

Clinical Course of the Non-Operated Hand in Patients With Bilateral Idiopathic Carpal Tunnel Syndrome

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Purpose: Patients with bilateral carpal tunnel syndrome (CTS) who had unilateral carpal tunnel surgery usually ask about the prognosis for the non-operated, opposite hand. In this study, we investigated the effects of unilateral carpal tunnel surgery on the clinical course of the non-operated, opposite hand in bilateral idiopathic CTS.

Methods: In this prospective study, only patients who had bilateral idiopathic CTS but had unilateral carpal tunnel surgery were included. Sixty-six patients were included in the study. All patients were women with the mean age 47 years and mean duration of symptoms 4 years. Forty-six surgeries were performed on right hands, and 20 surgeries performed on left hands. Forty-eight (73%) patients were housewives. Their non-operated, opposite hands were evaluated before and 6 months after unilateral surgery. The evaluations consisted of subjective symptoms and objective findings. Paired *t*-test and chi-square test were used for statistical analysis.

Results: There were no statistically significant differences between the means of symptom severity score, functional status score, power and pinch grip strength before and 6 months after unilateral surgery in the non-operated, opposite hands. There was no statistically significant differences among the percentages of the Tinel's sign, Phalen test, and electrophysiological changes before and 6 months after unilateral surgery on the non-operated, opposite hands. During the study period, 57 (86%) patients had surgery or intended to have surgery for their opposite hands.

Conclusions: It seems that unilateral surgery for bilateral idiopathic CTS does not affect the clinical course of the non-operated, opposite hand. We recommend that each hand of patients with bilateral CTS be managed separately, based on their symptoms. (*J Hand Surg* 2007;32A:1166–1170. Copyright © 2007 by the American Society for Surgery of the Hand.)

Type of study/level of evidence: Prognostic I.

Key words: Carpal tunnel syndrome, bilateral, carpal tunnel surgery, outcome, opposite hand.

Carpal tunnel syndrome (CTS) is produced by compression of the median nerve within the carpal tunnel. It may be idiopathic or secondary. According to the medical literature, approximately 60% of patients present with bilateral complaints and symptoms.¹ Padua et al postulate that CTS is bilateral in almost all cases, with similar nerve impairment, and most cases of unilateral CTS will probably become bilateral.² It is not well-known how the non-operated, opposite hand behaves following unilateral release in bilateral CTS. Patients frequently ask questions about the future of the opposite hand. Katz et al believe that unilateral carpal tunnel release does not relieve con-

tralateral symptoms, and patients with bilateral involvement remain symptomatic after surgery.³ Yoon et al suggested that after unilateral release, because of improving symptoms in the non-operated, opposite side, staged release of the non-operated, less symptomatic side may not always be necessary.¹ In this study, we investigated the effect of unilateral carpal tunnel surgery on the clinical course of the non-operated, opposite hand in the bilateral idiopathic CTS.

Materials and Methods

This prospective study was conducted between September 2005 and February 2007. The university com-

mittee for medical research ethics approved the study. All of the patients provided informed consent to participate in the study. All of the patients were women with the mean age 47 years (27 to 71) and mean duration of symptoms for 4 years (6 months to 20 years). There were 7 patients with thenars muscle atrophy. Sixty-two patients were right handed, and 4 were left handed. Surgery was performed on the right side in 46 (70%) and left side in 20 (30%) of the cases. There was not any change in occupation before or after the operation. None of the patients was involved in worker's compensation. From an initial group of 103 patients, 4 were excluded because of secondary CTS (2 diabetes, 1 thyroid dysfunction, and 1 rheumatoid arthritis). Eleven patients were excluded because of loss of contact or the patient's preference not to participate. Twenty-two patients were excluded because follow-up evaluation was done before 6 months. Sixty-six patients who had bilateral idiopathic CTS and unilateral carpal tunnel surgery were included in the study. Sixteen of 66 patients refused to undergo the second electrophysiology study at the 6-month evaluation after the unilateral surgery. Most patients were housewives (73%; 48 of 66), and other occupations included 9 teachers, 4 clerical workers, 3 manual workers, 1 hairdresser, and 1 baker. The patients included in the study had bilateral CTS but had unilateral carpal tunnel release. Their opposite, non-operated hands were evaluated before surgery and 6 months after surgery. The evaluations consisted of subjective symptoms, objective findings, and electrophysiology study. The patients with secondary CTS (diabetes, thyroid dysfunction, and rheumatoid arthritis) with fewer than 6 months follow-up evaluation, and those who did not want to be included in the study were excluded.

The clinical diagnosis of CTS was based on a history of nocturnal pain and paresthesia, activity-related pain, sensory deficit in the territory of the median nerve, thenar muscle atrophy, a positive Phalen test, and a positive Tinel's sign. Before surgery, each patient had a trial of non-operative therapy consisting of wrist splinting, anti-inflammatory agents, steroid injection into the carpal tunnel, or all of these. All patients had proven bilateral CTS, as determined by electrophysiology studies. Most of the patients had unequal symptoms in their hands. Unilateral open carpal tunnel surgery was performed for the patients who preferred their most symptomatic side to be treated first. All patients had open carpal tunnel release under local anesthesia with limited

open incision. No adjunctive therapy, such as epineurotomy, internal neurolysis or tenosynovectomy, was performed. The patients were also asked two direct questions, "Are you satisfied with the results of surgery?" and "In retrospect, would you have the surgery again?" Twenty-eight patients were very satisfied and 38 were satisfied with the operation, and their symptoms on the operated side decreased or resolved. All of the patients would have the surgery again.

