

POST-AMPUTATION PAIN OUTCOMES IN DIABETIC PATIENTS: THE IMPACT OF PROPHYLACTIC RPNI SURGERY

Melanie J Wang MD¹; Ahneesh J. Mohanty, MD¹; Toby Chen, BA¹; Isabel Taboada, BA¹; Niki Matusko¹; Paul S Cederna MD¹; Theodore A. Kung, MD¹

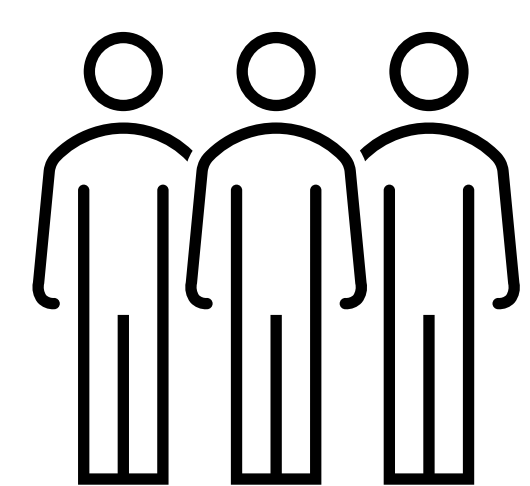
¹ Section of Plastic Surgery, Department of Surgery, University of Michigan, Ann Arbor, MI 48109, USA

Introduction

Diabetes mellitus (DM) is the leading cause of non-traumatic major limb amputations worldwide, accounting for 60-70% of non-traumatic lower-extremity amputations. Individuals with diabetes remain at risk of symptomatic neuroma formation and phantom limb pain (PLP), which can impair prosthetic use, rehabilitation, and quality of life. In addition, individuals with diabetes may also develop neuropathy resulting in dysesthesias and anesthesia, compounding the risks of socket intolerance, skin breakdown, and reduced mobility. Regenerative Peripheral Nerve Interface (RPNI) surgery has been shown to reduce the incidence of neuroma pain, PLP, and improve prosthetic tolerance. However, the efficacy of RPNI surgery in patients with diabetes has not been fully defined. Given the high prevalence of amputation in this group and their unique pathophysiology, understanding the prophylactic benefit effect of RPNI surgery is essential.

Methods

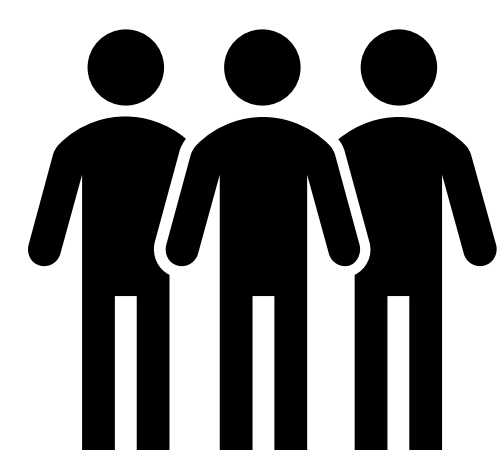
A retrospective cohort study was performed. Adults with type 2 DM who underwent major upper or lower limb amputation between 2000 and 2025 were included. Patients were categorized by whether they received prophylactic RPNI surgery versus standard nerve management at the time of limb amputation. Primary outcomes were PLP severity (Numeric Rating Scale 0-10), symptomatic neuroma presence, and opioid consumption (MME/day) across postoperative intervals. Secondary outcomes included benzodiazepine, antidepressant, and GABAergic medication use.



Group 1

DM + prophylactic RPNI surgery

vs.



