CHAPTER 7

SURGICAL EXCISION OF TARSAL COALITIONS IN JUVENILE ATHLETES: Three Case Reports

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Tarsal coalitions are rare anomalies that exist when there is a fusion of two or more tarsal bones. The union may consist of bone (synostosis), cartilage (synchondrosis), fibrous tissue (syndesmosis), or any combination of the three. Coalition, bar, and bridge are terms often used to describe this abnormal union. Buckholz differentiated between a true coalition, in which there is an intra-articular fusion of two bones (i.e. talonavicular, talocalcaneal, and calcaneocuboid), and a bar or bridge which is an extra-articular fusion of two bones (i.e., calcaneonavicular).

The three most common types of coalitions are ones between the talus and calcaneus (most often middle facet), the calcaneus and navicular, and the talus and navicular. Other less common coalitions occur between the calcaneus and cuboid, and the cuboid and navicular. Talocalcaneal coalitions and calcaneonavicular bars account for approximately 90% of all coalitions. The literature suggests that talocalcaneal coalitions are slightly more common. Speculation exists as to the true incidence of talonavicular coalitions. They are the least symptomatic, and are often noticed only as incidental findings. Therefore, unless these patients have other problems, the talonavicular coalition will go undiagnosed.

Symptoms resulting from a tarsal coalition most frequently appear in the second decade of life. This is directly related to the time at which ossification of the coalition occurs. The earliest to ossify, and the least symptomatic, is the talonavicular coalition, which ossifies between the ages of 3 and 5 years. Calcaneonavicular coalitions ossify between the ages of 8 and 12 years, while talocalcaneal coalitions ossify between the ages of 12 and 16 years. The most common findings are limited subtalar or midtarsal joint motion, vague pain in the foot, peroneal spasm, and a flatfoot. Although none of these signs in combination or alone are pathognomonic for a tarsal coalition, they are highly suggestive and should raise the examiner's suspicion.

CONSERVATIVE TREATMENT

Conservative treatment of the juvenile with tarsal coalition symptoms should always be employed before surgical treatment is attempted. Goals of conservative therapy consist of limiting subtalar and midtarsal joint motion, and reducing inflammation. Conservative therapeutic modalities include pronated orthotics, strapping, padding, peroneal nerve blocks, and casting. Many advocate a short-leg walking cast for three weeks. If this fails to alleviate the pain, application of a short-leg cast with the patient non-weight bearing may be implemented. Most practitioners agree that if two attempts at casting fail, the patient is most likely a candidate for surgical treatment.

SURGICAL TREATMENT

Controversy exists regarding the indications of and the surgical procedures used to treat tarsal coalitions. Perlman and Wertheimer stated that the presence of secondary degenerative changes are a contraindication to the resection of any coalition. They stated that an arthrodesis is the procedure of choice in these conditions.

O'Neill and Micheli reported consistently good results after resection of tarsal coalitions. This was true in adolescent athletes even in the presence of talar beaking, as long as other degenerative changes were absent. A study was conducted by Morgan and Crawford in 1986 evaluating the resection of tarsal coalitions in adolescent athletes. However, no consideration was given to the presence or absence of secondary arthritic changes. They felt the initial option of triple arthrodesis to be too aggressive, and preferred to excise the coalition regardless of the radiographic changes present in the foot. They claimed to have had good results. Most of the controversy in the literature is in reference to the resection of talocalcaneal coalitions.

Some authors claim arthrodesis is the procedure of choice due to the secondary degenerative changes associated with these coalitions. They state that resection of the coalition will disrupt the weight-bearing function of the joint. However, other investigators have described good results after resection of the coalition with interposition fat grafts, or conjunctive arthroeresis procedures.

