

Case Report

Hybrid external fixation with primary closure for a Gustilo-Anderson type III A proximal tibial fracture: a case report

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ABSTRACT

Open fractures of the proximal tibia are associated with a high risk of infection because of limited soft-tissue coverage and compromised vascularity. Although staged management with delayed internal fixation is commonly practiced, external fixation may serve as a definitive option in selected Gustilo-Anderson type IIIA injuries with adequate soft tissue condition. A 19-year-old male sustained a right proximal third open tibial fracture following a road traffic accident on 30 October 2023. Intravenous broad-spectrum antibiotics and tetanus prophylaxis were administered immediately upon admission. Surgical treatment was performed on 31 October 2023 using hybrid external fixation with primary wound closure. Early callus formation was noted at six weeks, and bridging callus across all cortices was confirmed at approximately eighteen weeks. The external fixator was removed on 05 March 2024 following confirmation of union, followed by short-term protective casting. Radiographs at twenty-three months demonstrated maintained alignment and complete cortical remodelling. Hybrid external fixation with primary wound closure may provide a reliable definitive treatment option for carefully selected Gustilo-Anderson type IIIA proximal tibial fractures when adequate debridement and stable fixation are achieved.

Keywords: Open tibia fracture, Gustilo IIIA, Proximal tibia, External fixation, Case report

INTRODUCTION

Open tibial fractures are associated with a high risk of infection due to limited soft tissue coverage and the subcutaneous location of the tibia. The Gustilo-Anderson classification is widely used to guide treatment decisions in such injuries.¹ Epidemiological studies have shown that open fractures of long bones frequently result from high-energy trauma and carry significant risks of infection and complications.⁴

Fractures involving the proximal third of the tibia are particularly challenging because of metaphyseal instability and deforming muscular forces acting on the proximal fragment. Maintaining alignment in this region is difficult

due to the biomechanical forces acting across the knee joint.

Staged management with delayed internal fixation is commonly practiced in severe open injuries. However, in selected type IIIA fractures with adequate soft tissue condition after debridement, external fixation may serve as a definitive method of treatment.^{2,3} Previous studies have demonstrated that external fixation can provide adequate stability for fracture healing while minimizing additional soft-tissue damage.⁵

We report a case of a Gustilo-Anderson type IIIA proximal tibial fracture managed with hybrid external fixation and primary wound closure, resulting in successful union without the need for secondary internal fixation.

CASE REPORT

A 19-year-old male presented approximately three hours after a road traffic accident on 30 October 2023. Intravenous broad-spectrum antibiotics and tetanus prophylaxis were administered immediately upon admission according to the institutional protocol for open fractures. Examination revealed an open injury over the proximal third of the right tibia, with exposed bone and a lacerated wound measuring approximately 12–15 cm. The injury was classified as Gustilo–Anderson type IIIA. A pre-operative radiograph obtained on the same day showed a proximal third tibial fracture with comminution (Figure 1).



Figure 1 (A and B): Pre-operative radiograph (anteroposterior and lateral views) obtained on 30 October 2023 demonstrating proximal third tibial fracture with comminution.

Surgical treatment was performed on 31 October 2023 under spinal anesthesia. Thorough debridement was carried out with excision of devitalized tissue, followed by copious saline irrigation. As adequate soft tissue coverage was achievable after debridement and to minimize the risk of deep infection, hybrid external fixation was chosen as the definitive method of stabilization. A hybrid external fixator (C-curve configuration) was applied using three proximal and three distal Schanz pins without spanning the knee joint. Reduction and alignment were confirmed under

fluoroscopy (Figure 2), and stable fixation was achieved. Primary wound closure was performed.



Figure 2: Intra-operative fluoroscopic image showing hybrid external fixation with maintained alignment.



Figure 3 (A and B): Radiograph at six weeks (12 December 2023) showing early callus formation.

At six weeks (12 December 2023), radiographs demonstrated early callus formation (Figure 3). At ten weeks (10 January 2024), progressive callus formation was noted with maintained alignment (Figure 4).



