Dorsal Foot Pain Due to Compression of the Deep Peroneal Nerve by Exostosis of the Metatarsocuneiform Joint

Robert G. Parker, DPM*

Podiatric physicians often encounter patients with dorsal foot pain related to either an exostosis or a ganglion arising at the junction of the first metatarsal and the cuneiform. Removal of the exostosis or ganglion is routine but may not relieve the pain. Exostosis surgery can result in worsening of pain owing to injury of the deep peroneal nerve. In this retrospective series, ten patients with dorsal foot pain–related exostosis or ganglion underwent measurement of the cutaneous pressure threshold of the skin of the dorsal first web space to determine whether compression of the deep peroneal nerve was related to their symptoms. The Pressure-Specified Sensory Device (Sensory Management Services LLC, Baltimore, Maryland) was used for this measurement bilaterally, and the results were compared with age-related normative data. Ninety percent of the patients had abnormal sensibility in the first dorsal web space. During surgery, each patient was noted to have a site of compression of the deep peroneal nerve by the extensor hallucis brevis tendon at the metatarsocuneiform exostosis. Patients with compression of the deep peroneal nerve had pain relief in the immediate postoperative period and have remained pain-free for a mean of 14 months (range, 1–22 months). Neurosensory testing can identify pain related to the deep peroneal nerve in patients with a dorsal exostosis or ganglion in this region. (J Am Podiatr Med Assoc 95(5): 455-458, 2005)

The exostosis at the junction of the first metatarsal and cuneiform bones has been classified into five types.[1] We are primarily concerned with the simple type 1 exostosis, which can be disturbing to the patient because of its appearance but also because it may produce pain with and without footwear when coupled with compression of the deep peroneal nerve. A space-occupying mass, such as a ganglion of this joint, can also be a source of dorsal foot pain. Dorsal foot pain has been reported to result from entrapment of the deep peroneal nerve as well.[2] Failure to relieve the patient's dorsal foot pain after resection of the exostosis or ganglion may be due to failure to recognize a coexisting entrapment of the deep peroneal nerve or to injury to that nerve at the time of surgery for the bone or ganglion deformity. A positive Tinel sign is a reproducible technique used to diagnose chronic nerve compression[3] at the dorsal sensory territory of the cuneiform, sending sensation to the first and second digits. This condition can be differentiated from the anterior tarsal tunnel syndrome, which is caused by entrapment of the deep peroneal nerve by the inferior extensor retinaculum overlying the talus and the navicular deep to the tendons of the extensor hallucis longus and extensor digitorum

*Institute for Peripheral Nerve Surgery Fellowship Group, Baltimore, MD; Harris County Podiatric Residency Program, 14441 Memorial Dr, Ste 16, Houston, TX 77079.

longus muscles.[4] The branching pattern of the deep peroneal nerve varies. In some patients, the nerve does not provide sensory innervation to the first web space; in others, it may supply sensation to the inner side of the great toe and the second and third web spaces. An accessory deep peroneal nerve is present in 28% of patients.[5] To document the condition of the deep peroneal nerve before dorsal foot surgery, and to learn the relationship between the patient's dorsal foot complaints and the presence of entrapment of the deep peroneal nerve, a retrospective series of patients was evaluated.

Materials and Methods

A consecutive series of ten patients (eight women and two men) whose initial complaint included dorsal foot pain and an associated mass were included in this evaluation. Their mean age was 42 years (range, 31–66 years). One patient had a history of trauma. In one patient, footwear was implicated, with straps on sandals causing pain. The duration of their complaints ranged from 2 weeks to 13 years (mean, 22.5 months). On physical examination, nine of the ten patients had various degrees of dorsal exostosis of the first metatarsocuneiform area (Fig. 1). Four of the ten patients had a ganglion associated with the bony deformity. Neurosensory measurements were performed in nine of the ten patients using the Pressure-Specified Sensory Device (Sensory Management Services LLC, Baltimore, Maryland).[6] All of the patients had a positive Tinel sign at the metatarsocuneiform area that was differentiated from the anterior tarsal tunnel syndrome caused by entrapment of the deep peroneal nerve by the inferior extensor retinaculum overlying the talus and the navicular deep to the tendons of the extensor hallucis longus and extensor digitorum longus muscles. There was no Tinel sign noted proximal to the metatarsocuneiform joint.

