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Original Research Article

EVALUATION OF THE OUTCOME OF THE ILIZAROV TECHNIQUE FOR THE TREATMENT OF TIBIAL BONE AND SOFT TISSUE INJURY

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Abstract: *This study was designed to assess the outcome of the illizarov method for treating patients with dead bone segments or open fractures along with severe soft tissue injury. This retrospective study was conducted at Bakhtawar Ameen Trust Hospital, Multan, from September 2019 to September 2022. A total of 35 patients having non-union tibial fractures and dead bone segments were included in the study. These patients had tibia grade 3 open fractures and had undergone bone grafting and soft tissue closure. The defective bone segment was debrided, and radical resection was done. Illizarov technique was performed on all subjects. All patients reported good smooth tissue coverage and bone transport. The mean docking period of bone transport in all subjects was 3.87 ± 0.45 months. A leg length discrepancy of 1 cm occurred in 4 subjects. No subject complained of pain at follow-up. The Illizarov method is effective for the management of bone and soft tissue injuries.*

Keywords: Illizarov method, open tibial fracture, soft tissue defect, radial resection, bone transport, leg length discrepancy

Introduction

A tibial fracture is common, with a 25% prevalence of open fracture. During trauma, the soft tissue cover of the tibia is lost quickly, resulting in frequent open fractures(Lua et al., 2017). It is important to reconstruct bone and provide sufficient soft tissue coverage to manage tibial fractures effectively. Open tibial fractures are associated with various complications such as non-union, infection and limb loss (Thabet et al., 2022). Soft tissue injury to tendons and muscles adversely affects functional outcomes. Treatment progression is determined by physical closure and functional outcome(Hsu et al., 2020). Infected non-union is the common complication of open tibial fracture. It poses challenges for the patient and the surgeon, as it leads to joint stiffness, bone gaps, sclerotic bone ends, complex deformities, n recalcitrant infection. The tibial non-union can be treated with various surgical methods such as internal fixation, intramedullary nailing and plate osteosynthesis. Though these methods are effective, but have some limitations as well(Yushan et al., 2020).

In contrast, the Illizarov technique effectively addresses bone defects and associated problems such as joint contractures, soft tissue loss and bone shortening and deformity. This approach was first used in Russia for treating complex bone and soft tissue defects. This technique uses an external fixation device for bone and soft tissue transport. This may involve the monofocal approach, in which two bony segments around the defect are moved closer, the bifocal approach, in which osteotomy distant from the fault is utilized; or the trifocal approach, in which two lengthening osteotomies are used along with defect compression(Li et al., 2020). It allows stress release, thus stimulating callus formation and biosynthetic activity, providing adequate blood supply, early loading, and limb function. Dynamic frame results in deformity correction and gradual lengthening through minimally invasive procedures (Tomić and Baljozović, 2018). A study reported that the Illizarov technique for managing lower limb segmental defects resulted in a 95% union rate (Roddy et al., 2018). Due to its structure, it is cost-effective and suitable for use in developing countries like ours. Thus, this study aims to assess the outcome of the illizarov method for treating patients with dead bone

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segments or open fractures and severe soft tissue injury.

Methodology

The retrospective study was conducted in Bakhtawar Amin Trust Hospital, Multan, from September 2019 to September 2022. The study included patients who had non-union tibial fractures with a minimum 4 cm defect and loss of tissue coverage. The patients who were unavailable for follow-up or had additional pathology were excluded. A total of 35 patients having non-union tibial fractures and dead bone segments were included in the study. Informed consent of the participants was taken. The ethical board of the hospital approved the study.

Data including sex, age, diagnosis and previous surgeries were recorded. Radical resection was performed on infected or dead bone and soft tissue, thus creating a long bone defect. Extended bone defects produced space allowing primary soft tissue closure. In some cases where primary closure was impossible, secondary healing was facilitated through open treatment. Bone transport was then performed using the Illizarov frame(Figure I). Towards the end of bone transport, soft tissue folded in the docking site was surgically reconstructed, and the docking site was compressed. Bone grafting was not performed in any patient. Patients were advised to practice partial weight-bearing after 4 weeks of operations. Then limb length discrepancy was corrected through bone lengthening. Patients practiced full weight bearing after 3 months of frame removal. International Knee Documentation Committee (IKDC) score(Hansen et al., 2022) and Foot and Ankle Disability Index (FADI) score (Leigheb et al., 2020) were used for post-operative evaluation.

