

Complications following the extended lateral approach for calcaneal fractures do not influence mid- to long-term outcome



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ABSTRACT

Background and aim: Open reduction and internal fixation (ORIF) of intra-articular calcaneal fractures through an extended lateral approach is frequently accompanied by a high complication rate. However, ORIF currently provides the best long-term clinical results. The aim of this study was twofold: (1) to evaluate both mid- to long-term clinical and radiological results of a consecutive series treated by ORIF and (2) to determine the influence of short-term complications on long-term clinical outcome.

Methods: Patients with a displaced intra-articular calcaneal fracture, treated with ORIF, through an extended lateral approach, in a level-2 trauma centre between 1995 and 2008 were evaluated for the study. The long-term functional outcome (American Orthopaedic Foot & Ankle Society (AOFAS), 36-Item Short-Form Health Survey (SF-36) and Visual Analogue Scale (VAS)) and radiographic results (e.g., Böhler and Gissane angle, height, width and joint reduction) were determined. Short- and long-term complications were documented.

Results: A total of 57 patients matched the inclusion criteria, from which 39 patients agreed to participate in this study (68%). The median follow-up was 6.5 years (range 2–16 years). Based on the AOFAS hindfoot score, 74% of the patients had a good-to-excellent long-term clinical result. Radiological results were satisfying with a median postoperative Böhler angle of 26° and 25° at follow-up. Complications occurred in 32% of all patients; mainly wound-healing problems were noted. Short-term complications did not influence mid- to long-term clinical results ($p > 0.05$). Anatomic reconstruction of the calcaneus was associated with improved long-term clinical results ($p < 0.05$).

Conclusion: Despite the high complication rate following ORIF of a calcaneal fracture, complications do not affect mid- to long-term clinical outcome. Surgical treatment should focus on restoring the anatomy.

Level of evidence: Therapeutic level IV.

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Introduction

Displaced intra-articular fractures of the calcaneus constitute 1–2% of all fractures. They are accompanied by a prolonged rehabilitation time, long-term complaints and a costly socio-economic burden [1,2]. Recent published results [3–6], although not definitive due to the lack of a sufficient number of prospective randomised studies, suggest that the current treatment of choice for displaced fractures of the calcaneus, in suitable patients, is open reduction and internal fixation (ORIF) through an extended lateral approach. ORIF seems favourable over conservative treatment in terms of the ability to wear regular shoes, the ability to return to

work, gait abnormalities, radiological parameters and the need for a secondary arthrodesis. The main limitation of ORIF is a frequently reported high short-term complication rate (e.g., wound-healing problems) [7–9]. To prevent wound-healing problems, the extended lateral approach has been introduced with various modifications [10–12]. Using this technique, the vascularisation off the full-thickness skin flap is thought to be optimally preserved [10]. However, wound-healing problems remain a problem, occurring in 20–40% of all patients [7–9]. The aim of the current study was twofold: (1) to determine the mid- to long-term clinical and radiological results after ORIF through an extended lateral approach in a level-2 trauma centre and (2) to determine the influence of short-term complications on overall outcome.

Patients and methods

A retrospective cohort study was undertaken among patients treated surgically in a level-2 trauma centre for displaced intra-articular fractures of the calcaneus. Between 1995 and 2008,

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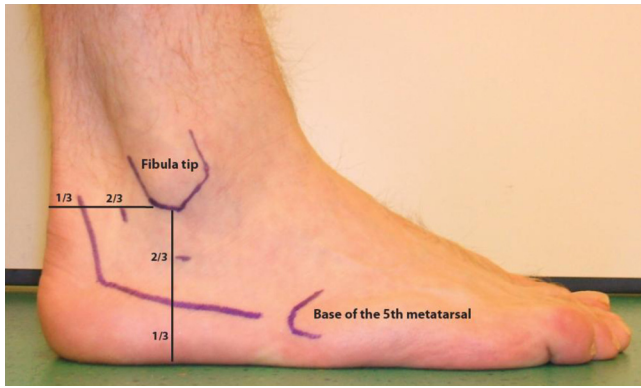


Fig. 1. Extended lateral approach, as performed in this study.

86 people were treated by means of ORIF through an extended lateral approach. Inclusion criteria for this study were a displaced (>2 mm in the posterior subtalar joint) intra-articular calcaneal fracture (Sanders type II–IV), age between 18 and 70 years and a minimum follow-up period of 2 years. Patients with open fractures ($n = 4$), primary arthrodesis ($n = 2$), severe mental illness ($n = 8$), patients who lived outside the Netherlands ($n = 5$) or who demised ($n = 10$) during follow-up (unrelated to the initial procedure) were excluded. A total of 57 patients matched the criteria, of which 39 (68%) patients were willing to participate in this study (Fig. 1). The remaining 18 patients were interviewed by telephone. Most patients who declined participation were not willing to take a day off from work. Institutional Reviewing Board approval was obtained prior to the start of the study.

