

# The Use of Peripheral Nerve Stimulation for the Treatment of Tibial Neuralgia: Description of the Use of Ultrasound Guidance Technique for Percutaneous StimRouter Lead Placement with Anatomical Considerations

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## Introduction

Tibial neuralgia is a common source of foot and ankle pain. The primary etiologies include: compression (tarsal tunnel syndrome), crush injuries, or trauma.

Patients commonly present with numbness, tingling, and neuropathic pain in the distribution of the tibial nerve with or without weakness. If traditional conservative care fails, the use of peripheral nerve stimulation may be a reasonable and effective treatment option. The StimRouter® is a novel, fully implanted peripheral nerve stimulation system that is powered by a small, External Pulse Transmitter (EPT) and battery external power source worn by the patient. Placement of the lead can be performed using paresthesia mapping which can be difficult, painful, and lead to sub-optimal placement. We describe the use of ultrasound (US) guidance with US landmarks and pearls to ensure proper lead placement directly adjacent to the nerve using two techniques.

## Methods:

At 3 separate institutions, 10 patients had StimRouter implants for tibial neuralgia using US guidance from 1/17 to 5/17.

- 1. In-Plane technique:** Tibial nerve is identified in tarsal tunnel in short-axis view then traced proximal 5-7 cm where nerve lies deep to soleus. A lateral to medial approach is used placing the lead through the facial plane to lie over tibial nerve and under soleus. The receiver is tunneled cephalad and medial which allows EPG to be placed over medial leg.
- 2. Out-of-Plane Technique:** The tarsal tunnel is identified short axis adjacent to the medial malleolus. The Tibial nerve is visualized adjacent to the tibial artery and veins. The nerve is traced proximally about 5-7 cm. The nerve is kept short axis while utilizing a distal to proximal out-of-plane needle approach. The guidewire targets first the superficial side so the lead can be placed 'long' on the nerve. The receiver is then tunneled cephalad away from the medial malleolus.

Figure 1

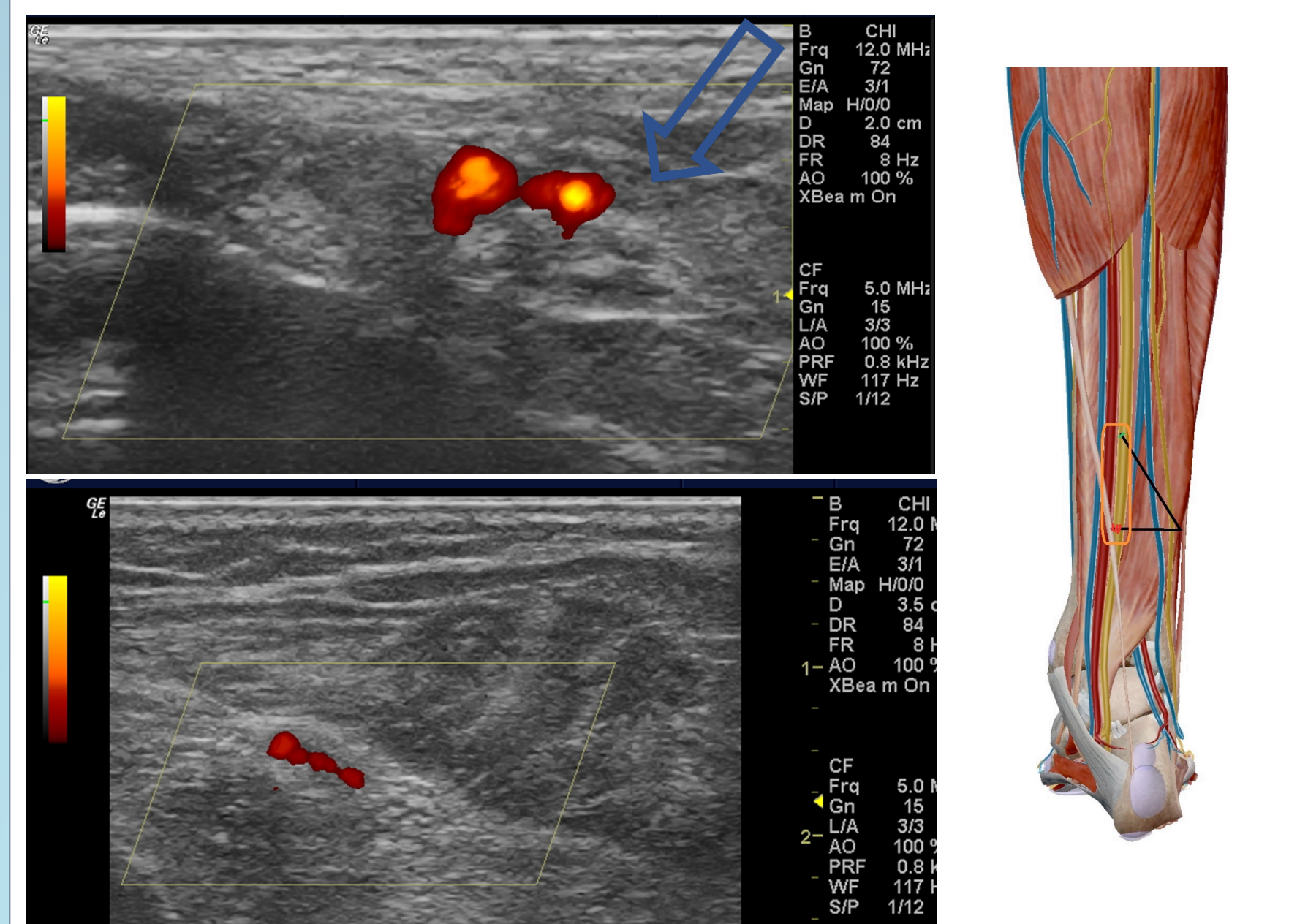
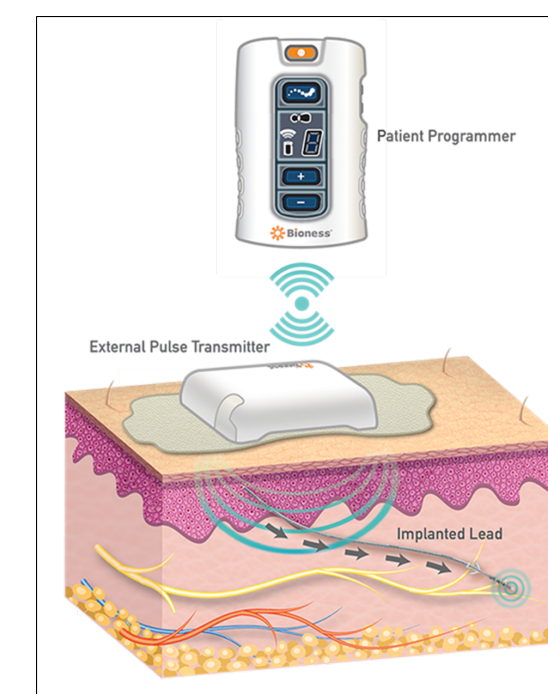


