



A Clinical Case Report on the Role of External Fixation in the Management of Open Tibial Fractures: Early Outcomes and Complications

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ABSTRACT:

Background:

External fixation remains an important damage-control strategy in the management of high-grade open tibial fractures, especially Gustilo–Anderson Grade IIIB injuries where severe soft-tissue damage and contamination often preclude immediate internal fixation. Case presentation: We report a 32-year-old male who sustained a Grade IIIB open midshaft tibial fracture following a high-speed road traffic accident. Initial management included resuscitation according to ATLS principles, broad-spectrum intravenous antibiotics, tetanus prophylaxis, and urgent surgical debridement. Fracture stabilization was achieved with a uniplanar external fixator, permitting repeated wound inspection and staged soft-tissue management. The wound was managed with daily dressings and delayed secondary closure. The external fixator was retained for 6 weeks until satisfactory soft-tissue healing and radiographic evidence of early callus formation were observed,



Anderson.

after which conversion to intramedullary interlocking (IMIL) nailing was performed as definitive fixation. The patient achieved full weight-bearing by 6 weeks post-injury with acceptable alignment and good early functional recovery. A minor pin-tract infection was encountered and managed successfully with oral antibiotics and local care. Conclusion: This case underscores the value of a staged approach using temporary external fixation followed by intramedullary nailing in Grade IIIB open tibial fractures. When combined with meticulous debridement, appropriate soft-tissue management, and vigilant pin-site care, this strategy can provide stable fracture healing, early mobilization, and satisfactory functional outcomes, particularly in resource-limited trauma settings.

INTRODUCTION

Open tibial fractures are among the most frequent and challenging injuries in orthopaedic trauma. The subcutaneous location of the tibia, combined with high-energy mechanisms such as road traffic accidents, predisposes it to severe soft-tissue injury, contamination, and segmental bone loss. These factors contribute to high rates of infection, delayed union, non-union, and functional impairment.^{1,2}

In Gustilo–Anderson Grade III injuries, particularly Grade IIIB fractures with extensive soft-tissue stripping and exposed bone, immediate internal fixation is often contraindicated due to the high risk of deep infection and failure of soft-tissue coverage. External fixation provides rapid, minimally invasive skeletal stabilization while preserving fracture biology and maintaining access to the wound for repeated debridement and soft-tissue reconstruction.³

Once infection is controlled and adequate soft-tissue coverage is achieved, conversion to internal fixation—most commonly intramedullary nailing—can confer superior biomechanical stability, earlier mobilization, and improved patient comfort.^{3–5}

This case report describes the staged management of a Grade IIIB open tibial shaft fracture using initial external fixation followed by intramedullary interlocking nailing, and discusses the early clinical outcome and complications in the context of current literature.

CASE REPORT

A 32-year-old male presented to the emergency department following a high-speed road traffic accident. On arrival, the patient was hemodynamically stable with no evidence of polytrauma. Local examination of the right leg revealed a large anteromedial wound over the midshaft of the tibia with exposed bone, gross contamination with road debris, and soft-tissue stripping. The injury was classified as a Gustilo–Anderson Grade IIIB open tibial shaft fracture. Distal pulses were

palpable, capillary refill was normal, and no neurological deficit was noted.

Initial management followed ATLS guidelines. After primary and secondary surveys confirmed an isolated limb injury, the patient received broad-spectrum intravenous antibiotics and tetanus prophylaxis. The limb was temporarily splinted, and urgent operative intervention was planned.

Under regional or general anaesthesia, thorough surgical debridement was performed. All devitalized skin, subcutaneous tissue, muscle, and contaminants were excised, and the wound was copiously irrigated with normal saline. Fracture ends were freshened, and the limb was aligned under fluoroscopic guidance.

Fracture stabilization was achieved with a uniplanar external fixator applied to the anteromedial aspect of the tibia. Two Schanz pins were inserted proximal and two distal to the fracture site, ensuring safe corridors away from the zone of injury. Final fluoroscopic images confirmed acceptable alignment and length. Given the extent of soft-tissue damage, the wound was left partially open and covered with sterile dressings for ongoing assessment.

Postoperatively, the patient underwent daily dressing changes. The limb was elevated, and pin-site care was initiated from the second postoperative day. Broad-spectrum antibiotics were continued as per institutional protocol. Once pain allowed, the patient was mobilized with non-weight-bearing crutch ambulation.

