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ORIGINAL STUDY

The Relation between Carpal Tunnel Syndrome and Ulnar Nerve Entrapment: An Electrophysiological Study

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ABSTRACT

Entrapment of the median nerve; carpal tunnel syndrome (CTS), is a common neuropathy that result from compression, ischemia or repetitive movement of the wrist. Ulnar nerve entrapment (UNE) frequency come after the median nerve syndrome, it occurs at the wrist and at the elbow. The neurological finding of median and ulnar nerves compression are presented as a sensory or motor or both.

Aim of the study: To investigate the frequency of carpal tunnel syndrome (CTS) and ulnar nerve entrapment (UNE).

Material and method: Fifty patients were included in this study suffering from CTS. The patients with the CTS diagnosis through; history taking, physical, clinical, and electrophysiological examination; the electrophysiological parameter (EPP) done for median and ulnar nerves for motor and sensory nerves; to study the distal motor and sensory latency (DML; DSL), motor and sensory nerve action potential (CMAP; SNAP), and the nerve conduction velocities (NCV); the EPP were done in Ibn-Sina Teaching Hospital (EMG Department); by using Neuropack EMG measuring system Nihoncodene (MEB-9400K); and Galileo NT Line (Nemus2).

Result: The EPP demonstrates that; there is nearly no relation between CTS and UNE in this study;(not significant) this may be due to anatomical difference in the course of the median and ulnar nerves. It reveals a positive association between the duration of the disease and severity of CTS. It also shows there is no relation between, severity of the CTS and the body mass index (BMI); the electrophysiological study considered a strong corner stone in CTS diagnosis along with the clinical assessment.

Keywords: Median nerve, Ulnar nerve, Carpal tunnel syndrome, Ulna nerve entrapment, Electrophysiological parameters

1. Introduction

Carpal tunnel syndrome (CTS) of the median nerve is a common entrapment neuropathy; Ten percentage of people are affected in their lifetime (Olney, 2001). It happens due to compression of the nerve in the carpal tunnel; paresthesia occurs at night, then at day time; then there is weakness and atrophy of the thenar muscle (Padua et al., 2023). The Prevalence of CTS is about 1–5% (the criteria that are used play a role in that); the estimated base of clinical criteria is higher than the electrophysiological stander (Padua et al., 2016). The women show high affection than male, the ratio varies among the studies (Padua et al., 2016; Pourmemari et al., 2018). The usual age group is 40–50 years, then 75–84 years (Aroori and Spence, 2008; Bland and Rudolfer, 2003; Warwick, Sirnivasan, and Solomon, 2010); older adults increasing the probability of CTS (Bland and Rudolfer, 2003). Although the association between old age and CTS has not clarified; Older individuals show sever sign and symptom; in addition to EPP severity (Stone et al., 2014). More than one cause that lead to CTS, the decrease in carpal tunnel volume, that increased pressure on the median nerve (Padua et al., 2023), other risk factors are inflammatory, traumatic, mechanical,

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or hormonal; other causative factors are diabetes, menopause, hypothyroidism, obesity, arthritis, and pregnancy (Padua et al., 2016). The fluid retention and hormonal changes in 3rd trimester is one of common cause for CTS (Padua et al., 2023); the sign and symptom are disappeared after labor, while in some patients the symptoms are persist after labor. The appearance of sign and symptom of CTS before the 3rd trimester will lead to increase the severity throughout the pregnancy, early onset, before the third trimester of pregnancy, increased severity of CTS symptoms during pregnancy and even 12 months postpartum (Padua et al., 2023; Meems et al., 2017) after menopause, the hormonal changes that cause water retention will increase the risk of CTS; the researcher observed that the treatment by hormonal therapy reduce or prevent menopausal CTS to about 22% (Rousan et al., 2018). Rheumatoid arthritis and osteoarthritis are a common cause of CTS (Padua et al., 2023). Environmental workplace can cause CTS (Nilsson, Wahlström, and Burström, 2017). Vibrating tools exposure can increase the risk of CTS (Padua et al., 2023). The relationship between CTS and computer use is controversial (Padua et al., 2023). Cardiac and other manifestations of amyloidosis can be preceded by CTS for several years (Donnelly et al., 2019; Aus dem Siepen et al., 2019; Itzhaki Ben Zadok et al., 2020). Carpal tunnel syndrome and COVID-19; peripheral neuropathy and CTS can be the presenting clinical feature for the COVID-19; This may be due to reactive arthritis and synovitis which lead to median nerve compression (Lockey et al., 2021; Roncati et al., 2021).

