Comparison of Sensitivities between Median-Thumb Sensory Distal Latency and Conventional Nerve Conduction Studies in Electrodiagnosis of Carpal Tunnel Syndrome

Chinapat Gerawarapong MD*

** Department of Rehabilitation Medicine, Faculty of Medicine, Naresuan University, Phitsanulok, Thailand*

Objective: *Compare the sensitivities of median-thumb sensory distal latency (M-T sensory DL) with other standard nerve conduction studies (NCSs) in patients with carpal tunnel syndrome (CTS).*
Material and Method: *Eighty-eight participants' hands, obtained retrospectively between June 2012 and August 2013, were included and divided into two groups, 48 CTS hands and 40 control hands, respectively. All clinical data, demographic characteristics, and electrodiagnostic (EDX) findings of each test were compared and analyzed.*
Results: *M-T sensory DL had the highest sensitivity. It was 81.3% equal to wrist-palm sensory nerve conduction velocity (W-P sensory NCV) and median-radial sensory distal latency difference (M-RSLD). Specificity of the M-T sensory DL was 95.0%, less than wrist-palm motor nerve conduction velocity (W-P motor NCV) (100.0%), wrist sensory DL (100.0%), and median-thumb sensory nerve conduction velocity (M-T sensory NCV) (100.0%), respectively. Furthermore, using a combination of the EDX tests, both M-T sensory and median sensory NCSs performed equally with higher diagnostic predictive values than the median motor NCS.*
Conclusion: *The M-T sensory DL is a valuable NCS for the diagnosis of CTS. Overall, it performs with the highest sensitivity and accuracy when used in a single EDX test or combined with M-T sensory NCV.*

Keywords: *Carpal tunnel syndrome, Median-thumb sensory distal latency, Electrodiagnosis, Nerve conduction study*

J Med Assoc Thai 2014; 97 (9): 969-76
Full text. e-Journal: *http://www.jmatonline.com*

Carpal tunnel syndrome (CTS) is a clinical syndrome of numbness, tingling, burning, and/or pain associated with localized compression of the median nerve at the wrist[1]. It is the most common entrapment neuropathy in the upper extremity region[2,3]. Diagnosis of CTS is usually based on clinical symptoms and signs with objective electrodiagnostic (EDX) findings[3-5]. Although standard EDX techniques may fail to detect some CTS patients with normal median sensory and motor distal latencies (DLs) or with additional ulnar neuropathy or polyneuropathy, various EDX techniques have been used to improve the sensitivity of the standard nerve conduction studies (NCSs)[3,6,7]. Several techniques of median NCSs and/or their comparisons with ulnar or radial NCSs have been described[1,3,6,7]. However, the use of multiple comparisons for the evaluation of CTS may increase the risk of a type I error (false-positive result)[1,8]. Alternatively, the EDX finding of more than one abnormality of the CTS would lower the possibility of a type I error. Any attempt to increase the sensitivity of a testing paradigm will have the impact of lowering the specificity of the testing[1,8,9]. Median-thumb sensory distal latency (M-T sensory DL) is a quick, easy EDX test or parameter which frequently has been used in the EDX comparison between median and radial sensory NCSs or median-radial sensory distal latency difference (M-RSLD), which commonly has been used to diagnose the CTS[1-4,6,7,10-12]. However, there has been no study that directly compared the M-T sensory DL with other conventional NCSs. Therefore, the present study was aimed to compare the EDX sensitivities of M-T sensory DL with other standard NCSs in CTS patients.

Correspondence to:
Gerawarapong C, Department of Rehabilitation Medicine, Faculty of Medicine, Naresuan University, Phitsanulok 65000, Thailand.
Phone: 055-965-666 ext. 5066
E-mail: chinapatjqka@gmail.com

Material and Method

Participants

One hundred six consecutive hands of patients with EDX reports to diagnose CTS between June 2012 and August 2013 at the EDX laboratory of Naresuan University Hospital were recruited in the retrospectively cross-sectional study. The participants' hands were divided into two groups. The goup I was the CTS group. The patients' hands diagnosed with CTS using

clinical and EDX methods. The inclusion criteria were (1) aged more than 18 years, (2) presented clinically defined CTS hands with at least one abnormal EDX parameters of the conventional NCSs including wrist-palm motor and sensory NCSs, and M-RSLD techniques to identify median neuropathy at the wrist, and (3) examined by the same physiatrist. A history of previous carpal tunnel surgery or trauma, cervical radiculopathy, thoracic outlet syndrome, brachial plexopathy or plexitis, hereditary or acquired polyneuropathy, or a systemic disease that could lead to polyneuropathy were excluded.

