

신경근육재활 및 전기진단

게시일시 및 장소 : 10 월 18 일(금) 08:30-12:20 Room G(3F)

질의응답 일시 및 장소 : 10 월 18 일(금) 10:00-10:45 Room G(3F)

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Ulnar Nerve Conduction Studies:Reference Standard with Extended Uncertainty in Healthy Korean Adults

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INTRODUCTION

Since the nerve conduction study (NCS) is widely used to diagnose neuromuscular disorders, solid reference data is of critical importance to differentiate normal from abnormal. While there have been several reports with small sample size, still there are no unified reference data in Korea because of methodological limitation and uncertainty.

OBJECTIVE

To develop reference standards for motor and sensory ulnar NCSs in Korean population with detailed consideration of uncertainty

METHODS

The NCS results from a total 97 healthy subjects (50 in twenties including 25 men and 25 women; 47 in fifties including 23 men and 24 women) were included in the analysis. We conducted standardized ulnar motor and sensory NCSs according to a standardized protocol in 3 university hospitals (Figure 1). We calibrated 5 NCS instruments of 3 sites with a standard current generator. Uncertainty factors including intra- and inter-observer variability, instrumental variation, distance measurement with a tape ruler, skin surface temperature, and the resolution of NCS machines were considered. The indoor temperature and humidity were maintained to pre-defined ranges. In motor conduction study, we produced reference standards of onset latency, baseline to peak amplitude, peak to peak amplitude, negative peak area, duration, and nerve conduction velocity. In sensory conduction study, we produced reference data of onset latency, baseline to peak amplitude, area, and duration. Finally, we produced normal cut-off value for each parameter with mean value and expanded uncertainty.

RESULTS

In the motor nerve conduction study, the mean latency of ulnar distal CMAP was 2.55ms (cut-off value, 3.27ms). The mean amplitude of ulnar distal CMAP was 11.33mV (cut-off value, 7.14mV), and the average distal conduction velocity was 60.43m/s (cut-off value, 47.89m/s). In the sensory nerve conduction study, the mean latency of ulnar distal SNAP was 2.39ms (cut-off value, 2.96ms), and the mean amplitude of ulnar distal SNAP was 43.94uV (cut-off value, 12.68uV). Each parameter`s specific mean and cut-off value for

each group are presented in Table 1 and 2. We compared value of main parameters between each group, and there was significant difference in baseline to peak amplitude in all comparisons ($p < 0.05$).

CONCLUSION

We present the reference standards of motor and sensory NCSs for the ulnar nerve with due consideration of uncertainty. These standards are expected to improve the diagnostic reliability for the ulnar nerve abnormalities.

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fig. 1 Demonstration of ulnar nerve motor and sensory conduction study technique

- a) Active electrode(G1) is placed over the belly of the abductor digiti minimi and reference electrode(G2) is attached on the proximal phalanx of the fifth digit. Distal motor sites is at 8cm proximal to the active electrode, just lateral to the flexor carpi radialis tendon at the wrist stimulation
- b) First proximal motor stimulation site is at 4cm distal to the midpoint of line connecting medial epicondyle and medial tip of olecranon. The arm is abducted and externally rotated with the elbow is flexed, and forearm slightly supinated
- c) Second Proximal motor stimulation site is at 6cm proximal to the medial epicondyle, between the biceps and medial head of the triceps.
- d) For sensory stimulation, active electrode(G1) is placed halfway on the proximal phalanx of the fifth digit and reference electrode(G2) is placed 4cm proximal to the active electrode, Stimulation is performed 14cm proximal to the active electrode, near the tendon of the flexor carpi ulnaris at the wrist.

Table 1. Reference data for each group in ulnar nerve motor conduction study

Parameter	Mean	Expanded Uncertainty (k=2)	Range (Mean±Expanded Uncertainty)
Men, 20s			
Onset latency (ms)	2.59	0.65	1.94 – 3.23
Baseline to peak amplitude (mV)	11.59	4.26	7.33 – 15.85
Peak to peak amplitude (mV)	19.45	8.33	11.12 – 27.78
Velocity (m/s)	60.00	10.74	49.26 – 70.75
Area (mVms)	37.27	14.50	22.78 – 51.77
Duration (ms)	6.10	1.20	4.90 – 7.30
Women, 20s			
Onset latency (ms)	2.57	0.78	1.79 – 3.35
Baseline to peak amplitude (mV)	11.25	4.94	6.31 – 16.19
Peak to peak amplitude (mV)	18.56	7.99	10.57 – 26.54
Velocity (m/s)	61.16	13.18	47.98 – 74.34
Area (mVms)	34.56	14.40	20.15 – 48.96
Duration (ms)	5.92	1.44	4.48 – 7.37
Men, 50s			
Onset latency (ms)	2.58	0.64	1.94 – 3.22
Baseline to peak amplitude (mV)	11.52	3.61	7.91 – 15.13
Peak to peak amplitude (mV)	18.77	5.20	13.57 – 23.98
Velocity (m/s)	59.99	12.05	47.94 – 72.03
Area (mVms)	35.75	12.16	23.59 – 47.91
Duration (ms)	6.01	1.06	4.95 – 7.07
Women, 50s			
Onset latency (ms)	2.48	0.76	1.72 – 3.24
Baseline to peak amplitude (mV)	10.95	3.72	7.24 – 14.67
Peak to peak amplitude (mV)	17.13	6.05	11.08 – 23.18
Velocity (m/s)	60.53	14.43	46.10 – 74.96
Area (mVms)	31.11	11.60	19.51 – 42.70
Duration (ms)	5.62	0.92	4.70 – 6.54

Table 2. Reference data for each group in ulnar nerve sensory conduction study

Parameter	Mean	Expanded Uncertainty (k=2)	Range (Mean±Expanded Uncertainty)
Men, 20s			
Onset latency (ms)	2.43	0.56	1.87 – 2.99
Baseline to peak amplitude (uV)	43.61	28.36	15.25 – 71.97
Area (uVms)	40.12	38.22	1.90 – 78.34
Duration (ms)	1.89	0.54	1.34 – 2.43
Women, 20s			
Onset latency (ms)	2.39	0.62	1.78 – 3.01
Baseline to peak amplitude (uV)	59.43	26.15	33.28 – 85.57
Area (uVms)	58.04	48.03	10.01 – 106.07
Duration (ms)	1.97	0.71	1.26 – 2.69
Men, 50s			
Onset latency (ms)	2.41	0.52	1.89 – 2.41
Baseline to peak amplitude (uV)	31.78	22.41	9.37 – 31.78
Area (uVms)	27.60	26.29	1.31 – 53.90
Duration (ms)	1.86	0.62	1.25 – 2.48
Women, 50s			
Onset latency (ms)	2.41	0.56	1.78 – 2.34
Baseline to peak amplitude (uV)	39.81	17.74	22.07 – 39.81
Area (uVms)	37.02	29.52	7.50 – 66.54
Duration (ms)	1.86	0.56	1.30 – 2.42