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Original Article

# Factors Correlated with Unfavorable Outcome after Carpal Tunnel Release Surgery

**Fakhr Fakhouri, Rana Alnasser Alsukhni[1], Bashar Altunbi, Zakaria Hawoot[1], Rasha Dabbagh[2]**

*Departments of Surgery and [1]Internal Medicine, Division of Neurosurgery, Aleppo University Hospital, [2]Department of Laboratory Medicine, Aleppo University Hospital, Aleppo, Syria*

## Abstract

**Objectives:** Carpal tunnel release surgery has excellent results. The aim of this study was to identify which baseline clinical and demographic factors could predict a good outcome from surgery. Understanding the impact of prognostic factors will enable surgeons to indicate surgical intervention better, provide appropriate preoperative counseling, and manage expectations postoperatively. **Materials and Methods:** A prospective, observational study included 620 carpal tunnel syndrome patients (age 42.38 ± 11.18 years; mean ± standard deviation). After the diagnosis had been confirmed by electrodiagnostic studies, patients underwent open carpal tunnel release surgery. Patients were evaluated initially after 2 weeks and eventually after 6 months. Surgical outcome was compared with presurgical findings. **Results:** Response to surgery was good in 89.4% and 94.2% after 2 weeks and 6 months, respectively. Factors correlated significantly with unfavorable outcome of surgery included old age, longer duration of symptoms, negative Phalen's test, abnormal two-point discrimination test, and weakness of abductor pollicis brevis muscle. Gender, retrograde radiation, and nocturnal symptoms did not correlate with surgical outcome. **Conclusion:** Elderly patients with longstanding disease, neurological deficits, and negative Phalen's test may not respond to surgery as others. This should be kept in mind in preoperative counseling and postoperative expectations.

**Keywords:** *Carpal tunnel release, carpal tunnel syndrome, outcome, prognostic factors*

## Introduction

Carpal tunnel syndrome (CTS) is the most common peripheral neuropathy.[1] Incidence is estimated at 0.125%–5% according to diagnostic criteria. Incidence peaks in the late 1950s, particularly in women, and the late 1970s, when the sex ratio is more equal.[2] Elderly people tend to present with more severe CTS for the same length of history, with 59% of patients aged over 65 having thenar and/or atrophy at presentation compared with 18% of younger patients.[3] CTS in older patients is more readily confused with other, less treatable, disorders.[4]

A large amount of research has been dedicated to identifying clinical variables that may predict the success of surgical treatment.[5] Preoperative discussion provides patient with appropriate postoperative expectations, while also giving the surgeon a framework to best judge success in each single patient.[6]

## Materials and Methods

### Ethics

This study was conducted in the Neurosurgery and Orthopedics Divisions of Aleppo University Hospital (AUH), Aleppo, Syria, from 2011 to 2014. Before the collection of data, approval for this study was obtained from the Scientific Research Board, University of Aleppo. Full written consent, including the permission of publication, was obtained from all participants at their initial visit.

### Subjects

Patients were recruited among those referred to AUH with a complaint of CTS. Patients with bilateral disease were enrolled only once for the first affected side.

### Inclusion and exclusion criteria

Inclusion criteria were age over 18 years, primary idiopathic CTS, disease duration of at least 6 months, and failed medication therapy. The diagnosis was made clinically based on typical history and physical



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***Address for correspondence:***
*Dr. Fakhr Fakhouri, Department of Surgery, Division of Neurosurgery, Aleppo University Hospital, Jama Square, Almuhafaza, Aleppo, Syria.*
*E-mail: fakhrf@msn.com*

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findings and confirmed by nerve conduction study according to the guidelines of the American Association of Electrodiagnostic Medicine.

Exclusion criteria included joint or thyroid disease, contraindication to surgery, history of wrist trauma/surgery, pregnancy, or lactation. We ruled out patients with clinical or electrophysiological findings, suggesting conditions that could mimic CTS.

### Baseline records

Before surgery, patients were questioned for the symptoms territory (whole hand vs. radial fingers), presence of retrograde pain radiation, and symptom-related nocturnal awakening. Neurological examination included two-point discrimination test, abductor pollicis brevis muscle strength, Phalen's test, and Tinel's sign.

### Intervention

All patients underwent open carpal tunnel release surgery under local anesthesia. The surgical technique used was open-field carpal tunnel release using longitudinal incision.

### Outcome assessment

Patients were asked to rate response to surgery as "good," "fair," or "poor" depending on overall symptoms relief (complete relief, partial relief, or minimal or no relief, respectively). Patients were followed up for 6 months, and response to surgery was recorded twice:

1. Response to surgery after 2 weeks (RTS2W).
2. Response to surgery after 6 months (RTS6M).

### Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences (version 19.0, IBM SPSS Statistics, Armonk, NY, USA). Independent samples *t*-tests were used for two-group comparisons of continuous data (age and duration of complaint). Chi-square and Fisher's exact tests were used to compare differences between the groups. $P < 0.05$ was considered statistically significant.

