Outcome of Reoperation for Carpal Tunnel Syndrome

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One hundred thirty-one patients with reoperation for carpal tunnel syndrome were followed for a mean of 11 years. Reoperation failed in 15 patients, necessitating a third operation. Satisfaction, symptom severity, and functional status scores were assessed with a standardized questionnaire in the other 116 patients. Patients with normal findings on preoperative nerve conduction studies, those who filed for compensation, and those who had pain in the distribution of the ulnar nerve had significantly worse results. Those with abnormal findings on nerve conduction studies who had not filed for compensation had the best symptom and function scores and satisfaction at latest follow-up examination; those with normal findings on nerve conduction studies who had filed for compensation had the poorest outcome. Although most patients were satisfied with the overall outcome, many reported residual symptoms; in addition to the 15 patients who required a third operation, 22 patients were dissatisfied with the final result. (J Hand Surg 1996;21A:347–356.)

The most common complication after carpal tunnel operations is failure to relieve symptoms. Mackinnon[1] recently reviewed this complication and found a reported incidence range of 7–20%. Inadequate release of the distal portion of the flexor retinaculum is the most frequently reported cause of this complication.[2–6] Incomplete proximal release and transverse incisions have also been implicated.[7]

To date, no large series on reoperation for carpal tunnel syndrome has been reported. Furthermore, outcome has not been well standardized. The purpose of this study was to evaluate a large series of patients undergoing reoperation for carpal tunnel syndrome and to report the long-term outcome for this procedure by using a standardized questionnaire as a measure of outcome.

Materials and Methods

The surgical records at our institution were reviewed to identify all patients undergoing a second operation for carpal tunnel syndrome between 1970 and 1990. Between 1970 and 1990, 253 patients had a first reoperation for carpal tunnel syndrome. Eighteen cases of bilateral carpal tunnel reoperations were excluded because of the likely confusion in evaluating the results obtained with the questionnaire. Follow-up data were collected through questionnaires mailed in 1993. Eleven patients were lost to follow-up evaluation, 48 had died, and 24 were unable (eg, because of Alzheimer's disease) and 21 were unwilling to answer the follow-up questionnaire. Thus, 131 patients met the inclusion criteria and were available, willing, and capable of completing the questionnaire. Fifteen of these patients had had subsequent surgical procedures for failure to relieve symptoms. In these patients, the questionnaire, which asked patients to report their current status, could not survey the long-term result of the first reoperation. For the purpose of

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this study, these patients were considered to have had treatment failure and were excluded from the questionnaire evaluating outcome, but they were included in the other analyses. Each of the 116 other patients completed a standardized questionnaire that surveyed symptoms, functional status, and satisfaction.[7] The mean follow-up period for the 131 patients was 11 years (range, 2–23 years).

The 131 patients included 87 women and 44 men. At the time of reoperation, their median age was 52 years (mean age, 51 years; range, 20–79 years). The right hand was affected in 80 patients and the left hand in 51. The cause of carpal tunnel syndrome was idiopathic in 73 patients, repetitive motion in 27, acute trauma in 13, diabetes mellitus in 11, rheumatoid arthritis in 4, and other causes in 3. Of the patients, 60 were manual laborers, 38 were office workers, and 19 were homemakers; 14 patients performed other work or the work was not specified. One hundred three patients were right-hand dominant, and eight were left-hand dominant. Hand dominance was not recorded in the medical records of the 20 other patients.

The demographics of the patients who were unable to respond or refused to respond to the questionnaire were assessed to allow comparison of the respondents and nonrespondents. There were 24 patients who were unable to respond. The mean age of this group was 52 years (range, 20–90 years). There were 11 men and 13 women. Of the 21 patients who refused to respond, 12 were men and 9 were women. The mean age of this group was 64 years (range, 36–89 years), which is 14 years older than those who responded to the questionnaire.

Statistical Methods

Surgery outcomes were categorized in ordinal scores, because the questionnaire requested that the patient select one of five responses in a Likert scale for each item.[7] The effects of risk factors such as workers' compensation on outcome scores were evaluated with Wilcoxon's rank sum test. Comparison of proportions such as the proportion of patients with a symptom-free period were made with the chi-square test. Spearman's correlation was used to assess the association of functional status and symptom scores with patient satisfaction. P values of less than .05 were considered significant.

