

Tarsal Tunnel Release

Surgical Indications and Considerations

Anatomical Considerations: The tarsal tunnel is a fibro-osseous tunnel created by the tibia anteriorly, posteriorly by the talus, and laterally by the calcaneus. The flexor retinaculum (lacinate ligament) overlays the contents of the tarsal tunnel, which includes the posterior tibialis, flexor digitorum, flexor hallucis longus, posterior artery/vein, and the posterior tibial nerve. The posterior tibial nerve has three main entrapment sites: proximal at the flexor retinaculum, and distally at the medial and lateral plantar nerve (branches from the posterior tibial nerve located at the distal ends of the tarsal tunnel).

Pathogenesis: Tarsal tunnel syndrome is an entrapment neuropathy, which occurs as a result of compression of the posterior tibial nerve. In some cases, it is referred to as an ischemic compartment syndrome and exceeding the threshold of tissue pressure at the tunnel can be associated with a reproduction of symptoms and changed in nerve function.

Epidemiology: Specific causes of the syndrome can be identified in 60-80% of patients. The most common causes including trauma, varicosities, heel varus, fibrosis, and heel valgus. Tendonitis within the tunnel can cause entrapment of the posterior tibial nerve due to the decreased space, and tethering at the abductor hallucis can cause a stretch injury at the branches tibial nerve within the tunnel. Generally the causes of this syndrome can be placed into three categories: 1) Trauma, 2) Space occupying lesion, and 3) Deformities of the foot. It tends to have a slight female predominance of 56%. Other factors that predispose the patient to a tarsal tunnel syndrome can include rapid weight gain and inflammatory arthropathies such as ankylosing spondylitis and rheumatoid arthritis. The inflammatory autoimmune diseases cause an increase in synovium causing synovitis within the tunnel. Along with this syndrome, development of a “Double Crush Syndrome” can occur. This is when there are multiple sites of nerve entrapment. When pain radiates up the proximal leg, this is called “Valleix Phenomenon,” and is commonly seen with the “Double Crush Syndrome.”

Diagnosis:

- History of pain/paresthesia along the posterior tibial nerve and its branches
- Physical examination includes: inspection of foot deformities, sensory testing, muscle strength testing of the foot intrinsics (especially the flexion of the toes), palpation/percussion (Tinel’s test) of the posterior tibial nerve, and tibial nerve tension testing
- Radiograph’s to determine deformities or bony injury
- EMG study to determine motor and sensory nerve damage
- MRI to determine soft tissue damage or deformity, nerve damage, thickening of the flexor retinaculum, and space occupying lesions.
- Differential Diagnosis: lumbosacral radiculopathy, matatarsalgia, rheumatoid arthritis, plantar fasciitis, peripheral neuritis, diabetic neuropathy, peripheral vascular disease, and morton neuroma.

Nonoperative Versus Operative Management: Nonoperative treatment is most effective when the nerve entrapment/compression is caused by tenosynovitis and flexible foot deformities. Space occupying lesions tend not to respond to conservative treatments. The space occupying lesions can include ganglia's, lipomas, chronic thrombophlebitis, and varicosities. Better surgical results are seen in the following: young, short history of symptoms, no history of ankle pathology, early diagnosis prior to motor involvement, and a localized lesion is identified. Failure of the decompression or decreased satisfaction with the surgical release tends to occur with the following factors: older, chronic symptoms with motor involvement, double crush syndrome, vallix phenomenon, systemic disease process, idiopathic causes, inadequate release of the tissue, and pes plantus feet.

Surgical Procedure: An incision is made 10 cm to the tip of the medial malleolus and 2 cm posterior to the posterior margin of the tibia. During the proximal release, the flexor retinaculum is released from its proximal extent near the medial malleolus to the sustentaculum tali. The tunnel is followed distally, and release of the fascial arcade around the medial and lateral plantar nerve branches should be followed through to the abductor hallucis.

Discussions of surgical complications have been infrequently reported in literature. One case study published an incident of the posterior tibial tendon subluxing following decompression. Follow-up studies on patients who have had decompression have also been infrequent. Currently, the longest follow up study has been an average of 31 months post surgery, with the result of only 44% of the patients receiving significant benefit out of a total of 32 surgical decompressions.

