

Anterior Tarsal Tunnel Syndrome

Marc R. Bernbach, D.P.M.

Anterior tarsal tunnel syndrome is one of many nerve compression syndromes which have been described in the foot. In 1962, Keek described a nerve compression syndrome of the posterior tibial nerve, and in 1963, Kopell and Thompson described a compression syndrome of the deep peroneal nerve underlying the inferior extensor retinaculum. This condition was subsequently called the anterior tarsal tunnel syndrome.

Posterior tibial nerve compression has been well-described in the literature and is a familiar clinical entity. Anterior tarsal tunnel syndrome of the deep peroneal nerve is an often under-diagnosed and poorly recognized clinical entity.

CASE 1

A 34 year-old female sustained an inversion injury to the right foot and ankle after slipping on a wet floor. She was initially evaluated at a local emergency room where no fractures were noted. Several days later, she saw her primary physician due to pain and swelling of the right foot. She was placed on crutches, told to use ice, and given a nonsteroidal anti-inflammatory medication (NSAID). Some of the swelling decreased over six weeks, but the pain in the right foot persisted. Over the course of one year post-injury, the patient related pain at the antero-medial foot, radiating to the hallux and first intermetatarsal space. The pain was most intense with ambulation, although the pain was also present to a lesser degree when at rest.

Clinical examination revealed normal range of motion of the ankle, subtalar, midtarsal, and metatarsophalangeal joints were without pain or crepitus. Deep tendon reflexes were also normal, however, there was evidence of a positive Tinel's sign starting at the proximal dorsum of the right foot, with radiation to the first intermetatarsal space. Mild weakness of the extensor digitorum brevis was noted during active toe extension.

Electrophysiologic studies were inconclusive, although definitive dysesthesia of the first intermetatarsal space was evident. Computed tomography and MRI of the lower extremity and spine were unremarkable.

The patient was treated over the course of a month with orthotic control, repetitive corticosteroid injections of the anterior tarsal tunnel (twice weekly for four weeks, per Gessini, et al.), change in shoes, and non-weight bearing, all without success. Subsequently, surgical neurolysis of the deep peroneal nerve was performed at the level of the inferior extensor retinaculum, resulting in relief of paresthesia and dysesthesia of the foot. Over the course of one year, gradual sensation returned to the previous hypoesthetic region of the first intermetatarsal space.

CASE 2

A 24 year-old white male sustained direct trauma to the right ankle when a 100 lb iron bar fell across the anterior foot and ankle. Initial evaluation revealed marked edema and ecchymosis of the anterior foot and ankle, without evidence of fracture or dislocation. After resolution of the initial clinical symptoms, the patient presented with pain and paresthesia of the dorsal foot, extending to the first intermetatarsal space and hallux.

Physical examination revealed pain with palpation to the dorsal medial foot and first intermetatarsal space. There was evidence of dysesthesia to the integument overlying the first intermetatarsal space. A Tinel's sign was present upon palpation of the anterior ankle, lateral to extensor hallucis longus tendon. Electro-physiologic studies of the extensor digitorum brevis muscle and deep peroneal nerve revealed mild fibrillation potentials, however, nerve conduction velocities were normal.

Conservative treatment consisted of corticosteroid

injections into the anterior tarsal tunnel, twice weekly for three weeks. Orthotic control was used as well. Resolution of pain and paraesthesia ensued, however, the dysesthesia to the skin persisted.

DISCUSSION

Anatomy

The deep peroneal nerve arises as a branch of the common peroneal nerve at the level of the head of the fibula. The nerve runs infero-medially and meets the anterior tibial vessels on the interosseus membrane. At the level of the ankle, the nerve is surrounded by the fascia overlying the talus, the extensor hallucis longus muscle/tendon as well as the inferior extensor retinaculum (Fig. 1). The lateral boundary of the anterior tarsal tunnel is the attachment of the inferior extensor retinaculum to the lateral malleolus and calcaneus. The inferior extensor retinaculum's medial attachment to the medial malleolus, navicular, first cuneiform, and plantar aponeurosis distally, may be considered to be the medial boundary.

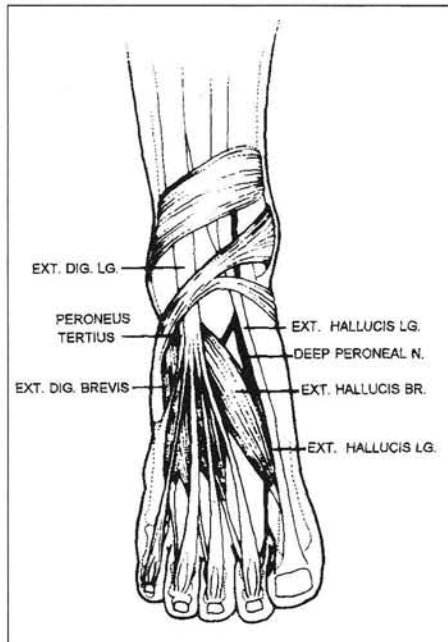


Figure 1. Anatomic relationship of the deep peroneal nerve to structures crossing the anterior ankle and digitorum of the foot.

