

Limiting Donor Site Morbidity in Autograft Nerve Reconstruction: Comparing Sural Nerve Grafts With and Without TMR to Motor Nerve Grafts

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Introduction

The Problem: Sensory nerve harvest (sural nerve) is the gold standard for autologous reconstruction but is associated with significant donor-site morbidity, including paresthesias (87.2-92.9%), chronic neuropathic pain (19.7-25.6%), and functional impairment (5-10%).

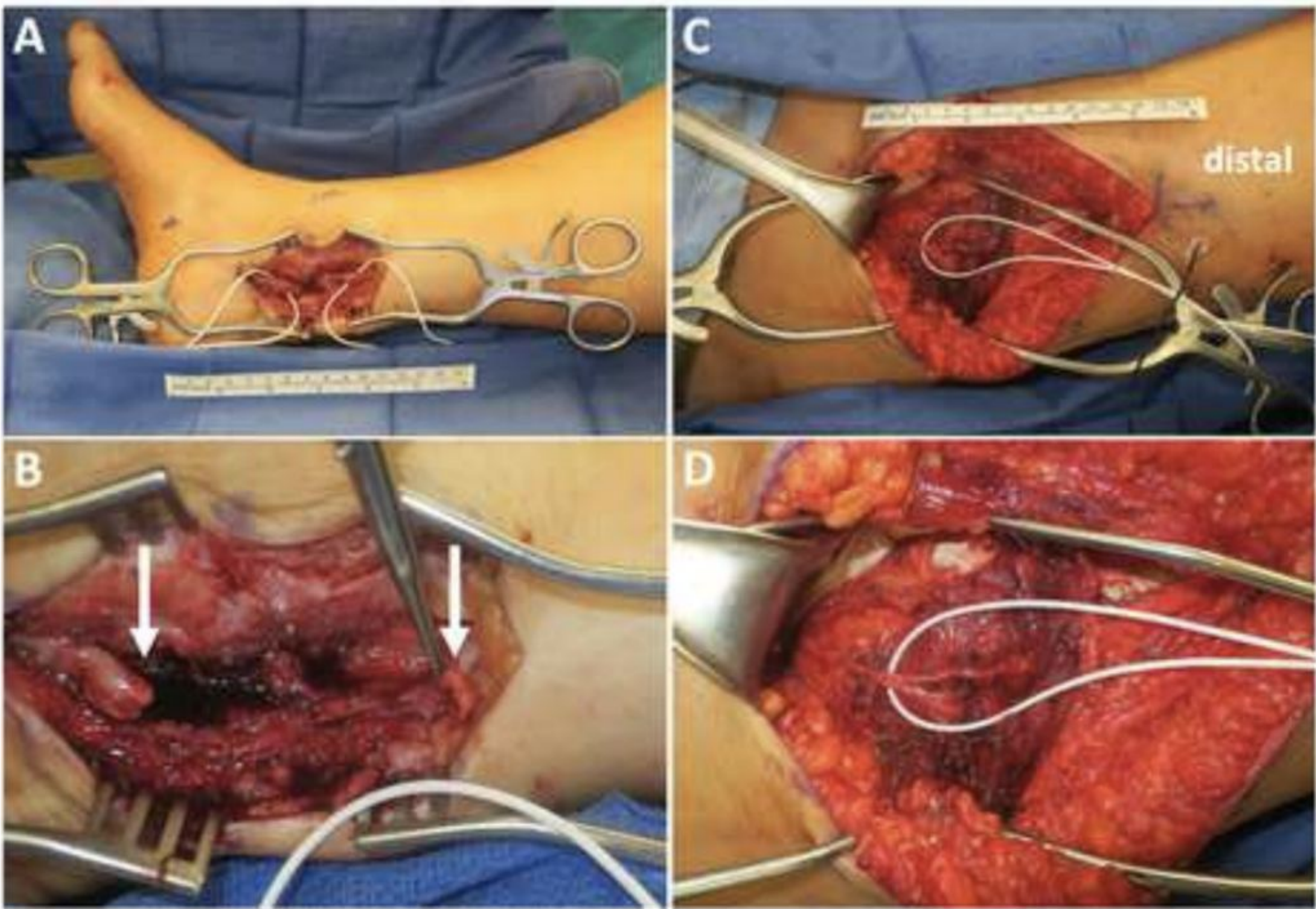
Targeted Muscle Reinnervation (TMR): Performing TMR at the proximal sural nerve stump may mitigate donor-site pain.