Survey questionnaires were sent to all patients. The questionnaires asked patients to report their status during the 2 weeks immediately before the questionnaire was received. The questionnaire included scales for symptom severity and function[7] (Tables 1, 2). The symptom severity score is derived from patient responses to 11 questions that assess the symptoms on a 1-to-5 scale with respect to severity, type, frequency, and timing[7] (Table 1). A patient with

Table 1. Symptom Severity Scale

Question	*No. of Patients*	*No. of Patients Not Responding to Question*
How severe is the hand or wrist pain that you have at night?		1
1. I do not have hand or wrist pain at night	63	
2. Mild pain	24	
3. Moderate pain	23	
4. Severe pain	4	
5. Very severe pain	1	
How often did hand or wrist pain wake you up during a typical night in the past 2 weeks?		1
1. Never	76	
2. Once	19	
3. Two or three times	18	
4. Four or five times	2	
5. More than five times	0	
Do you typically have pain in your hand or wrist during the daytime?		1
1. I never have pain during the day	50	
2. I have mild pain during the day	32	
3. I have moderate pain during the day	27	
4. I have severe pain during the day	5	
5. I have very severe pain during the day	1	

(Table continues)

Table 1. *(Continued)* Symptom Severity Scale

Question	*No. of Patients*	*No. of Patients Not Responding to Question*
How often do you have hand or wrist pain during the daytime?		2
1. Never	53	
2. Once or twice a day	25	
3. Three to five times a day	12	
4. More than five times a day	4	
5. The pain is constant	20	
How long, on average, does an episode of pain last during the daytime?		1
1. I never get pain during the day	52	
2. Less than 10 minutes	19	
3. 10 to 60 minutes	16	
4. Longer than 60 minutes	4	
5. The pain is constant throughout the day	24	
Do you have numbness (loss of sensation) in your hand?		1
1. No	42	
2. I have mild numbness	29	
3. I have moderate numbness	29	
4. I have severe numbness	9	
5. I have very severe numbness	6	
Do you have weakness in your hand or wrist?		1
1. No weakness	33	
2. Mild weakness	28	
3. Moderate weakness	42	
4. Severe weakness	10	
5. Very severe weakness	2	
Do you have tingling sensations in your hands?		1
1. No tingling	48	
2. Mild tingling	32	
3. Moderate tingling	25	
4. Severe tingling	9	
5. Very severe tingling	1	
How severe is numbness (loss of sensation) or tingling at night?		1
1. I have no numbness or tingling at night	59	
2. Mild	24	
3. Moderate	19	
4. Severe	8	
5. Very severe	5	
How often did hand numbness or tingling wake you up during a typical night during the past 2 weeks?		1
1. Never	82	
2. Once	18	
3. Two or three times	13	
4. Four or five times	2	
5. More than five times	0	
Do you have difficulty with the grasping and use of small objects such as keys or pens?		1
1. No difficulty	49	
2. Mild difficulty	25	
3. Moderate difficulty	24	
4. Severe difficulty	13	
5. Very severe difficulty	4	

no symptoms has a score of 1, and a patient with the most severe symptoms has a score of 5. The functional status score is designed and scored similarly and consists of eight questions that assess the effect of the symptoms on the activities of daily living[7] (Table 2). The patients were also surveyed for use of medications, work status, medicolegal status, satisfaction, and comorbidity. The total number of

Table 2. Functional Status Score

Activity	Difficulty Level: None		Mild		Moderate		Severe		Cannot Do at All Because of Hand or Wrist Symptoms		No. of Patients Not Responding
	No. of Patients	% of Responses	No. of Patients	% of Responses	No. of Patients	% of Responses	No. of Patients	% of Responses	No. of Patients	% of Responses	
Writing	52	50	20	19	20	19	10	10	1	1	13
Buttoning of clothes	51	45	25	22	21	19	10	9	6	5	3
Holding a book while reading	53	48	21	19	25	23	8	7	4	4	5
Gripping a telephone receiver	66	58	21	19	19	17	5	4	2	2	3
Opening jars	32	29	19	17	29	26	18	16	14	13	4
Household chores	44	40	29	26	28	25	9	8	1	1	5
Carrying grocery bags	50	46	23	21	21	19	9	8	6	6	7
Bathing and dressing	71	63	22	20	16	14	3	3	1	1	3

patients reported for each question did not always equal 116, because some patients (usually less than 3) did not respond to every question.

