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Case Report

Complicated Calcaneal Fracture with Displacement Following Osteosynthesis and Successful Reoperation: A Case Report

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ABSTRACT

Background: Calcaneal fractures are relatively uncommon but account for a significant proportion of tarsal injuries. Often resulting from high-energy trauma, they carry a high risk of complications and remain a clinical challenge. Although open reduction and internal fixation (ORIF) is often successful, certain risk factors may predispose to failure and unexpected complications.
Case Presentation: A 49-year-old female sustained a closed, displaced tongue-type calcaneal fracture after a fall from height and underwent acute screw fixation. At four weeks, radiographs revealed fracture recurrence and hardware failure, necessitating urgent reoperation with realignment and re-fixation, followed by a restrictive postoperative regimen. At 14 weeks post-reoperation, radiographs confirmed fracture healing. Upon completion of the treatment course, the patient was referred for continued physiotherapy to support ongoing functional recovery. Despite slight residual limitations, the patient reported minimal discomfort and regained mobility, reflected in an American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score of 81.
Discussion: Calcaneal fractures are complex injuries with a high complication rate. Initial fixation of tongue-type calcaneal fractures may fail due to factors such as obesity, age, gender, surgical technique, or inadequate aftercare. A good functional outcome was ultimately achieved through timely reoperation, strict rehabilitation protocols, and close follow-up.
Conclusion: This case underscores the importance of early surgical intervention, mitigating risk factors, and structured rehabilitation in managing complex calcaneal fractures. Risk factors should guide both surgical planning and aftercare. Early recognition of fixation failure and reoperation within four to six weeks can still result in favourable outcomes, even in high-risk patients.

Keywords: Calcaneus; Bone fractures; Internal fracture fixation; Postoperative complications; Human and medicine

INTRODUCTION

Calcaneal fractures represent approximately 2% of all fractures and account for 50-60% of tarsal injuries.[1,2] Fractures of the calcaneus typically result from high-energy trauma, most commonly due to fall from height or motor vehicle accidents.[1,3] These injuries are challenging to manage due to their complex anatomy, frequent comminution, and close association with vulnerable soft tissue structures. Tongue-type fractures comprise a small percentage of calcaneal fractures,[4] but are considered orthopaedic emergencies and require prompt treatment.[5,6] The injury mechanism often results in complex fractures, joint depression and risk of impaired function, and complications remain relatively common. Typical complications include skin and wound issues, infection, malunion and hardware failure with an overall complication rate of approximately 40%.[7,8] The tongue-type calcaneal fractures, in particular, are associated with heightened risk of complications,[4,9,10] such as soft tissue injury, skin necrosis, and hardware failure, due to increased pressure on the posterior calcaneal soft tissue and tractional forces from the displaced tuberosity fragment.[8,11]

Treatment options include conservative management for minimally displaced fractures and surgical intervention, typically ORIF, for displaced intra-articular fractures. Given their complexity and high risk of complications, calcaneal fractures pose a significant challenge in orthopaedic management. The primary treatment objectives include restoring joint congruity and hindfoot alignment, while minimising long-term functional impairment.[1-3,12] Various operative approaches and techniques for the reduction and fixation of calcaneal fractures exist, and the optimal treatment approach remains a topic of debate.[13]

This case report presents a case of early postoperative failure following ORIF of a displaced tongue-type calcaneal fracture. It highlights the complexities involved in managing calcaneal fractures and discusses the potential contributing factors to failure.

CASE REPORT

A 49-year-old female with no significant medical history, aside from adiposity and a body mass index (BMI) of 40.7 kg/m², presented to the emergency department after falling from a stool and landing directly on her right heel. Upon admission, she presented with pain and swelling in the foot. On physical examination, significant swelling and pain were noted in the hindfoot, along with discoloration due to hematoma formation. A displaceable bone fragment was palpable near the distal attachment of the Achilles tendon, with overlying skin compromise. Radiographs revealed a displaced tongue-type calcaneal fracture, a slightly displaced distal diaphyseal fracture of the fourth and fifth metatarsals (Figure 1), and a small transverse avulsion fracture at the tip of the lateral malleolus.

The patient was scheduled for and acute operation with ORIF to stabilise the displaced calcaneal fracture and prevent posterior heel skin necrosis and progression to an open fracture due to overlying skin compromise. A posterior minimally invasive osteosynthesis approach (MIO) using a slight J-shaped lateral incision was employed. The calcaneal fracture was stabilised using cannulated screws with washers (Figure 2), while the remaining fractures were managed conservatively. Postoperatively,

Figure 1. Radiographs at the time of injury. (A) Anteroposterior view of the foot showing fractures of the fourth and fifth metatarsals. (B) Mortise view of the ankle demonstrating a small avulsion fracture of the lateral malleolus. (C, D) Axial and lateral views of the calcaneus showing a displaced tongue-type calcaneal fracture and associated metatarsal fractures.

