SCIENTIFIC ARTICLE

Self-Reliance and Postoperative Hand Recovery After Simultaneous, Bilateral Endoscopic Carpal Tunnel Release: A Prospective Study

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Purpose Outcomes and recovery of endoscopic carpal tunnel release (ECTR) have been broadly examined in studies. The total recovery time can potentially be reduced by performing simultaneous, bilateral ECTR. In this study we prospectively investigated days to self-reliance. As secondary outcomes, we investigated direct postoperative recovery of hand function and pre and postoperative symptom severity after simultaneous, bilateral ECTR.

Methods In this single-center prospective case series, we included all patients willing to participate after undergoing bilateral ECTR between December 2015 and July 2019. Every patient recorded days to self-reliance (when a patient could perform basic activities of daily living without the need for assistance from another person) and completed a preoperative and postoperative Boston Carpal Tunnel Questionnaire (BCTQ) evaluating postoperative hand function and pre and postoperative symptom severity.

Results In total, 81 patients received simultaneous, bilateral ECTR. Median days until self-reliance was 4; mean number of days was 4.9. Concerning BCTQ scores, postoperative functional status increased significantly each day, and mean BCTQ score decreased gradually from intense difficulty to little difficulty in daily tasks over a period of 7 days. Preoperative BCTQ symptom severity showed significant improvement compared to postoperative symptoms, evolving from medium to slight symptoms.

Conclusions Simultaneous, bilateral ECTR offers recovery to self-reliance in 4 to 5 days with a gradual and significant increase of hand function in the following postoperative days. *(J Hand Surg Am. 2022;47(5):475.e1-e7. Copyright © 2022 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic II.

Key words Boston Carpal Tunnel Questionnnaire, carpal tunnel syndrome, endoscopic carpal tunnel release, hand function, hand recovery, self-reliance.

Online Exclusive

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Received for publication December 9, 2019; accepted in revised form May 28, 2021.

Dr Fechner was the developer of the guiding canulla that was used for the ECTR. No benefits in any form have been received or will be received by the other authors related directly or indirectly to the subject of this article.

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0363-5023/22/4705-0011$36.00/0
https://doi.org/10.1016/j.jhsa.2021.05.020

CARPAL TUNNEL SYNDROME (CTS) is one of the most common compression neuropathies of the upper limb with an estimated incidence of 0.9 per 1,000 in men and 2.8 per 1,000 in women in the Netherlands.[1] Patients often present with symptoms of pain, paresthesia, sensory disturbance, and weakness in the median nerve distribution of the hand.[2] The incidence of bilateral involvement of CTS has been reported in 60% to 87% of patients, and bilateral symptoms seem to increase in frequency with the duration of symptoms.[3–5]

In most cases, operative treatment such as carpal tunnel release (CTR), where the transverse carpal ligament (TCL) is opened, is superior to nonsurgical treatment.[6–8] A range of methods for CTR have been reported, with open carpal tunnel release (OCTR) and endoscopic carpal tunnel release (ECTR) the most widely used.[9]

ECTR was first described by Okutsu et al[10] in 1989. Several authors have suggested short-term recovery after ECTR progresses more quickly than after OCTR, meaning reduced postoperative pain, faster recovery of grip strength, and fewer acute wound-related problems, but with roughly equivalent long-term recovery outcomes.[11–17] This is relevant for all patients, but especially for patients in need of fast recovery, such as caregivers and the self-employed. Stated disadvantages of ECTR are mainly its known technical difficulty in comparison to OCTR and the higher costs, largely due to the use of disposable materials.[18,19]

By combining operative release of both hands during a single procedure, there is a potential shortening of the total recovery time if it is assumed that a combined operation will not lengthen the recovery time of each individual hand. One of the principal patient concerns of simultaneous, bilateral CTR can be postoperative return to self-reliance. Postoperative recovery of activities of daily living after simultaneous, bilateral ECTR has been previously evaluated in a sample of 30 patients, showing that patients were able to eat, dress, and perform personal hygiene after a mean of 4.4 days.[20] These outcomes are comparable to the definition of our primary outcome, because we have defined self-reliance as when a patient can perform basic activities of daily living without the need for assistance from another person. Basic activities of daily living are defined by those activities necessary every day for independent living at home (ie, personal hygiene, dressing, and eating).