Primary Carpal Tunnel Surgery

Thirty-one patients had their primary operation at our institution, and 100 had it performed elsewhere.

The mean symptom-free period after the initial carpal tunnel release was 50 weeks (range, 0–936 weeks), with no symptom-free period for 85 of the patients, 1–6 weeks of symptomatic relief for 15 patients, and more than 6 weeks of symptomatic relief for 31 patients. Pain was worse after the primary carpal tunnel release in 35 patients. Strength was worse in 4 patients, and 10 complained that numbness was worse.

Complications after the first carpal tunnel release included infection in 3 patients, wound healing problems in 8, reflex sympathetic dystrophy in 10, and various other problems in 8. Associated medical conditions included diabetes mellitus in 13 patients, previous local trauma in 9, rheumatoid arthritis in 5, and various other disorders in 13 others. Thirty patients were smokers who averaged 20 packs per year of exposure.

Reoperation

The indications for reoperation were based on the presence of persistent or recurrent disabling symptoms. Most patients had multiple symptoms. The chief complaints of those presenting for revision carpal tunnel release were numbness in 91 patients, pain in 90, weakness in 14, tingling in 58, cramping in 3, and swelling in 5. On clinical examination, 41 patients were found to have some degree of motor weakness.

Before reoperation for carpal tunnel syndrome, a Tinel sign was present in 70 patients, absent in 28, and not recorded in 33. Phalen's test was positive in 50 patients, negative in 30, and not recorded in 51. The carpal tunnel compression test[8] was positive in 27 patients, negative in 11, and not recorded in 93. Mean (± SD) grip strength for the study group was 19.8 ± 12.6 kg. Mean (± SD) tip pinch was 3.7 ± 2.3 kg. Mean (± SD) side pinch was 6.1 ± 3.6 kg. All 131 patients had electromyographic testing preoperatively, and of these patients, 24 (18.3%) had normal results and 107 (81.7%) had abnormal results, confirming the clinical diagnosis of carpal tunnel syndrome.

The mean (± SD) interval between the first and second operations was 2 ± 3 years. The shortest interval was 29 days and the longest was 18 years. The reoperation was performed under general anesthesia in 54 patients, with regional block in 20, and with local anesthesia in 56. The mean length of the operation was 68 minutes (range, 6–195 minutes). At the time of reoperation, the flexor retinaculum was found to have an incomplete distal release in 29

patients (22%), incomplete central release in 2 (1.5%), incomplete proximal release in 11 (8.4%), and incomplete release of the entire flexor retinaculum in 11 (8.4%). Seventy-eight patients (59.5%) previously had complete division of the flexor retinaculum. Fibrosis and regrowth of the retinaculum were reported in 20 and 73 patients, respectively.

Flexor tendons were adherent to the median nerve in 11 patients. Fibrosis of the flexor tendons was reported in 15 patients. The nerve was noted to be subluxed or dislocated anteriorly out of the confines of the carpal tunnel in 4 patients. The median nerve was adherent to the flexor retinaculum in 61 patients, and intraneural fibrosis was observed in 33.

The flexor retinaculum was released or rereleased in 104 patients, repaired in 6, and resected in 8. Other procedures included 66 flexor tenosynovectomies, 6 tenolyses, 67 epineurotomies, 33 epineurectomies, 92 external neurolyses, and 19 internal neurolyses. Soft tissue flaps were used to cover the nerve in 11 patients. Two patients had associated Dupuytren's release, and five had associated trigger-finger release.

