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Relationship between clinical and electrophysiological results in surgically treated carpal tunnel syndrome

Cerrahi tedavi uygulanan karpal tünel sendromunda klinik ve elektrofizyolojik sonuçlar arasındaki ilişki

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Objectives: In this study, relationship between clinical and electrophysiological results of decompression via mini incision technique was investigated.

Patients and methods: Thirty-nine hands of 38 patients (35 females, 3 males; mean age 54.8 years; range 33 to 81 years) with carpal tunnel syndrome who were treated surgically in our clinic between April 2004 and February 2009 were included into the study. Patients were evaluated clinically and electrophysiologically both in pre- and postoperative period.

Results: There was a difference between pre- and postoperative clinical results (p=0.00). Clinically, the mean symptom severity and functional status scores were decreased in 36 hands (92.3%). Postoperative electrophysiological grades were significantly improved compared to the preoperative ones. There was a significant difference between the pre- and postoperative clinical scores in all of the preoperative electromyography grades, except for the moderate grades. However, no relation was found between the electrophysiological grades and the clinical results in both pre- and postoperative period.

Conclusion: This study shows that in spite of clinical improvement after carpal tunnel syndrome surgery through mini incision technique, electrophysiological findings were still suggesting the presence of varying degrees of carpal tunnel syndrome in postoperative period.

Key words: Boston; carpal tunnel syndrome; electrophysiological processes.

Amaç: Bu çalışmada mini insizyon tekniği ile dekompresyon uygulanmasının klinik ve elektrofizyolojik sonuçları arasındaki ilişki incelendi.

Hastalar ve yöntemler: Nisan 2004 - Şubat 2009 tarihleri arasında kliniğimizde cerrahi olarak tedavi edilen karpal tünel sendromlu 38 hastanın (35 kadın, 3 erkek; ort. yaş 54.8 yıl; dağılım 33-81 yıl) 39 eli çalışmaya dahil edildi. Hastalar ameliyat öncesi ve sonrası dönemde klinik ve elektrofizyolojik olarak değerlendirildi.

Bulgular: Ameliyat öncesi ve sonrası klinik sonuçlar arasında anlamlı fark bulundu (p=0.00). Klinik olarak, ortalama semptom şiddeti skoru ve fonksiyonel kapasite skoru 36 elde (%92.3) azaldı. Ameliyat sonrası elektrofizyolojik evrelendirmede ameliyat öncesi evrelere kıyasla belirgin iyileşme görüldü. Orta dereceli evre hariç, tüm ameliyat öncesi elektromiyografi evrelerinde, ameliyat öncesi ve sonrası klinik skorlar arasında anlamlı fark vardı. Ancak, elektrofizyolojik evreler ile klinik sonuçlar arasında hem ameliyat öncesi hem de ameliyat sonrası dönemde ilişki bulunmadı.

Sonuç: Bu çalışmada mini insizyon tekniği ile cerrahi tedavi uygulanan hastalarda klinik olarak düzelme olmakla birlikte ameliyat sonrası dönemdeki elektrofizyolojik bulgular hala değişik derecelerde karpal tünel sendromu varlığını desteklemektedir.

Anahtar sözcükler: Boston; karpal tünel sendromu; elektrofizyolojik süreçler.

Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy.[1] In the presence of severe and long-standing symptoms and in cases with resistance to conservative treatment, surgical release is preferred.[2,3] Surgical release can be performed with three different approaches; open, endoscopic and mini.[4-7] Recently,

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mini approaches have been popularized to decompress the carpal tunnel. It is an easy and effective method with low morbidity without using additional expensive instruments. It also allows good exposure with less scarring.[8-10]

Electrophysiological results after surgery are controversial. To the best of our knowledge, the relationship between electrophysiological and clinical results in patients treated with decompression through mini approach has not been reported in the literature until now.

The aim of this study is to investigate the relationship between clinical and electrophysiological results in patients treated with decompression via mini approach.

PATIENTS AND METHODS

Thirty-nine hands of 38 patients with carpal tunnel syndrome who were treated surgically were included into the study. In one patient, decompression was performed bilaterally. Carpal tunnel syndrome was diagnosed with the presence of pain, paresthesia and/or hypoesthesia, paralyses in the region innervated by the median nerve. Also, provocative Tinnel and Phalen tests were used in the physical examination. In all patients, diagnosis was confirmed by preoperative electromyography (EMG).

Cases with peripheral nerve disease, polyneuropathies, recurrent carpal tunnel syndrome, cervical radiculopathies, endocrinological pathologies, inflammatory and infectious arthritis and patients with wrist trauma history were excluded from the study. In addition to these disorders, patients who were pregnant and those less than 18-years-old were not included in the study.

