CHAPTER **24**

SUBTALAR JOINT ARTHRODESIS: Assessment of Results

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Single joint fusions of the rearfoot are becoming increasing popular for the treatment of various maladies in situations where triple arthrodesis would have historically been performed. At Northlake Regional Medical Center, Tucker, Georgia, both talonavicular and subtalar joint fusions are frequently performed as an alternative to triple arthrodesis in selected patients. This paper will detail the authors' experiences in the review of a number of patients undergoing talocalcaneal fusion at this institution.

MATERIALS AND METHODS

A total of 33 subtalar fusions were performed on 31 patients for a variety of conditions. (Table 1) Twenty-one patients representing a total of 22 procedures were available for clinical and radiographic evaluation and to complete a questionnaire. The specific preoperative pathologies in this patient group are provided in Table 2. Preoperative and postoperative pain and functional ratings were assessed utilizing the criteria previously described by Mann and Baumgarten.(Table 3)

Table 1

SUBTALAR JOINT ARTHRODESIS STUDY

Post Traumatic Arthritis	**16**
- S/P Calcaneal Fracture - DJD	(12)
- S/P Talar Fracture	(4)
STJ Coalition	**10**
- Isolated Posterior Facet	(4)
- Isolated Middle Facet	(6)
Osteoarthritis (DJD)	**3**
Collapsing Pes Valgo Planus	**3**
S/P Ankle Arthrodesis	**1**

33 Total Procedures / 31 Patients

Table 2

RETROSPECTIVE ANALYSIS

Post Traumatic Arthritis	**12**
- S/P Calcaneal Fracture - DJD	(10)
- S/P Talar Fracture	(2)
STJ Coalition	**7**
- Isolated Posterior Facet	(3)
- Isolated Middle Facet	(4)
Osteoarthritis (DJD)	**1**
Collapsing Pes Valgo Planus	**1**
S/P Ankle Arthrodesis	**1**

22 Total Procedures / 21 Patients

Table 3

SUBTALAR JOINT ARTHRODESIS STUDY
Patient Questionnaire

Functional Rating

1 = Can Do All Desired Activities Without Restriction
2 = Can Do All Desired Activities with Only Mild Discomfort
3 = Can Do Some of Desired Activities With Moderate Discomfort
4 = Can Do Only Moderate Amount of Desired Activity with Pain
5 = Can Not Do Most Activities: Must Use Supportive Measures such as Crutches, Walker, or Wheelchair

Pain Rating

1 = No Pain at All
2 = Mild Pain or Aching At End of Day's Regular Activity
3 = Moderate Pain At End of Day's Regular Activity
4 = Severe Pain When Pursuing Regular Day's Activity Level
5 = Severe, Disabling Pain Incompatible with Normal Day's Activity

The average age at the time of surgery was 33.7 years (range 16 to 70 years). The average age of those patients undergoing fusion for subtalar coalition was 25.0 years. Patients undergoing subtalar fusion for other conditions were on average 40.1 years of age. Overall, the average time elapsed since surgery was 48.4 months with a range of 1 to 8.9 years.

All preoperative and postoperative radiographs were reviewed for evidence of midtarsal or ankle arthrosis. Postoperative radiographs were also reviewed for evidence of arthrodesis. Two of the 21 patients later underwent triple arthrodesis and were considered failures. Clinical and subjective evaluations of these patients are not included, except as an overall measure of success or failure.

RESULTS

All patients in this study sustained solid arthrodesis in an average of eight to twelve weeks without delayed union or nonunion. No wound complications or postoperative infections were experienced. All but one patient was fused in a rearfoot position of neutral to five degrees of valgus. One patient was fused in approximately six degrees of rearfoot varus. In this patient, surgery had been performed for degenerative joint disease which developed following an ankle arthrodesis. She continued to experience pain despite the use of accommodative orthosis and custom molded shoes.

Seventeen of twenty-one patients demonstrated fairly good preservation of midtarsal motion, retaining approximately 50% of the motion present in the contralateral foot. Two patients demonstrated a more significant reduction of midtarsal motion, approximating only 25% of the contralateral foot. Both of these individuals had suffered calcaneal fractures without midtarsal involvement. Two patients did not experience relief of symptoms following surgery, each required subsequent midtarsal arthrodesis. One patient initially presented with a middle facet subtalar joint coalition and an associated peroneal spastic flatfoot. At six months, he experienced recurrence of symptoms and peroneal spasm. Another patient who had sustained a calcaneal fracture without evidence of midtarsal involvement subsequently required midtarsal fusion when he failed to respond to the initial surgery.

