COMPARISON OF SENSITIVITY OF LUMBRICAL AND INTEROSSEI LATENCY RECORDING AND STANDARD MEDIAN NERVE CONDUCTION STUDIES IN ELECTRODIAGNOSIS OF CARPAL TUNNEL SYNDROME

*MOHAMMAD FAROUK LAWIND AND HANY A. BASSIOUNY**

Rheumatology & Rehabilitation Department, Tanta University Faculty of Medicine and Orthopedic Surgery Department, Benha University Faculty of Medicine*

KEY WORDS: ELECTRODIAGNOSIS CTS, LUMBRICAL LATENCY, INTEROSSEI LATENCY.

ABSTRACT

Hypothesis: *Carpal tunnel syndrome (CTS) is the most widely known entrapment neuropathy. Electrophysiological procedures e.g., nerve conduction studies (NCSs) are of established value in the diagnosis of CTS and can confirm the clinical diagnosis in the majority of patients. It also detects an incidental finding in some asymptomatic subjects. One must therefore carefully check the test results and the clinical findings before resorting to surgical intervention. However, there are patients with symptoms and signs suggestive of CTS who remain difficult to diagnose with standard electrodiagnostic tests. A variety of NCSs have been employed to demonstrate patients with mild CTS. The lack of sensitivity of distal motor latency (DML) may be due to either to sparing of motor as compared to sensory fibers or to the inability of standard median motor studies to detect an abnormality.*

Objective: *To demonstrate early and mild CTS and compare sensitivity of standard median NCSs with 2^{nd} lumbrical and interossei latency differences using the same active recording electrode placed over the motor point of 2^{nd} lumbrical lateral to the 3^{rd} metacarpal with stimulation of median and ulnar nerves at wrist at equal distances.*

Methodology: *This study included 40 normal control hands and 61 patients hand with CTS; the control group was 14 males and 28 females; their mean age was 39.5 years (yrs) ± 9.9 SD, ranged from 21 to 56 yrs. The patients group included 61 patient hands with clinical signs and symptoms suggestive of CTS (i.e., paresthesias in the median nerve distribution, nocturnal symptoms, intermittent wrist and arm pain, positive Tinel's and Phalen's signs, etc...).They were subsequently proven to have CTS with electrophysiological median nerve standard NCSs; they were 15 males and 46 females, their mean age was 45 yrs ± 10.8 SD, and their age ranged from 28 to 63 yrs. All subjects were subjected to electrophysiological standard median NCSs e.g., DML to abductor policis brevis (APB), median nerve Antidromic distal sensory latency (ADSL) to index finger, median and ulnar ADSL differences to ring finger, and compared with 2^{nd} lumbrical and interossei latency differences.*

Results: *A prolonged 2nd lumbrical – interossei latency differences > 0.4 msec was found to be a sensitive indicator of CTS in all patients; the sensitivity of the 2nd lumbrical- interossei latency difference (96%) was higher than the highest sensitive test of standard median NCSs (Median – Ulnar ADSL difference) (89%). CTS patients were divided into Grade 1. Very mild CTS, Grade 2. Mild CTS, Grade 3. Moderate CTS, Grade 4. Severe CTS and possible CTS; the sensitivity or percentage of abnormal 2nd lumbrical-interossei latency differences was 80%, 87%, 95%, 100% and 67%, respectively.*

Conclusions: *Thus, the more sensitive the study needed to demonstrate the CTS, the more severe the CTS was graded. The comparison of 2nd lumbrical and interossei latency differences is a sensitive measure technique can help and demonstrate early and mild CTS patients as it is safe, simple and easy to perform in any electrophysiology laboratory. We provide the evidence of 2nd lumbrical-interossei latency differences that could be a standard technique for electrodiagnosis of CTS.*

INTRODUCTION

The median nerve is derived from C5-6-7-C8 and T1 roots and arises from the lateral and median cords of the brachial plexus. The median nerve supplies no muscles in the upper arm, but it innervates most flexors in the forearm and the muscles of the thenar eminence. The main branch descends the forearm and enters the hand by passing through the carpal tunnel between the wrist and palm. It gives rise to the recurrent thenar nerve at the distal edge of the carpal ligaments, which innervates the abductor pollicis brevis (APB), the lateral half of the flexor pollicis brevis, and the opponens pollicis. After giving off the motor branch to the thenar eminence, the terminal branches of the median nerve supplies lumbrical I and II1.

Carpal tunnel syndrome (CTS) is by far the most common entrapment neuropathy. It is defined as "a constellation of clinical symptoms and signs caused by compression and slowing of the median nerve at the wrist within the carpal tunnel" [(2)]. The tunnel is bounded by the carpal bones and contains the median nerve and nine extrinsic digital flexors. The transverse ligament, attached to the scaphoid, trapezoid, and hamate, forms the root. Anatomic studies show the narrowest cross section at 2 to 2.5 cm distal to the entrance. Here the tunnel is rigidly bound on the three sides by bone structures and roofed by a thickened transverse carpal ligament. In the CTS [(3)], the lesions primarily lie at the distal edge of the transverse carpal ligament and less commonly within the inter-metacarpal tunnel. Pathologically myelinated fiber size is strikingly reduced under the retinaculum at this point [(4)].

