

TREATMENT OUTCOME OF OPEN TIBIAL SHAFT FRACTURES IN A TEACHING HOSPITAL IN GHANA

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Abstract

Background: Objective of this prospective study is to report results of treatment of open tibia fractures in Korle-Bu Teaching Hospital Accra Ghana.

Patients and Methods: In this prospective study 47 patients were considered over a 6-month period from February 2012 to July 2012, and each patient was however followed up for at least 3 months. Treatment of these fractures was guided by the unit protocol.

Results: Out of the 47 patients, 35 (74%) had a good

outcome and 12 (26%) had complications.

Conclusion: The results of treatment of open fracture of tibia in this study are encouraging (with 74% of patients having a good outcome). Considering that three decades ago an open fracture of the tibia in Ghana had the common fate of surgical Amputation, Sepsis and Death. Further improvements in treatment of these fractures with early antibiotics, Debridement and irrigation and modern stabilization methods are recommended.

Key Words: Treatment outcomes; Tibia; Open fracture

Introduction

An open fracture is defined as osseous disruption with interruption of power transmission along the bone, in which a break in the epithelial surface and underlying soft tissue communicates directly with the fracture and its haematoma.

Although the tibia is the most commonly affected site in an open fracture¹, its treatment still remains controversial^{2, 3}. A century and half ago, open tibia fractures were often treated with amputation, with a high probability of patients evolving to sepsis and death. Today, fracture stabilization with an intra-medullary nail or external fixator enables early rehabilitation, minimizes hospitalization time and the number of postoperative complications. Due to the evolution of fixation methods for open tibia fractures, and the studies addressing the use of antibiotics and soft tissue management, the outcome of open tibia fracture has improved a lot. It is well established that open fractures must be treated with antibiotics, wound irrigation, debridement, fracture stabilization, and early coverage of soft tissue.

However, there are some variations regarding those concepts in literature, with the majority of controversial aspects being related to: the real surgical need for open type-I fractures and gunshot fractures^{4,5,6}; the best irrigation product and pressure for surgical cleaning^{7,8}; the best moment for wound closure and coverage of soft tissue^{9,10,11}; time of antibiotics use^{12,13}; and the best method for fracture stabilization³.

There are many methods for stabilizing open fractures, with external fixators, intramedullary nails and plates being mostly used. The evidence in the literature suggests the locked intramedullary nail as the method of choice for stabilizing these fractures³. However, a different reality is present in Ghana and in other developing countries. The high costs of implants, the lack of availability of equipment for emergency situations and the technical difficulties, restrain the use of intramedullary nails. Thus, other methods such as external fixators, plates and plaster immobilization are still most commonly used.

The objective of this study is to determine the treatment outcomes of open tibia fractures in the Korle-Bu Teaching Hospital.

Patients and methods

The study was prospective in design, spanning for about 6- months from February, 2012 to July, 2012 with 47 patients who reported with open tibia fracture. The inclusion criteria were all consenting patients with open fractures of the tibia with or without fibula involvement.

However, excluded in the study were patients who refused to participate, those with underlying bone pathology, those who had debridement before arrival, patients who had their fracture with intra-articular extension and those requiring vascular repair of the effected leg. Also patients loss to follow up, incomplete data, and default of appointment were excluded in the study.

Treatment of patients with open tibia fracture was guided by the unit protocol (Table 1), and each patient was followed up for at least 3 months. A special form was used to evaluate adequate use of the protocol, classification of the open tibia fracture, time interval between injury and arrival at the hospital, time of debridement, use of antibiotics, tetanus prophylaxis, type

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of skeletal fracture stabilization done, other steps of surgical intervention and outcome of treatment.

The treatment of open fracture of the tibia is a

challenge for orthopaedic surgeons all over the world. In Korle Bu we have a treatment protocol in place for these category of patients (Table1).

Table 1: Unit Protocol implemented for all open tibia fracture patients.

<p>Wound swabs are not obtained before starting antibiotics.</p> <p>Anti- tetanus prophylaxis as well as intravenous cefuroxime is given at the emergency room.</p> <p>All open tibia fractures are treated as surgical emergencies.</p> <p>Cefuroxime is continued in 3 divided doses for 72 hours then continued with oral clindamycin for a minimum of two weeks.</p> <p>Intravenous metronidazole or intravenous penicillin is added if injury occurred in the farm or in the gutter.</p> <p>Plain films are taken of the affected bones after temporary splint application.</p> <p>Thorough wound debridement and copious irrigation is emphasized.</p> <p>The wound classification system of Gustilo and Anderson is used.</p> <p>Soft tissue coverage is dependent on Gustilo and Anderson classification.</p> <p>The most common methods of fracture stabilization employed is external fixator, above knee Plaster of Paris cast or intramedullary nailing</p> <p>Outcome of treatment is analyzed in respect to speed of fracture union and presence of complications as wound infection and osteomyelitis.</p> <p>Fracture union is evaluated by clinical and radiological examinations at six weeks, three months, and subsequently at six months' intervals. The fracture is considered united if there is no pain, tenderness or abnormal movement at the fracture site and bridging callus is visible on radiograph. Delayed union is diagnosed when the fracture unites between four and six months.</p>
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Table 2: Classification of Open Fractures

