REPAIR OF TIBIALIS POSTERIOR TENDON DYSFUNCTION WITH FLEXOR DIGITORUM LONGUS TRANSFER

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INTRODUCTION

Tibialis posterior tendon dysfunction is now being recognized and managed with increasing frequency and success. The clinician treating the lower extremity must be aware of this problem and its various stages of presentation in order to make a proper diagnosis. Once correctly identified and staged, appropriate conservative and surgical treatment can be instituted. This article reviews the typical clinical presentation and stages of tibialis posterior tendon dysfunction, and discusses the role of flexor digitorum longus anastomosis and transfer in the surgical management of this disabling condition.

CLINICAL PRESENTATION

Tibialis posterior dysfunction is a common deformity which generally occurs in adults older than 35, and occurs more frequently in women.[1-4] The clinical presentation of a patient with tibialis posterior tendon dysfunction varies according to the chronicity and deformity associated with the condition. Johnson and Strom[5] divided tibialis posterior tendon problems into 3 distinct stages. (Table 1)

TABLE 1.

Changes associated with various stages of **tibialis posterior (TP) tendon dysfunction**

	Stage 1	Stage 2	Stage 3
TP tendon condition	Peritendinitis or degeneration	Elongation	Elongation; complete rupture
Pain	Medial; diffuse; mild to moderate	Medial; along TP tendon course; moderate	Medial and/or lateral; moderate to severe
TP muscle testing	Mild weakness	Marked weakness	Marked weakness
Single-heel-rise test	Mild weakness	Marked weakness	Marked weakness
"Too many toes" sign	Normal	Positive	Positive
Rearfoot	Flexible; normal alignment	Flexible; valgus position	Rigid; valgus position
Pathology/ MRI	Synovial proliferation; mild degeneration	Marked degeneration; partial rupture	Marked degeneration; complete rupture

In Stage 1, the tibialis posterior tendon is of normal length, but is associated with early tenosynovitis and tendon degeneration. The involvement of the tendon is often unrecognized in this early stage, as the patient complains of only mild to moderate pain. Further, the pain is often diffuse, and often it is described as only an aching along the medial aspect of the ankle that is exacerbated by activity. Rarely will the patient recall a specific initial injury or onset. Upon examination, edema, warmth, and tenderness to palpation may be identified over the distal course of the tibialis posterior tendon. Manual testing of the tibialis posterior muscle/tendon complex, and the single-heel-rise test may demonstrate or accentuate weakness, especially when compared to the contralateral, unaffected limb.

In Stage 1 dysfunction, the alignment of the midfoot and rearfoot are still comparatively normal. If collapsing pes valgo planus deformity is present, it is usually pre-existing, bilateral and symmetrical. Thus, routine radiographs are seldom helpful in the diagnosis. Conversely, MRI may demonstrate the tenosynovitis about the tibialis posterior tendon. (Figures 1A, 1B)

In Stage 2, the tibialis posterior tendon becomes elongated and the rearfoot begins to collapse. This change occurs over several months to years. Along with these pathologic changes, the pain increases in severity and is more specifically localized to the course of the tibialis posterior tendon. The patient usually perceives weakness, "tiredness," or fatigue on the affected side, and the deformity is more debilitating. Swelling, warmth, and tenderness are more pronounced along the course of the tibialis posterior tendon. Palpation of the tendon should be performed, checking for the presence of thickening, partial defects, or total disruption. This examination may be facilitated by placing a small amount of Vaseline along the course of the tendon to enhance tactile sensation.[6] Manual muscle testing and the single-heel-rise test reveal the weakened, but intact tibialis posterior muscle/tendon complex. Abduction of the forefoot, increased collapse of the medial longitudinal arch, and heel valgus will be readily apparent, especially when compared to the contralateral normal foot. The "too many toes" sign, described by Johnson,[7] is evident. This sign is observed by evaluating the patient in a weight-bearing attitude from the posterior aspect. With increased forefoot abduction, more toes will be visible lateral to the patient's heel, thus, the "too many toes" sign. (Figure 2) Changes on radiographs confirming these structural changes may also be identified. MR images often show tendon irregularity, splitting, degeneration, and

