Carpal tunnel syndrome with severe sensory deficit

Endoscopic release in 18 cases

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ABSTRACT – Carpal tunnel syndrome (CTS) with severe sensory deficit was treated with endoscopic carpal tunnel release in 18 hands of 16 consecutive patients (median age 72 (28–92) years). In all hands, preoperative 2-point discrimination (2-PD) exceeded 15 mm in the radial and ulnar sides of the pulps of at least 2 of the 3 radial digits. All patients underwent an independent evaluation and answered a questionnaire concerning 11 activities of daily living (ADL) preoperatively and 6 months postoperatively. Complete resolution or improvement in daytime numbness and tingling was reported in 12 of 17 hands, of night symptoms in 12 of 16 hands, and of pain in 10 of 11 hands. The median ADL score improved from 3.1 to 1.4 (on a 1- to 5-point scale). 13 of the 16 patients were satisfied with the outcome. Two-PD had normalized in 14 hands and improved in 2. The results indicate that endoscopic carpal tunnel release is effective in improving symptoms and function in patients with CTS and severe sensory deficit, and that the prognosis for sensory recovery is good.

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Carpal tunnel syndrome (CTS) can cause severe sensory loss and surgical treatment is generally recommended in these cases (Dawson et al. 1990). Although endoscopic division of the transverse carpal ligament has been shown to be an effective treatment (Chow 1989, Brown et al. 1993), most previous studies involved patient populations with a wide spectrum of disease severity in terms of sensory deficit. No studies have prospectively investigated the outcome in patients with severe preoperative sensory loss. We evaluated prospectively the results of endoscopic carpal tunnel release in a consecutive cohort of 16 patients with CTS and severe sensory deficit.

Patients and methods

During a 3-year period (1992–1994) 16 consecutive patients (18 hands) with CTS and severe sensory deficit were prospectively studied. The inclusion criteria were CTS, diagnosed on the basis of the presence of daytime (activity-related or continuous) and/or nighttime numbness or tingling in the median nerve distribution in the hand, and 2-point discrimination (2-PD) exceeding 15 mm in the radial and ulnar sides of the pulps of at least 2 of the 3 radial digits. Patients with diabetes, rheumatoid disease, or previous carpal tunnel surgery in the symptomatic hand were excluded. Nerve conduction testing of the median nerve (Atroshi et al. 1996) showed pathologic distal motor latency (≥ 4.5 ms) and/or pathologic distal sensory latency (≥ 3.6 ms) in 15 hands. In the remaining 3 hands, only distal motor latency was measured, and this was normal.

There were 13 women with a median age of 72 (28–92) years and 3 men aged 49, 81 and 82 years, respectively. The dominant hand was involved in 10 patients. Preoperative symptoms included daytime numbness and/or tingling in 17 hands (15 with continuous numbness), nighttime paresthesias in 16, and pain in 11. The median duration of symptoms was 36 (6–240) months. A positive Tinel sign was recorded in 16 hands and a positive Phalen test in 16. Two-PD exceeding 15 mm was found in both sides of the pulps of all 3 radial dig-

its in 14 hands and in both sides of the pulps of 2 radial digits in 4 hands. In all hands, the Semmes-Weinstein monofilament test (pressure sensibility) was pathologic (lightest monofilament perceived was the 3.61 or heavier) on both sides of the pulps of all 3 radial digits. Thenar atrophy and/or weakness (examiner judging the thenar eminence to demonstrate flattening or concavity or the power of resisted thumb's palmar abduction to be reduced, respectively) were found in 16 hands.

Carpal tunnel release was performed using the 2-portal endoscopic technique (Chow 1989). No complications occurred. 2 patients had bilateral procedures performed on the same occasion in 1 patient, and at a 2-week interval in the other.

All patients were evaluated by an independent examiner, using a standardized protocol to record data and a validated activities of daily living (ADL) questionnaire (Atroshi et al. 1998) preoperatively and at the follow-up evaluation 6 months postoperatively.