GRADE	QUALIFICATIONS
I	Clean skin opening of < 1cm, usually from inside to outside. Minimal muscle contusion. Simple transverse or short oblique fracture.
II	Laceration >1cm, with moderate soft tissue damage and contamination. Minimal to moderate crushing component. Simple transverse or short oblique fracture with minimal fragmentation.
IIIA	Extensive soft tissue laceration usually >10cm long, high contamination. Severe soft tissue crushing and usually multifragmented fractures. Adequate soft tissue coverage of bone possible
IIIB	Extensive soft tissue injury usually >10cm long, with extensive periosteal stripping and bone exposure. Moderate to severe multifragmentation of fractures, segmental bone loss. Inadequate soft tissue cover requiring soft tissue flap closure.
IIIC	Any open fracture with a vascular injury requiring repair.

Patients with tibia fractures reported to Korle-Bu Teaching Hospital were categorized based on the Gustilo and Anderson classification of open fractures¹⁴(Table 2)

Results

The study participants of 47 patients with open tibia fractures treated at the Korle-Bu Teaching Hospital were successfully followed up for 3 months.

Gender distribution: The study participants were 40 (85%) males and 7 (14.9%) females giving a male to female ratio of 5.7:1.

In terms of age distribution, the results showed between 4years to 70 years with the mean age being 34.6years as presented in Figure 1. Most of the patients who reported with open fracture of the tibia were in the age group of 31-40 years 20(42.6%), followed by those within the ages of 21-30 years 10 (21.3%). It is thus clear that these two age groups (31-40years & 21-30years) are more active and therefore more prone to fractures of the tibia. The results also shows that the extreme age groups that is patients less than 20 years and those more than 50 years are less affected with the condition of open fracture of the tibia.

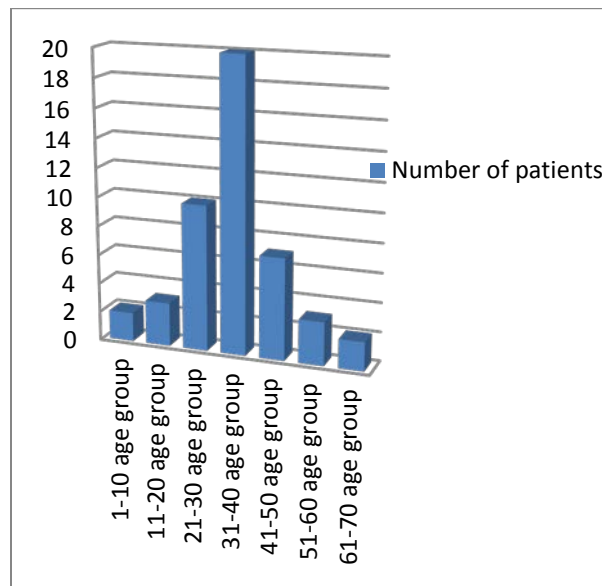


Figure 1: Age distribution of patients with open tibia fractures

The causes of open fracture of the tibia for the patients who reported to the Korle-Bu Teaching Hospital were motor vehicular accidents (MVA) 41 (87.4%), falls from heights 3 (6.3%), assault 2 (4.2%) and fall of heavy object (block) on the leg 1 (2.1 %).

Treatment outcome: The study revealed that, out of the 47 patients who were treated and followed up, 35 (74.47%) had good treatment outcome while 12 (25.5 %) developed complications.

The complications that were identified were as follows: Delayed union 5(41.7%), wound infection 3(25%) and mal-union made of 2(16.7%).

However 1(8.3%) developed chronic osteomyelitis and 1(8.3%) died at the end.

1. Related to Fracture grading

The outcome based on the fracture grading for the patients is presented in Table 3.

