RESEARCH PAPER

Challenges in Tibial Shaft Fracture: A Case of Failed Ilizarov Fixation Converted to Interlocking Nailing

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Abstract
Management of complex open tibial fractures remains a formidable challenge in orthopaedic practice. The Ilizarov technique has been widely employed for such injuries, particularly in the presence of bone loss, infection, and soft-tissue compromise. Despite its advantages, failures may occur due to mechanical, biological, or patient-related factors. We report the case of a 32-year-old male who sustained a Gustilo–Anderson type IIIB open tibial fracture following a road traffic accident. After failure of Ilizarov fixation with persistent nonunion, the patient was successfully treated with intramedullary interlocking nailing (IMIL) and autologous bone grafting. At one year, the patient achieved union, satisfactory function, and return to activities of daily living. This case highlights the limitations of Ilizarov fixation and the role of IMIL nailing as a salvage option in selected cases.

Keywords: Tibial shaft fracture, Ilizarov failure, Interlocking nailing, Nonunion, Salvage procedure
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Introduction
Tibial shaft fractures are the most common long bone fractures, often associated with high-energy trauma and open injuries (Court-Brown & Caesar, 2006). The Ilizarov external fixator has been widely used to address segmental defects, infected nonunions, and complex tibial fractures (Paley et al., 1989). It provides stability, allows for deformity correction, and facilitates early weight-bearing. However, failure rates have been reported due to poor regenerate formation, mechanical instability, persistent infection, and patient non-compliance (Tetsworth & Paley, 1994). Intramedullary interlocking nailing (IMIL) remains the standard of care for diaphyseal tibial fractures in non-infected settings (Court-Brown & McBirnie, 1995). Increasingly, IMIL has been used as a salvage procedure after failed external fixation, provided infection is adequately controlled (Ueng et al., 1997). This case illustrates the successful conversion of a failed Ilizarov fixation to IMIL nailing with bone grafting.

Case Presentation
A 32-year-old male presented after a road traffic accident (lorry versus two-wheeler) on 17/12/2022 with an open fracture of the left tibia (Gustilo–Anderson IIIB). Initial management included external fixation and serial wound debridements.

Subsequently, Ilizarov ring fixation was applied on 24/02/2023 following muscle transposition of tibialis anterior (05/01/2023) and later bone grafting (17/09/2023). Despite these interventions, the patient developed persistent infection, pain, and inability to bear weight.

On presentation to our center, radiographs revealed nonunion at the middle and distal third junction of the tibia. A CT angiogram confirmed adequate vascularity. Following two weeks of intravenous antibiotics, definitive surgery was planned.

Operative Findings
- Procedure: Under spinal anesthesia, a fibulectomy was performed, followed by exposure and freshening of the nonunion site.
- Fixation: After docking osteotomy, intramedullary reaming was performed. A 9 × 30 cm IMIL nail was inserted under fluoroscopic guidance and fixed with proximal and distal locking screws.
- Bone grafting: The defect was filled with autologous iliac crest graft.
- Closure: Drain was placed, and wound closed in layers.

Postoperative Course
The patient was started on partial weight-bearing, progressing to full weight-bearing. At six months, radiographs demonstrated callus formation, although proximal screw loosening necessitated removal of the static screw.

At one year, the fracture had united with 3 cm shortening, which was compensated with customized footwear. Knee flexion improved to 90–100°. The patient resumed normal daily activities without pain.

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Discussion

The Ilizarov method has been widely documented as an effective treatment for complex tibial fractures and nonunions (Paley et al., 1989). However, failures occur due to several factors, including poor regenerate quality, frame instability, pin site infection, and inadequate docking site compression (Tetsworth & Paley, 1994; Khan et al., 2015). In the present case, persistent infection and nonunion necessitated conversion to IMIL nailing. Court-Brown et al. (1995) demonstrated the reliability of IMIL in achieving union in diaphyseal tibial fractures, while Ueng et al. (1997) reported favorable outcomes when converting failed external fixation to intramedullary nailing once infection is controlled. Reaming enhances endosteal blood supply and, combined with autologous bone grafting, provides both biological and mechanical support (Keating et al., 1997). More recent reports also support intramedullary nailing as a salvage strategy following Ilizarov failure, provided careful infection control is ensured (Catagni et al., 2011; Yin et al., 2015).

Conclusion

Although Ilizarov fixation remains a valuable tool in managing complex tibial injuries, it can fail due to biological, mechanical, or patient-related reasons. IMIL nailing, when infection has been controlled, provides a stable internal fixation, promotes union, and facilitates functional recovery. This case underscores the importance of individualized treatment planning and supports the role of IMIL as a salvage option in failed Ilizarov cases.

