CHAPTER 39

TIBIALIS POSTERIOR DYSFUNCTION: A Clinical and Radiographic Classification

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The identification and treatment of disorders of the tibialis posterior tendon has become one of the most important advances developed by foot and ankle specialist over the past two decades. As the knowledge surrounding this entity evolves, it becomes quite apparent that disease to the tibialis posterior tendon can present in many forms. This diversity in pathology subsequently demands a wide range of treatment options. It is these latter two statements that can make understanding disorders of the tibialis posterior tendon difficult and at times confusing.

To assist the treating physician in understanding tibialis posterior tendon dysfunction, several classification schemes have been presented over the years. Collectively, these classification schemes discuss etiology, mechanism of injury, progression of deformity, and suggested treatments. However, no one scheme has brought the entire syndrome together as a whole. In addition, many new surgical techniques need to be applied to specific types and stages of deformity. It is for these reasons that a comprehensive classification system that also considers appropriate treatment options be developed. Although the staging system presented in this paper will potentially need to be modified as our knowledge increases, it is currently the most comprehensive one available.

As the staging system is discussed, emphasis will be placed on the presenting symptomatology, objective findings, etiologic factors, radiographic and MRI findings, and suggested treatment options. The classification divides tibialis posterior tendon dysfunction into 5 stages, with Stage 1 being the mildest and Stage 5 the most severe.

STAGE 1

In the first stage of tibialis posterior dysfunction, the patient will typically present with more acute symptomatology. The precision with which the patient can locate their area of discomfort is much better in this stage than in all the others. The pain that is described is pinpoint and relatively recent in onset. There is usually no history of a traumatic event initiating the pain, but the patient should be questioned. In addition, many patients relate a decrease in the pain when wearing athletic shoes, and an increase when less supportive shoes are worn.

Objectively, the most remarkable finding is the pain upon direct palpation over the area of injury. The location of pain is usually confined to a well-defined anatomic area with the most common sites being the retro-malleolar and navicular insertion areas. The foot has an essentially normal appearance and alignment, with the exception of mild edema along the area of involvement.

Manual muscle testing can be misleading at this stage. Commonly, the patient demonstrates little resistance when tested, suggesting a significant tendon rupture. In contrast to patients with more severe tendon damage, the lack of resistance in Stage 1 is often a result of significant pain that improves when opposition to testing is ceased. The actual tendon damage in these cases is negligible. This rationale can explain the positive "single-heel rise" test seen occasionally in this stage. It is the pain that prevents the patient from accurately performing this test, as opposed to actual tendon damage. Gait examination will often reveal an antalgic limp with reluctance to pronate during midstance.

In Stage 1, standard x-rays will usually be negative. The presence of an os tibiale externum should be noted. Magnetic Resonance Imaging (MRI) demonstrates tenosynovitis along the course of the tendon but no actual tendon damage is noted (Fig. 1).

Identifying the tendon damage at this stage offers an excellent chance of successful treatment with conservative measures. The typical

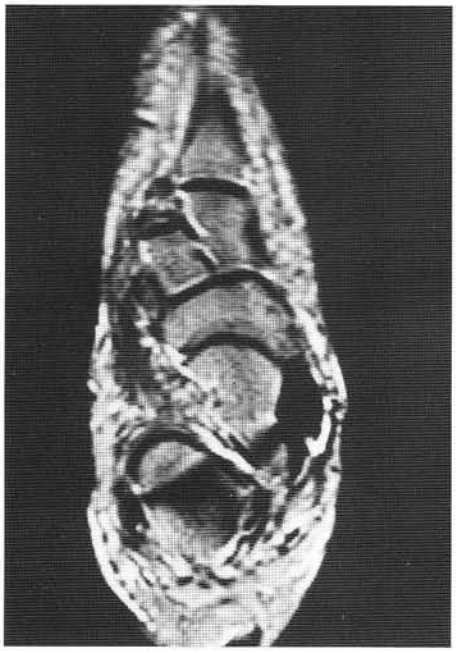

Figure 1. Tenosynovitis noted on the lateral view.

conservative treatment used by the authors includes an initial 2 to 4 week period of immobilization with casting or splinting and no weight bearing. NSAIDs are used for symptomatic relief. Following the period of immobilization, aggressive physical therapy is started, centered on strengthening the tibialis posterior tendon. If symptoms improve at this stage, final conservative care includes biomechanical control with orthotic therapy. If conservative care fails and significant symptoms remain, surgical intervention may be necessary. The previously performed MRI should be used as an objective measure of the degree of deformity. Surgery at this stage consists of tenosynovectomy of the involved area and close inspection of the tendon itself. In the authors' experience surgical intervention is rarely needed at this stage.

