Open tibia fracture treated by external fixation: Our experience in two private hospitals, in Aden, Yemen

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Received: September 2019; Accepted: October 2019; Published: November 1, 2019.
Citation: Abdulsalam Abdullah Hadi Mohsen. Open tibia fracture treated by external fixation: Our experience in two private hospitals, in Aden, Yemen .World Family Medicine. 2019; 17(11): 44-48. DOI: 10.5742MEWFM.2019.93694

Abstract

Background: The aim of this study was to describe the characteristics of the patients, to evaluate the outcome of an external fixation for tibia open fracture.

Materials and method: The study was a retrospective study involving 92 patients who have open tibia injuries, and who underwent surgical intervention by external fixation during the period January 2014 to December 2016, in Aden, Yemen.

Results: There were 71(77.2%) male and 21(22.8%) female patients and the male to female ratio was 3.4:1.

The fracture patterns were categorized according to Gustilo open fracture classification: There were 51(55.5%) type 3A fractures, 29(31.5%) type 3B, and 12(13%) type 3C.

The mean age of all patients was, at the time of the injury, 37.3±10.3 years (range 18–57 years). The mean age of male patients was 36.5 ± 11.1 years and the mean age of females was 40.1 ± 6.6 years. The difference between means showed no statistical significance ($p > 0.05$).

Bone union was achieved in 70(76.1%) patients and delayed union 12(13%). Mal-union was observed, in 4(4.4%) patients. There were 2(2.2%) patients who exhibited a shortening of 2 cm and another 1(1.1%) exhibited a shortening of 1.5 cm.

Pin tract infection was observed in 7(7.6%) patients and chronic osteomyelitis in 2(2.2%) patients. Six (6.5%) patients had non-union.

Conclusion: External fixation is the method of choice for the primary treatment of tibia open fracture. However, this is a small study in two private hospitals and larger studies are needed.

Key words: Tibia, open fracture, external fixation, results, Aden

Introduction

Open tibia fractures are common long bone fractures, often resulting in extensive bone and soft tissue damage [1,2].

It's incidence has increased because of motor vehicle accidents and war injuries [3].

The subcutaneous location of the tibia as well as its poor blood supply makes it susceptible to non-unions and infections [4,5]. Injuries to the neurovascular structures are also a known complication [1].

The goals of open fracture management are prevention of infection, soft tissue coverage, achievement of bony union and restoration of function. Important principles involve antibiotic utilization, timing of initial surgical intervention, thorough debridement, type of wound closure and fixation of fracture after proper alignment [6,7].

The standard treatment for open tibial fractures has been external fixation particularly in fractures associated with severe soft tissue injuries [8,9].

Although there are controversies over the use of external fixation, it has to be used in severe open fractures. The U.S. Army termed the external fixator a "non-union machine" because the incidence of non-union is about 6% to 41%. This incidence varies according to the severity of the trauma, soft tissue injury, early bone grafting, and the quality of reduction [10].

Accordingly, surgeons have tried to find a method of treatment that is safer, less expensive, less complicated, more effective, and has less union time for the treatment of open tibial fracture. They use external fixation as a primary treatment until soft tissues have been healed and then employ another technique to secure union [8,11,12].

The objective of this study was to describe the characteristics of the patients, to evaluate the outcome of an external fixation for open tibia fracture as a primary and definitive treatment.

Materials and Method

The study was a retrospective study involving 92 patients who have open tibia injuries, and who underwent surgical intervention by external fixation during the period January 2014 to December 2016, in two private hospitals in Aden, Yemen.

Inclusion criterion was an open fracture corresponding to Gustilo Type 3A, 3B, 3C.

External fixators from different manufacturers were used, and determined by availability. The collected data were tabulated and statistical analysis was done by estimating rates, means and standard deviations, paired sample t-test was used and p-value < 0.05 was considered as statistically significant. The statistical software package SPSS version 17 was used.

Results

We analyzed the medical records and collection data of the 92 patients' management by external fixation for tibia. There were 71(77.2%) male and 21(22.8%) female patients and the male to female ratio was 3.4:1.

The fracture patterns were categorized according to Gustilo open fracture classification: There were 51(55.5%) type 3A fractures, 29(31.5%) type 3B, and 12(13%) type 3C. Two (2.2%) of the study sample were diabetic patients (Table 1).

Table 2 revealed the following variables: the mean age of all patients was, at the time of the injury, 37.3±10.3 years (range 18–57 years). The age range of female patients was 30 – 54 years. The mean age of male patients was 36.5 ± 11.1 years and the mean age of females was 40.1 ± 6.6 years. The difference between means showed no statistical significance ($p > 0.05$).

Table 3 summarizes the follow up outcome of external fixation for tibia fracture managements. Bone union was achieved in 70(76.1%) patients, delayed union 12(13%). Mal-union was observed, in 4(4.4%) patients - 2(2.2%) varus angulation, 1(1.1%) valgus angulation and 1(1.1%) recurvatum. Other complications were 2(2.2%) patients exhibited a shortening of 2 cm and another 1(1.1%) exhibited shortening of 1.5 cm.

Pin tract infection was observed in 7(7.6%) patients and chronic osteomyelitis in 2(2.2%) patients. Six (6.5%) patients had non-union.

