondylar fractures in children, and fractures of the femur and tibia each constituted 16.9%. Similar to this, in the report by Memon and colleagues [12], humeral fractures constituted 32.75% of their series with supracondylar fractures alone making up 22.41% while in the lower extremity their most common fracture was that of the tibia (18.96%) followed by the femur (13.79%). The difference in the various series may be partly explained by the varying contribution of the predominant age group affected. In the series by Memon et al [12], their common affected age groups were the 1st and 2nd decades and in the series by Dada and colleagues [18], those in the 1st decade constituted as much as 21.5% of their series. In our series, those in the 1st decade only made up 8.45%. Supracondylar fractures of the humerus are common in the 1st decade. The aetiology of the injury could also contribute to the difference.

The most frequent aetiology in the present series was road traffic accidents (42.25%) and these were mostly motorcycle-related, followed by falls (30.99%) and sports injuries (9.86%). In the report by Ikpeme et al [7], road traffic injuries constituted 73% with motorcycle related accidents being commonest (61.2%) followed by falls (14.3%). In the series by Memon and colleagues [12], road traffic accidents were the commonest (63.7%) followed by domestic fall (36.2%). The series by Dada et al [18], also reported road traffic accidents as the commonest (47%) followed by falls (36%). Other causes of injury included sports, civil violence and gunshot injuries. All these point to the fact that trauma, especially due to road traffic accidents, is an important cause of injuries worldwide.

The duration of treatment with the traditional bonesetters varied in different studies. The average duration in the studies by Ogunlusi et al [11] and OlaOlorun et al [19] were similar (10.8 weeks), while that reported by Memon and colleagues [12] was lower (9 weeks) and that reported by Dada et al [18] was higher (37.4 weeks). In the present study, 69% of our patients spent 4 months or more with the traditional bonesetters before presentation. The long duration of treatment with the TBS, which is enough time for most of the fractures to have united, implies loss of useful time and also significant financial loss [1]. Traditional bonesetters are mostly illiterate and thus lack knowledge of anatomy, physiology, pathology and radiography [6,8,12]. As a result these and their techniques of frequent massages, re-splinting, scarification and very tight bandaging, complications with are largely limb and life threatening are unavoidable.

The most frequent complication seen in the present series was nonunion (36.47%) and mostly affected the femur and tibia. In the series by Alonge and colleagues [22], their commonest complication was nonunion which made up 8 of their 25 cases (32%) and the femur was most frequently affected. In the study by Ogunlusi et al [11], nonunion was the most common reason (55.1%) responsible for the patients seeking modern orthopaedic services. The picture was also similar in the study by Dada et al [18], in which nonunion one of the two was most common complications with each making up 16.1%. However, it was the second most common complication in the series by OlaOlorun and colleagues [19] (25%), Solagberu [20] (20.0%) and Memon et al [12] (12.06%). In the study by Oginni [17], on the use of traditional splints, nonunion was the second most common complication (25%), and even in the study by Onuminya [24] on the performance of a trained traditional bonesetter, nonunion was still a significant complication. A known predisposing factor to nonunion is poor splintage with excessive mobility at the fracture site [25]. This plays out in the technique of immobilization by traditional bonesetters as the joints above and below the site of fracture is not usually included in the splint. Also, the materials that are used for splinting are rather weak to support fractures and the frequent removal and re-application are contributory. In the thigh, due to the muscle bulk and the fact that their techniques do not overcome the muscle strength, there is a tendency to soft tissue interposition which is known to cause nonunion [25].

The second most common complication in our series was malunion (24.71%). It was also the second most common complication in the series by Ikpeme et al [7] (15%), Ogunlusi and colleagues [11] (40% when the upper and lower limbs are combined),Nwadiaro et al [21] (21.5%) and in that by Alonge et al [22] [6 of the 25 cases (24%)]. In the study by Dada et al [18], it was one of the two most common complications (16.1%). However, malunion was the commonest complication in the series by Memon and colleagues [12] (25.86%), OlaOlorun et al [19] (58.3%) and Solagberu [20] (38.3%). It was also the commonest complication in the study by Onuminya [24] on a trained bonesetter and in that by Oginni [17] on the use of traditional splints for bonesetting (50% of the fractures that united had malunion). The fact that the bonesetters do not utilize anaesthesia to reduce fractures makes the attempted reduction inadequate. Furthermore in the event of displacement at the fracture site with overriding the development of malunion becomes inevitable since the utilized splints do not adequately hold the reduction.

Shortening was a significant finding among the patients that had nonunion and malunion, making up 31.76%. Shortening with its consequent limb length deformity has also been

reported by other workers. Oginni [17] in his study reported shortening of 6cm to 20cm and Dada et al [18] reported shortening in 10.1% in their series. As the techniques of bonesetting do not adequately take care of overriding of displaced fragments at the fracture site and soft tissue contraction will follow the overriding if the duration is long, shortening will be associated with both malunion and nonunion .