CTS is more common in women. Symptoms appear most commonly in the fifth or sixth decades, usually involving the dominant hand [(5)] or contralateral to amputation [(6)]. The risk of development of CTS appears to be associated, at least in part, with a number of different epidemiological factors, including genetic, medical, social, vocational, a vocational, and demographic. A complex interaction probably exists between some or all these factors, eventually leading to the development of CTS. Definite causative factors, however, are far from clear. The CTS often affect people with jobs that require heavy and repeated use of the hands [(7)]. Symptoms with onset during pregnancy may resolve after delivery [(8)]. The majorities of patients suffer from CTS

alone, although the syndrome may rarely be familial [9] or accompany a variety of polyneuropathy and systemic illness [10].

Paresthesias in the hand frequently awaken these patients at night. The pain may extend to the elbow and sometimes the shoulder, mimicking a cervical spine disease or high median nerve compression. Manipulation of the neck or shoulder girdle exacerbates the symptoms of proximal lesions; in contrast, moving the hand alleviates the pain in the CTS ([11]).

Sensory changes vary greatly in the early stages but typically spare the skin of the thenar eminence innervated by the palmar cutaneous branch that arises proximal to the carpal tunnel. Sensory changes involve the first three digits and the radial half of the fourth digit or, not uncommonly, only the second or third digit. Patients may complain of a hyposthesia outside the median nerve distribution. Characteristic sensory splitting of the fourth digit into median and ulnar halves is rarely seen in radiculopathies ([12]).

Symptoms may worsen following passive flexion or hyperextension of the affected hand at the wrist for more than 1 minute [2]. This maneuver may also enhance a delay of motor or sensory conduction across the wrist [13]. Tinel's sign, or paresthesia of the digits induced by percussion of the median nerve at the wrist, has no diagnostic value specific to the CTS [14]. In fact, based on electrodiagnostic data, the compressed segment usually lies about 2 to 3 cm distal to the traditional percussion site on the volar aspect of the wrist [15]. The phenomenon was originally described to localize the proximal stump of an injured nerve by tapping. Parenthesis induced by this maneuver serves as an indication for axonal regeneration and not for entrapment neuropathy [16].

Major wasting of thenar muscles, considered a distinctive feature of the syndrome in advanced cases, does not occur in early CTS. Patients may, however, develop slight weakness of the affected hand compared with the normal side. The APB is best tested in relative isolation, with the patient pressing the thumb upward perpendicular to the plane of the palm.

Aim of Work:

To compare the sensitivity of standard median nerve conduction studies and 2nd lumbrical-interossei latency differences in patients with CTS to demonstrate early and mild CTS.

MATERIALS AND METHODS

This study included two groups. The control group consisted of 40 normal controlled hands; they were 28 females and 14 males. Their mean age was 39.5 years (yrs) ± 9.9 SD, ranged from 21 to 56 yrs.

The patient groups included 61 patient hands with clinical signs and symptoms suggestive of CTS (i.e., paresthesia in the median distribution, nocturnal symptoms, intermittent wrist and arm pain, positive Tinel's and Phalen's signs[2], etc...).They were 15 males and 46 females, their mean age was 45.2 yrs ± 10.8 SD, and their age ranged from 28 to 63 yrs.

Those patients met clinical CTS and were subsequently proven to have CTS by standard electrophysiological nerve conduction criteria.

All patients' studied had one or more abnormalities of the following standard median nerve conduction studies:

Distal motor latency to abductor policis brevis ((DML - APB) recording: > 4.1 ms: Normal values: 3.7 ± 0.3 msec (mean ± 1SD), range 3.2 to 4.2 msec.

Antidromic distal sensory latency

(ADSL) to the 2nd digit recording: > 3.4 ms: Normal values: latency to peak 3.2± 0.2 msec (mean ± SD).

Difference between median and ulnar antidromic distal sensory latencies (M-U ADSL) to 4th digit (ring finger) > 0.4 ms

In the patients group with CTS, the sensitivities of standard median conduction studies and the 2nd lumbrical - interossei differences study were calculated and compared. A study was considered abnormal if the latency was prolonged or the potential absent. Patients group with CTS were divided into subgroups electro physiologically into sever, moderate, mild and very mild CTS according to the least sensitive standard median nerve conduction study needed to diagnose the CTS.

All subjects in this study were subjected to detailed history taking and complete physical examination. The group study was done on patients referred to electrophysiology laboratory, Department of Physical Medicine and Rehabilitation. Written informed consent was obtained from all subjects.

Neurophysiologic procedure:

An electro myographic device Nicolet Viking 4-channels manufactured in U.S.A was used to all subjects. Surface recording with 10-mm silver disk and ring electrodes was used. Palmar skin temperature was maintained above 31 C^o. Electrodes were positioned as follows:

1) Median nerve distal motor latency (DML) *(17, 18)*: (Fig.1)

Pick up: The active surface electrode was placed one-half the distance (prominence of APB) between the metacarpophalangeal joint of the thumb and the mid point of the distal wrist crease.

Reference: the reference was placed on the distal phalanx of the thumb.

Stimulation: was applied with the cathode 8 cm proximal to the active electrode between flexor carpi radialis and palmaris longus tendons.

Ground: was placed between the pick up electrode and stimulating electrode.

