Pain Frequency at Night Reflects Median Nerve Injury in Carpal Tunnel Syndrome

Karpal Tünel Sendromu Olgularında Gece Ağrı Sıklığı Median Sinir Hasarını Yansıtır

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Özet

Amaç: El bileğinde median sinir sıkışmalarının değerlendirilmesinde ağrı sorgulaması yararlıdır. Biz bu çalışmada ağrının karakteri ile karpal tünel sendromunun (KTS) klinik şiddeti arasındaki ilişkiyi araştırdık.
Gereç ve Yöntem: Prospektif bu çalışmada, ağrının karakteri (şiddeti, sıklığı, gece veya gündüz olması) kendi kendine uygulanabilen düzenlenmiş semptom şiddet sorgulama formu ile değerlendirildi. KTS tanısı klinik bulgular ve elektrofizyoloji çalışmaları ile kondu. İdiyopatik KTS tanısı almış 41 (32 kadın ve 9 erkek) olguya ait ağrı ile elektrofizyolojik bulgular arasındaki ilişkiler değerlendirildi.
Bulgular: Bu çalışmada KTS tanısı almış 63 el (38 sol el, 25 sağ el) değerlendirildi. Hastaların ortalama yaşı 43,9±12,1 (23-78) yıldı. Daha önce yapılmış bir çalışmada klinik ve nörofizyolojik bulgular arasında güçlü bir ilişki rapor edilmesine rağmen, biz yalnızca gece ağrı sıklığı ile median sinir bileşik kas aksiyon potansiyelleri arasında istatistiksel olarak anlamlı bir ilişki bulduk (p=0,03). Bu ilişki cinsiyet, yaş, tuzağın olduğu taraf, diğer sinir ileti çalışması verileri ve sorgulanan diğer ağrı özelliklerinden bağımsızdı. Diğer sinir ileti çalışması parametreleri ile ağrı skorları arasında bir ilişki bulunamadı.
Sonuç: Bu bulgulara dayanarak, gece ağrı sıklığının sorgulanmasının biyolojik bir önemi olduğuna ve median sinir hasarını daha iyi yansıttığına inanmaktayız. *Türk Fiz Tıp Rehab Derg 2005;51(4):138-141*
Anahtar Kelimeler: Gece ağrısı, semptom şiddet skalası, karpal tünel sendromu, sinir iletim çalışmaları

Summary

Objective: Assessment of pain is useful in evaluating the median nerve entrapment in wrist. We aimed to examine the relationships between characteristics of pain and clinical severity of carpal tunnel syndrome (CTS).
Materials and Methods: In this prospective study, the characteristics (severity, frequency, occurrence during day life or night) of pain were evaluated by using modified self-administered Symptom Severity Questionnaire with idiopathic carpal tunnel syndrome. The diagnosis of CTS was made clinically and electrophysiologically. We assessed the relationship between electrophysiological findings and pain in 41 patients (32 female and 9 male) with idiopathic CTS.
Results: Sixty-three hands (38 left hands, 25 right hands) with CTS were included in this study. The mean age was 43.9±12.1 (Range: 23-78) years. Although a previous study reported a strong relationship between clinical and neurophysiologic findings, we found a significant correlation only between nocturnal pain frequency and median nerve compound muscle action potential amplitudes (p=0.03). This significant correlation was independent from gender, age, side of entrapment, other parameters of nerve conduction studies, and other characteristics of pain. We did not find any correlation between pain scores and other median nerve conduction study parameters.
Conclusion: Based on these findings, we suggest that nocturnal pain frequency has biological significance and better reflect median nerve injury. *Turk J Phys Med Rehab 2005;51(4):138-141*
Key Words: Nocturnal pain, symptom severity scale, carpal tunnel syndrome, nerve conduction studies

Introduction

Median nerve compression at the wrist or carpal tunnel syndrome (CTS) is the most common of all compression syndromes and should be diagnosed only when typical symptoms are associated with significant electrophysiological abnormalities (1). Although electrophysiological testing is accepted as a standard for the diagnosis of CTS, the studies point out that subjective symptoms are poorly correlated with changes of nerve conduction studies (NCS) of the median nerve (1-4). We undertook

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this study to examine the relationship between pain which is the most commonly seen complaint and electrodiagnostic findings in CTS.

