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Epidemiology of Long Bone Fractures in the Elderly and Treatment Outcome with Interlocking Nailing in Southwest of Nigeria

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Abstract

Background: According to the literature, long bone fractures are not common in the elderly, with fractures occurring as a result of low energy and trivial falls. While epidemiological studies of long bone fractures in elderly patients in developed countries are scarce, it is almost non-existent in resource-poor location. Hence, this study of the patterns and presentation of long bone fractures amongst the elderly population in an African poor resource setting and their short-term outcomes following operative intervention

Methodology: This was a retrospective study involving 48 patients who were 60 years and above and had intramedullary nailing for their long bone fractures. Biodata and other variables of interest such as fracture aetiology, level, type, infection, union and further surgeries were extracted. Collected data were analyzed using the SPSS version 20. Statistical significance was inferred at $p<0.05$.

Result: Forty-eight interlocking nailings done in the elderly patients who were 60 years old and above over a 15-year period (February 2004 -January 2019) were retrieved. The average age was 70.0 ± 7.51 years, with 56.3% as females. Closed fractures accounted for 75%, while the mechanism of injury was mostly Road Traffic Accident {RTA} (70.8%). Non-union was significantly related to the level of fracture, $p = 0.04$. While the infection rate was related to the type of fracture (open fractures), $p = 0.02$.

Conclusion: Elderly long bone fractures followed majorly Road traffic accident (motorcycle-pedestrian) in resource-poor setting. for which most of the fractures united. The adverse outcome was associated with open fractures and proximal fractures.

Keywords: long bone, fractures, elderly

1. Introduction

Long bone fractures are usually synonymous with the young adults and are thought to result from high energy injuries. The young adults are highly mobile and are actively engaged in frequent journeys which predisposes them to motorized accidents. Elderly patients are believed to live a more sedentary life with reduced frequency of travel hence they are less prone to road trauma. Long bone fractures are not common injuries in the elderly who are thought to be prone to fragility fractures (Kingsberg & Altman, 2018). This fragility fractures are as a result low energy fractures resulting from falls and are typically located in the flat bones of the body including the neck of femur and distal radius. Data from the western world revealed lots of these fractures in the elderly resulted from falls (Sterling & O'Connor, 2001). Intramedullary nailing is the treatment modality of choice as it is said to have a superior outcome compared to other modalities of treatment (Ricci & Gallagher, 2009). While epidemiological studies of long bone fractures in elderly patients in developing countries are scarce, it is almost non-existence in the resource-poor environment hence the need to conduct this study among the elderly population to look at the epidemiology of long bone fractures and short-term outcome following operative intervention (Cox, Jones, Nikolaou, & Kontakis, 2010).

2. Methodology

It was a retrospective study conducted at the Department of Orthopaedic Surgery and Traumatology of a tertiary health facility in Nigeria. Institutional ethical clearance was obtained and the study was done according to the ethical standards laid down in the 1964 Declaration of Helsinki. Medical records of patients who were 60 years old and above who had long bone fractures fixed with reamed interlocking nailing system that uses external jig for

placement of interlocking screws (Surgical Intervention Generation Network, SIGN which are given free for patients' use) at our facility were retrieved from the hospital record system(United Nations et al., 2017). The biodata along with other variables of expression such as fracture aetiology, type, location, intraoperative blood transfusion, co-morbidities, and outcomes measures such as infection, union, malalignment, need for further surgeries amongst the rest were extracted from the case note.

Collected data were analyzed using the SPSS version 20 (IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp.) Univariate analysis done included frequency distribution, charts, summary statistics like mean and standard deviation. Cross tabulation was done and associations between variables were tested using chi-square statistical method. Statistical significance was inferred at $P<0.05$.

3. Results

A total of 48 elderly (60 years and above) patients 'data who had interlocking nailing done over a 15year period (February 2004 – January 2019) and were followed up to union and weight bearing (4 months - 10years) were extracted from the record unit of the hospital. Females 27(56.3%) were in the majority. The average age of the patients in this series was 70.0 ± 7.51.