Out of the 47 fractures 5(11%) were type I fractures, 17 (36%) type II fractures, 10 (21%) type IIIA fractures, 15 (32%) type IIIB fractures. The overall complication rate in open tibia fractures was 26% (12). Based on the classification we found different types of complications (Table 3) among the study population. Of the type I fractures, 1 (2.12%) died at home two days after discharge from the hospital. The cause of death was unknown because no autopsy was done. Of the type II fractures, 1 (2.12%) developed soft-tissue infection and 1 (2.12%) developed delayed union. While for the type IIIA fractures, 1 (2.21%) developed soft-tissue infection and 2 (4.25%) developed delayed union. In the type IIIB fractures, 1 (2.12%) developed soft-tissue infection, 1 (2.12%) developed osteomyelitis, 2 (4.25%) developed delayed union and that of mal-union was 2(4.3%).

2. Related to Time of presentation:

Early reporting with fractures enables the surgeons to take prompt actions thereby reducing complications. Of the 47 patients who were part of the study, 27 (57.4%) reported within 6 hours of the injury, 15(31.9%) reported between 6 hours and 24 hours, while 5 (10.6%) presented after 24 hours.

Outcome related to presentation time shows that there is no clear difference of prevalence of complication between patients presenting within six hours after injury 6 (22.3%) and those presenting between 6 and 24 hours 4 (27%). Even after 24 hours of presentation the complication rate was not higher 2 (40%) (Table 4).

3. Related to wound debridement:

Wound debridement and irrigation as one of the treatment modality was done in 35 (74.5%) of the patients between 6 hours to 24 hours with the exception of 1 (2.1%) patient who had it within 6 hours. About 11 (23.4%) of the patients had their debridement done after 24 hours of reporting. All 47 patients received intravenous antibiotics and anti- tetanus prophylaxis according to the unit protocol in the emergency room. It is generally accepted that emergent care with debridement, irrigation and antibiotics will minimize morbidity (2,3, 4). In our series 35 (74.5%) patients who had debridement between 6 hours -24 hours, about 6 (18%) developed complications and those treated after 24 hours, 6 out of 11 constituting about 55% also developed complications (Table 5).

Table 3: Fracture grade, treatment outcome and specified Complication

Grade	Number of Pat.	Good Outcome	Complic.	Delayed Union	Mal-Unions	Wound Infection	Osteo-Myelitis	Death
I	5 (11%)	4(80%)	1(20%)	0	0	0	0	1
II	17 (36%)	15 (88%)	2 (12%)	1	0	1	0	0
IIIA	10 (21%)	7 (70%)	3(30%)	2	0	1	0	0
IIIB	15 (32%)	9 (60%)	6(40%)	2	2	1	1	0
IIIC	0 (0%)	0(0%)	0(0%)	0	0	0	0	0
Total	47(100%)	35(74%)	12 (26%)	5	2	3	1	1

Table 4: Time of presentation and treatment outcomes

Time of Present.	Number of Pts.	Good Outcome	Complication
< 6 h.	27 (57.4%)	21 (77.7%)	6 (22.3%)
6 – 24 h.	15 (31.9%)	11 (73 %)	4(27%)
>24 h.	5 (10.6%)	3 (60%)	2 (40%)
Total	47 (100%)	35(74%)	12 (26%)

Table 5: Time of debridement and treatment outcomes

Time of Debridement	Number of Patients	Good Outcomes	Complications.
< 6 h.	1 (2.1%)	1 (100%)	-
6 – 24 h.	35 (74.5%)	29 (82%)	6 (18%)
> 24 h.	11 (23.4%)	5 (45%)	6 (55%)
Total	47 (100%)	35 (74%)	12 (26%)

Table 6: Type of stabilization and treatment outcomes

Stabilization Type	Number Patients	Good Outcome	Complications
P.O.P.	14 (29.8%)	9 (64%)	5 (36%)
External Fixator.	32 (68.1%)	25 (78%)	7 (22%)
IM Nailing	1 (2.1%)	1 (100%)	-
Total	47 (100%)	35 (74%)	12 (26%)

Table 7: Type of soft tissue management, treatment outcome with specified complications.

Soft Tissue Cover	Number of Pat.	Good Outcome	Complic.	Delayed Union	Mal-Unions	Wound Infection	Osteo-Myelitis	Death
Primary closure	10 (21.3%)	6 (60%)	4 (40%)	1		2		1
Delayed prim. closure	17 (36.17%)	15 (88.24%)	2 (11.76%)	1				
Skin grafting	11 (23.40%)	9 (81.81%)	2 (18.18%)	1	2			
Flap cover	4 (8.51%)	2 (50%)	2 (50%)	1			1	
Secondary healing	5 (10.64%)	3 (60%)	2 (40%)	1		1		
Total	47	35	12	5	2	3	1	1

4. Related to Stabilization method:

Stabilization of open fractures has a number of beneficial effects in reducing complications⁵.

