CHAPTER 1

RESECTION OF MIDDLE FACET TALOCALCANEAL COALITIONS

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Tarsal coalitions are an abnormal union between any two or more tarsal bones. This abnormal union causes a restriction in normal joint function and can be a complete union (i.e., a synostosis or osseous union) or an incomplete union (i.e., a synchondrosis-cartilaginous union or a syndesmosis-fibrous union). The coalition is termed a "bar" or "extra-articular coalition" if it is occurring between two bones which do not normally share an articulation. The most common example of this type of coalition is the calcaneonavicular coalition or bar. The coalition is termed a "bridge" or "intra-articular coalition" if it is occurring between two bones which do normally share an articulation. The middle facet talocalcaneal coalition is the most common example of a bridge or intra-articular coalition.

Historically in the literature, extra-articular coalitions have been generally reasoned to be more amenable to resection, while intra-articular coalitions have been traditionally considered an indication for arthrodesis. Resection of an intra-articular coalition leaves an irregular defect in the articular area of a major weight-bearing joint, and puts additional stress on any unresected remaining portion of the joint. More recently, despite these drawbacks, numerous articles have been published describing good success in the surgical management of intra-articular coalitions with resection arthroplasty. Although each of the papers has presented the authors' experience, no consensus has been reached regarding when resection of a coalition might be advantageous or preferred to joint fusion techniques. It is the goal of this paper to review the author's personal indications, technique, and experience with the surgical resection of middle facet talocalcaneal coalitions.

INDICATIONS

In the literature, there has been no consensus regarding when resection of a symptomatic middle facet talocalcaneal coalition is preferable to one of the two primary alternatives - subtalar joint arthrodesis or triple arthrodesis. However, certain criteria have been described which, if present, suggest that arthroplasty might be preferred to arthrodesis. The author has previously described a classification system, the *Articular Classification System,* which divides coalitions based upon the patient's osseous maturity, the articular involvement, and the presence or absence of secondary adaptive or arthritic changes (Table 1).[1]

Table 1

ARTICULAR CLASSIFICATION SYSTEM*

JUVENILE (OSSEOUS IMMATURITY)

Type I - Extra-articular coalition
- A - No secondary arthritis
- B - Secondary arthritis

Type II - Intra-articular coalition
- A - No secondary arthritis
- B - Secondary arthritis

ADULT (OSSEOUS MATURITY)

Type I - Extra-articular coalition
- A - No secondary arthritis
- B - Secondary arthritis

Type II - Intra-articular coalition
- A - No secondary arthritis
- B - Secondary arthritis

*Classification of tarsal coalitions based on patient age, articular involvement, and secondary arthritic changes.

Generally speaking, extra-articular coalitions are more amenable to resection; coalitions in patients who have not reached skeletal maturity are more amenable to resection; and coalitions with minimal to no secondary adaptive or arthritic changes in surrounding joints are more amenable to resection. Thus, although a middle facet talocalcaneal coalition is an intra-articular coalition,

resection might still be preferable if the patient has not reached osseous maturity and does not have significant secondary changes in surroundings joints (i.e., the midtarsal joints and ankle joints). Other criteria to consider when deciding between coalition resection and joint fusion are the tissue type of the coalition and the size of the coalition. Consensus of opinion is that an incomplete coalition (i.e., a synchondrosis or syndesmosis) is more amenable to resection than a complete coalition (i.e., synostosis), and a coalition involving less than 50% of the joint is more amenable to resection arthroplasty.

In the *Articular Classification System,* the "Juvenile IIA" coalition is an intra-articular coalition, such as a middle facet talocalcaneal coalition, that occurs in a younger patient with minimal or no secondary degenerative changes. If small enough and/or if incomplete in nature, this coalition may be amenable to resection arthroplasty. It should be remembered that future arthrodesis may be necessary following any attempt at resection of a coalition, and this should be related to the patient (and the parents, if appropriate) when informed consent for the surgery is given. Finally, surgical intervention is only considered in symptomatic patients who have failed to respond to conservative treatment efforts.

SURGICAL TECHNIQUE

Resection of a middle facet talocalcaneal coalition should only be performed by a surgeon experienced with the technique and the anatomy of the medial aspect of the rearfoot and the area of the sustentaculum tali. The anatomic approach and dissection for the resection of this coalition are unique and not regularly utilized by most foot and ankle surgeons.