Although delayed union was seen in only 1.18% of the present series, in other studies it contributed significantly. In the series by Solagberu [20] it constituted 17.3% of the complications and 3.6% in that by Dada et al [18]. The factors that contribute to nonunion also play out in delayed union.

In the present series, chronic joint dislocation was the third most common complication (9.41%). All the 13 dislocations in the study by Dada and colleagues [18] remained unreduced. In the series by Alonge et al [22], 4 of the 25 patients had chronic joint dislocations. Taking into consideration that bonesetters do not utilize anaesthesia in their reduction [8], they are unlikely to have adequate relaxation to reduce dislocated joints and the joints will thus remain unreduced.

Other joint complications in our series included joint stiffness (4.71%), ankylosis (5.88%), arthrosis/arthritis (3.53%) and osteonecrosis (2.35%) of the femoral and humeral heads. In the report by Ikpeme and colleagues [7], joint stiffness constituted 11.6% and joint contractures 6.7%. In the series by Dada et al [18], joint stiffness constituted 10.8% of the complications, osteoarthritis from degenerative changes made up 6.6%, avascular necrosis constituted 5.4%, joint instability made up 1.8% and bony ankylosis constituted 1.2%. OlaOlorun and colleagues [19] reported fixed joint deformity in 2.8% of their 36 patients while Nwadiaro et al [21] reported stiffness/ankylosis in 15.9%. Joint stiffness occurs when the lubrication of the joint breaks down. The joint could be injured, a haemarthrosis forms and leads to synovial adhesions[25]. The stiffness is more often due to oedema and fibrosis of the capsule, the ligaments and muscles around the joint or adhesion of the soft tissues to each other or the underlying bone [25]. In ankylosis, there is usually a complete loss of useful joint movement [25,26]. However, if this is due to fibrosis (fibrous ankylosis), some trace of movement remains, but in rare situations the whole joint movement can be abolished by bony union (bony ankylosis) . Osteoarthritis can occur with damage to the articular cartilage and even malunion can alter the mechanics of a nearby joint and lead to secondary osteoarthritis [25].

Chronic osteomyelitis was a complication in 3.53% of the present series. Chronic osteomyelitis constituted as much as 22.4% of the complications in the series by Nwadiaro et al [21] (this was actually the most common complication in their series). Solagberu [20] reported bone infection in 15.6% of the complications in his series while it was seen in 2 of the 25 cases in the series by Alonge et al [22]. OlaOlorun and colleagues [19] reported it in 2.8%, Ogunlusi et al [11] in 3.5%, Dada and colleagues [18] in 3.6% , and Memon et al [12] reported bone infection in 5.17% . Even in the report on a trained traditional bone setter [24], post-traumatic osteomyelitis was significant, constituting 5.0% in the trained and 12.5% in untrained bonesetters practice outcome. Chronic osteomyelitis is a significant morbidity. The application of herbal concoction creams (which has no consideration for antisepsis or asepsis) and the practice of scarification over the fracture site predispose to the development of bone infection. In addition the process of scarification also converts close fractures to open fractures.

The practice of scarification, massage with herbal concoctions and creams as well as tight splintage to prevent movement of fracture fragments creates a wide tourniquet at high pressure and results in vascular compromise, compartment syndrome, ischaemia of muscles, and nerves with pressure on the skin and bony prominences. This sets up a cascade resulting in complications that may terminate in gangrene or death [15,27].

In the present series, pressure ulcer was a complication in 1.18%. Pressure ulcer was seen in one of the 25 patients in the series by Alonge et al [22]. Pressure on the skin from tight splintage especially over bony prominence is responsible for this.

Although our series did not have any patient with compartment syndrome , which is part of the cascade that could end up in gangrene , Dada et al [18] reported it in 0.6% of their patients while, Alonge and colleagues [22] reported it in one of their 25 patients along with Memon et al [12] who reported it in 10.34% of their subjects.

Neuropathy was a complication in 2.35% of the present series; it involved the radial nerve in one case and the common peroneal nerve in another. In the series by Alonge et al [22], a case of sciatic nerve palsy was seen. Although the nerve involvement could have been as a result of the initial injury, it is possible that the usually very tight splintage contributed to its occurrence.

In the present series, Volkmann's ischaemic contracture was seen in 2.35%. Alonge and colleagues [22] reported this in 2 of their 25 cases while Memon et al [12] reported it in 3.44%, OlaOlorun and colleagues [19] in 2.8% , and Dada et al [18] reported it in 0.6% of their series. The tight splintage with vascular compromise and muscle ischaemia also contributes to this.