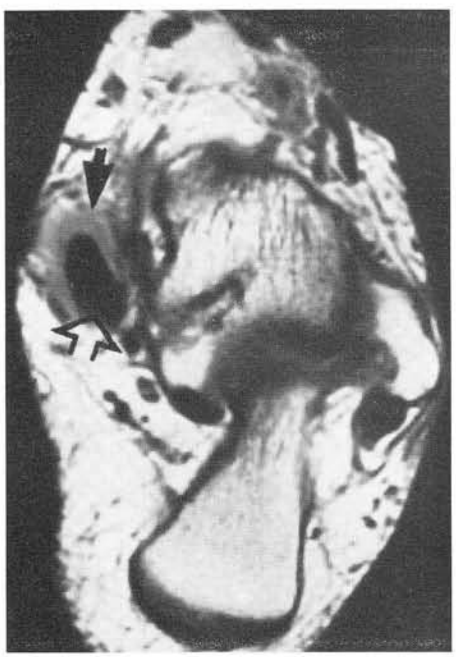

Figure 1A. Coronal (frontal) plane magnetic resonance images (MRI) of synovitis of the tibialis posterior tendon. Tendon (open arrow); Tenosynovitis (closed arrow). T1-weighted image. Note the intermediate signal intensity of tenosynovitis.

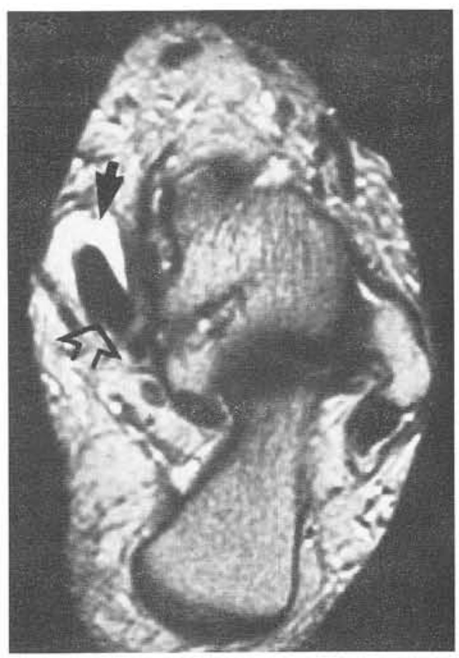

Figure 1B. T2-weighted image. Note the high signal intensity of tenosynovitis.

elongation, with or without associated tenosynovitis. (Figures 3A, 3B)

In Stage 3, the tibialis posterior tendon is markedly elongated or completely ruptured, and is minimally functional or non-functional. These patients typically have been left untreated, or have been inappropriately treated, for several years or more. Frequently, these patients will have seen a multitude of physicians, have no established diagnosis, and too often have been told that "nothing can be done." In this stage, deformity is the most prevalent change. Debilitating pain may still be present medially, but concomitantly the pain transfers to the lateral aspect of the foot due to the severe rearfoot deformity. With increased hindfoot valgus, the sinus tarsi is impinged or lateral osseous abutment occurs between the talus and calcaneus, resulting in lateral symptomatology. In very advanced cases, the fibula may abut the calcaneus causing pain. Manual muscle testing of the tibialis posterior and the single-heel-rise test will demonstrate marked weakness or absence of tibialis posterior muscle function. The "too many toes" sign will be positive. Severe rearfoot valgus with associated forefoot abduction and medial longitudinal arch collapse will be present. The pedal position is more fixed and a semi-rigid or rigid pes valgo planus deformity is present. Thus, the Hubscher maneuver (i.e., dorsiflexion of the hallux) will fail to recreate the medial longitudinal arch. In more advanced cases, subluxation of the talonavicular and subtalar joints may occur. In such instances, the patient may feel that they are walking on their "ankle bone" or medial malleolus. In Stage 3, secondary degenerative changes with joint narrowing and osteophyte formation of the subtalar, ankle, and/or midtarsal joints will be readily apparent on radiographs.

TREATMENT

With an understanding of the various stages and presentations of tibialis posterior tendon dysfunction, the clinician can predict the pathologic changes present, anticipate future deformity, and subsequently offer and establish an appropriate treatment plan. Although treatment should always be vigorous for this deformity, the more advanced the deformity, the more aggressive the treatment must be.

Figure 2. "Too many toes" sign. When viewed from the posterior aspect, more toes are visible lateral to the patient's left heel secondary to the severe heel valgus and forefoot abduction.

