Available online at www.sciencedirect.com
SCIENCE DIRECT
The Foot 15 (2005) 212–216
The Foot
www.elsevierhealth.com/journals/foot

Review

The surgical treatment of tarsal tunnel syndrome

Samrendu K. Singh *, Michael G. Wilson, Christopher P. Chiodo

Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

Abstract

Tarsal tunnel syndrome is an entrapment neuropathy involving the posterior tibial nerve within the tarsal canal. Typical symptoms include burning pain and paraesthesia along the medial ankle and plantar aspect of the foot. Although potential causes of tarsal tunnel syndrome include trauma, varicosities, tenosynovitis, space-occupying lesions, and hindfoot deformity, in most cases the aetiology is idiopathic. Surgical release of the posterior tibial nerve and its terminal branches is indicated if symptoms persist despite non-operative treatment. In this article, we discuss the pre-operative evaluation of these patients and illustrate in detail our preferred technique for surgical release.

Keywords: Tarsal tunnel syndrome; Nerve entrapment; Surgery; Posterior tibial nerve

Contents

1. Introduction

The tarsal tunnel is a fibro-osseous space located posterior to the medial malleolus. Several structures pass through this space, including the posterior tibial nerve, the posterior tibial artery and vein, and the tendons of the flexor hallucis longus, flexor digitorum longus, and posterior tibial muscles. The tarsal tunnel is bordered by the tibia anteriorly and the talus and calcaneus laterally. Medially it is covered by the flexor retinaculum. The flexor retinaculum, also referred to as the lacinate ligament, is contiguous with the crural fascia proximally.

Tarsal tunnel syndrome is an entrapment neuropathy of the tibial nerve or one of its branches as it passes through the tarsal tunnel. Potential causes of tarsal tunnel syndrome include trauma, varicosities, tenosynovitis, space-occupying lesions, and hindfoot deformity; however, in many cases the aetiology is idiopathic [1–4]. It is also important to note that compression of one of the distal branches of the nerve as they pass deep to the abductor hallucis muscle can produce symptoms similar to those caused by proximal compression within the tarsal tunnel proper [5]. Compared with carpal tunnel syndrome, tarsal tunnel syndrome is much less common. One possible explanation for this is the fact that the tarsal tunnel is wide and shallow. Further, it is covered by a thin retinaculum making it a more compliant space than the carpal tunnel [6].

2. Pre-operative assesment

Patients with tarsal tunnel syndrome typically complain of burning pain and/or paraesthesia along the medial ankle and the plantar aspect of the foot. The pain may radiate distally

* Corresponding author. Present address: "Fermain", Bickley Park Road, Bickley, Kent BR1 2AY, UK. Tel.: +1 617 983 7202; fax: +1 617 983 7201.
E-mail address: samrendu@yahoo.co.uk (S.K. Singh).

0958-2592/$ – see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.foot.2005.07.005

or proximally. Proximal radiation, although less common, is referred to as the Valleix phenomenon. Infrequently, patients will complain of numbness in the sole of the foot. A complete past medical history and review of systems should always be obtained. Specifically, patients should be queried about a history of back pain, radiculopathy, diabetes, or peripheral neuropathy.

Physical examination of a patient suspected of having tarsal tunnel syndrome begins with assessment of hindfoot alignment with the patient standing. Biomechanically, hindfoot valgus puts the tibial nerve under tension. Alternatively, hindfoot varus may contribute to nerve compression. Next, with the patient sitting, the tarsal tunnel is inspected for inflammation and palpated for masses. The posterior tibial nerve should be percussed over its entire course. Percussion over the entrapped segment of nerve typically produces a Tinel's sign and reproduces the patient's symptoms. Kinoshita et al. have described a dorsiflexion-eversion test for diagnosing tarsal tunnel syndrome [7]. With this test, the ankle is passively maximally everted and dorsiflexed while all of the metatarsophalangeal joints are maximally dorsiflexed and held in this position for 10 s. This should temporarily induce or exacerbate the numbness or pain. Distal sensory examination of the foot should be performed although usually it is not revealing.

