Isolated subtalar arthrodesis after fractures of the calcaneus

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Background
Involvement of the subtalar joint in fracture calcaneus may give rise to chronic pain and permanent functional impairment. This can be produced by subtalar incongruity with calcaneofibular abutment and/or impingement of the tendon, nerve, or other soft tissue.

Patients and methods
Twenty patients (16 males and four females) underwent subtalar arthrodesis for the treatment of subtalar arthrosis after calcaneal fracture. All patients were initially treated conservatively; the mean time for fusion operation was 20 months (range: 12–36 months). The indications for operation were severe pain and disability in an incongruent subtalar joint with lateral impingement after failed conservative treatment. The fusion was fixed by using cannulated screws in all cases.

Results
All patients studied at the time of follow-up had a solidly fused subtalar arthrodesis. Two cases had a superficial wound infection and were treated with antibiotics. The mean postoperative period of recovery after which the patient could return to work or daily activities was 9 months (range: 6–12 months). In 16 (80%) patients, there was some residual pain; only four (20%) had no complaints. The result assessments with respect to the American Orthopedic Foot and Ankle Society score showed four (20%) patients with excellent score, good in 10 (50%), fair in four (20%), and poor in two (10%). There was no correlation between the type of accident, the weight of the patient, the recovery period, and the outcome of the American Orthopedic Foot and Ankle Society.

Conclusion
Isolated subtalar arthrodesis with screw fixation is an effective surgical intervention with significant clinical improvements in some patients with post-traumatic arthrosis of the subtalar joint.

Keywords:
arthrodesis, calcaneus, fracture, isolated, subtalar

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Introduction

The single-axis subtalar joint modifies the forces of ambulation imposed on the rest of the skeleton and influences the performance of the more distal foot articulations as well [1]. Intra-articular fractures of the calcaneus, which account for 56–75% of cases, are complex injuries, with extensive damage to the bone and soft tissue [2,3]. Fifteen to fifty percent of cases whether treated operatively or conservatively present with pain, loss of joint mobility, and functional disability [4]. Involvement of the subtalar joint may give rise to chronic pain and permanent functional impairment [5]. This can be produced by subtalar incongruity [6], a decrease in calcaneal height [7], a widened heel with calcaneofibular abutment, and/or impingement of the tendon, nerve, or other soft tissue, a hindfoot deformity. Subtalar arthrodesis, with or without a bone block, can give accepted results in patients with a painful subtalar joint secondary to post-traumatic subtalar osteoarthritis [8].

The aim of this study was to evaluate the results of subtalar arthrodesis using cannulated screws fixation to treat complicated intra-articular calcaneal fractures by subtalar fusion.

Patients and methods

Between May 2008 and November 2013, 20 patients underwent subtalar arthrodesis for the treatment of subtalar arthrosis after calcaneal fracture. The initial trauma was a fall from a height in 16 patients and a car accident in four. There were 16 males and four males; the right side was affected in 12 and left side in eight. All patients were initially treated conservatively; the mean time for fusion operation was 20 months (range: 12–36 months). The mean age of patients at the time of follow-up was 32 years (27–42 years). The indication for operation was severe pain and disability in an incongruent subtalar joint with lateral impingement

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after failed conservative treatment. The fusion was fixed by using cannulated screws in all cases. Two out of the 20 cases were revised after primary fixation with staple. Radiologically, anteroposterior, lateral, and oblique views were done monthly after surgery until union of the arthrodesis.

Solid union of the arthrodesis was defined as continuous trabeculae between the talus and the calcaneus. Furthermore, radiographs were examined for metal failure. At the final follow-up the anteroposterior weight-bearing view of both feet was taken with the patient standing. The X-ray beam was centered on the midfoot and tilted 15° toward the ankle. The lateral weight-bearing radiograph of both feet was made with the film cassette positioned in contact with the medial aspect of the foot. The beam was orientated perpendicular to the foot at the level of the navicular tuberosity and 10 cm from the plane of the film.

The time required for solid union of the arthrodesis in weeks, the medical records, duration of surgery, duration of cast immobilization, and postoperative complications were recorded for final evaluation. The mean follow-up period for all 20 patients was 30 months (range: 24–60 months).

