The Journal of Foot & Ankle Surgery 57 (2018) 514–517

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Superficial Peroneal Nerve to Deep Peroneal Nerve Transfer With Allograft Conduit for Neuroma in Continuity

Christopher Bibbo, DO, DPM, FACFAS [1], Edgardo Rodrigues-Colazzo, DPM [2], Adam G. Finzen, DPM [3]

[1]*Chief, Foot & Ankle, Plastic Reconstructive & Microsurgery Service, Rubin Institute for Advanced Orthopaedics, Sinai Hospital of Baltimore, Baltimore, MD*
[2]*Fellowship Director, Lower Extremity Deformity Correction Center & Microsurgical Limb Reconstruction, Presence St. Joseph Hospital, Chicago, IL*
[3]*Chief Resident, Podiatry Section, Presence St. Joseph Hospital, Chicago, IL*

ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:
ankle arthrodesis
deep peroneal nerve
intercalary nerve allograft
nerve transfer
neuroma
superficial peroneal nerve

ABSTRACT

The anterior approach to the ankle for surgery can result in injury to the superficial peroneal nerve, resulting in a painful neuroma and significant patient morbidity. A paucity of data is available evaluating the role of the superficial peroneal nerve to deep peroneal nerve transfer as a method of treatment of neuromas in continuity after ankle arthrodesis. We describe 11 patients who underwent nerve transfer with nerve allograft and conduit repair to treat recalcitrant painful neuromas after ankle arthrodesis. At a mean follow-up period of 31 months, the mean visual analog pain scale score had improved from 7.9 preoperatively to 2.45 postoperatively ($p < .0001$). These data suggest that nerve transfer with a nerve allograft can provide significant clinical improvement for painful neuromas of the peripheral nerves at the ankle.

The branches of the common peroneal nerve have been reported to be the most commonly injured lower extremity nerves, from both iatrogenic and traumatic causes (1,2). The anterior approach to the ankle, such as that for ankle arthrodesis, can result in painful neuromas of the superficial peroneal nerve, which can impart significant patient morbidity. Treatment of intractable lower extremity nerve pain from neuromas has ranged from neurectomy to neuroma excision or amputation, with varying results (2–6). Although painful neuromas of the superficial peroneal nerve have been well described (3,5,7), a consensus on the management of painful neuromas of the superficial peroneal nerve has not been reached. Recently, the creation of a "closed nerve circuit," using nerve caption with nerve wrapping to dampen undesired neuronal impulses, has been demonstrated to prevent painful neuroma in patients undergoing above-the-knee amputations (8). Nerve transfers combined with nerve allografts for the treatment of recalcitrant neuromas of the lower extremity have more recently been demonstrated to produce good outcomes (1). The purpose of the present study was to evaluate and assess the clinical and subjective patient outcomes with surgical management of severe, recalcitrant, neuromas of the superficial peroneal of the ankle using an intercalary nerve allograft transfer technique. The transfer was performed between the superficial and deep peroneal nerves in the mid-leg, where the neuronal tissue is relatively free to glide without tension in a deeper plane of cushioning muscle.

Patients and Methods

Patient Selection

The patients were selected consecutively as they presented to clinic over the course of 3 years (January 2009 through December 2011). Each patient must have undergone an anterior approach ankle arthroplasty and presented with symptoms along the dermatome of the superficial peroneal nerve, with pain elicited over the course of the superficial peroneal nerve at the ankle and dermatomal pain or dysesthesia present. In addition, a visual analog scale (VAS) for pain score of ≥7 was required. Each patient must also have undergone a nerve conduction velocity test, with the findings demonstrating an abnormal nerve conduction velocity and dampened amplitude of the superficial peroneal nerve. All the patients had also exhausted the available nonoperative therapies, including physical therapy, pharmacologic agents, and bracing. All 11 patients in the present study met the inclusion criteria, and no patient who had undergone anterior ankle approach arthroplasty and presented with the symptoms described was excluded from the study. The patients' demographic data were collected. Each patient completed a VAS (9) for pain at the clinic immediately before surgery and at the final clinic visit. At the final clinic visit, the patients were also asked to rate their outcome after the surgery and compare it with their preoperative condition. The scale is nonscientific and was used to collect aggregate data relating to the patients' overall experience from their initial visit to their final visit. The scale ranged from failure to moderate, good, and excellent outcomes. The final question was whether the patient would undergo the surgery again if given the opportunity. For the outcomes analysis, the demographic data were catalogued, and the differences in the mean preoperative and postoperative VAS for pain scores were analyzed (Student *t* test; $p = .05$; available at: www.physics.csbsju.edu/stats/t-test_bulk_form.html).