Resection of the coalition is most easily accomplished through a medial approach. A linear or slightly curvilinear incision is made, extending from just posterior and inferior to the medial malleolus to the plantar-medial aspect of the medial cuneiform (Fig. 1A). The incision is carried bluntly deep to the level of the deep fascia. The tendons and neurovascular bundle which comprise the tarsal tunnel are palpated, and the incision is carried deep between the flexor digitorum longus tendon and the neurovascular bundle. The tibialis posterior and flexor digitorum longus tendons are retracted dorsally, and the neurovascular bundle and the flexor hallucis longus tendon are retracted plantarly. A Keith needle, small osteotome, or other flat instrument is then used to identify the area of the middle facet (Fig. 1B). If necessary, intraoperative radiographs or fluoroscopy are utilized to localize the coalition.

Once identified, the coalition is resected with hand instrumentation. Typically an osteotome and mallet are utilized for the bulk of the resection. Any remaining prominence is removed with a rongeur and/or rasped or burred smooth. Care is taken to preserve the substance, or at the very least the inferior margin, of the sustentaculum tali. The coalition must be generously resected, with the width of the resection being slightly larger than the coalition itself. This width can vary from as small as 4 mm to as large as 1 or 2 cm. An immediate increase in subtalar joint motion is typically

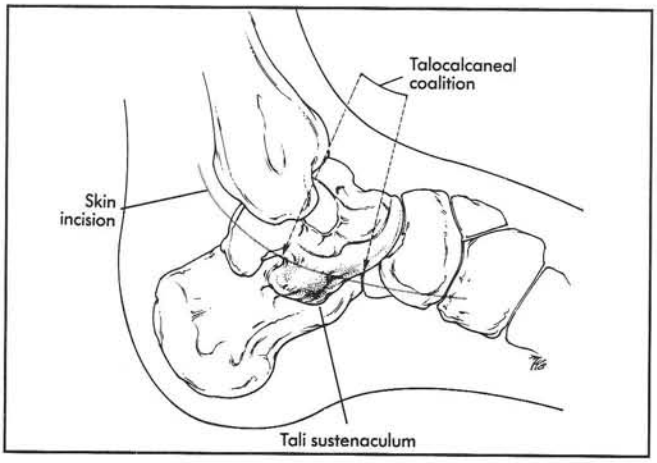

Figure 1A. Diagram of the medial incisional approach for resection of a middle facet talocalcaneal coalition.

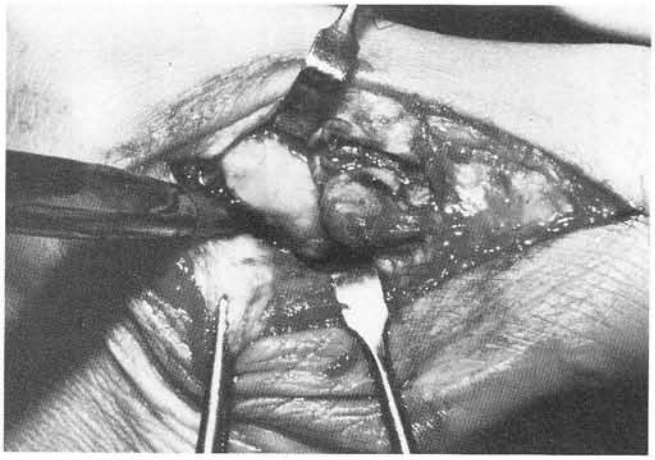

Figure 1B. Surgical exposure of a middle facet talocalcaneal coalition in a left foot. Note the flat instrument placed into the area of the coalition.

observed after resection of the coalition (Fig. 1C). After resection, layer closure is performed.

In younger patients, the author prefers to perform resection of the middle facet talocalcaneal coalition in conjunction with the lateral insertion of a subtalar joint arthroereisis to maintain the joint space. In such cases, the aforementioned medial incision is still used to resect the coalition. A second incision is placed laterally over the sinus tarsi. This incision will be used to insert the arthroereisis, but may also be used to aid in anatomic localization of the coalition. A small osteotome or other instrument can be introduced through the lateral incision and gently passed medially. The instrument can then be manually felt medially and the surgeon will have a better idea as to where the coalition is located. In cases involving larger coalitions, the small osteotome can be introduced through the lateral incision and then struck medialwards through the coalition until the tip of the osteotome is palpated medially. Once the middle facet talocalcaneal coalition has been resected, an arthroereisis is inserted into the sinus tarsi laterally. Used in this fashion, the author feels the arthroereisis helps maintain a space where the coalition has been resected, and aids in the prevention of ossification or recurrent formation of the coalition.[2]

Postoperatively, a below-knee non-weight-bearing cast is applied for 3 to 4 weeks. If pes valgus was present preoperatively, the subtalar joint is maintained in a neutral or supinated position within the cast. The cast may be split or bivalved at any point desired, and subtalar and midtarsal joint range-of-motion exercises started. Weight bearing is initiated after approximately 3 to 6 weeks. Aggressive physical therapy, including aggressive range-of-motion exercises are typically recommended. Long-term, the patient is fitted with functional orthoses to attempt to maintain the motion achieved following surgery.

