

Overview

Patients presenting with or experiencing one or more of the following symptoms: Tingling, burning, numbness, pain including shooting and localised may have Tarsal Tunnel syndrome. The typical presentation can be felt on the inside of the ankle and or on the plantar surface of the foot. Symptoms may be isolated or occur in just one localised area, in others it may extend to the heel, arch, and toes and can even radiate to the calf. Onset of symptoms can be suddenly brought on by or aggravated by overuse of the foot such as prolonged standing, walking or exercising. Early presentation, diagnosis and treatment are important as prolonged and untreated tarsal tunnel syndrome can lead to permanent nerve damage. Correct evaluation is essential so that the diagnosis can be made and appropriate treatment put into place.

The tarsal tunnel is a narrow space found on the inside of the ankle next to the ankle bones. It is covered with a thick ligament called the flexor retinaculum with the function being to protect and maintain the structures within the tunnel namely arteries, veins, tendons and nerves. One of these structures is the posterior tibial nerve which is the focus of tarsal tunnel syndrome. The compression or squeezing on the posterior tibial nerve produces symptoms known as tarsal tunnel syndrome. The posterior tibial nerve runs along the inside of the ankle into the foot. It is a cause of foot and ankle pain mainly in adults.

Aetiology

In 1962 Keck and Lam first described the syndrome and its treatments. It was described as a compression of the tibial nerve or its associated branches as the nerve passes underneath the flexor retinaculum at the level of the ankle or distally. Multifaceted compression neuropathy typically manifests itself with paresthesia and pain that radiates medially to the ankle, medial ankle distally and has been known to be proximally. The causes can be described as extrinsic, intrinsic or tensioning factors in the development of signs and symptoms.

- (a) Extrinsic factors contributing to the development of tarsal tunnel syndrome, such as trauma, a crush injury, fractures, dislocation of the ankle and hind foot, severe or repetitive ankle strain.
- (b) Intrinsic causes includes base occupying masses, tumours, bony prominences, ganglion cysts, swollen tendons, arthritic bone spurs, ankle sprains and other injuries leading to an inflammatory response and swelling in or around the tunnel can lead to compression of the nerve.



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- (c) A rear foot valgus deformity may increase the potential for tarsal tunnel syndrome as it increases the tension due to the eversion and dorsiflexion of the foot
- (d) Diabetes, arthritis and other systemic diseases can also cause swelling within the compartment leading also to compression of the nerve.

Compression and tension neuropathies are similar in aetiology and can co-exist therefore it is important to distinguish the differences when assessing for tarsal tunnel. Soft tissue masses such as tendon sheath ganglion, neoplasms within the tarsal canal, nerve tumours and varicose veins.

A study by Daniels et al showed that a valgus deformity of the rear foot may be a contributing factor to neuropathy by increasing the tensile load on the tibial nerve. A study by Upton and McComas in 1973 published a hypothesis of the double crush phenomenon. It states local damage to the nerve at one side along its course may sufficiently impair the functioning of the nerve cells (axonal flow) leading to nerve cells becoming more susceptible to compression trauma at distal sites transmitting afferent and efferent signals along the nerve path as well as moving their own nutrients for optimal functioning is the responsibility of the nerve. If the flow of nutrients along the nerve path is blocked the nerve tissue distally to that site of compression is nutritionally deprived and therefore more susceptible to injury.

Upton and McComas also suggested that a higher proportion up to 75% of patients with one peripheral nerve lesion did in fact have a second lesion elsewhere leading to the conclusion that both lesions contributed to patients' symptoms. The study looked at the brachial plexus injury with an increase in incidents of carpal tunnel neuropathy. Further conclusions were drawn that a double crush phenomenon in the feet could exist with the compression of S1 nerve root increasing the compression neuropathy into the tarsal tunnel.

CLINICAL PRESENTATION

As with any suspected neuropathy a careful review of the patients past medical history is important. Systemic diseases associated with peripheral neuropathy include diabetes and hypothyroidism should be considered. Medications can also cause neuropathy such medications include nitrous oxide, lithium, disulfiram and thalidomide. Conditions requiring such medication are also typically associated with distal symmetry sensory motor neuropathy. A patient's exposure to solvents, heavy metals, drugs and alcohol should also be noted. Vague symptoms of foot pain can often be confused with the presentation of plantar fasciitis. Eversion and dorsiflexion at the end point range of motion may cause symptoms to increase. Paresthesia and numbness are not uncommon. Atrophy of the intrinsic foot muscles may be noted however difficult to palpate.

The tinel sign is used to detect irritated nerves. To perform the clinician lightly tapping (percussing) over the nerve may elicit a sensation of tingling or pins and needles in the distribution of the nerve. It is deemed positive when the percussing causes tingling to occur along the nerve path as reported by the patient. Patients report sensation is induced posterior to the medial malleolus.

American Orthopaedist named George S. Phalen created a diagnostic test called the "Phalen's sign" which involves the compression of the suspected nerve for 30 seconds leading to the reproduction of the patient's symptom. There may be a reduced sensitivity to light touch and temperature. This can be ascertained using a pin-prick test or a monofilament.

Radiographic examination can show a decrease in bone density, thinning of the phalanges or in longstanding neuropathies, example Charcot disease.