Figure 1. Type 1 exostosis of the first metatarsocuneiform joint.

Results

All nine patients tested had an abnormal cutaneous pressure threshold for the deep peroneal nerve on the side of the bony deformity, as determined from normative data and compared with the contralateral, noninvolved side (Fig. 2). All of the patients had compression of the deep peroneal nerve by the extensor hallucis brevis tendon (Figs. 3–5). In one patient, there was additional scarring of the deep peroneal nerve related to a previous Lapidus fusion.

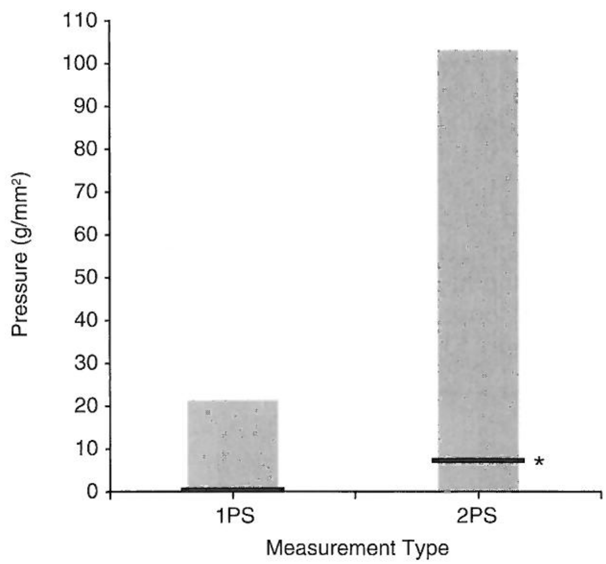

Figure 2. Preoperative abnormal cutaneous pressure threshold for the right deep peroneal nerve in one patient, with distance and pressure above the confidence limit, consistent with compression of the deep peroneal nerve. Measurement was made using the Pressure-Specified Sensory Device. Vertical bars represent the actual quantitative pressure threshold test result. The horizontal line on each bar indicates the normal 99% confidence level for each measurement type. The asterisk indicates increased spacing of probes placed on skin during testing. The increased spacing is indicative of axonal nerve loss. 1PS, one-point static touch; 2PS, two-point static touch.

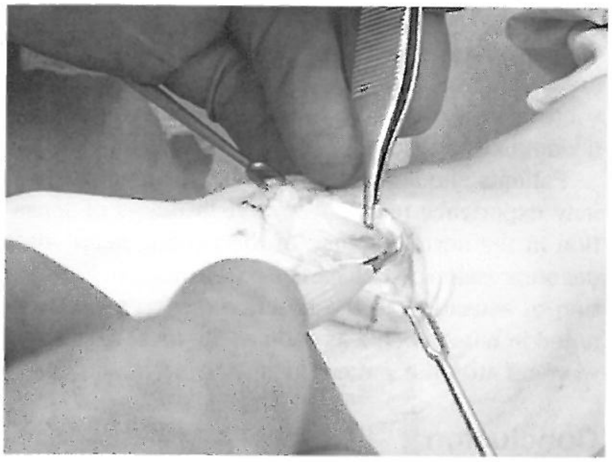

Figure 3. Excision of the extensor hallucis brevis tendon (in the forceps). The bipolar coagulator is shown cauterizing the musculotendinous junction.

