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ORIGINAL STUDY

Differences in outcomes according to the primary treatment options chosen by patients with carpal tunnel syndrome and negative neurophysiological studies: Conservative versus operative treatment. Do we need neurophysiological studies?

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The purpose of this study is to compare the outcomes of conservative versus operative treatment in patients with a positive history and clinical findings for Carpal Tunnel Syndrome (CTS) and negative nerve conduction studies (NCS).

A cohort of 126 consecutive patients (34 males, 92 females) with mean age of 48 years old, positive history and clinical findings for CTS but negative NCS was studied. The mean duration of symptoms was 9.1 months. Group I (94 patients) underwent conservative treatment, whereas group II (32 patients) underwent mini open carpal tunnel release. The clinical diagnosis was based on the Harrington criteria. Patients were evaluated at baseline and at 12-months follow-up using the Boston Carpal Tunnel Questionnaire (BCTQ) and the Disabilities of the Arm, Shoulder and Hand (DASH) instrument.

At baseline, group I had lower BCTQ and DASH scores, compared to the respective scores of group II. At the final 12-month follow-up, patients in group I had higher BTCQ scores. Post-treatment, group II showed significant improvement of BTCQ score ($p < 0.001$) and DASH score ($p<0.05$).

The additional value of NCS is limited when there is strong clinical suspicion.

Keywords: carpal tunnel syndrome ; DASH questionnaire ; Boston questionnaire ; mini open carpal tunnel release.

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INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common upper limb compression neuropathy accounting approximately for 90% of the entrapment neuropathies *(16,25)*. The diagnosis of CTS is based on a positive medical history, clinical symptoms, physical signs and may be confirmed by nerve conduction studies (NCS) *(1)*. Despite extensive literature review, there is a lack of a gold standard for its diagnosis *(11)*. Some authors consider the positive medical history and clinical examinations being enough to set the diagnosis *(4,7,8,12,18,13,3)*, whereas others advocate the necessity of the nerve

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conduction studies (NCS) *(24,27)*. However, NCS may be negative in up to 13-34% of patients with clinically diagnosed CTS *(3,31)* and controversy exists regarding the management of this group of patients *(23)*. The purpose of our study is to compare the outcomes of treatment, conservative versus operative, chosen by patients with positive history and clinical findings for CTS and negative NCS.

MATERIALS AND METHODS

From January 2008 to December 2011, a cohort of 143 consecutive patients with positive history and clinical findings for CTS and negative NCS were reviewed at the Authors' Institution. All patients provided informed consent prior to being included in the study, which was approved by the local ethical committee. Seven patients were lost during the follow-up period and in 10 patients the follow-up was incomplete. The remaining 126 patients (34 males and 92 females) were included in the study. The mean age of the patients was 48 years (range, 29-67 years). There was no significant statistical difference between the two groups for age (p=0.71) and gender (p=0.267). The mean duration of symptoms prior to treatment was 9.1 months, with a minimum of 6 months.

Eight clinical features suggestive of CTS were recorded: 1) pain or paresthesia or numbness in the radial three digits, 2) nocturnal exacerbation of symptoms relieved by shaking of the hand, 3) weakness or loss of dexterity, 4) radiation of symptoms proximally, 5) sensory deficits in the hand region innervated by the median nerve 6) Phalen's test 7) Tinel's test and 8) weakness of abductor pollicis brevis muscle (APB) or thenar muscle atrophy (Table I). The clinical diagnosis was established following the Harrington's criteria *(14)*. Exclusion criteria included patients with prior carpal tunnel decompression, cervical radiculopathy, thoracic outlet syndrome or other entrapment neuropathies in the upper limb, patients with diabetes mellitus, women with pregnancy-related CTS, patients with hereditary CTS (amyloidosis), and renal failure patients with arteriovenous shunts in the arm.

All patients underwent NCS at the Authors' Institution according to the American Association of Neuromuscular and Electrodiagnostic Medicine (AANEM) *(22)*, and had no electrophysiologic evidence of CTS. The patients were subsequently reviewed at the clinic. Further evaluation was carried out using the Boston Carpal Tunnel Questionnaire (BCTQ) *(21)* with its two components, the SSS (Symptom Severity Score) and FSS (Function Severity Score) scores, and the DASH (Disabilities of the Arm, Shoulder and Hand) instrument *(15)*. Available treatment options were thoroughly discussed and the patients decided to undergo either non-operative (group I) or operative management (group II). Group I (non-operative treatment) consisted of 94 patients (28 males, 66 females), whereas group II (operative treatment) consisted of 32 patients (6 males, 26 females). In the non-operative treatment group, non-steroid anti-inflammatory drugs, splinting, physical therapy, activity modification, steroid injection or a combination of the above were offered, while in group II a mini open carpal tunnel release under regional anesthesia was undertaken. Follow-up evaluation was performed at 12 months after the index clinic evaluation using the same outcome

Table I. —Analysis of symptoms and signs of CTS for group I and group II

	Group I (non-operative treatment) n=94	Group II (operative treatment) n=32
Pain or paresthesia or numbness in the radial 3 digits of the hand	92 (98%)	32 (100%)
Nocturnal exacerbation of symptoms relieved by shaking of the hand	71 (75%)	28 (87%)
Weakness or loss of dexterity	31 (33%)	11 (34%)
Proximal radiation of symptoms	19 (20%)	9 (28%)
Sensory deficits in the hand region innervated by the median nerve	31 (33%)	19 (59%)
Phalen's test positive	30 (32%)	19 (59%)
Tinel's test positive	17 (18%)	9 (28%)
Weakness of abductor pollicis brevis muscle (APB) or thenar muscle atrophy	10 (10%)	8 (25%)

instruments. Student's t-test was used to compare CTS SSS, FSS and DASH scores *(15,21).* A p-value less than 0.05 (alpha level (a)) was accepted as statistically significant.