## Results

### Demographic and clinical features

Patients who were lost to follow-up were excluded from the study. This resulted in a total sample of 620 CTS patients, aged 23–77 years. The mean age of participants was 42.38 ± 11.18 years (mean ± standard deviation [SD]). Female to male ratio was 10.48:1. The mean duration of complaint was 4.28 ± 4.99 years (mean ± SD). Table 1 shows descriptive statistics for baseline clinical data.

The most consistent clinical feature was nocturnal awakening (96.1%), followed by positive Phalen's test (93.2%). 21.3% of patients had both sensory and motor deficits consistent with severe disease.

### Overall surgery outcome

All patients responded to surgery to some degree, corroborating that diagnosis was strictly confirmed. Overall response to surgery is shown in Table 2.

### Relation between response to surgery and baseline records

#### *Gender*

Response to surgery was similar between male and female patients after 2 weeks although male patients response was better at 6 months (100% vs. 93.6%; $P = 0.034$) [Table 3].

#### *Age*

The mean age of those with fair response was significantly larger. Age had a strong impact on the outcome, especially in the long term [Table 4].

**Table 1: Patients distribution according to baseline (presurgical) clinical data**

| Variable | *n* (%) |
|---|---|
| Symptom distribution | |
| Whole hand | 398 (64.2) |
| Radial fingers | 222 (35.8) |
| Retrograde radiation | |
| Present | 482 (77.7) |
| Absent | 138 (22.3) |
| Nocturnal awakening | |
| Present | 596 (96.1) |
| Absent | 24 (3.9) |
| Phalen's test | |
| Positive | 578 (93.2) |
| Negative | 42 (6.8) |
| Tinel's sign | |
| Positive | 416 (67.1) |
| Negative | 204 (32.9) |
| Sensory two-point discrimination test | |
| Normal | 291 (46.9) |
| Affected | 329 (53.1) |
| Motor APB muscle strength | |
| Normal | 476 (76.8) |
| Affected | 144 (23.2) |
| Both sensory and motor exam normal | 279 (45) |
| Either examination affected | 209 (33.7) |
| Both sensory and motor test affected | 132 (21.3) |

APB – Abductor pollicis brevis

**Table 2: Overall surgical outcome**

| | Response to surgery | | |
|---|---|---|---|
| | Good, *n* (%) | Fair, *n* (%) | Poor, *n* (%) |
| RTS2W | 554 (89.4) | 66 (10.6) | 0 |
| RTS6M | 584 (94.2) | 36 (5.8) | 0 |

RTS2W – Response to surgery after 2 weeks; RTS6M – Response to surgery after 6 months

**Table 3: Relation between response to surgery and gender**

| | RTS2W | | | RTS6M | | |
|---|---|---|---|---|---|---|
| | Good, *n* (%) | Fair, *n* (%) | *P* | Good, *n* (%) | Fair, *n* (%) | *P* |
| Gender | | | | | | |
| Male | 48 (88.9) | 6 (11.1) | 0.907* | 54 (100) | 0 | 0.034** |
| Female | 506 (89.4) | 60 (10.6) | | 530 (93.6) | 36 (6.4) | |

*Pearson Chi-square, **Fisher's exact test. RTS2W – Response to surgery after 2 weeks; RTS6M – Response to surgery after 6 months

**Table 4: Relation between response to surgery and age**

| | Age (mean±SD), years | *P* |
|---|---|---|
| RTS2W | | |
| Good | 41.79±10.37 | 0.006* |
| Fair | 47.36±15.70 | |
| RTS6M | | |
| Good | 41.33±10.38 | <0.001* |
| Fair | 59.42±9.89 | |

**P*-value was calculated using Student's *t*-test. RTS2W – Response to surgery after 2 weeks; RTS6M – Response to surgery after 6 months; SD – Standard deviation

### *Clinical examination/findings*

When patients confined complaint to the radial fingers, the RTS6M was significantly better, though RTS2W was not. The presence of retrograde radiation or nocturnal awakening did not affect the outcome. Phalen's test had much more impact on the outcome than Tinel's sign. Table 5 shows that response to surgery was clearly worse when Phalen's test was negative for the two periods of follow-up. The presence of either sensory or motor deficit obviously affected RTS2W. Moreover, RTS6M was good in all patients except those with concomitant sensory and motor deficit altogether.

### Which patients are more likely to get better with time?

Response to surgery improved with time, indicating that outcome of surgery should not be judged solely on short-term basis. Sixty-six patients did not respond shortly after surgery (at 2 weeks). However, some of them ($n$ = 30) did respond after 6 months (Group 1) while others ($n$ = 36) did not (Group 2). We studied this subset of patients in more details and noted that age and duration of disease of those who got better with time were much lower than those who did not show improvement with time Table 6.

Hence, of patients who do not respond well shortly after surgery, younger ones and those with shorter duration of disease are more likely to get better with time.