Materials and Methods

We tried to find out the relationships between the pain and nerve conduction studies in consecutive CTS cases who meet inclusion criteria. Pain was evaluated as nocturnal pain or pain felt during daily life by using modified self-administered Symptom Severity Questionnaire which was validated, transcultural adapted and used by Heybeli et al. (5) in 41 patients (63 hands) with idiopathic carpal tunnel syndrome. The diagnosis of CTS was made clinically and electrophsiologically. Medical history and symptoms were assessed by interview, and electrodiagnostic studies were used to measure median nerve function. Patients diagnosed with unilateral or bilateral CTS at the electromyography laboratory, were asked to participate in this study immediately after their nerve conduction studies if they met following criteria: (1) Presence of pain as a typical sensory symptom; (2) age >18 years; (3) no surgery for CTS on the involved limbs. After giving informed consent, the patients immediately were asked about their pain (Table 1). Patients undergoing systemic treatment for arthritis, with chronic renal failure under hemodialysis, with endocrinopathy and diabetes, with polyneuropathy and with trauma-related conditions were excluded. To prevent problems with multiple hands from a subject being included in the analysis, we asked the symptom severity questions for each hand.

Table 1: The pain symptom severity scale evaluated in the present study.

PAIN SYMPTOM SCALE
Please could you sign the answer which is correct for your pain?
1. What is the severity of pain during day? 0.No pain 1.Mild 2.Moderate 3.Severe 4.Unbearable
2. How many times do you complain pain during day? 0.Any time 1.1-2 times per day 2.3-4 times per day 3.More than 5 times per day 4.Permanent
3. What is the duratin of pain during day? 0.No pain 1.Less than 5 minutes 2.Between 10-60 minutes 3.More than 60 minutes 4.Permanent
4. What is the severity of pain during night? 0.No pain 1.Mild 2.Moderate 3.Severe 4.Unbearable
5. How many times do you awake during night? 0.Any time 1.Once a night 2.2-3 times per night 3.4-5 times per night 4.More than five times per night

A part of the assessment questionnaire developed by Levine et al. (6) i.e. Boston Questionnaire (BQ) and modified by Heybeli et al. (5) was utilized to evaluate the severity of pain for each hand with CTS with respect to the magnitude, frequency, or duration of an episode for pain symptom. BQ is self-administered and evaluates the severity of symptoms and the functional status of carpal tunnel syndrome patients (6). The symptom severity scale consists of eleven questions and the functional status scale consists of eight questions. Each question has a 1-to-5 scale, in which 1 indicates no symptom and 5 indicates the most severe symptoms. The symptom severity scale assesses the symptoms with respect to severity, frequency, time and type. BQ had been translated into Turkish, and has been validated in a preliminary study (5). We used only questions (5 in number) related to the pain (Table 1). The responses were then converted to a scale of 0 (no symptoms) to 4 (most severe) and hands were categorized into five grades according to pain symptom severity score. We evaluated the correlation, independence, and association among pain characteristics as well as relationship with NCS.

All nerve conduction studies were performed using standard techniques of supramaximal percutaneous stimulation with a constant current stimulator and surface electrode recording, maintaining skin temperature >32°C and using Nihon Kohden neuropack machine. Sensory responses were obtained antidromically, stimulating at the wrist and recording from the middle finger (median nerve) with ring electrodes. The distance between the stimulator and the recording electrodes was 14 cm. Motor responses were obtained with stimulation at the wrist using belly-tendon recordings from the thenar muscles. The median nerves were stimulated 7 cm proximal to the anodal electrode by a hand-held stimulator. Sensory conduction velocity was the distal conduction velocity, determined by dividing the wrist-to-electrode distance (14 cm) by the distal onset latency of the sensory nerve action potential. The following median nerve measures were used: (1) baseline-to-peak amplitude of the sensory nerve action potential (SNAP); (2) distal peak latency of the sensory nerve action potential (DSL); (3) conduction velocity of the sensory nerve fibers (CV-S); (4) baseline-to-peak amplitude of the compound muscle action potential (CMAP); and (5) distal onset latency of the compound muscle action potential (DML). Carpal tunnel syndrome was diagnosed as being present when ulnar nerve studies were normal and median nerve studies met one of the following criteria for abnormality based on normal values obtained and used in our laboratory: (1) DSL>3.3ms; (2) DML>4.2ms; and (3) CV-S<48m/s.

Statistical Analysis: In description, frequency and mean analysis were used. Student's T test and Pearson's correlation analysis were used to assess the relationships between the pain severity scores and electrodiagnostic measures.

Results

Forty-one patients (32 female and 9 male) participated in this study yielding 63 hands (38 left hands, 25 right hands) with CTS. The mean age was 43.9±12.1 (Range: 23-78) years. The affected hand side was right in 36.6% (n=15) of patients, left in 9.8% (n=4) of patients and both in 53.7% (n=22) of patients. The mean values of pain severity scores and nerve conduction study results were summarized in Table 2.