For the primary outcome, we assessed the number of days until self-reliance after simultaneous, bilateral ECTR. For the secondary outcomes, hand function and hand symptoms were evaluated using the Boston Carpal Tunnel Questionnaire (BCTQ).[21] We have compared pre and postoperative hand symptoms after simultaneous, bilateral ECTR with patient data from the BCTQ.

METHODS

In this prospective case series, all patients undergoing simultaneous, bilateral ECTR between December 2015 and July 2019 in the Máxima Medical Center in Veldhoven, the Netherlands, were asked to participate. Patients were allowed to decline participation without reason. Patients with a clinical diagnosis and positive electrodiagnostic study results for bilateral CTS were eligible for simultaneous, bilateral ECTR and were asked to participate. Patients were only referred to us with an indication for surgery. Previous carpal tunnel treatment (ie, nonsurgical, splinting, or corticosteroid injection) was performed by the primary care physician or neurologist. Clinical diagnosis was based on symptoms such as tingling sensation, pain and numbness in the median nerve area, nocturnal symptoms, and influence of wrist position/movement on symptoms, as stated by the guidelines of the Dutch Society for Plastic Surgery.[22]

All patients received both oral and written postoperative instructions. Patients were included after providing written informed consent, and the study was approved by the local medical ethical review board.

The article has been written in adherence to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Treatment/surgery

Patients were operated on by either 1 of 2 hand surgeons with extensive endoscopic carpal tunnel surgery experience. ECTR was performed bilaterally and simultaneously under local anesthesia (ropivacaine 10 milligram/milliliter, 10 cc per side). A single-port technique with a guiding cannula according to Fechner et al[23] was used. The guiding cannula was shaped with equally-raised borders at both sides, designed to prevent unexpected popping up of the median nerve in the area of TCL release. A 3 mm, 30 degree endoscope (Lemke Vision MC404s), a knife with a U-shaped blade (Karl Storz 28146K), obturator, dilator, and elevator were used. A pneumatic tourniquet was inflated to 250 mm Hg for optimal vision during the operation. After this, a 1 cm long incision was placed 1 cm radial and 1 cm proximal to the pisiform bone (Fig. 1), along the skin crease of the wrist and

ulnar to the tendon of the palmaris longus. After transverse incision of the antebrachial fascia, blunt dissection to the proximal edge of the TCL was done. The guiding cannula was introduced underneath the TCL, followed by the endoscope while visualizing the TCL fibers. The end of the TCL was marked by a needle inserted into the cannula approximately 4 cm distal to the transverse wrist crease. The proximal 1 cm of the TCL was cut with scissors under direct vision of the endoscope, followed by insertion and anterograde cutting of the TCL through the cannula by the U-shaped blade. Only the TCL was cut, preserving the muscle fibers. The cannula and blade were removed. Complete release was checked by a dilator in the carpal tunnel. The same procedure with the same surgical equipment was repeated on the contralateral side. The skin was closed with two 5-0 absorbable vertical mattress sutures, and a soft dressing was applied for 2 days.[23]

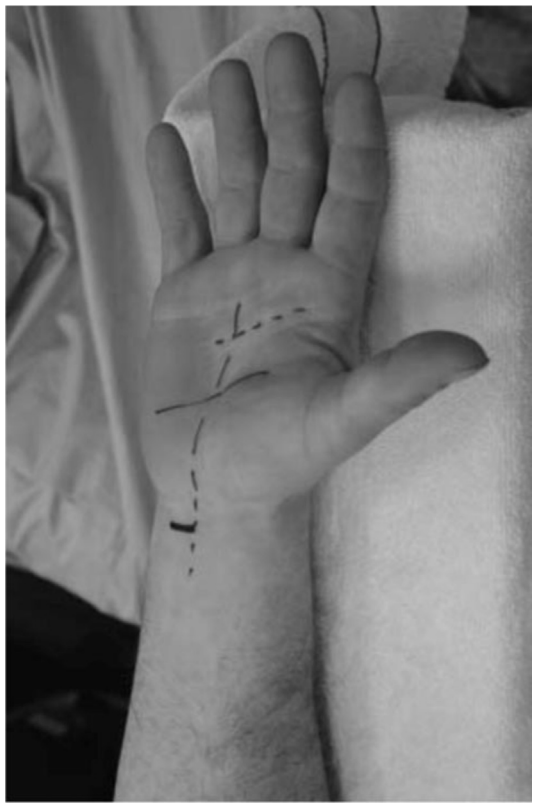

FIGURE 1: Drawing of anatomic landmarks before incision. These landmarks are drawn to indicate the correct location for incision and show the insertion point for the needle, 4 cm distal to the transverse wrist crease, to mark the end of the TCL perioperatively. The incision is made 1 cm radial and 1 cm proximal to the pisiform bone.