Weight-bearing radiographs of the foot and ankle should be obtained in all patients suspected of having tarsal tunnel syndrome. These will identify bony abnormalities and allow for further assessment of hindfoot alignment.

Magnetic resonance imaging (MRI) plays a valuable role in elucidating the individual aetiology of tarsal tunnel syndrome. In one recent investigation, abnormal findings were present in 85% of patients with this disorder [8]. While in most cases the abnormal pathology consisted of tenosynovitis, other diagnoses included varicosities, ganglion, lipoma, hemangioma, and neurofibrosarcoma. Given this data, we routinely obtain MRI scans in patients with refractory symptoms and in those undergoing surgical release (Fig. 1).

Electrodiagnostic studies also play a crucial role in the pre-operative evaluation of patients with tarsal tunnel syndrome. It addition to confirming the diagnosis, electrodiagnostic studies also help to differentiate tarsal tunnel syndrome from radiculopathy or peripheral neuropathy. Motor-nerve conduction studies are the least reliable with an overall diagnostic sensitivity of 47% [9] while the reported diagnostic sensitivity of sensory-nerve conduction studies ranges from 90–100% [10]. Mixed-nerve conduction studies have been used in the assessment of patients with tarsal tunnel syndrome. Although this technique has a sensitivity of 86% [11], its specificity is superior to sensory-nerve conduction velocities and is therefore a useful adjunct. When a patient's symptoms and physical examination are consistent with tarsal tunnel syndrome, a positive electrodiagnostic test can help to confirm the diagnosis. It is important to note, however, that electrodiagnostic tests are not 100% accurate and that a normal study does not exclude the diagnosis.

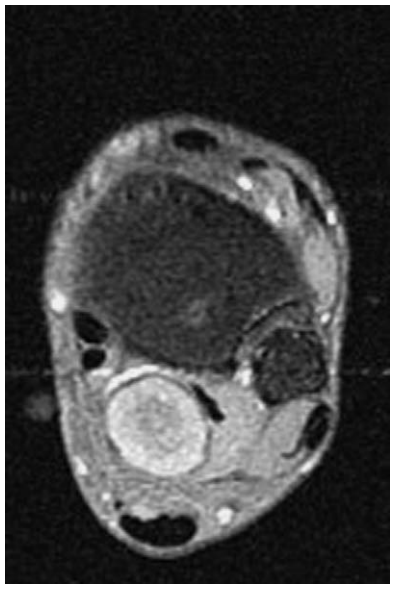

Fig. 1. A 42-year-old male presented with tarsal tunnel syndrome. The T1 axial MRI-scan showed a posteromedial mass. This lesion was found to be a nerve sheath tumour.

The differential diagnosis of tarsal tunnel syndrome is extensive and includes posterior tibial tendon dysfunction, FHL and FDL tenosynovitis, plantar fasciitis, stress fracture, arthritis, hindfoot deformity, radiculopathy, peripheral neuropathy, peripheral vascular disease, and venous varicosities. Each of these disorders should be considered in the evaluation of patients with symptoms of tarsal tunnel syndrome.

3. Technique for surgical release

Surgical release of the tarsal tunnel is indicated in symptomatic individuals who do not respond to at lease three months of non-operative therapy. Potential non-operative treatment measures include non-steroidal anti-inflammatory medications, physical therapy, orthotics, and immobilization in a cast or fracture boot.

At surgery, the patient is positioned supine on the operating table. Either general or regional anesthesia is used. To maximize visualization of the nerve, especially its smaller distal branches, the use of a pneumatic thigh tourniquet and loupe magnification is recommended. Bipolar electrocautery should also be used; otherwise, no special instrumentation is required.

The incision begins 6–8 cm proximal to the tip of the medial malleolus and extends distally along the course of the nerve, approximately 1–2 cm posterior to the tibia and medial malleolus. Respectful handling of the soft-tissues and meticulous hemostasis will help to minimize post-operative swelling and pain. At the level of the malleolus, the incision curves gently anteriorly, approximating the course of the main branch of the lateral plantar nerve (Fig. 2). The incision is deepened through the subcutaneous tissues to expose the