The clinical rating system of the American Orthopedic Foot and Ankle Society (AOFAS) was used for the clinical evaluation preoperatively and postoperatively. On examination the localized sites of pain were lateral. Pain was defined as pain on palpation of the fibulocalcaneal area. Other sites of pain included the heel pad, the anterior tibiotalar region, the longitudinal arch, the forefoot, and the tarsal tunnel.

Operative technique

The patient was positioned supine with a pad under the ipsilateral hip. The lower limb was exsanguinated using an elastic bandage, and a pneumatic tourniquet was placed in the proximal third of the thigh. Lateral L-shaped incision was made to approach the talocalcaneal joint with a single dissection toward the bone plane in all cases. The prominence in the lateral calcaneal wall was then resected. After opening and releasing the talocalcaneal joint capsule, cartilage of the posterior facet of the calcaneus and the talus was removed to expose the subchondral bone.

Bone graft was harvested from the anterolateral aspect of the iliac crest. Two 6.5 mm partially threaded cannulated screws were inserted from the calcaneus to the talus over the preinserted guide-wire under image intensifier (Figure 1).

Figure 1

Male patient 34 years old with subtalar posttraumatic arthritis; A & B) preoperative X-Ray; C & D) Postoperative X-ray with screw fixation and fusion of the joint.

At the end of the procedure, the tourniquet was released for hemostasis and rinsing with saline, followed by subcutaneous closure with bioabsorbable suture and skin closure with non-absorbable suture and placement of a plaster splint.

The plaster splint was applied for two postoperative weeks until sutures were removed, when the splint was replaced with a non-weight-bearing cast boot. After 6 weeks, partial weight-bearing was allowed with the cast boot until there was clinical and radiographic evidence of solid union of the arthrodesis, when weight-bearing was allowed as tolerated without immobilization, and then the rehabilitation program was started.

