Subtalar arthrodesis with internal compression for post-traumatic arthritis

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We studied retrospectively the results in 24 patients (25 feet) who had been treated by subtalar arthrodesis with internal compression for post-traumatic arthritis from 1988 to 1992. Fifteen patients were men (16 feet) and nine (9 feet) were women. Their mean age was 43 years (22 to 68), and the average duration of follow-up was four years (2 to 6). A single compression screw was used in all feet and iliac-crest bone grafting in ten.

Union was achieved in 24 of the 25 feet (96%). Based on a clinical scale the results were excellent in 10 feet, good in 7, fair in 6, and poor in 2 and on the Angus and Cowell score they were good in 19 feet, fair in 4, and poor in 2. The two poor results were due to nonunion in one patient and reflex sympathetic dystrophy in the other. One reoperation was performed for nonunion. Eighteen patients (18 feet) were satisfied with the results, four were satisfied with reservations, and three were dissatisfied. Progressive ankle and midfoot arthritis did not occur in the absence of pre-existing degenerative changes in these joints.

We conclude that isolated subtalar arthrodesis with internal compression was effective treatment for post-traumatic subtalar arthritis. Iliac-crest bone grafting was not routinely required.

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Arthritis of the subtalar joint occurs after trauma, systemic inflammatory disease, neurological disorders and deformities of the hindfoot. For symptomatic subtalar arthritis, when conservative management has failed, the operative treatment of choice is arthrodesis of the hindfoot. Triple arthrodesis has been judged to be the standard treatment by some surgeons, but because of the complications which may occur, less extensive options such as subtalar arthrodesis have been considered.

In the few published reports of subtalar arthrodesis in adults, the operation was considered successful in 44% to 89% of patients. Many different techniques and methods of internal fixation have been used for patients with a variety of diagnoses.

Our aim was to evaluate the results of subtalar arthrodesis with internal compression in patients with post-traumatic arthritis.

Patients and Methods

We retrospectively reviewed the records of all patients with post-traumatic subtalar arthritis who had been treated by subtalar arthrodesis with internal compression by one of the authors (HBK) between 1988 and 1992. Patients who had had a previous or concurrent ankle or midfoot arthrodesis were excluded and one had died. This left 24 patients (25 feet) in the study. There were 15 men and nine women with a mean age of 43 years (22 to 68).

All the patients had had injuries. There were 19 calcaneal, three talar and three ankle fractures. The mean interval from injury to arthrodesis was four years (0.3 to 33). All patients had pain due to subtalar arthritis which had not been adequately relieved by conservative management, including orthotics, callipers and immobilisation in a plaster cast, walking aids, non-steroidal anti-inflammatory drugs, and corticosteroid injection. Before operation they all had had moderate or severe limitation of daily and recreational activities.

Operative technique. We operated through a standard lateral hindfoot incision over the sinus tarsi dorsal to the peroneal tendons, taking care to avoid the sural nerve. The fat pad in the sinus tarsi was incised, and the attachment of the extensor digitorum brevis to the calcaneum reflected distally to expose the subtalar joint (Fig. 1a). The remaining articular and subchondral bone was carefully resected with an osteotome, but the contour of the talar and calcaneal joint surfaces was preserved. Using a combined aiming device a guide wire was passed via an incision in the heel through the posterior facet of the calcaneum (Fig. 1b).
This was rotated internally in relation to the talus so that adequate bony opposition was achieved and the heel was ultimately placed in 5 to 10° of valgus. The guide wire was then advanced across the subtalar joint into the body of the talus, a cannulated drill was passed over the guide wire, and fixation secured by a cannulated 7.0 mm cancellous screw.

In 15 feet, the non-articular portion of the anterior process of the calcaneum was fragmented and placed in the sinus tarsi as a bone graft.

Supplementary iliac-crest bone grafting was used in ten feet when there was a large gap after reduction, such as in patients with original central depression-type intra-articular...
calcaneal fractures. Bony impingement such as that between the calcaneum and fibula was treated by realignment of the hindfoot or exostectomy.

Postoperatively, a Robert Jones compression dressing with plaster splints was applied for two days, followed by a non-weight-bearing below-knee cast for six weeks. A below-knee walking cast was then used for an additional five to six weeks until there was radiological evidence of union (Fig. 2).

The mean follow-up was four years (2 to 6). In 15 patients (15 feet) we performed radiography and clinical examination and in the remaining nine (10 feet) follow-up details were obtained by telephone interview and from radiographs.