The second group (II) was the control group, patients' hands diagnosed as having no EDX evidence of CTS using clinical and EDX methods, served as controls.

Clinical diagnosis of the CTS was based on the presence of the following (i) at least one of the sensory symptoms (numbness, tingling, burning or pain) in median nerve distribution, (ii) at least one of the provocative or mitigating factors: sleep, sustained position, repetitive actions, hand shaking or hand position change, and (iii) at least one of the following signs: Tinel's or Phalen's signs, sensory loss or weakness in median nerve distribution[3,6,12]. Fig. 1 showed a flow chart of all recruited participants' hands. The study was approved by the Ethics Committee of Naresuan University Institutional Review Board (IRB No. 214/56).

Electrodiagnostic methods or protocols

The EDX studies were performed using a Micromed electromyography machine. Surface recording and stimulation were carried out for all studies. Recording electrodes were two adhesive touch proof electrodes for motor and sensory NCSs of median, ulnar, and sensory radial nerves. The skin temperature of the hand was maintained at or above 32°C. All of the EDX techniques used for examination were according to Lee and Delisa's manual of nerve conduction study and surface anatomy for needle electromyography[13]. All reference values for the NCSs were derived from the control group consisting of 40 asymptomatic, normal EDX hands tested by the same physiatrist and in the same laboratory.

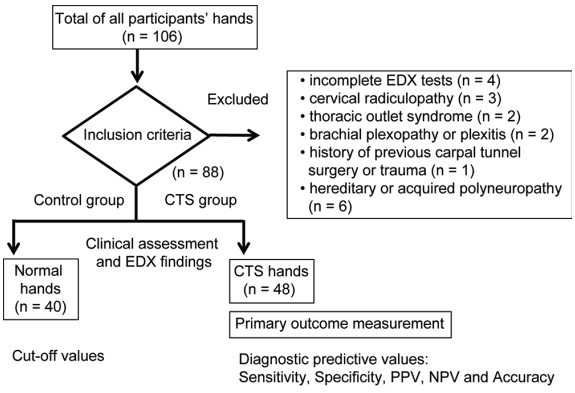

Fig. 1 Flow chart of all recruited participants' hands.

Motor nerve conduction study

Median motor NCS was recorded from the abductor pollicis bravis (APB) muscle by stimulating the median nerve at the wrist and elbow, orthodromically. A fixed distance of 8 cm between the stimulating and active electrodes was used for wrist stimulation. The wrist motor DL was performed. Median motor conduction in the palm was stimulated 3-4 cm distal to distal wrist crease. Wrist-palm motor nerve conduction velocity (W-P motor NCV) was calculated by dividing the distance between stimulation sites by the latency difference. The palm motor DL and W-P motor NCV were also recorded.

Sensory nerve conduction study

Median sensory NCS was recorded antidromically from index or middle finger 14 cm between the stimulating and active electrodes of the median nerve. The wrist sensory DL was determined at the wrist. Median sensory conduction in the palm was stimulated with a fixed distance of 8 cm distal to distal wrist crease. The palm sensory DL and wrist-palm sensory nerve conduction velocity (W-P sensory NCV) were also measured.

Median-radial sensory distal latency difference

Median-radial sensory distal latency difference (M-RSLD) is called thumb diff[1,3,10,11]. It was comparatively stimulated between the median and radial nerves at the wrist, antidromically. The active electrodes were also applied on the thumb with a distance of 10 cm from each stimulation site.

Median-thumb sensory distal latency

Median-thumb sensory distal latency (M-T sensory DL) was applied from the M-RSLD. M-T sensory DL was recorded using only the stimulation over the median nerve at the wrist, 10 cm proximal to the active electrode on the thumb, antidromically (Fig. 2).