UNE is the 2nd nerve entrapment after CTS (Carlson et al., 2010; Warwick, Sirnivasan, and Solomon, 2010). The neurological presentation of UNE could be sensory; motor or both; the patient presented by numbness, tingling, paresthesia, and pain in the hand (Olney, 2001; Padua et al., 2016, 2023; Pourmemari et al., 2018); pain and aching in the medial side of elbow and forearm. (Aroori and Spence, 2008; Carlson et al., 2010; Shi and MacDermid, 2011; Warwick, Sirnivasan, and Solomon, 2010; Wolgin) 4th and 5th digits; ulnar side of the dorsum of the hand and the hypothenar eminence show numbness and tingling (Wojewnik and Bindra, 2009; Houston Methodist Orthopedics and Sports Medicine). The active and passive flexion and extension of the elbow express a painful snapping or popping; there is difficulty in abduction of fifth digit due to weakness of the third palmar interosseous muscle (Wartenberg sign); the rang of movement (active and passive) not affected. Some time there is enlargement, palpable and tender ulnar nerve in its groove (Sebelski); the intrinsic muscles of the hand develop atrophy of that muscle and a claw posture of the 4th and 5th fingers can be expressed (Assmus, Antoniadis, and Bischoff, 2015).

Electrophysiological evaluation complements clinical assessments for the CTS and UNE. It gives a sure diagnosis that support the clinical diagnosis; it supplies a quantitative data the exact methods chosen, test execution, and the patient population play a role in the specificity and sensitivity of that test; CTS and UNE diagnosis highly dependent on this tool (Padua et al., 2023). The American Academy of Neurology, the American Association of Electro diagnostic Medicine, and the American Academy of Physical Medicine and Rehabilitation have had a certain recommendation for electrophysiological testing (Jablecki et al., 2011, 1993); the gold stander diagnosis tests is gained by the EEP; it is crucial procedure for median and ulnar nerve task in CTS and UNE. The Association between CTS of the median nerve and the UNE remains controversial (Padua et al., 2023). Aim of the study: To investigate the frequency of carpal tunnel syndrome (CTS) and ulnar nerve entrapment (UNE).

2. Materials and methods

This study is accepted by the systematic group at AL-Noor University. After explanations of the trial to the patients; the formal consent was taken from patients. Fifty patients; 20 males (40%); 30 females (60%) were included in this study; their age are ranged between (20–55 year); the mean age are (30.64 ± 9.556). All of them are diagnosed that they having CTS; through detail history taking, clinical, physical, neurological examination and electrophysiological study for the median nerves. The patients were selected from Neurophysiology and Rheumatology department in Ibn-Sina Teaching Hospital, and from the private clinic, during the period from 15\5\2024 to 15\10\2024.

Electrophysiological study performed for the median and ulnar nerves affording to the plane of the American association of neuro-muscular & electrodiagnostic medicine (Jablecki et al., 2011, 1993). Electrophysiological parameter (EPP) study were done bilaterally for median and ulnar nerves (motor and sensory) for the patients; to study the sensory and motor nerve action potential (SNAP, CMAP), distal sensory and motor latency (DSL, DML), and conduction velocity (NCV); the EPP were done by using Neuropack EMG\EP measuring system Nihoncodene (MEB-9400K); and Galileo NT Line (Nemus2) in Ibn-Sinna Teaching Hospital and Private Clinic.