Measurements

For subjective evaluation the patients completed two scored questionnaires (symptom severity scale and functional status scale) about the non-operated hands before the operation and 6 months after surgery. A nursing instructor supervised the patients. We used a translated version of the Brigham Hospital CTS questionnaire produced by Levine.^{4,5} We found the questionnaires were in accordance with our social and cultural conditions. We have standardized the questionnaire, and its standard criteria were compared with the original English version, which was sufficient to be used in the Farsi language.⁵

The *symptom severity scale* consisted of 11 questions with multiple-choice answers. The scale (including pain, nocturnal symptoms, numbness, tingling, and weakness) has 5 ordinal response categories ranging from 1 (no symptom) to 5 (very severe symptom). The score was calculated as the mean of the score for the 11 individual items.

The *functional status scale* consisted of 8 questions for activities of daily living. Each task was rated with a level of difficulty from 1 (no difficulty) to 5 (unable), specifically related to the patient. The score was calculated as the mean for the 8 different tasks. For objective evaluation, the non-operated hands were examined for Tinel's sign, Phalen test, power grip, and pinch grip. Power and pinch grip strengths were measured by using a dynamometer (Jamar: Asimov Engineering, Los Angeles, CA). Electrophysiology studies (electromyography and nerve conduction) were done before and 6 months after unilateral carpal tunnel surgery in 50 patients. The electrophysiological severity of CTS was graded normal, mild, moderate, and severe, according to the recommendation of Stevens, based on the electrophysiological findings (Table 1).^{6,7}

Statistical Analysis

The distribution of the parameters was normal. Comparison of means of the scores of symptom severity scale, functional status scale, power and pinch grip

Table 1. Stevens' Recommendation for CTS Grading Scheme Based on the Electrophysiologic Findings

Mild	Prolonged (relative or absolute) sensory or mixed nerve action potential distal latency (orthodromic, antidromic, or palmar \pm CNAP amplitude below the lower limit of normal)
Moderate	Abnormal median sensory latency as above and (relative or absolute) prolongation of median motor distal latency
Severe	Prolonged median nerve motor and sensory distal latencies, with either an absent CNAP or mixed nerve action potential or low-amplitude or absent thenar CMAP. Needle examination often reveals fibrillations, reduced recruitment, and motor unit potential changes

strength of the non-operated hands before and 6 months after the unilateral carpal tunnel release was made using paired *t*-test. Comparison of the frequency of the Tinel's sign, Phalen test, and electrophysiological severity changes of the non-operated hands before and 6 months after the unilateral carpal tunnel release was made using chi-square test. P values less than .05 indicated statistically significant effects.

Results

Table 2 shows the subjective and objective findings of the non-operated, opposite hands before and 6 months after unilateral surgery in 66 patients. For the non-operated, opposite hand, the mean symptom severity score was 2.47 ± 1.05 and the mean functional status score was 2.37 ± 1.03 before surgery. Six months after the surgery, the

Table 2. The Subjective and Objective Findings of the Non-Operated, Opposite Hands Before and 6 Months After Unilateral Carpal Tunnel Surgery in 66 Patients With Bilateral Idiopathic CTS

	Before surgery	Six months after surgery
Symptom severity score	2.47 ± 1.05	2.34 ± 0.93
Functional status score	2.37 ± 1.03	2.33 ± 0.89
Tinel's sign	50%	53.2%
Phalen test	69.7%	70.2%
Power grip (kg)	24.2 ± 6.87	24.45 ± 6.5
Pinch grip (kg)	6.82 ± 1.72	7.15 ± 1.57

Table 3. The Severity Grading of the Electrophysiological Findings of the Non-Operated, Opposite Hands Before and 6 Months After Unilateral Carpal Tunnel Surgery in 50 Patients

	Before unilateral surgery	Six months after unilateral surgery
Normal	—	6 (12%)
Mild	10 (20%)	12 (24%)
Moderate	28 (56%)	23 (46%)
Severe	12 (24%)	9 (18%)
Total	50 (100%)	50 (100%)

scores were 2.34 ± 0.93 and 2.33 ± 0.89 , respectively. There was no statistically significant difference between the means of the symptom severity score and the functional status score for the non-operated, opposite hands before and 6 months after unilateral surgery. There was no statistically significant difference between the frequency of the Tinel's sign and Phalen test of the non-operated, opposite hands before and 6 months after unilateral surgery. There was no statistically significant difference between the means of the power and pinch grip strength of the non-operated, opposite hands before and 6 months after unilateral carpal tunnel surgery.