Group 2

DM + standard nerve management

Results

Neuropathic Pain (PLP)

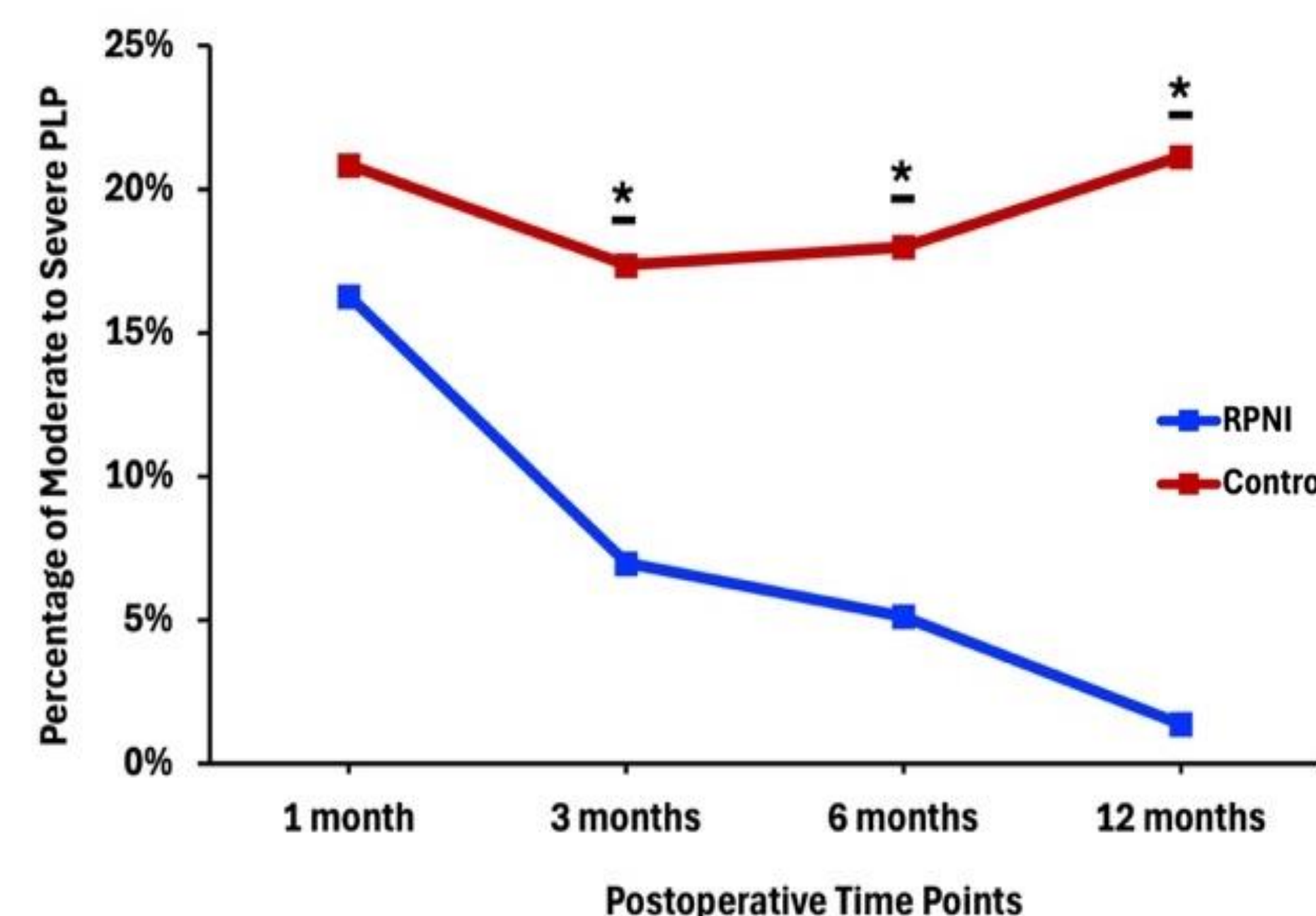


Figure 1. Percentage of patients with moderate-to-severe PLP at 1, 3, 6, and 12 months postoperatively. The RPNI group demonstrated significantly greater reduction in PLP over time compared to controls ($p < 0.001$).

