Comparison of 2 methods of neuropathic pain assessment in carpal tunnel syndrome and hand functions

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ABSTRACT

الأهداف: لمقارنة فعالية تقييم ليدز من أعراض الاعتلال العصبي وعلامات مقياس (LANSS) إلى استبيان ألديديكت (PD-Q) في متلازمة النفق الرسغي (CTS)، وتحديد ما إذا كان هناك أي اختلافات بين وظائف اليد ذات الصلة في ٢ الاستبيانات.

الطريقة: أجريت هذه التجربة السريرية المتوقعة من أبريل إلى يوليو 2014. اشتملت الدراسة على 90 مريضا كانت نتيجتهم إيجابية لاختبار فالين أو قرع العصب. تم تقييم الأيدي عن طريق تخطيط كهربية وتصنيفها خفيفة أو معتدلة أو شديدة. تم تحليل آلام الأعصاب من قبل لانس و PD-Q. تم تقييم وظائف اليد من قبل مؤشر دوروز اليد (DHI)، واختبار سيمس وينشتاين وقوة مسكة اليد.

النتائج: كشفت النتائج اليكتروميوغرافيك 32.9% من الأيدي كانت خفيفة، 61.8% كان معتدل و 5.3% كان CTS شديد. كان هناك ارتباط بين درجات LANSS والمقياس التناظري البصري (VAS)، في حين كانت نتائج PD-Q ترتبط مع الألم ، VAS DHI وسيمس وينشتاين (SWM). وأظهرت المقارنة بين المعلمات ذات الصلة باليد من الاستبانات وجود فرق ذو دلالة إحصائية بين المجموعتين فيما يتعلق باختبارات DHI و SWM في PD-Q. ومع ذلك، لم يكن هناك فرق في LANSS.

الخاتمة: على الرغم من وجود علاقة ارتباط معنوية بين نتائج LANSS ودرجات PD-Q، فقد كشفت نتائج PD-Q عن معاملات ارتباط أفضل في ألم VAS، و مؤشرات DHI، واختبارات إدارة النفايات الصلبة. في الختام، PD-Q يبدو أفضل من LANSS سواء في آلام الأعصاب وفي الكشف عن الوظائف المتعلقة قدرات اليد.

Objectives: To compare the effectiveness of the Leeds Assessment of Neuropathic Symptoms and Signs Scale (LANSS) to the painDETECT questionnaire (PD-Q) in Carpal Tunnel Syndrome (CTS), and determine if there are any differences between hand related functions in the 2 questionnaires.

Methods: This prospective clinical trial was conducted from April to July 2014. Ninety patients with a positive Tinel or Phalen sign were recruited. Hands were evaluated by electromyography and grouped according to mild, moderate or severe involvement. Neuropathic pain was analysed by the LANSS and the PD-Q; hand functions were evaluated by the Duruöz Hand Index (DHI), Semmes Weinstein monofilaments and grip strength.

Results: Electromyographic findings revealed 32.9% of hands had mild, 61.8% had moderate and 5.3% had severe CTS. There was a correlation between the LANSS scores and the Visual Analogue Scale (VAS) pain, while the PD-Q scores were correlated with the VAS pain, DHI and Semmes Weinstein Monofilaments (SWM). Comparison of the hand related parameters of the questionnaires showed there was a statistically significant difference between the 2 groups with respect to the DHI and SWM tests in the PD-Q. However, there was no difference in the LANSS.

Conclusion: Although there was a significant correlation between the LANSS and PD-Q scores, the PD-Q scores revealed better correlation coefficients in VAS pain, DHI scores and SWM tests. In conclusion, the PD-Q seems to be better than the LANSS both in neuropathic pain and in detecting functions related to hand abilities.

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Carpal Tunnel Syndrome (CTS) is an entrapment neuropathy. The estimated prevalence is 5%-16% in the general population, including all adults globally.[1,2] It occurs due to the compression of the median nerve beneath the transverse carpal ligament, and the increased pressure within the tunnel results in mechanical compression and/or local ischemia in the nerve.[3] Primary features of CTS include pain in the hand, unpleasant tingling and numbness, reduction of the grip strength and problems in hand functions. In CTS, in addition to soft tissue and other musculoskeletal disorders, peripheral nerve lesions and nociceptive mechanisms of musculoskeletal problems can also be caused by pain.[4]

Clinical tests, such as the Tinel sign and Phalen test, are helpful in diagnosing CTS.[5] However, the diagnosis becomes definite by using nerve conduction studies where prolonged motor and sensory latencies, as well as reduced sensory and motor conduction velocities, are determined.[6] In clinical evaluations of CTS, sensibility tests such as tuning forks, vibration tests, Semmes-Weinstein monofilaments and two-point discrimination tests can be used.[7,8]

