CHAPTER **48**

PERIOPERATIVE EVALUATION OF STAGE 2 POSTERIOR TIBIAL TENDON DYSFUNCTION

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OVERVIEW

Posterior tibial tendon dysfunction (PTTD) and the resultant pes planovalgus deformity is a commonly encountered condition in podiatric medicine and surgery. It is estimated that approximately 5 million people have PTTD in the US alone.[1,2] While it is an easily recognizable entity, there is significant debate about how to best approach the condition from a surgical standpoint.

While there are numerous classification systems in use for PTTD, the most commonly utilized is the Johnson and Strom classification as modified by Myerson[3] (Table 1). The staging of the deformity incorporates clinical observations to stratify the patients and prescribe possible treatment options based on the specific stage. While the treatments for Stages 1, 3, and 4 are relatively universal, there is the question among many surgeons about how to best address the Stage 2 deformity.[3-7]

PREOPERATIVE EVALUATION

The preoperative evaluation of the patient with PTTD involves both clinical criteria and radiographic evaluation. Clinically, one must determine if there is a pes planovalgus deformity and if so, if it is flexible or rigid. Additionally, if the valgus deformity of the rearfoot is flexible, the presence of a forefoot supinatus deformity should be assessed. The areas of maximal tenderness should be evaluated and incorporated into the surgical plan. Weight-bearing radiographs of the ankle should be obtained in addition to the weight-bearing radiographs of the foot. If clinically indicated, magnetic resonance imaging (MRI) of the posterior tendon may be completed. The radiographs should be evaluated to assess for the presence of degenerative changes in the rearfoot joints. If tendon transfers are planned in the surgical intervention, evaluation of the MRI should include the degree of degeneration and the presence of rupture of the posterior tibial tendon as well as the integrity of the flexor digitorum longus (FDL) tendon.

OPERATIVE OPTIONS

Gastrocnemius Recession

The role of gastrocnemius equinus in pes planovalgus has been well established.[8-10] Therefore, regardless of the strategy to correct the deformity in the stage 2 PTTD foot, neutralization of the equinus influence must be a component. This may be accomplished in a variety of ways at either the gastrocnemius aponeurosis or the Achilles tendon level. The level of correction is not as important as neutralization of the deforming equinus force. Some authors propose a decreased risk of over-lengthening with a gastrocnemius recession when compared with an Achilles tendon lengthening.[9]

Table 1

STAGES OF TIBIALIS POSTERIOR TENDON DYSFUNCTION

	STAGE 1	STAGE 2	STAGE 3	STAGE 4
Tendon Condition	Tenosynovitis	Elongated	Elongated, ruptured	Elongated, ruptured
Rearfoot	Flexible, normal	Flexible, valgus	Rigid, valgus	Rigid, valgus rearfoot and ankle
Single Heel Rise Test	Mild Weakness	Marked Weakness	Marked Weakness	Marked Weakness
Treatment	Conservative; Tendon debridement	Soft Tissue repair/ augmentation, Osseous realignment	Isolated rearfoot arthrodesis, Triple arthrodesis	Tibiotalocalcaneal or pantalar arthrodesis

Adapted from: Mahan KT, Flanigan KP Tibialis Posterior Tendon Dysfunction In: Banks AS, Downey MS, Martin DE, editors. Comprehensive textbook of foot surgery, 3rd edition. Philadelphia: Williams & Wilkins; 2001; p. 862-99.

Posterior Tibial Tendon Repair

If the MRI shows isolated longitudinal tears within the tibialis posterior tendon, then exploration of the tendon may be warranted. If tears are noted intraoperatively, Topaz microcoblation (Arthrocare, Austin, TX) and/or re-tubularization should be performed to restore the posterior tibial tendon. If the tendon is noted to be non-repairable, then a tendon augmentation by removing the damaged segment with z-lengthening of the healthy portion may be contemplated.[10]

Flexor Digitorum Longus Transfer

If the posterior tibial tendon is weakened, its action across the midtarsal joint is disrupted. This allows the peroneus brevis to function with a mechanical advantage, producing abduction and eversion across the midtarsal and subtalar joints, respectively. A symptomatic foot that has failed conservative treatment may be treated with an FDL transfer as long as 15 degrees of subtalar joint inversion and 10 degrees of transverse tarsal adduction are available.[11] An FDL transfer results in restoration of adduction and inversion, and proper balance with the peroneus brevis. This corrected balance allows the posterior leg muscles a stable foot with which to plantarflex the ankle.[12] However, if there is more than 10 degrees of fixed forefoot varus, the osseous components of the deformity need to be addressed.[11] In addition, medializing the pull of the Achilles with a medial displacement calcaneal osteotomy (described below) can provide tremendous support for a relatively weak FDL transfer.[11]

Tibialis Anterior Transfer (Cobb Procedure)

Often referred to as a "surgically convenient" procedure, this technique offers a solution in a variety of circumstances, often that of PTTD.[13] By leaving the distal insertion intact, the procedure maintains the function of the donor tendon, while providing a tenodesing mass effect to the weakened PTT. The transfer offers a non-dynamic reinforcement of the PTT, though if completely detached, allows the unopposed plantarflexion from the peroneus longus on the medial column.[6] The Cobb procedure can be used alone, although it is especially useful in conjunction with osseous procedures.

