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Outcomes of Calcaneal Fracture Fixation in a One-Day Surgery Setting

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Purpose: This study aimed to evaluate the feasibility and outcomes of minimally invasive calcaneal fracture fixation with screws in a one-day surgery setting. This study investigated whether this technique achieves satisfactory clinical, radiographic, and patient-reported outcomes without increasing the incidence of postoperative complications.

Methods: A retrospective review was conducted of 23 consecutive patients with Sanders type II tongue-type intra-articular calcaneal fractures treated with minimally invasive screw fixation in a one-day surgery setting between January 2010 and February 2024. All procedures were performed by one surgeon under regional anesthesia. Standardized perioperative management included a popliteal sciatic nerve block, multimodal oral analgesia, and structured follow-ups. The outcomes assessed were operative time, postoperative pain (visual analog scale [VAS]]), Böhler angle, perioperative complications, and patient satisfaction.

Results: The patients' mean age was 44.9 ± 10.6 years, with a mean injury-to-surgery interval of 9.2 ± 4.6 days. Sixteen patients underwent fixation via the sinus tarsi approach and seven via a percutaneous approach. Immediate postoperative pain was minimal (VAS; 0.4 ± 1.2), increasing to a mean of 3.2 ± 2.4 at 24 h; one patient (4.3%) experienced severe pain, managed with oral analgesics. The mean Böhler's angle increased from 3.6 ± 11.4° preoperatively to 25.2 ± 6.3° postoperatively. No hospital readmissions, wound complications, sural nerve injuries, or losses of reduction were observed. Patient satisfaction was high (mean; 4.8 ± 0.4/5). At four weeks, radiographs showed progressive fracture healing with initiation of weightbearing, and by 12 weeks, all cases demonstrated union without implant failure, infection, or delayed union.

Conclusions: Calcaneal fracture fixation with screws through the sinus tarsi approach can be effectively performed in a one-day surgery setting, resulting in favorable outcomes.

Keywords: calcaneal fracture, one-day surgery

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Calcaneal fractures, particularly intra-articular fractures, present significant challenges because of their complex anatomy and potential for long-term functional impairment. Traditional open reduction and lateral extensile internal fixation often necessitate prolonged hospitalization, increasing the burden on healthcare systems and

patients[1]. Minimally invasive techniques for calcaneal fracture fixation have demonstrated comparable outcomes to the lateral extensile approach while significantly reducing wound complications[2].

One-day surgery (ODS) has emerged as an effective and patient-centered alternative to traditional inpatient surgical care, eliminating the necessity for overnight hospitalization[3]. Advancements in anesthesia, surgical techniques, and perioperative care have significantly expanded the feasibility of ODS for several procedures, including orthopedic trauma surgeries[4].

Moreover, ODS offers several additional benefits, such as alleviating the strain on healthcare resources, optimizing hospital bed allocation for more critical cases, and minimizing the risk of hospital-acquired infections. Moreover, patients often prefer recovering at home, a setting associated with improved psychological well-being, reduced stress, and greater satisfaction[5]. The success of ODS in orthopedic procedures has been facilitated by effective pain management strategies, particularly regional anesthesia techniques, such as the popliteal nerve block, which provide adequate analgesia while mitigating the side effects of general anesthesia and opioids[6].

Minimally invasive surgical techniques, such as the sinus tarsi approach for calcaneal fracture fixation, have further facilitated the transition to ODS[7]. This approach minimizes soft tissue disruption, reducing postoperative pain, and promoting early mobilization[8,9]. However, concerns remain regarding postoperative pain control, complication rates, and the effectiveness of fracture reduction in an ODS setting.

This study aimed to assess the feasibility and clinical outcomes of calcaneal fracture fixation with screws, using a minimally invasive approach in an ODS setting. Specifically, this study evaluated postoperative pain management, Bohler's angle restoration, complications, and patient satisfaction.

METHODS

This was a retrospective review of several consecutive studies. All procedures were performed by an orthopedic foot and ankle surgeon. Clinical and operative data, including operative time, anesthesia type, and perioperative complications, were extracted from the hospital's electronic medical records by the treating surgeon and research team. Pain scores were recorded using the visual analog scale (VAS) immediately at discharge and after 24 h postoperatively via a structured telephone interview. Patient satisfaction was assessed during the same follow-up call using a 5-point Likert scale.

The Böhler's angle was measured on postoperative lateral radiographs using the hospital's PACS digital tools, and all measurements were independently reviewed by two investigators.