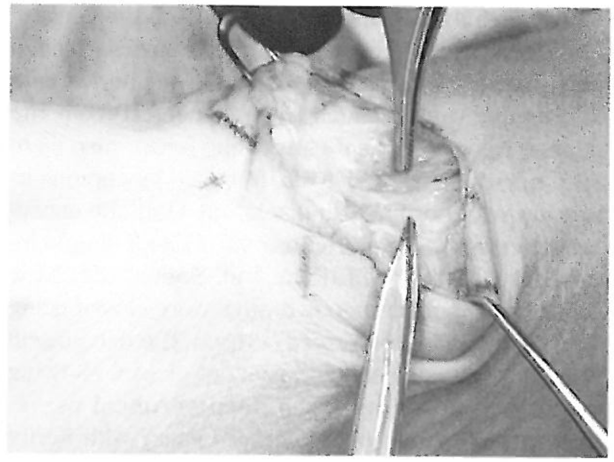

Figure 4. After resection of the extensor hallucis brevis tendon, the deep peroneal nerve usually has an indentation in it, as noted here in the structure between the forceps and the scissors.

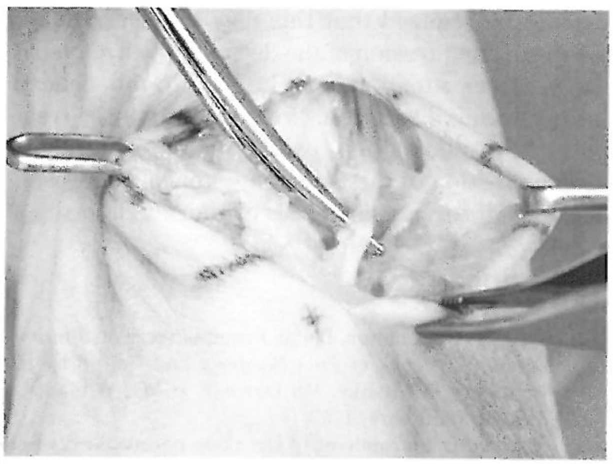

Figure 5. Neurolysis of the deep peroneal nerve from the inferior extensor retinaculum proximally to the subcutaneous tissue of the first dorsal web space distally.

Patients with compression of the deep peroneal nerve experienced relief of their pain in the immediate postoperative period and have remained free of pain for a mean of 14 months (range, 1–22 months).

Surgical Procedure 1: Neurolysis of the Deep Peroneal Nerve

Under a pneumatic tourniquet, and using loupe magnification, attention was directed to the dorsal aspect of the foot at the level of the first interspace between the medial and intermediate cuneiform, where a linear incision approximately 3 cm long was made. The incision was deepened to the deep fascia, protecting the superficial peroneal nerve. Hemostasis was accomplished by using a bipolar coagulator. The extensor hallucis brevis tendon was recognized as a structure oriented transversely across the incision, with the red muscle belly proximal. The deep peroneal nerve was visualized inferior to the tendon and was noted to be compressed between the bony prominence and the tendon. The tendon was isolated from the surrounding soft tissue by excising this section of the tendon starting where it joined the extensor hallucis longus muscle and following it to the myotendinous junction, where the myotendinous structure was cauterized using a bipolar coagulator (Fig. 3). The deep peroneal nerve was readily identified as a "plump" nerve distal to the traversing tendon with a noticeable flattened area of compression previously under the extensor hallucis brevis tendon and the tendon sheath (Fig. 4). The deep peroneal nerve was carefully released using microscissors. The taut deep fascia was also released distally, where it pierced the deep fascia to the first and second digits as the nerve was followed to normal relaxed tissue, and proximally to the inferior extensor retinaculum (Fig. 5).

Surgical Procedure 2: Exostectomy, Medial and Intermediate Cuneiform and Base of the First Metatarsal

Once decompression of the entrapment neuropathy of the deep peroneal nerve was accomplished, the obvious enlarged bony prominence or bony exostosis was readily identified and resected in the conventional manner.[7] A longitudinal incision was placed over the bony prominence, and all of the periosteum and ligamentous tissues were dissected from the bone. A rongeur and a reciprocating power rasp were used to reduce the exostosis, followed by copious irrigation with normal saline solution. Only the capsular structures were closed using 3.0 Vicryl simple interrupted sutures (Ethicon, Inc, Somerville, New Jersey). The subcutaneous tissues were closed using 4.0 Vicryl simple interrupted sutures. The deep fascia was left decompressed and was not closed, allowing for no compression of the deep peroneal nerve. Dressings consisted of sterile 4 × 4 gauze with Kerlix (Kendall Health Care Products, Mansfield, Massachusetts) and Ace (Becton, Dickinson, Franklin Lakes, New Jersey) bandages applied in a mildly compressive manner. Patients were instructed to walk minimally for 3 days and then were allowed to participate in guarded activities until the sutures were removed at day 10. At that time, patients were allowed to change into a loose-fitting casual shoe for another 4 weeks.