Financial Disclosure: None reported.
Conflict of Interest: None reported.
Address correspondence to: Christopher Bibbo, DO, DPM, FACFAS, Sinai Hospital of Baltimore, 2401 W Belvedere Ave., Baltimore, MD 21215.
E-mail address: DrChrisbibbo@gmail.com (C. Bibbo).

1067-2516/$ - see front matter © 2017 by the American College of Foot and Ankle Surgeons. All rights reserved.
https://doi.org/10.1053/j.jfas.2017.11.022

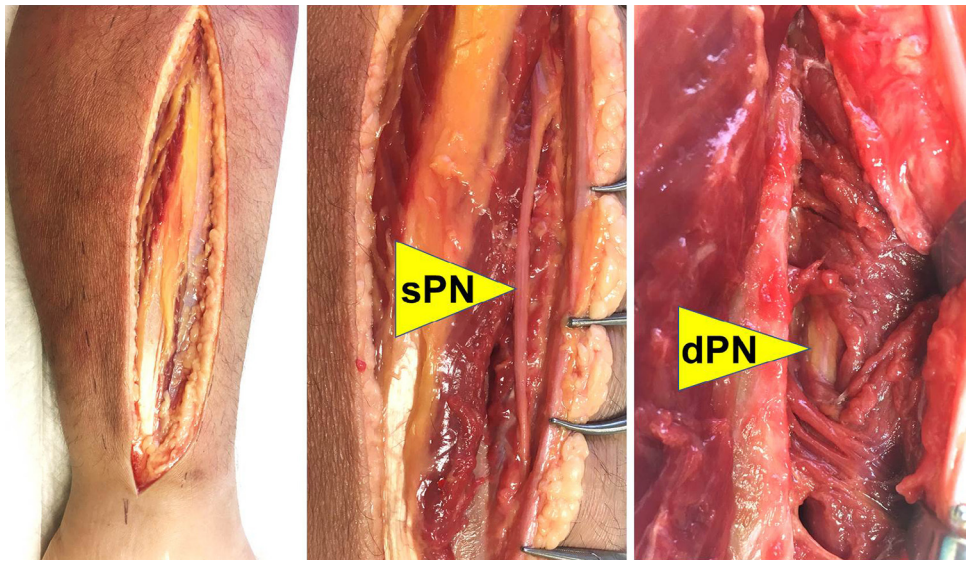

Fig. 1. Cadaveric photograph defining the superficial peroneal nerve (sPN) and deep peroneal nerve (dPN) in the leg. (Photograph courtesy of Dr. Edgardo Rodrigues-Colazzo, all rights reserved.)

Operative Technique

The present study was exempt from approval from the Presence Saint Joseph Hospital institutional review board. Surgery was performed with the patient under general anesthesia without a nerve block or tourniquet to allow for intraoperative nerve stimulation. The procedure was also partially performed using the operating microscope (6×) for nerve reconstruction and surgical loupe (2.5× or 4.0×) for nerve dissection. Because of the extensive fibrosis at the ankle and distal one third of the leg, nerve transfer was performed in the mid-leg, below the typical level of motor points for the anterior and lateral compartment muscles. An incision was placed midway between the anterior and lateral aspects of the leg. Dissection proceeded until both the superficial nerve (laterally based) and the deep peroneal nerve (anteriorly based) had been identified (Fig. 1). Microscopic nerve dissection was performed to release all adhesions to the nerve (epineurectomy). Nerve stimulation was performed, beginning at the lowest setting and progressing to the maximal setting of 1.5 mA. The surgeon noted the anatomic level of the deep peroneal nerve that was below the emanation of the motor branches, which was evidenced by a visual lack of a motor response (Fig. 2). This level of no motor response from native nerve stimulation is the most proximal level at which nerve surgery was considered safe, without risk of loss of motor function (nerve "checkpoint"). The injured superficial peroneal nerve (the sensory nerve of interest) was identified and transected until normal nerve tissue was reached, which was clinically evidenced by "mushrooming" of nerve fascicles and bleeding from the nerve nutrient vessel. To ensure that perineural fibrosis was maximally reduced, external neurolysis of the proximal superficial peroneal nerve was performed. Transection of the deep peroneal nerve was performed as far below the motor checkpoint of the nerve as possible (Figs. 3 and 4).

