

# Complex Compound Fracture of Tibia Managed with Distraction Osteogenesis

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## What to Learn from this Article?

Management of complex situation with ilizarov

### Abstract

**Introduction:** The treatment of tibia bone loss can be challenging. The surgical options for the treatment of bone loss include bone transport, vascularized fibula graft, and induced membrane.

**Case Report:** We present a case of complex compound fracture of tibia with bone loss. Interestingly patient sustained this injury in spite of having intramedullary nail in tibia which was inserted to stabilize previous fracture 9 months prior to trauma. The proximal half of the nail was protruding out of the wound at the time of presentation in emergency department. The nail was removed and stabilized with external fixator after wound closure. The bone gap and nonunion at fracture site was managed with Ilizarov fixator. At the end of treatment patient got satisfactory functional outcome.

**Conclusion:** Ilizarov method is a biologic and comprehensive method for management of bone loss, non union and limb length discrepancy.

**Keywords:** Fracture tibia, bone loss, Ilizarov, distraction osteogenesis.

### Introduction

The treatment of tibia bone loss can be challenging because of associated co-morbidities such as soft tissue problems, infection, deformities, adjacent joint contractures and socio-

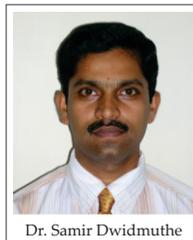
economic factors. The surgical options for the treatment of bone loss include bone transport 1vascularized fibula graft, and induced membrane [2].

Vascularized fibula graft has certain limitations like highly

### Author's Photo Gallery



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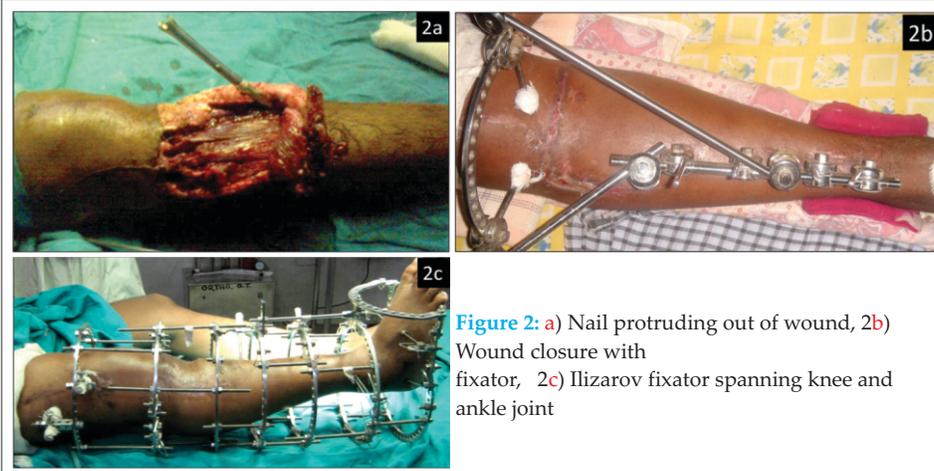
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**Figure 1:** Previous closed fracture tibia fixed with interlocking nail.



**Figure 2:** a) Nail protruding out of wound, 2b) Wound closure with fixator, 2c) Ilizarov fixator spanning knee and ankle joint

demanding surgical technique, risk of microvascular anastomosis failure, graft fracture; graft non-union and donor site morbidity [3]. Bone transport with Ilizarov has become gold standard for the treatment of bone loss [1,4,5]. We are reporting this case report due to its unusual pattern of injury and complexity of treatment.

### Case Report

28 years male was presented in the emergency department with history of road accident. He sustained injury to his right leg. It was a grade III B compound fracture with large wound over the proximal tibia. Interestingly proximal portion of previously done interlocking nail was seen protruding out of the wound (Fig 2a).

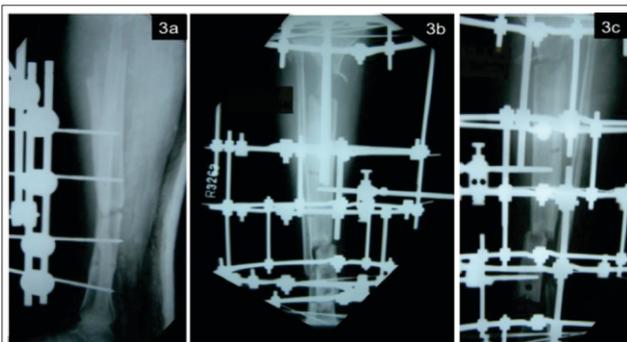
The previous surgery was done 9 months back. Then he had sustained a closed fracture of tibia which was managed with closed reduction and interlocking nailing. He was walking on the affected extremity prior to second injury. As the patient was presented in casualty with this complex injury he was directly taken to operation theatre for debridement without performing preoperative radiographs. The fracture pattern was visualized by image intensifier in operation theatre. During surgery proximal part of tibia was found to be missing. The bone loss is probably the result of extrusion of intramedullary nail with its proximal bolts out of the wound. The previous fracture site was showing signs of nonunion.