The methods employed in our study as primary device were mostly external fixators 32 (68.1%), P.O.P 14 (29.8%) and intra medullary (IM) nailing 1 (2.1%).

The used protocol liberalized the choice of fracture stabilization method based on the group, fracture configuration and the most suitably available material at the time of treatment. We found great ease in the use of external fixation and plaster of Paris as a first choice because they were always available and cheap. We recorded a higher incidence of complications in the P.O.P-group than in the external fixation group (22% compared to 36 %) (Table 6)

5.Related to soft tissue management:

Soft tissue management choices depend on the grade of the wound (see table2). About 17 (36%) patients had delayed primary closure. Primary closure was performed in 10 (21.27%) patients, 11 (23%) patients had skin grafting, while 4 (8.51%) cases had flap coverage. 5(10.64%) patients wound healed by secondary intention. Plastic surgeons were involved when skin grafting becomes the choice of tissue cover for extensive traumatic ulcers.

Type of soft tissue cover and treatment outcome are shown in Table 7. In the group treated by primary closure and healing occurring by secondary intention recorded 40% complications. Those treated with the delayed closure (2 of 17) in this study had better results when compared with those whom delayed split thickness skin graft (2 of 11) method was used. Flap coverage, which were carried out on type IIIB resulted in 50% (2 of 4) complication rate. There was correlation between the presence of complication and type of tissue cover. Delayed union was observed in all types of tissue cover. This was followed by wound infection in primary closure and mal-union in skin grafting.

Discussion

The results of the study showed that 85% of the patients with open tibia fractures are males, within the age range of 20years to 40years. With the main cause of the fractures being vehicular, a situation which is similar to those independently reported by Alabi¹⁵ and Onabowale *et al*¹⁶ who indicated that about 63.8% of patients reporting with fracture are between the ages of 20years-40years.

Although the operative treatment of our patients was beyond 6 hours the study revealed that about 74% of the patients had a good treatment outcome, with 26% developing complications. These findings also agree with other studies that shows that notwithstanding the time of presentation, treatment outcome is generally good,^{17,18} thereby disagreeing with the studies that support the "six-hour rule" of operative treatment of open tibia fractures^{19,20}. The good outcome of our series could be as a result of early antibiotic therapy, adequate debridement and irrigation of the wound.

Increased rate of complication with increasing Gustilo type was found in this study. Out of the twelve patients who developed complications, 50% (6) of the complications were found in type IIIB. These findings are in congruent with the work done by Khatod, and Botte, on Outcome in Open Tibia Fractures: Relationship between Delay in Treatment and infection²¹.

All types of wound infections were found in type IIIB in our series. This also supports the Gustilo grading system of open fractures as a significant prognostic indicator for infection as a complication. Delayed primary closure correlates with a lower complication grade. A number of studies have demonstrated excellent outcomes with closure performed within three days after injury^{22,23}.

Based on the use of Plaster of Paris (POP) the incidence of complications was much higher than in the use of external fixator. This finding is also supported by Edwards *et al.* who reported in their prospective study

of 202 type-III open tibia fractures treated with external fixation and concluded that, the method was successful for the treatment of severe open tibia fractures²⁴.

Conclusion

Open tibia fracture is a challenge in Ghana, as it is in the whole world. In Ghana, the young and economically active males are the most at risk. These fractures tend to occur mainly among the low income earners. Motor vehicular accident is the main cause of the injuries. Despite improvements in technology and surgical techniques, rates of complications are still a challenge, but a lot of improvement has been seen in Ghana within the last three decades with this study registering 74% good outcome in patients.

Recommendations

1. Early administration (< 6hours) of antibiotics after open tibia fracture, coupled with early and meticulous irrigation and debridement, could decrease rates of infection.
2. The use of all modern stabilization implants for open tibia fractures such as external fixators and intra medullary nails should be advocated.
3. The limitation to this study is the relatively small number of patients as the sample. A multicentre prospective study with the incorporation of qualitative research method is proposed to look at a larger sample of patients and duration to validate the findings.

