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Minimal Invasive Percutaneous Bipolar Radiofrequency for Plantar Fasciotomy: A Retrospective Study

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ABSTRACT

The purpose of this study was to present the results of a relatively new, minimally invasive surgical technique for the treatment of chronic plantar fasciitis in 14 patients, 2 of whom underwent the treatment bilaterally one foot at time on separate occasions. This was a retrospective, multicenter, nonrandomized study. All of the patients had failed conservative therapy and had symptoms for at least 6 months. The mean follow-up duration was 15.25 months (range, 6–33 months). The postoperative mean American Orthopaedic Foot & Ankle Society hindfoot score was 82.06 (range, 56–100). None of the patients developed complex regional pain syndrome, and all but 2 (14.29% of patients, 12.5% of feet) of the patients were able to return to regular shoe gear by 2–4 weeks postoperative, and only 1 (7.14% of patients, 6.25% of feet) patient was considered a treatment failure. Based on our experience with minimally invasive percutaneous bipolar radiofrequency plantar fasciotomy, we believe the technique to be a relatively easy intervention that is effective and requires less healing time in comparison with traditional open surgical procedures.

Plantar fasciitis is known to be the most common inferior heel pain, accounting for approximately 11% to 15% of all foot problems that require medical attention (1). Plantar fasciitis affects approximately 2 million individuals and accounts for at least 1 million outpatient visits annually in the United States alone (2), hence it poses a substantial burden to the health care delivery system. Fortunately, plantar fasciitis symptoms resolve within 10 to 15 months in about 80% to 95% of patients with conservative therapy (3–5). Approximately 90% of patients diagnosed with plantar fasciitis (fasciosis) respond satisfactorily to nonsurgical therapy and do not require surgical intervention (2, 6). The etiology of plantar fasciitis has been described in the literature by many authors; however, the precise mechanism remains debatable. Suspected etiologies include obesity, overuse due to walking or running or standing, excessive subtalar pronation, seronegative arthritis, and limited dorsiflexion of the ankle joint. Conservative therapy usually entails the use of foot orthoses, application of ice, stretching exercises, local corticosteroid injection, oral nonsteroidal anti-inflammatory drugs, shoe therapy, immobilizing brace or walking boot, plantar fascia night splinting, other physical therapy modalities, and nonweight-bearing status and rest.

Historically, chronic plantar fasciitis has been treated surgically by open fasciotomy, which has a satisfaction rate of 50% to 95% (7, 8). The recovery period for open plantar fasciotomy has been documented to range from 4 to 8 months. Endoscopic plantar fasciotomy has been associated with more rapid return to regular activities in comparison with open surgical approaches, and has also been shown to be effective, although not without potential complications (9). One of the worst postoperative complications associated with the surgical treatment of recalcitrant plantar fasciitis is complex regional pain syndrome (CRPS), which has been associated with both open plantar fasciotomy and endoscopic plantar fasciotomy (9, 10). Postoperative CPRS has been documented after endoscopic plantar fasciotomy in 5% to 10% of cases (9–11), and it has been reported to occur in approximately 2% of open fasciotomy cases in one report (7). Another risk of plantar fasciotomy is lateral column symptomatology (12). Extracorporeal shockwave therapy for the treatment of chronic plantar fasciitis has been reported to be successful in 48% to 77% of cases (13, 14).

In an effort to determine the effectiveness and safety of minimally invasive percutaneous bipolar radiofrequency plantar fasciotomy for the treatment of recalcitrant plantar fasciitis (fasciosis), we undertook a retrospective analysis of consecutive patients whom we treated with this therapeutic option. Our hypothesis was that percutaneous

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radiofrequency plantar fasciotomy would demonstrate effectiveness without excessive postoperative complications and with rapid recovery in comparison with more traditional surgical approaches to this common pedal pathology.

Patients and Methods

Patient Population

The participants were selected from the authors' surgical records for the time period beginning January 9, 2007, and ending May 20, 2009. This study was conducted at 2 different facilities by 2 different surgeons (S. L., D. H.), with institutional review and approval. The surgeon who had performed their surgery followed each participant, and both surgeons used the same surgical technique. The diagnosis of recalcitrant plantar fasciitis (fasciosis) was made by the operating surgeon and was based on each individual patient's history and physical examination, as well as standard foot radiographs. All patients had a minimum of 6 months of conservative therapy before they had surgery, including local icing, plantar fascia rest taping, calf and arch stretching, shoe modification to include roller soles and antipronation designs, functional foot orthotics, plantar fascia night splinting, oral and/or local corticosteroid injections, oral and topical nonsteroidal anti-inflammatory drugs, professional and self-managed physical therapy, immobilization with a "cam" walker brace, and nonweight-bearing ambulation with crutches or other assistive devices. Physical findings had to entail focal proximal plantar fascia tenderness upon deep palpation, plantarmedial heel pain without distinct neuritic radiation, poststatic dyskinesia affecting the proximal plantar fascia and plantar heel. Exclusion criteria entailed distinct findings indicative of lumbosacral radiculitis, peripheral neuropathy, systemic arthritis, prior heel trauma, bone tumor, tarsal tunnel syndrome or findings consistent with entrapment of Baxter's nerve, patients <18 years of age, pregnant women, individual dependent on narcotic analgesics for pain relief, worker's compensation claim participant, and concomitant participation in any other clinical investigation.

The surgeons also evaluated the participants throughout the postoperative period and procured the data used in the study analyses. Telephone interviews were used to procure information that was not obtained in the clinic setting. Each patient provided answers to the American Orthopaedic Foot & Ankle Society (AOFAS) hindfoot scoring scale (15) and the answers to 2 additional questions were also required of each patient, specifically: "Would you recommend this surgery to a family member or friend?" and "Would you do the surgery over again, if the heel pain returned?"