Data collection and outcomes

All patients received and completed a preoperative and postoperative questionnaire, consisting of all components originating from the Dutch translation of the BCTQ, approved by the Dutch Society for Plastic Surgery.[24] The BCTQ is a CTS-specific measure of self-reported symptom severity and functional status.

Preoperatively, patient symptoms were evaluated by the 11-item symptom severity scale of the BCTQ concerning type and severity of left and right hand symptoms during day and night.

For postoperative days 1 to 7, the 8-item functional status scale of the BCTQ, evaluating restrictions and difficulties in daily tasks, was completed at home. During an outpatient check-up 2 weeks after surgery, the symptom severity scale was repeated for comparison to preoperative status.

The primary outcome of interest was time to self-reliance, which was recorded by the participants at home on a form attached to the BCTQ questionnaire, asking patients to document the postoperative day on which they were self-reliant. The outcome was reported as the number of days after surgery until self-reliance. Self-reliance, as mentioned earlier, was defined by the moment when a patient could perform basic activities of daily living without the need for help from another individual. For analysis, completed BCTQ answers were converted to numbers (1 to 5) for each question. Mean scores for both symptom severity scale (preoperative and postoperative) and functional status scale (per day) were calculated by dividing the sum of item scores by the number of items.

Statistical analysis

Descriptive statistics were used to describe baseline patient characteristics and the main outcome. Mean time to self-reliance and standard deviation (SD) were calculated in days. Median time to self-reliance was calculated using Kaplan-Meier survival analysis. In these analyses, patients rather than arms were included as the unit of analysis. Postoperative functional status scale data was analyzed using a linear mixed model to account for the repeated assessments within patients. In this model, mean score was included as the dependent variable, and postoperative day was included as a factor. Distribution of preoperative and postoperative symptom severity scale data was checked for skewness, kurtosis, Shapiro-Wilk test, and a visual inspection of histograms and Q-Q plots. The pre and postoperative symptom severity scale data were compared using a Wilcoxon signed-rank test for paired data.

