

# Carpal tunnel release by using two mini incisions

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## ABSTRACT

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The Egyptian Orthopedic Journal; 2019 supplement (2), December, 54: 84-88

### Background:

Carpal Tunnel Syndrome (CTS) is an idiopathic median neuropathy characterized by entrapment. It produces paresthesia, pain, and other symptoms in the median nerve's distribution as a result of its confinement in the carpal tunnel at the wrist. The pathophysiology is not completely understood but can be considered compression of the median nerve traveling through the carpal tunnel.

### Patients and methods:

In this study, 60 cases presented with symptoms suggestive of C.T.S Patients were evaluated for any predisposing factors or etiological causes. The following symptoms were required to be indicative of carpal tunnel syndrome: nocturnal pain or par aesthesia in the median nerve distribution, weakness of the thenar muscles, or a poor hand grasp. The average age of the patient at the time of the operation was 38 years, with a range of 20 to 59 years. Females were more affected than males. The dominant hand was affected in 50% of patients, with 20% of patients complaining of bilateral manifestation, usually affecting one hand more than another. All cases were idiopathic with no specific cause found, with 6.67% of patients giving a history suggestive of a job requiring repeated hand movements.

### Results:

In our study, all patients (100%) were operated by double-mini incision release. There are marked improvement in pain, and marked improvement in weakness of hand. Complications were only seen in 13.3% of patients, 8.3% of patients complained of poor hand grip although they had marked improvement of numbness, and 5% of patients had tender scars.

### Conclusion:

Double mini-skin incision for treatment of CTS is a reliable, safe method of treatment.

### Keyword:

Double mini skin incision, transverse carpal ligament, good healing, no excessive scar formation

## Introduction

The numbness usually occurs at night, as humans tend to have Carpal Tunnel Syndrome (CTS) is an idiopathic median neuropathy characterized by entrapment. It produces paresthesia, pain, and other symptoms in the median nerve's distribution as a result of its confinement in the carpal tunnel at the wrist. The pathophysiology is not entirely comprehended; however, it can be interpreted as the compression of the median nerve as it traverses the carpal tunnel (1)

Piere Marie and Charles Foix submitted a report to the French Neurological Society in 1913 that detailed the extent to which the transverse carpal ligament contributes to the atrophy and paralysis of the thenar muscles. (2) In 1933 Abbott and Saunders published a large series of patients with chronic median neuropathy following fractures of the distal radius. Later that year James Learmonth reported on the first surgical release of the transverse carpal ligament for post-traumatic median nerve compression. (3)

The National Center for Biotechnology The most prevalent cause of CTS, according to current

information and highly cited older literature, is typing. (4)

Lozano-Calderón's most recent research has identified inheritance as a more significant factor than use (5)

The main symptom of CTS is intermittent numbness of the thumb, index, long, and radial half of the ring finger. (6) to sleep with flexed wrists. It can be alleviated by donning a wrist splint that prevents flexion (7)

The permanent nerve injury that results from long-standing CTS is characterized by constant numbness, atrophy of certain muscles in the thenar eminence, and weakness of palmar abduction (8)

## Patients and methods:

### Patients:

In this study 60 cases presented with symptoms suggestive of C.T.S. This study was performed in Menoufia University Hospital and Al Sahel Teaching Hospital. These cases were subjected to:-

- ❖ Clinical examination to define the main symptoms, signs, and features of C.T.S and its differential diagnosis.
- ❖ Plain x-ray of the wrist to exclude bony abnormalities.
- ❖ Electrophysiological studies.

#### Inclusion criteria:

1. History and clinical examination to confirm the diagnosis of carpal tunnel syndrome and exclude other possible causes. Patients had to have substantial symptoms that were not relieved by conservative management.
2. Thenar wasting or progressive hand dysfunction due to carpal tunnel syndrome was an indication for surgery.
3. Nerve conduction studies confirm carpal tunnel syndrome. If a patient's symptoms were not alleviated medically, and they exhibited distinct symptoms and signs of carpal tunnel syndrome with normal neurophysiological studies, they were considered a candidate for surgery.