Table 1. Age, sex, body mass index (BMI), disease duration, right and left-hand affection of the median nerve compression (CTS) patients.

Parameters	Total no. = 50 patient (100%)		
Age (year)	Male = 20 (40%). Female = 30 (60%)		
Range	(20–55)		
Mean	(30.64 ± 9.556)		
Sex			
Males	20 (40%)		
Females	30 (60%)		
BMI	Males	Females	Total
Normal weight = 18.5–24.9%	19 (38%)	27 (54%)	46 (92%)
Over weight = 25–29.9%	1 (2%)	3 (6%)	4 (8%)
Disease duration (month)	1–2	3–4	>5
Male 20 (40%)	5 (10%)	7 (14%)	8 (16%)
Female 30 (60%)	8 (16%)	10 (20%)	12 (24%)
Right\Left hand CTS.	Patient no. (%)	Males	Females
Rt. Hand	43 (86%)	17 (34%)	26 (52%)
Lt. Hand	7 (12%)	3 (6%)	4 (8 %)

Table 2. Median nerve compression, rendering to their severity (mild, moderate, severe); for the patients.

Mild – CTS			Moderate – CTS			Severe – CTS		
Patients no. (%)	Sex		Patients no. (%)	Sex		Patients no. (%)	Sex	
	Males	Females		Males	Females		Males	Females
23 (46%)	8 (16%)	1 (30%)	21 (42%)	9 (18%)	12 (24%)	6 (12%)	3 (6%)	3 (6%)

2.1. Statistical analysis

The data were analyzed according to a simple experimental system and using a completely randomized design. The T- test, used to compare the means. F- test, used to compare among the treatment under the 1% probability level.

3. Results and discussion

Fifty patients were included in this study; 20 males (40%), and 30 females (60%); there age were ranged between 20–55 years; the mean age is (30.64 ± 9.556). Forty-six patients have normal body mass index (BMI = 18.5–24.9%); and only 4 patients were overweight (BMI = 25%–29.9%). The duration of the disease was 1–2 months seen in 13 patients (26%); 3–4 month in 17 patients (34%); and more than 5 months in 20 patients (40%). Right hand CTS affecting 43 patients (86%); while left hand affected in 7 patients (14%) only; as shown in Table 1.

The severity of the CTS was divided to mild, moderate and sever. Mild CTS was seen in 23 patients (46%); moderate CTS in 21 patients (42%), and severe CTS in 6 patients (12%); Table 2.

The EPP for the right median and ulnar nerves (motor and sensory), reveals high significant difference between them; as shown in Table 3.

The EPP (electrophysiological parameters) for the left median and ulnar nerves (motor\sensory); that reveals highly significant difference between them; as shown in Table 4.

The EPP for mild, moderate, severe CTS, and its relation to disease duration, reveals a positive and significant relationship; Table 5.

This study shows; ulnar nerve entrapment (UNE) in 3 patients only (6%); 1 male (2%), and 2 female (4%); affecting the right ulnar nerve; all of them are mild in severity; that means there is no relation between the CTS and the UNE.

4. Discussion

This study is accepted by the systematic group at AL-Noor University. In this study the clinical measures and demography for patients is mimic to other studies apart from the mean of age at examination (30.64 ± 9.556) years; and this is not mimic other studies reported higher mean age (Agarwal et al., 2005; Flondell et al., 2010; Tay, Urkude, and Verma, 2006). this may be due to overtask of the house wives and early child bearing in our society. The current study show that; the CTS are far more common in women than in men, and this is similar to other study (Aroori and Spence, 2008; Warwick, Sirnivasan, and Solomon, 2010). Electrophysiology study considered

Table 3. The EPP (electrophysiological parameter) for the right median and ulnar nerve (motor and sensory).

