

Morbidity of Open Tibia Fractures in Lagos, Nigeria.

G.O. Enweluzo, T.O Adekoya-Cole, B.O Mofikoya, S.O. Giwa, O.O. Badmus.

Department of Surgery, College of Medicine, University of Lagos / Lagos University Teaching Hospital, Lagos, Nigeria.

Correspondence to: Dr. G.O. Enweluzo, Email: enweluzog@yahoo.com

Background: Open fractures of the tibia are complex injuries of bone and soft tissue. And on account of the open nature has a tendency to increase morbidity. The main objectives of this study was to determine peculiar issues in the management of open tibia fractures with regards to the pattern, aetiology and management outcome of treatment of open tibia fractures. Outcome measures included functional outcome, complications, morbidity and case fatality in our environment Lagos; Nigeria.

Methods: This prospective study was carried out at Lagos University Teaching Hospital (LUTH), Lagos Nigeria between July 2011 and June 2014. Demographic data, fracture related characteristics, aetiology, location radiologic features and microbiological cultures were collected. Diagnosis of open tibia fracture was based on clinical and radiological evaluation. Infection was diagnosed on the basis of a combination of clinical evidence\microbiological evidence (culture). All cases were followed up till discharge or death and subsequently in our out -patient clinic after discharge for 12months. Complications arising in the course of case management as well as functional outcome were documented.

Results: A total of 197 patients with open tibia fracture out of 6071 patients presenting to the accident and emergency department over 3 years period were reviewed. Open tibia fracture represented 3.24% of all presentation. 145 (73.6%) were male, while 52 (26.4%) were female with average age range from 1-90 years (mean 36.9 ± 18.9 years). The peak age of incidence was in the age bracket 21- 50 years. Vehicular accident accounted for 78.2%, whereas other forms of injury accounted for 21.8%. The pattern of fracture was oblique 93 (47.2%), Transverse fracture 63(32%). while comminuted, segmental and spiral were 22(11.2%), 11 (5.6%) and 8 (4.1%) respectively the most common lesion was type II (49.2%) injury. The complication rate was 68 (34.5%) patients with wound infection accounted for 44(22.3%). Other complication observed included malunion 6.6%; non-union 3%, four patients (2%) had amputation. Both of whom had Gustilo Anderson type III c Injuries with mangled extremities severity score greater than seven. The functional outcome was quite satisfactory.

Conclusion: This study has shown that open fracture pose some unique risks beyond those encountered with similar closed fractures that may occur with similar amount of force and that wound infection is the commonest complications. It also shows that morbidity is associated with injury severity.

Keywords: Open tibia fracture, Internal fixation, External fixator, Plaster of Paris (POP)

Introduction

Open fractures of the tibia are complex injuries of bone and soft tissue. Open fracture refer to osseous disruption in which a break in the skin and underlying soft tissue communicates directly with the fracture and its haematoma¹. Open fracture are orthopaedic emergencies due to the risk of infection secondary to contamination and compromised soft tissue and sometimes vascular supply^{1, 2}.

Open tibia fractures are the most common open fractures in orthopaedics and are still associated with significant complications². At one time, open fractures were a death sentence. Today, Orthopaedic surgeons deal mostly with infection, non-union and functional deficit^{2, 3}. Open fractures usually result from high energy trauma and occur in a third of cases of multiply

injured trauma.²The injured extremity is assessed for extent of wound, soft tissue injury, contamination and neurovascular status of the limb is also assessed including exclusion of compartment syndrome³.

The system of classification of open fractures into three types of increasing severity was first introduced by Veliskakis⁴. This concept was fully developed by Gustilo and Anderson⁵. It was subsequently modified by Gustilo et al⁶. This classification had an inter-observer agreement of about 60% as shown by Brombark and Jones in a study of classification of tibia fractures by 245 orthopaedic surgeons⁷. The high energy nature of most of these fractures contributes to the increased proportions of Gustilo type III injuries⁸. In their epidemiological study, Court-Brown et al found that nearly 60% of open fractures were Gustilo type III⁸.

