

Single-Stage Hybrid Fixation of a Grade III Open, Unstable Trimalleolar Ankle Fracture with Syndesmotic Disruption and Posterior Talar Subluxation

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Learning Point of the Article:

Single-stage hybrid fixation offers an effective and safe solution for complex open trimalleolar ankle fractures with syndesmotic injury and posterior talar subluxation, promoting early stability and functional recovery.

Abstract

Introduction: Trimalleolar ankle fractures, which involve syndesmotic damage and talar subluxation, are serious injuries that are complicated by open wounds. This article describes a novel single-stage hybrid fixation strategy designed to address these issues.

Case Report: A 65-year-old female was involved in a car accident and suffered a Grade IIIA open trimalleolar fracture-dislocation. Radiographs confirmed the syndesmotic disruption and posterior talar subluxation. She underwent emergency surgery that included open reduction and internal fixation of the medial and lateral malleoli, as well as the use of an ankle-spanning external fixator. Her surgical recovery went smoothly, with fast union and functional mobility restored.

Conclusion: This case shows that single-stage hybrid fixation can be a stable and successful approach for treating severe open ankle fractures with various anatomical disturbances.

Keywords: Ankle injuries, fracture fixation, external fixators, syndesmotic injuries, open wounds.

Introduction

Trimalleolar ankle fractures are high-energy injuries involving disruption of the medial, lateral, and posterior malleoli. These fractures are frequently associated with posterior talar displacement and syndesmotic injury, which together can destabilize the ankle mortise and impair long-term function [1-3]. The management becomes more complex when the injury is open, particularly in Gustilo–Anderson Grade IIIA cases, where soft tissue compromise and infection risk pose significant challenges to definitive fixation [2].

Posterior malleolar fixation has been shown to contribute significantly to syndesmotic stability, reducing the need for additional hardware such as trans-syndesmotic screws [1,3]. In parallel, the role of hybrid fixation – combining internal hardware with external stabilization – is being explored in complex cases to simultaneously achieve mechanical stability and soft tissue preservation [4,5].

While some reports advocate staged fixation in such injuries [6], this approach may delay functional recovery and increase exposure to surgical morbidity. Therefore, a single-stage hybrid

Author's Photo Gallery



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Figure 1: Pre-operative X-ray anteroposterior view of the left ankle.



Figure 2: Pre-operative X-ray lateral view of the left ankle.

approach offers a potential solution for select patients by addressing both osseous and soft-tissue challenges in one surgical event.

This report presents a case of an open trimalleolar fracture-dislocation with syndesmotomic disruption and posterior talar subluxation, managed successfully using a novel single-stage hybrid fixation technique.

Case Report

A 65-year-old previously healthy female was brought to the emergency room after a high-speed motor vehicle collision. She suffered an isolated right ankle injury with no history of trauma, systemic illness, or medication. She was a non-smoker with no comorbidities who worked in manual jobs.

When the patient arrived, her right ankle was clearly deformed,

with a 6 cm open wound across the medial malleolus and exposed bone. The ankle was unstable and had aberrant movement. There was no distal neurovascular impairment, and the capillary refill was intact. No symptoms of compartment syndrome were found. The injury was categorized as a Grade IIIA open fracture using the Gustilo–Anderson system.

The initial plain radiographs (anteroposterior and lateral) revealed a trimalleolar fracture pattern: A lateral malleolar fracture, displaced medial and posterior malleolar fragments, posterior talar subluxation, and expanded syndesmosis (Fig. 1 and 2). Due to the urgency of the open injury, a computed tomography scan was performed. Basic blood work was unremarkable.

The patient was promptly transported to the surgery room. After extensive irrigation and debridement, the medial malleolus was reduced and internally fixed with two partially



Figure 3: Intra-operative showing application of the ankle spanning external fixator.



Figure 4: Intra-operative C-arm image after fixation.



Figure 5: Post-operative day 7 with wound healing well.



Figure 6: Post-operative image. Wound healing well and sutures removed.



Figure 7: Post-operative X-ray taken after removal of external fixator.

threaded 4 mm cancellous screws. The lateral malleolus was fastened with a 2.5 mm K wire. The posterior malleolus was found to be anatomically smaller. The syndesmotic stability was reviewed intraoperatively and determined to be satisfactory. To improve external stability and protect the soft tissues, an ankle-spanning external fixator with Schanz pins in the tibia and calcaneum was used (Fig. 3 and 4).

