

Anatomy Primer

The Tibial Nerve and Tarsal Tunnel Syndrome

The term 'heartsink' has with good reason fallen out of fashion, however I must admit to a certain sense of dread when some cases arrive at the EMG clinic. Number one in my dread list is the phrase 'please exclude tarsal tunnel syndrome'. This diagnosis is often the last resort of orthopaedic surgeons and podiatrists when trying to explain painful feet. Unfortunately tarsal tunnel syndrome is rare, and the electrophysiological assessment tricky. So this month I will share my woes by reviewing the anatomy of the tibial nerve at the ankle and briefly reviewing the clinical features of tarsal tunnel syndrome.

Derived from L4-S3 nerve roots, the tibial nerve is the larger of the two terminal branches of the sciatic nerve. It leaves the popliteal fossa between the heads of the gastrocnemius and supplies all muscles in the posterior compartment of the legs (Table 1). The tibial nerve descends in the median plane of the fibula, deep to the soleus. At the ankle the tibial nerve descends towards the foot and runs posterior to the medial malleolus under the flexor retinaculum. This flexor retinaculum forms the tarsal tunnel, which also contains the tibial artery, the flexor hallucis longus tendon, the flexor digitorum longus tendon and tibialis posterior tendon. Passing out of the tarsal tunnel, the nerve then divides into four branches (Figure 1). Two of these, the medial and lateral calcaneal nerves are purely sensory and supply sensation to the heel of the foot. The other two branches, the medial and lateral plantar nerves innervate the intrinsic muscles of the foot (Table 1) and provide sensation to the medial and lateral sole respectively. The medial nerve supplies the first three toes and sometimes the fourth toe, while the lateral nerve supplies the little toe and sometimes the fourth toe (Figure 2). Proximal tibial mononeuropathy is quite rare and almost always occurs as a result of trauma directly to the nerve or injury to the tibial fibres in the sciatic nerve trunk.

Tarsal Tunnel Syndrome

Tarsal tunnel syndrome is analogous to carpal tunnel syndrome occurring as a result of compression of the tibial nerve under the flexor retinaculum. On rare occasions the nerve may be compressed by mass lesions in the tarsal tunnel or by local trauma as a result of injury to the ankle. Patients may present with perimalleolar pain or burning pain or paraesthesia in the feet. There are generally not a lot of physical signs although wasting of intrinsic foot muscles may sometimes be seen. It is my

experience however that most patients with this constellation of symptoms and physical signs turn out to have either a polyneuropathy, a radiculopathy, lumbosacral plexopathy or local orthopaedic problem.

Electrophysiological Assessment

In proximal tibial neuropathy the aim is firstly to distinguish if the tibial nerve only is involved or whether there is lumbosacral plexus or sciatic nerve involvement. Assessment therefore should include nerve conduction studies from both tibial nerve and ipsilateral common peroneal and sural nerves. Electromyography is then the most useful means of obtaining anatomical localisation. If there is denervation in the tibial-innervated hamstrings then the lesion is proximal to the popliteal fossa, if there is gastrocnemius and soleus denervation then the lesion is proximal to the ankle. In tarsal tunnel syndrome there may be slowing of distal tibial motor conduction. Nerve conduction studies should therefore be performed on both the symptomatic and contralateral ankle. You can also perform studies on the medial and lateral plantar nerves to assess sensory nerve conduction. This is an unreliable sign as the responses are sometimes absent in normals, the sign is only useful if a response is obtained on the asymptomatic side and there is a reduced or absent response on the symptomatic side. Patients should also be assessed for polyneuropathy or plexopathy so I always check a sural and common peroneal response in the asymptomatic limb.

Table 1

Muscular Branches of the Tibial Nerve below the knee

Branches in the Leg
Plantaris
Soleus
Gastrocnemius
Tibialis Posterior
Flexor Hallucis Longus
Branches in the Foot
Abductor Hallucis
Abductor Digiti Quinti Pedis



Figure 1: Medial view of the ankle showing the pathway of the tibial nerve through the tarsal tunnel and the terminal branches of the tibial nerve.



Figure 2: Plantar view of the foot showing the sensory distribution of the sensory branches of the tibial nerve.



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