Opinions differ with regard to the method of closure of the skin and the method of stabilization of such fractures. Compared with open fractures in other areas of the body, open tibia shaft fractures pose a more difficult challenge because of their high infection rate. The infection rate reported in the literature has ranged from 2% to 40%⁹. These high rates are attributed to restricted soft tissue coverage over the tibia and the relatively poor osseous blood supply. While there is agreement that open fractures should be treated as an emergency, differences of opinions exist with regard to the method of closure of the skin and the method of stabilization of such fractures. The principles of treatment remain the same, but some of the details of treatment can reduce the rate of common complications. Because a large portion of the tibia is subcutaneous, and the soft tissue envelope is difficult to treat, special care must be taken in all stages of the management of these frequent severe injuries.

The aim of this study was to determine peculiar issues in the management of open tibia fractures with regards to the Pattern, aetiology and Management outcome of treatment of open tibia fracture in our Centre. Outcome measures included functional outcome, complications, morbidity and case fatality in our environment Lagos, Nigeria.

Patients and Methods

This prospective study was carried out at Lagos University Teaching Hospital (LUTH), Lagos, Nigeria a tertiary reference hospital in Lagos metropolis; which admits an average of trauma cases annually. Ethical approval was received from the LUTH HREC. The study was conducted between July 2011 and June 2014. Patients were recruited from cases presenting to the Accident and Emergency Department of LUTH. The inclusion criteria were diagnosis of open tibia fracture based on clinical and radiological evaluation. Cases with pre-morbid bone pathology based on history were excluded. Data documented included baseline demographic data (age, gender), fracture related characteristics, aetiology, location, radiologic features (e.g. fracture pattern), and microbiological features.

Tibia fracture was classified based on the Gustilo classification. In summary, the criteria classify tibia fracture into three based on injury severity. Infection was diagnosed on the basis of a combination of clinical evidence of cellulites or Osteomyelitis, and microbiological evidence (culture) from samples obtained pre-operatively, peri-operatively or post-operatively. All cases were followed up till discharge or death and subsequently in our out-patient clinic after discharge for 12 months. Complications arising in the course of case management were documented. Specifically, the occurrence of non-union, mal-union and amputation were also noted.

In addition, discharged cases were evaluated at out-patient follow-up clinic to assess functional outcome. Functional outcome was assessed in relation to Good- return to previous mobility with no impairment, Fair- return to previous mobility with some impairment and Poor- unable to return to previous mobility due to severe impairment such as amputation.

Results

The study included a total of 197 patients out of 6071 patients presenting to the A&E department over the 3yr period. Thus, open tibia fractures represented 3.24 % of all presentations. 145 (73.6%) were male, while 52 (26.4%) were female, with average age range from 1 – 90 years (mean 36.9 ± 18.9 years). The male to female ratio was thus 2.8 to 1.

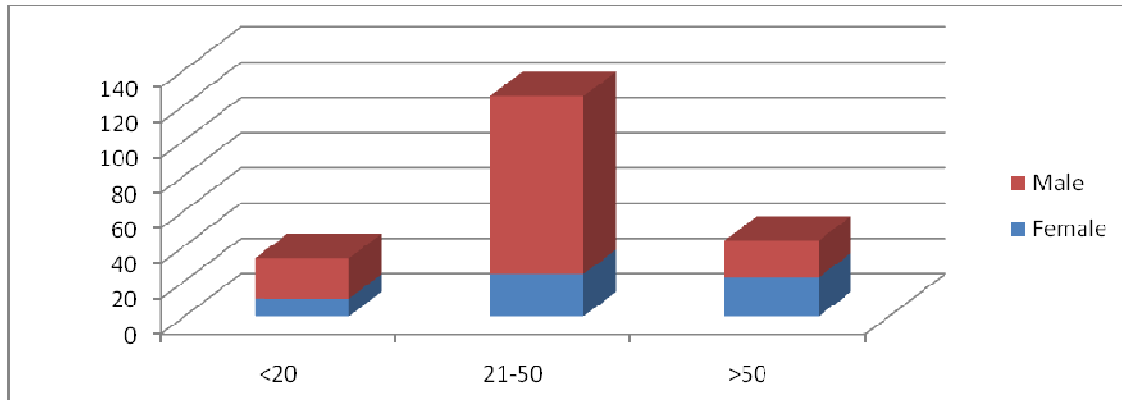


Figure 1. Age/Sex ratio Distribution

Foot note: M: F ratio of tibia fractures overall 2.8 to 1, <20 (2.3 to 1); 21-50 (4. To 1) and >50 (1 to 1).