Neuroma

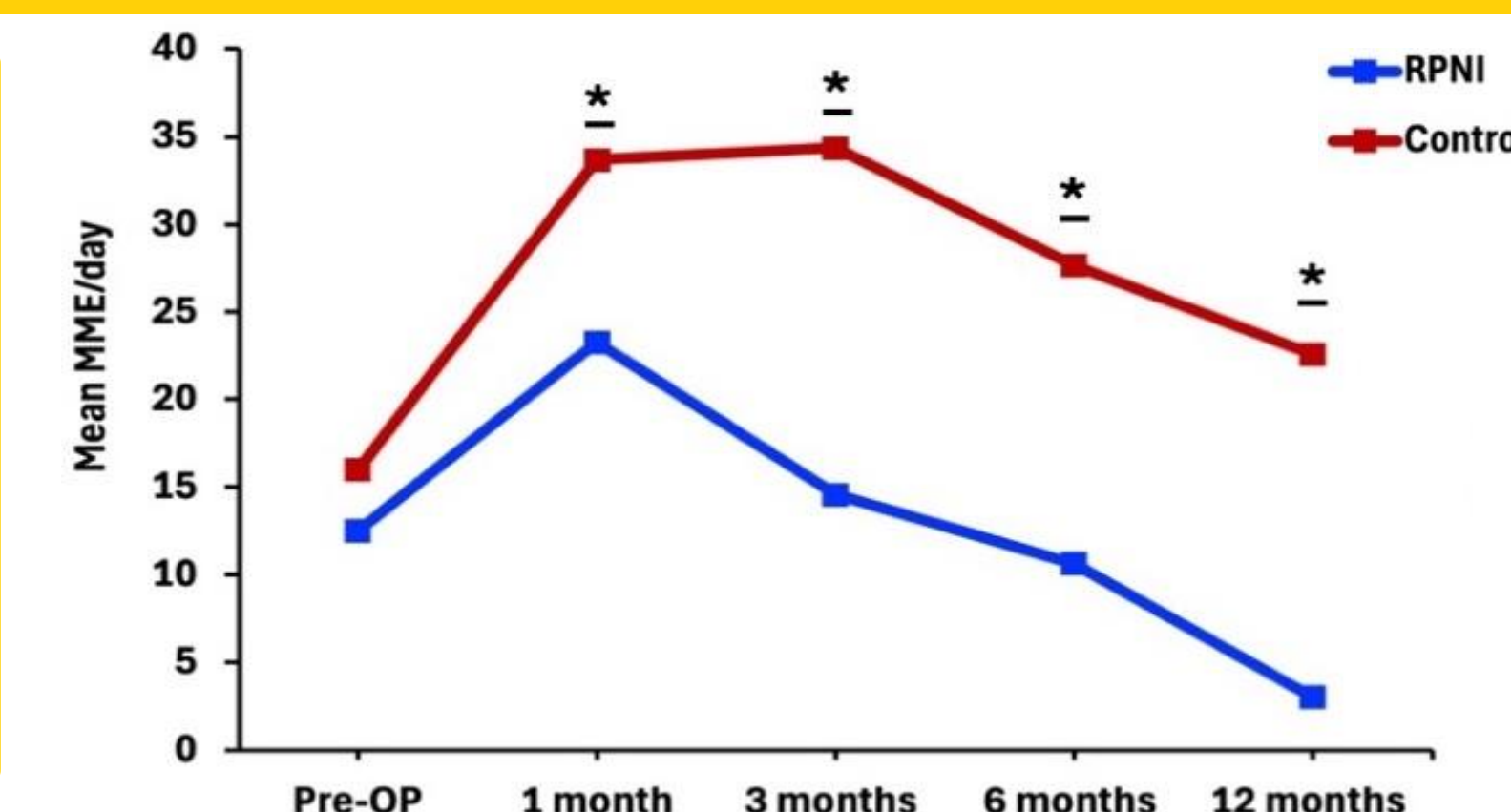
	RPNI surgery	Control	p-value
Symptomatic neuromas	0 (0.00)	11 (7.80)	0.008

Table 2. Symptomatic neuromas were absent in the RPNI group and present in 7.8% of controls ($p = 0.008$).