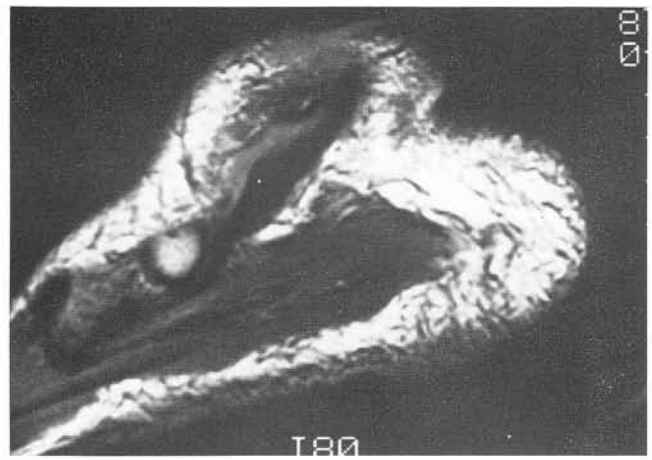

Figure 3A. Longitudinal (sagittal) plane MRI of partial midsubstance tibialis posterior tendon rupture. T1-weighted image.

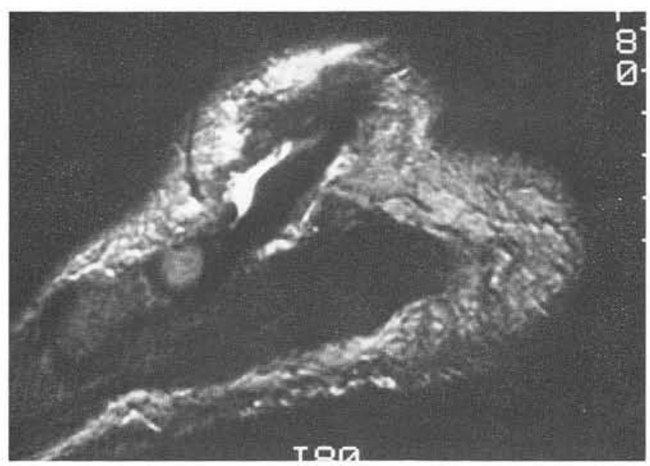

Figure 3B. T2-weighted image. Note thickening of the tendon in the area of partial tear and surrounding tenosynovitis.

Conservative treatment has met with varying success and has primarily included shoe modifications (arch pads, Thomas heels), orthoses, immobilization, physical therapy, non-steroidal anti-inflammatory drugs, and local corticosteroid injections. The author has found that Stage 1 or early Stage 2 tibialis posterior tendon dysfunction is most likely to respond to these nonoperative modalities. Steroid injections along the tendon's course should always be accompanied by cast immobilization for a minimum of 3 weeks. As with the tendo Achillis, the author has observed several ruptures of the tibialis posterior tendon following steroid injections without cast protection. If the patient is to be treated conservatively, Stage 2 and 3 dysfunctions usually necessitate high-top shoes, preferably molded, or including a "T"-strap, combined with a functional foot orthosis, a hinged anklefoot orthosis, or a patellar-tendon bearing brace. When conservative treatment has failed to alleviate the progression of the deformity or symptomatology, or when it is deemed inadequate, surgical intervention is considered.

Surgical treatment also varies according to the stage of the tibialis posterior tendon dysfunction. Stage 1 dysfunction is surgically treated with synovectomy and tendon debridement. (Figure 4A, 4B) Small flap tears or tendinous frays are debrided and any defects repaired. If the tendon is enlarged to more than 1.5 times its normal size, a small portion of the tendon is removed in line with the tendon's fibers and the gap is sutured closed.

Stage 2 dysfunction is treated with a similar repair of the tibialis posterior tendon combined with anastomosis to, and transfer of, the flexor digitorum longus tendon. If the tibialis posterior tendon is avulsed from its insertion, it is reattached to the navicular tuberosity and anastomosed to the flexor digitorum longus tendon. If the tibialis posterior tendon has a mid-substance rupture, this is repaired in an end-to-end fashion (if possible) with subsequent anastomosis to the flexor digitorum longus tendon. If the tibialis posterior tendon has mid-substance degeneration, this is excised and the defect repaired, with anastomosis to the flexor digitorum longus tendon. In most cases, the insertion of the flexor digitorum longus tendon is transferred to the navicular tuberosity.

