# Posterior Tibialis Tendon Dysfunction & Repair

Surgical Indications and Considerations

*Anatomical Considerations*: The posterior tibialis muscle arises from the interosseous membrane and the adjacent tibia and fibula in the proximal 1/3 of the leg. The tendon runs within its sheath, posterior to the medial malleolus, beneath the flexor retinaculum. The tendon also runs posterior to the axis of the ankle joint and medial to the subtalar joint. It inserts in a fan-like manner into the navicular, the three cuneiforms, and the plantar surfaces of the base of the second, third, and fourth metatarsals. The posterior tibialis muscle is a plantar flexor and invertor of the foot. At the midtarsal joint, it is an adductor of the forefoot opposing the action of the fibularis brevis.

This muscle functions mainly in the stance phase of gait. After heel contact, the muscle acts as a shock absorber for the subtalar joint limiting hindfoot eversion through eccentric contraction. In midstance, contraction of the posterior tibialis muscle causes subtalar inversion thereby causing the calcaneocuboid and talonavicular joints to lock. This locking creates a right lever for forward propulsion of the foot over the metatarsal heads. During the swing phase, the tibialis posterior functions to accelerate subtalar joint supination and assists in heel lift.

If there is an existing dysfunction in the posterior tibialis muscle, there is a decrease in tibial deceleration and greater hindfoot eversion. This then leads to increased tension and stretching in the ligaments during contact phase. This also results in a lack of a rigid lever for push-off and decreased tarsometatarsal joint stability and hindfoot inversion. The gastrocnemius and soleus muscles begin to act at the midfoot rather than at the metatarsal heads, which starts creating excessive midfoot stress allowing increased midfoot abduction. All these add to a dysfunction in gait resulting in progressive midfoot collapse, forefoot abduction, and excessive hindfoot valgus.

From an anatomical and biomechanical view, the posterior tibialis tendon hugs the undersurface of the medial malleolus and takes on a shaper curve compared with all the other tendons passing along the medial aspect of the ankle. The tendon is also under an increased amount of tension in the area posterior and distal to the medial malleolus, especially during dorsiflexion and eversion of the foot.

There is a zone of hypovascularity present in the mid-portion of the posterior tibial tendon. This zone starts approximately forty millimeters from the medial tubercle of the navicular and runs proximally for about fourteen millimeters.

*Pathogenesis*: Studies have shown that a healthy tendon will not tear with acute stress. Instead the muscle, insertion, origin, or musculotendinous junction will fail first. On the other hand, a diseased tendon will rupture secondary to the application of a sudden force. Rupture of the posterior tibial tendon may be related to both local and systemic vascular impairments. Age, hypertension, diabetes, obesity, previous foot or ankle trauma/surgery, traumatic disruption of local blood supply, and the administration of corticosteroids may lead to vascular compromise and subsequent tendon rupture.

*Epidemiology*: Posterior tibialis tendon ruptures occur predominantly in the late middle-aged population (average age 57 years). For posterior tibialis dysfunction, the patient is typically a female over the age of 40 who exhibits ligamentous laxity in multiple joints and has an occupation that requires extended periods of standing. They usually do not recall any acute traumatic event. There is another subset of the populations in which posterior tibial tendon insufficiency occurs and that consists of the 20- to 40-year old athletes. They usually recall a traumatic event, usually a direct blow to the medial malleolus. Or, they present with years of involvement in athletics with a pronated foot.

*Diagnosis*

- Swelling along the medial aspect of the foot and ankle
- Progressive loss of longitudinal arch → pes planus and heel valgus
- "Too many toes" sign secondary to an increase in forefoot abduction and heel eversion
- Positive first metatarsal rise sign
- Palpable pain between medial malleolus and navicular
- Positive single heel rise (painful but normal rise; rise without inversion of the hindfoot; no elevation of the heel possible)
- Radiographic studies taken with patient weight bearing along with the contralateral foot to evaluate for pathologic changes secondary to the dysfunction

*Classification of Posterior Tibial Tendon Dysfunction*

| Author | Stage I | Stage II | Stage III |
|---|---|---|---|
| Johnson and Strom | Peritendinitis with mild weakness and pain | Elongation of tendon, moderate pain, weakness of tendon, mobile valgus rearfoot | Fixed valgus position of rearfoot with subtalar joint arthrosis, medial and lateral rearfoot pain |

**Myerson also describes an additional stage, Stage IV: rigid hindfoot, valgus angulation of the talus with ankle joint degeneration.

*Nonoperative Versus Operative Management*: The patient's age, weight, and activity level, and the severity of the deformity influence treatment. As with many other pathologies, conservative treatment should be attempted before any surgical interventions are considered. As the severity of the pes planus increases, the treatment options become more and more limited. Once the deformity reaches stage IV, arthrodesis is the only option.

Conservative treatment can be broken down into two sections, those with an acute onset and those with a chronic condition. For the patient with an acute onset, rest and oral anti-inflammatory medication is given initially. In 2 to 3 months, if the symptoms do not resolve, the treatment progresses to include a lower extremity casting. This cast is left on for 4 to 6 weeks, which provides a longitudinal arch support and guarantees rest to the posterior tibialis muscle. With this cast, the patient is allowed to bear weight as tolerated and uses pain level as a guide. If after the cast is removed and the patient remains to have symptoms but still does not opt for surgical intervention, the patient is fitted for orthotics and their shoe is modified permanently.

