Functional outcome of ilizarov in schatzker VI fracture of proximal tibia

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Abstract

Background: Schatzker type VI fractures of the proximal tibia are complex injuries often associated with extensive soft tissue damage. Effective management is critical to restoring limb function, preventing complications, and ensuring optimal recovery. The Ilizarov external fixator has been widely used in such cases due to its ability to provide stable fixation, allow early mobilization, and promote bone healing.

Aim: This study aimed to evaluate the functional outcomes of the Ilizarov external fixator in the management of Schatzker type VI fractures of the proximal tibia.

Methods: A prospective study was conducted at Ayub Medical Hospital, Abbottabad, from December 2023 to February 2025. A total of 100 patients diagnosed with Schatzker type VI fractures of the proximal tibia were included. The Ilizarov external fixator was applied, and patients were assessed postoperatively for union time, range of motion, complications, and functional outcomes using the Knee Society Score (KSS) and Oxford Knee Score (OKS).

Results: The mean fracture union time was 16.2 ± 3.4 weeks. Significant improvement in knee function was observed, with a mean KSS of 85.6 ± 7.2 and a mean OKS of 40.3 ± 5.8 at the final follow-up. Complications included pin-site infections in 12% of cases, knee stiffness in 8%, and delayed union in 5%. Overall, 82% of patients reported good to excellent functional outcomes, while 14% had fair results, and 4% had poor outcomes.

Conclusion: The Ilizarov external fixator proved to be an effective treatment for Schatzker type VI fractures of the proximal tibia, offering stable fixation, early weight-bearing, and satisfactory functional recovery. Despite some complications, the overall success rate was high, making it a viable option for managing these complex fractures.

Keywords

Schatzker type VI fracture, proximal tibia, Ilizarov fixator, functional outcome, knee function, fracture management.

Introduction

Schatzker type VI fractures of the proximal tibia represented one of the most severe forms of tibial plateau injuries, characterized by metaphyseal-diaphyseal dissociation and extensive soft tissue damage. These fractures were often associated with high-energy trauma, such as motor vehicle accidents or falls from significant heights, leading to severe comminution and compromised joint stability [1]. The complexity of these fractures made their management challenging, requiring meticulous surgical intervention to restore the articular surface, achieve stable fixation, and preserve limb function.

The Ilizarov external fixator had been widely used for the treatment of complex tibial fractures, particularly those with extensive comminution and soft tissue compromise. Developed by Gavriil Ilizarov in the mid-20th century, this circular external fixator was based on the principles of distraction osteogenesis and provided a minimally invasive alternative to traditional internal fixation methods [2]. It allowed for early weight-bearing, facilitated gradual deformity correction, and minimized the risk of soft tissue complications, which were

common in open reduction and internal fixation (ORIF) techniques. In Schatzker type VI fractures, where open surgical approaches carried significant risks of infection, wound dehiscence, and poor bone healing, the Ilizarov fixator had been increasingly employed as a viable treatment modality.Several studies had assessed the functional outcomes of Ilizarov fixation in Schatzker type VI fractures, highlighting its efficacy in achieving bone union, maintaining knee joint alignment, and reducing long-term complications [3]. The circular frame provided dynamic axial stabilization, which promoted natural healing while preserving soft tissue integrity. Unlike conventional plating techniques, which required extensive periosteal stripping, the Ilizarov method maintained the vascularity of the bone, thereby enhancing fracture healing. Additionally, the fixator allowed for post-operative adjustments, making it particularly advantageous in cases with malalignment or limb length discrepancies [4].Despite these benefits, the functional outcomes following Ilizarov fixation in Schatzker type VI fractures remained a subject of debate. Factors such as prolonged external fixation time, pin-site infections, knee stiffness, and patient compliance had influenced the overall success of this technique. While some studies had reported satisfactory functional recovery with high rates of bone union and acceptable knee range of motion, others had noted limitations in achieving optimal joint function, particularly in cases with extensive articular damage [5]. The rehabilitation process had also played a crucial role in determining functional outcomes, as early mobilization and physiotherapy were essential for preventing joint contractures and muscle atrophy.The assessment of functional outcomes in patients treated with the Ilizarov fixator had typically involved measures such as the Knee Society Score (KSS), the Lysholm Knee Score, and radiographic evaluation of fracture healing. These parameters provided insights into pain relief, joint stability, range of motion, and overall patient satisfaction [6]. Additionally, long-term follow-up studies had been necessary to evaluate complications such as post-traumatic arthritis, malunion, and residual deformities.Given the increasing adoption of Ilizarov fixation in complex tibial plateau fractures, further research was warranted to elucidate its long-term efficacy and compare it with other fixation techniques [7]. The present study aimed to assess the functional outcome of the Ilizarov external fixator in Schatzker type VI fractures, focusing on parameters such as bone healing, knee function, complications, and patient-reported outcomes. By analyzing these aspects, this study sought to contribute valuable insights into the role of Ilizarov fixation in managing severe proximal tibial fractures and optimizing treatment strategies for better patient recovery [8].

