

Original Article

# The outcome of carpal tunnel syndrome with modified mini-incision technique.

Aurangzeb Kalhoro<sup>ID</sup>, Abdul Sattar M. Hashim<sup>ID</sup>  
& Abdul Basit Sattar<sup>ID</sup>

Neurospinal Cancer Care Institute, Karachi-Pakistan.

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**Corresponding Author Email:**  
draurangzebkalhoro@gmail.com

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## Abstract

**Background:** Median nerve compression in hand at the level of transverse ligament leads to numbness and pain in the hands, which results in discomfort in daily routine work has a psychological impact. The objective of the present study was to evaluate the modified mini-incision at the transverse crease in carpal tunnel syndrome.

**Methodology:** A prospective descriptive study was conducted at Neurospinal & cancer care Institute, Karachi, from January 2012 – February 2020. Patients who were diagnosed with clinical symptoms, positive Phalen and Tinel test and confirmed with EMG finding of carpal tunnel syndrome were included in the study. Patients were operated through modified mini-incision at the transverse crease. The outcome was recorded in the form of pain relief, healing time with restoration of daily life activity and scar adhesion on follow-up.

**Results:** A total of 97 patients were included. The male to female ratio was 1:7.8. The mean age was 40 ± 19.5 years. The right hand was 72.2%, the left hand was 13.4%, and the bilateral was 14.4%. VAS score improved 2 grades in 96%, and pinch grip improved in 98% of patients in one month. Only 2% of patients had stiffness after surgery

**Conclusion:** Minimal incision carpal tunnel release has shown positive outcome in median nerve compression, having limited skin incision, safe, feasible and minimizing the scar assist help in early return to work.

## Keywords

Carpal Tunnel Syndrome, Mini Incision, Carpal Tunnel Release.



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## Introduction

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Carpal tunnel syndrome (CTS) is seen as one of the most common compressive neuropathies of the upper limb. The prevalence in the United States is around 1 to 5% and is frequently found in the female population. CTS may occur in unilateral hand or bilaterally due to systemic disease or using vibrating tools, or repeated wrist movements like a drilling machine<sup>1</sup>.

Carpal tunnel syndrome is characterized by the symptoms of pain, paresthesia along with the distribution of the median nerve, especially aggravate at night during sleep, thenar muscle weakness is a late presentation. Phalen's test (holding the wrist at maximum flexion for 30 to 60 seconds) and Tinel's test (percussion over the median nerve at the level of the carpal crease) are clinical examinations that help establish the diagnosis of CTS. Ultrasound imaging and Electromyography (EMG) were used to confirm the diagnosis<sup>2</sup>. Repetitive mechanical stress, diabetes, rheumatoid arthritis, thyroid dysfunction, genetic factors, acromegaly and pregnancy, are known risk factors for carpal tunnel syndrome<sup>1,3,4</sup>.

Mild to moderate disease patients of CTS is treated with local corticosteroid injection with night splints<sup>4</sup>. Surgical treatment is recommended for about 4 - 5/1000 females and 1- 2/1000 males who are either refractory to medical treatment or having the severe disease at presentation<sup>5</sup>. Surgical release of the carpal tunnel was first described by Galloway in 1924, followed by Phalen, with time, methods have evolved to become the most frequently used and safe. The surgical method of the carpal tunnel has been modified from 5 cm incisions to endoscopic methods just to improve efficacy, safety and cosmetic issues<sup>6</sup>. Minimal incision surgery in CTS may have an advantage over endoscopic methods in that it has limited complication, early recovery, less retraction and small scar mark<sup>7</sup>. Despite the progressive research about multiple treatment options, very limited knowledge is about treatment trends that have changed over time, however for a common condition such as carpal tunnel syndrome extent use of surgical treatment options is considered

important for clinical practice and healthcare planners and providers<sup>8</sup>. Visual analogue scale (VAS) is a significant method to assess the outcome of the surgery with 3-6 months follow up, and many other tests can be used<sup>9</sup>.

Although the endoscopic surgical option is available in developed countries for CTS, it is unavailable in most developing countries, and it is expensive, needs expertise for this surgery. Modified mini-incision surgery is another option that can be used for CTS with less complication, early healing of incision and cost-effectiveness, and a cosmetic effect.

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## Methodology

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This was a prospective descriptive study conducted at a Neuro spinal and cancer care institute, Karachi; the duration of the study was from January 2012 – February 2020. Ethical approval was taken from the ethical committee (IRB No: 1098/2012), and written informed consent was taken from all the patients.

Total 97 patients were included, the inclusion criteria were patients aged above 20 years, patients of any gender, patients with severe pain through median nerve distribution (CTS), or refractory to medication. Exclusion criteria includes operated cases for CTS, trauma at the wrist and compression at cervical MRI.

Diagnosis of CTS was made on clinical symptoms, Phalan and tinel test and confirmed via EMG finding of CTS. At the same time, the severity of the disease is assessed on a visual analogue scale (VAS) pain before and after surgery. All patients were operated on with modified mini-incision at the transverse crease for release of compression symptoms. Patients who had CTS in both hands then, the hand with more severity and weakness, were operated first, and patients who had pain and severity equally in both hands then-dominant hands were operated first<sup>19</sup>.

