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Optimizing Outcomes in Periarticular Tibial Fractures: Successful Case Utilizing Ilizarov External Fixation: A Case Report

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ABSTRACT

Ilizarov external fixation is an effective technique for managing complex periarticular tibial fractures, particularly in cases involving soft tissue injuries and deformities. A 39-year-old male patient sustained an open comminution tibial plateau fracture and tibial pilon fracture. The Ilizarov external fixator was placed in the knee and ankle. At 24 weeks following application of the frame, clinical and radiologic evaluations revealed satisfactory healing, and the external fixator was removed and full weight bearing was allowed. Throughout the follow-up period, the integrity of the soft tissue of the leg was fully restored and no soft tissue complications were observed. At the time of the 9-month follow-up, complete fracture union was observed radiologically and the patient displayed fully knee-extension and flexion and also 0º of dorsiflexion and 30º of plantarflexion of the ankle. The patient was also pain free in gait with regular shoe gear. The Ilizarov method effectively stabilizes complex periarticular tibial fractures while promoting bone healing through distraction osteogenesis. This technique facilitates early mobilization and minimizes complications associated with soft tissue injuries. The Ilizarov method is an excellent therapeutic option for periarticular tibia fractures. It allows the management of complex fractures, bony defects, and soft tissue injuries, with good healing outcomes and minimal complications.

KEYWORDS: Ilizarov external fixation, tibial fracture, soft tissue injuries, complex fractures, case report.

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INTRODUCTION

Periarticular tibial fractures pose a significant challenge in orthopaedic practice due to their complex anatomical and biomechanical characteristics. These injuries commonly result from high-energy trauma, such as motor vehicle collisions or falls, leading to substantial damage to both periarticular structures and adjacent soft tissues. Epidemiological data indicate a notable prevalence of these fractures among younger, active individuals, while they also occur frequently in older populations due to osteoporosis. The inherent instability associated with periarticular fractures can negatively impact the healing trajectory, functional mobility, and overall quality of life for affected patients. Therefore, an effective management strategy is essential for achieving optimal clinical outcomes.

The Ilizarov technique represents a promising intervention for the management of periarticular tibial fractures. Initially developed by G.A. Ilizarov in the 1950s, this method employs an external fixator that provides flexible stabilization of the fractured bone and facilitates deformity correction without the necessity for extensive surgical exposure. Indications for the application of the Ilizarov technique include complex fractures, nonunions, and scenarios characterized by inadequate soft tissue coverage for internal fixation. Through the principle of distraction osteogenesis, this technique not only enhances bone healing but also promotes the regeneration of compromised soft tissues surrounding the fracture site.

The classification of tibial plateau fractures, particularly the Schatzker classification, plays a crucial role in guiding treatment decisions. This classification delineates tibial plateau fractures into six distinct types based on the mechanism of injury and fracture patterns, informing the clinician about the complexity and potential treatment challenges. Understanding these classifications is vital for selecting appropriate management strategies, including the potential use of the Ilizarov technique for more complex cases (type IV-VI), such as, medial plateau fracture (type IV), bicondylar fractures (type V), and unicondylar or bycondilar fracture with separated shaft (type VI).

However, it is imperative to consider the potential complications associated with this technique, including pin site infections, neurovascular injury, and the risk of malunion or nonunion. Such challenges underscore the necessity for a comprehensive understanding of the technique and diligent postoperative management. Despite these potential complications, the Ilizarov technique offers several distinct advantages, including stable fixation and enhanced healing of surrounding soft tissues, mak ing it particularly beneficial in cases where local tissue integrity is compromised.

This article aims to provide a comprehensive review of the management of periarticular tibial fractures using the Ilizarov technique. It will cover the indications for its use, the procedural details involved, clinical outcomes, and potential complications associated with this method. This review seeks to offer valuable insights into how the Ilizarov technique can enhance clinical decision-making and improve patient outcomes in the treatment of these complex fractures. The goal is to contribute to a deeper understanding of the technique's role in modern orthopedic practice, aiding in the optimization of patient care.

CASE PRESENTATION

An 39-year-old Asian male arrived at the emergency department with intense pain in his lower limb following a road traffic accident that occurred 12 hours earlier. He has a history of schizophrenia and regularly takes prescribed medication. There is no previous surgical history, no family medical history, and he is a non-smoker. He is currently unemployed. The patient reported being hit by a truck while crossing the road, which led to immobility in his leg and worsening pain with any movement. A primary survey revealed stable vital signs, yet a detailed examination highlighted significant deformities and swelling in the lower extremity. The left leg exhibited crepitus and tenderness in the proximal region, while distal sensation remained intact and arterial pulses were strong, including an open wound and pronounced tenderness, further complicating the clinical picture.