Table 1. Socio-demographic, injury and fracture outcome characteristics of the patients

Characteristics	Number (n)	Percentage (%)
Sex		
Male	21	43.8
Female	27	56.3
Total	48	100
Bone involved		
Femur	28	58.3
Tibia	20	41.7
Total	48	100
Fracture location		
Proximal third	15	31.3
Middle third	18	37.5
Distal third	15	31.3
Total	48	100
Type of fracture		
Closed	36	75
Open	12	25
Total	48	100
Aetiology		
Falls	11	22.9
RTA	34	70.8
Tumour	1	2.1
Gunshot	1	2.1
Non-union	1	2.1
Total	48	100
Infection		
Yes	8	17.8
No	37	82.2

Total	45	100
Non-Union		
Yes	7	15.9
No	37	84.1
Total	44	100
Loose Screw		
Yes	3	6.5
No	43	93.5
Total	46	100
Malrotation		
Yes	1	2.2
No	45	97.8
Total	46	100
Further surgery		
Yes	11	24.4
No	34	75.6
Total	45	100

A total of 28 patients were managed for femoral shaft fracture out of which 27(96%) were closed fractures while 20 patients were treated for tibia shaft fracture out of which 11(55%) represented open fractures. Proximal 1/3 fracture of the femur accounted for 28.6% of all the femoral fractures while the middle and distal 1/3 fractures accounted for 35.7% respectively. In the tibia fractures, proximal 1/3 accounted for 35% while middle 1/3 fractures amounted to 40% of the fractures. The distal tibia fracture seems to be the least common and accounts for 25% of the total tibia fractures in our practice. Motorcycle-Pedestrian Accident (62.5%) accounted for most of the accidents recorded in our series while the rest were as a result of Motorcycle- Motorcycle, Motorcycle- Motor vehicular accident, fall from the height and the rest.

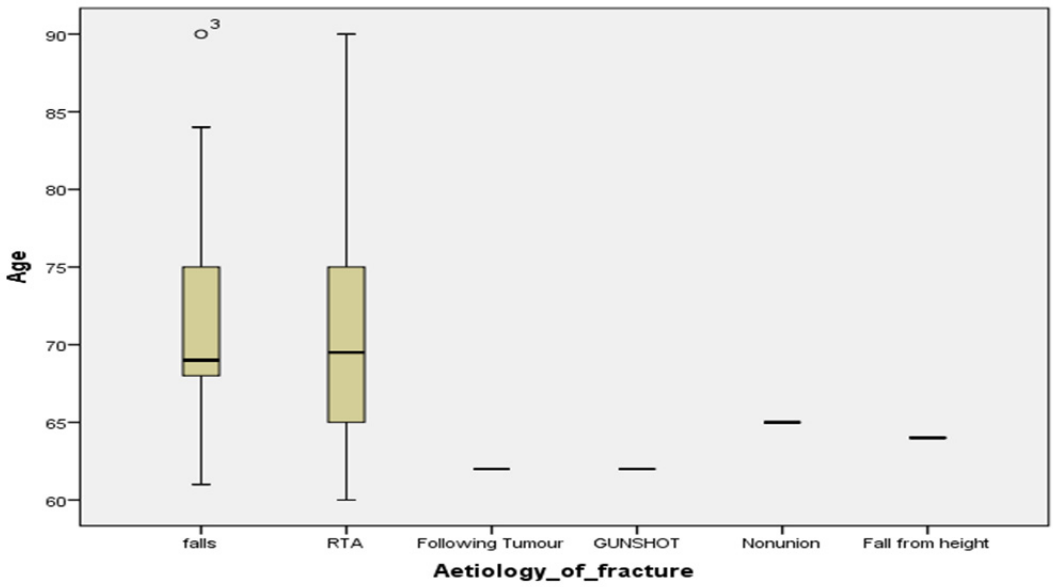

Figure 1. Age distribution of aetiological factors

Eight (16.7%) of our patients visited the traditional bone setter before presenting at our facility. Furthermore, 14.6% had bone grafting done and they all achieved union. A further 22(45.8%) patients had an intraoperative blood transfusion out of which only 3 had post-operative wound infection. A total of 29.2% had their surgical procedure done under 2 hours. Out of the 48 patients in this series, one died at 3 weeks after surgery bringing the perioperative mortality rate (POMR) as 2.1% (within the first month) and by extension within the first 3 months, while 4 other patients did not return to the clinic for follow-up as necessary after discharge. The earliest radiographic evidence of healing was seen first between 6 and 12 weeks, while most of the fractures (76.74%) were noted to have healed within the first 4 - 6months and the overall union rate was 83.7%.

Outcome measures with the result of their test of association is presented in Table 2 below.