Surgical technique

Surgery was performed by a single trauma surgeon (AJF), using an L-shaped, extended lateral approach (Judet/Seattle approach), slightly modified from the incision described by Zwipp [12] (Fig. 2). The full-thickness skin flap, including the peroneal tendons and the sural nerve, was retracted using one K-wire in the fibula and two in the talus. Subsequently, the fracture was exposed by extirpating the capsule of the lateral side of the subtalar joint. Loose parts of the lateral fragment were mobilised and, if necessary, temporarily stored in saline. Fracture fragments were temporarily fixated using K-wires. Small fragments were fixated using stainless steel cortical screws (3.5 mm). When complete radiological reduction was achieved, and the Böhler and Gissane angles restored, a calcaneal

plate (Synthes® non-locking calcaneus plate) was fixated using small fragment screws. K-wires were removed and the skin was closed using Ethilon 3.0. No wound drain was used. A pressure bandage was applied for a few days and, thereafter, the patients started with active and passive range of motion exercises under the supervision of a physiotherapist. Patients remained non-weight bearing for 6–8 weeks followed by gradual weight bearing.

Study procedure

The patient and fracture characteristics of the 57 patients who matched the inclusion criteria were retrieved from the medical charts. Short-term complications, for example, wound infection and wound dehiscence, were documented. Wound infection was defined using the definition of the US Centre for Disease Control and Prevention. Wound dehiscence was defined as failure of wound closure 2 weeks post surgery with negative wound cultures. Long-term complications, for example, secondary arthrodesis and implant removal, were documented including the indication for removal.

Fractures were classified on pre-operative conventional radiographs and computed tomography (CT) scans according to the classifications of Essex-Lopresti and Sanders [11,13]. Böhler's angle, the angle of Gissane, posterior facet height and heel width were measured on the pre- and postoperative radiographs by an independent radiologist and trauma surgeon. Heel width was measured at the widest point of the calcaneus on the axial radiograph. At follow-up, standardised axial and weight-bearing lateral radiographs of both feet were obtained. Again, Böhler's angle, the angle of Gissane, heel width and posterior facet height were calculated. To obtain a patient-specific degree of anatomic reconstruction of the calcaneus, a ratio was calculated using the follow-up radiographs. The Böhler and Gissane angles, posterior facet height and heel width of the injured foot were divided by values of the non-injured foot creating a ratio. Grade of arthritis was measured according to the Morrey and Wiedeman scale [14].

Subsequently, the 39 patients who were willing to participate were invited to the outpatient clinic. They were asked to complete a questionnaire consisting of three outcome scores: the disease-specific American Orthopaedic Foot & Ankle Society (AOFAS) hindfoot score, the general health Short Form health survey (SF-36) score and the VAS for patient satisfaction [15,16]. In addition, some additional questions on disabilities in daily living were asked. Patients with bilateral fractures were asked to answer all questions concerning their most symptomatic foot. Only in the most symptomatic foot correlation with radiological outcome was

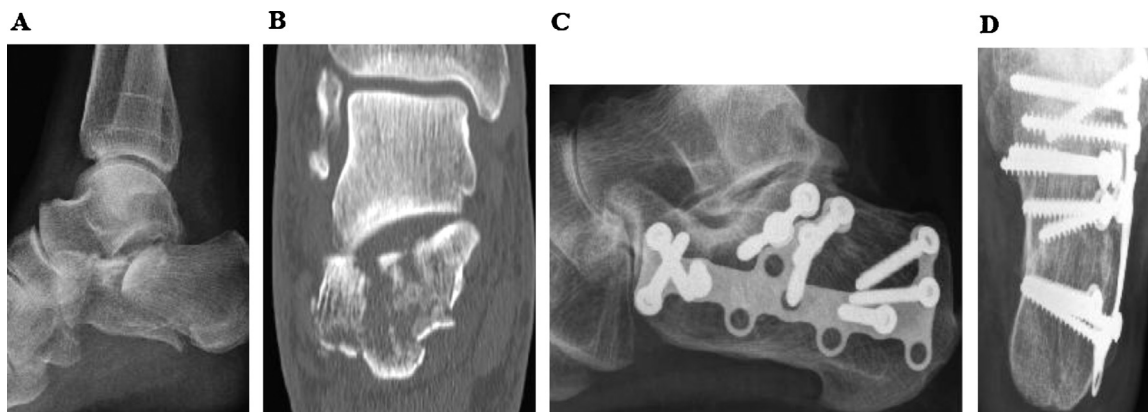


Fig. 2. Illustrative images from the series. (a) Conventional radiograph showing an intra-articular fracture of the calcaneus (tongue-type). (b) CT scan showing a comminuted intra-articular fracture of the calcaneus (Sanders type IV). (c) Lateral view of the calcaneus following ORIF through an extended lateral approach. (d) Axial view of the calcaneus following ORIF through an extended lateral approach.

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