	Pt. No. = 50 (100%) Median nerve	Pt. No. = 50 (100%) Ulnar nerve		
Parameter Motor	Mean ± SD	Mean ± SD	t-value	P-Value
DL (ms)	5.242 ± 0.728	3.354 ± 0.183	–17.780	0.00
CMAP (mv)	11.780 ± 2.656	23.040 ± 2.955	20.027	0.00
NCS (m\s)	41.840 ± 4.229	53.840 ± 2.411	17.429	0.00
Parameter Sensory				
DL (ms)	5.310 ± 0.701	3.326 ± 0.147	–19.578	0.00
CMAP (μv)	11.780 ± 2.659	27.520 ± 4.001	23.166	0.00
NCS (m\s)	40.540 ± 7.638	53.840 ± 2.410	11.742	0.00

Table 4. The electrophysiological parameters (EPP) for the left median and ulnar nerves (motor and sensory).

	Pt. no. = 50 (100%) Median nerve	Pt. no. = 50 (100%) Ulnar nerve		
Parameter Motor	Mean ± SD	Mean ± SD	t-value	P-Value
DL (ms)	5.150 ± 0.672	3.290 ± 0.147	–19.126	0.00
CMAP (mv)	14.040 ± 2.634	24.600 ± 1.979	22.663	0.00
NCS (m\s)	43.620 ± 3.510	55.200 ± 1.927	20.448	0.00
Parameter Sensory				
DL (ms)	5.096 ± 0.650	3.362 ± 0.170	–18.243	0.00
CMAP (μv)	13.660 ± 2.471	23.040	17.218	0.00
NCS (m\s)	41.840 ± 4.229	53.840 ± 2.411	17.429	0.00

the vital method for measuring the median nerve task in CTS due to its characteristic dependability, objectivity and reproducibility, (Aroori and Spence, 2008; Aygül et al., 2009). In this study there is no association between the CTS and the BMI; not mimic other study (Aris et al., 2000; Aygül et al., 2009).This may be due to low number of patient that had over weight in this study, there is only 4 patients (8%) show over weight. The current study shows positive relation between the CTS and disease duration, which is highly significant; and this is mimic to other study (Masud, Rashid, and Akhtar Malik, 2019). This study reveals; there is no relation between the CTS and UNE; and this is mimic other study (Lewańska and Walusiak-Skorupa, 2017). This may be due to anatomical differences between the ulnar and median nerve; and the functional movement of the upper limb that can cause median and ulnar nerves compression. Other

Table 5. The relation between disease duration and EPP for median nerve; it shows positive relation.

Disease duration (month)	DL	CMAP	NCV
1			
Mean	4.2500 d	13.0000 ab	45.5000 a
Pt. no.	2	2	2
Std. Deviation	0.07071	0.00000	3.53553
2			
Mean	4.5789 c	13.5789 a	45.3684 a
Pt. no.	19	19	19
Std. Deviation	0.22992	2.21900	1.57093
3			
Mean	5.4385 b	11.3846 b	40.9231 b
Pt. no.	13	13	13
Std. Deviation	0.40319	1.19293	0.75955
4			
Mean	5.6700 b	11.8000 ab	41.2000 b
Pt. no.	10	10	10
Std. Deviation	0.18886	0.78881	0.78881
5			
Mean	6.5333 a	6.5000 c	32.5000 c
Pt. no.	6	6	6
Std. Deviation	0.13663	0.54772	1.04881
p-value	0.00	0.00	0.00

study shows high relation between CTS and UNE (Cassvan, Rosenberg, and Rivera, 1986); this may be due to a small sample of patients in this study; while the other has a retrospective study, with large sample.

5. Conclusion

The relation between CTS and UNE is statistically non-significant. Ulnar involvement was found in 3 patients only (6%) among 50 patients with CTS patients.

Conflicts of interest

There is no conflict of interest.

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References

Olney, R. K. (2001) Carpal tunnel syndrome: complex issues with a “simple” condition. *Neurology.*, 56, 1431–2.

Padua, L., Cuccagna, C., Giovannini, S., Coraci, D., Pelosi, L., Loreti, C., *et al.* (2023) Carpal tunnel syndrome: updated evidence and new questions. *Lancet Neurol.*, 22, 305–16.