Postoperative treatment included immobilization in 121 patients for a mean (± SD) of 16 ± 10 days. Excised tissue from 75 patients was submitted for histologic examination and revealed fibrosis in 63 and inflammation in 8. Postoperatively, there were nine complications of wound healing, four infections, and three cases of reflex sympathetic dystrophy.

Results

Fifteen patients stated that they had had additional surgical treatment after the index reoperation. The questionnaires of these patients were excluded from further analysis, and for the purposes of this study, the result in these 15 patients was considered to be failure. Of the 116 other patients, 21 stated that they had had additional nonsurgical treatment after the index reoperation. This treatment included splinting in 12 patients, steroid injection in 9, physical therapy in 12, and other forms of nonsurgical treatment in 8. These 21 patients were included in the subsequent analysis.

During the 2 weeks preceding completion of the evaluation form, 4 patients stated that they had used narcotic medications (primarily codeine and propoxyphene) on a daily basis to treat the symptoms of carpal tunnel syndrome, 16 stated that they had used narcotics but not daily, and 95 stated that they had never used narcotic medications. Seventy-one patients stated that they had never used non-narcotic medications for hand or wrist pain, and 21 stated that they had occasionally used non-narcotic medications. Non-narcotic medications were used almost daily by 10 patients and daily by 14 others.

Work Status

At the time the patients answered the questionnaire, most of them were retired, unemployed, or worked in the home. At the time of completion of the questionnaire, 28 patients (24%) were working full time and 11 (10%) were working part time. Sixteen of these patients (14%) stated they were working with restrictions because of carpal tunnel syndrome. Nine patients (8%) stated that they were currently without work because of carpal tunnel syndrome, because their hands were too uncomfortable (2 patients), their employer was unable to modify their job (6 patients), their physician instructed them to discontinue their work (3 patients), or their employer recommended that they stop work (3 patients). One patient had to change jobs in the previous year because of carpal tunnel syndrome, and 19 stated that they had to modify their job to improve their comfort. Workers' compensation claims were pending for 1 patient, active for 8, and closed for 17. No compensation claim had been filed by 84 patients. Seventeen patients had contacted an attorney because of carpal tunnel syndrome. Only two patients stated that they had missed any time from work because of carpal tunnel syndrome in the 6 months preceding completion of the questionnaire.

The mean (± SD) time to regular employment after reoperation was 7.8 ± 8 weeks. The mean (± SD) time to resumption of normal recreational activities after reoperation was 8 ± 8 weeks. The mean (± SD) time to resumption of normal household and yard work after reoperation was 9 ± 9 weeks.

Symptom Severity and Functional Status Scores

The mean (± SD) symptom severity score was 1.92 ± 0.82. The mean functional status score of this group was 1.95 ± 0.9. Work relatedness of carpal tunnel syndrome as documented from review of the medical records was not significantly related to the final symptom severity or functional status scores. However, the status of having filed for compensation, as reported by the patient on the questionnaire, at the time of latest follow-up examination did have

a significant effect. For the purpose of the questionnaire, compensation was defined as workers' compensation, private disability insurance, Social Security disability income, or supplemental security income. For those who had filed claims, the mean symptom severity score was 2.35 and the mean functional status score was 2.40, and for those who had not filed for compensation, these scores were 1.85 ($p < .07$) and 1.91 ($p < .014$), respectively.

Patients who had abnormal findings on nerve conduction studies before reoperation had a mean symptom severity score of 1.88 and a mean functional status score of 1.95. For those with normal results on nerve conduction studies, these scores were 2.42 and 2.30, respectively. Those who had abnormal findings on nerve conduction studies before reoperation had significantly better final symptom severity scores ($p = .005$) and functional status scores ($p < 0.07$) than those with normal findings.

The patients were stratified by the variables of preoperative electromyography and filing for compensation. Those with abnormal findings on nerve conduction studies who had not filed for compensation had the best results. In this group, the mean symptom severity score was 1.8 and the mean functional status score was 1.9. Those with normal findings on these studies who had filed for compensation had the poorest outcome, a mean symptom severity score of 2.7 ($p < .02$) and a mean functional status score of 2.8 ($p < .03$).

