

# Carpal Tunnel Release in Patients With Diabetes: A 5-Year Follow-Up With Matched Controls

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**Purpose** To compare clinical outcomes 5 years after carpal tunnel release among patients with and without diabetes.

**Methods** In a prospective consecutive series, 35 patients with diabetes (median age, 54 y; 15 type 1 and 20 type 2 diabetes) with carpal tunnel syndrome were age- and sex-matched with 31 control patients without diabetes (median age, 51 y) with idiopathic carpal tunnel syndrome. Exclusion criteria were other nerve entrapment, cervical radiculopathy, inflammatory joint disease, thyroid disorder, previous wrist fracture, and long-term exposure to vibrating tools. Participants were examined independently at baseline, 1 year, and 5 years after surgery for sensory function (Semmes-Weinstein), motor function (abductor pollicis brevis muscle strength and grip strength), cold intolerance, and completion of the Boston Carpal Tunnel Questionnaire symptom severity and functional status score.

**Results** Five years after surgery, the overall attendance rate for clinical examinations and completion of the Boston Carpal Tunnel Questionnaire were 86% and 95%, respectively. Between 1 and 5 years after surgery, there was a tendency toward a decrease in sensory function but an increase in motor function, with no statistically significant difference between groups. Cold intolerance demonstrated long-term significant improvement for patients with diabetes. The improvement in symptom severity and functional status score, as well as the large effect size, were maintained at 5 years in both patient groups.

**Conclusions** Long-term improvement in patients with diabetes remained after carpal tunnel release to the same extent as for patients without diabetes. Furthermore, improvement in cold intolerance in patients with diabetes suggests the potential for the long-term regeneration of small nerve fibers. (*J Hand Surg Am.* 2014;39(4):713–720. Copyright © 2014 by the American Society for Surgery of the Hand. All rights reserved.)

**Type of study/level of evidence** Prognostic I.

**Key words** Carpal tunnel syndrome, clinical outcome, cold intolerance, diabetes.

**C**ARPAL TUNNEL SYNDROME (CTS) is the most common entrapment neuropathy that arises in patients with diabetes. Patients with type 1 diabetes have a substantial 80% lifetime risk of

developing symptomatic CTS, compared with 10% for the general population.<sup>1,2</sup>

We previously published short-term results from a prospective study on carpal tunnel release among

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age- and sex-matched patients with and without diabetes.<sup>3,4</sup> We were able to demonstrate that both patient groups experienced significant sensory and motor function improvement. Patient satisfaction and improvement of quality of life were high in both groups. Only cold intolerance symptoms were relieved to a lesser extent for patients with diabetes.

Prospective studies on intermediate and long-term results after carpal tunnel release in patients without diabetes have demonstrated satisfaction rates as high as 90%.<sup>5,6</sup> Nonetheless, recurrent symptoms have been reported to occur in 3% to 19% of patients and to require reoperation in up to 12%.<sup>7,8</sup>

The purpose of this investigation was to extend our previously published clinical trial, compare outcomes 5 years after open carpal tunnel release in patients with and without diabetes.

## MATERIALS AND METHODS

Over a 3-year period (2004–2007), consecutive patients referred to our clinic with type 1 or type 2 diabetes and duration of CTS for at least 6 months were invited to participate in the study. The patients with diabetes were age- and sex-matched with patients without diabetes who had idiopathic CTS. Details on eligibility criteria, surgical procedure, and pre-operative results, and 6-week, 12-week, and 1-year follow-up results have previously been published.<sup>3,4</sup> In the present study, performed from 2010 to 2012, patients were included for a follow-up at least 5 years after surgery.

### Measurements

**Physical assessment:** Physical assessment concerning perception of touch with the Semmes-Weinstein monofilament (minikit; North Coast Medical, Inc, Gilroy, CA),<sup>9</sup> strength of thumb palmar abduction,<sup>10</sup> and grip strength and key and lateral pinch, measured using a Jamar dynamometer and a pinch gauge, respectively (GMB Medical AB, Stockholm, Sweden),<sup>11</sup> was performed before, at baseline, and 1 year after surgery. The same experienced occupational therapist involved in the original study performed the assessments at the 5-year follow-up. Detailed procedures are described in the previous report.<sup>3</sup>

**Questionnaires:** Patients were asked to submit a subjective evaluation of cold intolerance in the hands (exaggerated reaction to cold exposure causing discomfort and pain). Rating was performed on a visual analog scale (VAS) from 0 (no pain or discomfort) to 100 (severe pain or discomfort). Those reporting cold intolerance completed the Cold Intolerance Symptom

Severity (CISS) score, which rates the frequency and persistence of symptoms and their impact on activities of daily living.<sup>12</sup> The score range is from 4 to 100, where a CISS score greater than 30 is considered abnormal.<sup>12</sup>

The Boston Carpal Tunnel Questionnaire (BCTQ) represents a disease-specific outcome questionnaire that encompasses 2 multi-item scales: the symptom severity scale (11 items) and the functional status scale (8 items).<sup>13,14</sup> Reply categories from each item vary from 1 (no symptoms/no functional impairment) to 5 (severe symptoms/cannot perform the activity at all). Accordingly, higher scores indicate more severe symptoms or dysfunction. An overall symptom severity and functional status score was calculated as the mean of their included items. Patient satisfaction was recorded separately using the reply categories: completely satisfied, very satisfied, quite satisfied, dissatisfied, and very dissatisfied.

### Study population

In the previous clinical trial, 35 patients who had diabetes and CTS (15 type 1 and 20 type 2 diabetes) participated. They were age- and sex-matched with 31 control patients without diabetes, and who had idiopathic CTS. In the current extended study, 2 patients with diabetes were unable to participate owing to severe illness, and 6 patients declined clinical investigation for various practical reasons. However, these 6 patients completed and returned the BCTQ. One patient with idiopathic CTS no longer lived in the local area and declined to participate. Thus, the study population consisted of 27 patients with diabetes and CTS, and 30 patients without diabetes having idiopathic CTS (overall attendance rate, 86%). Concerning BCTQ, 33 patients with diabetes and 30 patients without diabetes participated (overall attendance rate, 95%). [Table 1](#) lists patient characteristics.

### Statistical analysis

Data are presented as median and range, if not otherwise stated.  $P < .050$  was considered statistically significant.

We used the McNemar test for correlated proportions to evaluate within-group changes over time in binary and dichotomized variables. Changes in ordinal and continuous variables between groups and within groups were tested using 2-tailed Mann-Whitney  $U$  test and Wilcoxon signed-rank test, respectively.

Differences in change over time from baseline to 1 year and from baseline to 5 years were compared between patients with and without diabetes using

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