Section: Orthopaedics

Original Research Article

IS THE ILIZAROV METHOD THE BEST OR ONLY OPTION? A RETROSPECTIVE STUDY OF MY EXPERIENCES WITH THE ILIZAROV FIXATION IN COMPLEX TIBIAL FRACTURES OVER THE PAST TWO DECADES

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Abstract

Background: Tibial fractures are common and challenging injuries. The Ilizarov method has been widely used for the fixation of compound tibial fractures. This study aims to evaluate the efficacy and patient outcomes associated with the Ilizarov method over the past two decades. **Material and Methods:** This retrospective study reviewed 93 patients treated with the Ilizarov fixation for tibial fractures between 2003 and 2023. Data collected included patient demographics, injury characteristics, treatment details, clinical and functional outcomes, and patient satisfaction. **Results:** The study cohort consisted of 84 males (92%) and 9 females (8%), aged 18 to 70 years, with a mean age of 45 years. Open fractures were predominant, accounting for 75.3% of cases, while closed fractures were 24.7%. Traffic accidents and falls were the leading causes of fractures. On average, surgical treatment was performed within 6 hours post-injury. The Ilizarov apparatus typically required an average of four rings. Bone healing was achieved in 91.4% of cases, with a smaller proportion experiencing delayed union (16.1%) or non-union (5.4%). Complications were primarily pin-site infections (21.5%), joint stiffness (16.1%), and neurovascular compromise (2.2%). Functional outcomes, as assessed by the Modified Merle d'Aubigné Score, were excellent in 66.7%, good in 21.5%, and fair in 11.8%. No patients reported poor outcomes. Patient satisfaction was generally high, with 66.7% being very satisfied, 21.5% satisfied, and only 11.8% expressing dissatisfaction. **Conclusion:** The Ilizarov method provides a high rate of bone healing and patient satisfaction in the treatment of Open tibial fractures.where as no other alternative treatment methods give as good as results.

INTRODUCTION

Tibial fractures are among the most prevalent skeletal injuries encountered in orthopedic practice due to the tibia's vulnerability in traumatic incidents.[1] The management of these fractures, particularly when they are open or comminuted, remains a significant challenge in orthopedic surgery.[2] Various methods have been developed to address the complexities of tibial fractures, among which the Ilizarov method has gained prominence.[3] Developed in the mid-20th century by Dr. Gavriil Ilizarov in Russia, the Ilizarov method uses a circular external fixator to stabilize and lengthen bones.[4] This technique is highly versatile and can be used for various orthopedic applications including limb lengthening, complex fracture repair, and correction of deformities.[5] Its use in tibial fractures is particularly noted for enabling precise control of the healing process, even in cases of severe bone loss and soft tissue damage.[6]

Despite its advantages, the Ilizarov method is not devoid of complications, with issues such as pin-site infections, joint stiffness, and neurovascular compromise being commonly reported. Moreover, the method requires a high level of patient compliance and can be resource-intensive.[7]

Given the method's complex dynamics and mixed outcomes, there is a need to evaluate its long-term effectiveness and patient-reported outcomes. This

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retrospective study aims to assess the clinical and functional outcomes of 93 patients treated with the Ilizarov method for tibial fractures over the past two decades, providing insights into its efficacy and areas for potential improvement.

Through this investigation, we seek to contribute to the broader understanding of the Ilizarov method's role in modern orthopedics, particularly focusing on its application in tibial fractures, and to ascertain whether the benefits justify the complications and resources involved.

Aim and Objectives

The aim of this study is to evaluate the long-term effectiveness and patient outcomes of the Ilizarov method in the treatment of tibial fractures.

To determine the rate of bone healing and incidence of complications, including pin-site infections and joint stiffness, in patients treated with the Ilizarov method.

To assess the functional outcomes of patients using the Modified Merle d'Aubigné Score.

To evaluate patient satisfaction with the treatment in terms of pain management, mobility, and overall treatment experience.

To identify potential correlations between patient demographics, injury characteristics, and treatment outcomes, enhancing personalized treatment approaches.

MATERIALS AND METHODS

Study Setting and Setting

This retrospective cohort study reviewed medical records of 93 patients who underwent tibial fracture treatment using the Ilizarov method at our tertiary care center between January 2003 and December 2023.