Preoperative Rehabilitation: Conservative treatments include as immobilization, orthotics, strengthening and balance exercises, pharmacological medications, steroid injections, and inflammatory reducing modalities. In some studies, conservative treatments also included whirlpool therapy and having the patient wear wider shoes. These conservative tools are most effective with tenosynovitis cases and flexible foot deformities. When the co-existence of lumbar nerve root compromise or sciatic nerve entrapments occurs with tibial nerve entrapments, the treatment of both entrapment sites is considered to be essential for a favorable outcome to occur. Once the source of the mechanical nerve entrapments have be addressed, neural gliding techniques may be employed in order to minimize fibrosis at peripheral nerve interfaces. It is very important to understand patient irritability and peripheral nerve healing rates, so as to not increase neurogenic complaints with neural gliding techniques. The ones who are most likely not to respond to these treatments are patients with space occupying lesions, long-term nerve irritation that has produced motor deficits, and a long, chronic history of tarsal tunnel syndrome symptoms.

POSTOPERATIVE REHABILITATION

Note: The research articles only released information for phase one for post-operative procedures. For phase two and three, common rehabilitation protocols for ankle rehabilitation

were taken from: Stephenson K, Saltzman C, Brotzman S. Foot and Ankle Injuries. In Brotzman A, Wilk K., *Clinical Orthopaedic Rehabilitation*. Philadelphia, 2003, Mosby.

Phase I for Immobilization and Rehabilitation: Weeks 1-3

Goals: Protect joint/nerve Integrity
 Control inflammation
 Control pain/edema

Intervention:

- Immobilization with non-weight bearing precautions to protect the nerve and overstretching of the surgical site
- Passive mobilization to prevent edema and maintain joint integrity post 1-2 weeks per MD request. This may include selective hallux, phalange, and ankle PROM in order to prevent fibrosis of the FHL, FDL, and Posterior Tibialis tendons as they traverse through the tarsal tunnel.
- Instruct in surgical site protection and infection prevention strategies
- Elevation and ice to control swelling
- Educate and monitor non-weight-bearing crutch ambulation

Phase II for Immobilization and Rehabilitation: Weeks 3-6

Goals: Prevent contractions and formation of scar tissue adhesions
 Maintain soft tissue and joint mobility

Intervention:

- Progress weight bearing as tolerated - starting from non-weight bearing to weight bearing
- Gentle passive, active-assist, and active ankle stretches out of splint
- Initiate gentle passive dorsiflexion stretching with towel or strap
- Initiate tibial nerve gliding techniques, starting with anti-tension techniques of the tibial nerve (foot plantarflexed and inverted), and moving from the hip or knee. As irritability decreases and no evidence of post-treatment latency is evident, progressing to mobilization of the foot into dorsiflexion and eversion.
- Initiate gentle, pain free, weight-bearing dorsiflexion stretches
- Gait training wearing protective splint, to tolerance
- Pool therapy under buoyancy conditions – walk or run

Phase III for Immobilization and Rehabilitation: Weeks 6-12 to 24

Goals: Normal gait mechanics for walking and running on level surfaces
 Symmetric ankle mobility and single-leg proprioception
 Ability to perform repeated single leg heel raises pain free
 Initiate sport-specific or job-specific skill development exercises

Intervention:

- Gait training out of walking splint to pain free tolerance
- Pain free resistive ankle exercises using elastic tubing or band
- Continue intervention strategies listed in Phase II as indicated by remaining impairments
- Progress stretching exercises to initiate body weight stretching over incline or wedge
- Progress resistive exercises to body weight exercises
 - Partial to full weight bearing Progression
 - Evaluate compensations and muscular weakness determine specific therapeutic exercises
- Progress proprioceptive and balance training from single to multi-planar unstable conditions (such as a BAPS board, BOSU ball, ½ roller, foam surfaces) or advanced single-leg balance activities
- With no pain with over pressure or during walking, patient may begin pain walk/run progression and/or sport-specific or job-specific skill development
- Cardiovascular conditioning on stationary bicycle to pain free tolerance
- Resistive exercises for weakened muscle groups
- Initiation of low level plyometric activities for sport specific activities

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