STAGE 2

In the second stage of tibialis posterior dysfunction, the subjective presentation is one of greater chronicity. Although the pain can still be fairly well-localized to the medial arch region, the history behind the pain and its duration are less accurately recalled. The pain in this stage is more constant throughout the day and does not necessarily respond to supportive shoes.

Clinically, there are greater objective changes noted along the area of tendon damage. Notable swelling is seen along the course of the tendon as it runs from the medial malleolus to the navicular. Pain, with range of motion and manual muscle testing can be severe. The degree of tendon weakening with manual muscle testing, as noted in Stage 1, can be difficult to accurately gauge due to painful splinting. In addition, the "single heel rise" test is often too painful to perform. Gross malalignment of the foot is rarely noted at this stage. The gait examination continues to reveal painful splinting with resistance in allowing the foot to pronate.

Standard radiographs reveal increased soft tissue definition along the medial arch and talar-navicular joint (Fig. 2). MRI confirms actual tendon damage at this stage. Longitudinal splitting and intratendinous edema are the classic findings. However, the tendon is intact with no loss of continuity (Fig. 3).

Treatment of Stage 2 disease requires early and aggressive conservative care. A period of at least 4 weeks of complete immobilization should be instituted initially. Upon removal of the immobilization, aggressive physical therapy and strict biomechanical control is needed. Due to the actual tendon damage, the biomechanical control should be more extensive than standard orthotics.

Figure 2. Note the soft tissue edema medially.

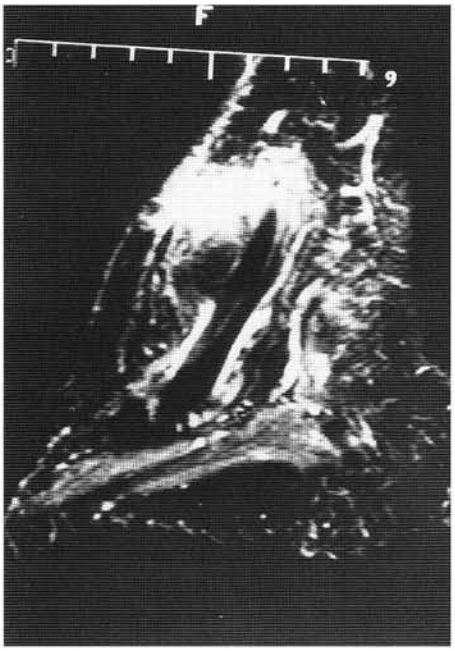

Figure 3. Intact tendon with intratendinous edema.

The authors have found a University of California Biomechanical Laboratories type brace (UCBL) to be extremely effective in supplying the strict sub-talar and medial arch control needed at this stage (Fig. 4). As the condition improves, the patient can possibly switch to a more traditional orthosis.

As compared to Stage 1 patients, a greater failure rate with conservative care exists with Stage 2 patients. This can be attributed to any number of factors, including poor tolerance of the UCBL. If conservative care fails, surgical intervention is warranted. At this stage, the authors prefer to use primary tendon repair with augmentation via flexor digitorum longus transfer. In addition, an Evans calcaneal osteotomy may be performed to afford greater correction of the often present biomechanical fault. This also lends significant stability to the subtalar and mid-tarsal joints. Another option at this stage is to perform a subtalar arthroereisis procedure instead of the Evans osteotomy.

STAGE 3

Patients presenting with Stage 3 disease give a much more vague history than in previous stages. Few patients can recall a specific event that started the painful process. However, they do report a

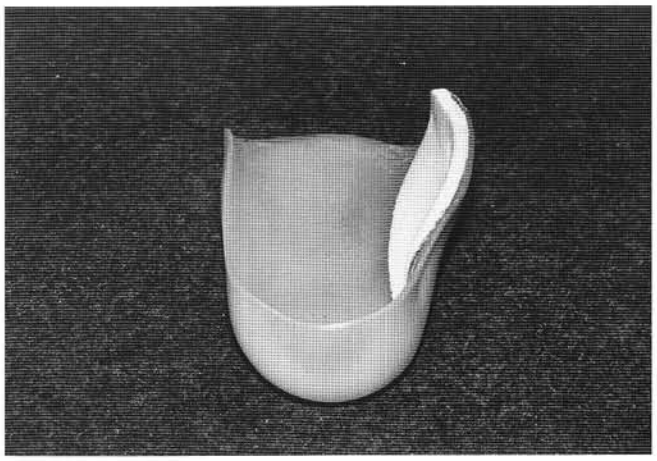

Figure 4. Typical high flange UCBL.