Participants The study included patients who:

Were aged 18 years and older at the time of injury.

Suffered from closed or open tibial fractures.

Patient's with previous failed surgery with Interlocking nail/ plate with Infection and Nonunion…

Received the Ilizarov fixation as the primary treatment method.

Exclusion criteria included patients with:

Previous chronic diseases affecting bone metabolism (e.g., osteoporosis, cancer)[8].

Incomplete medical records.

Data Collection: Data were extracted from electronic health records and included:

Demographic information (age, gender).

Injury details (type of fracture, cause).

Treatment specifics[9] (time to surgery, number of rings used, duration of fixation).

Clinical outcomes (time to bone healing, complications such as pin-site infections and joint stiffness).

Functional outcomes assessed using the Modified Merle d'Aubigné Score.

Patient satisfaction, collected through follow-up interviews and standardized questionnaires.

Statistical Analysis: Descriptive statistics were used to summarize demographic and clinical characteristics. The rates of bone healing, complications, and satisfaction levels were calculated as percentages. Chi-square and Fisher's exact tests were employed to examine the relationships between categorical variables. A p-value of less than 0.05 was considered statistically significant. Statistical analysis was performed using SPSS software, version 25.

Ethical Considerations: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration. As this was a retrospective study, patient consent was waived, but patient confidentiality was rigorously maintained throughout the study.

RESULTS

A retrospective review was conducted on 93 patients treated for tibial fractures using the Ilizarov method over the past two decades. The demographic and clinical characteristics, treatment details, and outcomes of these patients are described below.

Patient Demographics: The study included 84 males (92%) and 9 females (8%), with an age range of 18 to 70 years and a mean age of 45 years (Table 1).

Injury Characteristics: Our study found that open fractures (75.3%) were more prevalent than closed fractures (24.7%). The leading causes of these fractures were traffic accidents (40%) and falls (30%), with a notable proportion (25%) attributed to failed index surgeries or other causes (5%)(Table 2).

Treatment Details: The average time to surgery post-injury was 6 hours, with a range from 1 to 48 hours. The Ilizarov apparatus typically involved the use of an average of 4 rings, ranging from 3 to 6. The duration of fixation averaged 150 days, with a range from 90 to 210 days (Table 3).

Clinical Outcomes: Indicated favorable results, with union achieved in 91.4% of cases. However, a subset of patients experienced delayed union (16.1%) or non-union (5.4%), and complications such as pin-site infections (21.5%), joint stiffness (16.1%), and neurovascular compromise (2.2%) were observed(Table 4).

Functional Outcomes: as assessed by the Modified Merle d'Aubigné Score, demonstrated promising results, with 66.7% of patients achieving an excellent outcome, 21.5% a good outcome, and 11.8% a fair outcome. Notably, no patients were categorized as having a poor outcome (Table 5).

Patient Satisfaction: With the Ilizarov Method was generally high, with 66.7% of patients reporting being very satisfied and an additional 21.5% reporting being satisfied. Dissatisfaction was relatively low, with 11.8% of patients expressing

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dissatisfaction and none reporting being very dissatisfied (Table 6).

Table 1: Patient Demographics

Demographic	Count	Percentage
Male	84	90.3%
Female	9	9.7%
Age Range	18-70	-
Mean Age	-	45 years

Table 2: Injury Characteristics

Characteristic	Count	Percentage
Closed Fractures	23	24.7%
Open Fractures	70	75.3%
Traffic Accidents	37	40%
Falls	28	30%
Failed Index Surgeries	23	25%
Other Causes	5	5%

Table 3: Treatment Details

Treatment Detail	Count/Range
Average Time to Surgery Post-Injury	6 hours (Range: 1-48 hours)
Average Rings Used	4 (Range: 3-6)
Average Fixation Duration	150 days (Range: 90-210 days)

Table 4: Clinical Outcomes

Outcome	Count	Percentage
Union Achieved	85	91.4%
Delayed Union	15	16.1%
Non-Union	5	5.4%
Pin-Site Infections	20	21.5%
Joint Stiffness	15	16.1%
Neurovascular Compromise	2	2.2%

