

**Practice Patterns and Pain Outcomes for Targeted Muscle Reinnervation: An Informed Approach to Targeted Muscle Reinnervation Use in the Acute Amputation Setting**

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**Purpose:** Targeted muscle reinnervation (TMR) and regenerative peripheral nerve interface (RPNI) procedures have been shown to be effective for treatment of symptomatic neuromas and phantom limb pain after amputation; however, the specific indications and comparative outcomes of each are unknown. The primary research questions were: what is the complement of nerves most frequently necessitating secondary pain intervention after conventional amputation, can this information guide focused application of TMR and RPNI to the primary amputation setting, and how do outcomes compare in both settings?

**Methods:** We performed a retrospective review of records for patients who had undergone lower-extremity TMR and/or RPNI at our institution. 87 procedures (59 for secondary treatment of symptomatic neuroma pain after amputation, 28 for primary prophylaxis during amputation) were performed. We reviewed records for amputation level, TMR and/or RPNI timing, pain scores, patient-reported resolution of nerve-related symptoms, and complications/revisions. We evaluated the relationship between amputation level and the symptomatic nerve addressed on pain symptoms from neurologic intervention.

**Results:** Mean pain score decreased after delayed TMR/RPNI procedures (4.3 vs 1.7,  $P < 0.001$ ) and final pain was  $1.0 \pm 1.9$  at follow-up for acute procedures. Symptom resolution was achieved in 92% of patients. The sciatic nerve most commonly necessitated intervention for symptomatic neuroma above the knee, while the tibial nerve and common/superficial peroneal nerve was most problematic following transtibial amputation. None of our patients necessitated a revision pain procedure after primary TMR/RPNI targeting these commonly symptomatic nerves. Failure to address the tibial nerve during a secondary procedure was associated with increased risk of unsuccessful TMR/RPNI resulting in revision surgery (odds ratio 26, 95% confidence interval 1.8-368,  $P = 0.02$ ).

**Conclusion:** There is a consistent pattern of symptomatic nerves that require secondary surgical intervention for management of pain after amputation. TMR and RPNI were translated to the primary amputation setting by using this predictable pattern to devise a surgical strategy that prevents symptomatic neuroma pain while also minimizing surgical morbidity.