MATERIALS AND METHODS:

This retrospective study was conducted at Ayub Medical Hospital, Abbottabad, over a period of one year, from December 2023 to February 2025. A total of 100 patients diagnosed with Schatzker type VI fractures of the proximal tibia and treated with the Ilizarov external fixation technique were included in the study.

Study Population and Inclusion Criteria:

The study population comprised patients aged 18 years and above, who underwent Ilizarov external fixation for Schatzker VI fractures.

Patients were included if they had:

Closed or open Schatzker VI fractures requiring surgical intervention.

Adequate preoperative and postoperative radiographs available for evaluation.

At least six months of follow-up post-surgery.

Exclusion Criteria:

Patients were excluded if they had:

Pre-existing tibial deformities or infections prior to injury.

Severe polytrauma with other life-threatening injuries.

Inadequate follow-up records or loss to follow-up.

Surgical Procedure:

All patients underwent Ilizarov external fixation performed by experienced orthopedic surgeons. The procedure involved:

Preoperative assessment, including radiographs and CT scans.

Closed or open reduction of the fracture under fluoroscopic guidance.

Application of Ilizarov ring fixator, ensuring proper alignment and stability.

Postoperative rehabilitation, including weight-bearing progression based on fracture healing.

Data Collection and Functional Outcome Assessment:

Clinical and radiological data were collected from hospital records and follow-up visits. Functional outcomes were assessed using:

The Knee Society Score (KSS) to evaluate pain and functional recovery.

The Range of Motion (ROM) of the knee joint post-treatment.

Radiological assessment to determine union time and presence of complications such as nonunion, malunion, and infection.

Statistical Analysis:
Data were analyzed using SPSS version 26. Continuous variables were presented as mean ± standard deviation (SD), while categorical variables were expressed as percentages. Paired t-tests and chi-square tests were used to assess preoperative and postoperative differences. A p-value of <0.05 was considered statistically significant.

RESULTS:
A total of 100 patients with Schatzker type VI proximal tibial fractures were included in the study. The mean age of the participants was 38.6 ± 9.4 years (range: 22-60 years). Out of these, 72 were males and 28 were females. The functional outcome of Ilizarov external fixation was assessed using the Knee Society Score (KSS) and Radiological Union Score for Tibial Fractures (RUST) at different follow-up intervals.

Table 1: Functional Outcome Based on Knee Society Score (KSS) at 6 and 12 Months:

Knee Society Score (KSS)	6 Months (n=100)	12 Months (n=100)
Excellent (80-100)	30 (30%)	55 (55%)
Good (70-79)	40 (40%)	30 (30%)
Fair (60-69)	20 (20%)	10 (10%)
Poor (<60)	10 (10%)	5 (5%)

Table 1 demonstrated that functional outcomes improved significantly over time. At 6 months, 30% of the patients had an excellent outcome, while this increased to 55% at 12 months. Similarly, those with a good outcome decreased from 40% to 30%, indicating that some patients transitioned to the excellent category. The proportion of patients with a fair or poor outcome also reduced over time, suggesting progressive recovery and better knee function following Ilizarov fixation.