The Innovation: Lower extremity motor nerves (Femoral Motor Nerve to Vastus Lateralis - MNVL) offer redundant innervation and may avoid sensory-related morbidity.

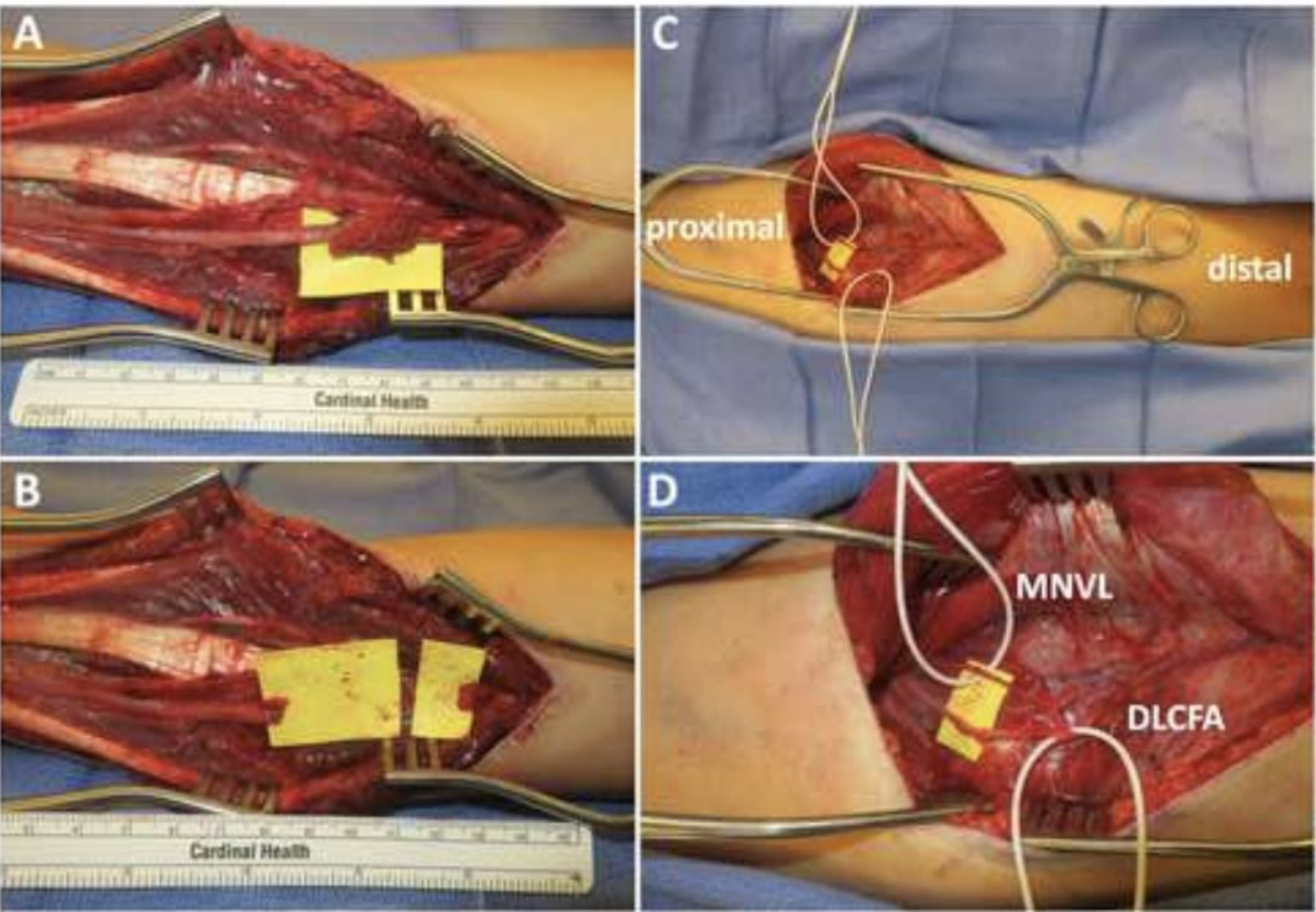
Hypothesis: MNVL will result in the fewest donor site sensory symptoms, followed by the sural nerve with TMR cohort.

