

Pain and Function in Individuals with Amputations: Exploring Indications for Nerve Surgery to Address Neuropathic Pain

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INTRODUCTION: Around 60% of individuals with amputations experience persistent post-amputation pain. Targeted Muscle Reinnervation (TMR) is among the promising interventions that have been suggested to alleviate pain and improve prosthetic functional outcomes. This study investigates subgroups of individuals with lower limb loss—based on their level of amputation and underlying cause—and their pain levels. These findings may also have important implications for individuals with upper extremity amputations, where similar pain challenges exist. The purpose is to determine who may benefit most from advanced nerve surgeries to treat or prevent neuropathic pain

METHODS: This cross-sectional study included 117 individuals with unilateral lower-limb amputations, classified by amputation level (above-knee amputation [AKA] vs. below-knee amputation [BKA]) and indication (diabetes, trauma, arterial insufficiency, and malignancy). Patient-reported outcomes were assessed using the PROMIS Scale for Pain Intensity (3a), PROMIS for Pain Interference (8a), PROMIS Scale for Neuropathic Pain Quality (5a), and Neuro-QOL Lower Extremity Function form. For categorical variables, a Fisher's exact test was performed, and for continuous variables, a Mann-Whitney U test was performed.

RESULTS:

The AKA group reported higher pain intensity, higher pain interference, and higher pain quality scores compared to the BKA group, with pain intensity nearing significance.

Furthermore, BKA patients reported worse functional outcomes without a prosthesis compared to AKA patients, and this finding was borderline significant.

Analysis by amputation indication revealed that patients with diabetes reported lower pain intensity and pain interference compared to those with trauma, malignancy, or arterial insufficiency. Furthermore, patients in the malignancy group reported better lower limb function without a prosthesis compared to all other groups and this difference was found to be significant ($p = 0.005$). Patients in the diabetic cohort reported the greatest improvement in function when comparing their ability without a prosthesis to their ability with a prosthesis

DISCUSSION AND CONCLUSION:

TMR may be more beneficial for patients with AKA amputations and those due to trauma or arterial insufficiency, as they experience higher pain levels and greater daily interference due to pain. While functional ability improved with prosthesis use across all groups, these improvements were not directly correlated with pain levels.

Table 2: Outcomes by Amputation Indication

	Arterial Insufficiency (N = 25)	Diabetes (N = 24)	Malignancy (N = 9)	Trauma (N = 47)	p-value
Do you feel any pain in your amputated limb right now?	3.36 (3.00)	2.22 (3.49)	4.22 (4.15)	3.19 (2.98)	0.272
PROMIS T-Score Pain Intensity	47.02 (10.82)	40.54 (11.11)	46.50 (11.30)	47.48 (11.31)	0.073
PROMIS T-Score Pain Interference	56.65 (12.77)	51.30 (11.43)	55.82 (9.94)	57.69 (10.88)	0.178
PROMIS T-Score Pain Quality	49.88 (8.65)	47.66 (8.20)	47.49 (8.81)	53.65 (10.18)	0.077
Lower Extremity Function T-Score w/o Prosthesis	32.50 (9.39)	32.76 (9.73)	45.93 (8.43)	34.83 (10.73)	0.005
Lower Extremity Function T-Score w/ Prosthesis	37.74 (10.64)	46.66 (10.80)	47.37 (10.32)	44.39 (8.07)	0.119

Table 1: Outcomes by Level of Amputation

	AKA (N = 44)	BKA (N = 72)	p-value
Do you feel any pain in your amputated limb right now?	3.48 (3.33)	2.80 (3.11)	0.274
PROMIS T-Score Pain Intensity	48.11 (11.28)	44.07 (11.39)	0.069
PROMIS T-Score Pain Interference	57.73 (11.15)	54.30 (11.78)	0.127
PROMIS T-Score Pain Quality	52.37 (9.90)	49.44 (9.32)	0.114
Lower Extremity Function T-Score w/o Prosthesis	36.87 (9.61)	33.10 (10.19)	0.052
Lower Extremity Function T-Score w/ Prosthesis	42.53 (9.98)	43.81 (11.00)	0.643