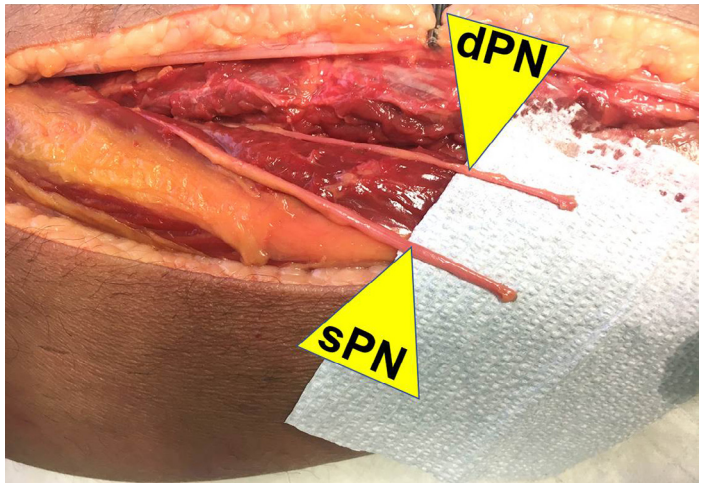

Fig. 2. Cadaveric photograph demonstrating truncation of the deep peroneal nerve (dPN) well below the motor branches and truncation of the superficial peroneal nerve (sPN) far above the ankle-level neuroma in preparation for intercalary nerve allografting with a nerve wrap. (Photograph courtesy of Dr. Edgardo Rodrigues-Colazzo, all rights reserved.)

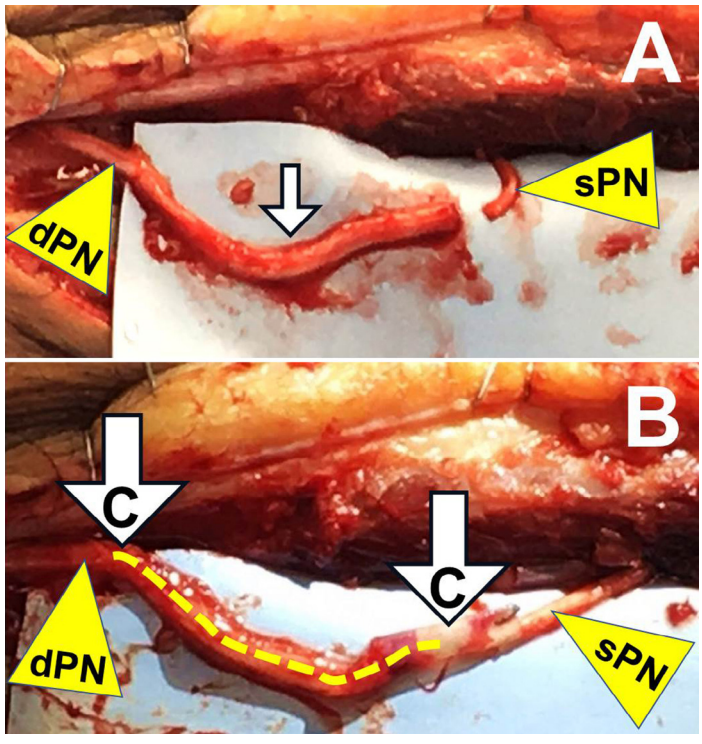

Fig. 3. *(A)* Intraoperative photograph of intercalary nerve allograft *(white arrow)* with anastomosis completed between the deep peroneal nerve (dPN) and free end of the nerve allograft to be anastomosed to the superficial peroneal nerve (sPN). *(B)* Intercalary nerve transfer of the superficial peroneal nerve (sPN) to the deep peroneal nerve (dPN) using the nerve allograft with nerve wrap *(dashed yellow line between white arrows)*. (Photograph courtesy of Dr. Edgardo Rodrigues-Colazzo, all rights reserved.)