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The hand side of CTS did not affect the conduction study parameters and pain characteristics (student's T, p>0.05). In comparison, there were significant correlations between pain severity scores (p<0.01, 2-tailed). As it was seen on Table 3, the nerve conduction study results showed significant interrelations to each other except CMAPs. We found a significant correlation between pain frequency at night and median nerve CMAPs (p<0.05). There was no correlation between pain severity, frequency or duration (day or night) and other median nerve conduction studies.

Discussion

The clinical diagnosis is mostly based on only history, and no motor deficits are observed on clinical examination of CTS patients. Furthermore, regarding the symptoms, a clinical and neurophysiological dissociation is often observed. In the study of The Italian Carpal Tunnel Syndrome Study Group patients with mild-to-moderate carpal tunnel syndrome seemed to function well, although severe symptoms may be reported by the patient; however, when nerve impairment becomes severe, the patient's hand function is extremely impaired although symptoms may be milder. The data show that the patient's point of view is reliable (7). The BQ evaluates symptoms from the patient's point of the view and it is a subjective measure. We analyzed the pain characteristics by using a part of BQ scale. The relationships between some symptoms e.g. tingling, nocturnal pain and nerve conduction studies were shown in some literatures (8-11). Although minimal electrophysiological abnormality or minimal functional impairment is observed, a large part of the CTS population complains of severe symptoms which could be explained by a low pain and discomfort threshold in the first phase of nerve impairment (8). As all we see in the outpatient clinics, the patients complain of severe pain. We considered only pain related assessment in CTS because of that reason in the present study. Our results were similar to previous literature reports with respect to presence of nocturnal pain. Our results show that the frequency of pain episodes is important and this finding is at variance with previous reports (6,12,13).

Although Pauda et al. (8) found a strong relationship between clinical and neurophysiologic findings, Levine et al. (6) found an insignificant correlation between the overall symptoms severity scale in CTS and conduction velocity of median sensory nerve. Based on this finding, Levine et al. (6) concluded that the severity of symptoms could not be estimated by nerve conduction measurement. The significant relationship between the sensory and motor nerve conduction measures indicate that all the nerve fibers in the median nerve are usually impaired simultaneously (2). We found strong relationships similar to findings of You et al. (3) among the nerve conduction measures studied except for the motor amplitude. Nathan et al. (12) found that the presence of nocturnal pain was significantly related to nerve conducti-

Table 2: The mean values of study parameters of which the relationships were evaluated.

Mean values	Result	SD	Range
Pain Severity Score	1.84	1.45	0-4
Pain Duration Score	2.02	1.71	0-4
Day Time Pain Frequency Score	1.95	1.71	0-4
Nocturnal Pain Severity Score	2.19	1.60	0-4
Nocturnal Pain Frequency Score	1.98	1.59	0-4
SNAP amplitude of median nerve (μV)	9.19	6.67	1-32
DSL of median nerve (ms)	4.31	1.12	3.3-9.3
CV-S of median nerve (m/s)	34.54	6.61	15-49
DML of median nerve (ms)	5.48	1.81	3.8-14.1
CMAP amplitude of median nerve (mV)	5.05	2.03	1-10

Abreviations: SNAP: Sensory nerve action potential, DSL: distal peak latency of the sensory nerve action potential, CV-S: Conduction velocity of the sensory nerve fibers, CMAP: Compound muscle action potential, DML: Distal onset latency of the compound muscle action potential.

Table 3: The correlations between nerve conduction studies and pain symptom severity scores.

		SNAP amplitude (μV)	DSL (ms)	CV-S (m/s)	CMAP amplitude (mV)	DML (ms)
Pain Severity Score	Correlation Coefficient	0.026	0.099	-0.137	0.097	0.110
	Sig. (2-tailed)	0.838	0.439	0.286	0.448	0.390
Day Time Pain Frequency Score	Correlation Coefficient	0.121	0.086	-0.141	0.047	0.135
	Sig. (2-tailed)	0.345	0.501	0.270	0.713	0.292
Pain Duration Score	Correlation Coefficient	0.002	0.065	-0.132	0.090	0.183
	Sig. (2-tailed)	0.987	0.611	0.304	0.483	0.152
Nocturnal Pain Severity Score	Correlation Coefficient	0.001	-0.001	-0.032	0.007	-0.104
	Sig. (2-tailed)	0.993	0.993	0.801	0.955	0.420
Nocturnal Pain Frequency Score	Correlation Coefficient	0.080	-0.146	0.095	0.268	-0.094
	Sig. (2-tailed)	0.535	0.254	0.460	0.034*	0.461