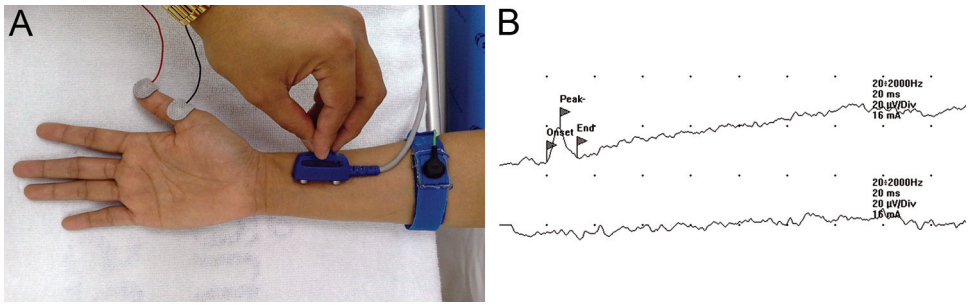

Fig. 2 The electrodiagnostic method (A) and waveforms (B) of median-thumb sensory distal latency (M-T sensory DL) recorded on the thumb by stimulation over the median nerve at the wrist at a distance of 10 cm antidromically. Normal M-T sensory waveform is shown in the upper part of B; abnormal or no response of the M-T sensory waveform is shown in the lower part of B.

Statistical analysis

Statistical analysis was performed using SPSS for Windows version 17.0. The data and each EDX parameter were analyzed using descriptive statistics, including mean and standard deviation (SD). Numbers, percentage, median and range were also revealed for clinical and demographic characteristics. Abnormal values were defined as ±1 to 2 SD beyond or below the mean calculated for the control group[13]. A *p*-value <0.05 was considered statistically significant.

Results

Eighty-eight hands (from 52 participants) aged 42 to 62 years were included for the present study and analysis. Forty hands with normal EDX findings (18 males and 22 females) were included in the control group, and 48 CTS hands (14 males and 34 females) were included in the CTS group. Ten participants demonstrated normal of both hands and 20 participants presented bilateral CTS hands, respectively. Median duration of CTS was 8 months, ranged from 2 to 48 months. In the comparison of clinical and demographic characteristics between CTS and normal hands, there were no significant differences of gender, side of hands and height, respectively. However, there were marked significant differences of age and BMI (body mass index) (*p*-value = 0.002 and <0.001, respectively). These data summarized in Table 1. Among the cut-off or reference values, all EDX findings of 40 normal hands were within normal limits[2,3,9-13] (Table 2).

For the 48 CTS hands, Table 3 showed diagnostic predictive values consisting of sensitivity,

Table 1. Comparison of clinical and demographic characteristics of the participants' hands between carpal tunnel syndrome and control groups (n = 88 hands)

Characteristics	CTS (n = 48 hands)	Control (n = 40 hands)	*p*-value
Age (years; mean ± SD)	50.3±10.1	46.05±2.9	0.002
Female (n; %)	34 (70.8%)	22 (55.0%)	0.181
Right hand (n; %)	25 (52.1%)	22 (55.0%)	0.832
BMI (kg/m^2; mean ± SD)	24.6±3.9	21.8±1.0	<0.001
Height (cm; mean ± SD)	160.9±7.9	158.7±7.7	0.108
Duration of CTS (median; range in months)	8 (2-48)		
Numbness (yes)	38 (79.2%)		
Paresthesia (yes)	29 (60.4%)		
Thenar muscle weakness or atrophy (yes)	20 (41.7%)		
Phalen's test (positive)	23 (47.9%)		
Tinel's test (positive)	22 (45.8%)		

CTS = carpal tunnel syndrome; BMI = body mass index

Table 2. Electrodiagnostic tests on the controls (n = 40 hands)

Tests	Mean ± SD	Range	Normal limits
Wrist motor DL (ms)	3.5±0.3	3.1-3.8	<4.1 ms
W-P motor NCV (m/s)	57.0±9.7	47.1-70.0	>47.3 m/s
Wrist sensory DL (ms)	2.3±0.3	2.0-2.6	<2.9 ms
W-P sensory NCV (m/s)	60.9±15.5	41.2-80.0	>45.5 m/s
M-RSLD (ms)	0.2±0.2	0.0-0.5	<0.5 ms
M-T sensory DL (ms)	1.6±0.2	1.4-1.8	<1.9 ms
M-T SNAP (μV)	42.8±18.3	26.8-61.2	>6.2 μV
M-T sensory NCV (m/s)	61.6±4.9	55.6-71.4	>50.0 m/s

