

DORSAL NERVE ENTRAPMENT FOLLOWING PLANTAR NEURECTOMY

Craig A. Camasta, DPM

Scott R. Roman, DPM

Lee Gray, DSP

A neuroma is a benign neoplasm composed chiefly of neurons and nerve fibers usually arising from a nerve tissue. Intermetatarsal neuroma is a common foot problem that is classified as a mechanically induced degenerative neuropathy or an entrapment type syndrome. The third common digital branch of the medial plantar nerve is most often affected, and termed Morton's neuroma. This condition was originally described by Durlacher in 1845¹ and later by Morton in 1876.² The neuroma found between the third and fourth metatarsal heads in the third interspace of the foot. Although this is the most common area affected, this pathology has been reported in the second and fourth interspaces.

CLINICAL

The diagnosis of intermetatarsal neuroma may be accomplished with an extensive clinical history and good physical examination of the involved area. Pain and paresthesia such as burning, numbness, and tingling sensations are common occurrences and may present in the metatarsal region. The pain can be sharp, burning, dull, or throbbing in the same area or may radiate distally into the digits or proximally up the leg. In chronic conditions, patients may describe sensations of a hardened mass at the site of discomfort. Neuromas affect females more frequently than males, and encompasses patients in a wide age group. The pain is usually associated with tight fitting shoes and increases with periods of activity. Temporary relief may be attained with rest, removal of shoes, and rubbing the affected foot.

There is usually no evidence of actual sensory loss to the digits. Reproduction of the patients symptoms may be induced by dorsoplantar compression of the intermetatarsal space. Application of manual pressure to the medial and lateral aspects of the forefoot at the metatarsal head region may produce similar symptoms and/or an audible 'click'.

DIFFERENTIAL DIAGNOSIS

There are multiple conditions that may mimic a diagnosis of Morton's neuroma, including tumor, intermetatarsal bursitis, metatarsophalangeal joint synovitis/capsulitis, tendon tenosynovitis, rheumatoid arthritis and nodules, rupture of the metatarsal plate, tarsal tunnel syndrome, and metatarsal stress fracture. Most of these can be differentiated by careful physical and clinical examination. The use of various imaging modalities such as plain film radiography, bone scan, computed tomography, ultrasound, or magnetic resonance imaging, may help definitively excluded a competing diagnosis.

CONSERVATIVE TREATMENT

Early detection of Morton's neuroma may be critical to the reasonable success of conservative care.³ Attempts to avoid nerve irritation and compression may begin with wider, flatter shoes, tape strapping, or a metatarsal pad to preserve the intermetatarsal space. Ice application may also provide relief after activities that historically cause pain and neuroma symptoms.

Nonsteroidal anti-inflammatory drugs may relieve acute pain and inflammation. Care must be taken to avoid longterm use of NSAIDs due to side effects such as stomach irritation and bleeding. If NSAIDs provide insufficient relief, a local anesthetic injection can relieve acute pain and confirm the correct intermetatarsal space of the affected nerve. This form of therapy is mainly diagnostic and rarely therapeutic.

Corticosteroid injection has been reported to provide relatively fast and prolonged relief of neuroma symptoms. This form of therapy does not restrict prolonged absence from activities and may provide pain relief when other forms of conservative care fail. Other forms of injection therapy have been reported to be vitamin B12 and 4% alcohol sclerosing solutions.⁴ Approximately 25% or less of patients with clinical neuromas will respond to conservative treatment.

SURGICAL TREATMENT

When conservative methods of treatment fail to alleviate painful symptoms to a tolerable or acceptable level, surgical treatment is the next viable option. There are several surgical approaches described, with the most common being the dorsal incision and a plantar longitudinal incision. Regardless of the surgical approach used, the goals are the same. The digital branches should be identified and sharply transected distally, and the nerve trunk should be transected proximal to the metatarsal heads. Other nerve branches that may exist between these points also need to be identified and sharply cut.

The greatest benefit to the dorsal approach is early ambulation and weight bearing due to the incision being on a non-weightbearing surface.⁵ The technical procedure is more difficult, requiring greater dissection skills and identification of appropriate anatomy. The deep transverse intermetatarsal ligament must also be incised for adequate visualization of the nerve.

The plantar approach provides the best exposure for nerve visibility, making all branches easily accessible for identification and transection.⁶ Sectioning of the deep transverse intermetatarsal ligament is avoided due to the nerve coursing superficial to it from this approach. The disadvantage arises with patient acceptance at being non-weight-bearing. A painful scar may also be concerning, this can be avoided or minimized with proper incision placement between the metatarsal heads, alleviating plantar pressure on the scar.⁷

Regardless of the surgical approach used, other complications may arise including infection, continued pain, vascular compromise, tendon sectioning and hammertoe, and recurrent or stump neuroma. With the use of anatomic dissection and good aseptic technique, most of these complications can be avoided. Stump neuromas may be minimized with sharp sectioning of the nerve or implantation of the nerve end into muscle. Satisfactory results can be achieved in about 85% of patients following surgical intervention.⁸