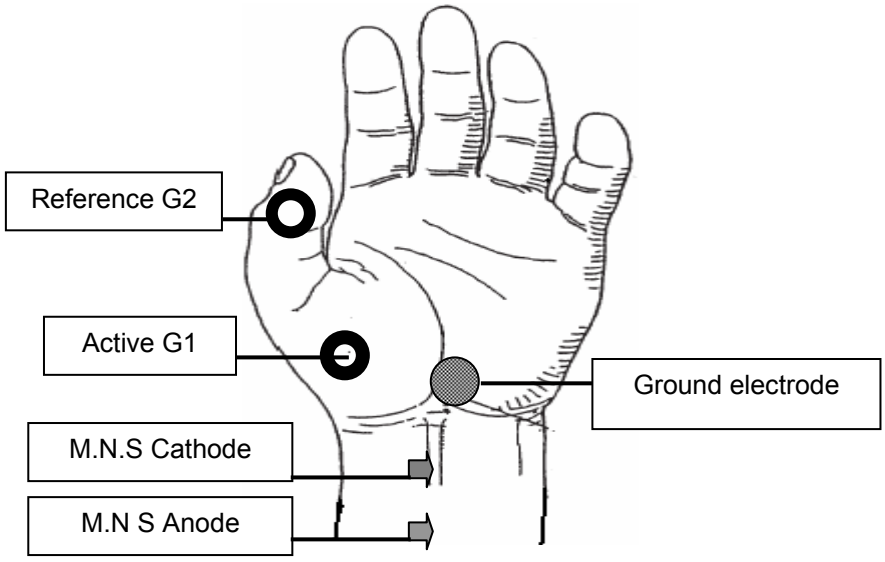

Fig. (1): Median nerve distal motor latency (DML): recording and stimulation sites.
M.N.S: median nerve stimulation. G1: Active recording electrode on Abductor policis brevis (APB). G2: Reference recording electrode on distal phalanx of the thumb.

2) Median nerve Antidromic distal sensory latency (ADSL) to the 2nd digit: (Fig. 2)

Pick up: The ring recording electrodes are placed on 2nd digit (index finger). The active and reference electrode are placed 4cm apart, with an active proximal at the base of the digit.

Stimulation: Stimulating cathode is applied 14 cm proximal (straight lines) from the active ring electrode, over the median nerve between the tendons of the palmaris longus and flexor carpi radialis.

Ground: The ground is placed between the pick up and stimulation electrodes.

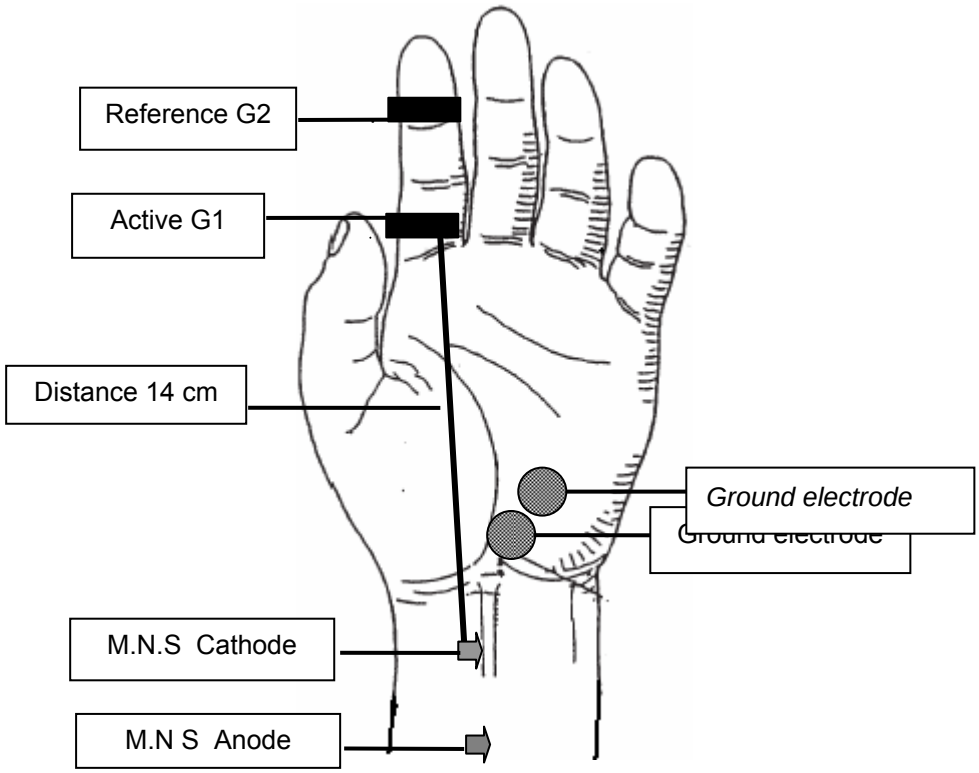

Fig. (2): Median nerve Antidromic distal sensory latency. (ADSL): recording and stimulation sites to digit 2 (index finger). M.N.S: median nerve stimulation.G1: Active recording ring electrode at base of 2nd digit. G2: Reference recording ring electrode on distal phalanx.

3) Median and ulnar antidromic sensory latencies (M-U ASL) to the 4th digit (ring finger): (Fig.3)

Pick up: Ring active and reference electrodes were placed on the 4th digit (ring finger) with at least 4 cm separation. The active is proximal at the base of the digit.

Stimulation: was done over the median and ulnar nerves at the wrist 14 cm proximal to the recording electrodes.

Ground: was placed between the stimulation and pick up electrodes.