gradual worsening of the condition over time. Symptoms have been present for many months if not longer. The location of symptoms also becomes more vague at this stage. Although pain is still most severe medially, lateral symptomatology is common. Pain is constantly present throughout the day and little to no improvement occurs with shoe style changes. Patients will often notice uneven shoe wear with greater medial breakdown and a "rolling-in" effect occurring in the rearfoot and ankle regions.

Objective findings are fairly pronounced at this stage. The edema along the medial arch is obvious and increased as compared to previous stages. Malalignment with forefoot abduction and heel valgus is frequently noted. Range of motion and palpation can elicit pain medially along the course of the tibialis posterior and long flexor tendons, as well as laterally at the subtalar joint. Manual muscle testing confirms the significant pain and weakness at the tibialis posterior tendon. The flexor hallucis and digitorum longus tendons should also be closely evaluated. It is not uncommon to see secondary weakness begin to occur at these locations. The classic "too many toes sign" also begins to appear at this stage. Gait examination will often confirm the unilateral flatfoot deformity with the involved side being maximally pronated throughout the gait cycle. An extremely important objective finding in this stage is the ability to reduce any deformity that is present. In other words, there is no rigidity to the subluxations.

In Stage 3, standard radiographs begin to demonstrate subtle to more advanced subluxatory

Figure 5. Mild to moderate subluxation at the metatarsal joint and subtalar joint.

changes at the mid-tarsal and subtalar joints (Fig. 5). Although not common, degenerative articular disease and spurring may also be seen at these locations. MRI studies confirm advanced tendon damage with significant transverse and longitudinal degeneration. Although there may be a loss of some continuity of the tendon, there is a portion of the tendon still intact from origin to insertion (Fig. 6). This becomes important when surgical intervention is needed. Degeneration of the flexor hallucis and digitorum longus tendons can occasionally be seen at this stage.

Conservative care should be attempted, although it is often ineffective at this stage. The measures described in Stage 2 should also be applied here. A longer course of wearing the UCBL type device is often needed in this advanced stage.

Surgical intervention is required more frequently in Stage 3 dysfunction. These patients often have damage beyond what conservative management can help. Surgical options at this point depend on the degree of tendon damage, adjacent tendon involvement, and the presence of degenerative joint disease. In the presence of isolated tibialis posterior disease without joint degeneration, the previous combination of primary tendon repair, flexor digitorum longus augmentation, and Evans calcaneal osteotomy is still a viable option. Due to the increased amount of tendon damage, a complete medial arch repair is recommended. This includes repair and tightening of the tibialis posterior tendon and plication of the spring ligament. Although transfer of the tibialis anterior tendon into the "key-hole slot" of the navicular is not typically performed by the authors, it is a consideration.

Figure 6. Significant tendon disruption with little continuity remaining.

A subtalar arthroereisis procedure can be used in place of the Evans calcaneal osteotomy. In cases where there is significant damage to the long flexor tendons, the flexor tendon transfer procedure is not recommended. These patients are best managed by talar-navicular arthrodesis along with the Evans calcaneal osteotomy or subtalar arthroereisis. Tibialis posterior tendon repair with augmentation from the tibialis anterior is another possibility in this latter stage. The authors have no experience with this particular alternative.

STAGE 4

Stage 4 patients tend to present with more severe subjective and objective symptomatology. Subjectively, their pain is described as chronic and persistent through the day. The area of discomfort can be medial, lateral, or both. There is little to no response to a change of shoe styles. The "rolling in" appearance of the ankle described in Stage 3 is very pronounced in Stage 4. Shoes typically demonstrate greater medial heel wear and medial counter breakdown. More proximal symptomatology, such as ankle and knee pain, is also common in Stage 4.

Objectively, the deformity becomes apparent with early inspection. Medial and lateral edema and malalignment at the subtalar and mid-tarsal joints

are the most readily noted findings. The involved foot will often sit in an abducted attitude compared to the contralateral foot. Pain is present throughout the medial arch and medial malleolar area. Direct palpation and range of motion exams are painful and poorly tolerated.