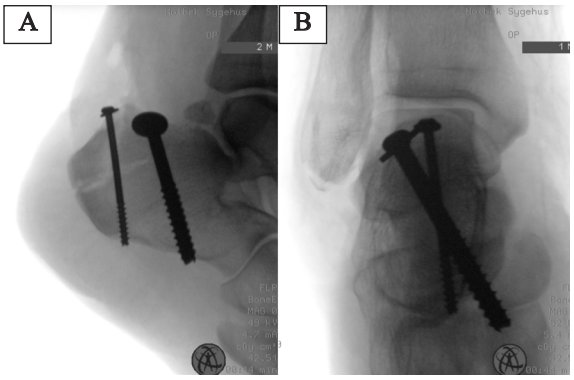

Figure 2. Intraoperative radiographs during initial fixation, showing (A) lateral view of the calcaneus and (B) anteroposterior view of the ankle, with good fracture alignment and appropriate positioning of cannulated screws.

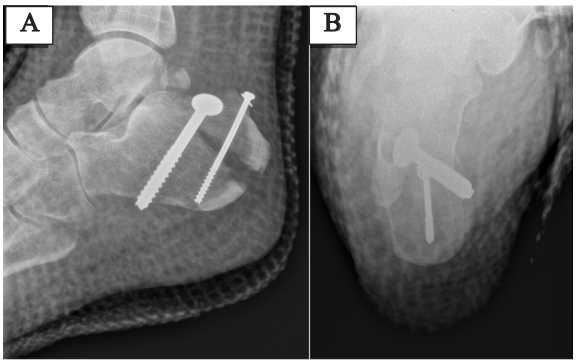

Figure 3. Radiographs at four-week follow-up. (A) Lateral and (B) axial views demonstrating recurrent displacement of the tongue-type calcaneal fracture and hardware migration.

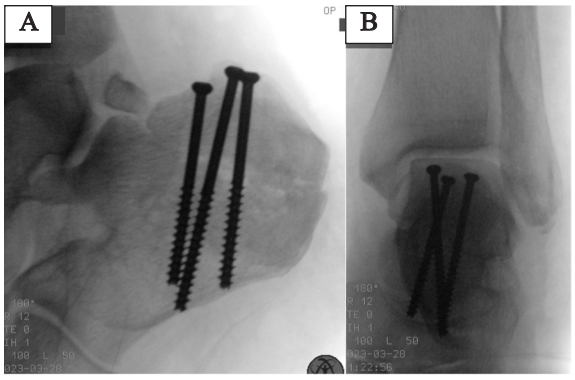

Figure 4. Intraoperative radiographs during reoperation, showing (A) lateral view of the calcaneus and (B) anteroposterior view of the ankle with restored alignment following re-fixation.

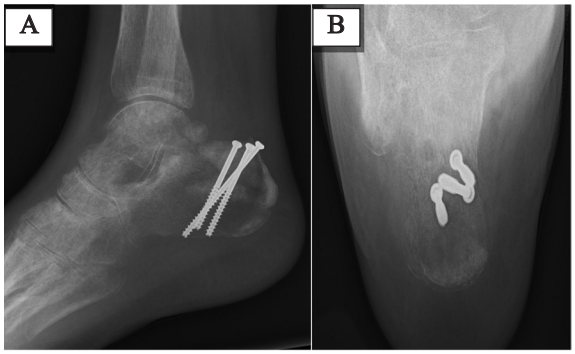

Figure 5. Radiographs at 14-week follow-up post-reoperation. (A) Lateral and (B) axial views of the calcaneus demonstrating maintained alignment, correct screw positioning, and signs of fracture healing.

the foot was immobilised in a short leg splint with the ankle in slight plantarflexion (equinus position). The patient was discharged the following day with instructions to avoid weightbearing for 8 weeks, with scheduled follow-up in the outpatient clinic.

At the two-week follow-up, radiographs confirmed stable fracture alignment and osteosynthesis. The short leg cast was replaced with a circular cast in neutral alignment. By the four-week follow-up, the foot remained significantly swollen. Physical examination showed intact skin, perfusion, and sensibility, but radiographs revealed recurrence of the tongue-type fracture and hardware displacement, with an 8 mm diastasis at the distal fracture end (Figure 3).