There is more consistency with regard to the treatment of calcaneonavicular bars. The most common procedure involves resection of the coalition with interposition of the extensor digitorum brevis muscle belly. The muscle acts as a "spacer" in the resection site, to decrease the chance for recurrence of the coalition and hematoma formation. The traditional procedure uses an absorbable suture to attach the muscle belly into the resection site. The sutures are passed plantar-medially using Keith needles, and tied over a button on the plantar aspect of the foot. In this article, the authors present a technique for attaching the EDB muscle belly using the Mitek soft tissue anchoring system (Mitek Surgical Products, Norwood, Massachusetts).

CASE REPORTS

Patient A

Patient A is a 13-year-old male previously treated for a tibial fracture. Following full recovery from the fracture, the patient began to play football. Shortly thereafter, his coach noticed that he was continually limping. The coach related his concern to the patient's mother, who brought the patient in for evaluation. Radiographic examination revealed bilateral calcaneonavicular bars. The patient denied significant pain, but walked with an obvious limp involving the right leg. After a regimen of unsuccessful conservative therapy, including orthotics, the patient and his mother elected for surgical excision of the calcaneonavicular bars.

An Ollier-type incision was made, starting at the distal fibula and extending over the sinus tarsi to the calcaneocuboid joint superiorly. The incision was deepened through the subcutaneous tissues, where bleeders were electrocaurterized to gain hemostasis. The subcutaneous tissue was divided and bluntly spread from the deep fascia overlying the extensor digitorum brevis (EDB) muscle belly. An inverted "L" incision was made through the deep fascia and periosteum over the sinus tarsi. Sharp dissection was used to free the extensor digitorum muscle belly from its attachment to the calcaneus. The muscle belly was retracted distally and inferiorly. This allowed for visualization of the calcaneonavicular bar, which appeared to be a combination of a synostosis and synchondrosis. Approximately 1.5 cm of this bridge, extending from the calcaneus to the navicular, was resected with an osteotome and mallet.

A rasp was used to smooth all bony prominences. Intra-operative x-rays were obtained, demonstrating satisfactory resection of the coalition. The extensor digitorum brevis muscle belly was then interposed between the calcaneus and navicular at the resection site overlying the calcaneus. A Mitek soft tissue anchor was used to attach the muscle belly into the calcaneus, covering the exposed cancellous portion of the resection. The deep fascial periosteal layer was closed using 2.0 absorbable suture in an over-and-over fashion. A closed-suction drain was inserted to prevent hematoma formation. Closure of the superficial fascial layer was accomplished utilizing 4-0 absorbable suture in a continuous running fashion. The skin was reapproximated with 5-0 absorbable suture using a running intradermal stitch.

Patient B

Patient B is a 17-year-old male who was injured while playing football. He related that he "cracked" his calcaneus, and was treated by the team orthopedic surgeon with a removable cast for four weeks. The patient had full recovery until several months later, at which time he developed a dull, aching pain over the anterior lateral aspect of the calcaneus.

Radiographic examination revealed a fracture fragment of the anterior beak of the calcaneus, and a large synostosis between the anterior beak of the calcaneus and the body of the navicular. A second coalition was found connecting the cuboid to the navicular. Initial conservative treatment included a period of non-weight bearing in a below knee cast, which proved to be unsuccessful. The patient and his parents choose to have surgical intervention for this condition.

The patient was placed in a right lateral decubitus position on a vacuum bean bag. A curvilinear incision was made on the lateral aspect of the foot, inferior to the fibular malleolus, extending across the sinus tarsi and body of the cuboid distally. Dissection was carried through the superficial fascia to the level of the deep fascia overlying the

extensor digitorum brevis muscle belly. The adipose tissue over the sinus tarsi was reflected superiorly, exposing the inferior extensor retinaculum. A J-shaped incision was then made through the deep fascia over the extensor digitorum brevis muscle belly inferiorly, and the inferior extensor retinaculum superiorly. After further dissection, a large synostosis between the anterior beak of the calcaneus and the body of the navicular was noted. The coalition between the cuboid body of the navicular was also found. Fracture fragments from the anterior beak of the calcaneus and the lateral wall of the calcaneus were identified.