A previously undescribed complication of neuroma surgery has been observed in two patients, both of whom had a dorsal incision to remove a painful plantar neuroma. These patients developed a scar entrapment of the dorsal common digital nerve at the surgical incision site. Both patients had been mis-diagnosed as having a recurrent plantar neuroma, since manual dorsal to plantar compression over the interspace produced pain. Closer examination revealed that the actual problem was dorsally located and just beneath the skin at the proximal end of the

scar. Both patients had a diagnostic subdermal injection of local anesthetic dorsally at the scar line, and had temporary but complete relief of pain. Surgical excision of the painful scar entrapment neuroma provided significant relief of pain and return to normal activities in desired footwear.

PATIENT 1

A 35-year-old athletic female patient sought a fourth opinion for pain in her left foot two and one-half years following surgery to remove a painful second interspace neuroma. Her chief complaint was a pulling and drawing sensation in her foot with cramping of her toes after a short period of physical activity. She was a previous runner, unable to do any form of weight-bearing activity, including cycling, for more than twenty minutes. She reported that the pain that was present before the first surgery was different than what she was experiencing, but otherwise she had an unremarkable recovery with no infection or wound dehiscence.

When asked to locate her pain, the patient compressed the distal second interspace with her hand, from dorsal to plantar, in the region of the surgical scar. Closer examination revealed that the pain was mostly dorsally directed over the proximal end of the dorsal scar. Paresthesias were produced with light percussion of the dorsal proximal scar, avoiding dorsal to plantar compression that normally produces pain in a typical neuroma.

A diagnostic local anesthetic dorsal subdermal injection of 0.2 cc of bupivacaine provided temporary but profound relief of pain. Serial attempts at cortisone (two) and sclerosing alcohol (two) failed to provide long-term pain relief. Surgical exploration was performed, with an attempt to release the nerve from the scar tissue (external neurolysis) as shown in Figure 1A. Due to extensive scar tissue and nerve enlargement, the nerve and its digital branches were resected (Figure 1B). The proximal end of the nerve was sharply transected three centimeters proximal to the end of the skin incision, taking care to tent the skin with a deep retractor so that the end of the nerve was distant to the end of the skin scar line. The chosen proximal level of nerve transection was proximal to where a shoe vamp would compress the dorsum of the foot, and distal the ankle joint, avoiding both joint motion and shoe compression.

The patient was followed eighteen months following surgery (Figure 1C) and was able to return to desired sporting activities and had no limitations regarding footwear.

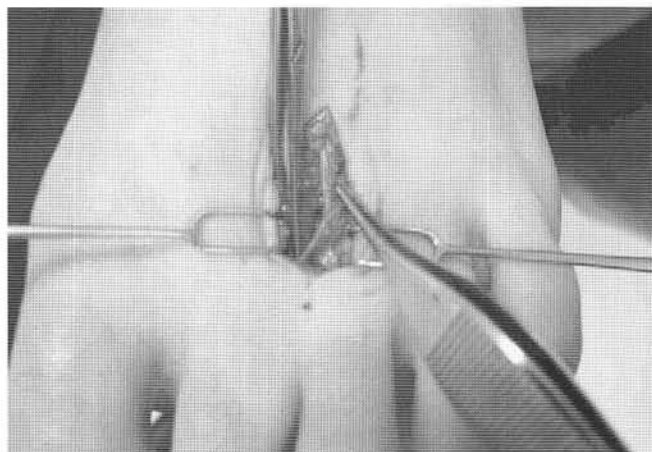


Figure 1A.

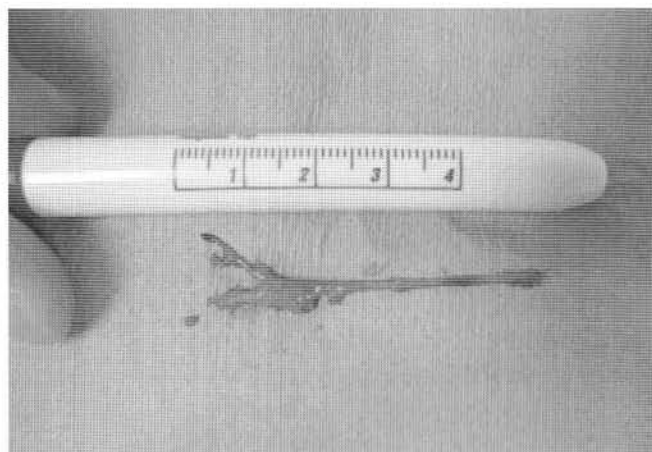


Figure 1B.