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FIGURES

Fig 1 : Clinical image

Fig 2 : Xray post ex-fix removal

Fig 3 : Preop xray

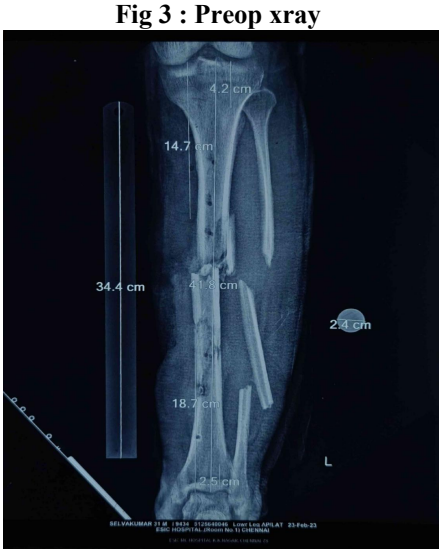

Fig 4 : Immediate Post-Op Xray

Fig 5 : Postop Xray 1 month follow up

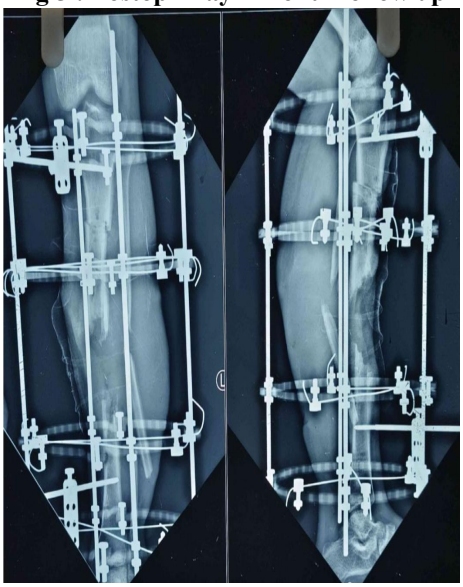

Fig 6 : Postop Xray 4 month follow up

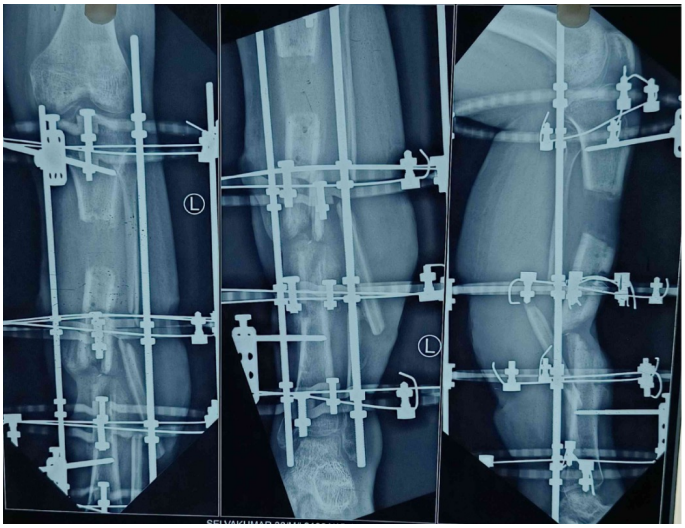

Fig 7 : Postop Xray 1 year follow up

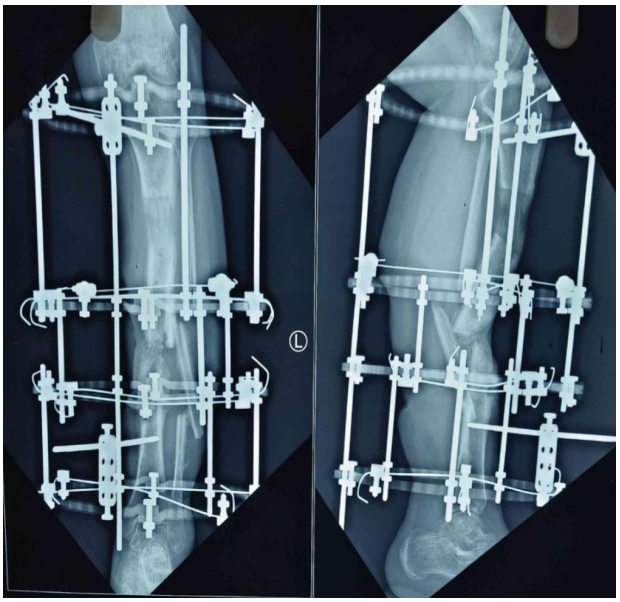

Fig 8: Post Ilizarov removal

Fig 9 : Xray ater 20 days of weight bearing

Fig 10 : Intraoperative images

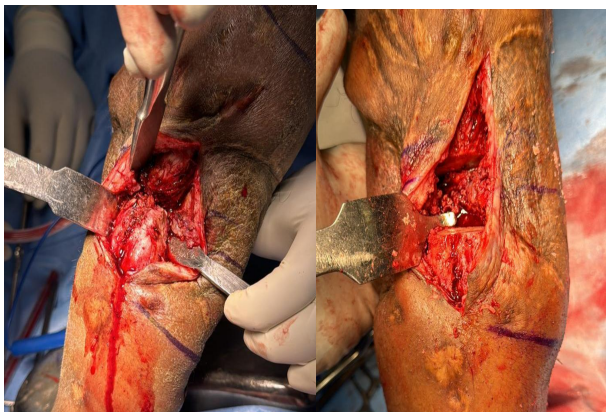

Fig 11 : C-arm Images

Fig 12 : C-arm Images

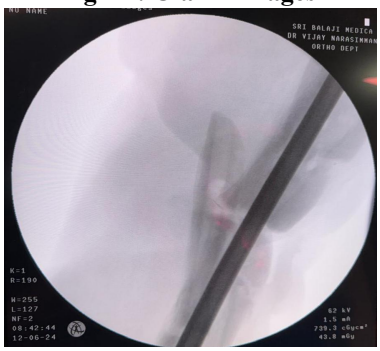

Fig 13: C-arm Images

Fig 14: C-arm Images

Fig 15 : Immediate Postop Xray

Fig 16 : Postop Xray 1 month follow up (proximal screw loosening)

Fig 17 : Postop Xray 2 month follow up (proximal screw loosening)

Fig 18 : Postop Xray 3 month follow up (proximal screw loosening)

Fig 19 : Postop Xray 3 month follow up (loose proximal screw removed)

Fig 20 : Postop Xray 6 months follow up

Fig 21 : Postop Xray 1 year follow up

Fig 22 : Clinical Image

Fig 23 : Clinical Image

Fig 24 : Clinical Image

Fig 25 : Functional outcome - Sitting cross-legged

Fig 26 : Functional outcome – Squatting

Fig 27 : Functional outcome - Flexion