

Morton's neuroma

Anatomy & Pathophysiology

PLANTAR NERVE ANATOMY

- The tibial nerve divides into three terminal branches before reaching the foot: the medial calcaneal nerve, lateral plantar nerve, and medial plantar nerve [3].
- The medial plantar nerve innervates the abductor hallucis and continues under the abductor and plantar fascia to form common digital nerves terminating in the first, second, and third web spaces [3].
- The medial plantar nerve provides motor branches to the interossei and lumbricals [3].
- The lateral plantar nerve passes deep to the abductor fascia and plantar fascia, over the quadratus plantae, and continues distally under the flexor digitorum brevis [3].
- The lateral plantar nerve terminates in the fourth web space and supplies a branch to the third web space [3].
- The lateral plantar nerve supplies motor branches to the intrinsic muscles of the foot [3].
- The medial calcaneal nerve branches first from the tibial nerve and travels posteriorly to the subcutaneous tissue [3].
- The plantar surface of the foot is innervated by the digital branches of the medial plantar nerve [4].

FOREFOOT NEUROVASCULAR ANATOMY

- The dorsalis pedis artery is a continuation of the anterior tibial artery that passes deep under the inferior extensor retinaculum [4].
- The dorsalis pedis artery lies between the tendons of the extensor hallucis longus medially and the extensor digitorum longus laterally as it passes anterior to the ankle joint [4].
- The deep peroneal nerve lies immediately lateral to the dorsalis pedis artery [4].
- The arcuate artery arises in the region of the bases of the metatarsals and passes laterally [4].
- The second, third, and fourth dorsal metatarsal arteries arise from the arcuate artery and descend to the dorsal surfaces of the respective dorsal interosseous muscles [4].

- The first dorsal metatarsal artery is the continuation of the dorsalis pedis artery and runs distally on the dorsal surface of the first dorsal interosseous muscle [4].
- The first dorsal metatarsal artery supplies branches to the dorsal skin, the first and second metatarsals, and the interosseous muscles [4].
- The deep plantar artery leaves the dorsalis pedis at the base of the first metatarsal and passes toward the plantar surface of the foot between the heads of the first dorsal interosseous muscle [4].
- The deep plantar artery communicates with the lateral plantar artery to complete the plantar arterial arch [4].
- The first plantar metatarsal artery is the continuation of the deep plantar artery and passes distally in the first interosseous space [4].
- The first dorsal metatarsal artery may lie superficial to or within the substance of the first dorsal interosseous muscle in 78% to 88% of feet [4].
- The first dorsal metatarsal artery may lie plantar to the first metatarsal in 12% to 22% of feet [4].
- The dorsal surfaces of the toes and foot receive sensory innervation through the superficial peroneal nerve branches [4].
- The first web space is innervated by the deep peroneal nerve [4].

FOOT COMPARTMENTS

- The interosseous compartment of the foot lies dorsal to the medial, lateral, and central compartments between the metatarsals [9].
- The interosseous compartment contains digital nerves [9].
- Manoli and Weber demonstrated that each of the four interosseous muscles and the adductor hallucis lies in separate compartments [9].
- The barrier between the superficial and calcaneal compartments of the foot becomes incompetent at a pressure of 10 mm Hg [9].

TARSAL TUNNEL ANATOMY

- The tarsal tunnel is a fibroosseous tunnel within the posteromedial ankle and hindfoot [3].
- The tibial nerve, posterior tibial artery, accompanying veins, posterior tibial tendon, flexor digitorum longus, and flexor hallucis longus tendons pass through the tarsal tunnel into the foot [3].
- The flexor retinaculum acts as the roof of the tarsal tunnel and extends from the medial malleolus to the medial side of the calcaneal tuberosity [3].
- The medial distal tibia, talus, and calcaneus make up the floor of the tarsal tunnel [3].
- Septa projecting from the fibrous roof to the calcaneus separate the posterior tibial, flexor digitorum longus, and flexor hallucis longus tendons [3].
- The tibial nerve, posterior tibial artery, and accompanying veins pass between the flexor digitorum longus and flexor hallucis longus tendons to enter the foot [3].

- The tibial nerve typically branches within the tarsal tunnel just proximal and deep to the upper edge of the abductor hallucis muscle [3].

Investigations

CLINICAL EXAMINATION

- The diagnosis of interdigital neuroma is usually made by conducting a careful history and physical examination [14].
- Plantar foot pain just distal to and between the metatarsal heads, often described as “burning,” is characteristic of interdigital neuroma [14].
- Patients with interdigital neuroma often feel as if they are walking on a marble [14].
- Symptoms of interdigital neuroma are typically aggravated by activity or by wearing shoes with high heels or a narrow toe box [14].
- Patients with interdigital neuroma often note that they feel better in their bare feet and get quick relief by removing their shoes [14].
- The Mulder sign is elicited by squeezing the foot while palpating the web space [14].
- A painful click during the Mulder sign is diagnostic of an interdigital neuroma [14].
- Neuromas rarely occur in the first and fourth web spaces, so for pain that occurs in these areas, other causes of forefoot pain should be considered [14].
- The involved ray should be evaluated for metatarsophalangeal (MTP) joint instability, especially if the second web space is symptomatic [14].

IMAGING

- Weight-bearing radiographs are useful for excluding a stress fracture of the metatarsal neck in the evaluation of interdigital neuroma [14].
- Ultrasonography has been reported to be 85% accurate in diagnosing interdigital neuroma [14].
- MRI may be useful in the diagnosis of interdigital neuroma, and the administration of contrast medium may increase its accuracy [14].
- Interdigital or Morton neuroma is most frequently found in the distal third metatarsal interspace [20].
- Unlike most other tumors, interdigital or Morton neuroma lacks increased signal on T2-weighted MRI sequences [20].
- MRI can be useful in the diagnosis of metatarsalgia, such as distinguishing among a neuroma, cyst, bursa, or synovitis [18].

DIAGNOSTIC INJECTION

- Injection of the involved web space with local anesthetic that results in relief of the neuritic symptoms is diagnostic of interdigital neuroma [14].

- Injections performed under ultrasound guidance had higher short-term relief compared with blind injections for interdigital neuroma [14].

References

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