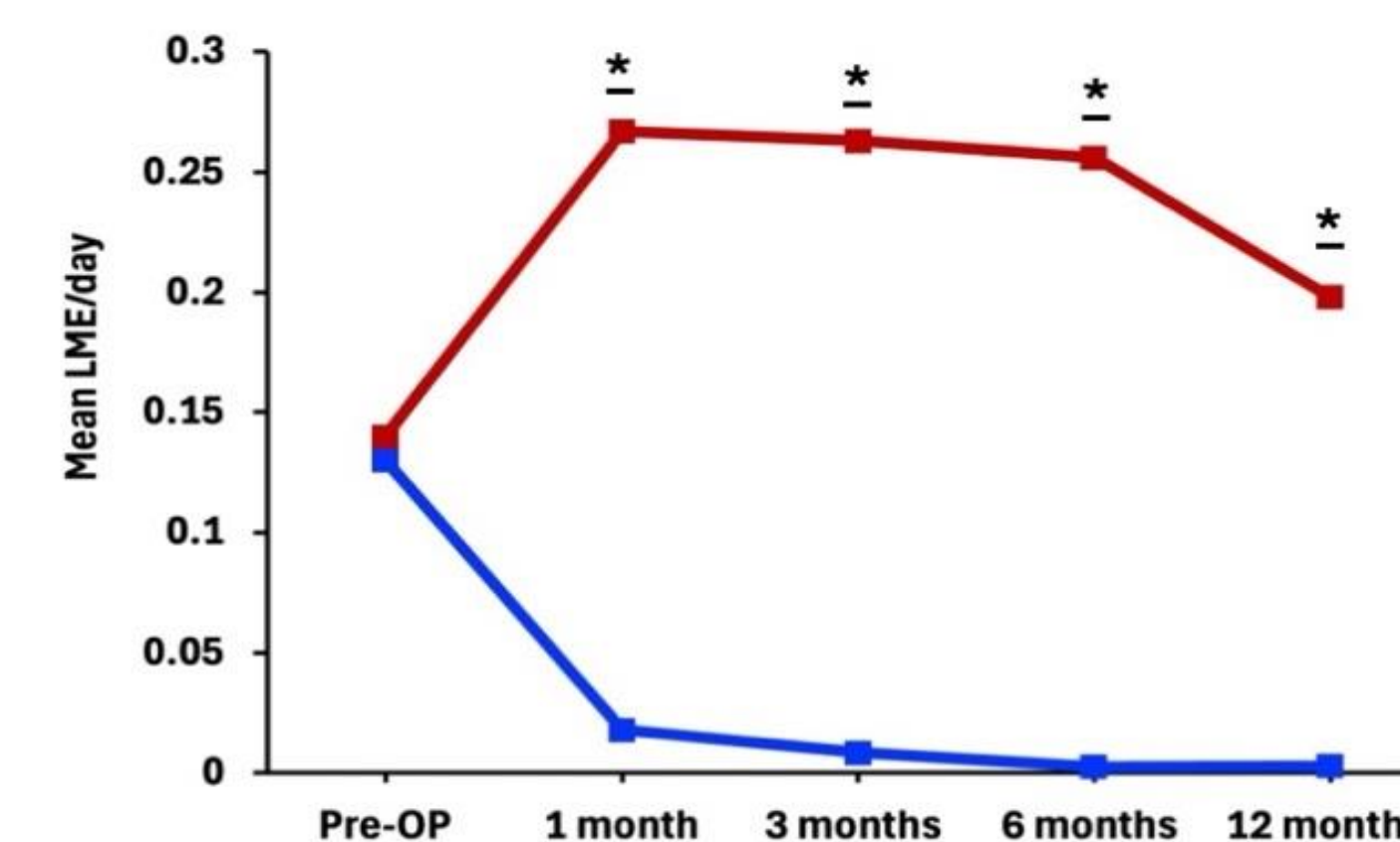
	Rate of PLP	
	RPNI Surgery (% ± SE)	Control (% ± SE)
1 month	45.54 ± 5.74	60.00 ± 3.95
3 months	30.70 ± 3.91	55.15 ± 4.27
6 months	27.69 ± 3.80	53.81 ± 4.37
12 months	20.95 ± 4.24	48.58 ± 4.66
p-value	<0.001	

Table 1. Estimated rates of PLP over time, demonstrating significantly lower PLP in the RPNI group compared to controls ($p < 0.001$).