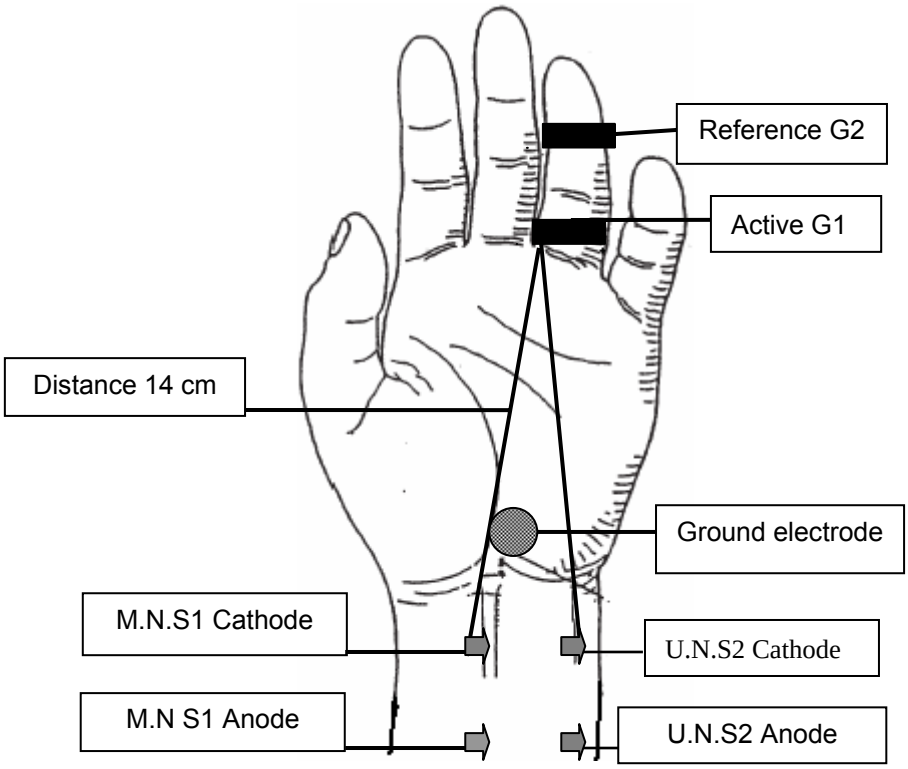

Fig. (3): Median and ulnar nerve Antidromic sensory latency (M-U ASL): recording and stimulation sites to 4th digit (ring finger). M.N.S1: median nerve stimulation, U.N.S2 ulnar nerve stimulation. G1: Active recording ring electrode at base of 4th digit. G2: Reference recording ring electrode on distal phalanx of ring finger.

4) Lumbrical and Interossei Latency recording[7]: (Fig. 4):

Pick up: The DML between 2nd lumbrical and interossei using the same active electrode. The active electrode was placed slightly lateral to the midpoint of the third metacarpal. The reference electrode was placed over a bony prominence of the proximal interphalangeal joint of the second digit *(19, 20)*. The motor point of 2nd lumbrical was identified by an initial negative deflection with the fastest rise time. Occasionally the median mixed nerve potential was seen prior to the motor response *(20)*. However, this potential never obscured the initial negative deflection of the 2nd lumbrical compound muscle action potentials (CMAP).

Stimulation: The median and ulnar nerves were stimulated at the wrist using identical distances from the active electrode. A supramaximal CMAP was recorded from each and the differences between their distal latencies recorded of 2nd Lumbrical – interosseous. Sweep speed was 2 ms/ division, and the sensitivity was either 1 or 2 mV/ division. The same sensitivity was always used to compare latencies within subjects. The 2nd Lumbrical and interosseous were recognized by their characteristic shape, and care was taken to avoid co-stimulation of both nerves at the wrist.

Ground: was placed between the stimulation and pick up electrodes.

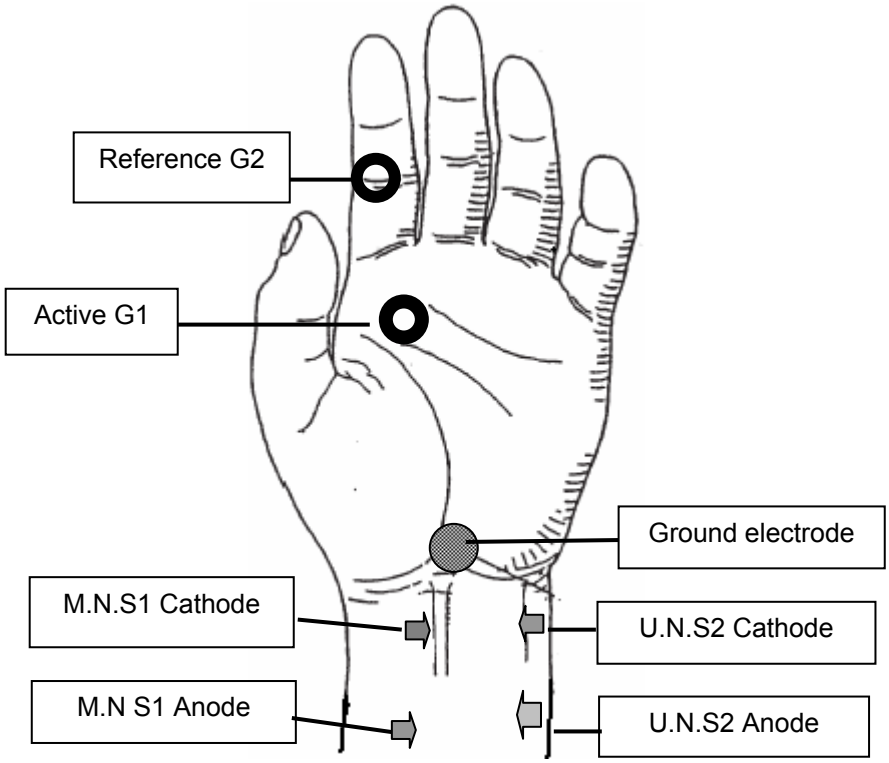

Fig. (4): The 2nd lumbrical and interossei latency recording and stimulation sites. M.N.S1: median nerve stimulation, U.N.S2: ulnar nerve stimulation. G1: Active recording electrode, G2: Reference recording electrode. G1-S1 distance equal to G2-S2.