Post-operative patients were followed for pain relief, VAS score (mild 1-4 score, moderate >4-6 score, severe > 6-10 score), return of normal hand functions through Medical research council (MRC)

scale and complication of scar in the form of hand stiffness (scar adhesion) and tender scar. Follow-up was done at two weeks, one month, second month and third month of surgery to assess the outcome of mini-incision and hand functionality and any associated complication, for example, scar mark, hand stiffness. SPSS version 24.0 was used for data analysis purpose, mean and standard deviation was taken for quantitative data, and frequency was taken for qualitative data.

### Surgical technique

The patient was admitted on the day of surgery; fitness was taken for general anesthesia. Carpal tunnel release was done under general anesthesia with a pneumatic tourniquet on the upper arm. Under aseptic measures, the wrist was kept in the mildly extended position, then a 1cm transverse incision was made on wrist crease between the flexor carpi radialis tendon and palmaris longus tendon incision, between the proximal and distal wrist creases, centered over the line joining the 3rd interdigital space to the crease in between the thenar and hypothenar muscles, after the incision was made then the white palm aponeurosis was divided carefully by blunt dissection.

In this way, the distal edge of the branch of the median nerve and flexor retinaculum was exposed, exposure of the proximal edge of the flexor retinaculum and the median nerve trunk. The superficial and deep tissue of the ligamentum carpi transversum was bluntly disassociated while the wrist was mildly hyperextension. A long nasal instrument was inserted proximally from the second incision to the first incision and introduced between the superficial and deep plane of the ligamentum carpi transversum.

Ensuring the ligamentum carpi transversum was exposed to the operator as clearly as possible under direct visualization, fine scissors were then gently pushed distal to the longitudinal incision in the ligamentum carpi transversum. The surgeon confirmed that the carpal tunnel was completely released. The incision was closed with subcutaneous vicryl 2/0, mild pressure dressing was done at the wrist, after which the tourniquet

was removed from the arm. During admission, the patient was kept on ceftriaxone and gentamicin. The patient was discharged on 2nd post operative day. The wound dressing was removed after 5 days.



**Figure 1: Showing 1 cm transverse incision closure**

### Results

A total of 97 patients were included in the study. The mean age was  $40 \pm 29.5$  years. Females were 86(88.6%), and males were 11(11.3%). The male to female ratio was 1:7.8. The mean age was  $40 \pm 19.5$  years. The right hand was involved in 70(72.2%), the left hand in 13(13.4%), and the bilateral hands were involved in 14 (14.4%).

EMG findings showed moderate disease in 39(40.2%) and severe disease in 58(59.7%). Patient presentation is shown in table 1. VAS score mean was  $8 \pm 2$  before surgery, and the VAS score mean of  $3 \pm 2$  was after surgery. VAS score showed improvement in 97(100%) in 2 weeks.

Pinch Grip function improvement measure with MRC score results shown in the table. Improvement in Paresthesia and Numbness took 1 month in 92% of patients. Twenty-six (26.8%) had diabetes, 14 (14.4%) had hypothyroidism and 57 (58.73%) patients were idiopathic.

No patient had redo surgery, nerve injury or local hematoma, skin infection. Hand stiffness was found in 2(2%) of the patient, while the total skin-to-skin operative time was 15 minutes. Follow-up was done at two weeks, one month, second month and third month of surgery to assess any complication.

**Table 1: Presenting characteristics**

Characteristics	n(%)
<b>Pain*</b>	97(100)
<b>Paresthesia*</b>	92(94.8)
<b>Numbness*</b>	91(93.8)
<b>Weakness</b>	38(39.1)
<b>nocturnal awakening</b>	45(46.3)
<b>Palmar tenderness</b>	28(28.8)

\*Along with the median nerve supply

**Table 2: Patient Pinch Grip for moderate to severe cases**

Duration	Improved patients n(%)
<b>1<sup>st</sup> week</b>	15(15.4)
<b>2<sup>nd</sup> week</b>	24(24.7)
<b>3<sup>rd</sup> week</b>	30(30.9)
<b>4<sup>th</sup> week</b>	35(36)
<b>3 months</b>	Improved

\*Measured on MRC Grading system

## Discussion

Carpal tunnel syndrome is common in females than in males that are also be seen in our study, commonly due to the exertion work at the wrist, conservatively and surgical methods are used to make patient pain free while pain free state either on conservative medication or surgical method, depending on severity and patient to patient. Minimally invasive surgery has made advancements to provide less risk, minimal scar, early recovery and return to routine activities.