The presence of an incomplete release of the flexor retinaculum was significantly associated ($p < .02$) with the absence of a symptom-free period after the initial carpal tunnel release. For the 67 patients found to have a complete release, the mean ($\pm$ SD) symptom-free period was 75 ± 178 days after the initial carpal tunnel release. Patients found to have an incomplete release at the time of reoperation had a mean symptom-free period of 17 ± 70 days. Although the absence of a symptom-free interval and incomplete release were statistically associated, neither was associated with poorer outcome or satisfaction, and the presence of an incomplete proximal release did not correlate with either an abnormal Phalen's test or abnormal electrodiagnostic study result.

Patients who reported pain in the ulnar nerve distribution (ring and small fingers) had a final mean symptom severity score of 2.3 and a final mean functional status score of 2.3; for those who did not report pain, these scores were 1.8 and 1.9, respectively. These differences were significant for both symptom severity ($p < .005$) and functional status scores ($p < .02$).

No other variable was significantly associated with symptom severity score or functional status score.

The functional status scores (Spearman correlation coefficient = 0.59; $p < .0001$) and symptom severity scores (Spearman correlation coefficient = 0.68; $p < .0001$) correlated significantly with satisfaction. Patients who were completely satisfied had mean scores of 1.7 and 1.8 for symptoms and function, respectively, and those who were dissatisfied had mean scores of 2.6 and 2.5, respectively.

Patient Satisfaction

Thirty-eight patients rated the surgical procedure as completely successful, with 100% relief of their problems. Another 27 patients rated the procedure as very successful, with 75% relief. Twenty-two patients considered the surgical procedure somewhat successful (50% relief), 12 as not very successful (less than 50% relief), and 14 as completely unsuccessful.

Sixty-six patients denied any pain or tenderness at the incision or scar from the carpal tunnel reoperation. Mild, moderate, and severe pain was found in 20, 22, and 4 patients, respectively. Pain or tenderness limited activities slightly in 23 patients and considerably in 6. Mild pain (other than at the incisional site) was reported by 14 patients, and moderate and severe pain was reported by 24 and 5 patients, respectively. Twenty-eight patients stated that the condition was made worse in some respects by the operation.

Overall, carpal tunnel symptoms were reported to be completely resolved in 26 patients. The symptoms were said to be much better by 24 patients, somewhat better by 12, somewhat worse by 29, and much worse than expected by 15. The patients were asked, "If you could go back in time and make the decision again, would you choose to have the operation?" Seventy-two patients said that they would definitely have the operation again, 12 said that they probably would have the operation again, and 10 were unsure. Nine patients stated that they probably would not have the operation, and 10 said that they definitely would not have the operation again.

Fifty-two patients stated that the operation greatly improved their quality of life, but 21 said that it made little or no improvement in their quality of life. According to 20 patients, the operation made the quality of life worse or much worse. Patient satisfac-

tion was also rated for specific symptoms. Satisfaction was higher for pain relief than it was for numbness, strength, or ability to perform specific activities (Table 3).

Discussion

Division of the flexor retinaculum for median nerve compression in the carpal tunnel is one of the most common procedures performed on the hand.[7,9] Results of this procedure are generally good, with a successful outcome in up to 100% of patients in some series.[6,10] Nevertheless, failures occur.[4,5,11–19] The reported incidence of failure ranges from less than 1% to more than 25%.[18,20–22]

Several small series of reoperations after failed carpal tunnel release have been reported.[1,3,5,12,14,16–19,23–26] The present report describes long-term results in a large clinical series. Outcome based on the perceptions of patients has not been well established for such a group.

Failures requiring a third operation for symptoms persisting after the second operation occurred in 15 of the 131 patients who were followed after a second operation for carpal tunnel release in the present series. An additional 14 of the 116 patients who responded to the questionnaire stated that the second operation was completely unsuccessful, producing no relief of symptoms, and 22 of the 116 patients were dissatisfied with the result of the reoperation. Thus, about one fourth of the 131 patients in this review can be considered to have had a poor result. Failure rates of up to 40% have been reported by others.[5,7] Residual symptoms after reoperation for carpal tunnel syndrome were present in 43% of the patients in the study of Chang and Dellon,[25] in 90% of those in the study by O'Malley et al.,[5] in 82% of those reviewed by Rose et al.,[16] in 41% of those reported by Roullet and Morin,[27] and in more than 95% of those reported by Strasberg et al.[28] These results are comparable to our findings of residual symptoms in 68% of patients.