Statistical analysis:

All tabulated data are expressed as means and standard deviations (mean ± SD) for age and calculated parameters in both control and patient groups e.g.; DML, ASL, M-U ASL, CMAP amplitude measured from baseline to the peak of 2nd lumbrical and interossei; and difference between these two muscles latency within each group. Analysis of variance models were used to test the significance of means and test for linear trends across groups *(Armitage & Perry 1987)* [21].

Between groups, the comparison was performed using bivariate analyses. They were made by one-way analysis of variance with regard to calculated parameters using analysis of variance for quantitative variables by means of unpaired student's t tests. Statistical comparison of the distal latency to the 2nd lumbrical and interossei was done using a two-tailed Student's t test. Non-parametric Spearman rank test were performed to calculate the correlation between age and 2nd lumbrical and interossei latency differences within each group *(Kleinbaum et al., 1988)* [22]. For all statistical tests, significance was defined as level of probability p value of < 0.05. Computations were made with the statistical package of StatView version 4.0 for Apple Macintosh computer used for analysis.

RESULTS

The normative data of 2nd lumbrical and interossei latency recording in 40 control hands (Fig. 5). The latencies mean values of 2nd lumbrical was 2.88 msec, interossei was 2.81 msec and 2nd lumbrical – interossei latency differences was 0.07 msec. There was no significant difference between the 2nd lumbrical latency and the interossei latency in control group using

two-tailed t test p= 0.6. The mean ± 2SD and the upper limit of the range were 0.4 msec. Therefore, an abnormal 2nd lumbrical – interossei latency differences was set at > 0.4 msec. The mean amplitude of interossei (5.8 mV) was higher than that of 2nd lumbrical (3.0 mV) ($p<0.05$). There was no significant correlation between 2nd lumbrical and interossei latency differences and age using non parametric correlation (r = -0.12) as shown in table (1) and (Fig. 5).

In the patient group with CTS, the 2nd lumbrical and interossei responses were recorded from all patients whereas absent responses were occasionally noted in the standard median conduction studies. The sensitivities of median nerve conduction studies using 2nd lumbrical – interossei latency differences was the highest in 58/61 (95%) comparable to the most sensitive test of standard median conduction studies (median – ulnar ADSL) was 89%.

Table (1): Mean values of 2nd lumbrical and interossei latency recoding (latency and amplitude) and standard median nerve conduction studies in control group.

Electrophysiological test	Mean	Mean + 2SD	Range
2nd Lumbrical distal latency (msec)	2.88 *	3.5	1.9 – 4.0
Interosseous distal latency (msec)	2.81*	3.6	2.0 – 4.0
2nd Lumbrical – Interosseous Difference (msec)	0.07	0.4	0.04 – 0.4
		Mean -2SD	
2nd Lumbrical amplitude (milli volt)	3.0 **	0.5	1.5 – 7.1
Interosseous amplitude (milli volt)	5.8 **	1.4	2.2 – 11.9
Standard Median Nerve conduction studies			
		Mean ±1SD	
Distal motor latency	4.1	3.7 ± 0.3	3.2 – 4.2
Antidromic distal sensory latency to 2nd digit (latency to the peak) (msec)	3.4	3.2 ± 0.2	2.4 – 3.5
Median (Antidromic distal sensory latency) to 4th digit (msec)	3.7	3.2 ± 0.3	2.8 – 3.3
Ulnar (Antidromic distal sensory latency) to 4th digit (msec)	3.4	3.04 ± 0.2	2.9 – 3.1
Difference between Median and ulnar nerves (Antidromic distal sensory latency) to 4th digit (msec)	0.4	0.3 ± 0.1	0.1 -0.4

* Two-tailed test, p= 0.6 NS ** Two-tailed test, p= 0.05 Significant
Mean distance wrist to active electrode =10 cm (range 7-12 cm)

Table (2): Sensitivity comparison of median nerve conduction studies in patients group with CTS.

Electrophysiology Test	Values	Patients Number =61	Sensitivity %
2nd Lumbrical – Interossei latency difference	> 0.4 msec	58	95%
Median – Ulnar ADSL difference	> 0.4 ms or absent	54	89%
Antidromic distal sensory latency -2nd Digit difference	> 3.4 ms or absent	40	66%
Distal motor latency – APB difference	> 4.1 ms or absent	32	53%

However, 3/61 patients (5%) who did not meet the criteria for an abnormal 2nd

lumbrical – interossei difference each had a border line values of 0.4 msec. The most sensitive standard median study was Median – ulnar ADSL to 4th digit 89%, followed by sensitivity of median ADSL to 2nd digit was 66 % and the least sensitive test of standard median nerve conduction study was the DML to APB (53%) as shown in table (2).