RESULTS

Many different approaches and success rates have been described for the resection of middle facet talocalcaneal coalitions. The most popular surgical approach in the literature is a medial resection of the coalition with subsequent interposition of autogenous fat into the defect. Other approaches involve similar resection, but vary in how the space

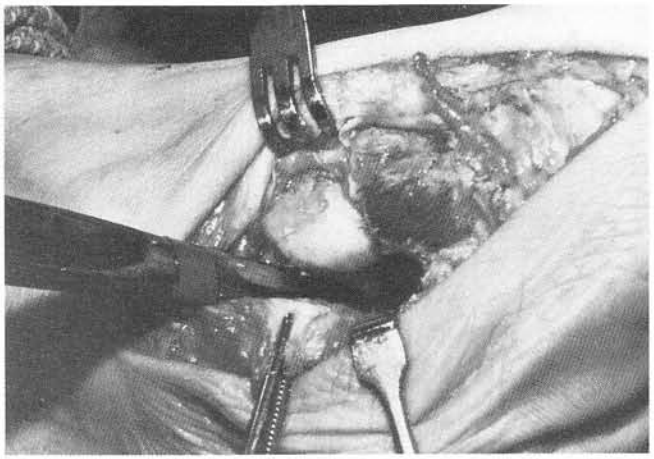

Figure 1C. The same foot after resection of the coalition. Note the increased space in the area of resection.

created between the talus and calcaneus is managed after resection. Whether the insertion of organic or non-organic material is necessary as an attempt to maintain the resection space remains unknown. The diversity of the surgical approaches and the criteria for grading the results at follow-up make concise conclusions difficult.

In 1987, Olney and Asher[3] reported their results on middle talocalcaneal coalition resections in 10 feet (9 patients). They used a medial approach and, after resection, pressed bone wax into the resected surfaces and packed the defect with an autogenous free fat graft obtained from the buttocks. Their patients ranged in age from 10.5 years to 22-years-old with a mean age of 13 years, 7 months. Their average length of follow-up was 3.5 years, and in 8 of the 10 feet (80%) the results were excellent (i.e., no pain) or good (i.e., occasional pain but no limitation of activity). In addition, these authors quantitated the subtalar joint motion postoperatively and found that the motion in the surgically-treated foot was roughly 81% of the normal range of motion in the contralateral foot without apparent coalition. Subjectively, they noted that all their patients felt postoperatively that their motion had increased. They noted no correlation between the age, sex, or tissue type of the coalition and the results obtained by coalition resection.

In another retrospective study, Scranton,[4] in 1987, reported on 14 cases of middle or posterior talocalcaneal coalition resection. Of these 14 cases (9 patients), 10 cases (7 patients) were resections of middle facet coalitions. Scranton approached the coalition through a medial approach and, like

Olney and Asher, used bone wax on the bleeding osseous surfaces and an autogenous free fat graft to fill the defect. Scranton took his fat grafts from behind the calcaneus through the superior portion of his incision. The patients undergoing middle facet talocalcaneal resection varied in age from 12 years to 24-years-old with a mean age of roughly 15 years, 8 months. Scranton did not determine the average postoperative follow-up for just his middle facet coalition resections, but the results on the patients in his study were evaluated from 2 to 9 years (mean-3.9 years), regardless of whether the treatment was conservative or surgical. Of the middle facet resection patients, 9 cases (90%) in 6 patients were considered to be good results (i.e., no limitation of function, some motion of the talocalcaneal joint, and no pain during everyday activity), one (10%) had a satisfactory result (i.e., some limitation of function, motion of the talocalcaneal joint could be absent, and pain could be present after prolonged standing and walking), and none had a poor result (i.e., definite functional limitation, no motion of the talocalcaneal joint, and pain with standing, walking, or at rest). Although these results appear promising, it is important to note that Scranton selectively limited who he would attempt to perform a resection on. Scranton believed that degenerative arthritis in the talonavicular joint, but not talar beaking, was a contraindication to resection. Further, he arbitrarily reasoned that a coalition involving more than one-half of the surface area of the subtalar joint, as determined preoperatively with a CT scan, precluded a good result with resection. Thus, Scranton's middle facet talocalcaneal resections were all done in patients with less than one-half of their middle facet involved and with no degenerative narrowing at the talonavicular joint.

