

CLINICAL AND FUNCTIONAL OUTCOMES IN PATIENTS WITH DISTAL TIBIAL FRACTURE TREATED BY CIRCULAR EXTERNAL FIXATION

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Abstract: The method of circular external fixation arises as a wide type of treatment for these fractures, bringing advantages of stability of the fracture, keeping soft tissue integrity and early rehabilitation. **Objectives:** The main objective of the study is to find the clinical and functional outcomes in patients with distal tibial fractures treated by circular external fixation. **methods:** This retrospective study was conducted at Abwa Medical College Faisalabad from January 2023 to October 2023. Data were collected from 80 patients with distal tibial fractures. Data were collected according to the inclusion and exclusion criteria of the study. Clinical and demographic data were extracted from electronic medical records and radiographic imaging studies. Data also contain patient age, gender, mechanism of injury, fracture classification, AO/OTA classification, soft tissue injury severity, comorbidities, smoking status, and preoperative functional status. **Results:** Data were collected from 80 patients. The mean age of the patients was 45 ± 12.5 years. Out of 80, 55 (68.8%) were male and 25 (31.3%) female patients. The main mechanism of injury was road traffic accidents containing 40 (50%), falls from height 25 (31.3%) and sports related injuries 15 (18.8%). Range of motion shows a significant increase as compared to preoperative as 30 ± 10 degrees to 45 ± 15 degrees. Pain score was also decreasing from 7.5 ± 2.0 to 2.0 ± 1.5 . **Conclusion:** It is concluded that circular external fixation demonstrates favourable clinical and functional outcomes in patients with distal tibial fractures, with high fracture union rates and significant improvements in range of motion and pain scores.

Keywords: Circular External Fixation, Distal Tibial Fracture, Clinical Outcomes, Functional Outcomes, Fracture Union

Introduction

The fractures of the distal tibia have a different anatomy which creates some difficulty during the orthopaedic practice. These bones have a complex structure that provides biomechanical demands of the lower extremity. The method of circular external fixation arises as a wide type of treatment for these fractures, bringing advantages of stability of the fracture, keeping soft tissue integrity and early rehabilitation (1). However, the success of the patients applying parallel external fixation for the distal tibial fracture needs a full-theory evaluation which can be further utilized in framing the evidence-based treatment strategies and enhancing patient care. These puncture tibia contusions are mostly generated by a mixture of high-energy impaction and rotation and are usually related to soft tissue trauma like sprains, contusions or muscle strains (2). There have been many different beliefs in treatment given the high complication rates, they include: 1-3 to prevent soft-tissue damage to progress arrest as well as to reduce implant area the treatment will be done by definitive external fixation. The absence of documentary proof of the effects of distinct treatments and outcomes is becoming evident (3). However, assessing large-scale RCT-UK distal tibial fractures with external fixation was also not included in the FixDT trial, which is commonly associated with intra-

articular injuries and had not been considered in the citation. The same further amplifies the challenge to be exact in our risk assessment for the possible surgical complications as there are some variations in the clinical presentations. Especially in such cases, where the ligament is predominantly intact, the injury can turn out to be more serious if not catastrophic later on, even in the cases without the articular involvement (4). Another important determinant of the high mortality rate could be the fact of the soft tissue injuries that are not reflected in the fracture classification. The goal here is to maintain the length by using a joint-bridging fixator or a fibular plate, and if you assess that the soft tissue trauma allows for it, here the subsequent step is considered a standard model is formerly performed using specially shaped screws and plates (5). There are relevant researches which point to the probability of increasing the precision of the implementation of staged protocols that come with fewer side effects. About 3%-10% of all tibial fractures are caused by distal tibial fractures and 1% of all fractures in the lower extremity can be attributed to the result of distal tibial fractures (6). A fibula fracture is seen in 70-85 % of complicated situations. These injuries are found in less than 15-20 % of other usually simple injuries. While the female sex does not make the difference as to the direction of fracture in the distal tibia [7], the male

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one is predisposed more easily to such type of fracture. People of all ages are affected, but they are usually older people. The age range is from 35 to 40 years old. Shaft fractures and ligament injuries of the ankle joint, which are associated with axial and rotational stresses, may present as varying degrees of ankle joint damage and malalignment. For many years, the physiotherapy of the distal tibia was tried using different means (7). Thus the objective of the study is to find the clinical and functional outcomes in patients with distal tibial fracture treated by circular external fixation.

Methodology

This retrospective study was conducted at Abwa Medical College Faisalabad from January 2023 to October 2023. Data were collected from 80 patients with distal tibial fractures.

The study included patients aged 18 years and above who had been diagnosed with a distal tibial fracture confirmed by radiographic imaging. The primary treatment modality for these patients was circular external fixation. Additionally, patients who underwent concomitant surgical procedures for associated injuries were also included in the study.

Data were collected according to the inclusion and exclusion criteria of the study. Clinical and demographic data were extracted from electronic medical records and radiographic imaging studies. Data also contain patient age, gender, mechanism of injury, fracture classification, AO/OTA classification, soft tissue injury severity, comorbidities, smoking status, and preoperative functional

status. The fracture union was reassessed radiographically based on the presence of a bridging callus and the absence of radiolucent lines. Range of motion is assessed using goniometry or functional outcome scores such as the American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot score. Pain scores were measured using the Visual Analog Scale (VAS). Complication rates including pin tract infection, nonunion, malunion, and the need for secondary procedures were also measured.

