

# Management of segmental fracture tibia by ilizarov technique

**Keywords:** Cubitus valgus, Ilizarov, Osteotomy

## Introduction

Segmental fracture is defined as two level fractures with an intact circumferential cortex of the intermediate segment. It is usually follows high energy trauma as is often associated with a significant soft tissue injury. Sometimes it may combine with comminuted fracture of the fragments.<sup>1</sup> The use of the Ilizarov method for treating segmental tibial fractures is an attractive concept as it offers many advantages over existing techniques of fracture stabilization. It minimizes surgical trauma at the fracture site, with a percutaneous approach that does not further compromise the biological condition of the fracture site, therefore utilizing the full capacity of the bone and soft tissue to achieve the bone healing.

The tibia has many unique fractures that make it vulnerable to many complications. It is a subcutaneous bone with poor soft tissue coverage on the medial border with a high incidence of open fractures. Its blood supply is also limited particularly, at the distal end. These factors results in a higher incidence of significant soft tissue damage and susceptibility to infection, wound breakdown and non union.<sup>2</sup>

The Ilizarov apparatus is a universal, stable and yet dynamic constructs that permits functional axial loading of the injured limb. This in turn stimulates bone angiogenesis and promotes osteogenesis, leading to quicker remodeling.<sup>3</sup> Its versatility allows correction of any residual deformity. These characteristics allow the Ilizarov method to be used to treat segmental tibial fractures with minimal interference at the fracture site, minimizing the deep infection and non union.

## Materials and methods

36 patients with segmental tibial fractures (25 male, 11 female) were treated using Ilizarov fixator, 26 were open with a mean age of 35 years (range 20-65 years). 6 patient were initially treated by interlocking nail, 10 patients were treated conservatively in plaster and 2 with uniaxial fixator.<sup>4-7</sup> The mean length of intermediate segment was 9.5 cm (range 5.5 to 16 cm) soft tissue coverage was required in 6 cases; intra-articular involvement occurred in 8 cases (6 plateau and 2 pilon). 6 cases of compartment syndrome were treated by fasciotomies, 2 cases with vascular injury required vascular repair. 8 cases of infection 4 of them after nailing which required nail removal and excision of non viable

segment and bone transport, and other 4 cases were superficial infection treated by debridement and antibiotics<sup>2</sup> (Table 1).

## Advantages of ilizarov

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## Surgical technique

1. Absolute stability without compromising the soft tissue envelope.
2. Minimal blood loss.
3. Minimally invasive.
4. Ability to achieve reduction comparable to open reduction technique.
5. The limb is suspended in the frame, avoiding pressure in vulnerable areas in the heel avoiding therefore pressure sores.
6. Early mobilization.
7. Reduced length of hospitalization.

## Post-Operative care

Correction of residual displacement can be done in OPD, without the need of anaesthesia. Angulation, translation, rotation and shortening can be corrected by the traditional Ilizarov adjustment techniques.

## Results

The mean time of union of the proximal segment was 36.5 weeks and 38.2 weeks for the distal segment. Non-union in 3 cases required

reapplication of Ilizarov, this happened due to the lack of proper follow up of the patient. Knee ROM less than 90° was observed in 2 cases (Figure 1 & 2).



Figure 1 Case-1.

1. Segmental fracture right tibia
2. Lt side femur fracture (same patient)
3. Interlocking nail in the left femur (same patient).
4. Patient is in standing front view, six weeks after surgery with Ilizarov fixator.
5. Diaphyseal fractures at two levels (Segmental). Five rings is required to stabilize this type of injury. Two sets of two rings at the level of the proximal and distal fragments and a ring in between.
6. Clinical picture of the patient after 6 months
7. Final outcome after 7 months.

### Discussion

In our series (total 36 patients), the treatment of segmental fractures was challenging for us due to associated high energy trauma and interrupted blood supply to the intermediate segment. Segmental fracture is almost always associated with high incidence of non-union and infection. But we treated all the patients meticulously by Ilizarov technique with Ilizarov external fixator, better results are being reported even in severe injuries. Today this Ilizarov fixator is versatile, modular and allows free wire placement. It allows secondary correction of segmental fracture during the course of treatment. Open

fractures of G-II and III with compartment syndrome is definitely a treatment of choice with the Ilizarov fixator. This fixation does not further damage the vascularity at the segmental fracture sites. By providing it allows in growth of the new capillary buds, increasing the vascularity. The frame configuration allows for the proper care of the injured soft tissues and also for the subsequent cross leg flaps, and other vascular procedures.<sup>8</sup> The early wound management in open segmental fractures allowed by Ilizarov fixator makes it possible to save a limb from being amputated. It helps in aligning the comminuted fracture and allows soft tissue to heal. Plate fixation is not recommended in majority of cases. Bone grafting should be carried out early in cases, around 3 to 6 weeks time, where union does not progress satisfactorily, more so with Ilizarov fixation.<sup>9-11</sup>



Figure 2 Case-2.

1. Open comminuted fracture right tibia fibula GIIIA.
2. Radiograph of right tibia fibula (Segmental comminuted).
3. Ilizarov fixator in the right tibia fibula, 6th post OP, 24 years old male.
4. After 21 days follow up with Ilizarov fixator.
5. Patient can stand with Ilizarov frame without any support.
6. Radiographic final result after 4 months.
7. Clinical appearance of the patient after 4 months

**Table 1** Initial treatment

Initial Treatment	No. of Cases
Interlocking nail	6
Conservatively in plaster	10
Uniaxial fixator	2
Intra-articular involvement occurred	8
Vascular injury required vascular repair	2
Infection	4
Superficial infection	4
Total	36

## Conclusion

The Ilizarov method and frame is very versatile and empowers the skilled surgeon to treat all types of tibia fractures.<sup>12</sup> The method can be used to treat the most complex tibia fractures including open fractures, fractures with bone loss, segmental fractures, tibia with open growth plates and with small intramedullary canals. Advanced techniques of bone and soft tissue transport or temporary intentional deformation to enable wound closure can be implemented early to optimize the clinical results. The use of Ilizarov device and technique is an excellent, effective method simultaneously to overcome all above mentioned problems where alternate methods are expected to fail.

## Acknowledgments

None.

## Conflicts of interest

None.

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