Study Design and Patient Selection

This retrospective review included a consecutive series of patients treated between January 2010 and February 2024. All procedures were performed by an orthopedic foot and ankle surgeon. Adults aged 18–65 years with Sanders type II tongue-type intra-articular fractures amenable to fixation using the sinus tarsi approach were included. Surgical fixation was performed within three weeks of injury. The exclusion criteria were Sanders type III–IV fractures, open fractures, delayed presentation, polytrauma, and significant medical comorbidities requiring inpatient management. Baseline demographic and clinical characteristics, including age, fracture classification, and interval from injury to surgery, were recorded.

All patients underwent standard preoperative evaluation, including lateral and axial radiography, and preoperative computed tomography (CT) scans were obtained to evaluate the fracture morphology and assist in surgical planning. The patients were counseled regarding the outpatient protocol, including perioperative pain management, weight-bearing restrictions, and the requirement of a responsible caregiver during the first 24 h after discharge.

Anesthesia and Pain Management

Most patients underwent regional anesthesia with a single-shot, ultrasound-guided popliteal sciatic nerve block using 20 mL of 2% lidocaine, without additional perioperative agents[10]. In two

cases, total intravenous anesthesia (TIVA) was administered at the discretion of the anesthesiologist.

Postoperative analgesia was standardized for all patients and comprised oral paracetamol 500 mg every 6 h as needed, oral naproxen 250 mg twice daily for three days, and oral tramadol 50 mg every 8 h as needed for three days. All patients received verbal and written instructions regarding medication use and expected postoperative pain levels.

Surgical Technique

The patients were placed in the lateral decubitus position with a sterile tourniquet applied to the calf. Depending on the fracture characteristics, either a sinus tarsi or percutaneous approach was selected. The sinus tarsi approach enables direct fracture visualization through a 3–5 cm incision[11], whereas percutaneous reduction is performed under fluoroscopic guidance using K-wires and a periosteal elevator. Once the reduction was confirmed with intraoperative fluoroscopy (Böhler's angle and Broden views), bicortical 3.5 mm cortical screws were percutaneously inserted. Wounds were closed with absorbable sutures, and the limbs were protected with a short leg slab.

Outcome Measurements

The effectiveness of calcaneal fracture fixation in an ODS setting was assessed based on surgical, radiographic, and patient-reported outcomes. Operative time was recorded from the first incision to the final wound closure. Pain levels were measured using the VAS at discharge and after 24 h postoperatively through a follow-up phone call.

Radiographic outcomes were assessed by measuring Bohler's and Gissane angles on postoperative lateral radiographs. Complications were monitored in two stages; early complications within 24 h, including excessive pain, bleeding, or wound-related issues requiring hospital readmission, and late complications within six weeks, such as infection, sural nerve injury, fixation failure, or loss of reduction.

All patients were contacted 24 h postoperatively to assess pain levels, response to analgesic medication, and the presence of any postoperative complications. Patient satisfaction with the outpatient surgical experience was recorded during follow-up. Satisfaction with the ODS experience was measured using a 5-point Likert scale (0 = extremely unsatisfying, 5 = extremely satisfying).

At the two-week follow-up, clinical and radiographic evaluations focused on wound healing, hardware position, and fracture alignment. In-person visits were conducted for most patients, whereas telemedicine follow-ups were offered as an alternative for those who were willing and able to participate remotely[12]. Subsequent follow-ups at four and eight weeks assessed radiographic evidence of bone healing.

RESULTS

The study cohort comprised 23 patients with Sanders type II tongue-type intra-articular fractures (mean age; 44.9 ± 10.6 years, mean waiting time from injury to surgery; 9.2 ± 4.6 days). Of these, 16 underwent fixation through the sinus tarsi approach, and seven underwent fixation through a percutaneous approach. None of the patients required hospital readmission owing to complications within the 24-h post-discharge period. Immediate postoperative pain at discharge was well controlled, with a mean VAS score of 0.4 ± 1.2. At 24 h postoperatively, the mean pain score was 3.2 ± 2.4. One patient experienced severe pain at 24 h, which was effectively managed with oral analgesics.

The mean preoperative Böhler's and Gissane angles were 3.6 ± 11.3° and 143.8 ± 3.2°, which improved significantly to 25.2 ± 6.8° and 129.1 ± 2.5° postoperatively, respectively. These findings suggest the effectiveness of reduction achieved through a minimally invasive approach. The quality of reduction was assessed using Böhler's and Gissane angles; however, without postoperative computed tomography, a definitive evaluation of subtalar joint congruity could not be performed. No wound complications, sural nerve injuries, or loss of reduction was observed during the follow-up period.