Discussion

The patient who underwent the Lapidus procedure, with continued postoperative pain in the area of the deep peroneal nerve and the medial branch of the superficial peroneal nerve, had good recovery with excision for the entrapped nerve and implantation into the more proximal navicular. There was good resolution of the patient's pain and the expected distal sensory loss. This patient had markedly abnormal neurosensory testing findings due to the neuroma of the deep peroneal nerve. This case is mentioned in this article as an example of how this nerve can be injured if careful attention is not paid during surgery in this area. All of the remaining patients had a positive Tinel sign with varying degrees of radiating sensation into the first dorsal interspace territory, with manifestations in the hallux and the second digit. Findings from neurosensory testing were abnormal but not absent in the deep peroneal nerve territory. These nine patients underwent neurolysis of the deep peroneal nerve plus exostectomy to remove the dorsal exostosis.

The exact location of any nerve may vary anatomically, frequently by as much as 17%.[8, 9] The location of the deep peroneal nerve entrapment can be determined at the point of the positive and most proximal Tinel sign before surgery. Confirmation of this can also be attained by instilling local anesthesia just proximal to the exostosis and positive Tinel sign as a diagnostic test. Intraoperative restoration of or an increase in circulation of the delicate blood vessels associated with the nerve is readily seen at the time of decompression.

Patients should be informed in advance that they may experience postoperative vicissitudes of sensation in the normal course of the healing nerve after decompression, which can be 3 to 6 months. Restoration of sensation or the absence of nerve pain was noted in nine patients as soon as the local anesthesia wore off after the surgery.

Conclusion

When patients complain of "shooting pain in the toes" or "numbness in the big toe area with burning and pain," the foot and ankle surgeon should consider decompression of the deep peroneal nerve as a diagnostic possibility. When, at the time of examination, a very small exostosis seems to be present, it should be realized that this may be symptomatic owing to compression of the deep peroneal nerve. Finally, closer attention must be paid to this delicate nerve during dissection. When conservative treatment of this dorsal foot pain is no longer adequate, decompression of the common peroneal nerve is effective in the treatment of this painful condition.

References

1. Smith TF: "Common Pedal Prominence," in *Comprehensive Textbook of Foot Surgery*, 2nd Ed, ed by ED McGlamry, AS Banks, MS Downey, p 421, Williams & Wilkins, Baltimore, 1992.
2. Dellon AL: Entrapment of the deep peroneal nerve on the dorsum of the foot. Foot Ankle **11:** 73, 1990.
3. Tinel J: "The Tingling Sign in Peripheral Nerve Lesions," in *Injuries to the Major Branches of Peripheral Nerves of the Forearm*, ed by M Spinner, p 8, WB Saunders, Philadelphia, 1978.
4. Mandel S, Willis J: "Entrapment Neuropathy," in *Handbook of Lower Extremity Neurology*, p 142, Churchill Livingstone, New York, 2000.
5. Kosinski C: The course, mutual relations and distribution of the cutaneous nerves of the leg and foot. J Anat **60:** 274, 1926.
6. Dellon AL: "Lower Extremity," in *Somatosensory Testing and Rehabilitation*, p 346, Institute for Peripheral Nerve Surgery, Baltimore, 2000.
7. Giannestras NJ: "Problems of the Tarsal Portion of the Foot in the Adolescent and the Adult," in *Foot Disorders: Medical and Surgical Management*, p 432, Lea & Febiger, Philadelphia, 1967.
8. Dellon AL, Mackinnon SE: *Surgery of the Peripheral Nerve*, pp 306, 329, Thieme, New York, 1998.
9. Hirose CB, McGarvey WC: Peripheral nerve entrapments. Foot Ankle Clin N Am **9:** 255, 2004.