Patient was posted for emergency surgery. Under regional anaesthesia the intramedullary nail was removed. After thorough debridement, the wound was closed primarily. Fracture and nonunion was temporarily stabilized with external

fixator (Fig 3a). The wound healed completely over three week period (Fig 2b). Then the linear external fixator was replaced by ring fixator spanning knee and ankle joint. As the proximal fragment (proximal to bone loss) and distal fragment (distal to corticotomy) were very short, frame was extended to include lower femur and foot for better stability (Fig 2c). Corticotomy was done in distal tibial metaphysis between non-union site and ankle joint.

Gradual distraction was started at distal corticotomy site (0.25mm four times a day). The proximal bone gap was simultaneously compressed. The distal non-union site was also put under compression (Fig 3b & 3c). Proximal fracture site showed delayed healing and needed bone grafting from iliac crest. Patient himself stopped the distraction at corticotomy site because of pain. This resulted in the residual shortening of 3cm. Finally good consolidation was achieved at proximal fracture; distal fracture and corticotomy site -Trifocal osteosynthesis. (Fig 4a & 4b).

Total bone lengthening achieved was 7cm. Total external fixator duration was 11 months. The external fixator index was 47days/cm. Patient was followed up for 15 months after the fixator removal. At the time of latest follow up patient was having residual shortening of 3cm with limp while walking. There was no flexion contracture at knee. The ankle movements were significantly restricted probably due to prolonged ring fixator application and bone transport. The patient returned to daily activities and but needed change in his job profile. The outcome was assessed according to bone results and functional results as described by Paley [5]. The patient has good bone result and functional result.



**Figure 3:** a) Radiograph showing proximal bone loss and distal non union. 3b) & 3c) Radiographs showing distraction at corticotomy site and compression at the site of bone loss with the use of ring fixator – Trifocal Osteosynthesis



**Figure 4:** a), 4b) & 4c) - Final radiological and clinical outcome

## Discussion

Treatment of compound fracture of tibia is always a challenge to treat. Open fractures with bone loss require special attention as not only the wound coverage but the bridging the gap is required [6]. In cases of compound fractures the immediate treatment is in the form of airway management, early resuscitation followed by immobilization of extremity and administration of intravenous antibiotics. Urgent debridement of wound with skeletal stabilization is recommended. In certain cases repeated debridement may be needed and wound closure may be delayed [6]. This case was unusual as, in spite of having previous intramedullary nail in tibia, patient sustained compound fracture with bone loss with the half of the nail protruding through the wound. Interestingly the previous fracture which was stabilized with the intramedullary nail was also in nonunion. This resulted in complex reconstructive problem. There was extensive soft tissue injury with segmental fracture with bone loss of 10cm. The bone defect was in proximal metaphysis and diaphysis with no place for corticotomy in upper tibia. The nonunion was in lower tibial diaphysis leaving a short distal segment for corticotomy and bone transport. Various options are available to manage the bone loss and nonunion like bone transport, vascularized fibula graft, induced membrane [5,7,8]. Distraction osteogenesis with aid of ring fixator has been reported to be a useful technique in the treatment of bone loss especially if associated with severe soft tissue injury [8].

In our case good consolidation was achieved at proximal fracture, distal fracture and corticotomy site. There was residual shortening of 3 cm with limp. Patient was able to resume his daily activities and alternate job. According to Paley's criteria patient has good bone and functional result. Paley et al [9] reported 100 % union in 22 patients with tibial

bone defects treated by Ilizarov method. The bony results were 74 %excellent, 16 % good, 5 %fair and 5% poor with functional results of 63 % excellent,32% good and 5% poor. Rozbruch et al [10] reported on 38 tibial nonunions, bony results of 53 % excellent, 37 % good, 5%poor versus functional results of 53% excellent, 37%good, 5% fair, and 5 % poor. The principle advantage of this minimally technique is that it provides sufficiently stable fixation without extensive soft tissue dissection that is necessary for open reduction and internal fixation. The corticotomy is usually advised in proximal metaphysis of tibia as it more vascular as compare to distal metaphysis. But in this case bone loss was extending to involve the proximal tibial metaphysis, so the corticotomy was performed in distal metaphysis [9].

## Conclusion

Treatment of compound fractures of tibia treatment is always challenging. Wound coverage, control of infection and temporary stabilization are the cornerstone of the treatment. In cases of bone loss and nonunion distraction osteogenesis helps us to address these issues effectively to have good functional outcome at the end of treatment.

### Clinical Message

Ilizarov is a biologic and comprehensive technique to address union, manage bone defect, equalize limb lengths, permits eradication of infection and correct any deformity at the same time maintaining static function and permitting weight bearing as tolerated.

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