Table 1. Age and Sex Distribution of Patients.

Age	Frequency		Total	Percentage (%)
	Male	Female		
<20	23	10	33	16.8
21-50	101	24	121	61.4
>50	21	22	43	21.8
TOTAL	145(73.6%)	52(26.4%)	197	100.0

Table 2. Distribution in relation to Trauma aetiology

Aetiology	Frequency	Percentage (%)
RTA	154	78.2
Automobile	89	45.2
Motorcycle	45	22.8
Tricycle	11	5.6
Pedestrian	9	4.6
Gunshot	21	10.6
Fall from height	8	4.1
Industrial accident	8	4.1
Assault	4	2.0
Domestic Accident	2	1.0
Total	197	100.0

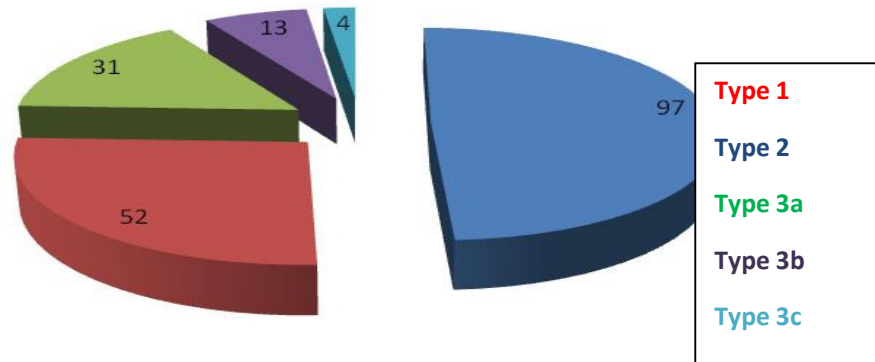


Figure 2. Distribution of fracture by the classification of Gustilo and Anderson ($P < 0.001$)

Table 4. Types and Frequency of complications associated with open tibia fractures.

Complications	Frequency	
	Number	Percentage (%)
None	129	65.5
Infection	44	22.3
Malunion	13	6.6
Non-union	8	3.0
Amputation	4	2.0
Death	1	0.5
Total	197	100

Aetiology of Open Tibia Fractures

The aetiology of open tibia fractures is shown in Table 2. Overall, vehicular accidents accounted for the majority (78.2%) whereas other forms of injury accounted for only 21.8%.

Fracture characteristics: Pattern and subtype

The right tibia was the most frequent location (124 i.e. 69.2%) compared to the left (73 i.e. 37.1 %). The pattern of fracture was oblique 93(47.2 %), Transverse fractures 63(32%). While comminuted, segmental and spiral were 22(11.2%), 11(5.6%) and 8(4.1%) respectively. Based on the classification by Gustillo and Anderson (Figure 2), the most common lesion was type II (49.2%) while the least frequent was type I (25%).

Treatment and treatment outcome

Treatment protocol included initial debridement in the majority of cases, followed by application of Plaster of Paris (POP) for 141 patients (or 71.7%). While 34 (17.3%) had internal fixation with either plates and screw or interlocking nails. Twenty (10.2%) patients had external fixation. Complications were recorded in 68 (34.5%) of the patients. Wound infections accounted for 44 (22.3%). Other complications included mal-union (6.6%) and non-union (3%). Four patients had amputation (all of whom had Gustilo-Anderson type IIIc injuries with mangled extremities severity score greater than seven). There was one death (Table 4). The mean age of male ages was 31.6 ± 14.02 compared to females (42.21 ± 6.92). The difference was statistically significant ($P=0.01$). The peak age of incidence was in the age bracket 21-50 years overall and in both sexes as shown in Figure 1

The functional outcome was quite satisfactory. A total of 124 (62.9%) of the patients returned to pre-morbid work while 56 (28.4%) patients returned to work but had some limitations which include knee stiffness while 17 (8.7%) of the patients were unable to return to pre-morbid work as a result of amputations, significant shortening or persisting bone infection. Hospital stay ranged from one day to 223 days with a mean of 51.5 days. The majority (63.4%) of those that were hospitalized for more than 60 days had associated wound infection.