Table 5: Functional Outcomes (Modified Merle d'Aubigné Score)

Outcome	Count	Percentage
Excellent	62	66.7%
Good	20	21.5%
Fair	11	11.8%
Poor	0	0%

Table 6: Patient Satisfaction

Satisfaction Level	Count	Percentage
Very Satisfied	62	66.7%
Satisfied	20	21.5%
Dissatisfied	11	11.8%
Very Dissatisfied	0	0%

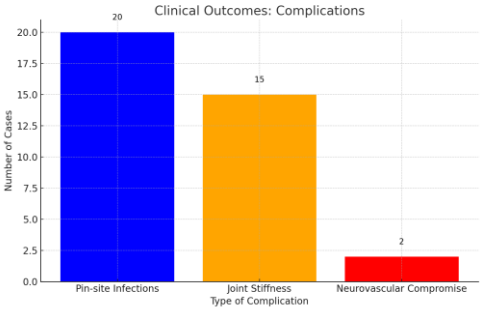

Figure No:1 Complication Rates Post -Tibial Fracture Treatment

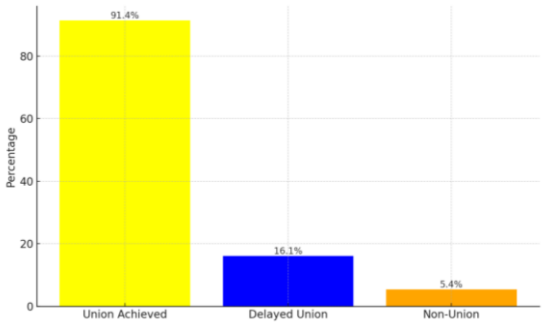

Figure No:2 Bone Healing (Union) Outcomes

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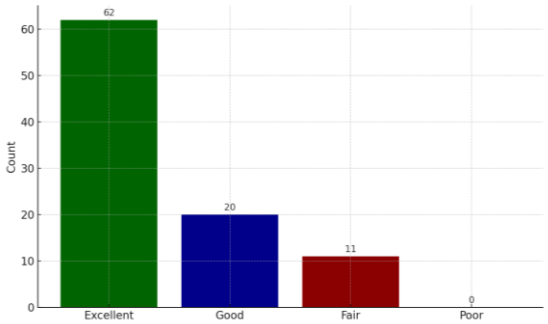

Figure No:3 Functional Outcomes (Modified Merle d'Aubigné Score)

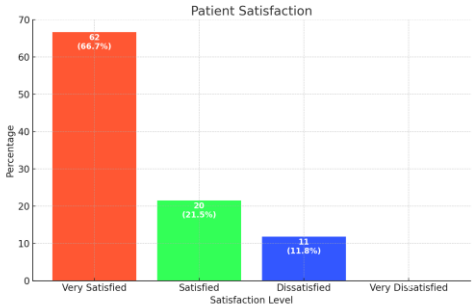

Figure No:4 Patient Satisfaction Levels

Figure No : 5 Infected Non union Tibia with exposed Titanium Plate...Patient came for asking Amputation, Patient assured and Limb Saved

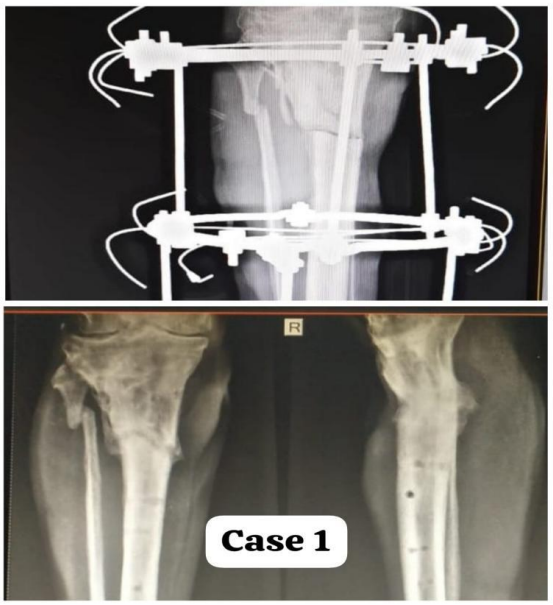

Figure No : 6 Post OP and after 1yr image's of same patient (post frame removal) Showing good Union

Figure No :7 Pre OP and Immediate Post OP image's of Case No : 2
No plastic surgery intervention needed.