Padua, L., Coraci, D., Erra, C., *et al.* (2016) Carpal tunnel syndrome: clinical features, diagnosis, and management. *Lancet Neurol.*, 15, 1273–84.

Pourmemari, M. H., Heliövaara, M., Viikari-Juntura, E. and Shiri, R. (2018) Carpal tunnel release: lifetime prevalence, annual incidence, and risk factors. *Muscle Nerve.*, 58, 497–502.

Warwick, D., Sirnivasan, H. and Solomon, L. (2010) Peripheral nerve disorders. In: Solomon L, Warwick D, Nayagam S, editors. Apley’s system of orthopaedics and fractures. 9th ed. London: *Hodder Arnold.*, 269–301.

Aroori, S. and Spence, R. J. (2008) Carpal tunnel syndrome. *Ulster Med J.*, 77(1), 6–17.

Bland, J. D. P. and Rudolfer, S. M. (2003) Clinical surveillance of carpal tunnel syndrome in two areas of the United Kingdom, 1991–2001. *J Neurol Neurosurg Psychiatry.*, 74, 1674–9.

Stone, O. D., Clement, N. D., Duckworth, A. D., Jenkins, P. J., Annan, J. D. and McEachan, J. E. (2014) Carpal tunnel decompression in the super-elderly: functional outcome and patient satisfaction are equal to those of their younger counterparts. *Bone Joint J.*, 96-B, 1234–8.

Meems, M., Truijens, S. E. M., Spek, V., Visser, L. H. and Pop, V. J. M. (2017) Follow-up of pregnancy-related carpal tunnel syndrome symptoms at 12 months postpartum: a prospective study. *Eur J Obstet Gynecol Reprod Biol.*, 211, 231–2.

Rousan, T., Sparks, J. A., Pettinger, M., *et al.* (2018) Menopausal hormone therapy and the incidence of carpal tunnel syndrome in postmenopausal women: findings from the Women’s Health Initiative. *PLoS One.*, 13.

Nilsson, T., Wahlström, J. and Burström, L. (2017) Hand-arm vibration and the risk of vascular and neurological diseases: a systematic review and meta-analysis. *PLoS One.*, 12.

Donnelly, J. P., Hanna, M., Sperry, B. W. and Seitz, W. H. Jr. (2019) Carpal tunnel syndrome: A potential early, red-flag sign of amyloidosis. *J Hand Surg Am.*, 44, 868–76.

Aus dem Siepen, F., Hein, S., Prestel, S., *et al.* (2019) Carpal tunnel syndrome and spinal canal stenosis: Harbingers of transthyretin amyloid cardiomyopathy? *Clin Res Cardiol.*, 108, 1324–30.

Itzhaki Ben Zadok, O., Abelow, A., Vaxman, I., *et al.* (2020) Prior carpal tunnel syndrome and early concomitant echocardiographic findings among patients with cardiac amyloidosis. *J Card Fail.*, 26, 909–16.

Roncati, L., Gianotti, G., Gravina, D., *et al.* (2021) Carpal, cubital, or tarsal tunnel syndrome after SARS-CoV-2 infection: a causal link? *Med Hypotheses.*, 153, 110638.

Lockey, S. D., Nelson, P. C., Kessler, M. J. and Kessler, M. W. (2021) Approaching “elective” surgery in the era of COVID-19. *J Hand Surg Am.*, 46, 60–4.

Carlson, H., Colbert, A., Frydl, J., Arnall, E., Elliot, M. and Carlson, N. (2010) Current options for nonsurgical management of carpal tunnel syndrome. *Int J Clin Rheumtol.*, 5(1), 129–42.

Warwick, D., Sirnivasan, H. and Solomon, L. (2010) Peripheral nerve disorders. In: Solomon L, Warwick D, Nayagam S, editors. Apley’s system of orthopaedics and fractures. 9th ed. London: *Hodder Arnold.*, 269–301.