Evans Osteotomy

An Evans osteotomy is a useful procedure for the correction of the flexible planovalgus deformity in stage 2 PTTD. It is able to reduce the forefoot abduction as well as the calcaneal valgus components of the deformity. It also helps to reduce the talar head uncovering on the AP radiograph.[7,14] One important determinate of efficacy is the size of the graft. Generally, a smaller graft size must be utilized in adults when compared with pediatric patients. Additionally, calcaneo-cuboid joint pain or arthrosis may be noted post-operatively. Several authors have advocated the calcaneo-cuboid distraction arthrodesis to prevent this complication.[15]

Medial Displacement Calcaneal Osteotomy

A medial displacement osteotomy through the posterior tuber of the calcaneus has been used extensively to reduce the calcaneal valgus deformity in the stage 2 PTTD. Its proposed mechanisms of action are by redirecting the force of the Achilles tendon to a more supinatory axis in addition to moving the ground reactive force in a more medial direction. When compared with the lateral column lengthening, one study showed that the medial displacement calcaneal osteotomy resulted in less adjacent joint arthritis over time. However, this result was at the cost of less overall correction and double the re-operation rate of a lateral column lengthening.[16]

Double Calcaneal Osteotomy

Occasionally, the full extent of the planovalgus deformity cannot be corrected with an Evans or displacement calcaneal osteotomy alone. In this instance, some authors have advocated the use of a double calcaneal osteotomy.[7,17] This is accomplished through the individual incisions that are utilized for each procedure separately.

Isolated Arthrodesis

In the significantly unstable foot, especially those with an apparent radiographic fault, an isolated joint arthrodesis may be necessary. The two most common isolated arthrodeses that have been described for the correction of the flexible pes planovalgus deformity are the subtalar joint and talonavicular fusion. Each works via a separate mechanism, however, both arthrodeses stabilize the entire foot by limiting pathologic rearfoot motion.

The talonavicular joint has been termed the acetabulum of the foot due to its ball and socket configuration and the fact that it is thought to be the most mobile joint in the foot. Cadaver models have shown that when it is fused, the mobility of the subtalar joint and the calcaneal cuboid joint are significantly reduced. Additionally, the excursion of the posterior tibial tendon is almost eliminated.[18] Recent research has shown the isolated talonavicular fusion to produce statistically significant improvements in both visual analog scale pain scores and radiographic findings for flexible pes planovalgus deformities as seen with PTTD.[19] In the supple pes planovalgus deformity, these effects are very useful in stabilizing the foot and offloading the diseased posterior tibial tendon.

The subtalar joint functions as a torque converter allowing conversion of rotation of the leg to inversion/eversion in the foot. This motion may be likened to that of a screw with abduction coupled with eversion and adduction coupled with inversion. When the subtalar joint is fused, pathologic rearfoot pronation is eliminated. Without excessive pronation at the subtalar joint the posterior tibial tendon is offloaded.

As one of the more distal components in pes planovalgus deformity, the naviculocuneiform joint is also a possible location for fault or failure. In a supple stage 2 deformity, an naviculocuneiform arthrodesis accompanied by the appropriate soft tissue augmentation can be a very successful form of treatment. Specific indications include a naviculocuneiform fault, degenerative joint disease, or hypermobility within the joint. Based on the theory that the naviculocuneiform joint is "non-essential" for normal gait, its sacrifice for fusion suggests little to no effect on the gait cycle.[20] The naviculocuneiform fusion will not correct for rearfoot valgus but, under the right circumstances, the procedure can reduce pain and restore function of the medial column while sparing rearfoot biomechanics.[20]

Arthroeresis

Initially popularized for treating pediatric CPPV deformities, the arthroeresis involves the use of an implant to block medial and plantar displacement of the talus. When used in conjunction with other soft tissue or osseous procedures, studies have shown success rates as high as 95% (2,4). If treating a more severe stage 2 PTTD with a medial calcaneal slide osteotomy or FDL tendon transfer, an arthroeresis can temporarily be utilized to support the healing construct. Decreased subtalar joint mobility and extra lateral column support helps reduce tension on healing medial tissues. Once healing is complete, the implant may be removed.[4]

CONCLUSION

Tibialis posterior tendon dysfunction is a common podiatric deformity with various available treatment options. Stage 2 PTTD, specifically, can be difficult to both identify and formulate patient specific treatment plans. It is important to understand the available surgical and conservative options for the proper treatment for each individual patient. While conservative therapy is effective for long term control of the pain experienced with Stage II PTTD, approximately 40% of patients will require surgical intervention to achieve optimal outcomes.[21] The surgeon must use caution when selecting the best procedure for each individual patient to fully address the deformity and to try to preclude the need for future surgery.

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