*Correlation is significant at the 0.05 level. Abreviations: SNAP: Sensory nerve action potential, DSL: distal peak latency of the sensory nerve action potential, CV-S: Conduction velocity of the sensory nerve fibers, CMAP: Compound muscle action potential, DML: Distal onset latency of the compound muscle action potential.

on measures and it might better reflected axonal nerve damage. Differing from those reports, the nocturnal pain frequency – number of times the patient wakes up during night - was the most important symptom related to nerve conduction studies in our study ($p<0.05$). We concluded that the nocturnal pain frequency had a relationship by decreased CMAP amplitudes indicating axonal nerve damage. The evaluation of nocturnal pain frequency is more meaningful in a symptom assessment tool for CTS. We believe that nocturnal pain frequency may better reflect nerve injury and those patients should be sent for more specific testing, such as nerve conduction studies. In critics, inadequate number of patients or one scale usage for assessments may be a cause of this result. The limitations of this study are small number of patients included and small number of men, precluding analysis of gender differences regarding symptoms. Additionally, regarding the correlation between CAMP amplitude and pain, the CAMPs in these patients were not actually abnormally low in amplitude, but just low normal.

We conclude that the nocturnal pain frequency had a relationship by decreased CMAP amplitudes signing axonal nerve damage. The evaluation of nocturnal pain frequency is more meaningful for a symptom assessment tool in order to ask in CTS. We expect that nocturnal pain frequency measured by a scale may better reflect nerve injury and those patients should be sent for more specific testing, such as nerve conduction studies. In critics, inadequate number of patients or one scale usage for assessments may be a cause of this result. The number of patients included is small and, in particular, the very short number of men precludes analysis of gender differences regarding symptoms. Also regarding the correlation between CAMP amplitude and pain, the CAMPs in these patients were not actually abnormally low in amplitude, but just low normal.

References

1. Rayan GM. Carpal tunnel syndrome between two centuries. J Okla State Med Assoc 1999;92:493-503.
2. Lu Z, Tang X. Carpal tunnel syndrome: ethiological, clinical and electrophysiological aspects of 262 cases. Chin Med Sci J 1995;10:100-4.
3. You H, Simmons Z, Frivols A, Kothari MJ, Naidu SH. Relationships between clinical symptom severities scale and nerve conduction measures in carpal tunnel syndrome. Muscle Nerve 1999;22:497-501.
4. Heybeli N, Kutluhan S, Demirci S, Kerman M, Mumcu EF. Assessment of outcome of carpal tunnel syndrome: a comparison of electrophysiological findings and a self-administered Boston questionnaire. J Hand Surg 2002;27:259-64.
5. Heybeli N, Özerdemoğlu RA, Aksoy OG, Mumcu EF. Functional and symptomatic scoring used for the assessment of outcome in carpal tunnel release. Acta Orthop Traumatol Turc 2001;35:147-51.
6. Levine DW, Simmons BP, Koris MJ, Daltroy LH, Hohl GG, Fossel AH, et al. A self-administered questionnaire for the assessment of severity of symptoms and functional status in carpal tunnel syndrome. J Bone Joint Surg Am 1993;75:1585-92.
7. Atroshi I, Johnsson R, Sprinchorn A. Self-administered outcome instrument in carpal tunnel syndrome. Reliability, validity and responsiveness evaluated in 102 patients. Acta Orthop Scand 1998;69:82-8.
8. Padua L, Padua R, Aprile I, D'Amico P, Tonali P. Carpal tunnel syndrome: relationship between clinical and patient-oriented assessment. Clin Orthop 2002;395:128-34.
9. Mondelli M, Reale F, Sicurelli F, Padua L. Relationship between the self-administered Boston questionnaire and electrophysiological findings in follow-up of surgically-treated carpal tunnel syndrome. J Hand Surg 2000;25:128-34.
10. Porras AF, Alaminos PR, Vinuales JI, Villamanan MA. Value of electrodiagnostic tests in carpal tunnel syndrome. J Hand Surg 2000;25:361-5.
11. Westropp NM, Grimmer K, Bain G. A systematic review of the clinical diagnostic tests for carpal tunnel syndrome. J Hand Surg 2000;25:120-27.
12. Nathan PA, Keniston RC, Myers LD, Meadows KD, Lockwood RS. Natural history of median nerve sensory conduction in industry: relationship to symptoms and carpal tunnel syndrome in 558 hands over 11 years. Muscle Nerve 1998;21:711-21.
13. Gonzalez Del Pino J, Delgado-Martinez AD, Gonzalez GI, Lovic A. Value of the carpal compression test in the diagnosis of carpal tunnel syndrome. J Hand Surg [Br] 1997;22:38-41.