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References

1. Court-Brown CM, Rimmer S, Prakash U, McQueen MM. The epidemiology of open long bone fractures. *Injury* 1998; 29: 529-534.
2. Bhandari M, Guyatt GH, Swiontkowski MF, Tornetta P 3rd, Hanson B, Weaver B. Surgeons' preferences for the operative treatment of fractures of the tibial shaft: an international survey. *J Bone Joint Surg Am* 2001; 83:1746-1752.
3. Bhandari M, Guyatt GH, Swiontkowski MF, Schemitsch EH. Treatment of open fractures of the shaft of the tibia: a systematic overview and meta-analysis. *J Bone Joint Surg Br* 2001; 83:62- 68.
4. Brettler D, Sedlin ED, Mendes DG. Conservative treatment of low velocity gunshot wounds. *Clin Orthop* 1979; 140:26-31.
5. Miclau T, Gerich T, Foglar C, Lindsey RW, Krettek C. Treatment approaches in Gunshot injuries of the extremities. *Unfallchirurg* 2002; 105:188-198.
6. Yang EC, Eisier J. Treatment of isolated type I open fractures: is emergent operative debridement necessary? *Clin Orthop* 2003; 410:289-294.
7. Bhandari M, Guyatt GH, Tong D, Adili A, Shaughnessy SG. Reamed versus nonreamed intramedullary nailing of lower extremity long bone fractures: a systematic overview and meta-analysis. *J Orthop Trauma* 2000; 14:2-9.
8. Bhandari M, Adili A, Schemitsch EH. The efficacy of low-pressure lavage with different irrigating solutions to remove bacteria from bone. *J Bone Joint Surg Am* 2001; 83: 412-419.
9. Fisher MD, Gustilo RB, Varecka TF. The timing of flap coverage, bone-grafting, and intramedullary nailing in patients who have a fracture of the tibial shaft with extensive soft-tissue injury. *J Bone Joint Surg Am* 1991; 73:1316-1322.
10. Gopal S, Majumder S, Batchelor AGB, Knight SL, De Boer P, Smith RM. Fix and flap: the radical orthopedic and plastic treatment of severe open fractures of the tibia. *J Bone Joint Surg Br* 2000; 82:959-966.
11. Weitz-Marshall AD, Bosse MJ. Timing of closure of open fractures. *J Am Acad Orthop Surg* 2002; 10: 379-384.
12. Antrum RM, Solomkin JS. A review of antibiotic prophylaxis for open fractures. *Orthop Rev* 1987; 16:246-254.
13. Patzakis MJ, Bains RS, Lee J, Shepherd L, Singer G, Ressler R et al. Prospective, randomized, double-blind study comparing single-agent antibiotic therapy, ciprofloxacin, to combination antibiotic therapy in open fracture wounds. *J Orthop Trauma* 2000; 14:529-533.
14. Gustilo RB, Mendoza RM, Williams DN. Problems in the management of type III (Severe) open fractures: a new classification of type III open fractures. *J Trauma*.1984;24:742-746.
15. Alabi ZO. The pattern of tibial fractures in Ilesa, Nigeria. *Nig Med J* 1981; 11 (1): 22-29.
16. Onabowale BO, Onuminya JE, Essien IAJ, Ukegbu ND. The management of open tibial shaft fractures: the National Orthopaedic Hospital experience. *Nig J Surg* 1995; 2 (2): 37- 42
17. Bednar DA, Parikh J. Effect of time delay from injury to primary management on the incidence of deep infection after open fractures of the lower extremities caused by blunt trauma in adults. *J Orthop Trauma*. 1993; 7:532-535.
18. Ashford RU, Mehta JA, Cripps R. Delayed presentation is no barrier to satisfactory outcome in the management of open tibial fractures. *Injury*. 2004; 35:411-416.
19. Kindsfater K, Jonassen EA. Osteomyelitis in grade II and III open tibia fractures with late debridement. *J Orthop Trauma*. 1995; 9:121-127.
20. Kreder HJ, Armstrong P. A review of open tibia fractures in children. *J Pediatr Orthop*. 1995; 15:482-488.

21. *Monti Khatod, Michael J. Botte, et al.* Outcomes in Open Tibia Fractures: Relationship between Delay in Treatment and Infection. *J Trauma*.2003; 55:949 –954.
22. Spencer J, Smith A, Woods D. The effect of time delay on infection in open long-bone fractures: a 5-year prospective audit from a district general hospital. *Ann R Coll Surg Engl.* 2004; 86:108-12.
23. Pollack AN, Castillo RC, Jones AL, Bosse MJ, MacKenzie EJ, and the LEAP Study Group. Time to definitive treatment significantly influences incidence of infection after open high-energy lower-extremity trauma. Read at the Annual Meeting of the Orthopaedic Trauma Association; 2003 Oct 9-11; Salt Lake City, UT.
24. Edwards CC, Simmons SC, Browner BD, Weigel MC. Severe open tibial fractures.
25. Results treating 202 injuries with external fixation. *Clin Orthop Relat Res.*1988; 230:98-115.