Electromyography (EMG) can be used to demonstrate prolonged posterior tibial distal nerve latency to the abductor hallucis or abductor digiti quinti muscle, low motor amplitude or absent responses must also accompany this. Early onset medial and or plantar sensory action may be affected with prolonged latency, slow velocity and decreased amplitude. In advanced cases sensory action potentials can be unobtainable. Nerve conduction velocity studies (NCV) are a helpful tool in evaluating suspected cases of tarsal tunnel and to allow confirmation the presence of a neuropathy. These tests are best performed by an experienced neurologist.

EMG and NCV testing values include the following: -

1. Prolonged distal motor latency. A reading longer than 7.0 ms is deemed abnormal when there is a terminal latency of the abductor digiti quinti muscle.
2. There is a terminal latency of the abductor hallucis muscle longer than 6.2 ms are abnormal. Small fibre neuropathies in patients can cause the NCV studies to be normal therefore electro diagnostic testing is not and should not replace good clinical examination. Imaging studies such as magnetic resonance imaging (MRI) and ultra sonography are also modalities if a suspected soft tissue mass or a space occupying lesion may be present in the tarsal tunnel.
3. Plain radiography will help evaluate the patient's underlying foot structure, potential fractures, bony masses, subtalar joint coalition and osteophytes.

The proliferation of fibrous tissue leading to nerve compression and therefore decompression will require removal of the fibrous tissue. In most cases an intact perineural sheath can be found. This results from a chronic nerve irritation or compression leading to swelling.

Ganglion cysts leading to compressing on the peripheral nerve are unusual however have been found to be combined with neuromas as a not uncommon aetiology. There is a theory that fibrillar degeneration of collagen and the accumulation of intracellular and extracellular mucin is a cause or source of the ganglion cyst. When found during surgery these lesions are also commonly removed.

MEDICAL TREATMENT

1. Conservative approach in early treatment of a tarsal tunnel neuropathy can include a local injection of steroids into the tarsal canal. To aid in patient pain reduction the use of local anaesthetics and steroids injected into the site have also shown to give a complete relief of symptoms, however additional nerve injury can occur for an inappropriate placement of the syringe needles.
2. Physical therapy has shown to be a value in reducing soft tissue swelling thereby causing a decrease in pressure on the compartment and a reduction in pain.
3. Stretching exercises have also been shown to have been of benefit when there is a contracture of the gastrocnemius muscle.
4. In patients with a pes planovalgus foot type a custom prescribed foot orthosis may reduce tension on the tibial nerve by decreasing the load on the medial column. Providing a medial longitudinal posting on the orthotic in both the forefoot and rear foot can accomplish this.

SURGICAL THERAPY

Surgical therapy should be considered when conservative therapy fails to elevate the patient's symptoms or when symptoms are due to a space occupying mass which requires removal. Knowledge of the anatomy is required before attempting to release the affected nerve. Adhesions or scar tissue if found in surgical exploration as being the cause of the nerve infringement then a release of the epineurium is warranted.

INTRA OPERATIVE DETAILS

A curved incision is made one centimetre posterior to the distal tibia inter plantar direction parallel to the shaft and malleolus and curving towards the sustentaculum tail gradually.

The retinaculum should be identified and released in its entirety. Thus allowing the posterior tibial nerve to be identified and left undisturbed along the course until its bifurcation at the porta pedis.



The medial plantar branch of the posterior tibial nerve should be identified and tracked along the margins of the flexor sheath of the hallucis longus. At this time fibrous bands that may be evident constricting the nerve should be carefully released. Once all the tibial nerve branches are free of any fascial covering the tourniquet can be deflated and one observes for and controls any bleeding.

Closure of the subdermal layer can be completed but not the flexor retinaculum. The skin is closed with sutures.

A mild compression dressing and immobilisation is applied with the foot in a slightly inverted position to the infected area. Splinting and non-weight bearing will be for approximately three weeks, after the splint is discontinued weight bearing can begin and mobilisation to follow.

Mobilisation early on will help decrease the formation of scar tissue which itself may contribute to compression neuropathy. Once suture removal has happened patient should be able to resume the use of soft shoes, taking care to avoid pressure and irritation at the surgical site.

Pes planus foot types at this time require custom orthosis to stabilise the foot. A failure in adequately releasing the retinaculum will lead to poor post-operative results. Plantar fasciitis can be associated with persistent pain in the medial calcaneal region post-operatively. This needs to be addressed separately.

Post-operatively a mark to decrease in pain followed by a reduction of symptoms can be to the extent that a patient is able to tolerate them. The complete resolution of signs and symptoms may not be possible due to the many aetiologies and the likelihood of irreversible nerve damage.

A study by Mann showed that approximately 75% of patients who undergo surgical decompression have noted pain relief, and 25% obtained little or no relief.

There are concerns regarding decompression of the tibial nerve in patients with a marked pes planovalgus deformity because decompression of the medial retinacula compartment may be associated with increase in nerve tension. To the author's knowledge no studies have been performed to assess the long-term efficiency of decompression and stabilisation or decompression in orthosis management.

REFERENCES

1. Daniels TR, Lau JT, Hearn TC. The effects of foot position and load on tibial nerve tension. Foot ankle int. February 1998.



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2. Kim J., Dellon AL. Pain at the site of tarsal tunnel incision due to neuroma of the posterior branch of the saphenous nerve. JAmPodiatr Med Assoc. March 2001.
3. Mann RA, DU Vries HL, In Mann VT, Eds. Surgery of the Foot 5th Edition.
4. Upton R M, McCormas AJ: The double crush syndrome in nerve entrapment syndromes. Lancet2: 359, 1973.
5. Podiatry Today- ISSN: 1045-7860- volume 16- Issue11 – November 2003- Pages: 36-42.