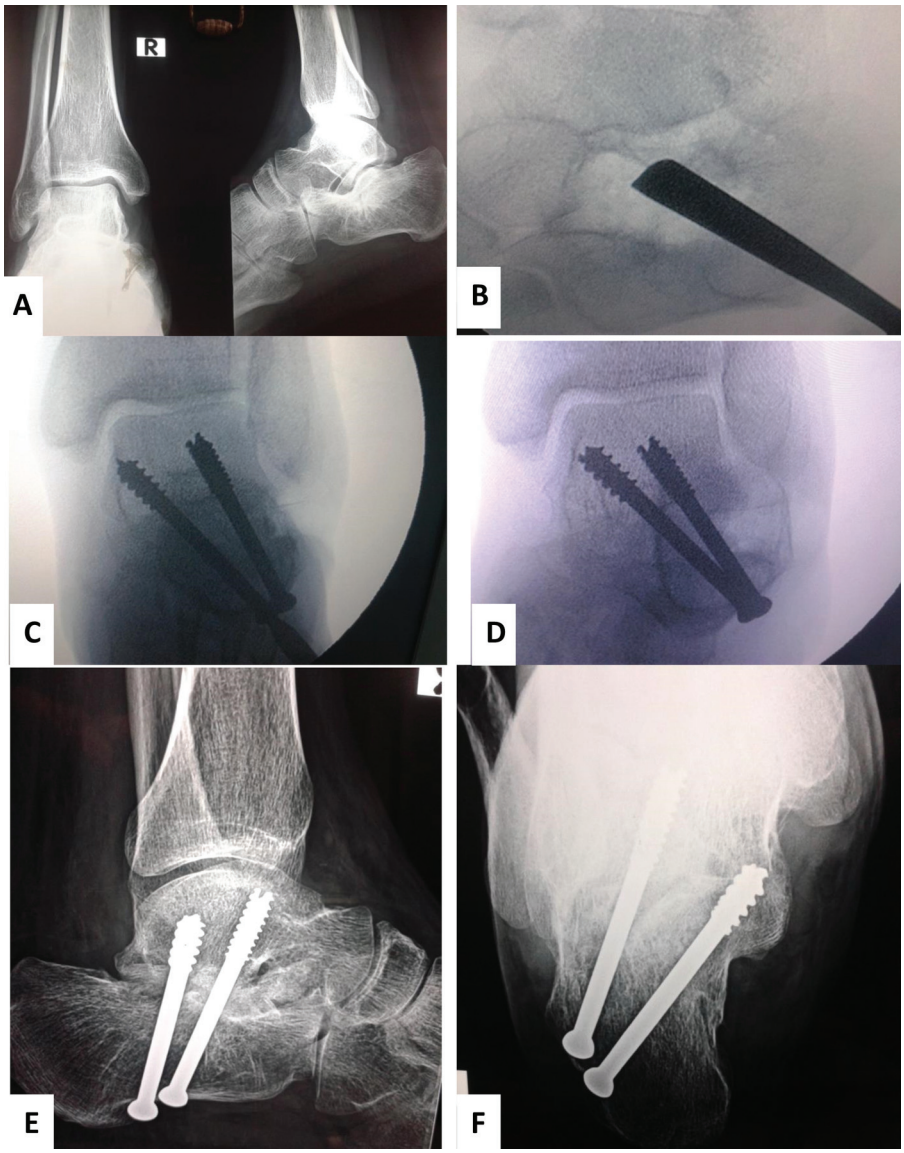
Results

All patients studied at the time of follow-up had a solidly fused subtalar arthrodesis (Figure 2). Two cases had a superficial wound infection and were treated with antibiotics. The mean postoperative period of recovery after which the patient could return to work or daily activities was 9 months (6–12 months). In 16 (80%) patients, there was some residual pain; only four (20%) had no complaints.

Foot score

The assessments with respect to the AOFAS score showed that four (20%) patients had excellent score,

Figure 2



Male patient 30 years old with subtalar osteoarthrosis after fracture calcaneus; A) Preoperative X Ray; B) intraoperative radiology during removal of articular cartilage; C & D) intraoperative radiology to insure screws position; E & F) X-Ray one year post-opertative with fusion of arthrodesis site.

good in ten (50%), fair in four (20%), and poor in two (10%). We also found degenerative changes in the calcaneocuboid joint in 12 out of the 20 operated feet and in the talonavicular joint in nine. On the normal side, the talonavicular joint was normal in all feet and two showed changes in the calcaneocuboid. There was no correlation between the type of accident, the weight of the patient, the recovery period, and the outcome of the AOFAS.

Discussion

In the surgical treatment of sequelae of calcaneal fractures, all possible causes of pain should be considered and the anatomy of the hindfoot restored. Many authors have attempted to measure the residual motion in the foot and ankle after selective arthrodesis in the foot [6,9,10]. Mann and Baumgarten [11] reported a 50% loss of forefoot abduction and adduction after an isolated subtalar arthrodesis. These authors have frequently encountered patients after successful subtalar arthrodesis that will have a transient synovitis of the ankle during the first 2–3 months after cessation of postoperative casting. They recommended that most patients should understand that the ankle is also a hinge and that, having the subtalar joint fused, rapid walking with long strides on uneven surfaces may cause the ankle to sustain forces out of its usual plane of motion [12]. Most authors proposing isolated arthrodesis of the subtalar joint as a therapeutic measure have concluded that, while degenerative radiographic changes can be appreciated at the ankle, talonavicular, and calcaneocuboid joints after isolated subtalar fusion, in most cases these

radiographic changes of arthrosis do not correlate with clinical symptoms [10,13,14].

Screw fixation has become an accepted and reliable fixation method in subtalar arthrodesis, with union rates often exceeding 90% [15–18]. Screw positioning can be technically demanding due to the orientation of the tarsal bones and the need to place the screws perpendicular to the joint plan for optimal compression. Targeting devices have been developed to improve the accuracy of screw positioning and to reduce intraoperative exposure. With regard to the number of screws, Decarbo *et al*. [17] demonstrated the efficacy of single-screw and double-screw fixation constructs. However, there are advantages and disadvantages of both fixation methods. Two screws are thought to limit rotational micromotion, which may result in a better union rate [19].

Conclusion

Isolated subtalar arthrodesis is an effective surgical intervention with significant clinical improvements in some patients with post-traumatic disorders of the hindfoot. Grafting of the joint space can be a determinant factor affecting the postoperative time to union and the restoration of the talocalcaneal relationship. Screw fixation with two cannulated screws can give compression and added stability for fusion of the arthrodesis site.

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Conflicts of interest

There are no conflicts of interest.

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