DL = distal latency; W-P = wrist-palm; NCV = nerve conduction velocity; M-RSLD = median-radial sensory distal latency difference; M-T = median-thumb; SNAP = sensory nerve action potential

Table 3. Summary of diagnostic predictive values of each test in the electrodiagnosis of carpal tunnel syndrome (n = 48 hands)

Tests	Diagnostic predictive value (%)				
	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	Accuracy
Wrist motor DL (ms)	75.0 (73.5-76.5)	77.5 (76.0-79.1)	80.0 (78.4-81.6)	72.1 (70.7-73.5)	76.1
W-P motor NCV (m/s)	54.2 (53.1-55.3)	100.0	100.0	64.5 (63.2-65.8)	75.0
Wrist sensory DL (ms)	62.5 (61.3-63.8)	100.0	100.0	69.0 (67.6-70.3)	79.5
W-P sensory NCV (m/s)	81.3 (79.8-82.7)	77.5 (76.1-78.9)	81.3 (79.8-82.7)	77.5 (76.1-78.9)	79.5
M-RSLD (ms)	81.3 (79.8-82.7)	77.5 (76.1-78.9)	81.3 (79.8-82.7)	77.5 (76.1-78.9)	79.5
M-T sensory DL (ms)	81.3 (79.8-82.7)	95.0 (93.3-96.7)	95.1 (93.4-96.8)	80.9 (79.4-82.3)	87.5
M-T SNAP (μV)	35.4 (34.7-36.1)	47.5 (46.6-48.4)	44.7 (43.9-45.5)	38.0 (37.3-38.7)	40.9
M-T sensory NCV (m/s)	56.3 (55.1-57.4)	100.0	100.0	65.6 (64.4-66.8)	76.1

DL = distal latency; W-P = wrist-palm; NCV = nerve conduction velocity; M-RSLD = median-radial sensory distal latency difference; M-T = median-thumb; PPV = positive predictive value; NPV = negative predictive value; SNAP = sensory nerve action potential

specificity, positive predictive value (PPV), negative predictive value (NPV) with 95% confidence interval (CI), and accuracy of each EDX test described as follows:

Median motor NCS

Twelve hands had normal wrist motor DL and 36 hands had abnormally prolonged or absent wrist motor DL. The diagnostic predictive values of wrist motor DL were sensitivity of 75.0% (73.5-76.5%), specificity of 77.5% (76.0-79.1%), PPV of 80.0% (78.4-81.6%), NPV of 72.1% (70.7-73.5%) and accuracy of 76.1%. Twenty-two hands had normal W-P motor NCV and 26 hands had abnormally slow or absent W-P motor NCV. The diagnostic predictive values were sensitivity of 54.2% (53.1-55.3%), specificity of 100.0%, PPV of 100.0%, NPV of 64.5% (63.2-65.8%) and accuracy of 75.0%.

Median sensory NCS

Eight-teen hands had normal wrist sensory DL and 30 hands had abnormally prolonged or absent wrist sensory DL. The diagnostic predictive values of wrist sensory DL were sensitivity of 62.5% (61.3-63.8%), specificity of 100.0%, PPV of 100.0%, NPV of 69.0% (67.6-70.3%) and accuracy of 79.5%. Nine hands had normal W-P sensory NCV and 39 hands had abnormally slow or absent W-P sensory NCV. The diagnostic predictive values were sensitivity of 81.3% (79.8-82.7%), specificity of 77.5% (76.1-78.9%), PPV of 81.3% (79.8-82.7%), NPV of 77.5% (76.1-78.9%) and accuracy of 79.5%.

Median-radial sensory distal latency difference

Nine hands had normal M-RSLD and 39 hands had abnormally prolonged or absent M-RSLD. The diagnostic predictive values were

sensitivity of 81.3% (79.8-82.7%), specificity of 77.5% (76.1-78.9%), PPV of 81.3% (79.8-82.7%), NPV of 77.5% (76.1-78.9%) and accuracy of 79.5%.