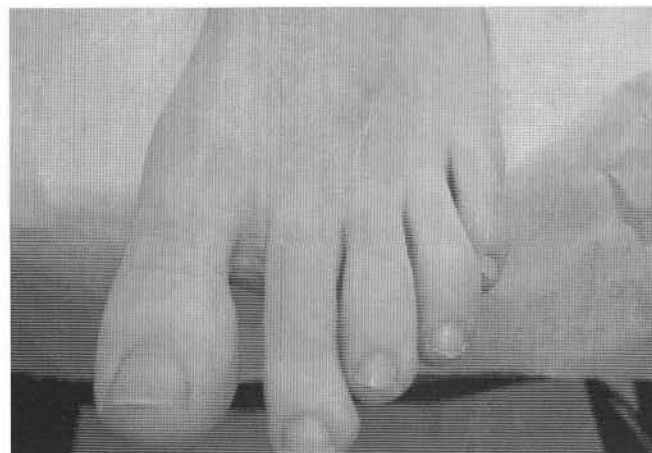


Figure 1C.

PATIENT 2

A 62-year-old mildly obese female patient had persistent pain in her left foot two years following neuroma surgery. She had a dorsal incision for the removal of a painful plantar neuroma located in the third intermetatarsal space. She reported that the pain that she had now was different than the original neuroma pain. Manual palpation of the third interspace, with dorsal-to-plantar compression, reproduced her pain. The pain was sharp, electrical-like, and radiating both proximally and distally. She was very reluctant to allow a physical examination due to the severity of pain. She ambulated poorly due to splinting of the ankle, avoiding forward propulsion across the foot. Most interesting, she resorted to sleeping at night with her foot resting against the footboard of the bed to avoid allowing her foot to plantarflex, as relaxation and plantar drift of the foot produced a pulling sensation of pain in her foot, and would awake her with pain.

Physical examination revealed pain to the dorsum of the foot at the proximal end of the surgical scar line. Subdermal infiltration of local anesthetic (Figure 2A) provided complete relief of pain. Surgical exploration revealed a stump neuroma with multiple branches of nerve invading the extensor digitorum longus tendon sheath to the third toe (Figure 2B). Complete excision of the stump neuroma was performed (Figure 2C), and the proximal end of the common digital nerve was allowed to retract proximally beneath the skin incision line, avoiding the zone of the dorsum of the foot, and distal to the motion of the ankle joint.

Ten months following revision surgery, the patient's pain was significantly improved, and she no longer had the night cramps and pain or need to support the foot while sleeping.

SUMMARY

In addition to the previously reported complications of plantar neuroma surgery, dorsal scar entrapment of the common digital nerve to the foot should be considered when planning a surgical approach for plantar nerve surgery. Avoidance of this troublesome complication can be afforded by the use of a plantar incision. It is now generally accepted that plantar longitudinal incisions between the metatarsal heads can be safely made with little worry about painful scars. Additional measures must be employed to assure uneventful healing of a plantar



Figure 2A.

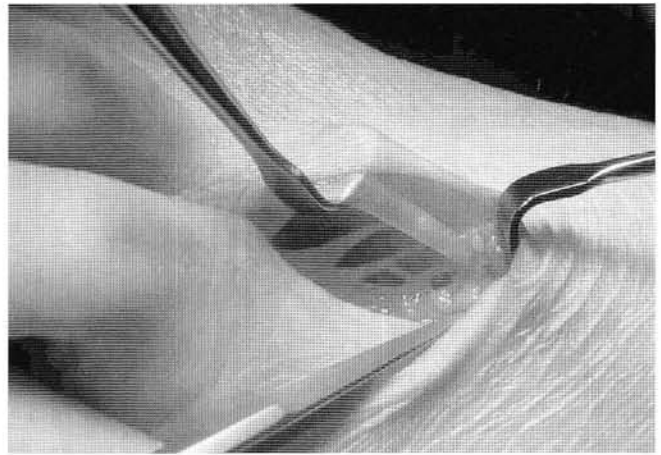


Figure 2B.

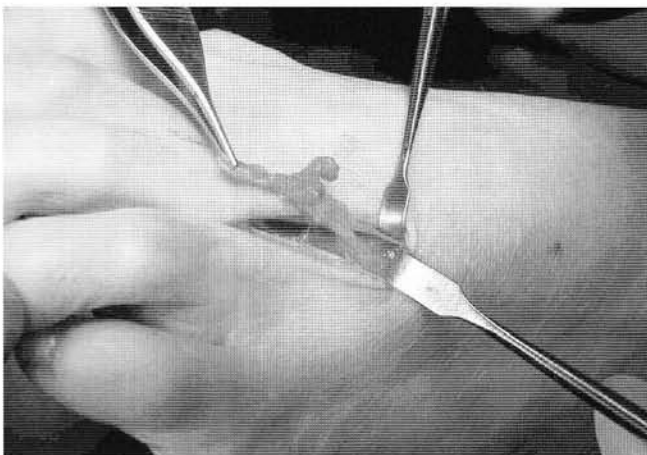


Figure 2C.

incision, such as limited ambulation and appropriate surgical shoe offweighting of the incision line. The authors also advocate the use of non-absorbable retention sutures, left in place for up to three weeks duration, for the management of plantar incisions of the foot.

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