

Operatively Treated Calcaneus Fractures: To Mobilize or Not to Mobilize

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Abstract: Background. This study compares the results of immediate post-operative mobilization versus immobilization after anatomic reduction and internal fixation of displaced, intra-articular calcaneus fractures. Two different post-operative protocols are used at our institution for surgically treated calcaneus fractures. One calls for immediate mobilization after the wound is healed, and the other involves cast immobilization until radiographic evidence of fracture healing.

Methods. All available charts for isolated, operatively treated calcaneus fractures with at least a six-month follow-up were reviewed. All patients being evaluated were treated with the same surgical technique and post-operative protocol, except for the length of post-operative immobilization. All fracture reductions were evaluated with intra- and post-operative radiographs, including Broden's Views.

Results: Eighteen fractures (16 patients) that were mobilized after surgery (Group A) were compared to 10 fractures (eight patients) that were casted for an average of 38.7 days (range: 29–61) until fracture healing (Group B). The AOFAS Scores for Group A (mean 78.9) and B (mean 68.8) are significantly different ($p = 0.017$). This difference in the AOFAS Scores is primarily attributable to a statistically significant difference in the pain subscores ($p = 0.001$) between Groups A (mean: 27.8) and B (mean: 21.0).

Conclusions. This study confirms our clinical impression that post-operative mobilization results in a better outcome for displaced, intra-articular calcaneus fractures. The findings demonstrate that immediate post-operative mobilization is correlated with a statistically significant improvement in AOFAS Scores, pain levels, and subtalar motion.

Introduction

Calcaneus fractures are the most common fracture of the tarsal bones, yet controversy still exists on the best treatment for these disabling injuries [1–9]. Historically, most calcaneus fractures have been treated closed because open reduction and internal fixation (ORIF) did not result in improved outcomes and had high complication rates [10]. However, as a better understanding of fracture patterns with computed tomography (CT) scans and modern surgical techniques and hardware have improved outcomes and low-

ered morbidity, a trend has developed toward ORIF for displaced, intra-articular calcaneus fractures [1–19].

Calcaneus fractures often result in a varus deformity with heel widening, loss of calcaneal height, and subtalar articular incongruity. ORIF can be used to address these deformities, restoring the anatomic morphology of the calcaneus and thereby the biomechanics and function of the hindfoot [4,8,9,19]. Restoring heel width prevents chronic peroneal tendinitis secondary to impingement from lateral wall blow-out of the calcaneus [2,4,7,8,15], and restoring the length and alignment of the Achilles tendon maintains plantar-flexion strength [4,8].

ORIF also provides the opportunity for anatomic reduction and rigid internal fixation of the subtalar joint. Normal subtalar motion is integral to the foot's ability to adapt to uneven surfaces with inversion and eversion. In addition, subtalar eversion unlocks Chopart's joint, creating a supple foot to absorb the force of heel strike, and subtalar inversion locks Chopart's joint, creating a rigid foot for toe off.

Controversy continues over the optimal post-operative regimen for displaced, intra-articular calcaneus fractures. Some believe that early physiotherapy may result in the loss of fracture fixation, but others feel that modern surgical techniques and hardware should permit early motion of the subtalar joint without compromising the reduction [3,15,18]. While most protocols call for early range of motion after ORIF [1,3–6,8–11,13–19], some orthopaedists still immobilize the fracture for prolonged periods after surgery, initially in a splint and after wound healing in a cast [2,12]. Even within our institution, two different post-operative protocols are used for displaced, intra-articular calcaneus fractures: one attending surgeon immediately mobilizes the subtalar joint after the wound is healed, and another attending uses cast immobilization until radiographic evidence of fracture healing is seen.

Some surgeons report excellent results with immediate post-operative mobilization of displaced, intra-articular calcaneus fractures [1,3–6,8–11,13–19]. However, to the best of our knowledge, no prior studies compare patients mobilized immediately after surgery to a contemporaneous group of patients immobilized in a cast post-operatively. The purpose of this study is to compare the results of immediate post-operative mobilization versus cast immobilization after anatomic ORIF of displaced, intra-articular calcaneus fractures in a contemporaneous group of patients.