During the 24-h follow-up phone call, the patients were assessed for pain, complications, and overall satisfaction. Most patients reported a

positive experience, with a mean satisfaction score of 4.8 ± 0.4 out of 5. Patients cited effective pain management, early mobilization, and the convenience of outpatient surgery as the key benefits.

At the two-week follow-up, radiographs were reviewed to assess hardware position and fracture alignment. Eighteen patients attended an in-person visit in which they underwent clinical and radiographic evaluations by the treatment team. The remaining five patients opted for telemedicine follow-up. Radiographs of the patients were obtained at a hospital near their homes before their scheduled consultation. No hardware-related complications or fracture displacement were detected in either group.

Four weeks postoperatively, radiographs demonstrated progressive fracture healing, and gradual weight bearing was introduced in all cases as tolerated. At the eight-week follow-up, all patients showed adequate fracture healing with no evidence of implant failure, infection, or delayed union. No complications occurred during the follow-up.

DISCUSSION

This study provides compelling evidence that ODS is a safe, effective, and patient-centered alternative to conventional inpatient management for calcaneal fractures. The application of minimally invasive sinus tarsi approach combined with percutaneous screw fixation successfully achieved anatomical reduction while minimizing soft tissue disruption. These results indicate that ODS can deliver radiographic and functional outcomes equivalent to those of traditional approaches with a reduced risk of postoperative complications.

Tongue-type fractures are generally easier to reduce because the posterior fragment can be manipulated effectively through limited exposure, and their morphology allows secure stabilization with percutaneous screws[13].Particularly, Sanders type II fractures are well suited for minimally invasive fixation, as the relatively simple fracture line can be addressed with limited dissection while still achieving reliable anatomical restoration. Contrastingly, more complex patterns, such as Sanders III and IV fractures, often require wider exposure, more extensive fixation, and longer operative times, making them less suitable for minimally invasive outpatient management. Similarly, all cases were treated within three weeks of injury, as percutaneous reduction becomes increasingly difficult once an early callus forms[14].

Cortical screws were selected for fixation because they provide reliable bicortical purchases in the dense calcaneal bone. Biomechanical studies have shown that cortical screws placed bicortically provide comparable stability to cancellous screws in areas of high bone density[15]. Additionally, long cortical screws are readily available at our institution, making them a practical and effective choice for this study.

Furthermore, radiographic analysis confirmed the efficacy of reduction, as the procedure successfully corrected Böhler's and Gissane angles from a mean preoperative value of 3.6 ± 11.3° and 143.8 ± 3.2° to 25.2 ± 6.8° and 129.1 ± 2.5° postoperatively, respectively. These radiographic improvements are consistent with previous reports demonstrating that minimally invasive sinus tarsi and percutaneous screw fixation techniques can reliably restore calcaneal morphology and alignment while minimizing soft-tissue complications[8,9].

A key factor contributing to the success of ODS is the use of the popliteal sciatic nerve block, which provides sustained postoperative analgesia and facilitates early discharge without compromising patient comfort. Previous studies have demonstrated the efficacy of the popliteal block in significantly reducing postoperative pain following calcaneal fracture fixation[10]. Moreover, our pain assessment data showed that patients reported minimal discomfort immediately postoperatively, with a mild increase in pain at 24 h, which was effectively managed with a standardized multimodal analgesic regimen.

The patients expressed a strong preference for recovery at home, and follow-up evaluations, including telemedicine consultations, were a viable and efficient method for monitoring recovery. The high patient satisfaction scores reflect a growing demand for less invasive and more convenient surgical interventions.

However, this study has several limitations. First, the relatively small sample size of 23 patients may have restricted the generalizability of our findings. Second, the study included only patients with Sanders type II tongue-type fractures who underwent surgery within three weeks of injury, which reflects deliberate patient selection and limits the applicability of our conclusions to more complex fracture patterns, such as Sanders types III and IV. Third, sinus tarsi open reduction, internal fixation, and percutaneous screw fixation were included in the cohort, introducing methodological heterogeneity and potential confounding factors. Although the outcomes were favorable across the series, the small sample size precluded meaningful subgroup comparisons between surgical techniques. Fourth, radiographic assessment relies primarily on Böhler's and Gissane angles, which provide only limited two-dimensional measures of reduction quality. The absence of postoperative computed tomography represents an additional limitation, as it remains the most accurate modality for evaluating subtalar joint congruity and three-dimensional fracture morphology but was not performed in this ODS cohort. Fifth, patient satisfaction was assessed using a single-item Likert scale, which may not have adequately captured the multidimensional nature of patient-reported outcomes. Finally, functional outcomes, such as the AOFAS score or other validated scoring systems, were not collected, limiting the ability to directly correlate radiographic correction with clinical recovery.

