Factors Influencing Ulnar Nerve Transposition in Cubital Tunnel Release and Revision Surgery

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INTRODUCTION: Cubital tunnel syndrome is the second most common peripheral compressive neuropathy behind only carpal tunnel syndrome. When symptoms are recalcitrant to conservative management, cubital tunnel release (CuTR) can be performed with or without transposition, often depending on the presence of nerve instability. We hypothesize that patients who received an ulnar nerve transposition were more likely to have ulnar nerve enlargement or instability on pre-op ultrasound (US) or clinical examination but less severe EMG than patients who received an *in situ* release.

METHODS:

Patients who underwent CuTR between 2015-2023 at a single academic institution were retrospectively analyzed. Patients age 18-75 without prior elbow trauma or surgery were included. Patient demographics, clinical examination, pre-operative EMG severity classification, ulnar nerve cross-sectional area (CSA), and transposition indications were recorded and compared with Chi-Squared and t-test when appropriate. Surgeon characteristics were also analyzed including surgery type performed, training background, and transposition technique.

RESULTS:

There were 491 patients that met inclusion criteria, with 335 (68.2%) patients in the *in situ* group and 156 (31.7%) that underwent transposition. Race, laterality, EMG severity classifications, and complication rates were not significantly different between the groups. However, the transposition group was significantly younger (54.2 vs 50.4; $p< 0.01$), had a higher percentage of males (58.4 vs. 67.9, $p <0.04$), and had a lower mean operative BMI (32.4 vs. 29.6, $p <0.01$) (Figure 1). The *in situ* group had a higher revision rate than the transposition group (7.2% vs. 3.2%, $p = 0.12$), with the main indications of recurrence and subluxation at an average time of 24.7 months in the in situ (range: 4.3-83.9) and 15.7 months in the transposed (range: 7.9 – 24.5).

Among those that had a pre-op US available (28.4% of in situ, 48.1% in transposed), there were no significant differences between procedure type with respect to nerve enlargement (77.5% vs 78.3%, $p = 0.32$), and mean CSA (14.8 mm^2 vs 14.3 mm^2 ; $p= 0.64$) (Figure 2). Furthermore, within this same cohort, nerve instability was detected with ultrasound in 13.3% (n =75) of patients who underwent transposition and in 2.0% (n = 101) of patients that underwent *in situ* decompression (Figure 2). In the transposition group, nerve subluxation was detected in 1.3% of patients with US alone, 12% by clinical exam only, and 12% by both. In the in situ group, nerve subluxation was detected in 1.3% of patients with US alone, 3.0% by clinical exam only, and 0.9% by both.

Within the entire cohort, 10.2% of patients had a documented pre-operative clinical assessment of nerve instability, of which 90.0% were transposed. Additionally, 23.6% of all patients had intraoperative instability, of which 95.7% received a transposition. Overall, 72.4% of all patients that received a transposition had instability noted pre-operatively or intra-operatively, or both. When instability was not noted, reasons listed in operative notes for transposition included the severity of motor and sensory deficits and prior transposition on the contralateral limb.

There were 24 surgeons included in this cohort; training backgrounds included 79.2% orthopedic surgery,16.7% neurosurgery, and 4.2% plastic surgery. Of these, 29.2% performed only *in situ* releases, and 66.7% of surgeons performed at least 1 subcutaneous transposition, and only 33.3% of surgeons performed at least one submuscular transposition. One orthopedic surgeon performed 37.5% of all the submuscular transpositions in the cohort. Neurosurgeons performed transpositions 73.9% of the time where orthopedic surgeons performed transpositions 27.8% of the time (Figure 3).

DISCUSSION AND CONCLUSION:

The ultrasound CSA, EMG severity classification, and complication rates were not significantly different in the *in situ* and transposition groups. The in situ group had a higher revision rate than the transposition group ($p=0.12$), that returned to the OR due to symptom recurrence or subluxation at an average time of 24.7 months in the *in situ,* and 15.7 months in the transposed. Of the patients with available preop US, nerve instability was detected in a minority of patients who underwent transposition (6.4%). Of the patients with pre-op clinical assessment of nerve instability or intraoperative findings of instability, the majority were transposed (95.7%).

Further analysis of surgeon training, procedure type, and rationale for transportation should be performed to understand differences in preferences and decision-making with nerve instability

Figure 1. Subgroup Demographic Comparison

	In Situ (n = 335)	Transposed (n = 156)	p-value
Sex			
Male	58.4%	67.9%	**0.04**
Female	41.6%	32.1%	
Age, years (mean, SD)	54.2 (11.9)	50.4 (14.5)	**<0.01**
BMI	32.4 (6.9)	29.8 (6.1)	**<0.01**
Laterality (%)			0.52
Right	45.1%	47.4%	
Left	54.9%	52.6%	
Race			0.53
White	83.9%	88.4%	
Black	10.7%	7.7%	
Other	4.2%	3.8%	
Not reported	1.2%	0.0%	
EMG Severity (%)			0.24
Normal	10.0%	15.0%	
Mild	18.2%	13.7%	
Moderate	14.9%	12.45	
Severe	22.5%	24.8%	
Not Reported	32.5%	22.9%	
No EMG	1.8%	11.1%	

Figure 2. Transposed vs. In Situ Nerve Instability, Ultrasound Comparison, and Outcomes

	In Situ	Transposition	P-value
Pre-Op Instability	1.4%	28.9%	<0.01
Intra-Op Instability	1.5%	71.2%	<0.01
Revision Rate	7.2%	3.2%	0.12
Complication	2.7%	1.3%	0.33
Ultrasound Subluxation	2.0%	13.3%	0.003
CSA Mean (SD)	14.8	14.3	0.64
CSA Enlargement (>10mm2)	77.5%	78.3%	0.32

CSA = nerve cross sectional area (mm2)

Figure 3. Surgeon and Surgery Characteristics

	Total Surgeons in Cohort
Surgeons, n (%)	
Orthopedic	16 (79.2%)
Neurosurgery	4 (16.7%)
Plastic	1 (4.17%)
Procedures , n (%):	
In situ	335 (68.2%)
Transposition	156 (31.2%)
Transposition technique, n (%) Subcutaneous	140 (89.7%)
Submuscular	16 (10.3%)
Surgeons who performed in situ procedure(s) (%)	95.8%
Surgeons who performed transposition(s) (%)	70.8