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Materials and Methods

Two different post-operative protocols are used at our institution by two different surgeons for displaced, intra-articular calcaneus fractures. One (EO) calls for immediate mobilization with a formal physical therapy program after the wound is healed, and the other (CTB) involves cast immobilization until radiographic evidence of fracture healing is seen. Otherwise, all closed fractures were treated with the same surgical technique using an extensile lateral exposure as described by Benirschke and Sangeorzan [11], anatomic reduction, and rigid internal fixation with plates and screws. None of the cases involved bone grafting. All the fractures were treated with the same post-operative protocol, except for length of immobilization.

A computer search was performed to identify all isolated Sanders Type II and III calcaneus fractures [16,17] that were treated with one of these two post-operative protocols between 1994 and 1997. Differentiation was not made between type II and III fractures, as both were treated the same by both surgeons. All multi-trauma patients were eliminated from this study.

All available charts with at least a six-month follow-up were reviewed. Specific attention was given to the findings on the most recent post-operative physical examination, including subtalar and ankle range of motion, ankle and hind-foot stability, and gait. Post-operative subtalar motion was determined by the operating surgeon, with care to stabilize the ankle while ranging the subtalar joint. The results of intra- and post-operative radiographs, including Broden's views, were reviewed to ensure that all the fractures were acceptably reduced, with the elimination of all significant articular step-offs in the subtalar joint. Post-operative CT scans to assess the fracture reduction were not clinically warranted in most cases and therefore were not routinely obtained.

All patients being evaluated for this study were contacted by a third, blinded orthopaedic surgeon to answer a questionnaire based on the American Orthopaedic Foot and Ankle Society (AOFAS) Score for the ankle and hindfoot [20], currently the most commonly used scoring system for orthopaedic foot and ankle procedures. Because of the difficulty in having trauma patients return for follow-up after having reached maximal medical management, most subjects in this study were unwilling to return for an examination by the third, blinded orthopaedic surgeon.

The AOFAS Score for the ankle and hindfoot is based on a 100-point scale. A maximum of 40 points is allocated for pain, ranging from zero points for severe pain to 40 points for no pain. Up to ten points are allocated for alignment, ranging from zero points for a non-plantigrade foot with severe malalignment symptoms to ten points for a plantigrade foot without symptoms. Finally, a maximum of 50 points is allocated for a variety of functions as determined by a history and physical examination. Specifically, ten points are allocated for the activity level and the need for assistive devices, five points for walking distance, and five points for the ability to walk on uneven surfaces. For the functional criteria assessed by physical examination, eight points are allocated for gait, eight points for ankle and hind-

foot stability, eight points for ankle motion, and six points for subtalar motion.

Results

Eighteen calcaneus fractures (eight left and ten right) in 16 patients were mobilized after surgery once the wound was healed (Group A). Ten fractures (six left and four right) in eight patients were immobilized first in a splint until wound healing and then a cast until fracture healing (Group B). The fractures in Group A were splinted until wound healing, which occurred at an average of 8.2 days (range: 7–10) after surgery, and the sutures were left intact for approximately three weeks. The fractures in Group B were immobilized post-operatively for an average of 38.7 days (range: 29–61).

The mean age of the patients at the time of injury was 40.4 years (range: 21.2–64.4) in Group A and 39.6 years (range: 27.3–70.6) in Group B ($p = 0.881$). All patients were followed-up until reaching maximal medical management. The fractures were followed-up for an average of 25.9 months (range: 6–52) in Group A and an average of 41.7 months (range: 6–82) in Group B ($p = 0.175$). The longer follow-up in Group B did not appear to affect the results, as the outcomes did not deteriorate after the first post-operative year.

The mean AOFAS Score for Groups A and B was 78.9 points (range: 57–97) and 68.8 points (range: 57–87), respectively. The difference in the AOFAS Scores between the two groups was statistically significant ($p = 0.017$). In Group A, one-third of the fractures scored in the nineties, and one-third scored in the seventies and eighties. In Group B, none of the fractures scored in the nineties, and only one of the fractures scored in the eighties.