Future research involving larger and more diverse cohorts is needed to validate these selection criteria and further evaluate their generalizability across different clinical contexts. Ongoing advances in minimally invasive surgical techniques, regional anesthesia, and telemedicine may expand the role of ODS as a safe, effective, and resource-efficient option for the management of calcaneal fractures.

CONCLUSIONS

ODS is a safe and effective option for calcaneal fracture fixation, offering outcomes comparable to those of inpatient care with fewer complications. Minimally invasive techniques and regional anesthesia enable early discharge without compromising recovery. High patient satisfaction and successful telemedicine follow-ups support the feasibility of this approach. Although further research is needed, ODS can improve fracture management by enhancing patient convenience and healthcare efficiency.

REFERENCES

1. Attenasio A, Heiman E, Hong IS, et al. Postoperative wound complications in extensile lateral approach versus sinus tarsi approach for calcaneal fractures: Are we improving? Updated meta-analysis of recent literature. Injury 2024;55:111560.
2. Li LH, Guo YZ, Wang H, et al. Less wound complications of a sinus tarsi approach compared to an extended lateral approach for the treatment of displaced intraarticular calcaneal fracture: A randomized clinical trial in 64 patients. Medicine (Baltimore) 2016;95:e4628.
3. Martín-Ferrero MÁ, Faour-Martín O, Simon-Perez C, et al. Ambulatory surgery in orthopedics: experience of over 10,000 patients. J Orthop Sci 2014;19:332-8.
4. Athar MS, Fazal MA, Ashwood N, et al. Daycase trauma list: a safe and cost-effective service delivery. Ann R Coll Surg Engl 2019;101:519-21.
5. Thoen CW, Sæle M, Strandberg RB, et al. Patients' experiences of day surgery and recovery: A meta-ethnography. Nurs Open 2023;11:e2055.
6. Mendicino RW, Statler TK, Catanzariti AR. Popliteal sciatic nerve blocks after foot and ankle surgery: an adjunct to postoperative analgesia. J Foot Ankle Surg 2002;41:338-41.
7. Albright RH, Schneider E, Majeed A, et al. Outpatient surgical fixation of complicated calcaneal fractures pose no excess risk for 30-day complications. J Foot Ankle Surg 2025;64:253-5.
8. Wang Z, Wang XH, Li SL, et al. Minimally invasive (sinus tarsi) approach for calcaneal fractures. J Orthop Surg 2016;11:164.

9. Zhang G, Ding S, Ruan Z. Minimally invasive treatment of calcaneal fracture. J Int Med Res 2019;47:3946-54.
10. Li Y, Zhang Q, Wang Y, et al. Ultrasound-guided single popliteal sciatic nerve block is an effective postoperative analgesia strategy for calcaneal fracture: a randomized clinical trial. BMC Musculoskelet Disord 2021;22:735.
11. Rayes J, Sharplin P, Maalouf P, et al. A stepwise minimally invasive sinus tarsi approach to open reduction and internal fixation of displaced intra-articular calcaneal fractures: Technique tip. Foot Ankle Int 2023;44:565-73.
12. Fahey E, Elsheikh MFH, Davey MS, et al. Telemedicine in orthopedic surgery: A systematic review of current evidence. Telemed J E Health 2022;28:613-35.
13. Cao Y, Xu X, Guo Y, et al. Percutaneous Cannulated Screw Fixation vs. Plating With Minimally Invasive Longitudinal Approach After Closed Reduction for Intra-Articular Tongue-Type Calcaneal Fractures: A Retrospective Cohort Study. Front Surg 2022:9:854210.
14. Allegra PR, Rivera S, Desai SS, et al. Intra-articular calcaneus fractures: Current concepts review. Foot Ankle Orthop 2020;5:2473011420927334.
15. Bailey EJ, Waggoner SM, Albert MJ, et al. Intraarticular calcaneus fractures: a biomechanical comparison or two fixation methods. J Orthop Trauma 1997;11:34-7.