Median-thumb sensory distal latency

Nine hands had normal M-T sensory DL and 39 hands had abnormally prolonged or absent M-T sensory DL. The diagnostic predictive values were sensitivity of 81.3% (79.8-82.7%), specificity of 95.0% (93.3-96.7%), PPV of 95.1% (93.4-96.8%), NPV of 80.9% (79.4-82.3%) and accuracy of 87.5%.

Moreover, the diagnostic predictive values of median-thumb sensory nerve action potential (M-T SNAP) and M-T sensory NCV were presented in Table 3.

In combination of EDX tests between median motor, sensory and M-T sensory NCSs, the results demonstrated that both M-T sensory and median sensory NCSs equally had higher diagnostic predictive values than the median motor NCS. Their diagnostic predictive values were sensitivity of 81.3% (79.8-82.7%), specificity of 100%, PPV of 100%, NPV of 81.6% (80.2-83.1%) and accuracy of 89.8% (Table 4).

Discussion

CTS is the most common entrapment neuropathy of the upper extremity. The CTS patients are the most frequent referral to the EDX laboratory[1,7,14]. The EDX study is required before surgical release[2,4,6,7]. When examining a CTS patient, it has been customary since the early 1970s to measure motor and sensory DL at wrist stimulation as the conventional or standard techniques[2,4,9]. However, the sensitivity is not good for all clinically suspected CTS. Association of Neuromuscular and Electrodiagnostic Medicine (AANEM) and American Association of Electrodiagnostic Medicine (AAEM) practice parameters for EDX studies in CTS reported the sensitivities of the conventional tests to be 56 to 85%, with specificities of 94% or greater[1,15,16]. In the present study, sensitivity of wrist motor DL and sensory DL were 75.0% and 62.5%, respectively. The most sensitive EDX parameter was M-T sensory DL (specificity, 95.0%) with sensitivity of 81.3% equal to W-P sensory NCV (specificity, 77.5%) and M-RSLD (specificity, 77.5%). While M-T SNAP (35.4%) in sensory and W-P motor NCV (54.2%) in motor NCSs were the least sensitive tests. However, sensory EDX parameters were more sensitive than motor NCSs. Previous studies involving the electrodiagnosis of the CTS have reported a wide range of the sensitivity of wrist motor DL (20-81%)[15-17], wrist sensory DL (40-100%)[18-25], W-P motor NCV (64-87%)[21-25], W-P sensory NCV (71-91%)[7,15-17,21,22,24] and M-RSLD (60-87%)[3,7,15,23-25]. Presumably, the wide variation was the result of selection factors or criteria. To date, there have been a few studies concerning the efficacy of various EDX techniques in the diagnosis of CTS[6,7,11,21-25].

In comparison to the sensitivities of M-T sensory DL as well as W-P sensory NCV and M-RSLD, the results in the CTS group showed that they had similar sensitivity because every hand with abnormal M-T sensory DL had an abnormal W-P sensory NCV and/or M-RSLD. These findings were probably related to the same sensitivity values, while the M-T sensory DL demonstrated higher specificity and accuracy than the others. In addition, the M-T sensory DL was more sensitive and suitable than derivation data of the M-T sensory NCV to avoid calculation errors. It was similar to other previous studies[7,21]. The present study showed that the M-T SNAP had the lowest sensitivity similar to the results of the median SNAP in other studies[6,8,21,22,24,25]. The cause of this EDX finding was still not clear.