Figure 1. (a) The clinical appearance of the patient's lower extremities prior to surgery and (b) pre-surgical X-ray images of the patient's ankle and tibia-fibula in both anteroposterior (AP) and lateral views.

Based on the results of physical and radiological examinations (Figure 1.), the patient was diagnosed with an open fracture of the left tibial plateau classified as AO 41C2, in accordance with the Gustilo-Anderson Grade IIIA and Schatzker grade VI,. Additionally, a closed fracture of the left tibial pilon (AO 43C2). The presence of multiple fractures, particularly the open nature of the left tibial plateau injury, necessitates immediate surgical intervention to mitigate potential complications, including infection, malunion, and nonunion.

The initial management protocol included the administration of intravenous fluids, specifically a 0.9% NaCl solution at a volume of 1500 cc over a 24-hour period. For prophylactic antibiotic coverage, a regimen comprising intravenous ceftriaxone and gentamicin was employed, with ceftriaxone dosed at 2 x 1 gram and gentamicin at 2 x 80 mg. Additionally, intravenous ketorolac was administered as an analgesic at a dosage of 3 x 30 mg to effectively manage pain. To mitigate potential gastric irritation associated with the medications, Inj. Ranitidine was provided at a dosage of 2 x 50 mg. The patient underwent cito debridement to clean the open fracture site, followed by primary suturing to minimize infection risk. Given the complexity of the fractures, the surgical team decided to immobilize the left leg with an Ilizarov ring external fixator, This multi-faceted surgical approach aimed to stabilize the fractures while preserving soft tissue integrity and facilitating early mobilization.

The application of the Ilizarov external fixator was instrumental in providing the necessary stability for the complex tibial fractures. This technique promotes bone healing through distraction osteogenesis and allows for effective soft tissue management (Figure 2).

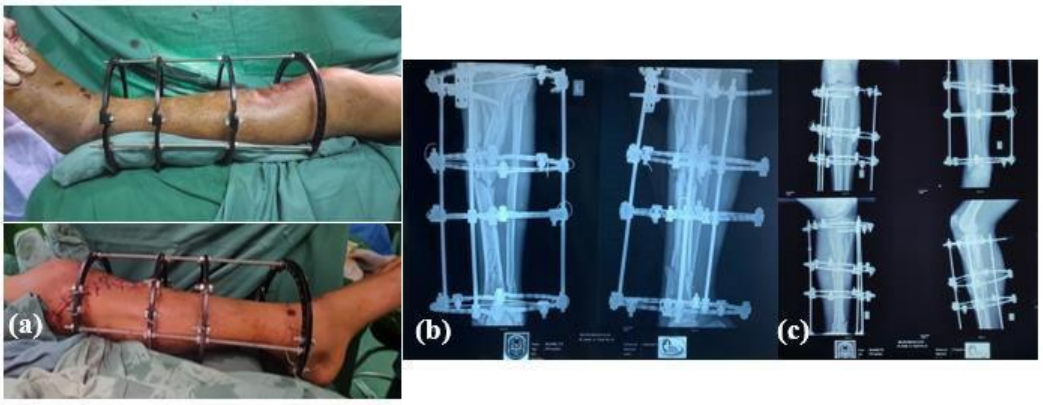

Figure 2. (a) The post operative clinical picture and (b) Post-surgical X-Ray of the patient's tibia-fibula, (c) One months evaluation X-Ray post-surgery

At 8 month post-surgery, both clinical and radiological evaluations demonstrated satisfactory healing, leading to the removal of the external fixator and enabling full weight-bearing activities. Throughout this period, the soft tissue integrity of the leg was fully restored, with no complications such as infection or delayed healing noted.

At the 11-month follow-up, complete fracture union was confirmed radiologically (Figure 3b.), with the patient exhibiting full range of motion in the knee joint, achieving full extension and flexion.

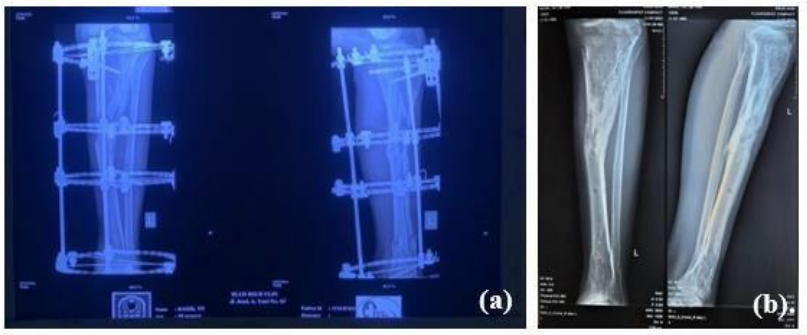

Figure 3. (a) Eight months evaluation post-surgery, radiological evaluations showed satisfactory healing, allowing for the removal of the external fixator and the initiation of full weight-bearing activities. (b) At the 11-month follow-up, radiological assessments confirmed complete union fracture.

