Treatment of Tibial Fractures by Ilizarov Technique: A Longitudinal Study

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Abstract

Introduction: Ilizarov technique has many advantages over conventional orthopedic treatment of fractures. It is minimally invasive and permits accurate reduction and alignment of comminuted, diaphyseal, and juxta-articular fractures. Acute infections following immediate fixation with nail or plate can be effectively managed with Ilizarov fixator.

Materials and Methods: In the present study, twenty patients with tibia fractures were operated with Ilizarov over a period of 2 consecutive years and the results were analyzed. Fixator used is Ilizarov external fixator with Schanz pins and tensioned wires.

Results: Results were assessed using bone score (ASAMI) and lower extremity functional scale. 68.4% had excellent, 15.8% patients had good, 5.3% patients had fair, and 10.5% patients had poor result. 57.9% patients had minimal disability, 26.3% patients had moderate disability, 10.5% patients had severe disability, and 1 patient crippled.

Conclusion: Ilizarov circular fixation is an ideal method for fracture when extensive dissection and internal fixation are contraindicated due to trauma to soft tissue, deficiency of bone stock, infection, and comminuted fracture.

Keywords: Comminuted fracture, External fixator, Fracture tibia, Ilizarov, Poly-trauma

INTRODUCTION

The Ilizarov apparatus is a type of external fixation used to treat complex/open fractures and to lengthen/reshape bones. Ilizarov frames provide a versatile fixation system for the management of bony deformities, fractures, and their complications.¹

In tibial fractures, invasive techniques such as open reduction internal fixation (ORIF) with plates/screws are the frequent modality of treatment. External fixation technique such as Ilizarov is minimally invasive and may be a better alternative, especially in comminuted fractures.

Ilizarov technique has many advantages over conventional orthopedic treatment of fractures. It is minimally invasive and permits accurate reduction and alignment of comminuted and juxta-articular fractures. Weight bearing and joint range of motion (ROM) can begin very early. It also permits secondary correction without further surgical invasion. It can be used very effectively in patients of polytrauma. Acute infections following immediate fixation with nail or plate can be effectively managed with Ilizarov fixator.

MATERIALS AND METHODS

A longitudinal study of a total of 20 patients with tibia fractures which were operated with Ilizarov for 2 consecutive years (between March 2012 and March 2014) in Belgaum Institute of Medical Sciences Hospital, Belagavi. The cause of injury was road traffic accident in all the cases. The patients were examined thoroughly and emergency care was given. Acute infected fractures, comminuted diaphyseal, and juxta-articular fractures of tibia were included in the study. 10 patients...
had open fractures, 10 had closed fractures, and 9 patients had acute infection following immediate nailing/plating for which Ilizarov was applied subsequently after removing nail/plate. The fracture was comminuted/segmental in 9 patients and in diaphysis, 10 patients had juxta-articular fracture. One patient had tibial plafond fracture. In 5 out of 10 juxta-articular fractures, joint was spanned. Associated other bone fractures were present in 6 patients. Two patients had persistent non-union. One patient required below knee amputation. One tibial plafond fracture was treated by Ilizarov technique in our study, which achieved union in 105 days with external fixation time of 120 days, bone score was excellent and had moderate disability.

All patients with open fractures were treated on emergency basis in the operation theater with thorough irrigation and debridement of wound, followed by fracture fixation. Antibiotics were used whenever indicated (for prophylaxis and/or management of infection). In case of comminuted fractures, initial gradual slight distraction at the rate of $\frac{1}{2}$ mm/day for 3 weeks followed by compression is done. Juxta-articular fractures were managed with maintaining articular surface congruency. Infections were controlled using antibiotic nail/beads. Physiotherapy and ROM exercises were started after 2-4 days. Partial weight bearing and subsequently full weight bearing allowed as much the patient tolerated.

Inflammation at pin site and pain were the most common complications in the study group and were managed with regular and proper dressings. Post-operative follow-ups are done every 3 weeks. Two patients did not follow-up regularly. Post-operative radiographs were taken every 3 weeks, until the fracture is healed. All patients were advised early range of motion exercises.

Results were assessed using bone score (Association for the Study and Application of Methods of Ilizarov Scoring System)\(^2\) and lower extremity functional scale.

**FINDINGS/RESULTS**

In the present study, it was found that Ilizarov fixation allowed early weight bearing without compromising fracture stability and healing. In our series, most of the fractures united following treatment with Ilizarov technique. Time from injury to application of frame ranged from 0 to 80 days (average = 15 days). Fixator used is Ilizarov external fixator with tensioned wires and Schanz pins. External fixator time ranged from 120 to 245 days (Figures 1a-d and 2).

**Bone Score**

68.42% (13) had excellent, 15.78% (3) patients had good, 5.26% (1) patients had fair, and 10.52% (2) patients had poor result (Table 1).

**Functional Result**

57.89% (11) patients had minimal disability, 26.31% (5) patients had moderate disability, 10.52% patients had moderate disability.