Figure 4 (A and B): Radiograph at ten weeks (10 January 2024) demonstrating progressive callus formation.



Figure 6 (A and B): Radiograph obtained on 13 April 2024 demonstrating maintained alignment during protective casting.

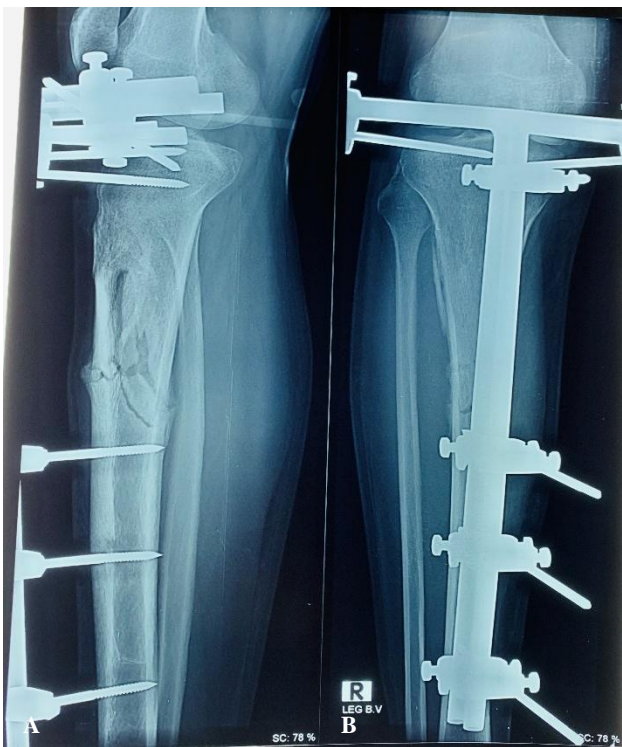


Figure 5 (A and B): Radiograph at eighteen weeks (05 March 2024) showing bridging callus across all cortices.



Figure 7 (A and B): Radiograph obtained on 04 October 2025 demonstrating complete cortical remodeling and maintained alignment.

Bridging callus across all cortices was confirmed at approximately eighteen weeks (05 March 2024) (Figure 5). The external fixator was removed on 05 March 2024 after radiological union and pain-free weight bearing were confirmed. A below-knee protective cast was applied for approximately four weeks. Radiographs obtained on 13 April 2024 demonstrated maintained alignment during the casting period (Figure 6). The cast was subsequently removed without complications.

A follow-up radiograph dated 04 October 2025, approximately twenty-three months after surgery, demonstrated complete cortical remodeling with maintained alignment and no evidence of late complications (Figure 7).

DISCUSSION

Gustilo–Anderson type IIIA injuries allow primary wound closure when adequate debridement restores viable soft tissue coverage.¹ Although staged fixation with delayed internal fixation is commonly practiced, selected open tibial fractures may be managed definitively with external fixation when stable alignment and satisfactory soft tissue conditions are achieved.^{2,3}

Fractures of the proximal third of the tibia are particularly prone to malalignment because of deforming forces from the quadriceps mechanism and limited metaphyseal bone stock. Maintaining reduction in this region is therefore critical. External fixation has been widely used in the management of severe open tibial fractures because it allows stabilization of the fracture while minimizing additional trauma to compromised soft tissues.⁵ Epidemiological studies have also demonstrated the significant burden of open fractures and the importance of timely surgical management to reduce complications.⁴

In this case, hybrid external fixation provided sufficient stability to preserve alignment throughout the healing process without secondary displacement. Radiological union was achieved at eighteen weeks, and long-term follow-up at approximately twenty-three months confirmed sustained union and cortical remodeling,

supporting the durability of hybrid external fixation in this selected type IIIA injury.

CONCLUSION

Selected Gustilo-Anderson type IIIA proximal tibial fractures may be successfully managed with hybrid external fixation and primary wound closure when careful debridement and stable fixation are achieved.

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