The only preoperative variables that were significantly associated with outcome in our study were compensation status and the results of preoperative nerve conduction studies. Patients who had abnormal findings on preoperative nerve conduction studies had significantly better final symptom severity scores ($p = .005$) and functional status scores ($p = .07$) than those with normal findings. Chang and Dellon[25] assessed this variable in 35 patients with persistent or recurrent carpal tunnel syndrome and

Table 3. Patient Satisfaction Rating

	Completely Satisfied		*Very Satisfied*		*Somewhat Satisfied*		*Dissatisfied*		*Very Dissatisfied*		*No. of*
Category of Satisfaction	*No. of Patients*	*% of Responses*	*No. of Patients*	*% of Responses*	*No. of Patients*	*% of Responses*	*No. of Patients*	*% of Responses*	*No. of Patients*	*% of Responses*	*Patients not Responding*
Relief of:											
Nighttime pain	51	48	18	17	24	22	9	8	5	5	9
Daytime pain	44	41	19	18	25	23	12	11	7	7	9
Tingling	44	42	14	14	19	18	21	20	6	6	12
Numbness	39	37	18	17	23	22	15	14	10	10	11
Sensation (ability to feel things) in hand and fingers	34	32	18	17	29	27	16	15	9	9	10
Strength	21	20	10	10	36	34	28	27	10	10	11
Ability to grasp and use small objects	27	26	17	17	29	28	20	19	10	10	13
Performance at work (leave blank if does not apply)	13	37	11	31	9	26	2	6	0		81
Performance of household tasks	29	28	23	22	34	32	13	12	6	6	11
Performance of recreational activities	24	24	24	24	25	25	19	19	9	9	15
Overall level of satisfaction	29	27	24	22	33	31	10	9	12	11	8

found no significant difference in sensorimotor function whether the test results were normal or abnormal. Differences in study design and size may account for the differences observed between their study and the present one. In their study, 16 patients with abnormal findings on nerve conduction tests were compared with 9 patients who had normal findings. In our study, 131 patients had preoperative nerve conduction studies, 24 of which had normal findings. Furthermore, the methods of assessment were different. In the study of Chang and Dellon, sensorimotor scores were used that were based on clinical measurements.[29] In our study, symptom severity and functional status scores were derived from information provided by the patients. Functional status and symptom severity scores have a positive but weak correlation with clinical measurements of median nerve dysfunction.[7,30] We suspect that questionnaires and clinical measurements assess different dimensions of outcome.[30] As in our study, questionnaire results often correlate well with patient satisfaction. Some clinical measurements, such as grip strength, also correlate well with satisfaction, but measures of sensibility correlate less well.[30,31] Other studies that have reported nerve conduction values for patients having reoperation for carpal tunnel syndrome did not include statistical comparisons.[3,5,16,19]

O'Malley et al.[5] reported the results of 20 cases of reoperation for unrelieved symptoms after carpal tunnel release. After reoperation, improvement was observed in eight of nine patients with the following characteristics: short or transverse incisions, symptoms that caused nocturnal awakening, symptoms exacerbated by activity, or positive Phalen's test. Unsatisfactory results were found in all four patients who did not have these findings. The authors concluded that these characteristics were important prognostic indicators. Our study did not assess the type of incision used in the primary operation, but neither Phalen's test nor symptoms were associated with poorer outcome.

An association has been observed between a distally incomplete release and a paradoxically negative Phalen's test,[26] suggesting that by releasing only the proximal aspect of the flexor retinaculum, the fulcrum effect of the flexor retinaculum is shifted distally and Phalen's test will be negative, whereas significant compression distally maintains median nerve compression. We analyzed the results of Phalen's test with respect to the type of incomplete release and found no such correlation in our patients.