All EDX parameters were more often abnormal in obese patients due to increased fat

Table 4. Comparison of diagnostic predictive values of each combination of electrodiagnostic tests between median motor, sensory, and median-thumb sensory tests in the electrodiagnosis of carpal tunnel syndrome (n = 48 hands)

Combination of electrodiagnostic tests	Diagnostic predictive value (%)				
	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	Accuracy
Wrist motor DL (ms) + W-P motor NCV (m/s)	75.0 (73.5-76.5)	100.0	100.0	76.9 (75.4-78.5)	86.4
Wrist sensory DL (ms) + W-P sensory NCV (m/s)	81.3 (79.8-82.7)	100.0	100.0	81.6 (80.2-83.1)	89.8
M-T sensory DL (ms) + M-T sensory NCV (m/s)	81.3 (79.8-82.7)	100.0	100.0	81.6 (80.2-83.1)	89.8

DL = distal latency; W-P = wrist-palm; NCV = nerve conduction velocity; M-T = median-thumb; PPV = positive predictive value; NPV = negative predictive value

deposition in the carpal tunnel[7,10,11,14,18-22]. In the present study, the mean BMI of the CTS patients was significantly greater than the controls (p-value <0.001). In the other studies, there was a slightly negative correlation between the BMI with sensory NCV, SNAP, and motor MCV. In addition, there was a positive correlation between the BMI and motor DL. However, a statistically significant difference was not presented in sensitivities of EDX parameters between the obese and non-obese patients[7,21,23,24].

In several studies, the combination of the EDX tests has been recommended to improve the sensitivity of NCSs and determine the best EDX test. The presented findings demonstrated that the combination of the EDX tests, both median sensory and M-T sensory NCSs equally presented higher diagnostic predictive values than the median motor NCS. However, in attempting to obtain a more sensitive test in CTS, there was a potential disadvantage of decreased specificity. This phenomenon depended on the size of the control group and the cut-off values. The specificity of the diagnostic test is important as well as the sensitivity, it is preferable to recommend the EDX test which performs with both high sensitivity and specificity[1,7,10,20]. These findings revealed that all combinations of EDX tests (Table 4) presented independently higher sensitivity and specificity than each single EDX test.

However, the present study performed retrospective collecting data. It was difficult to clarify the diagnosis of CTS by symptom scoring system because the control group does not classify in subgroups according to the severity comparing with the CTS subgroups. For example, the M-T sensory DL could not demonstrate degree of severity of CTS such as mild, moderate or severe. There was no data of sign of muscle membrane instability (e.g. fibrillation potentials, positive sharp waves) of thenar muscle to report the neuroaxonal degeneration condition in severe CTS. Hence, it could not use to consider the surgical intervention.

The limitations of the study were demonstrated as same as other studies. The first limitation was that the ratio of the bilateral CTS patients was too high (83.3%). Indeed, there are several studies which have reported the incidence of bilateral CTS at 59 to 87[15,16,22]. The ratio of 83.3% in the present study seemed acceptable. The second limitation was about using the EDX parameters from two hands tested from one person. This method is still commonly used in the electrodiagnosis of CTS and many other EDX studies. However, it is known that these EDX parameters are not independent. According to other previous studies, all sensitivities were slightly increased but the differences were not statistically significant[7,8,10,12,22,25]. The third limitation is about the gold standard for diagnosis of CTS. There is still a debate over the gold standard to diagnose CTS. Pathology is a definite method but it is very invasive. Hence, it is not possible to perform a pathological examination in all patients with suspected CTS. When compared to other previous studies[2,4,8,13,15,21-25], the EDX findings of the cut-off values (Table 2) were appropriated with statistically significant reliability in each EDX test.

Conclusion

The M-T sensory DL is a valuable NCS or technique for the diagnosis of CTS. It also presented the highest sensitivity and accuracy when used in a single EDX test or combination of EDX test.

What is already known on this topic?

The current AANEM guidelines exhibit the various EDX techniques used to evaluate CTS. It also demonstrates the limitations of each EDX study with a focus on the sensitivity and specificity of the tests[1]. In clinical practice, several studies suggest performing additional or comparison of different EDX techniques after conventional median sensory and motor DLs revealed normal EDX findings. Although sensory comparison techniques have been shown to be more sensitive and specific than absolute sensory DL, there is no ''gold standard'' for diagnosis of the CTS. Many EDX physicians or electromyographers do not only want to improve the sensitivity but they also have frequently inspected the high specificity in the populations. However, none of the comparison techniques has been clearly performed to be the best or better than the others.

What this study adds?

Findings of the present study were in agreement with the conventional wisdom that comparison of latency differences between median and ulnar or radial nerves is recommended to diagnose the patients with suspected CTS.