#### Exclusion criteria:

Presence of rheumatoid arthritis, presence of neuromuscular disorders, thyroid disorder, pregnancy, failed previous surgery, cervical spondylosis.

#### Methods:

A two-portal incision technique was performed during local anesthesia assisted by

intravenously administered analgesia and under tourniquet control. The proximal portal was a 1cm incision outlined longitudinally from the wrist flexion crease and proceeded proximally adjacent to the ulnar border of the palmaris longus tendon (or in the midline of the wrist if the palmaris longus is not present)(Fig.1, A). Blunt dissection exposes the palmar carpal fascia. This was punctured with a blade. The proximal skin was elevated and with the blunt-tipped scissors, the palmar carpal fascia was split longitudinally subcutaneously (Fig. 1, B). Distally, the fascia was incised to the thickened proximal border of the transverse carpal ligament. A retractor was placed beneath the distal skin and pulled upward. This causes the transverse carpal ligament to slightly elevate from the flexor sheath to allow direct visualization for the insertion of a blunt elevator. The blunt elevator was inserted beneath the transverse carpal ligament. The flexor sheath and nerve were freed from the ligament by sweeping the instrument back and forth beneath the "corrugated" internal surface of the transverse carpal ligament (Fig. 1, C).

It is important to directly visualize the entrance of the elevator beneath the transverse carpal ligament. It is possible to mistake the edge of the palmar fascia for the transverse carpal ligament if it is not directly visualized, and this could cause the elevator to enter Guyon's canal. The distal end of the transverse carpal ligament can be palpated by the opposite hand as the elevator exits beneath its edge in the ulnar palm.<sup>(9)</sup>



**Figure (1, A)** Incision outlined distal incision at the radial axis of ring finger and base of thumb web. **(B)** palmar carpal fascia incised proximally. **(C)** blunt elevator sweeps through the carpal canal.

The distal portal was a 1-cm incision that was made by drawing an imaginary line from the distal wrist crease to the crossing point of two perpendicular lines extending from the inferior edge of the extended thumb and to the line between the third and fourth digits. This imaginary line was divided into three equal parts, and the distal third skin part was opened. An important modification at this point was the

dissection and inspection of the distal incision. The fatty tissues were spread and small retractors were inserted in the distal incision. The palmar fascia was split longitudinally and distally 1 cm under direct vision. The soft deep tissues were gently spread with the small blunt-tipped scissors. This frees the superficial arch and flexor sheath-median nerve from any adherence to the adjacent soft tissues. Attention was then returned to the proximal portal and the blunt elevator was passed beneath the

transverse carpal ligament under direct vision. With the wrist slightly extended, the curved elevator was passed distally through the distal portal. The elevator should pass easily as the distal palmar fascia was split and the soft tissues have been released from the distal edge of the transverse carpal ligament (Fig. 2).

Under direct vision, the transverse carpal ligament was severed between the lateral aspect of the median nerve and the ulnar neurovascular bundle through the distal and proximal incisions. The transverse carpal ligament and the median nerve segment can be identified under the non-incised epidermis segment by extending the wrist. The ligament was severed to the inferior margin of the proximal incision. The proximal portion of the ligament is sectioned through the proximal skin incision. The median nerve was examined, and the ligament's sectioning was verified along the carpal tunnel<sup>(9)</sup>



**Figure (2)** The Elevator confirms the location of the exit incision.

#### **Skin Closure:**

At this point, the tourniquet was released, hemostasis was attained and the wounds were closed with 4-0 prollyn.

#### **Post-operative:**

The patients were discharged on the same day as the operation. After two weeks, the sutures were extracted. Hand use was advised to be minimal, particularly in the initial weeks, although patients were encouraged to move their digits on the same operative day.

Patients were advised to modify hand use to avoid recurrence or appearance of symptoms in the other

hand.