Fig 1 top left: Tarsal tunnel short axis view, big arrow is tibial nerve.

Fig 2 middle left: 7cm proximal of tarsal tunnel, tibial nerve to the right and adjacent to tibial artery deep to soleus.

Fig 3 top right: posterior view of leg showing technique 1 position of lead and battery, soleus removed.



## Results

With the StimRouter the “trial” is integrated into the implant procedure. The use of US guidance combined with patient feedback throughout stimulation and percutaneous placement of the permanent lead delivers additional confidence of the proper location of the lead electrodes adjacent to the target nerve.

## Discussion

Classically, electrode placement involves an open procedure under general anesthesia with dissections for nerve visualization, electrode placement, tunneling, and placement of a implantable pulse generator (IPG) with battery. The StimRouter is a novel percutaneously placed electrode with an external “wearable” worn by the patient controlled by a small “Patient Programmer” that resembles a small remote control, allowing the patient to be in charge of their pain management. Because there is no IPG it allows for a minimally invasive treatment option. The use of ultrasound provides a fast, easy, effective, safe, and reliable method of lead placement adjacent to the target nerve with local anesthesia while the patient is awake. We describe two novel US guided techniques for lead placement with consideration for patch location. Proper patch (EPT) placement allows for a better patient experience with day-to-day use and better treatment compliance.

## Conclusion

Recent advances in PNS technology allow for permanent, non-opioid, reversible, minimally invasive solutions for the management of chronic pain on the responsible peripheral nerve. Multiple visualization techniques can be employed to place the lead percutaneously using only local anesthesia with patient feedback, obviating the need for a separate trial lead procedure.

## References

1. Deer T, Pope J, Benyamin R, et al. Prospective, Multicenter, Randomized, Double-Blinded, Partial Crossover Study to Assess the Safety and Efficacy of the Novel Neuromodulation System in the Treatment of Patients with Chronic Pain of Peripheral Nerve Origin, Neuromodulation. 2016 Jan; 19(1):91-100.



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