Discussion

A fracture is well recognized as a break in the continuity of bone. The fracture may be associated with injuries to blood vessels, tendons, nerves and the overlying skin. When the skin is broken, then it becomes an open fracture, hence there is more to a fracture than just the broken bone.

Patients between 20 years and 50 years of age constituted 61.4% of the cases. This is probably because they are the active productive age group within the society. At the extremes of age (that is less than 10 years and greater than 60 years), open tibia fractures were observed to be uncommon (21.3% of the cases). This is presumably due to the fact that people in this age group tend to travel less. The male to female ratio 3:1 seen in this study had also been reported by the authors^{2,10} and this suggests that the young adult males who are very energetic and active are more prone to open tibia fractures.

Road traffic accidents caused 78.2% of the cases of which motor vehicle accidents accounted for about 45.2% and motor cycle, 22.8% and other means of transportation, 10.2%. However, it was noted that in patients less than 10 years old, pedestrian crossing a busy road unaided was the most common cause of open tibia fractures. This trend has also been observed by other workers^{11,12,13}.

Clinically, the right leg was more affected with 124 (62.9%) of cases while the left was affected in 73 (37.1%) of cases. This pattern was also observed by Imran et al in 2004. The most common pattern of the open tibia fractures encountered were oblique 97 (47.2%). Type II open fractures formed the majority (49.2%) in conformity with the findings of Gustillo⁵, while other authors^{15,16,17} presented with type III open fractures as most common. This discrepancy occurs due to the effect of variables such as location of services, degree of urbanization, type of etiology and risk factors. This may require new comparative studies of these variables to better correlate them.

In the open tibia fractures, above knee plaster of Paris cast was applied in 141 (71.6%) cases compared to external fixation devices 20 (10.2%) patients. Others 34 (17.3%) had primary open reduction and internal fixation. In types I and II open tibia fractures where wound healing is not

a problem, plaster of Paris cast is still the mainstay of stabilization in developing countries where external fixation is not readily available¹⁶. It allows the patients to be discharged home early¹⁷.

Prolonged plaster of Paris cast application caused joint stiffness and quadriceps wasting as seen in patients limited functional outcome. Similar findings were also observed by Ikemet al¹¹. Re-displacement of the fracture fragments was another setback observed with use of plaster of Paris cast 191(96%) cases resulting to mal-union and non union in most cases.

Nearly all the patients had wound debridement. Meticulous wound debridement and irrigation with copious fluid are essential for the care of all the patients wound. The aim is to reduce the bacterial load and increase the chances of early primary wound closure^{6,12,15}. In this study, the overall wound infection is very high. It occurred in 44(22.3%) cases of open tibia fractures. The literature reports infection rates in open tibia fractures between 2% and 40%⁹. Often in these series, it is not certain whether the figures refer to all wound infections or only deep infection involving bone. Our series includes both superficial and deep infections.

The severity of injuries was found to be an important prognostic indicator of infections as majority of wound infection occurred in type III fractures. Only 4 (2%) of our patients had amputations and all of them had Gustilo-Anderson type IIIC injury with mangled extremity injury severity score greater than seven. Helfet et al in their study showed that all patients with mangled extremity severity score of >7 had amputation¹⁰. The functional outcome was good despite universal prevalence of stiffness and malunion in many of the patients with open fractures. In spite of this, many of the patients returned to the premorbid occupation despite having varying degrees of limitations.

Conclusion

This study has shown that open fractures pose some unique risks beyond those encountered with similar closed fractures that may occur with similar amounts of force and that wound infection is the commonest complication in open fractures. It also shows that morbidity is associated with injury severity. These statistics call for determined efforts on the parts of the government to curb the incidence of road traffic crashes in our society. However functional outcome is relatively satisfactory.

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