In late Stage 2 dysfunction, adjunctive procedures such as gastrocnemius tendon recession, Tendo Achillis Lengthening, talonavicular desmoplasty, medial arch reconstruction, isolated arthrodesis, arthroereisis, or an Evan's calcaneal osteotomy with bone grafting might be considered.

Finally, Stage 3 dysfunction is generally treated with subtalar or triple arthrodesis.[8] Stage 3 deformities are not typically amenable to tendon reconstruction alone.

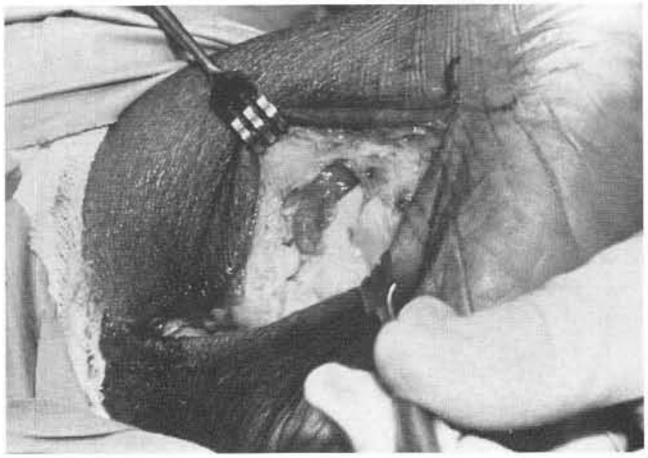

Figure 4A. Stage 1 posterior tibial tendon dysfunction treated with synovectomy and debridement. Initial intraoperative appearance. Note synovitis around the tendon, proximally.

Figure 4B. Appearance of the tendon after synovectomy and debridement.

Figure 5A. Repair of tibialis posterior tendon dysfunction with flexor digitorum longus transfer. Preoperative appearance of the foot. Note mild edema over the course of the tibialis posterior tendon.

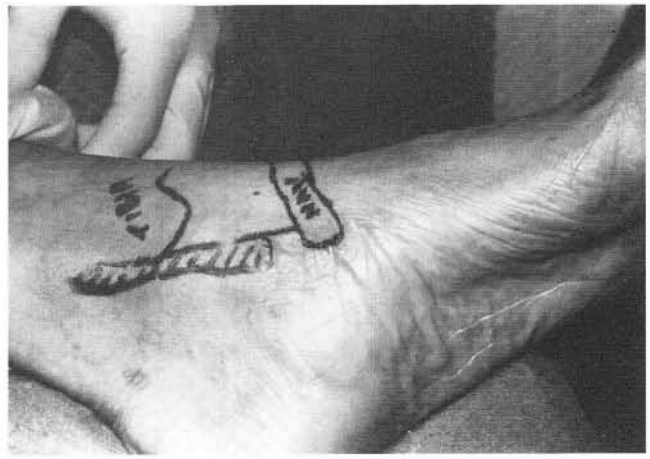

Figure 5B. Preoperative incision planning. The landmarks are the medial malleolus and navicular tuberosity. The incision is centered over course of the tibialis posterior tendon.

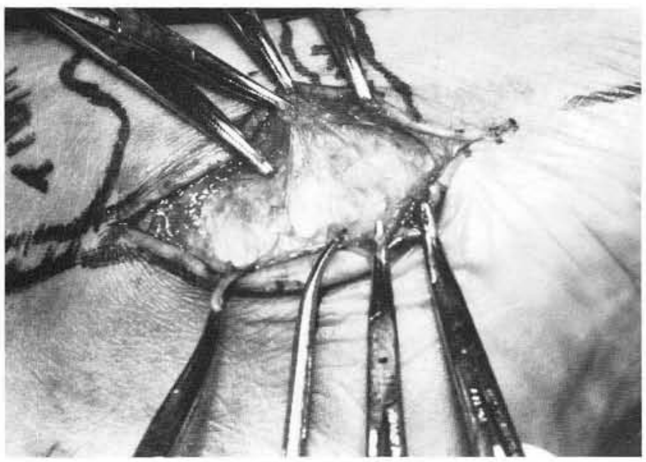

Figure 5C. Small veins are clamped and tied or electrocoagulated as necessary. The greater saphenous vein, medial marginal vein, and saphenous nerve are retracted dorsally if encountered.