Surgical Technique: MNVL Harvest

- **Axis:** Defined by the Anterior Superior Iliac Spine (ASIS) to the lateral patella.
- **Dissection:**
 - Interval developed between the rectus femoris and vastus lateralis.
 - The nerve is reliably found in this raphe, branching off the femoral nerve at the level of the greater trochanter.
 - The distal motor branch is the clinical target, verified with intraoperative stimulation.



An example of tibial nerve reconstruction with the nerve found to be in discontinuity who also required cable grafting.



A representative patient undergoing simultaneous reconstruction of the ulnar artery and nerve after traumatic injury demonstrating the complexity of reconstruction possible with a single donor site.

Methods

- **Study Design:** Retrospective chart review (2015–2024).
- **Cohorts (N = 50):**
 - **Cohort 1:** Sural nerve harvest without TMR (n = 18).
 - **Cohort 2:** Sural nerve harvest with TMR (n = 18).
 - **Cohort 3:** MNVL harvest (n = 14).
- **Outcome Measures:** Follow-up notes were screened for subjective symptoms, final sensory deficits, and donor-site pain.

	Cohort 1 (Sural Alone)	Cohort 2 (Sural + TMR)	Cohort 3 (MNVL)	p-value
Nerve Length Harvested	30.6 ± 15.8 cm (max 56 cm)	32.6 ± 11.9 cm (max 55 cm)	9.8 ± 5.7 cm (max 22 cm)	<0.0001
Recipient Site	6.9 ± 2.9 cm	7.3 ± 3.1 cm	4.6 ± 2.9 cm	0.022
Cable Grafting	94%	100%	50%	0.0003
Loss of Sensation	91%	91%	25%	0.01
Donor Site Pain	50%	9%	0%	0.02 (C2), 0.003 (C3)

Results

- **Inciting Events:** Majority of cases were due to traumatic causes (67-71%), followed by surgical/iatrogenic, then oncologic reasons.
- **Sensory Outcomes:** Loss of sensation at final follow-up was significantly less in the MNVL group compared to both sural cohorts (p = 0.01).
- **Pain Outcomes:** Cohort 2 (Sural + TMR) and Cohort 3 (MNVL) were individually superior to Cohort 1 (Sural - No TMR) (p = 0.02 and p = 0.003).
- **Equivalency:** No significant difference in pain was found between Sural + TMR and MNVL (p = 0.437).
- **Functional Safety:** No MNVL patients experienced disturbances to ADLs.

Discussion & Clinical Implications

- **A New Alternative:** MNVL is a viable autograft option that provides adequate length for many reconstructions while minimizing permanent sensory loss.
- **Optimizing the Gold Standard:** For cases requiring the sural nerve (e.g., long cable grafts), performing TMR at the harvest site significantly limits chronic pain.
- **Patient Selection:** The senior authors prefer MNVL for shorter, distal nerve injuries or for patients already experiencing preoperative nerve pain to avoid creating a secondary pain site.