Opioid Use



Benzo Use



GABAergic Use

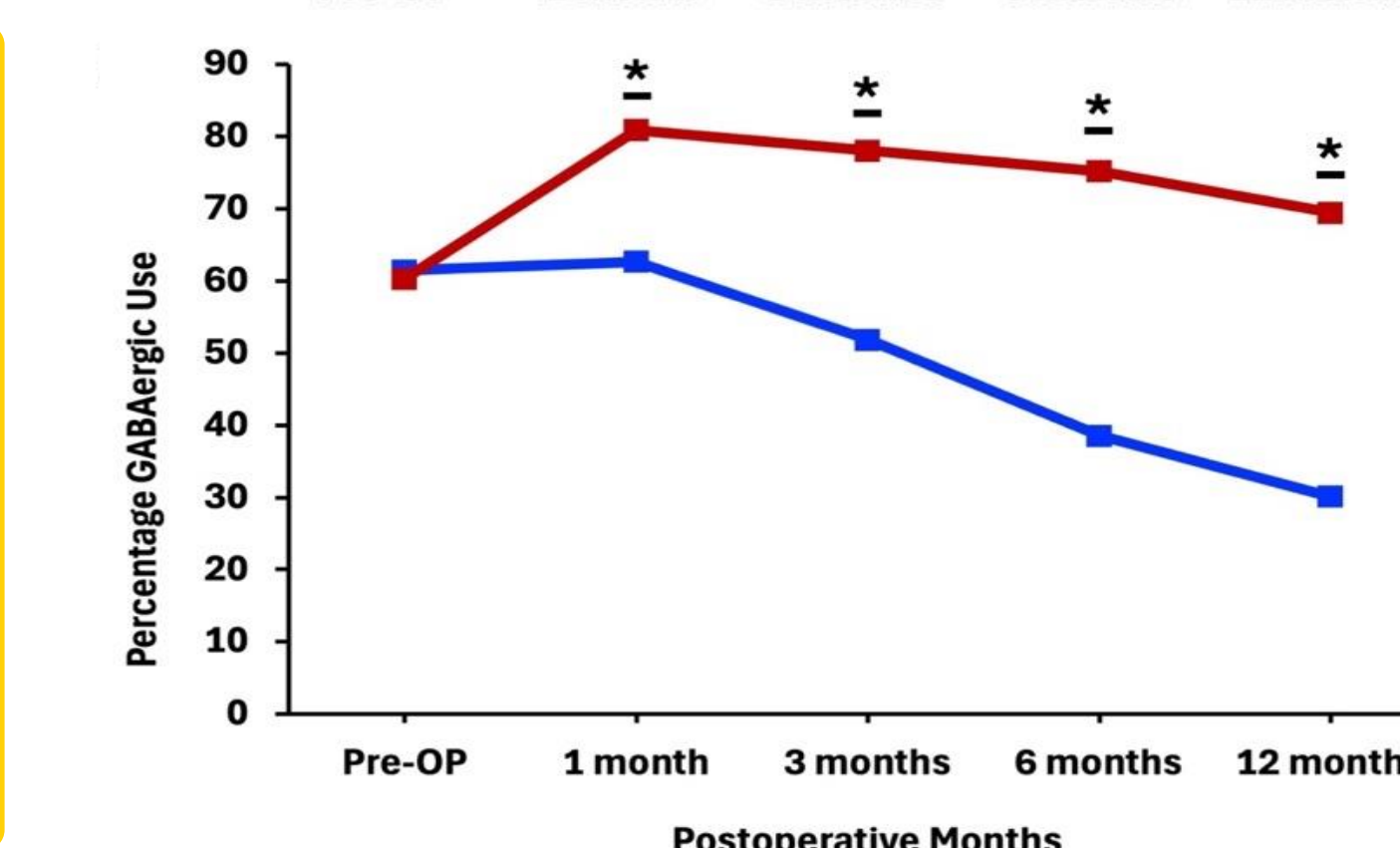
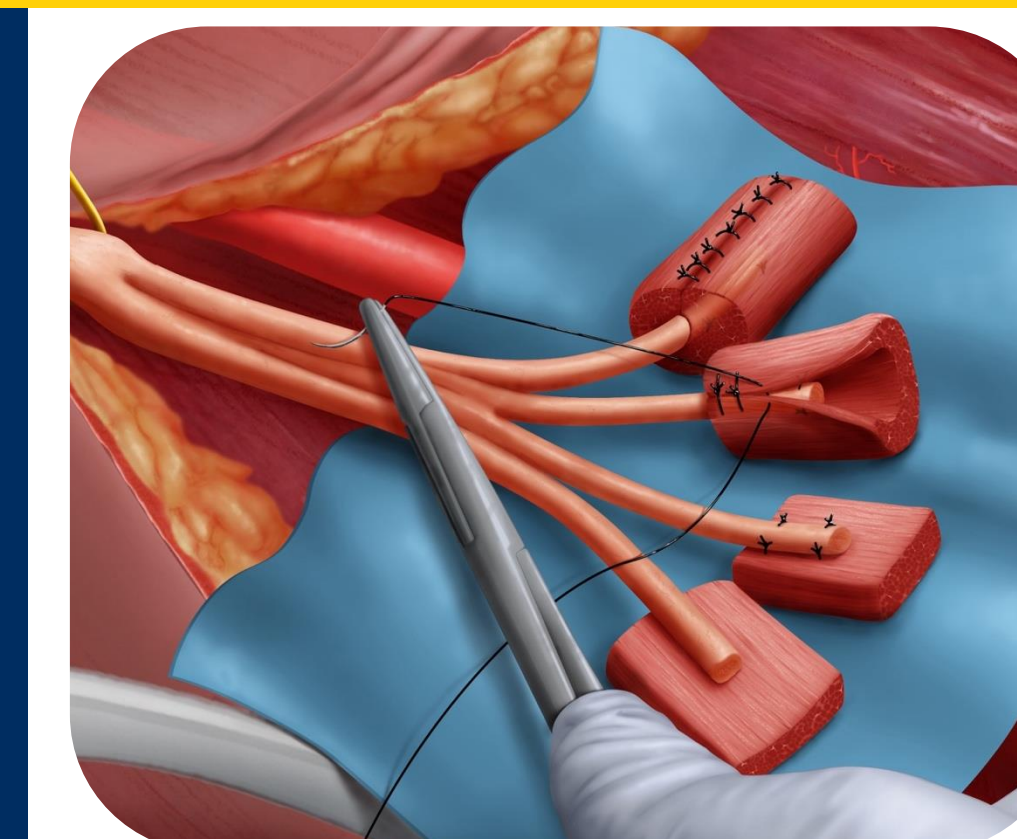


Figure 2. Opioid (MME/day), benzodiazepine (LME/day), and GABAergic use over time, demonstrating significantly reduced medication use in the RPNI group compared to controls across all postoperative time points ($p < 0.001$).

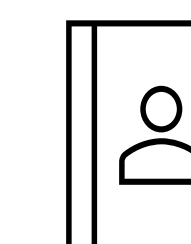
Conclusion

- Prophylactic RPNI surgery at the time of amputation reduces symptomatic neuromas, phantom limb pain, opioid use, and sedative medication requirements in diabetic amputees.
- Challenges assumption that diabetic neuropathy patients have less post-amputation pain
- Demonstrates RPNI is safe and effective in a high-risk population

Future Research Direction



Future research should use prospective studies to evaluate long-term pain outcomes and optimize perioperative and opioid-sparing strategies in RPNI surgery patients



Contact information: Melanie J. Wang, MD
meljwang@med.umich.edu