Intervention

Each surgeon, as an isolated surgical procedure in every case, performed percutaneous radiofrequency plantar fasciotomy. Before administration of anesthesia, the area of maximum tenderness was marked on the foot. After the area was marked, an anesthesiologist administered intravenous sedation, and an ankle block was administered with local anesthetic. The foot was then prepped and draped in the usual sterile manner, after which a skin marker was used to draw out a grid of 16 to 20 dots over the proximal plantar fascia, encompassing the point of maximum tenderness, each mark being 3 to 4 mm apart. Thereafter, a 0.062-inch smooth Kirschner wire was used to puncture through the skin and superficial fascia and subcutaneous fat layers down to the level of the deep fascia. After creation of the channels, the bipolar radiofrequency unit (Arthrocare, Sunnyvale, CA) was set to a power level of 175 volts (level 4) and a pulse duration of 500 msec. The radiofrequency wand was attached to a saline solution drip set to 2 to 3 drips per 3-second interval. Thereafter, the probe was inserted sequentially into each Kirschner wire channel, to the level of the plantar fascia, which is identified by palpable resistance to penetration by the probe. Once the deep fascia was contacted, the radiofrequency energy was applied, and the probe felt to pierce the deep plantar fascia, thereby effecting microfasciotomy (Figure 1). Penetration of the plantar fascia was carried out with 3 applications of radiofrequency energy in a fan-shaped pattern, wherein the first penetration was directed perpendicular to the fascia, the second directed proximally, and the third directed distally. The surgeon used the contralateral hand to apply gentle tension to the plantar fascia by dorsiflexing the metatarsophalangeal and ankle joints. Care was taken to avoid penetration through the intrinsic musculature deep to the plantar fascia, and also to avoid application of the radiofrequency energy to the skin. After completion of the microfasciotomy, a sterile dressing was applied and the patient placed in a "cam" walker and allowed to bear weight to tolerance. Use of a sneaker or soft shoe was resumed between 2 and 4 weeks postoperative, and regular shoe gear and weight-bearing activities resumed by 4 weeks postoperative.

Results

A total of 19 eligible patients were identified and invited to participate in this retrospective study; however, 5 (26.32%) of these were lost to follow-up (they did not respond to our calls and letters) for no identifiable reason. Therefore, 14 patients (16 feet) were included in the descriptive statistical analyses. A statistical description of the results is depicted in Table 1. The mean age of the patients was 48.7 years (range, 27–78 years). In regard to gender, 9 (64.29%) of the patients were female and 5 (35.71%) were male. Two (14.29%)

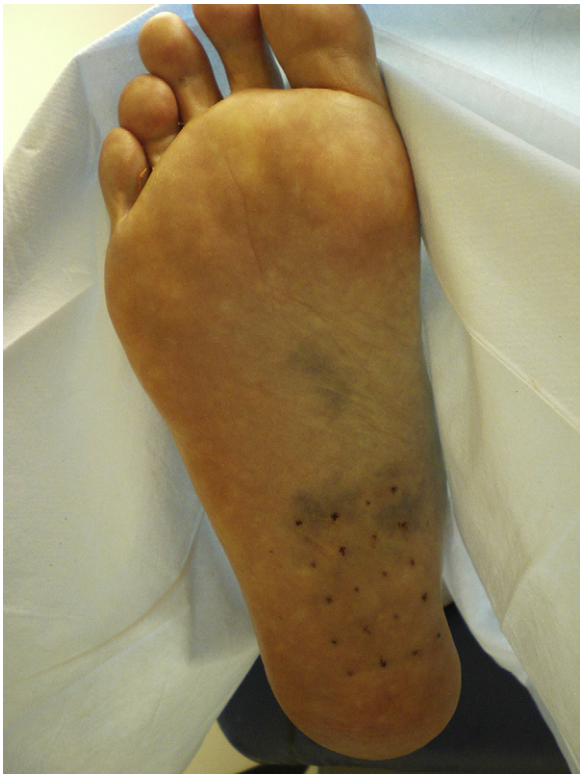

Fig. 1. Percutaneous microfasciotomy, plantar view immediately postoperative.

Table 1
Statistical description of the case series (N = 16 procedures in 14 patients)

Clinical Variable	Outcome*
Age (years)	48.7 (range, 27–78)
Sex	
Female	9 (64.29)
Male	5 (35.71)
Duration of symptoms (months)	6.5 (range, 6–14)
Bilateral intervention	2 (14.29)
Duration of follow up (months)	15 (range, 6–33)
Returned to regular shoe gear by 4 weeks postoperative	14 (87.5)
Recommend procedure†	
Yes	11 (78.57)
No	3 (21.43)
Repeat procedure‡	
Yes	9 (64.29)
No	5 (35.71)
AOFAS score	
Overall	82.06 (range, 56–100)
Yes to recommend	89.9 (range, 60–100)
No to recommend	69.0 (range, 56–80)
Yes to repeat	92.2 (range, 76–100)
No to repeat	65.1 (range, 56–70)
Complication§	1 (7.14)

* Results expressed as mean (range) for continuous data, or count (%) for discrete data.

† Would recommend the procedure to a family member or friend.

‡ Would undergo the procedure again should the symptoms recur.

§ There were no cases of CRPS, localized plantar neuropraxia, intrinsic muscle atrophy or paresis, lateral column syndrome, exacerbation of pes planus or planovalgus, plantar scar hypertrophy or pain, or any form of new symptomatology; however, one patient failed to experience satisfactory heel pain relief by 8 weeks postoperative and was considered a treatment failure.