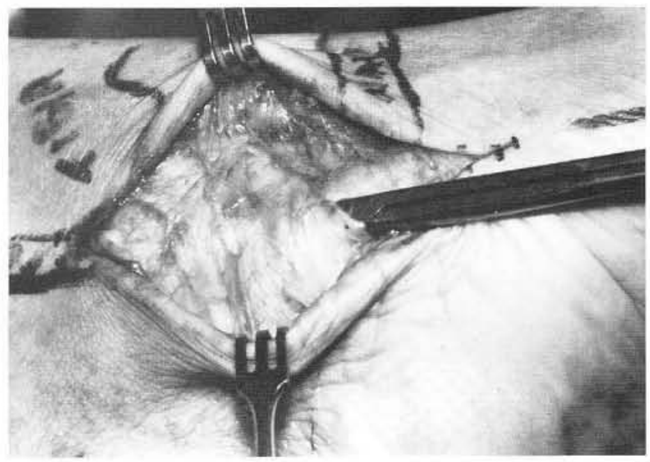

Figure 5D. Using Metzenbaum scissors, the flexor retinaculum is incised to open the first canal of the tarsal tunnel.

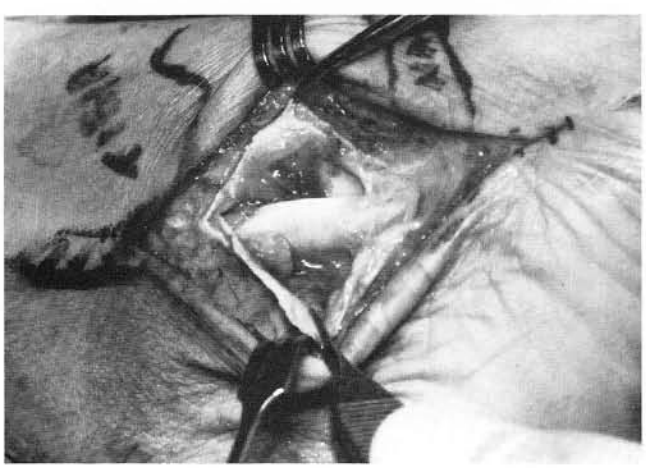

Figure 5E. The tibialis posterior tendon is exposed. Note the localized synovitis.

Figure 5F. The tendon is followed distally to its insertion, exposing it along the entire incision. Note the tendon has avulsed from the navicular tuberosity.

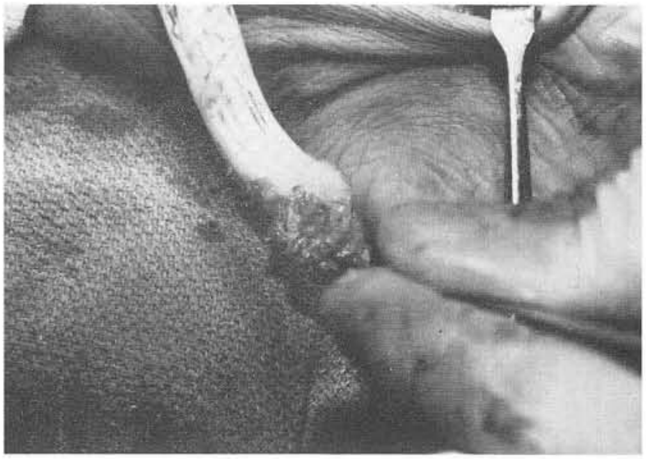

Figure 5G. The distal tendon end is retracted proximally.

Figure 5H. Using a Metzenbaum scissor, the septum between the first and second canal is incised.

Figure 5I. The flexor digitorum longus tendon is then easily identified.

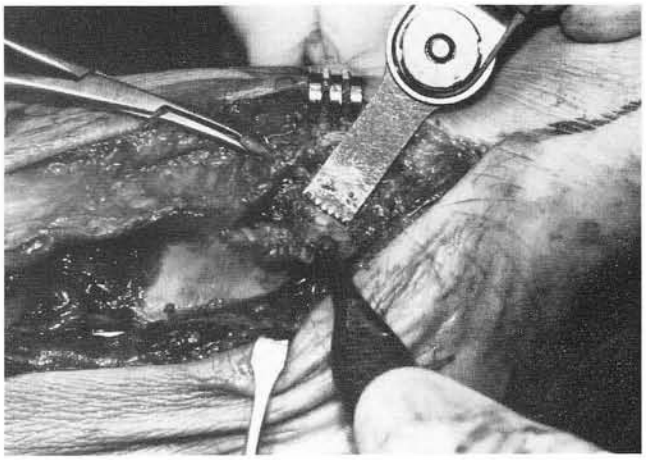

Figure 5J. Reattachment of the tibialis posterior tendon to the navicular tuberosity begins with abrasion of the navicular tuberosity.

