Original Article

Mean Time to Union of Open Tibial Fractures after using Autogenous Bone Graft as Primary Procedure

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ABSTRACT

Objective: To determine mean time to union of open tibial fractures after using autogenous bone graft as a primary procedure.

Methodology: It was a Descriptive study conducted in the Emergency unit of orthopaedics department, Jinnah Hospital Lahore. Study duration was six months. Eighty patients fulfilling the inclusion criteria were included in this study. Non-probability, purposive sampling was used.

Results: Out of 80 patients, 75(94%) patients had good results in terms of soft tissue healing and fracture union. Thirty three patients had union time of 28 weeks and 13(16%) had union time of 27 weeks while union time ranged between 25-40 weeks with mean time to union of 28.55 weeks.

Conclusion: Primary autogenous bone graft is a simple and effective method to achieve union in primarily applied external fixators in open tibial fractures in properly selected patients.

Keywords: *Autogenous bone graft. External fixator. Open fractures. Union.*

INTRODUCTION

A fracture in which there is a communication of the fracture with the external environment is termed as an open fracture. Gustilo and Anderson classified open fractures into three main types on the basis of the personality of fracture, the condition of the soft tissue and its vascular status. The treatment of open fractures of the tibial shaft of the tibia is still controversial.[1] These fractures also have adverse economical implications.[2] Although general principles of aggressive debridement, stabilization, antibiotics, adequate soft tissue coverage and early bone grafting are accepted, but still there is no standard method of stabilization of type II and type III fractures. Initial management with external stabilization is well established since it allows immediate stabilization with wound access for management of soft tissues.[3] Bony stabilization can be achieved in a variety of methods such as plates and screws, external fixation with and without bone grafting and with intramedullary nails.[4] Each of these modalities has inherent complications associated with the specific method of stabilization.[5] External fixation of fractures with severe soft tissue injury has been standard treatment during 1980's.[6] External fixation has been associated with many complications including wound problems, deep infections hardware failures, pin track infections, pin track loosening, malunion, non-unions and delayed union.[7]

The best technique of fracture stabilization depends on the anatomic location of the fracture and characteristics of the injury.[8]

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In the case of a subcutaneous bone as the tibia, the status of soft tissue envelope is the single most important factor influencing the outcome and aiming for the earliest debridement minimizes the infection.[9] External fixators are available in emergency department and provided to the patient free of cost. Cancellous bone grafting has been a standard way of inducing osteogenesis at the fracture site.[10] The conventional way of treating the open fractures of the tibia by applying external fixator for soft tissue healing and then removing the fixator and after a certain period of time performing another surgery for definitive fixation has a mean time to union of 32 $\pm$ 9.5 weeks.[11] Early bone grafting at 6 to 8 weeks post injury is well accepted as a method to increase the union rate and shorten the union time.[12] Long term morbidity of patients can be minimized using primarily autogenous bone graft at primary surgery.[13] We attempted to achieve enhanced union in lesser time and saved the patient from multiple surgeries by adding an autogenous cancellous

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bone graft to the fracture site at the time of emergency stabilization of fracture with the external fixator.

METHODOLOGY

It was a descriptive study carried out in the emergency unit of orthopaedics department Jinnah Hospital Lahore. Study duration was six months. Eighty patients fulfilling the inclusion criteria were included.

Inclusion Criteria

1. Age 18-65 years
2. Both genders
3. Open tibial fractures Gustilo type II, IIIA, IIIB
4. Patient presenting within 24 hours of injury

Exclusion Criteria

1. Patient with circumferential bone loss (radiological diagnosis)
2. Patient with vascular injury (clinical diagnosis)
3. Polytrauma patients (multiple fractures on x- ray)
4. Patient having previously infected bone (clinical and radiological)
5. Patient with pathological fracture (clinical and radiological)

The study was approval from ethical committee of the hospital and 80 patients presenting in the surgical emergency of Jinnah Hospital Lahore with open tibial fractures fulfilling the inclusion criteria were selected. Informed written consent from the patients was taken. The patients were operated by the consultant. External fixator was applied to each patient and at the same time, the cancellous bone graft was taken from the anterior superior iliac crest and was crushed into pieces all less than 5mm in size and was packed with plane forceps tightly at the fracture site. Patients were examined clinically and radiologically at follow-up visits after 4 weeks to evaluate the progression of the union.
Data was analyzed by SPSS 21. The mean and standard deviation was calculated for age. Frequency and percentages were calculated for gender, fracture type and results of surgery. Outcome of surgery were judged in terms of mean time to union.

RESULTS

The study included 80 patients. The mean age of the patients included in this study was 36±8.7 (mean± standard deviation), with the youngest patient being 19 years and the oldest patient being 55 years old (Table 1).

In the gender distribution, 73(91%) patients were male and 7(9%) were females (Figure 1).