Better results might be expected in patients found to have incomplete release of the flexor retinaculum,[5,18] but we found no difference in outcome between those who had incomplete release and those who had complete release. The release was complete in 67 patients and incomplete in 53. The flexor retinaculum was intact entirely in 11 patients and was intact proximally in 11 patients, centrally in 2, and distally in 29. The incidence of incomplete release of the flexor retinaculum after failed carpal tunnel release varies from 0% to 65% in reported series.[3–5,15,16,18,19,25,26] Incomplete release occurred most frequently at the distal aspect of the flexor retinaculum in our patients, which is consistent with the observations of previous studies.[3,26] Incomplete release has been reported to be the most common cause of failure after carpal tunnel release.[24] Langloh and Linscheid[3] found that patients with incomplete release had incomplete relief (lasting 2–3 months) or no relief after the initial operation, whereas the mean period of relief for those with complete release was 18 months. Comparable results were found in our study. The frequency of incomplete release as a factor in reoperation appears not to have decreased appreciably in the 20 years since the work of Langloh and Linscheid. In our study, the presence of incomplete release was statistically correlated with the absence of a symptom-free period after the initial carpal tunnel release but not with final symptoms or satisfaction after reoperation.

Levine et al.[7] developed a self-administered questionnaire for assessing severity of symptoms and functional status in patients with carpal tunnel syndrome. This scale was designed to address the principal concerns of patients and has been noted to be reproducible, internally consistent, and responsive to clinical change.[7,30] Levine et al.[7] reported on 38 patients and Amadio et al.[30] on 22 patients with primary carpal tunnel surgery; in those series, the postoperative symptom scores were 1.9 and 2.1, respectively, and the postoperative function scores were 2.0 and 1.8, respectively. These scores are comparable to our results of revision carpal tunnel operation; in our study, the mean symptom severity and functional status scores were 1.92 and 1.95, respectively. It should be noted that 15 of our patients had had a third operation before we assessed their symptoms. These failures were not included in the symptom and function scores. If these patients had been assessed before their third operation, their scores would likely have been higher.

We found no difference in outcome based on the type of surgical procedure performed. Our study covered a 20-year period during which various techniques were introduced to improve the results of reoperation.[16,18–20,25,32,33] Most of our patients had simple decompression, often with external neurolysis and local synovectomy. In this series, various procedures were used on the flexor retinaculum, including release, repair, resection, and reconstruction; associated procedures that were used included epineurotomy, epineurectomy, external neurolysis, internal neurolysis, and various soft tissue flaps. None of these additional procedures was associated with an outcome different from the overall mean. Internal neurolysis has been used in cases of revision carpal tunnel operation, but it is not clear that this technique improves outcome.[18,25] We noted a trend toward poorer results, without statistical significance, in patients who had had internal neurolysis. Because our study is retrospective, we have no way of knowing if this trend is due to patient selection or an adverse effect of internal neurolysis. Various soft tissue flaps have been reported to improve the quality of coverage and blood supply to the median nerve.[16,19,20,23,32,33] The clinical efficacy of these procedures has not been clearly established, and we noted no association with improved outcomes in our own series.

The strengths of the present study lie in its long-term perspective and focus on issues of importance to patients (ie, symptoms, function, work status, and satisfaction). The weaknesses relate to the loss of nearly half of the original sample because of death, severe medical impairment, and other factors, and the lack of "objective" physical measures of median nerve function and physical capacity. However, because previous work[7,30] has shown that such factors do not correlate as well with final patient satisfaction after carpal tunnel release, we believe this last weakness is a relative one. A third weakness relates to the size of effects noted for the differences that were significant. One might argue that a difference of less than one-half point on a five-point scale might be statistically significant but not clinically significant. The first weakness, we believe, is inherent in any long-term study. Although these weaknesses must temper any conclusions, we believe our observations to be reasonable and valid.

Although operative treatment for primary carpal tunnel syndrome is generally rewarding, revision procedures are less satisfying. Only about one fourth of the patients will be completely satisfied, with no residual symptoms occurring after a second operation for carpal tunnel syndrome. Furthermore, one in four operations will fail, requiring additional operations or resulting in dissatisfied patients.

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