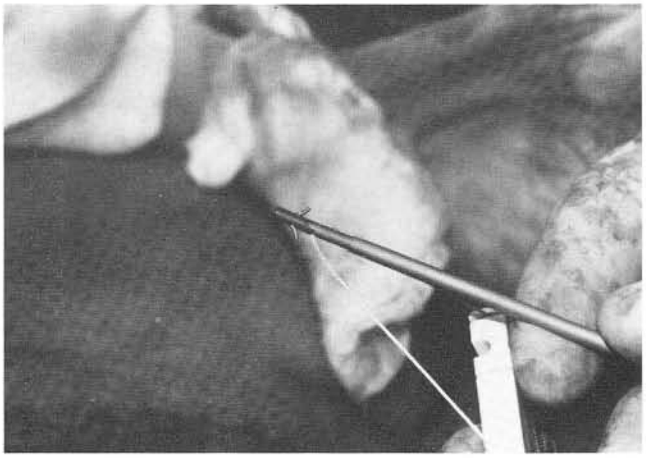

Figure 5K. A G-II Mitek bone anchor (Mitek Surgical Products Inc., 57 Providence Highway, Norwood, MA 02062), or similar instrumentation is used to assist reattachment.

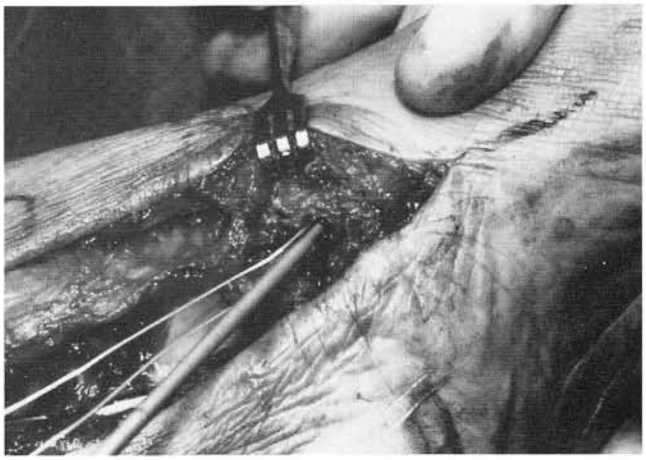

Figure 5L. The bone anchor is inserted into the navicular tuberosity.

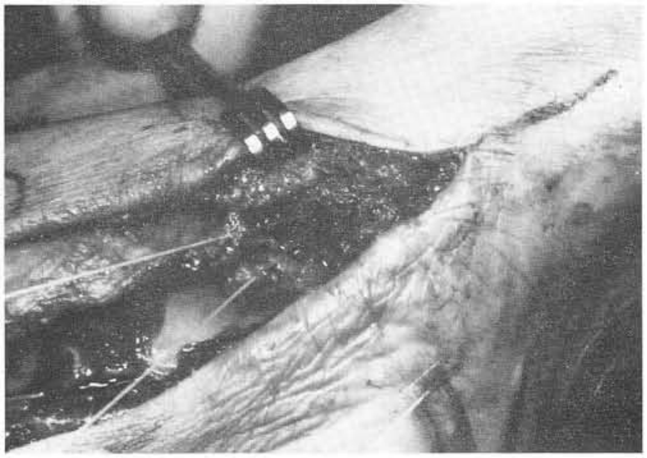

Figure 5M. Nonabsorbable suture attached to bone anchor.

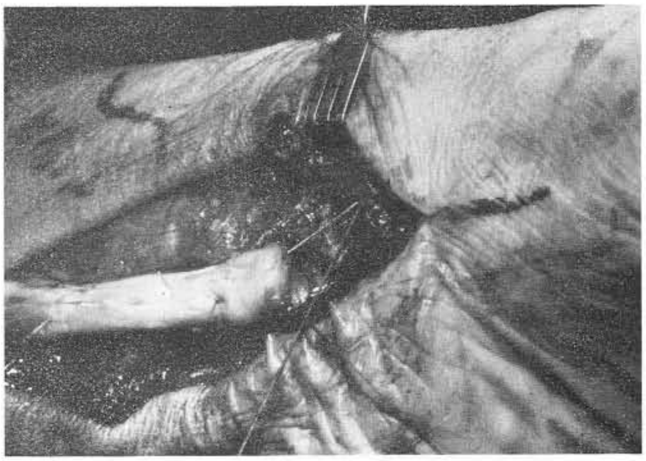

Figure 5N. The tibialis posterior tendon is approximated to the navicular tuberosity with a Bunnel or Kessler grasping stitch.