Peripheral neuropathy is one of the common causes of CTS pain. It is more common in patients with diabetes mellitus, vitamin B12 deficiency and dysproteinemias.[9] In our study, we aimed at detecting the neuropathic component of carpal tunnel syndrome. In the evaluation of neuropathic pain, different instruments can be used such as the Leeds Assessment of Neuropathic Symptoms and Signs Scale (LANSS), Douleur Neuropathique en 4 questions (DN4), the painDETECT questionnaire (PD-Q), the Neuropathic Pain Questionnaire, and others. The LANSS contains 5 items of symptoms and 2 items of clinical examination. PD-Q consists of 7 sensory descriptive items and 2 items related to spatial and temporal characteristics. It is one of the most frequently utilized scales.[10] In this study, we aimed at comparing the efficacy of the LANSS and the PD-Q in CTS and their relationship with hand functions.

Methods. The study took place from 01-04-2014 to 25-07-2014. Two methods of neuropathic pain assessment (LANSS and PD-Q) were compared. Ninety-five patients suffering from numbness in their hands and with a positive Tinel or Phalen sign were selected, consecutively, among the patients who were admitted to Physical Medicine and Rehabilitation outpatient clinics at Ankara Education and Research Hospital, Ankara, Turkey. Out of that number, 18 patients were excluded due to cervical radiculopathy, rheumatologic disease, diabetes mellitus and a history of upper limb surgery. A total of 77 patients were included in the study.

The study was approved by the local medical ethics committee, and written informed consent was obtained from each candidate. This was in accordance with the Helsinki Declaration Principles. A Nerve Conduction study (NCS) was performed, using a Nihon-Kohden Neuropack M1 (Tokyo, Japan), by the same physiatrist who was blinded to the subjects' identity and the clinical data. All studies were conducted at standard room temperature (25°C). The skin temperature of the hand was maintained at 32°C or above. The median compound muscle action potentials (CMAPs) were recorded over the abductor pollicis brevis muscle via median nerve stimulation and applied at 8 cm proximal to the active recording electrode. The onset latency and the baseline-to-peak amplitude of the CMAPs were measured. The median Sensory Nerve Action Potentials (SNAPs) were recorded antidromically with a bar electrode over the third digit and stimulated at 2 points located at 7 and 14 cm proximal to the active recording electrode. To test the transcarpal segment, the nerve was also stimulated at 2 points: at the Distal Wrist Crease (DWC) and 5 cm distal to the DWC in the palm. The latencies and the baseline-to-peak amplitudes of the median SNAPs were measured and the onset latency difference between the 2 points was calculated.

Carpal tunnel syndrome was diagnosed by a median SNAP peak latency of >3.7 ms, a SNAP peak latency longer in the proximal 7 cm segment than in the distal 7 cm segment, a SNAP amplitude <20 μV and a conduction block with a SNAP amplitude decrease of >50% with wrist stimulation compared to palm stimulation, a 5 cm transcarpal conduction time of >1.3 ms, a median CMAP distal latency of >4.2 ms, and a CMAP amplitude of <4.5 mV.[11] According to the results of electrophysiological findings, 77 patients were diagnosed with mild, moderate, or severe CTS. The severity of pain in the hands was analyzed by a Visual Analogue Scale (VAS) from 0-10 cm. Neuropathic pain was evaluated by the LANSS and the PD-Q. The LANNS is a seven-item pain scale that consists of a grouped sensory description and sensory examination with a simple scoring system. The first part is based on

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Table 1 - Minimum, maximum and mean±standard deviation of evaluation parameters.

Parameters	Minimum	Maximum	Mean±SD
Age (years)	22	73,00	47,43±10,6
VAS pain	0,00	10	4,15±2,8
LANSS	0,00	25,00	16,57±6,5
PD-Q	1,0	30,00	16,70±6,07
Hand grip strength(kg)	9	43,3	23,63±7,8
DHI	0,00	72,00	23,36±17,6
SWF	2,83	4,56	3,49±0,5

VAS - Visual Analoque Scale, LANSS - Leeds Assessment of Neuropathic Symptoms and Signs Scale, PD-Q - painDETECT Questionnaire, DHI - Duruöz Hand Index, SWF - Semmes Weinstein Monofilaments, SD - Standard Deviation

Table 2 - VAS-pain scores of neuropathic pain positive and negative groups by LANSS and PDQ.

