CASE REPORT

Use of the Checkpoint Guardian nerve stimulator in tarsal tunnel release and associated neuroplasty of the lower extremity

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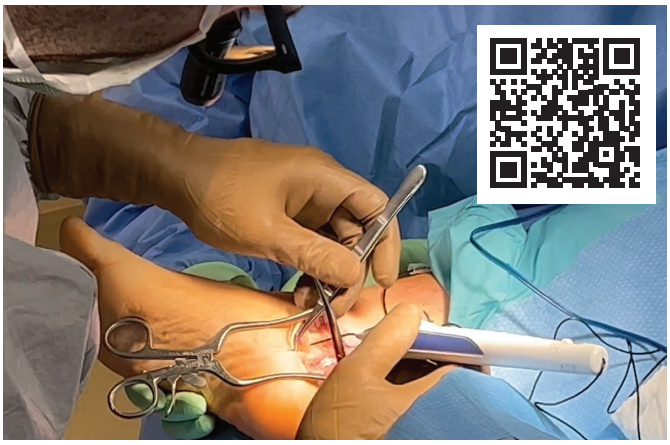
Introduction

We present a case demonstrating how intraoperative use of the CHECKPOINT GUARDIAN™ Nerve Stimulator can help guide a surgeon in neuroplasty of the tibial nerve and distal branches by direct stimulation of the nerve to evaluate motor response in the intrinsic musculature of the foot. This better allows for assessment of the nerve release and helps to determine if additional branches, both distally into the foot and proximally up the leg, may need to be addressed. This process is used as a guide to maximize postoperative recovery of function in strength, reduction of pain and improvement in sensation for return to more normal activity. We believe this more aggressive release, guided by information gained from using the Checkpoint Guardian intraoperative nerve stimulator, may decrease the chance of revision surgery.



Scan the QR code to watch the procedure described in this case report.

Case

This middle-aged woman worked long hours on her feet in the medical profession and had on and off bouts of plantar fasciitis. She performed daily stretching exercises and tried multiple types of footwear and orthotics from different podiatrists. The patient used a night splint accordingly and, despite plantar fasciitis symptoms improving, she started to experience more pain shooting from the ankle to the heel. Over time, she started to develop occasional numbness and tingling to the forefoot and toes. Her pain continued to get worse, which is when she was referred for evaluation. She received nerve blocks showing positive tarsal tunnel syndrome. She had temporary relief from a course of physical therapy followed by steroid injection to the tarsal tunnel, but the pain and nerve sensations continued to return. She underwent a nerve block to the tibial nerve in the ankle, which only temporarily resolved the pain. The patient then elected to proceed with surgery including decompression of the tibial nerve in the ankle and tarsal tunnel, releases of medial and lateral plantar branches, and release of the medial calcaneal branch.

Incision was placed halfway between the medial malleolus and the posterior aspect of the Achilles tendon and moving distally in a curvilinear fashion towards the distal edge of the transition of the heel to the arch. This was done to easily transect the laciniate ligament over the tarsal tunnel with direct visualization of all relevant structures.

Nerve stimulation was performed at 20 mA amplitude and 200 µs pulse duration for localization of the nerve. Mild flexion of the digits and contraction of the Abductor Hallucis muscle belly was observed. Then further evaluation was performed with 2 mA and 200 µs and no contraction was noted. The laciniate ligament was cut to perform the tarsal tunnel release and tissue was removed under bipolar cautery from both ends of the ligament to

prevent scar down and adhesions upon healing of the closure. Nerve stimulation was performed to compare to the baseline at both 20 mA/200 µs and 2 mA/200 µs, which showed stronger contraction at 20 mA and visible contraction of the toe flexors and abductor hallucis at 2 mA, which was not present prior to the release.

At this time, a standard tarsal tunnel release surgery would be closed, but further evaluation was performed proximally at the tibial nerve proximal to the laciniate ligament and under the posterior tibial fascia. It displayed a decreased response to stimulation compared to that at the tarsal tunnel release site, so a Metzenbaum scissor and bipolar cautery were used to transect the posterior tibial fascia and perform an external neurolysis with mobilization of the tibial nerve. It was placed through range of motion showing excellent excursion of the nerve with no adhesion points noted. The Checkpoint Guardian stimulator was then used at 2 mA/200 µs, showing substantial improvement in muscle contraction compared to previous response seen after the primary tarsal tunnel release alone.

The medial calcaneal branch was evaluated off the tibial nerve in the tarsal tunnel and traced down towards the heel. It was released as needed to attain full motion with no apparent adhesion points.

The Checkpoint Guardian stimulator was then used at 0.5 mA along the tibial nerve and showed mild muscle contraction when tested within the tarsal tunnel, so further evaluation was performed distally at the bifurcation of the medial and lateral plantar nerves. The contraction was no longer noted so another baseline was tested at both 2 mA and 0.5 mA at this bifurcation site.

Next the abductor hallucis muscle fascia was released and the septum separating the bifurcation of the medial and lateral plantar nerves was removed with bipolar cautery. Range of motion was tested on the foot and ankle showing excellent mobilization of both plantar branches, so the Checkpoint Guardian stimulator was used at 2 mA, and then 0.5 mA/100 µs settings. All levels showed substantial improvement in contraction of the abductor hallucis and the toe flexors at the appropriate course of the tibial nerve.

Copious irrigation was performed followed by bipolar cautery for additional hemostasis as needed along with further cauterization of all edges of the variety of fascia layers transected along the course of the procedures. This was performed to prevent adhesion and scar tissue after the closure. Closure was performed with 3-0 Monocryl suture of the subcutaneous level only, taking great care to avoid any of the fascial bands cut in the procedure. Skin was reapproximated with surgical staples to allow for further ambulation and physical therapy shortly after surgery. A compression dressing was applied and the patient instructed to start range-of-motion/nerve gliding exercises the same day of surgery with the lower extremity elevated as much as possible for the next 5 days. She was allowed to walk around the house with the compression dressing and surgical shoe.

Conclusion

At the 3-week follow-up, the patient stated all pain was resolved and most sensation and strength were already returned to the foot. The patient was back to work in a CAM boot at 2 weeks and started walking in regular sneakers at 4 weeks with full sensation to the foot and no further nerve shooting or tingling.

About the author

Dr. Matthew Wohlgemuth is a board-certified foot and ankle surgeon. He treats both adults and pediatric patients focusing on orthoplastics (flaps and nerve reconstruction), advanced limb salvage, foot and ankle reconstruction (internal and external fixation), Charcot reconstruction, deformity correction, wound care, minimally invasive and arthroscopic surgery, revision surgery, and trauma. He sees patients out of his Galloway, Hammonton, and Brigantine, New Jersey, offices.

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