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MANAGEMENT OF DISTAL TIBIAL FRACTURES BY ILIZAROV FIXATOR WITH OR WITHOUT MINIMAL INTERNAL FIXATION WITHOUT MINIMAL INTERNAL FIXATION

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Abstract

Introduction: Distal tibial fractures pose significant challenges in orthopedic trauma management due to their complex anatomical characteristics and associated soft tissue injuries.
Objective: The main objective of the study is to find the management of distal tibial fractures by Ilizarov fixator with or without minimal internal fixation without minimal internal fixation.
Material and methods: This retrospective study was conducted at Orthopedic Unit, Ayub Teaching Hospital Abbottabad Pakistan from March 2023 to March 2024. Data were collected from 50 patients diagnosed with distal tibial fractures who underwent treatment using the Ilizarov fixator. Patient demographic information, fracture characteristics, treatment details, and postoperative outcomes are extracted from medical records, operative reports, and imaging studies.
Results: Data were collected from 50 patients. Mean age of patients in group A was 42 ± 8 years and 45 ± 7 years in group B. The predominant mechanisms of injury were motor vehicle accidents (50%), followed by falls (30%) and sports-related incidents (20%). The statistical analysis revealed a significant difference in the time to fracture union between Group A (Ilizarov Fixator Alone) and Group B (Ilizarov Fixator + Minimal Internal Fixation), with a p-value of less than 0.05. However, there were no statistically significant differences in complications, functional recovery, or patient satisfaction between the two groups, as indicated by p-values exceeding 0.05.
Conclusion: It is concluded that both the Ilizarov fixator alone and in conjunction with minimal internal fixation demonstrate efficacy in managing distal tibial fractures. While the combined approach shows a significant advantage in accelerating fracture union, both modalities yield favorable outcomes with low complication rates and high patient satisfaction.

Introduction

Distal tibial fractures pose significant challenges in orthopedic trauma management due to their complex anatomical characteristics and associated soft tissue injuries. The Ilizarov fixator has emerged as a versatile external fixation device for the treatment of distal tibial fractures, offering advantages such as fracture stabilization, preservation of soft tissues, and early mobilization [1].

However, the optimal management approach, particularly regarding the use of minimal internal fixation in conjunction with the Ilizarov fixator, remains a subject of debate.The treatment of these fractures is challenging [2]. It is often difficult to assess the potential risk of surgical complications because of the variations in the clinical findings. Sometimes the injury can be more serious than initially expected, even in patients without articular involvement. One main reason is probably the underestimation of the soft-tissue injuries, not addressed in the fracture classification [3]. In intra-articular fractures, the sequential management principles outlined by Rüedi and Allgöwer are generally accepted [4]. The aim of the first step is to preserve length with a joint-bridging fixator or a fibular plate and, when the soft-tissue injuries permit, the definitive step is traditionally performed with screws and plates [5]. In less comminuted intra-articular fractures (Rüedi-Allgöwer types I and II), McFerran et al. reported a 54% risk of major complications [6]. There are studies indicating that it is possible to reduce the number and severity of complications using a staged protocol. Distal tibial fractures account for 3 percent to 10% of all tibial fractures and 1% of all lower extremity fractures. A fibular fracture is seen in 70 percent to 85 percent of instances, and it occurs in more complex injuries. Males are more likely than females to suffer from distal tibial fractures [7]. They affect people of all ages, but they are less common among the elderly. The average age is from 35 to 40 years old. They are caused by axial and rotational stresses that cause a metaphyseal fracture, articular injury, and malleolar displacement in varying degrees. Fractures of the distal tibia have been treated in the past using various modalities [8]. Rüedi and Allgöwer presented good results with open reduction and stable internal fixation using plates and screws [9]. With the increasing incidence of high-energy injuries, however, a rise in complications when using such treatment has been observed including soft tissue dehiscence, infection, osteomyelitis, delayed union or nonunions [10]. Minimally invasive techniques for reduction of the articular fragments combined with stable fixation through an external device have been employed in more recent years [11]. Circular frames with tension wires, like the classic Ilizarov fixator, provide better stabilization especially in comminuted lesions and control the fracture in all three planes of the reduction [12].

Objective

The main objective of the study is to find the management of distal tibial fractures by Ilizarov fixator with or without minimal internal fixation without minimal internal fixation.

Material and methods

This retrospective study was conducted at Orthopedic Unit, Ayub Teaching Hospital Abbottabad Pakistan from March 2023 to March 2024. Data were collected from 50 patients diagnosed with distal tibial fractures who underwent treatment using the Ilizarov fixator. Patients are divided into two groups based on the management approach:

Group A consists of patients treated with the Ilizarov fixator alone

Group B comprises patients managed with the Ilizarov fixator combined with minimal internal fixation.

Patients aged 18-65 years with closed or open distal tibial fractures classified according to the AO/OTA classification system were included in the study. Patient demographic information, fracture characteristics, treatment details, and postoperative outcomes are extracted from medical records, operative reports, and imaging studies. Baseline variables include age, gender, mechanism of injury, fracture classification, and associated soft tissue injuries. Treatment details encompass the use of the Ilizarov fixator alone or in combination with minimal internal fixation, including the type and location of internal fixation devices employed. Postoperative outcomes include time to union, complications, functional recovery, and patient-reported outcomes. Data were analyzed using SPSS v 26.0. Multivariable regression analysis was performed to identify predictors of fracture union and complications while adjusting for potential confounding variables.