#### **Follow Up:**

The most widely used is a questionnaire published by the Boston group (Levine 1993) called the Boston Carpal Tunnel Questionnaire (BCTQ), also known as the Levine scale, which is a patient-based outcome measure that has been specifically designed for patients with CTS. It possesses two distinct divisions, the Functional Status Scale (FSS), which comprises eight items that must be evaluated for their degree of difficulty on a five-point scale, and the Symptom Severity Scale (SSS), which comprises eleven inquiries and employs a five-point rating scale. The final score of each scale is the sum of the individual scores divided by the number of items. This score ranges from 1 (no symptoms) to 5 (the most severe symptoms), with a higher score indicating a larger degree of disability.<sup>(10)</sup>

#### **Results:**

In this study 60 cases presented with symptoms suggestive of C.T.S. This study was performed in Menoufia University Hospital and Al Sahel Teaching Hospital.

**Age:** The mean patient age at the time of operation was 38 years ranging between 20-59 years. 12 patients (20%) were between 21-30 years, 30 patients (50%) were between 31-40 years, 3 patients (5%) were between 41-50 years and 15 patients (25%) were above 50 years.

**Gender:** The cases included 60 (100%) females and 0 (0 %) males with female sex predominance.

**Occupation:** Four female patients (6.7%) worked as secretaries while the remaining 56 female patients (93.3%) worked as housewives.

#### **Predisposing and Etiological Factors:**

None of the patients had any general medical condition as a cause of the CTS. None had any of the other etiological factors of CTS. None of the female patients were pregnant at the time of presentation .4 patients (6.7%) had jobs that required repeated daily strenuous hand use as work-related predisposing factors (secretary).56 Patients (93.3%) had no work-related predisposing factors.

#### **Site and Bilateral Affection:**

30 patients (50%) complained of their right hand while 18 patients (30%) complained of left hand. On the other hand, 12 patients (20%) complained of both hands, 9 (15%) of whom had symptoms more in the right hand and the other 3 (5%) had symptoms more in the left hand. All patients (100%) were right-handed.

**Symptoms:**

All patients (100%) complained of pain along the median nerve distribution distal to the wrist predominantly in the palmar aspect of the thumb, index and middle fingers, and radial half of the ring finger. Pain was perceived in different forms. 44 patients (73.3%) complained of numbness, 12 patients (20%) complained of burning pain and other 4 patients (6.7%) complained of electric-like pain. The pain was exacerbated at night and in long-standing cases the pain was present night and day and exacerbated after effort and relieved by hand elevation, shaking, or hand rubbing.

Only 20 patients (33.3%) had pain radiated to the elbow while other patients (66.7%) had pain only in their hands. Also, 48 patients (80%) complained of weakness in their hands in the form of weak hand grip in 36 patients (60%) and the form of weak opposition in 12 patients (20%). The duration of symptoms also varied between patients. 12 patients (20%) had symptoms of CTS for less than 1 year, 40 patients (67%) had symptoms for duration between one to five years, and 8 patients (13%) had symptoms for duration between five to ten years.

**Signs:**

Weakness was seen in 48 patients (80%) in the form of weak hand grip in 36 patients (60%) and the form of weak opposition in 12 patients (20%). Thenar atrophy was seen in only 4 patients (6.7%) who had long-standing disease and electrophysiological studies showed severe nerve compression.

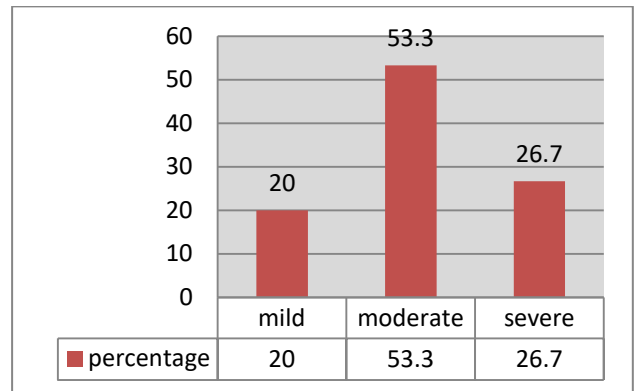
Tinel's sign and Phalen's test were **positive** in all patients.

**Diagnostic Studies:**

All patients performed plain X-rays of the wrist both AP and lateral views. No fractures were noticed, and no abnormal bony swelling or soft tissue shadow swelling.