M-T sensory DL is a novel modification method of EDX tests with the highest sensitivity and accuracy for the diagnosis of CTS. Therefore, the M-T sensory DL is one of the valuable NCSs or EDX techniques that demonstrated with a high diagnostic predictive value and easy application. Finally, it may

routinely be used to evaluate patients with suspected CTS.

Acknowledgements

The author thanks all members of the team of EDX laboratory, Department of Rehabilitation Medicine for their assistance.

Potential conflicts of interest

None.

References

1. Werner RA, Andary M. Electrodiagnostic evaluation of carpal tunnel syndrome. Muscle Nerve 2011; 44: 597-607.
2. Dumitru D, Zwarts MJ. Focal peripheral neuropathies. In: Dumitru D, Amato AA, Zwarts M, editors. Electrodiagnostic medicine. 2nd ed. Philadelphia: Hanley & Belfus; 2002: 1058-68.
3. Gerawarapong C. Usefulness of additional electrodiagnostic techniques for median neuropathy at the wrist (carpal tunnel syndrome) in patients with diabetic polyneuropathy. Srinagarind Med J 2012; 27: 58-65.
4. Kimura J. Assessment of individual nerves. In: Kimura J, editor. Electrodiagnosis in diseases of nerve and muscle: principles and practice. 3rd ed. Philadelphia: FA Davis; 2001: 130-78.
5. Bosch EP, Smith BE. Disorders of peripheral nerves. In: Bradley WG, Daroff RB, Fenichel GM, Jankovic J, editors. Neurology in clinical practice. 4th ed. Philadelphia: Butterworth-Heinemann; 2004: 2299-402.
6. Gazioglu S, Boz C, Cakmak VA. Electrodiagnosis of carpal tunnel syndrome in patients with diabetic polyneuropathy. Clin Neurophysiol 2011; 122: 1463-9.
7. Chang MH, Liu LH, Lee YC, Wei SJ, Chiang HL, Hsieh PF. Comparison of sensitivity of transcarpal median motor conduction velocity and conventional conduction techniques in electrodiagnosis of carpal tunnel syndrome. Clin Neurophysiol 2006; 117: 984-91.
8. Rivner MH. Statistical errors and their effect on electrodiagnostic medicine. Muscle Nerve 1994; 17: 811-4.
9. Dorfman LJ, Robinson LR. AAEM minimonograph #47: normative data in electrodiagnostic medicine. ff. Muscle Nerve 1997; 20: 4-14.
10. Robinson LR, Micklesen PJ, Wang L. Optimizing the number of tests for carpal tunnel syndrome. Muscle Nerve 2000; 23: 1880-2.
11. Robinson LR. Electrodiagnosis of carpal tunnel syndrome. Phys Med Rehabil Clin N Am 2007; 18: 733-46.
12. Simovic D, Weinberg DH. The median nerve terminal latency index in carpal tunnel syndrome: a clinical case selection study. Muscle Nerve 1999; 22: 573-7.
13. Lee HJ, Delisa JA. Manual of nerve conduction study and surface anatomy for needle electromyography. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2005.
14. Stevens JC. AAEM minimonograph #26: the electrodiagnosis of carpal tunnel syndrome. American Association of Electrodiagnostic Medicine. Muscle Nerve 1997; 20: 1477-86.
15. American Association of Electrodiagnostic Medicine, American Academy of Neurology, and American Academy of Physical Medicine and Rehabilitation. Practice parameter for electrodiagnostic studies in carpal tunnel syndrome: summary statement. Muscle Nerve 2002; 25: 918-22.
16. Jablecki CK, Andary MT, So YT, Wilkins DE, Williams FH. Literature review of the usefulness of nerve conduction studies and electromyography for the evaluation of patients with carpal tunnel syndrome. AAEM Quality Assurance Committee. Muscle Nerve 1993; 16: 1392-414.
17. Rosén I. Neurophysiological diagnosis of the carpal tunnel syndrome: evaluation of neurographic techniques. Scand J Plast Reconstr Surg Hand Surg 1993; 27: 95-101.
18. Monga TN, Shanks GL, Poole BJ. Sensory palmar stimulation in the diagnosis of carpal tunnel syndrome. Arch Phys Med Rehabil 1985; 66: 598-600.
19. Scelsa SN, Herskovitz S, Bieri P, Berger AR. Median mixed and sensory nerve conduction studies in carpal tunnel syndrome. Electroencephalogr Clin Neurophysiol 1998; 109: 268-73.
20. Charles N, Vial C, Chauplannaz G, Bady B. Clinical validation of antidromic stimulation of the ring finger in early electrodiagnosis of mild carpal tunnel syndrome. Electroencephalogr Clin Neurophysiol 1990; 76: 142-7.
21. Chang MH, Wei SJ, Chiang HL, Wang HM, Hsieh PF, Huang SY. Comparison of motor conduction techniques in the diagnosis of carpal tunnel syndrome. Neurology 2002; 58: 1603-7.
22. Lee KY, Lee YJ, Koh SH. Usefulness of the

