CHAPTER **6**

PLANTAR APPROACH FOR NEUROMA EXCISION

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INTRODUCTION

The clinical symptoms of a pedal neuroma are most commonly ascribed to Thomas George Morton, who in 1876 inaccurately attributed the clinical symptoms to an "affection of the fourth metatarsophalangeal joint"(1). Not to be confused with William Thomas Green Morton, the first to use ester as a general anesthetic during that same time period, TG Morton was a surgeon from Philadelphia who became known for his operating skills on the battlefield during the Civil War. TG Morton was also one of the first to remove an appendix after a correct diagnosis with the patient surviving. It was, however, for his description of the clinical symptoms of a neuroma for which he is remembered today. The cause of the interspace neuroma is still not certain 137 years later. Epineural and perineural fibrosis have been confirmed by histological examination of surgical specimens (2). That, along with the thickening and hyalinization of the walls of the epineural and endoneural vessels suggests that trauma and ischemia both likely play roles in the pathophysiology. The exact mechanism of this process is unknown.

Recent ideology has postulated that this process could be attributed to impingement against the deep transverse intermetatarsal ligament (DTIL) (1). However an anatomical study by Kim et al of the position of the DTIL in relation to bifurcation of the common digital nerve places the DTIL well proximal to the area of interest of the nerve in order to provide compressional forces (3).

SURGICAL TREATMENT OPTIONS

There is near uniform opinion that patients refractory to conservative treatment of primary Morton's neuroma should be referred for surgery (4). Overall success rates for surgical intervention have been reported to be between 57% and 93% (5). Dissection paths vary but the two main surgical procedures for primary Morton's neurectomy are the dorsal and plantar approaches (1).

Through an extensive review of literature, the Cochrane Database of Systematic Reviews only found 3 statistically reliable studies regarding the treatment of Morton's neuroma. The systematic review concluded that 3 postulates could be assumed from the current literature. The first, that there is a very limited indication that transposition of the transected nerve may yield better results. Second, that no evidence exists to support the use of supinatory insoles. Last, that there are very limited indications to suggest that dorsal incisions for the resection of the plantar nerve may result in less symptomatic postoperative scars when compared to the plantar approach (6).

One of the most commonly cited proponents for the dorsal incisional approach is Coughlin's retrospective study (1). Coughlin proposed that the dorsal approach, although not statistically more successful than the plantar approach, allowed for immediate weight bearing, less risk of delayed healing or infection, and less risk of painful scar formation. His retrospective study did note that there was no current statistically-significant proof in the literature to place the dorsal incision approach as a more successful procedure than the plantar approach. In 2008, Akermark et al produced the first retrospective comparative study of the plantar versus the dorsal approach to include the acquisition of histological specimens from each surgery. The study looked retrospectively at 2 orthopedic surgeons with similar training and experience who each preferred either the dorsal or plantar approach to neurectomy of the interspace. Neither procedure was deemed the statistical victor, with both having high percentages of overall satisfaction. The study did relate some advantages of the plantar approach. The dorsal approach had a higher rate of surgical excision failure as 3 of the 59 histological specimens were not neurological structures (1 artery and 2 granulation tissues). The plantar approach had 78 of 79 confirmed neuromas (1 normal nerve resected). The study did not conclude a higher risk of painful scars with the plantar approach. The authors did list the shortcomings of the study, but also concluded that a randomized prospective trial was needed (7).

In 2013, Akermark et al built on that conclusion with the publication of their randomized prospective trial comparing the plantar versus dorsal approach. This is the first and only level 1 prospective look at neuroma surgery techniques and outcomes thus far. This study demonstrated 87% (plantar) and 83% (dorsal) clinically good outcomes and

no significant differences between the procedures in regard to pain, restrictions in daily activities, and scar tenderness. However, there was a difference between the groups in the type of complications. Since the advent of the Kim anatomic study of 2007, which negated the idea that the DTIL was the cause of entrapment, more emphasis has been placed on preserving said structure as is done through a plantar approach. The authors did advocate that the plantar approach did not result in clinically more painful scars or longer bouts of postoperative non-weightbearing as they allowed the patients to weight bear on postoperative day 2 with a postoperative shoe. They also concluded statistically that the plantar approach resulted in less clinically bothersome sensory loss to distal structures. The authors attributed all of these results as reasons to prefer the plantar approach to the dorsal approach (4).

PLANTAR APPROACH

The procedure begins with local anesthesia infiltrated along the incision and the interspace with 0.25% Marcaine with epinephrine. General anesthesia is the authors' preferred choice, although monitored anesthesia is acceptable. The plantar incision is placed between the respective metatarsal heads, and cross-hatching the incision will assist in final meticulous closure (Figure 1). The initial incision is made deep into the subcutaneous tissue (Figure 2). Sharp dissection is continued down through the subcutaneous tissue until the nerve is exposed (Figure 3). This dissection limits undermining and keeps the subcutaneous tissue continuous all in one plane.

Once the nerve is identified, the nerve is traced distal and proximal and hemostats are used to contain the nerve (Figure 4). Each branch is identified and a #15 blade is used to sharply transect the nerve distal along its respective branches. The nerve is then traced proximal and transected sharply (Figure 5). The proximal nerve transection is sutured into the nearest muscle tissue with 6.0 nonabsorbable suture. The site is irrigated with saline in the usual fashion and meticulous closure is done with no subcutaneous sutures. Horizontal or vertical mattress sutures are used keeping the incision well apposed. The authors stress that closure with meticulous realignment of the incision is essential to avoid painful scar formation (Figure 6). A soft compressive dressing is applied, and patients are instructed on heel weightbearing only in a surgical shoe.