We recorded height, weight and body mass index (weight/height^2) for each patient. Alignment of the hindfoot was measured clinically with the standing tibiocalcaneal angle (normal, 0 to 10° valgus). The total range of sagittal movement from maximal dorsiflexion to plantar flexion was measured with a goniometer.

Clinical results were graded as recommended by the American Orthopaedic Foot and Ankle Society using a 100-point ankle-hindfoot scale (Table I). We used a 60-point score for analysis of the nine patients (10 feet) interviewed by telephone or by post because movement, abnormality of gait, and alignment of the hindfoot could not be measured. The results were graded as excellent (50 to 60 points), good (40 to 49 points), fair (30 to 39 points), and poor (less than 30 points). Nonunion was considered a poor result. We also graded results as good, fair or poor on the basis of the clinical scale used by Angus and Cowell (Table II).

A radiological assessment was done pre- and postoperatively (standing anteroposterior foot, standing lateral foot, oblique foot, and standing anteroposterior ankle projections). Union at the arthrodesis site was assessed. Radiological alignment was recorded by measuring the lateral talocalcaneal angle (normal, 25 to 45°). The extent of osteoarthritis in the ankle and midtarsal joints (talonavicular and calcaneocuboid joints) was graded pre- and postoperatively as follows: grade 0, normal joint space without degenerative cysts or sclerosis; grade 1, marginal osteophytes, mild joint-space narrowing, subchondral sclerosis, cyst formation; grade 2, prominent osteophytes, moderate joint-space narrowing, subchondral sclerosis, cyst formation; and grade 3, complete loss or ankylosis of joint space.

The results were expressed as means and standard deviations. Significant differences were determined by a paired two-tailed t-test with p < 0.05 taken as the level of significance.

Results

Clinical. One patient required a revision operation and was recorded as a failure. Of the 23 patients (24 feet) who did post-


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<tr>
<th>Rating</th>
<th>Signs and symptoms</th>
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<tr>
<td>Good</td>
<td>No pain or minimal pain after heavy use</td>
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<td>No deformity or minimal deformity</td>
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<td>No callosities</td>
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<td>No joint degeneration</td>
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<td>Fair</td>
<td>Pain after light use</td>
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<td>Moderate deformity</td>
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<td>Single callosity</td>
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<td>Single pseudarthrosis</td>
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<td>Mild joint degeneration</td>
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<td>Poor</td>
<td>Pain on standing or at rest</td>
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<td>Multiple callosities</td>
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<td>Multiple pseudarthrosis</td>
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<td>Severe joint degeneration</td>
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* From Angus and Cowell. By permission of the British Editorial Society of Bone and Joint Surgery

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not have reoperation, nine (9 feet) had no pain, ten (10 feet) had occasional or mild pain, three (4 feet) had moderate daily pain, and one (1 foot) had constant pain. The patient with severe pain had reflex sympathetic dystrophy, which had been diagnosed after his initial injury. Eleven patients (11 feet) had no significant limitation of daily or recreational activities, nine (10 feet) had significant limitation of recreational, but not everyday activities and three (3 feet) had significant limitation of recreational and everyday activities. No patient had severe limitation of activities. Two patients (2 feet) required a walking stick occasionally; all others walked unaided. Twelve patients (13 feet) had no restriction of footwear, nine (9 feet) had moderate restriction (some fashionable shoes tolerated) and two (2 feet) required modified shoes. Four patients (4 feet) reported painful callosities after the operation, two of whom had had callosities preoperatively. Fifteen patients (16 feet) were able to walk further than six blocks, five (5 feet) walked between four and six blocks and three (3 feet) walked between one and three blocks.

Abnormal gait was noted in three (3 feet) of the 15 patients (15 feet) for whom information on gait was available. Two of the remaining nine patients (10 feet) complained of a noticeable limp. Of the 15 patients examined, 14 had good ankle to hindfoot alignment and one had fair alignment (plantigrade foot, malalignment noted but not associated with symptoms). The mean tibiocalcaneal angle was 9 ± 2° of valgus on the involved side and 8 ± 2° of valgus on the uninjured side. The mean dorsiflexion was 6 ± 5° before and 8 ± 4° after operation (not significant). The mean plantar flexion was 29 ± 6° before and 33 ± 10° after operation (not significant). There was no evidence of instability or neuropathy in any of the 15 ankles examined and no patient complained of numbness.

