

Statement of Purpose

Demonstrate an effective limb salvage strategy for patients with calcaneal fractures complicated by osteomyelitis with significant past medical history by means of intramedullary nailing in combination with partial calcaneotomy

Introduction

Limb salvage, as an alternative to amputation, offers significant benefits in terms of both health outcomes and cost-effectiveness, particularly for patients with complex musculoskeletal injuries or infections. While amputation is sometimes deemed necessary in cases of severe infection or non-healing wounds, limb salvage allows for the preservation of function, mobility, and quality of life. This approach is especially valuable in patients with underlying comorbidities such as diabetes, hypertension, and end-stage renal disease, who may face additional complications from an amputation.

From a health perspective, limb salvage provides patients the opportunity to maintain independent mobility and reduce long-term complications associated with amputation, such as phantom limb pain, decreased functionality, and the need for prosthetics (1)). For diabetic and elderly patients, maintaining limb function can drastically improve rehabilitation outcomes, reduce the risk of further complications, and enhance the overall well-being of the patient (2). Moreover, limb salvage allows for the preservation of psychological well-being by avoiding the emotional toll that amputation can impose, including depression and reduced self-esteem (3).

From a cost perspective, limb salvage can be a more cost-effective solution in the long term. While initial treatments may involve extensive wound care, surgical interventions, and prolonged hospitalization, studies have shown that limb salvage leads to fewer long-term rehabilitation costs and a lower incidence of future medical interventions compared to amputation (4). Amputation often necessitates the use of prosthetics, ongoing physical therapy, and additional medical procedures, all of which increase the financial burden on the healthcare system and the patient (5). By contrast, the successful outcome of limb salvage can reduce the need for these long-term interventions.

In this case, the patient's successful journey through limb salvage provides an example of how careful management and timely interventions can preserve limb function, improve quality of life, and reduce overall healthcare costs.

Case Study

This case involves a 58-year-old patient with a significant medical history, including hyperlipidemia, hypertension, Type 2 diabetes, end-stage renal disease (on dialysis for 15 years), sleep apnea, and obesity (BMI of 40.49 kg/m²). On July 3, 2023, the patient presented to the emergency department with left ankle pain following a misstep that resulted in a "pop" sound. Imaging revealed a posterior calcaneal avulsion fracture with a beak-like fragment. Emergent open reduction internal fixation (ORIF) surgery was performed using titanium screws and a posterolateral incision with an orthopedic surgeon. The immediate post-operative course was complicated by a medical emergency marked by unresponsiveness, suspected septic shock, and the need for intensive care, antibiotics, and hemodialysis.

By late August and early September 2023, the patient developed blisters and full-thickness ulcers at the surgical site, which became infected with *Proteus mirabilis* and vancomycin-resistant enterococcus (VRE). A comprehensive wound care regimen, including Medihoney and Santyl, along with antibiotic therapy, was initiated. The patient underwent surgical intervention for hardware removal and irrigation & debridement (I&D) in late September, with IV antibiotics and the initiation of wound vac therapy. Throughout the fall of 2023 and into early 2024, ongoing care included physical therapy, wound care, and continued antibiotic treatment. By December 2023, the wound culture showed MRSA, *Proteus*, and VRE, complicating the recovery.

In January and February 2024, a vascular consultation recommended a below-knee amputation (BKA). However, the patient sought a second opinion on limb salvage. MRI findings suggested acute osteomyelitis and Achilles tendon damage. A limb salvage approach was devised, including I&D, partial calcaneotomy, TTC fusion, and potential graft application. On March 18, 2024, the patient underwent a partial calcaneotomy, TTC fusion with an intramedullary nail, and external fixation. Post-operative care included IV antibiotics, wound care, and frequent follow-ups to monitor healing and graft incorporation.

From April to December 2024, the patient continued with regular wound care appointments, during which minor complications such as dehiscence and ulceration were noted. In June 2024, a graft was applied to address the wound dehiscence. By September 2024, the wound was managed with triple antibiotics, and further dressing changes were made. As of November 2024, the patient transitioned to weight-bearing status, with ongoing management of the surgical site and continued infection monitoring.

Clinical Images



Fig 1. : Initial radiographs lateral view following initial ORIF of calcaneal fracture patient's left foot/ankle with screw fixation



Fig 2. :Final postoperative views from limb salvage procedure (partial calcaneotomy, TTC nail without joint prep, application of external fixation and application of graft) on left foot



Fig 3. :Final postoperative views from removal of external fixation with graft application demonstrating consolidation at the STJ



Fig 4. : Clinical images at most recent follow up appointment demonstrating resolution of all wounds

Discussion and Conclusion

The presented case highlights the complexity of managing severe post-surgical complications following a calcaneal fracture. This case demonstrates the challenges encountered when considering whether to proceed with limb salvage or amputation, particularly in patients with comorbidities such as diabetes, obesity, and end-stage renal disease (ESRD) and especially peripheral arterial disease.

Clinical Context and Challenges

The patient initially presented with a posterior calcaneal fracture and underwent emergent open reduction internal fixation (ORIF) surgery. Following the procedure, the patient developed significant post-surgical complications, including wound infections, ulcerations, and soft tissue damage, leading to repeated infections with *Proteus mirabilis*, VRE, and MRSA. These complications were further compounded by a history of chronic medical conditions and suboptimal arterial inflow to the lower extremity. Despite these issues, the patient demonstrated continued interest in exploring limb salvage.

Limb Salvage vs. Amputation:

In the face of such challenges, the vascular consultation was initially recommended by the referring provider for below-knee amputation (BKA) as a potential solution. However, after seeking a second opinion and reviewing diagnostic imaging, it became clear that limb salvage remained a feasible option. The MRI findings suggested acute osteomyelitis with degeneration of the Achilles tendon, which were amenable to surgical intervention through a comprehensive limb salvage approach. This approach involved irrigation & debridement (I&D), partial calcaneotomy, and talonavicular joint fusion (TTC) with an intramedullary nail.

The patient's decision to pursue limb salvage was supported by a multidisciplinary team, recognizing that early intervention and an aggressive treatment plan could help preserve the limb while controlling infection. Limb salvage not only provided an opportunity for functional recovery but also addressed the psychological and quality-of-life benefits for the patient, preserving mobility and independence.

Outcomes of Limb Salvage:

The patient's recovery after limb salvage surgery demonstrates that, with careful monitoring, infection control, and appropriate surgical interventions, limb salvage can be a viable alternative to amputation. Post-operative care included IV antibiotics, regular wound care, and the use of a wound vac. Over time, the patient progressed with partial weight-bearing and underwent several follow-up visits, demonstrating the gradual healing and incorporation of the grafts.

The patient's ability to maintain weight-bearing and prevent further infection is critical to the success of limb salvage. The continued monitoring, including regular wound care and imaging, provided insight into the healing process and allowed for timely interventions when complications arose, such as wound dehiscence. This proactive approach to wound management is essential to achieving long-term success in limb salvage.

Conclusion:

Limb salvage is a viable option in patients with complex, post-surgical complications, as long as a comprehensive and multidisciplinary approach is utilized. Early intervention, meticulous wound care, and ongoing infection management are essential for success. In this case, despite significant risk factors, the patient's decision to pursue limb salvage resulted in an opportunity for functional recovery, providing a clear example of how aggressive treatment plans and patient involvement can lead to positive outcomes in cases where amputation might otherwise seem inevitable. Limb salvage should continue to be considered a viable option in select cases, providing patients with the possibility of preserving their limbs and improving their overall quality of life.

References

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