Distal to the inferior extensor retinaculum, the nerve divides into medial and lateral branches which proceed into the foot. The lateral branch passes deep to and innervates the extensor digito-

rum brevis muscle. It also provides innervation to the nearby tarsal, tarsometatarsal and metatarsophalangeal joints. Proceeding distally to the dorsum of the foot, the medial branch passes under the extensor digitorum brevis tendon to supply the integument overlying the first intermetatarsal and interdigital space.

Pathogenesis

Distal to the ankle, the deep peroneal nerve is in a vulnerable location due to the lack of surrounding protective structures. Due to the precarious location of this nerve, constricting or tightly-laced boots and shoes have been implicated as causative factors. Direct blunt trauma at the level of anterior ankle may injure the nerve, or cause fibrosis and impairment of nerve movement at the level of the anterior tarsal tunnel. Ankle inversion or plantarflexion injuries may produce excessive traction on the nerve. Neural ischemia may result from tenosynovitis, edema or fibrosis producing pressure on the nerve and disrupting its vascular supply.

Ganglios described a biomechanical etiology for anterior tarsal tunnel syndrome, by which a compensated forefoot valgus (plantarflexed first ray) led to subtalar supination and midtarsal inversion. Obstructive and non-mechanical factors which produce pressure on the nerve and surrounding structures should also be considered. These include ganglions, lipomas, medial cuneiform hypertrophy, talo-navicular arthritic beaking, and talo-tibial articular degenerative changes.

Clinical Signs and Symptoms

Patients with an anterior tarsal tunnel syndrome will complain of numbness, hyperesthesia, and paresthesia of the first interdigital and intermetatarsal space. They may also complain of pain of the anterior ankle and foot, and a burning sensation in the distribution of the deep peroneal nerve. The pain may be influenced by particular body positions during rest and ambulation.

DIAGNOSIS

Although subtle in appearance, several objective findings may be evident upon clinical examination. Both sensory and motor signs may be present, since the deep peroneal is a mixed sensorimotor nerve. A positive Tinel's sign has been reported with percussion of the ankle lateral to the extensor

digitorum longus tendon. Forced plantarflexion and inversion of the ankle may replicate or aggravate the symptoms. Palpation of the anterior tarsal tunnel may produce pain, and examination of the extensor digitorum brevis muscle body may demonstrate atrophy. Electrophysiologic studies may provide the most conclusive diagnosis when positive. When the motor branch of the deep peroneal nerve is affected, electromyographic studies may reveal pathologic spontaneous activity such as fibrillation potentials, positive sharp waves, or high frequency discharge in the extensor digitorum brevis muscle. However, if only the sensory component of the nerve is involved, then the EMG may be normal. Likewise, the patient may exhibit weakness with extension of the digits due to involvement of the extensor digitorum brevis muscle.

The condition must be differentiated from superficial peroneal nerve entrapment, common peroneal nerve entrapment at the head of the fibula, lumbo-sacral radiculopathy, neuromuscular disorders, and polyneuropathy.

TREATMENT

Initial care for an anterior tarsal tunnel syndrome should be conservative. The patient should discontinue wearing tight footwear, boots, and high-heeled shoes which promote adverse stretching of the nerve. Orthotic management to prevent excessive traction on the deep peroneal nerve, as well as infiltration of the anterior tarsal tunnel with corticosteroids twice weekly for several weeks, as described by Gessini, is advised. When conservative measures fail, surgical exploration may be necessary. Critical factors for neural release involve adequate exploration and release of the nerve for several centimeters above and below the inferior extensor retinaculum, to prevent pathologic fibrosis and adhesion, which may inhibit mobility. Simple incision of the retinaculum is not satisfactory, as the etiology of this disorder may be more related to neural stretch than mere compression, as reported by Borges.

BIBLIOGRAPHY

- Borges LF, Hallett M, Selkoe DJ, Welch K: The anterior tarsal tunnel syndrome: report of two cases. *J Neurosurg* 54:89-92, 1981.
- Changeless CP, and Schnall, JS: The biomechanical aspects of anterior tarsal tunnel. *J Foot Surg* 70:291-292, 1980.
- Gessini L, Jandolo B, Pietrangeli A: The anterior tarsal syndrome: report of four cases. *J Bone Joint Surg(Am)* 66:786-7, 1984.
- Krause KH, Witt T, Ross A: The anterior tarsal tunnel syndrome. *J Neurol* 217:67-74, 1977.