	VAS neuropathic pain				*P*-value
	Negative		Positive		
	Min- max	Mean±SD	Min-max	Mean±SD	
LANSS	0-9	3.16±2.8	0-10	4.84±2.51	0.002
PD-Q	0-8	3.16±2.39	0-10	5.15±2.59	0.000

LANSS - Leeds Assessment of Neuropathic Symptoms and Signs Scale, PD-Q - painDETECT questionnaire, VAS - Visual Analoque Scale

5 questions that consist of the following: the presence of unpleasant skin sensations like pins and needles or prickling, color changes in the skin (red, mottled or pink), increased sensitivity of the skin to the touch and bursts of pain for no reason. In the second part, skin sensitivity is examined by comparing the painful area with the non-painful one for the presence of allodynia and an altered pin prick threshold. A score of less than 12 indicates that the pain is unlikely to be of neuropathic origin, whereas a score of 12 or more is likely to be neuropathic. The sensitivity and specificity of the LANNS questionnaire is 85% and 80% respectively.[12]

The painDETECT questionnaire is another neuropathic pain screening tool which was developed and validated in Germany for low back pain patients.[13] We used the questionnaire with 9 items. Seven of the items were sensory descriptor related items and 2 of them were related to the spatial and temporal characteristics of the pain pattern. A score of ≤12 indicates that neuropathic pain is unlikely. A score between >12 and <19 indicates neuropathic pain is possible, and a score of ≥19 demonstrates that neuropathic pain is likely. The sensitivity and specificity of the PD-Q are 85% and 80% respectively.[14] The PD-Q has been used to identify neuropathic pain in fibromyalgia, knee osteoarthritis, diabetic neuropathy and post-herpetic neuralgia.[15-17] Turkish validity and reliability of both the LANSS and the PD-Q have been carried out.[18,19]

Hand functions of the patients were evaluated by the Duruöz Hand Index (DHI).[20] The DHI is a self-report questionnaire which was developed to evaluate the capacity of carrying out manual functional activities in patients with rheumatoid arthritis. This scale is validated in scleroderma, hemiparesis, flexor tendon trauma and diabetic hands. It consists of 18 questions regarding manual tasks which are frequently carried out during daily activities. The patient was asked to evaluate the difficulty which he/she had in carrying out these tasks (from 0: no difficulty, to 4: nearly impossible); the total score ranges were between 0 and 90. The reliability and validity of the Turkish version of the DHI were proven in patients with stroke, diabetes mellitus, and hand flexor tendon injury.[21-23]

Hand grip strength was evaluated by the Jamar dynamometer. The patient sat on a chair with her/his shoulder in the neutral position, elbow at 90° and wrist at 0°. The second handle position was used in determining the grip strength. The average of 3 trials was recorded.[24] Hand grip strength is necessary in daily activities such as carrying laundry, vacuuming, turning a door knob etc. It is a simple marker of muscle strength in upper extremities. Low grip strength in healthy adults predicts an increased risk of functional limitations and disability at a more advanced age. Muscle function reacts early to nutritional deprivation and hand grip strength becomes a popular marker of nutritional status.[25]

Cutaneous sensibility of the hands was assessed by Semmes-Weinstein Aesthesiometer monofilaments (SWM). The examiner first established an area of normal sensibility in the patient's hand, familiarized the patient with the filament (2.83) to be used, and then demonstrated it in the normal sensibility area. Then, with the patient's eyes occluded, the examiner demonstrated the filament (2.83) on the median nerve innervation area. If the patient could not feel the touch of the 2.83 filament, the examiner tried with the 3.61, 4.31 and 6.65 filaments. Filament 2.83 represents normal sensation; 3.61 implies light touch diminution; 4.31 shows that protective sensation is decreased and 6.65 indicates loss of protective sensation.[26]

Statistical analyses. All statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS), version 15.0 for Windows. All numerical data are expressed as the mean±standard deviation. The comparisons between groups were performed by the Mann Whitney-U test. Correlations were analyzed using Spearman's rank correlation coefficient. The significance threshold was set at 0.05.

Table 3 - Correlation of the parameters with LANSS and PDQ.

Pparameters	VAS	JHG	DHI	SWF
LANSS	r=0.339** p=0.004	r=-0.152 p=0.203	r=0.232 p=0.050	r=0.050 p=0.657
PD-Q	r=0.439** p=0.000	r=-0.228 p=0.055	r=0.533** p=0.000	r=0.300* p=0.011

**Correlation is significant at the 0.001 level (2 tailed), *Correlation is significant at the 0.05 level (2 tailed), PD-Q - painDetect Questionnaire, VAS - Visual Analogue Scale, JHG - Jamar Hand Grip, DHI - Duruöz Hand Index, SWF- Semmes Weinstein monofilaments, SD - Standard Deviation

Results. The study consisted of 77 patients (66 females, 11 males); the mean age of the patients was 47.93±10.6 years. Electromyographic findings revealed that 25 (32.9%) hands had mild CTS, 47 (61.8%) hands had moderate CTS and 4 (5.3%) hands had severe CTS. In the PD-Q evaluation, we found that 19 of the 77 hands fell between >12 and <19. These patients were excluded and we continued with 58 patients in the PD-Q group.