Table 1: Sex distribution of patients, Gustilo classification and comorbidity (n=92)

Variables	No	%
Sex:		
Males	71	77.2
Females	21	22.8
Gustilo open fracture classification:		
Type 3A	51	55.5
Type 3B	29	31.5
Type 3C	12	13.0
Comorbidity:		
DM	2	2.2
Non	90	97.8

Table 2: Distribution of the age range and the mean age of the study patients (n=92)

Variables	Range (years)	Mean ± SD	p-value
Mean age of all patients *Age range of all patients*	18 – 57	37.3±10.3	
Age range of female patients	30 - 54		
Mean age of male patients *Mean age of female patients*		36.5 ± 11.1 40.1 ± 6.6	P > 0.05

Table 3: Distribution of, and other complications outcome variables (n=92)

Variables	No	%
Outcome of tibia fracture orthopedic surgery:		
Bone union	70	76.1
Delay bone union	12	13.0
Nonunion	6	6.5
Varus angulation	2	2.2
Valgus angulation	1	1.1
Recurvatum	1	1.1
Other complications:		
Shortening 2 centimeter	2	2.2
Shortening 1.5 centimeter	1	1.1
Pin tract infection	7	7.6
Osteomyelitis	2	2.2

Discussion

It has become a standard practice in traumatology to use external fixation as a temporary means of treatment for severely injured patients who cannot tolerate extensive surgery, such as bomb blast victims, to treat their open limb injuries. It may also serves as a stop gap procedure for the heavily contaminated limb injuries, in situations where the expertise and facilities to do open reduction and internal fixation and flap cover or other appropriate soft tissue cover is made on the same sitting or at a later date [13,14]. The patients who need this staggered treatment protocol are those who need expeditious stabilization due to vascular injuries or those who are multiply injured. It has become a technique of evacuating army service personnel with minimal physiologic insult allowing the surgeon maximal options for definitive treatment of such fractures. There is no consensus as to how long an external fixator should be left on the patient before it is converted to other definitive treatment [15].

Matter et al [16] mentioned that despite the improvements in surgical techniques in the last century, the optimum treatment for open type III tibial shaft fractures, fracture with severe soft tissues injuries, threatened compartment syndrome, and tibial fractures in multiply injured patients remains controversial and major problems with infection, malunion and nonunion have persisted.

In recent years, there has been increased interest in managing open fractures, even type IIIB, with reamed or unreamed nails [17]. In the belief that immediate

intramedullary nailing increases the risk of septic complications, nonunion and pulmonary dysfunction, a sequence in management using external fixation initially and then delayed reamed IM nailing has been advocated—particularly for the treatment of type-III open fractures and in polytrauma patients [18,19].

External fixation has seen renewal in modern trauma management and new articles have appeared in the literature concerning the military use of external fixation in multiply injured or for the control of soft tissue problems in casualties of war (Croatia 1991,1992, Iraq 2003) [20,21,22]. Several reports of patients treated only by external fixation have been published with different and conflicting results [23,24,25].

Our study included 92 individuals who had seen, admitted and who underwent orthopedic surgery “external fixation” for open tibia fracture and who were postoperatively evaluated on the outcome and the complications.

The male patients were predominant 71(77.2%) while female patients were 21(22.8%). The male to female ratio was 3.4:1.

These findings are in accordance with the findings of Yusof [26], Court-Brown et al [27] and Ikem et al [28] who in their studies also had males predominance.

The mean age of the patients in our study was 37.3±10.3 years (range 18 - 57 years). A similar finding was reported by Beltsios et al [29] from Greece who found in their study the mean patients’ age at the time of the injury was 36 years.

We found at the end of the one year follow up, bone union was achieved in 70(76.1%) patients, delayed union in 12(13%) and 6(6.5%) patients exhibited non-union. Valazev and Fleming [30] reported 12.5% of delayed union. Giannoudis et al [19] in 536 open fractures treated by external fixator of which 82% were Grade III open injuries, the incidence of delayed union was 24%.

In the present study we observed that mal-union was in 4(4.4%) patients - 2(2.2%) varus angulation, 1(1.1%) valgus angulation and 1(1.1%) recurvatum; also, we observed pin tract infection in 7(7.6%) patients and osteomyelitis in 2(2.2%) patients.

Similar findings were reported by Michail Beltrios et al [31] from Greece of 87.27% union, 18 nonunion, 21 delayed union and 4 mal-unions, pin-tract infection 26.36% and osteomyelitis in 3 cases (1.36%) in their study of 212 patients treated with external fixator as a definitive treatment.

Kumar et al [32] mentioned that in their study of 37 patients, 36 fractures united and there were 8 patients with pin-tract infection (24%) and one case of non-union (2.75%) and also, one case of chronic osteomyelitis (2.7%).

We found also in our study 2(2.2%) patients exhibited a shortening of 2 cm and another 1(1.1%) exhibited shortening of 1.5 cm. Beltsios et al (29d) found in their study that 5 tibia (2.27%) had 1.5 cm shortening.

Conclusion

Tibia open fractures can produce a huge disability in patients. External fixation is the method of choice for the primary treatment of tibia open fracture.

This study provides a reference for future intervention and the improvement of the quality of care for the management of open tibia fractures in the public and private hospitals in Aden. However, this was a small study in two private hospitals and larger studies are needed.

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