Table 1: Showing age of the patients included in this study

Age of the patients in years		
Minimum	Maximum	Mean ± Standard Deviation
19	55	36 ± 8.7

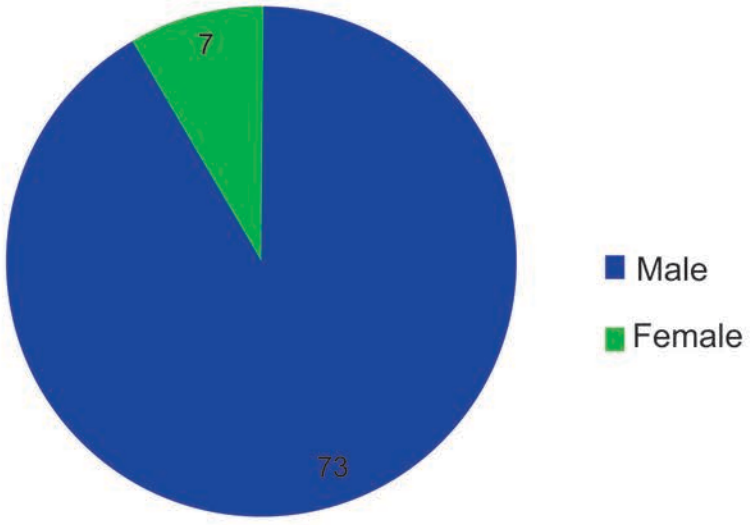

Figure 1: Showing gender distribution

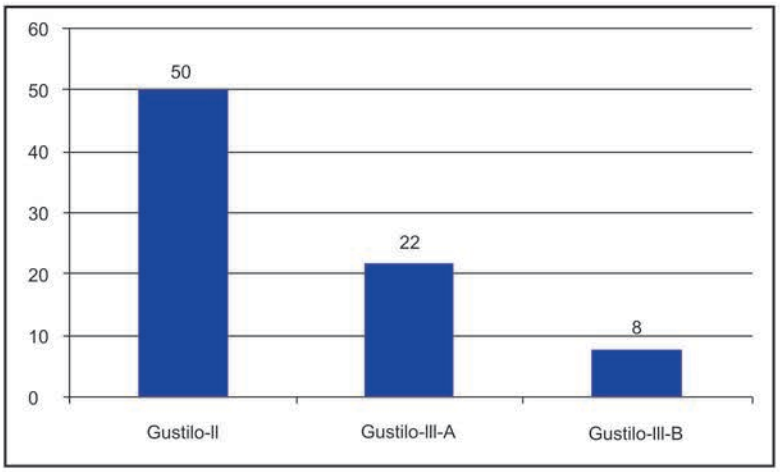

Figure 2: Showing types of fracture of the study subject

Table 2: Showing Mean time to union of the fracture

Mean time to union of the fracture.		
Minimum Time	Maximum Time	Mean ± Standard Deviation
25	40	28.55 ± 2.05

Regarding type of fracture, 50(63%) patients sustained Gustilo type II open tibial fractures, 22(28%) sustained type IIIA and 8 (10%) sustained open gustilo type IIIB fractures (Figure 2).

Seventy five (94%) patients had good outcomes of surgery in terms of soft tissue healing and union of fracture. Out of 80 patients, 33(42%) had union time of 28 weeks and 13(16%) had union time of 27 weeks while union time ranged between 25-40 weeks with mean time to union of 28.55 weeks (Table 2).

DISCUSSION

The goal of the open tibial fracture treatment is to obtain a functionally and anatomically normal limb with the return of the patient to their preinjury level. The study shows that common trauma victims were males (91%). Comparable results were seen in a study conducted by Tabatabai and Hosseini.[4]

The high rate of complications observed in open tibial fractures has been documented in another study.[14] The choice of fixation affects significantly the outcome of such injuries. Another study conducted on tibial fracture showed a 20-30% incidence of non-union and chronic infection among type III fractures treated with fixation.[15] Experience with the external fixators in open fractures shows favorable union rate approaching 100% but an incidence of chronic infection of 10-20%.[16] The problem of non-union associated with the external fixator can be overcome by using autogenous cancellous bone graft.[17]

In this study we found out of 80 patients, 75(94%) had good results and only 5(6%) patients had an infection. Cancellous bone graft has been a gold standard in inducing osteogenesis at the fracture site. Numerous authors agreed on the advantage of early autogenous bone grafting.[18] A study was conducted on the results achieved in patients with type III open tibial fractures who underwent primary autogenous bone grafting at the time of debridement and skeletal stabilization. According to that study between 1996 and 1999 twenty patients with a mean age of 35.8 years were operated. Out of these 20 type III fractures, eight were type A, 11 were type B and 1 was type C. Wound debridement, external fixation and autogenous bone grafting with bone coverage were done. The mean value of follow-up period was 46 months (range 34-55). The fixator was removed after a mean time of 21 weeks (range 14-35) with a mean union time of 28 weeks (range 19-45).[19] Similarly, in the present study union time was 28.55 weeks using primary bone graft.

It was concluded in a study conducted in India that it is more vital to attain fracture union than soft-tissue coverage in case of open fractures.[20] So, in open tibial fractures of type III wound debridement and cleansing followed by bone grafting with external fixator within 24 hours, decreases infection rate and shortens union time.

CONCLUSION

This study concluded that autogenous bone grafting is an effective method of enhancing union in open tibial fractures when used with an external fixator.

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