Table (3): Sensitivity of electrophysiological tests in CTS patient's subgroups

Grade	CTS Patient subgroups	Electrophysiological Tests	Patients Number (%)	% of Abnormal 2nd lumbrical-interossei difference
I	Very mild CTS	Normal standard tests: DML-APB ASL-2nd digit Abnormal comparative test: Prolonged M-U ADSL	10/61 (16%)	8/10 (80%)
II	Mild CTS	Normal Motor (DML-APB) With abnormal sensory	15/61 (25%)	13/15 (87%)
III	Moderate CTS	Abnormal median motor and sensory	21/61 (34%)	20/21 (95%)
IV	Sever CTS	Abnormal Motor (DML-APB) Absence of Sensory response	32/61 (53%)	32/32 (100%)
V	Possible CTS	Normal DML-APB Normal ASL-2nd digit Normal median-ulnar ADSL	3/61 (5%)	2/3 (67%)

CTS: Carpal tunnel syndrome, ADSL: Antidromic distal sensory latency, DML: Distal motor latency.

It was found the least sensitive standard median nerve conduction study needed to diagnose the CTS was DML-APB. Patients with CTS were graded into subgroup upon Electrodiagnostic grading of CTS (modified from Padua et al.1996 and 1997) [1, 23] into:

- Grade (1): Very mild CTS -normal standard tests, abnormal comparative tests.

- Grade (2): Mild CTS - abnormal sensory with a normal motor response.

- Grade (3): Moderate CTS - abnormal median sensory and motor response.

- Grade (4): Severe CTS -absence of sensory response, abnormal distal motor latency.

In Patients with very mild CTS (Fig. 6), there was normal standard median nerve NCSs tests (ASL and DML-APB) and abnormal comparative tests median-ulnar ADSL and the 2nd lumbrical – interossei latency differences were abnormal in 80%. In mild CTS (Fig. 7), where normal motor (DML – APB) and abnormal sensory (ADSL - 2nd digit), the 2nd lumbrical-interossei latency difference was abnormal in 87%. Patients with moderate CTS (Fig. 8), they had abnormal (prolonged) median sensory (ADSL - 2nd Digit) and motor (DML-APB), they had abnormal 2nd lumbrical-interossei latency differences 95%. Patients with sever CTS (Fig. 9), they were (32/61), they had abnormal (prolonged) motor (DML – APB), and absence ADSL, they recorded abnormal latency differences of 2nd lumbrical – interossei (100%) of such patients. In possible CTS (Fig. 10), patients where all standard median nerve conduction studies were normal, the 2nd lumbrical – interossei latency differences

were abnormal in 67% as shown in table (3).

DISCUSSION

CTS is the most common entrapment neuropathy affecting the upper extremity, it is a common clinical problem and frequently requires surgical therapy and is a frequent source of referral to EMG laboratory [24, 25]. Acroparesthesia is a common symptom of central and peripheral nervous system disorder, electrophysiologic confirmation of the diagnosis is important, especially before consideration of surgery [25].

Until the advent of electro-physiological testing in the 1940s, this syndrome commonly was thought to be the result of compression of the brachial plexus by cervical ribs and other structures in the anterior neck region. Now, it is known that the median nerve is damaged within the rigid confines of the carpal tunnel, initially undergoing demyelination followed by axonal degeneration. Sensory fibers often are affected first, followed by motor fibers. Autonomic nerve fibers carried in the median nerve also may be affected. The cause of the damage is subject to some debate; however, it seems likely that abnormally high carpal tunnel pressures exist in patients with CTS. This pressure causes obstruction to venous outflow, back pressure, edema formation, and ultimately ischemia in the nerve [26].

Simpson (1956) [27] originally demonstrated focal slowing of the median nerve at the wrist in patients with CTS, then a number of investigators [2, 28] have published conduction studies in this common entity. In the previous work [29], sensory conduction testing was said to have revealed a higher incidence of abnormality than studies of motor axons. However, other studies [15] showed a comparable incidence of abnormalities in the sensory and motor conduction. Further, involvements of motor fibers do not necessarily accompany similar abnormalities of sensory conduction and vice versa.

The sensitivity of the motor and sensory conduction studies may be improved by a number of methods. These include measuring the difference between the right and left sides, which is useful in unilateral lesions, although it is of limited help in assessing bilateral cases [18].

Paudua et al. (1996 and 1997) [1, 23] concluded that, internal comparison tests for CTS can be done If the standard tests are negative to identify cases of minimal or very mild CTS, to rule out CTS as a cause for patient symptoms and a search for other causes have to be made and to identify CTS in cases of polyneuropathy. If the standard tests are positive, CTS can be divided into extreme, severe, moderate and mild cases. Motor comparison study is useful in extreme CTS cases.

The Principles of comparison tests [1, 23]:

1. Identical distances employed between stimulating and recording electrode.

2. Factors affecting conduction time are constant: age, distance, temperature, muscle size.

3. Any mild slowing can be easily appreciated.

4. Meticulous attention to distance measurement, supramaximal stimulation and electrode placement.

5. Avoid over stimulation and spread of stimulus to adjacent nerves.

The distal median motor and sensory latencies were chosen as they are historically the oldest and most commonly used studies [25]. In addition, other studies [30, 31, 32, 25] felt by many to make a comparison of median and ulnar palmar

study to be the most sensitive test for mild CTS.