In all, decompression was performed through mini incision. After release of the transverse carpal ligament, the skin was closed and a compressive bandage was applied. All patients were encouraged to use their hand normally. Sutures were removed at the second week.

On physical examination, scar hypertrophy, scar tenderness and pillar pain was also assessed as 0 (none), 1 (mild), 2 (moderate) and 3 (severe). Before surgery and at last control, severity of symptoms and functional status of patients were evaluated clinically according to the Boston questionnaire scale (Turkish validated version).[11]

Electrophysiological evaluation

Electrophysiological tests were performed both in the pre- and postoperative periods in all patients, except one. A patient with cardiac pacemaker refused to take the test so 38 hands of 37 patients were examined electrophysiologically in the postoperative period. All patients were evaluated using the same protocol and the electrophysiological study was performed with Neuropack four EMG/EP machine (Nihon Kohden, Japan). Under standardized temperature conditions, sensory and motor conduction studies of the median nerve were performed using surface electrodes for stimulating and recording bilaterally.

Carpal tunnel syndrome was diagnosed according to normative data in our laboratory if the following were present: distal motor latency was prolonged (>4.5 msec) and compound motor unit action potential (CMAP) amplitude was decreased (<4 μV); antidromic wrist-to-digit sensory latency exceeded 3.5 msec, sensory nerve acton potential (SNAP) amplitude was less than 20 μV, and when the antidromic wrist-to-digit sensory nerve conduction velocity (SCV) was less than 50 m/sec. In patients older than 60 years, the normal SCV was 43 m/sec, and in patients older than 70 years, 40 m/sec.

Electrophysiological findings were graded into the following categories according to American Association of Electrodiagnostic Medicine (AAEM) guidelines as;

1. Mild CTS: Prolonged distal sensory latency with decreased sensory amplitude.
2. Moderate CTS: Abnormal median sensory latencies with prolongation of distal motor latency.
3. Severe CTS: Prolonged motor and sensory distal latency, either with a low or absent SNAP or CMAP.
4. Very severe CTS: Absent thenar motor or sensory response, with lumbrical response either present or absent.[12]

Statistical analyses

Statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, USA) package 15.0 version program for Windows XP. Results were presented as mean ± standard deviation (SD). In comparison of pre- and postoperative Boston questionnaire results, paired sample t-test was used. The differences between pre- and postoperative electrophysiological results were analyzed by chi-square test. Independent simple t-test was used in the comparison of pre- and postoperative clinical results with respect to preoperative EMG grades. In evaluating the relation between clinical results and EMG grades, one-way ANOVA test was used. A probability (p) value of less than 0.05 was considered significant for all parameters.

TABLE I

Pre- and postoperative clinical results

	Mean+SD	*p*
Symptom severity score (before surgery)	3.54+0.76	0.00*
Symptom severity score (final control)	1.65+0.88	
Functional status score (before surgery)	3.35+0.86	0.00*
Functional status score (final control)	1.66+0.89	

*: Statistically difference.

RESULTS

Mean follow-up period was 21.9 months (range, 3-51 months). On physical examination, there was a mild scar hypertrophy in one (2.5%) patient, mild scar tenderness in two (5.1%) patients and mild pillar pain in six (15.8%) patients.

Pre- and postoperative Boston questionnaire results are given in table I. There was a difference between pre- and postoperative clinical results in terms of both symptom severity scores and functional status scores. At the final control, mean symptom severity score was not changed in one hand and was increased in two hands. In the 36 other hands (92.3%), mean symptom severity scores were decreased. Functional status score was increased in one hand whereas no change was seen in two hands. In the 36 other hands, functional status scores were decreased.

Pre- and postoperative EMG results according to AAEM grades are shown in table II. Postoperative electrophysiological grades were improved with respect to preoperative ones.

The relationship between pre- and postoperative Boston questionnaire scores in terms of preoperative EMG grades is shown in table III. There was a difference between the pre- and postoperative clinical scores in all of the preoperative EMG grades, except the moderate ones.

No correlation was found between clinical results and EMG grades of the patients in both the pre- and postoperative period.

DISCUSSION

In this study, we compared clinical and electrophysiological findings in patients with carpal tunnel syndrome who were decompressed through a mini approach.

We used the Turkish version of the Boston questionnaire since it has been validated and proven reliable in the Turkish population.[11] In our patients, average symptom severity scores were decreased from 3.54 to 1.65 (1.89 decrease) whereas average functional status scores were decreased from 3.35 to 1.66 (1.69 decrease) after the surgery.