median terminal latency ratio in the diagnosis of carpal tunnel syndrome. Clin Neurophysiol 2009; 120: 765-9.
23. Kothari MJ, Rutkove SB, Caress JB, Hinchey J, Logigian EL, Preston DC. Comparison of digital sensory studies in patients with carpal tunnel syndrome. Muscle Nerve 1995; 18: 1272-6.
24. Sheu JJ, Yuan RY, Chiou HY, Hu CJ, Chen WT. Segmental study of the median nerve versus comparative tests in the diagnosis of mild carpal tunnel syndrome. Clin Neurophysiol 2006; 117: 1249-55.
25. Lew HL, Wang L, Robinson LR. Test-retest reliability of combined sensory index: implications for diagnosing carpal tunnel syndrome. Muscle Nerve 2000; 23: 1261-4.

การเปรียบเทียบความไวระหว่างการตรวจ median-thumb sensory distal latency กับเทคนิคการตรวจการชักนำกระแสประสาทโดยวิธีมาตรฐานในภาวะ carpal tunnel syndrome

ชินภัทร์ จิระวรพงศ์

วัตถุประสงค์: *เพื่อเปรียบเทียบความไวของการตรวจ M-T sensory DL กับเทคนิคการตรวจการชักนำกระแสประสาทโดยวิธีมาตรฐานในผู้ป่วยภาวะ CTS*

วัสดุและวิธีการ: *วิเคราะห์ผลการตรวจจากจำนวนมือของผู้ป่วยทั้งสิ้น 88 ข้าง แบ่งเป็น มือที่มีภาวะ CTS จำนวน 48 ข้าง และมือที่ปกติ จำนวน 40 ข้าง เก็บข้อมูลย้อนหลังระหว่างเดือนมิถุนายน พ.ศ. 2555 ถึง สิงหาคม พ.ศ. 2556 โดยนำข้อมูลพื้นฐานทางคลินิก ลักษณะทางประชากร และผลการตรวจทางไฟฟ้าวินิจฉัยของแต่ละการตรวจมาเปรียบเทียบ และวิเคราะห์ผล*

ผลการศึกษา: *พบว่าการตรวจ M-T sensory DL มีความไวสูงสุด คิดเป็นร้อยละ 81.3 เท่ากับการตรวจ W-P sensory NCV และ M-RSLD ความจำเพาะของ M-T sensory DL มีค่าเท่ากับร้อยละ 95.0 ซึ่งน้อยกว่าการตรวจ W-P motor NCV (ร้อยละ 100.0), wrist sensory DL (ร้อยละ 100.0) และ M-T sensory NCV (ร้อยละ 100.0) ตามลำดับ นอกจากนี้ ในการตรวจด้วยวิธี combination พบว่า ทั้งการตรวจ M-T sensory และ median sensory NCSs มีค่าพยากรณ์การวินิจฉัยเท่ากัน และสูงกว่า median motor NCS*

สรุป: *การตรวจ M-T sensory DL มีประโยชน์ในการวินิจฉัยภาวะ CTS โดยภาพรวมยังพบว่า การตรวจนี้มีความไวและความแม่นยำสูงสุดเมื่อเปรียบเทียบกับการตรวจตามมาตรฐานโดยวิธีอื่นไม่ว่าจะเป็นวิธีเดี่ยว หรือ ใช้ร่วมกับการตรวจ M-T sensory NCV*