**EMG and NCSs:**

NCSs were performed for all patients. 48 patients (80%) had abnormal NCSs in the form of sensory-motor affection while 12 patients (20%) had sensory affection only. 16 of them (26.7%) had severe CTS, 32 patients (53.3%) had moderate CTS while 12 patients (20%) had mild CTS.



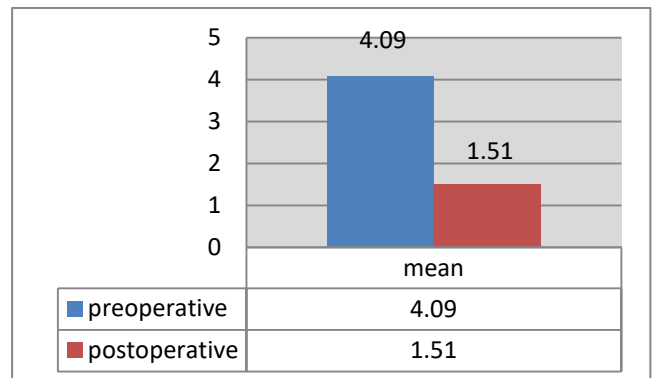
**Chart 1:** Graph showing severity of affection

30 patients (50%) operated on the right side and 18 patients (30%) operated on the left side. The 12 patients who complained of bilateral symptoms were initially operated upon on the most symptomatizing hand after which they were followed up, seven of them (11.7%) were satisfied with their current condition and felt they did not need another operation and could carry on with their lives and daily activities. The other 5(8.3%) patients operated for the other hand upon 6 weeks after the initial operation.

**Table 1:** Follow up and scoring

Score	Preoperative	Postoperative	P value <sup>#</sup>
Mean ± SD	4.09 ± 0.471	1.51 ± 0.213	<b>&lt;0.001*</b>
Range	3 – 5	1 – 2	

<sup>#</sup> compared by paired T test \* significant as P value <0.05



**Chart 2:** graph showing score range

**Discussion:**

Entrapment neuropathy is most frequently encountered in the form of carpal tunnel syndrome. It occurs most frequently during middle or advanced age.<sup>(11)</sup> There is a difference in the reported incidence between men and women with some reports showing women to be twice as much affected than men, while others showed women to be three to five times as much affected as men.<sup>(12)</sup> In our study we found that the incidence of carpal tunnel syndrome is very high in females. This could be attributed to the limited sample size of the study, which may not

accurately represent the actual incidence of carpal tunnel syndrome in the general population or the ratio of female to male affection.

The dominant hand is the most frequently affected, but the non-dominant hand may also be affected. The condition is bilateral in at least 10% of patients<sup>(13)</sup>. In our study the dominant hand was affected in 50% of cases, bilateral in 20% of cases, and non-dominant hand in 30% of cases.

Numerous conditions are linked to the presence of carpal tunnel syndrome. Median nerve compression and entrapment may result from any disease that decreases the cross-sectional area of the carpal tunnel or increases the volume of its contents. However, idiopathic causes are probably the commonest.<sup>(14)</sup> In this study we found no secondary cause and all patients had idiopathic carpal tunnel syndrome.

The median nerve is believed to be compressed in carpal tunnel syndrome as a result of the thickening of the flexor tendon sheaths; however, the precise cause of this thickening remains unknown<sup>(15)</sup>.

In at least 50% of cases of carpal tunnel syndrome, physical load factors, such as repetitive and forceful grasping, are likely a significant risk factor. This has led to the concept that carpal tunnel syndrome is a job-related disorder. Repetition, force, posture, external pressure, and vibration are the physical factors that have been extensively investigated and implicated in occupational CTS. The risk factor for occupational CTS that is most widely recognized is repetition. In epidemiological studies, high repetition is defined by the frequency of the task or the percentage of time spent on repetitive labor<sup>(16)</sup>. In our study only 4 patients gave a history suggestive of a job requiring repeated hand movements, yet the rest of the females were *housewives*, who engaged in repetitive daily household tasks, including cooking, cleaning, and laundry, which necessitated significant manual exertion and may have contributed to the development of carpal tunnel syndrome.