RESULTS

Patients who received operative treatment (group II) have statistically significant difference in their scores at the latest follow-up compared with their initial scores (Table II). Patients in group I, who received non-operative treatment have decrease in their outcome scores, that was not statistically significant (Table II). At the latest follow-up, 30 out of 94 patients (32%) of group I decided to undergo operative treatment, with symptom relief in all of the cases.

DISCUSSION

CTS is the most common entrapment neuropathy with prevalence of 5% in the general population *(19,16,25)*. There is no gold standard for its diagnosis *(11)*. Some authors rely on clinical symptoms *(4,7,8,12,18,13,32),* whereas others consider that performing NCS is essential *(24,27)*. Recent American Academy of Orthopaedic Surgeons guidelines *(17)* advice for a "confirmatory" test for patients with a clinical suspicion for CTS that are operative candidates *(9).* Lane LB et al. in 2014 conducted a survey among members of the American Society for Surgery of the Hand (ASSH) *(20)*. Although the majority of the members supported that with a positive clinical symptomatology and medical history they may procced to operative treatment, 57% were in favor of electrodiagnostic testing because of potential medicolegal consequences *(20)*.

Table II. —Patients' results of BCTQ and DASH scores

Baseline	Latest follow-up
Results of symptomatic severity score (SSS) for patients in group II 3.27 ± 0.72 p value* < 0.001	2.42 ± 0.75
Results of functional status scale (FSS) for patients in group II 3.10 ± 0.70 p value* < 0.001	2.16 ± 0.68
Results of DASH score for patients in group II 55,9±19,6 p value*<0,05	20,2 ± 20,0
Results of symptomatic severity score (SSS) for patients in group I 2,89 ± 0.74 p value* 0.413	2.85 ± 0.70
Results of functional status scale (FSS) for patients in group I 2,72± 1,13 p value* 0.424	2.54 ± 0.80
Results of DASH score for patients in group I 54,2±18,2 p value* 0.17	29,5 ± 20,9

*Student *t* test.

However, NCS may be negative in up to 13-34% of patients with typical symptoms of CTS *(3,31)* and there is controversy in the literature regarding the management of this group of patients *(23)*. Atroshi et al. randomly surveyed 2466 individuals to find out the incidence of CTS in general population, with 14.4% complaining of pain, tingling and numbness in the distribution of the median nerve. However, only 4.9% of the individuals with these symptoms had positive NCS *(2)*. Taylor-Gjevre et al. in 2010, reported that in their study the sensitivy of nerve conduction studies was 49.1%, with a specificity of 62.5% and the overal accurancy 51.4% *(30)*. Recently, Sear et al. having also recongized the lack of universal agreement on the pre-operative role of electrodiagnostic studies and the potential effect on delays to surgery and added costs, concluded that the role of electrodiagostic studies should be re-assessed *(26)*. Ancillary testing may delay the management, cause discomfort or additional economical burden.

Furthermore, the correlation between NCS and results of surgical decompression has been investigated in several studies. The results show no or only slight correlation between NCS and postoperative outcomes *(18,13,31)*. Patients that present with atypical clinical features are more

likely to be potential non-responders to surgery than those with classical symptomatology and negative NCS *(32)*. Finsen et al. reported outcomes of surgical treatment in 68 patients with typical symptoms and signs of CTS. At the 6-month follow-up, 63 patients (93%) responded well to surgery however, the preoperative NCS were found to be negative in 16 patients (23%), of whom 14 recovered and 2 did not *(8)*. Concannon et al. reported no differences in the outcomes of surgical decompression in patients who had clinically typical CTS and positive (n = 398) or negative (n = 62) electrophysiological studies and concluded that NCS provide no important information for the diagnosis of and decision-making about the treatment of clinically evident CTS *(5)*. In a recent study Zyluk et al. the results of carpal tunnel release in patients with the diagnosis of CTS based on only clinical findings were compared to those diagnosed on both clinical and electrophysiological findings *(32)*. Ninety-three patients with 'typical' CTS were randomly assigned to receive carpal tunnel release with (n = 45, 48%) or without (n = 48, 52%) NCS. The authors concluded that patients with clinically typical CTS can be safely referred for operative treatment without neurophysiological examination and NCS before operation does not improve outcomes of surgery *(32)*. Our findings are comparable with the results of other studies.

Our study is the first to our knowledge to compare the results of conservative versus operative treatment of patients with clinical diagnosis of CTS and negative NCS, using the Boston Carpal Tunnel Questionnaire (BCTQ) *(21)* and the DASH outcome instruments (15). At baseline, patients from group I had lower CTS SSS, DASH and FSS scores, compared to the respective scores from group II. However, at the last follow-up patients in group I had higher CTS SSS, DASH and FSS scores compared to the respective scores of group II. In our series improvement (statistically significant decrease) occurred in the SSS ($P < 0.001$) FSS ($P < 0.001$) and DASH scores ($P < 0.05$) in group II after mini open carpal tunnel release.

In this study there are some limitations that need to be considered. Patients were not randomized and were unblinded to treatment, but the patients choose the primary treatment options after discussion with the surgeon. This patient sample was referred to our department and might not represent the true incidence of the syndrome in the general population. Perhaps, the pre-test probability of having CTS would be higher in our study group compared to the community, which would decrease the value of the confirmatory value of NCS to the diagnosis.

Given the controversy and the ongoing discussions on the value of NCS for the diagnosis and management of CTS, our study support the limited additional value of NCS in the management of CTS when there is a strong clinical suspicion.

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