One of the most widely reported complications of traditional bone setters treatment is bone setter's gangrene [27,28] . It is a coinage used to describe gangrene, largely avoidable, arising from activities of traditional bone setters attempting to manage fractures. In our series, limb gangrene was a complication in 2.35% . In the series by Onuminya et al [28], 15 of their 25 cases had limb gangrene. Several other workers have reported this complication within and outside Africa. Ofiaeli [29] reported limb gangrene from TBS in 2 of the 3 patients requiring amputation for this in a rural hospital in Nigeria, Nwankwo and Katchy [30] reported 15 consecutive cases of limb gangrene from TBS in a private hospital in Nigeria and Bickler and Sanno-Duanda [31] reported 9 cases of bone setter's gangrene in children in Banjul, Gambia. In the series by Memon et al [12] bone setter's gangrene constituted 6.89% of the complications they saw. Alonge and colleagues [22] reported TBS gangrene in 2 of their 25 patients, Dada et al [18] reported it in 6.6% of their series, Solagberu [20] reported it in 4.7% of his series and OlaOlorun et al [19] reported it in 2.8% of their series. Even in the report by Onuminya [24] on the on the trained bone setter, limb gangrene was recorded. As a result of the gangrene,

amputations are commonly performed. Traditional bone setting is a major risk factor in limb amputation[32]. Although bonesetter's gangrene was the indication for major limb amputation in 60% of cases[8,33], Garba and Deshi[32] from Zaria reported its contribution as 38.7% of amputations and Umaru et al[16] from Maiduguri reported it as 31.7%. However, in a review of extremity amputations in Nigeria, Thanni and Tade [34] reported that it contributed overall to 23% of the amputations. Eshete [15] in Ethiopia reported gangrene from TBS in 25 of 49 amputations before and 7 out of 25 after the traditional bone setters were trained. In Nepal, gangrene from the practice of traditional healers has been reported [35] and even in a report from Turkey [36], 3 of their 475 amputations were from mistreatment by traditional bone setters. Surprisingly, in some of these cases of bonesetter's gangrene, there were only soft tissue injuries without fractures; a situation of avoidable loss of limb and its associated disability.

Other reported complications from traditional bone setters treatment include tetanus [22,37] , cellulitis [12] , wound infection [18] , heterotopic calcification [18] , femoral artery aneurysm [38] and even death [1,21] .

The most frequent interventions in our series were open reduction and internal fixation, manipulation under anaesthesia and open reductions alone among others. Other workers have also used similar interventions for definitive treatment [18-22] .

In the present series, 78.87% spent 4 weeks or less in hospital. If the patients had presented in hospital from the onset and the appropriate procedure offered to them, they would have returned earlier to their activities and saved themselves a lot of financial losses. Patients therefore need to be encouraged to present early in hospital and this will require a lot of education.

There was no mortality in the present series. However, Nwadiaro et al [21] reported a mortality of 5.5% and Nwankwo and Katchy [30] in their series on limb gangrene reported a mortality of 26%. This was usually due to gross sepsis and toxaemia.

In Nigeria, it has been estimated that over 70% of the rural population rely on traditional bonesetters for primary fracture care [8] and up to 85% of patients with fractures present first to traditional bonesetters before coming to hospital [2]. There have thus been advocacy for incorporation of traditional bonesetters into the primary care system [2,8]. In as much as this is a good proposal as there are not enough orthopaedic surgeons to cover the whole country, the deficiencies of traditional bonesetting needs to be taken into consideration. In China, traditional Chinese methods have been integrated with orthodox methods [39, 40]. For instance , in the treatment of forearm fractures , simple (close) fractures of the middle and lower thirds of the shaft of the radius or ulna or of both bones have been found suitable for the traditional methods while compound (open) fractures , comminuted fractures , complicated fractures with either blood vessel or nerve injuries and fractures complicated by separation of the inferior radio-ulnar joint or a badly damaged interosseous membrane are unsuitable and are referred for orthodox treatment [40] . This is not the situation in Nigeria, where there is still a lot of secrecy in the practice of bonesetting [7,18] , and their methods are not subjected to scientific scrutiny. Experience with training of traditional bonesetters [15,24] have shown significant reduction in complications from their practice but it did not completely eliminate them , especially gangrene which is avoidable in most instances . Therefore, more needs to be done to achieve this integration in Nigeria .

This study has limitations. This is the experience of a single private ortho-trauma facility and the sample size is small. These will limit the inference that can be drawn from it. However, when the sample sizes of other published works are considered, the sample size in the present study is significant.

CONCLUSION

Complications following treatment of fractures and dislocations by traditional bone setters are common. The common complications include nonunion, malunion both associated with shortening as well as chronic joint dislocation. The largely avoidable complication of limb gangrene still occurs. There is a need for basic training of traditional bonesetters emphasizing their limits, if they are to be successfully integrated into the primary care system.

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