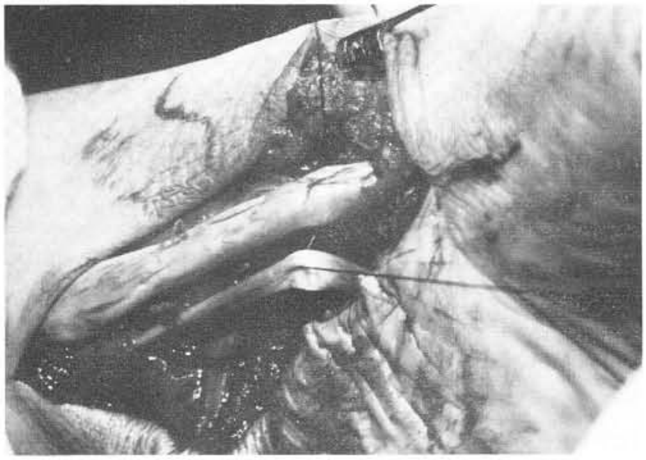

Figure 5O. The flexor digitorum longus tendon is then pulled distally as tight as reasonably possible, and with the ankle plantarflexed and the foot inverted, anastomosis to the tibialis posterior tendon is performed.

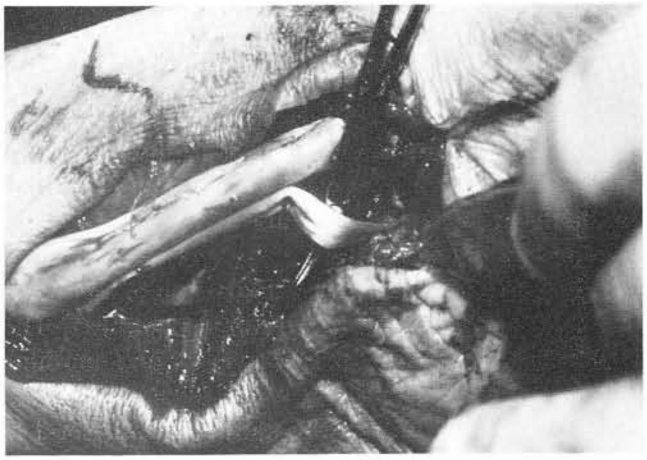

Figure 5P. The distal portion of the flexor digitorum tendon is then identified and transected.

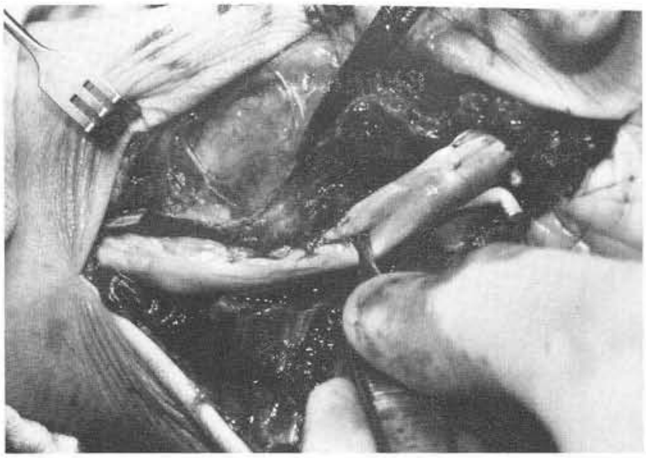

Figure 5Q. The flexor digitorum tendon is anchored to the navicular tuberosity through a drill hole or via a bone anchor.