During rehab, using ice after exercise and an air stirrup brace or lace-up ankle support can be beneficial. Strengthening and lightweight stretching should also be started after the tenderness has resolved. Orthotic control of excessive pronation and strengthening/movement re-education of the tibialis posterior, peroneous longus, and gastrocnemius-soleus has proven to be effective. The combination of these interventions has been shown to significantly reduce the magnitude of rearfoot pronation more than orthotics alone. This is important to realize for both conservative and post-operative management.

For the patients with a chronic condition, the goal of treatment is to relieve their symptoms and to slow the pes planus progression. A molded ankle foot orthosis, or patellar tendon bearing foot ankle orthosis, which redistribute forces proximally, thereby reducing stress in the foot and ankle region can be helpful.

*Surgical Procedure*: If constant attempts at conservative intervention fail, the next progression is operative treatment. There are several options when surgery is the treatment of choice. The decision on which type of procedure should be completed takes into account the severity of the rupture and the mobility of the hindfoot. Surgery types may include the following: primary repair, synovectomy, tendon transfer, calcaneal osteotomy, and arthrodesis.

Primary repair – Completed for an acute rupture or laceration. If no sign of degeneration is present and the tear or laceration is complete, repair consists of primary end-to-end suturing.

Synovectomy – Indicated by tenosynovitis or tendinitis of the intact tendon that continues despite efforts of conservative management. Debridement of the tendon and opening of the tendon sheath often results in resolution of symptoms. Failing to complete this operation may allow the tendon to degenerate and rupture eventually.

Tendon Transfer – May be completed if foot is mobile and supple without evidence of a fixed hindfoot or forefoot deformity. Contraindications of this procedure include obesity, large build, sedentary lifestyle, older than 70 years, and a hypermobile foot. The tendon that is transferred is the flexor digitorum longus.

Calcaneal Osteotomy – Those who have a flexible valgus deformity of the hindfoot may have this procedure completed. The calcaneus is shifted medially to place the hindfoot in a varus position. This redirects the gastrocnemius-soleus pull medial to the subtalar joint.

Arthrodesis – Indications include fixed deformities of the forefoot or hindfoot. Arthrodesis should be completed on as few joints as possible required to stabilize the foot, reduce pain, and establish a plantigrade position. This is due to the fact that the more joints subjected to arthrodesis, the more stable the foot becomes, yet it comes at the cost of lesser flexibility of the foot.

*Preoperative Rehabilitation:*

- Orthotics to prevent further hindfoot valgus
- Patient education on post-operative care
- Patient education on use of crutches secondary to non weight bearing post-operation

POSTOPERATIVE REHABILITATION
For tendon transfer procedure

**Phase I** for Immobilization and Rehabilitation: Weeks 1-4
Goals: Control edema and pain
Minimize deconditioning

Intervention:

- Patient has short leg cast with foot in plantar flexion and inversion
- Instruction on crutch ambulation with non-weight-bearing status on all surfaces
- Initiate cardiovascular program
- Ice (if possible) and elevate extremity

**Phase II** for Mobilization and Rehabilitation: Weeks 5-9
Goals: Continue to control edema and pain
Prevent cardiovascular deconditioning
Encourage full weight bearing during gait cycle
Out of cast approximately week 9

Intervention:

- Patient has short leg walking cast with foot in neutral
- Weight bearing as tolerated with appropriate assistive devices
- Gross strengthening and cardiovascular activities

**Phase III** for Mobilization and Rehabilitation: Weeks 9-23
Goals: Normalization of gait cycle
Obtain full ankle range of motion
Improve strength
Return to prior level of function

Intervention:

- Soft tissue mobilization to prevent scar adhesions
- Strengthening all foot musculature with focus on posterior tibialis muscle and intrinsic muscles of the foot
- Increasing ankle proprioception
- Gait training
- Balance activities
- Functional task specific training

**Phase IV** for Mobilization and Rehabilitation: Week 24

Goals: Return to sports activities

Intervention:

- Sport specific tasks

**Progression is dependent on status of repaired tendon and per physician's orders

Selected References:

Churchill R, Sferra J. Posterior tibial tendon insufficiency. Its diagnosis, management, and treatment. *Am J Orthop*. 1998;27:339-347.

Fleischli J, Fleischli J, Laughlin T. Treatment of posterior tibial tendon dysfunction with tendon procedures from the posterior muscle group. *Clin Podiatr Med Surg.* 1999;16:453-470.

Frey C, Shereff M, Greenidge N. Vascularity of the posterior tibial tendon. *J Bone Joint Surg Am.* 1990;72:884-888.

Holmes G, Mann R. Possible epidemiological factors associated with rupture of the posterior tibial tendon. *Foot Ankle.* 1992;13:70-79.

Janis L, Wagner J, Kravitz R, Greenberg J. Posterior tibial tendon rupture: classification, modified surgical repair, and retrospective study. *J Foot Ankle Surg*. 1993;32:2-13.

Johnson K, Strom D. Tibialis posterior tendon dysfunction. *Clin Orthop*. 1989;239:196-206.

Mosier S, Pomeroy G, Manoli A. Pathoanatomy and etiology of posterior tibial tendon dysfunction. *Clin Orthop*. 1999;365:12-22.

Weimer KM, Reischl SF, Requejo SM, Burnfield JM, Kulig K. Nonoperative treatment of posterior tibialis tendon dysfunction: a randomized clinical trial. Published abstract from APTA Combined Section Meeting, 2005.

Feltner ME, et al. Strength training effects on rearfoot motion in running. *Med & Science in Sport & Exerc*. 1994:1021-1027.