The dressing is typically changed 6 days postoperatively. The incision is painted with betadine or antibiotic ointment based on patient allergies. A soft dressing is reapplied and the patient is instructed on continued heel weightbearing. Sutures are removed between 2.5 and 3 weeks post-operatively. Patients are then instructed on using antibiotic ointment and large bandage daily for 1 week and can proceed with full weightbearing as tolerated (Figures 7, 8).

The treatment of interspace neuromas can be challenging, but they do respond well to conservative measures. The authors recommend exhausting all conservative treatment prior to surgical excision. The plantar approach has proven to be effective and should also be considered for stump-neuroma and failed ablation attempts. The authors have experienced 2 failed ablation procedures with significant adhesions and scarring of the nerve to the surrounding subcutaneous tissues, and the plantar approach offered superior exposure and resection potential. Care should always be taken, with meticulous closure technique to avoid hypertrophic tissue surrounding the incision line.

Figure 1. Incision placement.

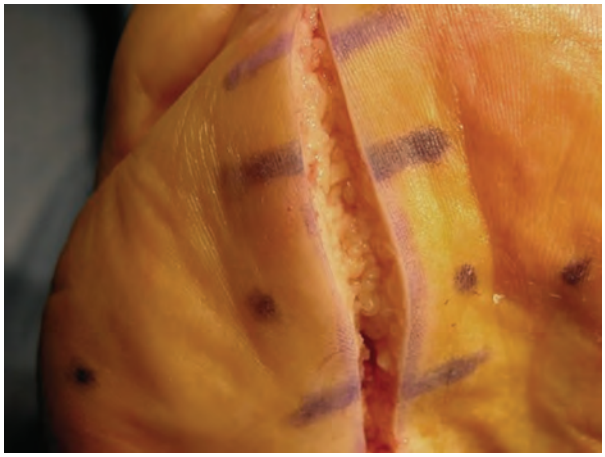

Figure 2. Sharp incision through subcutaneous tissue.

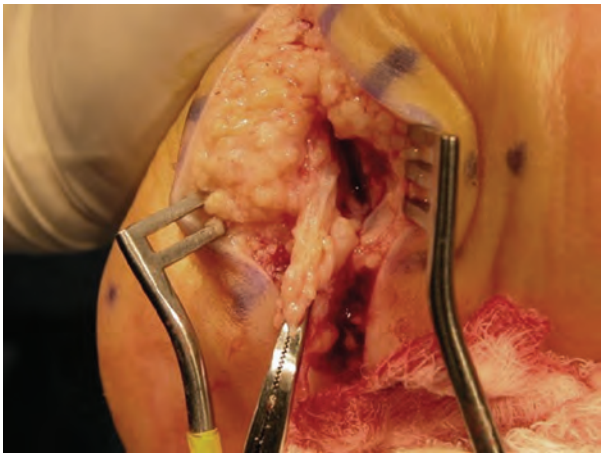

Figure 3. Identification of nerve.

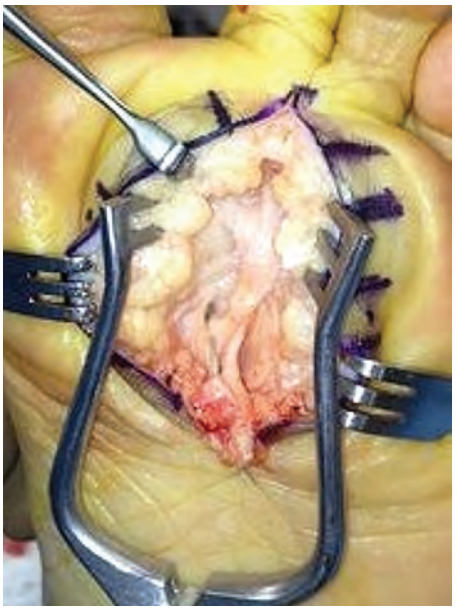

Figure 4. Isolation of nerve.

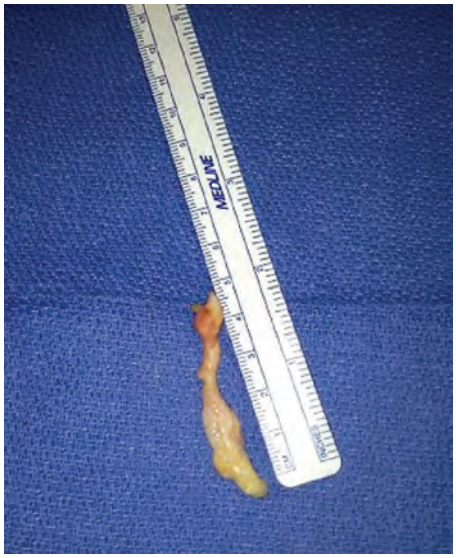

Figure 5. Nerve specimen.

Figure 6. Vertical and simple suture pattern.

Figure 7. Suture removal at 2.5 weeks postoperative.

Figure 8. View at 2 months postoperative.

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