To demonstrate early and mild CTS using a technique of internal comparison of DML between 2nd lumbrical and interossei latency recording using the same active recording electrode with stimulation of median and ulnar nerves at wrist at equal distances. The advantage of 2nd lumbrical and interossei latency recording technique include:

The axons innervating both muscles are of similar diameter size. Both muscles can be recorded from the same active electrode in the distal palm. Identical distances to each muscle were used allowing direct comparison of DMLs. The 2nd lumbrical is relatively spared in CTS [(20)], thus even in sever CTS when the APB muscle is completely wasted, a CMAP can be reliably recorded from 2nd lumbrical.

Temperature is comparable for each distal nerve segment and muscle. Thus, this technique is the only internal comparison technique where motor studies are used and creates an ideal internal control for median motor studies in which several variables are held constant (muscle and axon size, temperature and distances). The only difference between the median and ulnar studies is that one is via the carpal tunnel and the other is not [(33)].

In our study, a prolonged 2nd lumbrical – interossei latency differences > 0.4 msec was found to be a sensitive indicator of CTS in all patients group in agreement with *Preston et al. (1992)* [(3)3]. However, other studies [(24)] have also found the use of internal controls between the median and ulnar studies to be highly sensitive. Comparison with contra-lateral median studies that often failed in this regards, as CTS is frequently bilateral, either clinically or electrically.

Our study revealed the sensitivity of the 2nd lumbrical- interossei latency difference (96%) that was higher than the highest sensitive test of standard median nerve conduction studies (Median – Ulnar ADSL difference) (89%). Most studies [(30, 25, 34)] revealed the best test of standard median nerve conduction studies to detect mild CTS was comparison between median and ulnar distal latency but they did not compared with 2nd lumbrical-interossei latency difference.

In this study, the sensitivity of DML to APB was 53% nearly similar to other studies [(35)]; they found the median DML was normal in 35% to 50% in patients with CTS. They explained the low diagnostic yield of DML to APB to be the result of relative sparing of motor as compared to sensory fibers in mild CTS. Indeed, in rare cases of CTS, only motor fibers are involved [(25)].

Motor axons supplying lumbrical muscles are less severely affected than axons supplying thenar muscles in the CTS; sometimes lumbrical motor fibers are less affected than digit 2 sensory fibers. This pattern is consistent with compression of both the anterior and posterior aspects of the median nerve in the carpal tunnel because nerve fibers responsible for thenar, lumbrical and digit 2 functions lie in an anterior-posterior gradient within the distal median nerve. Recognition of lumbrical sparing supports the electrodiagnosis of CTS when the distal latency to thenar muscles or the palm-to-wrist mixed median nerve conduction velocity is normal [(20)].

Logigian et al. (1987), studies showed that 2nd lumbrical is spared as compared to the APB in CTS, this sparing of 2nd lumbrical muscle is only relative as it was cleared in our study with the use of internal comparison control, both 2nd lumbrical and APB muscles were affected, but the APB was more affected than 2nd lumbrical. However, from our study, is apparent that electrophysiological evidence of motor involvement is much more frequent.

Our study revealed the percentage of sensitivity or abnormal 2nd lumbrical – interossei latency differences in CTS patient's subgroups was 80%, 87%, 95%, 100% and 67% in Grade 1. Very mild CTS, Grade 2. Mild CTS, Grade 3. Moderate CTS, Grade 4. Severe CTS and possible CTS, respectively. That means that, the more sensitive the study needed to demonstrate CTS, the more sever the CTS was graded.

In our study, there was no statistically significant difference between the distal latency to the 2nd lumbrical and the distal latency to the interossei was found in control, although the ulnar nerve follows a slightly curved path to reach the interossei in the palm, one might have expected that the distal latency to the interossei would have been longer than the distal latency of 2nd lumbrical, when using identical linear distances.

Electrophysiological examination should always be considered as an extension of the clinical neurological examination. It is not a mere laboratory test, rather being as an electrodiagnostic consultation. Hence, each patient needs to be approached with a clear-cut strategy after gathering the clinical information so that appropriate tests could be performed within a stipulated time frame in a busy EMG laboratory. They believed that the algorithm will help to sort out the electrical diagnosis of CTS in a systematic way (Fig. 11) [(36)].