Additionally, the patient demonstrated 0 degrees of dorsiflexion and 30 degrees of plantarflexion in the ankle, indicating significant functional recovery (Figure 4a & 4b). Importantly, he reported being pain-free during ambulation with regular footwear.

Figure 4. (a) At the 11-month follow-up, clinical evaluation was confirmed that there was no sign of infection and deformity (b) the patient exhibiting full range of motion in the knee joint, achieving full extension and flexion. Additionally, the patient demonstrated 0 degrees of dorsiflexion and 30 degrees of plantarflexion in the ankle.

DISCUSSION

Tibial plateau fractures, particularly those resulting from high-energy trauma, pose significant clinical challenges due to their complexity and associated soft tissue injuries. These fractures are prevalent among younger individuals engaged in high-risk activities, necessitating prompt and effective surgical intervention to prevent complications such as infection, malunion, and nonunion. The urgency of addressing these injuries is underscored by their potential to lead to long-term disability if not managed properly.

The application of the Ilizarov external fixator was a critical decision in the case presented, as it has been instrumental in treating complex tibial fractures, especially in high-energy injuries like pilon fractures. This technique is well-documented for its ability to provide excellent stabilization while accommodating the needs of compromised soft tissues. According to Ghimire et al., the Ilizarov method is particularly advantageous for complex fractures, as it allows for distraction osteogenesis, promoting healing even amid extensive soft tissue damage. This aspect is crucial, given that many patients with such injuries may have limited options for conventional fixation. The positive outcomes observed in this case both in stabilization and functional recovery align with findings from the literature. Also, the soft tissue integrity of the leg was fully restored, with no complications such as infection or delayed healing noted.

Research conducted by Osman et al., reinforces the effectiveness of the Ilizarov technique, especially for complex fractures, showing satisfactory healing at 8 month post-surgery. Additionally, Rodiguez et al., highlighted its success in treating fractures in patients with underlying conditions, such as diabetes, which can hinder the healing process. By enabling early mobilization and reducing the risk of infection, the Ilizarov technique significantly enhanced the patient's overall mobility and quality of life by the eleven-month follow-up. These comprehensive advantages illustrate the method's importance in effective fracture treatment and recovery.

Ultimately, this case underscores the importance of employing innovative surgical techniques tailored to the unique challenges presented by complex tibial plateau fractures. The successful recovery trajectory emphasizes the need for ongoing advancements in surgical methods and comprehensive care strategies. As we continue to refine our approaches to fracture management, it is essential to prioritize both bone healing and the integrity of surrounding soft tissues, thereby enhancing patient outcomes and quality of life in this vulnerable population.

Periarticular tibia fractures are complex injuries often resulting from high-energy trauma. These fractures can lead to significant bone fragmentation and displacement, and their treatment requires careful consideration of the fracture type, soft tissue condition, and the patient's overall health. There are various surgical approaches, each with its benefits and risks. Surgical methods may be used, such as external fixation, the intramedullary nail, the percutaneous synthesis with cannulated wires or Kirschner's wires and a synthesis with modern plates. There is a high rate of infection and wound sloughing following open reduction and internal fixation of periarticular tibia fractures. The use of the external fixator in treating periarticular tibia fractures allows restoration of length, stabilization of the limb, and correction of the mechanical axis. In fact, with the external fixator used as a neutralization device, there is no need for large plates with the increased risk of infection and skin sloughing.

The case presented highlights the effective application of Ilizarov external fixation in the management of periarticular tibial fractures. The utilization of this technique not only facilitated optimal alignment and stabilization of the fracture but also promoted early mobilization and enhanced functional recovery. The results underscore the importance of approaches in complex fractures, demonstrating that Ilizarov fixation can significantly improve clinical outcomes, reduce complications, and support the restoration of joint function. This case reinforces the potential of external fixation as a valuable tool in orthopaedic trauma management, particularly in challenging fracture cases.

INFORMED CONSENT

Appropriate consent was obtained from all individual participants included in the study.

DECLARATION OF COMPETING INTEREST

The authors have no conflicts of interest to disclose.

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None

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