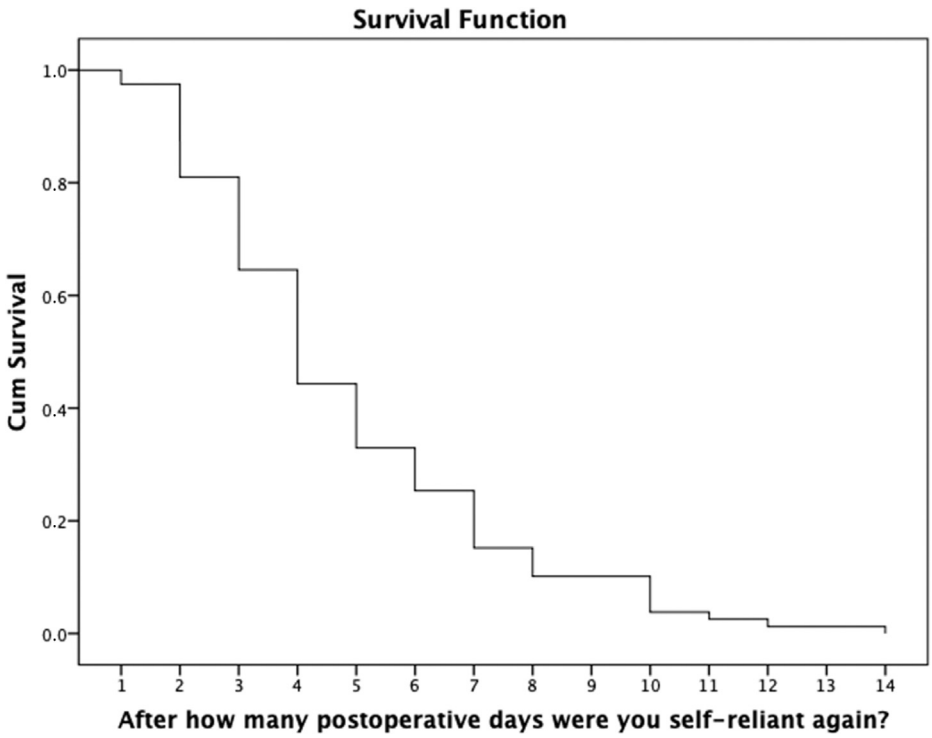

FIGURE 2: The Kaplan-Meier curve shows recovery to self-reliance. The Kaplan-Meier survival function shows a median recovery to self-reliance after 4 postoperative days, with a range from 1 day to 14 days.

RESULTS

We included a total of 81 patients. The sample consisted of 34 men (42%) and 47 women (58%). Of these, 56 patients (87.5%) were right-handed, 7 patients (10.9%) were left-handed, 1 patient (1.6%) was ambidextrous, and handedness of 17 patients was missing. The average age was 51.9 years (range 28 year to 82 years, SD 10.8). None of the patients had a history of carpal tunnel surgery. The mean number of days until self-reliance was 4.9 (SD, 2.7). The median number of days until self-reliance was 4 (95% confidence interval [CI], 3.5−4.5), ranging from 1 day to 14 days (Fig. 2).

Data on postoperative functional status were available for all 81 patients, and these improved significantly ($P < .05$) each day (Table 1). The mean functional status scale score decreased gradually from 3.9 (95% CI, 3.6−4.1) on day 1 postoperatively to 2.0 (95% CI, 1.9−2.2) on day 7 (Table 1).

Preoperative symptom severity scale scores were available for 68 patients, and postoperative scores were available for 78 patients. Preoperatively, the median score was 2.8 (interquartile range [IQR], 1.1) for left and 3.1 (IQR, 1.1) for right. Postoperatively, the median score was 1.6 (IQR, 0.6) for left and 1.8 (IQR, 0.8) for right. Pre- to postoperative symptoms were significantly improved for both left and right side ($P < .05$) after bilateral ECTR.

TABLE 1. Quick Recovery of Postoperative Function After Bilateral ECTR

		95% Confidence Interval*	
POD	Mean*	Lower Bound	Upper Bound
1	3, 9	3, 6	4, 1
2	3, 3	3, 1	3, 6
3	2, 9	2, 6	3, 1
4	2, 6	2, 4	2, 8
5	2, 4	2, 2	2, 6
6	2, 2	2, 0	2, 4
7	2, 0	1, 9	2, 2

POD, postoperative day.
*Mean score and 95% confidence intervals of postoperative functional status scale were calculated using the linear mixed model module.

DISCUSSION

The primary goal of this study was to evaluate postoperative days until self-reliance after bilateral, simultaneous ECTR.

Patients needed a median of 4 days to be self-reliant. Several patients mentioned that extra help

during the first several postoperative days was necessary before being self-reliant again. The probable reason for this, based on patient comments, was that 2 operated and painful hands were difficult to use immediately after surgery. Despite this, most patients clearly experienced gradual recovery to the extent of being able to handle daily tasks independently again, with a significant increase in functionality in the days following the procedure.

For secondary outcomes, we assessed the BCTQ functional status scale per postoperative day and saw a significant increase in function and reduction in pain each succeeding day. Thus, patients recovered quickly and could add daily tasks quickly, one of the known advantages of ECTR.[25] Comparing symptoms of CTS preceding and approximately 14 days following surgery, a significant reduction in symptoms was attained. ECTR offered not only quick, but also effective recovery. Mean BCTQ scores improved by 0.9 points from 2.9 to 2.0, meaning that patients still experienced mild symptoms 2 weeks after surgery. Clinical experience showed that full recovery to optimal level needed more than 2 weeks, depending on duration and intensity of median nerve compression.[26]

Costs for ECTR are known to be higher than for OCTR, mostly due to disposable materials and longer operating time.[19,27,28] Simultaneous CTR was found by Park et al[29] to be more cost effective than staged release. Costs for employers in terms of lost wages and productivity might also be reduced when patients with bilateral CTS involvement recover quicker. Saw et al[30] found return to work to be faster after ECTR.