Table 3 shows the electrophysiological findings of the non-operated, opposite hands before and 6 months after unilateral surgery in 50 patients. Some of the patients had undergone electrophysiological study before being referred to us, and their results were analyzed and graded according to the severity scale recommended by Stevens.^{6,7} There was no statistically significant difference between the frequency of the electrophysiological findings of the non-operated, opposite hands before and 6 months after unilateral surgery.

Therefore, using the parameters, we were not able to find significant effects from unilateral surgery in bilateral CTS on the non-operated, opposite hand from a statistical point of view. During the study period, 39 (59%) of 66 patients underwent carpal tunnel release for their opposite hands. Their initial electrophysiological findings were 13 severe, 21 moderate, and 5 mild on the non-operated, opposite hand. Eighteen additional patients (27%) wanted treatment for the non-operated, opposite hands. Because of personal preferences, however, they did not undergo surgery for their opposite hands during the study period. Nine patients (14%) did not want sur-

gery for the opposite hand because their symptoms resolved.

Discussion

Bilateral presentation or subsequent development of CTS in the opposite hand is common.¹ Padua et al reported that 87% of their patients had bilateral CTS, and 58% of those who had unilateral symptoms subsequently showed symptoms in the other hand.² Bagatur and Zorer believe that CTS usually starts in one limb and affects the other later. The first affected hand always has the worse symptoms and more severe neurophysiologic impairment. They assumed that bilateralism may be time dependent and believed that patients with unilateral symptoms should be closely monitored.⁸

It is well known that patients with CTS usually complain of bilateral symptoms. But, the question is whether surgical intervention affects the clinical course of the non-operated, opposite hand. Yoon et al studied 30 patients who had unilateral carpal tunnel release.¹ The average follow-up evaluation was 35 months. Twenty patients (group 1) had bilateral CTS, clinically confirmed by electrophysiology. Five patients had only CTS determined by electrodiagnosis in the opposite hand but no clinical findings (group 2), and 5 patients had neither clinical nor electrophysiology-determined CTS on the contralateral side (group 3). They found that of the 20 patients in group 1, 15 (75%) had long-term relief on the non-operated, opposite hand after unilateral release of the more symptomatic side, and the remaining 5 had no change (neither improvement nor aggravation). There was no change in the non-operated, opposite hand in the 10 patients of group 2 and 3. They had performed postoperative electrodiagnosis in 10 patients for the non-operated, opposite hands. Two patients showed improvement, but 8 patients did not show any significant changes. The authors observed that there was improvement of symptoms in the non-operated hands in most of those with bilateral involvement, and no aggravation of symptoms and no new development of CTS in the remaining patients. Therefore, they concluded that bilateral release for patients with bilateral involvement may not always be necessary.¹

In a personal observation, Dorwart noted that after unilateral release of the worse side, many patients have had relief on the non-operated hand for as long as 5 years.⁹ The hypothesis for improvement of the symptoms of the non-operated, opposite hand may be that since work, hand dominance, and repetitive ac-

tivities increase the risk of developing CTS, as the symptoms in the operated hand are alleviated, the loading on the other hand lessens, thereby resulting in improvement of symptoms.^{1,10,11} This hypothesis may be justified in the early stages of the disease because the pathophysiology of CTS shows an association between the stage of the disease and intra-neural microvascular dysfunction and nerve fiber injury.^{12,13} Clinical recovery and electrophysiological improvement of the non-operated hand is most likely when the loads and stresses are removed or reduced at the early stage of the disease.^{13,14}

In our study, we were unable to find significant statistical differences of subjective and objective findings between the presurgical evaluation and the evaluation taken 6 months after unilateral surgery in the non-operated, opposite hand. During the study period, most patients (59%) underwent carpal tunnel surgery for their opposite hands. Eighteen patients (27%) intended to have surgery for the non-operated, opposite hand. They may choose to have surgery if they have follow-up evaluations for a longer period of time. Our observation may be explained by the fact that the patients had a long duration of symptoms (mean 4 years), which results in advanced stages of the disease.

Because no direct relationship usually exists between the type of symptoms experienced and the severity of the electrophysiological abnormality,¹⁴ we recommend that each hand of a patient with bilateral CTS should be managed separately based on the symptoms. An advantage of this study is that it is a prospective clinical trial based on subjective and objective findings. Standard questionnaires were used for subjective assessment. The Yoon et al study was a retrospective study based on a rough subjective assessment.¹ We were unable to find comparable studies in the English-language literature with which to compare our results. We suggest further outcome investigations be conducted to evaluate the question, "How does the contralateral side behave after unilateral release in bilateral CTS?"

Our study has limitations. (1) It has a short follow-up (6 months) study, although we chose 6-months based on other CTS outcome studies. (2) All of the patients were women and the work of most was housekeeping. (3) There are not universally accepted clinical and electrophysiology criteria for grading the severity of the CTS. Clinical estimation is rough, and there are several CTS grading schemes based on the electrophysiology findings.^{1,6,8,14-17} (4) For a more effective comparison, pre- and postoper-

ative electrophysiological studies are best performed by one person and in the same clinical setting, which was not the case in all of our patients. This is a weakness in our study, and it happened because some patients were referred to us with a diagnosis of CTS, and electrophysiology studies had already been done.

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