Pain is the most commonly reported symptom, mostly in the form of numbness and tingling in 80% of patients. Patients describe numbness in all or part of the hand which often worsens at night. Other forms of pain presentation in patients include dull ache (20%), stiffness (6%), burning sensation (5%), or electric-like sensation (5%).<sup>(17)</sup>

In our study, numbness and tingling affected 44 patients (73.3%), burning sensation in 12 patients (20%), and electric-like sensation in 4 patients

(6.7%). 60% of patients complained of weakness of hand grip and 20% weakness of opposition. This shows that sensory manifestations are the most common presentations with nocturnal exacerbation as a prominent feature.

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## Conclusion:

Although conservative treatment, in the form of analgesics, diuretics, steroids, local injection of steroids, and the use of splints provides temporary relief of symptoms. Surgical release remains the definite mode of treatment, with 80% of patients showing marked improvement and 20% of patients showing mild improvement in sensory manifestation.

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## References:

1. Scott, Kevin R.; Kothari, Milind J. (October 5, 2009): "Treatment of carpal tunnel syndrome".
2. Leecc, Tindallsc, Kliot (2004) C.T.S. in winn; Youmans neurological surgery pp 3889- 3895.
3. Lee H, Jackson TA (1996).Carpal tunnel release through a limited skin incision under direct visualization using a new instrument, the carposcope.PlastReconstrSurg; 98:313-9.
4. Silverstein, B; Fine, L; Armstrong, T (1987). "Occupational factors and carpal tunnel syndrome". American Journal of Industrial Medicine 11 (3): 343-358.
5. Lozano-Calderón, S; Anthony, S; Ring, D (2008). "The quality and strength of evidence for etiology: example of carpal tunnel syndrome". The Journal of Hand Surgery 33 (4): 525-38.
6. Scangas, G; Lozano-Calderón, S; Ring, D (2008)."Disparity between popular (Internet) and scientific illness concepts of carpal tunnel syndrome causation". The Journal of Hand Surgery 33 (7): 1076-80.
7. Walker, Jennie A. (2010)."Management of patients with carpal tunnel syndrome". Nursing Standard 24 (19): 44-8.
8. Shiel, William C (2009)."Carpal Tunnel Syndrome & Tarsal Tunnel Syndrome". Medicine Net.
9. Cooney, W. P., Linscheid, R. L., & Dobyns, J. H. (Eds.). (1998). The wrist: diagnosis and operative treatment (Vol. 2). Mosby.
10. Levine, D. W., Simmons, B. P., Koris, M. J., Daltroy, L. H., Hohl, G. G., Fossel, A. H., & Katz, J. N. (1993). A self-administered questionnaire for the assessment of severity of symptoms and functional status in carpal tunnel syndrome. The Journal of bone and joint surgery. American volume, 75(11), 1585-1592.
11. Ibrahim I, Khan W, Goddard N, Smitham P. Carpal tunnel syndrome: review of the recent literature. Open Orthop J 2012; 6:69-76.
12. Bland J. Carpal tunnel syndrome. BMJ 2007; 335:343-346 .
13. Hales T, Bernard BF (1996): Epidemiology of work related musculoskeletal disorders. OrthopClin North Am 27:674-709.
14. Stevens JC, Beard CM, O'Fallon WM (1992): Conditions associated with carpal tunnel syndrome. Mayo ClinProc 67:541-548.
15. Ebenhichler GR, Resch KL, Nicolakis D, Wiesinger GF, Uhl F, Ghanem AH(1998): Ultrasound treatment for carpal tunnel syndrome: Randomized "Sham" controlled trial. BMJ 316:731-735.
16. Hayberg M, Morgenstern H, Kelsh M (1992): Impact of occupations and job tasks on the prevalence of carpal tunnel syndrome. Scand J Work Environ Health 18:337-347.
17. Besseette L, Keller RB, Lew RA, Simmons BP, Fossel AH, Mooney N, Katz JN(1997): Prognostic value of a hand symptom in the surgery for carpal tunnel syndrome. J Rheumatol 24:726-734.