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Original Article

Comparison of early postoperative period electrophysiological and clinical findings following carpal tunnel syndrome: is EMG necessary?

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Abstract: In this study, we aimed to compare the clinical findings and ENMG results of the patients who underwent surgery due to CTS, in the preoperative and early postoperative period. Methods: 33 wrists of 29 patients who underwent open carpal tunnel surgery in our clinic due to CTS, between 2009 and 2011, were evaluated. Electrophysiological progress was evaluated with ENMG and clinical state with Boston scale. Results: A significant decrease was observed in the postoperative BS symptomatic (SSS) and functional (FSS) scores of patients as compared to preoperative period (P=0.00). In the electrophysiological findings, statistically significant improvement was observed in all groups but very severe CTS group (P<0.05). When preoperative and postoperative EMG findings were compared, changes in DSL and DSA values were statistically significant (P<0.05). However, no statistically significant difference was seen between DML (P=0.085) and DMA (P=246) values on the 3rd month. When an examination was conducted on the patients whose DML and DSL values could not be obtained in the preoperative EMG, DML values were obtained in the early postoperative period in 6 of 7 cases (85.71%, P<0.001), and DSL values were obtained in 17 of 24 cases (70.8%, P<0.000). Conclusions: Sensory nerve findings were more significant, showed faster recovery compared to motor nerve findings, and accompanied the clinical recovery. Performance of an EMG test, especially on sensory nerves, will be more effective in patients selected in the early period, with the exception of patients with very severe CTS.

Keywords: Carpal tunnel syndrome, electromyography, clinical findings

Introduction

Carpal tunnel syndrome (CTS) is the most common peripheral neuropathy and develops due to compression of the median nerve in the carpal tunnel [1]. It is a significant health problem, as it affects daily activities and quality of life. Clinicians and surgeons from different departments frequently encounter cases of it. Decompression of the median nerve is the main target of treatment, and CTS can generally be treated successfully via surgical methods [2]. Although physical examinations and specific tests are often sufficient to make an accurate diagnosis, confirmation is finalized and the severity of CTS is determined through the use of an electromyography (EMG).

An universal scale except clinical findings to evaluate treatment results of CTS doesn't exist [3, 4]. Absence of methods to evaluate treatment results and severity scales, leads to lack in classification in post operative follow up. In this aspect, EMG can provide objective data. Despite inconsistent results from studies on early post operative EMG findings to evaluate treatment, there are studies reporting that evaluation of sensory nerves can provide important data in evaluation of surgical results [5-7].

In our study, we aimed to compare the clinical findings and EMG results of the patients who underwent surgery due to CTS, in the preoperative and early postoperative period. And also aimed to determine role of EMG during follow up.

Table 1. Comparation of preoperative and postoperative Boston scale scores

Grade	Preoperative	Postoperative	*P*-value
Mild			
-*FSS*	19.6 (5.9-54)	41 (16.9-54.5)	<0.001
-*SSS*	23.8 (5.4-53)	28 (7.5-70)	<0.001
Moderate			
-*FSS*	52.5 (25.5-98)	77.9 (50.7-143)	<0.001
-*SSS*	46.6 (18.4-109)	52.8 (24-128)	<0.001
Severe			
-*FSS*	13.9 (9.2-24.4)	23.2 (11.9-38.2)	<0.001
-*SSS*	16.3 (8.3-27.8)	19 (9.6-33.7)	<0.001
Very Severe			
-*FSS*	28 (20-65.3)	50 (27.6-79)	<0.001
-*SSS*	28.7(19.2-57.1)	36 (23.6-72)	<0.001

Bold *P* values show significance.

Materiel and methods

Participants

This study was planned retrospectively after obtaining the approval of the ethics committee. A total of 33 wrists of 29 patients who underwent open carpal tunnel surgery in our clinic due to CTS, between 2009 and 2011, were included in our study. During this period 49 wrists of 42 patients were operated in our clinic patients who did not have an EMG test [5], who developed CTS after undergoing a different operation on the wrist [1], who had a tumor (fibrolipomatous hamartoma) [1] or endoscopic surgery [4], or who developed complications [2] were not included in the study. Only those patients who underwent open surgical technique were included. All the patients were operated by the same surgeon.

Surgical method

Operations were performed with a tourniquet under regional anesthesia using the open surgical technique. A slightly curved longitudinal incision was made on the palmar face, and the transverse carpal ligament was completely transected. A piece was excised longitudinally from the transverse carpal ligament. None of the patients received a neurolysis. The skin was closed with non-absorbable sutures and dressing was applied.

Clinical evaluation

Patients' physical examination, EMG results, and the Boston scale (BS) scores, which we use in the follow-up of CTS patients, in the preoperative period and postoperative 3rd month were retrospectively scanned and obtained. The preoperative and postoperative 3rd month BS values of all patients were calculated. The BS is a reliable scale that was defined by Levine et al [8] in 1993. Adjusted for different languages, it has been medically proven in the clinical follow-up of CTS patients [9]. The BS features a total of 19 questions, 11 of which are in the symptom severity scale (SSS) and 8 in the functional state scale (FSS). In the scoring, 1 represents the slightest symptoms and best functional state and 5 the most severe symptoms and the worst functional state. The mean score is obtained by dividing the whole score by the number of questions.