Data were analyzed using SPSS v29. Chi-square tests are used for categorical variables and it employed to compare outcomes between subgroups.

Results

Data were collected from 80 patients. The mean age of the patients was 45 ± 12.5 years. Out of 80, 55 (68.8%) were male and 25 (31.3%) female patients. The main mechanism of injury was road traffic accidents containing 40 (50%), falls from height 25 (31.3%) and sports related injuries 15 (18.8%). (Table 1). The fraction union rate was 76 (95%) and the mean time to weight bearing was 6 ± 2.5 weeks in partial weight bearing and 10 ± 3.8 weeks in full weight bearing. (Table 2). Rabe of motion shows a significant increase as compared to preoperative as 30 ± 10 degrees to 45 ± 15 degrees. Pain score was also decreasing from 7.5 ± 2.0 to 2.0 ± 1.5 . (Table 3) There are different rates of complications in selected patients, as pin tract infection was found in 12 (15%), non-union in 4 (5%), malunion in 3 (3.8%) and need for secondary procedures in 8 (10%) patients

Table 1: Patients baseline values

Characteristics	Values
Total number of patients	80
Mean age (years)	45 ± 12.5
Gender	
- Male	55 (68.8%)
- Female	25 (31.3%)
Mechanism of injury	
- Road traffic accident (RTA)	40 (50%)
- Fall from height	25 (31.3%)
- Sports-related injury	15 (18.8%)

Table 2: Outcomes of treatment

Outcome Measures	Values
Fracture union rate	76 (95%)
Time to weight-bearing (weeks)	
- Partial weight-bearing	6 ± 2.5
- Full weight-bearing	10 ± 3.8

Table 3: Follow-up outcomes

Outcome Measures	Preoperative	Final Follow-up
Range of motion (degrees)	30 ± 10	45 ± 15
Pain scores (VAS)	7.5 ± 2.0	2.0 ± 1.5

Table 4: Rate of complications

Complication	Number of Patients	Percentage
Pin tract infection	12	15%
Nonunion	4	5%
Malunion	3	3.8%
Need for secondary procedures	8	10%

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Discussion

The treatment of Distal Tibial fractures is still a difficult issue in the field of orthopaedic practice because of the complex anatomy and the possibility of severe functional disability. Circular external fixation has recently become a new method of managing these fractures, turning out to be a stable, supporting fix for the patient and early mobilization at the same time. This paper presented the clinical and functional results of 80 patients who were treated with circular external fixation for distal tibial fractures (8). Through our research, we proved that the fracture union rate of 95% was the best, and 95% of the patients had radiographic evidence of union within 14 weeks after the operation. This fact is in line with the previous research which has proven the effectiveness of circular external fixation in accelerating fracture healing (9). The skills of stable fixation and optimal alignment and thus the favourable desirable outcomes of controlled axial compression and distraction were probably the reasons why these subjects achieved positive results. The time when a patient starts to bear weight is a very important point in the postoperative management of distal tibial fractures (10). The research revealed that patients could start partial weight-bearing at 6 weeks after the surgery and were able to walk fully after 10 weeks, on average. This early mobilization is of great help in that it helps bone healing, prevents muscle atrophy, and thus, reduces the risk of complications associated with long-term immobilization. The results of our research showed that there were substantial changes in the range of motion and pain scores of patients from the preoperative baseline to the final follow-up. Patients felt a mean increase of ankle range of motion from 30° preoperatively to 45° at the final follow-up, thus, showing that the joint function was restored and the mobility was increased. At the final follow-up, the 0 percentage indicates that the pain management and the patient comfort are well-regulated and thus the patient is satisfied. On the one hand, circular external fixation has numerous advantages but on the other hand, it is not devoid of complications. Pin tract infection, nonunion, malunion, and the need for a second surgery are some of the issues that are connected to this treatment method (11). In our research, the occurrence of pin tract infection was 15%, nonunion accounted for 5%, and malunion for 3%. 8% of patients, respectively. These complications show the need for good pin care, a close watch of the fracture healing and the intervention in cases of late union or malalignment, as soon as possible. Finally, we reviewed factors associated with the different functional outcome measures that were recorded at more than 6 months after the frame removal. Age, gender, fracture classification, seriousness of soft tissue injury, comorbidities and smoking status were investigated for their influence on range of motion and pain scores. Although our study did not find any strong correlations between these factors and functional outcomes, it can be concluded that future research with bigger sample sizes and multivariate analysis may find the predictors of functional recovery of patients undergoing circular external fixation for distal tibial fractures.

Conclusion

It is concluded that circular external fixation demonstrates favourable clinical and functional outcomes in patients with

distal tibial fractures, with high fracture union rates and significant improvements in range of motion and pain scores. Despite the efficacy of this technique, complications such as pin tract infection and nonunion necessitate careful postoperative management.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate.

Approved by the department concerned. (IRBEC/AMCKAD-9322 dated 8-12-22)

Consent for publication

Approved

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Conflict of interest

The authors declared an absence of conflict of interest.

Authors Contribution

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Concept & Design of Study

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