An osteotome was used to excise a triangular-shaped piece of bone connecting the anterior calcaneus, lateral navicular, and medial cuboid. Intraoperative radiographs and passive range of motion examination revealed satisfactory resection. A rasp was used to smooth all rough edges. Two Mitek anchors were used to reattach the inferior extensor retinaculum to the lateral body of the navicular, and the extensor digitorum brevis muscle belly into the anterior floor of the calcaneus. A third Mitek suture was required to affix the muscle belly into the calcaneus. A closed suction drain was placed under the deep fascial layer. Closure of the deep fascia, subcutaneous tissue, and skin was performed as in Case A.

Patient C

Patient C is a 19-year-old female soccer player with a five year history of pain in the medial talocalcaneal area of the right foot. A significant increase in the intensity of pain was experienced one month before the patient sought medical evaluation. The pain increased with activity and was relieved with rest. The patient's discomfort became disabling to the point where she could not continue to practice soccer. Conservative treatment, including orthotics, was unsuccessful. Radiographs and CT examination revealed a possible middle facet subtalar joint coalition of the right foot. The patient had a rectus foot – an unusual finding in the presence of a tarsal coalition.

The patient was taken to the operating room, where attention was directed to the posteromedial aspect of the ankle, where a curvilinear incision was made over the course of the tarsal canal. The incision was approximately 3.5 cm in length, and extended distally to the level of the middle facet of the subtalar joint. After dissection through the superficial fascia, the laciniate ligament was identified and incised along the full length of the incision. This allowed for visualization of the tibialis posterior and flexor digitorum longus tendons. These tendons were retracted dorsally, while the flexor hallucis longus tendon and neurovascular bundle were retracted plantarly. A hypertrophic bony prominence with an overlying soft tissue mass, consistent with a ganglion, was found at the level of the subtalar joint.

The ganglion cyst, measuring 4 mm in diameter, was removed and sent for histological examination. A considerable amount of hypertrophic bone was noted after the ganglion was removed. The periosteum covering the middle facet of the subtalar joint was removed. Utilizing an osteotome and mallet, the hypertrophied bone was resected and smoothed with a rasp. Intraoperative subtalar joint range of motion was tested, and it was determined that more bone resection would be necessary. Therefore, a 1 x 1.5 cm wedge of bone was resected from the middle facet. Range of motion at the subtalar joint was then satisfactory. A closed suction drain was placed, and closure of the tendon sheath and the laciniate ligament was performed utilizing 3-0 absorbable suture in an over-and-over interrupted fashion. The superficial fascia and skin were closed as in the previous cases.

DISCUSSION

The use of the Mitek soft tissue anchor system offers several advantages over traditional methods for anchoring the EDB muscle belly, or other soft tissue, into bone after resection of a tarsal coalition. Less suture is needed for the interposition of the extensor digitorum brevis muscle belly, decreasing the potential for suture reaction. Suture sizes available are #2, #0, and #2/0, each with a different anchor size. Also, there is no suture exiting the skin to serve as a potential nidus for infection. One of the most useful aspects of the Mitek system is the ability to anchor soft tissue to bone located in difficult areas such as the inferior surface of a bone (i.e. the talus).

There are 3 primary goals regarding the surgical resection of tarsal coalitions in the juvenile athlete. These include the alleviation of pain, prevention of further degenerative changes, and a rapid return to activity.

There is a direct correlation between an adolescent's participation in sports and the onset of symptoms associated with a tarsal coalition. One must maintain a high index of suspicion for coalition in the adolescent patient who presents with the cardinal signs and symptoms. A CT scan has proven to be a helpful diagnostic tool when the patient's signs and symptoms are consistent with a coalition, but radiographs are questionable. Early diagnosis is paramount, in order to prevent the development of secondary degenerative changes.

The juvenile athlete who undergoes resection of a tarsal coalition, prior to the onset of degenerative changes, can be expected to have a good or excellent outcome. The three patients presented here have all had good postoperative results, and are currently being followed for long-term results.

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