More recently in 1992, Kumar et al.[5] reported their results on 18 feet (16 patients) that had a middle facet talocalcaneal coalition resected. In their series, the coalition was resected through a medial approach, bone wax was applied to the bleeding ends of bone, but then the method of managing the space created varied. In 3 feet nothing was interposed into the space, in 6 feet fat obtained from the gluteal area or heel pad was interposed, and in 9 cases the flexor hallucis longus (FHL) was split and one-half of the tendon was interposed into the defect. When the FHL tendon was used, the tendon was split in half longitudinally and the superior half was placed into the resected area. Continuity of the FHL tendon was maintained superior and inferior to the split so that when the muscle contracts, the split tendon would move in its normal groove inferior to the sustentaculum tali and through the resection site. In this study, the average patient age at the time of surgery was 14-years-old (range, 7 to 19). The average length of follow-up was 4 years (range, 2 to 8 years). The results of resection arthroplasty were excellent (75% or more of subtalar joint motion, no symptoms, and no recurrence of the coalition) in 8 cases, good (50% to 74% of subtalar joint motion, no symptoms, and little cortical irregularity in the area of resection) in 8 cases, fair (25% to 49% of subtalar joint motion, pain at the end of the day) in 1 case, and poor (limited subtalar joint motion, constant pain, or re-formation of the coalition) in 1 case. Thus their results were excellent or good in 16 of 18 cases. In their patient with a poor result, a second attempt at resection was undertaken as it was felt that the coalition had recurred, and the authors reported an excellent result following the revisional surgery. The authors in this study did not feel that patient age, the type of coalition (i.e., osseous, cartilaginous, or fibrous), or the type of material interposed influenced the result of the procedure.

In another study published in 1992, Salomao et al.[6] reviewed their series of 32 feet (22 patients) undergoing resection of a middle facet talocalcaneal coalition. These authors resected the coalition through a medial approach, utilized electric cautery and bone wax on the bleeding bone surfaces, and interposed a free autogenous fat graft (obtained from the subcutaneous tissues through the same incision) between the talus and calcaneus. Their mean patient age was 14 years old with a range of 10 to 23 years. Their average follow-up was 2 years, 1 month. They noted 25 feet (78.1%) had no pain, and the remaining 7 feet (21.8%) had residual pain that was less intensive than before surgery. The mobility of the subtalar joint increased in 24 (75%) of the 32 feet. They concluded that surgical resection of the coalition produced "gratifying results."

Similarly, several other reports on smaller series have described good results in patients undergoing resection of the coalition through a medial approach with or without autogenous fat graft interposition.[7-15] Other authors have reported

resection of the coalition with varying additional procedures performed to attempt to decrease the likelihood of recurrent coalition formation and to attempt to maintain improved subtalar joint motion and pedal alignment. Lepow and Richman[16] reported a case treated successfully with resection and arthroereisis. Collins[17] described resection of the coalition through a medial approach with insertion of a condylar implant into the plantar aspect of the talar surface of the resection site. He reported success in five cases that were followed up from 1 to 4 years.

SUMMARY

The consensus of current results and opinion clearly supports the conclusion that surgical resection of a symptomatic middle facet talocalcaneal coalition is a reasonable and viable procedure and often preferable to a joint arthrodesis approach. Some other consensus findings from the literature regarding middle facet talocalcaneal coalition resection include:

1. Most studies have been on younger patient populations, and although age does not appear to be a contraindication to resection, generally younger patients are deemed more amenable to resection.
2. The presence of talonavicular joint beaking (talar beaking) does NOT seem to be a contraindication to resection. Narrowing of the talonavicular joint or degenerative changes of the talonavicular joint DOES appear to be a contraindication to resection.
3. The tissue type of the coalition does NOT seem to be a limiting factor as to whether resection may or may not be considered. However, incomplete coalitions are generally thought to be more amenable to resection than complete coalitions.
4. Debate continues as to whether the size of the coalition may or may not be a contraindication to resection. Coalitions involving less than 50% of the middle facet are considered good candidates for resection. Coalitions involving more than 50% of the middle facet may or may not be candidates for resection. Further studies involving resections in coalitions involving more than 50% of the middle facet are needed to determine whether they are amenable to resection.
5. The material interposed in the defect after coalition resection does NOT appear to influence the results obtained. Autogenous fat remains the most popular material to interpose.
6. A full return of subtalar joint motion frequently does NOT occur and does NOT seem necessary for a good or excellent subjective and objective result.

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