Table 2. Factors associated with identified outcomes (Non-union, Infection and further surgeries)

	Presence of Non-union N (%)	**Absence of Non-union N (%)**	**Total N (%)**	**Test of Significance; Degree of freedom (df); p-value**
Location of fracture				
Proximal third	3(25.0%)	9(75.0%)	12(100%)	*LR=6.16; df=2 p-value= 0.04
Middle third	4(23.5%)	13(76.5%)	17(100%)	
Distal	0(0%)	14(100%)	14(100%)	
Type of fracture				
Closed	5(15.2%)	28(84.8%)	33(100%)	Fishers exact
Open	2((20.0%)	8(80.0%)	10(100%)	p= 0.65
Presence of Co-morbidity				
Yes	3(15.8%)	16(84.2%)	19(100%)	Fishers exact
No	4(18.7%)	20(83.3%)	24(100%)	p =1.00
	Presence of infection N (%)	**Absence of infection N (%)**	**Total N (%)**	
Location of fracture				
Proximal third	2(15.4%)	11(84.6%)	13(100%)	*LR=0.63; df=2 p = 0.73
Middle third	4(23.5%)	13(76.5%)	17(100%)	
Distal	2(13.3%)	13(86.7%)	15(100%)	
Type of fracture				
Closed	3(9.1%)	30(90.9%)	33(100%)	Fishers exact
Open	5(41.7%)	7(58.3%)	12(100%)	p= 0.02
Presence of Co-morbidity				
Yes	3(15.8%)	16(84.2%)	19(100%)	Fishers exact
No	5(19.2%)	21(80.8%)	26(100%)	p =1.00
	Need Further surgeries N (%)	**No Further surgeries N (%)**	**Total N (%)**	
Location of fracture				
Proximal third	6(42.9%)	8(57.1%)	14(100%)	*LR=5.59; df=2 p=0.06
Middle third	4(25.0%)	12(75,0%)	16(100%)	
Distal	1(6.7%)	14(93.3%)	15(100%)	

Type of fracture				
Closed	5(15.2%)	28(84.8%)	33(100%)	Fishers exact
Open	6(50.0%)	6(50.0%)	12(100%)	p = 0.04
Presence of Co-morbidity				
Yes	5(26.3%)	14(73.7%)	19(100%)	Fishers exact
No	6(23.1%)	20(76.9%)	26(100%)	p =1.00

*LR= Likelihood Ratio.

Four patients with non-union had exchange nailing while 3 other patients with infection (infected non-union) had implant removal and replacement with other forms of stabilization (External fixation). Other infected cases had treatment with antibiotics and serial debridement. Weight-bearing was commenced between the 10th and 16th week in 42.8% of the patients. Grade 2 open fracture (41.7%) according to Gustilo and Anderson classification was the commonest presentation among patients with an open fracture. It is interesting to know that the observed outcome when the long bones were merged was similar to the outcome when each of the long bones were taken as individual. Tables 3 and 4 below shows the outcome measures as related to individual long bone.

Table 3. Bone specific variables and union outcome

Specific bones	**Variables**	**Presence of Non-union N (%)**	**Absence of Non-union N (%)**	**Total**	**Statistical significance**
Location of fracture					
Femur	Proximal third	2(33.3%)	4(66.7%)	6(100%)	*LR=5.93 df=2 P=0.05
	Middle third	3(33.3%)	6(66.7%)	9(100%)	
	Distal	0(0%)	10(100%)	10(100%)	
Tibia	Proximal third	1(16.7%)	5(83.3%)	6(100%)	*LR =1.12 Df=2 P=0.57
	Middle third	1(12.5%)	7(87.5%)	8(100%)	
	Distal	0(0%)	4(100%)	4(100%)	
Type of fracture					
Femur	Closed	5(20.8%)	19(79.2%)	24(100%)	Fishers exact P=1.00
	Open	0(0%)	1(100%)	1(100%)	
Tibia	Closed	0(0%)	9(100%)	9(100%)	Fishers exact P=0.47
	Open	2(22.2%)	7(77.8%)	9(100%)	
Co-morbidity					
Femur	Present	2(22.2%)	3(77.8%)	5(100%)	Fishers exact P=1.00
	Absent	3(18.8%)	13(81.2%)	16(100%)	
Tibia	Present	1(10.0%)	9(90.0%)	10(100%)	Fishers exact P=1.00
	Absent	1(12.5%)	7(87.5%)	8(100%)	

*LR= Likelihood Ratio.

Table 4. Bone specific variables and infection outcome

Specific bones	Variables	Presence of Infection N (%)	Absence of Infection N (%)	Total	Statistical significance
	Type of Fracture				
Femur	Closed	3(12.5%)	21(87.5%)	24(100%)	Fishers exact
	Open	0(0%)	1(100%)	1(100%)	P=1.00
Tibia	Closed	0(0%)	9(100%)	9(100%)	Fishers exact
	Open	5(45.5%)	6(54.5%)	11(100%)	P=0.03
	Location of Fracture				
Femur	Proximal third	0(0%)	6(100%)	6(100%)	*LR=2.31 df=2
	Middle third	2(22.2%)	7(77.8%)	9(100%)	P=0.31
	Distal	1(10.0%)	9(90.0%)	10(100%)	
Tibia	Proximal third	2(28.6%)	5(71.4%)	7(100%)	*LR=0.12 df=2 P=0.94
	Middle third	2(25.0%)	6(75.0%)	8(100%)	
	Distal	1(20.0%)	4(80,0%)	5(100%)	
	Co-morbidity				
Femur	Present	1(11.1%)	8(88.9%)	9(100%)	Fishers exact
	Absent	2(12.5%)	14(87.5%)	16(100%)	P=1.00
Tibia	Present	2(20.0%)	8(80.0%)	10(100%)	Fishers exact
	Absent	3(30.0%)	7(70.0%)	10(100%)	P=1.00

*LR= Likelihood Ratio.