This difference in the AOFAS Scores is primarily attributable to a statistically significant difference in the pain sub-scores between Groups A and B ($p = 0.001$). The average pain sub-score for Groups A and B was 27.8 points (range: 20–40) and 21.0 points (range: 20–30), respectively. No other sub-scores of the AOFAS Scale were significantly different between the two groups. In Group A, two-thirds of the fractures were associated with either no pain or only mild, occasional pain. In Group B, all but one of the fractures was associated with moderate, daily pain. Consideration was not given to the use of analgesics and/or non-steroidal anti-inflammatory drugs, a limitation of the AOFAS Score.

In regards to subtalar range of motion, the mean for Group A was 21.9 degrees (range: 0–40) and for Group B was 13.5 degrees (range: 0–25). The difference in talar-calcaneal motion between the two groups was statistically significant ($p = 0.044$). In Group A, only 11% of the fractures had less than ten degrees of subtalar motion. In Group B, 50% of the fractures had ten degrees or less of subtalar motion.

In Group A, two of the 18 fractures (11.1%) suffered post-operative complications. Both experienced delayed wound healing requiring only local wound care and temporary immobilization for approximately an extra week. One of the patients was a 37-year-old laborer who sustained a calcaneus fracture after falling off a ladder at work. At 13 months follow-up, his AOFAS Score was 73, and he expe-

rienced only mild, occasional pain. He had 25 degrees of subtalar motion and reported some difficulty with uneven surfaces. The other patient was a 60-year-old man who sustained his calcaneus fracture after falling out of a tree. At 21 months follow-up, he had an AOFAS Score of 82, reporting only mild, occasional pain. Even though he experienced only some difficulty with uneven surfaces, he demonstrated no subtalar motion by physical examination.

In Group B, two of the ten fractures (20.0%) suffered post-operative complications. One of the patients was a 30-year-old woman who developed a post-operative cellulitis requiring intravenous antibiotics. She was casted post-operatively for 61 days. At 16 months follow-up, she had an AOFAS Score of only 57 and experienced moderate, daily pain. Her subtalar motion was only 10 degrees, and she reported some difficulty with uneven surfaces. The other patient was a 39-year-old woman who suffered an isolated calcaneus fracture in a motor vehicle accident. She was casted post-operatively for 46 days and developed a deep venous thrombosis requiring anti-coagulation. At 27 months follow-up, her AOFAS Score was 72, and she reported moderate, daily pain. She had 20 degrees of subtalar motion and experienced some difficulty with uneven surfaces.

Discussion

A review of the literature indicates continued controversy over the optimal post-operative regimen for displaced, intra-articular calcaneus fractures. Currently, most orthopaedists believe that one of the primary goals of ORIF is to achieve a rigid enough fixation for early range of motion of the subtalar joint. Accordingly, most recent studies examining displaced, intra-articular fractures use protocols involving immediate post-operative physiotherapy [1,3–6,8–11,13–19]. Unlike prior articles, our study sought to compare patients mobilized immediately after surgery to a contemporaneous group of patients immobilized in a cast post-operatively.

A prospective, randomized study comparing immediate post-operative mobilization versus immobilization would be ideal, but the two attending surgeons are not willing to randomize their patients to the two protocols. Although this retrospective study compares the results of two different orthopaedists, both surgeons of comparable experience used the same operative technique and post-operative protocol, except for the length of post-operative immobilization. In addition, intra- and post-operative radiographs, including Broden's Views, were used to confirm that all the fractures were acceptably reduced. Post-operative evaluation of fracture reduction with CT scans, although preferable for this study, was not clinically warranted in most cases and therefore was not routinely obtained.

Because the post-operative questionnaire was obtained by a third, blinded orthopaedic surgeon, the AOFAS Scores, including the sub-scores, are comparable. However, the findings on the physical examinations, which were obtained by the two different operating surgeons, are not necessarily comparable and must be evaluated with some reservation. Because of the nature of following-up trauma patients, most

of the subjects in this study were unavailable for examination by the third, blinded orthopaedic surgeon.

Comparing two contemporaneous groups of displaced, intra-articular calcaneus fractures treated with two different post-operative protocols, this study confirms our clinical impression that early post-operative mobilization results in a better outcome. The findings demonstrate that immediate post-operative mobilization of anatomically reduced calcaneus fractures is correlated with a statistically significant improvement in AOFAS Scores, pain levels, and subtalar motion.

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