The demographic characteristics of the patients can be seen in **Table 1**. The distribution of the VAS pain scores between neuropathic pain positive and negative groups is shown in **Table 2**. There was a statistically significant difference in the VAS pain scores between neuropathic pain negative and positive groups in both the LANSS and the PD-Q evaluations, and the VAS pain scores were also found to be significantly higher in the neuropathic pain positive groups.

Correlations of the VAS, hand grip strength, Duruöz hand index score, SWF with LANSS and PD-Q can be seen in **Table 3**. While the evaluation parameters, except for age and hand grip strength, correlated significantly with the PD-Q and only the VAS had significant correlation with the LANSS.

In the comparison of hand grip strength, DHI scores, and SWF scores between neuropathic pain positive and negative groups in both questionnaires, we found that all parameters in the PD-Q were significantly different between the neuropathic pain positive and the negative groups, while no difference existed between the neuropathic pain positive and the negative groups of the LANSS (**Table 4**).

Discussion. Carpal tunnel syndrome is an entrapment neuropathy which is a commonly encountered peripheral nerve lesion of the median nerve. It can cause neuropathic pain and functional decrease in hand functions. Patients have a burning sensation and decreased function in the first three fingers, which are very important in daily activities.[27]

We evaluated neuropathic pain by the LANSS and the PD-Q and investigated if there was a difference between the questionnaires in determining neuropathic pain of the hands. We also examined if there was a difference between the 2 questionnaires on hand functions in terms of hand grip strength, cutaneous sensibility and DHI evaluations. An important limitation of our study was the limited number of the patients.

It was stated, in a systematic review of Mathieson et al[28] that of all the neuropathic pain screening questionnaires, none were found to be satisfactory. Although these questionnaires provided an indication of the presence of neuropathic pain, they could not replace a clinical assessment. Also, in Tampin et al[29] study, neuropathic pain was examined in patients with neck and upper limb pain by the PD-Q and the LANSS. The authors indicated that both of the questionnaires had limited diagnostic accuracy.

The main complaint by our patients was about hand pain of a neuropathic nature. We evaluated the pain status of the patients with the VAS 0-10 scale and found that both of the questionnaires had a significant correlation with the VAS scores and there was also a statistically significant difference between neuropathic pain positive and negative groups in both questionnaires (LANSS p=0.002; PD-Q p=0.000). Similar to our findings, Sonohata et al[30] found significant differences in the pain scores between the patients with and without neuropathic pain (p<0.01).

Table 4 - Comparison of hand related parameters between neuropathic pain positive and negative groups of LANSS and PD-Q.

Parameters	LANSS	LANSS	LANSS	PD-Q	PD-Q	PDQ
Neuropathic pain	Positive (n=56)	Negative (n=17)	P	Positive (n=32)	Negative (n=21)	p
JHG	22.48±7.84	23.13±7.72	0.715	21.51±7.15	26.68±8.3	0.032*
DHI	24±18	21.29±16.86	0.602	30.34±18.6	8.61±11.58	0.000*
SWF	3.55±0.5	3.46±0.47	0.971	3.60±0.52	3.16±0.39	0.005*

JHG - Jamar hand grip, DHI - Duruöz hand index, SWF - Semmes Weinstein monofilaments, *significant difference by Mann Whitney U test, PD-Q - painDetect Questionnaire, LANSS - Leeds Assessment of Neuropathic Symptoms and Signs Scale

In our study, we found a significant difference between neuropathic pain positive and negative groups in the VAS of the LANSS and the PD-Q. In clinical evaluations, we compared the hand grip strength, DHI, and SWF scores of neuropathic pain positive and negative groups of both questionnaires. In comparisons of hand related evaluations, we found a statistically significant difference between neuropathic pain positive and negative groups in all parameters of PD-Q. However, we found no significant difference between the groups in the LANSS. In hand related evaluations, the PD-Q had significant correlations. We found only 2 studies about neuropathic pain and hand related evaluations. In two studies by Sonohata et al[31] PD-Q patients were grouped as "unlikely", "possible" and "likely neuropathic pain" and they did not find any statistically significant difference between the groups in terms of pain, hand grip strength and SWF tests.[30]

There are limitations to our study. The study was conducted in patients with mild, moderate and severe CTS, but the number of severe CTS patients was inadequate. The other limitation was the use of the Turkish versions of the tests. Our findings may not be directly generalizable over the versions in other countries.

In conclusion, in this study, although there was a significant correlation between the LANSS and the PD-Q scores, we found that neuropathic pain was positive in 77 hands of LANSS and 58 hands of PD-Q assessments. When the hand functions and hand sensory evaluation results are considered, the PD-Q seems to be more effective than the LANNS in evaluation of neuropathic pain in patients with CTS.

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Statistics

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