4. Discussion

This study revealed that more women presented with long bone fractures compared with men in our series. This finding is similar to what other workers obtained in their studies. This shows a reversal of sexual predilection to fracture with ageing. This may not be unconnected with the fact that the females are more prone to fragility fractures as a result of estrogen withdrawal at menopause. However, the motor cycle-pedestrian accident was found to be the commonest cause of long bone fractures in our series. This is at variance with other studies in the developed world where falls remain the commonest aetiology (Kingsberg & Altman, 2018; Clement et al., 2013; Sterling & O'Connor, 2001b; Neubauer et al., 2012). The motorcycle is a licensed mode of transportation in this part of the world, some of these commercial riders are poorly trained and often flout the safety regulations leading to an unprecedented increase in trauma (Gellman, 2016; Zirkle, 2008). These elderlies who are community ambulant often get knocked down by the roadside or while attempting to cross the road. There was no age difference when patients who had fall were compared with those who had motorcycle injury as both groups fell within the same range as shown in Figure 1. This shows that elderly patients are not exempted from road trauma in our region as opposed to what is obtained in the developed world. A combination of factors such as poorly organized transport system run by untrained personnel, poor reaction time to avoid being knocked down, visual problem and hearing difficulties may also have a role to play in the reason why this is common. Though our study only found one patient with visual impairment.

Our 3-month perioperative mortality rate was 2.1% in this study. This is low compared with what others obtained which was as high as 17% in the first 3 months (Clement et al., 2013; Holt, Smith, Duncan, & Finlayson, 2008). Patel and other workers obtained 21% mortality at 1 year of follow up in his series (Patel et al., 2014). This patient died from complications of a co-morbid condition (advanced prostatic cancer). The reason for this observation in our study may be due to the smaller number of participants as less than half (43.8%) of our patients have associated comorbidity.

Fracture location was predictive of non-union as the proximal and middle third fractures were associated with non-union compared with the distal fractures. Fracture comminution could not account for this finding as most of

the non-union (57.1%) had simple fracture pattern. Other factors such as the effect of co-morbidity and the presence of open fractures were not associated with the presence of non-union. Clement and his group (Clement et al., 2013) found that the rate of non-union is independent of age in his study while Chatziyiannakis'group (Chatziyiannakis, Verettas, & Raptis, 1997) found a positive association between open fracture and non-union. Our rate of non-union was however found to be higher than what other workers obtained in their studies where values such as 10% were obtained by clement et al(5) and 5% by Oni et al. (Clement et al., 2013; Oni & Hui, 1988). Though Oni and Hui (Oni & Hui, 1988) considered only closed fractures and managed the patients non-operatively while Clement and other workers (Clement et al., 2013) with a higher non-union rate considered both open and closed fractures and in turn combined both operative and non-operative modality of management. Our series combined both open and closed fractures which is similar to the series done by Ocalan et al and while our management involved intramedullary fixation only, though we had fewer patients in our series (Ocalan et al., 2017).

Presence of open fracture predicted the occurrence of surgical site infection in this study while another outcome of interests such as the level of fracture and the presence of co-morbidity did not. This outcome is not unexpected as other workers have established a relationship between open fractures and occurrence of infection (Shannon & Mullett, 2002; Saleeb Hany, Tosounidis, & Papakostidis, 2019). Our patients often present late to the hospital and time to operative intervention is often prolonged due to logistic issues in the developing world (Boschini, Lu-Myers, Msiska, & Cairns, 2016). Need for further surgeries was equally statistically predicted by the presence of an open fracture. With more infection in this category of patients, it is not unexpected that the need for further surgeries will be more in this type of fracture. We were limited by small number and poor consistency in follow up of our patients as few patients were followed up above 2 years. Majority were only followed up for more than a year and as soon as they were able to ambulate stopped attending the clinic. A multicentre prospective study design with patient's consent to participate for a long follow-up duration may be a way out of this limitation.

We, therefore, conclude that elderly long bone fractures are almost always following a motorcycle-pedestrian accident in our practice for which most of the fractures united. The adverse outcome was also associated with open fractures as well as proximally placed long bone fractures.

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Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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