## Discussion

Although this study does not deal with the surgical decision, we aimed to identify patients with suboptimal results, in order to fit patients' expectations more accurately.

Preoperative counseling is an essential part of surgeon job. The availability of medical information is getting wider and wider. Patients nowadays have a greater understanding of the risks, benefits, and outcomes of surgery.[7] Involving patients in the decision-making process has been proven to increase patient satisfaction.[8]

Satisfaction after carpal tunnel release can be predicted from clinical evaluation. In general, patients without neurologic deficits, of younger age, with short duration of symptoms, and with positive Phalen's test have greater satisfaction and more predictable outcomes from their surgery. Once median nerve compromise has progressed to clinically evident weakness, the goal of carpal tunnel release is to stop further progression of the disease. When the response to surgery in the immediate postoperative period is "not so good," younger patients with shorter duration of disease are still expected to get better with time.

Patient gender has been considered in most studies regarding carpal tunnel surgery. Most studies have not shown any substantial impact of gender on outcome after carpal tunnel surgery.[9-11] Only one study demonstrated that women have higher satisfaction than men after endoscopic carpal tunnel surgery.[12]

Physicians should work to accurately identify patients who are at greatest risk for poor outcomes and use preoperative education and counseling to establish appropriate, customized expectations for treatment.

An evaluation of patients through an individualized, patient-centered approach will enable the best assessment and treatment of patients with CTS.

### Study limitations

This study did not adhere to Levine or Michigan questionnaire to evaluate the severity of clinical symptoms or the surgical outcome. The use of such a questionnaire could have increased the value of the study.

## Conclusion and Recommendations

In the appropriately selected patient, carpal tunnel surgery has the potential for excellent outcomes with high levels of patient satisfaction. In a certain subset of patients, however, a reliable outcome cannot be predicted. Long duration of disease is one factor that can be controlled. It is not advisable to let patients go through a very extended period of conservative management.

### Financial support and sponsorship

Nil.

**Table 5: Relation between response to surgery and clinical findings**

| Variable | RTS2W | | | RTS6M | | |
|---|---|---|---|---|---|---|
| | Good, *n* (%) | Fair, *n* (%) | *P* | Good, *n* (%) | Fair, *n* (%) | *P* |
| Symptom distribution | | | | | | |
| Whole hand | 350 (87.9) | 48 (12.1) | 0.126 (*P*) | 362 (91) | 36 (9) | <0.001 (*P*) |
| Radial fingers | 204 (91.9) | 18 (8.1) | | 222 (100) | 0 | |
| Retrograde radiation | | | | | | |
| Present | 428 (88.8) | 54 (11.2) | 0.400 (*P*) | 458 (95) | 24 (5) | 0.1 (*P*) |
| Absent | 126 (91.3) | 12 (8.7) | | 126 (91.3) | 12 (8.7) | |
| Nocturnal awakening | | | | | | |
| Present | 530 (88.9) | 66 (11.1) | 0.064 (*P*) | 560 (94) | 36 (6) | 0.231 (*F*) |
| Absent | 24 (100) | 0 | | 24 (100) | 0 | |
| Phalen's test | | | | | | |
| Positive | 524 (90.7) | 54 (9.3) | 0.001 (*F*) | 554 (95.8) | 24 (4.2) | <0.001 (*F*) |
| Negative | 30 (71.4) | 12 (28.6) | | 30 (71.4) | 12 (28.6) | |
| Tinel's sign | | | | | | |
| Positive | 362 (87.0) | 54 (13.0) | 0.007 (*P*) | 392 (94.2) | 24 (5.8) | 0.955 (*P*) |
| Negative | 192 (94.1) | 12 (5.9) | | 192 (94.1) | 12 (5.9) | |
| Two-point discrimination | | | | | | |
| Normal | 285 (97.9) | 6 (2.1) | <0.001 (*P*) | 291 (100) | 0 | <0.001 (*P*) |
| Affected | 269 (81.8) | 60 (18.2) | | 293 (89.1) | 36 (10.9) | |
| APB muscle strength | | | | | | |
| Normal | 452 (95.0) | 24 (5) | <0.001 (*P*) | 476 (100) | 0 | <0.001 (*P*) |
| Affected | 102 (70.8) | 42 (29.2) | | 108 (75) | 36 (25) | |

RTS2W – Response to surgery after 2 weeks; RTS6M – Response to surgery after 6 months; APB – Abductor pollicis brevis

**Table 6: Compare mean age and symptom duration for the two sub-groups**

| Variable | Group 1 (*n*=30) | Group 2 (*n*=36) | *P* |
|---|---|---|---|
| Age (mean±SD), years | 32.90±6.11 | 59.42±9.89 | <0.001 |
| Duration of disease (mean±SD), years | 3.1±3.51 | 8.78±8.2 | |

SD – Standard deviation

## Conflicts of interest

There are no conflicts of interest.

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