Heybeli et al.[13] obtained a 2.1 decrease in symptom severity scores and 1.9 in functional status scores after surgery, but the type of surgery was not documented. Cellocco et al.[14] compared the results of mini open technique and limited open technique. For the mini open technique, they obtained a mean 2.56 decrease in symptom severity scores and 1.99 in functional status scores. For the limited open technique, they obtained a decrease in both symptom severity scores and functional status scores of 2.27 and 2.06, respectively. The authors declared that the mini open technique was superior to a limited open technique.

On the other hand, Amirfeyz et al.[15] reported cut-off values for a mean correction in symptom severity scores and functional status scores of 0.16 and 0.47, respectively.

In our study, symptom severity scores and functional status scores were improved in 36 of 39 (92.3%) hands according to these cut-off values. We also think that the results should be evaluated according to cut-off values because of objectivity and reliability.

TABLE II

Pre- and postoperative electrophysiological results according to American Association of electrodiagnostic medicine criteria

	Postoperative electromyography									
	Normal		Mild		Moderate		Severe		Very severe	
	n	%	n	%	n	%	n	%	n	%
Preoperative electromyography										
Mild (n=5)	1	20	4	80	–	–	–	–	–	–
Moderate (n=3)	1	33.3	2	66.7	–	–	–	–	–	–
Severe (n=14)	2	14.3	9	64.3	3	21.4	–	–	–	–
Very severe (n=16)	–	–	3	18.8	3	18.8	8	50	2	12.5
Total (n=38)	4	10.5	18	47.4	6	15.8	8	21.1	2	5.3

TABLE III

The relationship between pre- and postoperative clinical results in terms of preoperative electromyography grades

	Boston questionnaire (mean±SD)					
	Symptom severity score			Functional status score		
	Before surgery	Final control	*p*	Before surgery	Final control	*p*
Preoperative EMG grades						
Mild	3.72±1.17	1.87±1.19	0.02*	3.65±1.15	1.65±0.89	0.002*
Moderate	3.15±0.64	2.78±1.42	0.77	3.08±1.09	3.17±1.66	0.95
Severe	3.76±0.71	1.58±0.93	0.00*	3.23±0.85	1.59±0.89	0.00*
Very severe	3.36±0.68	1.43±0.46	0.00*	3.40±0.80	1.45±0.44	0.00*

EMG: Electromyography; *: Statistically difference.

Electrophysiological results in our study were graded according to AAEM criteria.[12] Despite significant clinical improvement, final electrophysiological tests of most of the patients were still showing carpal tunnel syndrome in various degrees.

Iida et al.[16] reported electrophysiological improvement in 91% of the cases after mini open decompression technique. But they noticed no improvement in five of eight patients with severe preoperative electrophysiological findings.

In our study, there was no relation between pre- and postoperative Boston scale and EMG findings. Some authors reported no relation between pre- and postoperative Boston questionnaire and electrophysiological findings.[13,17]

On the other hand, Schrijver et al.[18] reported a modest correlation between neurophysiologic and clinical outcome measures. According to Bland,[19] outcomes of treatment are not correlated with electrophysiological findings. Glowacki et al.[20] stated that EMG gives additional information to the clinician in the diagnosis of CTS, however, it is not important in deciding to change the treatment algorithm. Chan et al.[21] reported that no relation was found between the clinical and the electrophysiological results.

It is known that the reasons of abnormal changes in EMG of carpal tunnel syndrome are demyelination of myelinated large nerve fibrils or the axonal loss. Additionally, status of the small diameter myelinated or nonmyelinated nerve fibrils can not be evaluated with EMG.[22] For this reason, we think that no relation can be found between the clinical and electrophysiological findings.

In our study, we also evaluated scar hypertrophy, scar tenderness and pillar pain in clinical assessment. Mild scar hypertrophy was seen in one, mild scar tenderness in two and mild pillar pain in six (15.8%) patients. In reviewing the relevant literature, the incidence of pillar pain is between 0 to 1.2%.[9,23,24] In these studies, pillar pain has been assessed as present or absent. In our study, Pillar pain ratio was high but all were in mild grade. We evaluated the pillar pain as none, mild, moderate and severe. We think that the higher ratio may be related with the subjectivity of our assessment method and the limited number of patients.

The weak points of the study are the inclusion of limited number of patients, short follow-up period and the absence of needle electrophysiological assessment.

In conclusion, no relation was found between postoperative electrophysiological findings and clinical results in decompression of carpal tunnel syndrome via mini approach. However, release of the transverse carpal ligament through mini approach gives satisfactory clinical results.

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Declaration of conflicting interests

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