Following surgery, the patient received IV antibiotics for 5 days and oral antibiotics for 1 week. The wound healed satisfactorily (Fig. 5 and 6). She was kept non-weight bearing for 8 weeks. Serial radiography revealed bony union. The ankle-spanning external fixator with Schanz pins in the tibia and calcaneum and the fibular wire was moved after 2.5 months (Fig. 7). After 3 months, the patient was able to resume everyday activities and walk independently (Fig. 8). Her American Orthopedic Foot and Ankle Society score was 86, indicating a favorable functional result.

Discussion

Open trimalleolar ankle fractures with syndesmotic rupture and posterior talar displacement are a challenge for orthopedic surgeons. Particularly in high-grade open wounds, these injuries test the orthopedic surgeon not only in terms of exact anatomical reduction but also in terms of safeguarding vulnerable soft tissues and reducing infection risks. Studies have also emphasized the importance of early soft-tissue coverage and stabilization in open ankle fractures to lower infection rates and improve union outcomes [7]. The uniqueness of this constellation of injuries, along with their degree, calls for a

customized and quick intervention.

In our situation, the internal biomechanical demands as well as the external soft-tissue considerations were addressed using a single-stage hybrid fixation technique. While an ankle-spanning external fixator gave more support without compromising soft-tissue integrity, this approach helped the medial and lateral malleoli and posterior fragment stabilize right away. The synergy of internal and external fixation in a single stage has been validated in polytrauma and open injury scenarios, promoting both mechanical stability and biological recovery [8].

Several treatment strategies for such injuries exist in the literature. With open trimalleolar fractures, Górski et al. showed effectiveness with Ilizarov external fixation alone [4]. Although this gave sufficient fracture alignment and wound treatment, the absence of internal fixation might affect long-term joint mechanics and articular congruency. Further, it has been shown that in high-energy ankle injuries, articular congruity restoration remains a key prognostic factor for post-traumatic arthritis and functional return [9].

Conversely, Kim and Park presented a hybrid method combining internal screws and suture-button constructions [5] for Danis-Weber type C fractures on the other end of the continuum. Although their approach helps to control confined fractures with syndesmotic injuries, it might not be the best in open situations when soft-tissue handling is critical.

Xu et al. detailed a “floating ankle,” in which internal fixation comes later following exterior fixation [6]. Although suitable in unstable soft-tissue disorders, this approach can postpone



Figure 8: Post-operative images showing a good range of motion.

rehabilitation, extend hospital stay, and call for more surgical visits.

Biomechanical data directly guided the choice to correct the posterior malleolus. Gardner et al., who underlined the need for posterior stabilization in preserving ankle mortise congruency [1], concluded that fixation of the posterior fragment improves syndesmotic stability more effectively than trans-syndesmotic screws alone [3].

Our experience combines these ideas into one operational solution. We obtained union, conserved alignment, and promoted early rehabilitation without the need for artificial operations by combining internal fixation of all malleolar components – including the posterior fragment, with external fixation to minimize strain on soft tissues. To our knowledge, no published case reports a one-stage hybrid method treating an open trimalleolar fracture with syndesmotic disturbance and posterior talar displacement in the way reported. A recent

systematic review by Vopat et al. discussed evolving concepts in syndesmotic injury management and called for more case-based innovations tailored to complex patterns [10].

This case emphasizes the possible advantages of a strong but precisely carried out hybrid approach. When soft-tissue conditions are appropriate, this can help to lower surgical load, improve stability, and produce positive results in even the most complicated fracture situations.

Conclusion

Open trimalleolar ankle fractures with syndesmotic damage and posterior talar subluxation are difficult to treat surgically. Nuance and balance are needed to restore anatomy while maintaining soft tissue. A single-stage hybrid fixation method allowed us to internally restore the bone architecture and externally fix the damaged soft-tissue envelope.

The effective union, function restoration, and lack of problems in our patient demonstrate the potential of this comprehensive technique. This method reduces surgical procedures, infection risk, and recovery time. Our experience suggests that properly designed hybrid fixation may be a pragmatic and effective treatment for high-energy open ankle fractures with complicated anatomical abnormalities. Patient selection is still important.

More large case series and extended follow-up are needed to confirm these findings and improve surgical techniques for difficult fracture forms.

Clinical Message

In carefully selected cases, a single-stage hybrid fixation approach combining internal fixation and external stabilization can successfully manage complex open trimalleolar ankle fractures with syndesmotic disruption and posterior talar subluxation, ensuring fracture stability, protecting soft tissues, and leading to favorable functional outcomes.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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