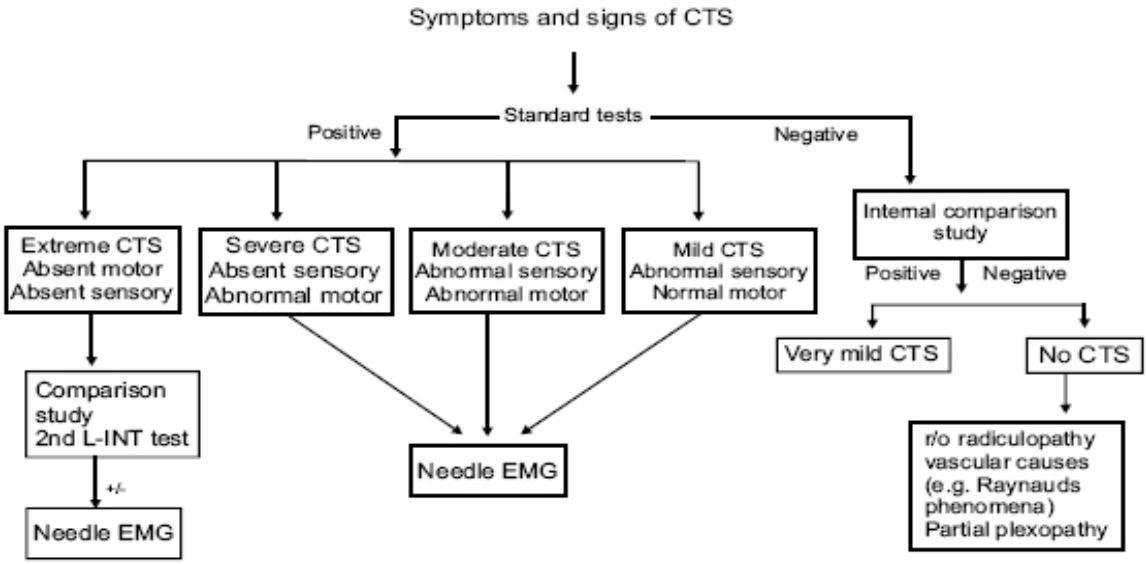

Fig. (11): An algorithm for an electrophysiological approach to CTS.

An algorithm for an electrophysiological approach to CTS is proposed. This technical note takes into account the standard tests, comparison tests and needle electromyography. If the standard tests are negative, a comparison study can be done to identify cases of minimal or very mild CTS. If comparison studies are negative, CTS can be ruled out and searches for other causes have to be made. If the standard tests are positive, CTS can be divided into extreme, severe, moderate and mild cases. Motor comparison study is useful in extreme CTS cases. Needle electromyography is a must in all cases where the standard tests are positive. This streamlined approach allows accurate diagnosis with minimum essential tests.

Conclusions:

The comparison of lumbrical and interossei latency differences is a sensitive measure technique can help and demonstrate early and mild CTS patients as it is safe, simple and easy to perform in any electrophysiology laboratory just require active recording electrode on 2nd lumbrical motor point. Furthermore, a reasonable flow chart and recommendation for electrodiagnosis of CTS for electromyographers.

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دراسة مقارنة إختبار قياس سرعة التوصيل الحركي من العضلة الثانية الخرطونية (الدودية) والسلامية الثانية لليد باختبارات التشخيص الكهربائي القياسية في مرضى اختناق العصب الأوسط

محمد فاروق لاوند، هاني عبد المنعم بسيوني*

أستاذ مساعد الطب الطبيعي والتأهيل كلية طب طنطا، أستاذ مساعد جراحة العظام كلية طب بنها*

المجوعة الثانية : مجموعة المرضى اللذين لديهم إختناق بالعصب الأوسط لليد وإشتملت على 61 يد بها إختناق للعصب الأوسط ثم تشخيصهم بالتشخيص الكهربائي بالإختبارات الاعتيادية 15 رجال 46 سيدات ومتوسط أعمارهم 45 سنه يتراوح أعمارهم من 28 -63 سنة.

النتائج: أظهرت النتائج الآتي:

وجود زيادة في نسبة حساسية قياس سرعة التوصيل الحركي بالمقارنة بالإختبارات القياسية لإختناق العصب الوسط لليد مثل (قياس سرعة التوصل الحركي – قياس سرعة التوصل الحسي للإصبع السبابة – الفرق بين سرعة التوصيل للأعصاب الحسية للإصبع الرابع بين العصب الزندي والأوسط).

زيادة دقة حساسية إختبار قياس سرعة التوصيل الحركي في الإكتشاف الدقيق والمبكر لاختناق العصب الأوسط حتى في حالة وجود نتائج طبيعية لباقي إختبارات القياس.

الخلاصة: استخدام اختبار قياس إستجابة التوصيل من العضلة الثانية الخرطونية (الدودية) والسلامية الثانية العصب الأوسط لليد لتشخيص الإختناق المبكر الدقيق ذو حساسية عالية بالمقارنة للإختبارات الأخرى والتوصية بضرورة أدراجة ضمن الطرق الروتينية في قياس وتشخيص إختناق العصب الأوسط.

المقدمة: يعتبر إختناق العصب الأوسط لليد من أكثر الأسباب شيوعاً في الم اليد وخاصة ليلا وتزيد نسبته في السيدات بالمقارنة للرجال بنسبة 1:3 وأيضا ينتشر في أصحاب الحرف المهنية ومبرمجي الكمبيوتر لكثر إستخدام اليد وتعرض العصب الأوسط للضغط والإختناق. والتشخيص الكهربائي لهذه الحالات من العوامل التشخيصية الرئيسة لثبوت وجود إختناق وتأخر بسرعة التوصيل بالعصب الأوسط لسرعة التدخل وإنقاذ الألياف العصبية الحركية بالعصب ومنع ضمور وهزل عضلات اليد.

الغرض من البحث: هو مقارنة نسبة دقة وحساسية إختبار قياس سرعة التوصيل الحركي من العضلة الثانية الخرطونية (الدودية) والسلامية الثانية لليد بالإختبارات القياسية الأخرى والمستخدمة في مجال التشخيص الكهربائي مثل سرعة توصيل العصب الحركي وسرعة توصيل العصب الحسي – الفرق بين التوصيل الحسي لعصبي اليد الأوسط والزندي للاصبع الرابع.

رؤية مدى قدرة هذه الاختبار على التشخيص الكهربائي المبكر للحالات البسيطة والمبكرة.

مواد البحث: إشتملت الدراسة على مجموعتين:

المجموعة الأولى: مجموعة الأشخاص الطبيعيين والأصحاء واشتملت على40 يد لأشخاص طبيعيين منهم 14 رجال 28 سيدات وكان متوسط أعمارهم 39.5 سنة يتراوح أعمارهم من 21 -56 سنة.