Mardanpour et al., had 300 hands with 1.5 cm longitudinal mini-incision 132 (70%) females and 56 (30%) males 178 operations on the right hand and 122 on the left hand with a follow-up duration of 18.6 months<sup>10</sup>. None of the patient experienced loss of wrist strength, stiffness. The mean time of recovery was two weeks compared to the study at our centre, 70 (72.2%) patients had carpal tunnel in right hand, in 13(13.4%) patient it was in the left hand. In contrast, 14 (14.4%) had bilateral CTS Follow-up was 3months, and there was no redo surgery, and an incision was transverse about 1cm rather than longitudinal.

Bilge et al had 200 CTS patients in their study with double the female ratio to male<sup>11</sup>. They had two groups; 11 did not receive local administration of anti-adhesion gel; on the other hand, group 2 received anti-adhesion gel consisting of hyaluronic acid-carboxymethylcellulose that was locally applied to patients. All patients received conservative treatment consisting of non-steroidal anti-inflammatory drugs, replacement of vitamin B, steroid injection, and splints. Refractory cases that had no benefit or minimal benefit from the conservative management after 1 year were assigned as candidates for surgical treatment. In contrast, in our study, all patients were in a moderate to severe state of pain and developing weakness, so only surgical patients were included in the study.

In a study by Abdel-Moneim & Said, all patients had carpal tunnel release, and patients were discharged one day after the surgery<sup>12</sup>, while in their study, 1 patient had mild residual pain and 1 had hand grip weakness. 38 out of 40 (95%) patients operated upon showed good functional pain relief was the satisfactory and fine cosmetic

result. Similarly, in our study, the patients were discharged the very second day while no patient showed residual pain in our study at follow-up. Compared to the study above, the number of patients was higher in our study treated with transverse incision of 1 cm at the wrist.

In our study, we had 97 patients, surgery was performed in all patients, we did not use splints, and we had significant improvement in the outcome while compared to study by Güvenç et al<sup>13</sup> studies had 78 patients, who were surgically treated while 33 patients were treated conservatively with hand splint technique and steroids were used for 8 weeks., their study concluded that the patients who had surgical treatment had a better outcome than those with conservative treatment.

Akkurt et al., reported both endoscopic and open method have similar long-term clinical outcomes with minimal complications<sup>14</sup>. However, the extended technique had higher scar rate because of lengthier incision in both groups had potential injuring the palmar cutaneous branch of the median nerve. Compared to our study, with both groups (I & II) mentioned above, we had mini transverse incisions about 1 cm with no scar issues. Similar to their study, we did not have any major complications.

In Beck et al study<sup>15</sup>, total 278 patients (358 procedures) underwent Endoscopic carpal tunnel release. Among them, 12 patients were converted to Open carpal tunnel release 2-year period. No repeat surgery for recurrence of carpal tunnel symptoms. Observed no major neurovascular complications. Conversion significantly diminished with an increased surgeon and anaesthesia experience. Patients may be at a higher risk of conversion to open carpal tunnel release during the learning curve while finding no increased morbidity.

Calotta et al<sup>16</sup> included 126 patients. 39 patients were managed with Endoscopic release carpal tunnel syndrome and 99 open methods. The 68% were female patients, and 56% of cases involved

the dominant hand. The treatment completely improved carpal tunnel syndrome symptoms in 82% of Endoscopic carpal tunnel syndrome cases and 39% of Open carpal tunnel syndrome. Complication rates were similar for both procedures. Compared to our study, we did not have any redo case in 3 month follow-up, during all procedures, mini transverse incision at the wrist crease with no major complications.

Similarly, another regional study by Ahmed et al.<sup>17</sup> reported that the mini-incision technique has better outcomes in functionality and early return to work. However, they had larger patients than our study, plus we had modified transverse incision. Another different aspect regarding carpal tunnel release is that Yoshii et al<sup>18</sup> reported that the Pressure-strain ratio was the effective method to judge the clinical recovery. At the same time, we in our study did not have pressure stains to measure, but the dressing was firmly tight.

Mini-incision release surgery is a modified technique. Having fewer complications and minimal scar reduces the chances of stiffness of the hand; after the release of the carpal tunnel, the significant improvement in pain is seen from immediate post-operative to pinch grip improvement as per patient sense and how he feels. It is also worth mentioning that the patient bears the pain and develops progressive weakness of the handgrip. This sense of feeling takes some time to overcome; at the same time, it is also important that in case of bilateral pain in hand, the dominant hand was given preference, we also followed that similar method of surgery in case of bilateral carpal tunnel as mentioned in Greenberg et al<sup>19</sup>. The hand with the severity of pain must be operated on first. If both hands have equal severity, then the dominant hand must be operated first or the hand with weakness, postoperatively; we did firm dressing and did not use splints.

The limitation of the study was performed at a single with minimal, surgery requires experience, fatty patients and redo surgery were not considered in the study due to thickness and distorted anatomy respectively which may injure

the hand. The study may help expertise the modified method, which may help early recovery, minimize scar, and minimize complication.

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## Conclusion

Minimal incision carpal tunnel release has given good outcome in median nerve compression, help in early return to work and having limited skin incision, safe, feasible and minimizing the scar associate complication.

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## Conflicts of Interest

The authors have declared that no competing interests exist.

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