Symptoms

The patients were asked to rate each of the symptoms of CTS (daytime numbness/tingling, nighttime paresthesias, and pain) as absent, mild, moderate or severe.

Function

The ADL questionnaire consisted of 11 items (writing, buttoning clothes, personal hygiene, dressing, hair care, opening jars, slicing bread, using knife and fork, using keys, driving, leisure activities). For each activity, the response was scored as 1 (no difficulty), 2 (mild difficulty), 3 (moderate difficulty), 4 (severe difficulty) and 5 (unable to perform the activity because of hand symptoms). The mean of the scores for all answered items was recorded as the patient's ADL score.

Patient satisfaction

The patients were asked whether they were satisfied or dissatisfied with the results of surgery.

Sensibility

Two-PD and Semmes-Weinstein monofilament sensibility were measured on the radial and ulnar sides of the pulp of each digit in all 18 hands preoperatively and at follow-up (except for 1 hand that did not undergo monofilament testing at follow-up). Testing of 2-PD was performed using the Disk-Criminator (Dellon et al. 1987) with two prongs being applied longitudinally to the skin at an initial inter-prong distance of 4 mm. If the patient failed to perceive 2 points, the distance was successively increased by 2 mm and finally to 15 mm. During testing, a single prong was applied at random intervals. The smallest inter-prong distance at which 2 prongs were perceived by the patient was recorded. For the analysis, 2-PD was recorded on a scale from 6 mm (upper limit of normal 2-PD) to 16 mm which was the value used when 2-PD exceeded 15 mm (presence of protective sensation only). The mean of 6 values recorded for the 3 radial digits was calculated. The Semmes-Weinstein monofilament test was performed by applying each monofilament perpendicularly to the skin and pressing until the monofilament bent. Testing was begun with the lightest monofilament (2.83). If the patient failed to perceive it, heavier monofilaments (3.61, 4.31, 4.56 and 6.65) were successively applied. Each monofilament was applied 3 times, and the first one perceived by the patient was recorded (Bell-Krotoski et al. 1993). For the analysis, the median of 6 monofilament values recorded for the 3 radial digits was calculated. Interpretation of the monofilament test results is based on the lightest monofilament that the patient can perceive, with the 2.83 monofilament considered as normal sensation, the 3.61 monofilament as diminished light touch, and the remaining monofilaments as diminished to absent protective sensation.

Strength

The grip strength was measured with the Jamar dynamometer (Preston, Jackson, MI) and the key pinch strength with the Vigorimeter (Martin, Tuttlingen, Germany). The mean of 3 measurements in each hand was recorded.

Statistics

Analysis was performed with the Wilcoxon signed rank test.

Symptoms in 18 hands with carpal tunnel syndrome and severe preoperative sensory deficit treated with endoscopic carpal tunnel release, number of cases

		6 months postoperatively		
Symptom	Preoperatively [a]	Complete resolution	Improvement [b]	No change [a]
Daytime numbness/tingling	17 (0, 6, 11)	9	3	5 (0, 2, 3)
Nighttime paresthesias	16 (2, 1, 13)	12	2	2 (0, 0, 2)
Pain	11 (1, 1, 9)	7	3	1 (0, 0, 1)

[a] number of hands with symptoms (mild, moderate, severe)
[b] all hands had mild residual symptoms

Results

Symptoms

Complete resolution of all the preoperative symptoms was reported in 10 of the 18 hands. Improvement in one or more of the preoperative symptoms was reported in 6 hands, and no change in any of the symptoms in 2 hands.

Significant improvement in each of the preoperative symptoms ($p < 0.01$ for all comparisons) was noted (Table).

Function

The median (interquartile range) ADL score was 3.1 (2.7–3.9) preoperatively and 1.4 (1.1–1.5) at 6 months postoperatively. The improvement in the ADL scores was significant ($p < 0.001$).

Patient satisfaction

13 of the 16 patients were satisfied with the results of surgery. The 2 patients who had undergone bilateral surgery were satisfied with the results in both hands. 2 of the 3 patients who had normal preoperative median nerve distal motor latency, but no sensory latency testing were satisfied with the results of surgery.