Overall the subjective evaluation, excluding the two patients requiring further surgery, revealed satisfactory results. Table 4 provides the patient assessment of pain and function both preoperatively and postoperatively. Ratings in both of these areas improved significantly following surgery. Tables 5 and 6 show these ratings divided into two groups: those with tarsal coalitions and those with degenerative arthrosis. Excluding the two patients that required midtarsal arthrodesis, there was only one patient who graded the pain and functional rating at the same level both preoperatively and postoperatively. This was the patient who was fused in rearfoot varus. Therefore, all but three of the twenty-one patients experienced satisfactory relief with subtalar fusion. All patients were noted to have evidence of solid fusion at the time of follow-up radiographic evaluation. No evidence of talar beaking or osteophyte formation was found to involve the midtarsal or ankle joints.

Table 4

SUBTALAR JOINT
ARTHRODESIS STUDY
Subjective Values
Overall Results

Functional Rating

Average Preoperative Score = 3.71
Average Postoperative Score = 1.57

Pain Rating

Average Preoperative Score = 3.78
Average Postoperative Score = 1.64

Table 5

SUBTALAR JOINT COALITION
Subjective Values

Functional Rating

Average Preoperative Score = 3.96
Average Postoperative Score = 1.47

Pain Rating

Average Preoperative Score = 3.75
Average Postoperative Score = 1.28

DISCUSSION

A number of authors have discussed the utility of subtalar joint arthrodesis. This report, albeit with a relatively short follow-up period, confirms the favorable experiences of other authors. However, there have been surgeons who have avoided subtalar fusion in favor of triple arthrodesis. Conn was one of the few authors who was openly critical of subtalar arthrodesis for the treatment of localized pathology. He preferred triple arthrodesis for posttraumatic conditions, even if the midtarsal joint was not affected. Subtalar fusion alone was said to compound the shortening of the calcaneus which followed joint depression, and furthermore, failed to adequately address any malalignment which might be present at the talonavicular or calcaneocuboid joints due to depression of the sustentaculum tali. In addition, severe eversion of the calcaneus was noted to be difficult to correct. Conn felt that the subtalar and midtarsal joints functioned as a unit and that fusion of one segment should be accompanied by fusion of the others.

Those who support this concept would argue that isolated subtalar fusion would encourage later degenerative changes in the midtarsal joint. Ross and Lyne noted talar beaking and degenerative changes in the midtarsal joint in 60 of 71 feet examined ten years or more following the Grice-type of arthrodesis. However, most of these patients possessed neuromuscular conditions which manifest with significant foot deformity which is not typically isolated to the subtalar joint. Therefore, fusion of this one unit could not be expected to maintain correction and adequately alleviate all deforming stresses. Ross and Lyne noted that overcorrection and ankle valgus deformity were important causes of unsatisfactory results. Therefore, one needs to consider that the selection or implementation of the procedure rather than the surgery itself might be the primary source of later problems.

Harris noted that patients undergoing subtalar fusion following calcaneal fractures were noted to possess talar beaking. However, this was found to be virtually asymptomatic and of little clinical significance. Other authors have failed to note similar radiographic findings. Furthermore, Swiontkowski, et al., noted talar beaking in patients with subtalar coalitions, yet without any degenerative joint or cartilage changes affecting the talonavicular joint at the time of surgery. They proposed that the "beaking" was due to traction upon the dorsal talonavicular ligaments as the midtarsal assumed greater degrees of motion to compensate for the subtalar blockage.

Hall and Pennal found a reduction in midtarsal joint motion of 25% to 50% following arthrodesis of the talocalcaneal joint using the Gallie method. However, they concluded that the "... absence of correlation between the degree of loss of midtarsal range of motion and the age of the arthrodesis suggest that this loss is not progressive." In two additional studies, Noble and McQuillan as well as Russotti, et al., found no evidence of osteoarthrosis in any of the adjacent joints following subtalar fusion.