Manual muscle testing and the "single heel rise" test demonstrate severe weakness and confirm the complete tear documented on MRI of the tibialis posterior tendon. The long flexor tendons are also affected in many of these patients. The degree of weakness does not rival that of the tibialis posterior tendon, but can be very significant. The lateral aspect of the foot, including the subtalar and calcaneal-cuboid joints, are typically more symptomatic during this stage. In addition, the deltoid ligament along the medial ankle region is often weakened and painful. Gait examination confirms the complete rupture as the foot remains completely pronated throughout the gait cycle. An antalgic limp can also be appreciated in most instances. Although the deformities are still at least partially reducible, early arthritic changes at the involved joints are beginning to occur. In some instances, especially those present for a long duration, the arthritic changes can be advanced. This becomes important when selecting appropriate treatment options.

Standard radiographs reveal advanced subluxations occurring at the subtalar and mid-tarsal joints (Fig. 7). Increased soft tissue edema is noted medially and often laterally. Actual arthritic changes can vary from mild to advanced, depending in large part on the duration of deformity. An anteroposterior view of the ankle should be taken to rule out medial ankle tilting. MRI confirms a complete rupture of the tibialis posterior tendon. This can occur either intra-tendinous or as an avulsion from the navicular (Figs. 8A, 8B). An area of scar and fibrosis is seen between the ruptured ends. Secondary damage to the flexor hallucis and flexor digitorum longus tendons is very common and should be suspected until proven otherwise (Fig. 9).

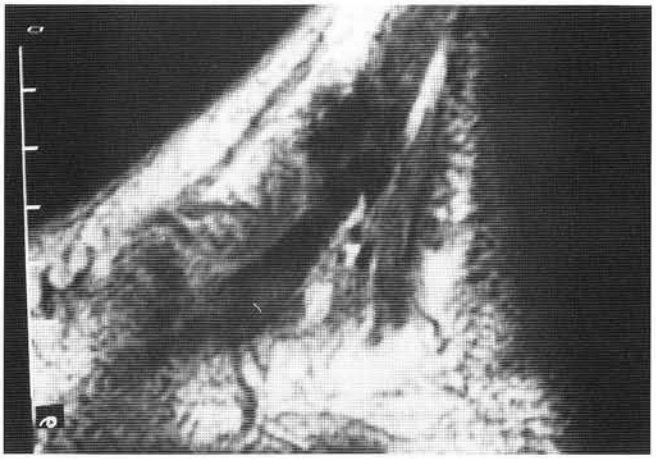

Figure 8A. Complete mid-body rupture.

Figure 7. Severe transverse plane subluxations at the metatarsal joint and subtalar joint.

Figure 8B. Avulsion from the navicular.

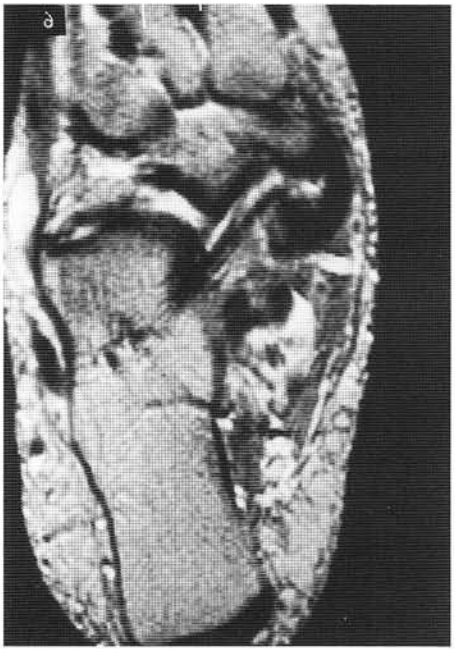

Figure 9. Early breakdown occurring at flexor hallucis longus and flexor digitorum longus.

Conservative management is primarily palliative at this stage. There is little hope of rehabilitating the ruptured tendon to any degree of normalcy. Physical therapy should be aimed at supplying symptomatic relief. The UCBL device should be attempted, but is many times poorly-tolerated due to the degree of subluxation that occurs. The authors have also used an ankle-foot orthosis (AFO) with some success in this stage of deformity. Molded or orthopedic shoes can also be helpful in those patients who are not good surgical candidates.