Electrophysiological evaluation

All patients were evaluated electrophysiologically with the same device and by one neurologist. In preoperative and postoperative EMG evaluations of patients, distal motor latencies (DML) and amplitudes (DMA) and distal sensory latencies (DSL) and amplitudes (DSA) were evaluated. CTS staging of patients was classified according to the recommendations of the American Association of Electrodiagnostic Medicine (AAEM) [10]. Differences in the preoperative and postoperative BS scores and EMG values were determined and compared.

Statistical analysis

The SPSS 18.0 version (SPSS, Inc., Chicago, IL, USA) program was used for the statistical analysis of the study. The Shapiro-Wilk test was used to determine whether the data showed an abnormal distribution. For parametric and nonparametric measurements, the matched sample t analysis and Wilcoxon test were performed, respectively. Differences between preoperative and postoperative CTS stages were evaluated using the McNemar-Bowker test. Statistical significance was set at $P<0.05$.

Results

A total of 33 wrists of 29 patients (8 Males, 21 Females) with mean age of 52±10, were included in this study.

A significant decrease was observed in the postoperative BS symptomatic (SSS) and func-

Table 2. Classification of the preoperative and postoperative EMG finding according to AAEM (%) [10]

	Preoperative	Postoperative
Mild	3 (9%, 09)	12 (7 hasta ağır, 2 hasta orta, 3 hasta 1 hafif) (36%, 36)
Moderate	4 (12%, 12)	11 (9 hasta ağır, 2 hasta orta) (33%, 33)
Severe	19 (57%, 57)	3 (3 hasta ağır) (9%, 09)
Very Severe	7 (21%, 21)	7 (21%, 21)

tional (FSS) scores of patients compared to preoperative period (P=0.00), and clinical recovery was seen on the postoperative 3rd month (**Table 1**).

In the electrophysiological findings, the change in DSL and DSA values was statistically significant when the preoperative and postoperative EMG findings were compared (P<0.05). However, no statistically significant difference was seen between DML (P=0.085) and DMA (P=246) values on the 3rd month.

The preoperative and postoperative CTS electrophysiological staging of patients is given in **Table 2**. Severity of CTS did not change in the 7 patients with very severe CTS. Among the 19 patients with severe CTS, 9 recovered up to the moderate level, 7 recovered up to the mild level and 3 remained at the severe level. In the 4 patients with moderate CTS, 2 remained at the moderate level, but 2 recovered up to the mild level. Statistically significant improvement was observed in all groups but very severe CTS group (P<0.05).

When an examination was conducted on the patients whose DML and DSL values could not be obtained in the preoperative EMG, DML values were obtained in the early postoperative period in 6 of 7 cases (85.71%, P<0.001), and DSL values were obtained in 17 of 24 cases (70.8% P<0.000).

Discussion

Preoperative and early postoperative EMG and clinical findings of the patients who were operated due to CTS were compared in this study. The most telling result was that sensory nerve findings were more significant, showed faster recovery compared to motor nerve findings, and accompanied clinical recovery. But when the cases whose DML and DSL values could not be obtained were evaluated among themselves, a significant change was observed in the DML and DSL values in the early follow-ups compared to preoperative findings, and the rate of recovery in latency levels was higher in motor nerves (85.71%-70.8%). In only one patient, no change was seen in the early period compared to preoperative EMG findings as a result of severe axonal damage.

When early period electrophysiological studies performed after surgical treatment of CTS are reviewed, varying results are observed in the literature. In the study of Kim et al [6], a significant change was seen in the DML, DMA, DSL, and DSA values in the EMG examinations performed on the 3rd week and 3rd month after performance of carpal tunnel loosening. In a similar study of Mondelli et al [11], significant improvement was seen in the electrophysiological results on the 1st and 6th month compared to preoperative values. However, Tuncalı et al [5] did not observe any electrophysiological change on the postoperative 3rd month, and Toshiro et al [12] reported no statistically significant improvement in DML values on the 3rd month in their study on quality of life and electrophysiological response of the CTS patients who underwent operation. We believe that these inconsistent results from different studies are due to differences in etiology of CTS and demographical characteristics of patients, differences in EMG results and CTS staging due to utilization of variety of EMG devices by different clinicians. Rotman et al [13] reviewed postoperative DML values in the 1st hour, on the 2nd and 6th week, and in the 3rd and 6th month in their nerve conduction study. They reported a significant change only in the 1st hour (since the mechanical pressure disappears), and no improvement was observed in the group with preoperative MDL values of <4 ms and only slight improvement was seen in the group with 4-6 ms. The greatest improvement was observed in the group with >6 ms. This supports the idea that the number of patients with preoperative severe and very severe CTS affects the results. It was shown, however, that more similar results are obtained in the electro-

physiological evaluations performed in the postoperative 6th month or later and that significant electrophysiological improvement is seen together with the clinical recovery [14-19].

The retrospective structure of our study, the fewer number of patients compared to previous studies, absence of long-term follow-up, even though the operations were performed by the same surgeon using the same method, among our patients qualify as the limitations of our study.

In our study, while the change in DSL and DSA values were significant, the change in DML and DMA values were not. Furthermore, no electrophysiological improvement was seen in patients with very severe CTS during the first 3 months. In a similar prospective study of Andreu et al [17], they found an improvement in DML values, even at the end of the 12th month (P=0.002), whereas no significant improvement was seen in the DMA values (P=0.091).

As a result of our study, the performance of an EMG test, especially on sensory nerves, will be more effective in patients selected in the early period, with the exception of patients with very severe CTS. We conclude that clinical findings and EMG findings are not always consistent. EMG may be useful in patients with subjective complaints in early post operative period

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Disclosure of conflict of interest

None.

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