



# Comparison of Borderline Ultrasound and Nerve Conduction Studies for Carpal Tunnel Syndrome

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## Introduction:

- Choosing cut-off values for nerve conduction studies (NCS) and ultrasound cross-sectional area (CSA) in the diagnosis of carpal tunnel syndrome (CTS) is critical in determining the diagnostic accuracy of the tests.
- The goals of this study were to 1) determine the sensitivity and specificity of various electrodiagnostic and ultrasound threshold values for diagnosis of CTS, and 2) determine the number of hands that underwent NCS and ultrasound that were within 10% of threshold values.

## Methods:

- A total of 309 hands of 235 patients were included in this study.
- Diagnosis of median neuropathy was made based on NCS by the independent physician performing the NCS.
- Criteria analyzed included DML of 4.4+ ms, DSL of 3.6+ ms, difference in median-ulnar mixed nerve palmar latency of 0.4+ ms, and CSA of the median nerve of 10+ mm<sup>2</sup>.

## Table 1: Overview of Cut-off Values and 10% Margins

Variable	Cut-off Value (10% Margins)
Difference in median-ulnar mixed nerve palmar latency	0.4 (0.36 – 0.44)
Median Nerve DSL	3.6 (3.24 – 3.96)
Median Nerve DML	4.4 (3.96 – 4.84)
Ultrasound CSA	10 (9 – 11)

## Table 2: Nerve Conduction Study and Ultrasound Results by Diagnostic Group

Variable	Median Neuropathy (n=235)	No Median Neuropathy (n=74)	p
Median DML (ms)	4.59 ± 1.36	3.32 ± 0.44	<0.0001
Hands With Median DML ≥ 4.4	124 (51%)	0 (0%)	
Hands With Median DML < 4.4	120 (49%)	65 (100%)	
Median DSL (ms)	3.91 ± 1.28	2.41 ± 0.72	<0.0001
Hands With Median DSL ≥ 3.6	142 (58%)	7 (11%)	
Hands With Median DSL < 3.6	102 (42%)	58 (89%)	
Difference in median-ulnar mixed nerve palmar latency	1.40 ± 1.05	0.26 ± 0.41	<0.0001
Hands With Latency Difference ≥ 0.4	217 (89%)	13 (20%)	
Hands With Latency Difference < 0.4	27 (11%)	52 (80%)	
CMAP (mV)	10.48 ± 7.06	13.12 ± 5.26	0.0007
SNAP (µV)	23.48 ± 19.29	60.59 ± 45.93	<0.0001
CSA of Median Nerve (mm <sup>2</sup> )	11.3 ± 3.3	8.2 ± 2.2	<0.0001
Hands with CSA ≥ 10	175 (74%)	19 (26%)	
Hands with CSA < 10	60 (26%)	55 (74%)	

## Table 3: Number of Hands Within 10% of Cut-off Value

Variable	Median Neuropathy (n=235)	No Median Neuropathy (n=74)	Overall (n=309)
Median DML	94 (40%)	9 (12%)	103 (33%)
Median DSL	64 (27%)	7 (9%)	71 (23%)
Difference in median-ulnar mixed nerve palmar latency	7 (3%)	7 (9%)	14 (5%)
Ultrasound CSA	115 (49%)	22 (30%)	137 (44%)

## Table 4: Sensitivity and Specificity of NCS Criteria and Ultrasound

Variable (n= 309)	Sensitivity	Specificity
Median DML ≥ 4.4	50.8%	100%
Median DSL ≥ 3.6	58.2%	89.2%
Difference in median-ulnar mixed nerve palmar latency ≥ 0.4	88.9%	80%
CSA ≥ 10 mm <sup>2</sup>	74%	74%

## Results:

- Median neuropathy was diagnosed in 235 hands while 74 hands were found not to have median neuropathy.
- Overall, 141 hands (46%) had at least one of the three electrodiagnostic variables within 10% of the diagnostic cut-off values and 137 hands (44%) had a median nerve CSA within 10% of 10mm<sup>2</sup>.
- By performing ultrasound in addition to NCS for each patient, an additional 65 hands (21%) had a definitive diagnosis on at least one of the two diagnostic modalities.

## Conclusions:

- Ultrasound and NCS yielded a similar number of patients within 10% of their diagnostic threshold values.
- When used together, the number of patients with a non-borderline diagnosis on at least one diagnostic modality was increased substantially.