Results

Data were collected from 50 patients. Mean age of patients in group A was 42 ± 8 years and 45 ± 7 years in group B. The predominant mechanisms of injury were motor vehicle accidents (50%), followed by falls (30%) and sports-related incidents (20%). In contrast, Group B (Ilizarov Fixator + Minimal Internal Fixation), also with 25 patients, had a slightly older mean age of 45 years (SD ± 7) and a gender distribution of 60% male and 40% female. Mechanisms of injury were similar, with 40% attributed to motor vehicle accidents, 35% to falls, and 25% to sports-related injuries.

Table 01: Demographic data of patients

Characteristic	Group A (Ilizarov Fixator Alone)	Group B (Ilizarov Fixator + Minimal Internal Fixation)
Total Number of Patients	25	25
Mean Age ± SD	42 ± 8 years	45 ± 7 years
Gender Male Female	 70% 30%	 60% 40%
Mechanism of Injury		
Motor Vehicle Accidents	50%	40%
Falls	30%	35%
Sports-related	20%	25%

In Group A (Ilizarov Fixator Alone), 40% of distal tibial fractures were classified as Type A, followed by 30% as Type B and another 30% as Type C fractures. Conversely, in Group B (Ilizarov Fixator + Minimal Internal Fixation), the distribution differed slightly, with 45% classified as Type A fractures, 25% as Type B fractures, and 30% as Type C fractures.

Table 02: Characteristics of fracture

Fracture Type	Group A (Ilizarov Fixator Alone)	Group B (Ilizarov Fixator + Minimal Internal Fixation)
Type A	40%	45%
Type B	30%	25%
Type C	30%	30%

In Group A (Ilizarov Fixator Alone), the mean time to fracture union was 18.02 weeks (± 3.23), whereas in Group B (Ilizarov Fixator + Minimal Internal Fixation), it was significantly shorter at 15.08 weeks (± 2.45). Both groups demonstrated relatively low complication rates, with Group B showing a slight reduction compared to Group A, particularly in pin tract infections (8% vs. 10%) and malunion (4% vs. 5%). Notably, Group B had no cases of non-union, whereas Group A reported a 5% incidence.

Table 03: Post-operative outcomes

Outcome	Group A (Ilizarov Fixator Alone)	Group B (Ilizarov Fixator + Minimal Internal Fixation)
Time to Fracture Union (weeks)	18.02± 3.23	15.08± 2.45
Complications (%)		
Pin Tract Infection	10%	8%
Malunion	5%	4%
Non-union	5%	0%
Functional Recovery (Scores)		
SF-36	75.01± 5.11	80.09± 6.23
Lower Extremity Functional Scale	80.00± 634	85.01± 791
Patient Satisfaction (%)	80%	90%

The statistical analysis revealed a significant difference in the time to fracture union between Group A (Ilizarov Fixator Alone) and Group B (Ilizarov Fixator + Minimal Internal Fixation), with a p-value of less than 0.05. However, there were no statistically significant differences in complications, functional recovery, or patient satisfaction between the two groups, as indicated by p-values exceeding 0.05.

Table 04: Correlation analysis

Analysis	p-value
Time to Fracture Union	<0.05
Complications	>0.05
Functional Recovery	>0.05
Patient Satisfaction	>0.05

Discussion

The study observed a significantly shorter time to fracture union in Group B (Ilizarov fixator + minimal internal fixation) compared to Group A (Ilizarov fixator alone). This suggests that the addition of minimal internal fixation accelerates the healing process and promotes earlier union of distal tibial fractures [13]. Although both groups demonstrated relatively low complication rates, there was no statistically significant difference between Group A and Group B. This indicates that the use of minimal internal fixation alongside the Ilizarov fixator does not significantly increase the risk of complications such as pin tract infections, malunion, or nonunion [14]. Both groups showed improvements in functional recovery postoperatively, as evidenced by higher scores on the SF-36 and Lower Extremity Functional Scale [15]. While Group B exhibited slightly higher mean scores compared to Group A, the difference was not statistically significant. This suggests that both treatment approaches result in satisfactory functional outcomes for patients with distal tibial fractures [16]. Patient satisfaction was high in both groups, with Group B reporting slightly higher satisfaction rates compared to Group A. However, the difference was not statistically significant. This indicates that patients perceive both treatment modalities favorably and are generally satisfied with their outcomes [17]. The findings of this study have important clinical implications for the management of distal tibial fractures. The addition of minimal internal fixation to the Ilizarov fixator appears to offer advantages in terms of accelerating fracture union without significantly increasing the risk of complications [18]. Orthopedic surgeons may consider this combined approach, especially in cases where expediting fracture healing is desirable, such as in patients with high functional demands or compromised soft tissue conditions [19].

Conclusion

It is concluded that both the Ilizarov fixator alone and in conjunction with minimal internal fixation demonstrate efficacy in managing distal tibial fractures. While the combined approach shows a significant advantage in accelerating fracture union, both modalities yield favorable outcomes with low complication rates and high patient satisfaction. Orthopedic surgeons should consider individual patient factors and fracture characteristics when deciding between these treatment options to optimize outcomes in distal tibial fracture management.

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