An acute reoperation was performed using the same posterior MIO approach, uncovering significant lateral bone loss and questionable bone vitality in the calcaneus. The screws were removed, and after thorough irrigation, three new cannulated screws were inserted (Figure 4). Postoperatively, a restrictive regimen was implemented, consisting of a short leg splint in slight equinus position for six weeks, followed by a walker orthosis with wedges. Weightbearing was prohibited for at least 12 weeks, with regular follow-ups. To address concerns about bone vitality, the patient received one day of intravenous antibiotics followed by a seven-day oral course.

Two weeks after the reoperation, radiographs confirmed stable positioning of the screws and fracture. At the six-week follow-up, radiographs demonstrated proper fracture alignment and osteosynthesis, with early signs of healing. The cast was replaced with a walker orthosis fitted with three wedges, to be removed gradually every two weeks, and range of motion exercises were initiated. However, the weightbearing restrictions remained in place. By the 12-week follow-up, the fracture and osteosynthesis remained stable,

with near-complete healing observed. Mild tenderness persisted over the calcaneus, leading to an extension of the walker orthosis use and weightbearing restrictions by two weeks. At 14 weeks, radiographs confirmed fracture healing with intact osteosynthesis (Figure 5). Physical examination revealed mild tenderness over the lateral calcaneus but no indirect tenderness or pain during weightbearing and a Visual Analogue Score (VAS) of 0. The ankle's range of motion showed a 10-degree dorsiflexion deficit and a 20-degree plantarflexion deficit, likely due to prolonged immobilisation. The patient was discharged with instructions for gradual weight-bearing and referred to further physiotherapy for continued strength and mobility recovery.

During an extraordinary follow-up one and a half years after the reoperation, the patient reported a positive functional outcome, describing herself as pain-free, unrestricted in daily activities, and able to walk briskly without discomfort. Nevertheless, some physical limitations persisted, particularly with running and engaging in strenuous activities. VAS remained of 0, and the patient reported an AOFAS Ankle-Hindfoot Score of 81 points. Despite the slight decline in function following injury, the patient remained satisfied with the overall treatment and long-term outcome.

DISCUSSION

This case illustrates the occurrence of early postoperative fixation failure following ORIF of a displaced tongue-type calcaneal fracture, illustrating some of the challenges encountered in managing these severe injuries. The causes of failure are multifactorial, spanning patient-related, preoperative, surgical, and postoperative factors.

Patient-related factors, notably morbid obesity (BMI 40.7), likely played a significant role. Although obesity previously was thought to protect against osteoporosis and fractures, recent studies have emphasised that obesity is corelated with an increased fracture risk.[14] Moreover, obesity is linked to altered bone metabolism and impaired healing, both of which contribute to an increased risk of fixation failure and delayed union. Studies suggest that these metabolic changes are driven by increased adipocyte differentiation, fat accumulation, and proinflammatory signalling during adipogenesis, ultimately impairing fracture healing and reducing new bone formation.[15,16] Obese patients also place greater mechanical loads on hardware, potentially overwhelming fixation constructs in cases of premature or improper mobilisation. This correlates well with recent studies showing obesity is strongly associated an increased risk of failure.[17]

Tongue-type calcaneal fractures are mechanically unstable and prone to redisplacement. Recent studies emphasise that even anatomically reduced fractures may fail if fixation strategies do not adequately resist shear forces.[3,4] Therefore, thorough preoperative surgical planning and careful intraoperative technique are essential. The optimal surgical approach for calcaneal fractures remains a matter of debate, with various techniques available for reduction and fixation.[13] Despite initial reduction and screw placement were satisfactory, displacement and failure still occurred by the four-week follow-up. Although there are no clear guidelines for surgical treatment, the consensus is that no single method is suitable for all calcaneal fractures,[12] with the approach and fixation method determined on a case-by-case basis and influenced by the surgeon's preference. In high-risk patients, augmented fixation or alternative approaches may be required to provide sufficient stability and fixation. Timing of surgery depends on the severity and location of the calcaneal fracture. Closed calcaneal fractures are usually treated with osteosynthesis within 1–2 weeks after the injury, once haematoma and swelling have decreased,[3,13] as early surgery, particularly within the first two days after trauma, has been associated with a higher risk of complications.[10] In contrast, open fractures or closed fractures with soft tissue incarceration by displaced bony fragments require acute surgical intervention.[13] The timing of surgery in cases of fixation failure

is critical. Evidence indicates that revision can be performed successfully in the early postoperative period, before substantial callus complicates reduction. Recent studies have reported reoperations within 4 weeks for inadequate reduction and successful revisions at approximately 30 days for recurrent displacement.[18,19] Similarly, Yu et al. reported that when malreduction or hardware migration is identified within six weeks of surgery, reoperation can still be performed successfully before significant callus formation develops, which would otherwise complicate revision and increase the risk of complications.[20] Consistent with these findings, our case underwent reoperation at 4 weeks, which allowed reestablishment of alignment and resulted in successful fracture healing.