Sensibility

The median (interquartile range) 2-PD was 16 (14–16) mm preoperatively and 6 (6–8) mm at 6 months postoperatively. Two-PD had normalized (i.e., 6 mm) in 14 hands, and the median 2-PD had improved in 2 hands and was unchanged in 2 hands. The improvement in 2-PD was significant ($p < 0.001$).

The median (interquartile range) Semmes-Weinstein monofilament was 4.31 (4.31–6.65) preoperatively and 3.61 (2.83–4.31) at 6 months postoperatively. The monofilament test had normalized (i.e., 2.83 monofilament) in 5 hands, and the median monofilament had improved in 9 hands and was unchanged in 3 hands. The improvement in the Semmes-Weinstein monofilament test was significant ($p < 0.01$).

Strength

The median (interquartile range) grip strength was 13 (9–21) kg preoperatively and 18 (12–21) kg at 6 months postoperatively. The change in grip strength was not significant ($p = 0.08$). The median (interquartile range) pinch strength was 0.24 (0.15–0.39) kPa preoperatively and 0.32 (0.21–0.4) kPa at 6 months postoperatively. The change in pinch strength was significant ($p < 0.01$).

Discussion

We found that endoscopic division of the transverse carpal ligament improves median nerve function in CTS even in the presence of preoperative severe sensory deficit. Although our study is not randomized and has a small sample size, it has a number of strengths including the prospective and consecutive design, the complete follow-up and the independent assessment.

The high age of our patients suggests that severe sensory loss might be commoner in the older age group of patients with CTS. It is not clear whether this is due to longer disease duration or to an age-related vulnerability of the median nerve to the effects of compression. The sensory recovery evidenced by the normalization or improvement in 2-PD and Semmes-Weinstein monofilament

sensibility at the 6-month follow-up indicates that good recovery in nerve function may occur, even in old patients. Considering the high prevalence of CTS in this age group, and especially among older women (Atroshi et al. 1999), the finding of favorable prognosis of surgical treatment in older patients with CTS is important.

The literature about the outcome of carpal tunnel release in patients with CTS and severe sensory deficit is limited. Gelberman et al. (1987) studied 33 hands (mean patients' age 55 years) with CTS and thenar atrophy or pathologic 2-PD, and reported preoperative 2-PD exceeding 15 mm in 14 of the hands, but did not mention how 2-PD was computed. They found symptom improvement in most patients and normalization of 2-PD in 12 of the 14 hands 1–2 years after open carpal tunnel release. Nolan et al. (1992) studied retrospectively 15 hands (mean patients' age 70 years) with CTS and absence of sensory responses on nerve conduction testing. They reported preoperative 2-PD exceeding 15 mm in 5 hands and exceeding 6 mm in another 6; the method of computing 2-PD was not mentioned. Follow-up 1–5 years after open release showed symptom improvement in all patients and 2-PD normalization or improvement in 9 hands.

In our study, recovery of 2-PD was quicker than that of Semmes-Weinstein monofilament sensibility which, although improved, remained pathologic 6 months postoperatively in most of the patients. Semmes-Weinstein monofilament sensibility might normalize with a longer follow-up time (Gelberman et al. 1987). Assuming that both tests are valid and reliable measures of sensibility, and with the cutoff values currently used, the Semmes-Weinstein monofilament test appears to be more sensitive than 2-PD in detecting residual median nerve dysfunction caused by chronic compression (Mackinnon et al. 1991). It might also be more useful for monitoring recovery in nerve function.

In our inclusion criteria, we chose a strict definition of severe sensory deficit to avoid borderline cases that might confound the results. We did not include thenar weakness or atrophy in the inclusion criteria because of the difficulty of evaluating change in these variables, which is based on the examiner's judgment. However, as would be expected in CTS with severe sensory loss, most of the patients had thenar weakness and/or atrophy preoperatively. Considering the improvement in symptoms and ability to perform ADL after surgery, as well as the high rate of patient satisfaction, division of the transverse carpal ligament seems to be an adequate treatment, even in the presence of thenar atrophy.

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