Due to the severe degree of damage present in the various medially-placed tendons, soft tissue repairs are usually ineffective. These patients typically require at least a talar-navicular fusion if not a triple arthrodesis. If an isolated talar-navicular fusion is performed, an Evans calcaneal osteotomy or subtalar arthrosis should be included in the reconstruction.

STAGE 5

In Stage 5 tibialis posterior dysfunction, the patient is at the end stage of the deformity. The pain described at this stage is a result of the severe arthritic changes as much as it is from tendon rupture. Symptomatology is typically present both medially and laterally, and gross deformity is easily appreciated (Fig. 10). More supportive shoes do not seem to alter the pain, because the valgus subluxations occurring at the subtalar and ankle joints are too severe. Although the patients can rarely trace a history of a traumatic event, they do usually relate a slow, steady progression of pain and deformity. Secondary ankle and knee pain is commonly seen in conjunction with the pedal manifestations. This stage represents the classic end-stage unilateral flatfoot deformity described in the early literature. As knowledge of this entity has increased over the years, fewer patients progress to this stage.

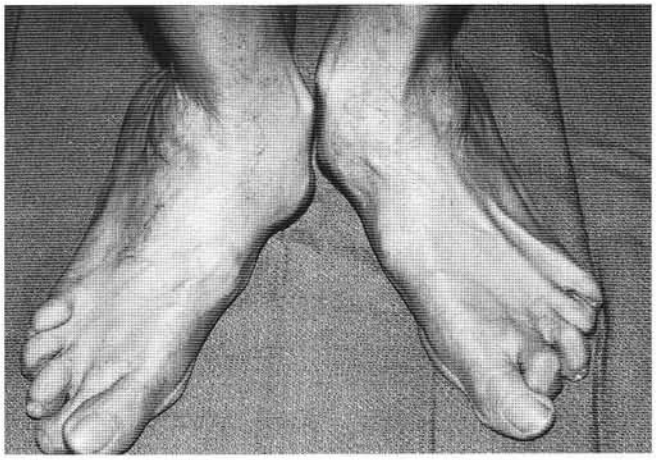

Figure 10. Clinical appearance of end-stage flatfoot.

Objectively, the patient presents with severe pain and deformity. Gross deformity is usually noted at the ankle, subtalar, and mid-tarsal joints. The majority of deformity is seen in the transverse (midfoot abduction) and frontal (subtalar and ankle valgus) planes. In many instances, a forefoot supinatus is present as well. Deformity in the sagittal plane also exist, represented by a severe equinus condition. The subluxations seen in this stage are usually rigid and non-reducible. Gait examination demonstrates severe valgus rotation at the heel and ankle often causing weight bearing to occur on the talar head.

Standard radiographs confirm the severely arthritic subluxations along the subtalar and mid-tarsal joints (Fig. 11). MRI studies are not usually needed for confirmation at this stage due to the obvious clinical presentation. If they were performed, they would be consistent with the complete rupture described in Stage 4, with the only difference being the advanced arthritic changes and rigid nature of the subluxations seen in Stage 5.

Figure 11. Note the severe joint malalignment and degenerative arthritis at the metatarsal joint and subtalar joint.

Due to the advanced degree of deformity seen in these patients, conservative treatment is once again aimed at pain relief. Correction of the deformity is unrealistic at this point. Biomechanical and structural support with orthotic therapy or bracing is poorly tolerated. Molded shoes to accommodate the subluxations can offer some subjective improvement with pain and gait disturbances.

When conservative treatment fails and if the patient is a good surgical risk, surgical intervention should be entertained. The only legitimate surgical option is a triple arthrodesis with an equinus release. This stage of deformity is typically seen in an older population, making the decision to perform surgery even more difficult. When performed properly, the triple arthrodesis can drastically improve the patient's quality of life.

CONCLUSION

This classification scheme offers a comprehensive look at tibialis posterior tendon dysfunction. It takes into account the etiology, actual tendon damage, progression of deformity, and clinical and radiographic findings. In addition, it takes the various conservative and surgical treatment options that are sporadically described in the literature and identifies their proper place in managing this condition. Although it is not universally accepted, the authors firmly believe an MRI study is required to accurately identify the stage of deformity and apply appropriate treatment. It is of paramount importance to know the degree of actual tendon damage to all the medial tendons (TP, FHL, FDL). This will obviously help determine whether soft tissue repair is possible or if arthrodesis is needed. The exception to this statement is the end-stage deformity seen in the final phase.