Immobilisation and rehabilitation play an important role for optimising and regaining functional outcomes following the injury. Consensus states that the patient should be immobilised with non-weight-bearing for a period of 8–12 weeks.[21] Inadequate offloading or poor adherence to weight-bearing restrictions can result in early hardware failure. Patient compliance represents another potential challenge, as even appropriate surgical and after-care care, poor compliance may compromise outcomes. Rehabilitation remains essential but complex. While early motion can prevent stiffness, premature weightbearing increases the risk of hardware failure. In this case, a structured regimen combining extended immobilisation and controlled rehabilitation enabled fracture healing and recovery.

At the additional follow-up, the patient reported an AOFAS Ankle-Hindfoot Score of 81. The AOFAS Ankle-Hindfoot Score is a widely used tool for evaluating outcome in patients with ankle and hindfoot injuries.[22] Outcomes are classified as excellent (90–100 points), good (80–89 points), fair (60–79 points), and poor (below 60 points). A score of 81 points reflects a good functional outcome, although some limitations remain. Other recent studies have reported equally good outcomes in patients with calcaneal fractures.[23-25] This indicates a favourable outcome following the injury. However, despite extensive rehabilitation, full recovery and restoration of pre-injury activity levels cannot be guaranteed. The variability in patient outcomes highlights the necessity for continued research into optimised rehabilitation protocols to enhance recovery and reduce long-term complications.

Calcaneal fractures are associated with high complication rates, significantly influencing prognosis and long-term functional outcomes. These fractures typically result from high-energy trauma, which not only contributes to their severity but also increases the risk of concomitant injuries. Previous studies have reported that more than 70% of patients with calcaneal fractures present with concomitant injuries,[1] which can further complicate management if not appropriately identified and addressed. Notably, posterior calcaneal fractures, particularly tongue-type fractures, exhibit an even higher risk of complications,[4,9,10] underscoring the importance of timely diagnosis and optimal treatment strategies to mitigate adverse outcomes. Delayed or missed diagnoses of postoperative complications can result in permanent foot dysfunction and severely impact the patient's quality of life. Common long-term complications include post-traumatic arthritis, chronic pain, reduced mobility, and, in some cases, avascular necrosis. Despite best efforts, the risk of postoperative complications cannot be eliminated entirely. In cases of persistent pain, instability, or restricted function, an MRI is indicated to assess potential soft-tissue injuries, osteochondral lesions, or signs of post-traumatic arthritis or osteonecrosis that may not be evident on conventional imaging.[26,27]

This case highlights the importance of identifying high-risk patients, anticipating failure mechanisms, and intervening early when complications arise. Our report supports recent findings suggesting that prompt revision surgery combined with strict postoperative care can yield favourable and good outcomes. Further research is needed to define fixation strategies and rehabilitation protocols, especially for high-risk patients with obesity.

CONCLUSION

In conclusion, the clinical outcome of calcaneal fractures is influenced by fracture complexity, timing of intervention, quality of fixation, and adherence to postoperative protocols. Tongue-type calcaneal fractures are challenging to manage due to the deforming forces acting on the fracture and their unstable nature, and they require prompt surgical intervention to minimise the risk of complications. This case illustrates that hardware failure can occur even when initial reduction and positioning appear satisfactory. Several risk factors – particularly obesity – may significantly increase the risk of failure. Timely recognition of hardware failure and fracture displacement at the four-week follow-up allowed for successful reoperation, ultimately leading to fracture healing and a good functional outcome. Vigilant postoperative monitoring and clear patient education on weight-bearing restrictions are recommended. Additionally, maintaining immobilisation in slight plantarflexion for four to six weeks may help reduce shear forces on the posterior fragment and protect the fixation construct during early healing, thereby lowering the risk of complications.

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CONFLICT OF INTERESTS

The author declares no conflicts of interest.

ETHICAL APPROVAL

Ethical approval was not required for this case report in accordance with the institutional policy.

INFORMED CONSENT

Written informed consent was obtained from the patient for the publication of this case report and accompanying images. A copy of the signed consent is available for review upon request.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this case report are not publicly available due to patient confidentiality and privacy restrictions. Additionally, no datasets were generated or analysed during the present study.

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