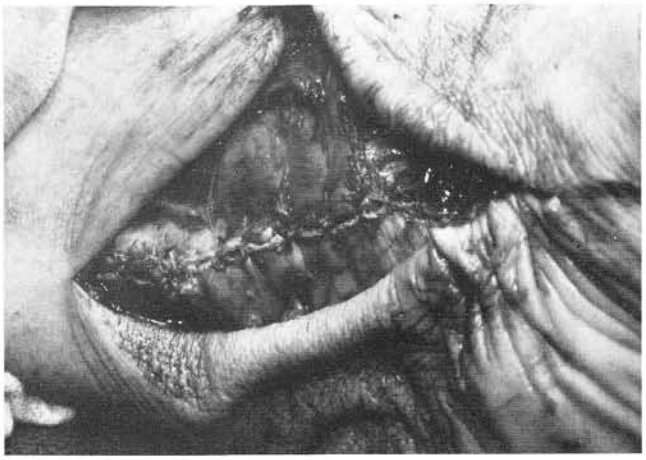

Figure 5R. The flexor retinaculum is then approximated.

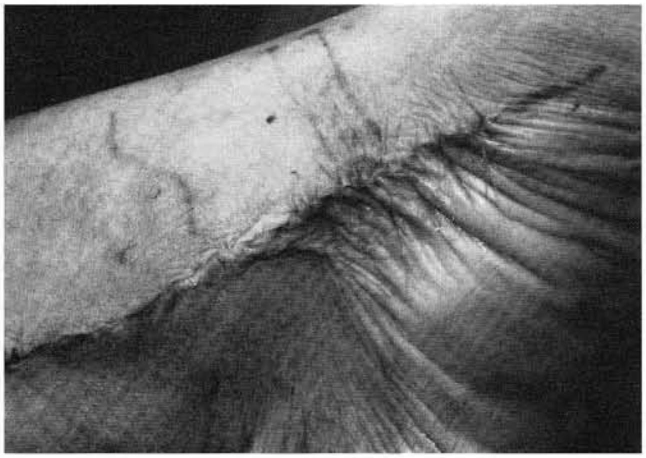

Figure 5S. Skin closure completes the procedure.

POSTOPERATIVE COURSE

Following this procedure, the wound is evaluated after 3 to 5 days. A below-knee synthetic cast is applied, and the patient is kept non-weightbearing for the first 4 to 6 weeks. The patient is then gradually returned to weightbearing in a cast over the next 2 weeks. The cast is changed every 2 weeks and the ankle and subtalar joints are slowly brought back to their neutral positions. The cast is removed after 6 to 8 weeks and gradual, progressive physical therapy and rehabilitation are instituted. Long-term, the patient is maintained in functional orthoses and appropriate shoes.

RESULTS

Repair of tibialis posterior tendon dysfunction with a flexor digitorum longus transfer has been reported to have predictably good results in Stage 2 deformity.[1-7] Similarly, the author has performed this procedure in 9 cases over the last 3 years with consistently satisfactory results.

In practical terms, the flexor digitorum longus (FDL) seems aptly suited for this reconstruction. First, the tendon is readily accessible with minimal dissection. Second, the FDL has roughly the same phasic activity as the tibialis posterior muscle/tendon.[9,10] Third, the FDL muscle/tendon complex appears strong enough to replace the lost tibialis posterior function. The anatomic cross-sectional area of the FDL is only about 33% of that of the tibialis posterior, but it consistently holds up well clinically.[5] Fourth, the loss of the FDL tendon distal to the transfer site does not appear to have a detrimental effect on toe plantarflexion strength. The flexor digitorum brevis and other intrinsic toe flexors clearly are capable of providing this function. There have been no reports of long-term problems caused by the FDL transfer.

Long-term following this procedure, supinatory function typically returns, but an increase in arch height cannot be expected.[1,11] Often, mild edema and calor will remain over the course of the reconstructed tibialis posterior/flexor digitorum longus tendon anastomosis. However, the pain consistently resolves despite the appearance of the foot.

SUMMARY

With increasing frequency, tibialis posterior tendon dysfunction is being identified as a cause of progressive pes valgus. When the diagnosis is delayed, the condition rapidly progresses to a more severe, less flexible, arthritic deformity. In this late stage, only major reconstructions or fusions can provide lasting surgical relief. By knowing the various stages and presentations of this disorder, the physician treating the lower extremity can recognize the problem earlier, and institute technically easier soft tissue and tendon reconstructions or repairs. In this vein, repair of the dysfunctional tibialis posterior with flexor digitorum longus transfer has yielded consistently satisfactory results and should be considered for reconstruction of Stage 2 deformity.

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