Shi, Q. and MacDermid, J. C. (2011) Is surgical intervention more effective than non-surgical treatment for carpal tunnel syndrome? A systematic review. *J Orthop Surg Res.*, 6, 17.

Wolgin, M. A. Cubital tunnel syndrome. [Internet]. Available from: http://www.drwolgin.com/Pages/CubitalTunnelSyndr.aspx.

Wojewnik, B. and Bindra, R. (2009) Cubital tunnel syndrome - review of current literature on causes, diagnosis and treatment. *J Hand Microsurg.*, 1(2), 76–81.

Houston Methodist Orthopedics and Sports Medicine. A patient’s guide to cubital tunnel syndrome. [Internet]. Available from: http://www.methodistorthopedics.com/Cubital-Tunnel-Syndrome.

Sebelski, C. A. Current concepts of orthopaedic physical therapy. The elbow: physical therapy management utilizing current evidence. 4th ed. [Internet]. doi: 10.17832/isc.2016.26.2.3

Assmus, H., Antoniadis, G. and Bischoff, C. (2015) Carpal and cubital tunnel and other, rarer nerve compression syndromes. *Dtsch Arztebl Int.*, 112(1–2), 14–25, quiz 26.

Jablecki, C. K., Andary, M. T., Floeter, M. K., *et al.* (2011) Evidence-based guideline: treatment of painful diabetic neuropathy: report of the American Academy of Neurology, the American Association of Neuromuscular and Electrodiagnostic Medicine, and the American Academy of Physical Medicine and Rehabilitation. *Neurology.*, 76, 1758–65.

Jablecki, C. K., Andary, M. T., So, Y. T., Wilkins, D. E., *et al.* (1993) Literature review of the usefulness of nerve conduction studies and electromyography for evaluation of patients with carpal tunnel syndrome. *Muscle Nerve.*, 6, 1392–414.

Agarwal, V., Singh, R., Sachdev, A., Shekhar, S. and Goel, D. (2005) A prospective study of the long-term efficacy of local methyl prednisolone acetate injection in the management of mild carpal tunnel syndrome. *Rheumatology.*, 44(5), 647–50.

Flondell, M., Hofer, M., Björk, J. and Atroshi, I. (2010) Local steroid injection for moderately severe idiopathic carpal tunnel syndrome: Protocol of a randomized double-blind placebo-controlled trial. *BMC Musculoskelet Disord.*, 11, 76.

Tay, L. B., Urkude, R. and Verma, K. K. (2006) Clinical profile, electrodiagnosis and outcome in patients with carpal tunnel syndrome: a Singapore perspective. *Singapore Med J.*, 47(12), 1049–52.

Aygül, R., Ulvi, H., Kotan, D., Kuyucu, M. and Demi, R. (2009) Sensitivities of conventional and new electrophysiological techniques in carpal tunnel syndrome and their relationship to body mass index. *J Brachial Plex Peripher Nerve Inj.*, 4, 12.

Aris, J., Kouyoumdjian, M., Da Penha, M. A., *et al.* (2000) Body mass index and carpal tunnel syndrome. *Arq Neuropsiquiatr.*, 58(2A), 252–6. doi: 10.1590/S0004-282X2000000200008.

Masud, M., Rashid, M. and Akhtar Malik, S. (2019) Does the duration and severity of symptoms have an impact on relief of symptoms after carpal tunnel release? *J Brachial Plex Peripher Nerve Inj.*, 14(1).

Lewańska, M. and Walusiak-Skorupa, J. (2017) Is ulnar nerve entrapment at the wrist frequent among patients with carpal tunnel syndrome occupationally exposed to monotype wrist movements? *Int J Occup Med Environ Health.*, 30(6), 861–74. doi: 10.13075/ijomeh.1896.00970.

Cassvan, A., Rosenberg, A. and Rivera, L. F. (1986) Ulnar nerve involvement in carpal tunnel syndrome., 67(5), 290–2. doi: 10.5555/uri:pii:0003999386910476.