Our study has some limitations. We did not collect data on the availability of assistance for patients at home and did not report patients who did not consent to a simultaneous, bilateral procedure. Thus, there is a potential selection bias for patients in our study group. The specific group of patients who choose bilateral, simultaneous surgery may include patients who either have assistance at home and therefore, feel more confident choosing bilateral surgery, or patients who are self-employed and have a high need for fast recovery, as also implicated by Fehringer et al,[31] Herisson et al,[32] and Nesbitt et al.[33] The effect on our results may be that the number of days until self-reliance in our study group is lower than it would be in the general population. Therefore, individual patient characteristics must be taken into consideration before advising bilateral surgery to patients. Osei et al[34] reported postoperative daily function after unilateral versus bilateral OCTR and found that most of their patients would not recommend simultaneous, bilateral OCTR to patients without help at home. The majority needed personal hygiene and nonhygiene-related assistance. Nonetheless, one-third of patients still recommended the simultaneous and bilateral surgery without having help. Contrary to the belief that simultaneous, bilateral carpal tunnel surgery caused more impairment than consecutive surgery, Weber et al[35] concluded that both groups had the same functional abilities due to the pain and symptoms experienced in the contralateral hand with consecutive surgery. Almost a quarter of the simultaneous group was less willing to endorse the surgery, but willingness to repeat was not found to be influenced by having individual assistance during the recovery period.[35] Furthermore, we did not include patient professions in data collection of this study, which might give more insight into which group of patients is interested in or chooses bilateral ECTR. Moreover, we did not compare hand symptom severity in relation to hand dominance. Since pain is partially related to experience and circumstances, patients might notice symptoms earlier in the hand that is in use most of the time, being the dominant hand. This can result in a more reliable symptom severity score for the right hand than for the left hand, since most patients are right-handed. Lastly, a prospective study design with a control group comparing staged, bilateral ECTR to simultaneous, bilateral ECTR would have improved the external validity of our outcomes.

The study we conducted mainly focused on days until self-reliance. Other studies have researched the same field of interest. DeGeorge et al[20] performed a retrospective, single-center study with 30 patients to evaluate mean time to resume activities of daily living and return to work after simultaneous, bilateral ECTR. After an average of 4.4 days, patients were able to resume all personal activities such as feeding, personal hygiene, and dressing. Wang et al[36] performed a prospective study with 20 patients on postoperative activities of daily living in combination with patient satisfaction after simultaneous, bilateral OCTR. All patients stated they would have bilateral simultaneous surgery again. Osei et al[34] conducted a prospective cohort study on performing postoperative activities of daily living comparing unilateral to bilateral OCTR, measuring results using the *Quick*-DASH as well as the BCTQ symptom severity and functional status scales.[37,38] Ten days after surgery, bilateral patients reported a mean BCTQ functional status score of 2.4 $\pm$ 0.9, which was higher than the functional status score of 2.0 in our endoscopic group after only 7 days. The bilateral patients noted

significantly more difficulty in several daily functions on postoperative days 1 and 2 than the unilateral. Two main reasons for choosing bilateral surgery were to avoid 2 procedures (42%) and having severe bilateral symptoms (26%).[34]

Pagnanelli et al[39] included 228 bilateral OCTR patients and found 95% regularly used their hands in fewer than 7 postoperative days, 40.6% went back to work in 1 week or less, none of the patients needed assistance postoperatively, and 94.6% were satisfied with the result after an average 1.6 years postoperatively.

Fehringer et al[31] reported that patients were able to return activities of daily living rapidly and were all independent and able to perform personal hygiene the day of surgery.

To date, no other studies besides DeGeorge et al[20] have specifically studied the number of days until self-reliance after simultaneous, bilateral ECTR.

In conclusion, bilateral ECTR can reduce recovery time with an acceptable time to self-reliance, relevant especially for patients in need for fast recovery, and might save substantial costs to society compared to single CTR. We advise future researchers to focus on a randomized and controlled trial comparing the number of days until self-reliance between staged and simultaneous, bilateral ECTR.

ACKNOWLEDGMENTS

The authors would like to thank Jeanne P. Dieleman, PhD, for her statistical help.

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