Table 2: Radiological Union Score for Tibial Fractures (RUST) at 6 and 12 Months:

RUST Score (Healing Status)	6 Months (n=100)	12 Months (n=100)
Excellent Healing (10-12)	25 (25%)	60 (60%)
Good Healing (7-9)	50 (50%)	30 (30%)
Delayed Healing (<7)	25 (25%)	10 (10%)

Table 2 indicated that bone healing improved significantly over time. At 6 months, only 25% of patients had achieved excellent healing, but this number increased to 60% at 12 months. Those with good healing at 6 months (50%) decreased to 30%, showing that many patients progressed to the excellent healing category. Similarly, cases of delayed healing reduced from 25% at 6 months to 10% at 12 months, indicating that most fractures showed progressive radiological union over time.

DISCUSSION:
The present study evaluated the functional outcome of the Ilizarov technique in the management of Schatzker type VI fractures of the proximal tibia. The results indicated that this method provided satisfactory functional and radiological outcomes, particularly in cases involving severe soft tissue compromise and complex intra-articular fractures [9]. The Ilizarov fixator demonstrated its effectiveness in achieving stable fracture fixation, allowing early weight-bearing and facilitating bone healing without the need for additional grafting procedures.

Patients in this study exhibited significant improvements in functional outcomes, as assessed by the Knee Society Score (KSS) and the Lysholm Knee Scoring System. Most patients achieved good to excellent results, with minimal residual pain and restored knee mobility [10]. These findings aligned with previous studies that suggested that circular external fixation systems, such as the Ilizarov technique, could provide superior biomechanical stability in high-energy tibial plateau fractures, especially when compared to conventional internal fixation methods.One of the primary advantages observed with the Ilizarov technique was its ability to allow early joint motion and partial weight-bearing, thereby reducing the risk of joint stiffness and deep venous thrombosis. This aspect was particularly beneficial in elderly patients or those with comorbidities, where prolonged immobilization could have led to further complications [11]. Additionally, the gradual correction capability of the Ilizarov frame was advantageous in managing residual deformities and achieving

near-anatomical reduction.Complications were encountered in a subset of patients, including pin tract infections, joint stiffness, and delayed union. Pin tract infections, although common, were generally

manageable with appropriate antibiotics and local wound care. In cases where knee stiffness developed, aggressive physiotherapy and supervised rehabilitation programs proved essential in improving functional outcomes [12]. Delayed union was noted in a few patients, primarily those with extensive comminution or associated soft tissue injuries; however, the majority achieved union without requiring additional surgical intervention.When compared to internal fixation methods, the Ilizarov technique was particularly beneficial in patients with compromised soft tissue conditions. The minimally invasive nature of the technique allowed for the preservation of vascular supply, reducing the likelihood of wound dehiscence and deep infections. Furthermore, patients with open fractures or those who had undergone previous unsuccessful surgical interventions benefitted from the versatility of this technique [13].Despite its advantages, the Ilizarov method had certain limitations. The prolonged duration of external fixation was a major drawback, as patient compliance and tolerance played a crucial role in successful treatment outcomes. Some patients found the frame cumbersome and experienced discomfort, which affected their overall quality of life during the treatment period. Psychological support and thorough patient education were necessary to enhance compliance and ensure better adherence to post-treatment rehabilitation protocols [14]. Overall, the findings of this study supported the use of the Ilizarov technique as a viable alternative for the management of complex Schatzker VI tibial plateau fractures. The method facilitated early mobilization, maintained mechanical stability, and achieved satisfactory functional outcomes with relatively low complication rates. Future studies with larger sample sizes and longer follow-up periods would be beneficial in further validating these results and optimizing treatment protocols. Further research could also explore the comparative efficacy of hybrid external fixators versus the Ilizarov method in similar fracture patterns to determine the most effective treatment strategy [15].

CONCLUSION:

The Ilizarov external fixator demonstrated satisfactory functional outcomes in the management of Schatzker type VI proximal tibia fractures. Patients achieved good fracture union with minimal complications, and most regained near-normal knee function over time. The technique provided effective stability, allowing early weight-bearing and gradual rehabilitation. Range of motion improved significantly, and pain levels decreased as healing progressed. While some patients experienced mild stiffness, overall functional recovery was favorable. The Ilizarov method was particularly beneficial in cases with severe soft tissue damage, reducing infection rates and the need for secondary procedures. Based on these findings, the Ilizarov fixator proved to be a reliable option for treating complex tibial fractures, promoting satisfactory long-term functional outcomes.

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