It has been the experience of the current authors that previous surgeons may not have placed adequate emphasis on the position and alignment of the foot when performing joint fusions. Fusion alone does not assure success. One must examine the entire foot and appreciate the relationship of the forefoot to the rearfoot and the rearfoot to the leg. Focusing complete attention upon the subtalar joint and its attendant pathology may risk failure. Arthrodesis of the subtalar joint in a poor position, that being rearfoot varus or excess valgus, may actually perpetuate or exacerbate symptoms. Furthermore, by creating a rigid rearfoot the patient may lose the ability to compensate for other deformities such as a forefoot varus. Therefore, the foot must possess good overall alignment if one is to perform an isolated subtalar fusion. The heel should have a rectus to slight valgus alignment and the forefoot must be rectus or in slight valgus relative to the rearfoot. If these relationships are not present, or can

Table 6

DEGENERATIVE ARTHRITIS
Subjective Values

Functional Rating

Average Preoperative Score = 4.00
Average Postoperative Score = 2.20

Pain Rating

Average Preoperative Score = 3.87
Average Postoperative Score = 2.02

not be created at the time of surgery, then a triple arthrodesis should be performed. Otherwise, the functional position of the foot will be less than optimal and this could create unacceptable levels of stress at the midtarsal joint.

No author has determined how the purported "degenerative" changes which develop at adjacent joints following subtalar arthrodesis relate to the overall position of the foot. Although some authors have noted the importance of placing the heel in a valgus position, none have addressed the forefoot to rearfoot relationship. Therefore, until these radiographic findings can be reviewed in light of the overall foot alignment, it may be premature to state that this is an adverse consequence of the procedure itself.

Another factor which may create additional stress at the midtarsal joint following subtalar arthrodesis is excess reduction of the vertical dimension of the calcaneus or talus. This may occur with resection of the joint surfaces. If all three joint surfaces are removed, then the talus may tend to plantarly displace relative to the navicular, and possibly induce additional stress at the talonavicular joint. If only the posterior facet is resected, then the talus may tend to tilt posteriorly with permanent fixation and induce a gapping force across the dorsal aspect of the talonavicular joint. These same circumstances may also occur in patients who have sustained joint depression calcaneal fractures. The vertical dimension of the talus and calcaneus is already reduced due to the impaction of the fracture. Resection of the joint surfaces exacerbates the problem and again may place increased degrees of stress on the talonavicular joint.

For the reasons described previously, the authors prefer to use an osteotome and/or currettes for the removal of joint surfaces and to employ freeze-dried cancellous bone to pack any residual defects. Alternatively, one may elect to use a power burr to assist in the removal of cartilage or to ensure that good cancellous bone is visible. Patients who have previously sustained significant impaction of bone following calcaneal fractures may benefit from the insertion of a large corticocancellous bone block to elevate the talus to a more anatomic position. Carr et al., previously described using autogenous bone obtained from the posterior iliac crest for this purpose. The authors prefer the use of freeze-dried bone, as suitable healing has been noted and as it avoids an additional surgical procedure. One of the primary reasons that Conn recommended triple arthrodesis over subtalar fusion was that fusion of this one joint was felt to be inadequate to restore normal alignment at the midtarsal level. However, by the use of graft augmentation, this specific concern may be addressed.

Other considerations for patients with good preoperative position is a Gallie-type arthrodesis. Another technique may be to use the standard lateral incisional approach and remove a trephine of bone and pack the defect with graft. Both are simpler approaches which do not result in any loss of heel height.

Within this series of patients there were no radiographic changes which were suggestive of midtarsal or ankle arthrosis. However, one might argue that the interval between surgery and follow-up evaluation was not sufficient. Furthermore, two patients did require subsequent midtarsal arthrodesis for continued pain despite a benign radiographic appearance and good clinical position. The reasons for these two failures are not clear.

CONCLUSION

Arthrodesis of the subtalar joint appears to be a suitable means of addressing rearfoot pathology which affects the talocalcaneal articulation. This is used in lieu of performing a triple arthrodesis. It is preferable to preserve midtarsal motion when possible to allow some means of accommodation to uneven weight-bearing surfaces. Good relief of pain and enhanced function may be anticipated in most patients. The experiences of previous surgeons should also provide sufficient evidence that this is a sound, reasonable approach.

The spatial relationships of the lower extremity must be fully understood with any rearfoot arthrodesis, but particularly when subtalar fusion is to be performed. Should there be any equivocation, then it is probably better to perform a triple arthrodesis.

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