<table>
<thead>
<tr>
<th>Table 1: Bone score among patients</th>
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<tbody>
<tr>
<td><strong>Score</strong></td>
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<tr>
<td>Excellent</td>
</tr>
<tr>
<td>Good</td>
</tr>
<tr>
<td>Fair</td>
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<tr>
<td>Poor</td>
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**Figure 1:** Bone score excellent, (a) pre-op radiograph, (b) post-ilizarov - affected limb with fixator, (c) post-operative check X-ray, (d) fracture united

**Figure 2:** Lower extremity functional scale-minimum disability
(2) patients had severe disability, and 1 patient crippled (Table 2).

**DISCUSSION**

In comminuted fractures of tibia, the goal of treatment is getting reduction and stability without compromising the soft tissue attachment and vascularity of fragments. This can be achieved using Ilizarov technique.

The Ilizarov apparatus is a type of external fixation used to treat complex/open fractures and to lengthen/reshape bones. Ilizarov frames provide a versatile fixation system for the management of bony deformities, fractures, and their complications.\(^1\)

Ilizarov technique has many advantages - If Ilizarov technique with original recommendations is used, the reduction and fixation of fracture fragments can be achieved with minimal soft tissue exposure/blood loss. Fixation is stable enough to attain early weight bearing.

Pin tract infections are one of the common complications, which can be overcome by regular proper dressings. One patient had persistent non-union, which may be attributed to non-compliance to treatment and irregular follow-up. One patient needed below-knee amputation, non-compliance to treatment and persistent infection may be attributed to amputation.

40 patients were studied by Foster et al.\(^6\) (19 were open fractures and 21 closed fractures). Time from injury to the application of frame was 0-35 days (average = 8 days), mean time for union was 187 days (87-370 days). Four patients had non-union. In our series, there were 9 cases of tibial shaft fractures (4 were open, 5 closed). Time from injury to the application of frame was 0-80 days (average = 15 days), mean time for union was 134 days. Two patients had non-union. Dendrinos et al. studied 24 cases (11 open and 13 closed fractures), average union time was 14.4 weeks. In our series, 10 patients had tibial plateau/juxta-articular fractures (6 open and 4 closed fractures) and average union time was 18.6 weeks.

Tucker et al.\(^9\) studied 41 tibial diaphyseal fractures that required operative stabilization, which were treated using the external fixator and concepts of compression-distraction of Ilizarov and found that the Ilizarov method can be a versatile tool in the management of complex tibial shaft fractures.\(^9\)

However, a retrospective analysis of tibial plafond fractures by Bacon et al. concluded that both “definitive external fixation and staged ORIF” have similar rates

<table>
<thead>
<tr>
<th>Authors</th>
<th>Findings (parameters)</th>
<th>Time from injury to frame application (days)</th>
<th>Mean time for union (days)</th>
<th>Non-union (number of patients)</th>
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</thead>
<tbody>
<tr>
<td>Foster et al.(^6)</td>
<td>Complex tibial shaft fractures</td>
<td>0-35 (average = 8)</td>
<td>187</td>
<td>4</td>
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<tr>
<td>Present study</td>
<td>Complex tibial shaft fractures</td>
<td>0-80 (15)</td>
<td>133.8</td>
<td>2</td>
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<tr>
<td>Dendrinos et al.(^4)</td>
<td>Tibia-plateau fractures</td>
<td>24 (11 open fracture, 13 closed fracture)</td>
<td>14.4</td>
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<tr>
<td>Kumar et al.(^7)</td>
<td>Tibia-plateau fractures</td>
<td>11</td>
<td>15.54</td>
<td></td>
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<tr>
<td>Kumar et al.(^7)</td>
<td>Tibia-diaphyseal fractures</td>
<td>24</td>
<td>27.7</td>
<td></td>
</tr>
<tr>
<td>Telmo et al.(^5)</td>
<td>Proximal tibia fractures</td>
<td>30</td>
<td>12</td>
<td></td>
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<tr>
<td>Present study</td>
<td>Tibia-plateau fractures</td>
<td>10 (6 open fracture, 4 closed fracture)</td>
<td>18.6</td>
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<tr>
<td></td>
<td>Tibia-diaphyseal fractures</td>
<td>9 (open fracture, 5 closed fracture)</td>
<td>19.1</td>
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of union, time to union, and similar complication rates, but suggested larger randomized prospective studies to determine validity of the findings/to assess long-term functional outcomes.10

Another study concluded that Ilizarov technique in combination with minimally invasive internal fixation is an effective method to treat complicated tibial pilon fractures with severe soft tissue trauma.11 Few other sources have reported similar results.12,13

CONCLUSION

In comminuted fractures, the goal is to achieve accurate reduction and stability without compromising the soft tissue attachment and vascularity of fragments. Inability to bear weight early and difficulty in internal fixation can cause longer times to healing and other problems. Ilizarov fixator permits stable fixation and a very slight initial distraction increases soft tissue tension to help indirectly stabilize comminuted fractures. Within few weeks, early soft callus will permit compression and gradually increases weight bearing. Ilizarov circular fixation is an ideal method for fracture when extensive dissection and internal fixation contraindicated due to trauma to soft tissue, deficiency of bone stock, and comminuted fracture.

REFERENCES


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