Figure No .8 :Image showing Solid union, Clinical image of same patient no:2

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Figure No : 9 A young girl with multiple fractures in leg and foot....No plastic surgery intervention done

Figure No :10 Images on Day 1 and after well healing of wounds and Solid Union of Case no:3

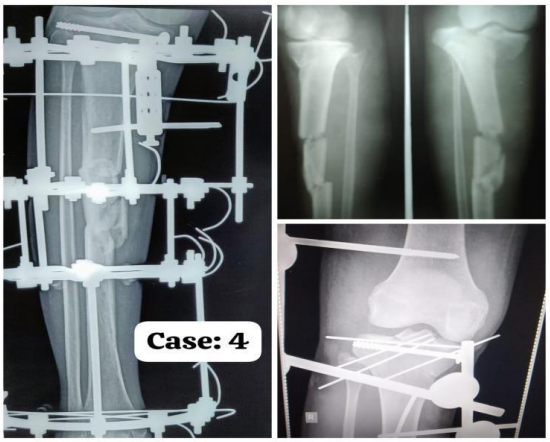

Figure No :11 Segmental fracture of Tibia plus Intra articular fracture with Knee Subluxation

Figure No : 12 Good Union after 15 months
Same patient with frame, Case no:4

Figure No .13: Infected DC Plate fixation (known Diabetic)
Pre op after Plate removal and PO after Bone resection and Ilizarov Fixation

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Figure No .14 : 1.5 yr old Infected ILT with Nonunion + Chronic Osteomyelitis.
Bone resection and Ilizarov Fixation, Secondary Procedure of Bone Grafting Done

DISCUSSION

This retrospective study examined the outcomes of 93 patients treated with the Ilizarov method for tibial fractures over the past two decades. The findings reveal a high rate of bone healing (91.4%) and patient satisfaction (88.2% reporting satisfied to very satisfied (66.7% very satisfied plus 21.5% satisfied)), corroborating the method's effectiveness as reported in previous studies.[10] However, the complication rate, particularly pin-site infections (21.5 %) and joint stiffness (16.1%), aligns with the concerns noted in the existing literature about the challenges of post-operative care and rehabilitation.[11]

Effectiveness of the Ilizarov Method The high rate of bone union in our study highlights the Ilizarov method's capacity for effective fracture stabilization and osteogenesis, even in complex cases. This is consistent with the principles of distraction osteogenesis, which have been well-documented to facilitate bone growth under mechanical stress.[12]

Complications Associated with the Ilizarov Method Despite its benefits, the Ilizarov method is not without drawbacks. The significant rate of pin-site infections is similar to findings from other studies, which suggest that meticulous pin care and patient education are crucial for reducing this risk.[13] Joint stiffness, another common complication, underscores the importance of incorporating regular physiotherapy into the post-operative care regimen to enhance joint mobility and functional recovery.[14]

Patient Satisfaction The level of patient satisfaction reported in our study is encouraging and suggests that patients perceive a positive outcome despite the lengthy treatment duration and potential discomfort associated with the Ilizarov apparatus. This finding should be explored further to understand the factors that influence patient perceptions, such as pain management, support services, and the cosmetic outcomes of treatment.[15]

Study Limitations Our study's retrospective design inherently limits the ability to control for confounding variables that may influence outcomes. Additionally, the absence of a control group treated with alternative methods restricts comparative conclusions about the Ilizarov method's relative effectiveness.

Future Research Further prospective studies comparing the Ilizarov method with other treatment modalities, such as internal fixation or newer external fixation devices, are needed. Additionally, investigating strategies to minimize complications, such as advanced pin-site care protocols or innovative ring designs, could significantly improve patient outcomes.

CONCLUSION

Overall, our findings affirm the utility of the Ilizarov method is best and only Choice in managing tibial fractures especiasly complicated tibial fractures where regular nailing or plating is not suitable and also in failed cases with infections ...As the orthopedic field continues to evolve, ongoing research and technological advancements will likely enhance the effectiveness and patient experience associated with this venerable treatment method.

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