Over the following weeks, progressive granulation tissue formation and reduction in wound contamination were observed. Delayed secondary closure of the wound was performed once the soft tissues were deemed viable and clean. Partial weight-bearing was initiated thereafter.

The external fixator was maintained for 6 weeks. Serial radiographs demonstrated maintained alignment and early callus formation at the fracture site. With satisfactory soft-tissue coverage and no clinical or



laboratory evidence of deep infection, conversion to definitive internal fixation was planned.

At 6 weeks post-injury, the external fixator was removed, and intramedullary interlocking nailing of the tibia was performed via a standard infrapatellar approach under fluoroscopic guidance. Reaming and nail insertion were carried out in a controlled manner, and locking screws were placed proximally and distally to achieve stable fixation.

The postoperative course was uneventful except for minor pin-tract infection at one of the previous Schanz pin sites, which presented as localized erythema and serous discharge. This was managed successfully with a short course of oral antibiotics and regular local pin-site care.

The patient was mobilized with progressive weight-bearing after nailing and achieved full weight-bearing by approximately 6 weeks post-injury with good pain control. Follow-up radiographs showed maintained alignment and progressive callus formation. Clinically, the patient reported satisfactory early functional recovery with no wound breakdown or deep infection at the most recent follow-up.

DISCUSSION

High-grade open tibial fractures, particularly Gustilo–Anderson Grade IIIB injuries, pose a significant challenge due to the combination of severe soft-tissue damage, contamination, and compromised vascularity. These factors increase the risk of infection, delayed union, and non-union, making the choice and timing of fixation crucial.^{1,3}

External fixation serves as a cornerstone of damage-control orthopaedics in such settings. Its advantages include minimal additional soft-tissue disruption, preservation of fracture hematoma and periosteal blood supply, rapid application in unstable patients, and unobstructed access to the wound for serial debridement, negative pressure therapy, or flap coverage.³

In the present case, external fixation enabled:

- **Rapid, stable skeletal stabilization** in the emergency setting
- **Repeated wound access** for dressing changes and delayed closure
- **Preservation of fracture biology** while controlling contamination

However, external fixation is not free of complications. Pin-tract infection, malalignment, joint stiffness, and delayed union are well-recognized concerns.³ In our patient, a minor pin-tract infection occurred but was

successfully managed with oral antibiotics and local care, without progression to deep infection or osteomyelitis. Careful pin placement outside the zone of injury, strict aseptic technique during insertion, and rigorous pin-site hygiene are essential to minimizing these complications.

Once soft-tissue coverage is stable and infection is controlled, conversion to internal fixation is recommended to improve patient comfort, permit earlier full weight-bearing, and enhance functional outcomes.^{3–5} Intramedullary nailing is considered the gold standard for diaphyseal tibial fractures due to its superior biomechanical stability, load-sharing characteristics, and relatively low infection and non-union rates when used in appropriately selected open fractures.³

The timing of conversion from external fixation to intramedullary nailing remains a matter of clinical judgment. Many authors advocate conversion within 6–8 weeks, provided that:

- Soft tissues have healed or are adequately covered
- There is no clinical or laboratory evidence of infection
- Previous pin-sites are avoided by nail entry and screw paths

In our case, conversion at 6 weeks fulfilled these principles and resulted in good early radiological and functional outcomes, with no deep infection or hardware-related complications observed in the short term.

Our experience aligns with published series supporting staged management protocols for Grade III open tibial fractures, combining the soft-tissue advantages of external fixation with the functional and biomechanical benefits of intramedullary nailing.^{3–5} This approach is particularly valuable in resource-limited or high-volume trauma centres, where simultaneous orthopaedic and plastic surgical intervention may not always be immediately available.

CONCLUSION

This case report highlights the effectiveness of a staged management strategy using temporary external fixation followed by intramedullary interlocking nailing in a Grade IIIB open tibial shaft fracture. Key factors contributing to the favourable outcome included:

- Prompt and meticulous surgical debridement
- Appropriate application of a stable external fixator
- Careful soft-tissue management with delayed closure



- Vigilant pin-site care and early recognition of minor complications
- Timely conversion to intramedullary nailing once soft tissues and infection status allowed

In similar clinical scenarios, especially in resource-constrained or damage-control environments, this protocol remains a practical and reliable option to achieve stable fracture union, early mobilization, and good functional recovery.

PATIENT CONSENT

Written informed consent was obtained from the patient for publication of this case report and any accompanying clinical images. A copy of the written consent is available for review by the Editor-in-Chief of the journal on request.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this case report.

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