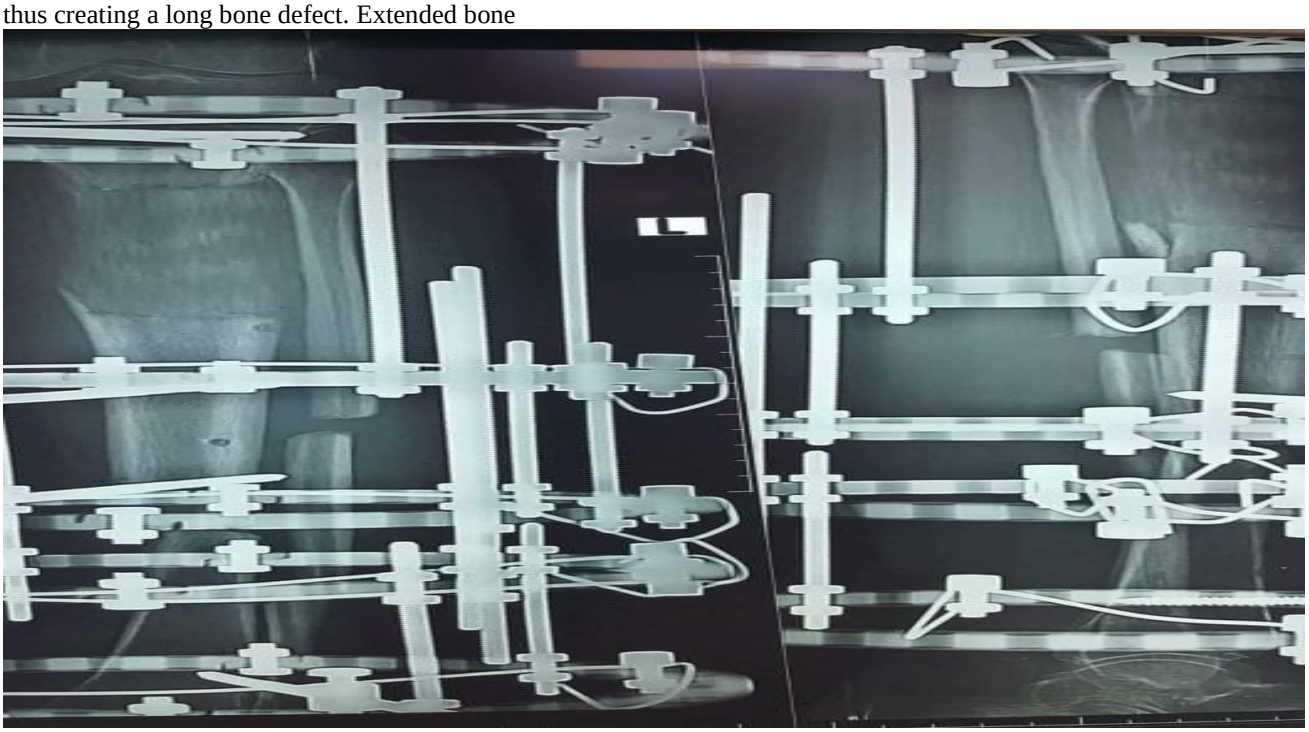

Figure I Radiograph showing placement of lizard frame on the fractured tibia

Result

The study was conducted on 35 patients, 6 females and 29 males. The mean age of the subjects was 30.69 ±15 years. The mean bone defect was 13.07 ± 4.4 cm. The majority of patients had undergone operations previously (Table I). Bone was exposed in all the patients; in 8 patients, regional flaps failed due to severe soft tissue injury.

All subjects underwent the Illizarov technique and showed good soft tissue coverage, bone transport and no re-infection. Leg Length Discrepancy (LLD) of 1 cm occurred in 4 subjects; others had no discrepancy. Union and consolidation of callus occurred in all topics. The mean docking period of bone transport in all issues was 3.87 ± 0.45 months. Seven patients complained of ankle stiffness. FADI score and IKDC score are summarized in Table II.

Table I Demographic characteristics of the participants

Characteristic	Mean
Age (year)	30.69 ±15
Bone defect (cm)	13.07 ± 4.4
Previous leg length discrepancy (cm)	1.77± 0.96

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Docking period(months)	4.97 ± 1.68
Union period (months)	8.61 ± 1.85

Table II Treatment Outcome

Outcome	Mean
Union (months)	9.81± 1.11
LLD (cm)	0.20 ±.41
IKDC score (%)	88.37± 7.28
FADI score (%)	85.85 ±8.58

Discussion

Tibial open fracture leads to many complications, such as soft tissue loss, limb length discrepancy, non-union and infection(Sharma et al., 2021). In the current study, most patients had previously undergone different treatments. These patients presented with non-union, infected bone and soft tissue defects. The Illizarov technique effectively provides stability, smooth tissue coverage and bone transport(Feltri et al., 2022). In the current study, the cases with a history of unsuccessful flap operations or severe soft tissue injury radical resection were done to eradicate infection and create space to enable primary closure. Radical debridement resulted in primary closure in all patients. This study's results align with a previous study in which Illizarov method resulted in the infection-free union in cases with poor soft tissue coverage and long defect(Feltri et al., 2022). Another study shows that fractures of the femur and tibia Illizarov methods results in good functional outcome(Feltri et al., 2022). The mean bone defect in patients in our study was 13.07 ± 4.4 cm, and docking time was longer for the longer bone gap. It was seen that the Illizarov method corrects limb length discrepancy and extended bone defects, though patient compliance and time are required. In this study, LLD of 1 cm was reported in 4 subjects; it was because of muscle contraction caused by infection and soft tissue defect which interfered with bone lengthening. This LLD was clinically insignificant and tolerable for the patients, as shown by FADI and IKDC scores. In the current study, bone grafting was not done, and bone union occurred in all patients. A previous study reported that the Illizarov method resulted in the bone union without bone grafting (Aktuglu et al., 2019).

Similarly, a study showed that the Illizarov technique effectively enhances the consolidation of the callus and union of the docking site without bone grafting(Agha et al., 2020). In this study, adequate soft tissue coverage was achieved by primary closure; this finding was in line with the results of previous studies(Abula et al., 2020; Biz et al., 2021). Though relatively minimum, the Ilizarov method has a few advantages, such as failure of distraction and pin-track infection.

Conclusion

Illizarov method effectively manages bone and soft tissue injury in open tibial fracture.

Conflict of interest

The authors declared no conflict of interest.

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