Seventeen patients (18 feet) were satisfied, three (4 feet) were satisfied with reservations, and three (3 feet) were dissatisfied. One patient was dissatisfied because of reflex sympathetic dystrophy and another because of nonunion. The third had mild pain but difficulty with activities because of persistent hindfoot and ankle degenerative arthritis. Fifteen patients (16 feet) returned to the same preinjury occupation or level of activity, six returned to modified work, and three were unable to return to work.

Based on the modified American Orthopaedic Foot and Ankle Society Clinical Scale, the results were excellent in 10 feet, good in 7, fair in 6, and poor in 2. The poor results were attributed to nonunion (one foot) and to reflex sympathetic dystrophy and hindfoot and ankle degenerative arthritis (one foot). On the Angus and Cowell scale, the results were good in 19 feet, fair in 4, and poor in 2.

Eighteen of the 24 patients were considered to be overweight or obese by the calculated volume mass index, which averaged 28.2 ± 6.5. The mean volume mass index was 28.3 in the feet of patients who had excellent or good results and 28.2 in those with fair or poor results.

Radiological. Union was achieved in 24 of the 25 feet (96%). Five patients had arthritis of adjacent joints. One had grade-2 talonavicular arthritis, one had grade-3 calcaneoncuboid arthritis, and three had grade-2 ankle arthritis. All patients with arthritis of adjacent joints on postoperative radiographs had preoperative evidence of this. We were unable to find any consistent association between the presence of arthritis of adjacent joints and the overall clinical result.

The mean lateral talocalcaneal angle was 32 ± 10° before and 30 ± 9° after operation (not significant). Late union occurred radiologically at a mean of 12 weeks. There was no evidence of osteonecrosis of the talus.

Complications and reoperation. There were no postoperative infections or nerve injuries. One patient (one foot) had delayed wound healing, which was treated successfully by local wound care. One patient (one foot) had recurrence of reflex sympathetic dystrophy, but similar symptoms had been noted preoperatively.

One patient required an additional operation. A revision arthrodesis for nonunion was performed in one foot (a failure), using supplementary iliac-crest bone grafting. Union was achieved with a satisfactory clinical result.

Discussion

Arthrodesis is established as salvage treatment for chronic pain with or without deformity due to degenerative disorders of the adult hindfoot. Triple arthrodesis is more technically demanding than talocalcaneal arthrodesis and is associated with a higher likelihood of problems such as infection, nonunion, malunion, and avascular necrosis of the talus. \(^7,8,12,14\) It should be reserved for patients with more complex problems such as arthritis affecting multiple joints or severe, rigid deformities of the hindfoot.

There are a few reports of the use of isolated subtalar arthrodesis in adults, \(^2,2^\) but not specifically for post-traumatic arthritis. Our study showed that isolated talocalcaneal arthrodesis is an effective treatment and has a high rate of union, a low rate of complications, and a low rate of progressive arthritis of adjacent joints. Five patients in our series had evidence of degeneration of adjacent joints and in all five these joints had been affected preoperatively. This observation stresses the importance of informing patients who have evidence of early arthritis of the midfoot or ankle that progressive degeneration may occur after subtalar arthrodesis, although these changes were asymptomatic before the operation. Some authors have reported that hindfoot arthrodesis through a lateral approach causes or accentuates a varus hindfoot. They therefore advocate the use of supplementary iliac-crest bone grafts for correction of the deformity either as a morcellised graft packed into the joint or as a dowel-shaped graft or strut of cortico-cancellous bone wedged into the region of the posterior facet of the subtalar joint. \(^1,2,4,12\) In our series, we did not routinely use iliac-crest bone grafting and the complications associated with this were avoided. Satisfactory hindfoot
alignment was achieved in nearly all patients without a calcaneal osteotomy. No patient has residual symptoms from calcaneofibular impingement. We found no difference in the results in those with local bone graft (anterior process of the calcaneum) and those with iliac-crest bone grafting. Adequate fixation was achieved with a single 7.0 mm cancellous screw because there was sound bony apposition. The passage of the screw through the heel from the plantar to the dorsal surface minimises the risk of injury to the adjacent neurovascular structures, and there were no consistent complaints of heel pain. Anterior impingement of the screw head on the tibia with ankle dorsiflexion, which has been reported in other studies using dorsally placed screws, was therefore not a problem. Breakage of the screw did not occur, and there were no complaints of pain enough to lead to its removal.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References